Préhistoire Européenne, volume 14, 1999, p. 79 à 106.

GRAVETTIAN/EPIGRAVETTIAN TRANSITION IN THE VAH VALLEY IN THE LIGHT OF NEW EXCAVATIONS IN THE MORAVANY-BANKA AREA NEAR PIEST'ANY (WESTERN SLOVAKIA)

Witold P. ALEXANDROWICZ, Anna D'URIŠOVA, L'ubomira KAMINSKÁ, Barbara KAZIOR, Janusz K. KOZLOWSKI, Maciej PAWLIKOWSKI, Krzysztof SOBCZYK

INTRODUCTION

Investigations into the Gravettian sites at Moravany on the Vah river which had begun in 1991 (HROMADA, KOZLOWSKI, *ed.* 1995, KOZLOWSKI *ed.* 1998) continued in 1997 in the locality of Banka. The research were conducted as part of an international agreement between the Institute of Archaeology of the Slovakian Academy of Sciences and the Institute of Archaeology of the Jagiellonian University in Kraków (Fig. 1) in the framework of the Polish Scientific Research Committee project N° 1161/H01/97/12.

The sites at Banka are situated – as are the sites at Moravany – on a high loess terrace of the Vah, on its left bank. Many Palaeolithic sites are known from the area of the village of Banka, but prior to 1997 no systematic excavations had been conducted. Geological investigations were carried out in 1943 by L. Zotz (BAČA 1988, 31), and shortly after that by F. Prošek and V. Ložek (1954). J. Bárta (1965) in his publications drew attention to the Palaeolithic settlement at Banka. From the area there are amateur collections of lithic artefacts – at present in private possession – also collections from the illegal amateur diggings of L. Duraček from Piešt'any.

Systematic archaeological investigations in 1997 were conducted in the fields of Banka called "Horné farské role" or Kniazovica (KAMINSKÁ *et al.*1997). They are situated on the western slopes of the Považsky Inovec and cut by numerous ravines. The name "Horné farské role" refers on maps to a broad area used for cultivation or as pastures (Fig. 2).

The Gravettian sites at Banka have been systematically damaged by deep ploughing, but first of all by amateur illegal diggings of L. Duraček during the last several years. The story of his collection seems to be closed now as it has been sold to other unknown collectors and is unavailable for academic research. The archaeological content of Duraček's collection can only be described on the basis of photographs which he has kept, but which mainly show shouldered points.

Before our investigations began we were able to obtain some information about the location of the trenches Duraček had made. In the area Duraček identified we made 27 trial trenches (S-1–27) forming two belts along the NW-SE axis, at an elevation of 254 to 265 m a.s.l. When a culture layer was uncovered, the trial trench was widened (Tr-I–V) and block excavations were conducted. On the basis of the trial trenches and archaeological excavations we established that the damage done by Duraček was greater than we thought as the central portion of the upper part of the site has been destroyed. In order to clarify the stratigraphy of the site, a geological trench was made in the uppermost section (Tr-G).

EXCAVATIONS AT BANKA ("HORNÉ FARSKÉ ROLE" SITE)

Site location

The site is situated at the edge of the broad Vah valley cutting into detritic sediments and Cretaceous limestones. The mild hills surrounding the valley are covered by late Pleistocene loess overlying the residual red clays from weathered Cretaceous

limestones; these clays are probably of Palaeogene age. The Pre-Palaeogene sediments are cut by numerous faults which causes the dominant tectonics to be horst-stepped. The interior parts of the hills are mainly Cretaceous limestones. Further to the east, away from the edge of the valley, the higher lying hills that form the slopes of the Považsky Inovec are quartz-mica gneiss containing hematite. Their contact with the limestones is tectonic.

Site stratigraphy

The most complete sequence of loess sediments forming the hill mantle that covers the Cretaceous limestones and detritic material from the weathering of limestones is displayed in the profile of geological trench Tr-G located in the highest part of the hill. The profile comprises the following stratigraphical units (Fig. 3):

1 – brown-earth loess type soil, from 25 to 50 cm thick, ploughed many times and mixed by deep ploughing.

2 – clayey loess, in its upper part an illuvium of brown-earth Holocene soil. Microscopic examinations of this loess have revealed in the fraction > 0.6 mm predominance of rounded quartz grains (72.4–87.5%), a small proportion of angular grains from eolian transport (1.5–16.4%), a small proportion of muscovite (0.8–5.9%), the absence of biotite and a relatively small proportion of ferruginuous-manganese concretions (0.2–2.0%). Pieces of rocks such as gneiss also occur. The character of this loess is a washed-out eolian sediment with admixtures of lumps of pre-Quaternary rocks. The lowest portion of this sediment (2a) differs from the middle and the upper portions of this unit, although macroscopically no differences are observed (similar texture and colour of the layer). The floor portion of layer 2 reveals a more clearly eolian loess character with a larger proportion of angular quartz grains (45.2%) and a smaller proportion of rounded grains (only 39%). The proportions of muscovite, ferruginuous-manganese concretions and absence of biotite in this part of layer 2 do not differ from its upper portions.

In this layer only a few shells occur, represented by typical loess species: *Pupilla loesica* (see Table 1).

3 – loamy loess, darker, with lumpy structure. Mineralogical examinations of finer fractions have shown the occurrence of a larger proportion of fractions of less than 10 μm. Besides quartz grains, this fraction contains clayey minerals such as illite-muscovite. This is probably clayey material in secondary position, from the washing-out of older loess and – possibly – also clay sediments. The micromorphological examinations seem to suggest that this is brown soil in the early stage of development. The fraction > 0.6 mm shows, again, a higher proportion of rounded quartz grains (68.2%), and rock fragments and muscovite. This soil developed on clayey-loess material washed onto the erosional surface that cuts the top of unit 4. Dessication cracks filled with the clayey material from layer 3 and carbonates developed on this surface.

Malacofauna represented exclusively by typical loess species *Trichia hispida*.

4 – calcareous, laminated, light-yellow loess with an increased content of calcium carbonate. In the lighter layers there is calcite from the limestones that underlie loess and which are revealed in the higher parts of the slope. In the darker layers the clayey material from the clays overlying the limestones was redeposited. The fraction of more than 0.6 mm in unit 4 contains a considerable quantity of rounded quartz grains (66–80%) and a small proportion of angular grains (12–22%). The proportion of muscovite is about 4%, biotite – 2.5%, and ferruginuous-carbonate concretions – 0.7–1.2%.

Malacofauna in layer 4, represented mostly by loess species, points to a cool, medium-dry climate with bushes, evidenced by the presence of shade-loving species [*Arianta arbustorum* (L), *Semilamax kotulai* (west.)], (Table 1). In the general composition, species of open and dry habitats prevail.

5 – clayey loess containing carbonate concretions. In the fraction of more than 0.6 mm, rounded quartz grains are 68 to 84%. Muscovite is from 1.7 to 3.0% and biotite – 0.2 to 1.6%. The proportion of angular grains of quartz is slightly higher only in the lowest portion of unit 4 (24%). There are fairly large quantities of biotite gneiss and biotite-muscovite.

The malacofauna in this unit indicates milder conditions with the presence of more shady habitats (Table 1).

6 – brown fossil soil indicating a higher content of clay minerals and concentrations of manganese and iron oxide microconcretions. This sediment developed in warmer and fairly wet conditions which favoured the growth of vegetation evidenced by numerous root-casts. At the same time, the relatively large concentration of gneiss pieces, as well as a higher biotite content, show that the role of washing out was important.

7 – less clayey loess, brown, with numerous carbonate precipitations. The proportion of rounded quartz is, however, fairly large (59–82%), whereas that of angular quartz is small (5–11%). Relatively numerous fragments of rocks, muscovite (up to 5%) and biotite (1–3%) continue to occur. In the lower part of this sediment the proportion of angular quartz grains is slightly higher. This confirms the pattern wherein every loess level begins with a phase of stronger eolian sedimentation – probably a drier phase – which is followed by a phase of more intensive slope washing in wetter conditions. Below unit 7 there are weathered clays (8) and Cretaceous limestone (9).

Identification of culture levels on the basis of anthropogenic indices in profile Tr-G

The fraction of 0.1–1.0 mm was isolated from the samples obtained from profile Tr-G. In this fraction the presence of burnt quartz grains, charcoals, bones and microchips from siliceous raw materials was identified under a microscope. The whole set of these anthropogenic indices occurred in the top portion of unit 2 (samples 3, 4 – see Fig. 6). Below, in the lower portion of unit 2, burnt quartz grains, charcoals and bones were identified (samples 6, 7). The charcoal content was fairly high (4.4%) in unit 3 (sample 8). They were accompanied by burnt quartz, but unequivocal anthropogenic indices were absent. This situation may indicate a forest fire at the time when initial soil was being formed (unit 3). Anthropogenic traces occur in the upper portion of unit 5 (samples 11 and 12) such as: traces of burning, fine bone fragments and microchips from siliceous materials (notably sample 11). Finally, the fossil soil in unit 6 revealed charcoals and bone microfragments (sample 16), and unit 7 charcoals only (sample 20). The number of culture levels identifiable on the basis of anthropogenic indices in the fine fraction is larger in profile Tr-G than in the profiles of trenches where culture levels were identified on the basis of macroscopic indices and evident structures (khshemenitsas and bone concentrations). The relations between evident and latent levels is shown in Table 2.

Trench Tr–IV

Excavation Tr–IV covers an area of 14 sq metres. Archaeological material occurred in the interface of layer 4 and 5, and in the top of layer 5 (Fig. 4). A total number of 458 chipped stone artefacts were discovered. Six specimens showed traces of polishing and hammering. There were also 377 bones. Lithic artefacts and bones were uniformly distributed in most of the square metres, with – on average – about 33 lithic artefacts per 1 sq m. An exception is a bone concentration in metres A2 and B2 (Fig. 5). We have identified bones of four reindeer, two polar foxes, one hare, one mammoth and – possibly – Bos or Bison and a single bone of a raven (Table 3). Reindeer bones came from the parts of the animals that are least attractive for consumption and were probably a waste dump in the peripheral zone of the camp. Some bones were in a partially anatomical position.

The investigated zone is the periphery of the main concentration adjacent to excavation Tr–IV in the east and damaged by amateur diggings. A large number of lithic artefacts was obtained from this concentration but all we know is that there were about 20 shouldered points among them, and possibly a total of about several thousand flakes, tools and cores from "northern" flint.

Major technological groups

The most numerous category in the lithic inventory from Tr–IV were flakes (74.2%), but only 13.3% were complete specimens. The remaining specimens were flake fragments, fine flakes (less than 1.5 cm) and chips. Blades and fragments were the next, small group (12.7%). Retouched tools (8.1%) and burin spalls (4.8%) were rare. One initial core was recorded (Table 4).

When the raw material structure is examined we can see that patinated flint (87.8%) is the most important raw material. Radiolarite was less frequent (8.9%), and other raw materials such as quartzite, limnoquartzite, and silicified limestone were used sporadically (Table 5, 6).

