

Lost in time? Repatriated animal remains from Anelli's excavations at Betalov spodmol (SW Slovenia)

Izgubljeni v času? Živalski ostanki z Anellijevih izkopavanj v Betalovem spodmolu pri Postojni

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Abstract

Betalov spodmol is one of the most important Upper Pleistocene archaeological and paleontological sites in Slovenia, yielding finds ranging from the Riss/Würm Interglacial to the Holocene. Unfortunately, most of the Late Upper Pleistocene/Early Holocene material has long been deemed unsuitable for scientific research, as the field documentation related to the removal of the uppermost two meters of the original deposits was lost. This paper presents the results of an attempt to contextualize the paleontological finds originating from these sediments, with the aim of providing a solid base for future research into the local Late Upper Pleistocene and Early Holocene fauna.

Key words: Betalov spodmol, Slovenia, Upper Pleistocene, Early Holocene, fossil fauna

Izvleček

Betalov spodmol je med najpomembnejšimi mlajšepleistocenskimi arheološkimi in paleontološkimi najdišči v Sloveniji z najdbami iz obdobja od zadnjega interglaciala do holocena. Žal je pretežni del gradiva iz poznega mlajšega pleistocena in starejšega holocena že desetletja razumljen kot neprimeren za znanstveno obdelavo, saj je bila terenska dokumentacija o izkopu zgornjih dveh metrov sedimenta izgubljena. Ta prispevek predstavlja rezultate poskusa kontekstualiziranja paleontoloških ostankov iz teh sedimentov z namenom oblikovanja trdne podlage za prihodnje raziskave lokalne favne iz časa mlajšega poznega pleistocena in starejšega holocena.

Ključne besede: Betalov spodmol, Slovenija, mlajši pleistocen, starejši holocen, fosilna fauna

“Due to Anelli’s removal of the top 1.80 m of deposits in Betalov spodmol, only the archaeological and paleontological material of Early Upper Pleistocene age can be legitimately used for inter-site comparisons. Middle and Late Upper Pleistocene finds are but scanty remains of the original accumulation.”

V. Pohar, 1991 (p. 25)

Introduction

For decades, the research of animal remains from paleontological/archaeological sites in Slovenia has been focused on Early, Middle and Later Stone Age material. Most of the work has been carried out by a quartet of prominent researchers, composed of Ivan Rakovec, Katia Drobne, Ivan Turk and Vida Pohar (e.g. Rakovec 1959; 1961; 1967; Drobne 1964; 1973; 1975; Turk et al. 1992; Turk, Dirjec 1997; 2007; Pohar 1981; 1985; 1990). Apart from studying and publishing paleontological/archaeozoological material from individual sites, each of them was also engaged in broader systematic studies (e.g. Rakovec 1973, Drobne 1973; Turk 2014). Vida Pohar focused on the local Late Glacial and Early Holocene mammalian macrofauna (Pohar 1990; 1991; 1997), studying paleontological assemblages from more than a dozen Upper Pleistocene and Early Holocene sites, including the one from Betalov spodmol (Fig. 1). She later observed the mentioned site to be “[...] in its diversity such an important of local Palaeolithic stations, that would be suitable for being used as the referential point for studies of all other contemporaneous sites in the region” (Pohar 1991, 25).



Figure 1: *Betalov spodmol.*

(Photo: Archives Notranjska Museum Postojna)

The first to excavate at Betalov spodmol was Franco Anelli between 1932 and 1939. He removed the top 1.8 m to 2.0 m of the original deposits but had mostly failed to publish his results (for the only exception, see Anelli 1933). Moreover, during WWII, the material he yielded has been moved abroad and was thus not available to later researchers working on the site. In the post-war years, systematic excavations at Betalov spodmol were resumed, this time under the leadership of Srečko Brodar. This second campaign lasted from 1947 to 1953 but was only comprehensively published at the beginning of the 1990s (Osole 1990; 1991). The results of fauna studies, in contrast, were first presented a few years after the conclusion of the excavations (Rakovec 1952; 1959).

In his publications of the fauna from Brodar’s excavations, Rakovec put great emphasis on assessing the paleo-environment of the area (e.g. Rakovec 1959, 323–330). Unfortunately, he did not have access to the material excavated by Anelli, so he was only able to analyse a minor part of the material from Gravettian, Tardigravettian and Epigravettian contexts. Decades later, while working on her study of Late Glacial mammalian macrofauna from Slovenia, the topic was picked up by Pohar (1991; 1997). She added several taxa to the existing fauna list of Betalov spodmol by analysing some of the previously neglected finds from Brodar’s excavations (Pohar 1991, 27–29). She might have also attempted to further improve the resolution of the obtained results by analysing the then already repatriated Anelli’s material. Nevertheless, due to the field documentation having been lost, she evidently deemed the task to rightfully include these finds in her paleo-environmental analysis to be very difficult if not impossible to perform. Consequently, in order to avoid the corruption of the results by considering chronologically non-representative material, the repatriated animal remains were completely ignored.

Now, a good two decades later, the option to study the faunal remains from Anelli’s excavation has been considered once again. Nevertheless, as we share Pohar’s view of the near uselessness of the material from unknown chronological/cultural contexts, we focused on the attempt to (at least broadly) contextualize

these finds. If successful, our results might provide a substantial opportunity to obtain deeper insights in many aspects of local Late Upper Pleistocene fauna.

