

Quaternary elephants in Portugal: new data

M. T. ANTUNES +*

J. L. CARDOSO*

+ Academia das Ciências de Lisboa

* Centro de Estratigrafia e Paleobiologia da UNL, Faculdade de Ciências e Tecnologia,
Quinta da Torre, P-2825 Monte de Caparica, Portugal.

Ciências da Terra (UNL)	Lisboa	Nº 11	pp. 17-37 figs. 1, 4 pl.	1992
-------------------------	--------	-------	-----------------------------	------

RESUMO

Palavras-chave: Elefantes — Quaternário — Portugal.

Além do resumo de dados anteriores, apresenta-se a descrição de exemplares novos (*) ou inéditos, provenientes de jazidas quaternárias portuguesas - tufos de Condeixa; terraços do Tejo, perto do Carregado (*) e na Foz do Enxarrique (*); Gruta da Figueira Brava (*); Algar de João Ramos.

Na maior parte, são atribuíveis a *Elephas antiquus*, a forma melhor representada. Material da Figueira Brava e do Algar de João Ramos pertence a *Mammuthus primigenius*, espécie citada pela primeira vez em Portugal.

RÉSUMÉ

Mots-clés: Éléphants — Quaternaire — Portugal.

Outre une mise au point sur les données disponibles auparavant, on présente une étude concernant des spécimens nouveaux (*) ou inédits, récoltés dans les tufs calcaires de Condeixa; dans les terrasses du Tage près Carregado (*) et à Foz do Enxarrique (*); dans le remplissage moustérien (ca. 31000 BP) de la grotte de Figueira Brava (*); et dans l'Algar de João Ramos. La plupart des échantillons appartient à *Elephas antiquus*; des pièces de la Grotte de Figueira Brava et de l'Algar de João Ramos sont attribués à *Mammuthus primigenius*, espèce reconnue pour la première fois au Portugal.

ABSTRACT

Key-Words: Elephants — Quaternary — Portugal.

In this paper, a synopsis on the already known data, and the study of further specimens either new (*) or hitherto undescribed are presented. The specimens dealt with have been collected at the Condeixa travertines; in the Tagus terraces near Carregado (*) and at Foz do Enxarrique (*); in the mousterian, about 31000 BP infilling from the Figueira Brava cave (*); and at Algar de João Ramos (*). Some specimens are ascribed to *Elephas antiquus*, the best represented form. Material from Figueira Brava cave and Algar de João Ramos is ascribed to *Mammuthus primigenius*, a species recognized here for the first time in Portugal.

HISTORICAL DATA

The first account on fossil elephants in Portugal is that of Carlos RIBEIRO (1880). He reported the discovery at Mealhada of elephant remains ascribed by Albert Gaudry to *Elephas antiquus*. A more detailed account was produced (RIBEIRO, 1884).

Paul CHOFFAT (1895-98) described a molar collected in the Condeixa tuffs and travertines, at the lower levels of this unit (conglomerates). Photographs were sent by him to some distinguished paleontologists, i.e. Charles Depéret, who referred the specimen to *Elephas meridionalis*. However, Marcellin Boule and Pohlig classified it as an archaic *Elephas antiquus*. This opinion was adopted by Choffat.

References to portuguese quaternary elephants may be found at Édouard Harlé's memoir (HARLÉ, 1909/1910), but no further specimen was studied.

The opening of a water well at Casal do Torquato near Carregado afforded some *lamellae* of one molar that were submitted to Eduardo Hernández-Pacheco, who hesitated between *Elephas meridionalis* and *E. antiquus*. R. S. PINTO (1931) ascribed this molar to *Elephas meridionalis* cf. *antiquus*.

In 1941, Georges ZBYSZEWSKI (1943) collected some bones from an elephant (apparently killed by man) at the banks of a channel near Santo Antão do Tojal. A femur and a tibia were found in association with mousterian flint artifacts, an horse tooth and a coprolithe, reportedly from hyaena. Thirty years later, a phalanx (likely from the same individual) was found there again (ZBYSZEWSKI, 1977a). The same author produced some further references to a fossil elephant from Mealhada (ZBYSZEWSKI, 1977 b).

Until now, however, a single synthesis on the portuguese fossil elephants has been published (ZBYSZEWSKI, 1943). This paper deals with a revision of the previously known material and the description of some additional specimens.

LOCALITIES AND THEIR GEOLOGICAL SETTING

Elephant remains have been found at the following sites[(*) caves; (+) terraces from the Mondego, Tagus or tributaries (Fig.1)], whose age is given in brackets:

- Mealhada (+) (Riss interstadial)
- Condeixa (+) (probably Mindel-Sicilian II interstadial)
- Conimbriga (+) (the same as Condeixa)
- Algar de João Ramos (*) (Würm IV, 14 170 ± 330 BP)
- Foz do Enxarrique (+) (33 600 ± 500 BP)
- Casal do Torquato (+) (Riss-Würm, Eemian)
- Carregado (motorway) (+) (as Casal do Torquato)
- Santo Antão do Tojal (+) (first Würm interglacial)
- Figueira Brava cave (*) (late Würm, 30 930 ± 700 BP)
- Santa Cruz (age not accurately known).

Mealhada

The discovery of fossil mammals near Mealhada, in alluvial deposits from the Certima river lower terrace, was made during water well digging (last quarter of the XIX th century) at several points. Somewhat later, excavations were carried on under the sponsorship of the Geological Survey (RIBEIRO, 1880; CHOFFAT, 1895-98).

In 1966 new collecting was done in the foundations of the "Adega Cooperativa da Mealhada" building. Stratigraphy has been described (ZBYSZEWSKI, 1977 b; ANTUNES *et al.*, 1988). Upper Acheulean artifacts indicate that the Mealhada deposits may be reported to the Riss, at least in part. However, the presence of *Hippopotamus* excludes a really cold

climate; this suggests instead that the fossil-bearing strata may be assigned to a Riss interstadial.

