

THE ROLE OF CAVE SITES AND THEIR CHRONOSTRATIGRAPHY IN THE RESEARCH OF THE PALEOLITHIC OF HUNGARY

Dr. Árpád Ringer

Cave sites have played a particular role in the history of research on the Paleolithic in Hungary and the archaeo-, bio- and lithostratigraphical-chronological data of Upper Pleistocene sediments studied in them were also used in equally interesting ways.

This particular role may be illustrated by the fact that between 1906 and 1938 Hungarian Paleolithic research concentrated — with some exceptions — almost exclusively on cave excavations. The balance was slowly regained between 1938 and 1959 and over the period from 1959 to the present day the situation is the very opposite of the first stage: open-air sites are much better studied than those in caves.

The original archaeostratigraphy of the cave deposits of Hungary was based upon the French typochronology early this century and in general it is still correct.

The French school is still followed in many respects, but the name of cultures is rightfully no longer exclusive. Our Paleolithic research has become 'Central European' over the decades and recognises its own range of issues. At the same time, it has retained and even developed further the links with international investigations first established in 1907 (for instance, GÁBORI, 1976; GÁBORI—CSÁNK, 1968, 1986; RINGER, 1983; T. DOBOSI, 1983; VÉRTES, 1964).

In biostratigraphy the faunal phases described by M. Kretzoi (KRETZOI—VÉRTES, 1965) and D. Jánossy (JÁNOSSY, 1979), primarily built on small mammal successions or — using J. Chalin's terminology — climatozones are important elements in the divisions of the Upper Pleistocene in Hungary and in European distant correlations. The results of Hungarian Quaternary research are internationally known and respected.

The same does not apply to the lithostratigraphical-chronological divisions of cave deposits. In Hungary, the investigations of loesses and other subaerial sediments have a long history and the results are internationally acknowledged (PÉCSI

ed. 1985), however, the study of cave deposits was given less importance in Quaternary research.

But, as the history of Paleolithic excavations in caves suggest, as early as the period between 1906 and 1938 the base profiles from caves were known and studied in an interdisciplinary approach (as we would say now) and the same profiles could be the references for a cave chronostratigraphy through modern interpretation, oxygen isotopic dating (KORDOS—RINGER, 1986) and correlations with Hungarian loesses (PÉCSI—RINGER, 1987; RINGER, 1987).

In the 1950s and even up to the second half of the 1960s the results achieved were promising (VÉRTES, 1959, 1965).

Regrettably, since the late 1960s, when Western European polyphase Upper Pleistocene chronology had just been established (LABEYRIE, 1984), the data collected about cave deposits before that time has remained without further research and virtually unutilised.

Today with the spreading paleoecological approach in the ever widening Paleolithic research, the historical study of the relationships between prehistoric man and the paleoenvironment has become the leading consideration, and the mentioned archaeo-, bio- and lithostratigraphy of the Hungarian Pleistocene needs ever closer correlation, refinement and detailed paleoecological investigations with international comparisons.

In the present paper, written on the 50th anniversary of the end of the first stage in cave excavations in Hungary, the changes of the complex Upper Pleistocene chronology of cave deposits and its contribution to the modern, paleohumanecological trend of Hungarian prehistoric research are described.

In the light of the complex nature of this topic, only the benchmark achievements and historical science issues which pointed towards the present polyphasal division of the Upper Pleistocene are dealt with in the following.



Fig. 1. Geographical location of caves investigated from archaeological point of view. **BÜKK MOUNTAINS:** 1. Subalyuk Cave, 2. Bűdöspeszt Cave, 3. Szeleta Cave, 4. Lambrecht Cave, 5. Háromkúti Cave, 6. Herman Cave, 7. Istállóskő Cave, 8. Peskő Cave. **TRANSDANUBIA:** 9. Jankovich Cave, 10. Szelim Cave, 11. Pilisszántó Rock Shelter No. 1., 12. Bivac Cave, 13. Remete Cave, 14. Remete-Felső Cave. (Gábori, 1977).

Landmarks in the research of cave Paleolithic and sediments in Hungary 1906–1938

Regular Paleolithic research in Hungary began in 1906 with excavations in the caves of the Bükk Mountains. Some years later work started in the caves of the Transdanubian (Buda, Pilis and Gerecse) Mountains (Fig. 1).

The work done before 1938 was impressive, excavations were carried out in the fill of almost all the important caves of the country.

The leaders of the excavations were originally geologists, paleontologists and anthropologists. In their activities they followed the French Paleolithic research system and for chronology they initially held equivocally monoglacial views.

Archaeostratigraphy. In the old cave excavations the majority of finds consisted of leaf tools, considered uniform by researchers and dated after the French model to Solutrén. Its evolution was subdivided into four phases (HILLEBRAND, 1935; KADIĆ, 1934).

