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PRESENCE OF FOSSIL ELEPHANTS IN THE AREA OF PENIOS VALLEY (NW PELOPONNESUS, GREECE)

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ΠΑΡΟΥΣΙΑ ΑΠΟΛΙΘΩΜΕΝΩΝ ΕΛΕΦΑΝΤΩΝ ΣΤΗΝ ΠΕΡΙΟΧΗ ΤΗΣ ΚΟΙΛΑΔΑΣ ΤΟΥ ΠΟΤΑΜΟΥ ΠΗΝΕΙΟΥ (ΒΔ ΠΕΛΟΠΟΝΝΗΣΟΣ)

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PRESENCE OF FOSSIL ELEPHANTS IN THE AREA OF PENIOS VALLEY (NW PELOPONNESUS, GREECE)*

by

A. ATHANASSIOU**

I. INTRODUCTION

The material of the present study comes from an excavation that was carried out illegally in 1996 by a fossil collector in the area of the village Roupaki on the left bank of the river Penios. The approximate position of the site is indicated in Fig. 1. Because of the improper excavating technique that was followed, part of the material (mainly a tusk) is badly damaged. These specimens are currently part of the collections of the Ephorate of Palaeoanthropology and Speleology (Ministry of Culture), where they have been examined and described for the first time, by the geologist E. Kambouroglou. Recently they were prepared by the present author, who undertook their study.

Peloponnesus has yielded numerous elephant remains. The most important locality is Megalopolis, where remains of *Mammuthus meridionalis, Elephas antiquus* and Mammuthus primigenius are described by MELENTIS (1961, 1963, 1966a). Other known

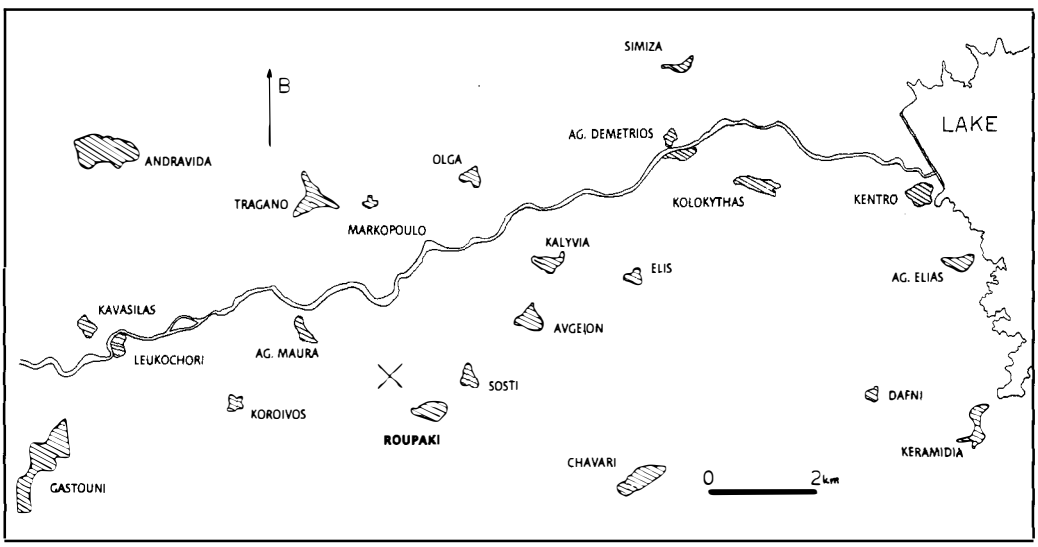

Fig. 1. Schematic map of the Penios valley area, The approximate position of the elephant finds is marked by X.

* Παρουσία απολιθωμένων ελεφάντων στην περιοχή της κοιλάδας του ποταμού Πηνειού (ΒΔ Πελοπόννησος).

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localities are Patras and Canal of Corinth (with *Elephas antiquus* – ΓΕΩΡΓΑΛΑΣ, 1929), as well as Vlachioti (with *Mammuthus meridionalis* – ΣΥΜΕΩΝΙΔΗΣ & ΘΕΟΔΩΡΟΥ, 1986b). The region of the Penios valley is already known for its fossil Mammals, as some scanty *Hippopotamus* specimens have been found there (THENIUS, 1955; ΣΥΜΕΩΝΙΔΗΣ & ΘΕΟΔΩΡΟΥ, 1986a). Recently, some new elephant remains (mainly tusk parts) were found in the area (THEODOROU, pers. com.).

