Vlastimil Konečný, Jaroslav Lexa, Patrik Konečný
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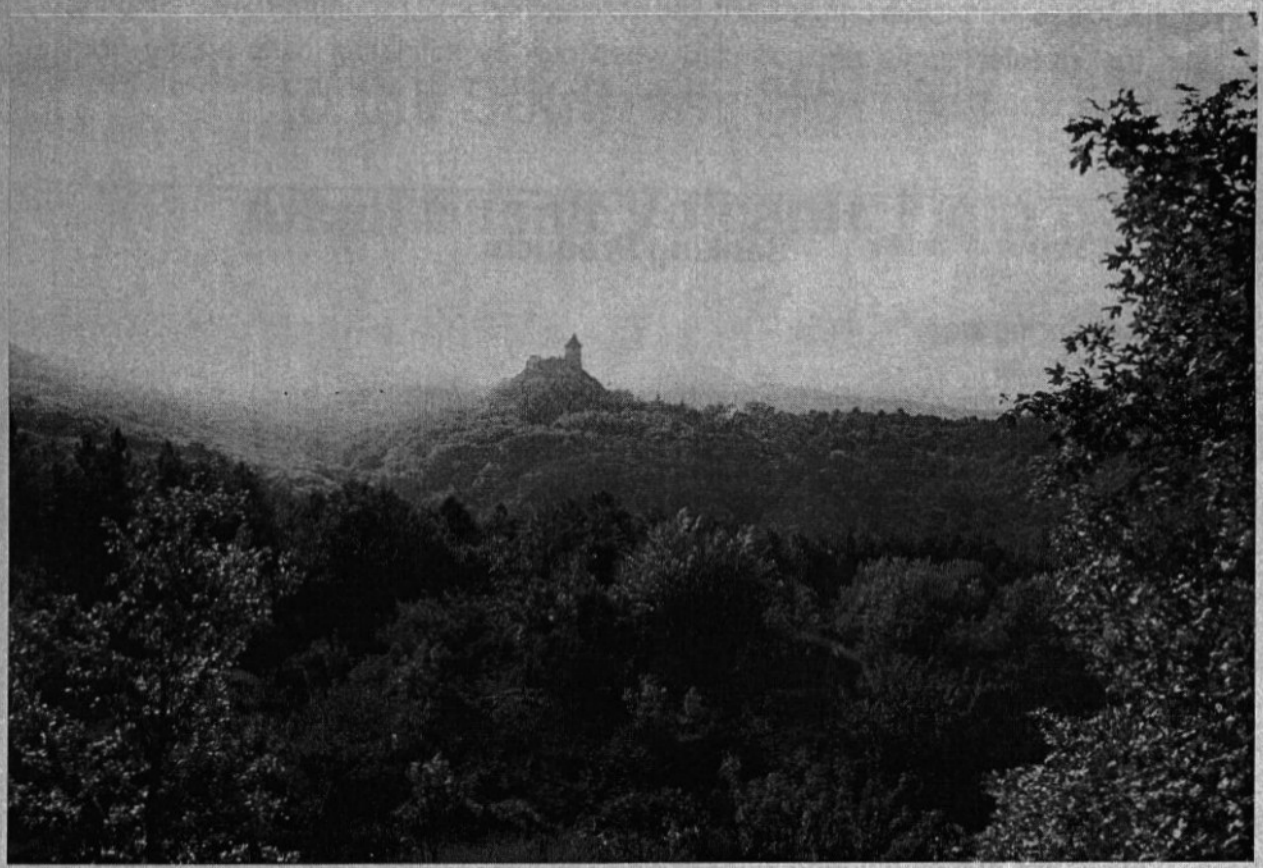
Guidebook to the Southern Slovakia Alkali Basalt Volcanic Field