Description of the site

Betalov spodmol is a karst cave, lying on the south-eastern edge of the Lower Pivka valley near the town of Postojna (SW Slovenia; for a more detailed description of the site, see Osole 1990). It was registered and documented, to a length of 174 m, soon after the establishment of the Italian Speleological Institute (Istituto Italiano di Speleologia) in Postojna in 1929. The cave has been included in the cave cadastre under the name of 'The cave to the southwest of the church of S. Andrew at Veliki Otok' (Jama severozahodno od cerkvice sv. Andreja pri Velikem Otoku; cadastre number: VG. Št. 1611¹).

¹Later, the cave's cadastre number was changed to JZS 473.



Figure 2: Anelli's excavations at Betalov spodmol. (Photo: Archives Notranjska Museum Postojna)

In 1932, the then curator/assistant at the Institute, Franco Anelli, initiated systematic excavations at the site (Fig. 2) and presented the results of the first field season at the 1st Italian Speleological Congress in Trieste (Anelli 1933). The excavations continued until 1939, with up to two-metre deep trenches having been excavated both in the cave and in front of it (Fig. 3). Anelli found a considerable number of mostly Late Upper Palaeolithic artefacts and a rich assemblage of fauna remains, yet failed to publish his observations. In 1943, he arranged for the material and the field documentation to be moved to Recoaro Terme (Italy). It was only in the 1960s that part of the transferred material was repatriated to Slovenia. Unfortunately, the field documentation (drawings, plans, excavation diaries) were lost and thus not sent along with the material itself. As a consequence, the contextualization of the repatriated artefacts and animal remains has been mostly seen as too problematic for them to be intensively studied. The scientific potential of this material, however, remains high.

Methods

The analysed material represents only part of the remains excavated by Anelli in the 1930s, namely the part repatriated in 1961. All the available mammal remains were taxonomically and anatomically identified as precisely as possible, while avian and amphibian finds were only ascribed to the appropriate order (i.e. Aves and Amphibia). In identifying the teeth and

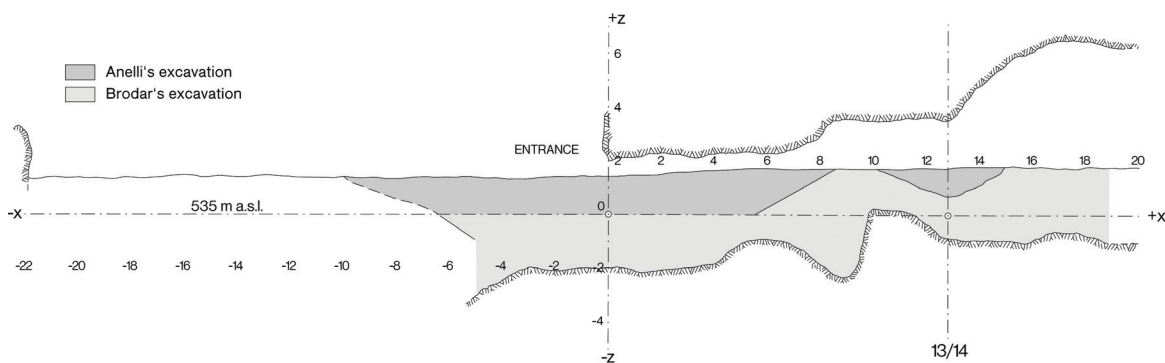


Figure 3: Longitudinal section of Betalov spodmol. The deposits removed by F. Anelli (1932–1939) and S. Brodar (1947–1953) are marked. Taken from Osole 1990 (App. 6).

bones, we were assisted by fossil and recent comparative material from Slovenia (collections of the Institute of Archaeology ZRC SAZU and the Department of Palaeontology NTF, University of Ljubljana). In terms of systematic classification, we mostly followed the system given by Guérin, Patou-Mathis (1996).

Quantitative comparisons among taxa are based on the *Number of Identified Specimens* (NISP; Grayson 1984). Measurements were taken according to von den Driesch (1976). Allochronous faunas were compared by *Multidimensional scaling* on rectangular symmetric matrix of Euclidean distances (StatSoft Inc. 2001). Based on their abundance, individual taxa were arbitrary grouped into five classes: class 0 (taxon absent), class 1 (NISP < 5 % of total NISP), class 2 (NISP = 6 % to 20 % of total NISP), class 3 (NISP = 21 % to 50 % of total NISP) and class 4 (NISP > 50 % of total NISP). Statistical analyses were performed using the program package STATISTICA for Windows, version 6.0 (StatSoft Inc. 2001).

The animal remains from Betalov spodmol presented here are stored at Notranjska Museum in Postojna (*Notranjski muzej Postojna*).

Results and discussion

Taxonomy

The analysed archaeozoological assemblage includes a total of 2 469 animal remains, mostly belonging to mammals ($N = 2\ 452$). Of these, 386 (= 15.7 %) were taxonomically identified at least to the level of genus. They were ascribed to 21 species from 11 families. The majority of them still inhabit Slovenia today, although some only because of reintroduction after previous local extinction (e.g. *Marmota marmota*). Of the total of four species no longer present in Slovenia, a single one became extinct in the Late Upper Pleistocene (*Ursus spelaeus*). The remaining three either became extinct during Holocene (*Bos primigenius*) or simply withdrew elsewhere (*Rangifer tarandus*, *Alces*

Table 1: Animal remains in the paleontological assemblage from Anelli's excavations at Betalov spodmol per taxa and skeletal element

