

## What knowledge did the Minoans have of elephants? Phaistos graters and Zakros tusks

Sevket SEN & Martine FAURE





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Une coupe avec râpe du site minoen de Phaistos et une défense d'éléphant trouvée dans les ruines de Zakros en Crète (conservées au Musée archéologique d'Héraklion). Crédit: S. Sen / *A grater from the Minoan site of Phaistos, and an elephant tusk from the ruins of Zakros in Crete (both preserved at the Archaeological Museum of Heraklion). Credits: S. Sen.*

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# What knowledge did the Minoans have of elephants?

## Phaistos graters and Zakros tusks

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### ABSTRACT

The present study is based on two observations: the presence of a type of Minoan vessel at Phaistos and Agia Triada, and the elephant tusks found in the storeroom of the Palace of Zakros, three sites in Crete. The examination of these objects allowed us to develop two hypotheses. The first concerns the cups called “grater”, which include inside an element that served as rasp. The shape and surface of the rasp are surprisingly reminiscent of the outline and the design of the masticatory surface of elephant molars. This led us to revisit the fossil elephants of this island and to look for the degree of similarity between the elephant molars and the design of some rasps from Phaistos and Agia Triada, dating from *c.* 1800-1700 BC. The second hypothesis relates to the provenance of elephant ivory, used in Crete from *c.* 1600 BC to manufacture many precious objects (seals, plaques, figurines, statuettes, etc.), based on the raw elephant tusks found in a storeroom at Zakros, and dated to 1500-1450 BC. The morphological comparison of these tusks with those of fossil elephants from Crete and the extant species from Asia and Africa, as well as the examination of palaeontological, archaeological, iconographic and epigraphic data, allow us to suggest the attribution of the tusks of Zakros to *Elephas maximus* Linnaeus, 1758 which lived in the Levant until around 1200 BC. This affinity would deserve to be supported by microstructural and isotopic analyses.

### KEY WORDS

Minoan graters,  
elephant tusks,  
Crete.

## RÉSUMÉ

*Quelle connaissance les Minoens avaient-ils des éléphants? Les râpes de Phaistos et les défenses de Zakros.* La présente étude s'appuie sur deux observations: la présence d'un type de vaisselle minoenne à Phaistos et Agia Triada, et l'examen des défenses d'éléphants retrouvées dans les réserves du Palais de Zakros, trois sites en Crète. L'analyse des caractéristiques de ces objets nous a permis de développer deux hypothèses. La première concerne un type de vaisselle appelé «grater». Il s'agit de coupes comportant un élément servant de râpe. La forme et la surface de la râpe rappellent étonnamment la forme et le dessin de la surface masticatrice des molaires d'éléphant. Ceci nous a conduit à revoir les éléphants fossiles de cette île et à rechercher le degré de similitude entre les molaires d'éléphant et les râpes de Phaistos et Agia Triada, qui datent de *c.* 1800-1700 BC. La seconde hypothèse se rapporte à la provenance de l'ivoire d'éléphant, utilisée en Crète à partir d'environ 1600 BC. Les Minoens ont utilisé l'ivoire pour fabriquer de nombreux objets précieux (sceaux, plaquettes, figurines, statuettes...), mais son origine reste inconnue. Que peuvent dire à ce propos les défenses d'éléphant brutes trouvées à Zakros? La comparaison de leur morphologie avec celle des éléphants fossiles de Crète et actuels d'Asie et d'Afrique, ainsi que l'examen des données paléontologiques, archéologiques, iconographiques et épigraphiques, nous permettent de suggérer l'attribution des défenses de Zakros à *Elephas maximus* Linnaeus, 1758 qui a vécu au Levant jusque vers 1200 BC. Ce résultat mériterait d'être étayé par des analyses microstructurales et isotopiques.

**MOTS CLÉS**  
Râpes minoennes,  
défenses d'éléphant,  
Crète.

## INTRODUCTION

The great civilization that flourished in Crete during the Bronze Age was popularized by Evans (1921) as the Minoan civilization, after the name of the legendary king of Crete, Minos. He also first coined the Minoan chronology and subdivided it into three main periods: the Early Minoan (3100-2000 BC), the Middle Minoan (2000-1600 BC) and the Late Minoan periods (*c.* 1600-1075 BC), which are in turn subdivided in subperiods such as EM I, EM II, EM III, etc. Levi (1976) presented a comparative table of ten different proposals, including his own, which consists of a division in “Palatal” periods. Over the course of a century, archaeologists have preferred the one or the other of these chronologies, and above all considerably improved the precision of their durations and limits. Our intention is not to discuss the accuracy of this or that chronology. We take as a reference the chronology published by Knappett (2020) which seems to be the consensus today. The above dates and others mentioned in the text refer to this book.

The Minoans produced a great variety of ceramics of exceptional beauty. Among this abundant production our interest has focused on some clay cups known as graters. These are bowls of a certain size used in the kitchen to extract the juice from fruits and vegetables thanks to a rough oblong protuberance inside them. Pernier (1935: 394) is apparently the first author to mention the discovery of such cups at Phaistos, to describe and to interpret them as basins “used for domestic use and specifically for grating or kneading”. Later on, several other cups of that kind have been found at Phaistos in particular during the excavations led by Doro Levi in the 1950s and 1960s. Two of these graters are on display at the Archaeological Museum of Heraklion. Their label indicates that they are “Clay ‘graters’ for juicing fruits (...) Phaistos, 1800-1700 BC”. The shape and ornamentation of their rasps

bear a striking resemblance to the molars of dwarf elephants well known in Crete from many Pleistocene sites (Bate 1905, 1907; Simonelli 1908; Kotsakis 1980; Poulakakis *et al.* 2002; Van der Geer *et al.* 2010; Sen 2017; Athanassiou *et al.* 2019; Lyras *et al.* 2022). Indeed, Crete and many other Aegean islands hosted dwarf elephants during the Pleistocene, and also during the Holocene in Tilos Island near the Anatolian coasts, where dwarf elephants survived till about 3.5 thousand years BC (Theodorou *et al.* 2007; Masseti 2009; Athanassiou *et al.* 2019; Lyras *et al.* 2022).