Štátny geologický ústav Dionýza Štúra, Bratislava 2004

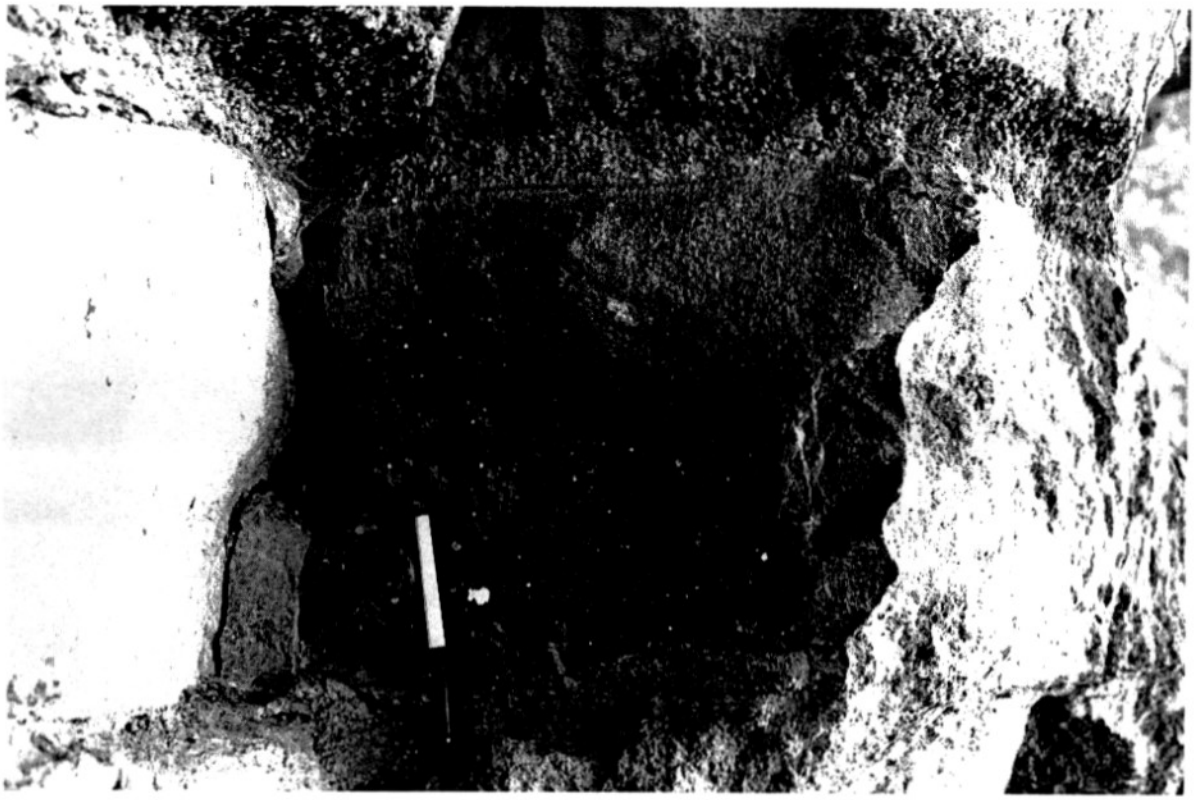


Photo 53. Detail from the photo 51. A thick bed laid down by the pyroclastic flow.

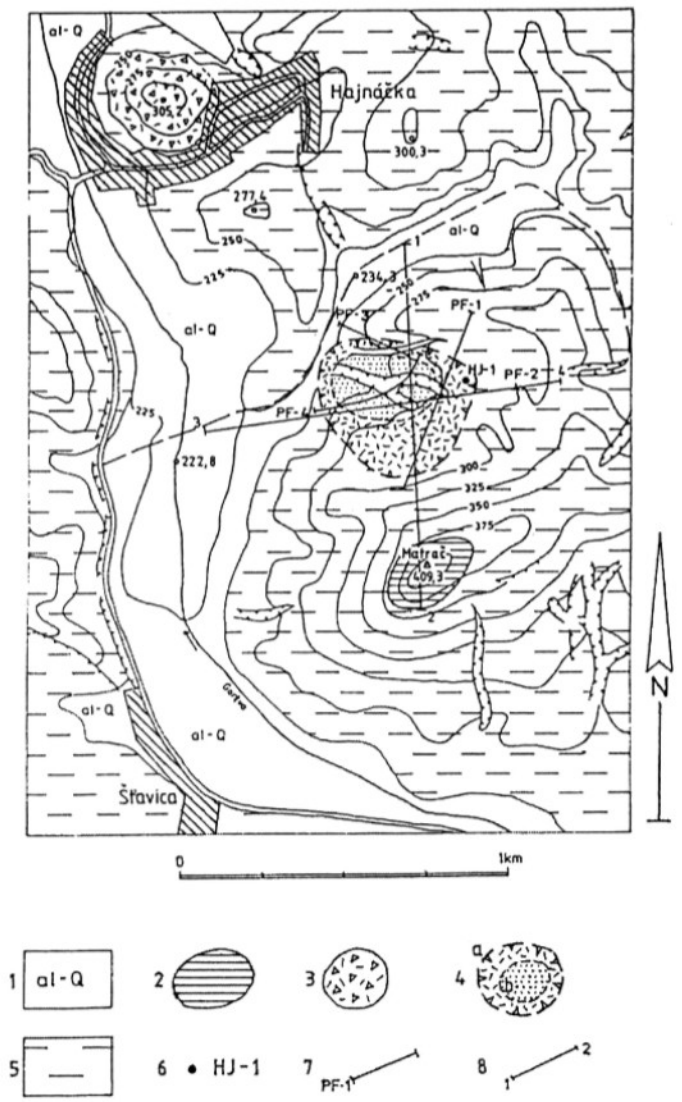
13. Maar Hajnáčka – Kostná dolina (Bone Gorge)

The maar is situated approximately 1.5 km to southeastward of the Hajnáčka village (fig. 30). It is well expressed in morphology as a bowl-shaped flat at the northern side of the hill Matrač (fig. 34, photo 54). The maar is of the oval shape with the dimension 580 x 370 m. Eggenburgian sandstone of the Fiľakovo Formation represent the surrounding and basement rocks. With few exceptions the primary maar filling is not exposed. In the roadcut at the northern margin of the maar there is exposed a chaotic megabreccia of sandstone blocks in sandy matrix (diatreme wall collapse) passing upward into breccia of sandstone blocks in tuffaceous matrix (slump deposits) and stratified succession of inward dipping tuffaceous sandstones (deposits of phreatic to phreatomagmatic explosive activity) (fig. 31). Section of the maar ring in the artificial pit 15/56 situated at the western margin of the maar (fig. 32) demonstrates that early deposits rich in sedimentary material were followed by typical phreatomagmatic deposits rich in volcanic material. The bore hole HJ-1 at the eastern side of the maar demonstrated the same type of lithologic succession.