This complex of finds is subdivided into two cultures today, primarily by eponym localities: the Bükk-Szeletian and the Jankovichian of Transdanubia (Fig. 1 — localities 3 and 9 — GÁBORI, 1977, 1984; GÁBORI—CSÁNK, 1973, 1983, 1986; RINGER, 1987, 1988).

With in the leaf-tool complex, often from the same layers finds classified as Aurignacian were recovered, primarily from the Istállóskő and Peskő Caves of the Bükk Mountains (Fig. 2 — localities 7 and 8 — HILLEBRAND, 1935; KADIĆ, 1934). Naturally, over the years, the interpretation of the Aurignacien of Hungary has changed several times (VÉRTES, 1965; GÁBORI, 1977, 1984). This assemblage of remains was the first dated by C^{14} method at 30,000 to 40,000 years BP (VÉRTES, 1965).

The remnants of the cultures older than the Aurignacien, the Moustérien, and the younger Magdalénien were first found in the Kiskevély and

Szelim caves of the Transdanubian Range, which are more diverse in Paleolithic cultures than the Bükk, and from the classic Pilisszántó rock shelter (Fig. 1 — localities 10 and 11 — HILLEBRAND, 1935; KADIĆ, 1934). In the present evaluation of these cultures there are also many new aspects (GÁBORI, 1984; T. DOBOSI et al. 1983).

These results allowed the adaptation of the Western European Moustérien-Aurignacien-Solutrén-Magdalénien typochronology to Hungary and to build upon it a comparative complex bio- and lithostratigraphy.

Until 1932 a problem was presented in the systematisation and dating of Paleolithic cave cultures: the poverty of Moustérien caves compared to their abundance in Western Europe. In 1932, however, in superposition in the Subalyuk cave of the Bükk Mountains (Fig. 1 — locality 1) the long missing 'warm' and 'cold' Moustérien were found — in not less than 14 layers in continuous sequence. The first was dated to the last interglacial, while the latter to around the cold maximum of the last glacial (BARTUCZ et al. 1938).

Thus, the cave deposit sequence of the Upper Pleistocene (as interpreted today: Emiliani stages 5e to 2) became more diverse and lent itself for finer subdivisions.

Biostratigraphy. In vertebrate paleontology the most outstanding figure of this period was M. Mottl. A paleontologist and archeologist, who published in the Subalyuk monograph a table of the synthesis of chronostratigraphy for the subdivision of the Hungarian Pleistocene as known in her day, using the paleobotanical data by F. Hollendonner (MOTTL, 1938).

Then Mottl approached the polyglacial concept. She placed the 'Pleistocene stage' after the Preglacial of mediterranean climate and subdivided it into four substages.

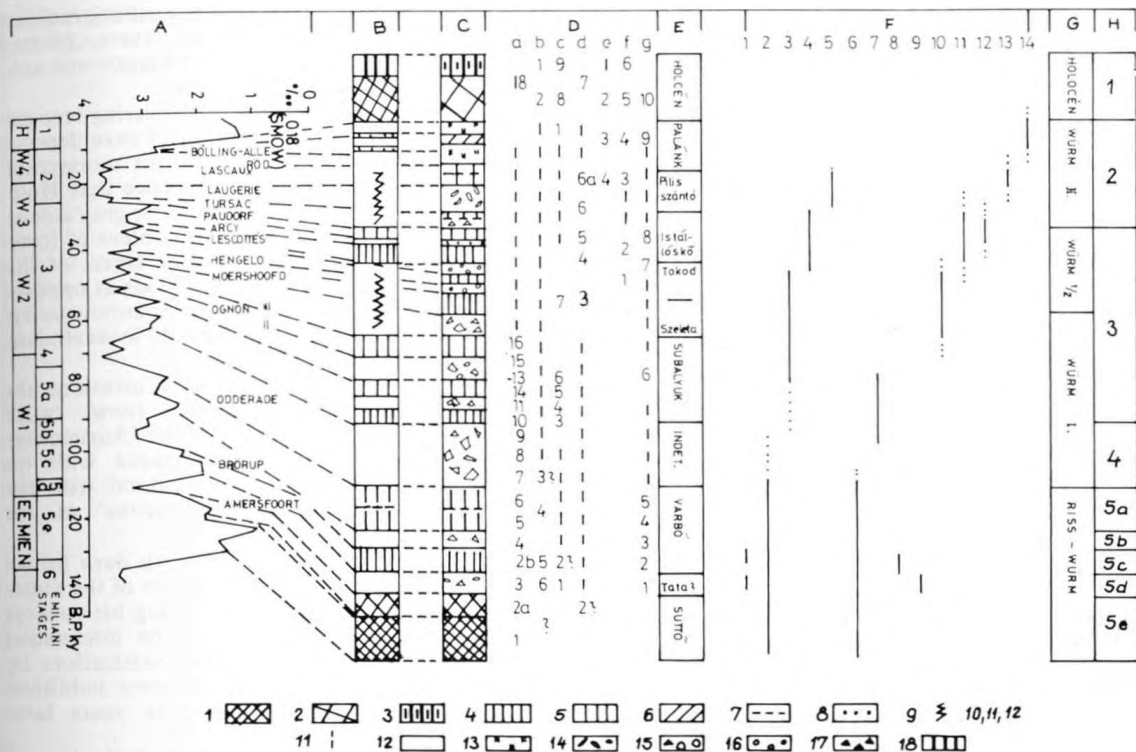


Fig. 2. Chronostratigraphy of the Upper Pleistocene of Northeastern Hungary.