Condeixa

At Condeixa-a-Velha, near the ruins of the Roman town of Conimbriga, middle Jurassic limestones are overlain by some 5 to 6 meters of quaternary conglomerates with limestone elements, and these by a thick succession of calcareous tuffs and travertines. The latter define a platform at 100-110m.

A section was described by CHOFFAT (1894-95); he reported that an elephant molar was found (February 26th, 1894 at a point 700 m SW from Condeixa-a-Velha) in bed 2, i.e., the conglomerates.

Conimbriga

The upper stratigraphic unit of tuffs and travertines (beds 3 and 4 of the section described by Choffat; see Condeixa) also yielded fossils. Most of these are impressions of plant leaves. However, at the "Museu Monográfico de Conimbriga" is kept a fragment of a very large elephant tusk, not previously studied. No details are known about the precise point where it was found. It may tentatively be assigned to bed 4, calcareous tuffs in thick layers. This finding is certainly rather old, and is most probably related to the ancient excavations of the Roman town made under the direction of Vergílio Correia.

Algar de João Ramos

This site corresponds to part of the infilling of a karstic sinkhole in Jurassic limestones in the county ("concelho") of Alcobaça. Excavations were carried on by M.Vieira Natividade, who exploited the neolithic and calcolithic beds (NATIVIDADE, 1899-1903). Pleistocene infillings were exploited later (1909) by Romão de Sousa (CARDOSO & CARREIRA, 1990).

The bone - rich bed is overlain by reddish silty and argillaceous sediments, about 2 m in thickness, apparently devoid of fossils. A ^{14}C date has been obtained for the fossiliferous layer: ICEN-349-14 170 ± 330 BP (ANTUNES *et al.*, 1989).

Foz do Enxarrique

The Ribeira do Enxarrique is a small tributary of the right margin of the Tagus, close by Vila Velha de Rodão. A middle Paleolithic site is located just at the confluence. It has been excavated since 1982 and yielded large numbers of lithic implements and vertebrate remains. These materials have been found at

a bed with carbonate concretions related to a lower 5-10 m terrace of the Tagus. An elephant tooth lamella was recovered in 1985 (RAPOSO & SILVA, 1986), quite away from the area of maximum industries and fauna concentration (Raposo, personal communication), but it is contemporary of the remaining materials. The bed with concretions is covered by 6 meters of still pleistocene silts and sands (RAPOSO & SILVA, 1987). A U series date: $33\,600 \pm 500$ BP (RAPOSO, 1991), is in agreement with the terrace level chronology and indicates the survival of the elephant until the Würm III. It is the latest reference for *Elephas antiquus* in Europe.

Casal do Torquato

Two molar fragments accounted for by PINTO (1931) are from the same tooth as two additional ones secured later by H. da Costa Cabaço. All were found during the digging of a well at Casal do Torquato (Lugar da Torre, freguesia de Triana), i.e about 4 Km southeast of Alenquer (PINTO, id.) or 1.5 Km to the northeast of Carregado (ZBYSZEWSKI, 1943). This locality concerns a low terrace of the right bank of the Tagus, at about 12 to 15 meters, that may be ascribed to the last interglacial (Riss-Würm, Eemian).

The fossil was found 5 to 6 meters deep in a gravel and sandy bed with pebbles, overlain by yellow clays with carbonate and lying on black clays (ZBYSZEWSKI, id., p.105).

ZBYSZEWSKI (1943) recognized that the fragments kept at the Museu Mineralógico e Geológico, Faculdade de Ciências, Universidade do Porto, formerly studied by Pinto, as well as those from the Cabaço collection were parts of the same tooth. Zbyszewski persuaded Cabaço to offer the materials in his possession to the Museum of the Serviços Geológicos de Portugal, where they were mounted together with one of the lamellae described by Pinto (the second one apparently was not located by Zbyszewski).

Recently, M.T.Antunes could observe it at Oporto; Professor M.Lemos de Sousa agreed in letting the specimen be studied again. At last, we could ascertain that the two Cabaço's fragments correspond to both extremities of the tooth, whereas the lamellae studied by Pinto were from the intermediate part of the same molar (the 3d and the 4th counting from the distal end) (ZBYSZEWSKI, 1943, pl.III).

Carregado (motorway)

Construction work for the Lisbon-Oporto motorway ("Auto-estrada do Norte") near Carregado cut into the same terrace deposits referred to about Casal do Torquato. Large bone (elephant?) fragments were found, unfortunately too much broken to be of any use.

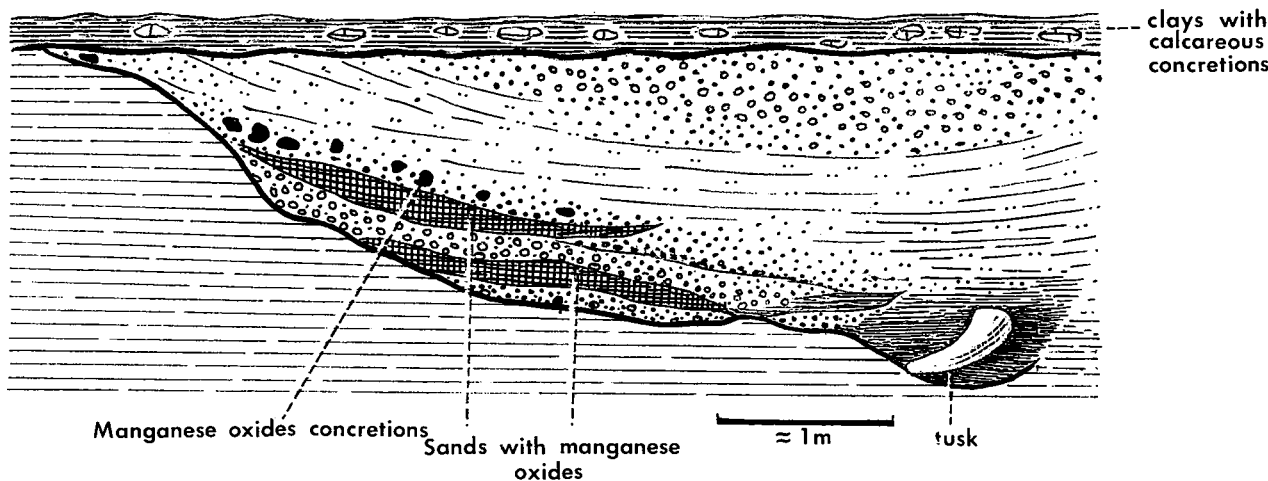


Fig. 1 - Carregado motorway section.

