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# Villafranchian Locality Hajnáčka I: Comparison of Older Data with New Ones

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*Abstract*. The Hajnáčka I site is one of the European paleontological localities dated to the Lower Villafranchian, MN 16a biozone (the Late Pliocene). From its discovery in 19th century, many scientists have dealt by the research of this site. After more than 35 years, the new systematic research started in the second half of 90s of the last century. The new research has yielded the quantity of the new material, especially paleontological one. This article gives the first results of this new research, which support the results of former researches.

*Key words*: Villafranchian, Late Pliocene, Hajnáčka, Slovakia

## Introduction

The paleontological locality Hajnáčka I is one of the type localities of the European Neogene Mammal time scale, dated to the MN 16a zone (Lower Villafranchian, Late Pliocene) (Fejfar & Heinrich, 1987). This site is world-known by its findings of the fossil vertebrates, especially mammals, buried in the ash. Fossil skeletal remains from Hajnáčka I site are known since 1863, when first literature evidence about it was put out by Kubinyi (Fejfar, 1964). In the next years of the research, many scientists have dealt with this locality (Szabó, 1865; Paul, 1866; Krenner, 1867; Schafarzik, 1899; Kormos, 1917; Fejfar, 1961a, 1961b, 1964; Fejfar & Heinrich, 1985; Fejfar et al., 1990; Konečný et al., 1995; Lindsay et al., 1997; Lupták, 1997; Uher et al., 1999; Vass et al., 2000; Pipík, 2000; Sabol, 2000; etc.).

After more than 35 years (last time Fejfar in 1955-58), the new systematic research started in 1996. The fieldwork part of this research, which was realised by the Department of Geology and Paleontology, Faculty of Sciences, Comenius University in Bratislava and the Gemer-Malohont Museum in Rimavská Sobota in the cooperation with scientists of the other scientific institutions (State Geological Institute of Dionýz Štúr, Geological Institute of the Slovak Academy of Sciences, Slovak National Museum – Museum of the Natural History in Bratislava and the Department of Paleontology, Faculty of Sciences, Charles University in Prague), has been finished in the summer 2000. The article gives the first results of this research.

## Locality

Paleontological site of Hajnáčka I is situated approximately 1 to 1.5 km SE of Hajnáčka village in the Rimavská Sobota district and 500 m N of the trigonometric point 410 m (Matrač hill) (see Fig. 1). The locality covers an area from 1,000 to 1,500 square metres (Fejfar, 1964). It consists of some deep erosive furrows (ravines) with steep walls, which are situated on the both right and left sides of way to the Békastó deck. The biggest of these erosive ravines with E-W orientation is 400 m long, to 30 m wide and its depth comes to more than 20 m in some places. On the basis of the quantity of skeleton remains, which were found here, this natural object was named as „Kostná dolina„ (Bone Valley) and proclaimed the protected natural object (see Fig. 2). The volcanic-sedimentary layers appear on the surface of these erosive furrow walls. They often contain the fossil remains of the Late Pliocene fauna and flora. From the hypsometrical point of view, the area of the paleontological site is limited by the contour lines of 233 and 287 metres above sea level.

The locality belongs to the Cerová Basalt Formation, which is mainly build up of the nepheline basanit and clastics of volcanic rocks. The radiometric age of the basalt varies since 5.03 until 1.16 Ma (Vass et al., 2000) (in older literature (Balogh et al., 1981 a Kantor & Wiegerová, 1981) the referred age is 2.7 – 1.5 Ma only). Thus, these volcanic rocks with their age correspond to the Late Pliocene to Early Pleistocene in the chronostratigraphical scale of the Paratethydian Neogene. The fossiliferous layers are situated in a maar depression of the elliptical shape (the Bone Valley maar) in the northern foothills of Matrač hill. The maar measurements are approximately 80x50 m (Bezák et al., 1992). The base of the maar filling consists of the redeposited Eggenburgian sediments of the Fiľakovo Formation (Tachty sands to sandstone) with the autochthonous tuffs, (lapilli) tuffites, fragments of basalt, and fine sands in the overlying. On the basis of the presence of the iron, some sediment is coloured to red and brown-red, and limonite crusts often envelop the sandy sediments. Also, redeposited palagonite tuffs and breccias are less frequently occurred in the maar filling. Locally, there are

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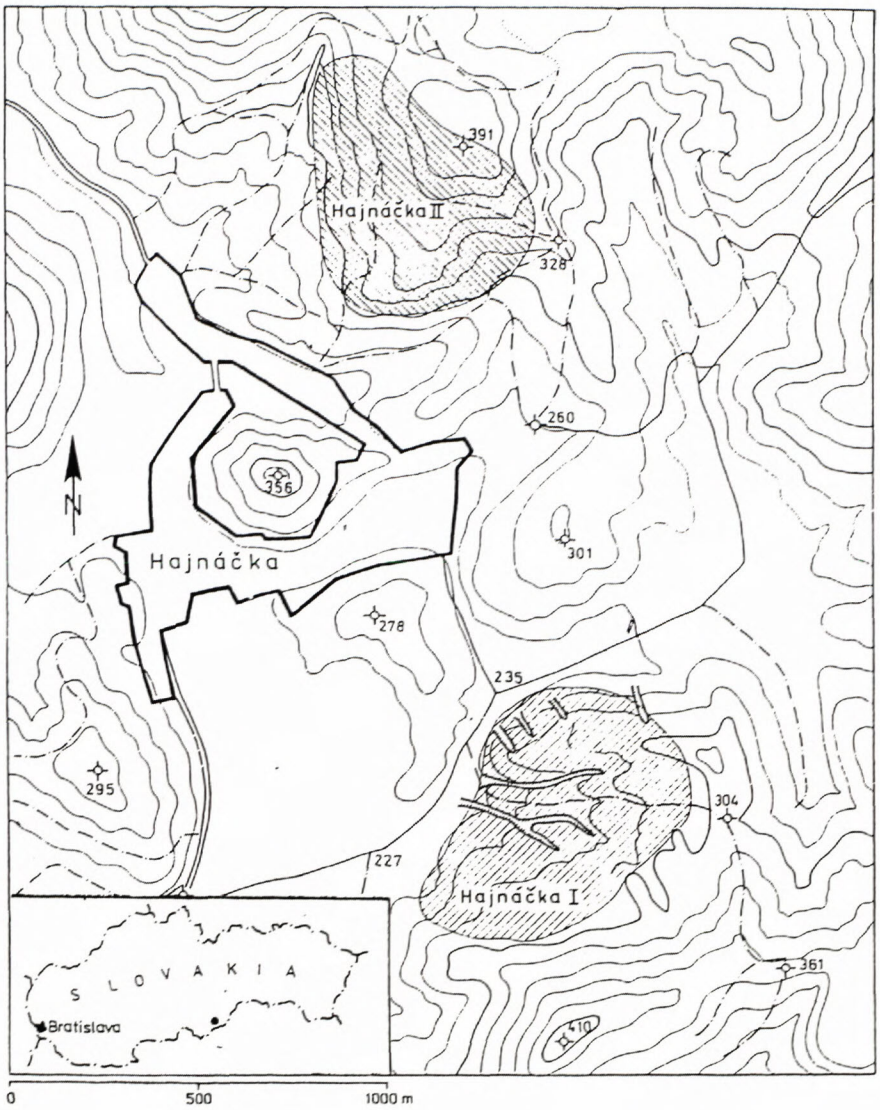



*Fig. 1. Location of the paleontological site Hajnáčka I. (modified after Fejfar et al., 1990).*

situated relicts of laminated bituminous beds in the upper part of this filling with the Quaternary loamy and loam-argillaceous deposits, covering the marginal parts of the Bone Valley maar. The fossil findings have been found in sediments, which were disrupted especially in the process of soil slides during the Quaternary Period. In spite of that, they are forming completely preserved stratigraphical unit, probably without hiatus.

