

CHRONOLOGICAL AND SYSTEMATIC POSITION OF CAVE BEARS FROM LOUTRÁ ARIDÉAS (PELLA, MACEDONIA, GREECE)

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Abstract: The cave bears from Loutrá Aridéas cave most likely belong to the species *Ursus ingressus* (RABEDER *et al.* 2004). This emanates from metrical and morphological comparisons. Radiometric data show that these cave bears lived at least 37.000 years ago. Between 34.000 and 32.000 years B.P. the fossil remains of bears and other large mammals were relocated from their initial deposit, which is completely destroyed today, and were dispersed on nearly all the ground of the cave.

Key words: Loutrá Aridéas Cave, *Ursus ingressus*, radiometric datings, Taphonomy.

INTRODUCTION

The cave-site of Loutrá (LAC: Loutrá Aridéas Caves) is located in Northern Greece (Macedonia), 120 km north-west of Thessaloniki and 2 km from the Loutraki village, in the so called “Almopia Speleopark”. The research in the area started in 1990 and in twelve systematic excavation circles, under strict paleontological rules, including micromammalian research, was carried out by the Geology School of Aristotle University, in cooperation with the Ephorate of Paleanthropology and Speleology of the Ministry of Culture. Since 1996 the excavations continued in co-operation with the Vienna University (TSOUKALA, 1994; TSOUKALA, RABEDER & VERGINIS, 2001; TSOUKALA & RABEDER, 2006). All the paleontological material is stored in the local Physiographical Museums of Almopia in the Loutrá area and Aridéa town. All the sediments of the 206 levels (about 5 cm of thickness each) have been washed through a system of double sieves, for micromammals with a mesh of 0.8 mm and for large mammal remains and milk teeth of 3 mm (CHATZOPOULOU, 2006; PAPPAS *et al.* 2006).

MATERIAL

The cave bear remains consist of abundant isolated teeth, bone fragments, while there are several mandibles and a very few skulls. For studies on the evolutionary level and systematic position, about 1500 teeth were measured:

202 I1 and I2, 68 I3, 64 i1, 125 i2, 124 i3, 141 canines (111 female, 30 male), 7 P3, 104 P4, 95 p4, 109 M1, 77 M2, 149 M1, 169 M2, 95 M3.

METHODS

For age determination of the cave bear remains several bone fragments were dated using AMS and two sinter samples were analysed using conventional radiocarbon dating.

Since we know, that at least 4 cave bear lines inhabited Europe in the Late Pleistocene, the question of affiliation to different cave bear species is a contemporary issue. DNA analysis of the bears from Loutrá was not successful; therefore we compare the mean values and morphological indices with other populations and try to find out the classification into one of three possible taxa. For the problem of local adaptation and the appropriate evolution, specific criteria of dentition are very interesting. So it is necessary to find out the significant metrics and morphodynamic indices of teeth and to use them for systematic classification. Typical faunas of *Ursus ingressus* (Gamssulzenhöhle), of *Ursus eremus* (Ramesch-Knochenhöhle) and of *Ursus ladinicus* (Conturineshöhle) as well as other representative populations were compared. Only DNA analysed or morphologically classifiable material was used for comparison.

That is:

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Table 1

Lab.	Lab.-nr.	material	sample nr.	Campaign	sector	square	depth (cm)	¹⁴ C Age	1 sigma		¹³ C (‰)
									+	-	
GrN	22770	sinter	Loutraki 1	1996	LAC I	N 10	15	32.060	520	490	+5,77
GrA	7573	bear femur	Loutraki 2	1996	LAC I	N 10	40	37.880	370	360	-21,35
GrN	22772	sinter	Loutraki 3	1996	LAC I	N 10	80	33.910	590	550	+5,25
VERA	-	bear Mt5	LAC 7005	2000	LAC Ib	W/V 4	170-175		no collagen		
VERA	-	bear Mt2	LAC 7023	2000	LAC Ib	W/V 4	170-175		no collagen		
VERA	-	bear Mc1	LAC 7068	2000	LAC I	O 10	85-100		no collagen		
VERA	-	bear Mt4	LAC 7079	2000	LAC I	O 10	85-100		no collagen		
VERA	-	bear Mc4	LAC 7170	2000	LAC Ib	V 4	180-185		no collagen		
VERA	-	bear bone	LAC III	2001	LAC III		32		no collagen		

Abbreviations: GrA and GrN - Centre for Isotope Research, University of Groningen (NL), VERA - Vienna Environmental Research Accelerator, University of Vienna.

