

CARPAL BONES OF *Mammuthus meridionalis* (NESTI, 1825) IN LEU (DOLJ DISTRICT)

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Abstract. This paper concerns the carpal bones of *Mammuthus meridionalis* (NESTI, 1825) discovered in Leu (Dolj district) unearthed by the author between 1998-2001. The bones belong now in the patrimony of the Museum of Oltenia, in Craiova. Descriptions and measurements, as well as comparisons with other similar discoveries are given.

Keywords: *Mammuthus meridionalis*, carpal bones, Leu, Early Pleistocene.

Rezumat. Carpenele de *Mammuthus meridionalis* (NESTI, 1825) de la Leu, jud. Dolj. În cuprinsul lucrării sunt studiate carpenele de *Mammuthus meridionalis* (NESTI, 1825), descoperite la Leu (jud. Dolj), în cursul săpăturilor efectuate de autor între anii 1998-2001 și aflate în patrimoniul Muzeului Olteniei din Craiova. Piesele au fost descrise și măsurate, fiind apoi comparate cu altele similare semnalate în referințele bibliografice.

Cuvinte cheie: *Mammuthus meridionalis*, carpiene, Leu, Pleistocen inferior.

INTRODUCTION

Bones that make up the post-cranial skeleton in proboscideans are extremely varied, both in morphology and size. Quite often, they are as different from individual to individual as they are from species to species (PIVETEAU, 1958).

Although discoveries of fossil proboscideans in Rumania are relatively frequent, there are only few and rather brief descriptions and measurements of the post-cranial skeleton bones. Authors generally focus on studying teeth. This happens because firstly, the tough enamel cover makes that the teeth preserve much better than bones, then because the accurate systematic assignation of the proboscidean species is based on dental features.

Among the authors who have reported in their papers post-cranial bones of proboscideans there are: DEMETRESCU & NICOLAESCU-PLOPSOR (1929) who in their paper regarding the mastodon (*Anancus arvernensis* CROIZET & JOBERT, 1828) discovered at Stoina gave the measurements of femur and tibia; in several contributions APOSTOL (APOSTOL & POPESCU, 1963; APOSTOL & VICOVEANU, 1970; APOSTOL, 1971; APOSTOL, 1972; APOSTOL, 1974; APOSTOL, 1976; BANDRABUR & APOSTOL, 1976; APOSTOL & IOANA CACOVEANU, 1980; APOSTOL & COSTACHESCU, 1981) gave brief descriptions and measurements of some bones belonging to several proboscidean species; in their paper about the Villafranchian in the middle basin of the river Jiu, SCHOVERT et al. (1963) mentioned the presence of some proboscidean bones in the area, without a description or any data about sizes; a valuable work is the one belonging to JURCSÁK & POPA (1976), where 65 teeth and bones originating from the skeleton of *Anancus arvernensis* discovered at Huta in 1974 are described and measured; CODREA & DIACONU (2003) mentioned, in their paper about the Plio-Pleistocene mammals at Husnicioara, a calcaneus related to *Mammuthus primigenius* (BLUMENBACH, 1799). In this paper, I give a description (including the measurements) of the carpal bones of *Mammuthus meridionalis* discovered in Leu, Dolj district.

MATERIAL AND METHOD

The material concerns eight carpal bones of *Mammuthus meridionalis*, which are part of the patrimony of the Museum of Oltenia (abbreviated NSMO). The bones were discovered in Leu, Dolj district (fig.1) through diggings undertaken by the author between 1998 and 2001. The age of the mammal assemblage is Early Pleistocene (POPESCU, 2004).

In order to assign the bones to the species, I compared them to similar ones exposed in the National Museum of Natural History "Grigore Antipa" in Bucharest.

The carpal bones have been described from anatomical point of view and have been measured. The measurements are made according to those mentioned by GARUTT (1954). For the anatomical description and comparison of the material I used data from: GARUTT, 1954 and DUBROVO, 1982.

