

Late Pleistocene gastropod and vertebrate fauna from Tokod (NE Transdanubia, Hungary)

by
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Abstract: The Late Pleistocene locality, near Tokod (Gerecse Mountains), was dated by the first excavation (1960) as the lower part of the Würm Glaciation (Tokodian faunal substage). During the next collections (in 1990 and 1991) a new profile was designated by the author, and it was separated in two members of deposits, which contained different snail and vertebrate faunas. The snail material includes 46, the vertebrate fauna at least 61 taxa (micro- and macrovertebrates). On the basis of some typically interglacial species among the micromammals, as *Crocidura cf. leucodon*, *Glis glis*, *Apodemus* sp., *Pitymys subterraneus*, and by comparing the composition of the fauna with faunas from other localities, the age of the lower layers is Varboian (middle and upper part of the Riss-Würm Interglacial) and in the case of the upper layers it is Lower Würm. The present paper comprises the description of the more important species of the fauna and its evaluation from stratigraphical, zoogeographical and climatological aspects.

INTRODUCTION

The village of Tokod lies about 30 km NW of Budapest in the eastern part of the Gerecse Mts. (Fig. 1). The Late Pleistocene locality is near the village, on the northern slope of the Hegyeskő Hill in a deep ravine ca. 175 m height above sea-level. The remains were found among travertine in sandy loess containing travertine rubbles (Jánossy 1971, p. 103). The travertine layers were deposited by freshwater springs originating from the northern side of the Hegyeskő, consequently the deposits represent a tetrata basin succession (Scheuer & Schweitzer 1979, p. 115, 1988, pp. 34-35). The loessy sediments were deposited at that periods, when the springs did not function.

The first collections were carried out in 3-8th June 1960 by Gyula TÖRÖK archaeologist (Török 1960, 1960a) and 15-17th September of the same year by Dénes JÁNOSY paleontologist (Jánossy 1960). They collected especially large mammal remains and microvertebrates of a minimal quantity. Jánossy (1971, p. 108, 1986, pp. 141-142) dated the fauna into the Late Pleistocene Würm Glaciation; Würm₁ cold substage. Because of the occurrence of large quartzite pebbles and charcoal spots the locality was regarded as an archaeological (Paleolithic) site, however neither the 1960's nor my collections yielded any sure archaeological find. By the last excavation in July of 1992 three small pieces of opal and jasper were found, but these could have been washed in from other, more distant places. After the excavations in 1960 also a radiocarbon dating was made, which established the age of the locality as approximately 36,200 years.

The next collections were carried out in July of 1990 and 1991, when the author exploited the deposits bed-by-bed and the whole material was washed through 1 mm mesh size sieve to get also the microfauna.

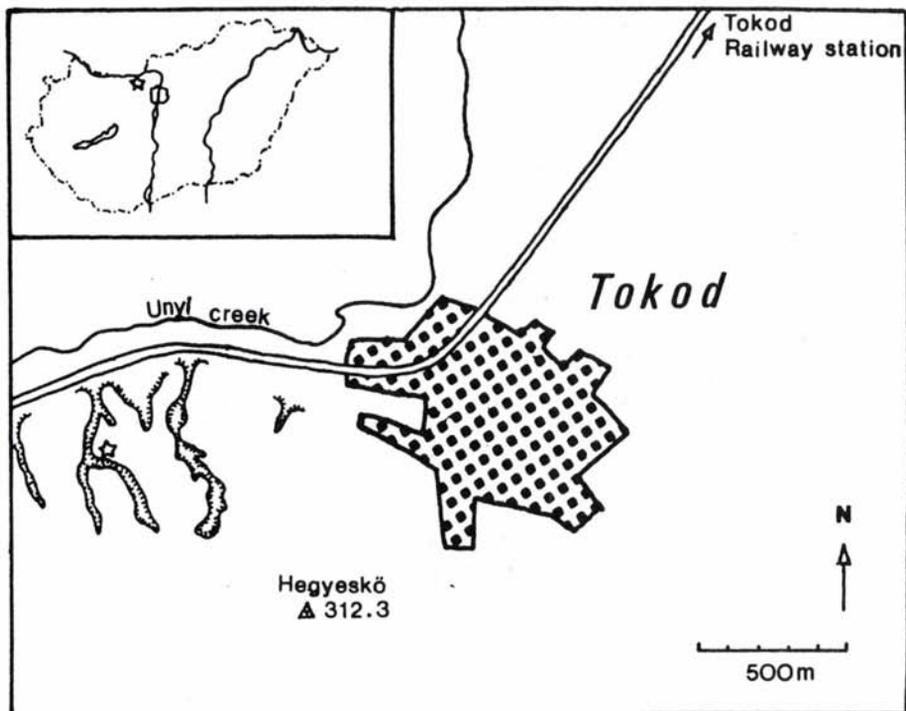


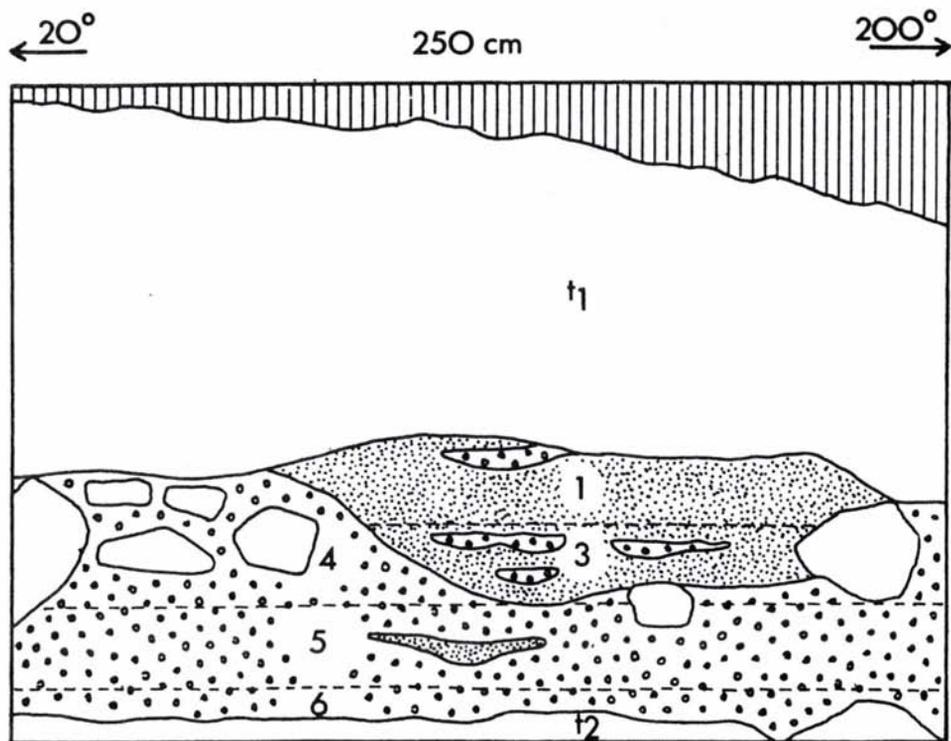
Fig. 1: Sketch map showing the situation of the Tokodian locality

Here I have to thank to Ferenc SCHWEITZER (Institute of Geographical Sciences) who was conducive to the start of my excavations, and above all I thank Dénes JÁNOSSY for his valuable help and advices given me during the study of the material.