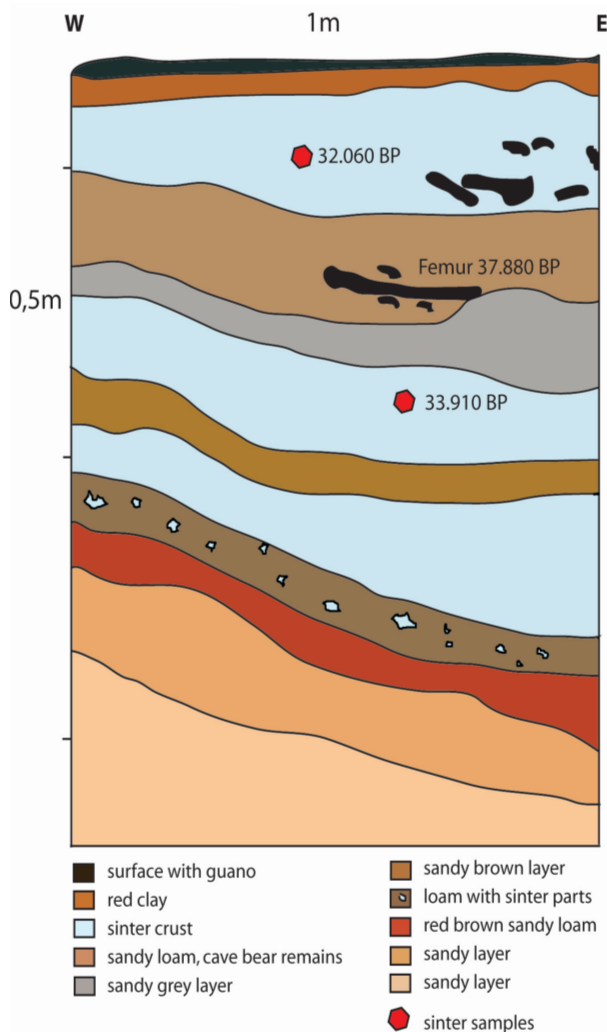


Figure 1. Profile of excavation site LAC I (first chamber), boundary of square N10 to O10, with position of dated sinter samples and cave bear femur.

Ursus ingressus: Gamssulzenhöhle (locus typicus), Hartelsgrabenhöhle, Herdengelhöhle layers 5-6, Ilianka, Krizna jama, Lieglloch, Merkensteinhöhle, Mokriská jama, Nixloch, Potocka zijalka, Vindija G.

Ursus eremus: Ramesch-Knochenhöhle (locus typicus), Ochsenhalthöhle, Pocala, Salzofenhöhle, Schreiberwandhöhle, Schwabenreith-Höhle.

Ursus ladanicus: Conturineshöhle (typical fauna), Brieglersberghöhle, Grotte Merveilleuse, Sulzfluh-Höhle

Ursus spelaeus: Zoolithenhöhle (locus typicus), Erpfingen, Weinberghöhle bei Mauern

s. DÖPPES & RABEDER (1997), HOFREITER *et al.* (2004), PACHER *et al.* (2004), RABEDER (1989; 1999; 2005), RABEDER & *et al.* (2004,) RABEDER & HOFREITER (2004).

