

Endemic oak jungles for the dwarf elephants and ungulates of the Mediterranean islands

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In some respect,
Mediterranean island ecosystems were quite different from
adjacent continental ecosystems in the course of the
Quaternary



The existence of endemic animal species is perhaps the most obvious example of this



The composition of the endemic insular mammalian assemblages, despite consisting of only a few *taxa*, were repeated monotonously on most of the islands

Nevertheless, they displayed peculiar endemic elements which differed greatly from one island to another

On islands, one of the most common trends of endemisation is the decrease in the size of macromammals, such as proboscideans and artiodactyls



These modifications are generally assumed to be primarily:

- a consequence of the genetic isolation from continental populations
- a quantitative and qualitative reduction in food supply
 - an alteration of intraspecific competition
 - the absence of large carnivores

and perhaps,
where the micromammals are concerned,
also of

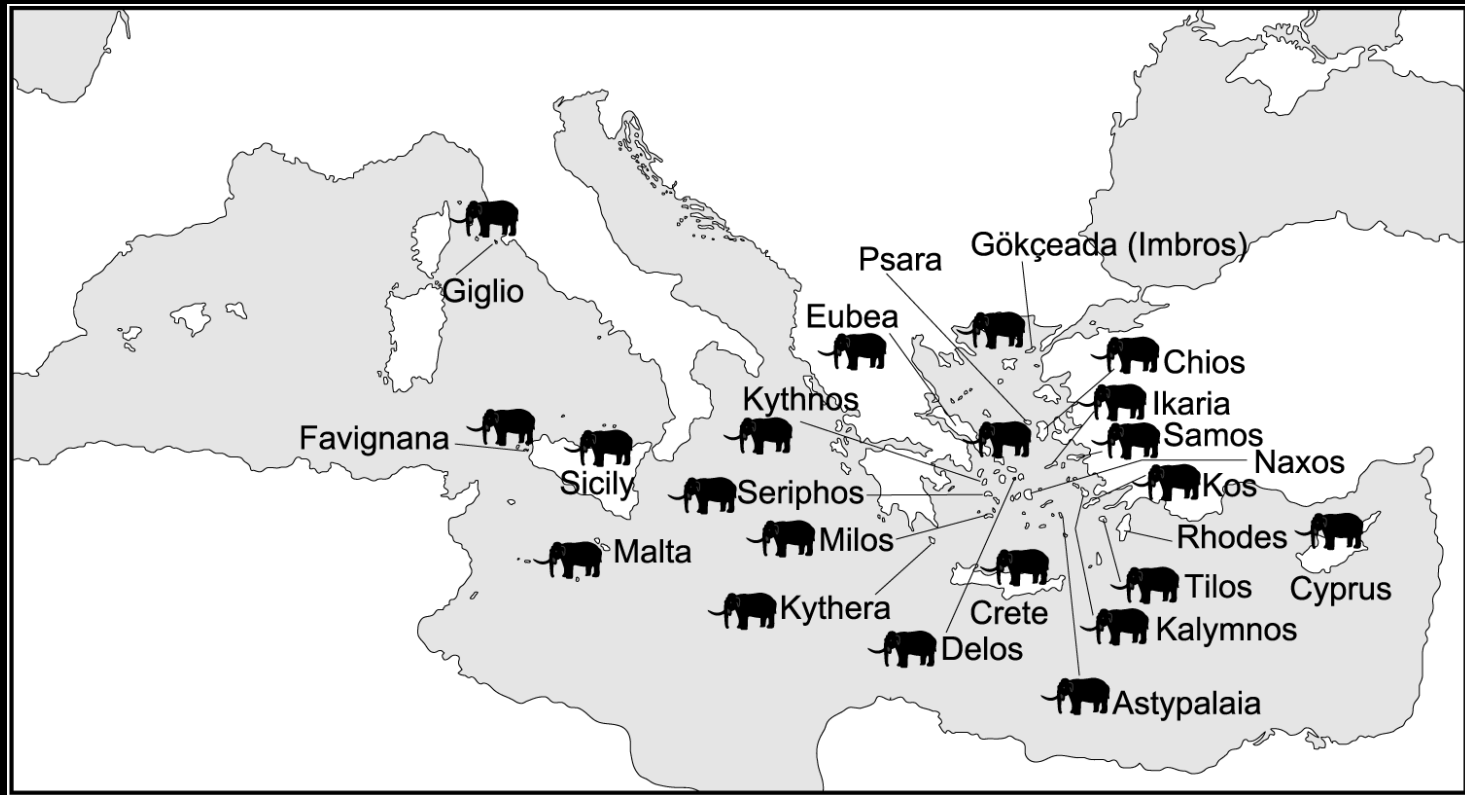
- endothermic adaptations

According to the theory of the
Island rule,

dwarfism seems to be the only alternative large-sized animals have to lower selective pressure when they move into insular settings