Cores

The single core was made on a fragment of a radiolarite pebble, with a scar of an irregular blade, detached from an unprepared platform.

Blades and flakes

In the group of 58 blades only 15 specimens were complete. The blades were predominantly made from flint (52 specimens) and the remaining ones were made from radiolarite (6 specimens). With respect to raw material flakes, their fragments and chips were a strongly varied group. Like blades, the majority of flakes were made on flint (296 specimens), and the next most numerous group was radiolarite (29). There were, also rare specimens of limnoquartzite (7), quartzite (5) and silicified limestone (3).

Retouched tools and production debris

The inventory in excavation Tr–IV contained 37 tools, accounting for 8.1% of the total inventory. The most numerous group was burins, mostly on blades (14 specimens). The next group was retouched blades (12). Backed pieces (4) and perforators (2) were rare. Other tools were represented by single specimens namely: a shouldered point, a Kostenki knife, a denticulated-notched tool, a retouched flake and a splintered piece. End-scrapers and composite tools did were absent (Table 7).

In the group of burins there are: 5 burins-on-a snap (3 single ones, one double and one triple), 4 dihedral burins, 4 truncation burins (3 are double). Of interest was a carenoidal truncation burin made on the proximal part of a blade. There was also an atypical polyhedral burin in the shape of a bec. The majority of specimens were shaped by more than one blow. Only one burin is on radiolarite, the remaining are made from flint (Pl. I.1, 2, 4, 5, 7, 9, 12, 17).

There were 22 burin spalls including 12 primary and 10 secondary specimens. As in the group of burins, only one burin spall was made on radiolarite and the remaining ones from flint.

Seven retouched blades have bilateral retouch and three have retouch on one lateral side. Two specimens are the distal parts of retouched *lames appointées*. Only one retouched blade is made on radiolarite. The remaining 11 blades are flint (Pl. I.3, 6, 8, 10, 13).

The two perforators are atypical specimens, with weakly distinguished, relatively broad points, made from flint.

Only one out of the four backed pieces has been wholly preserved. This is a fine backed bladelet with distal retouch, made from radiolarite. The other three are fragments of flint backed pieces namely: a fine specimen with a partially blunted back, two proximal fragments of backed pieces of which one is strongly burnt and could be a fragment of a shouldered point (Pl. I.11, 15, 18, 19).

The only shouldered point in the inventory is a flint specimen with a notch located at two thirds of its length. The distal part has careful, bilateral retouch. The proximal part has direct and inverse retouch (Pl. I.14).

A Kostenki knife was shaped by inverse and direct retouching of the distal part of a flint blade (Pl. I.16).

The inventory contained, in addition, a small, finely retouched flake, a denticulated-notched tool on a radiolarite flake and a bipolar splintered piece from flint.

Other lithic tools

There were six stone tools made on pebbles: four from sandstone and two from quartzite. They display traces of hammering and polishing and could have been used as hammers, grinders or envils.

Trench Tr–V

Trench Tr–V covered an area of 12 square metres. Archaeological material was

uncovered mainly in the interface of layers 3 and 4, although the vertical scatter of finds, up to 50 cm due to the desiccation cracks, was considerable. A total of 247 chipped stone artefacts have been discovered. Three specimens showed traces of polishing and hammering, two were mammoth bones, and four were lumps of mineral dye. The distribution of lithics was not uniform and the material concentrated mainly in four squares (C2, C3, A1 and B1). On average there were about 21 artefacts per 1 sq m.

Major technological groups

Nearly half of the lithic inventory (54.9%) were flakes, flake fragments and chips. Blades and retouched tools were almost equal in number (19.8% and 18.1% respectively). Burins spalls were 5.2%. There were 5 cores which is 2% of the total inventory (Table 4).

Analysis of the raw material structure has shown that flint, almost entirely patinated (66.2%), is the dominant raw material. Nearly one third of the inventory was made from radiolarite (27.8%), other raw materials such as patinated limnoquartzite (3.6%) or quartzite (2.4%) occur in smaller proportions (Tables 6, 8).

Cores

The five cores included a double-platform specimen made on a fragment of a quartzite pebble, a fragment of a double-platform flint specimen. The quartzite core had prepared platforms and preparation on one lateral side, the opposite side was unprepared. The flaking surface was located on the narrower lateral side, the back forming a crest. The platform of the core fragment was prepared, the flaking surface extended onto the sides. Two cores were made on radiolarite pebbles. They were single-platform, initial, with unprepared platforms. There was an initial, radiolarite core with a change of orientation. One of the single-platform cores and the change-of-orientation specimen displayed traces of strong hammering.

Blades and flakes

There were 49 blades but only 11 have been wholly preserved. The majority of blades have been detached from flint cores (43 specimens). Radiolarite specimens (13) were less numerous. Four blades were made from limnoquartzite.

In the group of flakes, flint specimens predominate (93 specimens); radiolarite flakes are nearly a third. There were five flakes from limnoquartzite and five from quartzite.

Retouched tools and production debris

The inventory of Tr–V contained 45 retouched tools, accounting for 18.2% of the total inventory. The most numerous group was retouched blades (17 specimens) followed by nearly the same number of burins (16 specimens). There were four backed pieces. There were, in addition : end-scrapers, retouched flakes and denticulated tools – two specimens each. Retouched tools included also a perforator and a splintered piece. No typical Kostenki forms or combined tools have been recorded (Table 7).

The group of retouched blades was represented by: nine unilateral specimens, seven bilateral and one *appointée*. Eleven specimens were made from flint and six from radiolarite (Pl. II.1-4, 7, 9).

Most burins were on a snap (7 specimens): single (4) or double (3). The second group includes all kinds of combined burins (4). There were two single-blow burins of which one was a Corbiac type. A flat truncation burin is also present. Only one burin was made on radiolarite, all the others on flint (pl. II.5, 6, 8. 11. 12).

To this group 13 burin spalls should be added: 12 primary and only one secondary specimen. Edge retouching can be seen on 8 primary burin spalls. As many as 11 burin spalls are from flint and only two from radiolarite.

Four backed pieces included a complete small backed bladelet and three fragments: the distal part of a backed point with a flat distal inverse retouch, proximal and mesial fragments. All the specimens were made from flint (Pl. II.13, 14).

One end-scraper was made from radiolarite and had a weakly rounded front. The other was made on a bilateral retouched blade from flint (Pl. II.10).

Both retouched flakes were made from flint and had almost continuous retouch on both lateral sides.

Denticulated-notched tools are represented by two fragments with a conspicuous notch located in the distal part of one flint specimen, and at the transversal break of the other tool made from radiolarite.

The only perforator in the inventory is a blade specimen, made from radiolarite. The point is partially broken off.

A bipolar splintered piece which can be interpreted as an atypical Kostenki knife was shaped on a flint burin.

Other tools

The inventory of Tr–V contained three anvils. Two were rounded sandstone tiles, one was a fragment of a quartzite pebble with one polished side displaying traces of hammering, and with the edges shaped by striking.

Dyes

Four small lumps of hematite were present.

Trench Tr–III

Trench Tr–III covered an area of 13 sq m. Archaeological material appeared in layer 2, about 30 cm thick. The layer yielded 329 lithic artefacts, 13 small fragments of animal bones (unidentifiable) and six lumps of mineral dye. The lithics were not uniformly distributed, but were concentrated in three metres (C2, C3, D2). On average there were about 24 artefacts per 1 square metre.

Major technological groups

The most numerous category was flakes (62.9%) of which 25.8% were intact flakes. Blades were the second biggest category but much less numerous (19.1%). Retouched tools were rare (8.8%) and there were also some burin spalls (6.4%). Cores were the least numerous group (2.7%) (Table 4).

The examination of the raw material structure has shown that radiolarite is the dominant raw material (55.3%), although its proportion in the various technological groups varies. The second most important raw material is flint (28.9%). Other raw materials are less frequently represented: quartzite – 7.6%, silicified limestone – 5.1%, limnoquartzite – 2.4% and sporadically quartz – 0.6% (Table 6, 9).

Cores

There were 9 cores. Four were double-platform specimens. Two double-platform cores had common flaking surfaces, one had separate flaking surfaces and one was with twisted flaking surfaces. The platforms of these cores displayed traces of preparation. The four cores were residual or even strongly residual. Three were made from flint and one was a radiolarite specimen. One of the flint cores was strongly burnt. There were three single-platform cores on radiolarite pebbles representing the residual phase of reduction. One of them had been initially a double-platform core but it was subsequently reduced only from one prepared platform. Finally, there were two residual radiolarite cores with changed orientation which originally had been single-platform forms.

Blades and flakes

The inventory contained 63 blades of which 26 were intact specimens. Nearly half of the blades were made from radiolarite (36 specimens), 19 from flint, six were made from limnoquartzite and two from silicified limestone.

In the group of flakes (207 specimens – including flake fragments and chips) the overwhelming majority are radiolarite specimens (125) followed by flint (40), quartzite (25) silicified limestone (15) and quartz (2) flakes.

Retouched tools and production debris

Trench Tr–III yielded 29 retouched tools accounting for 8.8% of the inventory. The biggest group is burins (12 specimens), followed by retouched blades (6) and denticulated-notched tools (3). There were, in addition, two end-scrapers, two perforators, a Kostenki knife, a retouched flake, a combined tool, and a splintered piece. Backed forms were absent (Table 7).

The group of burins consisted of 6 single burins and 6 multiple burins. The single burins were: four dihedral specimens, a single-blow burin, and a strongly burnt fragment of an unidentifiable burin. Out of the six multiple burins five were double and one a triple specimen. Only two of these specimens were combined with other burin types, namely : a truncation burin and a burin-on-a-snap. The majority of burins were rejuvenated by repeated burin blows. Eight burins were made from flint and four from radiolarite (Pl. III.1, 2, 5, 6, 8, 9, 16).

Burin spalls account for 6.4% of the inventory. There were 12 primary burin spalls, almost all displaying traces of original edge retouch (11 specimens). In the group of 9 secondary burin spalls, five specimens showed edge retouch and four were without retouch. Most specimens were made from flint (17) and only four from radiolarite.

There were 6 retouched blades: three with bilateral retouch including one specimen with discontinuous retouch, 2 distal parts of retouched *lames appointées* and a burin spall with secondary flat retouch. Only one retouched blade was made from a limnoquartzite blank, the remaining were flint (Pl. III.3, 4, 12,14).

There were 2 end-scrapers from radiolarite: one was made on a narrow blade with discontinuous unilateral retouch and a rounded front, the other was made on a fragment of a robust blade, also with a rounded front (Pl. III.15).

Perforators are represented by a flint specimen with a well-distinguished long point located in the proximal part of the blade, and by an alternate perforator from radiolarite (Pl. III.7, 10).

A Kostenki knife was made from flint. It was shaped in the proximal part of a bilaterally retouched blade (Pl. III.13).

A combined tool, made from flint, was a truncation burin + a tool of *pièce de la Bertonne* type (Pl. III.11).

Two radiolarite flakes had denticulated retouch, and a fragment of a limnoquartzite blade had a proximal notch.