METHODS AND MATERIALS

During the collection I separated the following beds (Fig. 2):

- t₁: massive, thin bedded, whitish grey travertine with tetarata structure
- 1: light-brown, sandy loess
- (2: light-brown, sandy loess with fine-grained travertine rubble. This bed was a lens within the layer 1, but later I included it into the same, because of their identical fauna.)
- 3: light-brown, sandy loess with small travertine rubble lens
- 4: greyish-brown, loessy, fine-grained sand with travertine rubble, quartzite pebbles and charcoal spots
- 5: light brownish-grey, loessy, fine-grained sand with travertine rubble, quartzite pebbles and charcoal spots (less than within the layer 4)
- 6: light-grey, fine-grained sandy lime mud with travertine rubble (transitional level between layer 5 and t₂)
- t₂: yellowish-white, crumbly travertine



-  travertine
-  soil
-  "fine-grained" levels
-  "coarse-grained" levels

Fig. 2: Profile drawing of the locality in frontal view

(one can find a similar profile drawing in Scheuer & Schweitzer 1979, p. 114, where layer 4 is termed fossilized soil.) (Fig. 3)

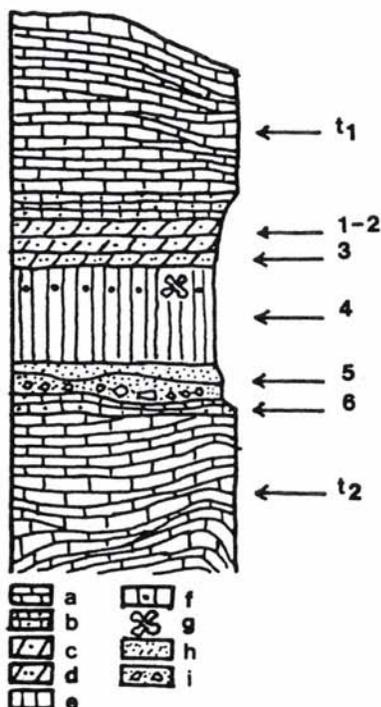


Fig. 3: Profile drawing of Tokod I (showing the layer numbers of Tokod II). a: thin bedded freshwater limestone with tetrata structure, b: lime mud, c: loess with fine-grained sand, d: loessy fine-grained sand, e: brown fossilized soil, f: charcoal spots, g: vertebrate remains, h: sand with lime mud, i: sand with travertine rubble and quartzite pebbles

The loessy deposits could be separated into two groups. I named the layers 1-2, 3 "fine-grained", and the layers 4, 5, 6 "coarse-grained" (because of the higher amount of travertine rubble). The latter ones had been deposited at high, and the former at low discharge, or by eolian processes. The remains also suggest this idea because larger bones were found only in the "coarse-grained" beds, while the "fine-grained" ones yielded only microvertebrate remains and small bone fragments. The stratification of the layers is lenticular: the fine-grained beds contain coarse-grained lenses and vice versa. These facts show that:

- the "coarse-grained" beds had been deposited under more humid, while the "fine-grained" ones under less humid conditions,
- the discharge of the spring was not constant,
- in rainier periods there were big wash-downs, which had modified the stratification. (One of the proofs of this wash-downs, rinsed down the whole hillside is that from every layer were found redeposited *Nummulites* (and some Tertiary gastropod fragments: e.g. in layer 5), which originate undoubtedly from the weathering of Eocene (and younger Tertiary) rocks nearby.

The fauna collected by Gy. TÖRÖK and D. JÁNOSSY showed indeed a glacial overall picture but their collection included microvertebrates, as mentioned above, of a minimal quantity only. In the following I present this list of fauna with numbers of specimens.

<i>Rana méhelyi</i> Bolkay and Ranidae indet.	34
Ophidia indet.	7
<i>Anas querquedula</i> L.	1
<i>Anas platyrhynchos</i> L.	1
<i>Lyrurus tetrrix</i> (L.)	5
<i>Rallus aquaticus</i> L.	1
<i>Asio flammeus</i> Pontoppidan	1
<i>Bubo bubo</i> L.	1
<i>Coloeus monedula</i> L.	1
Passeriformes indet.	6
<i>Sorex araneus</i> L.	2
<i>Talpa europaea</i> L.	3
Chiroptera indet.	6
<i>Lepus</i> sp.(aff. <i>timidus</i> L.)	13
<i>Ochotona pusilla</i> (Pallas)	5
<i>Castor fiber</i> L.	2
<i>Citellus citelloides</i> Kormos	10
<i>Dicrostonyx torquatus</i> (Pallas)	3 mandibles
<i>Arvicola terrestris</i> (L.)	7
<i>Myodes glareolus</i> (Schreber)	3 mandibles
<i>Microtus arvalis</i> (Pallas)	10 mandibles
<i>Microtus oeconomus</i> (Pallas)	5 mandibles
<i>Microtus gregalis</i> (Pallas)	13 mandibles
<i>Spalax</i> cf. <i>leucodon</i> Nordmann	5
<i>Allactaga jaculus</i> (Pallas)	7
<i>Canis lupus</i> L.	10
<i>Vulpes vulpes</i> L.	21
<i>Ursus spelaeus</i> Ros.-Heinroth	10
<i>Putorius evermanni</i> Lesson	2
<i>Crocotta spelaea</i> (Goldfuss)	15
<i>Leo spelaeus</i> (Goldfuss)	1
<i>Equus</i> sp.(large species)	26
<i>Asinus hydruntinus</i> Regalia	23
<i>Coelodonta antiquitatis</i> (Blumenbach)	4
<i>Cervus elaphus</i> L.	3
<i>Megaloceros giganteus</i> (Blumenbach)	10
? <i>Rangifer</i> sp.	1
<i>Bison priscus</i> (Bojanus)	44
<i>Mammuthus primigenius</i> (Blumenbach)	2

The main result of my excavations is that I could separate the younger, cold fauna of the upper "fine-grained" layers (1-2, 3) from the older fauna of interglacial character of the lower "coarse-grained" layers (4, 5, 6). The composition of the faunas of the single layers are shown in Table 1. (I intend to publish the snail fauna in the future.)

The differences between the faunal composition of the layers are more conspicuous if we merge the list of remains of the two "fine-grained" and the three "coarse-grained" ones respectively. (Here I have to remark that we washed less material from the layer 6 than from the others, thus the faunal picture of this layer provides only informative data.) The fauna formerly ranged into the cold substage of the Lower Würm obviously needs a revision, at least as far as the lower layers (4, 5, 6) are concerned. From climatic point of view important data are provided mainly by the micromammal remains. The wood mouse (*Apodemus*), the edible dormouse (*Glis glis*) and the white-toothed shrew (*Crocidura*) are unambiguous warm indicators, whereas the mole rat (*Spalax*) and the pine vole (*Pitymys subterraneus*) indicate more or less warm conditions. I have to add, that there are cold-indicators, found together the above forms, e.g. the arctic lemming (*Dicrostonyx*) and the narrow-skulled vole (*Microtus gregalis*). It is probable, however, that the habitat of the *M. gregalis* was not the same as today (although even today it is living also south of the taiga-zone in a wide strip together with steppe lemming (*Lagurus lagurus*)). Furthermore as far as the arctic lemming is concerned, in the foregoing I have referred to the irregular (lenticular) stratification of the layers, hence we have to reckon with a certain mixing of the material of the single levels. For example in the lower beds only some single molars occurred, while the mandible with M_1 was found in the upper beds. Apart from all the above uncertainties there is a very demonstrative difference between the upper and lower layers both from stratigraphical and climatical aspects. Figure 4 shows the well visible differences expressed by the percentage of different vole species bed-by-bed. On the figure one can recognize the followings:

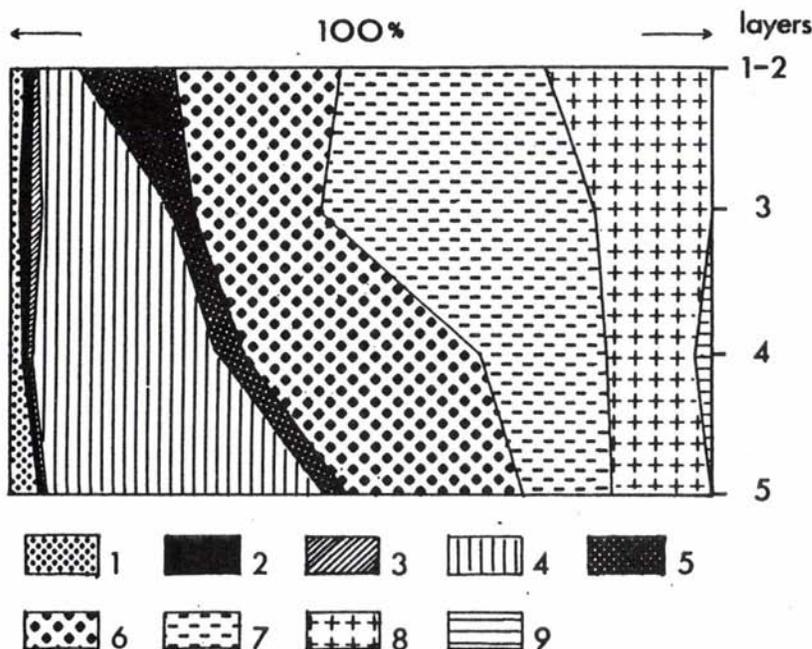


Fig. 4: The percentage of vole species from Tokod II. 1: *Arvicola terrestris*, 2: *Lagurus lagurus*, 3: *Dicrostonyx torquatus*, 4: *Microtus arvalis*, 5: *M. agrestis*, 6: *M. gregalis*, 7: *M. oeconomus*, 8: *Clethrionomys glareolus*, 9: *Pitymys subterraneus*

- Going from the lower (older) layers towards the upper (younger) ones the percentage of *Microtus arvalis* decreases gradually, in the case of *M. gregalis* - disregarding the fluctuation - it remains constant.

