

## The highlights of the cave bear research in Slovakian Western Carpathians

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### Abstract

Fossil remains of cave bears (*Ursus ex gr. spelaeus*) are known from Slovak caves at least from the Middle Age. Originally attributed to dragons and giants, these have been the object of the scientific study for almost 300 years. This research yielded so far many data on the taxonomy, phylogeny, palaeoecology, and palaeobiology of this one of the most famous extinct Pleistocene animals. The most important highlights of this cave bear research in the Slovakian Western Carpathians are presented.

### Zusammenfassung

Fossile Überreste von Höhlenbären (*Ursus ex gr. spelaeus*) sind aus slowakischen Höhlen zumindest seit dem Mittelalter bekannt. Ursprünglich Drachen und Riesen zugeschrieben, sind sie seit fast 300 Jahren Gegenstand der Wissenschaft. Bis heute liefert die Forschung eines der berühmtesten ausgestorbenen pleistozänen Tieres, Daten zur Taxonomie, Phylogenie, Paläoökologie und Paläobiologie. Die wichtigsten Erkenntnisse der Höhlenbärenforschung in den slowakischen Westkarpaten werden hier vorgestellt.

**Key words:** cave bear, Pleistocene, Western Carpathians, Slovakia

### 1. Introduction

Nearly 300 years of cave bear research in Slovakia, i.e. research focused on the fossils of bears from the *spelaeus*-group (SABOL, 2017), yielded many important data on these animals inseparably connected with European Late Pleistocene mammalian communities. Fossils of cave bears occur in every larger horizontal cave. To date their dental and skeletal remains have been found in deposits of more than one hundred Slovak karst sites, and other new localities are reported every year (SABOL, 2001). Simultaneously with that, new approaches in the field and laboratory researches based on modern methods and technologies are applied thus yielding new information about “old dragon bones”.

## 2. Highlights (Fig. 1)

The stratigraphically earliest fossil record of cave bears in the Slovak territory of the Western Carpathians is probably reported from Trojuholník Cave in the Borinka Karst (Malé Karpaty Mts.) near Bratislava capital city. Although fossil remains were attributed to cave bears probably from the Middle Pleniglacial (SABOL, 2005), these show also several primitive characters in dentition, with the predominance of rather simpler morphotypes in premolars (A, A/D, B in P4s and C1 and C3 in p4s). Also smaller dimensions of teeth, comparable rather with those of *Ursus deningeri*, and some taphonomic phenomena, such as a skull deformed by overlying sediments, indicating a longer sedimentary history, can point out a different taxonomic position of these cave bear fossils (*U. spelaeus* ssp.) than in cases of finds from other Slovak sites (*U. ingressus*).

