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The Small Mammal Fauna from the Loutra Aridea Bear-Cave (Pella, Macedonia, Greece) with Emphasis on the Third Chamber

Zusammenfassung:

Die Loutra Aridea Bärenhöhle (Nord-Griechenland) lieferte eine reiche pleistozäne Fauna mit Säugetieren, Amphibien und Reptilien. In der neuesten Forschung wird die Kleinsäuger-Fauna, welche mit Höhlenbären-Resten vergesellschaftet ist, untersucht, wobei der Schwerpunkt auf den Funden der dritten Kammer der Höhle (LAC III) liegt. Das neue Grabungsfeld R1 zeigt die höchste Diversität der Arten und den größten Reichtum an Knochen und Zähnen in der Höhle. Für die Loutra Aridea Bärenhöhle wurden zwei Arten erstmals nachgewiesen. Das Material stammt aus einem langjährigen Grabungsprojekt, welches noch andauert.

Abstract:

The Loutra Aridea Bear-Cave (Northern Greece) yielded a rich Pleistocene fauna including mammals, amphibians and reptiles. In the present study the small mammal fauna associated with cave-bear remains is studied, with emphasis on the findings of the third chamber of the cave (LAC III). The new trench square R1 shows the most remarkable diversity of taxa and great abundance of bone and tooth remains in the cave. Two species are being recorded for the first time in the material of Loutra Aridea Bear-Cave. The material comes from long excavation project, which is still in progress.

Résumé:

La grotte Loutra Aridea (Nord de la Grèce) a livré une faune pléistocène riche en mammifères, amphibiens et reptiles. Les recherches présentées ici concernent la microfaune découverte en liaison avec des restes d'ours des cavernes, et en particulier les pièces provenant de la troisième salle de la grotte (LAC III). La nouvelle zone de fouilles (R1) montre la grande diversité des espèces et la grande richesse en ossements et dents dans la grotte. Deux espèces ont été attestées pour la première fois à Loutra Aridea. Le matériel provient d'un projet de fouilles toujours en cours.

Key words: Loutra Aridea Bear-Cave (Northern Greece), Pleistocene, small mammal fauna

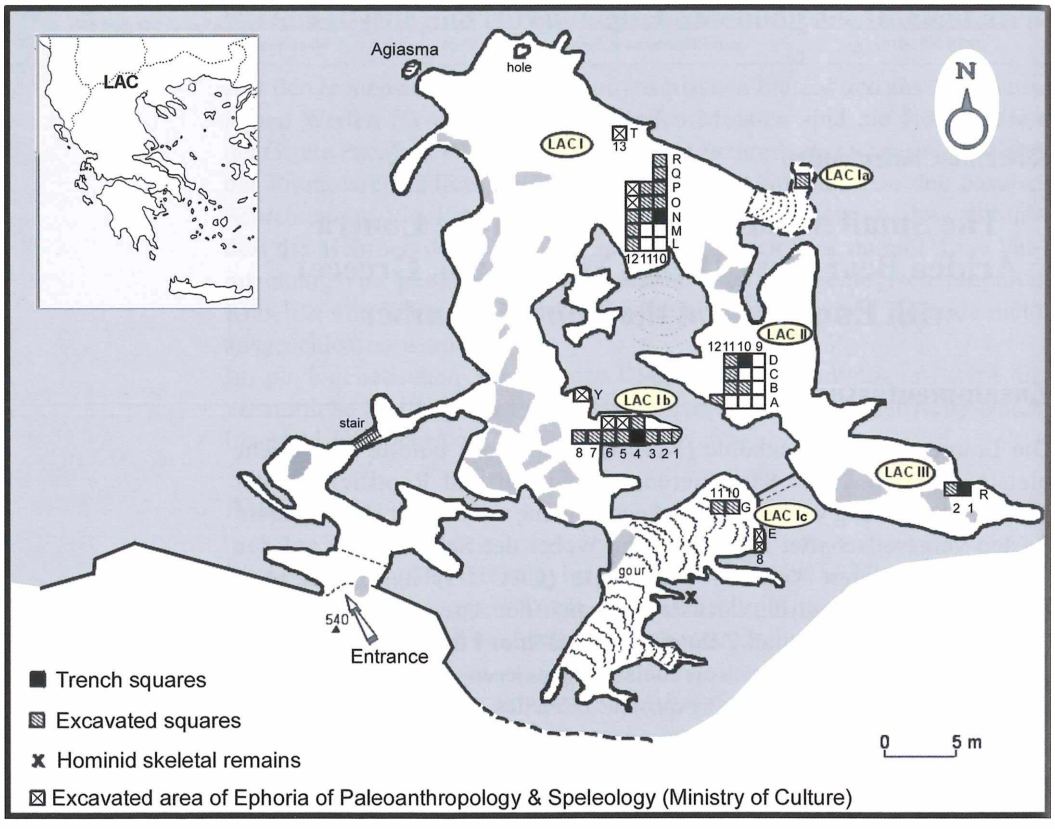

Figure 1. Bear-cave LAC, location and ground-plan. On the ground-plan the excavated trench squares are shown.