Is this a convergence of form? The shape and the design of the rasping surface suggest that the pottery artisans of Phaistos may have been inspired by the pattern of the masticatory surface of elephant molars to make these graters. This leads us to question: did the Minoans know the last dwarf elephants of the island, or did they collect their fossils?

The Minoans also used elephant ivory to make decorative or functional items (statuettes, plaques, inlays, seals, etc.). Ivory workshops are known in several Minoan cities. The origin of elephant ivory for the manufacture of these objects in Crete has been the subject of numerous morphological, iconographic and epigraphic studies, without reaching a consensus on the question. What do the raw tusks found at Zakros tell us about this?

## THE GRATERS OF PHAISTOS

Excavations carried out over the course of more than a century in the Minoan city of Phaistos have led to the discovery of several hundred pots and all kinds of clay vessels. Among them a few ceramics named “graters” are very peculiar in their shape and content. Pernier (1935: 238, fig. 114) was the first to discover and to report on these clay ceramics. Other graters were found during Levi's excavations from the 1950s onwards



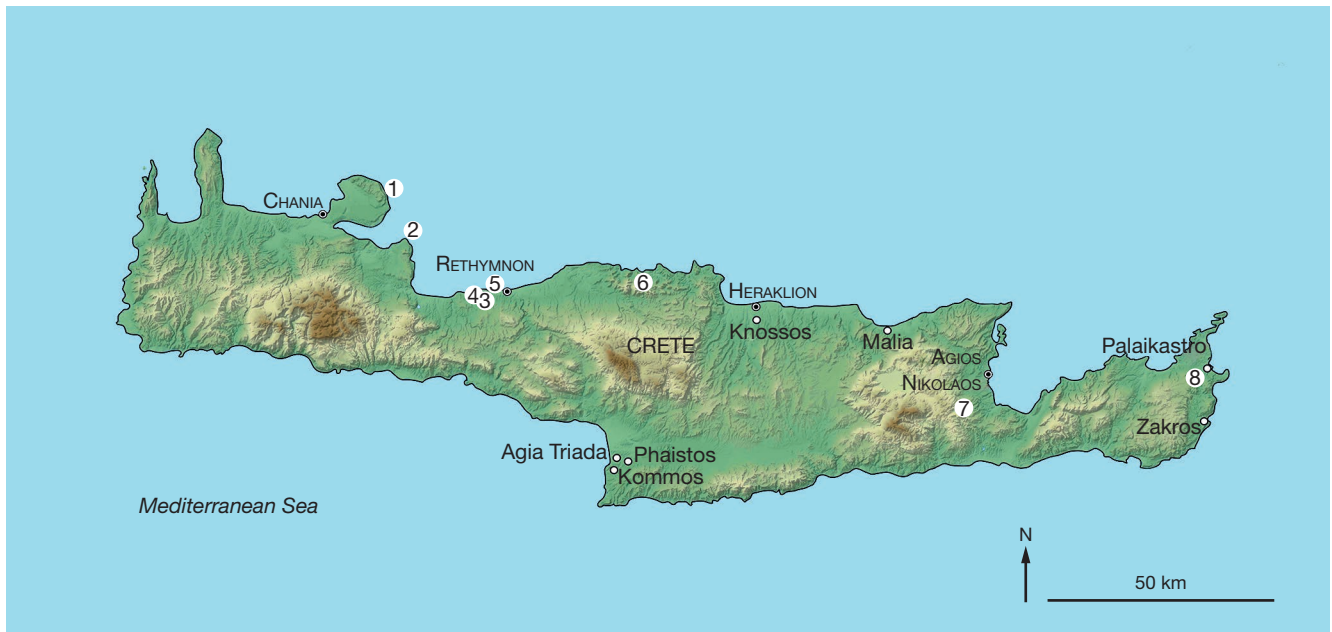


FIG. 1. – Simplified map of Crete with the main Minoan sites mentioned in the text, and main localities with elephantid remains: 1, Cape Maléka (*Mammuthus creticus* (Bate, 1907)); 2, Vámos Cave; 3, Coumbes Cave (*Palaeoloxodon chaniensis* (Symeonidis, Teodorou & Gianopoulos, 2000)); 4, Simonelli Cave; 5, Rethymnon fissures; 6, Kaló Choráphi Cave; 7, Katharó Plateau; 8, Karoumbes Cave (*Palaeoloxodon creutzburgi* (Kuss, 1965)). For a more detailed map of Minoan sites, see Driessen & Langohr 2014; Watrous 2021: p. 90; for palaeontological sites which yielded elephantid fossils, see Poulakakis et al. 2002; Iliopoulos et al. 2010; Athanassiou et al. 2019.

