

# “Who killed the Cretan dwarfs?”

The relation between Late Quaternary environmental changes and the extinction of the Cretan megafauna

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European Union  
European Social Fund



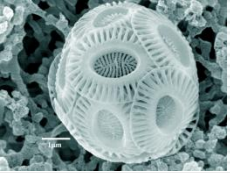
MINISTRY OF EDUCATION & RELIGIOUS AFFAIRS  
MANAGING AUTHORITY

Co-financed by Greece and the European Union



Island biodiversity  
and cultural evolution





## Some famous dwarfs



Cretan Dwarf Elephant -  
*Mammuthus creticus* in  
Emmen Zoo, the Netherlands



Cypriot Dwarf Hippopotamus -  
*Hippopotamus minor* in Natural  
History Museum of Vienna

# Insular dwarfism

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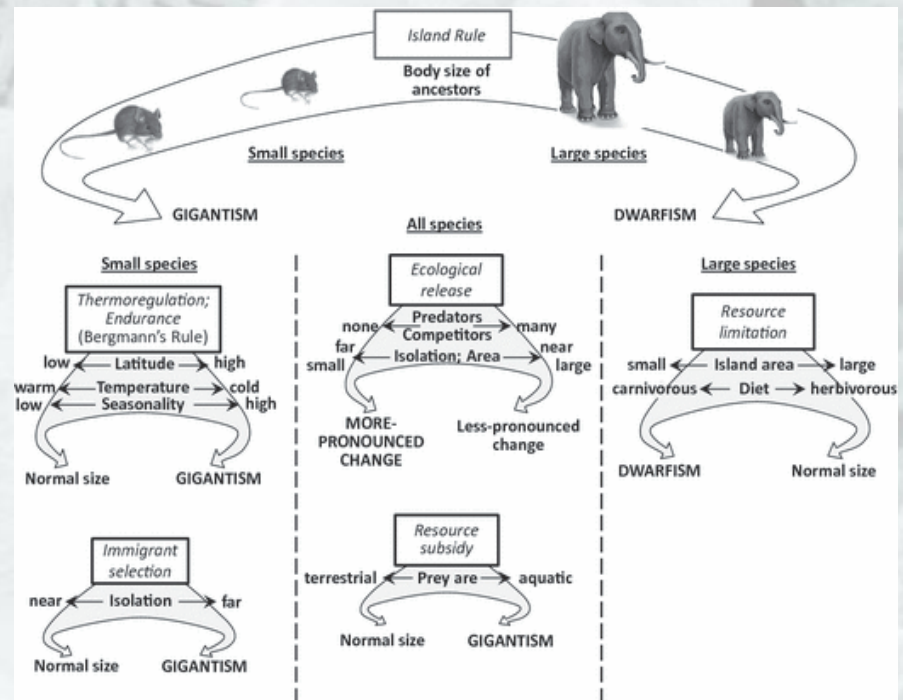
- ❑ Is a form of phyletic dwarfism.
  - ❑ Reduction in size when their population's range is limited to a small environment (e.g. islands).
  - ❑ Has occurred many times throughout evolutionary history (e.g. dinosaurs: *Europasaurus*, modern animals: elephants).
  - ❑ This “island genetics” artefacts can occur also in: caves, desert oases and isolated valleys or mountains (“sky islands”).
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# Insular dwarfism

- Follows the general “island rule” (Van Valen, 1973):

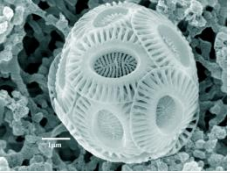
when mainland animals colonize islands, small species tend to evolve larger bodies and large species tend to evolve smaller bodies.



