

FOSSIL PROBOSCIDEANS IN INNER CARPATHIAN AREA (ROMANIA)

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Abstract**Fossil proboscideans in Inner Carpathian area (Romania)**

The oldest proboscideans ever reported in the Inner Carpathian area in Romania are the Middle Miocene dinotheres and gomphothere mastodons. Their First Appearance Datum (FAD) is in the Sarmatian in Minișu de Sus, Viscri and perhaps in the even older locality (?Badenian), Bănia. Next doubtless data concern only the Pontian *s.s.*, when large areas begun to be exhausted by the Pannonian Lake waters as in the Șimleu Basin, where *Tetralophodon longirostris*, *Anancus arvernensis* and *Deinotherium proavum* (= *D. gigantissimum*) occurred in Derșida. Some other finds, either in the Neogene western “gulf-basins” of the Apuseni Mountains, or on the easternmost border of the Pannonian Basin are lacking convenient stratigraphy. The dinotheres disappeared in the uppermost Miocene (MN 13), but mastodons survived in Pliocene too. The Pliocene deposits are poor documented in the whole Transylvania, excepting Țara Bârsei Basin, where *Anancus arvernensis* was coeval with *Mammuthus borsoni* until the Late Pliocene. In Păgaia (Bihor district), *Mammuthus praetypicum* could be Pliocene too, but the stratigraphic evidence is rather scarce there. Nothing is known in this region about the oldest mammoths, otherwise well known outside Carpathians, as *Mammuthus rumanus* and *M. gromovi*. Even *M. meridionalis* is rare in Transylvania. The steppe mammoth *M. trogontherii* had been mentioned in few localities, as well as the transitional forms towards the Upper Pleistocene woolly mammoth *M. primigenius*. This last one was widespread in this region, but its geological history remains rather poor known.

Key words: proboscideans, paleobiogeography, Inner Carpathians, Romania.

Rezumat**Proboscidiieni fosili din aria intracarpatică românească**

Cei mai vechi proboscidiieni fosili din aria intracarpatică românească au fost semnalati din Miocenul Mediu, revenind deinotheriilor și mastodonților. Apariția lor (First Appearance Datum – FAD) este consemnată în Sarmațianul Inferior de la Minișu de Sus și Viscri, precum și de la Bănia, localitate posibil mai timpurie (?Badenian). Date clare referitoare la acest grup de ierbivore mari sunt cunoscute apoi de abia din Ponțianul *s.s.*, când suprafețe vaste acoperite până atunci de apele Lacului Pannonic, devin uscaturi. Este și cazul Bazinului Șimleu, de unde *Tetralophodon longirostris*, *Anancus arvernensis* și *Deinotherium proavum* (= *D. gigantissimum*) au fost semnalate de la Derșida. O serie de alte descoperiri din așa-numitele « bazine-golf » din vestul Munților Apuseni și marginea estică a Bazinului Pannonic sunt din nefericire lipsite de date stratigrafice adecvate. Deinotherii s-au stins la finalul Miocenului (MN 13), însă mastodonții au supraviețuit și în Pliocen. Depozitele pliocene din Transilvania sunt puțin extinse, iar într-o serie de cazuri, chiar acolo unde sunt presupuse, sunt firav documentate prin descoperiri paleontologice. Bazinul Țara Bârsei face însă excepție de la această regulă. Acolo, *Anancus arvernensis* a fost contemporan cu *Mammuthus borsoni* până la finalul Pliocenului. Și la Păgaia, specia *Mammuthus praetypicum* ar putea fi eventual pliocenă, însă dovezi stratigrafice clare, lipsesc. În regiunea de interes pentru acest studiu, nu se cunoaște deocamdată nimic legat de primele forme de mamuți, altminteri bine dovediți la exteriorul Carpaților prin speciile *Mammuthus rumanus* și *M.*

gromovi. Chiar și *M. meridionalis* este rară în Transilvania. Mamutul de stepă (*M. trogontherii*) este în schimb semnalat dintr-un număr ceva mai mare de localități, la fel ca și forme de tranziție spre mamutul lănos din Pleistocenul superior (*M. primigenius*). Această ultimă specie a fost extrem de răspândită în această regiune, însă istoria ei evolutivă locală rămâne deocamdată insuficient clarificată în toate detaliile ei.

