

## A NEW LATE PLEISTOCENE MAMMAL LOCALITY FROM WESTERN CRETE

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### Abstract

*During the last five years systematic explorations of the Natural History Museum of Crete have added more than 20 Pleistocene fossil localities around Crete to the catalogue of the over 70 already known on the Island. The new localities are distributed in all four prefectures of Crete. The most important of these is the newly discovered site of Koutalas at Cape Drepano in Western Crete. The fossil remains are found in two levels and in red cemented clays of a collapsed cave. In the upper level a rich assemblage of micromammal, bird and large mammal remains has been discovered. The large mammals consist of dwarf hippopotamus (*Hippopotamus creutzburgi*) and elephants (*Elephas* sp.). A partly articulated skeleton (vertebral column, mandible and few long bones) of a dwarf hippo has been found next to a deciduous molar of an elephantid, indicating that the two taxa probably coexisted. The micromammal remains belong to the giant Cretan mouse *Kritimys catreus*. Therefore, the age of the assemblage is dated to the *Kritimys catreus* zone and thus to the late Middle Pleistocene. In the lower level scattered remains of deers, birds and micromammals have been identified, and their age is most likely younger than that of the upper level.*

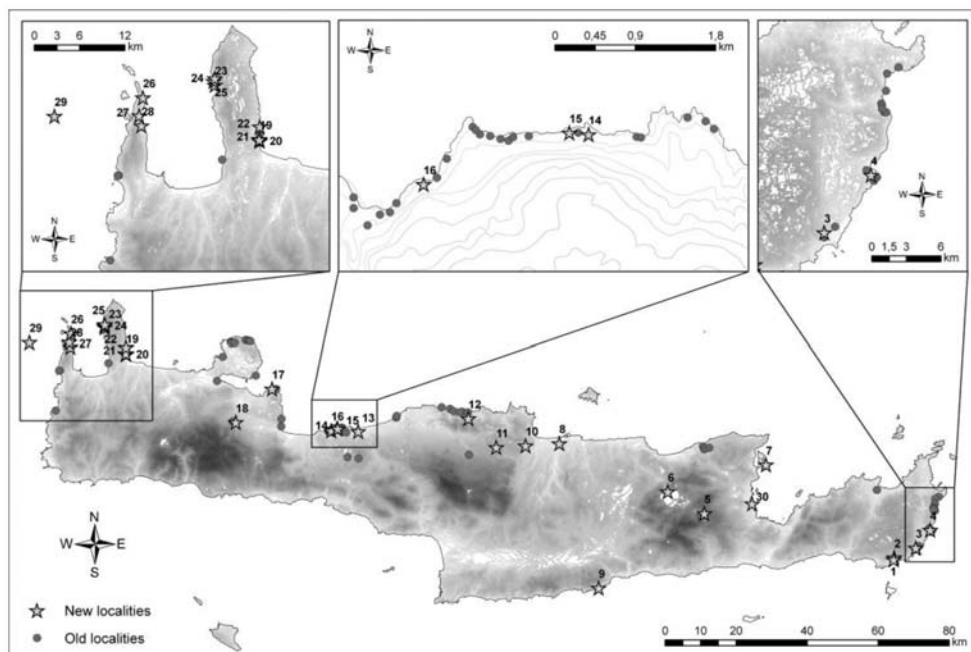
**Key words:** *Endemic island fauna, Pleistocene, dwarf hippopotamus, fossil mammals, Kritimys, Crete, Greece.*

### 1. Introduction

#### 1.1 General

In 1745, Pococke reported the first fossil bone findings from Crete Island, discovered in the Agios Georgios Cave (Akrotiri peninsula) in Western Crete. So, for more than 250 years the island has been widely acknowledged as an important and popular place for the study of endemic island faunas. All these years, several workers have surveyed the island, hunting out tens of Pleistocene fossiliferous localities (Fig. 1). In the mid nineteenth century Graves, Spratt and Raulin were those who discovered new fossiliferous sites, collected the first fossil remains from the island and handed them to well known palaeontologists of the time being for study (Owen, 1845; de Blainville, 1847; Lydekker, 1885). Based on their information almost half a century later, Simonelli (1907) and mainly Bate (1905), the latter has been proved fairly prolific, continued the surveys, discovering a significant number of new localities and most importantly they provided the first comprehensive accounts on the Pleistocene Cretan fauna. After the explorations of Simonelli and Bate the number of identified fossiliferous localities on the island was set to 16.

