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Deinothere and Mastodons from the Brukenthal Museum Natural Science Collection

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Abstract. Among the fossil vertebrate collection at the Brukenthal Museum of Natural Science in Sibiu, there are a number of mastodon cheek teeth and a single deinothere premolar. Some of these fossils are rare in Romania, documenting species as *Deinotherium giganteum* or *Gomphotherium angustidens*. Another molar fragment, which could be related to *Anancus arvernenis*, originates form Cheile Dâmbovicioarei. Its origin is strange, because this locality is devoid of Late Miocene or younger deposits, where this species should occur. All these Probiscidean localities are new for Romania.

Key words: Deinothere, mastodons, Transylvanian Basin, South Carpathians, Middle Miocene, ?Pliocene

Introduction

In 1841 as a consequence of progress in natural history research in Transylvania, some Sibiu intellectuals, founded the *Society for research of Transylvania (Verein für Siebenbürgische Landeskunde*), whose aim was to continue research concerning both the history and natural sciences of the area. Therefore, the society included several naturalists whose research results were issued in the review *Archives of the Society for Transylvanian knowledge (Archiv des Vereins für Siebenbürgische Landeskunde)*. Gradually, their number soon increased and after eight years they founded another society, dedicated exclusively to the natural sciences, the *Transylvanian Natural Sciences Society in Sibiu* (*Siebenbürgische Verein für Naturwissenschaften zu Hermannstadt)*. This new society conducted research in all natural sciences realms, trying to spread knowledge among all those interested in natural sciences. The society members did their best in forming new collections focused on different biological and geological samples. As a result the Natural Sciences Museum in Sibiu was opened in May 4, 1895. Among these collections, the palaeontological section rapidly expanded so that by 1852 it already included 1800 items, available to the general public.

As a result of this rapid expansion, the museum building becomes disorganized with, some collections being stored in other buildings in Sibiu.

The repeatedly transfers of specimens from one location to another as well as two world wars and the absence of professional palaeontologists for a number of years led to gaps in registers data, with some registers being lost, whilst others now only contain incomplete details on each finding of fossils. Therefore, the actual problem is not how many inventory numbers a fossil has, but the lack of synchrony between the labels and registers and the scantiness of data for a number of samples.

The fossil Proboscideans we decided to study are actually curate at Brukenthal Natural Science Museum in Sibiu (abbreviated, BkNSMS). They originate from the south Transylvanian Basin and from a doubtful locality in the Southern Carpathians (Fig. 1). Their inventory numbers are mentioned in a register made around the middle of the last century. However, in an older register dating from the second half of the 19th century, there are also older numbers for the same samples. As bad luck would have it we could not succeed in finding either the donator names, or the years when these fossils reached the society collections. It is possible that the society may have bought large collections of fossils including the Proboscidean items.

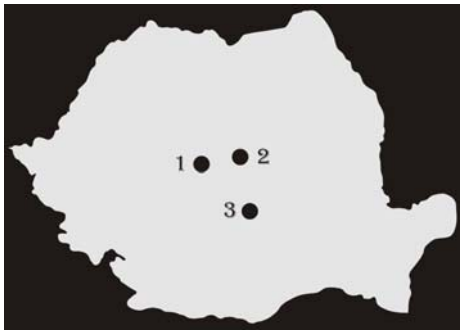

Figure 1. Location of the new Probocidean localities within Romania.

Systematic Palaeontology

Order Proboscidea Illiger, 1811

Family Deinotheriidae Bonaparte, 1845

Genus *Deinotherium* Kaup, 1829

Deinotherium giganteum Kaup, 1829

(Pl. I, Figs. 1-3)

Description (the dental nomenclature according Harris, 1975)

This deinothere is documented only by a right p4. According to its label, the tooth originated from Vurpăr, a village located 26 km NE of Sibiu. The old inventory number is BkNSMS 839 (now labeled BkNSMS 32620). In the collection registry the specimen is labeled as "*Mastodon*".

The premolar is composed only of its crown, with the roots broken on their proximal thirds. The tooth is biradiculate. The crown is damaged, being broken on its mesio-lingual side. A strong pressure mark can be seen on its distal side.