Between Vila Franca de Xira and Carregado, at the "trincheira da Meirinha", M.T. Antunes found (March 24, 1977) the tip of an elephant tusk (the only part that was exposed). Excavation was carried on the next day, by Antunes with help from O. da Veiga Ferreira, J. C. Pais, J. César Lopes and José Relvas. The specimen was isolated but almost complete. It lied on the bottom of a channel cut in mostly clayey terrace deposits. No other fossil was found close by; only a rather atypical quartzite flake was collected there.

Santo Antão do Tojal

The former "Junta de Hidráulica Agrícola" promoted some draining works at the Baixa de Loures depression, situated to the Northeast of Lisbon. A channel was cut in sediments from the lower (5 to 8 meters) terrace that limits to the North this depression, whose infillings are mainly modern alluvium.

In the channel banks, ZBYSZEWSKI (1943) collected in 1941 at several points some elephant and other mammalian remains. The main point is located 1080 meters South 27° West from the church of Santo Antão do Tojal.

Much later, ZBYSZEWSKI (1977a) reported new findings at the same point, including a 1st phallanx, maybe from the same individual.

Elephant remains were in association with stone implements, among which two small silex flakes stuck into a femur. Hence it is possible that an elephant was killed and torn apart there, so it could possibly be expected to find some further bones nearby.

No radiometric date was obtained; a bone fragment sent to the Southern Methodist University (Dallas, USA) for U - series dating failed to yield reliable results.

Figueira Brava cave

Figueira Brava cave is located at the southern versant of the Arrábida chain, at about 700 meters W

of the Portinho da Arrábida old fortress. As now, it is a cave opened in Miocene biocalcarenes, but it probably was a rock-shelter at middle Paleolithic (upper Mousterian) times. Stratigraphy is quite simple. Sands rich in shells and bone fragments brought in by man and in stone implements, dated from between 30 and 31 thousand years BP (¹⁴C, U series), directly overlie marine, Tyrrhenian III conglomerates. In the outer, exposed parts the sands are calcite-consolidated into a hard breccia.

Mousterian sands are overlain by stalagmite deposits. At some points they are mixed up with much later deposits with Roman amphorae fragments and patina-less shells and some bones.

Paleolithic fauna is varied. It includes a few neanderthalian and many mammal remains (either large carnivores and other species hunted by man, and small mammals mostly brought in by owls), more than 30 species of birds, other vertebrates, crustaceans and mollusks (also collected for food by humans).

A more detailed account has been given (ANTUNES, 1992). Among the animal bones there are a few elephant tooth fragments.

Correlation with the well known rock shelter of Devil's Tower, Gibraltar, seems well established.

Santa Cruz

At Santa Cruz, near Santiago do Cacém, an elephant's unciform was found at the surface. Stratigraphy cannot be clearly recognized. However this specimen is possibly related to pleistocene deposits that outcrop in this region-mainly rosy, sometimes brownish or red sands and gravels, eventually showing black mineralisations by manganese oxides, lying upon Lias and Dogger formations (ZBYSZEWSKI, 1977a, p.133).

DESCRIPTION

The elephant remains known so far in Portugal may be ascribed to *Elephas antiquus* and *Mammuthus primigenius*. A complete lamella from Catujal (near

Sacavém, to the Northeast of Lisbon), whose exact provenience is unknown, has been referred to by CHOFFAT (1895-98), PINTO (1931) and ZBYSZEWSKI (1943). It is kept at the museum of the Serviços Geológicos de Portugal. As the last author states, it belongs to a modern elephant maybe brought in by Romans and therefore is not a fossil at all. Indeed, a distinct loxodont sinus and grossly wrinkled enamel strongly point out to *Loxodonta africana*. Hence no further reference will be made in this paper.

Order Proboscidea ILLIGER, 1811
 Family Elephantidae GRAY, 1821
 Genus *Elephas* L., 1758

Elephas antiquus FALCONER & CAUTLEY,
 1847
 (Pl. 2, figs. 1-3; Pl. 3, figs 1-4; Pl. 4, fig. 3)

Localities

Mealhada

Several tooth and bone fragments are kept at Serviços Geológicos de Portugal, in Lisbon and at the Museu Mineralógico e Geológico, Coimbra University (ZBYSZEWSKI, 1943, 1977b). The most important specimen, a molar, was referred to by C. RIBEIRO (1880, 1884) and reported in his paper to *E. antiquus* according to Albert Gaudry and Charles Depéret (photographs having been submitted to them); however this specimen seems to be lost longtime ago and was not seen by Zbyszewski.

The same author (ZBYSZEWSKI, 1977b) ascribes all the Mealhada specimens to *E. antiquus*, but he did not justify his viewpoints.

In our opinion, the enamel is too thin (about 2 mm) and too minutely wrinkled in an adult molar tooth lamella to belong to *Mammuthus meridionalis*. Age and climate data concerning Mealhada also exclude *M. primigenius*. Hence we corroborate the determination as *E. antiquus*.

Condeixa

The specimen kept at the Serviços Geológicos de Portugal museum is poorly preserved. ZBYSZEWSKI (1943) regarded it as a molar, without more details. Indeed it is a lower right M₁ or M₂, uncomplete at its mesial part. Small enamel "islands" are present since the 4th rear lamella. Poor preservation does not allow us to recognize whether loxodont sinus are present.