A retouched flake and a bipolar splintered piece, both from radiolarite, were also present.

Dyes

Six small lumps of hematite were found.

SEDIMENTOLOGICAL SEQUENCE AND ENVIRONMENTAL EVOLUTION

On the basis of profiles obtained from three sites that have been systematically explored in recent years in the region of Moravany (Lopata II, Žakovska) and at Banka, the following sequence of lithostratigraphic units and palaeoclimatic events can be proposed (HROMADA, KOZLOWSKI *ed.* 1995; KOZLOWSKI *ed.* 1998, PAWLIKOWSKI *et al.* 1998) (Fig. 6, Table 10):

A – the topmost portion of the loess series at Moravany-Žakovska (layers 2/1, 2/2 and 2/3): typical loess divided by a horizon of cracks – probably of periglacial origin - which cut layer 2/2. This loess contains about 14 to 20% of angular quartz grains. It does not contain biotite but moscovite (1.5 to 6.0%) and iron-manganese concretions (14–16%) are present. The main Epi-Gravettian level from Moravany-Žakovska is situated in the central part of this series (top of layer 2/3), dated at 18 100±350 years B.P. This archaeological level yielded charcoal of pine and yew tree which suggests that, in the region of Moravany at that time, mild and wet climatic condition favourable to the survival of yew could have locally existed.

B – the topmost portion of the loess series at Banka (unit 2 without the lower portion of this unit). The mineralogy and sedimentology of this layer is similar to those of the topmost portion of the loess series at Moravany-Žakovska which continues the series from Banka (or – possibly – partially corresponds to it?). This unit contains the Epigravettian level at Banka (Tr–III), which unfortunately has no absolute dating.

C – unit 2a from Banka and units *b* and *c* from Moravany-Lopata II. This sequence is built from eolian loess with increased content

of angular quartz (unit 2a at Banka), corresponding to the eolian sediment *c* at Moravany-Lopata. The same eolian loess fills in the ice-wedges that cut the interface between units *b* and *c* at Moravany-Lopata. At this site the upper Gravettian archaeological horizon is situated on this interface, but the absolute age of this horizon is probably younger than the C14 date of 24 100±800 years. Lower down, unit *b* – also eolian – covers the next surface with the older Gravettian horizon which is cut by the earlier generation of ice-wedges. This Gravettian horizon has been dated to 21 400±610 years.

D – the surface cut by the older generation ice-wedges, corresponding to the older Gravettian level, yielded at Moravany-Lopata modest malacological assemblages indicating the domination of forest and bushwood species. This means that the interface of units *b* and *c* at Moravany-Lopata corresponds to the brown soil in the profile from Banka (unit 3) and to the thin clayey layer – possibly the counterpart of the brown initial soil – in the profile at Moravany-Žakovska (unit 2/4). At Moravany-Žakovska this clayey layer revealed the presence of fauna with *Arianta arbustorum* and *Trichia hispida* which evidence a wet, open, poorly shaded habitat. A possibility that this fauna represents also unit 2/5 lower down cannot be excluded.

E – the series of laminated loess deposited in wetter but not extremely cold conditions. The malacofauna indicate an open habitat with a fairly large component of mesophilous, medium-moist species. At Banka this loess occurs as unit 4, at Lopata this is unit *a* (layer 5) and at Žakovska as unit 2/5,6. The top portion of this loess at Banka contains the upper Gravettian level (Tr–V), whereas the floor and the interface with the next series are associated with the lower Gravettian level (Tr–IV). Comparison of the malacofauna from Moravany-Lopata (layer 5) and Banka (unit 4) suggests that at Banka the conditions were drier but, at the same time, there were more bushes.

F – clayey loess designated as layer 5 at Banka, layer 4 at Lopata II, and layer 3 at Žakovska. These layers do not contain archaeological levels. The malacofauna consist mainly of mesophilous, medium-moist species indicating, generally, somewhat milder conditions and more shady habitats that those existing during the sedimentation of series E.

G – fossil soil registered at Banka as unit 6.

H – lower loess (layer 7 at Banka, 2,3 at Lopata) which also contains the malacofauna of predominantly mesophilous medium-moist species but with a component of species living in a forest and bushwood habitat.

I – interpleniglacial, or earlier, fossil soils (Lopata II, layer 1 and Žakovska layer 5).

The dating of series E is difficult as there are no radiocarbon determinations. Series E sedimentation was preceded by the settlement of the Gravettian horizon with shouldered points which also occurs in the initial phase of series E sedimentation. The dating of layer 9 at Willendorf II – the stratotype of this Gravettian horizon in the middle Danube basin – in the range from 23 180±120 to 24 910±150 (HAESAERTS *et al.* 1996, p. 34) demarcates the chronological framework for the horizon in which Gravettian levels at Banka (Tr–IV and Tr–V), at Moravany-Noviny and Moravany-Podkovica should be contained (BARTA 1965, 1980; AMBROŽ *et al.* 1952).

If we assume that series E corresponds to the period between 23–24 Kyr B.P., then series D would represent a warmer period from about 22 to 23 Kyr B.P. The occurrence of such a warm event has been suggested by K. Valoch (1989 p. 15) on the basis of dates obtained for layer 6 at the Kulna Cave in Moravia with forest and forest-steppe fauna (moose, auroch, stag, horse) and a small proportion (7%) of mammoth and reindeer.

The loess layers that form series F must have been deposited in the period between 25 to 27 Kyr, whereas the fossil soil G should correspond to the Stillfried B–Maisières interstadial in the period between 27 to 29 Kyr.

The synchronization we have proposed here does not take into account the correlation with the Nitra-Čerman site where the fossil soil of the brunozem type, dated at 24 400±640 years B.P., occurs below

the archaeological horizon with the shouldered point Gravettian which is dated at 22 860±400 years B.P. (BARTA 1965, 1980).

GRAVETTIAN/EPIGRAVETTIAN SEQUENCE

The earliest occupational event in the proposed sequence is the Gravettian horizon with shouldered points from Banka, Tr–IV, Moravany-Podkovica (AMBROŽ *et al.* 1951) and Moravany-Noviny (BARTA 1970). The chronostratigraphical position of this horizon is – both at Banka and at Moravany-Noviny – at the interface of series E and F, possibly in the top portion of series F. Unfortunately the precise position of artefacts from Moravany-Podkovica is not known.

The next settlement episode is the late phase of the shouldered points horizon when the "Kostenkian" features of this horizon gradually vanish in central Europe. With almost complete certainty we can ascribe to this occupational phase Tr–V at Banka and two levels from Moravany-Lopata.

Finally, the Epigravettian was recorded in Tr–III at Banka and at Moravany-Žakovska (Fig. 7).

Occupational events from the shouldered points horizon are represented by fairly large base camps with a large number of lithic artefacts. Undoubtedly, Moravany-Podkovica belongs among camps like this, yielding more than 15 tanged points (when the collections of Zotz and Absolon are taken into account). Banka Tr–IV is almost certainly a part of a base camp whose main area was destroyed by amateur excavations. The peripheral part we have explored covered an area of 14 sq.m. and yielded 458 stone artefacts. There, an assemblage of bones with the least useful parts of skeletons of reindeer, polar fox, hare, mammoth and Bos or bison, was discovered. The whole picture of the camp representing the shouldered points horizon cannot, unfortunately, be reconstructed.

The investigations at Moravany-Lopata have shown that the camps of the second occupational phase are medium size khshemenitsas (5 to 6 m in diametre) concentrating around hearths. In the earlier occupational phase at Moravany-Lopata the pit with bones of mammoth, reindeer and bear was located next to the hearth. The pit could have functioned as a storage pit. The camps in both horizons at Moravany-Lopata functioned as autumn-early winter "transitory" camps where the carcasses of hunted reindeer were divided, skins, also of fur-bearing animals (fox, hare, volveine), were treated, food and possibly, meat supplies for winter prepared. At such "transitory" camps some working of radiolarite and other raw materials was carried out and tool kits were replenished. The production of mineral dyes was also important.

Objects of art and with symbolic meaning occurred in both chronological horizons: at Moravany-Podkovica, a Venus figurine and ornamented bones were found, at Moravany-Lopata ornamented bone artefacts and bones with incised zoomorphic (?) ornaments.

The Epigravettian camps were relatively small khshemenistas (about 3 to 4 m in diametre) but were accompanied not by traces of well–delineated hearts but rather traces of fired ground observed next to light tent-type constructions. This indicates that the area was occupied for a short period of time and frequently revisited. The brief occupational events are registered in the summer-autumn season.

Within the sequence described above, the shouldered points horizon – the Late Gravettian with rare shouldered points – the Early Epigravettian of the Žakovska type - a number of changes, especially in lithic inventories, can be seen. These changes form a seriation whose most important element is the raw material structure.

During the first phase the dominant raw material is "northern" flint from the moraines of Upper and Opava Silesia. At Banka its proportion is as much as 87.8% (Tr–IV). At Moravany-Podkovica this proportion is probably similar but as the collection has been dispersed it cannot be precisely calculated. Besides flint, local radiolarites and small quantities of limnoquartzite originating probably from central Slovakia

(Žiarska Kotlina – KAMINSKA 1991, p. 20) are also present.

The phase of the Late Gravettian with occassional shouldered points shows a gradually decreasing proportion of "northern" flint: at Banka Tr–V it is 66%, in the lower horizon at Moravany-Lopata it is 38%,whereas in the upper horizon – 35%. At the same time, the zone of procurement of flint broadens and more flint sources are used. In the lower level at Moravany-Lopata well-identified Jurassic flint from the region of Kraków and "chocolate" flint from the Holy Cross Mts appear. The importance of local radiolarites grows from 27 to 37%. Moreover, chert from Moravia (Stranska skala type chert), Hungarian flint (Tevel type flint) and limnoquartzites from central Slovakia are recorded. Although the proportions of these raw materials are not large, they document the zones of contacts or penetration by population groups during the Late Gravettian phase in the region of Moravany and Banka.

In the Epigravettian the importance of "northern" flint becomes distinctly smaller: although at Banka, Tr–III its proportion is 28.5%, at Moravany-Žakovska it is already only 1,4% (these could have been objects, mainly tools, found by the Epigravettian population at the neighbouring Podkovica). The local radiolarite is in ascendancy present almost entirely as pebbles from the alluvia of the Vah. Extralocal raw materials during this settlement phase are only limnoquartzite from central Slovakia and a single polished object (a kind of cylindrical point with a conical tip interpreted as a "fire drill"). It was made from metamorphic quartz-pyroxene-chlorite shale – an exceptionally hard rock probably from the Sudety Mts. Siliceous psudomorph formed on a piece of fossil wood (?), composed predominantly of quartz with traces of illite and chlorite, used as a similar 'drill' was found without the context of other artefacts at Banka, Tr 7/79 (not far from Tr–III); like most Epigravettian artefacts, it was located in the top of layer 2.