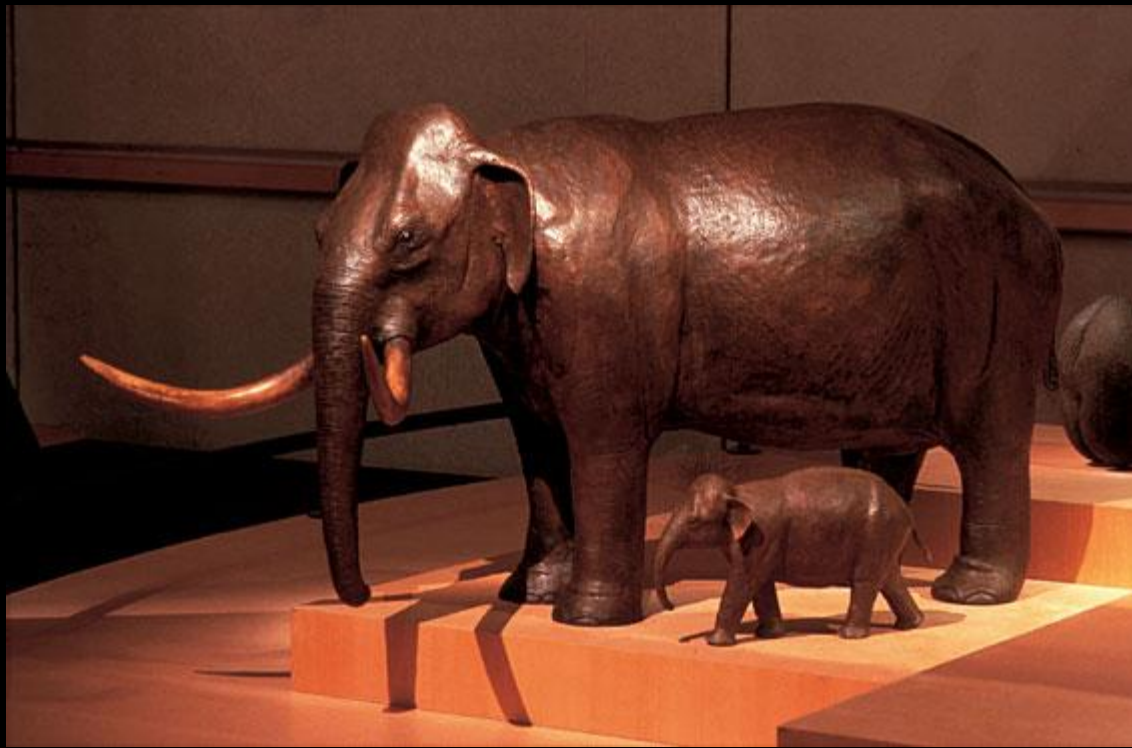
Most of all,
it appears that the low availability of resources sets insular populations under the strict control of both genetic and ecological constraints

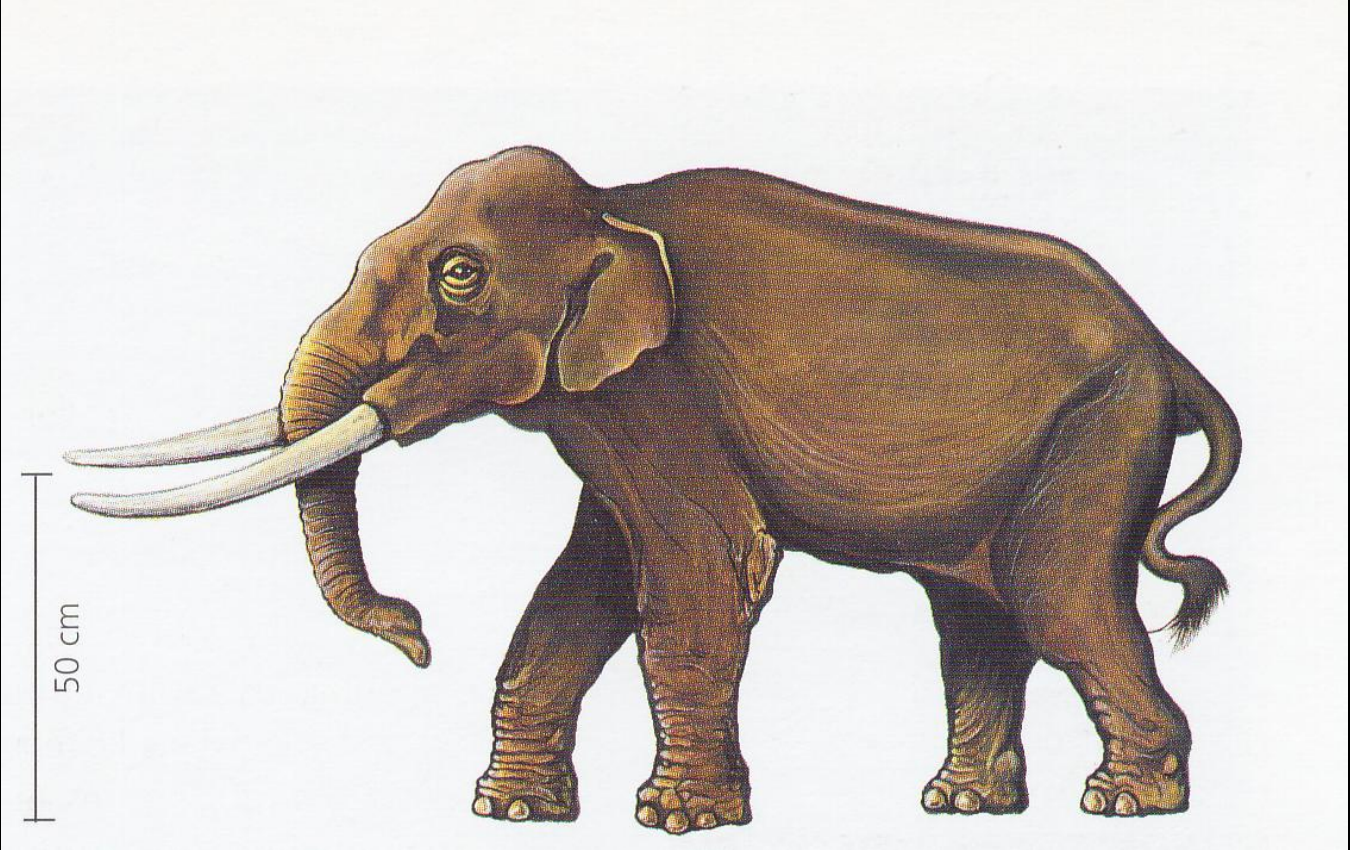
Many of the Mediterranean islands provided Middle and Late Pleistocene remains of proboscidean of the genus *Elephas* L., 1578