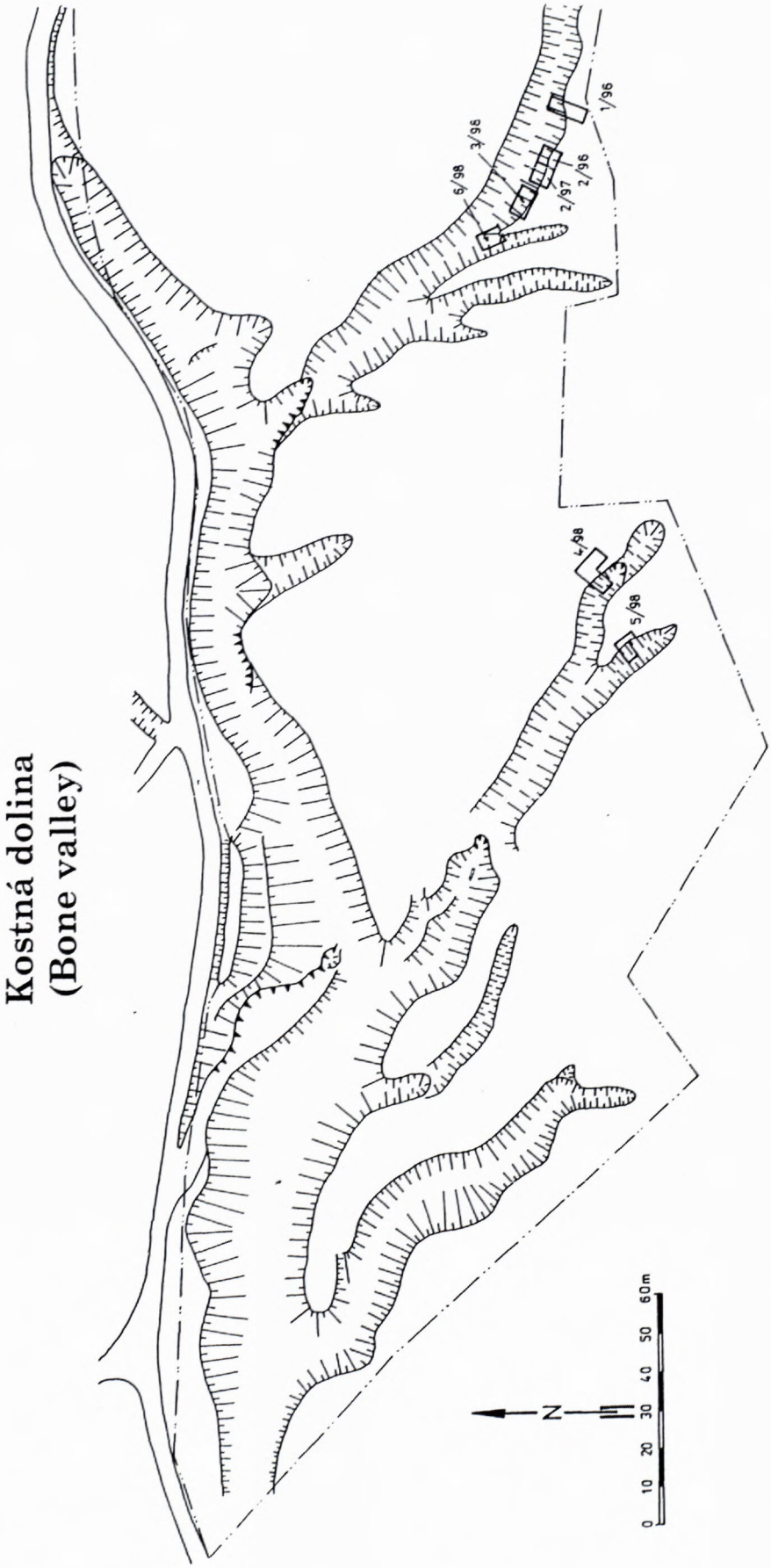
## Lithological and sedimentological description of pits, and their paleontological contents

During the new research of locality, six pits have been excavated in the upper parts of two lateral furrow outposts with SE orientation (see Fig. 2). There two vertical pits (1/96 and 2/96, which was marked as 2/97 after its broadening) and a horizontal one (3/98) have been dug in the place between probable occurring of the Fejfar's pits 8/56 and 9/56. The pit 3/98 was situated in the area 16 square metres approximately and method of archaeological research was partly used in searching of the vertebrate remains here (see Photo 1). Other two pits were vertical. The pit 4/98 has been excavated in the place of the Fejfar's pit 3/56, and the last one has been excavated in the place of the Fejfar's pit 9/56 probable occurring (see Fig. 2). Besides of these pits, still one (5/98) has been dug in the place of the chance finding of more quantity of the vertebrate bones. However, this new finding place in the territory of locality will be full described in a single paper. The deposits from the Pliocene to the Holocene have been ascertained in all these pits (see Fig. 3).

The most eastern pit 1/96 (see Fig. 3) is situated in the southern wall of the upper part of the Bone Valley longest furrow outpost. The pit had average width 70 cm and it has been dug to the 6.5 metre depth. Only 10 cm thick, the Quaternary sediments are represented by the dark-brown loamy soil from the Holocene. The underlying Pliocene deposits were divided to five layers. From upper to down, they are formed by the grey to grey-brown sandy tuffites with little fragments of basalt (from 3 to 7 cm in average); light sandy tuffites; grey, grey-black to black sandy tuffites with intercalation of the rusty-brown tuffaceous sands and approximately 20 cm thick position of pyroclastic rocks in the lower part of this layer; and grey-blue to grey-black lapilli tuffs with the lenses of grey-black sandy tuffites and rusty-brown tuffaceous sands with the large basalt fragments (to 20 cm in average) and findings of fossil remains of larger vertebrates, especially mammals (*Tapirus arvernensis* CROIZET ET JOBERT, 1828; *Dicerorhinus jeanvireti* GUERIN, 1972; *Pliocrocuta perrieri* CROIZET ET JOBERT, 1828; *Proboscidea* gen. et spec. indet., cervids etc.) (see Tab. 1). Also, the postsedimentary disturbances (microtectonic ones?) have been ascertained in this layer. The lowest one consists of the more-less sterile grey to grey-blue tuff with intercalation of rusty-brown tuffaceous sands.

Besides of findings of larger vertebrates, the fossil remains of fishes, reptiles (especially turtles) and rodents have been found too on washing of these sediments, mainly of rusty-brown tuffaceous sands (see Tab. 1). The colour of fossil bones was from grey to brown, whereas the teeth was coloured to white-grey, grey until brown, but in some cases to black as well.

The pit 2/96 (see Fig. 3) is situated in the southern wall of the upper part of the Bone Valley longest furrow




outpost too. It was orientated in a westward to north-westward direction of the pit 1/96. This pit has been dug to the almost 5 metre depth and subsequently deepened and expanded as the pit 2/97. The 5 layers have been distinguished here. The uppermost layer consists of the Holocene brown sandy loam and its thickness is 1 metre approximately. In the underlier of these Quaternary sediments, the Pliocene ones are deposited. There were ascertained grey-black to black tuffs without fragments of basalt; sandy tuffites and blue-grey to grey-black clayey tuffs with the basalt fragments (to 20 cm in average) and with the intercalation of gravel lenses of the rusty-brown tuffaceous sands, in which the fossil vertebrate remains have been found. Under this layer, that is probably equivalent of the grey lapilli tuffs with the lenses of grey-black sandy tuffites and rusty-brown tuffaceous sands in the pit 1/96, the blue-grey tuffs without fossil remains are bedded.