The primary maar deposits are covered by a complex of secondary deposits laid down in fluvial and/or limnic environment. Reworked sands, silts and clays of the Fiľakovo Formation dominate over sediments including tuffaceous material, fragments of tuffs or basalt fragments. Apparently the maar depression was open to the outside influence (the maar became a part of the local river system). These secondary sandy deposits host rich mammal fauna.

Vass et al. (2000) reconstructed the evolution of the maar as follows (fig. 33): (1) Mostly phreatic explosive activity changing gradually to the phreatomagmatic one gave rise to the maar as well as to its tuff ring. Textures of primary deposits point to the involvement of diatreme walls collapse

Photo 54. View of the area south of Hajnáčka from the hill Roháč. A bowl shaped flat in the middle of the picture with meadows is the „Bone Gorge" maar. Forested area at the western side of the maar is the Bone Gorge itself.



as well as extensive slumping of unconsolidated deposits on slopes of the maar depression. At this stage volcanic activity in the maar stopped and quiet limnic sedimentation took place in the maar lake under the eutrophic conditions. Laminated clays (found only as blocks in younger deposits) contain a rich assemblage of pollen, spores and algaes. Vass et al. (2000) listed *Peridiniopsis borelinense* (Lemmermann) Bourrely, *Peridiniopsis* spp., *Selenopempyx* sp., *Halodinium* sp., *Leiosphaera* sp. and *Cyclopsiella* sp. (2) Subsequently the maar and its filling were subject to erosion. Soft maar lake sediments were removed and the maar depression was opened to the local drainage. Secondary deposits accumulated in the maar depression hosting remnants of mammal fauna (see bellow). (3) Denudation of the maar and its filling to the present state. Remaining parts of primary deposits as well as a great part of secondary maar filling was removed.

Fig. 30. Geological scheme of the maar Hajnáčka – Kostná dolina ("Bone Gorge"). 1 – alluvial deposits, 2 – remnants of lava flow, 3 – diatreme Hajnáčka – castle, 4 – Bone Gorge maar, 5 – friable sandstones of the Fiľakovo Fm., 6 – borehole, 7 – magnetic profiles, 8 – sections.

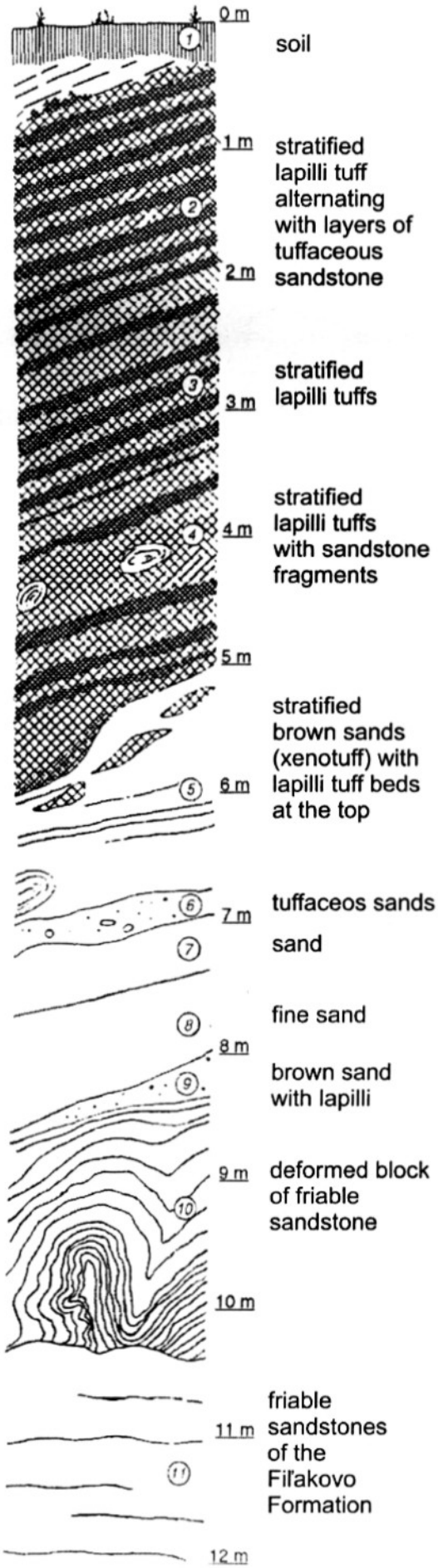


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Fig. 31. Section in the tuff ring at the western side of the Bone Gorge maar (Vass et al., 2000).

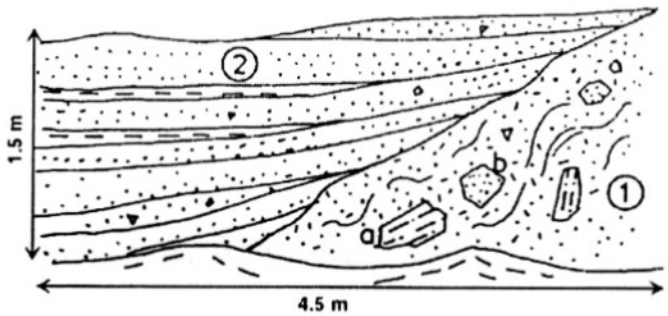

Fig. 32. Scheme of the outcrop in the road cut at the northern side of the maar (Vass et al., 2000). 1 – chaotic breccia with blocks of sandstones in sandy matrix, 2 – stratified tuffaceous sandstones and siltstones – products of phreatomagmatic eruptions.

