

Upper Pleistocene *Gulo gulo* (Linnaeus 1758) skeletal remains from the open air loess site Praha-Podbaba (Czech Republic)

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Samenvatting

In de 19e eeuw werd op de openlucht loess site Praha-Podbaba (Tsjechische Republiek) op de terrassen van de rivier de Moldau een incompleet skelet van een oudere, mannelijke veelvraat *Gulo gulo* ontdekt. Het skelet is op basis van de stratigrafie, kleine zoogdieren en de megafauna gedateerd in het vroege Laat Pleistoceen. Tijdens de eerste koude fase van het Weichselien was de mammoetfauna (*M. primigenius*, *C. antiquitatis*, *B. priscus*, *C. elaphus*, *R. tarandus*) vermengd met de alpiene megafauna van de gems *Capra ibex* en de carnivoren *P. leo spelaea*, *Ursus spelaeus* en de hier beschreven *G. gulo*. De taphonomische situatie is niet geheel duidelijk: het Podbaba assemblage zou een mix tussen een midden-paleolithische menselijke site en een hyenanest kunnen zijn. Het is waarschijnlijk dat in de verschillende perioden zowel hyenanesten als ook menselijke (jacht)kampen aanwezig waren langs de Moldau.

Summary

In the 19th century, an incomplete skeleton of an older adult male wolverine *Gulo gulo* was discovered at the open air loess site on the Moldau River terraces at Praha-Podbaba (Czech Republic). Using stratigraphy, micromammals and megafauna, it has been dated to the lower part of the Upper Pleistocene. During the first cold period in the Weichselian, the mammoth fauna such as *M. primigenius*, *C. antiquitatis*, *B. priscus*, *C. elaphus*, *R. tarandus* was mixed with the alpine mega fauna of *Capra ibex* and the carnivores *P. leo spelaea*, *Ursus spelaeus* and the here-described *G. gulo*. The taphonomic situation is unclear, because the bone accumulation at Podbaba may reflect a mix of a Middle Palaeolithic human site and hyena den or prey depot overlapping. Most likely, in different periods, hyena dens and human camp or hunter sites were both present along the Moldava River.

Introduction

Wolverine remains are quite rare at open air sites in Europe; they are usually found in caves dating to the Upper Pleistocene (e.g. Reynolds 1912, Wankel 1868, Pacher & Döppes 1997, Döppes 2001, Diedrich & Döppes 2004, Diedrich 2008). In the Czech Republic, wolverines were listed for the first time by Wankel (1868) from Moravian caves, and later by Beneš (1970). At archaeological Czech sites, *G. gulo* was present in Dolní Vestonice and Pavlov (Musil 1958).

The few bones found at open air sites in Central Bohemia are from the here-described loess site Praha-Podbaba (Czech Republic), a famous bone site at which hundreds of bones were excavated during the 19th century (e.g. Woldrich 1893, Kafka 1903). The Praha-Podbaba Meilbek brickyard was situated at the Moldau River and located between the present-day streets of Podbabská and Pod Julskou in the area of the existing Crown Plaza Hotel. The wolverine material must have been collected around 1888 in the "Meilbekova cihelna". At that time, a large loess pit was situated in the

Upper Pleistocene loess deposits on the west side of the river.

The fossil lion material from this locality was recently revised (Diedrich 2007a). Chewed bones from the woolly rhinoceros *Coelodonta antiquitatis* by Ice Age spotted hyenas and a chewed humerus from a neonate woolly mammoth *Mammuthus primigenius* were figured along with some typical examples of incomplete long bones (joints and/or shafts) (Diedrich 2009). This proves that this open air locality is at least partly of hyena den site origin, which has been mentioned in Diedrich & Žák (2006).

From the material presented here, only the wolverine skull has been previously figured (fig. 1) by Kafka. It is here refigured and described with all additional postcranial material.

In the Bohemian Karst two cave sites have produced important wolverine material, consisting of about 100 bones and teeth of Upper Pleistocene age, which have so far not been studied.

