

## Comparative study of ursid remains from the Quaternary of Greece, Turkey and Israel

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**Abstract.** Ursid remains from Quaternary cave sites in Greece, Turkey and Israel are compared and discussed. This material comes from Petralona and Loutraki (Greece), Yarimburgaz (Turkey) and an eroded karstic cave in the Upper Galilee (northern Israel). Each has been studied and analyzed previously. In Petralona, the predominant bear is a transitional form between *Ursus deningeri* and *U. spelaeus*, although three species (*U. deningeri*, *U. spelaeus* and *U. cf. arctos*) have been identified. These species have also been found in Yarimburgaz cave, while only *U. deningeri* has been recovered in Israel and *U. spelaeus* in the Loutraki caves. The discussion is based on both morphological and metrical analyses. The combination of arctoid and speleoid characters, as well as the astonishing size variability of *U. deningeri* from these sites, is notable. The Yarimburgaz remains of *U. spelaeus* represent one of the most robust morphotypes of the species, while those of *U. cf. arctos* represent one of the most slender types. The fourth premolars of the Yarimburgaz ursids show variation from very primitive to very evolved morphotypes. The lower premolar varies from a single cuspid to three cuspids, while the upper premolar varies from a simpler form to a more complicated one. There is thus a tendency to molarization of the lower premolars and a trend from broadened to more elongate occlusals. These characters are very clear in *U. spelaeus* from the Loutraki caves, as well as in the speleoid bear from Petralona, the elongation of the third lower molar of which is remarkable. The presence at Loutraki of abundant deciduous teeth, in spite of their fragility, as well as of abundant cranial remains, is remarkable, and in contrast to other sites, where even though there is an abundance of ursid material, milk teeth are rather rare.

**Key words:** Ursids, Quaternary cave sites, Greece, Turkey, Israel, dental morphology

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### I. INTRODUCTION

The fossil Ursidae from Greece, Turkey and Israel are still not well known. The aim of the present study was a comparative analysis of teeth and metapodials of Quaternary bears from eastern Mediterranean area.

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## II. MATERIAL

The material of *Ursus deningeri* REICHENAU, 1906, *Ursus spelaeus* ROSENMULLER & HEINROTH, 1794, and *Ursus arctos* LINNAEUS, 1758, which is compared and discussed comes from (Fig. 1):

a1) *P e t r a l o n a* (P E C, G r e e c e): About 300 ursid remains (the commonest taxon), besides many other fossils representing a very rich fauna associated with the well known hominid skull found on the floor of the cave have been studied and analyzed. Three species have been recognized: *U. deningeri*, *U. spelaeus* and *U. cf. arctos*, (TSOUKALA 1989, 1992), while the predominant type, according to the upper and lower P4 morphotypes (RABEDER 1983), is the Middle Pleistocene form transitional between *U. deningeri* and *U. spelaeus* (RABEDER & TSOUKALA 1990).

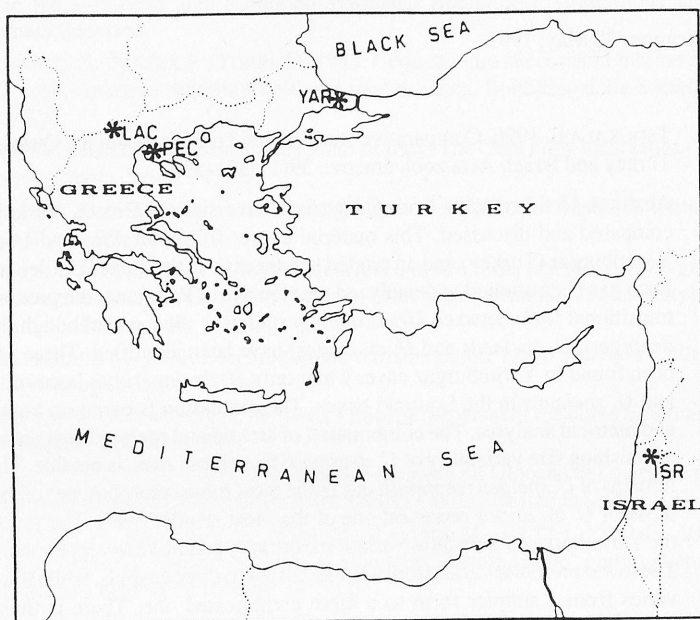


Fig. 1. Map showing the sites with ursid fossil remains compared in the present study. Legend: PEC: Petralona, LAC: Loutraki, YAR: Yarimburağ, ISR: Bears cave in the Upper Galilee.