Taxon	Cranium	Maxilla	Mandibula	Dentes	Vertebrae	Scapula	Clavicula	Humerus	Radius & ulna	Metacarpalia	Carpalia	Pelvis	Femur	Tibia & fibula	Metatarsalia	Tarsalia	Ossa sesamoidea	Phalanges	TOTAL	
<i>Apodemus sp.</i>			1																	1
<i>Talpa sp.</i>								1												1
<i>M. marmota</i>			6	17			1	1	3				1							29
<i>L. europaeus</i>															1					1
<i>Lepus sp.</i>				1																1
<i>U. spelaeus</i>	7	3	11	53	5			2	4	6	4		1	4	6	7	4	14		131
<i>U. arctos</i>														1						1
<i>V. vulpes</i>								1		1										2
<i>M. martes</i>			1																	1
<i>M. foina</i>			1																	1
<i>Martes sp.</i>								1												1
<i>M. meles</i>			3	2					2			1				1				9
<i>F. silvestris</i>									1				1							2
<i>Sus sp.</i>	4	19	18	65	2	2	4	4	4	7		1	1	7	8	11	2			158
<i>C. elaphus</i>	2				1	1					2	3		1	1	1		2		14
<i>C. capreolus</i>								3	1	2					4		1	1		12
<i>A. alces</i>			1	2											1					4
<i>R. tarandus</i>																2				2
<i>R. rupicapra</i>		1	1					1	2											5
<i>B. primigenius</i>																		2		2
<i>Bos sp.</i>				1																1
<i>Bos s. Bison</i>	1			3				1												5
<i>Ovis s. Capra</i>				1																1
<i>E. caballus</i>																1				1

alces). A complete list of repatriated mammal remains from Anelli's excavations per skeletal element is given in Tab. 1. It is noteworthy that most of the taxa were also recorded in the material excavated by Brodar, with exceptions including *Bos primigenius*, *Sus domesticus*, *Equus caballus*, *Felis silvestris*, *Martes foina*, *Ursus arctos* and *Lepus europaeus* (Rakovec 1959; Pohar 1991, Tab. 2).

Of the non-mammal taxa, 16 remains were ascribed to birds (*Aves*) and one to amphibians (*Amphibia*).

Order: Eulipotyphla

Family: Talpidae

Talpa europaea/caeca

The genus *Talpa* is represented by a single humerus, found at a depth of 0.55 m to 1.00 m. Currently, the only mole species to be present in Slovenia is European mole (*Talpa europaea* Linnaeus, 1758), which is also known from a couple of local Upper Pleistocene sites (e.g. Rabeder *et al.* 2004a; Toškan, Kryštufek 2007, 211). However, since the European mole cannot be always reliably distinguished from blind mole (*Talpa caeca* Savii, 1822) in paleontological material, the presence of the latter species in south-eastern Alps during the Upper Pleistocene (Pohar 1985) and/or Early Holocene (e.g. Toškan, Kryštufek 2004) cannot to be ruled out entirely. The humerus from Betalov spodmol could thus belong to either of the two aforementioned mole species.

Order: Rodentia

Family: Muridae

Apodemus sp.

The genus *Apodemus* is represented by a single fragmented mandible. According to published data (e.g. Toškan, Kryštufek 2007), at a minimum the yellow-necked mouse (*Apodemus flavicollis*) and the wood mouse (*Apodemus sylvaticus*) inhabited Slovenia in the Upper Pleistocene, with the pygmy field mouse (*Apodemus uralensis*) and the striped field mouse (*Apodemus agrarius*) joining them no later than the beginning of the Holocene (Toškan, Kryštufek 2004; Toškan 2009). In view of the considerable size and shape variation in recent popula-

tions of these species, the aforementioned field mouse mandible did not allow for the identification beyond genus level.

Family: Sciuridae

Marmota marmota (Linnaeus, 1758)

The alpine marmot is the third most represented species in the studied assemblage, after the wild boar and the cave bear (Tab. 1). Its remains were concentrated in the lower part of the stratigraphic sequence (Tab. 4), which is in line with the fact that the species has not been recorded in any of the Early Holocene sites in the area (Pohar 1990; Toškan, Dirjec 2004). In Upper Pleistocene contexts, in contrast, marmot remains are frequently highly numerous (e.g. Rakovec 1973, Tab. 2).

Order: Lagomorpha

Family: Leporidae

Lepus europaeus (Pallas, 1778)

The European hare is represented by a fragmented 4th metatarsal. The species is very rare in Upper Pleistocene contexts from Slovenia (see e.g. Rabeder *et al.* 2004a, 48), with most fossil hare remains belonging to the montane hare (*Lepus timidus* Linnaeus, 1758). Of the local Early Holocene sites, the European hare is known from Mala Triglavca (Pohar 1990, Tab. 1). Brodar's excavations in Betalov spodmol only yielded remains of the montane hare (Rakovec 1959, 294–296).

Lepus europaeus/timidus

In addition to the aforementioned European hare metacarpal, the genus *Lepus* is also represented in the studied assemblage by a fragmented incise. Unfortunately, the latter find did not allow for the identification to the species level, either by considering its size or morphology. It is worth noting, however, that the incise was found in the uppermost 40 cm of the sediment and is thus most probably of Holocene age. Since the area of distribution of the recent montane hare is mostly covered by tundra and taiga (Lequatre 1994), while the European hare prefers arable land, meadows and pastures (Kryštufek 1991, 118), the incise is almost certainly to be ascribed to the latter.