Cuvinte cheie: proboscideni, paleobiogeografie, aria intracarpatică, Romania.

1. Introduction

The proboscideans occurred in the Paleogene of Africa, more exactly in lowest Eocene (Ypresian) of Morocco (GHEERBRANT et al. 1996, 1998, 2005). In early Miocene (MN 3b, Burdigalian, Orleanian) their first representatives (the mastodons *Gomphotherium* and *Zygodon*) reached Europe, when the so-called “Eurasian-African Mammal Faunal Corridor” (STEININGER et al. 1985) opened, interrupting the marine gateway between the Mediterranean and Indo-Pacific realms. Soon after (MN 4a) the dinotheres arrived to, enriching the diversity (TASSY 1990; GÖHLICH 1999).

In spite these old roots, the majority of proboscidean fossils were found in Europe in Middle Miocene or younger localities. In Romania it works the same hard and fast rule, because the Lower Miocene representatives of this group had never been found, probably because of the restricted exposures of the Lower Miocene deposits and nearly absence of non-marine environment (RÖGL & STEININGER 1984). However, even unproved, one can assume the existence of earlier arrivals of these large herbivores in this region, if considering their occurrence (FAD) in Europe (STEININGER et al. 1985) or in Romania neighboring countries (e.g. GASPARIK 1993).

2. Proboscideans in Romanian Inner Carpathian area

2. 1. Miocene

The oldest proboscidean representatives in this region refer to middle-sized dinotheres and gomphothere mastodons. *Deinotherium giganteum* and *Gomphotherium angustidens* were reported in Minișu de Sus (Arad district), in Volhynian (Early Sarmatian; NICORICI 1976; JURCSÁK 1983; CODREA et al. 1991).

Rather coeval, is the same mastodon species in Viscri (Brașov district). The *D. giganteum* in Vurpăr (Sibiu district - perhaps somewhat younger, in Pannonian *s.s.*) exposes nearly the same evolutionary stage features as the one in Minișu de Sus (CODREA & CIOBANU 2008).

A close related mastodon species to *G. angustidens* is *G. subtapiroideum*, reported by SCHLESINGER (1922) in Bănia (Bozovici Basin). Strangely, subsequently Schlesinger's report this locality was completely ignored in the fossil vertebrate lists compiled for Romania (e.g. BARBU 1930; MACAROVICI 1978).

Beginning with the Pannonian *s.s.* the finds are rarer, possibly effect of the widespread area of submerged areas in this region. Both in the Basin of Transylvania, same as on the eastern border of the Pannonian Basin, the land environment occurred hardly in Late Miocene, rather in Pontian *s.s.* when the Pannonian Lake contracted and the sedimentary filling in the Transylvanian Basin ended.

In Derna-Tătăruș (Bihor district) *D. giganteum* had been reported in tar sands (JURCSÁK 1973 a, 1981; CODREA 1989). This deposit could be either Late Pannonian (*Congerina subglobosa*, "Rhenohassium" according KRETZOÏ 1982), or Pontian (CODREA 2000). This incertitude is the result of the lack of data concerning the dinotherium find, only loosely details being known. The fossils from Derna-Tătăruș were found during the coal or tar sand mining and frequently, the only data mentioned on the fossils labels is referring to the locality of origin, without any other details. It is interesting to point out that Kretzoï reported in the same localities the mastodon *Platybelodon* too. There, this mastodon could documents western trended migrations of the Easternmost European and Asian representatives happened in Late Miocene. However, its presence in Derna-Tătăruș could be never confirmed after Kretzoï's report (no fossil originating from this locality curate at the Hungarian National Geological Institute -MAFI- could be assigned to this mammal; László Kordos, *written communication*, 2008).

