A mandible of *Deinotherium* (Mammalia: Proboscidea) from Aksakovo near Varna, Northeast Bulgaria

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Abstract

The paper describes a mandible from Aksakovo near Varna, NE Bulgaria, referred to *Deinotherium giganteum* on the base of dental size, since morphology of p3 is not directly observable due to poor preservation. Also from Aksakovo, *Prodeinotherium bavaricum* is known with a molar recovered and published in the 1960s. The two deinotheriid specimens are the only fossil finds from Aksakovo so far and, while not associated, indicate a pre-Turolian, most probably middle Miocene age for the locality. Pre-Turolian land vertebrates are rare in Bulgaria, coming mostly from the northeast part of the country, mainly from the vicinities of Varna on the Black Sea coast. This is the first *Deinotherium giganteum* mandible from Bulgaria, with most of the deinotheriid finds from the country belonging to the Turolian species *Deinotherium gigantissimum*.

Keywords: Proboscidea, Deinotheriidae, *Deinotherium*, Miocene, Bulgaria.

Zusammenfassung

Ein Unterkiefer aus Aksakovo bei Varna in Nordostbulgarien wird beschrieben. Die Zuordnung zur Art *Deinotherium giganteum* beruht auf der Größe der Zähne, da wegen der schlechten Erhaltung der p3 morphologisch nicht zu beurteilen ist. Von Aksakovo kennt man auch einen Molar von *Prodeinotherium bavaricum*, der in den 1960er Jahren veröffentlicht wurde. Diese beiden Exemplare sind die einzigen Fossilien aus Aksakovo. Auch wenn sie nicht von derselben Fundstelle stammen, sind sie doch ein Indiz für ein vorturolisches, wahrscheinlich mittelmiozänes Alter. Vorturolische Landwirbeltiere sind in Bulgarien selten und stammen meistens aus dem Nordosten des Landes, hauptsächlich aus der Umgebung von Varna am Schwarzen Meer. Dies ist der erste Unterkiefer von *Deinotherium giganteum* aus Bulgarien, wo Deinotherien meist durch die turolische Art *Deinotherium gigantissimum* vertreten sind.

1. Introduction

Among the fossil proboscideans stored at the collection of the Varna Regional Museum of History – Department of Natural History, is a deinothere mandible from Aksakovo, a town near Varna (NE Bulgaria). Aksakovo was first listed as a fossiliferous locality by Bakalov & Nikolov (1962), who described an isolated molar (more precisely, the cast of the molar) as "*Deinotherium giganteum*, race minor" (i. e. *Prodeinotherium bavaricum*). The find was referred to *Deinotherium bavaricum* by Nikolov (1985), and was recently discussed by Markov (2008a). For decades, this remained the only fossil find from Aksakovo. In the 1990s, two halves of a deinotheriid mandible were accidentally found during construction works in Aksakovo, dug out and submitted to the museum in Varna in several fragments. Here, we provide a description of the specimen and discuss its affinities.

Institutional abbreviations

NHMW Naturhistorisches Museum Wien, Vienna, Austria
VRMH Varna Regional Museum of History – Department of Natural History, Varna, Bulgaria

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2. Material and methods

Material: VRMH 164, 166: left and right halves of a mandible with p3–m3 sin. and m2–m3 dext., Aksakovo.

Methods: Dental nomenclature follows Tassy (1996a); mandibular measurements after Tassy (1996b). All measurements are in mm.

3. Systematic palaeontology

Order Proboscidea Illiger, 1811
Family Deinotheriidae Bonaparte, 1841
Genus *Deinotherium* Kaup, 1829

Fig. 1. Geographic position of Aksakovo near Varna, NE Bulgaria.

Deinotherium giganteum Kaup, 1829

D e s c r i p t i o n . – The mandible is an accidental find from the town Aksakovo near Varna (see Fig. 1). VRMH 164, the left hemimandible (Fig. 2), is the worse preserved of the two, lacking the entire ascending branch. The horizontal branch and the symphyseal part have suffered some damage too. The tooth row is fully preserved, the p3 (L: >55, est. 60; W: 45) has a damaged occlusal surface of the crown and lacks its mesial end. The p4 (L: 66; W: 55/55.5) is fully preserved, with dentine exposed on both lophids (only on the pretrite side on the second). Anterior and posterior cingula are well developed, the ectolophid is relatively weak. Dentine is exposed on all three lophids of the m1 (L: 80.5; W: 53.5/57/57e), wear is strongest on the third lophid, which is also slightly damaged on the lingual side. The m2 (L: 80; W: 69/70), built of two lophids and a small posterior cingulum, is of quadrangular shape, with both lophids slightly damaged on the lingual side. The m3 (L: 86; W: 76.5/69) is perfectly preserved, with two lophids and a strong posterior cingulum making the shape of the m3 sub-triangular.