Order: Carnivora

Family: Ursidae

Ursus spelaeus (Rosenmüller, 1794)

The cave bear is represented in the studied assemblage by 131 remains, half of them being cranial skeletal elements (Tab. 1). Not surprisingly, the remains were concentrated in the lower half of the stratigraphic sequence, which was supposedly deposited in the Upper Pleistocene (see e.g. Osole 1990, App. 13). According to Pohar (1997, 152–153), cave bear finds from Epigravettian layers 5–7 of Betalov spodmol are to be seen as evidence of its prolonged existence traced down to the Late Glacial in this region. Although the idea of the extinction of the cave bear coinciding with the end of the Pleistocene has been shared by other authors (e.g. Martin, Steadman 1999; Barnosky et al. 2004), extensive radiocarbon dating now suggests that the global extinction happened much earlier, around 24,000 14C years before present (BP; 27 800 [cal.] BP; Stiller et al. 2014, 225). It thus seems very probable that either the cave bear remains from layers 5–7 of Betalov spodmol lay in a secondary context (cf. Rakovec 1959, 308), or that the dating of the mentioned layers to Epigravettian is not entirely correct (cf. Brodar 2009, 464–466).

In recent years, at least six different Upper Pleistocene cave bear morphotypes have been identified, but their taxonomic status is controversial. It has been argued that they may represent different species (e.g. Hofreiter et al. 2004), but also that they are not sufficiently distinct to warrant subspecies status (Baryshnikov, Puzachenko 2011). In line with this, the cave bear remains from Anelli's excavations at Betalov spodmol could be seen as belonging to either *Ursus spelaeus* or *Ursus ingressus* (see e.g. Rabeder et al. 2004b).

Ursus arctos (Linnaeus, 1758)

A damaged tibia is the only bear find to be ascribed to the brown bear. The identification of the bone is based on its gracility, with the smallest breadth of the diaphysis measuring a mere 21.5 mm. It was found at a depth of 1.70–2.00 m, which is indicative of it being of the Pleistocene age.

Fossil finds of the brown bear normally occur together with finds of cave bear although usually in much smaller numbers. In Betalov spodmol, no other brown bear finds have been recorded (Rakovec 1959; Pohar 1991, Tab. 2).

Family: Canidae

Vulpes vulpes (Linnaeus, 1758)

The red fox is represented in the studied assemblage by a fragmented humerus and a complete 3rd metacarpal. The species has been also identified in the material from Brodar's excavations (Rakovec 1959, 302–303), with three finds originating from the uppermost Pleistocene layers 5–9 (approx. depth 0.70–2.00 m; Osole 1990, 36; Pohar 1991, Tab. 2). The same is most probably true for the aforementioned 3rd metacarpal, which has been found at the depth of 0.80–1.00 m.

Family: Mustelidae

Martes martes/foina

A fragmented mustelid humerus has been ascribed to genus *Martes*, with no further identification to the level of species. Taxonomically relevant morphological differences between pine marten (*Martes martes* [Linnaeus, 1758]) and beech marten (*Martes foina* [Erxleben, 1777]) are rather limited. Because of this, and the considerable variability occurring in the size of the two species, accurate identification of fossil remains of the genus *Martes* is in general somewhat difficult (Castaños 1987).

Martes martes (Linnaeus, 1758)

The pine marten is represented in the studied assemblage by a fragmented mandible. The identification is based on the distance between the two mental foramina exceeding 4 mm and on the first lower molar lacking a definite notch in its middle (Kryštufek 1991, 215–216). The bone was found at a depth of 0.90–1.10 m, which is indicative of it being of Upper Pleistocene age.

Pine marten remains are known from a number of fossil assemblages from Slovenia (Rakovec 1973, Tab. 1), including the one yielded by Brodar's excavations at Betalov spodmol (Rakovec 1959, 308)

Martes foina (Erxleben, 1777)

The only other mustelid mandible in the studied assemblage has been ascribed to the beech marten, as the distance between the mental foramens falls below 3 mm (Kryštufek 1991, 215–216). According to Crégut-Bonnoure (1996) and Wolsan (1993), this species only appeared in Europe in the Holocene. In Slovenia, the only beech marten find to be reported from a Pleistocene site is the one from Potočka zijalka in the Savinja Alps, but its stratigraphic context is seen as problematic (Döppes 2004).

Meles meles (Linnaeus, 1758)

The badger is represented in the studied assemblage by nine remains (Tab. 1). They were apparently mostly found in the uppermost meter of the deposits, indicating that at least some of them might be of Holocene age. The presence of the badger at Betalov spodmol had been observed already by Anelli (1933, 232, 234), who happened upon its remains in the top 30 cm of deposits in two out of three trenches he excavated in 1932. In the archaeozoological material yielded by Brodar's excavations, the only recorded badger remain has been found at a depth of 55 cm (Rakovec 1959, 309).

The described stratigraphic position of (the bulk of) badger remains at Betalov spodmol is perfectly in line with the species having been recorded in most of the Early Holocene sites in Slovenia (Pohar 1990; Toškan, Dirjec 2004, Tab. 16.7; Toškan, Dirjec 2006a, 166). Its representation in Pleistocene contexts within the same area, however, is rather negligible (Rakovec 1973, Tab. 1; Pohar 1997, Tab. 1).

