

NEW FINDINGS OF FOSSIL LARGE MAMMAL REMAINS IN THE PENIOS VALLEY (AREA OF LARISSA, THESSALY, GREECE)*

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ABSTRACT

Fossil large mammal remains that come from the Penios valley, Thessaly, are described and compared to already known specimens. The studied material includes two elephant mandibles, tusk fragments and limb bones, as well as a part of a large bovid skull. On the basis of morphology and biometry the sample is taxonomically referred to the species *Elephas antiquus* and *Bos primigenius*. An Upper Pleistocene age is assumed.

ΣΥΝΟΨΗ

Στην παρούσα εργασία περιγράφονται και συγκρίνονται νέα ευρήματα απολιθωμένων Θηλαστικών, που προέρχονται από την κοιλάδα του ποταμού Πηνειού (Ν. Λαρίσης, Θεσσαλία). Πρόκειται για τμήματα δύο κάτω γνάθων ελεφάντων, τμήματα χαυλιοδόντων και οστών των άκρων, καθώς και τμήμα κρανίου μεγάλου βοοειδούς. Βάσει της μορφολογίας τους τα ευρήματα αποδίδονται στα είδη *Elephas antiquus* και *Bos primigenius* και χρονολογούνται στο Ανώτερο Πλειστόκαινο.

KEY WORDS: Greece, Thessaly, Penios valley, Pleistocene, Proboscidea, *Elephas antiquus*, Artiodactyla, *Bos primigenius*

ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ: Θεσσαλία, Κοιλάδα Πηνειού, Πλειστόκαινο, Προβοσκιδοπά, *Elephas antiquus*, Αρτιοδάκτυλα, *Bos primigenius*

1. INTRODUCTION

The material of the present study comprises some odontological and osteological elephant remains, as well as a specimen (partial skull) of a big bovid. It comes from an excavation carried out by amateurs in the riverbed of Penios, during the very dry summer of 1988, when the riverbed was exposed. The excavation site is situated between the city of Larissa and the gorge of Kalamaki. Its approximate position is indicated in Fig. 1.

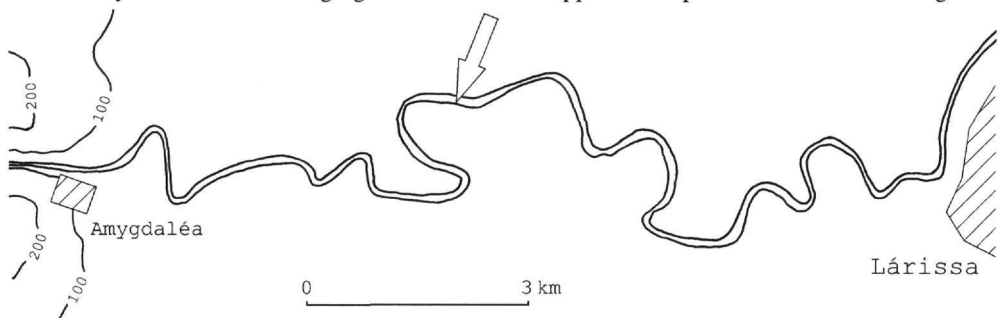


Fig. 1: Schematic map of the Penios valley area, between the city of Larissa and the gorge of Kalamaki. The arrow shows the approximate position of the fossil finds.

This area of the Penios valley is already known since many years for its fossil fauna, as well as for Palaeolithic artefacts (MILOJØIZ *et al.*, 1965; SCHNEIDER, 1968). Some other elephant remains found close to the mouth of the same river are reported by PARASKEVAIDIS (1977). The material under study was given by the excavators to the

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Museum of Geology and Palaeontology of the University of Athens and it currently belongs to its collections.

The locality is situated in the East Thessalian Plain, near to the area where Penios flows out of the Kalamotki gorge. The region is covered by alluvial fluvio-lacustrine sediments (silt, clay, sand and pebbles), which overlay marbles and crystalline limestones of the Pelagonian zone. The riverbanks are very steep, due to erosion, allowing the exposure of the lower fluvio-lacustrine strata during dry periods.

Fossil elephant remains, mainly of the species *Mammuthus meridionalis* (NESTL, 1825) and *Elephas antiquus* FALCONER & CAUTLEY, 1845, are quite common in Greece as mainland or insular (endemic) forms (ΔΕΡΜΙΤΖΑΚΗΣ *et al.*, 1982; ΔΕΡΜΙΤΖΑΚΗΣ & ΘΕΟΔΩΡΟΥ, 1980; ΔΟΥΚΑΣ & ΑΘΑΝΑΣΣΙΟΥ, in press).

