Gomphotherium '*annectens* group' (Proboscidea) in Hungary

by
Mihály GASPARIK & Georgi N. MARKOV

Abstract — Revised finds from the Early Miocene of Hungary are indicative of the widespread but sporadic *Gomphotherium* '*annectens* group', they increase the number of the few known localities, yielding these primitive gomphotheres. We ascertain that *Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939), based on material from Zagyvapálfalva (Hungary), is a valid taxon, however, its relationships and possible synonymy with *G. sylvaticum* TASSY, 1985 and *G. hannibali* WELCOMME, 1994 remain unclear due to scarcity of material attributed to all of these three taxa.

Keywords — Proboscidea, Gomphotheriidae, *Gomphotherium* '*annectens* group', early Miocene, Hungary

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Introduction

Gomphotherium '*annectens* group', as defined by TASSY (1985, 1996a), includes the most primitive members of genus *Gomphotherium*. The group was apparently widespread but finds are rare: TASSY (1996a, Fig. 10.3) lists seven localities in Africa and Eurasia. To these, Bestobe (Kazakhstan, MN4: LUCAS & BENDUKIDZE 1997), Kidong Formation (North Korea: LEE & TOMIDA 2005), Toki Lignite-bearing Formation (Mizunami Basin, Japan: SAEGUSA 2008), and Hérault Valley (France, MN4a: WELCOMME 1994; type locality of *G. hannibali*) could be added, as well as probably Auchas (Namibia, early Miocene: PICKFORD 2003; type locality of *Progomphotherium maraisi* PICKFORD, 2003). [The status of *P. maraisi* is unclear: it could be either a primitive gomphothere close to (or a member of) *G.* '*annectens* group' (PICKFORD 2003), or the most primitive amebelodont known (SANDERS 2008; SANDERS et al. in press). We follow the traditional assignment of the species of the '*annectens* group' to genus *Gomphotherium* BURMEISTER, 1837.] A possible occurrence of an early and primitive *Gomphotherium* in Sicily was mentioned by SANDERS et al. (2004).

An isolated upper third molar from Mátraszele, Hungary, displays the distinct morphology of the species included in *G.* '*annectens* group'. Another Hungarian locality, Zagyvapálfalva (now part of Salgótarján), (Figure 1) has yielded a primitive gomphothere apparently belonging to the group too. Below, we describe and revise the Hungarian material, discussing the taxonomical status of other European finds referred to *Gomphotherium* '*annectens* group'.

Figure 1 — Localities of *Gomphotherium* '*annectens* group' in Hungary. — The locality Zagyvapálfalva is currently part of Salgótarján.

Material and methods

The material is stored at two collections in Budapest, the Hungarian Natural History Museum and the Hungarian Geological Institute. Dental nomenclature follows TASSY (1996b); cranial and mandibular measurements after TASSY (1996c). All measurements in mm.

Institutional abbreviations — HGI: Hungarian Geological Institute, Budapest; **HNHM**: Hungarian Natural History Museum, Budapest; **MNHN**: Museum National d'Histoire Naturelle, Paris; **NHM**: Natural History Museum, London.

Systematic palaeontology

Order Proboscidea ILLIGER, 1811
Suborder Elephantiformes TASSY, 1988
Superfamily Elephantoidea GRAY, 1821
Family Gomphotheriidae HAY, 1922
Genus *Gomphotherium* BURMEISTER, 1837

Gomphotherium sp. (*Gomphotherium* '*annectens* group')

Material — HNHM V.72.128. M3 dext, Mátraszele, Co-operative sand-pit (early Miocene, MN4) (Figure 2). For measurements, see Table 1.

Description and comparison — The specimen is very well preserved, with the first posttrite semiloph and a small part of the first pretrite damaged and reconstructed in plaster. The rest of the crown is intact, with three fully developed lophs and an asymmetrical fourth, developed on the pretrite side. Central pretrite conules are weak, except for the anterior pretrite conule of the third loph; no posttrite conules. The morphology of HNHM V.72.128, and particularly the incomplete fourth loph, fused with the posterior cingulum, is typical for the primitive gomphotheres belonging to the *Gomphotherium* '*annectens* group' (TASSY 1985, 1996a). Despite being an isolated find of unknown precise age, the molar from Mátraszele, HNHM V.72.128, is sufficient to prove beyond doubt the presence of the '*annectens* group' in Hungary. The tooth was turned up from the Farmers' Co-operative sand-pit of Mátraszele which exposed early Miocene (Ottnangian) sand.