The measurements (in mm) and other data* are as follows (conventions as in AGUIRRE, 1968-1969):

Maximum length (L)	221.1
Operational functional length (LF)	166.0
Max. width (A)	72.0
Max.funct.width (AF)	72.0
Height (H)	20.5
Enamel thickness (e), n=3	2.2
Number of lamellae as preserved (T)	9.5*
Number of functional lamellae (U)	9.5*
Functional laminar index, Q=100 U/LF	5.7*

Length measures are not of much interest. Other ones were compared to those given by AGUIRRE (1968-1969) for *M. meridionalis* and *E. antiquus*. The most interesting are those concerning enamel thickness (e). These, the hypsodony index ($K=H/A$) and maximum width (A) show that the Condeixa tooth clearly belongs to *E. antiquus*. The functional laminar index corroborates this conclusion.

Furthermore, enamel is much more wrinkled than in *M. meridionalis*, where it also is much thicker. Different wrinkling was regarded by MAZO (1989) as very important in separating *M. meridionalis* from *E. antiquus*.

Although evidence leaves no doubt about the inclusion of Condeixa's specimen in *E. antiquus*, several parameters are unconvulsive. This also explains the difficulties that previous paleontologists had in classifying it, and may eventually justify that the tooth could belong to a primitive form of *E. antiquus* (an hypothesis presented by ZBYSZEWSKI, 1943). The same hypothesis may be reinforced if the fossiliferous Condeixa basal conglomerate can indeed be correlated to the Mindel interstadial, immediately after *E. antiquus* first appearance in Europe (KURTÉN, 1968).

Conimbriga

The only specimen, a fragment of a tusk, is kept at the Museu Monográfico de Conimbriga.

The tusk fragment is but near half of a longitudinal section with the following measurements (in mm):

Length	158
Maximum transverse diameter	160
Distal part transverse diameter	153

The alveolar cavity is close. By comparison, this fragment may correspond to the proximal (alveolar) third of the tusk.

The specimen is not suitable for precise identification. However, probable Mindel age and relationship to the nearby Condeixa locality with *Elephas antiquus* strongly suggest that the Conimbriga specimen may also be reported to this species.

Algar de João Ramos

A fragment of femur (?) with plentiful bite marks has been reported to an undetermined elephant by ZBYSZEWSKI (1943). The specimen belongs to the collection of the Serviços Geológicos de Portugal museum, Lisbon.

This bone fragment seems to have been brought into the sinkhole by a large carnivore.

This is the latest elephant fossil in Portugal, in the present state of our knowledge (see 2; about 14 000 BP). Age is apparently much too late to be compatible with *E. antiquus*.

Foz do Enxarrique

The only specimen, an unworn lamella from an upper molar, is kept at the Museu Nacional de Arqueologia.

On the mesial side there is a vestigial lamella like that of the Casal do Torquato molar.

Measurements (in mm):	
Maximum height (H)	131.2
Max. width (A) in the lower half of the tooth-	56.1
Enamel thickness (e) - n=3	2.47

Enamel thickness falls among the values for *Elephas antiquus* (cf. AGUIRRE, 1968-1969). Wrinkling also is in agreement with this classification.

Casal do Torquato

Material: a single right molar, one lamella being kept at the Museu Mineralógico e Geológico, Faculdade de Ciências, Universidade do Porto and all the remainder ones at the Museum of the Serviços Geológicos de Portugal.

The molar is almost complete, but the last (distal) lamella is lacking. Abrasion is slight; only the three mesial lamellae and the remaining part (about half) of the foremost one are worn. The specimen as it is preserved has ten and a half lamellae.

Each of the two intermediate worn lamellae shows a distal proeminence in the middle part that may suggest the presence of a median sinus.

Measurements (in mm) and other data (*) for the whole specimen as reconstructed (references as in AGUIRRE, 1968-1969) are as follows:

Maximum length (L)	150.0
Max. functional length (LF)	38.0
Max. width (A)	62.5
Max. functional width (AF)	42.3
Max. height (H)	126.4
Number of preserved lamellae (T)	10.5*
Number of functional lamellae (V)	3.5*
Enamel thickness (e) - n=3	2.06
Functional lamellar index (Q)	8.3*

ZBYSZEWSKI (1943, p.79) regarded the specimen as a last molar from a rather evolved *Elephas antiquus*. Indeed it is a right upper M¹⁻² (more probably a M¹). After comparison with the data from AGUIRRE (1968-1969) we can fully corroborate the attribution to *E. antiquus*. It may even be reported to an evolved morphotype of this species, if account is taken of the enamel thickness and of its minute wrinkling. This is also in agreement with the geological age of the specimen, definitely much younger than the less evolved morphotype represented at Condeixa.

Carregado (Motorway)

Material: a nearly complete left tusk kept at the Centro de Estratigrafia e Paleobiologia da UNL (INIC) at Monte de Caparica campus. Only a small part of the tip is wanting. Pulpar cavity is almost entirely preserved.

The tusk is gently and regularly curved, which is typical of *Elephas antiquus*.

Measurements (in mm):	
Overall length (accompanying the curve)	1800
Transverse anterior (distal) diameter	58
Dorso-ventral anterior (distal) diameter	58
Transverse posterior (proximal) diameter	149
Dorso-ventral post. (prox.) diameter	180
Diameters from the prox. end at 500, 750, 1000, 1250, 1500 and 1750 mm	
transversal	133 127 111 106 94
dorso-ventral	153 139 127 123 105 ca 72 (*)

(*) Tip was repaired (plaster).

Santo Antão do Tojal

Material: a right femur (about two-thirds collected in 1941 and the remainder about 1970 - see ZBYSZEWSKI, 1977 a) and a proximal half of a left tibia, both ascribed by this author (*loc. cit.*) to the same individual; a first phalanx, collected about 1970. Several bone fragments from the same locality may also be ascribed to elephants. The whole collection is kept at the Serviços Geológicos de Portugal museum, in Lisbon.

The above referred bones have been ascribed to *Elephas antiquus* by ZBYSZEWSKI (1943). No further data suggest any different classification.

Santa Cruz

Material: a left unciform collected by R. Jaquemay (unknown date). Museum of the Serviços Geológicos de Portugal, Lisbon.