(Levi 1955, 1958, 1976). These pots have no decorative aspect and were apparently kitchen utensils, for grating fruits and vegetables to extract the juice. It appears that this type of graters was apparently found only at Phaistos, except for one from Agia Triada (Girella 2005), another Minoan site about two kilometers northwest of Phaistos (Fig. 1). They were all made of semifine-coarse reddish clay (Antonello 2022: 281). The graters of Phaistos are from the latest Middle Minoan period (Levi & Carinci 1988; Antonello 2022).

The clearest definition of such vessels was done by Antonello (2022: 287): “The grater is a vessel with a peculiar shape, generally made up of a basin and, inside this, a protruding element characterized by some protuberances arranged in rows, which constitute a grater. It is attested at Phaistos in deposits of MM IB and MM IIB. This type of vessel was probably used in the preparation of food; the presence of a drain on some of these basins allows us to hypothesize their use for liquid substances”. To be clear, in the following pages, the whole vessel will be called the *grater*, and the element inside with protuberances is the *rasp*. We can distinguish three types of graters depending on the form and thickness of the protuberance (Fig. 2).

The first type of graters has rasps that are unmistakably reminiscent of the molars of dwarf elephants from Crete. Two examples of this type are particularly characteristic. A bowl-shaped grater, restored and exhibited at the Archaeological Museum of Heraklion, was initially described by Pernier (1935: 293, fig. 171). Its inventory number is C 5825, its diameter 22 cm, and its depth 9.5 cm. This is a hemispherical cup, made of a soft clay, having a trapezoidal element inside, inclined from the edge towards the centre (Fig. 2A). It has a

horizontal handle close to the upper rim on the one side, and opposite to it a pouring spout. It is of a beige-pink colour with three internal bands of dark decoration. The rasp is stuck on the bottom, placed close to the handle in a slightly oblique manner. Its surface is wide on the handle side and narrows towards the centre of the basin, and it measures 12.5 × 6.5 cm, with a vertical thickness of about 4.5 cm. The seven rough stripes of its surface, each about 10 mm wide, are separated by flat bands as grooves. The stripes are not worn, indicating that the vessel was not used much. The shape and surface of the rasp closely recalls a molar of elephantid from Katharó Plateau in Crete (Fig. 3C).

The second example of this type is a “boat shaped” grater, initially illustrated by Levi (1976: 133, pl. 140d), Levi & Carinci (1988: 222, fig. 49), and Antonello (2022: pl. 34, fig. 653). Its inventory number is F 1412, total length 28.8 cm, length without handle 25.6 cm, width 15.8 cm, and height 6.7 cm (Levi 1976: 133; Antonello 2022: 235). It is made of dark beige and semi-fine grainy clay, it has an ellipsoidal outline with rounded rims, a vertical handle set between the rim and the external wall, opposite of which is a pouring spout, and, in the basin, a central horizontal rasp of ellipsoidal outline (Fig. 2B). The rasp measures 10.2 × 5.1 cm on its surface, and its height is about 4.5 cm. The surface of the rasp bears eight rough transverse stripes, each about 6 mm wide, separated by seven flat interstripe bands wider than the rough stripes, and one smooth area on each end. The rough stripes are relatively worn, demonstrating that this object was used for grating or rasping. As on the previous one, the rasp of this grater closely recalls the chewing surface of a lower molar of an elephant (Fig. 3D).



FIG. 2. – Two graters from the Minoan site of Phaistos at the Archaeological Museum of Heraklion: **A**, Round grater (C 5825) with a rasp slightly inclined toward the basin center; **B**, boat-shaped grater (F 1412) carrying a rasp in the middle the surface of which bears rugged rows separated by smooth intervals. Credits: S. Sen



FIG. 3. – Comparison of the rasps of Minoan graters with dwarf elephant molars from Crete: **A**, The rasp of the round grater from Phaistos at the Archaeological Museum of Heraklion (C 5825); **B**, the rasp of the boat-shaped grater from Phaistos at the same museum (F 1412); **C**, occlusal view of a molar of *Palaeoloxodon creutzburgi* (Kuss, 1965) from Katharó Plateau in Crete. For Poulakakis *et al.* (2002: fig. 3), it is right second upper molar, whilst Herridge (2010: 125, fig. 4.9) identifies this specimen as “a left lower M3, based on wear and curvature”; **D**, occlusal view of a left third lower molar of *P. chaniensis* (Symeonidis, Teodorou & Gianopoulos, 2000) from Coumbes Cave in Crete. Note the resemblances of pattern between A and C, and B and D. Credits: A, B, S. Sen; C, Herridge 2010: fig. 4.9; D, Symeonidis & Theodorou 1982: plate V, coloured by L. Cazes.

The second type of graters from Phaistos, round or ellipsoid in outline, have been described and occasionally illustrated by Levi (1958: 234, figs 57d, 58; 1976: 81, 120, fig. 99, pl. 140), Levi & Carinci (1988: 222, 223, fig. 49, pl. 95), Tzedakis & Martlew (1999: 96, 97, pls 68, 69) and Antonello (2022: 158, 235, 269, 287, 346, pls 11, 34, 41). The size and shape of the bowl are as in the previous type; however, they differ in having the rasp not as a protuberance, but a thickening of the wall of the cup. The rasp element consists of an inclined extra-thick wall which extends from the edge to the bottom of the bowl, close to the handle, and it bears five bands of rugged stripes, separated by flat

bands (Fig. 4B, E-G). The pattern of the rasp calls once more elephant molars in some extant. The unique grater found at Agia Triada (Girella 2005: 399, fig. 40) is similar to the second type graters.