The morphology of the tooth has nothing to differentiate it from similar teeth already described (*e.g.* Tobien 1988, Gasparik 1993). It closely resembles the p4 mentioned by Codrea et al. (1991b) in Minişu de Sus (Arad district). The Vurpăr premolar is more worn, in a most advanced wear stage

compared with Minişu de Sus: the wear figures are extended on the whole protolophid, and more than a half of the hypolophid. Only the entoconid is still pristine. The protoconid is by far the largest and tallest cusp.

It is well known that in European *Deinotherium* representatives, the cheek-tooth morphology is extremely conservative. In these circumstances, a distinction of the genus' species based on morphological features is a hopeless task (Gasparik 1993, Huttunen 2002a). Therefore, the different species are distinguished by the size of the teeth. In Europe, this genus is restricted to only two species, *D. giganteum* and *D. proavum* Eichwald, 1835 (*D. gigantissimum* Ştefănescu, 1892 is a junior synonym of this species; for details, see Codrea 1994). Some authors rejected the latter of these species (*e.g.* Harris 1978, Huttunen 2002a), while others (Codrea 1994, Göhlich 1999) consider it valid.

Dimensions (mm):

L	Wa	Wp	H
69.5	+54.5	55.6	43

L - length; Wa – anterior width; Wp – posterior width; H – height; + - incomplete.

The Vurpăr tooth is highly elongated in comparison to the p4 at Minişu de Sus, but its width is nearly the same. The comparisons with other p4 are given in Fig 2.

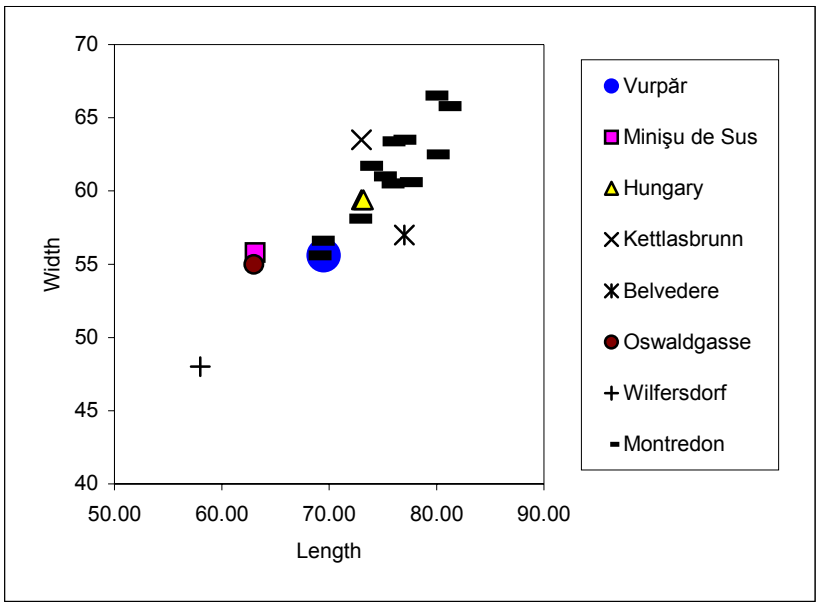

Figure 2. Last lower premolar (p4) L/W (mm) scatter diagram for different Deinotherium giganteum localities. Data from Bachmayer & Zapfe (1976), Tobien (1988), Codrea et al. (1991 b), Gasparik (1993), Huttunen (2002 b).

Discussion

Deinotheres first occurred in Europe in the Early Miocene (Tobien 1986, Göhlich 1999), more exactly in the MN4 unit (Orleanian; Steininger et al. 1985), or MN 4a subunit (Tassy 1990). Their cradle was in Africa, where they had a long geological history, from the Late Oligocene until the Early Pleistocene.

In Romania, the oldest known deinothere is the one at Minişu de Sus (Codrea et al. 1991b), found in Lower Sarmatian (Volhynian) diatomite. The mammal assemblage already known from the Minişu de Sus diatomite includes, apart from this deinothere: *Gomphotherium angustidens* (Cuvier, 1817), *Allicornops simorrense* Lartet, 1851, *Anchitherium aurelianense* Cuvier, 1812, *Dorcatherium crassum* Lartet, 1851, *Listriodon splendens splendens* von Meyer, 1846 (Codrea et al. 1991a, b, 2007, Codrea 1992, 1996). It is a typical Upper Astaracian *Anchitherium* fauna (MN 7+8), indicative of forested environments, riparian to a brackish-water gulf.