Measurements (in mm) are compared in TABLE I with data from BEDEN (1975, tabl.11):

		<i>E. antiquus</i>		<i>M. meridionalis</i>			<i>M. trogontherii</i> and aff.					<i>M. primigenius</i>		
Localities	Santa Cruz	Chatelard	Durfort	Senèze	Leffe	Mosbach		Sranska	Skala	Steinheim	Skaratri	Baulou		
Length	149	150	130	130	123	128	137	165	150	165	187	161	152	151
Width	131	145	125	125	---	109	122	130	137	131	151	131	122	123
Height	120	133	133	133	---	111	128	132	124	108	135	134	126	129
Anterior height	97	99	---	117	103	84	95	115	---	---	---	72	95	93

Our measurements are not identical to those presented by ZBYSZEWSKI (1977 a), who reported the bone from Santa Cruz to *E. antiquus*, without justifying his determination. After the comparisons established here we are not in measure to support or contradict Zbyszewski's attribution to *Elephas antiquus*; after measurements only, comparisons do not seem conclusive and do not allow a clear distinction of the involved forms.

Genus *Mammuthus* (BURNETT, 1850)

Mammuthus primigenius (BLUMENBACH, 1799)
(Pl. 4, figs. 1-2)

The presence of *Mammuthus primigenius* in Portugal was previously denied. It is a fact that elephant remains are not common, and most ones may be ascribed to *Elephas antiquus*. Nevertheless a few remnants from Figueira Brava cave and Algar de João Ramos may be reported to the woolly mammoth after their geological conditions and age.

Figueira Brava cave

A lamella fragment has been found at bed 2 (Antunes & Cardoso in ANTUNES, 1992). It is kept at the "Centro de Estratigrafia e Paleobiologia da UNL (INIC)", at Monte de Caparica campus.

The specimen is reduced to the upper part of a definitive molar; it is not abraded at all.

Enamel thickness is of about 2.0 mm; this value closely compares that of a lamella from Mealhada (*E. antiquus*), and approximately falls between the values given by E. AGUIRRE (1968-1969, fig. 45, 46) for *E. antiquus* and *M. primigenius*. However, in Figueira Brava specimen enamel is more intensely wrinkled; this character points out to *M. primigenius*. This conclusion is corroborated by radiometric age (ca 31 000 BP), since no *E. antiquus* remains are known in deposits of that (too modern) age.

CONCLUSIONS

In this paper are revised elephant materials collected in Portugal and studied some new speci-

mens from Carregado/motorway, Foz do Enxarrique and Figueira Brava cave or hitherto undescribed ones from Conimbriga and Algar de João Ramos. Our conclusions are the following ones:

1) By systematic and geological age order we identified the following taxa:

Elephas antiquus (early form):

— Condeixa terrace conglomerate, ca 70 meters; possibly Mindel.

Elephas antiquus (maybe the same early form):

— Conimbriga, the same terrace; of the same age or slightly younger than the Condeixa specimen.

Elephas antiquus:

— Mealhada, reported firstly to the Riss (TEIXEIRA, 1944), to the Mindel-Riss interglacial (ZBYSZEWSKI, 1943), and later to the Riss-Würm or to the first half of the Würm (ZBYSZEWSKI, 1977b); we reported it probably (at least in part) to a Riss interstadial (ANTUNES *et al.*, 1988).

— Casal do Torquato, Carregado (motorway), 12-20 meters terrace; Riss-Würm interglacial.

— Santo Antão do Tojal, 5-8 meters terrace; first Würm interstadial.

— Foz do Enxarrique - 5-10 meters terrace of the Tagus river. U series age is 33 600 ± 500 BP, which corresponds to the latest occurrence known in Europe.

Mammuthus primigenius: the remains described indicate the presence of this species. For the first time the presence of *M. primigenius* in Portugal is recognized at two caves (cave occupation was correlated with colder climate events — see ANTUNES *et al.*, 1989):

— Figueira Brava cave; Würm III, ca. 31 000 BP.

— Algar de João Ramos; Würm IV, about 14 000 BP, the last elephant occurrence so far known in Portugal. Even if the femur fragment is not suitable for accurate determination it must belong in *M. primigenius* since it was the only species surviving in Europe at these times.

- 2) Our results are in agreement with current views about Iberian Peninsula being the last refuge for surviving *Elephas antiquus* (B. KURTÉN, 1968), its last presence corresponding to the Würm I/II (E. AGUIRRE, 1968-1969). We have demonstrated their survivance until ca. 33 000 BP, the last occurrence.
- 3) We confirm that the lamella from Catujal is a modern one and may be ascribed to *Loxodonta africana*; it has to be eliminated from Portuguese fossil record.

ACKNOWLEDGEMENTS

We thank the following institutions and persons:

- Serviços Geológicos de Portugal, and Prof. M. Magalhães Ramalho who allowed us to study the specimens at this museum;
- Museu Mineralógico e Geológico from the Science Faculty, University of Oporto, and Prof. M. J. Lemos de Sousa, who kindly lent us the Casal de Torquato lamella in that collection.
- Museu Monográfico de Conimbriga and its Director, Dr. A. Alarcão, by the facilities granted to us in studying the tusk fragment kept at this museum.
- Mr. L. Raposo, from the Museu Nacional de Arqueologia, who allowed us to study of the Foz do Enxarrique specimen.
- Serviço Nacional de Parques e Conservação da Natureza, and Parque Natural da Arrábida for financial assistance that contributed to our excavations at the Figueira Brava cave.