RESULTS AND DISCUSSIONS

Scaphoid sin. (NSMO 45398) (*naviculare s. scaphoidem carpi. s. radiale*). A whole, well-preserved bone slightly damaged on its distal articular surfaces. The bone is latero-medially flattened. Its outline is similar to an irregular pentagon. It has two faces, two extremities and two margins. The medial face (Pl. I, 1a), rugged, with many foramens and ligament insertions, is traversed, on the dorsal-palmar face, by a large but not very deep groove. The

lateral face is smaller; it has a less rugged surface and a proximal-distally thickening (Pl. I, 1b). Towards the palmar edge one can notice the line of three tendinous groove and of their ligament insertions. The proximal extremity bears two sides set in angle: the upper one, larger and semicircular, for the articulation with the radius, and the smaller one, shaped as the segment of a circle, for the articulation with the semilunar. The distal extremity, much more elongated, presents on the medial side a facet in the shape of a segment of a circle for the articulation with the semilunar, and a large facet, convex latero-medially, for the articulation with the carpal bones from the distal row. The two margins are linking the extremities, the dorsal margin being shorter than the palmar one.

Scaphoid sin. (NSMO 43481). A bone which is missing a large fragment from the palmar margin and from the distal extremity; there are also some damages of the proximal extremity. Compared to the sample described above, the features of the two sides are rather effaced; the ruggedness and the transversal valley of the lateral face are no longer visible (Pl. I, 2b), and the relief of the medial face, together with the foramens and the ligament insertions are much attenuated (Pl. I, 2a). The facet of articulation with the radius of the proximal extremity is shaped as an ellipsis: a little more elongated and more convex dorso-palmary; the facet of articulation with the semilunar is smaller; the facets of articulation from the distal extremity are also smaller, and the palmar and dorsal margins are thinner.

Compared to the scaphoid of *M. meridionalis* from Nogaïsk (GARUTT, 1954), the scaphoids in Leu exposes some differences:

- the bones in Leu are more elongated than the one from Nogaïsk, the ratio of the maximum width of this bone compared to its height being 94% at the individual from Nogaïsk, while in Leu it is 83-86%, i.e. closer to *Mammuthus primigenius* (83,9-90,1) or to the actual *Elephas indicus* (81,5-83%);
- while in the scaphoids in Leu the shape of the articular surfaces with the semilunar is that of a segment of a circle, closer to that of *Elephas indicus*, in the specimen from Nogaïsk it is circular.

Table 1. Measurements for the scaphoids of *M. meridionalis* in Leu and Nogaïsk.

Tabel 1. Dimensiunile scafoidelor de *M. meridionalis* de la Leu și Nogaïsk.

Scaphoid sin.	Height	Proximal width	Distal width	Mid bone width	Maximum width/height ratio
	cm	cm	cm	cm	%
NSMO 45398	14.10	6.95	11.58	9.94	83
NSMO 43421	14.03	7.11	-	10.15	86?
Nogaïsk	15.1	9.7	14.2	10.6	94

Semilunar sin. (NSMO 44739) (*lunatum bone*). A whole bone, fair preserved. It has a triangular prism shape, with a round, characteristic curve. It has two extremities and three facets:

- the proximal extremity is wholly covered by a dorsally curved-inwards and palmary curved-outwards radius joining facet (Pl. I, 3a);
- the distal extremity shows a curved-joint facet, dorsally curved inwards and palmary curved outwards, serving for joining with the trapezium; palmary it shows a tubercle (Pl. I, 3b);
- the dorsal facet has a rugged surface, because of the many ligament insertions and foramens.
- the medial facet shows at each proximal and distal area a narrow and oblong facet for articulation with the scaphoid, disconnected by a wide and rugged trench, with numerous nutrition foramens and ligament insertions (Pl. II, 1a)
- the lateral face is smaller than the other faces and bears two joining facets: one at the proximal area, nearly round, serving for articulation with the cubitus, and another at the distal area, oval and oblong for articulation with the pyramidal. The two facets are disassociated by a wide and rugged trench (Pl. II, 1b).

Table 2. Measurements for the semilunar of *M. meridionalis* in Leu and Nogaïsk.

Tabel 2. Dimenisunile semilunarului de *M. meridionalis* de la Leu și Nogaïsk.

Semilunar	Maximum length	Maximum width	Maximum height	Width/Length ratio
	Cm			%
NSMO 44739	15.29	14.92	9.37	97
Nogaïsk	17.5	14.2	9.6	81

Compared to the similar bone from Nogaïsk, the bone in Leu reveals main differences. So, regarding sizes, the maximum length of the Leu bone's semilunar is much smaller, and width and height are rather equals. Morphologically, the Leu bone has a much greater relative width, 97% compared to 81%.