II. GEOLOGY

The area is covered by alluvial deposits (sands, gravels) of the Penios River that overlay Pliocene and Pleistocene sediments (sandstones, sands, grits, clays, marls) with very rich mollusc fauna (ΠΑΡΑΣΚΕΥΑΪΔΗΣ & ΣΥΜΕΩΝΙΔΗΣ, 1965). ΚΑΜΠΕΡΗΣ *et al.* (1993) divide the Pliocene and Pleistocene sediments in four formations: Katakolo Fm (Tyrrhenian), Kalathas Fm (Lower Pleistocene), Keramidia Fm and Bounargos Fm (Upper Pliocene – Pleistocene). The presence of another formation (conglomerates and sands of Miocene age) was traced by drilling. The basement of the Neogene sediments consists of the Oligocene flysch and the Mesozoic limestone and slate sequence of the Ionian zone. The river valley follows the main fault direction of the region (E–W), across the Pliocene and Pleistocene formations.

The Plio-Pleistocene mollusc assemblages and the sedimentary facies show a continuous alternation of swallow marine water, brackish and lacustrine environments (ΠΑΡΑΣΚΕΥΑΪΔΗΣ & ΣΥΜΕΩΝΙΔΗΣ, 1965). The presence of *Hippopotamus* in the Penios valley (Ag. Demetrios, Elis – THENIUS, 1955; ΣΥΜΕΩΝΙΔΗΣ & ΘΕΟΔΩΡΟΥ, 1986a) is also good evidence of fluvio-lacustrine environment in the area.

III. TAXONOMY

Order: Proboscidea ILLIGER, 1811
Suborder: Elephantoidea OSBORN, 1921
Family: Elephantidae GRAY, 1821
Subfamily: Elephantinae BONAPARTE, 1858
Genus: Elephas LINNAEUS, 1758

Elephas antiquus FALCONER & CAUTLEY, 1845

Material – Tusk (I^2, ΠΝ-1); tusk fragment (I^2, ΠΝ-2); tusk fragment (I^2, ΠΝ-3); upper right third molar (M^3 dext., ΠΝ-4); upper left third molar (M^3 sin., ΠΝ-5).

Description – The tusk ΠΝ-1, which is the best preserved, is of fairly big dimensions. The retained length, measured following the convex side of the tooth, is 1.98 m. The small diameter of the retained pulp cavity, as well as the dimensions of another fragment (ΠΝ-3), which may actually belong to the same tusk, show that the total length could be at least 2.40 m. The cross section is almost circular along the whole tooth. The perimeter at the most distal part is 48 cm. The tusk shows only a fairly weak curvature on a single plain and no considerable torsion.

The molars (ΠΝ-4, ΠΝ-5) belong to the upper jaw. Their condition is very good. Only the basal parts of the plates (especially of the ΠΝ-5) are broken. The total height

of the plates could therefore be a little higher than measured. Their big size, as well as the morphology of the last plates, show that they are the M^3. They surely belong to the same individual, as the dimensions and the wear stage is the same for both of them. Their main characters are the extremely big dimensions and the high plate number. The enamel is relatively thick, compared with most *Elephas antiquus* specimens, and intensively folded. The early wear stage of the teeth shows that the M^2 were plausibly also in use, though in an advanced stage of wear. The dimensions and the indices of M^3 are given in Table 1.

Table 1

Dimensions of the M^3 (measurements according to MAGLIO, 1973)

Upper Third Molar	**ΠΝ-4** (right)	**ΠΝ-5** (left)
Total length	355	340
Total width	95	93
*Total height**	≥250	>220
Plate number	19	18
Plate frequency	5.4	5.4
Enamel thickness	2.7 (1.7–3.9)	2.6 (2.0–3.2)
Hypsodonty index	≥263	>237

* Measured on the IX and X plates (plate counting from the distal end of the tooth).

IV. DISCUSSION

The morphology of the tusks (weak curvature, no torsion), as well as the anatomical characters of the molars (high plate number and plate frequency, folded enamel, high hypsodonty), are typical for *Elephas antiquus*.[1] The species is very common in the Middle and Upper Pleistocene of Europe and Greece in particular (ΔΕΡΜΙΤΖΑΚΗΣ *et al.*, 1982; DERMITZAKIS & THEODOROU, 1980; TSOUKALA, 1992; DOUKAS & ATHANASSIOU, 1999 – Fig. 2). Some other, recently excavated, elephant remains that come from Quaternary deposits of the Elia Prefecture tentatively belong to this species (THEODOROU, pers. com.).

