**Mammuthus rumanus (ȘTEFĂNESCU), the earliest mammoth in Europe**

Adrian M. Lister¹ & Hans van Essen²

¹Department of Biology, University College London, London WC1E 6BT, UK, email: a.lister@ucl.ac.uk
²Burg. Bloemersstraat 62, 6952 BB Dieren, The Netherlands

**Abstract**

European elephantid molars in the age range 3.0-2.5 Ma are distinctly more primitive, especially in plate formula, than typical *Mammuthus meridionalis* (Nesti), from the Upper Valdarno, c. 1.8-1.7 Ma. The material comes from Tulucești and Cernăuți, Dacic Basin, Romania; Montopoli, Italy; and the Red Crag Formation, England. The name *rumanus*, originally applied to a molar from Tulucești, is appropriate for this species, which we provisionally refer to the genus *Mammuthus*. The fragmentary nature and apparent loss of the holotype lead us to propose the complete Cernăuți molar as neotype of *M. rumanus*. The species "Mammuthus gromovi" (Alexeeva & Garutt), from Khapry, Russia (c. 2.3 Ma), is both geologically younger and morphologically more advanced than *M. rumanus* and, on dental evidence at least, differs little from typical *M. meridionalis*.

**Keywords**

*Mammuthus rumanus*, Mammoth, Tulucești, Cernăuți, Montopoli, Red Crag Formation

**Introduction**

The species of mammoth recognised throughout the Early Pleistocene in Europe, *Mammuthus meridionalis* (Nesti), has as its type material fossils from the Upper Valdarno area of Tuscany, Italy. The extensive sample of skulls and teeth available from these deposits is now placed largely within the Tasso and Olivola Faunal Units, dated to the basal Pleistocene, c. 1.8 - 1.7 Ma (Sardella et al. 1998).

Various authors have suggested that mammoth populations earlier and more primitive than typical *M. meridionalis* are to be found in the Pliocene of Europe. For example, Depéret and Mayet (1923) and Osborn (1942), believing *Elephas planifrons* Falconer & Cautley to be the direct ancestor of *M. meridionalis*, referred various early European mammothid specimens to that taxon. Maglio (1973) recognised a "Laiatico Stage" of *M. meridionalis* evolution, preceding the typical, "Montevarchi Stage" of the Upper Valdarno. Alexeeva and Garutt (1965) created the species "Archidiskodon" gromovi for early material from southern Russia, and fossils from various other localities in Europe have been referred to this taxon (Azzaroli 1977).

Of particular interest is the Romanian material referred to the species *Mammuthus rumanus* (ȘTEFĂNESCU, 1924), which has been regarded as an early mammoth ancestral to *M. meridionalis* (Radulesco and Samson 1995).

For many of these localities, especially the earlier, Middle Pliocene ones, the elephantid material comprises largely or exclusively molars, and we agree with Markov and Spassov (2003) that in the absence of cranial material, their attribution to *Mammuthus* is provisional, being based on dental characters that are in a cladistic sense "primitive". Nonetheless, in the absence of evidence to the contrary, we provisionally refer them here to *Mammuthus*, in view of their morphological similarity to undoubted *Mammuthus* which immediately succeeds them in the fossil record.

**Mammuthus fossils from the Dacic Basin, Romania**

Primitive mammoths are known from several assemblages in the Dacic Basin, Romania (Feru et al. 1983, Radulesco and Samson 1995, 2001). Principal among these are Tulucești and Cernăuți. The associated mammalian fauna at these localities includes *Mammuthus borsoni* (Hays), *Anancus arvernensis* (Crozet & Jobert), *Stephanorhinus elatus* (Crozet & Jobert) and *S. etruscus* (Falconer), *Cervus pardinensis* (Crozet & Jobert), *C. perrieri* (Crozet & Jobert), *Plesippus* sp. and *Poracamelus* sp. Feru et al. (1983), Radulesco and Samson (1995, 2001) and Spassov (in press) place the Cernăuți and Tulucești faunas in mammalian biozone MN16a (Fejfar et al. 1998), correlated to the Triversa faunal unit of Italy, and cite palaeomagnetic data indicating the middle Gauss subchron, c. 3.5 - 3.0 Ma.
The holotype of *M. rumanus*, from Tulucești, southern Moldavia

The partial molar from Tulucești was first described and figured by Athanasii (1915) (Fig. 1). It is the rear part of a worn lower molar, probably a left M₃, with only four full plates preserved and the rear part of a further plate at the broken front end. The four plates are very widely spaced, occupying 160 mm of preserved tooth length, and Athanasii (1915) estimated that total plate count cannot have been more than 9-11, a reasonable estimate since we reconstruct tooth length at not more than 300 mm - any longer would create an unnatural shape within which probably 9, possibly 10, full plates could have been accommodated. The measured lamellar frequency of the fragment is 3.0 (Athanasiu 1915); given the divergence of plates toward the base and rear of an M₃, we estimate c. 4.0 for the complete tooth.