Figure 2 — *Gomphotherium* sp. (G. '*annectens* group') M3 dext. — HNHM V.72.128. Mátraszele, Co-operative sand-pit (early Miocene, MN 4), ×0.5.

Table 1 — *Gomphotherium* '*annectens* group' from Hungary, measurements. — HNHM V.72.128., M3 from Mátraszele, and lower teeth (p4–m2 sin. et dext.) in HNHM V 2007.96.2–3., Salgótarján–Zagyvapálfalva, early Miocene (MN4) (syntype of *Gomphotherium praetypicum*); **L**: length; **W**: width (of first/second loph(id) etc.); **H**: height; **ET**: enamel thickness; **e**: estimated value.

		L	W	H	ET
V 72.128.	M3 dext, Mátraszele	143.5	75.5e/73/76/53	>51	6
V 2007.96.	p4 sin	45e	36.5		
V 2007.96.	p4 dext		37.5		
V 2007.96.	m1 sin	68e	49e		
V 2007.96.	m1 dext	68e	50e		
V 2007.96.	m2 sin	127	54/59/65	> 43	4
V 2007.96.	m2 dext	132	54/59/65	> 43	4

Gomphotherium praetypicum (TASNÁDI KUBACSKA, 1939)

Material — HNHM V 2007.96.1., maxillary fragment with left and right I2 (Plate I: 9); V 2007.96.2., left hemimandible with p4–m2 and erupting m3 (Plate I: 8); V 2007.96.3., right hemimandible with p4–m2 and erupting m3 (Plate I: 7), an isolated fragment of the symphysis (Plate I: 2) and distal fragments of the lower tusks (Plate I: 1, 4–6), all belonging to the same individual from the locality Salgótarján–Zagyvapálfalva, early Miocene (MN4). Type specimen of *Trilophodon angustidens* forma *praetypica* TASNÁDI KUBACSKA, 1939. Upper molar fragments mentioned in the original description by TASNÁDI KUBACSKA (1939) seem to be lost, most probably during the 1956 fire in the HNHM. Only fragments of the roots of the left P4 remained.

Description and comparison — The mandible (Figure 3; Plate I: 1–3, 7–8), although consisting of several fragments, is preserved well enough to permit observations on its overall shape. Both ascending branches are absent. The horizontal branches are low and narrow, widening at the root of the ascending branch. The symphysis, although partially damaged and with some *postmortem* deformation, especially of the left symphyseal border, seems to have been relatively short and stout, and not deflected ventrally. The distal end (and a medial part) of the symphysis is missing, the area of damage revealing the suboval cross-section of the lower tusks. The length of the mandible from the back of the horizontal ramus to the

proximal end of the symphysis (including the tusks) is ca. 315 mm. Unfortunately, the symphysis is so incomplete that it is impossible to make a precise estimation on its length.

Of the two fourth premolars, only the posterior lophids and talonids are preserved, and the alveoli for p3 are already resorbed. The first molars are heavily worn. The second molars are excellently preserved, with simple bunodont morphology: broad interlophids, moderately developed central pretrite conules and no posttrite ornamentation. In both m2's, posterior pretrite conules are developed on the first lophid and absent on the third; on the second lophid, anterior and posterior pretrite conules are of nearly equal size. The posterior cingulum in both m2's is rather strong, with one large cuspid on either side of the tooth and anteriorly positioned tubercles on the pretrite side. The first two lophids are worn to an extent revealing the dentine, third lophid at a very initial stage of wear. Lower tusks of suboval cross-section, with no ventral and a weak dorsal longitudinal sulcus (in this aspect, they are very similar to the lower tusks from Artenay, France, part of the type of *G. sylvaticum*: see TASSY 1985). The length of the left lower tusk fragment is 105 mm, and of the right 215 mm. Diameters of the right tusk, measured on its posterior end: 50 x 36.4 mm.

Table 2 — *Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939), craniomandibular measurements (after TASSY 1996c). — HNHM V 2007.96.1–3., Salgótarján–Zagyvapálfalva, early Miocene (?MN4); **e**: estimated value in mm.