A representative fauna for the Latest Miocene (MN 13) is the one in Derșida (Șimleu Basin, Sălaj district), including two mastodon species (*Tetralophodon longirostris* and *Anancus arvernensis*) and the largest sized dinotherium ever occurred in Europe, *Deinotherium proavum* (= *D. gigantissimum*; for details on this synonymy, see CODREA 1994). Besides proboscideans, in Derșida were tridactyl horses (*Hipparion*), beavers (*Dipoides*), various artiodactyls (*Procapreolus*, ?*Croizetoceros*, indeterminate bovidae) or hyenas (*Ictitherium pannonicum*) (JURCSÁK 1983; CODREA et al. 2002).

A series of finds located western from the Apuseni Mountains could also concern the Late Miocene but their stratigraphy remains poor known. It is the case for Arad (TOULA 1911; SCHLESINGER 1922, JURCSÁK 1973b, 1983) where "*Mastodon americanus*" had been mentioned, or Dijir (Bihor district) where *Tetralophodon longirostris* was reported (JURCSÁK 1983).

In Latest Miocene the last dinotheres vanished in the Inner Carpathian region, but mastodons continued their evolutionary history.

2. 2. Pliocene

As in whole Europe, the two coeval main Pliocene mastodon species *Anancus arvernensis* and *Mammut borsoni* roamed this region. To these two species, one could add a third one, *Mammut praetypicum*.

The most typical Pliocene deposits are located in Țara Bârsei Basin (Brașov Depression), where the first two mastodon species had been reported in several MN 15 and MN 16 localities (RĂDULESCU & SAMSON 1985; RĂDULESCU et al. 2003). *A. arvernensis* is known in Căpeni, Vârghiș, Debren -2 (MN 15), Iarăș – Cariera Noua –1 and 3, Araci - Fântâna Fagului, Ilieni (MN 16), while *M. borsoni* is accompanying it in the same localities, excepting Debren 2 and Ilieni where it is missing.

M. praetypicum, a disputed mastodon species (GÖHLICH, 1999) - some paleontologists considering as synonym with *M. borsoni* – had been reported until now only from a single locality, Păgaia (Bihar district; SCHLESINGER 1922; JURCSÁK 1983; CODREA et al. 2005). Aside this mastodon, the Păgaia deposits did not yielded other vertebrate fossils. Therefore, it is not possible to recompose a mammalian assemblage for this locality and its Pliocene age continues to remain uncertain.

2. 3. Pleistocene

Due to climate changes occurred already to the end of Pliocene, in the whole Europe the beginning of the Pleistocene marked turnovers in proboscidean diversity, but the evidence of this evolutionary stages in Transylvania is extremely scarce if comparing to the regions from outside Carpathians. Therefore, species as *Mammuthus rumanus* or *M. gromovi* are unknown in Transylvania.

Western to the Apuseni Mountains only a single locality-Dealul Viilor Oradea-documents the presence of *Mammuthus meridionalis* (APOSTOL 1968; JURCSÁK 1983). Even more than a century (the first fossils were unearthed in 1902) after this find, it continues to remain singular in this part of the country.

This species is better documented in Țării Bârsei Basin, where it is reported in Rotbav Silvestru and Rotbav Dealul Țiganilor (KOVÁCS 1981; RĂDULESCU & SAMSON 1985)

If the rise of the Pleistocene proboscideans is rather poor known in Transylvania, later representatives are somewhat better known. Even the steppe mammoth *Mammuthus trogontherii* is reported only from very few localities: Cluj-Napoca (in Nadășului Valley terrace, on the actual municipal railroad station area; SZENTPÉTERI 1914; PATTE 1936;

APOSTOL 1968); Feldioara Carieră, Zoltan (KOVÁCS 1981; RĂDULESCU & SAMSON 1985). This scarcity of steppe mammoth fossils could not be explained by rarefied populations, but to the rarity of the geological deposits of convenient geological age for this species preserved in this region and convenient environments for good fossilization.