Another seriation is the decreasing proportion of small flakes and chips which, at Banka, Tr–IV, are a dominant group (as much as 60%) but only about 30% at Moravany-Žakovska. This tendency can be accounted for by the growing intensity of reduction, transformation and tool rejuvenation in the assemblages that used primarily extralocal flints. These operations were less important in the phases when local radiolarites dominated and the proportion of cores and flakes from their preparation increased.

A seriation is also formed by the decrease in the proportion of burins in younger assemblages, notably from Moravany-Žakovska (1.1%). The domination of burins can clearly be seen in the shouldered points horizon when their proportion reaches as much 37.8% at Banka, Tr–IV. Subsequently, their proportion drops while that of end-scrapers and backed tools increases. The index of backed tools oscillates; this is not a chronological trend but the manifestation of changes in the function of the sites (rejuvenation and repair of hunting weapons).

When talking about the variability of the burin index, we should emphasize the relatively large proportion of burin spalls, especially in the assemblages belonging to the shouldered points horizon. This does not only indicate intensive rejuvenation of burins but generally increases the burin index (as a rule burin spalls do not form refits with burins). The rather sudden drastic change in the burins index between the Epigravettian at Banka, Tr–III and at Moravany-Žakovska (from about 30% to only 1.1%) suggests either an earlier than assumed chronological position of Banka, Tr–III or that essential changes took place in the activities performed at Moravany-Žakovska in comparison to Banka, Tr–III.

CHANGES IN ANNUAL TERRITORIES AND CORE RESIDENTIAL AREAS DURING THE GRAVETTIAN/ EPIGRAVETTIAN TRANSITION

Except for the radiolarite workshop at Nemšova (BARTA 1961) in the territory of western Slovakia there are no sites that can be ascribed to the typical Moravian Pavlovian or dated at between 29–24 Kyr B.P. We can conjecture that core residential areas of the Pavlovian did not comprise western Slovakia and that its eastern boundary line was at the Male Karpaty (Minor Carpathians) and the White Carpathians (KOZLOWSKI 1994).

The occurrence of large base camps that were inhabited not only in autumn but probably also in winter points to the shift of the core residential areas from Moravia to western Slovakia in the period of the shouldered points horizon (25–23 Kyr B.P.). These were camps where , in addition to evidence of the entire range of activities connected with food preparation and production and rejuvenation of tools, symbolic objects and objects of ceremonial character were recovered. In such camps the traditional systems of raw material procurement, which had developed in the Moravian Pavlovian and was based on the Silesian deposits of erratic flints, continued. In all likelihood, the penetration of the terrains in the Upper Oder basin took place in the summer season. The system of exploitation in an annual cycle covered, in a way similar to that used in the Pavlovian, the territories of western Slovakia, instead of Moravia, in the autumn-winter season, Upper Silesia and Opava Silesia in the spring-summer season (Fig. 8). At the end of the shouldered points horizon, at about 23 Kyr B.P., the first penetration of the Upper Vistula basin began. It is evidenced by the first Gravettian sites with shouldered points in the region of Kraków (Kraków-Spadzista sector C2, layer 6a, archaeological level III and Kraków-Spadzista sector B, layer 6a – KOZLOWSKI ed. 1996).

But the fauna hunted at the sites on the Vah and the fauna at the sites on the Upper Vistula differ distinctly. At the former sites, reindeer is the dominant species, at the latter it is mammoth. However, both on the Vah and on the upper Vistula, the second position belongs to fur-bearing animals, such as polar fox and wolf; and on the river Vah there was also hare. In the region of Krakow the shouldered points sites occur near mammoth bone accumulations. The origin of these bones could, at least partially, be natural (WOJTAL 1995). This phenomenon weakens, of course, arguments in favour of specialization of the Gravettian people on the upper Vistula in the hunting of mammoth. A similar problem is faced when we compare the fauna of the Moravian Pavlovian e.g. from Dolní Věstonice, with the fauna from western Slovakian sites. At Dolní Věstonice the large proportion of mammoth bones is connected with the presence of a bone depot ("skladki kosti"). But its nature and genesis have not been explained (SOFFER 1993, OLIVA 1997a, b).

The domination of reindeer in the fauna is also characteristic for the sites of the Late Gravettian horizon with rare shouldered points in the period from 22 to 21 Kyr B.P. During the same period the broadening of annual territories takes place. In the middle Vah basin "transitory" camps appear which use raw materials from the northern zone (Upper Oder and Upper Vistula basins), raw materials from the belt: from the Upper Dnester through central Slovakia to Moravia, and from the territory of Transdanubia. For this reason the more plausible model is that of seasonal exploitation of the territories north of the Carpathians during the summer (possibly the spring-summer season), the exploitation of the middle Vah basin in the autumn (possibly in the early winter with excursion to eastern Slovakia and even Dniester basin), and the shift in winter to the territories of middle Danube valley or even Transdanubia. This new system of territorial exploitation operated in the period when some hunters of the shouldered points horizon migrated to the territory of the Russian Lowland, giving rise to the Avdeevo-Kostenki culture (KOZLOWSKI 1998). In southern Poland, a gradual decrease in the diagnostic features of the shouldered points horizon at such sites, for example, the upper levels of the Kraków-Spadzista complex (sector C1 and C2, archaeological level II – KOZLOWSKI, SOBCZYK 1987), can be observed. The sites at Ostrava-Petrkovice also demonstrate this process in the period from 23 to 20 Kyr B.P. (JAROŠOVA *et al.* 1996).

The model presented above is an attempt at the interpretation of the relations between sites in the middle Vah basin, upper Oder and Vistula in terms of seasonal exploitation of each of these territories. This attempt does not, however, aspire to resolve all the complex questions such as the existence of sites used in winter in the Kraków-Spadzista complex (e.g. site F where teeth of polar fox hunted at the beginning of winter, were discovered – WEST 1996), or the occurrence of sites belonging to the shouldered points horizon in the Hornad basin (e.g. Hidasnémeti – SIMAN 1988). Moreover, the above model does not take into account the fact that contemporaneously with the end of the Pavlovian (about 25 Kyr B.P.) other

cultural units were present in Moravia (e.g. the Mediterranean Gravettian industries known from sector G at Milovce – OLIVA 1999). In the Middle Vah basin, too, Gravettian industries with leaf-points (Trencianske Bohuslavice – BARTA 1986) occur contemporaneously with the industries of the end of the shouldered points horizon.

Unquestionably the transition from the Gravettian to the Epigravettian on the middle Vah was connected with the replacement of the seasonal meridional shift by the exploitation of local raw materials during the whole year. Extralocal raw materials occur in very small quantities and very rarely. In addition, their deposit areas are arranged latitudinally. The presence of short term, smaller camps and accompanying light structures would suggest residential rather than logistic type mobility.

REFERENCES

AMBROŽ V., LOŽEK V., PROŠEK F., 1952,
Mladý pleistocén v okoli Moravan u Piešťan nad Vahem. *Anthropozoikum* I/1951, Praha, 53-142.

BAČA R., 1988,
Dejiny archeologického bádania v Moravanoch nad Váhom. (In:) *Vlastivedny spravodajca okresu Trnava. Hlochovec*, 27-43.

BARTA J., 1961,
K problematike paleolitu Bielych Karpát. *Slovenská Archeologia* 9, 1-2, 9-32.

BÁRTA J., 1965,
Slovensko v staršej a strednej dobe kamennej. Bratislava.

BARTA J., 1970,
Zur Problematik der gravetzeitlichen Besiedlung der Slovakei. *Slovenská Archeologia* 18, 207-215.

BARTA J., 1980,
Paleolit a mezolit. *Slovenská Archeologia* 28, 1, 119-136.

BARTA J., 1986,
Trenčanske Bohuslavice un habitat gravettien en Slovaquie occidentale. *L'Anthropologie* 93, 1.

HAESAERTS P., DAMBLON F., BACHNER M., TRNKA G., 1996,
Revised stratigraphy and chronology of the Willendorf II sequence, Lower Austria. *Archaeologia Austriaca* 80, 25-42.

HROMADA J., KOZLOWSKI J.K., ed., 1995,
Complex of Upper Palaeolithic sites near Moravany, Western Slovakia. Vol. I. Moravany-Žakovska, excavation 1991-1992. Kraków: Jagellonian University Press.

JAROŠOVA L., CÍLEK V., OCHES E., SNIESZKO Z., 1996,
Petřkovice excavation 1994-1995. (In:) *Paleolithic in the Middle Danube region. Brno.*

KAMINSKÁ L., 1991,
Vyznam surovinovej základne pre mladopaleolitickú spoločnosť vo východokarpatskej oblasti. *Slovenská Archaeológia* 39, 1-2, 7-58.

KAMINSKÁ L., KAZIOR B., KOZLOWSKI J.K., SOBCZYK K., PAWLIKOWSKI M., in press,
Výskum gravettienskej lokality v Banke v roku 1997. AVANS.

KOZLOWSKI J.K., 1994,
Le Paléolithique des Carpates occidentales. *Preistoria Alpina* 28, 2, 113-126.

KOZLOWSKI J.K., ed., 1996,
The Upper Palaeolithic Site Kraków-Spadzista, units D, E and F (excavations 1986-1989), *Folia Quaternaria* 67.

KOZLOWSKI J.K., ed., 1998,
Complex of Upper Palaeolithic sites near Moravany, Western Slovakia. Vol. II. Moravany-Lopata II, excavation 1993-1996. Kraków.

KOZLOWSKI J.K., SOBCZYK K., 1987,
The Upper Palaeolithic site Kraków-Spadzista street C2. Zeszyty Naukowe UJ. *Prace Archeologiczne* 42.

LIPECKI G., WOJTAL P., 1996,
Mammoth population from Cracow Spadzista Street (B) site. *Acta zoologica cracoviensia* 39, 1, 289-292.

OLIVA M., 1997a,
Pavlovienska sidliště u Předmosti. K otazce lovů mamutu v mladem paleolitu. *Časopis Moravského Muzea* 82, 3-64.

OLIVA M., 1997b,
O lidech a mamutech. K paleontologii moravského Gravettienu. *Archeologické Rozhledy* 49, 407-438.

OLIVA M., 1999,
L'industrie lithique de secteur G à Milovice (Moravie du sud). Le faciès "méridional" du Gravettien morave. (In:) *Le faciès leptolithique du Nord-Ouest Méditerranéen: milieu naturels et culturels*. Carcassonne, 139-150.

PAWLIKOWSKI M., ALEXANDROWICZ W.P., BANESZ L., HROMADA J., KOZLOWSKI J.K., SOBCZYK K, KAZIOR B., 1998,
Correlation between loess profiles on the basis of mineralogical, malacological and anthropogenic indicators: a case study from Moravany-Lopata, Western Slovakia. *Geoarchaeology* 13, 6, 565-594.

PROŠEK F., LOŽEK V., 1954,
Spraśovy profil v Bance u Piešťan Anthropozoikum III. Praha, 301-323.

SIMAN K., 1988,
Hidasnémeti – Upper Palaeolithic site in the Hernád valley, Northeast Hungary. *Acta Archaeologica Carpathica* 28, 5-24.