The right hemimandible, VRMH 166 (Fig. 3), although lacking p3–m1, is far better preserved than the left. Broken in two along a crack behind the m2 (see photo from the VRMH archive of the specimen in situ, Fig. 4), it is almost perfectly preserved up to the symphyseal part which is damaged anteriorly. As in the left hemimandible, the tusk is absent. The symphysis is massive and strongly curved downwards, the horizontal branch below the tooth row is straight, low and narrow (for mandibular measurements, see Tab. 1). The mandibular angle is well developed, at the same level as the ventral border of the horizontal ramus. The m2 (L: 80; W: 70/70) is slightly damaged on the buccal side (on both lophids); the right m3 (L: 88; W: 77/72), like its left counterpart, is perfectly preserved (Fig. 5).

D i s c u s s i o n . – Regarding the systematics of European deinotheriids, we follow the four-species model proposed by Gasparik (1993, 2001) and modified by Markov (2008a, 2008b), with Orleanian *Prodeinotherium cuvieri* and Turolian *Deinotherium gigantissimum* accepted as valid species, distinct from *P. bavaricum* and *D. giganteum*, respectively. This approach, together with the state of preservation of the Aksakovo mandible, makes most of the morphological characters accepted as diagnostic in recent research (see e. g. Huttunen 2002, 2004; Duranthon et al. 2007) inapplicable for the identification of the specimen. Mandibular morphology (or, more precisely, the shape of the mandibular angle) sets apart *P. cuvieri* from *P. bavaricum* and *D. giganteum* from *D. gigantissimum* (Markov 2008a, 2008b) but not *P. bavaricum* (s. str.) from *D. giganteum* (s. str.). One p3 is missing in VRMH 164/166 and the crown of the other is damaged, permitting

Tab. 1. *Deinotherium giganteum* Kaup, 1829 from Aksakovo, NE Bulgaria (VRMH 164/166). Mandibular measurements (in mm). Measurements after Tassy (1996b).

Maximal length	815
Alveolar distance	475
Ventral length (from angulus mandibulae to the tip of the symphysis)	730
Width of the horizontal ramus taken at the root of the ascending branch	173
Width of the horizontal ramus taken at the anterior of the tooth row	70
Maximal height of the horizontal ramus	200
Height of the horizontal ramus taken at the root of the ascending branch	130
Rostral height taken at the symphyseal border	170
Maximal mandibular height taken at the condyle perpendicular to the ventral border of the horizontal ramus	450
Maximal depth of the ascending ramus	310
Depth between gonion and the coronoid process	430
Height between gonion and condyle	430
Mid-alveolar length taken on the buccal side between the anterior alveolus (p3) and the root of the ascending ramus	375

