

EXCURSION 2 (Saturday, 15th of July)

STOP 1: Ipolytarnóc, an Early Miocene palaeohabitat

László KORDOS

Introduction

For the World Heritage nominated Ipolytarnóc fossil site (N Hungary) preserved three type of Early Miocene habitats: marine sequence with shark bearing sandstone, terrestrial sandstone with footprints, petrified tree trunks and plant impressions, and finally a rhyolite volcanic event covering the former landscape. It represents the event, when the African Plate moving to North attached to the Euro-Asian Plates cca 23-20 million years ago, at the beginning of the Miocene after some ten millions of years separation (IUCN, 2004).

Geological setting

In the area of Ipolytarnóc the Palaeozoic crystalline basement is found at a depth of some 600 m and is overlain by the Oligo-Miocene fine-grained deep-water marine siltstone (Szécsény Schlier Formation). Its topmost part is exposed on the surface and in certain levels contains abundant marine Eggenburgian mollusc fauna and shark teeth assemblage (Pétervására Sandstone Formation), and is in turn overlain by terrestrial strata of the Zagyva-pálfalva Variegated Clay Formation. At Ipolytarnóc it contains 1-6 m of fluvial conglomerate and sandstone, including the level of tree trunks, footprints and plant impressions. The sequence is capped by a 10-30 m thick ignimbrite layer (Gyulakeszi Rhyolite Tuff Formation). Former K-Ar dating produced a 19.6 Ma datum for it, but some new investigations showing a little younger age (Pálffy & Mundil, 2004).

Discovery and history

Ipolytarnóc has been known as a paleontological site since 1836. It was then that local shepherds showed the gigantic fossilized tree-trunk to F. Kubinyi – a landowner and representative from the neighbourhood. In 1854 in his book he introduced it with illustrations, so the locality became known. Kubinyi drew the attention to the fossil flora around the tree-trunk, too. Later several others collected the

flora of the sandstone and from the covered rhyolite tuff (Jablonszky, Rásky, Pálfalvy) and Hably (1985) made the latest revision. In 1990 H. Böckh, a teacher of the Mining Academy in Selmezbánya and J. Tuzson botanist visited the fossilized tree-trunk and Böckh discovered the footprints of prehistoric animals. After several excavations (Nopcsa in 1920; Tasnádi in 1940, 1958 and in the beginning of 1970's) Kordos since 1980 to present discovered, studied and described more than three thousand footprints of 11 different kind of animals. The fourth typical group of fossils in Ipolytarnóc is the Eggenburgian shark-teeth bearing sandstone. Koch was the first who wrote a publication (1903) and described several taxa from Ipolytarnóc. The classical shark-teeth sandstone locality could be discovered again in 1994, and later collected new fossils engaged a revision over the shark assemblage (Kocsis, 2003), and on the remains of *Odontoceti* (Kazár, 2003).



Fig. 1 — Location of the Ipolytarnóc paleovertebrate locality.

The Ipolytarnóc fossil park has been preserved since 1944. The first protective hall is opened for the public in 1985 over the main footprint surface. The area has been awarded by the Council of Europe (European Diploma, 1995).

Paleontological content

Shark teeth — From the cross-laminated, gritty, bankedly separated sand and sandstone of the Lower

Miocene Eggenburgian Pétervására Sandstone Formation provided 25 species of eight genera for Koch (1903) among which he could define new *species as well*: *Lamna tarnoczensis*, *Notidanus paucidens*, *Oxyrhina neogradensis*, *Notidanus diffusidens*. According to the revision of the shark teeth by Kocsis (2003), Koch's new species were re-determined as *Notorynchus primigenius* (= *Notidanus paucidens*, *N. diffusidens*), *Carcharias contortidens* (= *Lamna tarnoczensis*) and *Parotodus benedeni* (= *Oxyrhina neogradensis*). The revised fauna is very divers and includes 21 species of 26 genera. The Chondrichthyes fauna represents a warm-temperate, subtropical climate. Bones of marine mammals (Odontoceti, Sirenia), and crocodiles were found to be admixed to the shark-teeth assemblage.

Petrified tree-trunks — The giant petrified tree was discovered for the science and for the public in 1836, must have been at least 56 m tall. Its first scientific examiner Tuzson in 1901 defined it as a new species, *Pinus tarnoczensis*. Later others (Krausel, Greguss) re-classified it as a member of the *Pinuxylon* genus. Greguss determines several kinds of petrified wood from Ipolytarnóc, including six different coniferous species. The petrified tree-trunks of Ipolytarnóc probably grew in Lower Miocene (Eggenburgian), delta type flood basins and fell in natural way or during floods. Tree trunks often penetrates through as many as layers, that are the allochthonous surface of marine sandstone, the footprint-fotted sandstone and the rhyolite tuff cover. Quaternary river-erosion carried their remains as far as the valley of river Ipoly.