a2) *L o u t r a k i* (L A C, G r e e c e): About 2500 ursid remains, mostly very well preserved, from the Late Paleolithic bear cave are described and analyzed. The few artifacts found associated with the ursid remains add great interest to this site, where the excavations are still in progress. Preliminary study showed the presence of *U. spelaeus* while only very few specimens represent a small bovid and a large felid. The presence of abundant deciduous teeth, in spite of their fragility, is remarkable. There are hundreds of deciduous teeth, representing the entire deciduous tooth-row.

Other locations where Quaternary Ursidae have been identified in Greece are shown in Fig. 2, which is based mainly on THEODOROU (1992) and KOUFOS (personal communication).

b) *Y a r i m b u r a ğ* (Y A R, T u r k e y): About half of the ca 5000 bones, bone-fragments and teeth from this Early Paleolithic cave-site have been studied and analyzed (TSOUKALA, unpublished). These finds, together with other samples representing a rich macro- as

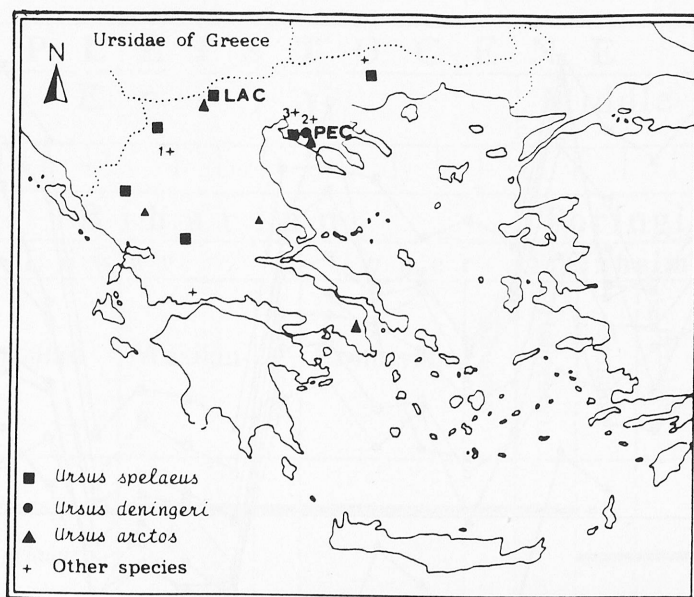


Fig. 2. Map of Greece showing sites where Quaternary Ursidae have been identified (THEODOROU 1992).  
 Legend: 1+=Dafnero, 2+=Appolonia, 3+=Vassiloudi (KOUFOS, personal communication).

well as microfauna, are the result of three field seasons of extensive excavations (HOWELL & ARSEBÜK 1989; ARSEBÜK 1993). The ursid remains represent animals of all ages, as commonly occurs in bear caves used as dens. Three species were recognized: *U. deningeri*, which is the predominant type, *U. spelaeus*, one of the most robust morphotypes of this species, and *U. cf. arctos*, one of the most slender morphotypes.

c) **Bears Cave (ISR, Upper Galilee, Israel):** There are 64 ursid remains, as well as a few other specimens, obtained during excavations carried out under the direction of Prof. E. TCHERNOV, in a cave which no longer exists. This material shows the presence of *U. deningeri* of Early Toringian age (TCHERNOV & TSOUKALA, unpublished).

### III. DISCUSSION

The discussion is based both on metrical (Fig. 3) and morphological analysis.

The Petralona faunas involve a sequence of bear populations, as two different faunas are known to exist: one is considered to incorporate archaic forms typical of Villafranchian faunas and includes *U. deningeri* of early Middle Pleistocene age (but younger than 700.000 years), and the other is considered to include late Middle-Late Pleistocene forms, as well as transitional, mainly endemic ones, such as the hominid skull (TSOUKALA 1989, 1992). The *U. spelaeus* from Petralona shows progressive, elongate  $M^2$  and  $M^3$  (Fig. 3) and a tendency to increasing breadth and coronal complexity of upper and lower P4, while the anterior premolars tend to be lost. A these are typical speleoid characters (ZAPFE 1946; MOTTI 1964; RABEDER 1983). On the other hand, there is no great tendency to increasing robustness of build, reflected for instance in the limb bones, which are long but rather slender. The predominant type is the intermediate stage between *U. deningeri* and *U. spelaeus* (RABEDER & TSOUKALA 1990).