Athanasiu (1915) identified the Tulucești molar as *Elephas meridionalis*. Ștefănescu (1924), in a brief note, referred the specimen to a very early form of *Elephas antiquus*, and specifically to a "mutation" which he named *E. a. rumanus*. The text suggests that he believed this to be an offshoot of *M. meridionalis*. Osborn (1942) accepted the referral of this specimen to the earliest mammothids in Europe - for him, *Archidiskodon planifrons rumanus*. Maglio (1973) dropped the name *rumanus*, including it within *M. meridionalis*, without specifying one of his three "stages" of that species. Garutt (1986) accepted "Archidiskodon" *rumanus* as the earliest stage of mammoth evolution in Europe, preceding his "Archidiskodon gromovi" (see later). Following the trend for assimilating all early mammoths within the genus *Mammothus* (Maglio 1973, Lister 1996), Radulesco and Samson (1995, 2001) refer to it as *Mammothus rumanus*.

Dr. Rădulescu indicated (personal communication to AML, August 1999) that the type specimen of *Mammothus rumanus*, formerly in the Laboratory of Geology, University of Bucharest, could not now be found.

The proposed neotype of *M. rumanus*, from Cernăuți, western Oltenia

Feru *et al.* (1983) and Radulesco and Samson (1995) refer to *M. rumanus* a right upper third molar from Cernăuți (Fig. 2). The specimen, no. ISER Cr 007-8/1001 is conserved at Speleological Institute "Emil Racoviță". These authors indicated that the tooth is 293 mm in length, has a plate formula of only "1/2-8-x", and an extremely low lamellar frequency of 3.07. Hypsodonty index is reported as 1.18, enamel thickness 4.25 mm. In 1999 Dr. Rădulescu kindly provided us with more information about this specimen, [as well as with photographs, for which see the caption of Fig. 2]. The identity of the tooth as an M³ is indicated by the reduction in both height and width of the plates towards the back of the tooth, and as an upper by the oblique angle of wear relative to the tooth's long axis. Most importantly, the molar is complete and relatively little-worn, so that its dimensions, plate count and crown height can be reliably measured. The early wear stage of the piece, the retention of several centimetres of crown height at the anterior end, and the apparent integrity of the anterior roots, all indicate that the first preserved element is the true front element of the tooth. This element has lost most of its anterior enamel band by pressure from the preceding tooth. Although it is almost as wide as the plate behind, several features suggest it is the anterior talon. It is much thinner (in an antero-posterior sense) than the other plates, in lateral view it is angled away from the succeeding plate, and its base is somewhat elevated above the cingulum. At the opposite end of the tooth, a small element marks the true posterior. In between are eight complete plates. We therefore count the plate formula as x9 or x8p, where p is a "platelet", a small plate extending to the crown base. This differs from Radulesco and Samson's estimation only in that we regard the last element as a platelet rather than a talon, since in sits on the crown base, albeit it appears considerably smaller than the plate in front. The wear figure of plate 1 shows the tripartite structure of lateral lamellar and central annular structures characteristic of the mammoth lineage, with subequal annuli in the more posterior (less worn) plates. The talon and plate 2 show a strong posterior extension (the posterior pretrite central column of Tassy (1996)). Although among elephants this structure is thought to be particularly prevalent in *Elephas planifrons* (Maglio 1973), it also occurs in *Mammothus meridionalis*, and its presence on the talon is not unusual, occurring also on specimens of *M. meridionalis* from the Upper Valdarno and North Sea (HvE, unpublished observations).

Other material referable to *M. rumanus*

European mammoth material, regarded at various times as more primitive than typical *Mammothus meridionalis*, is fully reviewed by Lister and Van Essen (in prep.). Some of this material barely differs from typical *M. meridionalis*, other specimens are too incomplete for determination, but there is a residue of material similar to *M. rumanus* from the Dacic Basin, both in its primitive morphology and in its early geological age. In particular, specimens from the Red Crag, England, and Montopoli, Italy, can be referred to this species.