- *Pitymys* can be found only in the lower layers.

- The percentage of *M. oeconomus* and *Clethrionomys* increases upwards more or less gradually.

- In the layer 1 the percentage of *M. agrestis* increases suddenly.

These changes show that during the deposition of the "fine-grained" beds the climate was colder than in the case of the "coarse-grained" ones. Furthermore the data show that - in spite of the fact, that there are definitely steppe or semi-desert elements in the fauna, as the steppe lemming (*Lagurus lagurus*) and the jumping mice or jerboa (*Allactaga jaculus*) - the climate did not become much drier, considering that - at least recently - *M. agrestis*, *M. oeconomus* and also *Clethrionomys glareolus* are living in cool and humid areas. Considering the composition of the fauna, the area was probably a forested steppe. (I remark here that plant remains were found too. These are: a few *Salix* sp. leaf moulds from the travertine and *Celtis* sp. seeds and seed fragments from each layer.)

SYSTEMATICAL REMARKS

In the following, the stratigraphically or paleozoogeographically most important forms of the fauna will be discussed.

GASTROPODS

Here I list the snail fauna, and first of all I express my gratitude to Endre KROLOPP (Hungarian Geological Institute), who determined and evaluated the snail remains.

By the indication of the material the aquatic species are separated from the terrestrial ones. (Table 2)

On the basis of E. KROLOPP's communication one can separate 2 or 3 groups having different age.

1.- Late Pleistocene, Würm, terrestrial species. Their shells are filled with loessy sand. These forms indicate cooler climate as compared to the recent.

Succinea oblonga

Pupilla triplicata

Pupilla muscorum

Vertigo alpestris

Columella edentula

Orcula dolium

Vallonia costata

Vallonia tenuilabris

Clausilia dubia

Nesovitrea hammonis

Trichia hispida

Arianta arbustorum

2.- Riss-Würm, interglacial species, partly forest-forms. These indicate mild climate. Their shell-casts are calcareous sand or travertine mud (rarely loessy sand), and in many cases they are encrusted with fresh-water limestone.

Cochlicopa lubricella
Orcula doliolum
Mastus bielzi
Cochlodina laminata
Laciniaria plicata
Discus rotundatus
Oxychilus inopinatus
Phenacolimax annularis
Limacidae indet.
Helicodonta obvoluta
Soosia diodonta
Cepaea vindobonensis
Helix pomatia

3.- Aquatic species. The cast of their shells is fresh-water limestone or lime mud in most cases. Their age probably is Riss-Würm (as by the former terrestrial species) or older.

Valvata cristata
Valvata piscinalis
Valvata naticina
Lithoglyphus naticoides
Lymnaea stagnalis
Radix peregra peregra
Radix peregra ovata
Planorbis planorbis
Anisus vorticulus
Gyraulus albus
Gyraulus laevis

Several species (not listed here) may belong both to the Würm loess-fauna and to the Riss-Würm material.

Two water species are fluvial, that means that the fresh-water springs, which had deposited the travertine, probably were discharged into a larger stream. (The specimens of the third fluvial species - *Theodoxus danubialis* - probably were drifted into the deposit secondarily.)

Comparing the snail fauna with the vertebrates, we can state that both material showed the climatical and stratigraphical differences between the "fine-grained" and "coarse-grained" layers, and that due to the depositional processes the faunas of the layers are somewhat mixed.

MAMMALIAN FAUNA

Insectivora

In many aspects the most important member of the fauna is the white-toothed shrew (*Crocidura* cf. *leucodon*) (Fig. 5). Its presence indicates well the interglacial climate, and at the same time suggests a stratigraphical relationship with two Riss-Würm localities: Sütő and Porlyuk Cave (Jánossy 1976, p. 39, fig. 5). It is supported by the fact that the measurements of the mandibles are larger than at the *Crocidura leucodon-russula* group, and approximate the measurements of the mandibles of *Crocidura robusta* Heller, which species was described from Lobsing bei Neustadt/Donau from the "letztinterglaziale" (last interglacial) beds. Another large form (*Crocidura* sp.) was described by Rzebik (1968) from the Tornewton Cave in England. She mentions that the stratigraphy of the small chamber, from where the remains were collected, was not clear. Her opinion is based on the two large sized *Crocidura* form (*Crocidura robusta* Heller, 1960 and *Crocidura zorzii* Pasa, 1952): "if they not only large members of the *Crocidura leucodon-russula* group, they probably belong to one and the same species" (Rzebik 1968, p. 260). (See Table 3)

The dimensions of the *Sorex araneus* mandibles fall into the Late Pleistocene and Recent size category, but there are some large mandibles constituting transition towards the older forms, namely towards the *Sorex araneus* ssp. described by D. Jánossy from the Ördöglyuk Cave at Solymár (Jánossy 1966, p. 134), from the

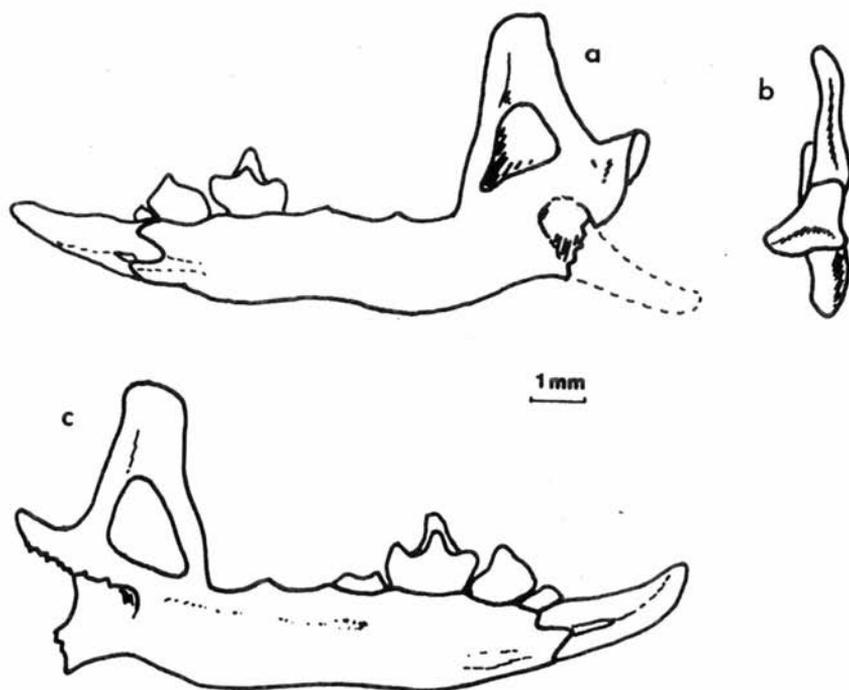


Fig. 5: *Crocidura* cf. *leucodon* from Tokod. a: right mandible, Tokod II/4, V.91.166; b: posterior view of 5a; c: left mandible, Tokod II/5, V.91.223

upper part of the Middle Pleistocene. It has to be mentioned, however, that this feature is not very useful, because - measuring the *Sorex* mandibles from the Late Pleistocene Istállóskő Cave - I found same large specimens within that material, too (Table 4).

Chiroptera

For the determination of the bat remains thanks are due to György TOPÁL (Hungarian Natural History Museum, Department of Zoology, Collection of Mammals). The material shows neither the mild climate nor the older age. A very worn molar was found in layer 6, and was determined as *Myotis schaubi*. In accordance with the present data this species became extinct in the Early Pleistocene. Both this fact and the strongly worn condition suggest, that the tooth was redeposited from older beds.

Rodentia

I classified the ground squirrel remains into the *Citellus citelloides* Kormos species. Many teeth and bones were found in each layer. Measuring the length/width data of the third lower molars (M_3), those were smaller without exception than at the recent *Citellus citellus* L. (Fig. 6).