From the paleontological point of view, the fossil remains of fishes, frogs, turtles, snakes, insectivores, rodents, lagomorphs, proboscides, tapirs, rhinos and other mammals have been ascertained in the fossiliferous layers of this pit. Also, the teeth of little squirrel (*Sciurus* sp.) and undetermined ursid (cf. *Ursus minimus*?) have been found here. Thus, these two mammal taxa are one of new elements in the Hajnáčka biocenosis (see Tab. 1). However besides of these Pliocene vertebrates, the findings of younger Pleistocene elements have been ascertained here as well (for example *Clethrionomys*). The bones of the Pliocene vertebrates were coloured from white-grey to light-brown, brown until black. Similarly, the colour of tooth enamel was from white to grey, brown and black in solitary cases.

*Fig. 2. The schematic map of the biggest furrow in Bone Valley with marked single pits, which during the new research have been excavated.*

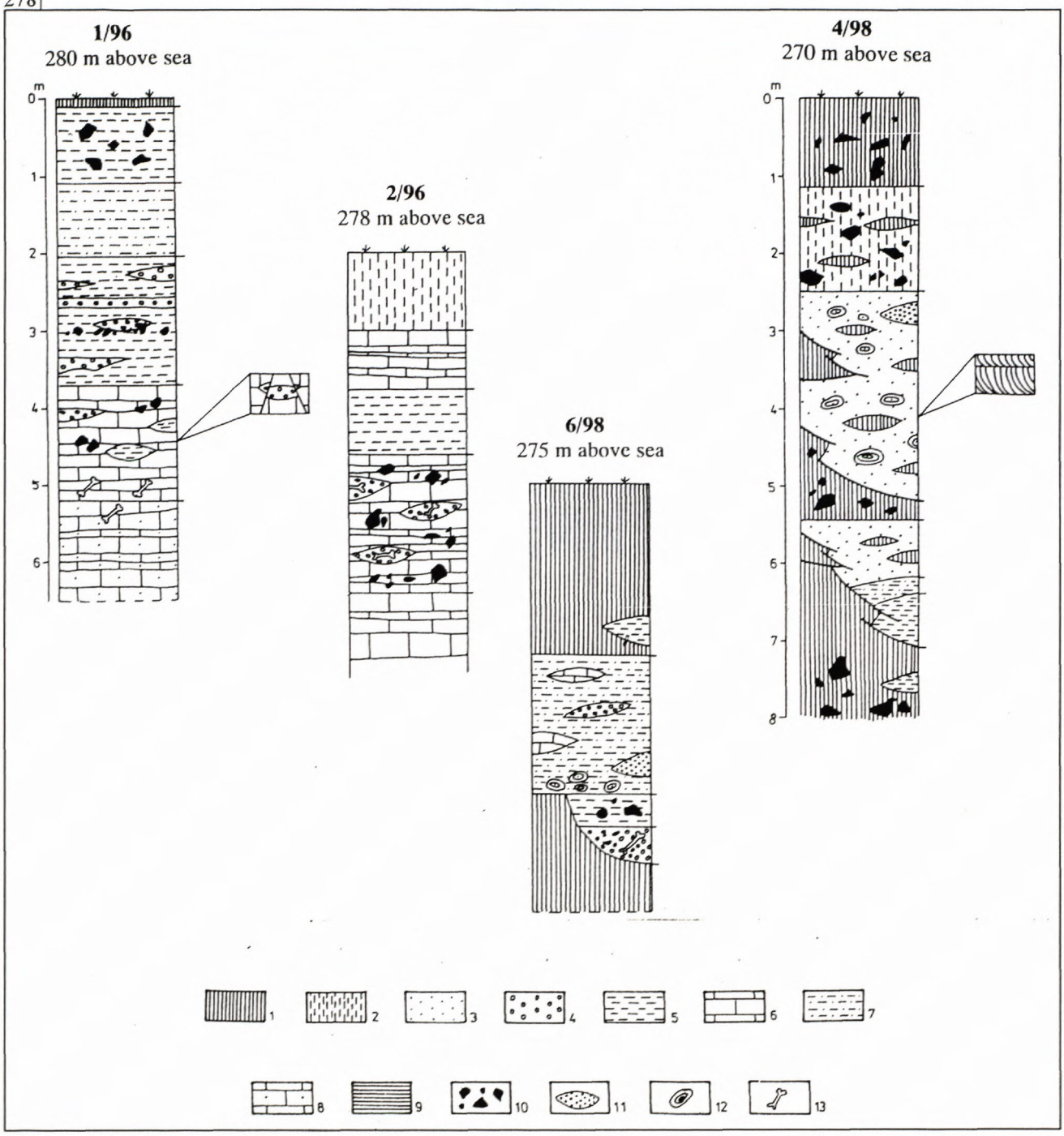



*Fig. 3. The schematic sketch of the single new pits (1/96, 2/96, 4/98, 6/98) in territory of the Hajnáčka I site.*
*1 – Holocene dark humous loam; 2 – Quaternary light sandy loam; 3 – light unconsolidated sands to tuffaceous sands; 4 – rusty-brown tuffaceous sands often with limonite concretions; 5 – dark sandy tuffites; 6 – blue-grey to grey-black tuffs, lapilli tuffs; 7 – light sandy tuffite with intercalation of rusty-brown tuffaceous sands; 8 – tuff with intercalation of rusty-brown tuffaceous sands; 9 – fine laminated tuff; 10 – fragments of basaltic rock; 11 – lenses of volcanic material; 12 – baked sandstone; 13 – findings of vertebrates, especially mammals.*

Excepting expanded pit 2/97, the horizontal pit 3/98 has been excavated in the depth of the occurrence of fossiliferous layer. The measurements of this researched area were approximately four times four metres (approx. 16 square metres). The excavations on this pit yielded numerous fossil remains of various vertebrate taxa (see Tab. 1). Besides known genera and species, some new taxa of insectivores (*Talpa* cf. *fossilis*, cf. *Deinsdorfia* sp. and *Soricidae* gen. et spec. indet.) have been ascertained too. Alike as findings of the squirrel and ursid from the former pit, these remains of shrews and mole represent new elements in the Pliocene fauna of Hajnáčka as well. Fossils, which have been found here, were coloured to same colour like findings of both pits 1/96 and 2/96-97.

The vertical pit 4/98 (see Fig. 3) has been dug to the 7.85 metre depth in the place of the Fejfar's pit 3/56. The