Again more than half a century passed before the scientific interest in the Cretan fossils was reheated.



**Fig. 1:** Simplified map of Crete Island showing the Pleistocene localities on the Island. The names of the numbered new localities are provided in Table 1. The positions of the old localities are based on the maps of Kuss (1970), Dermitzakis (1977), Lax (1996) and position information from Poulakakis et al. (2002), Theodorou et al. (2000), Symeonides et al. (2000).

During the 1960's and 1970's three groups of palaeontologists were working on the island performing systematic surveys and excavations. The first group was headed by the German S. Kuss, the second by the Dutch P. Sondaar. The third one consisted of Italian palaeontologists. Evidently, the two eminent scientists and their colleagues with their long term systematic work discovered numerous new localities, some of which were extremely rich in material and provided new important information on the Pleistocene fauna of Crete. As a consequence most of this material, until recently, was housed in the collections of several Museums and Universities in Western Europe. Recently, a significant part of the Dutch collection was given to the Historical Geology and Palaeontology department of the University of Athens and the Kuss collection, previously housed in the State Natural History Museum of Karlsruhe, was allowed to the Natural History Museum of Crete. In 1970 Kuss presented a catalogue with 36 fossiliferous localities and seven years later Dermitzakis (1977) enhanced the catalogue incorporating the new localities discovered in the 70s, and hence their number was raised to 64.

In the following years the active surveying on the island was significantly reduced and consequently the number of discovered new localities dropped. So, Lax in his 1996 gazetteer, where he reviews the Cretan Pleistocene localities, reports 71 localities; only seven new ones were added. Until recently only four more localities have been discovered, raising the total number of Pleistocene localities to 75 (Fig. 1). The 75 localities are distributed among three out of the four prefectures of Crete Island; 21 localities are found in Chania Prefecture, 34 in Rethymno Prefecture and 20 in Lassithi Prefecture (Fig. 1). Its worth noting that all these years no localities had been reported from the Herakleio Prefecture. Another interesting fact comes from the geographic distribution of the localities. The vast ma-

jority of the discovered sites are confined to the north coast of Crete, some to the east coast and only seven (out of 75) in the interior of Crete (Fig. 1). Most localities are associated with caves or other karstic structures and only an insignificant number of sites are situated in other depositional settings. Among all researchers that have worked in Crete, Kuss can be regarded as the most prolific concerning the number of discovered localities (more than 25 localities).

## 1.2 The Pleistocene Fauna from Crete

All these sites have yielded a plethora of fossils that reveal a very interesting island fauna. The Pleistocene endemic fauna of Crete is characterised as unbalanced once there is almost a total lack of carnivore mammals, with the exception of the endemic otter (*Lutrogale cretensis*), and the presence of mammals with proven swimming abilities. This filtering process indicates that the animals reached the island either by swimming or drifting (Dermitzakis and Sondaar, 1978). The fauna consists of a small number of amphibians and reptiles, several birds, 12 species of micromammals, and as the number of cervid species has not been resolved yet, around 10 large mammal taxa are estimated. According to Dermitzakis and de Vos (1987) the fauna can be separated into two biostratigraphic groups. This distinction is based upon the phylogeny of the Cretan murids as determined by Mayhew in 1977, and the presence of a different genus in each group. The two groups correspond to the *Kritimys* zone and the *Mus* zone, which are split further into the *K. kiridus* and *K. catreus* and the *M. bateae* and *M. minotaurus* sub-zones respectively (Dermitzakis and de Vos, 1987). The *Kritimys* zone is associated with the Middle Pleistocene and the *Mus* zone with the Late Pleistocene. The first zone is characterized by the presence of the pygmy mammoth, *Mammuthus creticus* (Poulakakis et al., 2006), and the pigmy hippopotamus, *Hippopotamus creutzburgi*, whereas the second zone is associated with the small sized elephants (*Elephas* cf. *creutzburgi*) and an undefined, until now, number of deer species such as the *Candiacervus ropalophorus*. To date, proboscidean material has never been found together with hippopotamuses in localities ascribed to the *Kritimys* zone, except from an uncertain and ambiguous report by Schlager (1996) from the Phangromouro I and II caves. The determinations of the elephants, as stated by the author, were performed by photographs and slides of the material *in situ*, thus making them questionable.