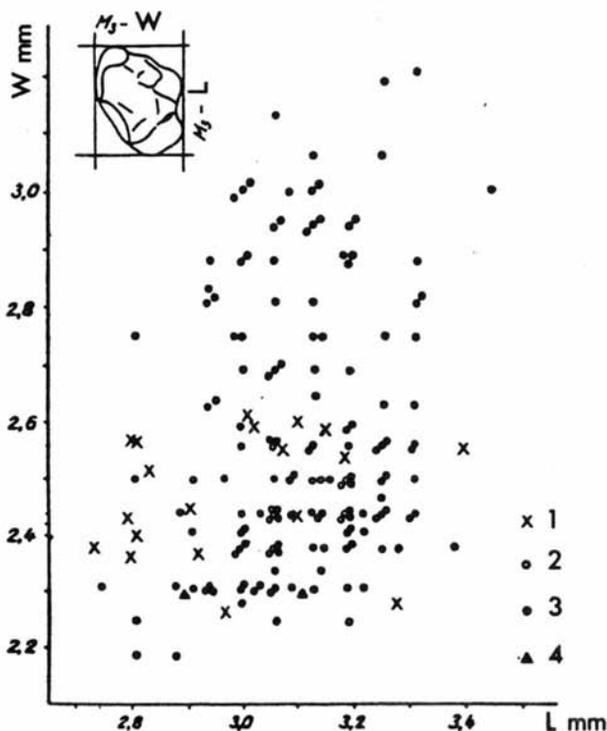


Fig. 6: Length/width data of third lower molars of *Citellus citelloides* from Tokod (With data of Jánossy 1976). 1: *C. citelloides* from Tokod, 2: *C. citelloides*, Burgtonna, 3: *C. citellus*, Recent, 4: *C. citelloides* from Castle Hill, Budapest, (Middle Pleistocene)

There is a single dormouse tooth in the whole material (from the layer 5), this is a fourth upper premolar (P^4). It is round shaped and has two roots, an anterior narrower and a posterior thicker one. According to the measurements ($L=1.35$ mm, $W=1.55$ mm) it is an edible dormouse premolar (*Glis glis* L.). The tooth is rather worn, so we are not allowed to preclude the possibility of mixing by redeposition.

I classified also on the basis of L/W datas the hamster remains into the *Crice-tulus migratorius* Pallas species (Fig. 7). This classification is apparently inconsistent with the Riss-Würm age, because in the Hungarian faunas this species is known since the Early Würm, however in Bulgaria it was found from the end of the Günz-Mindel Interglacial, too (lowermost part of Middle Pleistocene), together with *Allocricetus bursae* Schaub (Popov 1988).

Among the vole lower first molars there are 12 M_1 of *Arvicola*. Studying their enamel thickness I determined them as *Arvicola terrestris* L. species. On the teeth the enamel was thicker at the anterior wall of triangles and it was thinner at the posterior walls. By a broken M_1 from layer 5 the enamel thickness was equal, hence in this case also the *Arvicola cantiana-terrestris* determination is possible. Measuring the length of the molars, they fell into the Late Pleistocene large size-category (Jánossy 1986, p. 113). (Table 5)

Very important fact is the presence of the steppe lemming (*Lagurus lagurus*). The five M_1 , collected from Tökod, show the *L. lagurus* type morphology without exception; the "*Pitymys-rhombus*" is absent, the anterior caps are deeply impressed laterally, hence the T6 and T7 are well developed. At one part of the specimens these triangles are situated symmetrically to the longitudinal axis, at their other part the T7 is placed more anteriorly, the cap is asymmetrical. In the case of the M_1 from layer 6 the T6 is rather isolated. These forms (Fig. 8) are not characteristic in stratigraphical aspect. One can find such variants for example in the material of Ördöglyuk Cave at Solymár (end of the Middle Pleistocene) or at Subalyuk Cave (Late Pleistocene, Lower Würm) and such forms were described also from the upper part of Mindel Glaciation from Dobrogea in Romania (Radulesco & Samson 1974, p. 120, and fig. 1/6 on p. 119). More interesting is the fact that

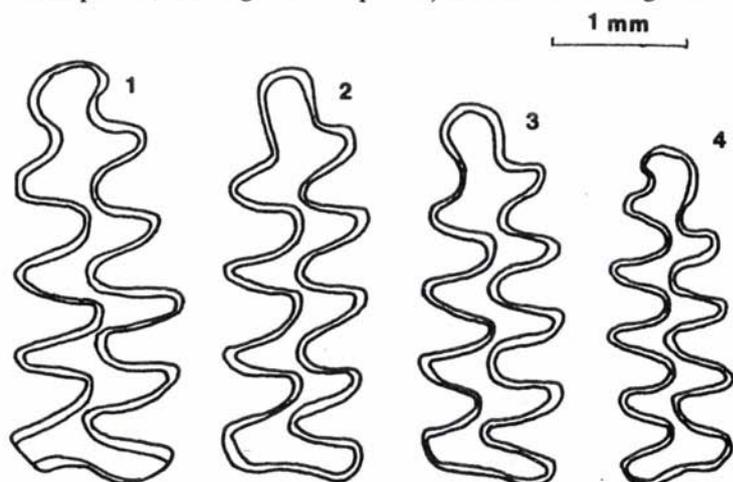


Fig.8: *Lagurus lagurus* first lower molars from Tökod, 1-2: Tökod II/1, V.91.109, 3: Tökod II/4, V.91.187, 4: Tökod II/6, V.91.294

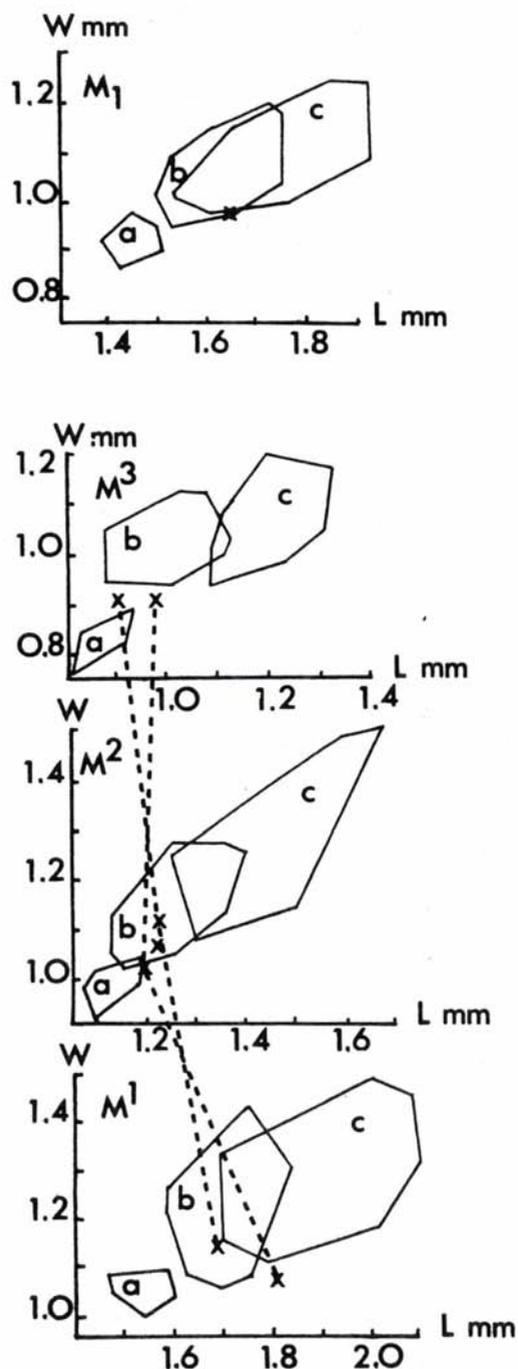


Fig. 7: Measurements of *Cricetulus migratorius* tooth remains from Tokod. (With data of Popov 1988.), a: *Phodopus songorus*, Recent, b: *Cricetulus migratorius*, Recent, c: *Allocricetus bursae*, x: *Cricetulus migratorius* from Tokod. (The teeth belonging to the same maxilla are connected with broken line.)

Lagurus occurs together with the jerboa (*Allactaga jaculus*). This co-occurrence connects the Tokod fauna with faunas of two other Hungarian localities both from stratigraphical and paleozoogeographical points of view: with the Lambrecht Kálmán Cave (Riss-Würm Interglacial) and with the above mentioned Subalyuk Cave. Both localities are situated in the Bükk Mountains (N-Hungary). In the Subalyuk material the percentage of *Lagurus* is strikingly high, while at the Lambrecht Cave this value is much lower. Furthermore, warm-indicator species are absent at Subalyuk and present at the Lambrecht Cave. All these suggest, that the fauna of the locality at Tokod is nearer to the fauna of the Lambrecht Cave in age.