1. Introduction

The cave-site of Loutra (LAC: Loutra Aridea Caves) is located in North Greece on the slopes of the Voras mountain (2524m), very close to the former Yugoslavian border, about 2km from Loutraki village and 120km north-west of Thessaloniki (Fig. 1). The caves have been developed mainly in the north side of the V-shaped Rema Nicolaou gorge. It is part of the „speleological park" in the region of the Loutra spa. The Rema Nicolaou gorge consists of Maastrichtian limestone with intense karstic phenomena, which have been caused due to the Tertiary faulting of the area. The erosion resulted a depth of about 150m of this gorge, to the bottom of which Thermopotamos is flowing.

The investigation of this area started in 1990 due to the great palaeontological interest. Six systematic excavation circles including micromammalian research took place in 1993, 1994, 1996, 1999, 2000, 2001, 2002, 2003 and 2004 by School of Geology of Aristotle University in cooperation with the Ephoria of Palaeoanthropology and Speleology, Ministry of Culture and the Vienna University. All the material is stored both in the Aristotle University of Thessaloniki and the local Physiographical

Museum of Almopia. There were three excavation-blocks of squares in three chambers (LAC I, LAC II and LAC Ib) of the cave. During the excavation in 2000 and 2001 a new square-trench was opened in the chamber LAC III in order to add data to the study. The aim of the research is the sediments as well as the palaeontological material of all chambers to be correlated. About 15.000 ursid remains, that are described and analyzed from five blocks of squares, are determined as *Ursus ingressus*. Other large mammalian fauna remains found in association with cavebears, confer to: *Vulpes vulpes, Crocuta crocuta spelaea, Panthera pardus, Bos primigenius, Capra ibex, Dama dama* (TSOUKALA 1994, 1996, TSOUKALA et al. 2001, TSOUKALA & RABEDER, this volume).

In order to study the micromammalian fauna from the new trench square R1 (LAC III chamber) (Fig. 1), the sediments were first put into water and perhydrol and then all the material was washed through a double system of sieves, one for micromammals (1mm) and the other (3mm) for larger, mainly ursid remains. Then the material was dried, packed up and transported to the Aristotle University's labs for sorting. Then the teeth were placed in special plates and they were numbered. The measurements of the teeth were taken using a WILD Photomakroskop M400 stereoscope. The teeth were figured in the Aristotle University.

2. Stratigraphy

Four stratigraphical columns are presented from the four square-trenches V4, N10, D10 and R1 of the chambers LAC Ib, LAC I, LAC II and LAC III respectively (Fig. 2) (CHATZOPOULOU 2001, 2003). The accumulation of sediments in Bear-cave was in cyclic intervals. The alternation of clastic