SOFFER O. 1993,
Upper Palaeolithic adaptations in Central and Eastern Europe and Man-mammoth interactions. (In:) *From Kostenki to Clovis*, New York: Plenum Press.

VALOCH K. 1989,
Osídlení a klimatické změny v poslední době lodové na Moravě. *Časopis Moravského Muzea* 74, 7-34.

WEST D., 1996,
Initial analysis of cementum annuli of fox teeth from Kraków-Spadzista. (in:) J.K. Kozlowski ed. The Upper Palaeolithic Site Kraków-Spadzista, units D, E and F (excavations 1986-1989), *Folia Quaternaria* 67, 35-37.

WOJTAL P., 1997,
The number of mammoths (Mammuthus primigenius/*Blumenbach*) at the site Cracow Spadzista. *Anthropozoologica* 25-26, 803-805.

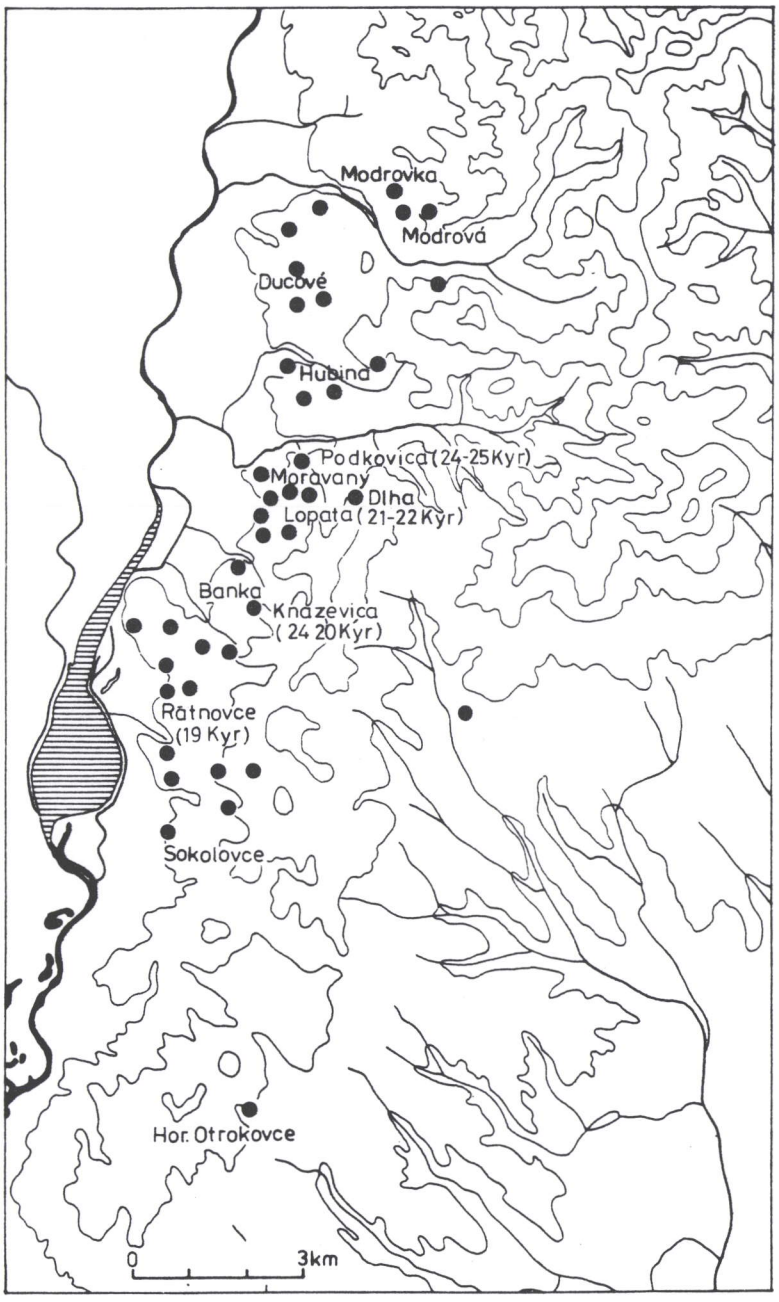


Fig. 1. More important Upper Palaeolithic sites in the region of Piešťany.

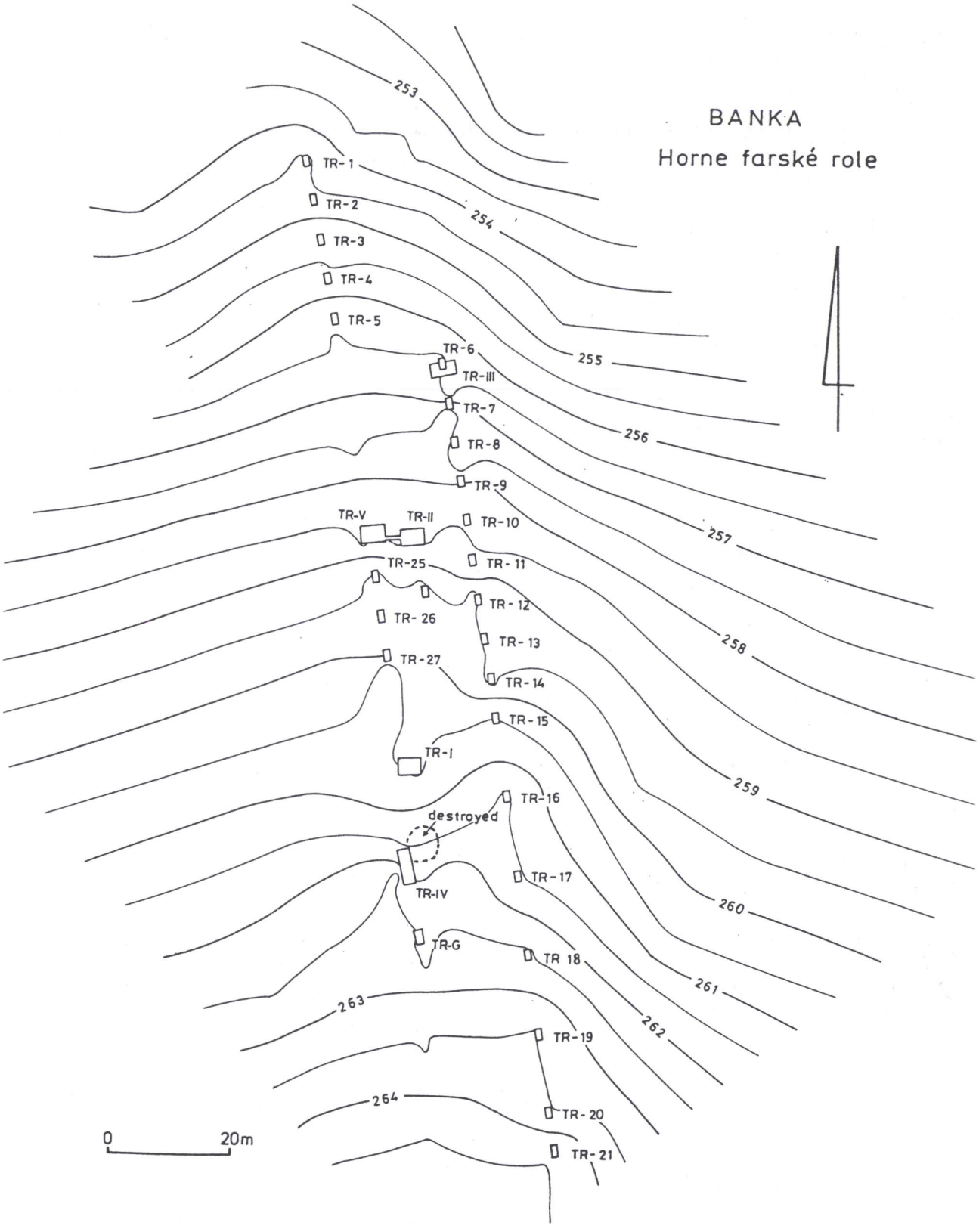


Fig. 2. Map of the Banka site with trial trenches (Tr-1–27), trenches (Tr-I–V) and geological trench (Tr-G).