The remains of the southern birch mouse (*Sicista* cf. *subtilis*) fit well to the forested-steppe fauna. Two species are living recently in the European region: the northern birch mouse [*Sicista betulina* (Pallas)] and the southern birch mouse [*S. subtilis* (Pallas)]. The former's habitats are the northern woodlands, birch copses, in Central Europe it occurs especially in the mountains. The latter is living more southerly, mainly on steppes and on dry woodlands (but not in the mountains). This fact also confirm the probability, that the birch mouse finds from Tokod belong to the *Sicista subtilis*. This is supported by some morphological characters too, because of which I ranged them to this species: the pattern of the crowns is not complicated; at the transversal cone-pairs the saggittally extending, little enamel columns (generally characteristic to the *S. betulina*) are absent, (though this crown-pattern is rather varied, so we cannot say more than *S. subtilis* shows a trend towards a more simple, while *S. betulina* towards a more complex crown morphology) (Jánossy 1953, p. 421). I measured the length of the posterior cone-pair (hypolophid) on the second lower molars, and - comparing them with the data of Jánossy (1953, p. 422) - also the measurements fall into the *S. subtilis* size-category (Table 6).

MACROMAMMALS

In what follows I deal with the more important members of the macromammal fauna.

Carnivora

The bear finds - except a phalanx III from layer 6 - are teeth, more than the half of them is deciduous. In the material the cave bear (*Ursus spelaeus*) is dominant, but there are two smaller teeth (a lower deciduous canine and a lower incisor: I₂), which are probably brown bear (*Ursus arctos*) remains. From among the most significant Riss-Würm faunas in Hungary, the olders - as Süttő and Porlyuk Cave - are characterized by the brown bear finds. In the case of Süttő, which is not far from Tokod, we are allowed to rule out the zoogeographical differences, i.e. we have to suppose stratigraphical difference. In the Lambrecht Cave (younger Riss-Würm) the cave bear is the dominant species (approximately two-third part of the bear remains).

There is only one sure lion remain in the material, a right upper canine from layer 4. (There is another, uncertain find, a deciduous upper incisor from layer 5.) On the basis of the measurements the tooth differs from the older, Middle Pleistocene forms and fall into the Late Pleistocene *Leo spelaeus* size-category (Table 7).

Perissodactyla

From among the Equidae two species can be found in the material, a larger and a smaller one. The former belong to the genus *Equus*. Azzaroli (1990, p. 349) classified all the Late Pleistocene large or medium sized horses into the species *Equus caballus* as well as into its different subspecies. According to this classification I described the finds from Tokod as *Equus caballus* ssp. Because of the small number of the remains a more precise determination was not possible. The measurements fall into the overlapping domain of the medium sized *E. caballus germanicus* (Nehring) and the large sized *E. caballus abeli* (Antonius). These species are stratigraphically rather far from one other.

The smaller species is undoubtedly *Asinus hydruntinus* Regalia. This species is very common in the European Late Pleistocene, especially in Southern Europe. In the south it appeared during the penultimate glaciation (Riss) and disappeared at the end of Pleistocene (Azzaroli 1990, p. 356). In Hungary the earliest remains turned up from the Riss-Würm Interglacial from the Lambrecht Cave, and they are absent even from the middle stage of Würm. Here I have to add, that some small equid remains are known from the Early Holocene of Hungary, which were identified first with *A. hydruntinus* Regalia as a Pleistocene relic form, but according to another theory these finds belong to *Equus hemionus anatolicus*, which form immigrated into the Carpathian Basin during the Mesolithic age (Vörös 1981, pp. 55-56).

Artiodactyla

Finally a few words about the deer remains from Tokod. I described 4 taxa; red deer (*Cervus elaphus*), giant deer (*Megaloceros giganteus*), reindeer (*Rangifer* sp.) and fallow deer (*Dama* ? sp.). It is very strange and enigmatic to find the reindeer and the fallow deer together, since the latter is a typically interglacial, while the former is a glacial form (although *Rangifer* is present in the Lambrecht Cave too, together with interglacial forms e.g. *Crocidura* and *Glis*, which can be found also in the Tokod fauna). Single remains of both species were found: an anterior phalanx I of *Rangifer* and a lower incisor (I_2 sin.) of *Dama*. The reindeer find is absolutely certain, but the *Dama* find is rather dubious. In view of its measurements the tooth is a left second lower incisor of a fallow deer, however its shape differs a bit from that, and more similar to a milk incisor (dI_2) of a red deer. The crown is narrow, considerably curved to labial direction, but along a short section above the root it is straight. At the fallow deer - in the material, what was available for me - the crown of the second incisors curved laterally immediately above the root (Fig. 9). Unfortunately the root of the tooth was broken, hence it cannot be known surely if it was a permanent or a deciduous tooth. It is sure, that the other teeth of *Cervus elaphus* from Tokod are larger than the equivalent teeth of a recent animal, but not so much. If definite fallow deer remains were found during the forthcoming excavations, that would signify a close stratigraphical connection with the Süttőian faunal substage.

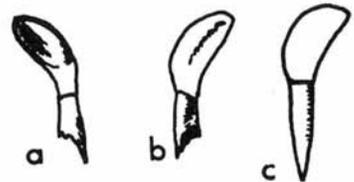


Fig.9: a: *Dama* ? sp. second incisor from Tokod (layer 5, V.91.273), posterior view; b: anterior view of the same; c: Recent *Dama dama* I_2

CONCLUSIONS

On the locality at Tokod - hitherto dated into the Lower Würm cold faunal substage - on the basis of the fauna collected by bed-by-bed washing of the loessy deposits, two substages have been separated, different from one another in climatic and in stratigraphical aspects. The lower layers fall into a mild, interglacial period, where the characteristic micromammals are: *Crocidura*, *Glis*, *Apodemus*, *Pitymys*, and *Microtus arvalis* is dominant over *M. gregalis*. The upper layers yielded remains of a beginning glaciation, where the characteristics are: the absence of *Crocidura*, *Glis* and *Pitymys*, the presence of *Dicrostonyx*, and the dominance of *Microtus gregalis* over *M. arvalis*. On the basis of the composition of the fauna and the presence of some characteristic forms (e.g. *Lagurus lagurus* together with *Alactaga*, presence of a large sized *Crocidura* (near the measurements of *C. robusta* Heller), *Asinus hydruntinus* and *Ursus cf. arctos*) the locality falls into the middle or later period of the Riss-Würm Interglacial (Varboian substage, type locality: Lambrecht Cave at village of Varbó in the Eastern part of the Bükk Mts., Northern Hungary) as well as (the upper layers) into the beginning part of the Würm Glaciation. One can draw similar conclusions on the basis of the gastropod fauna. In paleozoogeographical aspect the area was most probably a forested steppe with smaller or larger forests, groves and with large open areas. The climate was rather humid than dry, this is indicated by the high percentage of *Clethrionomys* and *Microtus oeconomus* among the voles.

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Table 1: The Gastropod fauna of the Tokod locality. (In round brackets: number of apertures, + = fragments.)

SPECIES	1-2	3	4	5	6
<i>Theodoxus danubialis</i> (C. Pfr.)	1				
<i>Valvata cristata</i> Müll.			1		
<i>Valvata piscinalis</i> (Müll.)	5	1	17	6	2
<i>Valvata naticina</i> Menke		13			
<i>Lithoglyphus naticoides</i> (C. Pfr.)				1	
<i>Lymnaea stagnalis</i> (L.)			2		
<i>Radix peregra peregra</i> (Müll.)	1				
<i>Radix peregra ovata</i> (Drap.)	55	49	160	119	21
<i>Planorbis planorbis</i> (L.)	23	25	61	58	17
<i>Anisus vorticulus</i> (Trosch.)	2				
<i>Gyraulus albus</i> (Müll.)			1		
<i>Gyraulus laevis</i> (Ald.)	1				
sum of aquatic species	89	75	245	184	40
<i>Succinea oblonga</i> Drap.	11	17	3	4	
<i>Succinea elegans</i> Risso	1	3		1	
<i>Cochlicopa lubricella</i> (Porro)		+	1		
<i>Granaria frumentum</i> (Drap.)	7	6	7 (39)	8	1
<i>Pupilla muscorum</i> (L.)	1	+		+	
<i>Pupilla triplicata</i> (Stud.)		1		+	
<i>Vertigo alpestris</i> Ald.		1			
<i>Columella edentula</i> (Drap.)		1			
<i>Orcula doliolum</i> (Brug.)			1		
<i>Orcula dolium</i> (Drap.)	1	+			
<i>Vallonia pulchella</i> (Müll.)	2	3			