Several of them were dwarf

The elephant of Falconer, *Elephas falconeri*
Busk, 1867



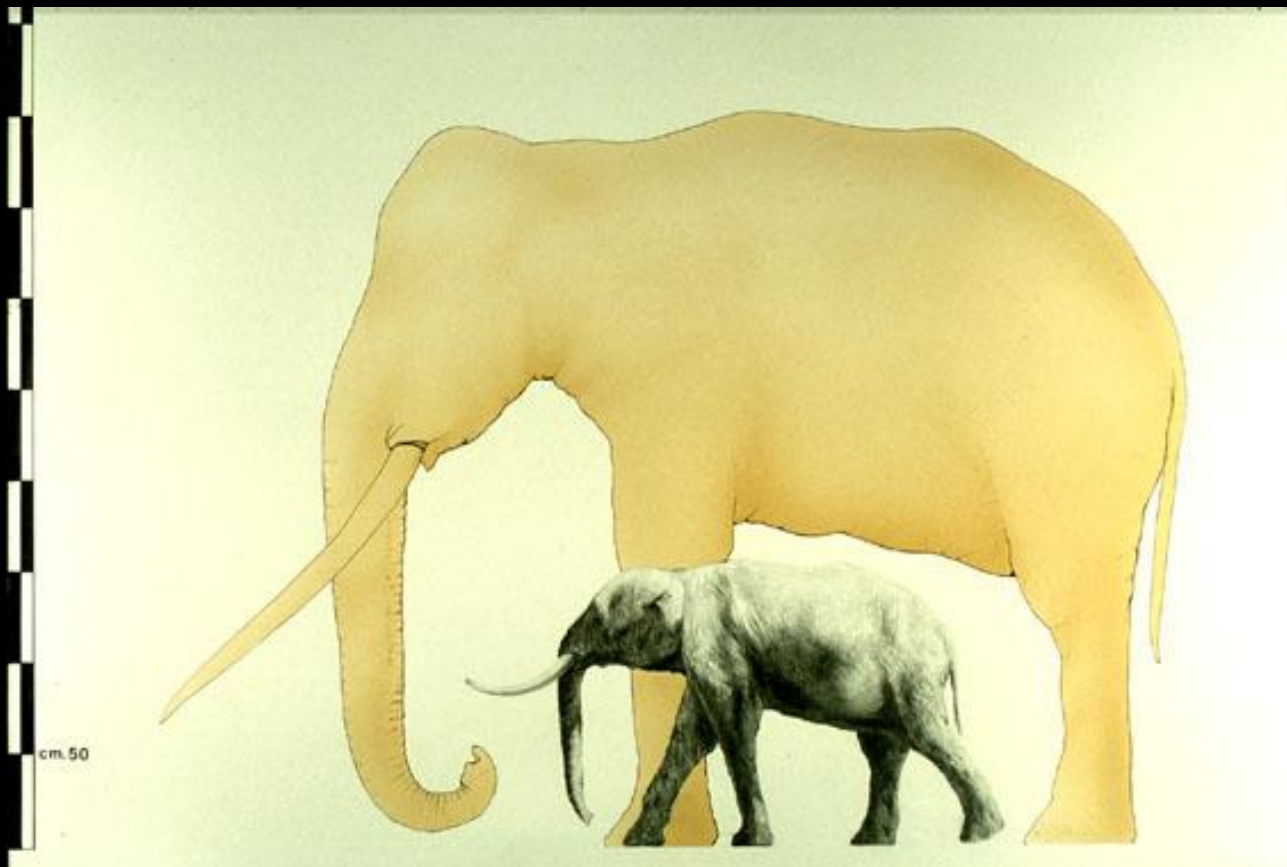


about 500.000 years ago



Tilian elephant, *Elephas tiliensis*

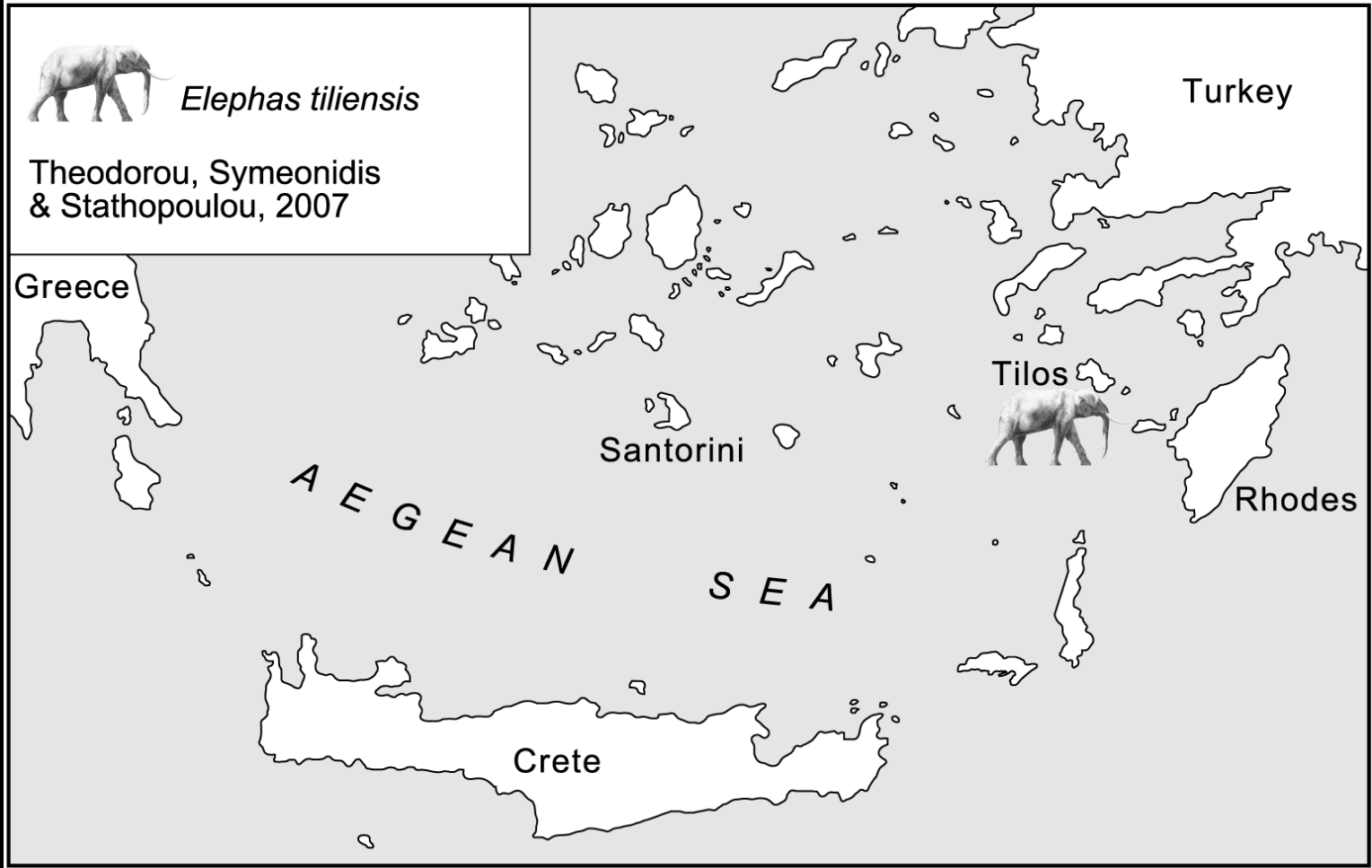
Theodorou, Symeonidis and Stathopoulou, 2007