REFERENCES

- AGUIRRE, E. (1968/69) — Revisión sistemática de los Elephantidae por su morfología y morfometría dentaria. 1ª, 2ª e 3ª Partes. *Estudios Geológicos*, 24, pp. 109-167; 25, pp. 123-177, 317-367.
- ANTUNES, M. T. (1992) — O Homem da Gruta da Figueira Brava (ca. 30 000 BP)/ Contexto ecológico, alimentação, canibalismo. *Memórias da Academia das Ciências de Lisboa*, Classe de Ciências, t. XXXI (1990-1991), pp. 487-536, 6 fig., 3 est.
- ANTUNES, M.T.; CABRAL, J.M.P.; CARDOSO, J.L.; PAIS, J. & SOARES, A.M. (198) — Paleolítico médio e superior em Portugal: datas ¹⁴C, estado actual dos conhecimentos, síntese e discussão. *Ciências da Terra* (UNL), 10, pp. 127-138.
- ANTUNES, M.T.; CARDOSO, J.L. & FAURE, M. (1988) — Présence de Hippopotamus incognitus au Portugal et remarques sur les sites quaternaires de Mealhada. *Comunic. Serv. Geol. Portugal*, 74, pp. 165-172.
- BEDEN, M. & GUÉRIN, C. (1975) — Les proboscidiens (Mammalia) du gisement pléistocène moyen des Abîmes de la Fage à Noailles (Corrèze). *Nouv. Arch. Mus. Hist. Nat.*, Lyon, 13, pp. 69-87.
- CARDOSO, J.L. & CARREIRA, J. R. (1990) — O espólio arqueológico do Algar de João Ramos (Alcobaça). *Actas das IV Jornadas de Associação dos Arqueólogos Portugueses* (no prelo).
- CHOFFAT, P. (1895/98) — Note sur les tufs de Condeixa et la découverte de l'hippopotame en Portugal. *Comunic. Serv. Geol. Portugal*, 3, pp. 1-12.
- KURTÉN, B. (1968) — Pleistocene mammals of Europe, 303 p., *Weidenfeld & Nicholson*, London.
- MAZO, A. (1989) — Nuevos restos de Proboscidea (Mammalia) en la cuenca de Guadix - Baza. Trabajos sobre el Neogeno - Cuaternario (MNCN) 11 — *Geología y Paleontología de la cuenca de Guadix - Baza*, pp. 225-234.
- NATIVIDADE, M. VIEIRA (1899-1903) — Grutas de Alcobaça. *Portugália*, 1(3), pp. 433-474.
- PINTO, R. SERPA (1931) — Sobre "*Elephas meridionalis*" cfr. "*antiquus* do Casal do Torquato" (Alenquer). *Anais da Faculdade de Ciências do Porto*, 17, pp. 104-106.
- RAPOSO, L. (1991) — Campanha de escavações arqueológicas no sítio da Foz do Enxarrique. *Alto Alentejo*, 9, pp. 1-2.
- RIBEIRO, C. (1880) — Discours du Secrétaire du Congrès. C.- R. Congrès International d'Anthrop et d'Archéol. *Préhistorique, 9ème Session* (Lisboa, 1880), pp.12-18 (1884).
- RIBEIRO, C. (1880) — Des formations tertiaires du Portugal. *Comptes-rendus du Congrès International de Géologie* (Paris, 1878), pp. 205-214.
- TEIXEIRA, C. (1944) — A estação arqueológica da Mealhada e a sua cronologia. *Trabalhos da Sociedade Portuguesa de Antropologia e Etnologia*, Porto, 10 (11), 20 p.
- ZBYSZEWSKI, G. (1943) — Les éléphants quaternaires du Portugal. *Comunic. Serv. Geol. Portugal*, 24, pp. 71-94.
- ZBYSZEWSKI, G. (1971) — Carta Geológica do Quaternário de Portugal na escala de 1/1000 000. Notícia explicativa. *Serv. Geol. Portugal*, 39 p.
- ZBYSZEWSKI, G. (1977a) — Três ossos de vertebrados quaternários. *Comunic. Serv. Geol. Portugal*, 61, pp. 191-194.
- ZBYSZEWSKI, G. (1977b) — Nova contribuição para o conhecimento da jazida quaternária da Mealhada. *Memórias e Notícias*, 84, pp. 1-37.

**DOCUMENTAÇÃO
FOTOGRAFICA**

PLATE 1

Fig. 1— Trancheira da Meirinha, near Carregado. General view of the site. The elephant tusk was found at the point where people are gathered.

Fig. 2 — The same site, detail showing a channel with the elephant tusk at its bottom.

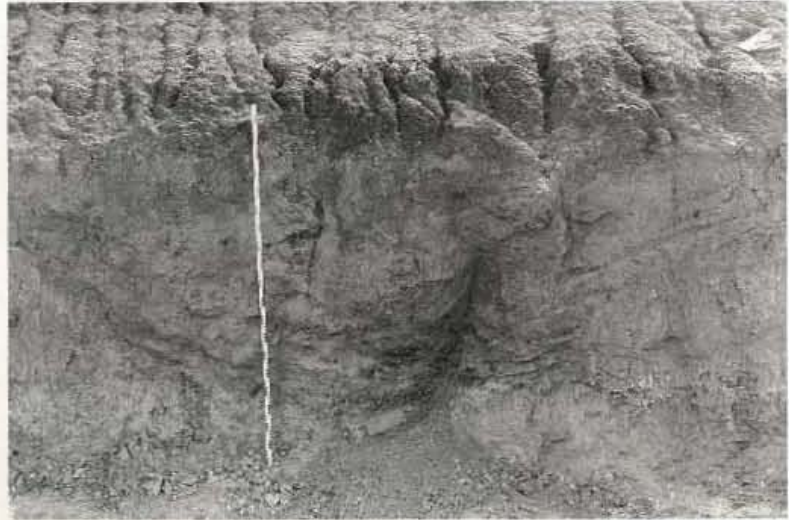
Fig. 3 — The same site: the tusk during excavation. Minimum scale divisions: 1 cm.

Fig. 4 — O. da Veiga Ferreira finishing the protective plaster coating of the tusk before being removed.

PLATE 1



1



2



3



4

PLATE 2

Fig. 1—*Elephas antiquus*. Uncomplete right M1 or M2, occlusal and lingual views. Casal do Torquato. Col.: Serviços Geológicos de Portugal.

Fig. 2—*Elephas antiquus*. Left tusk, internal view. Trincheira da Meirinha, near Carregado, Lisbon Oporto highway. Col.: CEPUNL.