D. giganteum is also mentioned in the Middle Sarmatian (Bessarabian) at Deleni-Hârlău (Macarovici & Zaharia 1967), in a poorly known stratigraphic level (probably Kersonian or Meotian) at Drăgeşti (Şova 1963) as well as in younger formations as in Derna (Latest Pannonian or Pontian; Jurcsák 1973b, 1983).

In the Sibiu region, only one reference could be linked to deinotheres. An anonymous list of fossils in Michael Ackner's collection (issued in 1850) mentions the presence of "*Tapirus giganteus*" at Guşteriţa (= Hammersdorf). "*Tapir gigantesque*" is the former name of *Deinotherium*, as used by Cuvier (p. 174; 1822). Surprisingly this taxon had never been mentioned in this locality in previous, or subsequent contributions by Ackner (1848, 1854). The geological age of the Guşteriţa Formation Lubenescu, 1981 is Pannonian *s. str.* (Popescu et al. 1995).

The museum registers do not give any data about the rocks where the fossil originated. However, the geological map of the Vurpăr region (1: 200 000, *folio* 27; Dessila-Codarcea & Dimitrescu 1968) indicates there is an area where only Pannonian rocks are exposed. This geological age is in accordance with this deinothere species' stratigraphic extension. Its size is slightly larger than the specimen from Minişu de Sus and could be interpreted as a more progressive evolutionary stage.

The presence of this fossil at Vurpăr is important for interpreting the Pannonian Transylvanian paleobiogeography too. It documents the existence during the Pannonian of a lake with low levels tendency episodes and an extension of land environments on the south Transylvanian Basin border. The paleogeographical reconstructions already issued (Magyar et al. 1999) are pointing out just a variable relationship between the submerged *vs.* emerged land, at the boundary between the Transylvanian Basin and the South Carpathians. The Pannonian littoral shoreline oscillations allowed the pre-

sence of such land vertebrate representatives at Vurpăr.

Family Gomphotheriidae Cabrera, 1929

Genus *Gomphotherium* Burmeister, 1837

Gomphotherium angustidens Cuvier, 1817

(Pl. II, Fig. 1)

Description (the dental nomenclature according Tassy, 1996 a)

An isolated left m2 crown represents this mastodon species. The fossil originated from Viscri (= Weisskirch bei Reps), a village nearby Rupea (on the southern side of the Transylvanian Depression). The old inventory number is BkNSMS 838 (now labelled BkNSMS 32621) and the specimen is labeled as "*Mastodon arvernesis*, Levantine strata".

The crown, devoid of its roots is damaged on mesial (the anterior cingulum was destroyed), distal and lingual sides (it is presumed that the tooth could have been reworked either before its burial, or in an actual process induced by the erosion of the deposits the fossil originated from). The distal lophid had been filled with plaster in a previous restoration, and the middle one has also several small breaks.

In occlusal view (Pl. I, Fig. 1) the molar has an elongate rounded rectangular outline. The bunodont cones are forming three transverse lophids. The largest is the distal one. Each of them is divided into two half-lophids - pretrite and posttrite - by the median sulcus. The attrition is in an advanced stage, wearing mainly the first two pretrite half-lophids, where trefoil-shaped wearing figures are occurring (wear stages XX-XXI; Tassy, 1996 b). The dentine on the third anterior pretrite conule is nearly completely covered by enamel. Due to attrition and wear stage, the highest part of the crown is on the postero-labial side.

The pretrite conules obstructing the transverse synclines are of a large size. In this manner, the molar is different from the Artenay teeth (Tassy 1977). The crown is devoid of lateral cingulums. However, one cannot completely exclude the possibility that a small vestigial cingulum could exist on the antero-lingual side, between the lingual endings of the two first posttrite half-lophids (where the crown is broken). As observed in the Artenay specimens, or in those from Portugal illustrated by Bergounioux et al. (1953), on the Viscri tooth one can distinguish the advance of the posttrite half-lophids on the pretrite ones, an anancoid feature.