## But ... why studying the island dwarfs?

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- ❑ Islands harbour a significant percentage of the world's biodiversity and cultural heritage sites. Still, our knowledge on islands is limited.
  - ❑ Islands are numerous, with multiple variations, and therefore they are appropriate places to test specific hypothesis.
  - ❑ Many insular animals (e.g. the larger vertebrates) play an important role in human societies.
  - ❑ During the geologically recent past (Late Pleistocene -Holocene) most island ecosystems degraded due to natural and/or human-induced changes.
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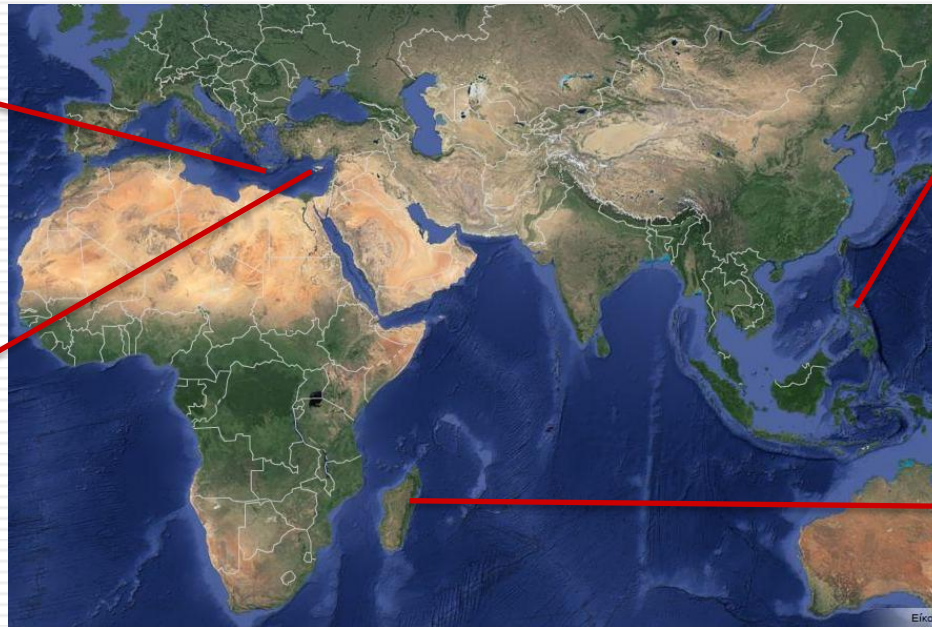
# Ok! Then, where to study them?

- ✓ Eastern Mediterranean Sea
- ✓ Indian Ocean
- ✓ Western Pacific Ocean

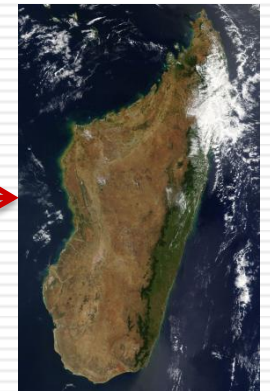


Crete & Karpathos

Cyprus

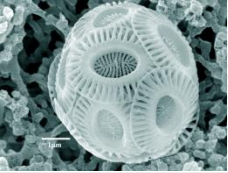


Luzon & Masbate



Madagascar & Mauritius





# Ok! Then, where to study them?

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Crete & Karpathos

Cyprus



- Different geologic, biogeographic and ethnographic background.

- Colonized by humans during different periods (800 ky B.P. -1700 A.D.).



Luzon & Masbate

Madagascar & Mauritius



# ISOLARIO is a multidisciplinary research

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## 5 countries

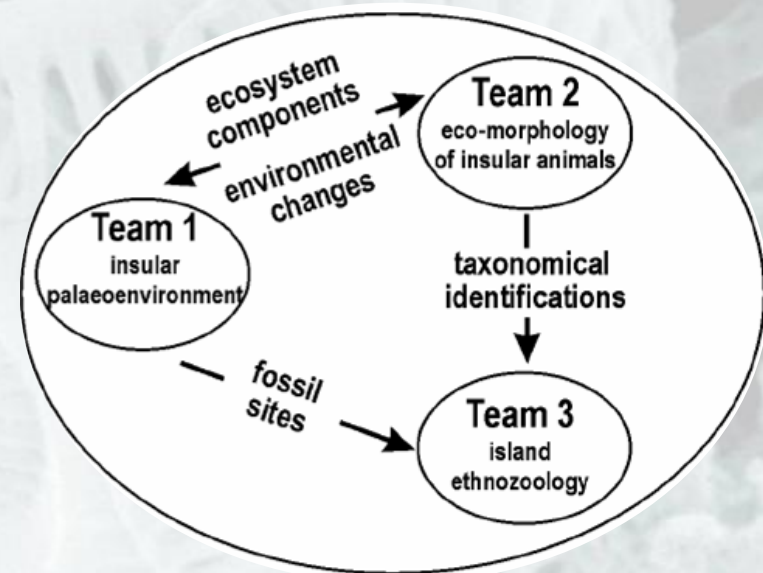
(Greece, Netherlands, USA, Switzerland, Philippines)

## 11 partners

(Universities, Institutes, Museums)

## 3 teams

- **Earth Sciences** (spatio-temporal data)
- **Life Sciences** (species in relation to their environment)
- **Humanities** (contribution of animals to the culture)



Coordinator: Ass. Prof. X. Drinia

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# Everything is correlated to everything!