Family: Felidae

Felis silvestris (Schreber, 1777)

A fragmented proximal end of an ulna and a diaphysis of a femur were ascribed to the wild cat. Both finds lay at a depth of 0.40–0.70 m. The proximal epiphysis of the ulna was not yet fused, indicating that the bone belonged to an up to a year-old individual (Smith 1969, 525). The aforementioned finds are the only known records of the wild cat from Betalov spodmol, as neither Rakovec (1959) nor Pohar (1994, tab. 2) included it on their fauna lists. The only feline mentioned by Anelli (1933, 235) is

a no better specified large cave felid from his trench 3, later ascribed by Wolf to the cave lion (*Panthera spelaea*; cf. Rakovec 1959, 323).

Order: Artiodactyla

Family: Suidae

Sus scrofa/domesticus

The genus *Sus* is the best represented of all mammal taxa in the assemblage, with its share falling just short of 40 % (Tab. 1). Unfortunately, it is often impossible to reliably distinguish between wild boar (*Sus scrofa* Linnaeus, 1758) and domestic pig (*Sus domesticus* Erxleben, 1777) on the basis of the size and shape of individual (often fragmented) bones and teeth. Consequently, of the 158 suid remains in the assemblage studied here, only 11 allowed for the identification to the level of species. With regard to their size, eight specimens were ascribed to the wild boar and three to the domestic pig (Tab. 2).

Almost half ($N = 77$) of the pig/wild boar remains from Anelli's assemblage were found in the uppermost 70 cm of the sediment, which was supposedly mostly deposited during Holocene (i.e. layers 1–4). Contrary to the expectations, however, two of the only three bones ascribed to domestic pig have been reportedly found below that depth (i.e. humerus: 1.10–1.55 m; astragalus: 0.70–1.20 m). Since the first domestic pigs appeared in Slovenia only in the middle of Holocene, the aforementioned two bones must have been found in secondary context.

Family: Cervidae

Cervus elaphus (Linnaeus, 1758)

The red deer is represented in the assemblage by 14 remains. With the exception of an antler fragment and part of a scapula, only skeletal elements of the less meaty parts of the body (i.e. feet) were found. The species has also been recorded in the paleontological material yielded by Brodar's excavations, but in relatively small numbers (Rakovec 1959, 318).

Capreolus capreolus (Linnaeus, 1758)

The number of roe deer remains in the studied assemblage is similar to that of the red deer

($N = 12$). A gnawed distal humerus is noteworthy, supposedly found at a depth of 1.20–1.60 m. Three out of a total of five bones with preserved metaphyseal parts were characterized by unfused epiphyses, indicating a high share of juveniles.

Alces alces (Linnaeus, 1758)

A fragmented mandible, two isolated lower premolars (P_3 and P_4) and possibly part of a metatarsal were ascribed to the moose. In Slovenia, the species is known from both Pleistocene and Holocene contexts, with the oldest record originating from the end of the Mindel-Riss Interglacial (Brodar 1970) and the youngest from the Roman period (Jamnik 2004, 293).

Rangifer tarandus (Linnaeus, 1758)

The reindeer is represented in the assemblage by two distal metatarsals, with the breadth of their distal ends measuring 42.5 mm and 43.0 mm. They were found at a depth of 0.70–1.20 m, which is in line with the species having gone locally extinct at the end of Pleistocene. In Slovenia, the most numerous finds of reindeer are known from contexts dated to the Late Glacial Maximum (= Pleniglacial II or Würm III; Pohar 1991, 14). Later, its importance decreased due to the dramatic climatic/palaeoenvironmental changes that took place in Late Glacial (Pohar 1997, Fig. 4).

Family: Bovidae

Rupicapra rupicapra (Linnaeus, 1758)

Five remains were ascribed to the chamois, two of them only tentatively. The only other record from Betalov spodmol is reported by Pohar 1991 (Tab. 2) for layer 8 (= Würm II). Represented in several Upper Pleistocene sites in the region (Rakovec 1973, Tab. 1; Pohar 1997, Tab. 1.; Toškan 2007, 259), the chamois is almost absent from archaeozoological records of the Holocene Southeastern Alps. Nevertheless, such a situation is at least partially attributable to difficulties in reliably differentiating between chamois and the then already ubiquitous sheep and goat (*cf.* Pucher, Engl 1997, 38–67).

Ovis aries / *Capra hircus*

An isolated upper molar is ascribable to either the sheep or the goat. It is (together with the already mentioned domestic pig remains and the horse calcaneus; see below) the only find in the assemblage to be clearly evident of Holocene Age. In central Slovenia, the earliest records of ovicaprids are known from the middle of the 5th millennium (Toškan, Dirjec 2006b), while on the Kras plateau they were present at least a millennium earlier (Budja *et al.* 2013, 102–103).

Bos primigenius Bojanus, 1827

The aurochs is represented in the assemblage with a first and a second phalange. The possibility of them belonging to steppe bison (*Bison priscus*) was ruled out on the basis of their morphological traits (Sala 1986, 161), while

Table 2: *Suid* remains in the paleontological assemblage from Anellis's excavation at Betalov spodmol, which allowed for the identification to species level