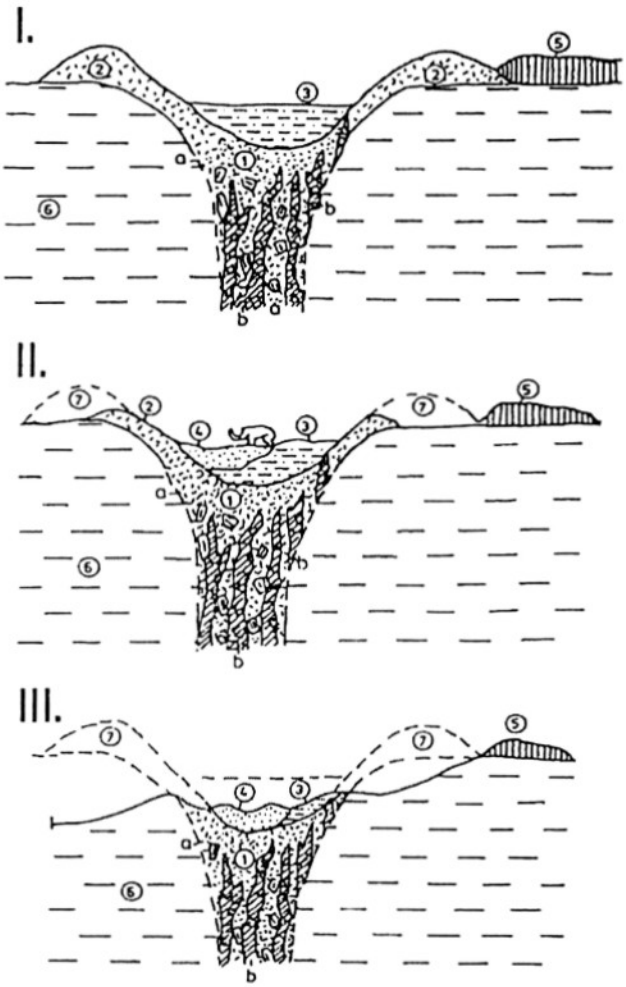

Fig. 33. Evolutionary scheme of the Bone Gorge maar. (For explanation see the text). 1 – diatreme filling – palagonite tuff/breccia and late stage dykes, 2 – tuff ring, 3 – primary maar lake sediments, 4 – secondary maar filling, 5 – lava flow, 6 – Early Miocene friable sandstones, 8 – reconstruction of the tuff ring removed by erosion.

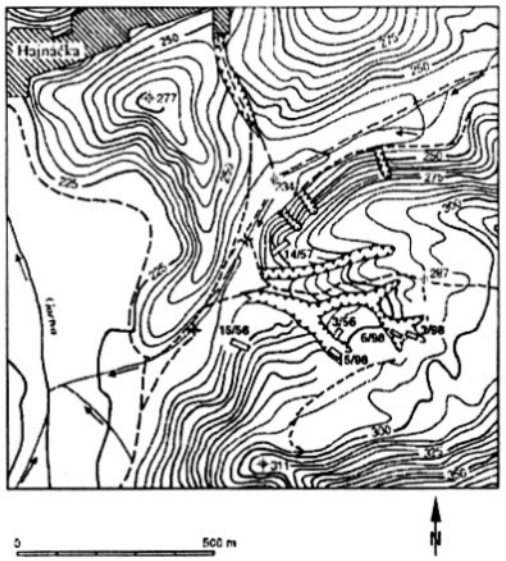

Fig. 34. Situation of the Hajnáčka I paleontologic site.

The Hajnáčka I paleontologic site

The site extends in the maar over the area 1,000 to 1,500 square meters in deep, erosive furrows with the E-W orientation (fig. 34). The largest of them is named as Bone Gorge (Kostná dolina) for many fossil bones, which have been found there. It is 400 m long, 30 m wide and 20 m deep in some parts. The furrows are cut in the secondary loam-sandy deposits of the Late Pleistocene age laid down in the maar depression. The age of Hajnáčka I site is well proved by fossil remains of vertebrates, especially of mammals. On the basis of the occurrence of *Mimomys* advanced species (*M. stehlini* and *M. hassiacus*), the site is dated to the lower part of the Late Pliocene (Romanian or Piacenzian stage) and represents a type site of the European Neogene Land Mammal time scale for the Villanyian, MN 16a zone (2.80 – 3.58 Ma; Fejfar et al., 1998), what corresponds to the middle part of the C2An chron with normal polarity.

The fossil remnants of animals at the site Hajnáčka I accumulated in the maar lake during the deposition of the secondary sedimentary filling, which replaced the removed primary sediments when the tuff ring was partly destroyed and eroded due to domatic uplift of the Cerová vrchovina Highland approximately 3.3 Ma ago. Animals used the maar lake as a watering place. Beside the change in environment the extinction of the Hajnáčka fauna and flora could be caused by the eruption of a nearby volcano and the subsequent volcanic ash falls and/or poisonous gas emissions. Remains of dead animals have been disintegrated by currents in the lake (Vass et al., 2000).