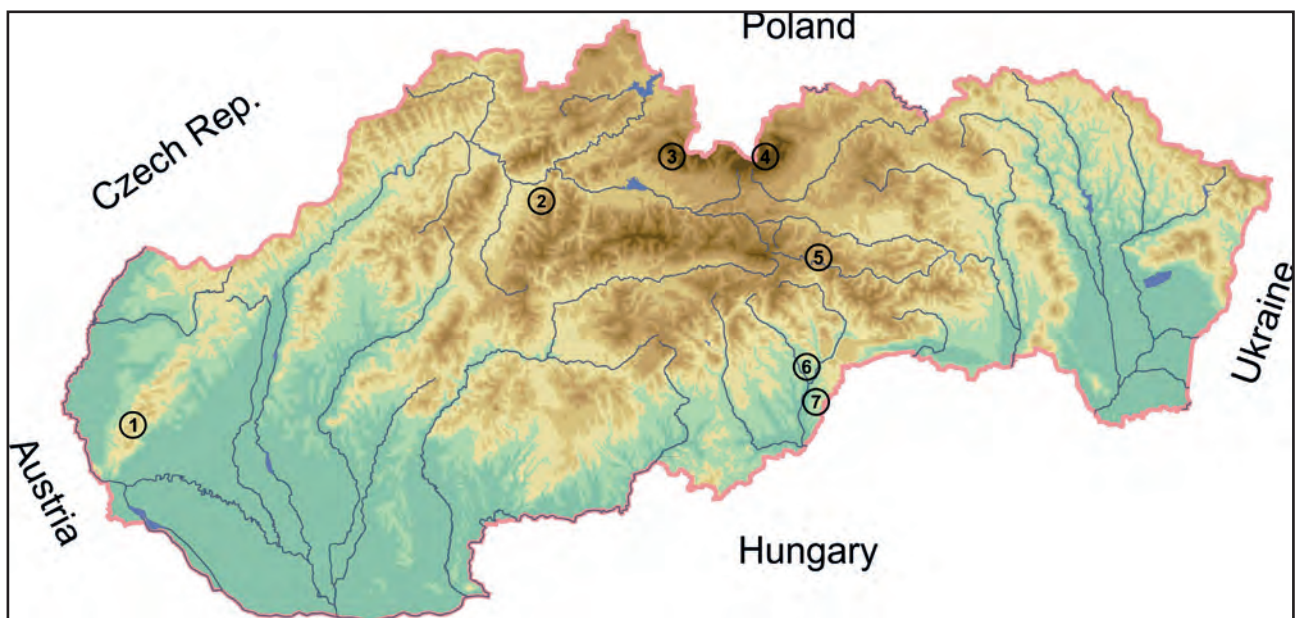


Fig. 1: Location of Slovak cave bear sites mentioned in the text.

- 1) Trojuholník Cave, 2) Jaskyňa Izabely Textorisovej Cave, 3) Medvedia jaskyňa Cave in the Západné Tatry Mts.,
- 4) Javorinka Cave and Mesačný tieň Cave, 5) Medvedia jaskyňa Cave in the Slovenský raj Mts., 6) Peško Cave,
- 7) Činčianska jaskyňa Cave.

So far the last occurrence of cave bears in the Slovak territory of the Western Carpathians is recorded from Jaskyňa Izabely Textorisovej Cave in the Veľká Fatra Mts. near Turčiansky Svätý Martin town. The  $^{14}\text{C}$ -AMS dating of two metapodial bones in the Vienna VERA-Laboratory yielded radiometric dates  $26,460 \pm 180$  (VERA-5680) and  $24,640 \pm 170$  (VERA-5679) years BP (SABOL et al., 2014). These data indicate the possible extinction period of cave bears in Western Carpathians just before the beginning of the Last Glacial Maximum or during its initial phase which is in good concordance with data on the species disappearing in the Alps and adjacent areas (PACHER & STUART, 2009).

The highest occurrence of cave bear fossil remains in Slovakia has until recently been reported from Javorinka Cave in the western part of the Kolový Úplaz Massif on the western slope of the Javorová dolina Valley on the northern side of the Tatry Mts. (SABOL et al., 2014). The cave bear fossils, dated to  $51,000 + 4,500 / - 2,900$  years BP, have been found here at altitudes between 1,525 and 1,559 m. However, new discoveries in Mesačný tieň Cave with its entrance at 1,767 metres above sea level yielded updated information about the highest situated Slovak fossil record of cave bears (Fig. 2). The cave, situated in the Javorinská Široká Massif in the Tatry Mts., is the second longest (34,085 m) and the third deepest (-451 m) cave in Slovakia. The highest located fossils of cave bears, attributed to *U. ingressus* (POPOVIČ et al., 2015), have been found in the Medvedia chodba cave part at an elevation of 1,587 metres. Their first radiometric dating yielded an age of 49,110 years BP (POPOVIČ et al., 2016), which corresponds relatively well with the age of fossil record from Javorinka Cave, indicating the MIS 3 period.

