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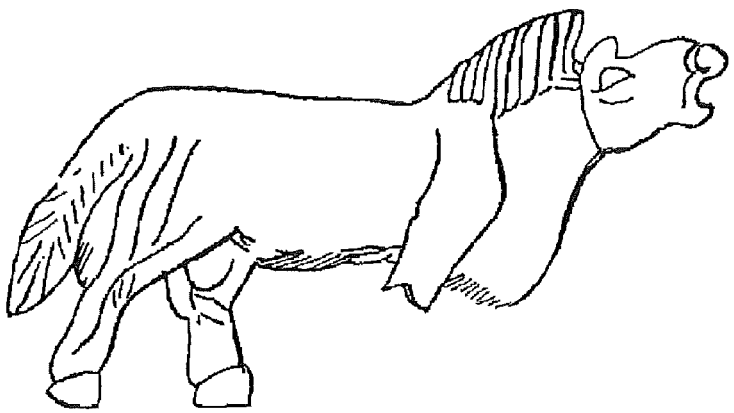

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MESOLITHIC ENVIRONMENT AND ANIMAL EXPLOITATION ON CYPRUS AND SARDINIA/CORSICA.

Paul Y. Sondaar[1] and Sandra A.E. van der Geer[2]

Abstract

The Late Pleistocene-Holocene archaeological and vertebrate paleontological record of Cyprus and Sardinia/Corsica is reviewed, on the basis of which the impact of Mesolithic human food exploitation on these island environments is discussed. On Sardinia and Corsica, *Prolagus sardus* with its high reproduction rate apparently supplied enough food to support a viable Mesolithic human hunter population over a long period without becoming exhausted, whereas the slow moving dwarf hippo and dwarf elephant of Cyprus became extinct due to overkill by Mesolithic hunters. After this extinction event the available food resources consisting of shellfish, vipers and birds probably were not sufficient to support a viable human population, as there is a gap of a millennium in the archaeological record before the appearance of aceramic Neolithic people on Cyprus. A possible explanation is the shortage of natural food resources which subsequently caused a dramatic drop in the human population, or even the disappearance of humans from the island.

Résumé

Les données archéologiques et de la paléontologie des vertébrés du Pleistocène final - Holocène de Chypre et Sardaigne/Corse sont reconsidérées afin de lancer les bases d'une discussion sur l'impact de l'exploitation humaine sur l'environnement de ces îles. En Sardaigne et en Corse, *Prolagus sardus,* avec son taux de reproduction élevé, subvenait apparemment aux besoins alimentaires d'une population de chasseurs mésolitiques durant une longue période sans pour autant montrer des signes de diminution. Or à Chypre, les animaux à déplacement lent, tels que l'hippopotame et l'éléphant nains, ont été exterminés suite à une sur-exploitation par les chasseurs mésolitiques. Après cette extinction, les ressources alimentaires disponibles composées de mollusques, vipères et oiseaux n'étaient probablement pas suffisantes pour subvenir aux besoins d'une population humaine. Le hiatus d'un millénaire dans les données archéologiques avant l'arrivée de la population néolithique acéramique à Chypre vient étayer cette hypothèse. Une explication possible est la diminution des ressources alimentaires naturelles qui causa par voie de conséquence une chute drastique de la population humaine, ou même sa disparition sur l'île.

Key Words: Cyprus, Colonization, Islands, Exploitation.

Mots Clés: Chypre, Colonisation, Iles, Exploitation.

Introduction

The arrival of humans on an oceanic island can result in the extinction of the endemic large herbivores. This hypothesis is questioned by Vigne (1996, 1998), who states that the extinction of the large herbivores on Sardinia/Corsica (*Megaloceros cazioti*) and Cyprus (*Phanourios minutes* and *Elephas cypriotes*) antedates the arrival of Mesolithic humans on the islands. However, no reason for such a catastrophic event, the extinction of all large herbivores in a closed eco-system that functioned well for thousands of years, is given at all. A much more likely starting moment for this extinction, the arrival of humans, has been well argued by several other scholars, based on the excellent fossil- and archaeological record from Late Pleistocene/Early Holocene Sardinia/Corsica and Cyprus (Arca *et al.* 1982; Bini *et al.* 1993; Klein Hofmeijer *et al.* 1987; Martini 1992; Sondaar *et al.* 1995; Boekschoten and Sondaar 1972; Reese 1996; Simmons 1988; Mandel and Simmons 1997; Sondaar, in press).