SPECIES	1-2	3	4	5	6
<i>Vallonia costata</i> (Müll.)	15	50	7	5	
<i>Vallonia tenuilabris</i> (A. Br.)	2	9			
<i>Chondrula tridens</i> (Müll.)	2	1 (6)	6 (14)	+ (6)	
<i>Mastus bielzi</i> (Kim.)			1		
<i>Clausilia dubia</i> Drap.	46	33	26	17	
<i>Cochlodina laminata</i> (Mont.)			1		
<i>Laciniaria plicata</i> (Drap.)			1		
<i>Discus rotundatus</i> (Müll.)		1		1	
<i>Discus ruderatus</i> (Fér.)	5	5	3	3	
<i>Oxychilus inopinatus</i> (Ul.)	2	1	2	1	
<i>Nesovitrea hammonis</i> (Ström)	4	2	1		
<i>Aegopinella minor</i> (Stab.)			1		
<i>Phenacolimax annularis</i> (Stud.)	1				
Limacidae indet.	15	6	44	25	2
<i>Bradybaena fruticum</i> (Müll.)	+	1	+	+	
<i>Helicopsis striata</i> (Müll.)	14	9	14	10	1
<i>Trichia hispida</i> (L.)	5	2	+	+	
<i>Helicodonta obvoluta</i> (Müll.)		1	+		
<i>Arianta arbustorum</i> (L.)		1		+	
<i>Soosia diodonta</i> (Fér.)	1		3	1	
<i>Cepaea vindobonensis</i> (Fér.)			1		+
<i>Helix pomatia</i> L.			+		
Helicidae indet.	+		3	1	
sum of terrestrial species	135	154	125	76	4

Table 2: The Vertebrate fauna of the locality. (Remarks to the table: (1) In the case of micromammals the data represent the numbers of mandibles - or the numbers of M₁-s at the voles; (2) At other taxa the data give the numbers of remains; (3) In round brackets are the estimated numbers of individuals; (4) At the *Microtus arvalis-agrestis* group the second numbers represent the estimated numbers of *M. arvalis* M₁-s; + = mass occurrence.)

SPECIES	1-2	3	4	5	6
Pisces indet.		1	10	10	1
Anura indet.	+	+	+	+	+
Ophidia indet.	2	1	7	4	1
Lacertidae indet.	17	7	9	21	2
<i>Rallus</i> cf. <i>aquaticus</i> L.				1	
<i>Falco</i> cf. <i>tinnunculus</i> (L.)			1	2 (1)	
<i>Lyrurus tetrix</i> (L.)		1	1	2 (1)	1
<i>Coloeus</i> sp.			1	2 (1)	2 (1)
? <i>Pinicola</i> sp.				1	
<i>Turdus</i> sp. (large)		1			
<i>Turdus pilaris</i> seu <i>viscivorus</i>			1		
Passeriformes indet.	2		3	2	
<i>Talpa europaea</i> L.	9	(2)	8	12(1)	
<i>Sorex araneus</i> L.	13	2	8	16	1
<i>Sorex minutus</i> L.	3	2		5	
<i>Crocidura</i> cf. <i>leucodon</i> (Herman)			5	2	
<i>Myotis nattereri</i> (Kuhl)	3	(2)	2	(1)	
<i>Myotis daubentoni</i> (Kuhl)	4	1	1		
<i>Myotis bechsteini</i> (Kuhl)				2	
<i>Myotis brandti</i> (Eversm.)		1			
<i>Myotis dasycneme</i> (Boie)			(1)		
<i>Myotis schaubi</i> Kormos					(1)

SPECIES	1-2	3	4	5	6
<i>Eptesicus nilssoni</i> (Keys. et Blas.)	8	3	4	1	
<i>Eptesicus cf. nilssoni</i> (large)	(1)				
<i>Plecotus auritus</i> (L.)	1	(1)	2		
<i>Ochotona pusilla</i> (Pall.)	4	3	20	9	(1)
<i>Lepus cf. europaeus</i> Pall.	(2)	1	(3)	5	1
<i>Citellus citelloides</i> Kormos	6	2	7	13	
<i>Glis glis</i> (L.)				1	
<i>Cricetus cricetus</i> (L.)	1			(1)	
<i>Cricetulus migratorius</i> Pall.	1	1	2	1	
<i>Apodemus</i> sp.	1	1	2	5	1
<i>Arvicola terrestris</i> L.	3	(2)	3	6	
<i>Microtus arvalis-agrestis</i> group	32/9	18/16	51/45	60/55	3/1
<i>Microtus cf. agrestis</i> L.	23	2	6	5	2
<i>Microtus gregalis</i> (Pall.)	38	16	58	34	2
<i>Microtus oeconomus</i> (Pall.)	47	35	32	18	1
<i>Pitymys subterraneus</i> (De Sél. Longch.)			3		1
<i>Clethrionomys glareolus</i> (Schreb.)	39	15	22	20	1
<i>Dicrostonyx torquatus</i> (Pall.)	1	1	(1)	(1)	
<i>Lagurus lagurus</i> (Pall.)	2	(2)	1	1	1
<i>Spalax cf. leucodon</i> Nordm.	(1)	(1)	(2)	1	1
<i>Sicista cf. subtilis</i> Pall.	5	4	3	2	1
<i>Allactaga jaculus</i> (Pall.)	(1)		(1)	(1)	
<i>Canis lupus</i> L.	? 1			12 (1)	1
<i>Vulpes vulpes</i> L.	2 (1)	2 (1)	10 (2)	13 (3)	2
<i>Ursus spelaeus</i> Ros.-Hein.		1	7 (3)	11 (4)	3

SPECIES	1-2	3	4	5	6
<i>Ursus cf. arctos</i> L.	1		1		
<i>Mustela nivalis</i> L.	1	1	4 (1)	4 (1)	
<i>Mustela erminea</i> L.	1	1	1		
<i>Crocotta spelaea</i> (Goldf.)			4 (1)	11 (3)	2
<i>Leo spelaeus</i> (Goldf.)			1	1	
<i>Equus caballus</i> ssp.		1	5 (1)	5 (2)	
<i>Asinus hydruntinus</i> (Reg.)			2 (1)	3 (2)	
<i>Coelodonta antiquitatis</i> (Blmb.)			1	3 (1)	1
Cervidae indet.				1	
<i>Cervus elaphus</i> L.			1	3 (1)	
<i>Megaloceros giganteus</i> (Blmb.)			2 (1)	3 (2)	
cf. <i>Dama</i> sp.				1	
<i>Rangifer cf. tarandus</i> (L.)				1	
<i>Bison priscus</i> (Boj.)			10 (2)	12 (2)	
Bovidae sp.			1		
<i>Mammuthus primigenius</i> (Blmb.)					1

Table 3: Length of M₁-M₃ and height of the coronoid process on several *Crocidura* remains. (With data of Heller 1960 and Rzebik 1968.)

	L M ₁ -M ₃ (mm)	H p.c.(mm)
Lobsing		
<i>Crocidura robusta</i>	4.8	5.3
Verona		
<i>Crocidura zorzii</i>	4.5-4.2	5.4-5.5
Gössweinstein		
<i>Crocidura "zorzii"</i>	4.8	5.3
Tornewton Cave		
<i>Crocidura</i> sp.	4.75	5.76
Süttő 6/A/1		
<i>Crocidura leucodon</i>	3.87	-
Süttő 9		
<i>Crocidura leucodon</i> group	4.48	-
	-	4.33
Porlyuk (lower 1)		
<i>Crocidura robusta</i>	4.75	5.28
	4.52	4.92
	4.27	5.22
	4.46	-
Tökod II/4		
<i>Crocidura</i> cf. <i>leucodon</i>	-	4.45
	4.53	4.53
	4.45	4.81
Tökod II/5		
<i>Crocidura</i> cf. <i>leucodon</i>	4.41	5.12
	4.53	-
<i>C. leucodon-russula</i> gr. (Recent)	3.4-4.4	3.9-5.0

Table 4: Length of M₁-M₃ and height of the processus coronoideus (H c.p.) on several Hungarian Pleistocene *Sorex araneus* forms. (In brackets: the mean values.)