Besides fossils of plants (Polyporaceae gen. et spec. indet., *Pteris palaeoaurita*, cf. *Gingko adiantoides*, *Torreya fejfarii*, *Picea* sp. 1, *Picea* sp. 2, *Salix* sp., cf. *Alnus* sp., *Betula* sp., *Carpinus grandis*, cf. *Pterocarya* sp., *Quercus* ex. gr. *roburoides*, *Ulmus braunii*, *Zelkova zelkovifolia*, *Vitis* cf. *teutonica*, *Acer integerrimum*, *Acer* sp. 1, *Acer* sp. 2, *Acer* sp. 3, *Acer* sp. 4, *Tilia* cf. *platyphyllos*, *Buxus pliocaenica*, Dicotyledonae gen. et spec. indet.) (Sitár et al., 1989), invertebrates (*Anodonta* sp., *Darwinula* sp., *Ilyocypris* sp., *Candona* sp., *Pseudocandona* sp.), fishes (*Scardinus? erythrophthalmus*, *Tinca furcata*, *Esox* sp., cf. *Parasilurus* sp. (Fejfar et al., 1990), Percidae gen. et spec. indet.), amphibians (*Pliobatrachus* sp., *Bufo bufo*, *Rana* cf. *temporaria*, *R.* cf. *arvalis*, *R.* cf. ex gr. *dalmatina-latastei*) (Fejfar et al., 1990), reptiles (*Emys orbicularis*, *Chelydra* aff. *decheni* (Fejfar et al., 1990), Serpentes gen. et spec. indet.), and birds (*Mergus* sp.) (Fejfar et al., 1990), the fossils of mammals represent the most important and most frequent part of whole paleontological record (figs. 35 to 37). This Late Pliocene mammalian assemblage consists of 9 orders (Lagomorpha, Rodentia, Carnivora, Erinaceomorpha, Soricomorpha, Primates, Artiodactyla, Perissodactyla, and Uranotheria) and 21 families (Leporidae, Sciuridae, Castoridae, Muridae, Cricetidae, Anomalomyidae, Seleviniidae, Felidae, Hyaenidae, Ursidae, Mustelidae, Procyonidae, Talpidae, Soricidae, Cercopithecidae, Suidae, Cervidae, Rhinocerotidae, Tapiridae, Mammutidae, and Gomphoteriidae) represented by approximately 45 taxa (*Hypolagus brachygnathus*, Lagomorpha gen. et spec. indet., *Sciurus* sp., *Pliopetaurista pliocaenica*, *Castor fiber* ssp., *Trogontherium minus*, *Apodemus* sp., *Baranomys loczyi*,