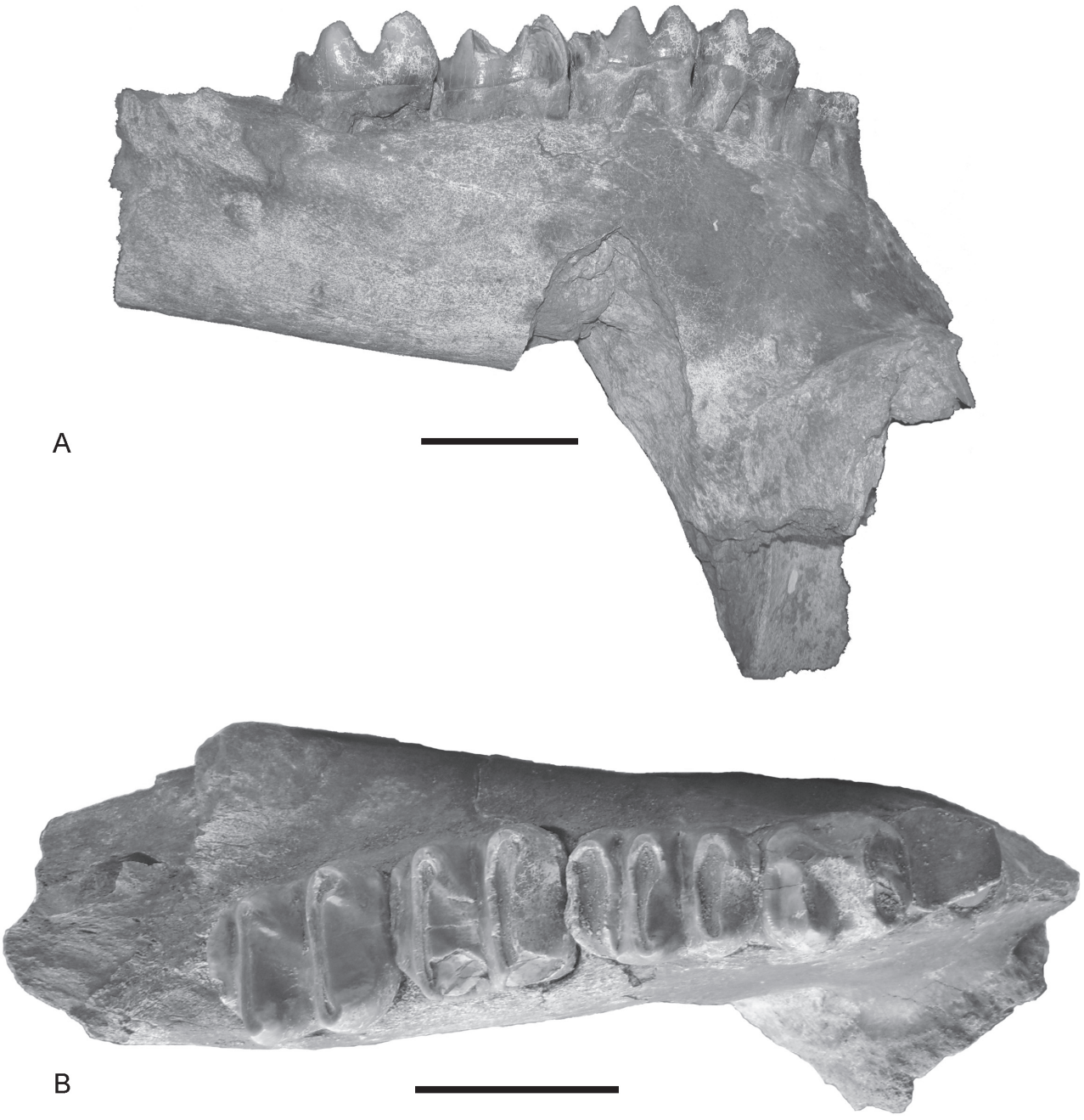

Fig. 2. *Deinotherium giganteum* KAUP, 1829, left hemimandible; VRMH 164; from Aksakovo. – **A**. Lingual view. **B**. Dorsal view. – Scale bars: 10 cm.

no observations on the protolophid morphology. Shape of the symphysis seems to be too prone to individual and/or sexual variation to be of diagnostic value. A morphometric character noted by HUTTUNEN (2004: 348), "depth between caput and the processus coronoideus", apart from its somewhat vague definition, is undermined by the value provided for the Unterzolling mandible *(P. bavaricum)* which falls within the variation for *D. giganteum* (280 vs. 250–330, respectively) provided by that author. Thus, attribution of VRMH 164/166 to *D. giganteum* is mainly based on dental size.

Size of the p3 in the Aksakovo mandible surpasses *P. bavaricum* and falls within the variation range for *D. giganteum* provided by DURANTHON et al. (2007: 408). Its