A third type of grater from Phaistos was reported by Pernier (1935: fig. 114) and another one by Levi (1955: 412, fig. 41; 1976: pl. 140a, c) (Inv. F 2056, height 10.5 cm, diameter 26.5 cm) from the 1953-1957 excavations. Pernier's illustration shows an incomplete cup, 9.5 cm high, while the grater illustrated by Levi (1955; 1976) is oval in shape, exactly like F 1412 described above (Fig. 4A, C). Both graters consist of a bowl containing a central or wall-displaced protuberance,



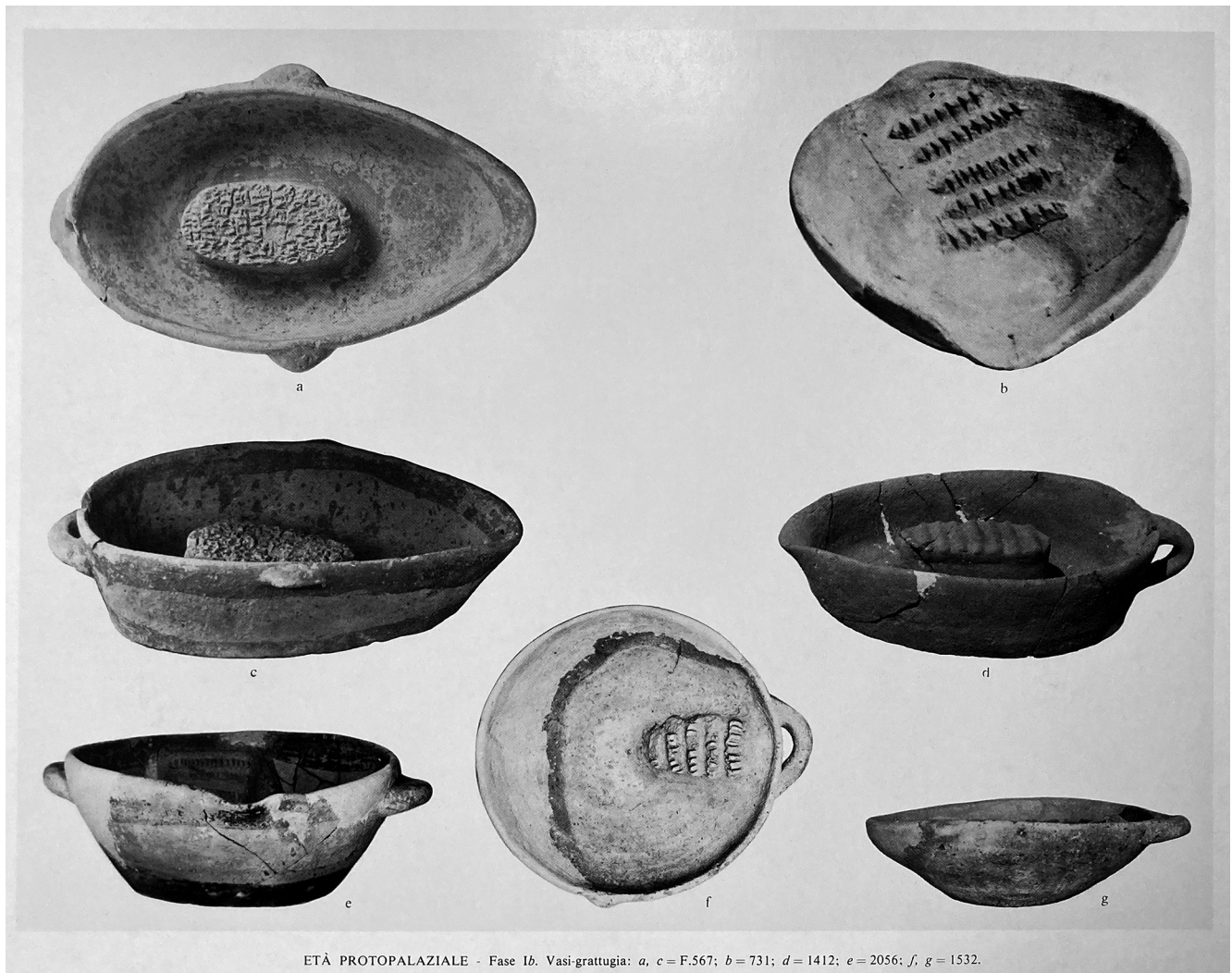


FIG. 4. – Minoan graters of Phaistos from the Protopalatial Period MM IIB illustrated by Levi (1976: pl. 140). Note the differences in the general shape of the graters, the place and the type of rugosity of the rasp surfaces.

as in the first type graters. The difference is that the surface of the protuberance is covered with cupules, not with alternating rough and smooth bands.

In summary, graters are rare among the countless pottery vessels found in the ruins of Phaistos. They were probably used as kitchenware for grating fruits and vegetables and extracting juice. Some of them have a protuberance or rough surface that are strangely reminiscent of elephant molars or at least the form and the pattern of their occlusal surface. It must be emphasized that these graters date from the Protopalatial period during which elephant ivory was unknown in Crete. This observation leads us to wonder if the Minoan potters knew of the dwarf elephants of Crete, or at least the fossils of their molars, to draw inspiration in the design of these kitchen utensils. The Minoan civilization flourished on Crete for almost two thousand years and used its resources, and in particular its soil to extract clay and to make potteries. While digging in the ground, the Minoans certainly saw the remains of fossil mammals, the most prominent and abundant of these being elephants, the remains of which are

now known from more than thirty localities (Poulakakis *et al.* 2002; Iliopoulos *et al.* 2010).