Elephas tiliensis

Theodorou, Symeonidis
& Stathopoulou, 2007

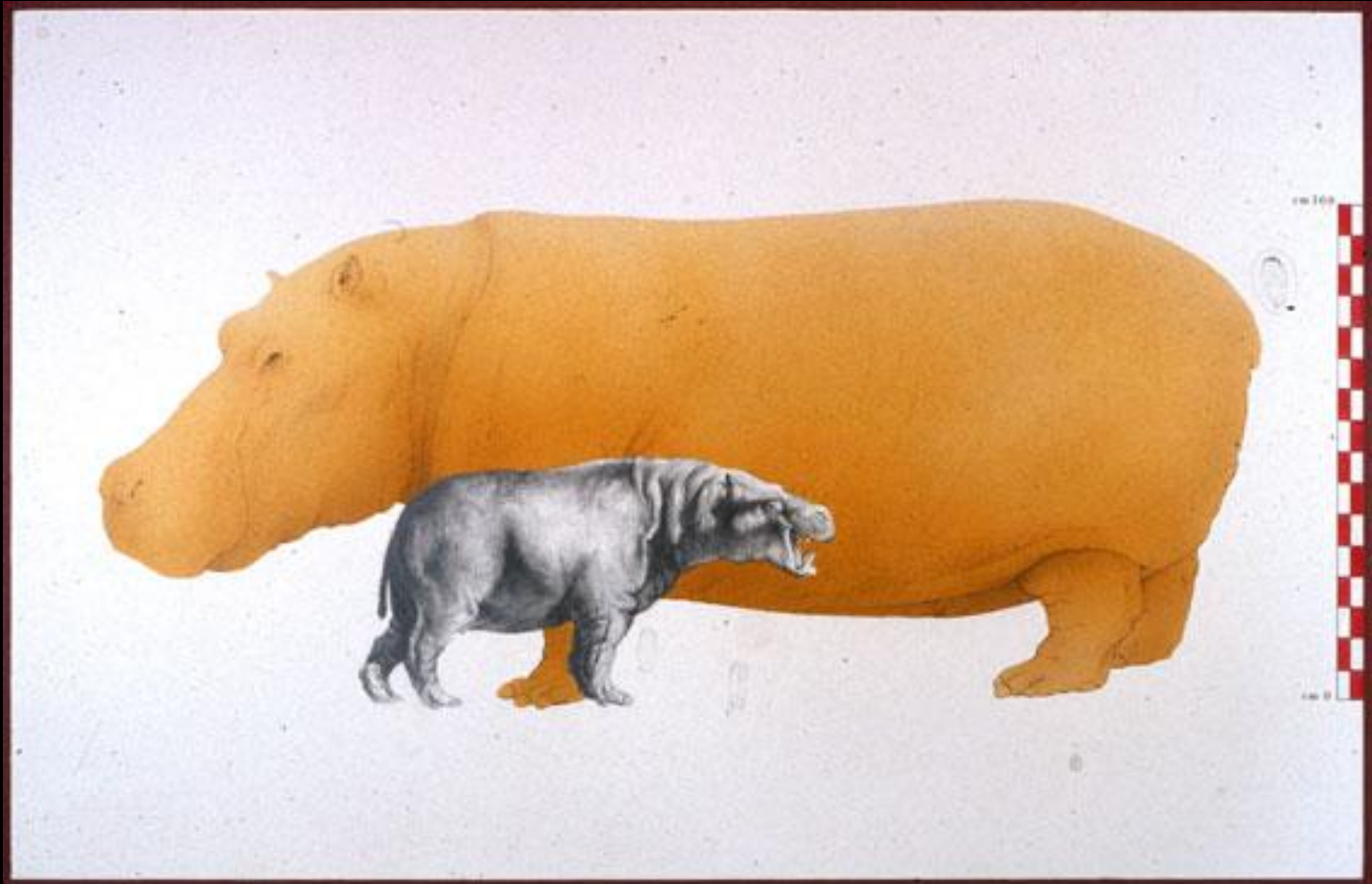


The Tilian elephant survived at least up to the beginning of the Aegean Bronze Age, being its osteological remains attributed to very recent times

(2.390 +/- 600 B.C.)