*Tab. 1. List of the Late Pliocene vertebrates from the Hajnáčka I site.*

| taxon | Fejfar et al., 1990 | *Hajnáčka I (1996 – 2000)* | | | | |
|---|---|---|---|---|---|---|
| | | 1/98 | 2/96-97 | 3/98 | 4/98 | 6/98 |
| **Osteichthyes** | | | | | | |
| *Scardinus? erythrophthalmus* Linné, 1758 | + | + | + | + | | + |
| *Tinca furcata* Agassiz, 1843 | + | + | + | + | | + |
| *Esox* sp. | + | | | + | | |
| cf. *Parasilurus* sp. | + | | | | | |
| Osteichthyes gen. et spec. indet. | + | + | + | + | | + |
| **Amphibia** | | | | | | |
| *Pliobatrachus* sp. | + | | | | | |
| *Bufo bufo* (Linné, 1758) | + | | | | | |
| *Rana* cf. *temporaria* Linné, 1758 | + | | | | | |
| *Rana* cf. *arvalis* Linné, 1758 | + | | | | | |
| *Rana* cf. ex gr. *dalmatina-latastei* | + | | | | | |
| Anura gen. et spec. indet. | + | | + | + | | |
| **Reptilia** | | | | | | |
| *Chelydra* aff. *decheni* H. von Meyer, 1852 | + | | | | | |
| *Emys orbicularis* Linné, 1758 | + | | | | | |
| Testudinata gen. et spec. indet. | + | + | + | + | | |
| Serpentes gen. et spec. indet. | | + | + | | | |
| **Aves** | | | | | | |
| *Mergus* sp. | + | | | | | |
| **Mammalia** | | | | | | |
| *Desmana nehringi* Kormos, 1913 | + | | | | | |
| *Talpa cf. fossilis* Petényi, 1864 | | | | + | | |
| *Talpa* cf. *minor* Freudenberg, 1914 | | | | | | + |
| cf. *Deinsdorfia* sp. | | | | + | | |
| *Petenyia hungarica* Kormos, 1934 | + | | | | | |
| *Blarinoides mariae* Sulimski, 1959 | + | | + | + | | |
| *Beremendia fissidens* (Petenyi, 1864) | + | | | | | |
| Soricidae gen. et spec. indet. | | | | + | | |
| Colobinae gen. et spec. indet. | + | | | | | |
| *Lutra* cf. *bravardi* Pomel, 1843 | + | | | | | |
| *Parailurus hungaricus* Kormos, 1934 | + | | | | | |
| *Megantereon*(?) sp. | + | | | | | |
| *Pliocrocuta perrieri* (Croizet et Jobert, 1828) | + | + | | | | |
| Ursidae gen. et spec. indet. | | | + | | | |
| *Pliopetaurista pliocaenica* (Depéret, 1897) | + | | | | | |
| *Sciurus* sp. | | | + | | | |
| Seleviniidae(?) sp. | + | | | | | |
| *Prospalax priscus* (Nehring, 1897) | + | + | | + | | + |
| *Apodemus* sp. | + | | | | | |
| *Baranomys loczyi* Kormos, 1933 | + | | | | | |
| *Mimomys (Cseria) stehlini* Kormos, 1931 | + | | + | + | | + |
| *Mimomys (Mimomys) hassiacus* Heller, 1936 (=*Mimomys (M.) hajnackensis* Fejfar, 1961) | + | + | + | + | | |
| *Mimomys* sp. | | + | + | + | | + |
| Arvicolinae gen. et spec. indet. | | | + | + | | + |
| *Germanomys* sp. | + | | + | | | + |
| cf. *Ungaromys* sp. | | | | | | + |
| *Castor fiber* ssp. | + | + | + | | | |
| *Trogontherium minus* Newton, 1890 | + | | | | | |
| Rodentia gen. et spec. indet. | | + | + | + | | + |
| *Hypolagus brachygnathus* Kormos, 1934 | + | | + | | | |
| *Mammut borsoni* (Hays, 1834) | + | | | | | |
| *Annancus arvernensis* (Croizet et Jobert, 1828) | + | | + | + | | |
| Proboscidea gen. et spec. indet. | | + | + | + | | + |
| *Tapirus arvernensis* Croizet et Jobert, 1828 | + | + | + | + | | + |
| *Dicerorhinus jeanvireti* Geurin, 1972 | + | + | + | + | | + |
| Rhinocerotidae gen. et spec. indet. | + | + | + | + | + | + |
| *Sus minor* (Depéret, 1890) | + | | | | | |
| *Capreolus* sp. | + | | | | | |
| *Cervus perrieri-Arvernoceros ardei* | + | | | | | |
| *Cervus pardinensis* Croizet et Jobert, 1828 | + | | | | | |
| *Croizetoceros ramosus* (Croizet et Jobert, 1828) | + | | | | | |
| *Muntjacus* sp. | + | + | | | | |
| Cervidae gen. et spec. indet. | | + | | + | | |
| Mammalia gen. et spec. indet. | | + | + | + | | + |
| Vertebrata gen. et spec. indet. | | + | + | + | + | + |

*Photo 1. The pit 3/98, where method of archaeological research has been used; photo J. Ferleťáková.*

*Photo 2. The detail view to one of fossiliferous lenses of gravel rusty-brown tuffaceous sands with the presence of the limonite concretions and small pyroclastics, pit 2/96; photo J. Ferleťáková, scale is 10 cm.*

width of this pit was to 6.60 metres in the two uppermost terraces of pit and in lower ones the width was moved in the boundary from 70 to 160 cm. The uppermost layer is represented by the brown to dark-brown humous loam with basaltic pebbles. To the depth, these probably Holocene sediments grade to the yellow-brown to brown sandy loam with basalt fragments too, and with the intercalation of the overlying dark-brown loam. This light loamy layer is slightly cemented in the base. In the underlier of these sediments, the light yellow to yellow-brown unconsolidated sands to tuffaceous sands with the intercalation of dark-brown loam with the basaltic pebbles are deposited. The sands are solitarily diagonal bedded. Also, they contain baked sandstone and lenses of the tuff to tuffaceous volcanic material. The dark-brown loam with basalt fragments is situated in the depth from 5.20 to 5.45 metres. This loam grades to the more thickness in the profile left part and separates thus the overlying sands from the underlying light yellow to yellow-brown unconsolidated tuffaceous sands with intercalation of the dark-brown loam, but without the baked sandstone. Approximately 20-cm thick layer of the cemented light sandy tuffites with the rusty-brown tuffaceous sand intercalation is deposited under these light sands. In underlier of tuffaceous sands, the grey-brown sandy tuffites are situated in the profile right side, which grade toward the depth to the irregular layer of the brown to dark-brown loam with pyroclastics and with the intercalation of the grey-brown sandy tuffites. It is not out of the question that this pit has been excavated partly in the place of the secondary rede-

posited volcanic and sedimentary material, which was relocated yet during former excavations. Also, this assumption is supported by the findings of only some light brown to brown bones of rhinos and other undetermined mammals in the sand. Any micromammals have been found here.

The pit 6/98 (see Fig. 3) has been excavated in the place of the Fejfar's pit 9/56 probable occurring. The depth of this pit was 5.5 metres approximately. More detailed determination of the single layers was limited the presence of the deposits from former field works. The uppermost layer consists of the brown loamy deposits with the occurrence of the grey-brown sandy tuffites with intercalation of the solitary grey tuffs and rusty-brown tuffaceous sands in the layer lower part. Underlying layer contains the grey-brown sandy tuffite with intercalation of the grey tuffs, rusty sands with the volcanic rock lens in the lower part, and with baked sandstone in the layer base. The brown loamy deposits form the lowest layer. There are two layers situated in its overlying in the pit right side. The upper of them is forming by the grey sandy tuffites with basaltic pebbles. Lower one consists of large lens of the rusty-brown tuffaceous sands with the volcanic rocks and with the occurrence of the vertebrate fossils. The remains of small mammals (insectivores and rodents) and large ones („mastodons", tapirs, rhinos, etc.) together with the abundant fish fossils have been found here (see Tab. 1). The insectivores are represented by one mole species only (*Talpa* cf. *minor*), but it is other new faunal element, ascertained at the locality. Also, rodent fauna from this pit probably contains new locality taxon of the subfamily *Prometheomyinae* (cf. *Ungaromys* sp.). However, the teeth of the Pleistocene voles (*Microtus* and *Clethrionomys*) have been found too. Their presence is only other evidence of the mixing older and younger sediments in the time after the extinction of Hajnáčka biocenosis, especially during the Pleistocene Period. As interesting is the colour of found fossil remains from the pit. Whereas tooth enamel is coloured from white-grey to grey, brown and black, the bones are coloured to the rusty-brown and dark brown until black. Thus, they differ from vertebrate bones of other pits.