Sk. element	Measurement	Observed value	Species
Humerus	Smallest breadth of diaphysis	13.0 mm	<i>Sus domesticus</i>
	Smallest breadth of diaphysis	21.0 mm	<i>Sus cf. scrofa</i>
	Breadth of trochlea	40.0 mm	<i>Sus scrofa</i>
1 st lower molar	Greatest breadth	14.5 mm	<i>Sus scrofa</i>
Ulna	Depth across processus anconeus	28.5 mm	<i>Sus domesticus</i>
Metacarpus 2	Breadth of proximal end	5.5 mm	<i>Sus scrofa</i>
Metacarpus 3	Breadth of proximal end	22.0 mm	<i>Sus scrofa</i>
Metacarpus 5	Breadth of proximal end	7.5 mm	<i>Sus scrofa</i>
Tibia	Breadth of distal end	37.5 mm	<i>Sus cf. scrofa</i>
Metatarsus 4	Breadth of proximal end	17.5 mm	<i>Sus scrofa</i>
Astragalus	Greatest length on lateral size	44.0 mm	<i>Sus domesticus</i>

their large size (Tab. 3) proved decisive in declining the option of domestic cattle (*Bos taurus*). On the second phalange, found at a depth of 0.55–1.00 m, cut marks were observed. The first phalange lay at a depth of 1.55–2.00 m.

The aurochs remains presented here are the only known records of this species from Betalov spodmol, as Rakovec (1959, 322) failed to identify bovid teeth and bones to the level of species (see also Pohar 1991, Tab.2).

Bos taurus/primigenius

An isolated third lower molar has been ascribed to the genus *Bos*, with the identification to species level having been deemed as impossible. The chance of the tooth belonging to steppe bison has been ruled out on the basis of its morphology (Boessneck *et al.* 1963, 165).

Bos primigenius / Bison priscus

Four bovid remains have proven impossible to be reliably identified even to the level of genus, although the possibility of them belonging to domestic cattle has been rejected on the basis of their large size.

Order: Perissodactyla

Family: Equidae

Equus caballus (Linnaeus, 1758)

The horse is represented in the assemblage with a single find: a calcaneus. It lay at a depth of 0.25–0.5 m. The domestication of the horse is believed to have occurred in the middle of the 4th millennium BC (Outram *et al.* 2009), while its oldest known remains from Slovenia are several centuries younger (own unpublished data).

Contextualization of the finds

With the field documentation of Anelli's excavations at Betalov spodmol having been lost, the only contextual information still available is represented by written references to the supposed depth at which teeth and bones from individual storage boxes/bags have been found. Such references are included in 29 out of a total of 46 repatriated items. In an attempt to counter the lack of data regarding the cultural and chronological contexts of the finds, we thus decided to take a closer look at the material from the aforementioned 29 boxes/bags. It became soon apparent that substantial differences in both species composition and species representation exist between individual sub-assemblages originating from different stratigraphic contexts (Tab. 4).

Supposing a linear deposition of the sediments, the observed differences in the composition of the sub-assemblages has been interpreted as a reflection of the differences between allochronous local fauna. The most pronounced temporal trends are seen in the cave bear, alpine marmot and wild boar. The cave bear, having gone extinct at the onset of the last glacial maximum, was almost not recorded except at the lowermost depths (sub-assemblages 3 and 4). The concentration of marmot finds in sub-assemblages 4 and 5 and those of the wild boar in sub-assemblage 1, in contrast, are to be seen as a reflection of significant palaeo-environmental changes that took place during the last 30 000 years. Specifically, the alpine marmot is known to prefer alpine meadows and open pastures of the zone 400–600 m above local timber line (Preleuthner 1999, 188), while wild boar is primarily an inhabitant of the temperate broadleaved or tropical monsoon forests (Spitz 1999, 380). Such forests are associable with warmer (Holocene) climate, so a greater share of wild boar remains in the uppermost strata, and vice-versa for the marmot, is actually not at all

Table 3: The size of the remains of *Bos primigenius* from the paleontological material yielded by Anelli's excavation at Betalov spodmol. All measurements are in mm

Measurement	Phalanx 1	Phalanx 2
Greatest length	56.5	55.0
Breadth of proximal end	39.5	48.0
Breadth of distal end	34.5	39.5

surprising. Similarly, the reindeer has been recorded as expected in sub-assemblages 4 and 5, while the more thermophilic roe deer and badger are best represented in sub-assemblages 1 and 3.

Encouraged by these preliminary results, we attempted to obtain further insights into the Late Upper Pleistocene/Early Holocene fauna at Betalov spodmol by including into the analysis additional contextual data in addition to the depth of the finds. We thus studied the sections of Brodar's excavations (*cf.* Osole 1990) in order to obtain a better knowledge of the depth data for selected stratigraphic horizons and layers. In spite of what was stated by Rakovec (1959, 335), no significant longitudinal inclination of the layers for within the cave area has been observed, at least as far as the uppermost two metres of the original sediment is concerned. It is true that most of these deposits have been already removed by Anelli, allowing Brodar to excavate only a very small

part of them. Consequently, the amount of data on the stratigraphy of the uppermost layers discernible from Brodar's documentation is rather poor. Nevertheless, by comparing cross sections at $x = -4$ m, $+4$ m, $+10$ m and $+20$ m (*cf.* Osole 1990), we still found it possible to tentatively associate the above mentioned sub-assemblage 1 with Brodar's layers 1–4 (*i.e.* Holocene), sub-assemblage 2 with layers 1–7 (Epigravettian, Holocene), sub-assemblage 3 with layers 5–9 (Gravettian, Tardigravettian, Epigravettian), sub-assemblage 4 with layers 5–7 (Epigravettian) and sub-assemblage 5 with layers 8–9 (Gravettian, Tardigravettian) (Osole, 1991).