On the other hand, the Minoan art shows how Minoan artists and artisans were excellent observers of the natural world. As already noted by Evans (1921), the “Minoan naturalism” frequently used animal or plant figures in wall paintings (e.g. Immerwahr 1990), seal imprints (e.g. Krzyszkowska 2005; Karnava 2019; Panagiotopoulos 2021), barbotin ceramics (e.g. Foster 1982), in the shape and decoration of jars, jugs, bowls, and so on. The shapes of many pots are inspired of animal forms (birds, reptiles, mammals; see Betancourt 2007; Poursat 2008; Legendart 2020; Poursat & Knappett 2022; Anderson 2024) the vessel, seals or frescos are often decorated of *mise en scène* of faunal or floral elements. In summary, there is a prevalence of skeuomorphy in Minoan pottery because vessels containing models of birds, mammals or flowers are not uncommon (Knappett 2020), in addition to anthropomorphic forms (Anderson 2024). To support our hypothesis on the resemblance of the rasps with elephant molars, it is appropriate to give an overview on Cretan dwarf elephants.

## ELEPHANTS IN CRETE AND NEIGHBORING ISLANDS

It was at the very beginning of the 1900s that an English palaeontologist Dorothea Bate (1878-1951) and a professor of geology at the University of Bologna, Vittorio Simonelli (1860-1929) discovered fossil bones in caves along the northern coasts of Crete, and they both described elephant remains (Bate 1905, 1907; Simonelli 1908). They noted remarkably small size of these elephants compared to their continental relatives. Some decades ago, Hugh Falconer (1868) and A. Leith Adams (1870) have reported on fossil bones of a very small elephant from Malta, *Elephas melitensis* Falconer, 1868. After these pioneer studies, the notion of dwarfism was born for mammals adapted to island conditions, and it became a subject of debate and controversy throughout the 20th century. Later on, fossils of endemic mammals have been found in many other sites in Crete, and some were the subject of detailed studies. Also, in the meantime, remains of more or less dwarf elephants have been discovered in several other islands of the Aegean realm such as Astypalaia, Delos, Kasos Kythera, Kythnos, Naxos, Rhodes, Tilos... (Lyras *et al.* 2022).

During the Pleistocene, before the introduction of other mammals by humans, Crete and several other Aegean islands were home to unbalanced faunas, composed of a limited number of species (elephants, hippopotamus, deer and murids), and lacking terrestrial carnivorans. As initially noted by Sondaar & Boekschoten (1967), Dermitzakis & Sondaar (1978), Sondaar & Dermitzakis (1982) and Dermitzakis & De Vos (1987), these mammals reached the islands, in particular Crete, by swimming or drifting.

In Crete, over thirty sites have yielded remains of dwarf elephants (Dermitzakis 1977; Dermitzakis & De Vos 1987; Poulakakis *et al.* 2002; Iliopoulos *et al.* 2010; Van der Geer *et al.* 2010; Sen 2017; Athanassiou *et al.* 2019; Lyras *et al.* 2022). Three species are recognized. The smallest and the oldest is *Mammuthus creticus* (Bate, 1907), only recorded from Cape Maléka in western Crete (Fig. 1). Herridge & Lister (2012) estimated its average body mass at about 310 kg and its shoulder height at 1.13 m. *M. creticus* apparently reached Crete during the first migration wave of land mammals during the Early Pleistocene (Mayhew 1977, 1996), i.e. c. 0.9 million years ago (Reese *et al.* 1996; Sondaar & Van der Geer 2005; Herridge 2010; Van der Geer *et al.* 2010; Van der Geer & Lyras 2011). The molars of this species have wide lamellae and in reduced number compared to the other Cretan elephantid species. For instance, its M3 has five lamellae as on the graters illustrated by Levi (1976: pl. 140b, f), reported here in Figure 4. Its tusk is unknown.

The second elephant species is *Palaeoloxodon creutzburgi* (Kuss, 1965). It is the most common elephant since it has been recognized in about twenty localities in every part of the island. Several jaw fragments, cheek teeth, tusks and postcranial bones were referred to this species (see synthesis in Lyras *et al.* 2022). Lomolino *et al.* (2013) estimated its body mass as 38 % of its ancestor *Palaeoloxodon antiquus*

(Falconer & Cautley, 1847), i.e., about 2600 kg, while for Burness *et al.* (2001) the body mass of this species was about 3200 kg. Amino Acid Racemization and Electron Spin Resonance methods applied on hippopotamus and deer bones and teeth from Katharó Plain, Simonelli Cave and Bate Cave, and on a femur of *P. creutzburgi* from Simonelli Cave yielded ages with very wide range, from c. 24 000 to 951 000 years (Reese *et al.* 1996), this showing the need to carry out new dating to define the time interval of this species. Its dental and skeletal features recall the European straight-tusked elephant *P. antiquus*, which inhabited Europe and Western Asia during the Pleistocene, c. between 900 and 33 000 years ago (Sousa & Figueiredo 2001; Mol *et al.* 2007; Stuart & Lister 2012; Palombo 2017). The first and second molars of *P. creutzburgi* have six to eight lamellae, eight to 12 lamellae in lower third molar and eight to nine lamellae in the upper third molar (Sen 2017). The surface of the Phaistos rasps closely resembles the occlusal pattern of the molars of this species (Figs 2, 3). Its tusks are known from the Simonelli Cave near Rethymnon (Kotsakis 1980), and an unpublished almost complete tusk from the same area is on display at the Palaeontological Museum of Rethymnon. They are thin (maximum diameter about 50 mm), hardly curved and slightly flattened. The size and shape of these tusks are different from those of Zakros (see below).