On the basis of the existing research we are able to draw that the occurrence of the vertebrate fossil remains is especially connected with the lenses and intercalation of gravel rusty-brown tuffaceous sands, often with the presence of the limonite concretions and small pyroclastics (see Photo 2). These tuffaceous sands consist of redeposited material of the original primary maar filling, which has been deposited on the inner slopes of this maar ring (VASS et al., 2000). The bones and teeth of tapirs, rhinos, mastodons and micromammals, especially rodents (see Fig. 4) have been found the most frequently of all terrestrial vertebrates in these fossiliferous layers together with the large quantity of fish fossil remains.

Besides of vertebrate fossils, the gem varieties of corundum (sapphire) have been discovered in these lenses too. The sapphires originated in the felsitic syenite-like melt, uplifted to the surface as xenoliths or as xenocrysts by a new portion of alkali basaltic melt. However, these xenoliths (xenocrysts respectively) were not in equilibrium with this surrounding alkali basalt magma. Subsequently, the sapphires have been redeposited to the maar filling. It is not clear so far, whether these minerals come from nearby basalt lava flows or from the maar itself (Uher et al., 1999).

**Discussion**

More or less broken sediments, often in allochthonous attitude, have been ascertained in all studied pits. These sediments were disrupted not only during their deposition, which has realised in very short time span (Fejfar et al., 1990), but also in the period after the extinction of the Hajnáčka biocenosis. In this time, the original layers of maar sediments were destroyed by the seismic shocks connected with explosive activity, and by the processes connected with the domatic rise of the Cerová Highland (Vass et al., 2000). Also, these sediments were disturbed in the later Quaternary Period, especially during the Late Pleistocene (erosion, solifluction and repeated landslides), when they have redeposited to the bottom of the Hajnáčka depression (Fejfar, 1964). The occurrence of the Late Pleistocene loess sediments (Bezák et al., 1992) together with the Pliocene sedimentary rock is evidence of that. Apart from malacofauna these Quaternary deposits contained the fossil remains of mammoths, horses and rodents (*Microtus, Clethrionomys*) as well. The occurrence of these Pleistocene elements together with the findings of the Pliocene fauna has been early referred from this site by SZABÓ (1865) (fossil remains of bison, mammoth and horse) and Fejfar (1964) (woolly rhinos, rodents) for example. On the ground of thus destroyed suitable stratigraphical data, it is difficult exactly to reconstruct the thickness of the Pliocene sedimentary maar filling.

It was frequently in the profiles of single pits that so called „older section" (limnic sands, sandy tuffites and lapilli ash with baked limonite sandstone) (Fejfar, 1964), is situated over the younger members of deeper facies (light grey coarse deposited tuffites and tuffs). Thus, this site is differing from Hajnáčka II locality, where volcanic ash has been deposited directly on the surface above the Miocene sediments, so that so called „older section" is missing here (Fejfar, 1964). This phenomenon of the „inverted" and mixed layers, which Fejfar (1964) also described from his pits 3/56, 8/56, 9/56 and 3/57, was distinct especially in our pits 1/96 and 2/96-97. Together, the profiles of these two new pits are more or less in good agreement with profiles of Fejfar's pit 8/56, especially in their upper and lower parts (see Fig. 5). The middle pit parts are less comparable to almost different, whereas grey-black to black tuffs (layer „2") of pit 2/96 are not correlated. It is not out of question that these dark tuffs represent isolated block of volcanic material. On the basis of this knowledge we are able to assume the lithological changes in short distances, which are the result of repeated secondary redeposition of original maar sediments.

Likewise, the sediments ascertained in the profile of pit 4/98 are relatively in good agreement with the sediments of older pit 3/56 (see. Fig. 6), but our pit was

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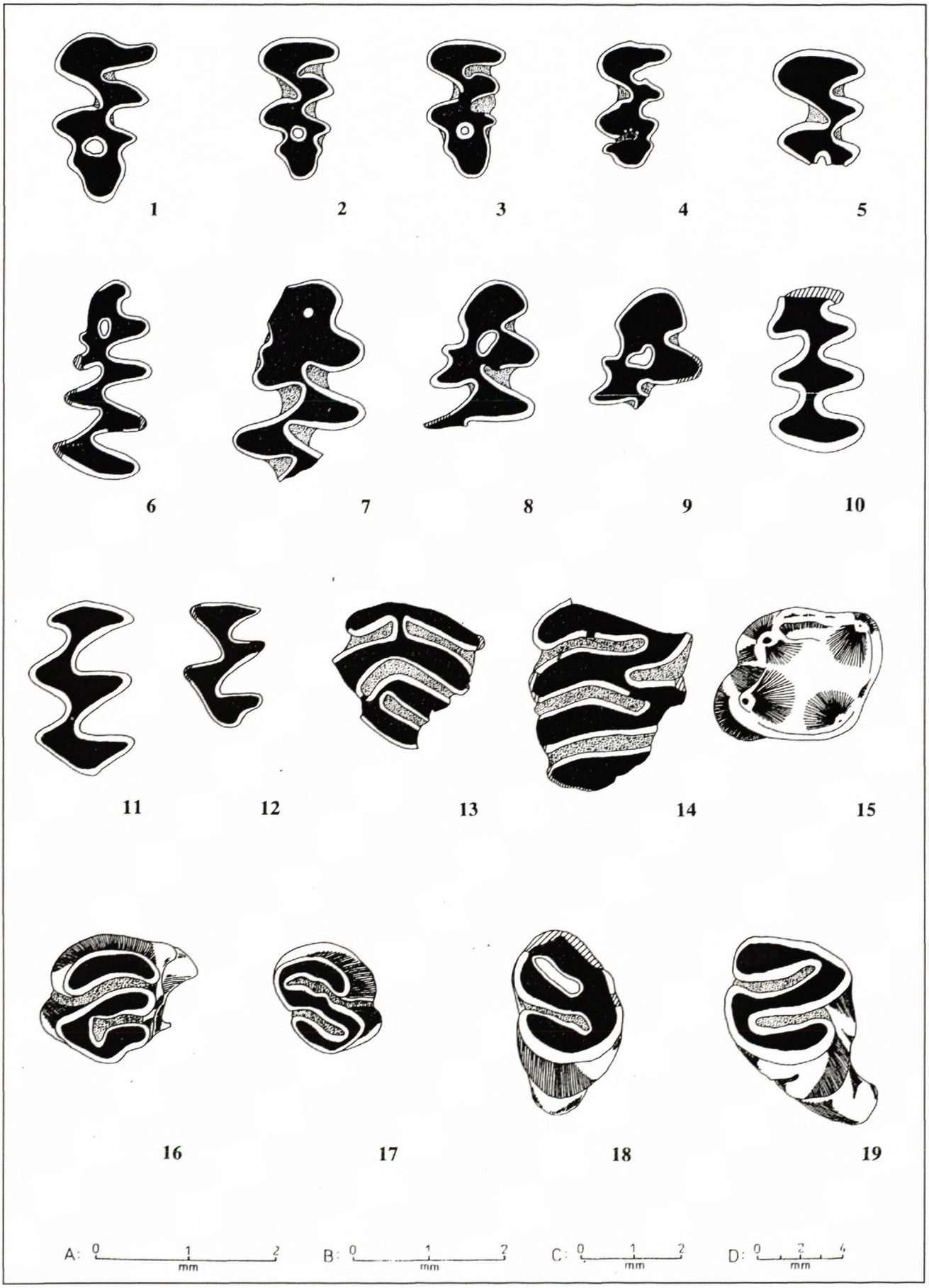