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Paleontology and taphonomy: Cyprus

The Pleistocene fauna of Cyprus contains two large herbivores, the dwarf elephant *Elephas cypriotes* and the dwarf hippo *Phanourios minutes* (Bate 1906; Boekschoten and Sondaar 1972; Houtekamer and Sondaar 1979; Spaan 1996). More than 90% of the fossils belong to the hippo and were found in more than ten sites, which means that the environment must have been quite favourable for Phanourios minutes. This dwarf hippo was well-adapted to walking on rocky soil and also to climbing, but it never evolved a better cursorial locomotion than its ancestor from the mainland. Its dentition was lophodont, indicating an adaptation to browsing, which is unique in the family Hippopotamidae. Accordingly, the Pleistocene Cyprus must have been forested or at least covered with shrubs.

As on other ocean islands, the established endemic mammal fauna from Cyprus did not change much through time. Fossil hippos from localities that differ in age, are quite similar in morphology and do not show different evolutionary stages on which a relative age could be based. Moreover, there are no clear stratigraphical sections in which a faunal succession could be studied (Boekschoten and Sondaar 1972; Houtekamer and Sondaar 1979). The morphology of the molars of *Elephas cypriotes* suggests an ancestry from the Pliocene/Early Pleistocene *Mammuthus meriodionales* from the mainland. Thus, the minimum age for the endemic *Phanourios minutes* - *Elephas cypriotes* fauna might be Early Pleistocene.

The discovery of the Akrotiri Aetokremnos site, in which the Pleistocene endemic dwarf hippos and dwarf elephants of Cyprus are found together with a lithic industry (Simmons 1988) brought not only new insights on their extinction, but also on the exploitation of food resources by the early human hunter groups on islands. At Akrotiri Aetokremnos, a large deposit of the extinct Pleistocene endemic fauna, that consists here mainly of dwarf hippos, is associated with artefactual material and burnt fossils dating to the mid ninth millennium BC. The main layers (layers 2 and 4) differ considerably in their zooarchaeological content. In the older layer 4, the bulk of the remains belong to the dwarf hippo (>98%), whereas this percentage is less than 20% in the younger layer 2 (Reese 1996). This suggests that the human consumption of hippos eventually resulted in a decline in their numbers (Simmons 1996; Reese 1996).

Although ^{14}C dating is available for both layers, they cannot be compared as such, because the samples from the stratigraphically older bone accumulation of layer 4 were taken from dwarf hippo bones, while those of the younger layer 2 were taken from shells and charcoal. The different ^{14}C ages are 10,640 ± 30 BP for stratum 2 and 9,835 ± 70 BP for stratum 4 (Simmons and Wigand 1994). Bunimowitz and Barkai (1996) consider this an "interesting case of reversed stratigraphy", and use these datings to cast doubt on the interpretations of Simmons (1988). In general, it may be said that for ^{14}C dating, mammal remains yield ages that are closer to the real age than charcoal. This is due to the longevity of trees and the fact that it never can be verified whether the charcoal from fires originates from burnt fresh wood or collected dead wood. Therefore, dating based on the hippo bones from layer 4 probably comes closer to the real age than the charcoal ages from layer 2.

We agree with Simmons (1996) that there might be only a small difference in age between layer 4 and 2. In other words, the sharp decline in the population of dwarf hippos took place in the time span between layer 4 and layer 2, which must have been of a short duration. Furthermore, if we look at the percentage of shellfish, we see that it is only about 1% in layer 4 against more than 70% in layer 2. The percentage of bird fossils is negligible in layer 4, while it rises to 10 % in layer 2. The great bustard, *Otis tardus*, and the goose, *Anser anser*, are dominant in this avifauna (Reese 1996). The above percentages clearly show an increase in shellfish collecting and bird hunting. This evident change in the food customs of the Akrotiri people might very well have been caused by a sharp decline in the hippo population due to overkill.