The evolutionary transition between the steppe mammoth and woolly mammoth (*Mammuthus primigenius*) was mentioned in various regions, but mainly in Braşov Depression. RĂDULESCU & SAMSON (1985) reported such transitional forms in Riss/Saale from Malnaş, Sf. Gheorghe-La Moară, Cariere Sud, Sânmartin (KOVÁCS 1981; RĂDULESCU & SAMSON 1985). Such transitions make sometimes difficult the species separations. In these circumstances, several finds could belong to such intermediate forms, which had been described as *M. intermedius* (LABE & GUÉRIN 2005). It is the case of the mammoth partial skeleton found in Oradea, in a Crişul Repede (JURCSÁK & MOISI 1983).

The last mammoth living in Transylvania was the woolly mammoth, reported from a large number of Upper Pleistocene localities (e.g. APOSTOL 1968; JURCSÁK 1983; VÖRÖS 1983; CODREA & ANDREICA 1988; CODREA & MĂRGINEAN 2008). The number of these localities is less important, because one can suspect that none of the lists and/or maps already done succeed to record all the finds, just because of the affluence of such fossils. Part of these finds is even now still neglected. However, the majority of woolly mammoth fossils refer only to isolate teeth, partial skeletons being rarer, none being complete.

Obviously, this mammoth spread in Late Pleistocene on the whole this area and its fossils exceed by far in number the other coeval large herbivores not only in Transylvania, but in whole Romania. In spite of these numerous finds, a series of details of real interest remains rather unclear, as their stratigraphy in a lot of cases remains poor (the majority of localities are devoid of radiometric dates and in few cases, they are associated with mammal assemblages well documented).

In these circumstances, it is not very clear when the extinction of the woolly mammoth took place in Romania, their last occurrence being firstly presumed and not clearly argued. Other details still waiting for answers refer to the inference between this animal and the human communities. Briefly, the mammoth evolution in Romania continues to remain a challenge for the Romanian paleontologists.

3. Conclusions

The fossil proboscideans are rather common presences in the Miocene, Pliocene and especially Pleistocene mammal assemblages in the Inner Carpathians area in Romania.

However, they are clearly documented only beginning with the Middle Miocene: nothing is known about the earliest representatives, mainly due to the very restricted exposures of such convenient formations in Transylvania. In Middle and Late Miocene, both dinotheres and mastodons are documented by several species, also reported from other areas either in Romania (KOCH 1900; SIMIONESCU 1930; BARBU 1930; SIMIONESCU & BARBU 1943; APOSTOL 1968; MACAROVICI 1978; TERZEA 1983; RĂDULESCU et al. 2003), or in the neighbouring countries (LUNGU & OBADĂ 2001; BAKALOV & NIKOLOV 1962).

In Pliocene the proboscideans rarified, by dinotheres disappearance occurred in the Latest Miocene (MN 13). The last representative was the large-sized *D. proavum*, last recorded in Derșida. The mastodons continued, as elsewhere in Europe, their evolution until the end of Pliocene.

Due to climate change and changing environments occurred even in the Late Pliocene at the beginning of Pleistocene, the mammoths replaced the mastodons. The earliest mammoth representatives had never been reported from the Inner Carpathian area in Romania, but this lack of data is due rather to the scarcity of the Uppermost Pliocene-Lowermost Pleistocene deposits, than to a peculiar biogeography of these species. In these circumstances, the oldest mammoth reported is *M. meridionalis*. The next species continuing the mammoth evolution are the ones well known in the whole continent: the Romanian finds do not add any peculiar detail.

It would be interesting to know more about the east-west or north-south mammoth migrations caused by the Pleistocene geological events, but such data are still missing, mainly due to the poor stratigraphy of a lot of proboscidean localities.

Acknowledgements. I am grateful to my colleague and friend Theodor Obadă (Chișinău) not only for providing several references, but for his enthusiasm in studying proboscideans and for discussion about this topic too. Same thanks to László Kordos (MAFI Budapest) for useful data and for collegial help during my visits in Budapest.

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