1 The European species *Elephas antiquus* (also attributed by older authors to the separate genus or subgenus *Palaeoloxodon* MATSUMOTO, 1924, due to the loxodont characters of its molars) has many affinities in size and morphology with the Asian *Elephas namadicus*. Some authors (as MAGLIO, 1973) consider the two species as synonyms, in which case all Middle and Upper Pleistocene Eurasian representatives of the genus *Elephas* should be named *E. namadicus*, as this name has priority against *E. antiquus*. However, most European authors still prefer to use the name *E. antiquus* for historical reasons, although they accept that the two "species" are hardly distinguishable between each other. PALOMBO (1994) states that both species names should be kept for the moment, considering the large variability of the elephants (that makes a possible distinction difficult) and the vast geographical distribution of the Eurasian *Elephas*. Until a detailed comparative study of the European and Asian samples is made, it is better to refer the European material to *E. antiquus*.

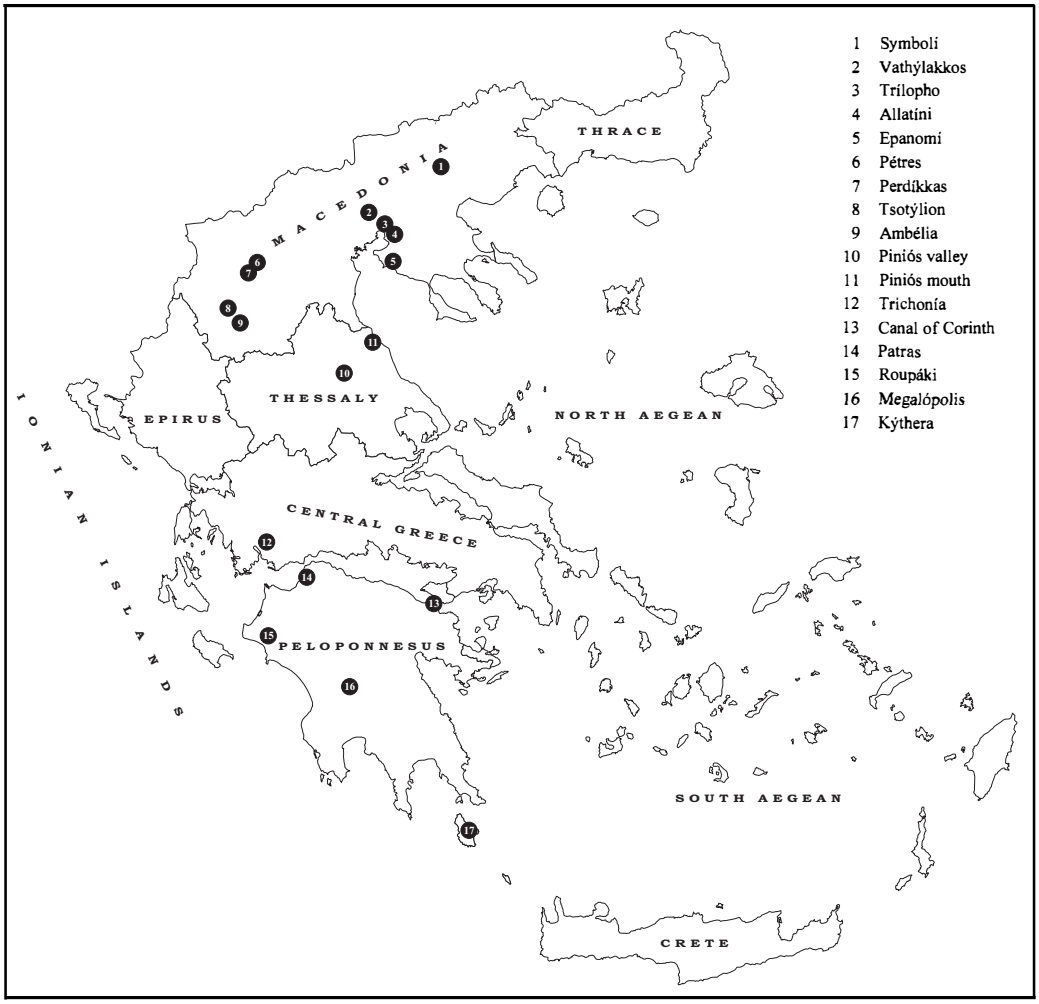

Fig. 2. Occurrences of *Elephas antiquus* in the mainland of Greece (data according to ΓΕΩΡΓΑΛΑΣ, 1929; PETROCHILOS, 1938; MELENTIS, 1961, 1963, 1965, 1966a, 1966b; SCHNEIDER, 1968; DE BONIS *et al.*, 1973; VELITZELOS & SCHNEIDER, 1973; PARASKEVAIDIS, 1977; ΔΕΡΜΙΤΖΑΚΗΣ *et al.*, 1982).