	L. M ₁ -M ₃ (mm)	H. c. p. (mm)
Solymár (Middle Pleistocene)		
<i>Sorex araneus</i> ssp. (N=20)	3.9-4.2 [4.0]	4.4-5.1 [4.83]
Süttő (Riss-Würm)		
<i>Sorex araneus</i> ssp. (N=2)	3.8-3.96 [3.88]	4.95
Istállóskő (Würm III)		
<i>Sorex araneus</i> (N=21)	3.77-4.13 [3.96]	4.33-5.05 [4.74]
Tökod II/1		
<i>Sorex araneus</i> (N=4)	3.81-4.1 [3.97]	-
Tökod II/4		
<i>Sorex araneus</i> (N=4)	4.09-4.3 [4.16]	4.62-5.12 [4.81]
Tökod II/5		
<i>Sorex araneus</i> (N=8)	3.81-4.18 [4.01]	-

Table 5: Length of the M₁ on *Arvicola* forms. (With data of Jánossy 1986.)

Early Pleistocene-early Middle Pleistocene	3.4-4.1 mm
Late Pleistocene	3.6-4.6 mm
Tökod	3.6-4.5 mm

Table 6: Average length of the M₂ at the posterior lophid on the *Sicista* species. (With data of Jánossy 1953.)

<i>Sicista betulina</i> (Recent)	0.7 mm
<i>Sicista subtilis</i> (Recent)	0.85 mm
<i>Sicista</i> cf. <i>subtilis</i> (Tökod)	0.87 mm (n=9)

Table 7: Length/width data of upper canines of some Hungarian Pleistocene lion remains. (With data of Jánossy 1966.)

Vértesszőlős (Mindel)	L (mm)	W (mm)
<i>Leo spelaeus wurmi</i> (N=5)	57-65	29-32
Subalyuk (Würm III)		
<i>Leo spelaeus</i> (N=1)	55	29
Istállóskő (Würm III)		
<i>Leo spelaeus</i> (N=2)	42	21
Tökod		
<i>Leo spelaeus</i> (N=1)	53.6	27

EXPLANATION OF PLATES

PLATE I

- 1: *Canis lupus* tibia sin. fr. (Tökod II/5, V.91.57), a: anterior view [0.5], b: posterior view [0.5], c: distal view [1]
 - 2: *Crocotta spelaea* radius sin. fr. (Tökod II/5, V.91.59), a: anterior view [0.5], b: posterior view [0.5], c: proximal view [1]
 - 3: *Crocotta spelaea* mc3 dext. (Tökod II/4, V.91.39), a: internal view [1], posterior view [1]
 - 4: *Crocotta spelaea* C sup. dext. (Tökod II/4, V.91.26), lingual view [1]
 - 5: *Canis lupus* C sup. dext. (Tökod II/5, V.91.70), lingual view [1]
 - 6: *Crocotta spelaea* P⁴ dext. (Tökod II/4, V.91.29), a: lingual view [1], b: occlusal view [1]
- [In brackets: the degree of enlargement.]

PLATE II

- 1: *Ursus spelaeus* P⁴ dext. (Tokod II/4, V.91.33), a: occlusal view [1], b: labial view [1]
 - 2: *Leo spelaeus* C sup. dext. (Tokod II/4), labial view [1.1]
 - 3: *Ursus spelaeus* M¹ dext. (Tokod II/5, V.91.46), occlusal view [1]
 - 4: *Ursus spelaeus* M₃ dext. (Tokod II/5, V.91.63), occlusal view [1]
 - 5: *Ursus spelaeus* M² sin. (Tokod II/5, V.91.30), occlusal view [1]
 - 6: *Equus caballus* ssp. anterior phal. III (Tokod II/5, V.91.18), proximal view [1.1]
 - 7: *Asinus hydruntinus* mc dext. (Tokod II/4, V.91.17), anterior view [0.5]
- [In brackets: the degree of enlargement.]

PLATE III

- 1: *Asinus hydruntinus* P⁴ dext. (Tokod II/4, V.91.27), occlusal view [1]
 - 2: *Equus caballus* ssp. P⁴ dext. (Tokod II/5, V.91.51), occlusal view [1.1]
 - 3: *Equus caballus* ssp. M¹ sin. (Tokod II/4, V.91.34), occlusal view [1]
 - 4: *Equus caballus* ssp. P² dext. (Tokod II/5, V.91.72), occlusal view [1]
 - 5: *Bison priscus* M² dext. (Tokod II/4, V.91.37), occlusal view [1]
 - 6: *Bison priscus* M³ dext. (Tokod II/4, V.91.38), occlusal view [1]
 - 7: *Bison priscus* mc sin. (Tokod II/4, V.91.19), anterior view [0.5]
 - 8: *Bison priscus* radius dext. (Tokod II/4, V.91.20), posterior view [0.25]
 - 9: *Bison priscus* mandibula sin. fr. with M₂ and M₃ (Tokod II/4, V.91.24), occlusal view [1.1]
- [In brackets: the degree of enlargement.]

PLATE IV

- 1a-b: *Cervus elaphus* right beam of the antlers (Tokod II/4, V.91.23), [0.5]
 - 2: *Rangifer* sp. anterior phal. I (Tokod II/5, V.91.71), a: proximal view [1], b: anterior view [1]
 - 3: *Megaloceros giganteus* posterior phal. II (Tokod II/4, V.91.28), a: lateral view [1.1], b: proximal view [1]
 - 4: *Megaloceros giganteus* P² dext. (Tokod II/5, V.91.67), occlusal view [1]
 - 5: *Megaloceros giganteus* M³ sin. (Tokod II/5, V.91.68), occlusal view [1]
- [In brackets: the degree of enlargement.]

PLATE I.

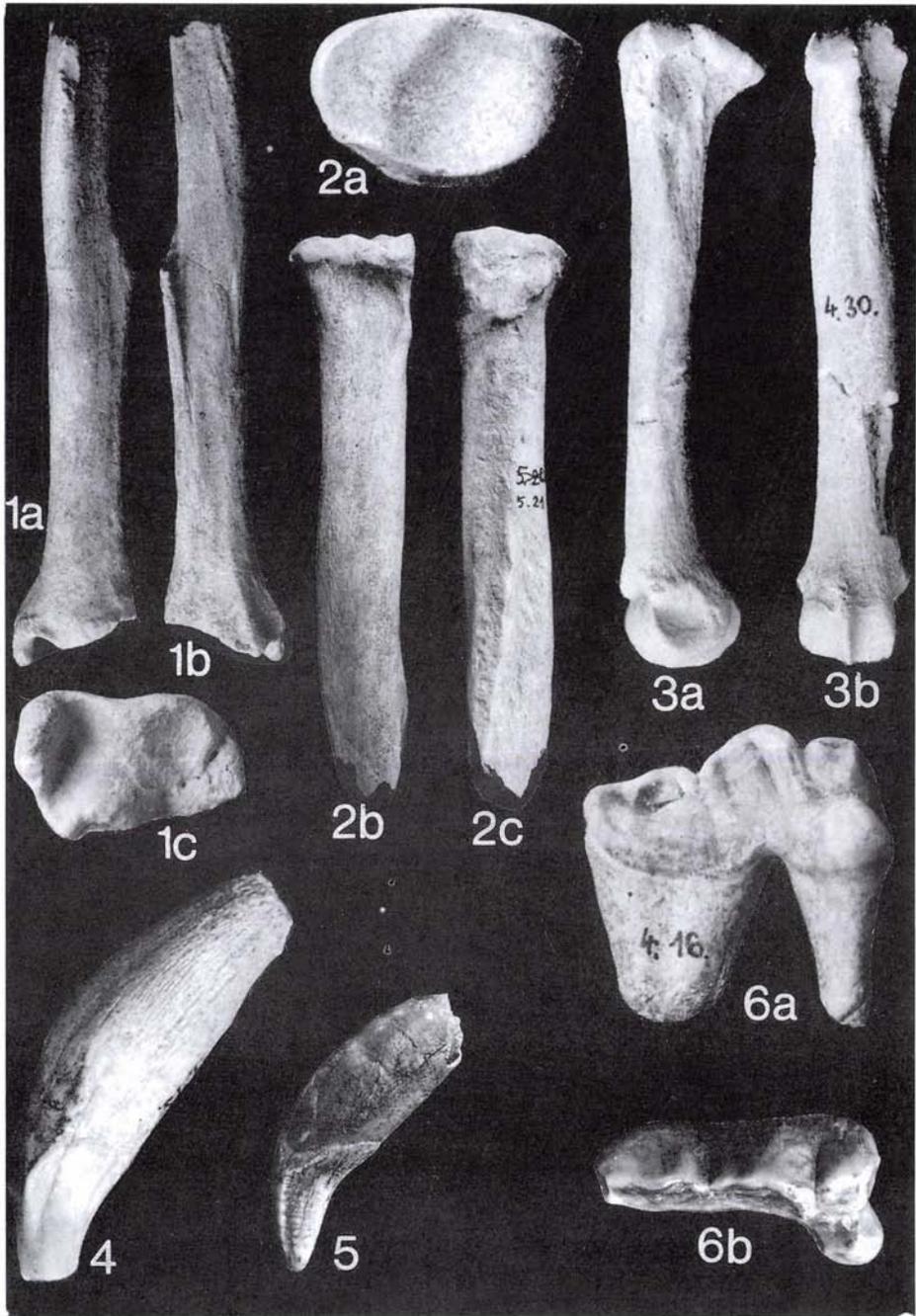


PLATE II.