## 2. New Pleistocene localities

During the last five years, after more than two decades of surveying “drought”, the Geodiversity department of the Natural History Museum of Crete of the University of Crete (NHMC) has conducted systematic palaeontological surveys all around Crete. The surveys focus among other tasks in the relocation of already known and published Pleistocene localities and particularly in the discovery of new ones that will provide more and novel data on the biostratigraphic and taxonomic affinities of the fauna and the distribution of the localities on the island. Obviously, by looking at Figure 1 one can easily notice that the distribution of the 75 recorded localities is biased. There are no localities in South Crete, as well as in the central part of the island (Herakleio Prefecture), and just a minor number in the interior of the island. In addition, there are some areas where Pleistocene localities are underrepresented for no evident reason.

In these five years 30 new Pleistocene localities have been found all over the island (Fig. 1 and Table 1), expanding their total number by 28% to 106. Most of these localities cover areas of Crete where no or few localities existed, and in addition they are situated in all four prefectures of Crete; 13 localities are found in Chania Prefecture, five in Rethymno Prefecture, eight in Lassithi Prefecture and four in Herakleio Prefecture (Fig. 1 and Table 1). So, for the first time Pleistocene localities are reported from Herakleio Prefecture. Similarly, the first three localities from the southern coast of the island are also cited here. Eight new localities found in the interior of the island double the recorded number of such sites

and two more have been traced on small islets around Crete. Several localities have been discovered on the north-western side of Crete, which has been barely explored, and in the Chania Prefecture in general due to a funding provided by the Chania Chamber of Commerce and Industry. Apparently, the distribution of the new localities has shown that the reason for the lack of localities in certain parts of Crete can be attributed to the exclusion of these areas from expedition surveying in the past. The majority of the old localities are concentrated around well populated areas of the island, such as the north coast, and around areas with previously reported localities, indicating a humanly driven surveying bias.

**Table 1.** The thirty new localities discovered on Crete during the last five years.

<i>No</i>	<i>Locality name</i>	<i>Prefecture</i>	<i>Taxa</i>
1	Alogaras Cave	Lasithi	Hippopotamus, micromammals
2	Katharades	Lasithi	Hippopotamus
3	Xerokampos	Lasithi	Hippopotamus
4	Cave Kato Zakros	Lasithi	Hippopotamus
5	Katharo plateau (new)	Lasithi	Deer
6	Lasithi plateau	Lasithi	Deer
7	Kolokitha Island	Lasithi	Micromammals
8	Mastabas Herakleio	Herakleio	Hippopotamus
9	Choirospilios Cave	Herakleio	Deer
10	Kamilari Cave	Herakleio	Micromammals
11	Kolenias Pothole	Herakleio	Large mammals
12	Mougri Cave	Rethymno	
13	Kastelakia Cave	Rethymno	Micromammals, deer
14	Small cave east of Simonelli Cave	Rethymno	Deer
15	West of Simonelli Cave	Rethymno	Deer
16	West of Bate Cave	Rethymno	Deer
17	Koutalas Cave	Chania	Hippopotamus, proboscidean, micromammals, birds, deer
18	Lentakas hole Cave	Chania	Deer?
19	Kolimpari 1	Chania	Deer
20	Kolimpari 2	Chania	Deer
21	Kolimpari 3	Chania	
22	Paralia Afrata	Chania	Micromammals
23	Aspri Limni Cave	Chania	
24	Tripitos Troulos Cave 1	Chania	Deer
25	Tripitos Troulos Cave 2	Chania	Deer
26	Gramvousa 1	Chania	Micromammals
27	Gramvousa 2	Chania	Deer
28	Gramvousa 3	Chania	Deer
29	Pontikos Island	Chania	Micromammals
30	Amoudara	Lasithi	Elephant, deer