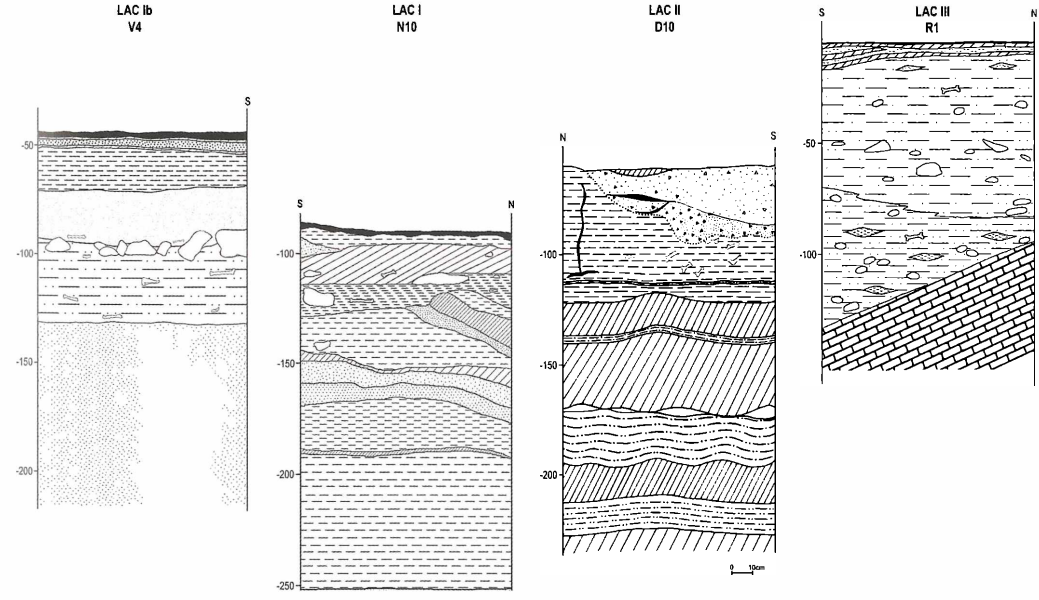

Figure 2. Stratigraphical sections of trench square V4 (LAC Ib), N10 (LAC I), D10 (LAC II), and R1 (LAC III). The depth in all the sections is considered from the reference-zero point of the cave and it is counted in cm. The fossiliferous layer appears to be thicker in R1 (~120cm).

and chemical sediments is evident in N10 and D10. The calc-crust layers (oblique stripes) were deposited during warm and humid intervals, while the clastic sediments (sand, clay, silt) were accumulated during colder periods. The study of the small grain size of the clastic sedimentation of the floor of the Bear-cave is an evidence of slow water flow in the deposition site. This is the result of the water mass surface increase flowing inside the cave, as well as of probable climate changes from wet to dry (TSIRAMBIDIS 1998). The sedimentation in V4 and R1 is basically clastic. At the superior beds of the fossiliferous layer in V4 a great accumulation of large stones and pebbles was observed. The lithological composition of the pebbles represents the rocks of the broader area (limestones, dolomites, ophiolites, phyllites). The sedimentation in R1 is rather monotonous. The fossiliferous layer appears to be the thickest (~120cm) of all chambers. It is mainly brownish sandy clay dotted with white calcareous pebbles. The fossiliferous layer ends on the limestone of the floor of the cave. Despite the distinctly different sedimentation in the four square-trenches, it is obvious that the fossiliferous layer is placed at the same depth (-130cm) in the cave.

3. Palaeontology

The material from a new square-trench R1 in the chamber LAC III adds new data to the study. R1 shows the most remarkable diversity of taxa and great abundance of bones and teeth remains in the cave regarding micromammals. All taxa that have been previously recorded from the excavations from LAC I, Ib and II (CHATZOPOULOU et al. 2001, CHATZOPOULOU 2003), have also been found in the new material from square R1.

The insectivors are represented by two families, Erinaceidae and Soricidae. The remains of the former family confer to *Erinaceus* cf. *europaeus*. Soricidae include a large-sized *Sorex* (*S. araneus* group) and a representative of the white-colored teeth genus *Crocidura*.

The remarkable abundance of arvicolids is described by six different species, *Arvicola terrestris*, *Microtus arvalis, M. agrestis, M. nivalis, M. (Pitymys)* cf. *multiplex* and *Clethrionomys* sp. The murids are represented by three different species. The large-sized teeth attribute to *Apodemus mystacinus*. Nevertheless their size is considerably smaller than this of other *A. mystacinus* populations. Among the teeth previously attributed to the group *Apodemus sylvaticus/flavicollis*, there are specimens whose dimensions of M^1 and M_1 are very small. These specimens belong to *A. sylvaticus*. The glirids are described by three species: the large-sized *Glis glis,* the abundant *Dryomys nitedula* and the rare *Muscardinus* cf. *avellanarius*.

Hare is very scarce in the assemblage of Aridea Bear-Cave. The LAC material is referred as *Lepus* cf. *europaeus*. In the microfauna, chiropterans as well as amphibians and reptiles were also found. Beside of the above species that were found in the initial examination, two additional species were identified from the new material. These will be defined in detail.

A new rodent species was recorded for the first time in the material of Loutra Aridea Bear-Cave in the square-trench R1 of the chamber LAC III.

Two isolated teeth belong to the genus *Sicista*, which is characterized by brachydont molars with simple morphology. At present, two species of the genus *Sicista* occur in Europe: *S. subtilis* and *S. betulina*. These two species differ in the absolute and relative dimensions of the teeth and the degree of folding of the enamel. Its simple molar structure and its dimensions, which considerably range the size of recent *S. subtilis*, characterize the LAC material.