General biometrical data for *Elephas antiquus* are given by MAGLIO (1973), while many authors give measurements for smaller samples or individual finds. Compared to these data, the studied molar material is of very large dimensions, especially regarding the total length and height, which are considerably higher than most of the maximum values given in the literature. However, some authors do refer to big specimens (Table 2): LEITH ADAMS (1881) describes third molars up to 330 mm long, consisting of up to 20 plates. GUENTHER (1954: 42-43, 1977: 269, 273) reports very high maximum values for samples from German localities, pointing out the great dimensional variation of the material. VAUFREY (1958), reviewing the order Proboscidea gives an even higher maximum length and great variation for the M^3 of the species. AGUIRRE (1969) notes considerable variation in the total height; the values measured on the studied material are in this range.

In comparison to the M^3 of *Elephas antiquus* from the nearby basin of Megalopolis, the studied material shows (apart from the larger size) lower lamellar frequency and higher enamel thickness (Table 2). It also has less tightly packed plates and more intensively plicate enamel. The difference in the total height is due to the generally advanced wear stage of the Megalopolis material.

A graphical comparison of various samples of M^3 is given in Fig. 3–5. The great length of the studied sample is outside the ranges given by AGUIRRE (1969) and MAGLIO (1973), but it is comprised in the ones given by VAUFREY (1958) and GUENTHER (1977). The relatively high plate number and low plate frequency (due to the great length) are also observed. It is clear that the material from Penios valley includes two molars, which are among the largest known M^3 of *Elephas antiquus* in Europe and in Greece in particular.

Many authors have distiguished several subspecies of *Elephas antiquus* in the past mainly based on the plate number, the lamellar frequency and the enamel thickness. OSBORN (1942: 1216-1245) divides the species in three subspecies, according to the number of plates in the last molars: *E. a. antiquus, E. a. germanicus* and *E. a. italicus*, with 16½–17, 17–19 and 20 plates in M^3 respectively. Taking into account the high morphological and biometrical variety of the elephants, the absence of any statistical definition of these subspecies and the small studied sample, a subspesific determination of the material is not possible. However, several older authors used to attribute even isolated finds of the species to known subspecies (MELENTIS, 1961, 1963, 1966a;

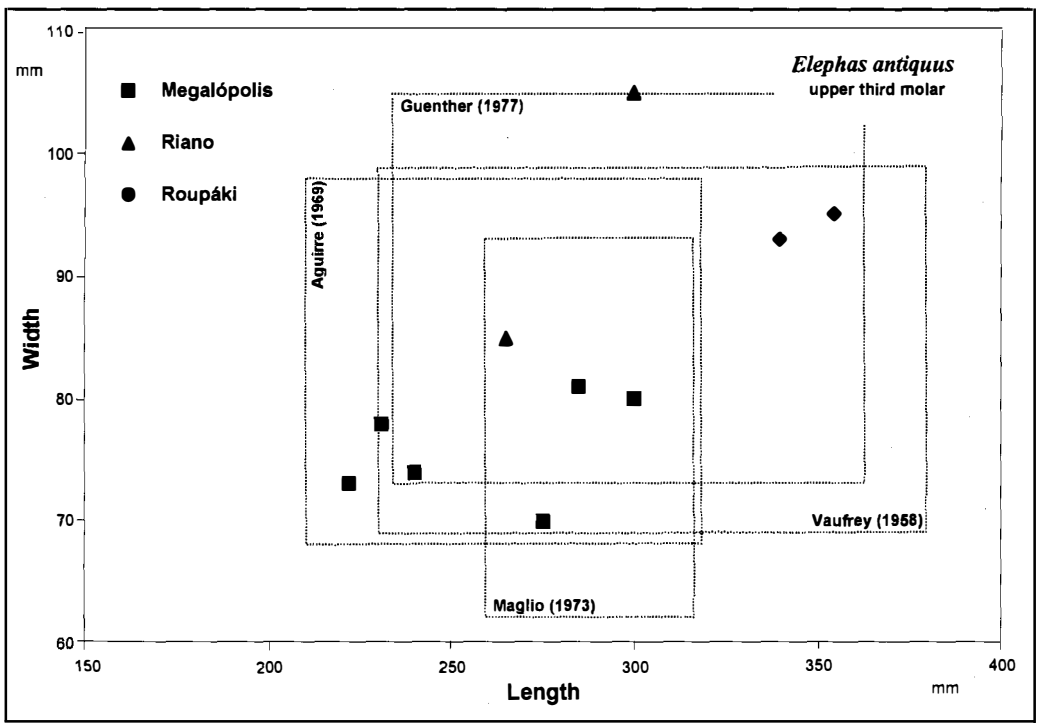

Fig. 3. Comparative scatter-diagram of the length and the width of M^3 of *Elephas antiquus* from Megalopolis (according to MELENTIS, 1961, 1966a), Riano (according to MACCAGNO, 1962) and Roupaki. The corresponding measurement ranges given by VAUFREY (1958), AGUIRRE (1969), MAGLIO (1973) and GUENTHER (1977) for the same species are plotted as squares.