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**Paleoenvironmental  
changes**

**Sea-level  
variations**

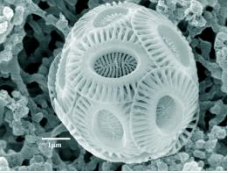
**Age models**

**Stratigraphy**

**Island mammals  
evolution**

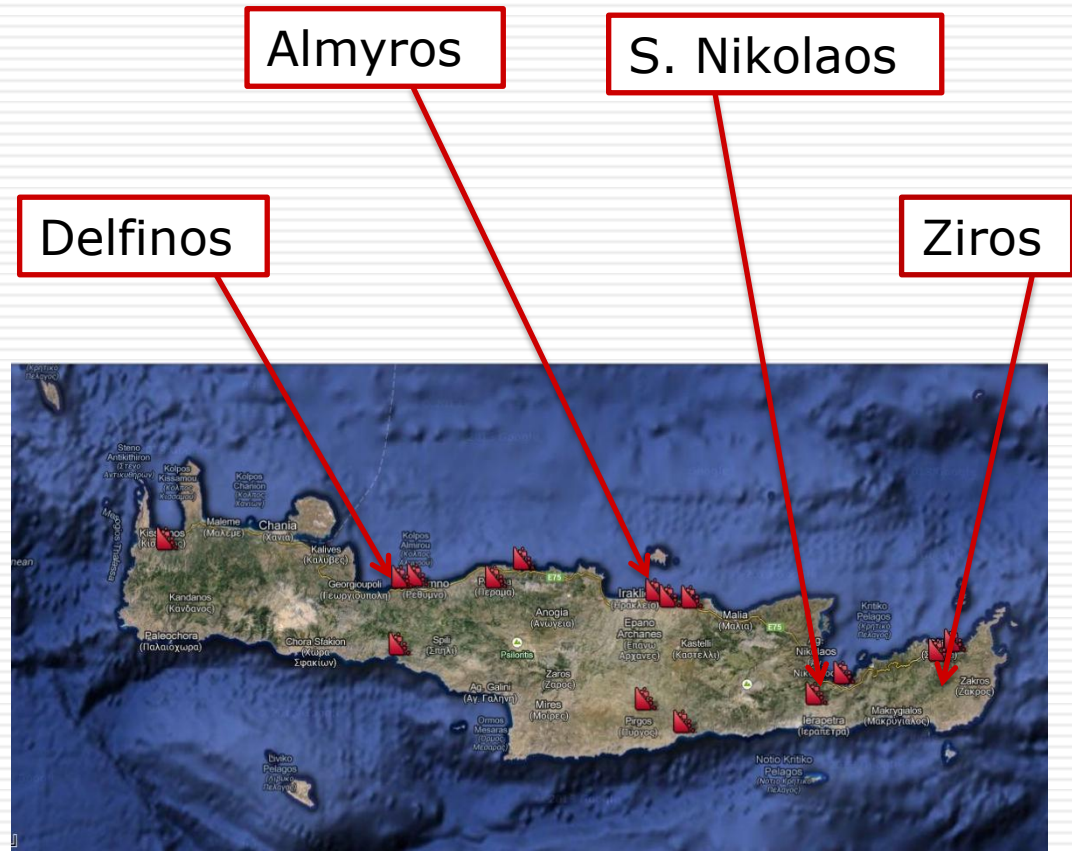
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# Why Crete?

- ❑ Numerous fossil sites excavated and already studied.
- ❑ Several marine cores available.
- ❑ Proximity to archeological sites.
- ❑ It is a nice and cheap island !



# Team 1: Insular Palaeoenvironment

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**Stratigraphic &  
palaeoenvironmental  
research on Crete**