Plant impressions — An extensive number of plant impressions were found in Ipolytarnóc in the footprint sandstone, and the its rhyolite tuff cover as well. According to the latest study by Hably (1985), 4524 plant impressions determined from Ipolytarnóc and could distinguished 65 taxa with defining 2 new species. The flora of sandstone that of tuff are not different, since the tuff covered the vegetation that grew on the sandstone. The leaves were carried to the area of rivers by water, this is why those plants that lived further were missing from the flora of Ipolytarnóc's sandstone. On the basis of the dominant species a *Platanus neptuni* forest can be traced, in which the *Litsea ipolytarnocense* diffused primarily. In the lower tree stratum *Daphnogene bilinica* was the predominant species, accompanied by *Engelhardtia*, *Cyclocarpa* and *Calamus*.



Fig. 2 — Footprints from Ipolytarnóc.

Footprints — The footprints on the surface and in several layers of the sandstone in Ipolytarnóc were discovered in 1900. After several examinations of Abel, Lambrecht, Tasnádi, Kretzoi, Thenius and Vialov, Kordos (1985) revised the previous records and finally distinguished four bird species (*Ornithotarnocia lambrechtii*, *Ariadactyla media*, *Tetraornithopedia tasnadii*, *Passeripeda ipolyensis*), four carnivores (*Bestiopedia maxima*, *Bestiopedia tarnocensis*, *Carnivoripeda neogradensis*, *Mustelipeda miocaenica*), a rhinoceros (*Rhinoceripeda tasnadyi*) and two artodactyles (*Megapecoripeda miocaenica*, *Pecoripeda hamori*) from Ipolytarnóc. Together with the later excavations, in 1993 we know of three footprint-dotted sites in Ipolytarnóc (Site I, II III) with a total surface of about 400 m². The occurrence of footprints in several horizons indicates that the contemporaneous depositional environment provided at the time of deposition a proper habitat for the life of terrestrial mammals and birds. Very rich in fossil plant remains, the third bed indicates that a forest or tree vegetation must have been here when the bed was being formed. The higher situated (younger) beds contain already quite sporadic paleobotanical remains suggesting that, at the time of their deposition, the contiguous foliage did not exist anymore. None of the observed types of vertebrate footprints is suggestive of an aquatic or palustral habitat. Most of the footprints were impressed into a fairly hardened ground. The footprint sandstone horizons of Ipolytarnóc must have been formed on a land surface with some vegetation around a spring which, from time to time, at the downpour of torrential rains at minor floods, was buried with a mud layer. The last covering, which has preserved the footprints, was formed as late as the accumulation of the rhyolite tuff began.

References

- Hably, L. 1985. Early Miocene plant fossils from Ipolytarnóc, N Hungary. *Geologica Hungarica ser. Palaeontologica*, 45: 133-256.
- IUCN 2004. IUCN Evaluation of Nominations of Natural and Mixed Properties to the World Heritage List. *Report to the World Heritage Committee*, Twenty-eight session, Sozhou, China
- Kazár, E. 2003. Miocén fogascet-leletek (Cetacea. Odontoceti) a Kárpát-medencében. Manuscript, PhD Thesis, Budapest
- Kocsis, L. 2003. Revision of the Lower Miocene Shark Fauna of Ipolytarnóc, Hungary. *1st EAVP Meeting*, Basel, p. 74.
- Koch, A. 1903. Tarnóczi Nógrádmegyében, mint a kövült czápafoágaknak új gazdag lelőhelye. *Földtani Közlemény*, 33: 22-44.
- Kordos, L. 1985. Footprints in the Lower Miocene Sandstone of Ipolytarnóc. *Geologica Hungarica ser. Palaeontologica*, 46: 359-415.
- Kubinyi, F. 1854. A tarnóczi óriás kövült fa és az ezt környező kőnemek földismeit tekintetben. *In: Vahot, I. & Kubinyi, F. (eds), Magyar- és Erdélyország képekben*, Pest, 3: 61-63.
- Pálfy, J. & Mundil, R. 2004. Az ipolytarnóczi ősmaradvány-lelőhely kora és korrelációja. 7. *Magyar Őslénytani Vándorgyűlés*, Beremend, Program, Előadáskivonatok, Kirándulásvezető, p. 20-21.