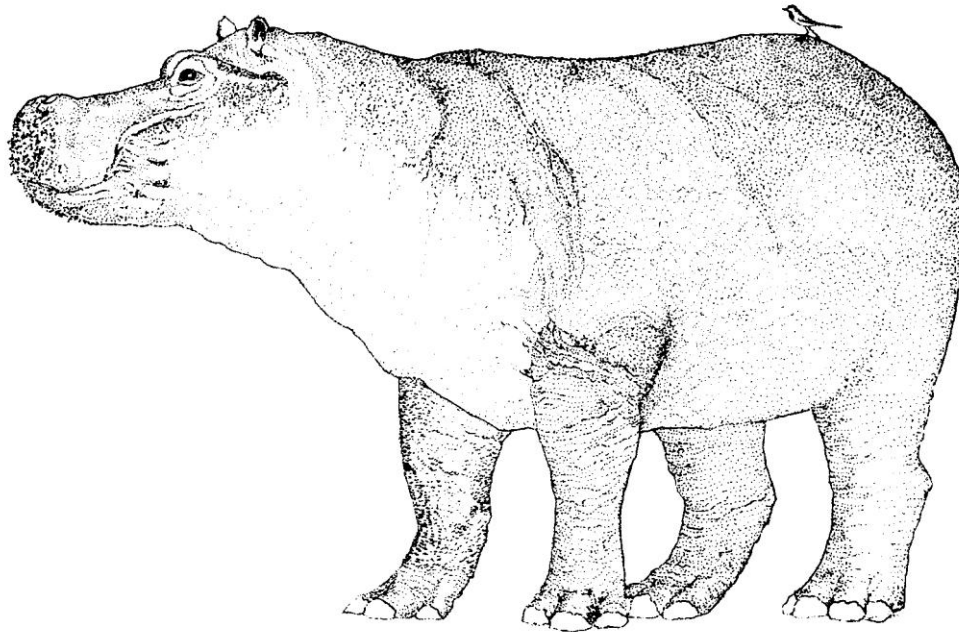


Cypriot dwarf hippopotamus,
Phanourios minor (Desmarest 1822)



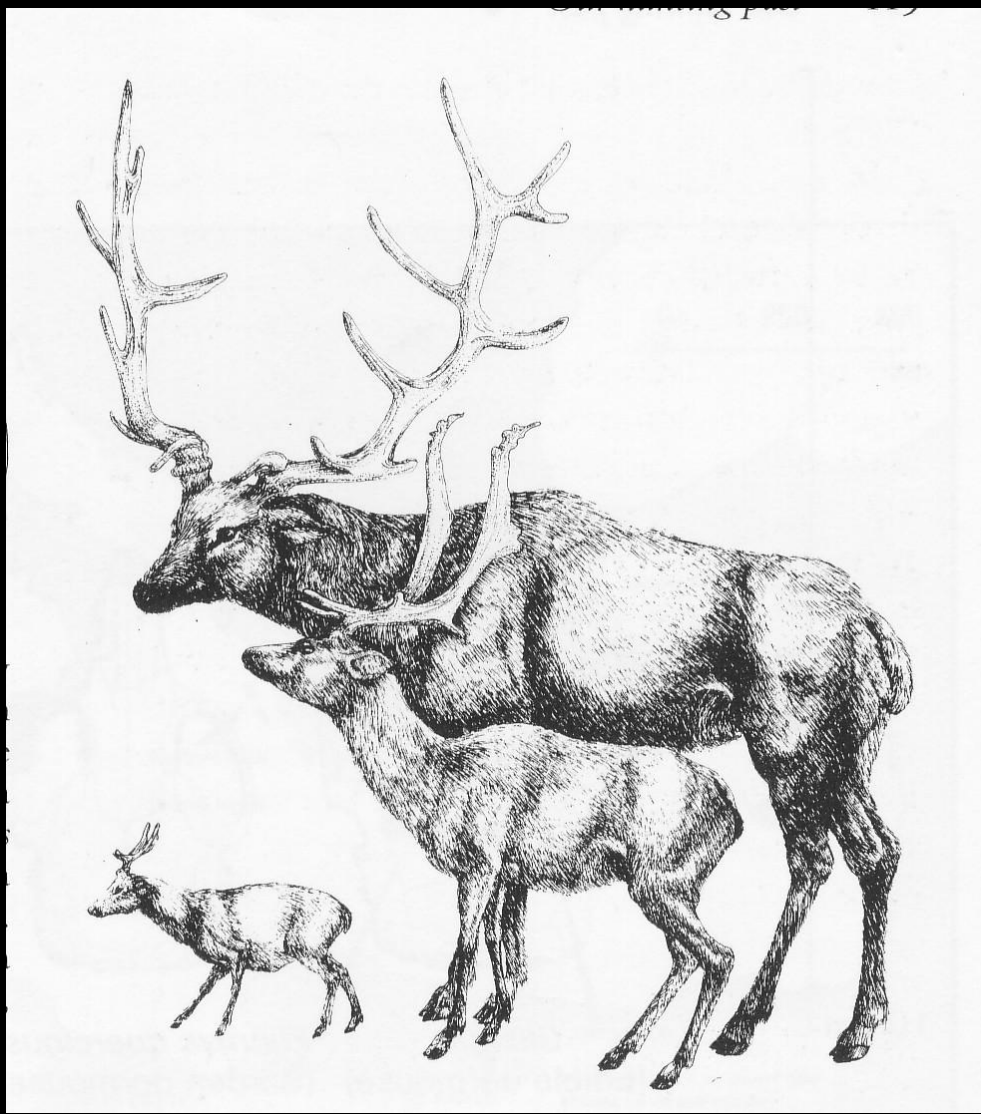
Together with Cyprus,
Late Quaternary remains of dwarf hippopotami have been
found in Sicily, Malta and Crete