The third and largest elephant species from Crete is *Palaeoloxodon chaniensis* (Symeonidis, Theodorou & Gianopoulos, 2000). Its type locality is the submerged Cave of Vámos, near Chania. The authors also included in this species a mandible from the Coumbes Cave near Rethymnon (Symeonidis & Theodorou 1982; Symeonidis *et al.* 2000: 106) diagnosed this species as “Endemic elephant of relatively large dimensions about 20 % smaller than continental *P. antiquus*”, and they estimated its size close to the extant Asian elephant, with a shoulder height of about 3-3.5 m and a body mass about 3200 kg. Symeonidis *et al.* (2001) calculated its age as about 18 000 years because the entrance of the Vámos Cave is 10 m below present sea level, but this age should be taken with caution.

We are aware that several authors (Poulakakis *et al.* 2002; Van der Geer *et al.* 2010; Athanassiou *et al.* 2019; Lyras *et al.* 2022) considered *P. chaniensis* a junior synonym of *P. creutzburgi*, arguing that there is a large overlap in size as in many other modern and fossil Proboscideans, and the size and morphological differences may be due to intra-specific diversity.

The Palaeontological Museum of Rethymnon exhibits a partial composite skeleton bearing complete tusks, and other cranial and postcranial remains, from several localities near Rethymnon, including the Coumbes Cave. These specimens were not studied. The illustrations in Symeonidis *et al.* (2000, 2001) and our observations on the material preserved at the Rethymnon Museum show that all these remains belonged to an elephant larger than *P. creutzburgi* and its molars have a larger number of lamellae than those of *P. creutzburgi*. As shown in Figure 5, the tusks of this ele-





FIG. 5. – A partial composite skeleton of *Palaeoloxodon chaniensis* (Symeonidis, Teodorou & Gianopoulos, 2000) from the fossiliferous sites near Rethymnon, Crete, as exhibited at the Palaeontological Museum of Rethymnon (bottom left) and its tusks. The second tusk is displayed in a showcase and pasted to the original photo. Credits: S. Sen.

phant are almost rectilinear, slightly curved upwards, and their thickness does not change much along the tusk, except at their tips, and they are larger (maximum diameter about 100 mm) than those of *P. creutzburgi*, of which two tusk fragments from Simonelli Cave were described by Kotsakis (1980) and other tusks are in display at the Rethymnon Museum. The published data and our preliminary observations on the material exhibited at the Rethymnon Museum lead us to suggest that the fossils referred to *P. chaniensis* are larger than those of *P. creutzburgi*, and the morphology of the tusks and molars differs from that of the latter species. The systematics of Cretan elephants are out of the scope of the present study, but it is important to emphasize that this question deserves a detailed analysis of the remains already available for both species before concluding on the status of these taxa.

The contemporaneity of the last elephants of Crete with the Minoans is not documented. Neither the Holocene sediments of Crete nor the archaeological sites have yielded any remains that could be attributed to dwarf elephants. Also, the elephant is totally absent in Minoan art, with the

exception of ivory used to make utilitarian or decorative objects. No statuette, seal imprint or painting represent elephants, and no text mentions them (Vanschoonwinkel 1996; Legendart 2020). In the Aegean realm, one exception comes from the island of Kos: Brown (1926: 535) reported a “small elephant tooth, identified as a milk molar of *Elephas antiquus* (...) found among the pieces of statuary and figurines in the ruins of the famous Asklepieion”. This is the only fossil elephant remain found in an archaeological context in the Aegean region. Once more the question arises: what did the Minoans know about fossil and modern elephants?

Since the Paleolithic, people from various cultures have been interested in fossil vertebrates and invertebrates, that were formerly called *curiosa*, and have collected them and sometimes transported them over great distances (Tassinon 2005). It is very likely that the Minoans recorded the remains of fossil elephants and were particularly interested in their molars and their tusks for inspiration and why not possibly for carving. Unfortunately, in the literature that we have been able to consult, no archaeologist mentions the discovery of fossil elephant remains in the Minoan sites.

Some archaeologists have questioned the possibility of working fossil ivory to make objects. Bégouen (1932) showed that replicas of Upper Paleolithic statuettes from Dolní Věstonice in the Czech Republic are done of fossil ivory, thus demonstrating the possibility of its carving. Also, many small Campaniform ornaments such as beads or buttons from Bell Beaker tombs in Spain indicate that they were manufactured from the tusks of *Palaeoloxodon antiquus* (Liesau von Lettow-Vorbeck 2016, and references therein). *A priori*, we cannot exclude the use of fossil ivory, even occasionally, for the manufacture of some objects.

## ORIGIN OF THE ELEPHANT TUSKS OF ZAKROS

Minoan craftsmen used elephant ivory for the manufacture of precious objects such as seals, plaques, amulets, figurines or statuettes (Krzyszkowska 1981, 1990; Hemingway 2000; Krzyszkowska & Morkot 2000; Poursat 2008, 2018). The origin of the elephant ivory (both zoological and geographical) has been discussed by several authors (Krzyszkowska 1981, 1983, 1988; Barnett 1982; De Hoff 1988; Hayward 1990; Krzyszkowska & Morkot 2000; Kelder *et al.* 2018; Poursat 2018). The possibility that elephant ivory was imported from Asia or Africa is often mentioned. However, in the Minoan iconography and epigraphy elephants are totally absent. What is clear is that elephant ivory begins to appear in Minoan art with the Neopalatial Period, i.e., c. 1600 BC or a little earlier (Poursat 2018). Where does this ivory come from? Could a comparison of Zakros' tusks with those of African and Asian elephants help us to suggest a hypothesis?