In proboscideans, the semilunar undergoes morphologic changes from species to species. Therefore, in all mastodons, in *Mammuthus trogontherii* (POHLIG, 1885), and *M. primigenius*, this bone is relatively wider than with other proboscideans. The relative width of this bone in *Mastodon atavus* BORISSIAK, 1936 is 93.5%, at the evolved form of the *M. trogontherii* of Novogheorghievsk is 105.9%, and in *M. primigenius* this size fluctuates between 96.1% and 116.4%. The relative width of the Indian elephant semilunar bone fluctuates between 97.3% and 88.4%, in the African elephant, 84.2%, and in the *Elephas planifrons* (FALCONER & CAUTLEY, 1846) from Groznâi, it is 88.9% (GARUTT, 1954). Therefore, the Leu type semilunar bone is morphologically, closer to *M. primigenius*, than to *M. meridionalis* from Nogaïsk.

The shape of the semilunar bone of elephants is subject to changes through their lifetime. The studies carried

on by HAYNES (1991) demonstrate the fact that in *Loxodonta* the carpal epiphysis ossifies around the age of 50 so, we can state that the carpal bones from Leu belong, however, to mature individuals.

Pyramidal sin. (NSMO 42552) (*triquetrum s. pyramidale s. ulnare*). Bone reconstructed of two fragments, with the joining surface little damaged. The shape can be compared to a triangle prism with a characteristic beak-shaped, laterally trended apophysis. It has two extremities and three facets. The proximal extremity has a lateral-medial outwards-bent and slightly dorso-palmar inwards-bent facet, for joining the ulna (Pl. II, 2a). The distal extremity has a round-surfaced, palmary outwards-bent facet, for joining the unciform (Pl. II, 2b). Along the dorsal border there is still another oblong, angle-placed facet, for joining the metacarp V. The dorsal face is proximally and distal circle arc wave-shaped, rugged and inwards-bent. The middle facet shows an elyptic, semilunar joining facet and a rugged trench. The palmar face shows a triangular facet, for joining the pisiform, and a tubercle.

Table 3. Measurements for the pyramidal of *M. meridionalis* in Leu and Nogaïsk.

Tabel 3. Dimensiunile piramidalului de *M. meridionalis* de la Leu și de la Nogaïsk.

Pyramidal	Length	Width	Apophysis length	Apophysis width	Thickness
	cm				
NSMO 42552	19.76	14.50	8.40	8.31	7.25
Nogaïsk	20.3	16.5	12.8	10.2	7.7

The dimensions of the pyramidal in Leu (table 3) are much smaller than the ones from Nogaïsk, the thickness of the front margin being closer (7.25 cm Leu compared to 7.70 cm Nogaïsk).

Beside the size differences, there is a morphological difference too: at the distal extremity, which in Leu bears, along with the little articulation facet with the V metacarpus, a continuous articulation facet, while in Nogaïsk one can see two surfaces, one larger, which stops at the basis of the apophysis, and the other one smaller, at the terminal part of the apophysis (GARUTT, 1954). In the same paper, GARUTT states that the distal extremity facet of the pyramidal continues to the apophysis only at *Mammuthus primigenius* and at contemporary elephants.

Pisiform sin. (NSMO 44648) (*os pisiforme*). A whole, excellently preserved bone. It is laterally-medial flattened and oblong, with extremities more dilated than the rest of the bone. It has two extremities, two facets and two margins. The proximal extremity bears two facets, one of them placed on the medial side, bigger and circle-sector shaped, for joining the pyramidal, and the other one, placed in angle on the very basis of the bone; the latter is smaller and circle-sector shaped for the articulation with the ulna. The distal extremity has a tuberosity on the medial side. The body of the bone is narrower, rugged on the lateral face (Pl. II, 3a) and smoother on the medial side (Pl. II, 3b). The proximal margin is smoother, the distal one – more rugged.

Pisiform sin. (NSMO 45373). The basis and the body of the bone are preserved, but the distal extremity is missing. Compared to the previous bone, the joining surface with the pyramidal is somewhat larger, the body is shorter, and the side facet presents a deep carve (Pl. III, 1a and 1b). The two bones in Leu are smaller than the one in Nogaïsk.