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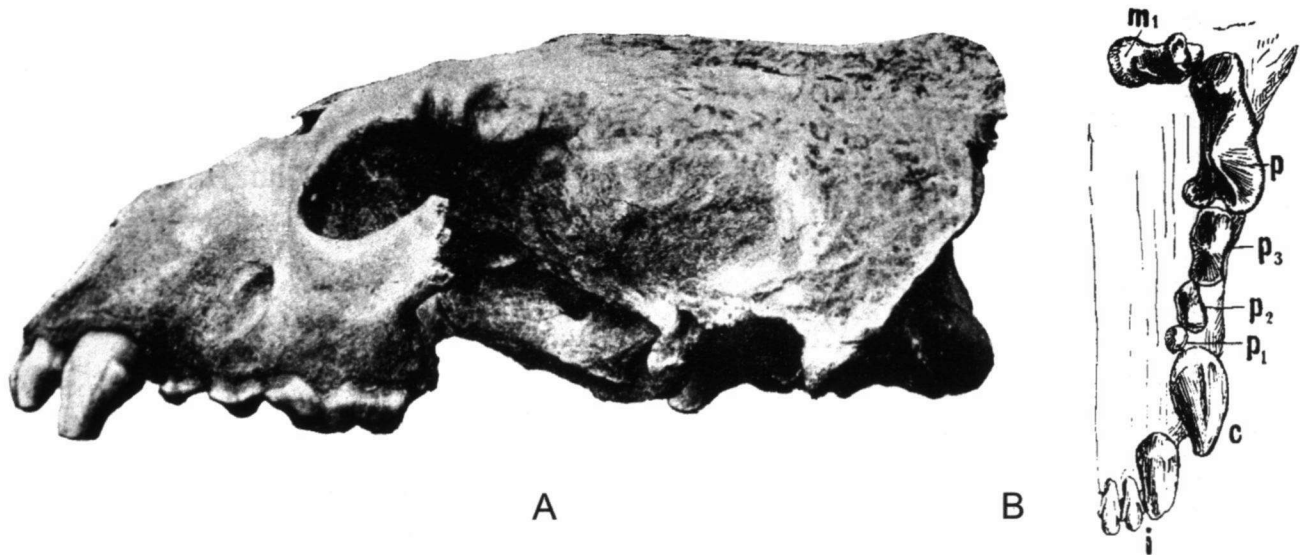


Fig. 1. Original figures of the wolverine skull from Praha-Podbaba, which show the skull and its dentition (from: Kafka 1903). A. Skull laterally, B. Dentition of the right upper jaw.

De originele afbeeldingen van de veelvraat schedel van Praha-Podbaba (naar: Kafka 1903). A. Lateraal aanzicht van de schedel, B. De tanden van de rechter bovenkaak.

