

THE TARSALS OF MAMMUTHUS MERIDIONALIS (NESTI, 1825) FROM LEU (DOLJ COUNTY, ROMANIA)

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Abstract. Results of detailed descriptions and measurements of nine bones from the postcranial skeleton of proboscideans collected from the Leu palaeontological deposit in Romania are presented. Where possible, comparison with similar samples described in other fossil sites was done. It could be ascertained that between the tarsals of *Mammuthus meridionalis* from Leu and those of *M. m.* from Nogaisk differences concern both the dimensions (in favour of the Nogaisk fossils) and bones morphology. This work represents a contribution to the study of the postcranial skeleton of proboscideans on the Romanian territory, which shows a deficit at the present moment.

Key words: proboscideans, postcranial skeleton, calcaneous, astragal, cuboid, navicular, right lateral cuneiform

1. INTRODUCTION

The palaeontological deposit from Leu (Mammalia, Pleistocene) was discovered on the right side of the Frasin Valley, 4 km south of Leu, 25 km south-east of Craiova, in the ballast pit of the locality.

The fossils belong to the following groups: **Proboscideans:** *Mammuthus (Archidiskodon) meridionalis* (NESTI, 1825); **Artiodactylas:** *Plesippus athanasiui* SAMSON, 1975; *Stephanorhinus gr. etruscus/hundsheimensis*; **Perissodactylas:** *Eucladoceros cf. dicranios*, *Alces gallicus* AZZAROLLI, 1952, *Leptobocus cf. furtivus*, *Pliotragus ardeus* (DÉPÉRET, 1884), Bovid indet. 1, Bovid indet. 2; **Rodents:** *Castor plicidens* FORSYTH MAJOR, 1875; **Carnivores:** *Ursus etruscus* (CUVIER, 1823) (POPESCU, 2004).

2. HISTORY OF THE RESEARCHES

Even though the discoveries of fossil proboscideans are relatively abundant in Romania, the descriptions and measurements of the postcranial skeleton are rare and, most of the time, they are concise, the authors concentrating on studies of the molars; this was possible because, on one hand, the strong enamel layer preserves the molars better than the other components of the skeleton and, on the other hand, because the determination of the proboscidean species is made taking into account the dental features.

Among the authors who studied the pieces of the postcranial skeleton in the proboscideans, the following should be mentioned: Demetrescu and Nicolaescu Ploșor (1929), who in their work regarding the mastodont (*Anancus arvernensis* Croizet and Jobert, 1828) discovered at Stoina, published the dimensions of a femur and of a tibia; Apostol, alone (1971, 1972, 1974, 1976) or in collaboration (Apostol and Popescu, 1963; Apostol and Vicoveanu, 1970; Bandrabur and Apostol, 1976; Apostol and Cacoveanu, 1980; Apostol and Costachescu, 1981) who published concise presentations, as well as dimensions of several bones which belonged to many proboscidean species; in the work about Villafranchian in the middle basin of the Jiu River, Schovert *et al.* (1963) mentioned the presence of some proboscidean bones in the research area, but without giving any description or dimensions; in the valuable work of Jurcsak and Popa (1976), 65 pieces from the skeleton of *Anancus arvernensis* (discovered in Huta, 1974) were measured and described; in their work about Plio-Pleistocene mammals in Husnicioara, Codrea and Diaconu (2003) mentioned a fragment of a calcaneous which was thought to belong to *Mammuthus primigenius* (BLUMENBACH, 1799).

3. MATERIAL AND METHOD

The material which was at our disposal is represented by nine bones (three calcaneouses, two astragals, two naviculars, a cuboid and a cuneiform); this material is in the patrimony of the Museum of Oltenia, Craiova. After the material

was collected from the field, it was cleaned and impregnated with a glue-type adhesive and stored in proper conditions; its dimensions were compared according to the literature (Garutt, 1954; Dubrovo, 1982).

4. RESULTS AND DISCUSSIONS

Calcaneous dex, inv. no. 42535, plate I, photo 1. Whole bone, well preserved, except for a small fragment which was missing from the distal side of the sustentaculum tali and some other slight deteriorations of the coracoid process.

At the dorsal side of the facet of the cuboid, a few well opened big foramina appear.

Facies articularis coracoideum is delimited by a semi-circular exterior, the two extremities of the semicircle being united by a very large sinusoid, which also makes the wall from the lateral side of the calcaneous ditch.

Facies articularis sustentaculus has the exterior outline like a triangle, with rounded vertexes, except for the one from the distal side of the calcaneous, which is missing. At the plantar limit of the cuboid surface, a few foramina appear, well opened and big-sized, in contrast with the other calcaneoses described in this work, where these details cannot be observed.

The dorsal limit of the cuboid surface, at the intersection with the calcanean ditch, has a large groove. The calcanean ditch is barely visible at the proximal side, deepening and enlarging a lot on the distal side. The foramina, together with the ligament insertions from the calcaneous ditch, as well as from the surface of the whole bone, are very well opened and visible. On the distal side of sustentaculum tali, there is a small semilunar facet meant for the articulation with the navicular. The distal extremity of this facet is clearly delimited by a ditch with a rugged surface, where there are various ligament insertions and foramina.