Table 4. Measurements for the pisiform of *M. meridionalis* in Leu and Nogaïsk.

Tabel 4. Măsurătorile pisiformului de *M. meridionalis* de la Leu și Nogaïsk.

Pisiform	Length	Proximal width
	cm	
sin. NSMO 44648	15.17	7.87
sin. NSMO 45373	-	7.89
Nogaïsk	20.1	10.9

Capitat sin. (NSMO 42554). A whole, perfectly preserved bone. It has an almost parallelepiped shape and displays two extremities and four facets: the proximal extremity, parallelogram shaped, is wholly covered by a rippled facet, which continues a little on the palmar face, for joining the semilunar (Pl. III, 2a). The distal extremity has two facets for joining: one larger, for joining the third metatarsus, another one somewhat smaller, for joining the second metatarsus. The two facets are divided by a dorso-palmar crest (Pl. III, 2b). The dorsal facet, with a trapezoidal shape, with the small basis at the distal part, is very rugged, due to the many ligament insertions. The palmar face has an irregular shape, approximately triangular, and has a tuberosity at the distal part. The lateral face presents, proximally placed, a wide, unciform-joining surface, and, distally placed, a wide, rugged and deep valley. The medial face has the shape of a parallelogram and shows a rippled surface, for joining the trapezoid; in the centre of the face there is a wide, deep depression with numerous nutrition foramens.

Capitat sin. (NSMO 44645) (Pl. III, 3a and 3b). During the diggings, the distal, lateral and medial facets were damaged, only the palmar one being less damaged. Unlike the previous bone, this one is narrower in its front part; the other anatomical and dimensional differences are insignificant.

Table 5. Measurements for the capitat of *M. meridionalis* in Leu and Nogaïsk.

Tabel 5. Dimensiunile capitatului de *M. meridionalis* de la Leu și Nogaïsk.

Capitat	Length	Front length	Rear length	Maximum thickness
Cm				
NSMO 42554	15.25	11.37	10.56	9.70
NSMO 44645		9.40	10.64	10.47
Nogaïsk	18.2	14.4	12.2	11.1

Unlike the capitulum dimensions in Nogaisk, the ones in Leu are significantly smaller. In the ancient forms, including *E. planifrons*, *M. meridionalis*, *E. antiquus*, as well as at the actual ones (*E. indicus* and *L. africana*) the width of the magnum bone at the front margin is equal or slightly bigger than the one of the rear margin. In *M. primigenius* and *M. trogontherii*, the magnum bone is, on the opposite, wider in the rear part and slightly narrower at the front part (GARUTT, 1954).

CONCLUSIONS

Out of descriptions done for every bone and the comparison of measurements I come to the conclusion that there are significant differences between the carpal bones discovered in Leu and those in Nogaisk. The carpal bones of the specimen in Nogaisk are larger, by that suggesting that it could belong to a more evolved stage. Nevertheless, from the morphological point of view, the specimens in Leu are closer to more evolved species (*M. trogontherii*, *M. primigenius*). This would be apparently a paradox, but one has to take also in consideration the possibility that the bones in Leu belonged to females, which would explain their smaller sizes. The close analysis of the other bones of the post-cranial skeleton would lead to a solution for this dilemma.