Of course, such an interpretation has many weaknesses. First, there are no doubts that the material included in individual sub-assemblage is in reality not as chronologically homogeneous as over-simplistically indicated by the above labels. Additionally, Brodar's sections are only indicative of the stratigraphy within the cave

Table 4: Animal remains in the paleontological assemblage from Anelli's excavations at Betalov spodmol by taxa and stratigraphic context. The depth of origin of individual sub-assemblages/stratigraphic contexts is given in parentheses. Identification of sub-assemblages (see text for explanation): sub-assemblage 1 – tentatively associated with layers 1–4 (*sensu* Osole 1991; *i.e.* Holocene); 2 – tentatively associated with layers 1–7 (*sensu* Osole 1991; *i.e.* Epigravettian, Holocene); 3 – tentatively associated with layers 5–9 (*sensu* Osole 1991; *i.e.* Gravettian, Tardigravettian, Epigravettian); 4 – tentatively associated with layers 5–7 (*sensu* Osole 1991; *i.e.* Epigravettian); 5 – tentatively associated with layers 8–9 (*sensu* Osole 1991; *i.e.* Gravettian, Tardigravettian)

Taxon	Subassembl. 1 (0.00–0.70 m)	Subassembl. 2 (0.00–1.00 m)	Subassembl. 3 (0.70–2.00 m)	Subassembl. 4 (0.70–1.00 m)	Subassembl. 5 (1.00–2.00 m)
<i>Talpa sp.</i>	-	1	-	-	-
<i>M. marmota</i>	-	6	-	2	6
<i>Lepus sp.</i>	1	-	-	-	-
<i>U. spelaeus</i>	-	2	3	-	69
<i>U. arctos</i>	-	-	-	-	1
<i>V. vulpes</i>	-	-	1	-	-
<i>M. martes</i>	-	-	1	-	-
<i>Martes sp.</i>	-	-	1	-	-
<i>M. meles</i>	3	-	4	1	-
<i>F. silvestris</i>	2	-	-	-	-
<i>Sus sp.</i>	80	1	6	10	4
<i>C. elaphus</i>	2	-	-	1	2
<i>C. capreolus</i>	4	-	3	-	1
<i>A. alces</i>	1	-	-	-	-
<i>R. tarandus</i>	-	-	-	1	1
<i>R. rupicapra</i>	1	-	1	-	-
<i>B. primigenius</i>	-	1	-	-	1
<i>Bos s. Bison</i>	-	-	-	-	1
<i>E. caballus</i>	1	-	-	-	-
<i>Aves</i>	1	1	5	1	2

itself and in the proximity of its entrance. Anelli's excavations, however, are known to have extended up to ten meters in front of the cave (Fig. 3), where significant changes in stratigraphy might have occurred. If, however, the contextualization of the finds within individual sub-assemblages is at least roughly correct, then one would expect their fauna composition to match the composition of contemporaneous paleontological accumulations from other sites in the region. Our next step was thus to compare the two largest and thus supposedly most representative sub-assemblages from Betalov spodmol (i.e. sub-assemblages 1 and 5) with three Interpleniglacial, two Pleniglacial II, two Late Glacial and three Early Holocene assemblages from Slovenia by applying the Multidimensional scaling procedure on a rectangular symmetric matrix of Euclidean distances between the analysed sites.

The results (Fig. 4) are entirely supporting the proposed chronological framework, as sub-assemblage 1 indeed clusters with Early Holocene accumulations (Mala triglavca, Viktorjev spodmol, Breg) and sub-assemblage 5 with those from Interpleniglacial/Early Pleniglacial II contexts (Divje babe I: layers 2–5; Parska golobina: layer 3; Betalov spodmol: layers 8–9 [Brodar's excavations]). The latter group is characterized by the great prevalence of cave bear remains, while in Early Holocene assemblages the leading role goes to thermophilic forest-dwelling species (e.g. red deer, wild boar, badger). Unfortunately, the proposed chronological associations for the remaining three sub-assemblages (i.e. sub-assemblages 2–4) could not be tested with the application of the multidimensional scaling procedure, as they include too few finds for them to be representative. Nevertheless, the species composition of these sub-assemblages seems to be generally consistent