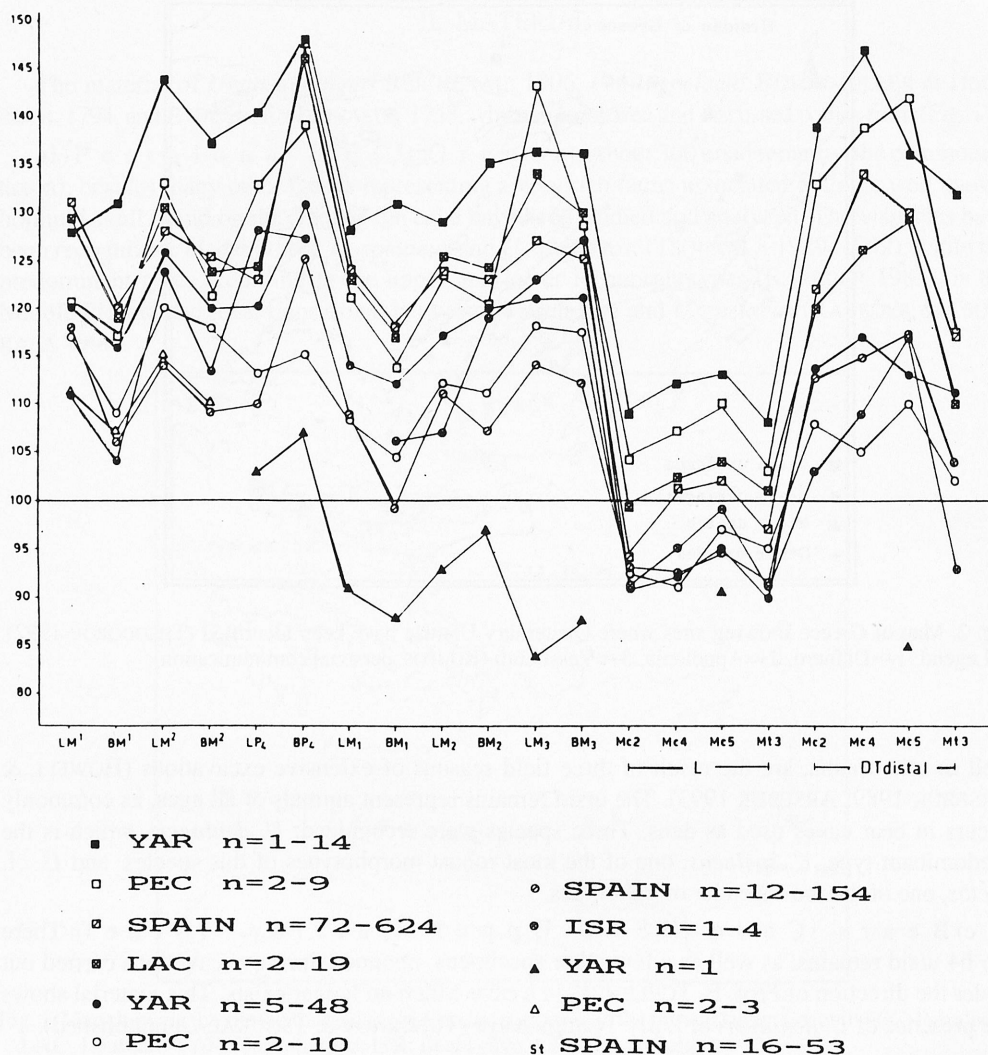


Fig. 3. Ratio diagram after SIMPSON (1941), comparing the dimensions of the upper ( $M^1$ ,  $M^2$ ) and lower ( $P_4$ ,  $M_1$ ,  $M_2$ ,  $M_3$ ) cheek teeth and the metapodials (Mc2, Mc4, Mc5 and Mt3) of *Ursus spelaeus* (squares), *U. deningeri* (circles) and *U. cf. arctos* (triangles), from Petralona Cave (PEC), Loutraki (LAC) (Greece), Yarımburgaz (YAR, Turkey) and Upper Galilee (ISR, Israel). The vertical scale represents the percent deviation from the standard specimen of each dimension. The ursid sample from Spain, including the standard specimen, was chosen for comparison because of the abundance of metric data (TORRES 1988). Legend: L – Length, B – Breadth, Dt distal – Distal width.