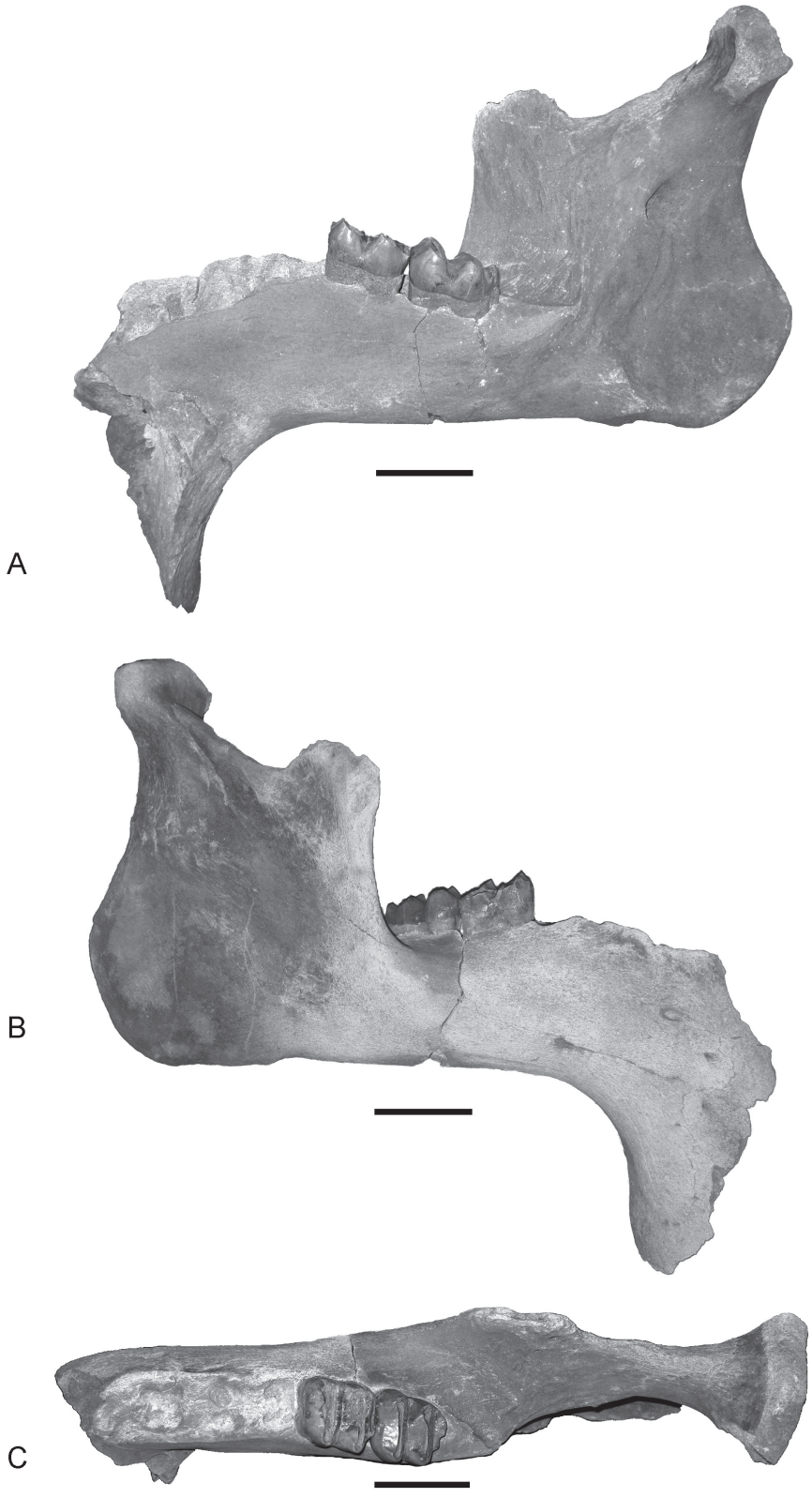

Fig. 3. *Deinotherium giganteum* KAUP, 1829, right hemimandible; VRMH 166; from Aksakovo. Same individual as VRMH 164. – **A**. Lingual view. **B**. Buccal view. **C**. Dorsal view. – Scale bars: 10 cm.

Fig. 4. *Deinotherium giganteum* Kaup, 1829, right hemimandible in situ; VRMH 166; from Aksakovo. Photo: VRMH Archive.

shape, despite the damaged mesial end, is closer to triangular rather than trapezoid. Size of the p4 is far beyond the range for *P. bavaricum* too, and the second lophid is slightly wider than the first (see Duranthon et al. 2007: 408, tab. 2). (Note that the size of the p4 in the holotype of the recently described Chinese species *Prodeinotherium sinense* (61 × 53, according to Qiu et al. 2007) is very close to the *D. giganteum* values provided by Duranthon et al. (2007) and either fills the hiatus between *Prodeinotherium* and *Deinotherium*, or rather belongs to the latter genus). Duranthon et al. (2007) noted a tendency towards widening of the m1 tritolophid in the process of deinothere evolution; unfortunately, it is the third lophid that is damaged in the Aksakovo m1, and its width is estimated, not measured with precision.