In the present study the elephant remains are measured and described according to the methods proposed by MAGLIO (1973).

2. SYSTEMATICS

Order:	Proboscidea ILLIGER, 1811
Suborder:	Elephantoidea OSBORN, 1921
Family:	Elephantidae GRAY, 1821
Subfamily:	Elephantinae GRAY, 1821
Genus:	<i>Elephas</i> LINNAEUS, 1758

Elephas antiquus FALCONER & CAUTLEY, 1845 (Fig. 2A, B)

Material — Tusk fragment (I²): ΛΑ-1; tusk fragment (I²): ΛΑ-2; tusk fragment (I²): ΛΑ-3; part of mandible with part of right M₃: ΛΑ-4; mandible without teeth: ΛΑ-5; distal part of right tibia: ΛΑ-6.

Description — The preserved tusk fragments are very small (length 18–40 cm), so their morphology (curvature, torsion etc.) is not known. All three fragments have small diameters, smaller than 14 cm. The cross section of the retained parts is circular.

The two available mandibles are heavily built and relatively large. In ΛΑ-4 only the right ramus is preserved, while the ΛΑ-5 is almost intact but it lacks the teeth. The former is relatively higher in comparison to the latter. It has only one alveolus that accommodates the M₃, which was the only functional tooth when the animal died. The ΛΑ-5 has strong symphysis that forms proximally a short, narrow and pointed process, typical of the species. The existing alveoli show that this individual used the molars M₂ and M₃. The alveolus of M₂ is very small, indicating that the molar was almost worn out and only its last plates were in use. The alveoli of M₃ are very large to accommodate the third molars, which were in a rather early stage of wear.

The molar of the mandible ΛΑ-4 is partly preserved, as its distal part is broken. The retained part consists of ten plates, of which the mesial are almost worn out. The last preserved distal plate is little worn, as the enamel forms islets on the occlusal surface. It is very possible that some more plates existed in the mesial part of the tooth, which have been worn out and discarded during the animal's life. The morphology of the alveolus shows that also at least 2–3 additional plates existed in the distal part of the molar. The tooth shows a lingual convexity, as well as a divergence of the plates towards the base, both being characters of the lower elephant molars (MAGLIO, 1973). The total length of the preserved part is 235 mm. The maximal width of the molar is 101 mm and it is measured in the fifth plate (counting from the mesial end of the tooth). The maximal height is measured in the tenth plate (the most distal one) and it is 132 mm. As the tenth plate is already worn, the total height of the third molar in life was surely greater. The retained height and width result to a hypsodonty index larger than 131. The enamel is relatively thick, 2.5–3.3 mm, and intensively folded, especially in the median area of the plates. The plate frequency is relatively low; the mean value calculated from measurements in several areas of the crown (lingually, buccally, near the occlusal surface and near the base of the crown) is 4.1 (plates per 10 cm of molar length).

The tibia ΛΑ-6 is preserved only distally. The diaphysis is triangular in cross-section. The distal articulation is almost trapezoid in shape. The minimal diameters of the diaphysis (DAP and DT) are 85 and 108 mm respectively. The maximal dimensions of the distal end of the bone (DAP and DT) are 136 and 177 mm respectively.

Discussion — Two proboscidean species classified in the genus *Elephas* are known in the Middle–Upper Pleistocene of Eurasia: the European species *E. antiquus* (also attributed by older authors to the separate genus or subgenus *Palaeoloxodon* MATSUMOTO, 1924, due to the loxodont characters of its molars) and the Asian *E. namadicus* FALCONER & CAUTLEY, 1845. Some authors (as MAGLIO, 1973) consider the two species as synonyms,

as they have many affinities in size and cranial and dental morphology to each other. In the case that the synonymy is accepted, all Middle and Upper Pleistocene Eurasian representatives of the genus *Elephas* should be named *E. namadicus*, as this name has priority over *E. antiquus*. However, most European authors still prefer to use the name *E. antiquus*, although most accept that the two species are hardly distinguishable between each other. Though considering the large variability of the elephants and the vast geographical distribution of the Eurasian *Elephas*, a possible distinction between the two alleged species could be difficult to see (see also PALOMBO, 1994; SHOSHANI & TASSY, 1996: 360). Until a detailed comparative study of the European and Asian samples is made, it is better to keep both species names for the moment, and provisionally refer the European material to *E. antiquus*.