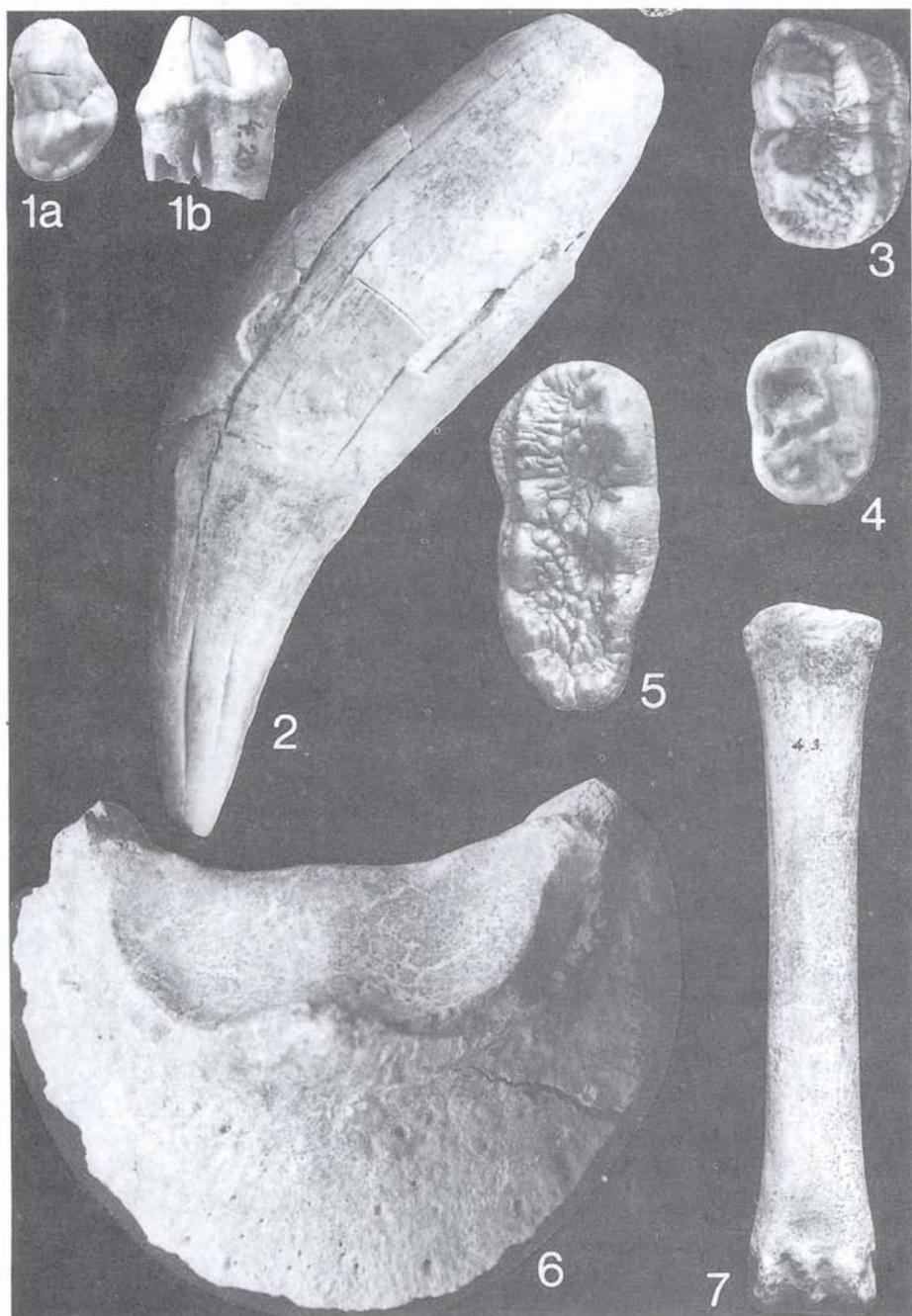


PLATE III.

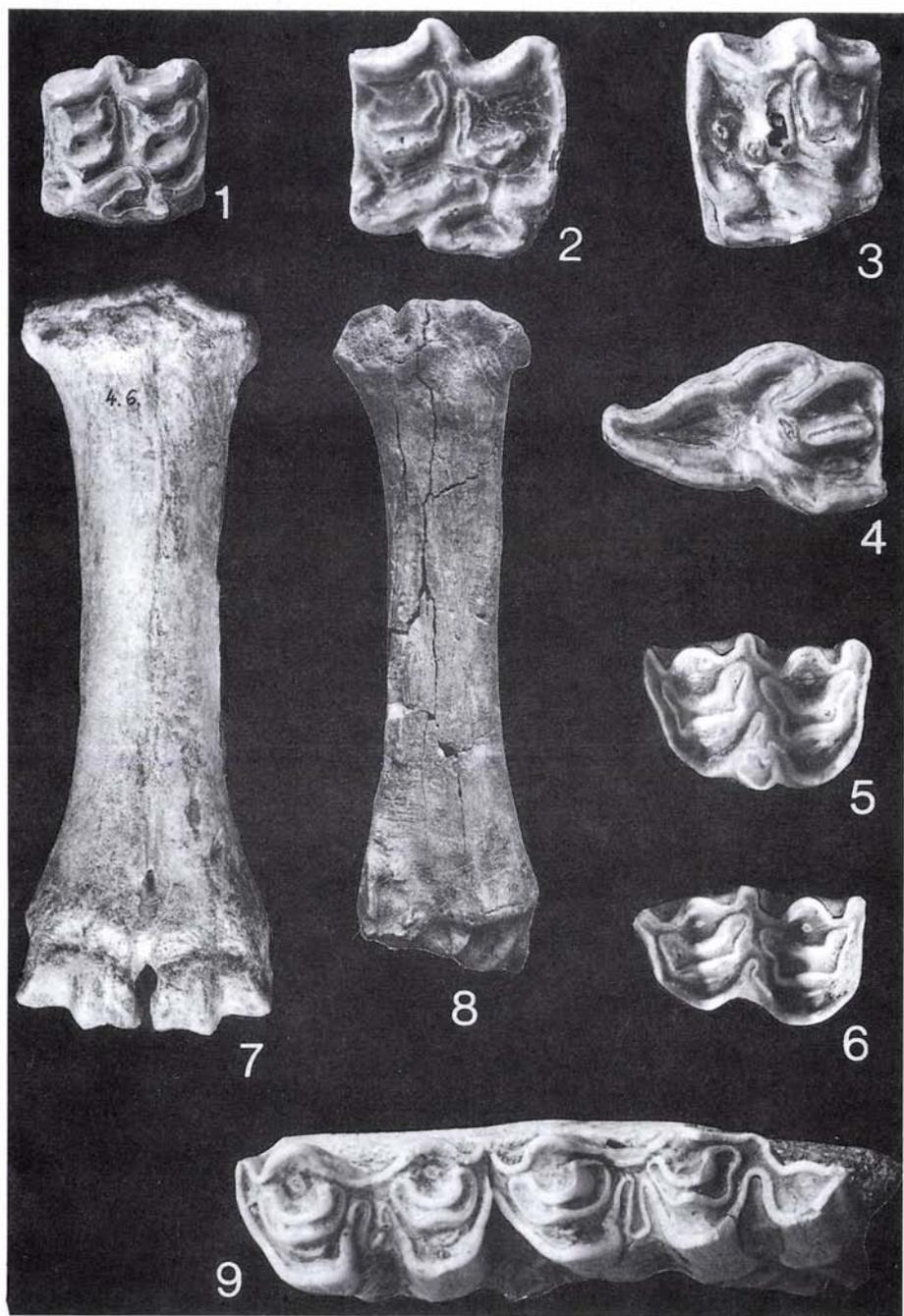


PLATE IV.