The Red Crag Formation, England

The Red Crag Formation of eastern England comprises marine shelly sands of Pliocene age. The
majority of surface exposures are of Pre-Ludhamian age, so it is likely that the bulk of the collected mammalian fauna is of this age. Head (1998a, b) and Farquhar (1998), on the basis of dinoflagellates and foraminifera, respectively, concur in placing this part of the Red Crag in the interval 2.6–2.5 Ma. Our re-

study of the Red Crag elephantid material has revealed measurable M3s from three individuals, each interpreted to have 10 plates excluding platelets and talons (Lister and Van Essen, in prep.).

Montopoli, Central Italy

In the Italian sequence, the earliest occurrence of elephantid fossils is in the Montopoli Faunal Unit. The Montopoli deposits are littoral sands immediately above a palaeomagnetic reversal regarded as the Gauss/Matuyama, and are therefore dated to c. 2.6-2.5 Ma (Lindsay et al. 1980, Sardella et al. 1998). A palate on display at the University of Florence has been described by many authors (Weithofer 1890, Azzaroli 1977). Lister and Van Essen (in prep.) show that the molars are complete M3s, with x 9 p plates on one side, x 9 1/2 p on the other.

Further material tentatively referred to M. rumanus

Two further specimens are quite likely to be referable to M. rumanus, although their stratigraphic position, and in the case of Laiatico, its morphology, are not quite certain.

Laiatico, Italy

The partial elephant skeleton found near Laiatico in the Lower Valdarno (Ramacchioni 1936) is of uncertain age, but is considered to belong to the later part of the early Villafranchian (Azzaroli 1977). Ramacchioni (1936) and Azzaroli (1977) indicate that the upper and lower M3s have 8 x and 9 x plates, respectively. Ramacchioni's photographs, however, suggest that the teeth may not be complete, since they are worn down to a dentine platform at the front. From the preserved length/width proportions of the lower molar, it seems unlikely that more than two plates have been lost, so that the original plate number was either 10 or 11, but the precise value remains uncertain. Maglio (1973) used this specimen as the basis for his early, "Laiatico Stage" of M. meridionalis evolution.

Bossilkovtsi, Bulgaria

Markov and Spassov (2003) describe a mandible with both M3s from the "Chantaluka" sand quarry at Bossilkovtsi, Bulgaria. The specimen was found immediately above remains of Mammut borsoni and Anancus arvernensis. Contemporaneity with these species is not certain, but if valid, their co-occurrence recalls the Romanian sites of Cerneaşti and Tuluceşti (see above) and suggests MN16a, c. 3.5-3.0 Ma. The molars have 10 full plates (Markov and Spassov 2003).

Comparison with other taxa

Mammuthus meridionalis

The holotype M3 of M. rumanus from Tuluceşti (Fig. 1) has a remarkably low lamellae frequency of 3.0, even allowing for the fact that the measurement was taken close to the crown base where lamellar spacing is greatest. This is well below the range of a sample of 25 M3s we have measured from the type area of M. meridionalis in the Upper Valdarno (Table 1). Although the tooth is not preserved complete, its extremely low lamellar frequency makes a plate count higher than 10 very unlikely (see above). The Cerneaşti M1, complete, shows 8 or 9 full plates and a lamellar frequency of 3.09, similar to that of Tuluceşti, both values clearly below the range of the large Upper Valdarno sample (Table 1).

Taking together the five individuals represented by complete M3s from Cerneaşti, the Red Crag and Montopoli, all have plate formulae of 9-10, possibly 8, excluding talons and platelets (Table 1). Although this sample is not large, it represents a highly significant statistical difference from typical Mammuthus meridionalis (Lister and Sher 2001). In the Upper Valdarno sample (Table 1), 33 of 34 M3s, upper and lower combined, have plate formulae (excluding talons) in the range 12 - 15. One M1 has 11 x full plates. The mean (n=36) is 12.9 full plates. There has clearly been an increase in mean plate number of around three plates between c. 2.6-2.5 Ma and 1.8-1.7 Ma.

In lamellar frequency and enamel thickness, the range of the combined Dacie/Montopoli/Red Crag sample overlaps with that of the U. Valdarno, but includes individuals close to or beyond the U. Valdarno range, strongly suggesting that if larger samples were available these features would very likely show differences in mean from typical M. meridionalis. Hypsodonty Index (HI) is measurable only on one Montopoli M3 and one Red Crag M1, and in this very small sample does not indicate any significant difference from the U. Valdarno sample.