*Fig. 4. New findings of rodent teeth from the Villafranchian sediments (MN 16a) of the Hajnáčka I site; deposited in the Gemer-Malohont Museum in Rimavská Sobota.*

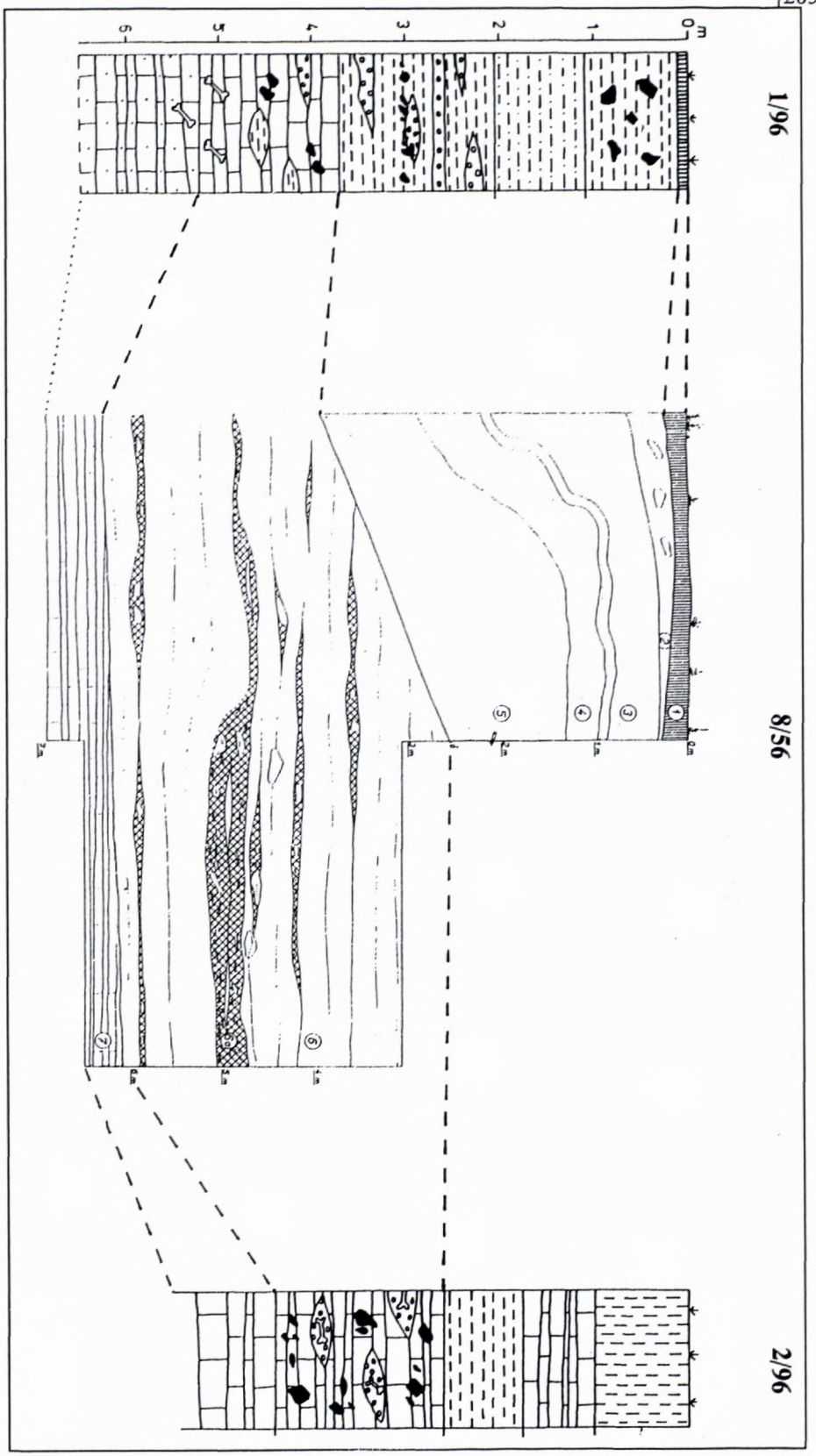


*Fig. 5. The schematic comparison of the profile of pit 8/56 (Fejfar, 1964) with the profiles of new pits 1/96 and 2/96.*
*Notes to the pit 8/56 (Fejfar, 1964): 1 – dark brown humous loam; 2 – rusty-brown sandy loam with boulders of compact basalt; 3, 4, 5 – dark to light brown not calcareous clayey sands with sporadic skeleton finds in secondary position; 6 – light or dark rusty-brown tuffitic sands with dispersed lenses of a dark rusty-brown lapilli tuff with numerous boulders of patinated compact basalt, fragments of cemented, fine banded tuffites with numerous small phenocrysts of amphibole, and very numerous light rusty-brown skeleton finds (the lenses of tuff are marked 6a); 7 – light grey, cemented, strongly calcareous, thicker-bedded tuffites.*
*Notes to pits 1/96 and 2/96 see fig. 3.*

*Mimomys (Mimomys) hassiacus* HELLER, *1936 (= Mimomys (M.) hajnackensis* FEJFAR, *1961): 5. M3 sin. (B-4140), 8. m1 dex. (inv., B-4138), 9. m1 dex. (inv., B-4139).*
*cf. Ungaromys sp.: 10. m1 sin. (B-4119).*
*Germanomys sp.: 11. M1 dex. (inv., B-4120), 12. M2 dex. (inv., B-4017).*
*Castor fiber ssp.: 13. P4 sin. (B-3058), 14. M1-2 dex. (B-3106).*
*Sciurus sp.: 15. m2 dex. (B-4012).*
*Prospalax priscus* (NEHRING, *1897): 16. M1 sin. (B-4136), 17. M2 dex. (B-4135), 18. m1 sin. (B-4112), 19. m2 dex. (B-4128).*
*Scales: A – 1, 2, 7, 12, 15; B – 3, 4, 5, 6, 8, 9, 10, 11; C – 16, 17, 18, 19; D – 13, 14.*

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probably situated more on the left from original pit. A quantity of findings is only different between both pits. Fejfar (1964) described larger number of fossil remains from this finding place, while new research yielded hence some bones of larger mammals only.

The correlation of pit 6/98 with the pit 9/56 was limited by the presence of loamy sediments, which have been redeposited during the first phase of excavations on pits 1/96 and 2/96-97. On the basis of that, only dark grey tuffites (or tuffs resp.) with the lens(-es) of rusty-brown tuffaceous sands, and partly light grey-brown sandy tuffites with the intercalation of grey tuffs and basalt fragments have been again ascertained here (see Fig. 7). Also, the colour of found bones is in good agreement with the colour of former findings.