Fig. 3—*Elephas antiquus*. Uncomplete lamella from the same molar as fig. 1, distal and lingual views. Casal do Torquato. Col.: Museu e Laboratório Mineralógico e Geológico, Faculdade de Ciências da Universidade do Porto.

PLATE 2

0 2cm

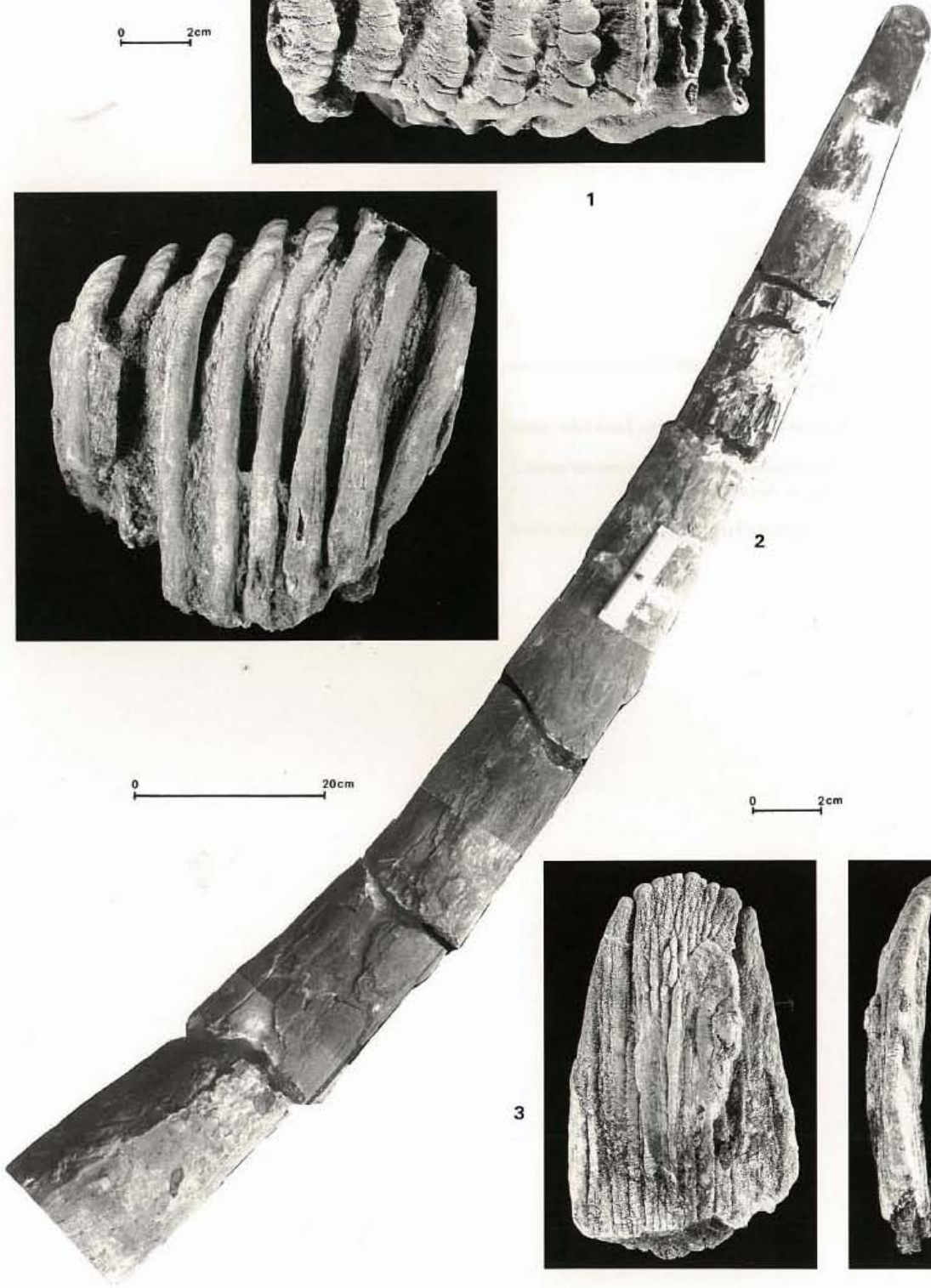


1



0 20cm

2



0 2cm

3



PLATE 3

Fig. 1—*Elephas antiquus*. Uncomplete lamella, underterminate molar, distal and lateral views. Mealhada. Col.: Serviços Geológicos de Portugal.

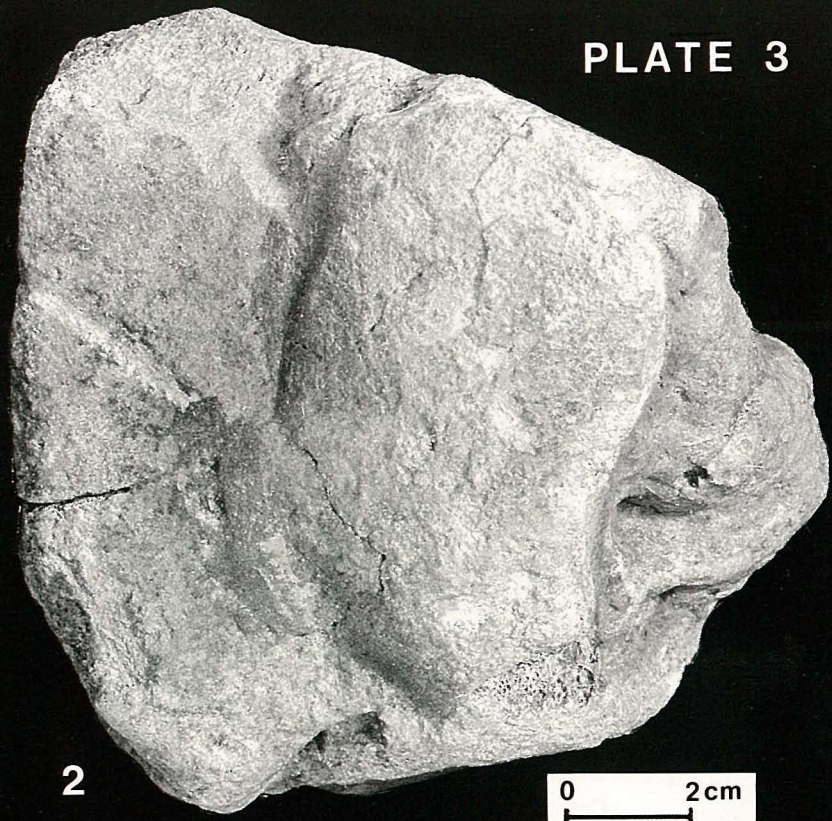
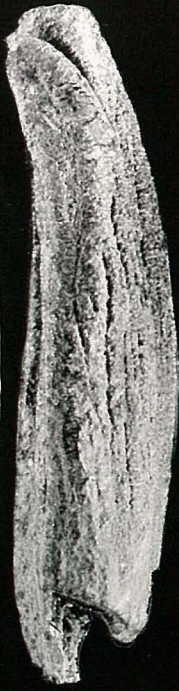
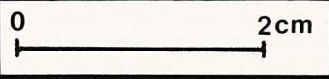
Fig. 2 — *Elephas antiquus*. Left unciform. Santa Cruz (Santiago do Cacém). Col.: Serviços Geológicos de Portugal.