Maglio (1973) included the remains from Montopoli in his "Laiatico Stage" of M. meridionalis, the earliest of three stages into which he informally subdivided that species. He also included the Laiaiko skeleton and remains from some other localities, some of which we believe to be of uncertain morphology and/or age (Lister and Van Essen, in prep.), but excluded the Tuluceşti type of M. rumanus, although he referred it to M. meridionalis in general.
Fig. 1. Left M\textsubscript{3} from Tulucești, the holotype of *Elephas antiquus rumanus*, first published by Athanasiu (1915).

Fig. 2. Right M\textsuperscript{3} from Cernățeni, the proposed neotype of *Mammuthus rumanus*. [Annotated photographs were provided by Dr. C. Rădulescu, but were replaced here by later versions]. A: labial view, B: lingual view (note accessory conules on cingulum), C: occlusal view. Specimen no. Cr 007-8/1001 conserved at ISER.
<table>
<thead>
<tr>
<th>Plate no. Lamellar Enamel Hypsodonty</th>
<th>(excl. platelets &amp; talons)</th>
<th>Frequency</th>
<th>Thickness</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upper M3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><em>M. rumanus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cernătești¹</td>
<td>8 or 9</td>
<td>3.07</td>
<td>4.25</td>
<td>1.18</td>
</tr>
<tr>
<td>Red Crag, Rendlesham</td>
<td>10⁵</td>
<td>4.72²</td>
<td>3.0</td>
<td>—</td>
</tr>
<tr>
<td>Montopoli 1077</td>
<td>9 (right)</td>
<td>3.56</td>
<td>4.0</td>
<td>1.35</td>
</tr>
<tr>
<td>Montopoli 1932V</td>
<td>—</td>
<td>4.94</td>
<td>3.2</td>
<td>—</td>
</tr>
<tr>
<td>'M. gromovi'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khapry/Liventsovka</td>
<td>12-12.8-14</td>
<td>3.9-4.58-5.9</td>
<td>2.9-3.5-4.1</td>
<td>1.01-1.23-1.49</td>
</tr>
<tr>
<td></td>
<td>(n=6)</td>
<td>(n=8)</td>
<td>(n=8)</td>
<td>(n=5)</td>
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<tr>
<td><em>M. meridionalis</em></td>
<td></td>
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<tr>
<td>Valdarno</td>
<td>12-13.0-15</td>
<td>4.45-5.33-6.41</td>
<td>1.7-3.11-3.7</td>
<td>0.99-1.25-1.46</td>
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<tr>
<td></td>
<td>(n=22)</td>
<td>(n=33)</td>
<td>(n=28)</td>
<td>(n=15)</td>
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<tr>
<td><strong>Lower M3</strong></td>
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<tr>
<td><em>M. rumanus</em></td>
<td></td>
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<tr>
<td>Tulucești²</td>
<td>—</td>
<td>3.0⁵ (crown base)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Red Crag, Rendlesham</td>
<td>10</td>
<td>4.93²</td>
<td>3.0</td>
<td>1.2⁶</td>
</tr>
<tr>
<td>Red Crag, Pontier³</td>
<td>10</td>
<td>4.0</td>
<td>4.0-5.0</td>
<td>—</td>
</tr>
<tr>
<td>'M. gromovi'</td>
<td></td>
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</tr>
<tr>
<td>Khapry/Liventsovka</td>
<td>14</td>
<td>4.09-4.15-4.25</td>
<td>3.0-3.5-4.1</td>
<td>1.17</td>
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<tr>
<td></td>
<td>(n=1)</td>
<td>(n=3)</td>
<td>(n=3)</td>
<td>(n=1)</td>
</tr>
<tr>
<td><em>M. meridionalis</em></td>
<td></td>
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</tr>
<tr>
<td>Valdarno</td>
<td>11-12.7-14</td>
<td>3.88-5.10-6.95</td>
<td>2.2-3.09-4.3</td>
<td>1.10-1.27-1.42</td>
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<tr>
<td></td>
<td>(n=12)</td>
<td>(mid-crown, n=21)</td>
<td>(n=25)</td>
<td>(n=5)</td>
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<tr>
<td></td>
<td></td>
<td>3.65-4.79-6.11</td>
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<tr>
<td></td>
<td></td>
<td>(crown base, n=25)</td>
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</table>