Only a mesial pressure mark can be observed. The distal cuspules are broken, but still visible.

Dimensions (mm):

L	W_1	W_2	W_3
+105.5	51	60.2	64

L – length ; W1, W2, W3 – width of first, second and third lophids.

In comparing the Viscri molar with other similar discoveries (Fig. 3) we

have to allow for the damaged status of this tooth. In particular its length should be initially slightly greater.

However, even in these circumstances, compared with the specimen from Serbia (Burovac; Petronijević 1967), the Viscri tooth is smaller. It is smaller than the m2 from Balcic (Sarmatian, Bulgaria; Bakalov & Nikolov 1962) too. The specimens from Hungary, at Káposztásmegyer and Sajókaza (Schlesinger 1922) have closer lengths, but they are slightly narrower.

Among the m2 originating from various sites in Portugal (Bergounioux et al. 1953), the Viscri tooth has an intermediary size. The same is valid if comparing it to the Artenay and Simorre fossils (Tassy 1977). Obviously, *vs.* the representative from Quinta das Pedreiras (Zbyszewski 1949) our mastodon tooth is considerably larger.

Discussion

In Europe, the "trilophodont gomphothere" *G. angustidens* is a species restricted to the early Middle to early Late Miocene (MN 5-MN 9; Tassy, 1990; Göhlich, 1999).

It is rather common in the European faunas. Around our country, it has

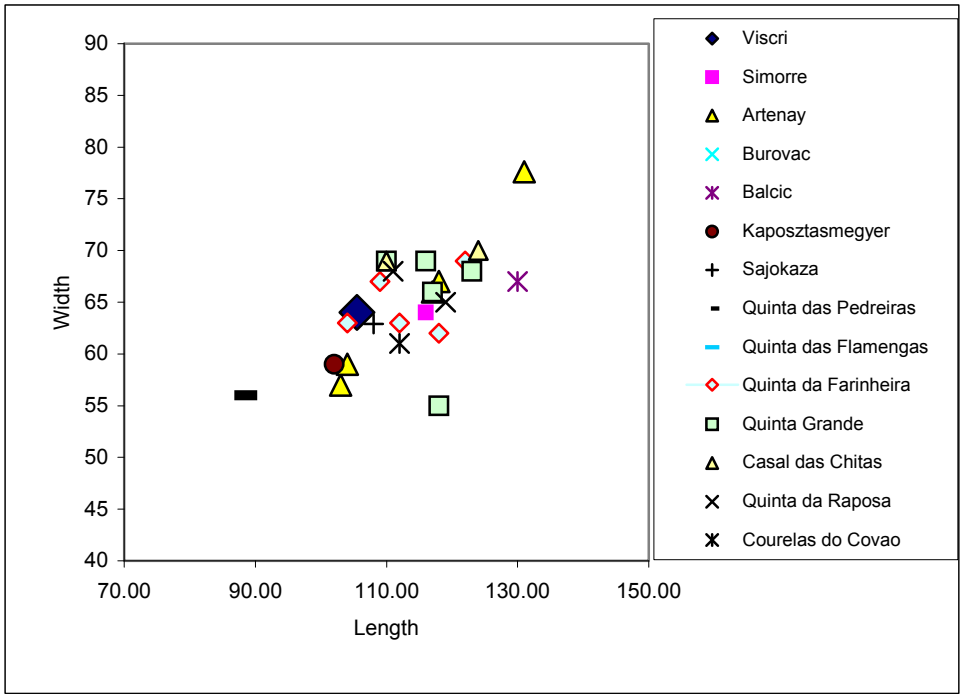

Figure 3. Second lower molar (m2) L/W (mm) scatter diagram for different *Gomphotherium angustidens* localities. Data from Schlesinger (1922), Bakalov & Nikolov (1962), Zbyszewski (1949), Bergounioux et al. (1953), Petronijević (1967), Tassy (1977).

been mentioned in several localities in Serbia (Petronijević 1967), Hungary (Schlesinger 1922), Bulgaria (Bakalov & Nikolov 1962, Nikolov 1985) and the Republic of Moldova (Lungu & Obadă 2001).