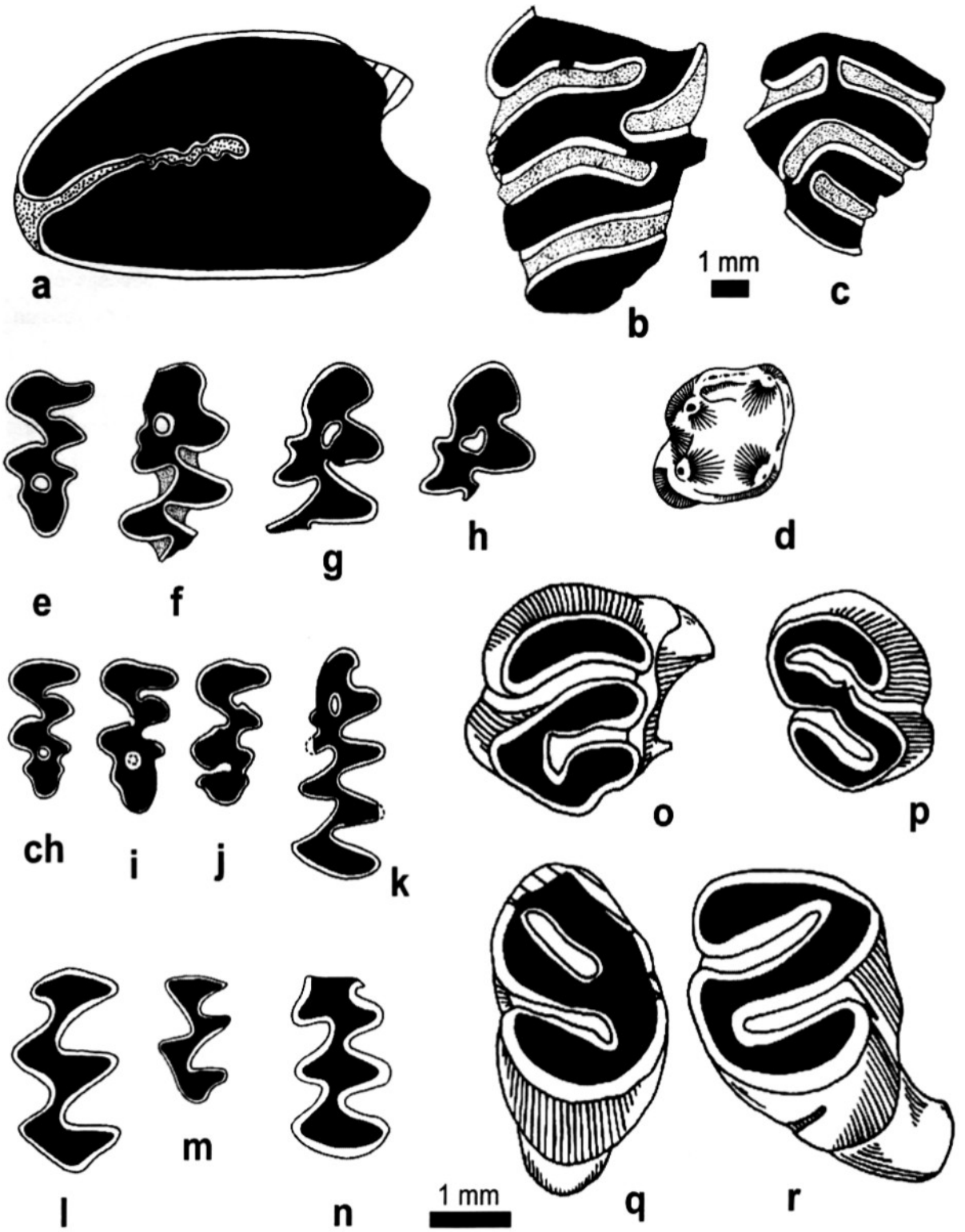

Fig. 35. New records of fossil mammals from the Hajnáčka I site: Lagomorpha and Rodentia; occlusal view. (according to SABOL et al., *in press*).
a) Lagomorpha gen. et spec. indet. (P4 - M1 sin., B-4067); b-c) *Castor fiber* ssp. LINNAEUS, 1758 (b - M1-2 dex., B-3106; c - P4 sin., B-3058); d) *Sciurus* sp. (m1-2 sin., B-4012); e-h) *Mimomys* (*Mimomys*) *hassiacus* HELLER, 1936 (e - M3 sin., B-4032; f – m1 sin., B-4033; g – m1 dex., B-4138, inv.; h – m1 dex., B-4139, inv.); ch-k) *Mimomys* (*Cseria*) *stehlini* KORMOS, 1931 (ch - M3 dex., B-4038, inv.); i – M3 sin., B-4122; j – M3 dex., B-4133, inv.); k – m1 dex., B-4130, inv.); l-m) *Germanomys* sp. (l - M1 dex., B-4120, inv.; m – M2 dex., B-4017, inv.); n) *Ungaromys* sp. (m1 sin., B-4119); o-r) *Prospalax priscus* (NEHRING, 1897) (o – M1 sin., B-4136; p – M2 dex., B-4135; q – m1 sin., B-4112; r – m2 dex., B-4128).