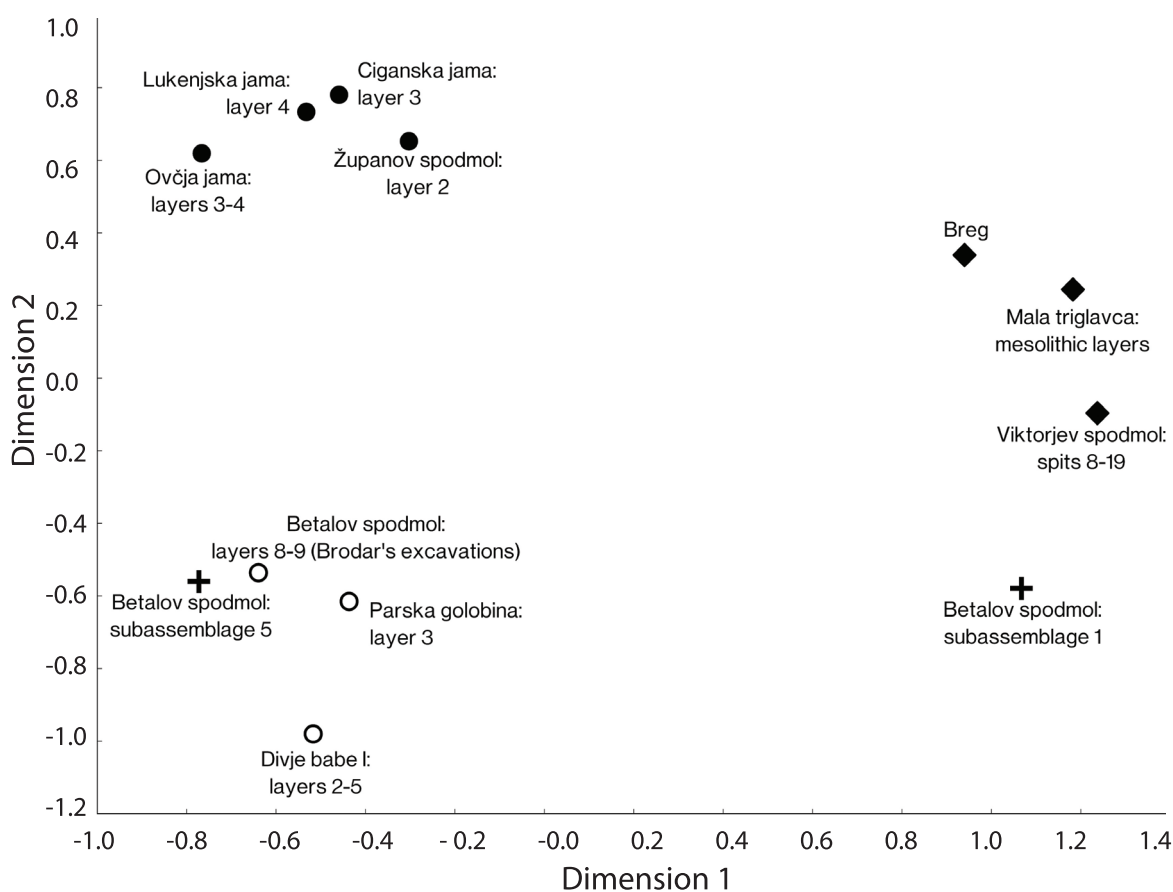


Figure 4: Final distribution of matrix derived from multidimensional scaling of Euclidean distances among Interpleniglacial/Pleniglacial II (dots), Late Glacial (open circles) and Early Holocene (diamonds) mammal assemblages from Slovenia (stress = 0.101). Data taken from Pohar (1991) and Toškan, Dirjec (2004).

with the proposed datings. Examples include the presence of cave bear and chamois remains in sub-assembly 3, which is thought to include both Interpleniglacial/Pleniglacial II and Late Glacial material (i.e. layers 5–9 *sensu* Osole 1991), and the presence of the alpine marmot with the concomitant absence of cave bear in sub-assembly 4, tentatively associated with Brodar's Late Glacial (Epigravettian) layers 5–7. The only sub-assembly to show some controversy is sub-assembly 2. It includes the material from the top meter of deposits excavated by Anelli, and has thus been tentatively associated with Brodar's Holocene layers 1–4, as well as Late Glacial (Epigravettian) layers 5–7. Due to the sub-assembly containing finds from the uppermost part of the stratigraphic succession, the inclusion of animal remains of Holocene age is not questionable. The presence of Late Glacial material can be less straightforwardly proven, even though the record of several marmot teeth and bones does seem to corroborate such a thesis (*cf.* Pohar 1991, 23). The presence of two cave bear remains (Tab. 4), in contrast, is contradictory as the species is believed to have gone extinct several thousand years before the onset of the Late Glacial. This might be indicative of sub-assembly 2 containing (also) Middle Upper Pleistocene material. An alternative option has been proposed by Brodar (2009, 464–466), who argues Osole's association of layers 5–7 to Epigravettian to be incorrect. In his view, these layers are to be dated to an earlier time, which would be in line with the presence of cave bear. Finally, the possibility of the cave bear finds having been found in a secondary context is also to be kept in mind (*cf.* Rakovec 1959, 308).

Conclusions

Betalov spodmol is one of Slovenia's most important Palaeolithic sites. Consequently, not having the chance to study the material excavated there by Anelli in the 1930s severely affected the attempts to obtain deeper insights into the continuity of occupation of the site into the Gravettian era (e.g. Osole 1991, 8, 21; Brodar 2009, 465). Similarly, palaeontologists were not able to properly address the Middle

and Late Upper Pleistocene faunas, as the number of available remains was too small to be truly representative (e.g. Pohar 1991, 25). It is thus understandable that any new find from the uppermost layers of Betalov spodmol would have been greeted as "very much welcoming" (Brodar 2009, 465). Unfortunately, due to the lack of filed documentation, the repatriated material from Anelli's excavations has been long seen as lost in time and thus unsuitable for scientific research.

Our results show that such a point of view is too conservative. It is true that with the field documentation missing, the contextualization of the finds is very difficult. Nevertheless, the existing references to the depth of origin of individual teeth and bones did allow for a tentative association of the paleontological material to cultural complexes. The appropriateness of such associations was tested by comparing both the species composition and representation within individual fauna sub-assemblages from Anelli's excavations at Betalov spodmol to analogous data referring to several other Pleistocene and Early Holocene contexts in the broader region. The results generally confirmed our attempted contextualization of the sub-assemblages. Possibly the most prominent indication of the legitimacy of the proposed associations is to be seen in the great similarity between animal finds originating from Brodar's (Tardi)Gravettian layers 8–9 and the remains found within Anelli's sub-assembly 5, which we tentatively associated with the very same layers (Tab. 4).

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