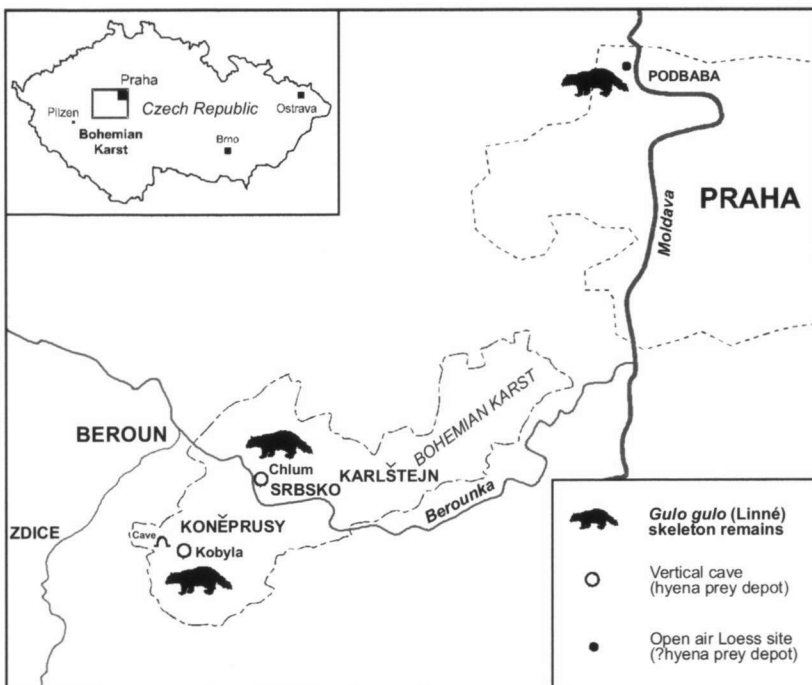


Fig. 2. Positions of Upper Pleistocene wolverine *G. gulo* (Linnaeus 1758) sites in the Bohemian Karst and adjacent areas in Prague-Podbaba, Czech Republic.

Posities van de laat-pleistocene veelvraat *G. gulo* (Linnaeus 1758) sites in het Boheemse karstgebied en aangrenzende regio's in Praag-Podbaba, Tsjechië.

selian age, which is the more or less vertical cave Srbsko Chlum-Komin (fig. 2). In this cave, where about 3,500 bones were accumulated (cf. Diedrich & Žák, 2006), the small amount of wolverines from the macro mammal remains (0.1%) was interpreted as imported hyena prey (Diedrich & Copeland, 2009).

At the second vertical cave, the Chlupáèova Sluj Cave in the Kobyla quarry east of the Koneprusy Cave, many wolverine bones were found, which have not yet been described. This cave is also interpreted as a hyena prey depot. In this faunal assemblage, the Eemian and Weichselian faunas from this site are mixed. It is difficult to distinguish between the warm and cold period faunas, as a result of the lack of stratigraphical information, similar bone preservations and because the documentation was not adequate.

Geology and Datation

In the area surrounding the Praha-Podbaba brickyard, several small pits yielded Middle Palaeolithic artefacts (including a stone tool fragment stuck in a long bone of a woolly rhinoceros (Lutovský et al. 2005)). The association between human and animal remains is uncertain, because the position of the bones was not documented during the excavations.

The macrofauna, newly determined by Diedrich (2007a) is represented by *Mammuthus primigenius* (Blumenbach), *Coelodonta antiquitatis* (Blumenbach), *Bison priscus* (Bojanus), *Equus ferus* cf. *przewalskii* (Poljakoff), *Equus hemionus* (Pallas), *Rangifer tarandus* (Linnaeus), *Cervus elaphus* (Linnaeus), and rarely the alpine *Capra ibex* (Linnaeus). The presence of the carnivores *Panthera leo spelaea* (Goldfuss), *Ursus* cf. *spelaeus* (Rosenmüller), *Canis lupus* (Linnaeus) and the here described *Gulo gulo* (Linnaeus), as well as the presence of the Ice Age spotted hyena, *Crocota crocuta spelaea* (Goldfuss), is in the latter case indicated indirectly by the typical chewing