Alveolar distance	354
Mandibular width taken at the root of the ascending rami	~ 340e
Width of the horizontal ramus taken at the root of the ascending branch	102
Width of the horizontal ramus taken at the anterior of the alveolus	70
Posterior symphyseal width	~ 200
Minimal symphyseal width	119
Minimal width of the rostral trough	35
Internal width between the anterior alveoli	53e
Maximal height of the horizontal ramus	130
Height of the horizontal ramus taken at the root of the ascending branch	113
Rostral height taken at the symphyseal border	107
Rostral height taken at the tip of the rostrum	53e
Depth between gonion and the coronoid process	~155e
Mid-alveolar length taken on the buccal side between the anterior alveolus and the root of the ascending ramus	275
Anterior rostral width	250e

Figure 3 — *Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939). — Mandible (HNHM V 2007.96.2./V 2007.96.3.) in lateral view; Zagyvapálfalva, MN4; × 0.187.

The maxillary fragment with the two upper tusks is preserved in grey sandy clay (Plate I: 9). It is deformed, especially on its left side, resulting in the current position of the left tusk. The upper tusks have a non-helicoid lateral enamel band (a plesiomorphic character: see TASSY 1985). The fragment is ca. 680 mm long, with lengths of the left and right tusk 515 and 360 mm correspondingly. Diameter of the right tusk at the insertion point: 70 x 65 mm, width of the enamel band at the same point: 58 mm.

Lower tusks without ventral longitudinal sulcus, upper tusks with a non-helicoid lateral enamel band and no torsion, and the deduced shape of symphysis in the Zagyvapálfalva gomphothere are plesiomorphic characters that set it clearly apart from *G. angustidens* (CUVIER, 1817) and are observed in members of the *G.* '*annectens* group' (see TASSY 1985, 1994, 1996a). Other elephantoids (e.g.

Archaeobelodon TASSY, 1984) also have upper tusks with a non-helicoid lateral enamel band, but the cross-section of the lower tusks (with dorsal yet without ventral sulcus) is known only for the *G.* '*annectens* group', an attribution further supported by the simple bunodont pattern of the molars.

Discussion — The Zagyvapálfalva specimen is important in several aspects. It is one of the few finds of the '*annectens* group' worldwide (and only the second that preserves, at least partially, the mandibular symphysis). Together with the molar from Mátraszele, it is the first find of this group from Central Europe. In addition, being a name-bearing type specimen, its attribution to the *G.* '*annectens* group' has some consequences to nomenclature.

The Zagyvapálfalva gomphothere was initially described by TASNÁDI KUBACSKA (1939) as *Trilophodon angustidens* forma *praetypica*, a designation implying subspecific rank under Article 45.6.4. of the International Code of Zoological Nomenclature (1999). The important differences with *G. angustidens* discussed above provide a good reason to elevate the name to specific rank, i.e. *Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939). Two more names are in use for European members of the '*annectens* group' – *Gomphotherium sylvaticum*, a species described by TASSY (1985) on the basis of material from Artenay, France, and *Gomphotherium hannibali*, erected by WELCOMME (1994) for a skull from Hérault Valley (France, MN4). Direct comparisons between the latter two are impossible and potential synonymy remains an open question (notably, *G. hannibali* was listed neither as a valid species, nor as a junior synonym for *G. sylvaticum* but as *G.* '*annectens* group' by SHOSHANI & TASSY (1996), Appendix C.1). The synchronous occurrence of three different primitive gomphothere species, all members of the '*annectens* group', in the early Miocene (MN4) of Europe, is unlikely. At first glance, an obvious solution would be to synonymize *G. hannibali* and *G. sylvaticum* with *G. praetypicum*, the oldest available name. In our opinion, however, this is not a good decision for two reasons. First, *G. sylvaticum*, although originally described in an unpublished thesis, is currently universally used and is based on an informative holotype that includes the upper M3's, so its suppression would destabilize nomenclature (see Article 23.2. of the ICZN). More importantly, the type specimens of *G. sylvaticum* and *G. praetypicum* differ in at least one aspect, the morphology of the m2. The posterior cingulum of the second lower molar is, as pointed out by P. TASSY (pers. comm. to MARKOV 2005), far better developed in the Zagyvapálfalva gomphothere than in the gomphothere from Artenay. [This character does not preclude attribution of *G. praetypicum* to the '*annectens* group'; NHM M12181, the type mandible of *G. cooperi* (OSBORN, 1932), another species of the group, has a well developed posterior cingulum on m2 (see OSBORN 1932); the additional tubercles on the pretrite side are much weaker though (MARKOV, pers. obs. 2006)]. Most probably, this difference reflects individual variation though material referable to the '*annectens* group' is so scarce in general that information on individual variability is virtually zero. Nevertheless, at the present stage of knowledge, it seems unwise to synonymize *G. sylvaticum* with *G. praetypicum*, especially considering the number of characters that cannot be directly compared, and the absence of data on M3 in *G. praetypicum*. Pending further discoveries, we suggest keeping the names *G. sylvaticum* and *G. praetypicum* as valid but to refer to any material not directly associated to the two holotypes as *Gomphotherium* '*annectens* group' in Europe. An approach adopted in this paper for HNHM V.72.128., the isolated M3 from Mátraszele (since M3's unknown in *G. praetypicum*, attributing HNHM V.72.128. to this species would not be justified; on the other hand, attributing it to *G. sylvaticum*, and thus implying the existence of two different species in Hungary, would not be particularly convincing either). As noted by TASSY (1996a), all the finds attributed to different species within the '*annectens* group' might actually represent a single cosmopolitan species but, with the material available at present, we simply do not know. One example: as said above, m2's in *G. praetypicum* and *G. cooperi* have a similarly developed posterior cingulum differing from the type specimen of *G. sylvaticum*. In the type mandible of *G. cooperi*, however, mesoconelets of the m2, especially on the posttrite side, are not clearly separated from the main cusps, differing from both the Zagyvapálfalva and the Artenay specimens (MARKOV, pers. obs. in NHM and MNHN). A character considered as derived by TASSY (1985): reduction of the dorsal longitudinal sulcus in lower tusks, resulting in suboval cross-section, is shared by both the gomphotheres from Zagyvapálfalva and Artenay in contrast to *G. annectens* (MATSUMOTO, 1925); state of this character is unknown in *G. cooperi*.