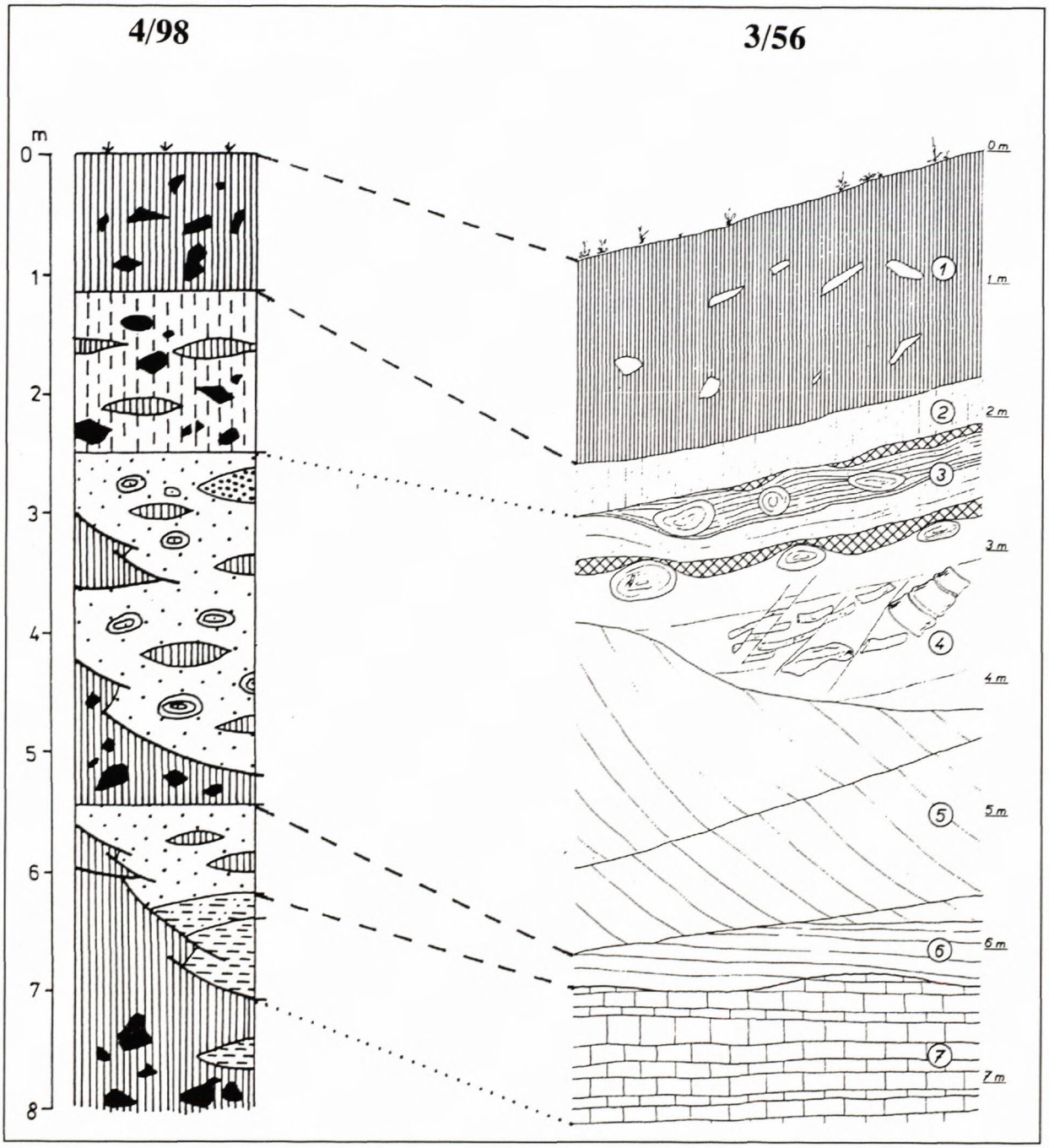


*Fig. 6. The schematic comparison of the profile of pit 3/56 (Fejfar, 1964) with the profile of new pit 4/98.*
*Notes to the pit 3/56 (Fejfar, 1964): 1 – dark brown humous loam with basaltic pebbles; 2 – rusty-brown sandy loam with sporadic skeleton remains in secondary position; 3a – coarse greyish lapilli tuff with fragments of baked sandstones; 3b – whitish-grey approx. 10 mm thick banks of slighty cemented, strongly calcareous fine arenaceous tuffites, alternating with approx. 5 mm thick slighty calcareous grey, very fine tuffitic sands; 3c – light grey, slighty calcareous fine tuffitic sands with a distinct microtectonic; 4 – unstratified slighty calcareous light rusty-brown fine sand, on the contact with layer 3c occurs an outstretched layer of grey coarse lapilli tuffs; 5 – light greyish-brown thinly bedded tuffitic sands without finds; 6 – light grey thinly bedded tuffitic sands without finds; 7 – light grey, cemented, strongly calcareous thickly bedded tuffites. Notes to pit 4/98 see fig. 3.*

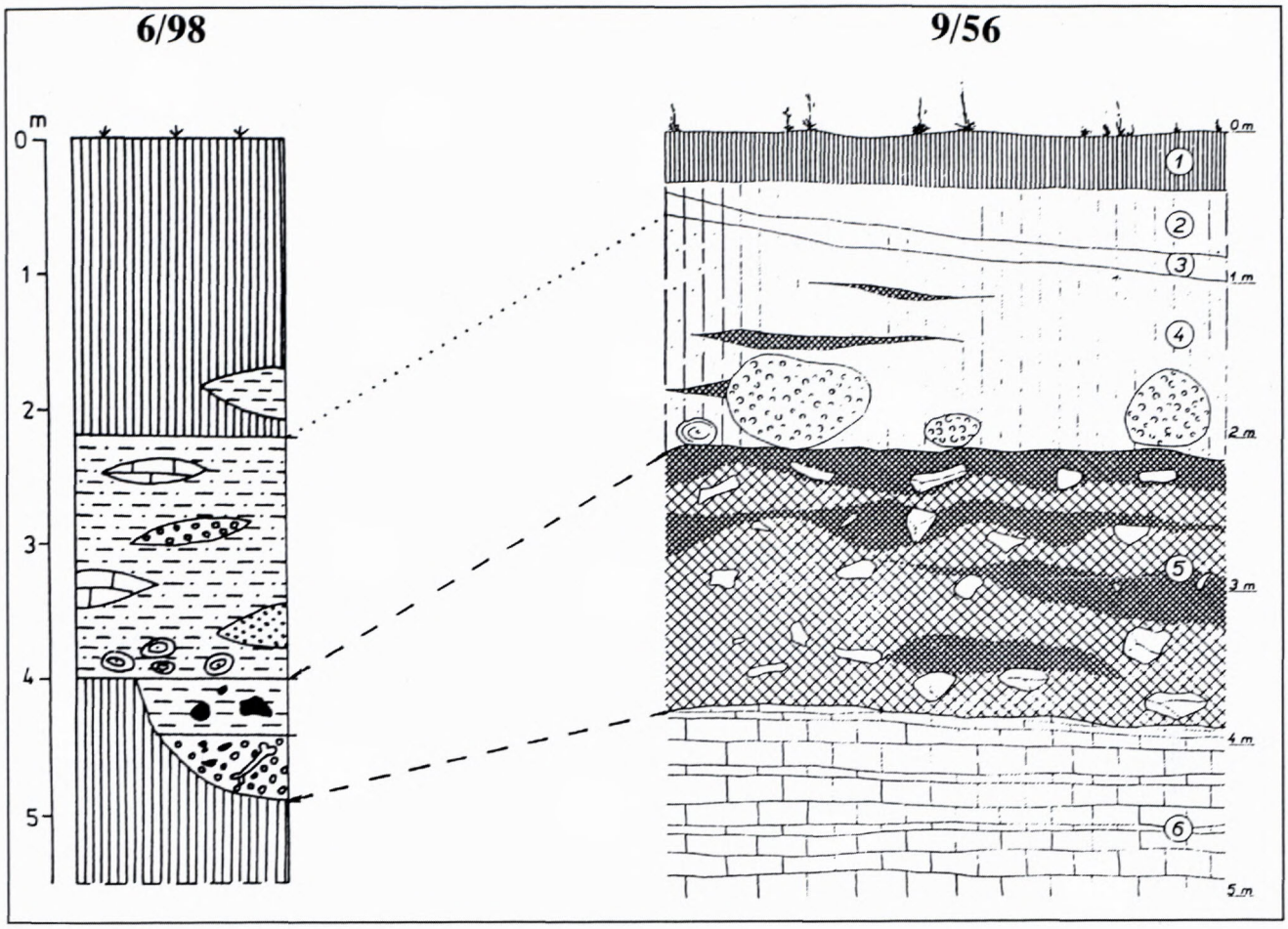


*Fig. 7. The schematic comparison of the profile of pit 9/56 (Fejfar, 1964) with the profile of new pit 6/98.*
*Notes to the pit 9/56 (Fejfar, 1964): 1 – dark brown humous loam; 2, 3 – light brown, slighty calcareous redeposited fine sands; 4 – light greyish-brown, strongly calcareous sandy loess with intercalations of coarse greyish.black tuffs, on the basis blocks of a strongly weathered porous basalt; 5 – dark grey to grey-black lapilli tuffs with numerous blocks of patinated compact basalt with a very abundant vertebrate fauna, dispersed lenses with a finer grain-size, with a comparatively abundant mammalian microfauna, alternated with coarser layers; 6 – light grey cemented strongly calcareous tuffites. Notes to pit 6/98 see fig. 3.*