Sicilian dwarf hippopotamus,
Hippopotamus pentlandi Meyer, 1832



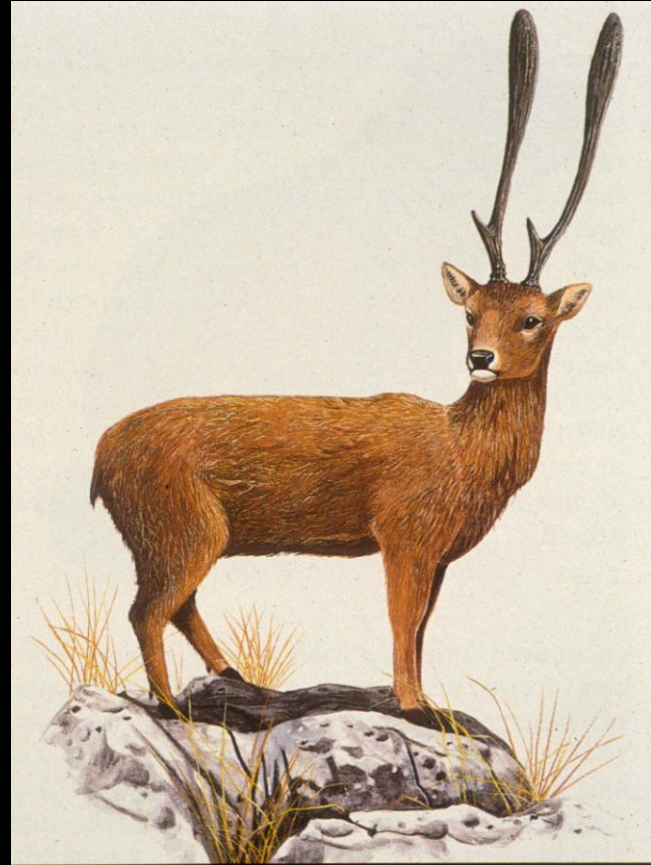
Also dwarf deer occurred on several islands





Cervus ropalophorus (de Vos, 1984)

endemic to Crete, stood about 40 cm at the shoulders when fully grown



The cause of the dramatic faunal turnover,
which led to the extinction of the endemic deer and
elephants,
may simply have been the arrival of palaeolithic
and/or neolithic humans

Several explanations for the dwarfing of island mammals have been suggested, and departures from the predictions of this rule are common among mammals of differing body size, trophic habits, and phylogenetic affinities

According to
Burness, Diamond & Flannery (2001),
the maximum body size and
taxonomic affiliation of the top terrestrial vertebrate
vary greatly

The body mass of the top species is found to increase with increasing land area, with a slope similar to that of the relation between body mass and home range area, suggesting that maximum body size is determined by the number of home ranges that can fit into a given land area

More recently, Raia et al. (2003) and Raia and Meiri (2006) observe that the dimensional evolution of large mammals in different trophic levels has different underlying mechanisms, resulting in different patterns

Absolute body size may be only an indirect predictor of size evolution,
with ecological interactions playing a major role

Dwarfism in large herbivores is an outcome
of the increase in fitness resulting from the acceleration
of reproduction in low-mortality environments
(Raia and Meiri, 2006)

In any case,
I personally am of the opinion that we should not undervalue the importance
of the selection exerted in relation to such specialisations by the principal
characteristics of the physical environment



If we pause to reflect
on the general appearance of the Mediterranean
islands in the Upper Pleistocene, or even only in the
Early Holocene, we realise how incommensurably
different it was from that of today

Virtually,
no ecosystems have been left untouched

Much of the environment of the Mediterranean islands is by now reduced to little more than a mineral skeleton



In the Upper Pleistocene,
when the existing botanical and faunal assemblages were already defined,
the majority of the Mediterranean islands must still have been cloaked in
the densely tangled vegetation that covered most of these environments



Before any human explorer set foot on them

Oak jungles consisted of downy oaks, *Quercus pubescens* Willd., evergreen oaks, *Q. ilex* L., 1753, Kermes oaks, *Q. coccifera* L., 1753...



... and of endemic species, such as
the golden oak of Cyprus, *Quercus alnifolia* Poech, 1842



Not to mention the dense undergrowth



These practically impenetrable vegetable formations must have been home to an entire fauna that was particularly adapted to living, moving, feeding, resting and hunting each other in such an environment

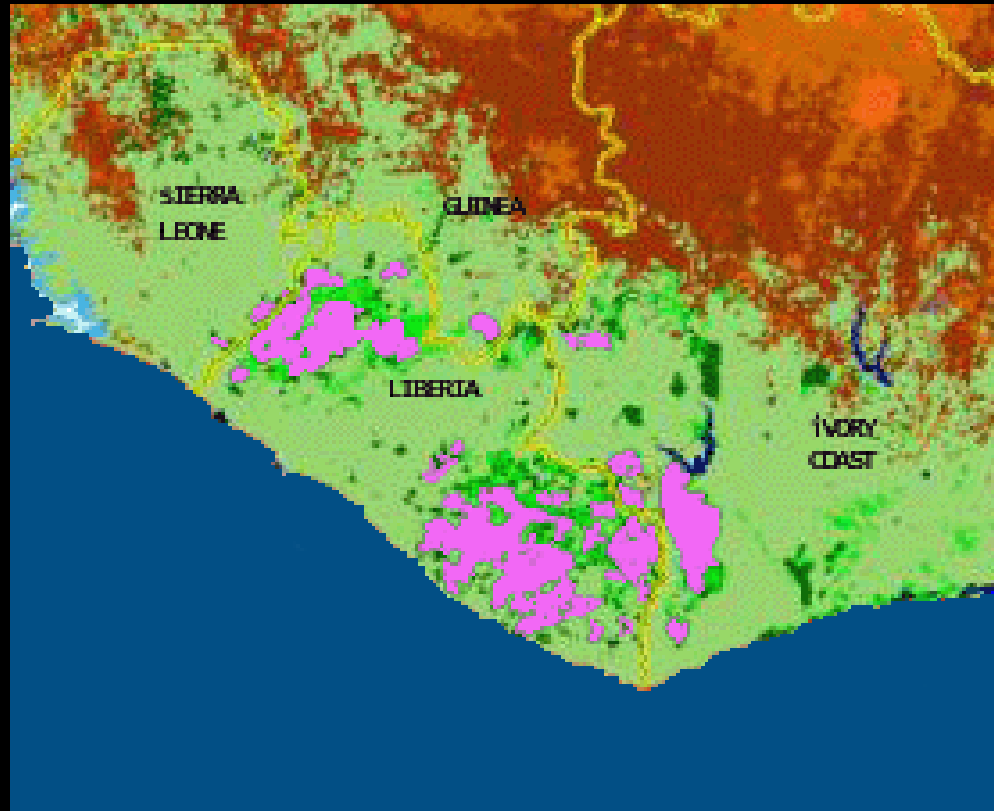


This is still the case, for example, in certain relic fragments of the rain forests of western Africa, where peculiar biological elements such as the last pygmy hippopotami, *Hexaprotodon liberiensis* (Morton, 1849), still survive