The morphology of the studied mandibles (with short and pointed chin), as well as the anatomical characters of the molar (inferred high plate number, folded enamel, hypsodonty), are typical for *Elephas antiquus*. The species is very common in the Middle and Upper Pleistocene of Europe and Greece in particular (ΔΕΡΜΙΤΖΑΚΗΣ *et al.*, 1982; ΔΕΡΜΙΤΖΑΚΗΣ & ΤΗΦΟΔΟΡΟΥ, 1980; ΔΟΥΚΑΣ & ΑΘΑΝΑΣΣΙΟΥ, in press).

General biometrical data for samples or individual finds of *Elephas antiquus* are given by several authors. The mandibles are comparable in size to the mandible 1960/27 from Megalópolis, described by ΜΕΛΕΝΤΙΣ (1961) (Table 2). The relatively higher ramus of the studied specimens could be due to more advanced ontogenetical age.

The molar seems to be rather short and wide, compared to other known samples of the species (Table 1). The relatively small total length and low plate number are due to the *post mortem* breakage and loss of the posterior plates, as well as to the possible loss of some mesial ones during the life of the animal, because of wear. The total width is, however, very high, usually higher than the maximal values measured in most available samples (Table 1). ΜΟΥΣΙ ΝΙΚΟΛΟΥΣΣΙ (1971) reports, however, an even higher value. The hypsodonty index (100 X height / width) is also very low, both because of the large total width and the low total height. The real total height of the molar could, however, be fairly higher, as the distal, i.e. less worn, plates are missing. The calculated lamellar frequency is very low, lower than that of any known sample, but comparable with the lowest value given by ΑΓΙΡΡΕ ΕΝΡΙΚΕΖ (1968-1969).

The dimensions of the tibia are small in comparison to the data given in the literature. ΤΡΕΒΙΣΑΝ (1954: 43) gives a distal DT measurement of 260 mm. ΜΕΛΕΝΤΙΣ (1963: Tabelle 20) gives 218–241 mm for the same measurement and 160–181 mm for the distal DAP of tibias from Megalópolis. The author refers the corresponding specimens to *Archidiskodon meridionalis*, though *Elephas antiquus* is provenly present in this locality. The modern aspect of the fauna shows, however, that they could well belong to the latter species.

Table 1: Comparative dimensions of selected *Elephas antiquus* M₃ samples from several European localities.

<i>Elephas antiquus</i> Lower Third Molar	Lárisa (Peniós Valley)	VAUFREY (1958)	ΜΕΛΕΝΤΙΣ (1961) Megalópolis	GUENTHER (1954)	ΑΓΙΡΡΕ ΕΝΡΙΚΕΖ (1968-1969)	Μουσ. Νικολουσσ. (1971)	MAGLIO (1973)	GUENTHER (1977) Taubach	GUENTHER (1977) Steinheim	ΤΣΟΥΚΑΛΑ & ΙΛΙΣΤΕΡ (1998) Grevená
Total length	235+	275-480	230	193-265	237-411	222-325	232-339	272-290	255-330	242
Total width	101	62-92	75	58-74	58-97	80-115	50-88	75-87	63-95	82.7
Total height	132	—	153	137-140	118-165	120-210	123-166	142-160	93-176	—
Plate number	10+	15-20	15	14	14-20	8½-17	13-18	13½-16	14-19	14+
Lamellar frequency	4.1	4.5-6.0	6.3	5.4-7.2	4.2-7.7 ¹	5.0-6.0	4.4-6.8	5.6-6.7	4.5-6.5	6.0
Enamel thickness	2.5-3.3	—	2-2.5	2.1-2.8	2.2-3.3	2.7-5	1.8-3.4	2.4-3.0	2.3-3.5	2.3-3.3
Hypsodonty index	131	—	204	185-241	140-200	140-213	145-302	171-215	—	—

¹ ΑΓΙΡΡΕ ΕΝΡΙΚΕΖ (1968-1969) uses the "functional lamellar frequency", which does not differ markedly from the plate frequency calculated according to the method of MAGLIO (1973).