Fig. 3 — *Elephas antiquus*. Lamella, undeterminate molar, lateral and distal views. Foz do Enxarrique. Col.: L. Raposo, Museu Nacional de Arqueologia.

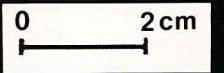
Fig. 4 — *Elephas antiquus*. Fragment of decidual molar, distal and occlusal views. Mealhada. Col. Serviços Geológicos de Portugal.



1



2



3



4

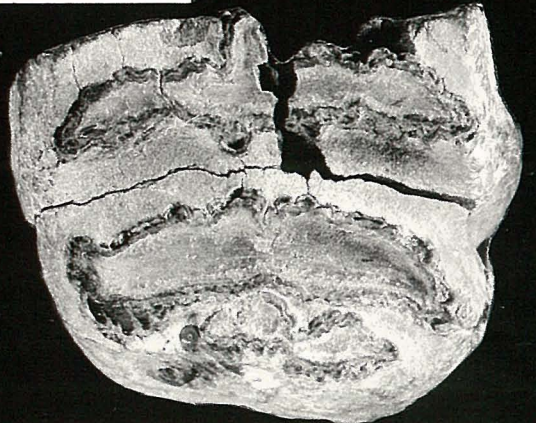
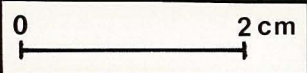


PLATE 4

Fig. 1 — *Mammuthus primigenius*. Uncomplete right femur; anterior view; shaft much gnawed by hyaenas. Algar de João Ramos. Col.: Serviços Geológicos de Portugal.

Fig. 2 — *Mammuthus primigenius*. Uncomplete lamella, undeterminate molar, lateral and distal views. Gruta da Figueira Brava. Col.: CEPUNL.

Fig. 3 — *Elephas antiquus*. Right lower M/1 or M/2, occlusal and labial views. Condeixa. Col.: Serviços Geológicos de Portugal.



Alma de la
Hoy
1907
Quinta
Sociedad

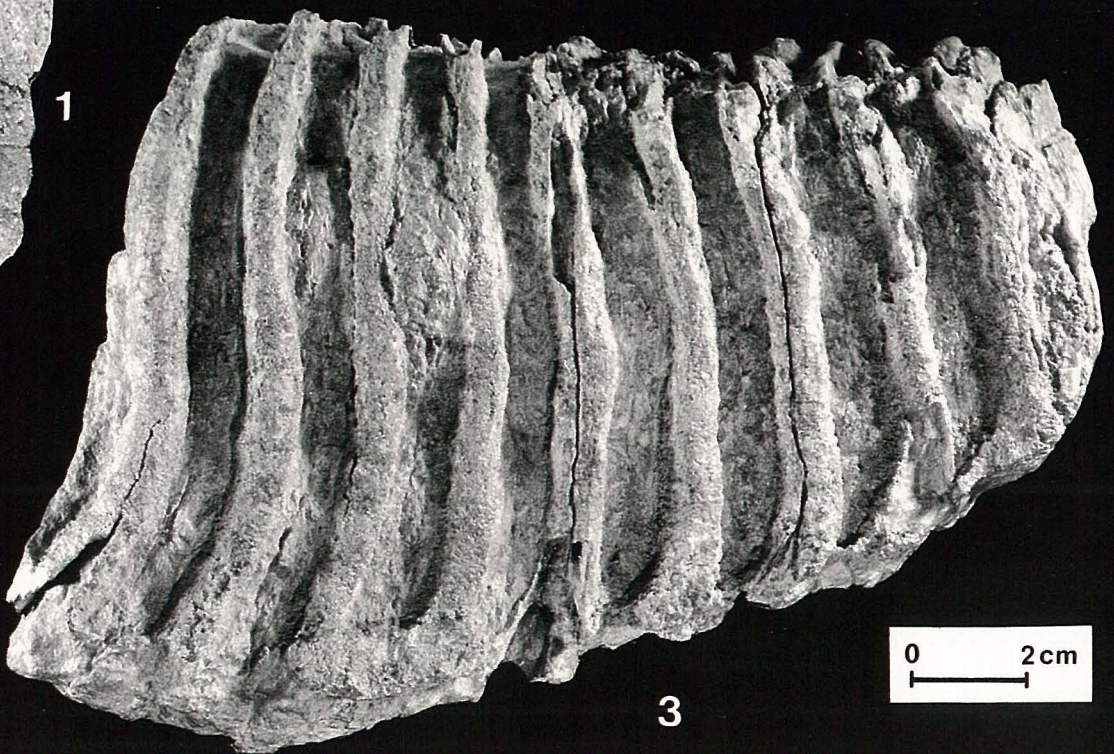
1

0 4 cm



2

0 2 cm



3

0 2 cm