The Hungarian material described above adds to the known localities of *Gomphotherium* '*annectens* group' (Figure 4) and necessitates a revision of early material from Central Europe formerly referred to *G. angustidens*. Certainly, not every specimen of supposed early Miocene age previously attributed to *G. angustidens* should automatically be relocated to the *Gomphotherium* '*annectens* group'. For example, the "*Gomphotherium angustidens*" from Bełchatów, a locality in Poland of assumed early Miocene (MN4) age, published by KOWALSKI & KUBIAK (1993), actually belongs to the mammutids, actually to *Zygolophodon turicensis* (SCHINZ, 1824) as far as it can be judged from the photos. Much of the Hungarian early Miocene material, being certainly not *G. angustidens*, does not necessarily belong in the '*annectens* group' either. Identification of isolated molars cannot be certain but two right m2's from two early Miocene localities, HGI V.11151 from Putnok, and HNHM V.63.1605 from Diósgyőr (Baráthegy), display a morphology similar to the amebelodontine species *Archaeobelodon filholi* (FRICK, 1933), known from various early and middle Miocene (MN4–MN7/8) localities in western Europe and found in Hungary from a Middle Miocene locality at Szurdokpüspöki (GASPARIK & MARKOV in prep.). At Kőbánya and Sajókaza, *Gomphotherium subtapiroideum* (SCHLESINGER, 1917) seems to be represented by finds described by SCHLESINGER (1922); for the status of *G. subtapiroideum*

see GÖHLICH (1998). Isolated molars from Etes (e.g. HGI Ob1292: GASPARIK 2001, Pl. II: 2, and HGI Ob4371) could belong either to *Gomphotherium subtapiroideum* or to the *Gomphotherium* '*annectens* group'. Finally, HGI V.19550, a left m3 from Salgótarján–Zagyvapálfalva, the type locality of *Gomphotherium praetypicum*, might belong to the *Gomphotherium* '*annectens* group', judging from its simple bunodont morphology.