**to correlate the  
response of fossil  
Cretan mammals  
to environmental  
changes**

**to track evidence  
of the first human  
settlers on Crete.**



# Team 1: Insular Palaeoenvironment

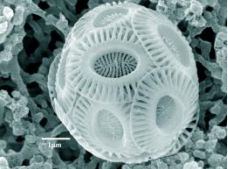
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**Stratigraphic &  
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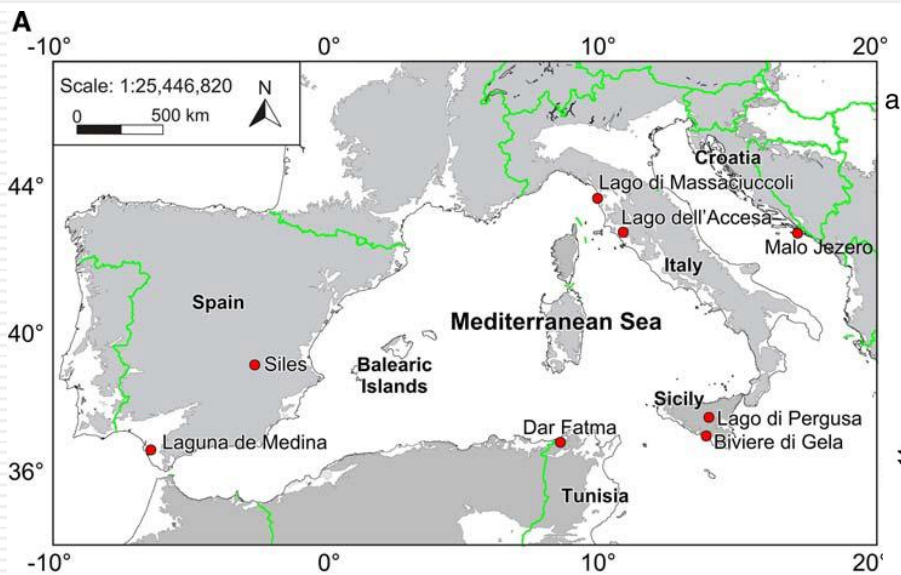
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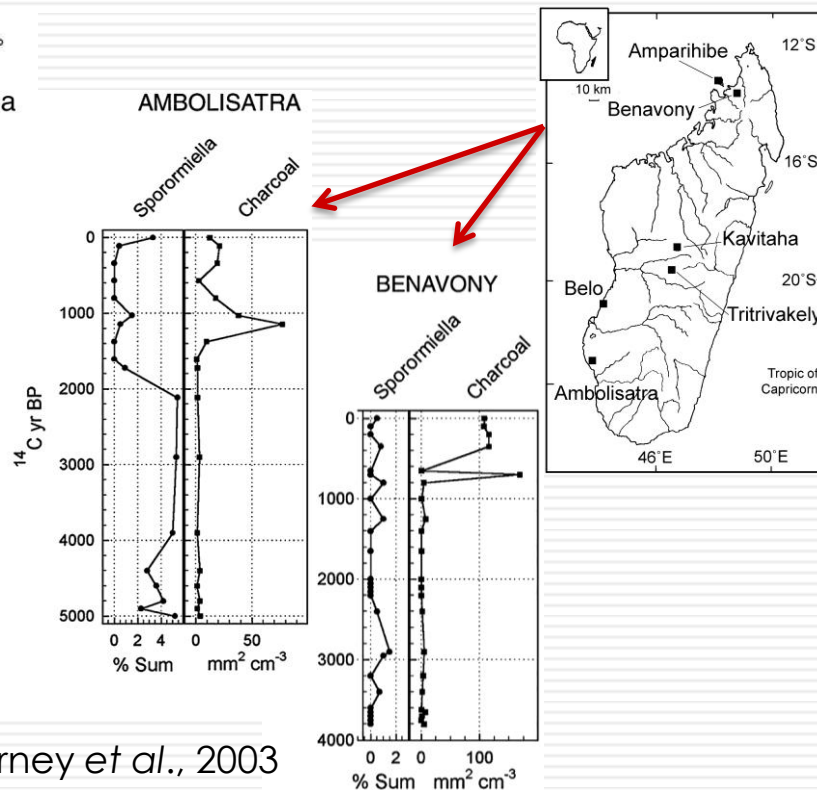


# Team 1: Insular Palaeoenvironment

## Human Arrival - Interpretation of Charcoal Study



Lotti *et al.*, 2009



Burney *et al.*, 2003

# Team 1: Insular Palaeoenvironment

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# Team 1: Insular Palaeoenvironment

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*W.P. 1. Reconstruction of Palaeogeography*

*W.P. 2. Bio-chrono-stratigraphic analyses*

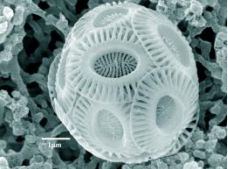
*W.P. 3. Analyses of palaeobiological models*

*W.P. 4. Palaeoclimate*

Necessary to apply a multi-proxy approach combining data from **stratigraphy, sedimentology, (micro)palaeontology, palynology, geochronology and geomorphology.**

## **Field work**

- **Sediments cores in lakes & coastal environment**
  - ✓ **Marine sediment cores**
  - ✓ **Excavations in selected sites**
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# What has been done?