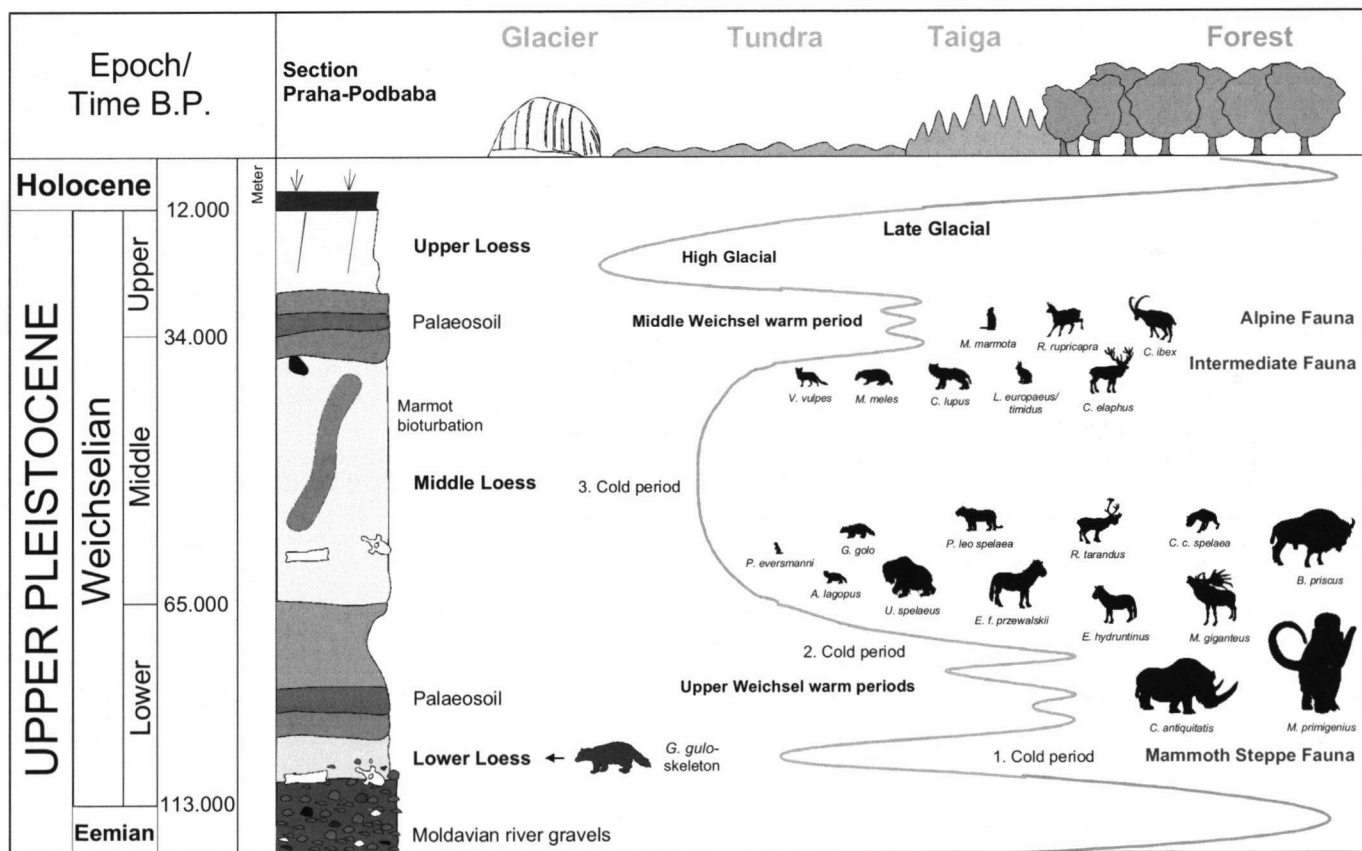


Fig. 3. Geological and palaeontological history of the loess section at the Upper Pleistocene bone site Praha-Podbaba, Czech Republic situated on the Moldavian river terrace (section redrawn after Kafka 1903, with new interpretation).

Geologische en paleontologische geschiedenis van het loessprofiel van de laat-pleistocene site Praha-Podbaba, Tsjechië, op een rivierterras van de Moldau (profiel overnieuw getekend naar Kafka 1903, met een nieuwe interpretatie).

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marks and the incomplete bones from the woolly rhinoceros, similar in preservation to those found in the hyena cave dens of the Bohemian Karst (cf. Diedrich & Žák 2006).

The loess section at the open-air site at Praha-Podbaba, documented by Kafka (1893, 1903) is important for the dating of many of the other finds in loess in the surrounding area. The section was redrawn by Diedrich (2007a), which gave a more modern geological-palaeontological and climatic interpretation (fig. 3). The loess section, several meters thick, overlays the river gravel of the Moldava River (terrace III after: Záruba *et al.* 1977), which belongs to the Saalian glacial or Eemian interglacial stages. The first thin layer of loess (= "Lower Loess") was probably deposited during the Lower Weichselian. In this Lower Loess a "mammoth steppe fauna" was found, including *M. primigenius*, *C. antiquitatis*, *B. priscus*, *E. ferus*, *U. spelaeus*, *P. leo spelaea*, as well as some remains of the here described *G. gulo* (Kafka 1903, Diedrich 2007a).