I. Units of the table. A. Paleoclimatic curve for the last 140,000 years by J. Labeyrie (LABEYRIE, 1984); B. Stratigraphy for subaerial loesses; C. Cave stratigraphy; D. Cave deposits: a) Subalyuk Cave, b) Lambricht Cave, c) Büdöspet Cave, d) Szeleta Cave, e) Puskaporos Rock Shelter, f) Peskő Cave, g) sequence of the Diósgyőr-Tapolca Cave foreland; E. fauna stages and climatozones by M. Kretzoi and D. Jánossy (modified after JÁNOSY, 1979); F. Paleolithic cultures: 1. Bábonyian in cave, 2. Bábonyian, open-air, 3. Early Szeletian, 4. Developed Szeletian, 5. Szeletian-solutroide, 6. Central European typical Moustérien, levallois débitage, rich in scrapers, 7. Bükk Charentien, 8. Bükk Taubachien in cave, 9. Bükk Taubachien open-air, 10. Bükk Aurignacien I, 11. Bükk Aurignacien II, 12. Aurignaco-Gravettien of Bodrogkeresztúr type, 13. Gravettien, 14. Pilisszántói; G. The classic chronological subdivision of the Upper Pleistocene in Hungary (after KADIC and MOTT, 1938); H. Emiliani's stages.

II. Legend to the table. 1 = brown forest soil and its sediment in caves, 2 = brown rendzina, 3 = black rendzina, 4 = paleosol or soil sediment of interstadial character, well developed, 5 = the same, poorly developed, 6 = paleosols or soil sediments of Late Weichselian moderate oscillations, 7 = double paleosols or soil sediments, 8 = travertine precipitation, 9 = unknown series, 10 = number of layers, 11 — unconformity, 12 = subaerial loess, 13 = cave loess, 14 = limestone bed cryofraction in cave loess, 15 = limestone blocks and debris in cave loess, 16 = limestone gravels in cave loess, 17 = small limestone debris in cave loess, 18 = Holocene chernozem soil.

In her opinion the Early Glacial substage ends with the Riss-Würm interglacial, represented by the layers of lower 'Hochmoustérien' (layers 1 to 3) and part of the upper 'Spätmoustérien' (layers 7 to 10). The fauna and flora consist of forest species, among them mediterranean elements.

At the end of the substage a temporary cold spell was identified on the basis of layers 11 to 14 in the 'Spätmoustérien' of the Subalyuk cave. In this fauna steppe species also occur and broadleaved trees are replaced by conifers in the forest vegetation.

The Pleniglacial substage with Aurignacien and Solutréen cultures, after the Early Glacial substage correlated with the Moustérien, is characterised by typical glacial fauna and flora. The coldest glacial, with arctic fauna (lemmings) and the dominance of *Pinus montana*, however, is only represented by the next, Late Glacial substage with Magdalénien I culture. Finally, the first half of the Postglacial substage has Magdalénien II culture.

Mottl also attempted to adapt Alpine chronology. After Penck and Brückner, she assumed a bipartite

Würm after the Riss-Würm interglacial and subdivided the former by the Würm I—Würm II interstadial, associated with the Aurignac culture.

Mottl's paleoclimatological-paleoecological Upper Pleistocene periodisation is only based on the study of macroscopic finds, collected without washing. Therefore, she could not follow the changes from layer to layer. Her works indicate that the Upper Pleistocene as we understand it today would be undividable except by the Riss-Würm optimum, the first and the last cold minimum of the Würm and the interstadial between them.

Her influential mistake was the extension of the last interglacial at the expense of the Würm. Thus the Hungarian Würm 1/2 interstadial took the place of the Würm 2/3 interstadial of the classic Western European Upper Pleistocene chronology.

Lithostratigraphy. The recognition of stratigraphical divisions in the Upper Pleistocene cave sediment sequences of Hungary was undertaken by the geologist-archaeologist O. Kadić (KADIĆ, 1915, 1934, 1938). Kadić's system was completed by the publication of the monograph on the Subalyuk locality.

I. Riss-Würm interglacial, Early Glacial fauna horizon. Its deposits are red or brown plastic cave clays with little limestone debris. The stratotype is layers 1—6 in the Subalyuk cave, i.e. the last interglacial in the broader sense (KORDOS—RINGER, 1986) or Emiliani's stage 5e to 5a (Fig. 2 C, D, G and H).