Tooth row length in the Aksakovo mandible (370), while below some of the larger *D. giganteum* specimens, clearly surpasses *Prodeinotherium* (see e. g. Huttunen 2004). It is very close to specimens referred to *Deinotherium* aff. *giganteum* by Dehm (1949) and is exactly the same as in NHMW 2007z0069/0001, a mandible from Nikolsburg (now Mikulov in the Czech Republic) labelled *Deinotherium* cf. *giganteum* (GM, pers. observations NHMW 2006). Teeth in the mandible are very close metrically to the Hussiatin deinothere described by Svistun (1974, as *D. levius*). At the same time, the Aksakovo tooth row and teeth are similar in size – and even surpass – some of the smaller specimens from the MN 10 locality Montredon published by Tobien (1988). This is a good illustration that while dental size helps distinguishing between the four deinotheriid species of Europe, it is not too useful in trying to identify earlier or later populations within a species – provided, of course, that the Montredon sample is not heterochronous.

As said, VRMH 164/166 is an accidental and isolated find, and its stratigraphy is not known. The only other find from Aksakovo (not, however, from the same precise location) is a molar published by Bakalov & Nikolov (1962, pl. 43, fig. 3). This specimen, a cast from a lost original, was published as m2 of "*Deinotherium giganteum* race minor" (i. e. *P. bavaricum*) by Bakalov & Nikolov (1962) and identified as M2 by M. Pickford (see Markov 2008a for a discussion of the specimen). Thus, the only taxa known from Aksakovo so far are *P. bavaricum* and *D. giganteum*. Co-occurrence of the two taxa is certainly possible (see e. g. Duranthon et al. 2007) but cannot be proved: exact locality is unknown for the *P. bavaricum* molar, stratigraphical data are missing for both, and the two finds are not associated in any way.

P. bavaricum (s. str., excluding the earlier *P. cuvieri*) is, in our view, a mainly Astaracian species with probable occurrences in MN 5 and MN 9. (The question of the species' FAD in MN 5 or MN 6 is interrelated with the assumed age for localities such as Chios, Psara, Çandır etc., as well as the debates on the definition and boundaries of the MN 5 zone – problems well beyond the scope of this paper. Similarly, supposed LAD of the species in MN 9 is related to the age of the finds from Deinotheriensande, where possi-

