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Rudabànya: Taphonomic analysis of a fossil hominid site from Hungary

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ABSTRACT

The late Miocene deposits at Rudabànya, Hungary, were laid down in a shallow valley sloping westwards from a range of hills and opening out into the Pannonian Lake. Rise and fall of lake level gave rise to varying conditions, from dry land with soil formation to swamp and lake. The stratigraphic and palaeontological succession has been investigated at one of the sites, Rudabànya 2, where two cycles of deposition and erosion are represented, with soil formation, swamp conditions with lignite formation, and periods of extended high lake level succeeding each other. Both mammal and plant fossils are present at several levels. Taphonomic modifications in the Rudabànya 2 vertebrate faunas include losses of skeletal elements through carnivore selection, fluvial sorting at some levels, and post-depositional destruction by leaching and/or acid soils. The lowest level, the lower lignite, has few fossils. The fossil mammals from the level above, the grey marl, are the least modified but they are mixed with abraded, probably allochthonous, bone fragments and more complete specimens resulting from near-lake deaths. Modifications of bones by carnivores are indicated, but the specimens were too broken post-depositionally for the impact of the carnivores to be assessed. Carnivore action is also indicated for the fauna of the black clay which formed on the surface of the grey marl. The fauna consists of relatively abundant small mammals and the primates *Anapithecus hernyaki* and *Dryopithecus hungaricus*, with the latter much less common. The predator accumulating the smaller species was probably a viverrid. The red marl fauna is a transported assemblage from higher up the valley with the fossils extremely fragmentary and abraded and few identifiable specimens, almost all of which are teeth. The black mud fauna is also probably a transported assemblage, lower energy than the red marl environment, and the bones are much modified subsequently by acid corrosion similar to that seen today in bone preserved in peat bogs. *Dryopithecus* is a major constituent of the fauna, with *Anapithecus* less common. *D. hungaricus* is thus associated more strongly with swamp forest and shallow riverine conditions with low energy movement of water, and *A. hernyaki* is associated with lake shore (probably forest) conditions, accumulating in lake sediments and lake-flat sediments. The palaeoecology of the area as a whole, based on the associated flora and fauna, is a combination of swamp forest, lake shore forest and open mud flats.

1. Introduction

The Rudabànya fossil deposits were first investigated at the end of the 19th century, and in the mid to late 20th century the site was extensively excavated first by Kretzoi (1969, 1975, 1984) and latterly by Kordos (1982, 1987, summarized in Kordos and Begun, 2001). More recently a team led by Bernor and Kordos excavated for three seasons at Rudabànya 2 in 1992–1994 (Bernor et al., 2003b). The two aims of the Bernor excavations were to investigate the taphonomy of the deposits to see if there were faunal differences within the stratigraphic section and to provide for a comprehensive systematic, biogeographic and paleoecologic assessment based on the vertebrate fauna (112 species; 69 species of mammals (Bernor et al., 2003a, 2005). The large mammal fauna known from Rudabànya is unusual in that the mammal fauna includes two primate species, *Dryopithecus hungaricus* and *Anapithecus hernyaki* (Kordos and Begun, 2001), for species of these two genera are rarely found together in one deposit (Andrews et al., 1996). The aim of the taphonomic excavations at Rudabànya was to investigate sources and associations of faunas and floras within the Rudabànya sequence, and in particular to see if the two primate species were present in the same levels and at the same time at Rudabànya.

There are a number of fossiliferous localities within the Rudabànya Basin, and this paper describes the excavations at one of these, Rudabànya 2 (Fig. 1). This is the site from which the majority of primates has come, including much of the material of *Dryopithecus* and *Anapithecus* described by Kretzoi (1975) and the skull described by Kordos (1991). Other sites include one with abundant fossil leaves well preserved (Kretzoi et al., 1974) and several mammal localities, but strict age equivalence cannot be determined for these and no

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Fig. 1. General view of Rudabànya 2 looking due east close to and up the axis of the Miocene valley in which the sediments accumulated. The lower excavation (foreground) has most of the grey marl exposed in section; in the middle is part of the surface of the red marl; and at the back is the upper excavation where the black mud and upper lignite are exposed.

taphonomic work has been done on their floras or faunas. The depositional setting of these sites appears to be broadly equivalent to Rudabànya 2, and they will be mentioned briefly when reconstructing the landscape ecology of the region during the Miocene.

The age of Rudabànya 2 is determined on the basis of its mammalian fauna. The sequence is too short to tie into the geomagnetic timescale, but on the basis of the evolutionary stage of the fauna, Rudabànya 2 fits into the MN9 land mammal stage, similar in age to Can Llobateres (Agusti et al., 1999).

2. Material and methods

Excavation was by stratigraphic level, and as far as possible all squares were excavated at the same level, following bedding planes. The total extent of the excavation was 7 by 4 m, although not every square was excavated to the same level and not every square was fully excavated. Excavation was done by hand trowel and brush, and all residues were collected, dried and washed in 800 µm screens. The marl deposits were soaked for at least 1 h in an 8–10% solution of hydrogen peroxide to facilitate break down of the sediment. This was partially successful, but in many cases the washed residues had to be washed again after drying. After washing, the residues were brought back to the laboratory for hand-picking. Because of limited facilities in the field, only the coarse residues were picked, and the fine residues were re-bagged for further work in Budapest. The fossils from the coarse residues were taken to the Natural History Museum, London, for counting, identification and taphonomic analysis.

Specimens found during the course of excavation were recorded in three dimensions. In addition to the location measurements, the square number of every find was recorded, together with a number of taphonomic observations. Where possible, the angle of dip was measured, and the angle of orientation was measured in the direction of dip. If the specimens were broken and too fragmentary to be conserved, their spatial coordinates were measured and drawings or photographs used to record their undisturbed state. Drawings were made by Eleanor Weston and photographs by Phil Crabb. If not measured in the field, all specimens were subsequently measured in the laboratory by DC, together with taphonomic observations on breakage and preservation of specimens and any evidence of pre-depositional or post-depositional damage or modifications.

Individual fragments of fossil bone from one element (e.g. femur) were not measured when associated with other fragments from the same bone (broken post-depositionally). Rather the full length/breadth of the "complete" element before disturbance by excavation was measured on site. Definitions for Bone Breakage Patterns are as follows:

1. Complete
2. Fragment (splitting–cracking undefined)
3. Shaft of long bone only (ends missing)
4. Proximal or distal end of bone (shaft missing)
5. Splinter spiral break (long bone fragment with angled break i.e., not transverse)
6. Transverse break (clean vertical break not angled)
7. Post-depositional breakage (bone fragments from one element clustering together)
8. Unidentified (unidentifiable).

The type of modification is subdivided into abrasion, trampling, weathering, root marks, insect marks, gnawing by carnivores and digestion by carnivores, and in each case, the degree of modification is divided into three classes, light, medium and heavy (Behrensmeyer, 1975, 1978). The definitions for surface modifications are as follows:

9. Abrasion and rounding (directional scratches with smooth edges)
10. Abrasion and chipping of edges (directional scratches with edges chipped)
11. Abrasion and pitting (directional scratches with pitting exposing cortex)
12. Trampling (very fine striations, usually numerous, often directional)
13. Weathering and pitting (bone shows cracks with pitting)
14. Weathering and splitting (bone shows cracks with finer splitting)
15. Root marks (irregular grooves)