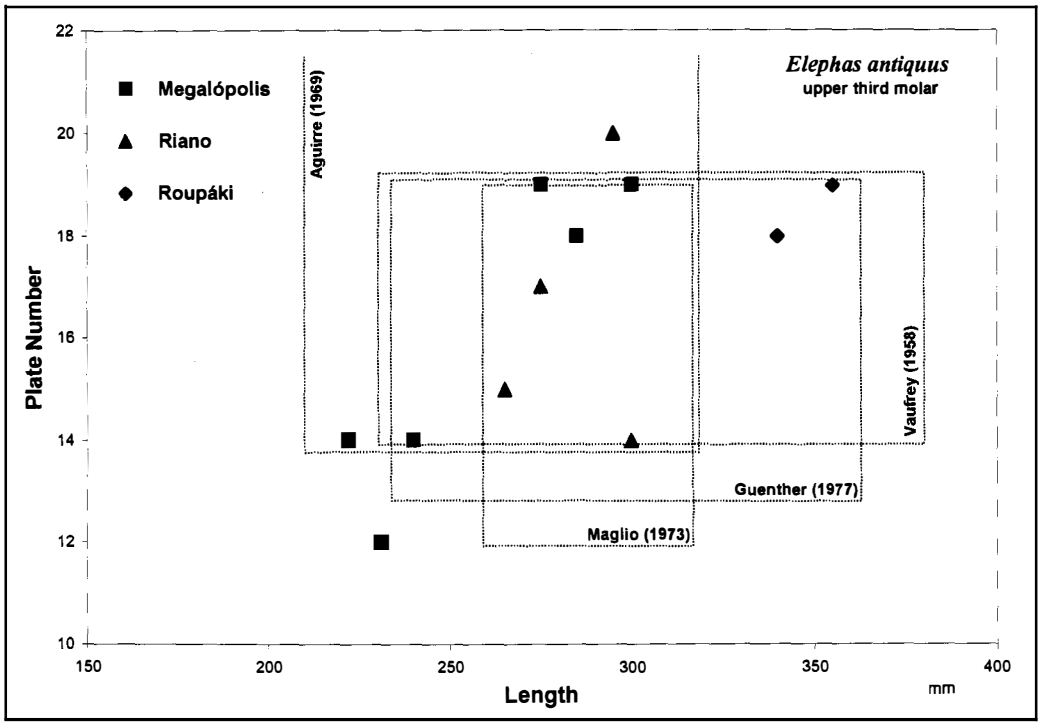

Fig. 4. Comparative scatter-diagram of the length and the plate number of M^3 of *Elephas antiquus*. Data as in Fig.3.