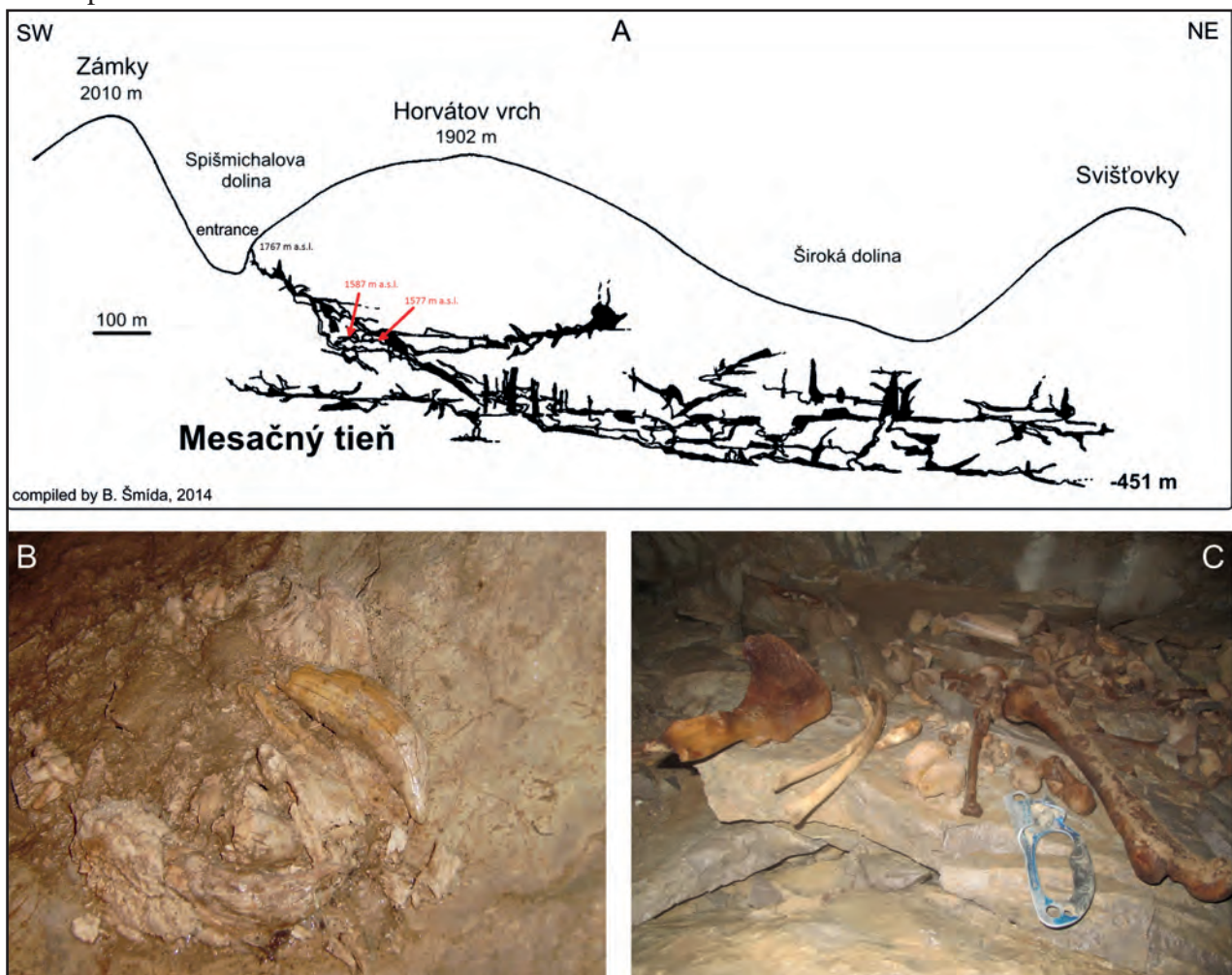


Fig. 2: The high-alpine fossil record of cave bears in Mesačný tieň Cave.

A) cross-section of the Javorinská Široká Massif with the cave and highlighted places, where cave bear fossils have been found, B) cave bear fossil record at an altitude 1,577 metres, C) cave bear fossil record at an altitude 1,587 metres. Cross-section and photos: B. Šmída.