II. Pleniglacial fauna horizon. Cave clays of various colour (light or dark brown, dark gray, greenish gray etc.), with limestone debris, blocks or gravels are typical. This stage coincides today with Emiliani's stages 4 and 3 (Fig. 2 C, G and H).

III—IV. Late Glacial and Postglacial fauna horizon. Both are characterised by fills of lithostratigraphically analogous character: "yellow loess-like layer, partly pure, partly mixed with limestone debris" (KADIĆ, 1934, p. 20). Their age corresponds to Emiliani's stage 2 (Fig. 2 C, G and H).

For the further subdivisions within the three major lithostratigraphical units, Kadić collected large amounts of well-interpretable data.

His observations are especially valuable related to phase II concerning the colour of the layers, the amount and nature of the incorporated limestone debris, the wearing of bones found in the layers, the dip of strata and other factor allowing distinction and description.

Kadić's name is also associated with the initiation of the geochemical analyses of cave sediments (BARTUCZ et al. 1938, pp. 31—34). This method only became general in international practice in the 1960s and 1970s.

Kadić and Mottl virtually agreed in the subdivision of the Upper Pleistocene in its broader sense and for the major units — with the exception of the upper boundary of the Riss-Würm. However, Mottl was forced to draw layers together because of her fauna collection without washing, whilst Kadić,

with meticulous documentation, lithostratigraphical identification and typification of layers, pointed to the modern polyphasal Upper Pleistocene subdivision and supported it with date.

Here we have to mention the pioneering recognition by J. Hillebrand of the colour of cave deposits (HILLEBRAND, 1935, p. 39). In his monograph Hillebrand started from the experience that Holocene cave deposits are of dark brown or gray colour, which he explained by the humus content of forest soils. In his opinion the Pleistocene layers of this colour are associated with warm periods as opposed to the light brown layers of the 'Spätmoustérien' or the yellow ones, formed under cold loess climate, of the Magdalénien.

As with Mottl, Hillebrand only mentions the Aurignacien and 'proto-Solutréen' (now: called Early Szeletian) layers related to the 'Aurignacien interstadial' which are in accordance with his assumption and made them correspond with the so-called 'Göttweiger Verlehmungszone' of the interstadial.

Unfortunately, for instance, the 5th dark brown and the 10th and 12th dark gray layers of the Subalyuk cave escaped his attention. Using his concept these would also have proved to be interstadial formations, as the anthracotomic investigations by F. Hollendonner confirmed. These were published in the Subalyuk monograph three years later (HOLLENDONNER, 1938).

Hollendonner found charcoals of *Tilia*, a thermophilous tree, in the 10th dark gray layer of the Subalyuk cave, as opposed to the *Pinus cembra* finds in the 11th, light brown layer, indicating a cold climate. This way, for the first time in Hungary he linked the paleoecological conditions of cave lithostratigraphical types with paleobotanical data. His pioneering results in the progress towards a polyphasal Upper Pleistocene subdivision were developed further only after almost twenty years (STIEBER, 1957).

After the break of 1939—1945, a new group of researchers resumed Paleolithic research.

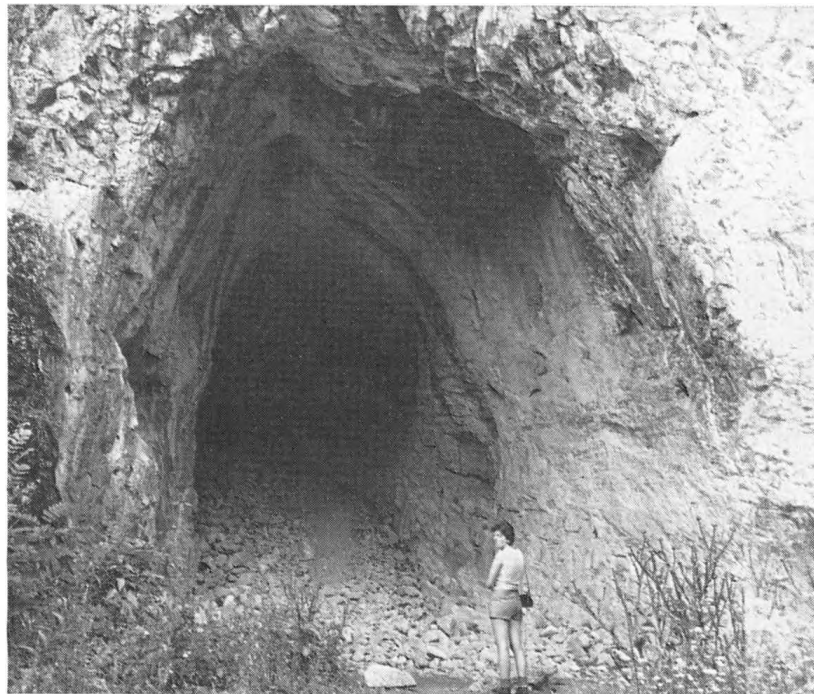
The excavations of the Istállóskő and Lambrecht Kálmán Caves, Petényi Salamon Rock Shelter and then the repeated one in the Peskő Cave, Bükk Mountains were conducted by the archaeologist L. Vértés and the paleontologist D. Jánossy (Fig. 1 — localities 4, 7, 8). The sequence of several Transdanubian caves was settled under the guidance of M. Gábori, D. Jánossy and L. Vértés.