Most of the Praha-Podbaba bone material from was discovered in the so-called "Middle Loess" which seems to have been deposited in the middle part of the Upper Pleistocene. In this "Middle Loess", bioturbation by marmot and other micromammals was frequently recognized, along with burrows of micromammals, living in a cold period (cf. Kafka 1893). The "Upper Loess" of the latest Weichselian has yielded no macrofauna, neither at this location

nor anywhere else among the open-air sites in the Praha region.

Material and methods

Family *Mustelidae* (Swainson 1835)

Genus *Gulo* (Pallas 1780)

Gulo gulo (Linnaeus 1758)

The material from Praha-Podbaba was historically collected and is listed in table 1. It consists of a skull, right and left humerus, right ulna, and one thoracic vertebra (fig. 4). This material and the material from other Bohemian Karst cave sites is deposited in the Nationalmuseum Prague (Abbreviation = NMP).

The skull misses the left jugal and the area around the frontals/nasals is damaged (fig. 5.1a). The left dentition is complete, except for the P¹, which is absent. In the right jaw the I¹, C and P¹ are missing. The right P² is also absent, but it was lost while the animal was still alive because the alveolus was completely fused after the tooth was lost. The teeth are well-used and the canines are half worn. The total skull length is 194 mm.

The forelimb bones are represented by both humeri (figs. 5.2-3). The right humerus is nearly complete and has a total length of 168 mm and a width of 47 mm. On both joints small damages are visible. This damage did not occur recently and might be the result of carnivore activity. The left humerus is only represented

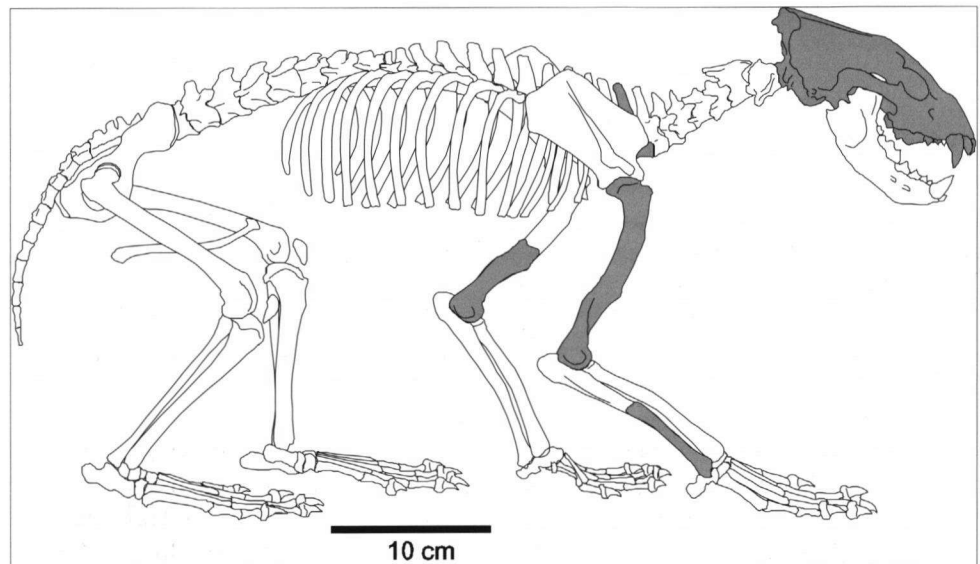
No.	Coll.-no.	Locality	Element	Commentary	side	sex	Age	Original	Collection
1	R 1944	Praha-Podbaba	Cranium	Incomplete		Male	Adult	x	National Museum Praha
2	R 2418	Praha-Podbaba	Humerus	Complete	right	Male	Adult	x	National Museum Praha
3	R 1325	Praha-Podbaba	Humerus	Half	left	Male	Adult	x	National Museum Praha
4	R 2417	Praha-Podbaba	Ulna	Half	right	Male	Adult	x	National Museum Praha
5	R 2416	Praha-Podbaba	Vertebra	First thoracic		Male	Adult	x	National Museum Praha

Table. 1. *Gulo gulo* bone remains from Praha-Podbaba.