Paleontology and taphonomy: Sardinia/Corsica

On Corsica, which was connected with Sardinia during stages of low sea levels, a Late Pleistocene Paleolithic occupation is recognized (Bonifay 1994). Moreover, between the Paleolithic and the Neolithic, a so-called "Preneolithic", now called Mesolithic, has been well-established by a series of sites (Vigne 1998; Lanfranchi 1998). This Mesolithic is characterized by the absence of pottery and domesticated animals, while *Megaloceros*, so characteristic for the Late Paleolithic on Sardinia/Corsica, must have been extinct, in contrast to *Prolagus*, which was the dominant mammal and is still present on the island. This ochotonid weighing about 800 grams is a giant compared to his extant relative *Ochotona* (140 grams). Artefactual material is composed of idiosyncratic lithics from local quartz and rhyolithe, without the obsidian that marks the beginning of the Early Neolithic (Vigne 1998).

The chronological position of the Corsican Mesolithic sites, occupied by permanent hunter-gatherer groups, covers the Middle and the second half of the 9th millenium, and probably also part of the 8th millenium BP (Vigne 1998). This is confirmed by the finding of Lanfranchi, who discovered a female skeleton, modern as regards morphology, in the Mesolithic of the abri d'Araguina-Sennola, dated to 8,520 ± 150 BP (Lanfranchi *et al.* 1973; Duday 1975; Lanfranchi 1998). Thus, the Mesolithic of Corsica might cover a time span of a millenium (Lanfranchi 1998; Vigne 1998).

Proportions of the weights of edible matter from sea-shells, fishes, birds, rodents and *Prolagus* from five Mesolithic sites on Corsica are calculated by Vigne (1998) on the basis of minimal numbers of individuals and (zoological group specific) average individual weight of edible matter. The percentage of *Prolagus* appears to vary between 78 and 95-98%. This indicates that for about a millennium, more than 80% of edible resources for the Sardinian/Corsica Mesolithic people was obtained from *Prolagus* hunting.

If we calculate the minimum number of *Prolagus* individuals needed to cover the metabolic costs of humans, we get the following figures. A *Prolagus* of 800 gram yields 0,8x530x8 = 3392 kJ, and 128 gram proteins, if we compare it with a wild rabbit. Present-day men of 70 kilos, age 20 to 35, and medium active, need 70 grams of protein at 12,1 MJ, whereas pregnant and breast feeding women of 60 kilos, age 20 to 35, and medium active, need 75 grams proteins at 11,6 MJ. Thus, these humans need only two ochotonids in three days to cover their protein needs, or four to cover their caloric needs also. Most calories, however, will come from non-animal sources like fruits, grains, roots and bulbs. A group of forty persons, consisting of, let us say twenty of the above high-energy-cost persons, and twenty 'three-quarters', will need 20 ochotonids a day (or 7300 a year) to cover their protein needs, if we assume that the flora contains no proteins, which is highly improbable. Most edible plants contain about at least 1,4 gram protein per 100 gram. If *Prolagus* females had 20 young a year,