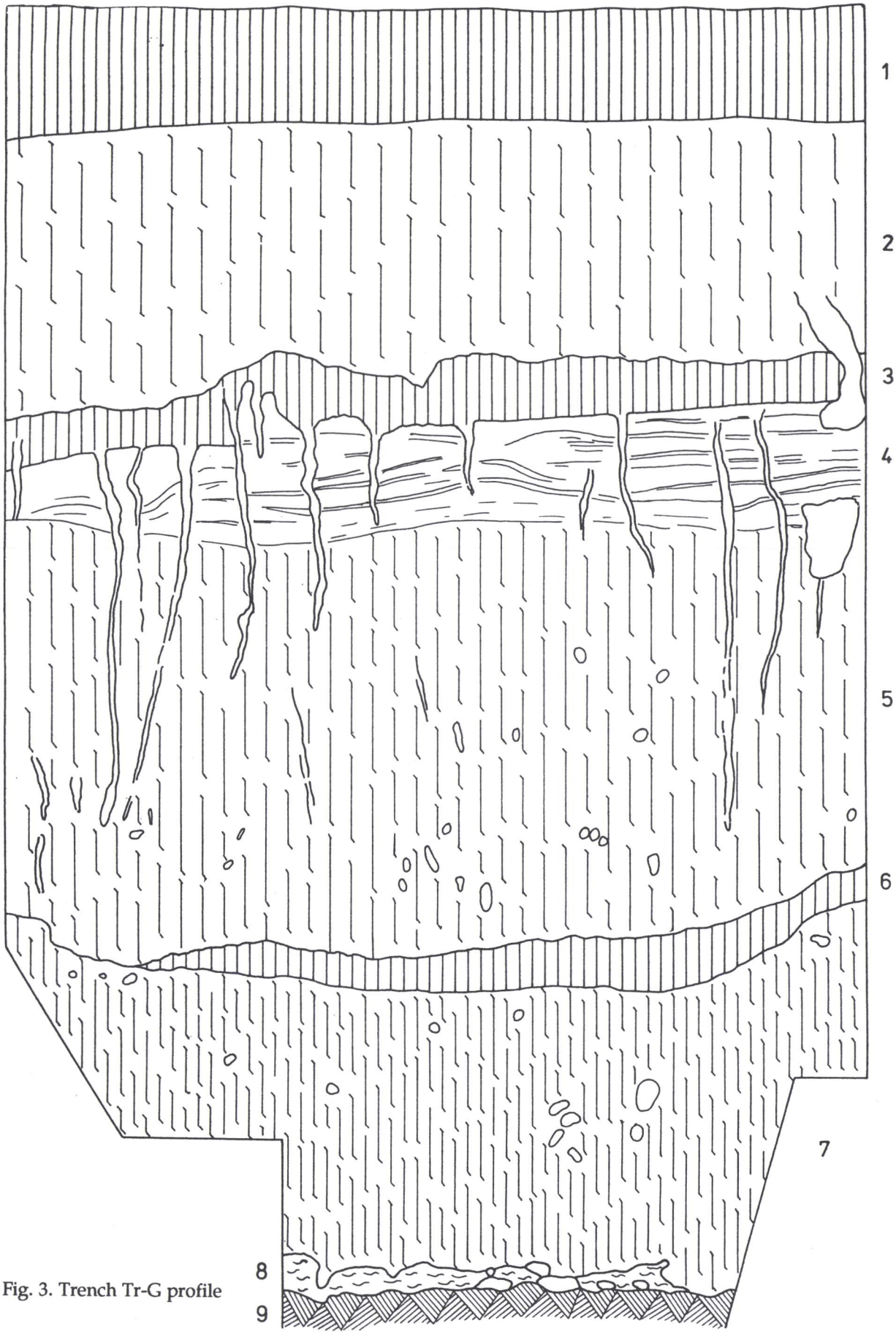


Fig. 3. Trench Tr-G profile

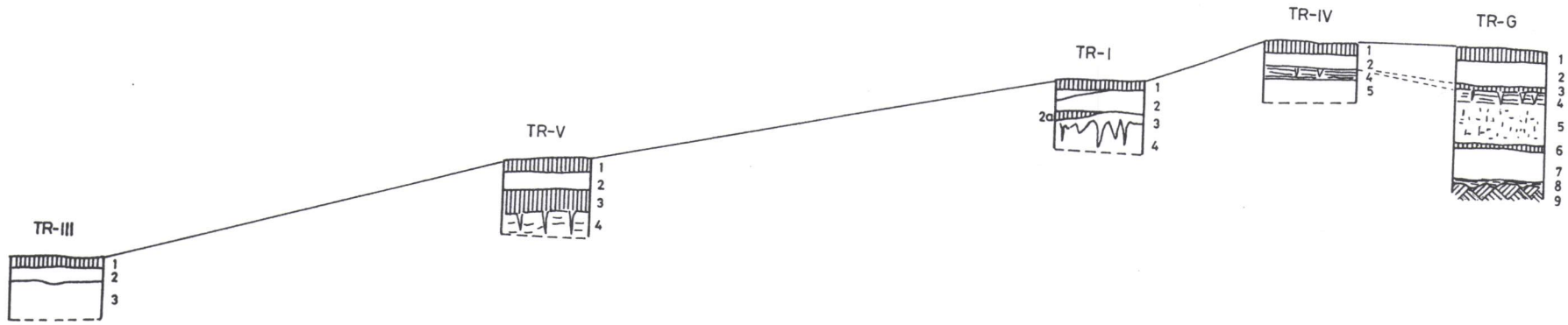


Fig. 4. Set of trench Tr-I–V and Tr-G profiles

Fig. 5. Bone concentration in trench Tr-IV

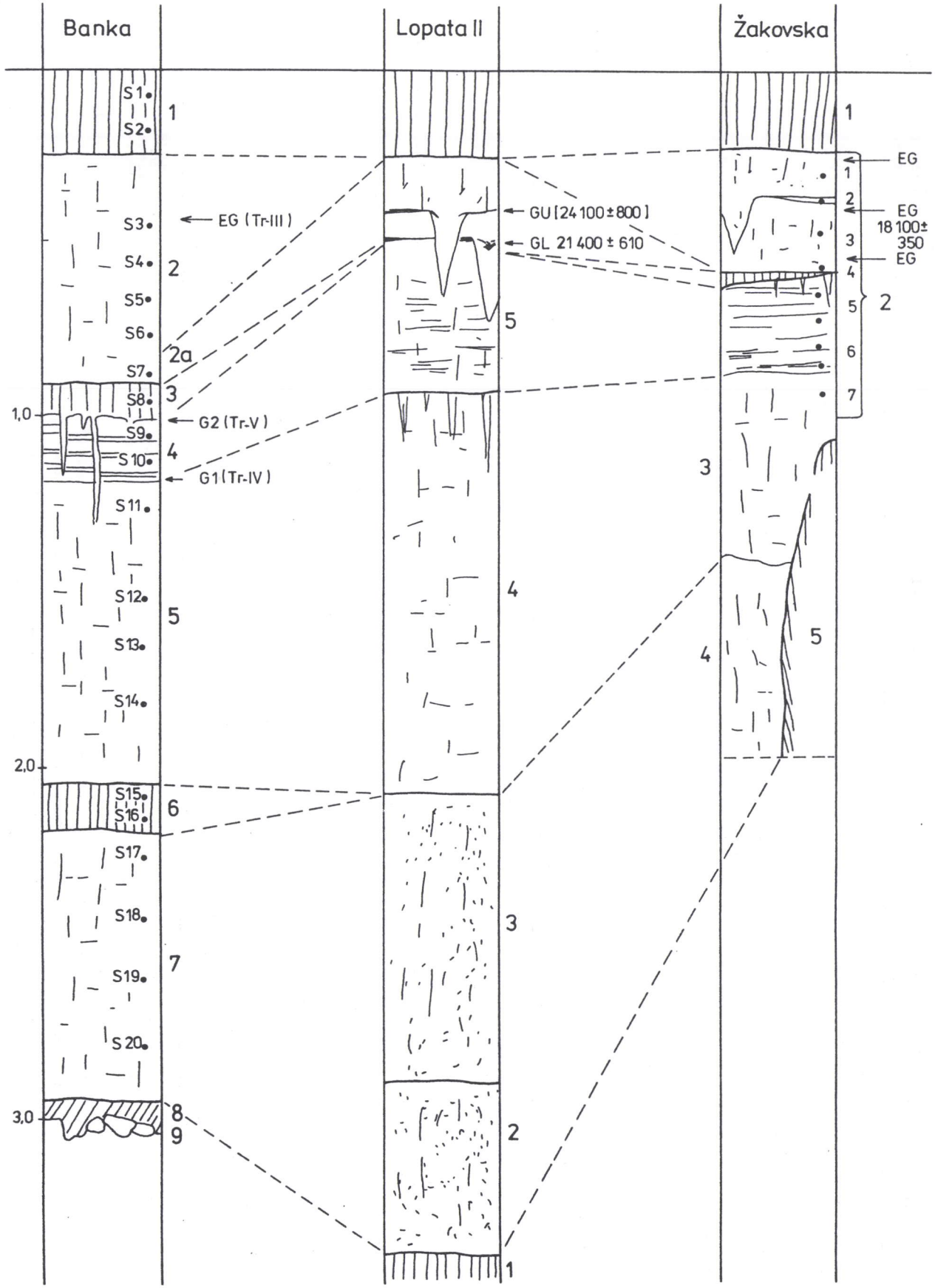


Fig. 6. Comparison of Banka, Moravany-Lopata II and Moravany-Zakŏvska stratigraphic sequences.

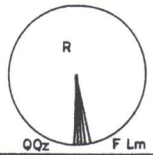
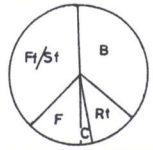
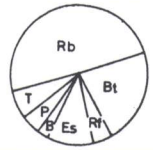
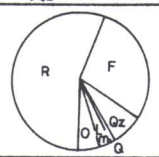
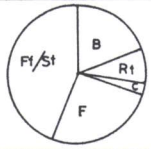
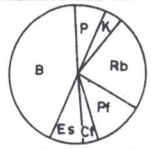
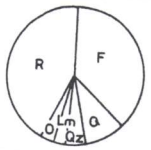
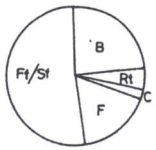
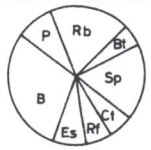
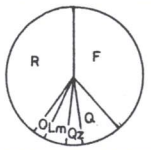
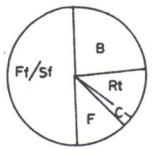
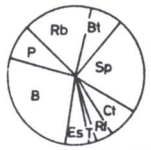
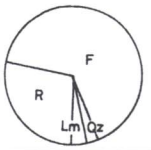
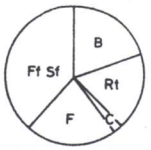
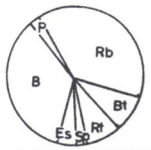
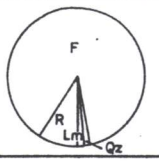
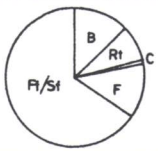
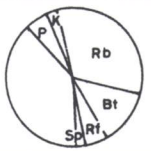
	Raw materials	Major technological groups	Major tool group	Fauna	Season	Nº artefacts (lithic)			Bone tools	Decorated objects	Surface m²
						Lithic	Ret.tools	Ground stone tools			
Žakovska				Mammoth Rangifer tarandus Capreolus capreolus Cervus elaphus Gulo gulo	15 VI-XII	330	26	-	-	-	13
Banka Eg					?	1485	192	9	-	-	49
Lopata II/L				Ursus arctos - 2+1 Canis lupus - 1 Vulpes vulpes - 1 Gulo gulo - 1 Mammoth - 1+1 Rangifer - 14+4	X - XII	2000	105 + 98*	3	3	-	~ 20
Lopata II/U				Vulpes vulpes - 1 Lepus sp. - 1 Equus sp. - 1 Rangifer tarandus - 10	X - XII	2213	191 + 123*	5	13	3	~ 36
Banka G2 (V)				Mammoth - 1	?	248	45	3	-	-	12
Banka G1 (IV)				Rangifer tarandus -4 Alopex lagopus -2 Lepus sp. -1 Bos/Bison -1 Mammoth -1 Corvus corax -1	VI - XII (?) (late fall/ early winter)	458	37	6	-	-	14
Podkovica	F > 70 %	Blades and tools	Burins Kostenki knives Shouldered points	?	?	Several thousands	>300	?	Several	Several and Venus figurine	?

Fig. 7. Sequence of Gravettian and Epigravettian occupations: R – radiolarite, F – flint, Lm – limnoquartzite, Q – quartz, Qz – quartzite, O – others, Ft/sf - flake fragments and small flakes, F – flakes, C – cores, B – blades, Rt – retouched tools, Rb – retouched blades, Bt – backed tools, B – burins, P – perforators, T – truncations, Es-end-scrapers, Rf – retouched flakes, K – kostenki knives, Ct – combined tools, Sp – splintered pieces.