RESULTS

1. Radiometric datings (tab. 1)

Interpretation: Taphonomic studies during the excavations showed that the fossil remains of ursids, hyaenids and felids were on secondary deposits in all parts of the cave. This is concluded from the alignment of limb bones and fragments and from the sediments, which contains allochthon elements, like crystalline debris (especially in site LAC Ib). The extensive presence of Ca-Mg rich primary and secondary minerals (clinozoisite, tremolite, talc, chlorite, chlorite/vermiculite) in the fine-grained sediments of the cave floor indicates the composition of the parent rocks of the broader drainage basin, which have been weathered (TSIRAMBIDES, 1998). Large mammals in original deposit have not been found up to now anywhere in the present preserved parts of the cave (except for an almost complete right anterior paw of a juve-

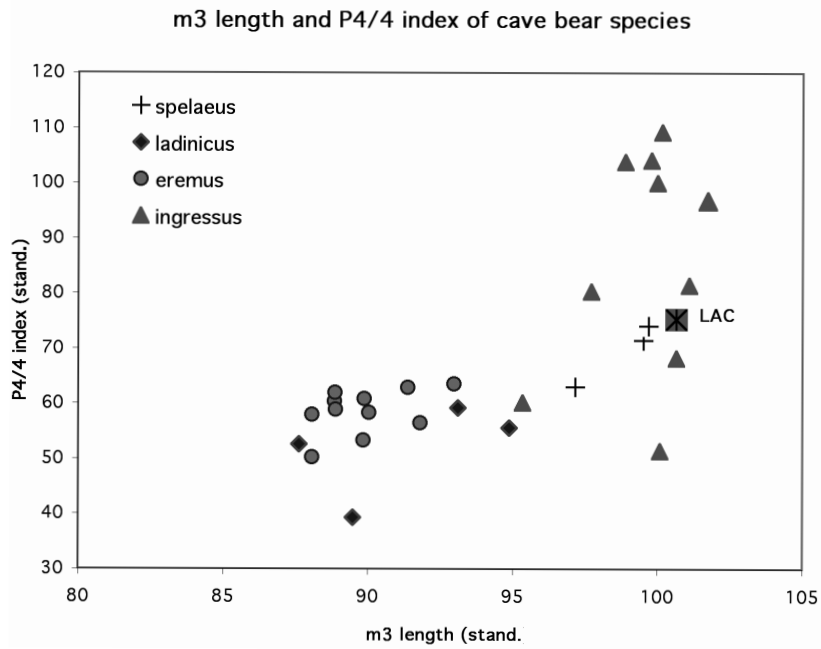


Figure 2. Comparison of means and index values of typical members of cave bear group in Europe.

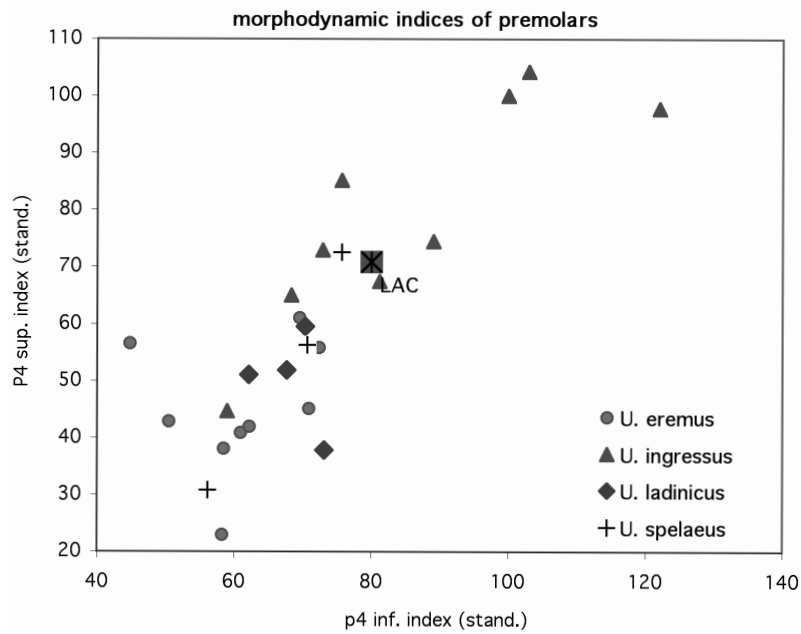


Figure 3. Comparison of index values of 4th premolars of typical members of the cave bears in Europe.