Gulo gulo botresten uit Praha Podbaba.

Fig. 4. Present bones of the *Gulo gulo* skeleton from Praha-Podbaba.

De aanwezige botten van het *Gulo gulo* skelet van Praha-Podbaba.



by the the distal part. It is also 47 mm in width. It is also slightly damaged at the joint. The distal proportions of both humeri are similar. Of the right ulna only the distal half is preserved. It was also more recently broken (fig. 5.4).

The axial skeleton is represented by the first thoracic vertebra, from which the dorsal spine is missing, but also other parts at the centrum and the zygapophyses (fig. 5.5).

Discussion

The skull with a length of 194 mm is quite large compared to the skull from the Sloup Cave skeleton which measures only 174 mm in length (Diedrich & Musil 2008). Based on these measurements, it is most likely a male individual. The humerus and ulna sizes, when compared to the fossil data and data from modern wolverines from Döppes (2001), again indicate a male, because its bones are larger than female ones. The right complete humerus of the Podbaba specimen is 168 mm in length, the humeri of the Sloup skeleton measure only 145 mm in length.

The cranium and postcranial bones from Praha-Podbaba could all belong to the same individual. This can be proved by bone proportions of larger and similar long bones compared to other described wolverine material, especially the complete right humerus (cf. Döppes 2001, Diedrich & Döppes 2004, Diedrich 2009). The complete fusion of skull suture, strong toothwear, the loss of a P¹ tooth and the alveolar overgrowth prove that it is an older adult individual. The postcranial bones, with their complete suture fusions, also support such an

age determination. Only one individual can therefore be proved at Prague-Podbaba.

The taphonomy is unclear, but the wolverine might have been imported as a complete carcass or prey by Ice Age spotted hyenas. It may have been documented earlier as lion remains as other prey remains were accumulated at the Praha-Podbaba bone site (Diedrich 2007, 2009). Such bone accumulations by hyenas at open air loess sites were also recently described at the Unstrut River at Freyburg a.U. (Saxony-Anhalt, Central Germany, cf. Diedrich 2010).

The incomplete skull of *G. gulo* and damage on the postcranial bone joints from Podbaba are probably the result of carnivore activity, but is difficult to prove this. Definitely, fresh fractures on the ulna, humerus and the vertebra were clearly made during the excavations.

As mentioned before, only one older adult individual is present at the Praha-Podbaba open air site. A similar situation was observed in the taphonomical record at the Czech Srbsko Chlum-Komin Cave (Diedrich & Copeland 2009), and also at the German Rösenbecker Cave (Diedrich, 2008) and Perick Caves (Diedrich & Döppes 2004, Diedrich 2008). Only adult to senile wolverine remains were found in hyena den caves in which many prey bone remains were found. At all sites the wolverines account for less than 0.1-0.2% of the fauna remains (= hyena prey). Also at Podbaba the wolverines are represented by less than 0.1% of some hundreds of collected bones. The absence of juvenile *G. gulo* remains prove that caves were not used to give birth and raise the cubs. Pleistocene wolverines must have used snow