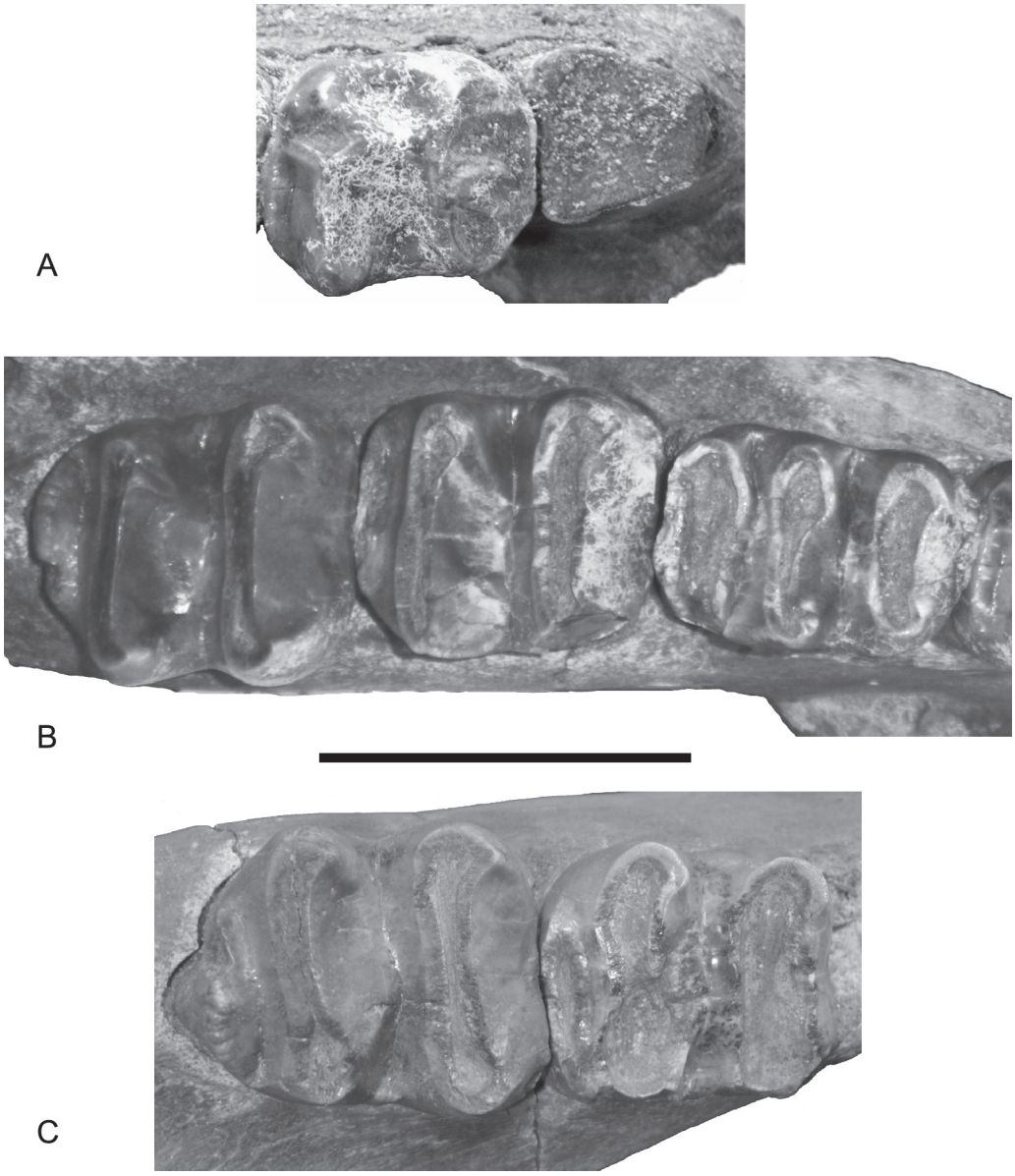

Fig. 5. *Deinotherium giganteum* Kaup, 1829, teeth from the Aksakovo mandible; VRMH 164, 166. – **A**. p3–p4 sin. **B**. m1–m3 sin. **C**. m2–m3 dext. – Scale bar: 10 cm.

ble reworking of fossils cannot be ruled out). *D. giganteum* appeared in MN 6 (Antoine et al. 1997; Duranthon et al. 2007) and disappeared by the end of the Vallesian, replaced in Europe by the Turolian species *D. gigantissimum*.

Emphasizing again that the two deinotheriid finds from Aksakovo are not associated, they certainly indicate a pre-Turolian age for the locality, which is rare for Bulgaria. The mandible described here is only the third find of *D. giganteum* from the country (the other two coming from the neighbouring localities Galata and Yarebichna: see Markov 2008a; most of the Bulgarian material referred to *D. giganteum* by previous authors actually belongs in *D. gigantissimum*: Markov 2004, 2008b). Proboscideans from Aksakovo and other localities in the area around Varna were taken as an indication for middle Miocene outcrops in the area by Markov (2008a), and the deinothere mandible from Aksakovo does not contradict this assumption, although its age cannot be objectively determined.

4. Summary and conclusions

The deinotheriid mandible from Aksakovo is referable to *Deinotherium giganteum* on the base of dental size. This is the first mandible of *Deinotherium giganteum* from Bulgaria, and only the third find from the country attributable to that species. The mandible is an accidental find of unknown stratigraphy, and its age can only be determined in the broadest terms. The only other fossil from Aksakovo is a molar of *P. bavaricum* published in the 1960s. Co-occurrence of the two deinotheriid taxa at Aksakovo, while certainly possible, cannot be proved with the available data. Both *P. bavaricum* and *D. giganteum* are quite rare for Bulgaria, as are pre-Turolian vertebrates in general. Bulgarian pre-Turolian faunas are poorly known, and the mandible from Aksakovo aptly demonstrates the need of further research in the vicinities of Varna.

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