The facet for the articulation with fibula is narrow, with an almost oval shape.

Calcaneous sin, inv. no. 42536, plate I, photo 2. The bone is intact, well preserved, except for some slight deteriorations at the contact between sustentaculum tali and the cuboid facet, as well as on the plantar outline, where some fissures appear.

The dorsal side is gray-blackish, the plantar side being whitish with reddish and blackish stains in the places where deteriorations appear.

Facies articularis coracoideum and facies articularis sustentaculus have the contour lines and the surfaces in a perfect condition. The configuration of facies articularis sustentaculus distal side is a little bit different; the lightly rounded vertex is being replaced by a new side with a reduced length. The articulation facet with the navicular has a less evident contour, like a triangle with the acute vertex to the medial extremity. The cuboid surface has side foramina and insertions to the plantar side; in part, they are plugged by the sedimentary material. The articulation part with the fibula is more difficult to be delimited, having a semilunar shape.

Calcaneous sin, inv. no. 42537, plate I, photo 3. The bone is intact and well preserved, except for a fragment from the plantar side which also contains the culis. It is gray with rare brown stains on a small surface. All the facets from the articulars are well defined, with clear outlines. Facies articularis coracoideum has the limit from the calcaneous ditch almost straight and the surface can be inscribed in an isosceles trapezium. The surface of facies articularis sustentaculus can be inscribed in an isosceles triangle. The calcanean ditch is larger and deeper to the proximal side than at the previous pieces.

Between the distal outline of the articular facet with fibula and the distal outline of the lateral surface, one more culis appears. The cuboid surface has an oval shape and the articular facet with the navicular, with indistinct outlines; it is semilunar, the plantar outline of this surface is rugged, due to the various foramina and muscle insertions. The articular facet with the fibula has parallel proximo-distal sides.

The dimensions of the *Mammuthus meridionalis* calcaneous from Leu are represented in Table 1.

Astragal dex, inv. no. 42549, plate II, photo 1. The piece is intact, perfectly preserved, without any deterioration. At the proximal side one can notice the smooth surface of the articular trochlea with tibia and the medial process with numerous and large nutrition foramina and ligament insertions. Facies articularis coracoideum does not represent the mirror-image of the similar articular facet from the calcaneous, being larger to the proximal side and narrower to the distal side.

The common outline from the astragal ditch and facies articularis sustentaculus has undulations. The astragal ditch is larger on the distal side and has a rugged surface, due to the presence of numerous nutrition foramina and of the insertion ligaments. On the lateral side, one can observe a small triangular facet (arc of a circle) which articulates with the fibula. The distal side which articulates with the navicular is smooth,

Table 1. The measurements of the *Mammuthus meridionalis* calcaneous from Leu

Measurements (cm)	<i>M. meridionalis</i> inv. no. 42535	<i>M. meridionalis</i> inv. no. 42536	<i>M. meridionalis</i> inv. no. 42537
Antero-posterior diameter	24.8	25	24.9
Transversal diameter	17.3	17.7	18.4
Maximum height	19.1	20.4	-

except for the lateral and distal outlines, where it is rugged, due to some ligamentary insertions and nutrition foramina.

Astragal sin, inv. no. 42551, plate II, photo 2. At the proximal side, the trochlelea has superficial fissures, and the medial process misses a fragment. The lateral side of the proximal side is a little bit deteriorated. Facies articularis coracoideum

has fissures on the lateral outline, and the astragalian ditch has superficial deteriorations to the distal side.

The small articulation surface with the fibula has deteriorations. The articulation facet with the navicular has a few fissures on the lateral side. The measurements are represented in Table 2.

Table 2. The measurements of the *Mammuthus meridionalis* astragal from Leu and Nogaisk

Measurements (cm)	<i>M. meridionalis</i> , Nogaisk	<i>M. meridionalis</i> Leu, inv. no. 42549	<i>M. meridionalis</i> Leu, inv. no. 42551
Antero-posterior diameter	18.1	17.2	17.4
Transversal diameter	19.5	16.2	16.4
Maximum height	10.3	10.1	10.1

Comparing the measurements of the the *Mammuthus meridionalis* astragal from Leu and Nogaisk we notice that the differences in size are not significant, but the Nogaisk specimen compared to the Leu specimen, has the antero-posterior diameter bigger than the transversal diameter, a fact that involves a different morphology of the bone.

Navicular sin, inv. no. 42556, plate II, photo 4. This is a perfectly preserved bone. The articulation facet with the astragal from the proximal side has a less undulated oval outline than the one from the distal part, which articulates four bones. The delimitation of the articular facets with the cuboid and cuneiform bones from the distal surface is visible; the small articulation facet with the calcaneous from the plantar limit has an almost trapezoidal shape. On the dorsal and plantar sides, there are nutrition foramina and ligament insertions marks. On the dorsal limit, in some places, the bone is gray with blackish and reddish stains.