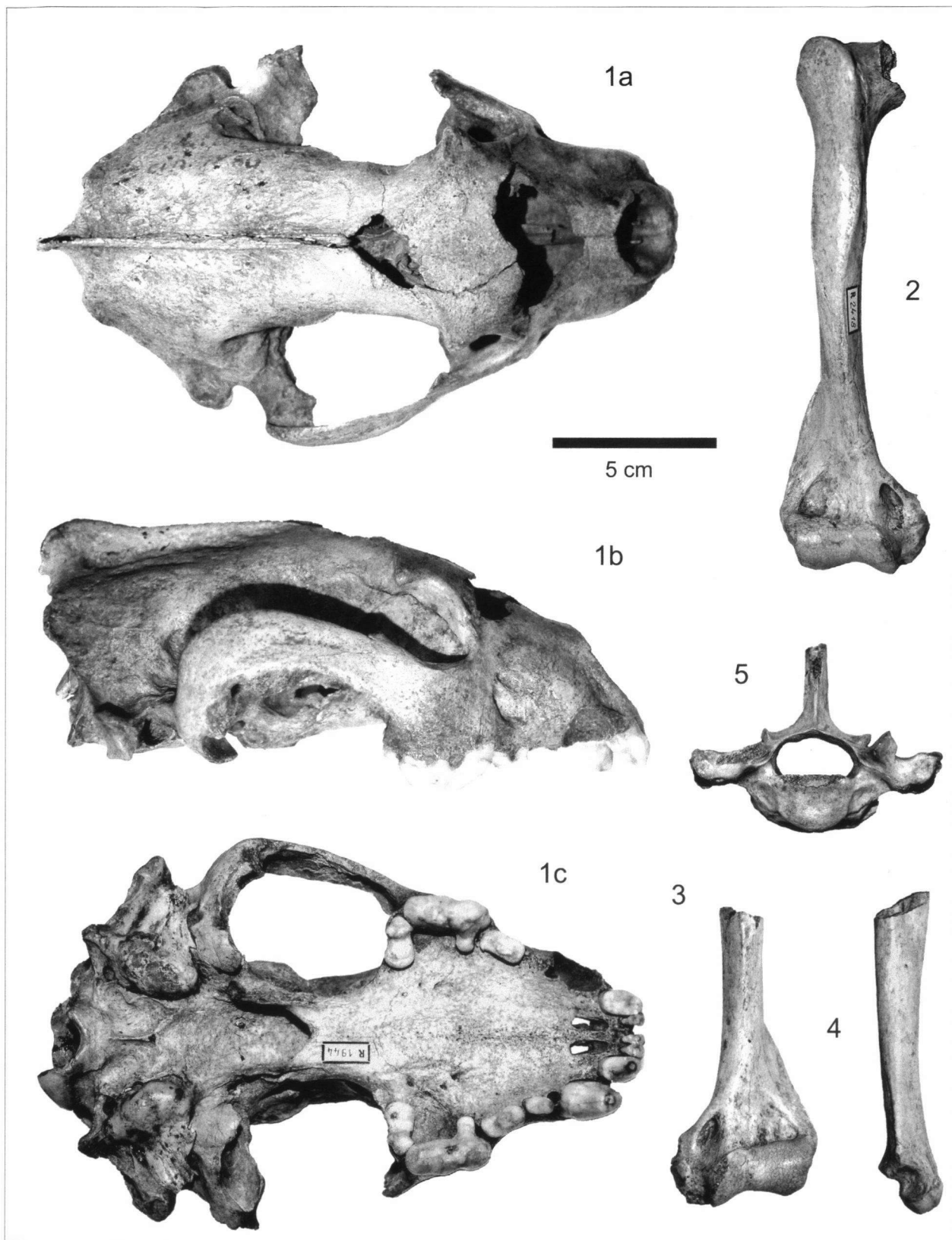


Fig. 5. The *Gulo gulo* remains from Praha-Podbaba. 1. Cranium (NMP No. R 1944), a. dorsal, b. lateral, c. ventral. 2. Right humerus (NMP No. R 2418), cranial. 3. Left humerus fragment (NMP No. R 1325), cranial. 4. Right ulna (NMP No. R 2417), lateral. 4. First thoracic vertebra (NMP No. R 2416), cranial.

De *Gulo gulo* resten uit Praha-Podbaba. 1. Schedel (NMP No. R 1944), a. dorsaal, b. lateraal, c. ventraal. 2. Rechter humerus (NMP No. R 2418), craniaal. 3. Fragment van een linker humerus (NMP No. R 1325), cra-

burrow dens like modern wolverines do, as has been observed in Norway and North America (e.g. Krott 2002). The wolverines were possibly killed as hyena antagonists. Their carcasses were imported into caves, but they were often not scavenged further by the hyenas. Similar to modern African hyenas, which only eat other carnivores in special situations or in the absence of their main prey, carnivores were the last prey to eat and to scavenge for the hyena at Podbaba (cf. Kruuk 1972, Estes 1999).

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