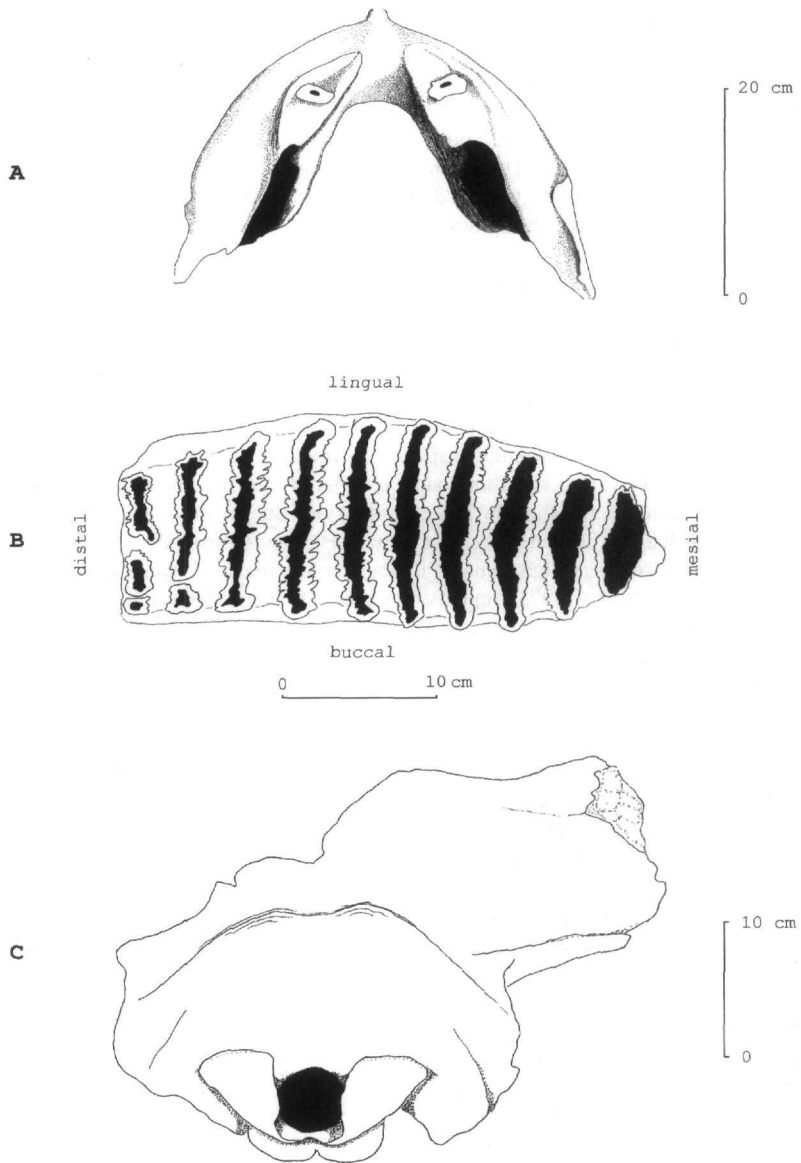


Fig. 2: Draft drawings of some of the specimens studied in this paper: **A:** *Elephas antiquus* FALCONER & CAUTLEY, 1845, occlusal view of the mandible AA-5; **B:** *Elephas antiquus* FALCONER & CAUTLEY, 1845, occlusal view of the right lower third molar (specimen AA-4); **C:** *Bos primigenius* BOJANUS, 1827, occipital view of the cranium AA-7.

Many authors have distinguished several subspecies of *Elephas antiquus* in the past mainly based on the plate number, the lamellar frequency and the enamel thickness. OSBORN (1942: 1217) divides the species in three subspecies, according to the number of plates in the last molars: *E. a. antiquus*, *E. a. germanicus* STEFANESCU, 1924 and *E. a. italicus* OSBORN, 1931 with 16½–17, +18+ and 18+ plates in M₃ respectively. Taking into account the high morphological and biometrical variety of the elephants, which is also intensified by marked sexual dimorphism (HAYNES, 1991), the absence of any statistical definition of these subspecies and the fragmentary state of the studied molar, a subspecific determination of the material is not possible. It is evident that many isolated and/or fragmentary finds that have been attributed to subspecies by several older authors (MELENTIS, 1961, 1963; MILOJČIĆ *et al.*, 1965; SCHNEIDER, 1968; ΔΕΡΜΙΤΖΑΚΗΣ *et al.*, 1982) need reconsideration.

Table 2: Comparative dimensions of *Elephas antiquus* mandibles.