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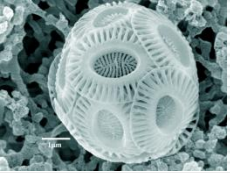
Dirk Hoffmann drilling sediments for OSL measurements (site Bali)



Lee Arlond counting the background radiation for OSL (site Katharo)

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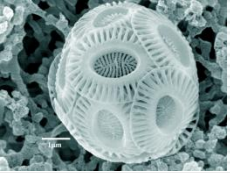
# What has been done?



Fossil mice & deers  
(site GERANI)







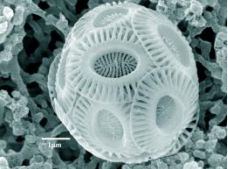
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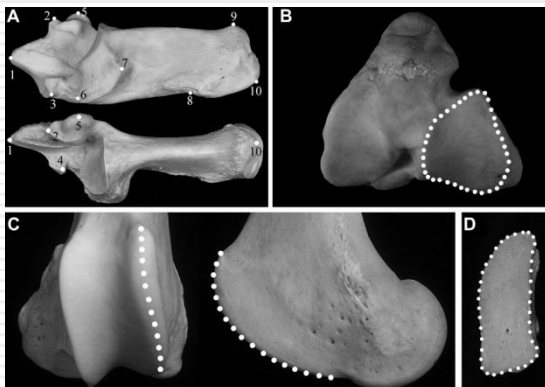
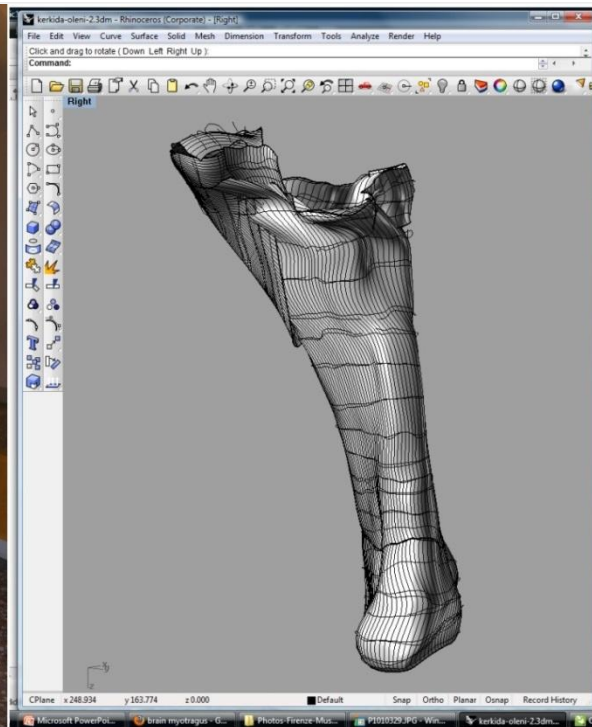
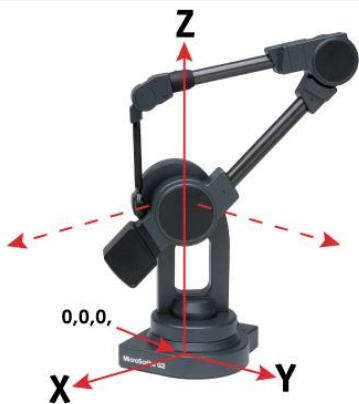


Fossil bones of Deer-candia (cave Liko)

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# What has been done?



# Team 1: Insular Palaeoenvironment

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## More to be done ...

### Bio-chrono-stratigraphic analysis

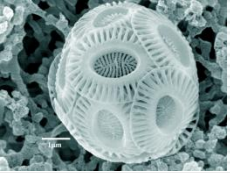
- micropalaeontological, palynological & geochemical analysis
- radiocarbon dating
- date several localities with fossil vertebrates

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### Palaeo- reconstructions

- sea-level variations
- environmental changes (pollen, ostracods, forams)
- climatic changes ( $\delta^{18}\text{O}$ ,  $\delta^{13}\text{C}$  in forams & ostracods)





## Some famous dwarfs



**mmm!  
maybe these  
palaeontologists  
are CSIs ...**

*Elephas Falconeri* - Siracusa - Museo Archeologico



**Thank you!**

**Questions?**

**Suggestions?**