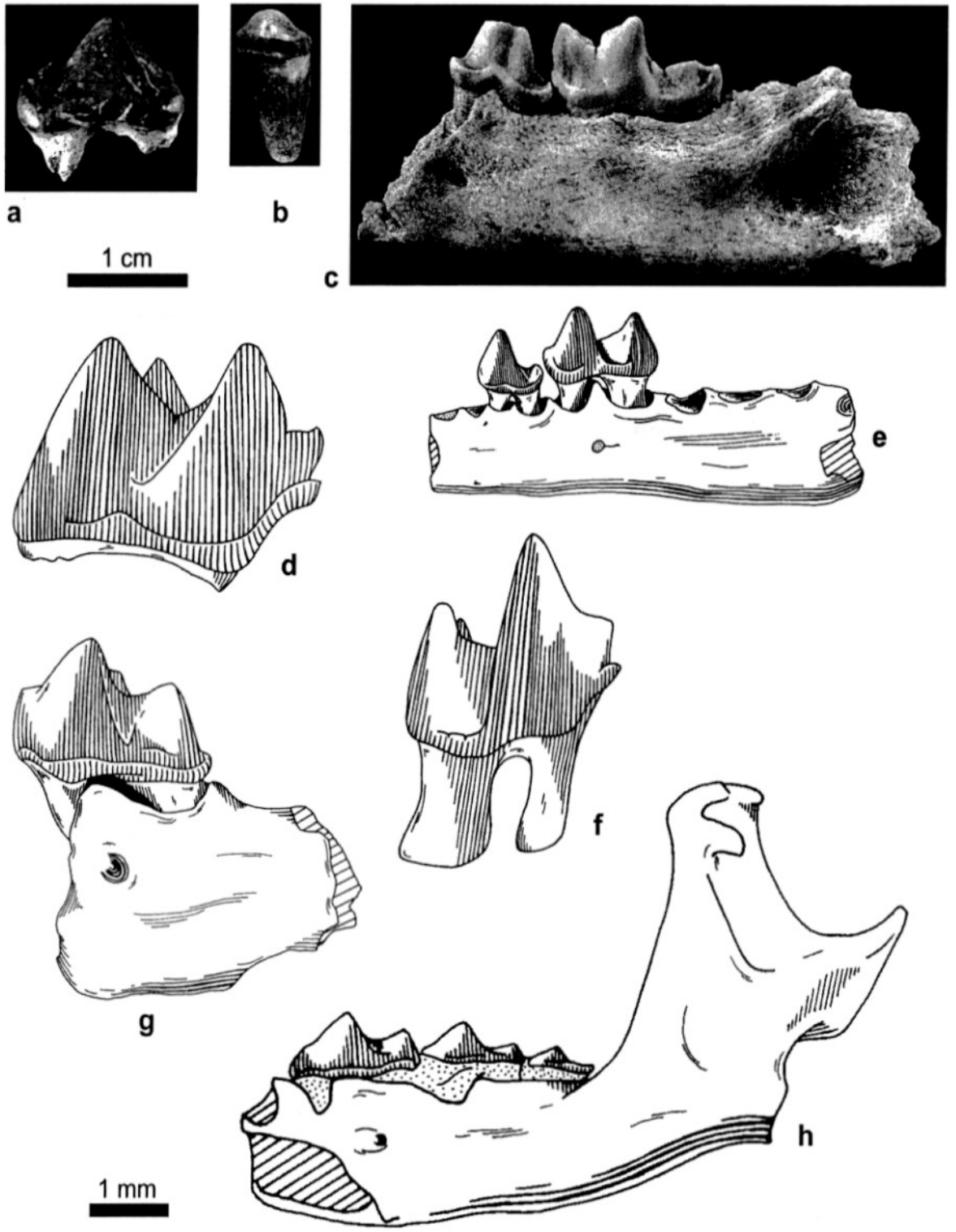

Fig. 36. New records of fossil mammals from the Hajnáčka I site: Carnivora and Lipotyphla. (according to SABOL et al., *in press*).
a) *Hyaena perrieri* CROIZET et JOBERT, 1828 (p2 dex., B-4063, buccal view); b) Ursidae gen. et spec. indet. (P1 dex. or p3 sin.?, B-4077, buccal view); c) *Lutra* cf. *bravardi* POMEL, 1843 (fragment of the left mandible with p4 and m1, B-3598, buccal view); d) *Desmana nehringi* KORMOS, 1913 (m1 dex., B-4143, buccal view); e) *Talpa* cf. *minor* FREUDENBERG, 1914 (fragment of the left mandible with p4 and m1, B-4152, buccal view); f) *Talpa fossilis* PETÉNYI, 1864 (m2 dex., B-4142, buccal view); g) *Blarinoides* cf. *mariae* SULIMSKI, 1959 (fragment of the left mandible with m1, B-4011, buccal view); h) *Deinsdorfia hibbardi* (SULIMSKI, 1962) (fragment of the left mandible with m1-3, B-4144, buccal view).