A particularly important excavation of a cave unstudied at the time took place in the Bivak Cave (Fig. 1 — locality 12). The achievements for the history of science can be summarized as follows:

Archaeostratigraphy. The small material of Archaic quartzite from the Lambrecht Cave, Bükk Mountains, was dated Premoustérien by Vértés and last interglacial on faunistic stratigraphical basis (VÉRTÉS, 1965).

In the 1950s the revision of the 'Szeleta culture' began and it still represents the typological and

Entrance of the famous Subalyuk Cave in Bükk Mountains



chronological revelation of one of the most important Paleolithic cave finds complex.

In his paper published in 1953, M. Gábori uses the name Solutréen after previous authors, but also emphasises the differences between the Transdanubian and the Bükk finds. He sought the origin in the industry now called Central European Micoquien, more precisely in the archaeological finds of the Kleine Offnet Höhle (GÁBORI, 1953).

The use of the term Szeletian began to spread in 1955. Hungarian researchers wanted to emphasise that this industry is, in every aspect, independent from the Solutréen (VÉRTES, 1965. p. 136).

Vértes correlated the Early Szeletian of the Bükk Mountains with the recently explored Bükk Aurignacien I and the developed Szeletian with the Aurignacien II, placing it in the Würm 1/2 interstadial (VÉRTES, 1955). In 1959 C^{14} date was obtained for the upper, Aurignacien II culture of the Istállóskő Cave (30,900 \pm 600 years BP).

During the revising excavations of the Pilis-szántó rock shelter, M. Gábori underlined the oriental origin of the finds, opposed to earlier authors. In general, the whole assemblage of finds dated Magdalénien earlier was identified as Eastern Gravettien (GÁBORI, 1962; VÉRTES, 1965).

Biostratigraphy. The most important new results of the period occurred after the introduction of the washing technology. New prospects opened up of layer-by-layer paleoecological research through the study of small mammal finds (JÁNOSSY, 1979). By the sixties the synthesis of the new results had become possible.

In paleobotany J. Stieber continued the layer-by-layer charcoal analyses of old and recent excavations and made paleoecological evaluations (STIEBER, 1957).

Lithostratigraphy. In this period of the discipline the archaeologist L. Vértes studied cave deposits in Hungary, relying on the results of R. Lais and E. Schmid and also raising new issues. He published his achievements in German in 1959 (VÉRTES, 1959). Vértes developed the geochemical analysis proposed by Kadić and supplemented it with mineralogical investigations. For his synthesis where he finally identified 15 climatic phases in the Upper Pleistocene, he applied vertebrate paleontology and anthracotomic findings. Although he insisted on the Alpine chronology, Vértes was flexible enough to adapt the Western European polyphasal Upper Pleistocene chronology and its terminology. Among others, he introduced the term Arcy-Paudorf interstadial, for which the C^{14} date of 30,600 \pm 900 years BP was first available.

He obviously recognised that cave sediments in Hungary are much more subdivided than they should be and forced them into the Alpine scheme. The advance towards modern Upper Pleistocene subdivision is unambiguous.

1958 — Present day

It is not easy to summarise the achievements of the last thirty years, even if — as was mentioned in the introduction — cave excavations were of much lesser importance in this period.

Major complex Quaternary geological excavations were only performed in the Remete Upper Cave, Transdanubia (GÁBORI—CSÁNK, 1983), in the Szeleta Cave, Bükk Mountains (VÉRTES, L.), at the entrance of the Diósgyőr—Tapolca Cave (HELLEBRANDT et al. 1976) and in the front of this cave (RINGER et al. under preparation) (Fig. 1 — locality 3).

The researchers viewed the archaeological finds at new sites in an increasingly European perspective and published voluminous monographs of interdisciplinary approach, usually in foreign language (GÁBORI, 1964; GÁBORI—CSÁNK, 1968; VÉRTES, 1964, 1965). M. Gábori's impressive monograph on the Middle Paleolithic of Central and Eastern Europe has particularly attracted great international attention (GÁBORI, 1976).

Archaeostratigraphy. Especially since the 1970s, with the growing number of publications abroad on this topic, the reevaluation of early Paleolithic finds has been continuing in Hungary.