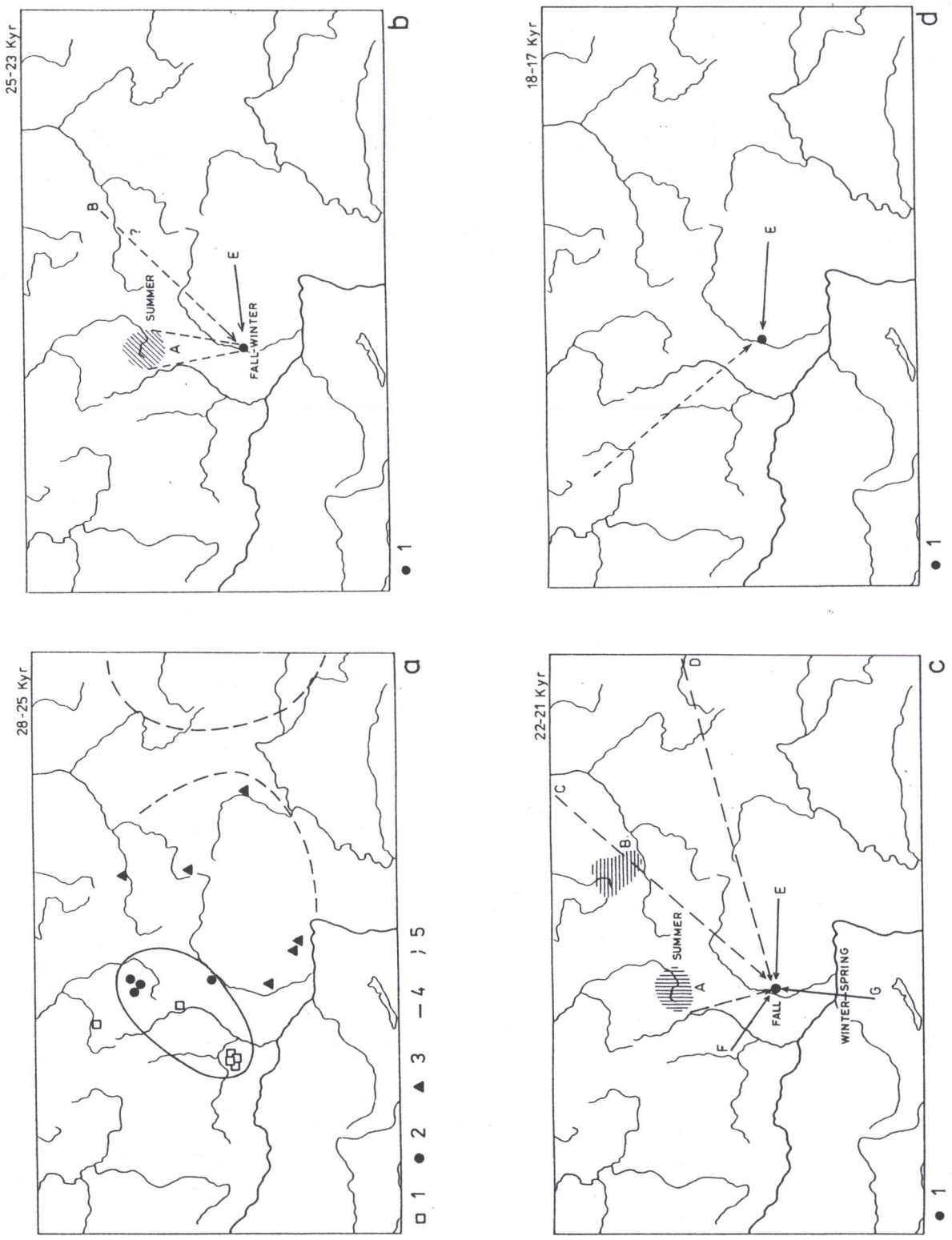
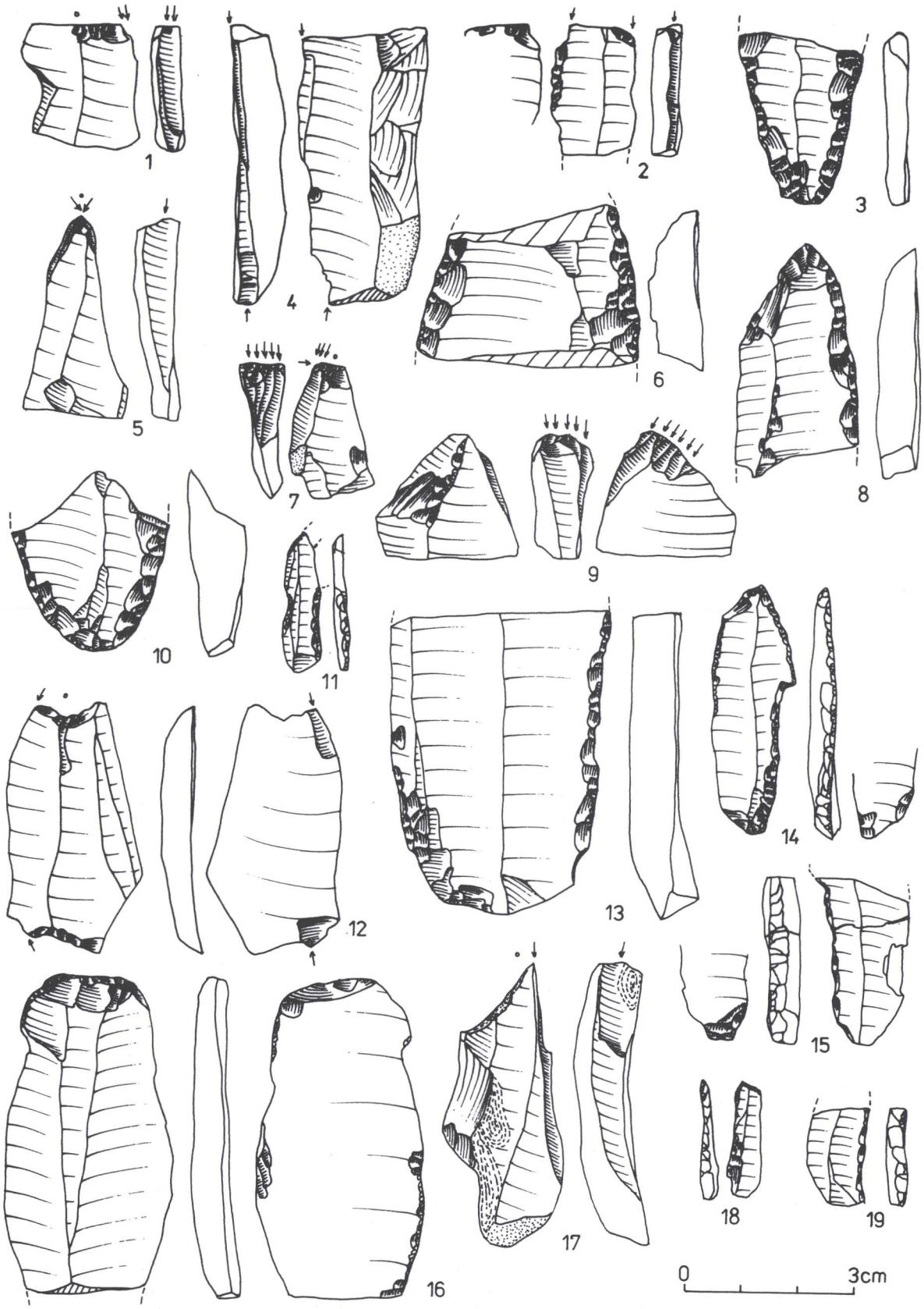
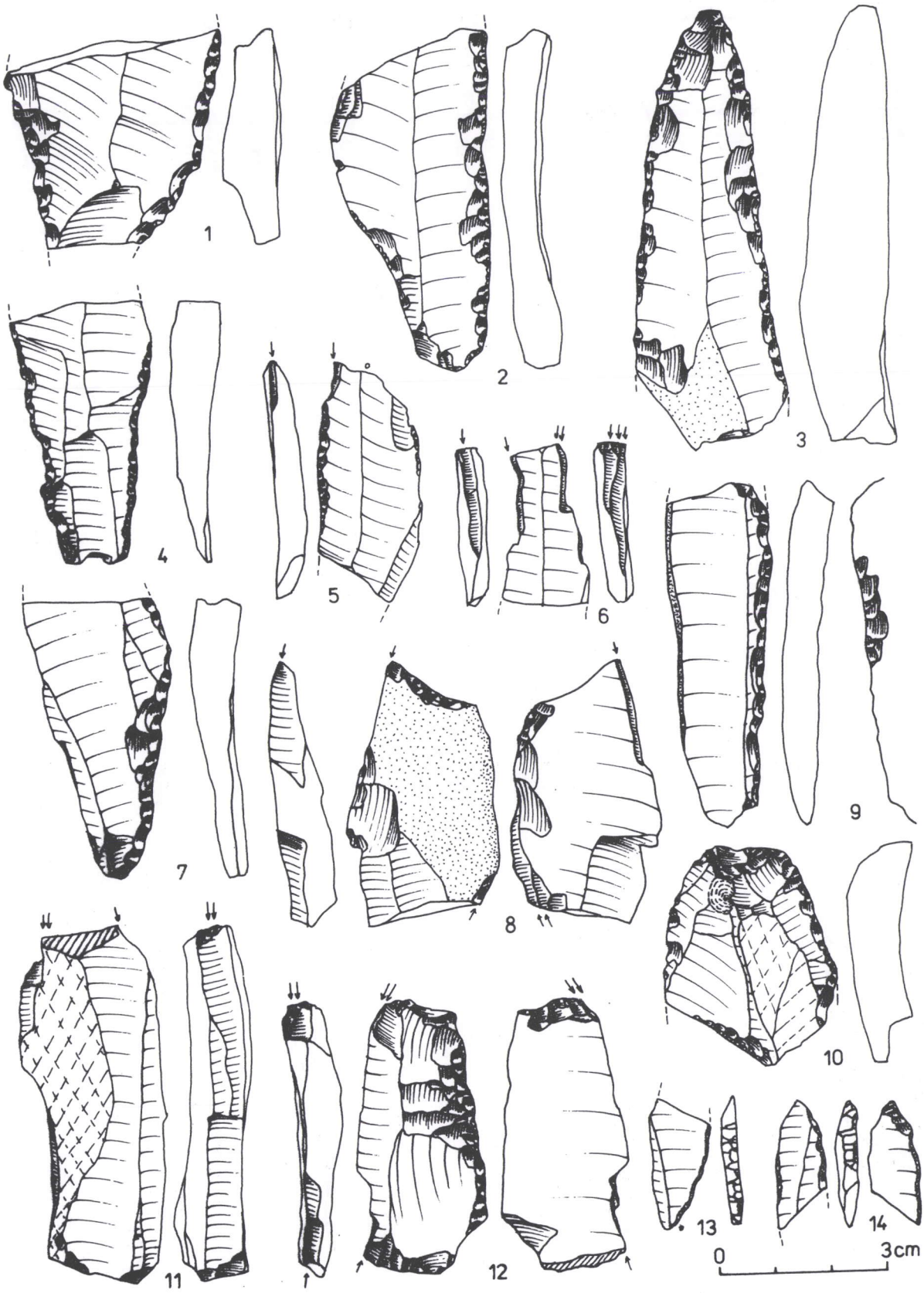