Table 1 - M3 measurements of mammoths here referred to *Mammuthus rumanus*, in comparison with the type samples of *M. meridionalis* from Valdarno and "M. gromovi" from Khapry/Liventsovka. All data original except: ¹ - from Radulesco and Samson (1995); ² - from Athanasiu (1915); ³ - from Depéret & Mayet (1923) and Pontier (1924). Other notes: ⁴ - the Red Crag lamellar frequencies are increased by the small size of the teeth (Lister & Joysey 1992) (noting superscript ⁵); ⁵ - lamellar frequency of complete Tulucești tooth was probably closer to 4.0; e - estimated. Methods follow Maglio (1973). Lamellar frequency is measured mid-crown except where indicated. For Khapry and Valdarno samples, the three figures give the range and mean. Enamel thickness is the modal value over the occlusal surface. For further details, see Lister and Van Essen, in prep.
The "Laiatico Stage" therefore corresponds only in part to our concept of *M. rumanus*, which we believe to be more coherent, both in age and morphology, and sufficiently distinct from later material to justify specific status.

"M. gromovi"

Mammoth remains from the Khapry faunal complex, especially the Liventsovka quarry, SW Russia, were described by Alexeeva and Garutti (1965) as *Archidiskodon gromovi*. The most recent revision of the Khapry Complex and its stratigraphic position confirms that this fauna presents a single chronological unit and places it in the early part of MN 17, c. 2.3 Ma (Titov 1999). These remains are therefore intermediate in age between those here referred to *M. rumanus* and typical *M. meridionalis*. The mammoths were regarded as more primitive than typical *M. meridionalis* on the basis both of molar morphology and cranial proportions, as well as the presence of a supposed atavistic fourth true premolar in one skull (Alexeeva and Garutti 1965).

In agreement with Dubrovo (1989), our own observations on the type sample of "*A. gromovi*" (Geological Institute, Moscow) indicate that in the key feature of plate formula, it does not differ from typical *M. meridionalis*. Seven sufficiently preserved molars have between 12 and 14 full plates (Table 1).

In lamellar frequency and enamel thickness, the Khapry teeth do seem slightly more primitive on average than *M. meridionalis* from the Upper Valdarno (Table 1) (Lister 1996), but these features alone are insufficient for taxonomic separation, and recent research has also discounted the supposedly distinctive features of dental replacement in "*M. gromovi*" (Maschchenko 2002). Although more work is needed on cranial morphology, on its defining dental features *M. gromovi* appears synonymous with *M. meridionalis*. By the same token, we discount the extension of the name "*M. gromovi*" to specimens such as those from Montopoli and Laiatico (Azzaroli 1977), since the latter material, here referred to *M. rumanus*, is both older and more primitive than the type sample of "*M. gromovi*" from Khapry.

Discussion and Conclusions

We believe that the elephantid remains from the Dacic Basin, Montopoli and the Red Crag, all in the age range 3.0 - 2.5 Ma, form a coherent grouping as far as limited present samples allow. The specimens from Laiatico and Bossilkovitsi, very likely also belong here. This grouping is both distinctly older, and of more primitive morphology, than both "*Archidiskodon gromovi*" (c. 2.4 - 1.8 Ma) and typical *Mammuthus meridionalis* (c. 1.8 - 1.7 Ma).

One of the specimens, the molar from Tulucești, formed the type specimen of *rumanus* ŞTEFĂNESCU, 1924. Although the specimen is incomplete, its Early Villafranchian age and its lamellar frequency link it to the Cernătești molar and to the Montopoli and Red Crag material. We therefore suggest that the name *rumanus* is valid for this grouping. Moreover, in view both of the incompleteness and apparent loss of the Tulucești holotype, we propose the Cernătești molar, from the same geological unit, as its neotype. Pending the discovery of cranial material, we provisionally refer *rumanus* to the genus *Mammuthus*. Much more remains to be learnt about the elephantids of this period: see Markov and Spassov (2003) for a discussion of the uncertain taxonomic relations among the taxa *rumanus*, the Asian *planifrons* and African *subplanifrons* and *africanavus*. We note in particular that dental morphology of *M. rumanus* overlaps that of N. African *M. africanavus* in some respects (Arambourg 1970, Maglio 1973), but believe that future study is best served by retaining their separateness pending further material and research.

Acknowledgements

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References