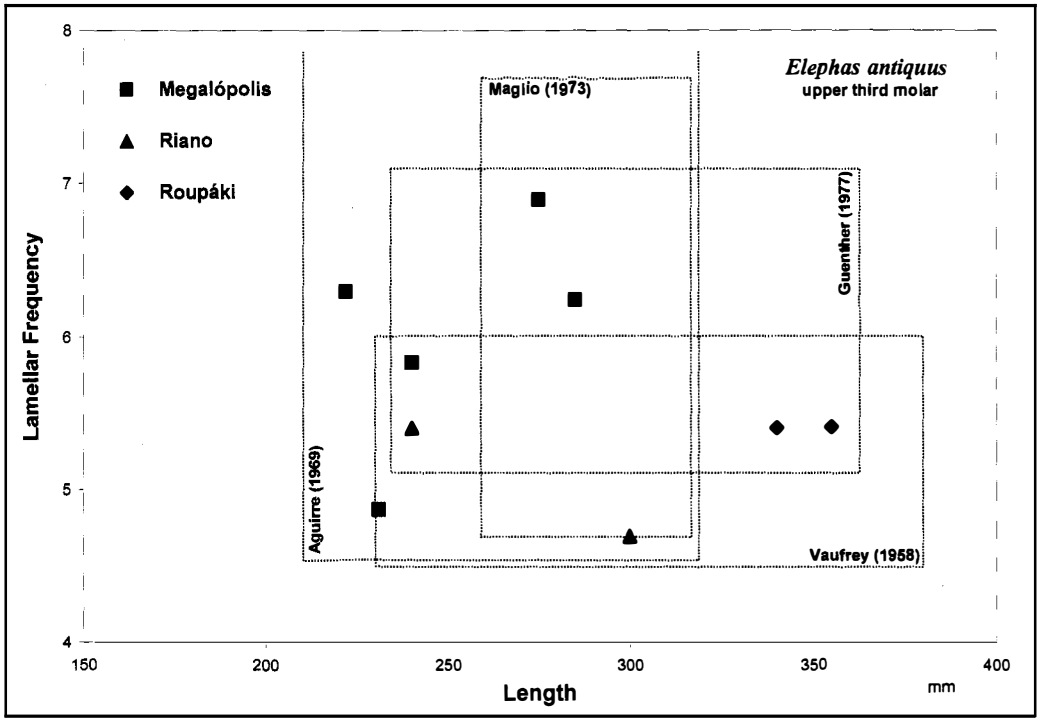

Fig. 5. Comparative scatter-diagram of the length and the lamellar frequency of M^3 of *Elephas antiquus*. Data as in Fig.3.

Table 2

Comparative dimensions of selected M^3 samples.

Upper Third Molar	Penios Valley	SOERGEL (1913)	VAUFREY (1958)	MELENTIS (1961) Megalopolis	MACCAGNO (1962) Riano	ΜΕΛΕΝΤΗΣ (1966a) Megalopolis	AGUIRRE (1969)*	MAGLIO (1973)	GUENTHER (1977) Taubach	GUENTHER (1977) Steinheim
Total length	340–355	239–317	230–380	222–275	265–300	285–300	210–319	259–317	234–274	245–362
Total width	93–95	62–84	68–98	70–75	85–105	80–81	68–98	62–93	74–95	73–105
Total height	≥250	157–218	—	178	190–210	74–76	130–270	151–218	152–212	160–215
Plate number	18–19	14–17	14–19	14–19	15–20	18–19	14–23	12–19	12–16	16–19
Plate frequency	5.4	4.7–7.1	4.5–6.0	5.8–6.8	4.5–5.4	6.5	4.5–8.5	4.7–7.7	5.5–6.9	5.1–7.1
Enamel thickness	1.7–3.9	1.5–3.0	—	1.5–3.5	2	2–3	2.1–3.2	1.8–2.7	2.5–3.8	2.3–3.1
Hypsodonty index	≥263	—	—	—	—	—	160–300	179–299	—	—

* AGUIRRE (1969) uses the "functional plate frequency", which does not differ markedly from the plate frequency calculated according to the method of MAGLIO (1973).

MILOJČIĆ *et al.*, 1965; SCHNEIDER, 1968; ΔΕΡΜΙΤΖΑΚΗΣ *et al.*, 1982) and the same is true for *Mammuthus meridionalis*. All these samples certainly need reconsideration and, if possible, re-investigation in the sites where they come from.

Considering the important sexual dimorphism of the elephants, the relatively big diameter of the tusk cross section indicates that they belong to a male individual (MELENTIS, 1961; MAGLIO, 1973; HAYNES, 1991). The early wear stage of the molars can give some clues about the biological age of the individual they 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 35–40 years.

Biostratigraphy–Palaeoecology – The species *Elephas antiquus* characterizes the European Middle and Upper Pleistocene (MAGLIO, 1973). It is generally accepted that Elephants trend towards more hypsodont molars with more and densily packed plates. The increased hypsodonty of the studied molars, as well as their very high number of plates, could therefore indicate an Upper Pleistocene age, although their lamellar frequency is rather low. An Upper Pleistocene age is also suggested by the geology of the region. A more detailed biochronology requires a larger sample of molars and, if possible, associated findings of other Mammals.

Elephas antiquus is considered to be a forest species, inhabiting Northern Europe during the Interglacials, adapted to the temperate climate of these periods (KURTÉN, 1968). However, the milder climatic conditions during the glacials in Southern Europe would make this area tolerable for the species, acting as a refuge for the cold periods. This is supported by the discovery of an *Elephas antiquus* skeleton in Grevena basin, dated in the Oxygen Isotope Stage 6 (TSOUKALA & LISTER, 1998).

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ABSTRACT

Fossil elephant remains that come from Penios valley, NW Peloponnesus, are described and compared to already known specimens. The studied material includes a nearly complete tusk, tusk fragments and two molars (M^3). On the basis of morphology (hypsodonty, number of plates, shape of the tusks) the sample is taxonomically referred to the species *Elephas antiquus*. An Upper Pleistocene age is assumed.