<i>Elephas antiquus</i> Mandible	Lárisa (Peniós Valley)	MELENTIS (1961) Megalópolis	MACCAGNO (1962) Riano	TSOUKALA & LISTER (1998) Grevená
Total length	>500	>360	540-700	—
Total width	>590	>490	—	630
Height of the horizontal ramus	205-230	185	158-250	—
Length of the diastema	134	140	—	—

The wear stage of the one available molar (AA-4) can give some clues about the biological age of the individual it belonged to. According to observations on recent elephants (MAGLIO, 1973; HAYNES, 1991) and considering the relatively larger size of the European *Elephas antiquus* that possibly implies a longer lifespan, the age of this animal could be about 45–50 years. The mandible AA-5 that seems to have had also a functional M₂ could belong to a somewhat younger individual, about 35–40 years old.

Order: Artiodactyla OWEN, 1848
 Family: Bovidae GRAY, 1821
 Subfamily: Bovinae GRAY, 1821
 Genus: *Bos* LINNAEUS, 1758

***Bos primigenius* BOJANUS, 1827**
 (Fig. 2C)

Material – Cranium fragment (distal part): AA-7.

Description – The cranium fragment AA-7 preserves the occipital region and a small part of the cranial roof with the base of the left horn core. It is massively built and very big in dimensions. The horn core is directed laterally and its base has a horizontal position. Internally it is full of sinuses, as it is common in bovins. The horn core cross-section is elliptical, the antero-posterior diameter being smaller than the dorso-ventral one. The horn cores are very similar in morphology and dimensions (see Table 3) to the horn core 388 from Megalópolis, which is described by MELENTIS (1966).

Table 3: Comparative dimensions of *Bos primigenius* cranium.

<i>Bos primigenius</i> Cranium	Lárisa (Peniós Valley)	MELENTIS (1966) Megalópolis
Occipital breadth	280	—
Total cranial height	>300	—
Breadth at the mastoid processes	245	—
Breadth of the occipital condyles	157	—
Horn core DAP (base)	105	87
Horn core dorsoventral diameter (base)	146	140
Horn core perimeter (base)	390	375

3. BIOSTRATIGRAPHY-PALAEOECOLOGY

The species *Elephas antiquus* characterises the European Middle and Late Pleistocene (MAGLIO, 1973). The rather primitive aspect of the molar (reduced hypsodonty, low lamellar frequency) could indicate a rather old age. The species *Bos primigenius* is, however, confined in the Late Pleistocene (KURTIN, 1968), being abundant during the postglacial. So, the available data point to a Late Pleistocene age for the studied specimens. A more detailed biochronology requires a larger sample of specimens and associated findings of other Mammals.

Elephas antiquus is considered as a forest species, adapted to temperate climate (KURTIN, 1968). *Bos primigenius* was probably a grassland or open woodland animal. This indicates dominance of mild climate and of a probably open woodland environment in the area.

ΕΥΧΑΡΙΣΤΙΕΣ

Θερμές ευχαριστίες οφείλονται στους κυρίους Τάκη Τλούπα και Κώστα Ταμβακά, οι οποίοι ανακάλυψαν, ανέσκαψαν και παρέδωσαν στο Μουσείο Γεωλογίας και Παλαιοντολογίας του Εθνικού και Καποδιστριακού Πανεπιστημίου Αθηνών τα μελετηθέντα ευρήματα, καθώς και στους Καθηγητή Ν. Συμεωνίδη και Αν. Καθηγητή Γ. Θεοδώρου, οι οποίοι μου ανέθεσαν την παρούσα μελέτη.