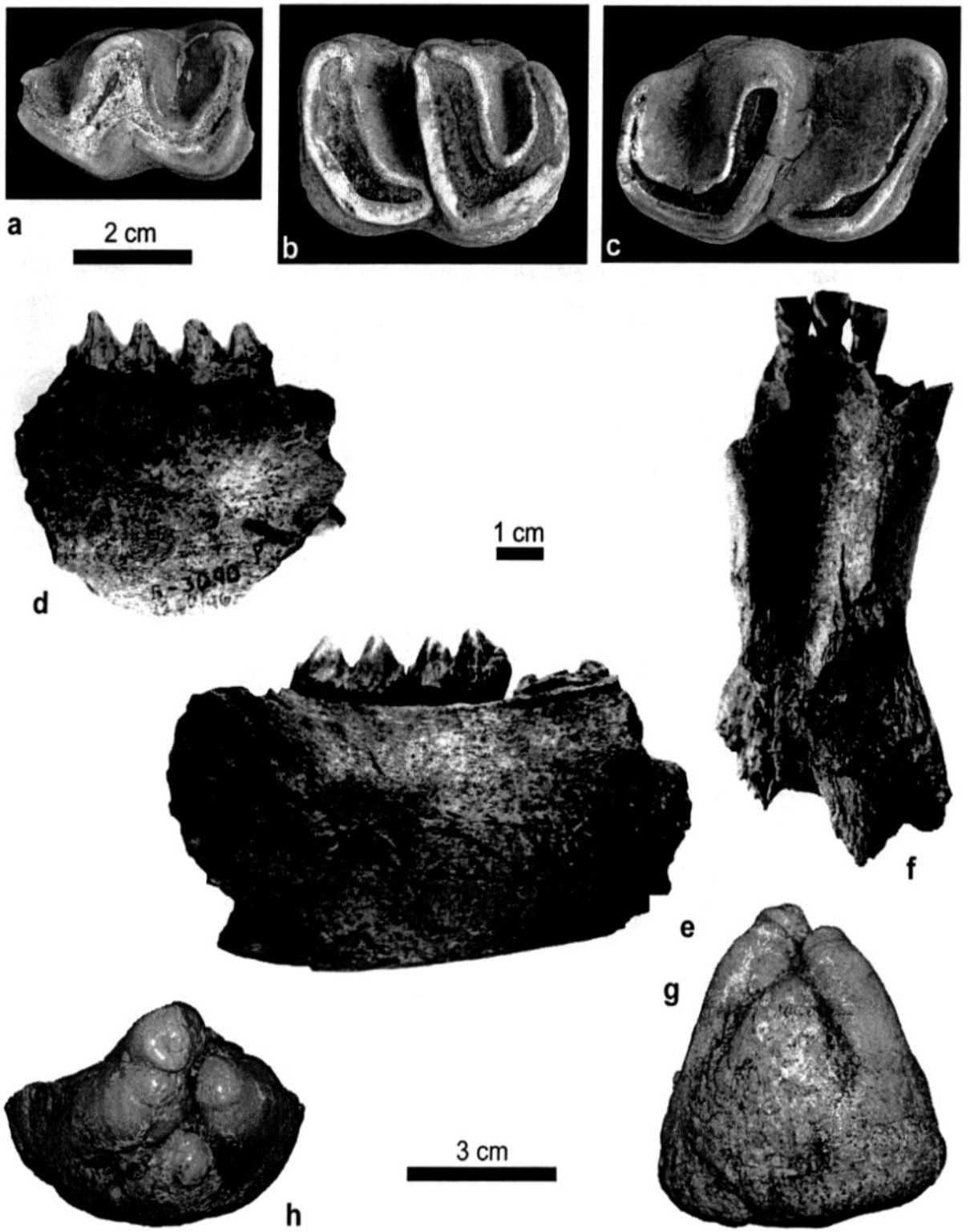

Fig. 37. New records of fossil mammals from the Hajnáčka I site: Perissodactyla and Proboscidea (according to SABOL et al., *in press*).
a-c) *Dicerorhinus jeanvireti* GUÉRIN, 1972 (a - p3 sin., B-2118, occlusal view; b - p4 dex., B-3039, occlusal view; c - m3 sin., B-3016, occlusal view); d-f) *Tapirus arvernensis* CROIZET et JOBERT, 1828 (d – fragment of the right mandible with m2 a m3, B-3090, lingual view; e – fragment of the right mandible with m1 and m2, B-1108, buccal view; f - fragment of the mandible front part with i1 dex., i1 sin., i2 sin., and with fragments of canine roots, B-3017, dorsal view); g-h) *Anancus arvernensis* (CROIZET et JOBERT, 1828) (fragment of m3 dex. talonid, B-3591, g – distal view, h - occlusal view).

Mimomys (*M.*) *hassiacus*, *M.* (*Cseria*) *stehlini*, *Mimomys* sp., Arvicolinae gen. et spec. indet., *Germanomys* sp., *Ungaromys* sp., *Prospalax priscus*, Seleviniidae (?) gen. et spec. indet., *Megantereon* sp., *Hyaena perrieri*, Ursidae gen. et spec. indet., *Lutra* cf. *bravardi*, *Parailurus hungaricus*, *Talpa* cf. *minor*, *T. fossilis*, *Talpa* sp., *Desmana nehringi*, *Deinsdorfia hibbardi*, Soricidae gen. et spec. indet., *Petenyia hungarica*, *Beremendia fissidens*, *Blarinoides mariae*, *B.* cf. *mariae*, Colobinae gen. et spec. indet., *Sus minor*, Cervidae gen. et spec. indet., *Muntiacus* sp., *Cervus perrieri - Arvernoceros ardei*, *Cervus pardinensis*, *Croizetoceros ramosus*, *Capreolus* sp., *Dicerorhinus jeanvireti*, *Dicerorhinus* sp., Rhinocerotidae gen. et spec. indet., *Tapirus arvernensis*, *Mammut borsoni*, and *Anancus arvernensis*).

According to the frequency of occurrence, the fossil assemblage from the Hajnáčka I site could be divided to three groups: 1) taxa abundant in all facies of the sedimentary filling (*Tapirus arvernensis*, *Dicerorhinus jeanvireti*, *Mammut borsoni*, and *Anancus arvernensis*); 2) taxa regularly occurring in the coarse tuff or arenaceous tuffite of the coastal facies (*Mimomys hassiacus*, *Mimomys stehlini*, *Trogontherium minus*, *Muntiacus* sp., *Capreolus* sp., *Castor fiber*, *Hypolagus brachygnathus*, and *Prospalax priscus*); and 3) isolated finds of taxa found in 1 or 2 specimens (*Talpa* cf. *minor*, *T. fossilis*, *Desmana nehringi*, *Deinsdorfia hibbardi*, *Petenyia hungarica*, *Beremendia fissidens*, Colobinae sp., *Sciurus* sp., *Ungaromys* sp., *Baranomys loczyi*, *Apodemus* sp., *Pliopetaurista pliocaenica*, *Hyaena perrieri*, *Parailurus hungaricus*, *Lutra* cf. *bravardi*, *Megantereon* sp., Ursidae gen. et spec. indet., *Sus minor*, *Croizetoceros ramosus*, etc.).

On the basis of the research, the mammal assemblage could be divided to three main ecological groups: 1) inhabitants of the aquatic and semi-aquatic environment (*Desmana*, *Lutra*, *Castor*, *Trogontherium*); 2) inhabitants of the forest (moles, shrews, monkeys, ursids, *Parailurus*, *Pliopetaurista*, *Sciurus*, *Tapirus*, *Dicerorhinus*, *Sus*, cervids, proboscideans); and indifferent inhabitants of the open land (*Hyaena*, *Megantereon*, cricetids, murids, *Prospalax*, *Hypolagus*). Fejfar (1964) considers the finds of inhabitants of the first two groups to be autochthonous, whereas indifferent elements of the third ecological group identifies as allochthonous.

From paleobiological point of view, the Hajnáčka assemblage indicates the presence of the thermophilous humid primeval forest biotope with south-eastern Asian affinity (*Parailurus hungaricus, Muntjacus* sp.) (Lindsay et al., 1997). As well, this assemblage is an evidence of the co-existence of ancient faunal elements (mastodons and tapirs) together with advanced species (e. g. *Mimomys*-species) in refugium with temperate climatic conditions. Tapirs, mastodons, rhinos and cervids dominated the forest, whereas representatives of hyaenas, machairodontids, lagomorphs and some rodent species were present on the warm, open steppe.

14. Maar Hodejov

Remnants of the maar / tuff ring complex next to the village Hodejov are situated about 50 m under the level of the former surface, indicated by distal facies of the tuff ring above Early Miocene sediments NW of the maar (fig. 38, photo 54). The low level of the paleosurface implies a relatively young age, much younger than the Buda lava flow capping the ridge south of the maar at the relative elevation 100 m and having the age 1,69 ± 0,22 Ma. The maar complex is dissected by the river Gortva and well exposed in an abandoned quarry. Exposed section consists of two units: