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PLEISTOCENE SMALL MAMMALS FROM SOME KARSTIC FILLINGS OF SLOVENIA - PRELIMINARY RESULTS

PLEISTOCENSKI DROBNI SESALCI IZ KRAŠKIH ZAPOLNITEV V SLOVENIJI - PREDHODNI REZULTATI

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Izvleček

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Jean-Pierre Aguilar & Jean-Yves Crochet & Katarina Krivic & Bernard Marandat & Jacques Michaux & Andrej Mihevc & Bernard Sigé & Stanka Šebela: Pleistocenski drobni sesalci iz kraških zapolnitev v Sloveniji - predhodni rezultati

Članek poroča o odkritjih nahajališč pleistocenskih drobnih sesalcev v kraških zapolnitvah v Sloveniji. Najdena favna glodalcev je sestavljena iz predstavnikov arvicolidov, muridov in v manjši meri tudi kritecidov. V polnilu enega nahajališča pa so najdene le gliride. Določenih je šest različnih vrst lipotiplanskih insektivorov. V jamskih sedimentih so določene kosti netopirjev, ki pripadajo drugim vrstam kot žive danes v jami.
Ključne besede: Rodentia, Insectivora, Chiroptera, pleistocen, kraška zapolnitev, Slovenija.

Abstract

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Jean-Pierre Aguilar & Jean-Yves Crochet & Katarina Krivic & Bernard Marandat & Jacques Michaux & Andrej Mihevc & Bernard Sigé & Stanka Šebela: Pleistocene small mammals from some karstic fillings of Slovenia - preliminary results

The discovery of Pleistocene small mammals in karstic fillings of Slovenia is reported here. The rodent faunas collected there are mainly composed of arvicolids, murids and to a lesser degree of cricetids, although in one filling only glirids have been recorded yet. Six species of Lipotyphlan insectivores have been identified. A cave filling has yielded bats which belong to species different of those which occupy the cave to date.
Key words: Rodentia, Insectivora, Chiroptera, Pleistocene, karstic filling, Slovenia.

INTRODUCTION

Karstic fillings of Slovenia have been investigated and sampled in 1997 and 1998 as part of the program Proteus n° 97011. Although many fillings have revealed to be azoic, five of them have however yielded mammalian remains and more particularly small mammals.

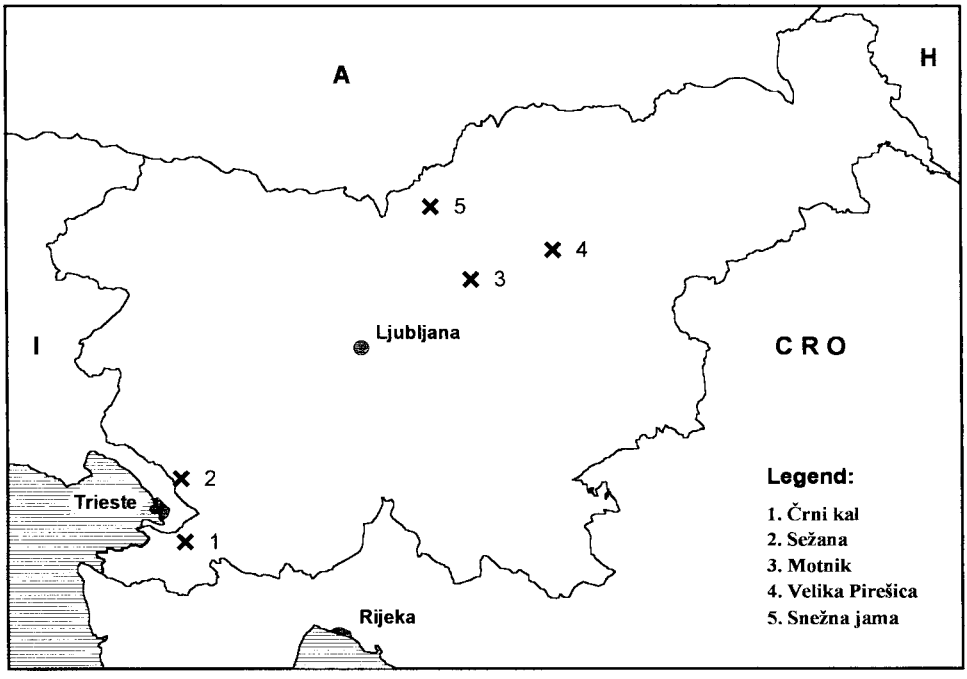

Fig. 1: Map of Slovenia with the position of the localities of discovered micro mammal fauna.
Sl. 1: Položaj nahajališč raziskane favne mikro sesalcev v Sloveniji.

1 - THE ČRNI KAL LOCALITIES

The quarry is situated about 1 km NW from the village of Črni kal on the SW edge of plateau Kras. The quarry is about 10 km from the coast of the Adriatic sea in elevation about 330 m above sea level. Paleogene limestone overthrusted to Eocene flisch rocks (Pleničar et. al 1969) are quarried. During quarrying filled horizontal caves or shafts are met. On the S side of the quarry in 1955 a horizontal cave was discovered. In the cave Pleistocene large mammal fauna was described by Rakovec (1958, 370, 424-415) and Brodar (1958), the small mammals were shortly represented.

The currently exploited Črni Kal quarry exposed several karstic fillings and three of them have yielded mammals.

The Črni Kal 1 site is located in the lowest part of the exploited quarry. It was a cavity filled with a red loam, boulders and calcareous concretions. The upper part of the cavity have been destroyed by the quarrying. Fossil bones are in within the sediments at elevation about 290 m, about

20 m below the surface.

The Črni Kal 2 site is a remain of the cavity in the E side of a quarry at elevation of about 310 m. Location was probably a shaft which has been filled with massive flowstone and collapse boulders and clay. Bones were found in clay mixed with rocks about 15 m below the present surface.

Črni Kal 3 is in the upper, N part of the quarry. There are two parallel shafts within a distance of some metres. The shafts were formed by percolation water. Work in a quarry removed most of the shaft walls, flowstone and other filling. Fossil bones were found in clay filling, some of the bones were cemented on the flowstone. Location of the bone bearing sediments was about 15 m below the surface.

The collected faunas in Črni Kal quarry are the following:

Črni kal 1

Rodentia (ten teeth)

Dinaromys sp., *Pliomys* cf. *episcopalis*, cf. *Ungaromys*.

Carnivora: Felidae indet.

Črni kal 2 (ca 300 teeth)

Rodentia

Dinaromys bogdanovi, *Clethrionomys glareolus*, *Microtus* cf. *agrestis-arvalis*, *Arvicola* sp., *Allocricetus croaticus, Apodemus sylvaticus, Apodemus mystacinus, Apodemus* cf. *microps*, *Glis glis, Eliomys* cf. *truci, Muscardinus* sp.

Insectivora

Talpa europaea, Sorex cf. *araneus, Sorex minutus*, Crocidurinae 1.

Črni kal 3 (ca 300 teeth)

Lagomorpha indet.

Rodentia

Dinaromys bogdanovi, Clethrionomys glareolus, Microtus cf. *subterraneus, Microtus* cf. *agrestis-arvalis* (primitive stage ?), *Microtus* cf. *oeconomus, Allocricetus bursae., Allocricetus croaticus, Apodemus sylvaticus, Apodemus mystacinus, Apodemus* cf. *microps, Glis glis, Glis sackdilligensis, Eliomys* cf. *truci, Sciurus* sp.

Insectivora

Sorex cf. *araneus, Sorex minutus,* Soricinae indet., Crocidurinae 1 and Crocidurinae 2

Chiroptera

Myotis size of *myotis*, *Leuconoe* size of *bechsteini* and *Leuconoe* size of *mystacinus* are documented by a few specimens, respectively : r. C/1 ; l. M/1 and r. M/3 ; anterior part of an edentulous r. jaw.

Carnivora indet.

2 - SEŽANA LOCALITY (about 50 teeth)

This site is located about 1 km NW of the Sežana. Locality, probably a part of a horizontal cave was exposed during the highway construction close to NE entrance to the road tunnel.

Rodentia
Microtus sp., *Apodemus sylvaticus, Apodemus* cf. *microps, Glis glis*
Insectivora
Crocidurinae 1
The *Glis glis* from this locality is the largest fossil *Glis* ever found in Slovenia.

3 - THE MOTNIK LOCALITY

The Motnik coal mine have been abandoned about forty years ago. The remains of coal washing and waste from the coal mine have been regulated and transformed into a meadows and a corn field The samples of sediment with pieces of coal and marl were taken from that field.

The coal mines of Motnik had formerly yielded some Eocene mammalian remains (Heissig, 1990). Other samplings have been done in the surroundings of the former mine. Except some pieces of dental enamel and two crocodilian teeth, no Eocene mammalian tooth has been recovered yet. But an arvicolid tooth here referred to *Cleithryonomys glareolus* has been collected and it bears evidence on the presence in the area of Quaternary sediments (Nadachowski, 1982).

4 - THE VELIKA PIREŠICA LOCALITIES

Velika Pirešica quarry is located in continental part of Slovenia, N of Žalec at elevation between 280 and 380 m. Quarrying is taking place on the side of river valley and levelled surface with dolines. Quarry is using well stratified and fractured Triassic limestone. Exploitation exposed several karstic fillings, mostly by corrosion enlarged fisurres and small shafts. In three fillings mammals were found.

Velika Pirešica upper locality is a shaft, filled with clay mixed with some stones. Sample where bones were found, was taken from the part of the shaft that was about 15 m below the natural surface.

In Velika Pirešica middle locality bones were found in clay sediment mixed with some rocks that were filling the shaft. Sample was taken from the part of the shaft that was about 20 m below the natural surface.

Velika Pirešica *glis* location was a loam filing with mammal fauna deposited in a shaft in the middle part of the quarry.

Because of intensive work in the quarry the localities or their fillings are quickly destroyed.

Velika Pirešica - Upper
Rodentia
Arvicola sp (form close to that from Črni Kal 2), *Clethrionomys glareolus, Apodemus sylvaticus, Glis glis.*
Insectivora
Talpa europaea, Sorex cf. *Araneus.*

Velika Pirešica - Middle

Arvicola sp., *Microtus* sp., *Clethrionomys glareolus, Allocricetus* sp.

Velika Pirešica - *Glis*

A filling sampled by A. Mihevc and K. Krivic in 1997 has not been found again in 1998. This locality is peculiar by the abundance and the exclusive presence of glirids, more especially of one species of Glis and of three other glirids otherwise rather scarce in Plio-Pleistocene localities.

Rodentia

Glis aff. *glis* (270 teeth), *Glis sackdilligensis* (2 teeth), *Glis* sp. (1 tooth),? *Reteliomys* cf. *podumcensis* (1 tooth).

Insectivora

Glis aff. *glis* exhibits features close to those found in the recent *Glis glis* from Poland (Kowalski, 1963), former Yougoslavia and Germany (Storch, 1978) but with lesser teeth measurements especially in the tooth width. It must be noted that we could measure a few teeth from the recent *Glis glis* from Slovenia and they show larger measurements than the specimens measured by Kowalski and Storch as well as those from the fossil population.

A second form, *Glis sackdilligensis* is represented only by a few teeth, it differs from the first one by smaller measurements.

A smaller sized third form of *Glis* is represented by a single M1/. It exhibits features and measurements similar to those from Weze (Fig. 14 in Kowalsky, 1963).

A single tooth could be assessed to the recently described genus Reteliomys (Malez & Rabeder 1984) described from the locality of Podumci 1 in Croatia.

5 - SNEŽNA JAMA Cave locality

Snežna jama cave is situated on the southern slopes of Raduha Mountain (2062 m) in the Alps. The entrance to 1062 m long cave is at 1556 m a.s.l. Main part of the cave is a large horizontal passage with permanent ice at the entrance. Further inside the cave there is a lot of flowstone deposited on the older fluviatile sediments, laminated loams and gravels of noncarbonate rocks. At the end of the cave bones of a cave bear have been found. There are bats recently living in a cave, their bones and corpses can be found on the cave floor.

Samples of laminated sandy loam and pebbles were taken from the cave as well as the bone remains of the recent bats.

This locality only yielded numerous and varied osteological remains of bats: fragmentary lower and upper jaws bearing teeth, isolated teeth and post cranial elements. All these elements are well fossilized and mineralized.

The fauna includes to date:

Leuconoe cf. *bechsteini*: many fragments correspond to a relatively large *Leuconoe* showing a certain dimorphism in measurements.

Leuconoe cf. *mystacinus*: some specimens correspond to a small *Leuconoe* resembling to *L. mystacinus.*

Vespertilioninae indet. an isolated lower molar bears evidence on the presence of a large sized nyctalodont form.

Rhinolophus cf. *euryale*: some specimens correspond to a medium sized *Rhinolophus*.

This bat fauna can not be dated yet. A thorough study of the recorded taxa and their comparison to recent and fossil faunas will provide better indications if the material correspond to well known lineage. A preliminary study already indicates that the fauna from the clay level is different from the recent fauna of the cave which includes *Myotis myotis*, *Leuconoe mystacinus* and *Barbastella barbastellus*.

Localities	ČRNI KAL 1	ČRNI KAL 2	ČRNI KAL 3	SEŽA-NA	MOT-NIK	VELI-KA PIRE-ŠICA UPPER	VELI-KA PIRE-ŠICA MIDLE	VELI-KA PIRE-ŠICA Glis	SNEŽ-NA JAMA
Rodents									
Allocricetus sp.							+		
Allocricetus bursae			+						
Allocricetus croaticus		+	+						
Apodemus sylvaticus		+	+	+		+			
Apodemus mystacinus		+	+						
Apodemus cf. *microps*		+	+	+					
Glis glis		+	+	+		+			
Glis aff. *glis*								+	
Glis sp.								+	
Glis sackdillingensis			+					+	
Eliomys cf. *truci*		+	+						
Muscardinus sp.		+							
Reteliomys cf. *podumcensis*								+	
Sciurus sp.			+						
Dinaromys sp.	+								
Dinaromys cf. *bogdanovi*		+	+						
Pliomys cf. *episcopalis*	+								
cf. *Ungaromys*	+								
Arvicola cf. *cantiana-terrestris*		+				+			
Arvicola sp.							+		
Microtus gr. *agrestis-arvalis*		+	+						
Microtus cf. *subterraneus*			+						
Microtus cf. *oeconomus*			+						
Microtus sp.				+			+		
Clethrionomys glareolus		+	+		+	+	+		
Insectivora									
Talpa europaea		+				+			
Sorex cf. *araneus*		+	+			+			
Sorex minutus		+	+						
Soricinae indet.			+						
Crocidurinae 1		+	+	+					
Crocidurinae 2			+						
Chiroptera									
Myotis cf. *myotis*			+						
Leuconoe cf. *bechsteini*			+						+
Leuconoe cf. *mystacinus*			+						+
Vespertilionine indet.									+
Rhinolophus cf. *euryale*									+

Tab. 1 - Small mammals distribution in the Pleistocene localities of Slovenia.
Tab. 1 - Razporeditev drobnih sesalcev iz pleistocenskih nahajališč v Sloveniji.

DISCUSSION

Rodents

Among the faunas collected, some fossil forms show significant statistical differences with recent faunas. It is the case for the genus *Glis* for which the Student test shows that the Velika Pirešica is different by the teeth width of the recent dormice populations from former Yugoslavia, Poland and Germany. Although the specimens from Sežana, Črni kal 2 & 3 can not be separated, they are however significantly different of those from the Velika Pirešica populations and of the recent populations from Poland, Germany and former Yugoslavia except Slovenia.

The *Dinaromys bogdanovi* from Črni Kal 2 is much larger (highly significant test) than that from Črni Kal 3. Also, the Črni kal 2 Dinaromys shows a more advanced linea sinuosa on its M1/. This indicates a greater evolutionary stage for the Črni Kal 2 form and a younger age for Črni Kal 2 is likely. Comparisons between the recent *Dinaromys bogdanovi* with those described from Italy (Bartolomei, 1970) should allow to precise the position of the Črni Kal faunas.

The molars which document *Arvicola* indicate an intermediate evolutionary stage between *Arvicola cantiana* and *Arvicola terrestris*. The time span corresponding to this stage is the Toringian (Fejfar & Heinrich, 1990).

The presence of the vole determined as cf. *Ungaromys* provides good biostratigraphical indications for it gives an upper limit to the Črni Kal 1 fauna, the early Biharian (Fejfar & Heinrich, 1983).

Three facts are noteworthy:

- the persistence in the middle and late Pleistocene of a small sized *Eliomys* formerly known from the Late Miocene up to the Late Pliocene in Western Europe (Mein & Michaux, 1970; Adrover, 1986);
- of *Allocricetus croaticus*, considered as endemic to Croatia and which was reported for the first time from the lower Pleistocene locality of Razvodje (Paunovič & Rabeder, 1996).
- the presence of a *Glis* having teeth measurements larger than the recent individuals measured by Kowalski (1963) and Storch (1978).

Insectivores

Talpidae:

The species *Talpa europaea* is represented in Črni Kal 2 and Velika Pirešica by two fragmentary molars which can be referred to the recent species by their size and morphology. It is frequently recorded in the Late Pleistocene faunas from Europe. The ancestral form from the Early and Middle Pleistocene is named *Talpa fossilis* but the differences between the two chono species are weak.

Soricidae:

The northerner Soricinae are twice more numerous in number of specimens than the southerner Crocidurinae. This has only an environmental significance for the recent distribution areas of both sub families are superimposed in the middle European area including Slovenia.

The Soricidae named *Sorex* cf. *araneus* and *Sorex minutus* (Tribe Soricini) appear in Europe during the Early Pleistocene for the former and during the Pliocene for the latter (Rzebik-Kowalska, 1998) and they are still present in the area.

The undetermined Soricidae can not be yet formally assessed to the genus *Drepanosorex* being given the lack of upper molars and incisors clearly referable to that genus.

Crocidurinae:

They are represented in the faunas only by rare isolated teeth and we can not propose specific attributions yet.

CONCLUSION

Most of the karstic fillings recently investigated and sampled in Slovenia correspond to the Middle and Late Pleistocene (Velika Pirešica Upper, Črni Kal 2 and 3, Sežana?), that of Črni Kal 1 is probably Late Early Pleistocene in age as well as that of Velika Pirešica which has yielded the *Glis* fauna. The three first localities are younger than those from Croatia: Razvodje, Tatinja draga and Podumci described by Malez & Rabeder (1984), Paunovič & Rabeder (1996).

The distribution of the localities clearly differentiates those found near the Mediterranean coast (Črni Kal, Sežana) and those with a more continental location (Velika Pirešica).

The faunal lists reflect indeed this opposition between faunas showing a "Dinaric" character (*Dinaromys, A. mystacinus*) and those with Central Europe affinities.

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PLEISTOCENSKI DROBNI SESALCI IZ KRAŠKIH ZAPOLNITEV V SLOVENIJI - PREDHODNI REZULTATI

Povzetek

Favna večine opisanih kraških zapolnitev, ki smo jih nedavno proučili v Sloveniji pripada srednjemu in zgornjemu pleistocenu (Velika Pirešica Upper, Črni Kal 2, Črni kal 3, Sežana). Te lokacije vsebujejo mlajšo favno kot je favna v hrvaških nahajališčih Tatinja draga in Podumci (Malez & Rabeder 1984; Paunovič & Rabeder 1996).

Favna zapolnjenega brezna Črni Kal 1 pripada gornjemu delu spodnjega pleistocena. Enake starosti je tudi ena od zapolnitev z ostanki favne gliridov iz kamnoloma v Veliki Pirešici.

Opazna je ostra razlika med nahajališči bliže Sredozemlja (Črni Kal, Sežana) in tistimi iz notranje, celinske Slovenije (Velika Pirešica). Razvidna pa je tudi razlika med lokacijami, ki kažejo "Dinarske" elemente (*Dinaromys, A. mystacinus*) in med tistimi, kjer prevladujejo srednje Evropske značilnosti.

Raziskave so bile v letih 1997 in 1998 opravljene s finančno pomočjo Ministère Français de Affaires Etrangères (A.P.A.P.E) in Ministrstva za znanost in tehnologijo Republike Slovenije v okviru znanstveno-tehničnega sodelovanja Proteus n° 97011 (Mammifières fossiles et karst - Fosilni sesalci in kras).