ΠΕΡΙΛΗΨΗ

Στην παρούσα εργασία περιγράφονται και συγκρίνονται ευρήματα απολιθωμένων ελεφάντων, προερχόμενα από την κοιλάδα του ποταμού Πηνειού στην Ηλεία. Πρόκειται για ένα σχεδόν πλήρη χαυλιόδοντα, τμήματα χαυλιοδόντων και δύο γομφίους (M^3), που βάσει της μορφολογίας τους (υψοδοντισμός, αριθμός ελασμάτων, σχήμα χαυλιοδόντων) αποδίδονται στο είδος *Elephas antiquus*. Τα ευρήματα χρονολογούνται στο Ανώτερο Πλειστόκαινο.

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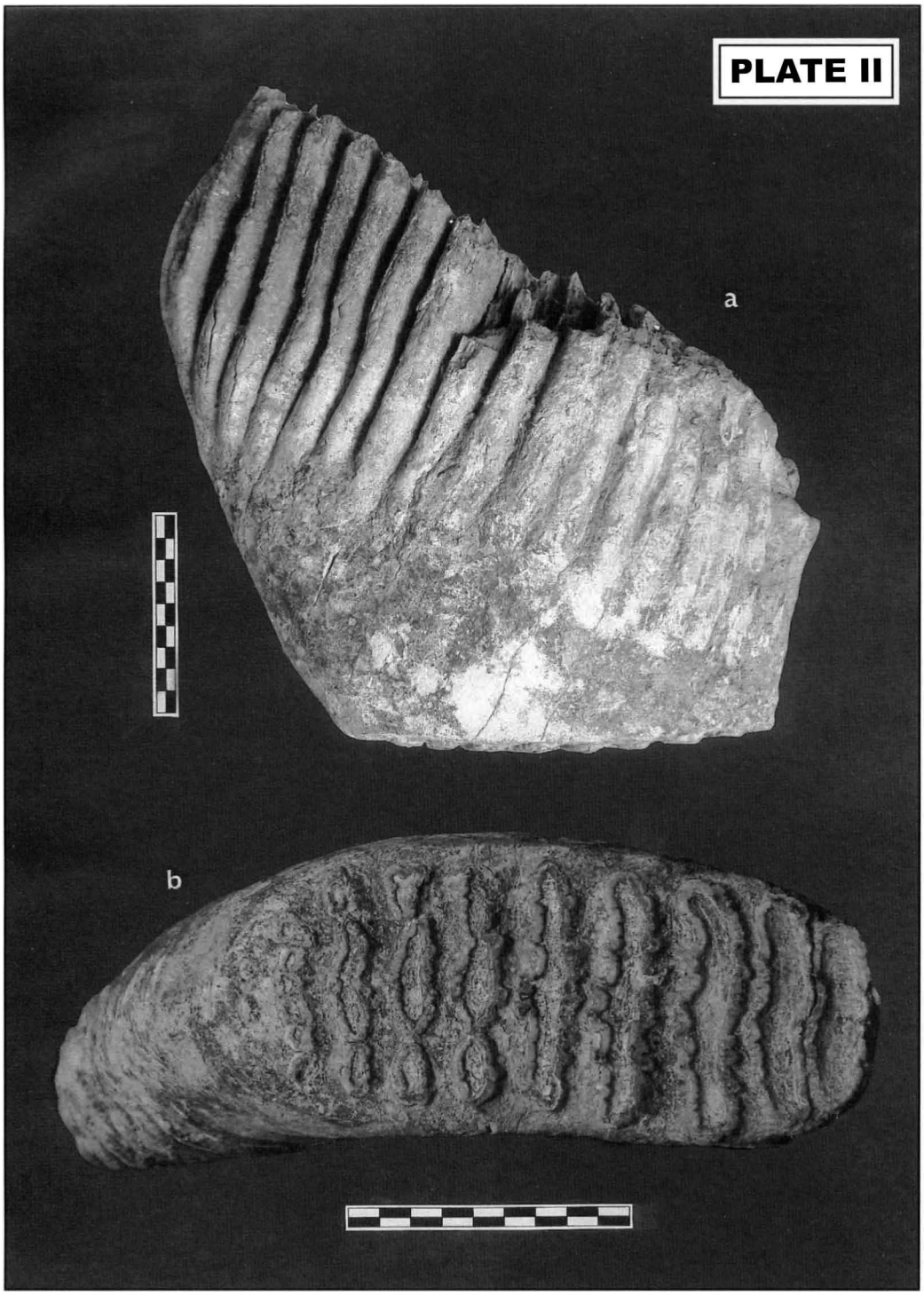
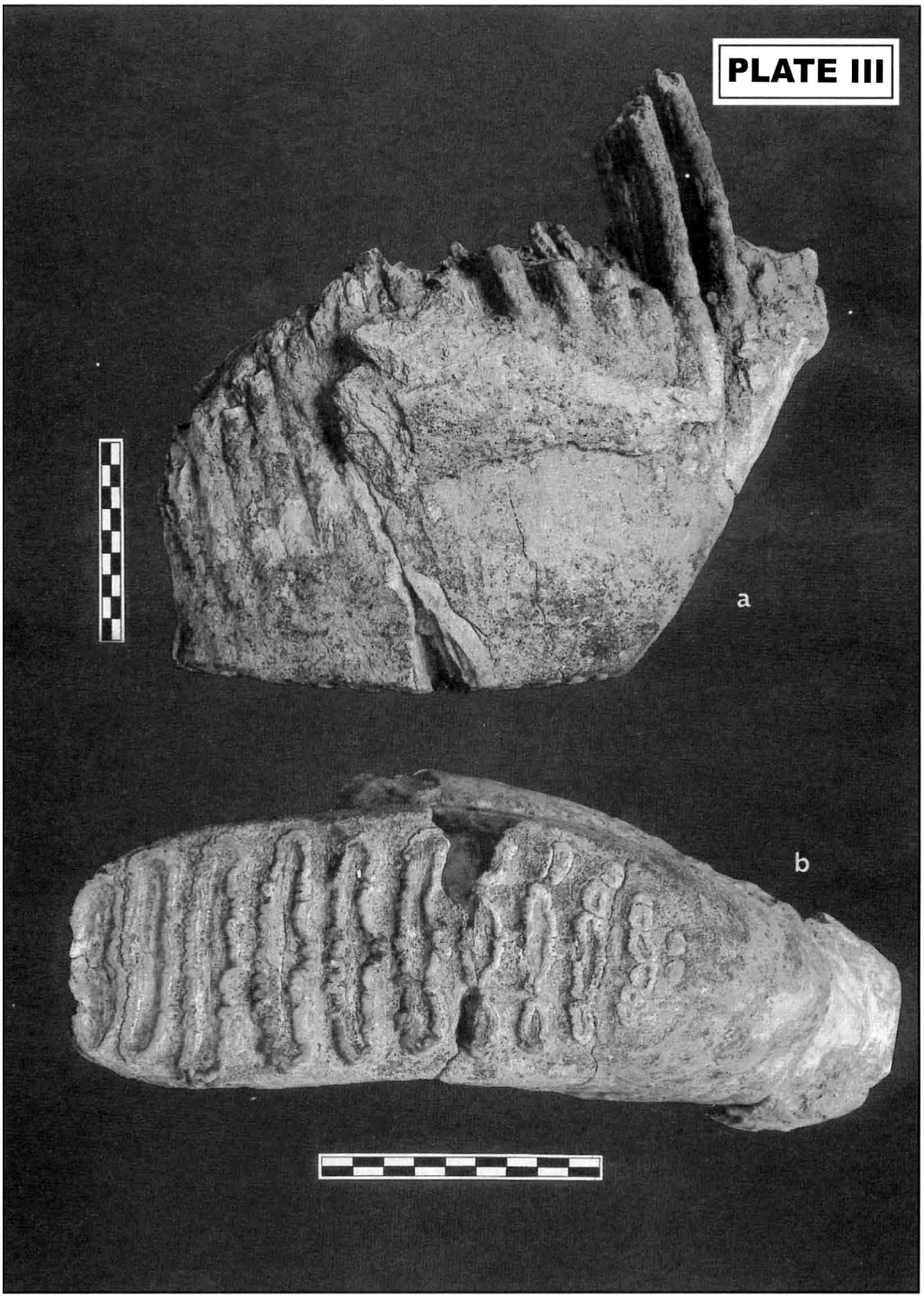
Elephas antiquus FALCONER & CAUTLEY, 1845
ΠN-1: tusk (I^2) – a. dorsal view, b. lateral view



Elephas antiquus FALCONER & CAUTLEY, 1845
ΠN-4: upper third moral (M^3) – a. labial view, b. occlusal view
scale: 9 cm



Elephas antiquus FALCONER & CAUTLEY, 1845
ΠN-5: upper third moral (M^3) – a. labial view, b. occlusal view
scale: 9 cm