This is a species dispersed at present only in western
Africa from Sierra Leone to Liberia and the Côte
d'Ivoire

*Putative hippo populations are shown in pink and are
based on existing forest habitat*



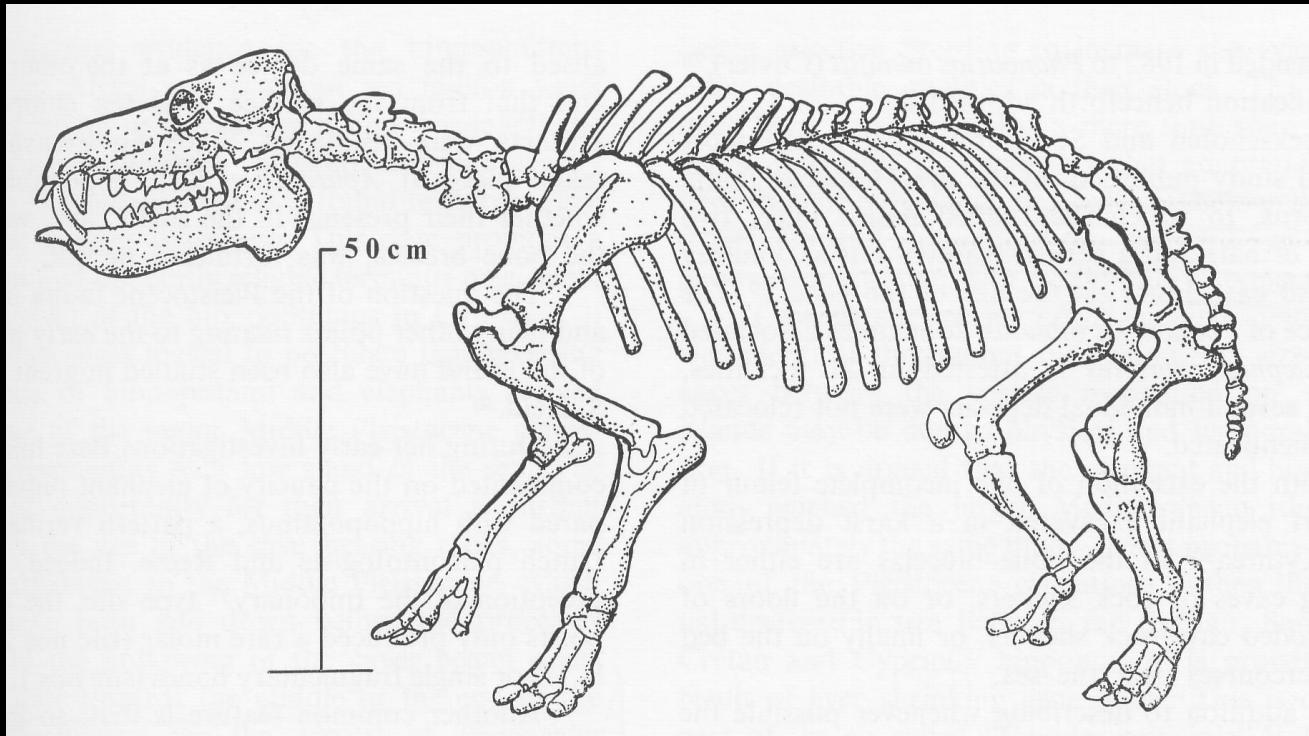
Its main habitat consists of forested watercourses where it shelters by day in ponds, rivers and swamps, grazing at night the dense riverine vegetation along grassy trails



It cannot be excluded that some of the dwarf hippopotami of Sicily, Malta, Crete, and Cyprus might have lived in similar environmental conditions too



The Cypriot dwarf hippo was even smaller and more slender than the extant Liberian hippo, being about the size of a pig



Furthermore,
its odontology and morphology suggest a mode of
living similar to that of leaf-eating pigs,
and it may have been an animal that was better
adapted to walking than
to swimming

The dwarf endemic elephant of Tilos has been described as a very agile animal well adapted to the island environment, capable of moving through rough terrain



It seems plausible that the reduced body size of the large mammals was one of the best adaptive responses to this type of environment



Analogous examples can be found in the populations of other large herbivores that still populate the primeval forest regions of Africa

For example, dwarf populations of African buffaloes, taxonomically defined as *Syncerus caffer nanus* (Boddaert, 1785), are regarded as still occurring in what remains of the African primeval forests



Elephants of reduced body dimensions
are still reputed to inhabit the rain forests of
west-central Africa too

However, the existence of a species of African pygmy elephant is not generally recognised



African forest elephants, *Loxodonta cyclotis* (Matschie, 1900), were thought to be a subspecies of the African elephant, *Loxodonta africana* (Blumenbach, 1797), but recent research has discovered that they are a separate species