The Loutraki *U. spelaeus* is a rather robust type, with a complicated premolar morphotype, especially of  $P_4$ , which is at the stage of three or four cusps, thus clearly showing a tendency to molarization and an advanced evolutionary stage (RABEDER 1983).

The Yarımburgaz *U. spelaeus* is a very robust type, while the *U. cf. arctos* is a very slender one for their respective species (Fig. 3). *U. deningeri*, which is the predominant form, is also a



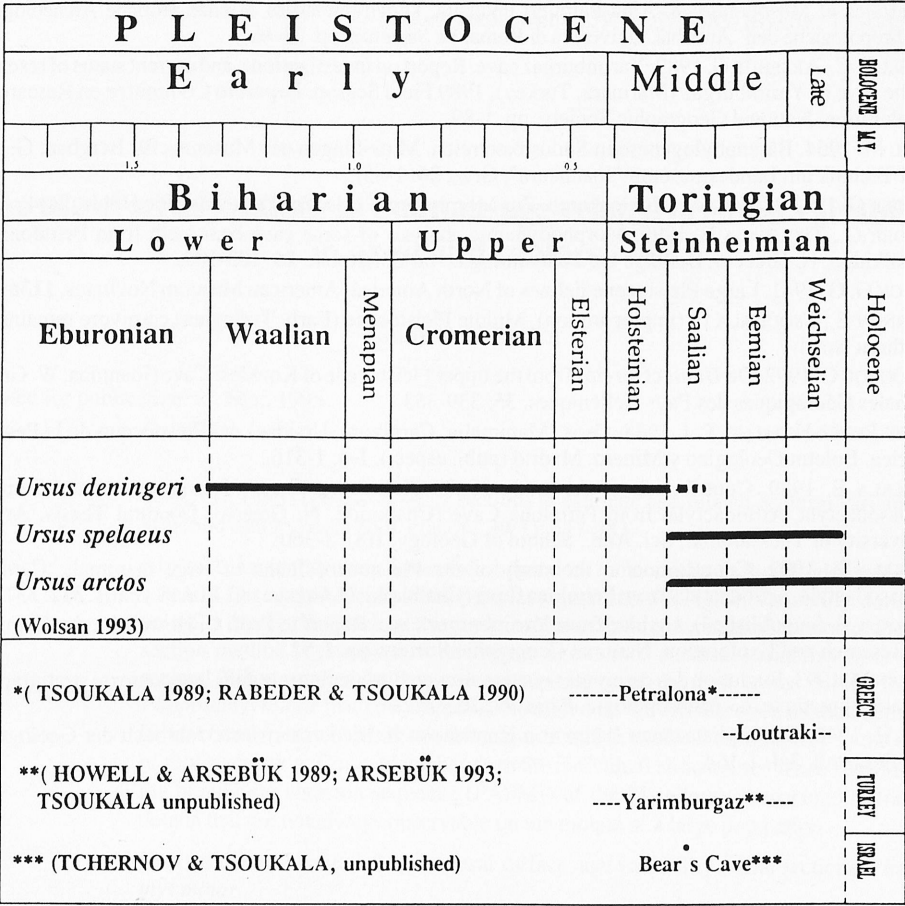


Fig. 4. Stratigraphic distribution of the ursids *U. deningeri*, *U. spelaeus* and *U. arctos* from the studied sites.

robust type. The morphotype of the fourth premolars shows great variability from very primitive to very evolved types. For  $P_4$  it varies from the stage of a single cuspid to the stage of three cuspids, while  $P^4$  varies from a simpler form to a more complicated one.

The Israel *U. deningeri* is a rather slender type, but with a long  $M^2$  and  $P_4$ , while there is an increase in breadth of  $M_2$  and  $M_3$  (Fig. 3). The protoconid of  $P_4$ , which is not so high, the undeveloped metaconid, and the morphotype based on the number of tubercles in the crown, show a rather primitive evolutionary stage, similar to that of *U. deningeri* from Petralona, and contrasting with that of Yarimbürgaz, which is more advanced.

The stratigraphic distribution of Quaternary ursid remains from the sites studied above is given in Fig. 4.

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