In 1973 V. Gábori—Csánk distinguished the Transdanubian Szeletian (as Jankovichian) from the Bükk Szeletian (GÁBORI—CSÁNK, 1976). By 1986 she had revealed its origin and relations as well as the paleoecological, paleoethnographical and archaeozoological implications of this culture (GÁBORI—CSÁNK, 1986). This Middle Paleolithic leaf-tool industry may be related to the Central European Micoquien of the Upper Danubian region. It was dated 50,000 to 35,000 years BP, between the recently described Bábonyian of Micoquien analogies, Bükk Mountains (RINGER, 1983), and the Early Szeletian.

The origin of the Bükk Szeletian is thought by Á. Ringer, — in agreement with M. Gábori (GÁBORI, 1984), to be in the Bábonyian (KORDOS, RINGER, 1986; RINGER, 1988), criticising Vértés' hypothesis, which places it locally, in the Bükk Moustérien (VÉRTES, 1958). In his papers, Ringer describes the true Moustérien industry of the Subalyuk Cave in the Bükk Mountains as "Moustérien typique riche en racloirs de débitage levallois" and suggests the term 'Charentien de Bükk' (KORDOS—RINGER, 1986; RINGER, 1987, 1988).

At the Paleolithic Colloquium in Nemours, 1988, he suggested the classification of the Late Szeletian finds of the Herman and Puskaporos rock shelters, Bükk Mountains, as a separate phase of evolution under the term 'Szelétien solutroïde' (RINGER, 1988).

After his excavations in 1988, he referred the oldest Middle Paleolithic finds of the Diósgyőr—Tapolca Cave into the Taubachian culture.

In the repeated re-evaluation of the 'Cave Gravettien' or Pilisszántóian culture, Gábori attaches equal significance to Gravettien and Magdalénien cultures and envisages the origin of the Gravettien culture in Hungary within Central Europe (GÁBORI, 1984).

Biostratigraphy. The upper Pleistocene vertebrate paleontological information, rapidly expanding in

the wake of the washing technology introduced in the fifties, was classified by M. Kretzoi (KRETZOI—VÉRTES, 1965) and D. Jánossy (JÁNOSY, 1979) into the Süttő—Varbó—Szeleta—Tokod—Istállóskő—Palánk fauna stage or climatozone. Finally abandoning the Alpine chronology he presented the paleoecological changes reflected in the Upper Pleistocene faunas of Hungary from the last interglacial to the Holocene in an independent local subdivision.

Recently L. Kordos attempted to correlate the small mammal successions of these fauna stages with the oxygen isotopic climatic curve by J. Labeyrie (LABEYRIE, 1984) back to 140,000 years (KORDOS—RINGER, 1986).

In Fig. 2 the time sequence of fauna stages is indicated according to this correlation. The Subalyuk fauna stage is parallelised with the fauna in the layers 10—16 of the cave after which it is named (JÁNOSY, 1979, p. 130) and intercalated between it and the older Varbó stage, a still unknown fauna stage is shown. This cold period, represented by layers 7—9 in the sequence of the Subalyuk Cave, may correspond to Emiliani's stage 4 and, according to L. Kordos, is contemporaneous with the first Upper Pleistocene occurrence of *Dicrostonyx torquatus* in Hungary (KORDOS—RINGER, 1986).

Lithostratigraphy. The author, an archaeologist-geomorphologist, began to study the correlations between loesses and cave deposits in the Geographical Research Institute of the Hungarian Academy of Sciences in 1981. He attempted to draw correlations between the Upper Pleistocene loesses and cave deposits of Hungary in his papers published in 1986 and 1987 (PÉCSI—RINGER, 1987; RINGER, 1987).

On this topic Fig. 2 demonstrates the opportunities of correlations between young loesses and cave fills is one of the focal areas of Hungarian Paleolithic and Quaternary research, the Bükk and Northeastern Hungary (Fig. 2 — B, C) in relation to the Paleolithic industries of the region (F) as well as the paleoclimatic (A) and paleoecological (E) conditions.

For this chronostratigraphy, J. Labeyrie's oxygen isotopic climatic curve, which also incorporates the parallelization of Emiliani's stages and the classic French prehistoric subdivisions (LABEYRIE, 1984), was applied.

The table also shows the old Hungarian chronology elaborated by Mottl and Kadić, in the above system (KADIĆ—MOTTL, 1938).

In the climatozones of Süttő and Varbó, corresponding to Emiliani's stages 5e—5a, the climate of the Bükk Mountains and its environs ranged from warm temperate with submediterranean influence to cool temperate. In the area, the Bábonyian, the typical Moustérien of the Subalyuk Cave and the Bükk Taubachien lived side by side.

It seems that in the cold spell of Emiliani's stage 4 the evolution of these cultures stopped or — in

the case of the Bábonyien — took a new trend. At any rate, in this stage the Subalyuk-type Charentien appears and during Emiliani's stage 3 the cave bear hunter Bükk Szeletian and the Aurignacien I and II emerge. In the cold spells coniferous forests were characteristic of the mountains, while in the interstadials forests mixed with deciduous tree species grew. This is the time of the Subalyuk and the Tokod—Szeleta—Istállóskő climatozones, respectively. In the latter periods the climate was occasionally very moist and cold.