REFERENCES

- AGUIRRE ENRIQUEZ, E. 1968-1969. Revisión sistemática de los Elephantidae por su morfología y morfometría dentaria. *Estudios Geológicos* XXIV (3-4), 109-167, XXV (1-2), 123-177, XXV (3-4), 317-367.
- ΔΕΡΜΙΤΖΑΚΗΣ, Μ.Δ., ΣΥΜΕΩΝΙΔΗΣ, Ν.Κ., BOER, L.E.M. DE & SONDAAR, P.Y. 1982. *Η Εξέλιξη των Ελεφάντων*, σελ. 85 (Εκδόσεις του Εργαστηρίου Γεωλογίας και Παλαιοντολογίας του Πανεπιστημίου Αθηνών, Αθήνα) [DERMITZAKIS, M.D., SYMEONIDIS, N.K., BOER, L.E.M. DE & SONDAAR, P.Y. *The evolution of the Elephants* (Publications of the Laboratory of Geology and Palaeontology of the University of Athens Athens)].
- DERMITZAKIS, M. & THEODOROU, G. 1980. *Map of the main fossiliferous localities of Proboscidea in Aegean area* (Athens).
- DOUKAS, C.S. & ATHANASSIOU, A. (in press). Review of the Pliocene and Pleistocene Proboscidea (Mammalia) from Greece. *2nd International Mammoth Conference, Rotterdam. Deinsea* 8.
- GUENTHER, E.W. 1954. Die diluvialen Elefantenzähne aus dem Nord-Ostsee-Kanal. *Meyniana* 2, 34-69.
- GUENTHER, E.W. 1977. Die Backenzähne der Elefanten von Taubach bei Weimar. *Quartärpaläontologie* 2, 265-304.
- HAYNES, G. 1991. *Mammoths, Mastodons and Elephants – biology, behavior and the fossil record*, 413 pp. (Cambridge University Press, New York).
- KURTIN, B. 1968. *Pleistocene Mammals in Europe*, 317 pp. (Weidenfeld and Nicolson, London).
- MACCAGNO, A.M. 1962. Gli elefanti fossili di Riano (Roma). *Geologica Romana* I, 33-131.
- MAGLIO, V.J. 1973. Origin and evolution of the Elephantidae. *Transactions of the American Philosophical Society* 63 (3), 1-126.
- MELENTIS, J.K. 1961. Die Dentition der pleistozänen Proboscidier des Beckens von Megalopolis im Peloponnes (Griechenland). *Annales Geologiques des Pays Helléniques* XII, 153-262.
- MELENTIS, J.K. 1963. Die Osteologie der pleistozänen Proboscidier des Beckens von Megalopolis im Peloponnes (Griechenland). *Annales Geologiques des Pays Helléniques* XIV, 1-107.
- MELENTIS, J.K. 1966. Die Boviden des Jungpleistozäns des Beckens von Megalopolis im Peloponnes (Griechenland). *Annales Geologiques des Pays Helléniques* XVI, 446-472.
- MILOJÓIZ, V., BOESSNECK, J., JUNG, D. & SCHNEIDER, H. 1965. Paläolithikum um Larissa in Thessalien. *Beiträge zur Ur- und Frühgeschichtlichen Archäologie des Mittelmeer-Kulturräume* 1, 65 pp. (Rudolf Habelt Verlag, Bonn).
- OSBORN, H.F. 1936-1942. *Proboscidea: a monograph of the discovery, evolution, migration and extinction of the Mastodons and Elephants of the world*. Vol. I, II, 1676 pp. (The American Museum Press, New York).
- PALOMBO, M.R. 1994. Gli Elefanti del Pliocene superiore e del Pleistocene dell'Italia centrale peninsulare: alcune considerazioni. *Studi Geologici Camerti* vol. spec. 1994 (B), 447-457.
- PARASKEVAIDIS, E. 1977. Säugetierreste aus Griechenland. *VIIth Colloquium on the Geology of the Aegean Region, Proceedings* III, 1143-1154.
- SCHNEIDER, H. 1968. Zur quartärgeologischen Entwicklungsgeschichte Thessaliens (Griechenland). *Beiträge zur Ur- und Frühgeschichtlichen Archäologie des Mittelmeer-Kulturräume* 6, 127 pp. (Rudolf Habelt Verlag, Bonn).

- SHOSHANI, J. & TASSY, P. (eds.) 1996. *The Proboscidea – evolution and palaeoecology of Elephants and their relatives*, 472 pp. (Oxford University Press, New York).
- TREVISAN, L. 1954. Lo scheletro di *Elephas antiquus italicus* di Fonte Campanile Viterbo. *Palaeontographia Italica* XLIV, 1-78.
- TSOUKALA, E. & LISTER, A. 1998. Remains of straight-tusked elephant, *Elephas (Palaeoloxodon) antiquus* Falc. & Caut., 1847 ESR-dated to oxygen isotope Stage 6 from Grevena (W. Macedonia, Greece). *Bollettino della Società Paleontologica Italiana* 37 (1), 117-139.
- VAUFREY, R. 1958. Proboscidea, étude systématique. In: PIVETEAU, J. *Traité de Paléontologie* VI (2), 203-295. (Masson, Paris).