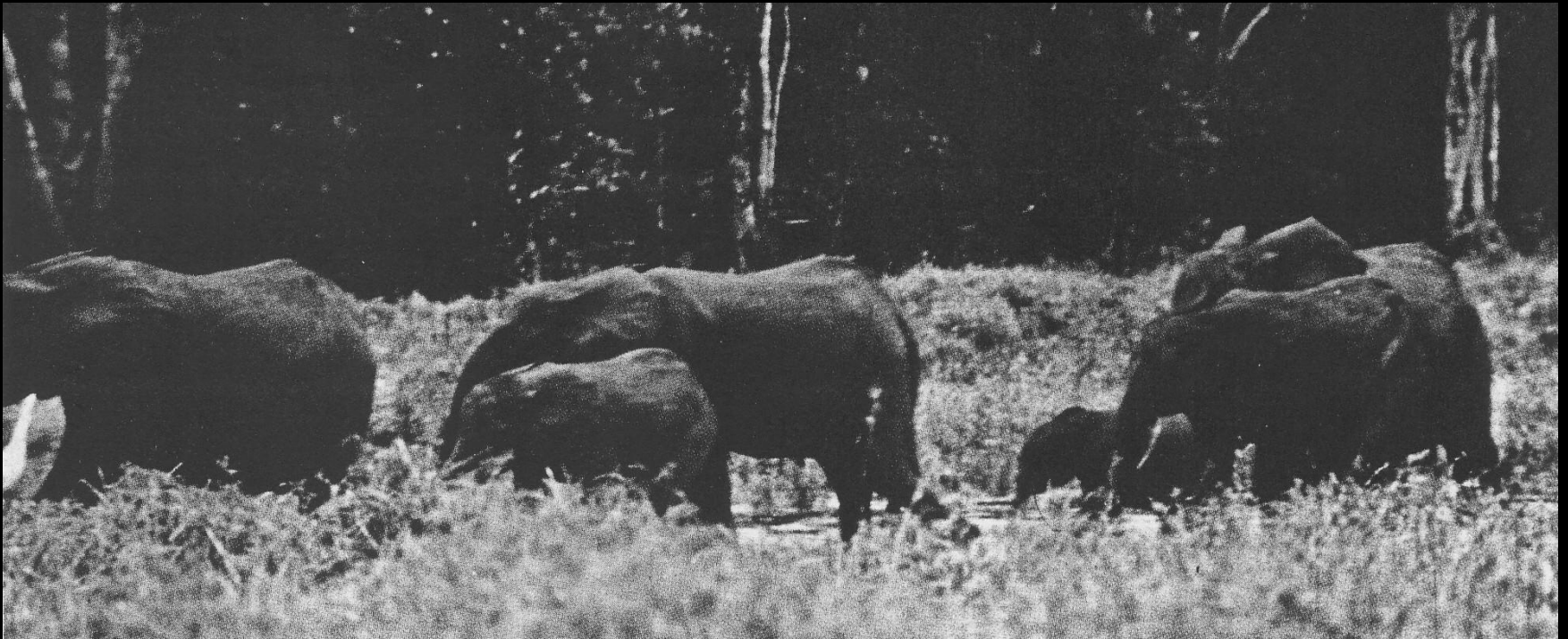
More specifically,
the disputed pigmy elephants of the
Congo basin,
often assumed to be a separate species,
Loxodonta pumilio Noack, 1906,
are probably forest elephants whose diminutive size
and/or early maturity is due to environmental
conditions

Nevertheless, several authors, such as *Basilio (1962)*, gave an accurate description of the latter supposedly existing form, which he considered to be widespread in the pluvial forest of west-central Africa



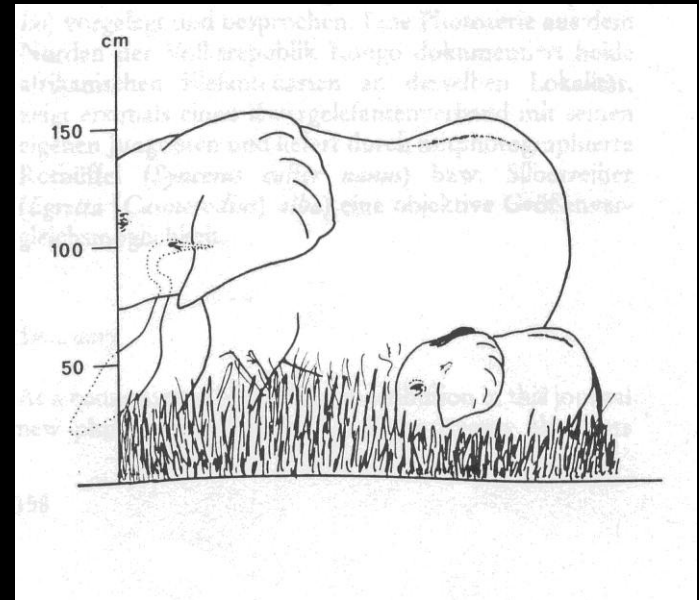
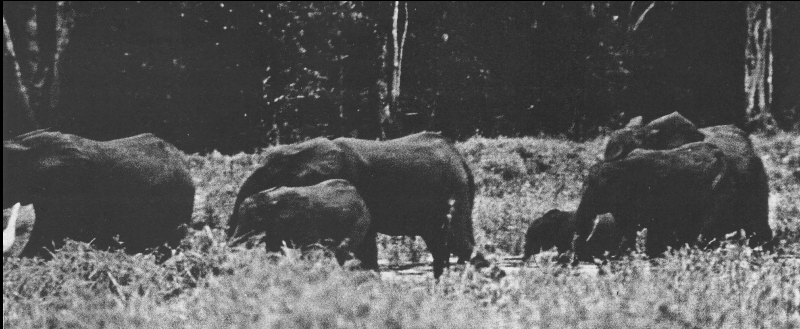
Not long ago,
researchers of the authority of *Martin Eisentraut & Wolfgang Böhme* have also come out in favour of the
existence of this pygmy form, still diffused
in the Congo basin

As for the size of these pygmy proboscideans,
for the first time they offered photographic documentation –
obtained in the north of the People's Republic of Congo
- of the objective scale by juxtaposing forest elephants with
dwarf buffaloes and above all with a ...



... great white egret, *Egretta alba* L., 1758





It is assumed that
the specific genome of the dwarf proboscideans and
ungulates of the Mediterranean islands was so plastic
as to allow these phenomenic modifications to
take place

Effectively,
if the characteristics of the genome did not permit
such adaptation, the species would logically be
destined to extinction

thank you