Hitherto, the identified taxa from these new localities consist mainly of hippopotamuses, deer and micromammals (Table 1). In one locality birds and in two proboscidean remains have been recognised. Based on the fossil findings, the most important of all these localities is considered to be Koutalas Cave.

### 3. The locality Koutalas Cave

#### 3.1 General

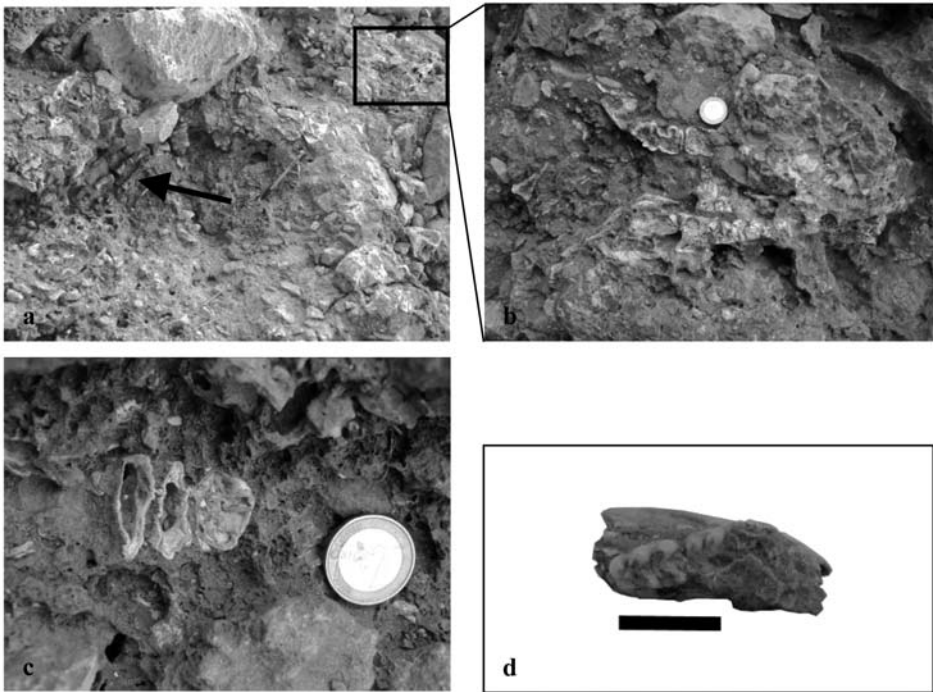
The Koutalas Cave is situated at the rock cliffs just above sea level on the west coast of Cape Drepano, north-east of village Kokkino Chorio in Chania Prefecture. It was discovered after one of the authors (H.E.) visited the area and recognised the vertebrate remains. The locality consists of two levels, the upper and lower one, and thus of two fossiliferous outcrops. The upper level is found at the top of the cliff and constitutes part of a collapsed cave. The lower level is located underneath the upper level at sea level, at the entrance of a cave. The fossiliferous deposits in the upper level consist of well cemented red clays that contain significant numbers of limestone debris. In the lower level they are made of well cemented red and sometimes yellow clays. The former and most important ones contain skeletal remains of microvertebrates in remarkable abundance, as well as some sparse remains of macromammals. The latter yielded a small number of scattered remains of macromammals and birds. Clearly the deposits in the two levels correspond to two different depositional events.