In spite of its wide geographic distribution, in Romania the species is surprisingly rare, being restricted to a single locality. Nicorici (1976) mentioned a lower tusk fragment originating from the Lower Sarmatian diatomite at Minişu de Sus.

Schlesinger (1922) mentioned an m2 fragment from Bănia (Caraş-Severin dept., in SW Romania) probably belonging to a related gomphothere species, *G. subtapiroideum* (Schlesinger 1917), which he considered then as a *G. angustidens* subspecies. As Göhlich (1999) stressed, this species "is object of never-ending taxonomic discussions" (p. 162).

In these circumstances, Viscri is the second locality in Romania where *G. angustidens* is documented, the specimen is better then that collected in Minişu de Sus, where the tusk fragment mentioned by Nicorici (1976) is however, less diagnostic.

The paleobiogeographic interpretation of this mastodon specimen is very similar to that of the previous deinothere. The geological map of the Viscri region (1: 200 000, *folio* 20; Ianovici & Rădulescu, 1968) indicates there is an area containing only Lower and early Middle Sarmatian outcrops. In this case, one can suppose that these deposits are probably comparable with the ones at Minişu de Sus.

In the Early Sarmatian, the East and South Carpathians, as well the Apuseni Mountains formed an archipelago area inside the Paratethys Sea (Rögl & Steininger, 1984). This land/sea configuration evolved under the influence of sea level oscillations. Krézsek & Filipescu (2005) and Krézsek & Bally (2006) mentioned in the late Early Sarmatian a lowstand sequence (LST 6) that could explain the presence on this fossil so far inside the basin, as a consequence of the land environ-ments expansion on the southern border of the Transylvanian Basin.

Genus *Anancus* Aymard, 1855

Anancus cf. *arvernenis* Croizet & Jobert, 1828

(Pl.II, Fig. 2)

Description

This molar fragment was found at Cheile Dâmbovicioarei by Gheorghe Căpăţînă in June 19, 1977. Its inventory number is BkNSMS 55871.

There is a posterior right m3 half molar crown, with obvious anancoid features, with an odd difference between the posttrite half lophfids and the pretrite ones. Four small cuspules are located at the tooth distal extremity.

Dimensions (mm):

L	W1	W2	W3
+98[1]	72.2	64.7	55.5

[1] - incomplete

Plate I. *Deinotherium giganteum*, p4, Vurpăr. Fig. 1: occlusal view; Fig. 2: labial view ; Fig. 3: lingual view. Scale bar: 30 mm.

Plate II. *Gomphotherium angustidens*, m2, Viscri. Fig. 1: occlusal view.
Anancus arvernensis, m3 fragment, Cheile Dâmbovicioarei. Fig. 2: occlusal view.
Scale bar: 30 mm.

Discussion

A. arvernensis is by far the commonest mastodon species recorded in Romania (Apostol 1968, Jurcsák 1983, Codrea & Iuga 2006). It occurs in the Late Miocene (Derşida; Jurcsák 1973a, 1983, Codrea et al. 2002) and continued to be present during the whole Pliocene (Athanasiu 1908, Feru et al. 1983, Rădulescu & Samson 1985). Up to now, there is no evidence of its survival in the Early Pleistocene.

However, the presence of this mastodon in Podu Dâmbovicioarei remains unlikely, since this mountainous locality is devoid of formations appropriate to bear this fossil (geological map of Romania, 1: 200 000, *folio* 28; Patrulius et al. 1968). Therefore, it would be desirable for additional details concerning this find to be available. However, as we are dealing with an old donation, it is unlikely these data will ever be available.

The deinothere and the Middle Miocene mastodon are particularly important for documenting the paleobiogeography tendencies on the southern border of the Transylvanian Basin. The last mentioned mastodon, originates from a doubtful locality from stratigraphical viewpoint. However, as long as its label mentions such an origin, we decided to add it here. The area would be worth the trouble of an additional survey.

All these fossils prove nothing else but the potential of the old Romanian natural sciences collections: one can expect to find such specimens sitting neglected in other museums too.

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