During the climatozones of Pilisszántó and Palánk, corresponding to Emiliani's stage 2 the mountains were covered by sparse *Pinus cembra* and *Larix*—*Picea* coniferous forests.

The number of *Ursus spelaeus* showed a major decline at that time. Its hunting experienced an ecological crisis. Contemporaneous with the last

phase of the Bükk Szeletien, the horse and reindeer hunting people of the culture, called Gravettien and then Pilisszántóian culture lived occasionally in the caves of the mountains.

In later periods the subarctic nature of climate gradually shifted towards cool temperate.



Dr. Árpád RINGER
archaeologist
Herman Ottó Museum
Miskolc
Felszabadítók útja 28.
H-3525

REFERENCES

- BARTUCZ L. et al. (1938): A cserépfalvi Mussolini-barlang (Subalyuk). — *Geol. Hungarica, ser. paleont.* 14.
GÁBORI M. (1953): Le Solutréen en Hongrie. — *Acta Arch. Hung.* 3.
GÁBORI M. (1964): A késői paleolitikum Magyarországon. (Upper Paleolithic and Mesolithic in Hungary.) — *Régészeti Tanulmányok*, 3.
GÁBORI M. (1976): Les civilisations du Paléolithique moyen entre les Alpes et l'Oural. — *Akadémiai Kiadó, Budapest*.
GÁBORI M. (1977): A magyar barlangok kutatásának régészeti eredményei. — *Karszt és Barlang*, I–II.
GÁBORI M. (1984): A régibb kőkor Magyarországon. (The Early Stone Age in Hungary.) — In: *Magyarország története I. I. Akadémiai Kiadó, Budapest*.
GÁBORI CSÁNK V. (1968): La station du Paléolithique moyen d'Érd, Hongrie. — *Akadémiai Kiadó, Budapest*.
GÁBORI CSÁNK V. (1973): Nouvelles observations sur le Szelétien. — Analyse des attributs, du matériel des phases initiales du Paléolithique Supérieur (Aurignacien, Szelétien, Périgordien. — *Colloque International UISP, Paris*.
GÁBORI CSÁNK V. (1983): La grotte Remete "Felső" (Supérieure) et le "Szeletien de Transdanubie". — *Acta Arch. Hung.* 35.
GÁBORI CSÁNK V. (1986): Az őskőkori Jankovich kultúra Nyugat-Magyarországon. — *Akadémiai doktori értekezés. Kézirat*.
HELLEBRANDT M.—KORDOS L.—TÓTH L. (1976): A Diós-győr—Tapolca-barlang ásatásának eredményei. — *MOM Évk.* 15.
HILLEBRAND J. (1935): Die ältere Steinzeit in Ungarn. — *Arch. Hung.* 17.
HOLLENDONNER F. (1938): A fosszilis faszenek vizsgálata. — In: *Bartucz et al.: A cserépfalvi Mussolini-barlang (Subalyuk). Geol. Hungarica, ser. paleont.* 14.
JÁNOSSY D. (1979): A magyarországi pleisztocén tagolása gerinces faunák alapján. — *Akadémiai Kiadó, Budapest*.
KADIĆ O. (1915): A Szeleta-barlang kutatásának eredményei. — *Földt. Int. Évk.* 23.
KADIĆ O. (1934): Der Mensch zur Eiszeit in Ungarn. — *Földt. Int. Évk.* 30.
KADIĆ O. (1938): Helyrajz, morfológia, rétegtan. — In: *Bartucz et al.: A cserépfalvi Mussolini-barlang (Subalyuk). Geol. Hungarica, ser. paleont.* 14.