#### 3.2 The Koutalas Cave fauna

The upper level has yielded numerous remains of micromammals and birds. The most common of these are skeletal parts that belong to a giant murid. We were able to extract some mandible parts and determine them. The morphology and the large dimensions of the teeth (Table 2) indicate that they belong to the largest of the Cretan murids *Kritimys catreus*. The studied first lower molars (m1) (Fig. 2d) compared to the respective molars of the other Cretan murids, *K. kiridus*, *Mus bateae* and *Mus minotaurus* (Table 2) are proven significantly larger, but within the range of *K. catreus* (Table 2). At this stage bird bone material has not been recognised yet. The vast majority of the macro remains belong to a dwarf hippopotamus, and most likely to *Hippopotamus creutzburgi*. It consists of post cranial and some cranial remains, nevertheless the most important finding is an almost complete, articulated skeleton with the mandible in place (Fig. 2a and 2b). Unfortunately, the skull is missing and probably was destroyed by weathering processes. In close proximity to the skeleton another exciting finding, a part of a deciduous molar of a dwarf elephantid was found (Fig. 2c), evincing the co-existence of the two taxa. The molar consists of three lamellae and as shown in Figure 2c is particularly small in size. It is not clear whether it belongs to an elephant or a mammoth although its minute size seems to favour an affiliation with *Mammuthus creticus*. A more accurate determination is not possible with only this sole specimen, thus identification as Elephantidae indet seems reasonable. Bearing in mind the above mentioned uncertain report by Schlager (1996), it is almost a truism that this is the first certain report of the two taxa being found together in the same locality.

From the sparse fossil material in the lower level it has been possible to identify the presence of deer from postcranial and cranial elements. In addition some bird bones were recognised.

The presence of *K. catreus* in the upper level indicates that this layer was deposited during the *Kritimys* biozone and more specifically during the *K. catreus* subzone, and thus its age can be characterised as Middle Pleistocene. Conversely, the presence of deer clearly supports a younger age and consequently a Late Pleistocene age can be attributed for the lower level.



**Fig. 2:** (a): View of the upper fossiliferous level where the almost complete and articulated *H. creutzburgi* skeleton is lying. The arrow points to some of the articulated vertebrae. The square indicates the area where the lower mandible lies; (b): The lower mandible of *H. creutzburgi* in situ; (c): The deciduous molar of the dwarf elephantid; (d): Part of a lower mandible of *K. catreus* with m1 and m2.

**Table 2.** Measured length and width at crown level of the first lower molars of the studied murid material from Koutalas Cave and for comparison the respective size range of the three larger Cretan murid taxa.

<i>Species</i>	<i>Crown length</i>	<i>Crown width</i>
<i>Kritimys kiridus</i> *	2.89 - 3.30 mm	1.66 - 1.92 mm
<i>Kritimys catreus</i> *	3.55 - 4.72 mm	2.07 - 2.98 mm
<i>Mus minotaurus</i> *	1.96 - 2.30 mm	1.05 - 1.46 mm
Studied specimens	3.85 - 3.95 mm	2.32 mm

\* Measurements from Mayhew, 1977

#### 4. Conclusions

Systematic studies conducted by the Natural History Museum of Crete in the last years have identified many of the old, previously reported, and recognised 30 new Pleistocene mammal fossil sites located all around the island of Crete. Most importantly, these studies have proven that possibly the Pleistocene fauna of Crete was not only present near the north coast or in cluster areas (like Lassithi mountains) but also such localities can be found all over the island, presenting thus for first time new

sites from the southern coast as well as from the Heraklion Prefecture. The total number of the Pleistocene sites has been risen up to 106.

The most profound among these new sites is the Koutalas Cave in Chania Prefecture, where for the first time the coexistence of hippopotamuses and Elephantidae can be undoubtedly documented. The fauna is distributed in two levels with the uppermost containing macro remains of dwarf hippopotamuses (*Hippopotamus creutzburgi*), a part of a deciduous molar of a dwarf elephantid, and numerous remains of micromammals and birds. The presence of the Cretan murid *K. catreus* dates the recovered faunal findings as Middle Pleistocene. The lower level which appears to be younger in age consists only of scattered bones of deers and birds.

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