The Minoan site of Zakros, in the far east of Crete (Fig. 1), yielded four elephant tusks during the 1963 excavation season in the storeroom XI next to the palace (Platon 1971, 1985: fig. p. 61). They are dated to the Neopalatial Period, c. 1500-1450 BC (Platon 1988). Two of the Zakros tusks are restored and are on display at the Heraklion Museum (Fig. 6). The one is preserved on 45 cm, and its maximum diameter is about 10 cm (catalog F-I-GI, no. 7; Platon 1988). The second tusk is almost complete (catalog F-I-GI, no. 6; Platon 1988), its length on the external face is approximately 113 cm and its maximum diameter at the base 14.5 cm. These tusks are well curved, their diameter refines from the base towards the tip, and their section is rather round. More detailed descriptions of the Zakros tusks and illustrations can be found in Platon (1971, 1985: fig. p. 61; 1988: pl. 19), Krzyszkowska (1981: pls 23, 24), and Masseti (2012: fig. 21). Platon (1988: 69) notes that "Their pointed ends are blunt and they are strongly curved, but are not very long (...) This particular type of curved and short tusk probably comes from Syria. This view is suggested by the discovery of copper ingots in the same place, perhaps coming from Cyprus. It is probable that these unworked materials were simultaneously imported to Zakros during one commercial journey in the area of the SE Mediterranean coasts".

These tusks cannot belong to any of the fossil elephants of Crete, because their size, curvature and the shape of their section are different. They only may belong to the African or Asian elephants, and consequently imported from North Africa or the Levant. We have to note that the tusks of African and Asian elephants cannot be securely distinguished based on their apparent morphology (Hooijer 1978). The African elephant *Loxodonta africana* (Blumenbach, 1797) occupied territories in North Africa until historical times. As for Egypt, its remains have been found both in natural sites (Kasr Es Saga-Fayum, Dakhla Oasis, El Nabta Basin, or Jebel Ouenat in the Western Desert) and in the tombs of Hierakonpolis, all older than 3000 BC (Friedman 2004; Van Neer *et al.* 2004; Manlius 2008). They are also abundantly represented in engravings in many sites north of the Sahara. Le Quellec (2021) presented a synthesis of ancient and recent discoveries of rock art in North Africa, and as for elephants, he concluded that the number of elephant engravings decreases from 4000 BC to disappear completely around 2000 BC. These observations do not support an African origin for the Zakros tusks.

A subspecies of the Asian elephant, *Elephas maximus asurus* Deraniyagala, 1950 (see Deraniyagala 1955; here below Syrian elephant) was roaming in the Middle East during the Bronze Age, at least until 1200 BC (Lenormant 1873; Hooijer 1978; Bökönyi 1985; Caubet & Poplin 1987, 2010; Becker 2005; Lister *et al.* 2013; Vila 2015; Yar *et al.* 2016) or until the 8th or 7th century BC (Pfälzner 2013, 2016; Çakırlar & İkrām 2016). Its remains are found in natural and archaeological sites, and it is also documented with the pictorial and textual evidence. For instance, its remains are abundantly unearthed from the sediments of an ancient lake named Gavur Gölü in southeastern Turkey (Albayrak & Lister 2012; Yar *et al.* 2016). Although three skeletons from this site are exhibited at the museums of Maraş, Ankara and İzmir, its tusks are unknown, the tusks on the mounted skeletons being fake resin tusks (Ebru Albayrak and Fabio Parenti, pers comm., February 2024). The rather complete tusks are only found at Alalakh-Tell Atchana (Hatay Province, Turkey; Woolley 1955), while other sites have only yielded tusk fragments, molars and bones. The two complete Alalakh tusks have a length of 160 and 140 cm, respectively (Woolley 1955: 404). Their size, upward curvature and progressive tapering toward the apical end recall that of the Zakros tusks. Woolley (1955: 288) noted that "Niya [the capital of Niya Kingdom on the Orontes River], which formed part of the territories of the king of Alalakh, was the elephant-reserve of north Syria and the source of commercial ivory (...) destined for export to Anatolia, the Aegean, Phoenicia, or Egypt to pass through the Amuq plain".

A fresco from the tomb of Rekhmire, grand vizier of Thutmose III (1481-1425 BC), has caused much ink to flow, in particular because there is a "small" elephant held on a leash by the Syrian emissaries (Davies 1944). This fresco bears five bands, the upper four represent, from top to bottom, the emissaries of Punt (approximately modern Somalia and Djibouti), Crete and/or the Aegean Islands, Nubia and Syria, the last band depicting the slaves. A Syrian emissary