REFERENCES

- APOSTOL L. 1971. *Données sur le squelette de Mammuthus trogontherii (Pohlig) découvert dans la Plaine Roumaine*. Travaux du Muséum d'Histoire Naturelle „Grigore Antipa”. București. **11**: 459-472.
- APOSTOL L. 1972. *Les mammifères pléistocènes de la zone de Prundu, district d'Ilfov*. Travaux du Muséum d'Histoire Naturelle „Grigore Antipa” București. **12**: 427-438.
- APOSTOL L. 1974. *Mammuthus trogontherii (Pohlig) dans la région Fetești (Stelnică-Vlașca), département Ialomița*. Travaux du Muséum d'Histoire Naturelle „Grigore Antipa” București. **14**: 481-488.
- APOSTOL L. 1976. *L'étude morphométrique des mammifères fossiles quaternaires de la Plaine roumaine et leur distribution paléozoogéographique*. Travaux du Muséum d'Histoire Naturelle „Grigore Antipa” București. **17**: 341-375.
- APOSTOL L. & POPESCU A. 1963. *Sur la présence d'Anancus arvernensis Croizet et Jobert à Covrigi, Région d'Olténie*. Travaux du Muséum d'Histoire Naturelle „Grigore Antipa” București. **4**: 541-546.
- APOSTOL L. & VICOVEANU D. 1970. *L'étude des Éléphantidés, des Rhinocerotidés et des Bovidés des dépôts quaternaires de la vallée inférieure du Bârlad, existants au Musée de Tecuci*. Travaux du Muséum d'Histoire Naturelle „Grigore Antipa” București. **10**: 365-382.
- APOSTOL L. & CACOVEANU I. 1980. *L'étude des restes fossiles quaternaires d'Éléphantidés, de Bovidés et de Cervidés dans les musées des villes d'Alexandria et de Roșiorii de Vede (Département de Teleorman, Roumanie)*. Travaux du Muséum d'Histoire Naturelle „Grigore Antipa” București. **22**: 587-607.
- APOSTOL L. & COSTĂCHESCU GH. 1981. *Mammifères fossiles quaternaires découverts à Padea (depart. de Dolj, Roumanie)*. Travaux du Muséum d'Histoire Naturelle „Grigore Antipa” București. **23**: 313-325.
- BANDRABUR T. & APOSTOL L. 1976. *Un nou punct fosilifer cu mamifere în sudul Olteniei*. Dări de seamă ale ședințelor. (63) 3. Paleontologie. Institutul de Geologie și Geofizică București: 3-7.
- CODREA V. & DIACONU F. 2003. *Plio-Pleistocene large herbivores from Husnicioara (Mehedinți district)*. Studii și cercetări. Geologie-Geografie Bistrița. **8**: 73-84.
- DEMETRESCU M. & NICOLĂESCU-PLOPȘOR C. S. 1929. *Mastodontul de la Stoina*. Edit. „Scrisul românesc” Craiova: 23 p.
- DUBROVO I. A. 1982. *Morfologia skeleta iuribeiskovo mamonta*. Iuribeiskii mamont. Academia Nauk S. S. S. R. Edit. „Nauka”. Moskva. 53-99 /in Russian/.
- GARUTT V. E. 1954. *Éléphant meridional Archidiskodon meridionalis (Nesti) din Pliocenule țărmlui de nord al Mării de Azov*. Academia de Științe a URSS. Lucrările comisiei pentru studiul perioadei cuaternare. X, broșura 2. Leningrad: 76 p. /in Russian/.
- HAYNES G. 1991. *Mammonts, Mastodons and Elephants. Biology, behavior and the fossil*. Cambridge University Press. Cambridge: 413 pp.
- JURCSÁK T., POPA E. 1977. *Anancus arvernensis Croizet et Jobert din Pliocenule de la Huta (Bihor, România)*. Nymphaea Oradea. **5**: 71-93.
- PIVETEAU J. 1958. *Traité de Paléontologie*. 6. 2. Masson & Co. Paris: 962 pp.
- POPESCU A. 2004. *Sur le gisement paléontologique Leu (Mammalia, Pléistocène)*. Acta Palaeontologica Romaniaae. Edit. Supergraph. Cluj-Napoca. **4**: 369-372.
- SCHOVERT E., FERU M., ȘERBĂNESCU V., TODOR R. 1963. *Observații asupra Villafranchianului din bazinul mijlociu al Jiului*. Studii tehnice și economice. Seria E. Hidrogeologie. Institutul Geologic București. **6**: 71-78.