nile found *in situ*, in B10 square, in the second chamber LAC II). The fossils originate from other places or cavities. Between 34.000 and 32.000 B.P. they were moved from those places, where the cave bears bones were initially deposited, to their present sites. This removal was caused

by floodwater, which invaded the cave and brought also a large amount of rubble. After this event the deposit of mountain milk was continued.

2. **Measuring teeth:** The means of the teeth length show that the bears of Loutrá Aridéas cave were as large

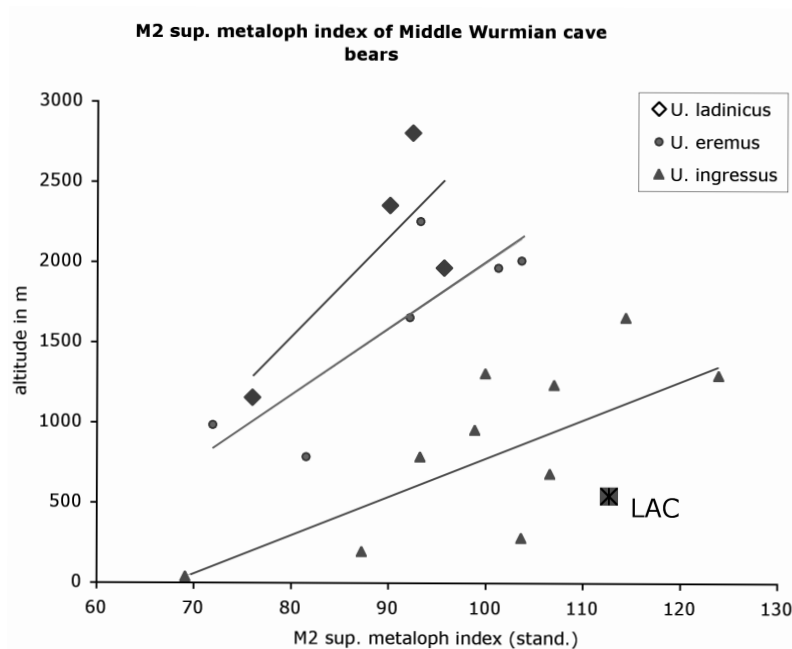


Figure 4. The relation between morphodynamic index values and altitudes of cave entrances.

as the bears from Gamssulzenhöhle and therefore a good deal bigger than *Ursus eremus* and *Ursus ladinicus* from the Alps. Representatives of the typical *Ursus spelaeus* from caves in Germany also reach these dimensions (as example m3 length, fig. 2). This points out that it is not possible to make a classification only by dimension.

3. **Morphodynamic indices** of premolars and molars (s. RABEDER, 1999).

The morphodynamic indices of premolars show that the bears from Loutrá Aridéas have much higher values than *U. eremus* and *U. ladinicus*, so these species are not represented in the cave, but there is an overlap (fig. 2 and 3) with the highly developed *Ursus spelaeus* (such as from Guloloch in Zoolithenhöhle and Bärenhöhle in Erpfingen), for other morphodynamic indices no data exists for *Ursus spelaeus*. The index values of the three cave bear species from the Alps show a dependence on the altitude of the cave. The higher the cave is situated, the higher are the index values. This is most obviously in *U. ingressus* and less in *U. ladinicus* (fig. 4).

The values of the bears from Loutrá Aridéas point to *U. ingressus*. This also applies to the enthyoconid index of m2 inf.

The occurrence of *Ursus spelaeus* in Eastern Europe is not verified through DNA analysis, but *Ursus ingressus* was found in many cases, so we can assume that the bears from Loutrá Aridéas belong to the species *Ursus ingressus*.

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