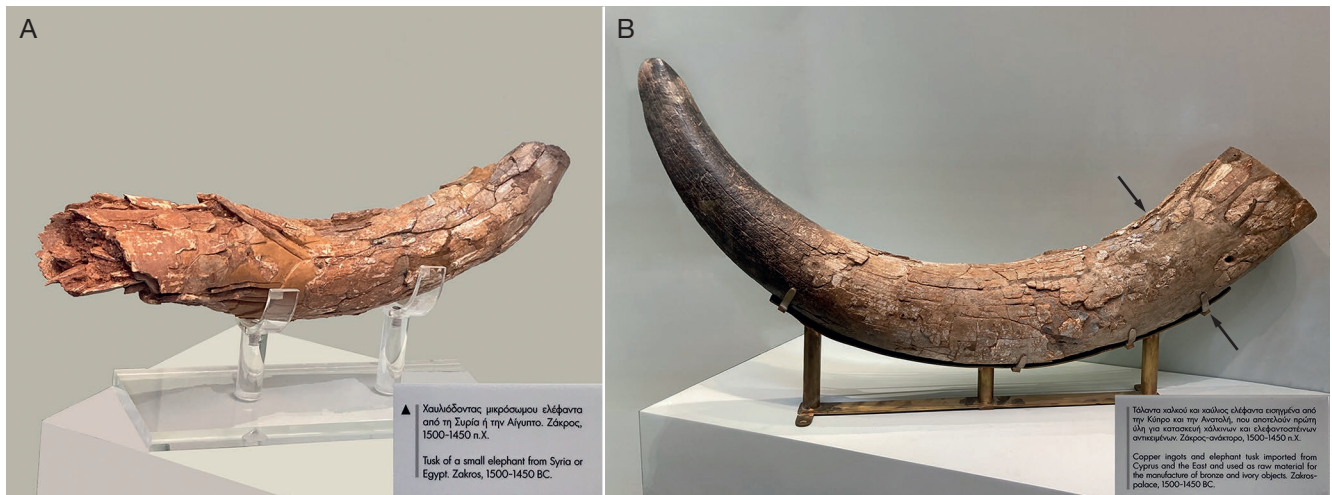


Fig. 6. – Two elephant tusks from Zakros, eastern Crete, on exhibit at the Archaeology Museum of Heraklion. Their labels indicate that they were imported from Syria or Egypt, and dated to between 1500-1450 BC. The arrows indicate the part of the tusk restored to remove the deformation of the basal part. Credits: S. Sen

pulls an elephant, and another carries two tusks to offer to the Pharaoh, in addition to other goods carried by other emissaries. This elephant is apparently adult, depicted in a reduced model for the needs of stylistic convention, but it does not mean that it was dwarf as some scholar seem to believe (Rosen 1994; Masseti 2001). In the same fresco one or more emissaries of all these peoples carry elephant tusks on their shoulders, including an emissary from Crete, to offer to the pharaoh of Egypt. In other words, this fresco does not faithfully represent the goods offered to the pharaoh coming from each of these regions, but an idealized representation of the prestigious goods offered to the pharaoh to solicit his benevolence towards these peoples.

Let us also recall the accounts of the hunting expeditions of Thutmosis III and Tiglath-Pileser I (1115-1077 BC) in Syria where the one has killed 120 elephants and the other slaughtered ten mighty male elephants and took four alive at the Khabur and Haran regions (Scullard 1974). All these data confirm Platon's (1971, 1985, 1988) opinion on the origin of the Zakros tusks: Syria or the Levant as a whole. Indeed, the Minoans traded with several port cities in the Levant and this is proven by the reciprocal exchange of objects and influences (Massa & Palmisano 2018; Poursat 2018).

However, this morphological and historical approach must be confirmed by microscopic examination of the microstructure of dentine, the shape of concentric growth lines (Lines of Owen), and X-Rays analysis to obtain evidence about absolute elemental concentrations, DNA analyses for phylogenetic relationships, or even stable isotope analyses that may reveal if they originated in Syria or Africa (Bass 1997; Trapani & Fisher 2003; Agiadi & Theodorou 2005; Nganvongpanit *et al.* 2016; Baker *et al.* 2020). All these characters differ more or less from one species to another, or even they vary from one population to another within the same species. Concerning the Zakros' tusks, and any other elephant ivory items found in Minoan sites, the application of these destructive methods cannot be currently envisaged.

## CONCLUSIONS

In this study, we aimed to shed light on some Minoan pots from Phaistos and raw elephant tusks found at Zakros in the light of palaeontological and archaeological knowledge. Among the thousands of ceramics found in the buildings from the Middle Minoan Period at Phaistos, there are a few kitchen vessels called graters. Most of them have inside the bowl a protuberant rasp the surface of which forms rugged bands separated by smooth lower bands or grooves, reminiscent of the pattern of elephant molars. The strong resemblance between these rasps and the molars of dwarfed fossil elephants of Crete leads us to hypothesis that the Minoans of this period could have discovered fossil elephant molars, and that the potters of Phaistos may have taken inspiration from them for the shape and the surface design of their rasps. This hypothesis is also supported by the fact that elephant ivory was not known in Crete during the Middle Minoan Period, and the importation and use of elephant ivory only began at the end of this period, around 1600 BC (Poursat 2018). Let us remember that elephant bones and teeth were never been found in Minoan settlements, and as noted by Krzyszkowska (1981) elephant molars are unsuitable for making objects.

Four elephant tusks were found in the ruins of Zakros Palace dating from the Late Minoan IB Period. In size, curvature and thinning towards the tip, they do not resemble tusks of any fossil elephants from Crete. Most archaeologists, based on the recovery of elephant remains in Levantine archaeological and natural sites, as well as iconographic and textual documents, argued for a Levantine origin of the Zakros tusks, consequently referred to *Elephas maximus asurus*, a subspecies of the Asian elephant that survived in this region until at least 1200 BC. Other archaeologists have suggested provenance via trade with Egypt by capitalizing on the regular commercial exchanges with the country of the pharaohs. The morphological similarities of these tusks rather support affinity with the Syrian elephant, complemented by iconographic and textual data, although this result must be confirmed by microstructural and isotopic studies.

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