Navicular dex, inv. no. 44745, plate II, photo 3. It is a perfectly preserved bone. There are small differences compared to navicular dex: the articulation surface with the calcaneous from the palmar limit has a semicircle contour, and the foramina are less numerous and more silted. Here and there, the colour is brownish-gray with blackish stains. At the meridional elephant from Nogaisk, this bone is large, massive, with a visible narrowing in the middle part of the diaphysis. At Indian and African elephants, the bones of the metatarsis can be characterized by a thinner shape, showing almost the same diaphysis thickness on their entire surface.

The front-back diameter and, especially, the transversal diameter are smaller at the *Mammuthus meridionalis* from Leu compared to the one from Nogaisk, but the height of the dorsal side is bigger at the *Mammuthus meridionalis* specimen from Leu. The measurements are represented in Table 3.

Table 3. The measurements of *Mammuthus meridionalis* navicular from Leu and Nogaisk

Measurements (cm)	<i>M. meridionalis</i> Nogaisk	<i>M. meridionalis</i> Leu, inv. no. 42556	<i>M. meridionalis</i> Leu, inv. no. 44745
Antero-posterior diameter	12.7	11.7	11.2
Transversal diameter	18.1	15.8	15.2
The height of the dorsal side	5.1	5.9	5.9

Cuboid sin, inv. no. 42553, plate II, photo 5. The bone is intact and perfectly preserved. On the proximal side, there is the articulation facet with the navicular, as an arc of a circle and the articulation facet with the calcaneous in an oval shape. The two facets are separated by a comb, which is prominent towards the dorsal edge and vanishes in a foramen towards the palmar side. On the distal side there are the articulation facets with the IV metacarpians - which is more elongated and narrower - and the V is shorter and larger, separated by a barely visible valley.

The medial edge has two articulation facets with the medial cuneiform: one towards the distal side, as a circle sector, and the other which is much longer, the proximal side, which are separated by a horizontal S shaped ditch, large and with a

rugged surface due to the numerous nutrition foramina and ligament insertions. The dorsal edge is rugged and the lateral one is narrow with a strong nutrition foramen. The tuberosity of the cuboid is visible at the palmar edge. The dimensions of the cuboid are represented in Table 4.

Table 4. The measurements of the *Mammuthus meridionalis* cuboid from Leu

Measurements (cm)	<i>M. meridionalis</i> Leu, inv. no. 48553
Antero-posterior diameter	11.7
Transversal diameter	12.6
The height of the dorsal side	5.7

Right lateral cuneiform, inv. no. 45734, plate II, photo 6. The bone is perfectly preserved. It is like a triangular prism, slightly thinning in the middle part. The facet from the proximal side for the articulation with the navicular has a mild concave surface in a dorso-plantar direction. A mild concavity is also shown by the articulation facet with the III metatarsian from the distal surface.

The medial edge has two small half-moon facets for the articulation with the intermediary cuneiform, which are separated by a large ditch showing a rugged surface; the lateral side has also two articulation facets with the cuboid, one of them being on almost all the entire proximal half, while the other is placed in a distal manner towards the dorsal edge, being separated by a ditch like a horizontal S, with a rugged surface. The dorsal edge is rugged. On the plantar edge it feels the direction of a tendinous culis. The dimensions of the cuneiform are represented in Table 5.

Table 5. The measurements of the A.m. (Leu) lateral cuneiform

Measurements (cm)	<i>M. meridionalis</i> Leu, inv. no. 45734
Antero-posterior diameter	11.4
Transversal diameter	6.5
The height of the dorsal side	4.9

5. CONCLUSIONS

Although fossil proboscideans are relatively abundant in Romania, most authors describing them largely focus on studies of the molars, while descriptions and measurements of the postcranial skeleton are rare and concise. Detailed descriptions and measurements of nine bones from the postcranial skeleton of proboscideans collected from the Leu paleontological deposit are presented: two calcaneouses sin, calcaneous dex, astragal dex, astragal sin, navicular sin, navicular dex, cuboid sin, right lateral cuneiform.

Where it was possible, the specimens from Romania have been compared to similar samples from literature. This way, it was possible to ascertain that, between the tarsals of *M.m.* from Leu and those of *M.m.* from Nogaisk, there are differences regarding both the dimensions (in favour of the Nogaisk fossils) and the bones morphology.

The present work represents a contribution to the study of the postcranial skeleton of proboscideans on the Romanian territory, an issue with deficits at present.

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PLATE I



Photo 1. Calcaneous dex, inv. no. 42535, dorsal



Photo 2. Calcaneous sin, inv. no. 42536, dorsal



Photo 3. Calcaneous sin, inv. no. 42537, dorsal

PLATE II



Photo 1. Astragal dex, inv. no. 42549, proximal



Photo 2. Astragal sin, inv. no. 42551, proximal



Photo 3. Navicular dex, inv. no. 44745, distal



Photo 4. Navicular sin, inv. no. 42556, distal



Photo 5. Cuboid sin, inv. no. 42553, proximal



Photo 6. Lateral cuneiform dex, inv. no. 45394, proximal

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