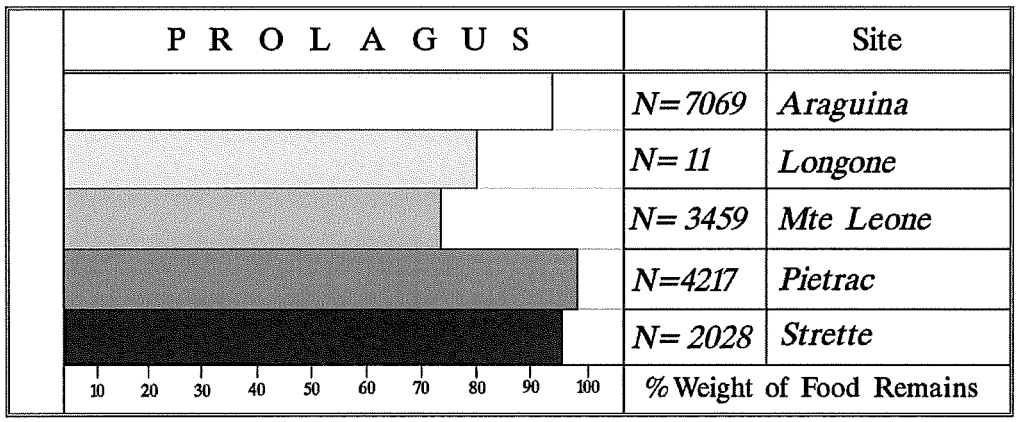

Fig. 1. The proportion of *Prolagus* by weight of food remains from five Mesolithic sites on Corsica (after Vigne 1998). *Prolagus*, with its high reproduction rate, supplied enough food to support a viable human hunter population without becoming exhausted, for about a millenium. The sites cover the middle and second half of the 9th and probably the 8th millennium

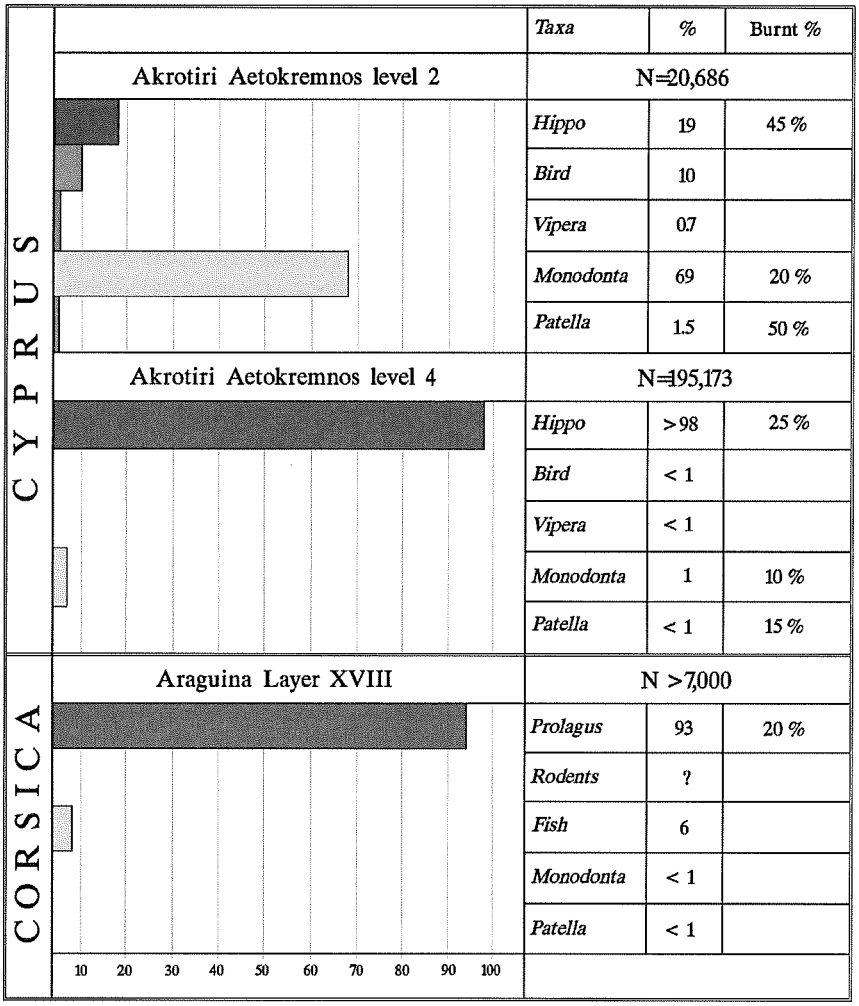

Fig. 2. Proportions in number of collected specimen from the Araguina Mesolithic on Corsica (Vigne 1998) and Akrotiri on Cyprus (Reese 1996), which might be considered food remains (burnt bones and shells). The patterns from Araguina and Akrotiri layer 4 are strikingly alike for the land mammals: dwarf hippo for the Akrotiri hunters, and Prolagus for the Mesolithic people from Corsica. However, the number of hippo remains drops dramatically in layer 2, which is only slightly younger in age. Probably the available food resources, consisting of shellfish, vipers and birds were not suficient to support a viable human population. There is a gap of a millennium in the archaeological record before the aceramic Neolithic people colonize Cyprus