After Vass et al. (2000), the layers ascertained in the pits (especially in 1/96 and 2/96-97) represent the disturbed secondary sedimentary filling, which originated in the environment of a drained lake after removal of primary one during the denudative and erosive post-volcanic period. Fejfar (1964) consider the part of these layers (lapilli tuffs with the lenses of fossiliferous rusty-brown tuffaceous sands), which have been ascertained in the pits 8/56, 9/56, 1/96, 2/96-97 and 6/98 as disrupted coastal facies of the lake sediments. The sandy material from the disintegrated underlying Eggenburgian sandstone of the Fiľakovo Formation has been also repeatedly deposited together with the tuffs and tuffites. The common occurrence of the redeposited Miocene foraminifers and shark teeth together with the Pliocene vertebrate fossils, what was referred by Kormos (1917) and Fejfar (1964) as well, is an evidence of that.

From the paleontological point of view, new research of locality yielded the enormous quantity of fossil vertebrate findings. Besides of large mammal remains, from which those of tapirs are prevailing, the fossils of small vertebrates, especially fishes and micromammals have been found too. Even thought some taxa were not again ascertained (for example *Parailurus hungaricus* KORMOS, 1934 and others), the fossil remains of seven (meanwhile) new elements of Hajnáčka biocenosis (*Talpa* cf. *fossilis* PETÉNYI, 1864; *Talpa* cf. *minor* FREUNDERBERG, 1914; cf. *Deinsdorfia* sp.; *Soricidae* gen. et spes. indet.; *Sciurus* sp.; cf. *Ungaromys* sp. and *Ursidae* gen. et spec. indet.) have been found here. Also, it is not out of question that some of these findings, especially those of shrews and squirrel, belong to the new taxa or species resp., but they are only studied now. Generally, more than 30 taxa of vertebrates have been yet recognised during research from 1996 to 2000, whereas Fejfar et al. (1990) determine 46 vertebrate taxa from Hajnáčka I site.

All these fossil remains belong to Pliocene animals, which lived in this territory during the creation of the secondary maar filling. In this time, the shallow swampy lagoons were forming on the coast of drained lake (Fejfar, 1964). The lagoons had been surrounded by the bushy humid (but after Lindsay et al. (1997) not swampy!) primeval forest with the flowing streams and backwater, in which the

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mammals as *Anancus arvernensis* (CROIZET et JOBERT, 1828); *Mammut borsoni* (HAYS, 1834); *Tapirus arvernensis* CROIZET et JOBERT, 1828; *Dicerorhinus jeanvireti* GUERIN, 1972; *Muntiacus* sp. and others dominated. The presence of the allochthonous indifferent elements, represented by the taxa *Pliocrocuta, Megantereon, Hapolagus* a *Prospalax* (FEJFAR, 1964) or *Baranomys* (FEJFAR et al., 1990) is the evidence of the presence of the steppe or open grassy land in the Hajnáčka environment too.

Generally, it can be draw that fauna and flora, which lived in the vicinity of maar during the forming of its secondary filling, constituted the uniform unit destroyed by the eruption of some near volcano (Fejfar, 1964). However, some animals were killed by the gas emanations at the lake bank still before the volcanic eruption and subsequent tephra fall. Some gnawed bones by the hyenas and their coprolites testify about it that the bodies (or remains) of dead animals were lying for some time on the coast (Fejfar, 1964). The animal carrion, which perished near lake either the suffocation by the gas emanations near drinking the water or were killed by the volcanic ash, were washed to the lake later on and deposited on its bottom near of the coast. The presence of fish bones, fragments of clam shells (probably *Anodonta* sp.) (Fejfar, 1964), and also ostracod shells (Pipík, 2000) together with the vertebrate osteological remains in the fossiliferous sediments is evidence of that. Their conservation as fossils was possible only for assumption of the quick covering their bodies (or remains) by sediments. Vass et al. (2000) suppose that skeletons of perished animals have been disintegrated by the convection in the drained lake. But some findings have been found in the autochthonous attitude too (Fejfar, 1964). On the basis of that, it is not out of the question that most vertebrate skeletons have been disintegrated together with the sediments during the later geological processes (seismic shocks, slides, solifluction and other).

From the biostratigraphical point of view, Fejfar and Heinrich (1987) have placed Hajnáčka fauna to the Late Pliocene MN 16a biozone (2.8 až 3.3 Ma). Thus, it was possible to correlate the Hajnáčka fauna with fauna from European sites Valensole (Cornillet, Grenouillet), Commenailles, Seynes, Violette, Triversa-Arondelli, San Giusto, Jucar (Carrasco, Valdeganga), Teruel (Concud, Escoriheula), Moreda, Zujar, Galera 2, and Beremend 1-3, 5 (Fejfar et al., 1999; Lindsay et al., 1997).

## Conclusion

During new paleontological research of the Villafranchian locality Hajnáčka I six pits have been dug. One of them (5/98, here not described) has been dug at new place of the finding of more quantity of vertebrate fossil remains. Other five pits have been situated more or less at the place of probable occurring of older ones, which have been excavated here in the time of Fejfar's research. Thus, it was possible to compare the results of former research with these of new one.

From the lithological and sedimentological points of view, the profiles of these five new pits are more or less in good agreement with the profiles of original pits, which were described by Fejfar (1964), and they support his results.

From the paleontological point of view, the validity of all the most important fossils have been repeatedly validated, although the fossil remains of some taxa (for example little panda and others) were not again ascertained here. On the other hand, the findings of seven new taxa of insectivores, rodents and carnivore have been found too. It is not out of question that some of them belong to new taxa or species respectively. Generally, more than 30 taxa of vertebrates have been described during new research, and the number of all known vertebrate taxa on the locality has increased meanwhile from original 46 (Fejfar et al., 1990) to 53 minimally.

However besides of fossils of the Pliocene vertebrates, the redeposited Miocene (foraminifers and shark teeth) and Pleistocene (rodents, horses and mammoths) elements have been found too. It only supports opinions about repeatedly redeposition of the underlying Eggenburgian sand and sandstone, and about the later mixture of maar sediments with the Pleistocene ones after the extinction of the Hajnáčka biocenosis.

Unlike the older research, the excavations on the pit 4/98 yielded only some fossil bones of larger mammals. In spite of it, we are able to draw that new research of the Hajnáčka I site helped to specify of our knowledge of the locality geological structure (Vass et al., 2000), and composition of this Late Pliocene biocenosis. Also, these first results support the results of former researches, but full detailed, especially paleontological results of new research will be published in short time.

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