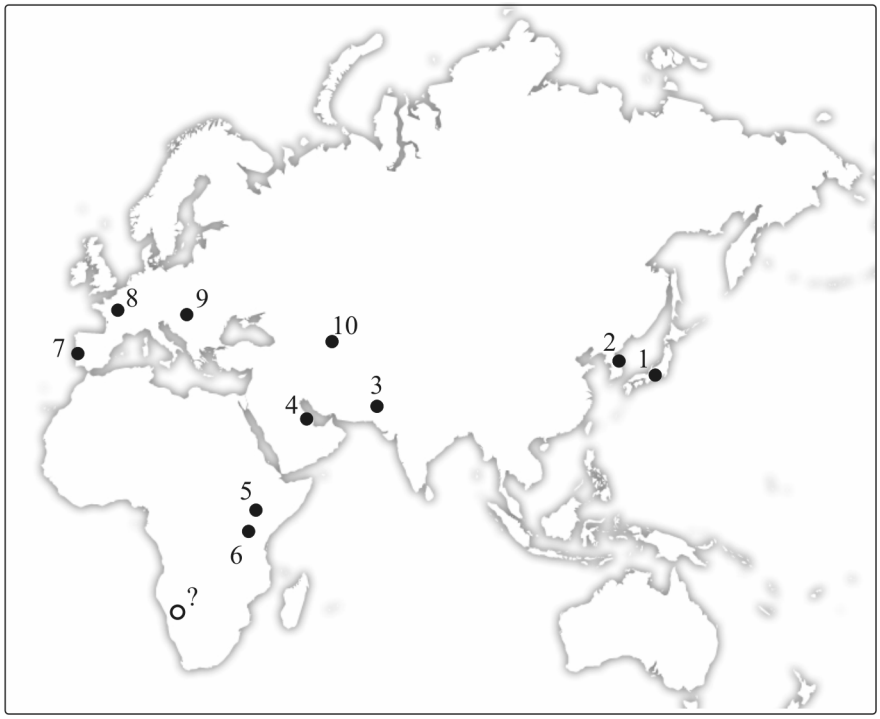

Figure 4 — Distribution of *Gomphotherium* '*annectens* group', modified after TASSY (1996a) and LUCAS & BENDUKIDZE (1997). — **1**: Hiramaki Formation, Japan; **2**: Kidong Formation, N. Korea; **3**: Bugti, Pakistan; **4**: Ad Dabtiyah, Saudi Arabia; **5**: Mwiti, Kenya; **6**: Mfwangano, Kenya; **7**: Quinta das Pedreiras, Portugal; **8**: Artenay, France; **9**: Mátraszele, Hungary; **10**: Bestobe, Kazakhstan; **?**: Auchas, Namibia (see text for details).

Summary and conclusions

Hungarian material, discussed in this paper adds to the scarce finds of the *Gomphotherium* '*annectens* group' that is widespread but rare, and previously unreported from Central Europe. An isolated M3 from Mátraszele proves beyond doubt the occurrence of the group in Hungary; a find from Salgótarján–Zagyvapálfalva is only the second worldwide to preserve symphyseal parts. The Zagyvapálfalva specimen was initially described as a "forma" (i.e. subspecies) of *G. angustidens*, here, we elevate the name to specific rank as *Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939). Although *Gomphotherium praetypicum* is potentially a senior synonym for *Gomphotherium sylvaticum* and *Gomphotherium hannibali*, two names used for European representatives of the '*annectens* group', we argue against suppressing the widely used name *Gomphotherium sylvaticum*. With virtually no data on individual variation in the '*annectens* group', we suggest using the designation *Gomphotherium* '*annectens* group' for all European finds that are not directly associated with the type specimens of *Gomphotherium praetypicum* and *Gomphotherium sylvaticum*.

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Authors' addresses:

Dr. Mihály GASPARIK
Hungarian Natural History Museum,
Department of Palaeontology and Geology
H–1431 Budapest, Pf. 137. Hungary
e-mail: gasparik@nhmus.hu

Dr. Georgi N. MARKOV
National Museum of Natural History
BAS, Tsar Osvoboditel Blvd. 1, 1000 Sofia, Bulgaria
e-mail: markov@nmnh.bas.bg

Explanation to Plate I

1–3 ***Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939), syntype, Zagyvapálfalva, MN4.** — Mandible (HNHM V 2007.96.2–3.) in occlusal view; ×0.194).

4 ***Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939).** — Fragments of the lower tusks in dorsal view; ×0.25.

5 ***Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939).** — Right lower tusk fragment (HNHM V 2007.96.3.) in proximal view; ×0.25.

6 ***Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939).** — Cross-section of the right lower tusk fragment at its distal part; ×0.46.

7 ***Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939).** — Right hemimandible fragment with p4–m2 (HNHM V 2007.96.3.); ×0.21.

8 ***Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939).** — Left hemimandible fragment with p4-m2 (HNHM V 2007.96.2.); ×0.25.

9 ***Gomphotherium praetypicum* (TASNÁDI KUBACSKA, 1939).** — Maxillary fragment with upper tusks (HNHM V 2007.96.1.) in ventral view; ×0.14.

Plate I