that is an average of 10 per indivual, the population needs to consist of at least 730 indivuals if the human hunters could not find any other protein source. In conclusion, it is very probable that a human group could survive on *Prolagus* alone, especially if we take into consideration that earlier humans were smaller, and had access to other food sources as well. Thus, it may be safely stated that the Sardinian/Corsican *Prolagus* population could support, without danger of becoming exhausted, a viable human population over a longer period of time (Fig 1).

Comparison and conclusions

Vigne compares the Mesolithic way of life of the Aetokremnos hunters of the 10th millennium BP with that of the Mesolithic hunters from Corsica of the 9th millennium BP and writes *"Except for the*

large bones (i.e. dwarf hippo and elephant) the faunal assemblage of this layer (i.e. layer 2) appears very similar to those of the Preneolithic Corsican sites. In my opinion, this offers support for the ideas that (a) the dwarf hippopotamus and elephant bones from this layer came from Stratum 4; (b) endemic large game was completely extinct by this time; and (c) these putative first human groups on Cyprus during the 11-10th milleninia cal BC subsisted exclusively by fishing, trapping and plant crops, as did those on Corsica during the 8th millenium cal BC" (Vigne 1996: 119).

In Figure 2 the percentages of identified specimens of different taxa are provided for layer 2 and 4 of Akrotiri Aetokremnos on Cyprus (after Reese 1996) and of Araguina on Corsica (after Vigne 1998). The diagrams for layer 4 Akrotiri and Corsica are strikingly similar. The only difference is that for the Akrotiri layer 4 hunter, the dwarf hippo was the main source of food, while for the Mesolithic hunter of Corsica, the pika *Prolagus* was most important. In contrast to the dwarf hippo, the *Prolagus* population was not reduced in number by overkill, most likely because of its high reproduction rate and way of life, that is, storing large amounts of dried food in huge piles of grass for scanty times. If we compare the small game of the Corsica Mesolithic with the Akrotiri hunters of Cyprus, than it becomes evident that there is no ecological counterpart for *Prolagus* in the Cypriotic assemblage.

The animal exploitation pattern of the Akrotiri hunters from layer 2 differs completely from that of layer 4. They collected more shells and hunted birds The dramatic decrease in the exploitation of dwarf hippo and an increase in the consumption of shellfish and goose is difficult to explain other than by a reduction of the slow moving endemic dwarf hippo population due to overkill. There is a gap of a millennium between the archaeological records of the Akrotiri site and the site of Shillourokambos, which yielded Preceramic Neolithic assemblages (Vigne 1998; Roonen 1995; Guilaine *et al.* 1995). This might be explained as caused by a paucity of natural food resources and a subsequent dramatic drop in the human population, or even the disappearance of humans from the island. Goose and shellfish probably were not sufficient to support a viable human population over a longer period of time after the extinction of the dwarf hippo.

Thus, in conclusion it can be said that: 1) the archaeological contexts of the faunal assemblages of Mesolithic Corsica and of Akrotiri-hunters of Cyprus have complete different zoogeographic and evolutionary histories and are different in age. To call them "very similar" and use this "similarity" (Vigne 1996) to suppose that the hippo fossil remains (n= 1,966) from layer 2 (Reese 1996) were not in situ is a working method which may be compared with using a telephone directory from New York to demonstrate that the telephone company from Tokyo works improperly; 2) the taphonomy of Cypriotic Akrotiri is much more easily explained by an overkill of the hippos; 3) the human hunters might well have been responsible for the extinction of the slow moving dwarf hippo (Simmons 1988; Reese 1996); 4) the data presented by Vigne (1998) on the taphonomy of the Mesolithic Corsican sites suggest that the *Prolagus* population, through its high reproduction rate, could support a viable human hunter population over a longer period, without becoming exhausted.

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