Against the abovementioned, the lowest recorded occurrence of cave bear fossils in the Slovak territory is so far reported from two caves situated in southern Slovakia at about 200 metres altitude. The lower situated site is 17 metres long fluvial-karst Peško Cave in the Rimavská kotlina Basin (Rožňava district) with its entrance at 200 metres above sea level. LOŽEK et al., (1989) found here a fragment of cave bear upper canine (*Ursus cf. spelaeus*) in complex of three layers (10 to 12) with a vertebrate fossil assemblage from the Last Glacial (originally dated to W2-W3).

The larger quantity of cave bear fossil remains is known from Činčianska jaskyňa Cave in the Bodvianska pahorkatina Upland, Revúca district. The entrance of this 28 metres long fluvial-karst cave is located at of 215 metres altitude.

The fossil material, discovered at the site in 1978 and consisting of 26 teeth, five cranial fragments and one fragmented mandible of cave bears from the Last Glacial, was later evaluated by SABOL (1997, 2000).

The fossil record of cave bears is relatively multifarious in Slovak caves – from several isolated finds of teeth or bones up to more or less completely preserved skeletons of individuals of different ages, sexes and sizes. Up to now, the largest cave bear specimen is from Medvedia jaskyňa Cave in the Slovenský raj Mts. in Eastern Slovakia. It is a skull belonging to a huge adult male. The maximum length of this cranial fossil, housed in the Slovak Museum of Nature Protection and Speleology in Liptovský Mikuláš (No. 501/77) is 571.4 mm, with the condylobasal length 513.0 mm (SABOL, 2002). The weight of this male could certainly reach over 500 kg.

Medvedia jaskyňa Cave in the Slovenský raj Mts. is also the site where the largest quantity of cave bear fossil remains have been found in the Slovak territory of the Western Carpathians. The palaeontological record of this cave, discovered in 1952, was preliminarily investigated by FEJFAR (1953) and later by JANÁČIK & SCHMIDT (1965) as well as by SABOL (1997, 2000, 2002). However, the systematic field campaign – the first modern one within the Slovakian cave bear research – was carried out by a scientific team composed of experts from Austria (Vienna University and Austrian Academy of Sciences) and Slovakia (Comenius University in Bratislava) under the direction of Prof. Gernot Rabeder (SABOL et al., 2008b). During the triennial campaign (2007-2009), more than 4,300 samples of fossils were excavated from three pits with the participation of 57 European researchers and students.

From the time of the first scientific reports on cave bear findings in the territory of Slovakian Western Carpathians (SABOL, 2017), many new sites with fossil remains of this extraordinary extinct animal have been discovered. In a few cases, research has revealed several peculiar finds. The fossil remains of cave bears influenced by various taphonomic and pathological processes, belong among the most interesting ones within this group of finds. One of the most exceptional is a skeleton of a three-legged



cave bear female in Jaskyňa Izabely Textorisovej Cave (SABOL et al., 2008a). Her left forearm have been attacked by large predator or violently removed in the case of injury, and the preserved part of the limb consisted only of a damaged humerus. The bone was pathologically modified by chronic inflammatory processes, which resulted in limited movement of this animal during its remaining life in the harsh conditions of the Last Glacial wilds. Another extraordinary, so far not detailed described findings are fossil remains of cave bear female and (her?) cub in one small hall of Medvedia jaskyňa Cave in the Západné Tatry Mts. together with the skeleton of a prime adult male of cave lion (SABOL et al., 2018). Their common presence in one cave part could indicate a prehistoric wildlife drama that took place over 40,000 years ago.

### 3. Conclusion

The Slovak territory of the Western Carpathians with more than 4,000 caves is rich in finds of cave bear fossils. However, the future research has to bring more detailed analyses, focused predominantly on taxonomical studies based on palaeogenetic (ancient DNA) data, on the reconstruction of cave bear palaeoenvironment on the basis of isotopic data, as well as on the study of population structure, age of death, causes of death, and extinction reasons of this bear species. More detailed taphonomic data can yield other information for its interaction with other species and environment. To prevent the return of cave bear research in Slovakia to the level of 20<sup>th</sup> century, a sufficient financial funding and cooperation with researchers from various world scientific institutions will be needed. Only then can it yield other interesting and important data about West Carpathian bears from the *spelaeus*-group.

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