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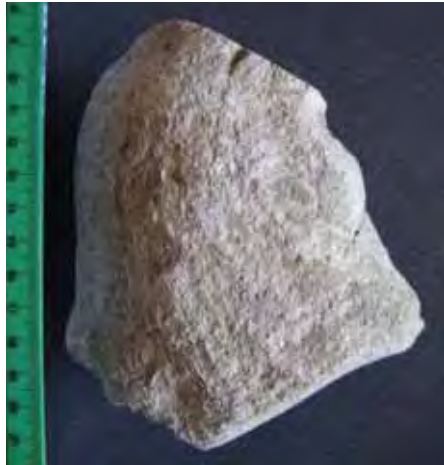
PLATE I



1a. Scaphoid sin, inv. no. 45398, medial face
1a. Scafoid sin, nr. inv. 45398, fața medială



1b. Scaphoid sin, inv. no. 45398, lateral face
1b. Scafoid sin, nr. inv. 45398, fața laterală



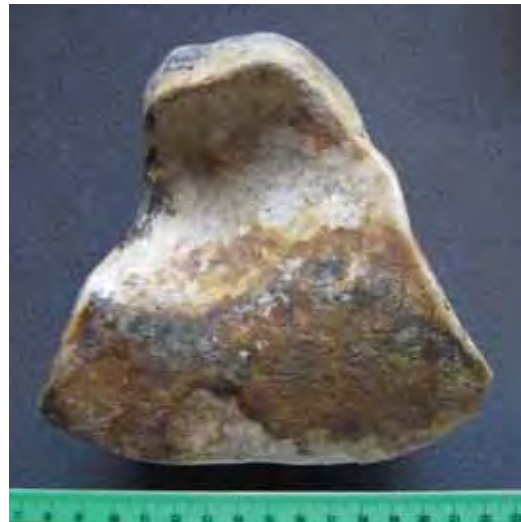
2a. Scaphoid sin, inv. no. 43481, medial face
2a. Scafoid sin, nr. inv. 43481, fața medială



2b. Scaphoid sin, inv. no. 43481, lateral face
2b. Scafoid sin, nr. inv. 43481, fața laterală



3a. Semilunar sin, inv. no. 44739, proximal extremity
3a. Semilunar sin, nr. inv. 44739, extremitatea proximală

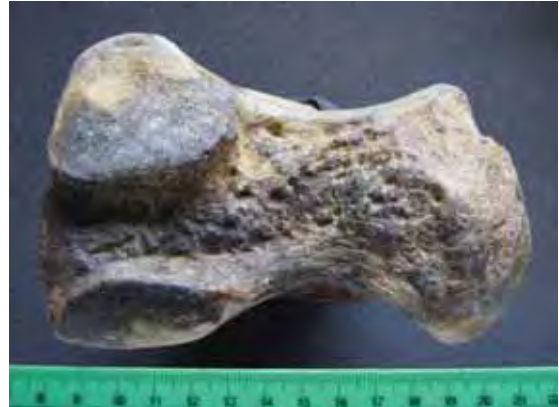


3b. Semilunar sin, inv. no. 44739, distal extremity
3b. Semilunar sin, nr. inv. 44739, extremitatea distală

PLATE II



1a. Semilunar sin, inv. no. 44739, medial face
1a. Semilunar sin, nr. inv. 44739, fața medială



1b. Semilunar sin, inv. no. 44739, lateral face
1b. Semilunar sin, nr. inv. 44739, fața laterală



2a. Pyramidal sin, inv. no. 42552, proximal extremity
2a. Piramidal sin, nr. inv. 42552, extremitatea proximală



2b. Pyramidal sin, inv. no. 42552, distal extremity
2b. Piramidal sin, nr. inv. 42552, extremitatea distală



3a. Pisiform sin, inv. no. 44648, lateral face
3a. Pisiform sin, nr. inv. 44648, fața laterală



3b. Pisiform sin, inv. no. 44648, medial face
3b. Pisiform sin, nr. inv. 44648, fața medială

PLATE III



1a. Pisiform sin, inv. no. 45373, lateral face
1a. Pisiform sin, nr. inv. 45373, fața laterală



1b. Pisiform sin, inv. no. 45373, medial face
1b. Pisiform sin, nr. inv. 45373, fața medială



2a. Capitat sin, inv. no. 42554, proximal extremity
2a. Capitat sin, nr. inv. 42554, extremitatea proximală



2b. Capitat sin, inv. no. 42554, distal extremity
2b. Capitat sin, nr. inv. 42554, extremitatea distală



3a. Capitat sin, inv. no. 44645, proximal extremity
3a. Capitat sin, nr. inv. 44645, extremitatea proximală



3b. Capitat sin, inv. no. 44645, distal extremity
3b. Capitat sin, nr. inv. 44645, extremitatea distală