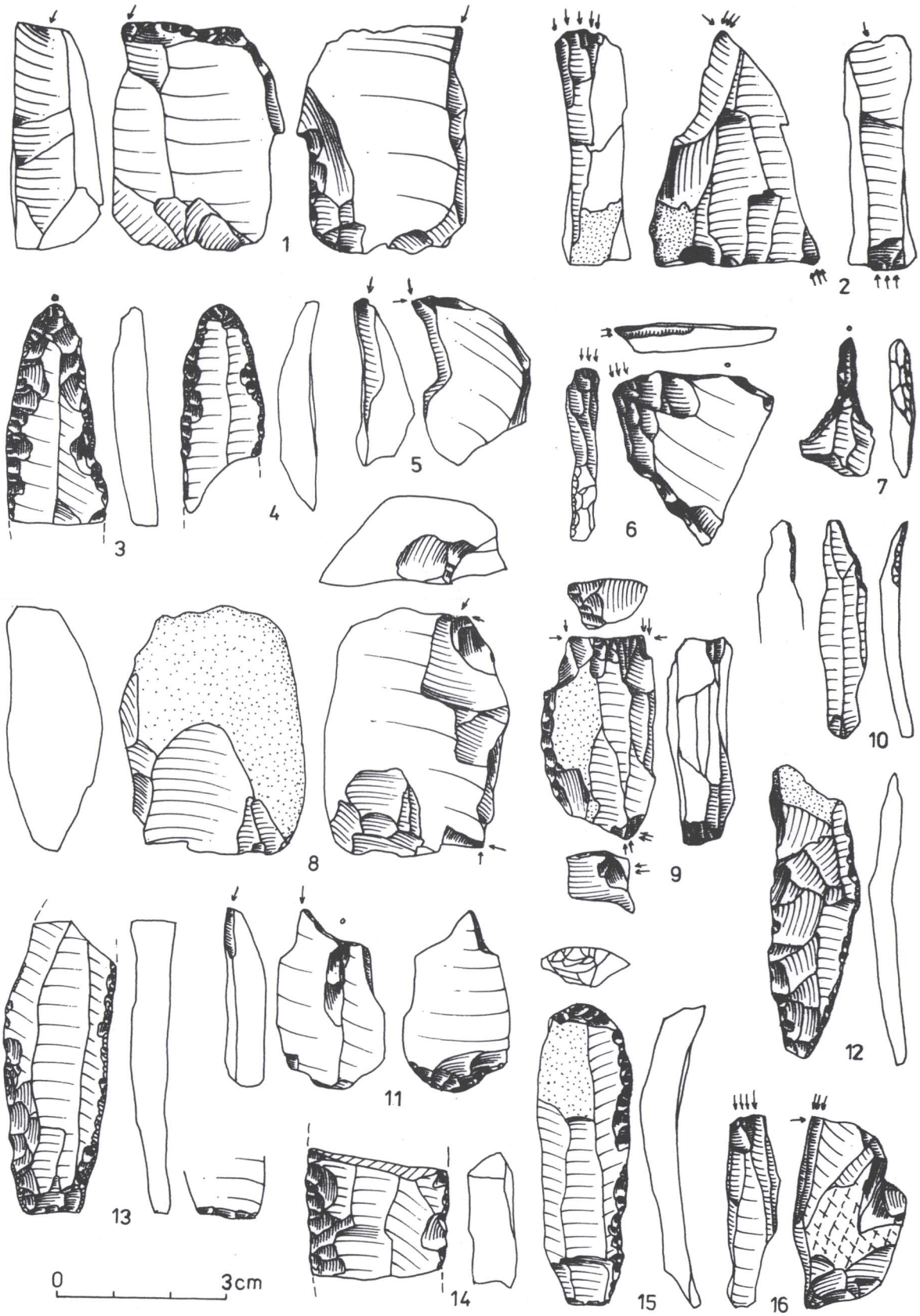
Fig. 8. Maps of the annual territories: a – 28-25 Kyr (Pavlovian), 1 – Pavlovian base camps, 2 – Pavlovian workshops, 3 – Pavlovian hunting camps, 4 – boundaries of the Pavlovian core territory, 5 – boundaries of the area exploited by Pavlovien hunters, b – 25-22 Kyr (shouldered point horizon), 1 – Moravany and Banka, A – Silesian flint outcrops, B – outcrops of Kraków Jurassic flint, E – limnoquartzites from outcrops in Central Slovakia, c – 22-21 Kyr (late shouldered point horizon), 1 – Moravany and Banka, A – Silesian flint outcrops, B – outcrops of Kraków Jurassic flint, C – chocolate flint, D – Dniester Cretaceous flint, E – limnoquartzites from outcrops in Central Slovakia, F – Moravian chert, G – Tevel flint, d – 18-17 Kyr (Epigravettian), 1 – Moravany-Banka, H – quartz-pyroxene-chlorite shale from the Sudety Mountains



Pl. I. Banka. Retouched tools from trench Tr-IV



Pl. II. Banka. Retouched tools from trench Tr-V



Pl. III. Banka. Retouched tools from trench Tr-III

Table 1. Malacological assemblages from Banka

E	Taxon	TR-I		TR-G									
		Layers		Layers									
		4	5	2	3	4		5			7		
				Samples									
				5	8	9	10	11	12	14	17	18	19
1	Discus ruderatus							I					
2	Semilimax kotulai	I	II										
2	Vitrea crystallina		I							I			
2	Arianta arbustorum	I	II			I			I		I		I
4	Granaria frumentum	I	II			I		I	I				
4	Chondrula tridens						I						
4	Cecilioides acicula	I	I										
5	Pupilla densegyrata		I			I	III						
5	Pupilla muscorum		I			II	III						
5	Pupilla loessica	II	III	I		II	III						
5	Vallonia tenuilabris	I	I							I			
7	Cochlicopa lubrica	I	I										
7	Limacidae		I										
7	Clausilia dubia	I	II			I				I			
7	Trichia hispida	II	II		I			I					
8	Succinea oblonga elongata	I	I			III	II	I				I	

Table 2.

Lithostratigraphic units	Trench TR-G („latent" levels*)	Cultural layers in trenches		
		Trench TR-III	Trench TR-V	Trench TR-IV
Top 2	+	2	-	-
Bottom 2				
Interface 2/3	+	-	-	-
3	Fire (?)	-	-	-
¾	-	-	Top 4 and 3/4	-
4/5	Top 5	-	-	Top 5 and interface 4/5
6	+	-	-	
Bottom 7	Fire (?)	-	-	

* based on anthropogenic indicators in microfraction

Table 3. Fauna species and their numbers at Banka-Kopanica

TAXON	Unit S IV NISP	MNI	Unit S V NISP	MNI
Rangifer tarandus	168	4	-	-
Alopex lagopus	6	2	-	-
Lepus sp.	4	1	-	-
?Bos seu Bison	1	1	-	-
Mammuthus primigenius	4	1	1	1
Corvus corax	1	1	-	-
TOTAL NISP			185	

Table 4. Banka. Major technological groups in trenches III-V

Trench	Cores		Blades		Flakes		Flake fragments and chips		Tools		Burin spalls		Total
	no	%	no	%	no	%	no	%	no	%	No	%	
TR-IV	1	0.2	58	12.7	61	13.3	279	60.9	37	8.1	22	4.8	458
TR-V	5	2.0	49	19.8	53	21.4	83	33.5	45	18.1	13	5.2	248
TR-III	9	2.7	63	19.1	85	25.8	122	37.1	29	8.8	21	6.4	329

Table 5. Banka, trench TR-IV. . Major technological groups and raw material structure

Technological group	SP	R	LQP	QZ	LS	Total
Cores		1				1
Blades	52	6				58
Flakes	45	10	2	3	1	61
Flake fragments and chips	251	19	5	2	2	279
Tools	33	4				37
Burin spalls	21	1				22
Total	402	41	7	5	3	458

Table 6. Banka. Raw material structure in assemblages from trenches III-V

Trench	SP		R		LQ		LQP		Q		QZ		LS		B		Total
	No	%	No	%	no	%	no	%	no	%	no	%	no	%	no	%	
TR-IV	402	87.8	41	8.9	-	-	7	1.5	-	-	5	1.1	3	0.6	-	-	458
TR-V	164	66.1	69	27.8	-	-	9	3.6	-	-	6	2.4	-	-	-	-	248
TR-III	93	28.3	182	55.3	1	0.3	7	2.1	2	0.6	25	7.6	17	5.1	2	0.6	329

Table 7. Banka. Tool categories in trenches III-V

Trench	End-scra-pers	Burins	Perfo-rators	Kos-tenki knives	Retou-ched blades	Backed blades	Pointe à cran	Retou-ched flakes	Notched – denticula-te tools	Com-bined tools	Splin-tered pieces	Total
TR-IV	-	14	2	1	12	4	1	1	1	-	1	37
TR-V	2	16	1	-	17	4	-	2	2	-	1	45
TR-III	2	12	2	1	6	-	-	1	3	1	1	29

Table 8. Table 4. Banka, trench TR-V. Major technological groups and raw material structure

Technological group	SP	R	LQP	QZ	Total
Cores	1	3		1	5
Blades	32	13	4		49
Flakes	28	18	4	3	53
Flake fragments and chips	55	25	1	2	83
Tools	37	8			45
Burin spalls	11	2			13
Total	164	69	9	6	248

Table 9. Banka, trench TR-III. Major technological groups and raw material structure

Technological group	SP	R	LQP	Q	QZ	LS	B	Total
Cores	2	7					1	9
Blades	19	36	6			2		63
Flakes	4	56		1	15	9		85
Flake fragments and chips	36	69		1	10	6		122
Tools	15	10	1	1			1	29
Burin spalls	17	4						21
Total	93	182	7	3	25	17	2	329

Table. 10. Stratigraphy and environment of archeological sites in the Moravany-Banka area

B A N K A		MORAVANY-LOPATA II		MORAVANY-ŽAKOVSKA		Lithostratigra-phic sequence	Cultural complex
Lithology and archaeology	malacofauna	Lithology and archaeology	malacofauna	Lithology and archaeology	malacofauna		
Layer 1		Holocene soil		Layer 1			-
				2/1 Epigravettian 1 Layers 2/2 Epigravettian 2 2/3 Epigravettian 3	(18100±350)	A 17-18,5 Kyr	Epigravettian
Layer 2 Epigravettian (Tr-III)		-		-		B 18,5-20 Kyr	Epigravettian
Layer 2a		Unit C Upper ice-wedges Upper cultural level Unit B Lower ice-wedges	(24100±800)	-		C 20-21 Kyr	Late Gravettian with rare shouldered points
		Lower cultural level (21400±610)	forest and bush species				
Layer 3				Layer 2/4	wet, open, poorly shaded	D 22-23 Kyr	
Cultural level Tr-V							
Layer 4	cold, medium dry, poorly shaded	Unit A (block excavation) Layer 5 (geological trench)	steppe and mesophilous medium moist habitats	Layer 2/5 Layer 2/6		E 22-23 Kyr	Gravettian: shouldered point horizon
Cultural level Tr-IV							
Layer 5	mild, more shaded habitats	Layer 4	steppe, open and mesophi-lous medium moist habitats	Layer 3		F 23-24 Kyr	
Layer 6		-		-		G 25-26 Kyr	-
Layer 7		Layers 2, 3	forest and bushwood, steppe and mesophilous species	Layer 4		H 25-26 Kyr	
-		Layer 1		Layer 5			
Layers 8, 9		-		-			