- KORDOS L.—RINGER Á. (1986): A magyarországi felsőpleisztocén biosztratigráfiai és régészeti kronológiai adatai. (Upper Pleistocene data on biostratigraphy and archeological chronology in Hungary.) *In press*.
KRETZOI M.—VÉRTES L. (1965): The role of vertebrate fauna and paleolithic industries of Hungary in Quaternary Stratigraphy and chronology. — *Acta Geologica* 9.
LABEYRIE J. (1984): Le cadre paléoclimatique depuis 140,000 ans. — *l'Anthr. (Paris)* 88.1.
MOTTL M. (1938): Külföldi összehasonlítások — In: *Bartucz et al.: A cserépfalvi Mussolini-barlang (Subalyuk). Geol. Hungarica, ser. paleont.* 14.
PÉCSI M. ed. (1985): Loess and the Quaternary. — *Studies in Geography in Hungary*. 18. *Akadémiai Kiadó, Budapest*.
PÉCSI M.—RINGER Á. (1987): Barlangi képződmények. — In: *A Dunántúli Középhegység, A. Akadémiai Kiadó, Budapest*.
RINGER Á. (1983): Bábonyien, eine mittelpaläolithische Blattwerkzeugindustrie in Nordostungarn. — *Diss. Arch. Ser. II. No. 11*.
RINGER Á. (1987): Possible Correlation between Loess and Cave Deposit Stratigraphies for the Upper Pleistocene in Hungary. — In: *Pécsi M.—Starkel L.: Paleogeography of Carpathian Regions. Geogr. Res. Inst. Hung. Acad. Sci. (In press.)*.
RINGER Á. (1988): Le Szelétien de Bükk en Hongrie. Les questions de l'origine, de la chronologie, et de la transition vers le Paléolithique supérieur. — *Colloque préhistorique de Nemours. (In press.)*.
STIEBER J. (1957): A magyarországi felsőpleisztocén faszénmaradványok anthrakotómiai vizsgálata. (Anthracomic investigations of Hungarian Upper Pleistocene charcoal remnants). — *Akadémiai kandidátusi értekezés. Kézirat*.
T. DOBOSI V.—VÖRÖS I.—KROLOPP E.—SZABÓ J.—RINGER Á.—SCHWEITZER F. (1983): Upper Paleolithic Settlement in Pilismarót—Pálrét. — *Acta Arch. Hung.* 35.
VÉRTES L. (1955): Paläolithische Kulturen des Würm I/II. Interstadials in Ungarn. — *Acta Arch. Hung.* 6.
VÉRTES L. (1959): Untersuchungen über Höhlensedimenten. — *Régészeti füzetek*.
VÉRTES L. (1964): Tata. Eine mittelpaläolithische Travertin—Siedlung in Ungarn. — *Arch. Hung.* 43.
VÉRTES L. (1965): Az őskőkor és az átmeneti kőkor emlékei Magyarországon. — *Akadémiai Kiadó, Budapest*.

GEOÉP: SOCIETY FOR SUBSURFACE AND PROTECTONING ENVIROMENTAL CONSTRUCTION

WIRTSCHAFTSGESELLSCHAFT FÜR UNTERIRDISCHE UND UMWELT- FREUNDLICHE BAUARBEITEN



TÄTIGKEITEN:

- Preparation and strenghtening of foundations
- Preparation and strenghtening of subsurface caverns, cellars and storage spaces, elimination
- Outcrop of subsurface caverns, preparation of test pits deeper than 2m in extraordinary circumstances
- Examination, repair of subsurface storage places, load test of soils
- Preparation of retaining walls
- Preparation of drainages and of deep-drainages without uncovering, using special materials, glued rubber filter
- Anfertigung und Befestigung von Gründungen
- Ausgestaltung und Verstärkung von unterirdischen Hohlräumen, Kellern, und Lagerräumen
- Verschüttung
- Aufschluss von unterirdischen Hohlräumen, Ausgestaltung von über 2M tiefen Schürfgruben bei besonderen Umständen
- Überprüfung, Reparatur der unterirdischen Hohlräume, Probelastung der Böden
- Aufbau der Stützwände
- Ausgestaltung von Sickergraben von Tiefsickergraben ohne Blosslegung, mit Verwendung von speziellen Materialien, geklebten Kiesfiltern

MEMBER COMPANIES

Central Mining Development Institute
1027 Budapest, Varsányi Irén u. 40-42.
T. 354-580

FTV Consulting Engineering
1088 Budapest, Revicky u. 4.
T. 183-281

Délborsod Agricultural Co-operative
3467 Ároktő, Széchenyi u. 45.
T. Ároktő 5

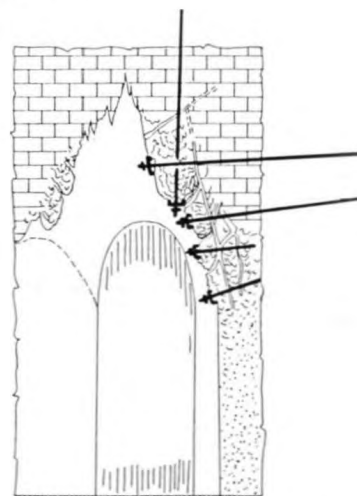
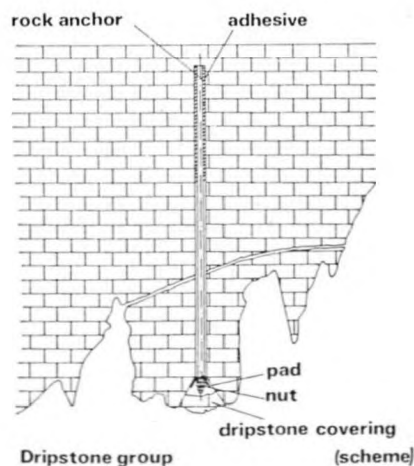
MITGLIEDSUNTERNEHMEN:

Zentrales Entwicklungsinstitut für den Bergbau

FTV Beratung und Planung

LPG Délborsod

BÜRO: 3300 EGER, Sertekapu u. 35.
T: (36) 14-129



LILLAFÜRED, ANNA CAVE instance