The dental features and the dimensions of the LAC samples are similar to those of *S. subtilis*, described by STORCH (1975) from Chios. MAYHEW (1977) has determined *S. subtilis* in Arnissa. The same species was also reported from Marathousa (KOUFOS et al. 2001) and Ravin Voulgarakis (KOLIADIMOU 1996). In Bulgaria, *S. subtilis* was reported from Bacho Kiro Cave (KOWALSKI & NADACHOWSKI 1982) and Morovitsa Cave (POPOV 1989). An Upper Pleistocene form is referred in Smolučka Cave assemblage (DIMITRIJEVIC 1991) as *S. subtilis*. It seems that *S. subtilis* occurred at the Balkans since the Early Pleistocene/Latest Biharian (KOLIADIMOU 1996).

A small-sized representative of the subfamily of Soricinae was also recorded in the material of the square-trench R1 of the chamber LAC III for the first time. The mandible from LAC is attributable to the genus *Sorex* because the buccal cingulum of M_{1-2} is narrow and the talonid is slightly shorter than trigonid. The mental foramen is not visible because the mandible is damaged. The study of the single tooth of *Sorex* showed that the size and the morphological characteristics conform rather well to *S. minutus* (REUMER 1984). However, as the material is so extremely scanty, the LAC material is referred as *S.* cf. *minutus*.

Remains of the *S. minutus* are known from many fossil localities in Europe since Pleistocene. In Greece, a rather large form is referred in Ravin Voulgarakis assemblage (KOLIADIMOU 1996) as *S.* cf. *minutus*. The same species was also reported from Marathousa (KOUFOS et al. 2001) and Arnissa (MAYHEW 1977). In Bulgaria, *S. minutus* was reported from Bacho Kiro Cave (RZEBIK-KOWALSKA 1982) and Morovitsa Cave (POPOV 1989). DIMITRIJEVIC (1991) has determined *S. minutus* in Smolučka Cave.

4. Conclusions

- The LAC assemblage consists of four orders of micromammals. The faunal list shows a remarkable abundance of the small mammals: at least 22 species belonging to 10 families.
- The presence of *Arvicola terrestris,* as well as the taxon rang zones of the micromammals of the eastern Europe (GUÉRIN & PATOU-MATHIS 1996) imply a Late Pleistocene to Holocene age for the fauna of the Bear-cave.
- The material from a new square-trench R1 in the chamber LAC III adds new data to the study. R1 shows the most remarkable diversity of taxa and great abundance of bones and teeth remains in the cave regarding micromammals.

Taxa	LAC I	LAC Ib	LAC II	LAC III
Chiroptera	+	+	+	+
Sorex sp.	-	-	+	+
Sorex cf. *minutus*	-	-	-	+
Crocidura sp.	+	+	+	+
Erinaceus cf. *europaeus*	-	-	+	+
Sicista subtilis	-	-	-	+
Spermophilus sp.	-	+	+	+
Arvicola terrestris	+	-	+	+
Microtus arvalis/agrestis	+	+	+	+
Microtus nivalis	+	+	+	+
Microtus (Pitymys) cf. *multiplex*	+	-	+	+
Clethrionomys sp.	-	-	+	+
Apodemus aff. *mystacinus*	+	+	+	+
Apodemus sylvaticus/flavicollis	+	+	+	+
Cricetulus migratorius	+	+	+	+
Mesocricetus newtoni	+	+	+	+
Dryomys nitedula	+	-	+	+
Glis glis	-	-	+	+
Muscardinus cf. *avellanarius*	-	-	+	+
Spalax leucodon	+	+	+	+
Lepus cf. *europaeus*	-		+	+

Table 1. Presence of the mammalian remains in the four chambers of the Aridea Bear-Cave.

- A new rodent species (***Sicista subtilis***) was recorded for the first time in the material of Loutra Aridea Bear-Cave in the square-trench R1 of the chamber LAC III.
- A small-sized representative of the subfamily of Soricinae (***Sorex* cf. *minutus***) was also recorded in the material of the square-trench R1 of the chamber LAC III for the first time.
- The LAC fauna contains predominantly species that are associated with open vegetation. Other species verify the presence of deciduous and mixed forests. The surroundings of the Bear-cave are geomorphologically very complex: forest peaks, rocky slopes, vast fields and mountain plateaus alternate in a small area. Just like today, in the Late Pleistocene geomorphological density had to result in vegetational and faunal variety.
- Some teeth and bones of micromammals show traces of transportation by water. This observation related to the taphonomy of the macromammals could be the result of the water mass surface increase flowing inside the cave. It is likely that during floods of the river, sediments and micro- and macromammalian remains came into the cave.
- Micromammals could be the remains of meals of various predators (owls and raptors), which upon their return to the cave digest and regurgitate their meals. Among the numerous bones and teeth, there were sometimes more or less complete mandibles, but no complete skulls were found, which is characteristic for owl pellets. This source of origin is also supported by the presence of erosion on the enamel and dentine of many of the teeth due to digestion by predatory birds.

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