

BEARS ON ISLANDS: THE FOSSIL RECORD, A RE-APPRAISAL

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Insular faunas are generally unbalanced: they lack certain functional groups, for example, carnivores (Sondaar, 1977). Despite this, fossil terrestrial mammalian carnivores are not rare on oceanic or oceanic-like islands (=those that were not reached by landbridge). The vast majority of insular carnivores is small or medium-sized. Otters, for example, are known from practically every island with a fossil record (van der Geer *et al.*, 2010). They are all endemic to their island and sometimes even placed in a genus on their own: e.g., *Isolalutra cretensis* (Late Pleistocene, Crete), *Megalenhydris barbaricina* (Middle or Late Pleistocene, Sardinia). More rare is the presence of dwarfed canids: *Cynotherium sardous* (Sardinia, Early–Late Pleistocene) and *Mececyon trinilensis* (Java, Middle Pleistocene), which evolved from large-sized wolf-like ancestors that acquired jackal size as a result of shift in prey spectrum (Lyras *et al.*, 2010).

What about large-sized mammalian carnivores? Bear fossils have been reported from two Mediterranean islands with endemic faunas: Malta and Tilos. The Maltese fossil (BM/M4679, Natural History Museum, London; Fig. 1) was retrieved from the Red Clay layers at Ghar Dalam cave in 1882 that also yielded abundant fossils of endemic small red deer (*Cervus cf. elaphus*), a small fox (*Vulpes* sp.), a vole (*Pitymys melitensis*), etc., but also human artefacts and remains (Cooke, 1892). The bear fossil was described as the left lower mandible of a brown bear (*Ursus cf. arctos*; Lpm4 14 mm, L m1 23 mm, L m2 25 mm) (Woodward, 1893), smaller than a continental brown bear (Zammit-Maempel, 1989). However, its context is unclear, because Ghar Dalam cave lacks a clear stratigraphy, and biozones likely are mixed. The Tilos fossil (lower canine, University of Athens) comes from a Late Pleistocene–Holocene level (depth 1.1 m) with dwarf elephants fossils and traces of human activity (Bachmayer *et al.*, 1976). It was never described in detail but suggested to be a hunter trophy from Asia Minor, because of its unlikely co-occurrence with dwarf elephants. Single remains from Chios (Final Neolithic/Chalcolithic) and Samos (Bronze Age) are considered trophies (Masseti 2012).

In our view, these rare findings should be reconsidered in the light of what we know today on insular carnivores. Large and medium-sized carnivores were thought to be lacking in

insular biotas but the numerous exceptions show otherwise. At present, many islands of northern America (British Columbia, Alaska) harbour bears. These bears are either larger or smaller than conspecific mainland bears (ISB database), largely as a function of the availability of nutritionally rich food (salmon). This is in line with the observation that carnivore body size on islands is mainly driven by prey size, type and availability and not on island size (Lyras *et al.*, 2010). The successful persistence of bears on islands today indicates their survival capacity in isolation, provided there is sufficient food. The partially omnivorous character of bears in general likely enhances their survival despite their large size.

This research was co-financed by the European Union and Greek national funds (Research Funding Program THALIS- UOA MIS375910, KA:70/3/11669).

LITERATURE

- Bachmayer, F., N. Symeonidis, R. Seeman, H. Zapfe (1976) Die Ausgrabungen in der Zwergelafanten "Charkadio" auf der Insel Tilos (Dodekanes, Griechenland) in den Jahren 1974 und 1975. *Annalen des Naturhistorischen Museums in Wien* 80, 113-144.
- Cooke, J.H. (1892) On the occurrence of *Ursus arctos* in the Malta Pleistocene. *The Mediterranean Naturalist* 2, 267-269.
- Geer, A. van der, J. de Vos, M. Dermizakis, G. Lyras (2010) *Evolution of island mammals: adaptation and extinction of placental mammals on islands*, Wiley-Blackwell, Oxford.
- ISB (International Society of Biogeography) database, <http://biogeography.org/html/resources/databases.html>
- Lyras, G.A., A. van der Geer, L. Rook (2010) Body size of insular carnivores: evidence from the fossil record. *Journal of Biogeography* 37, 1007-1021.
- Masseti, M. (2012) *Atlas of terrestrial mammals of the Ionian and Aegean*, De Gruyter, Berlin.
- Sondaar, P.Y. (1977) Insularity and its effect on mammal evolution. In: *Major patterns in vertebrate evolution* (M.N. Hecht, P.C. Goody & B.M. Hecht, eds.), pp. 671-707. Plenum, New York.
- Woodward, A.S. (1893) Report on the organic remains. *Proceedings of the Royal Society London* 54, 274-283.
- Zammit-Maempel, G. (1989) *Ghar Dalam cave and deposits*, Mid-Med Bank, Malta.



Fig 1 Left lower mandible of *Ursus cf. arctos* from the Late Pleistocene / Holocene of Malta (BM/M4679, Natural History Museum, London). Lateral view, scale bar 1 cm. Photograph: George Lyras.