

# A record of a three-legged female cave bear from the Cave of Izabela Textorisova (Velka Fatra Mountains, northern Slovakia)



**Abstract** ► Pathological modifications on the left humerus of a female cave bear from the Last Glacial deposits of the Cave of Izabela Textorisova (the Velka Fatra Mts., northern Slovakia) are described. They point to chronic inflammatory processes, probably caused by a chronic osteomyelitis. Impact of the injury on the life of the animal is discussed.

## Observation d'une femelle d'ours des cavernes à trois pattes dans la grotte Izabela Textorisova (Monts Velka Fatra, Slovaquie du nord)

**Résumé** ► Des modifications pathologiques de l'humérus gauche d'une femelle d'ours des cavernes trouvée dans des dépôts du dernier pléni-glaciaire dans la grotte Izabela Textorisova (Monts Velka Fatra, Slovaquie du nord) sont décrites. Ils indiquent un processus inflammatoire chronique, probablement causé par une ostéomyélite chronique. L'impact de la blessure sur la survie de l'animal est discuté.

## Beobachtung eines dreibeinigen Höhlenbärweibchens aus der Izabela Textorisova-Höhle (Velka Fatra-Berge, Nördliche Slowakei)

**Kurzfassung** ► Es werden pathologische Veränderungen des linken Oberarmknochens eines Höhlenbär-Weibchens aus den letztzeitlichen Ablagerungen der Izabela Textorisova-Höhle (Velka Fatra-Berge, Nördliche Slowakei) beschrieben. Diese deuten auf chronische Entzündungen hin, vermutlich ausgelöst durch eine chronische Osteomyelitis. Der Einfluss der Verwundung auf das Leben des Tieres wird diskutiert.

### Introduction

The dental and osteological remains of cave bears represent the largest amount of macrofaunal fossils found in the Late Pleistocene deposits of European caves. A bicentennial scientific research of this animal so far yields many data on its life, and together with the woolly mammoth, they are among the best explored Pleistocene mammals. In spite of that, however, everything is not yet revealed. One of the developing fields of research is the study of palaeopathological phenomena found in the fossil record and their comparison with recent ones within the actual palaeontological principles. Also, the relatively large quantity of cave bear fossils found comprise evidence of various diseases and wounds which struck this largest representative of the order Carnivora in its natural environment of the Late Pleistocene. A new unique proof of cave bear pathological phenomenon was discovered in

2006 during the palaeontological excavation in the Cave of Izabela Textorisova.

### Locality

The Cave of Izabela Textorisova is situated in the Kinsky dol Vale within the Gaderska Valley in the Tlsta National Natural Reservation in the territory of the Velka Fatra Mountains of northern Slovakia (Fig. 1). The site is formed by the Gader limestone (dark-grey compact limestone and light-grey crinoid limestone, Upper Anisian, Middle Triassic) of the Choc Nappe (Hronikum Unit). The cave consists of a large portal entrance and three halls, more or less connected by horizontal corridors. The bottom of the halls is mostly covered by coarse debris with loam or with layers of guano (with thickness to 20 cm). The main location of the discovery of cave bear fossils (named as "Hrobka" [Tomb]; Fig. 2) is situated at the

► **Martin Sabol**<sup>1</sup>

sabol@fns.uniba.sk

► **Andrej Bendik**<sup>2</sup>

bendik@snm-em.sk

► **František Stuller**<sup>3</sup>

stuller@jfmed.uniba.sk

► **František**

**Novomeský**<sup>3</sup>

novomesky@jfmed.

uniba.sk

► **Libor Necas**<sup>4</sup>

necas@mfn.sk

<sup>1</sup> Department of Geology and Palaeontology, Faculty of Science, Comenius University, Mlynska dolina, SK-842 15 Bratislava, Slovak Republic;

<sup>2</sup> Slovak National Museum in Martin, Museum of Andrej Kmet, A. Kmet Street 20, SK-036 01 Martin, Slovak Republic;

<sup>3</sup> Institute of Forensic Medicine, Jessenius Faculty of Medicine, Comenius University, SK-036 01 Martin, Slovak Republic;

<sup>4</sup> Clinic of Orthopedics and Traumatology, Teaching hospital, SK-036 01 Martin, Slovak Republic

**Keywords/Mots-clés/ Stichwörter:**

Cave bears, pathology, Last Glacial, Cave of Izabela Textorisova, Slovakia

Fig. 1: Location of the Cave of Izabela Textorisova within the Velka Fatra Mountains in northern Slovakia.

Fig. 1: Localisation de la grotte Izabela Textorisova près des Monts Velka Fatra, dans le nord de la Slovaquie.

Abb. 1: Lokalisierung der Izabela Textorisova-Höhle in den Velka Fatra-Bergen in der Nördlichen Slowakei.

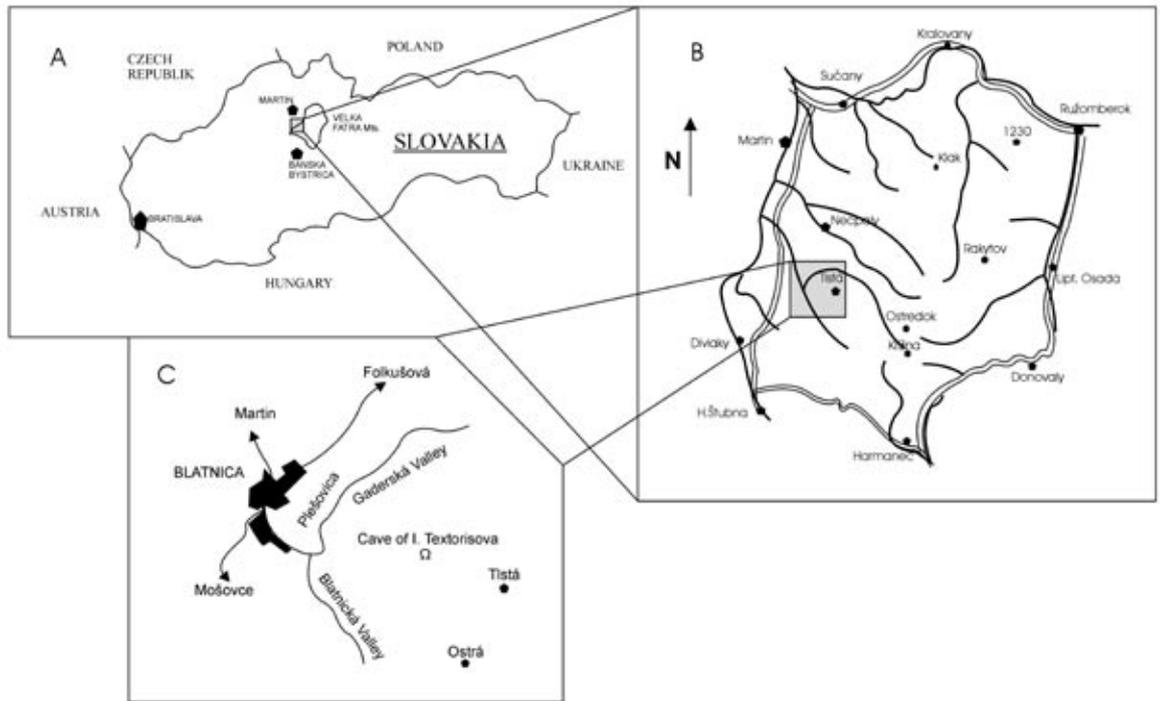
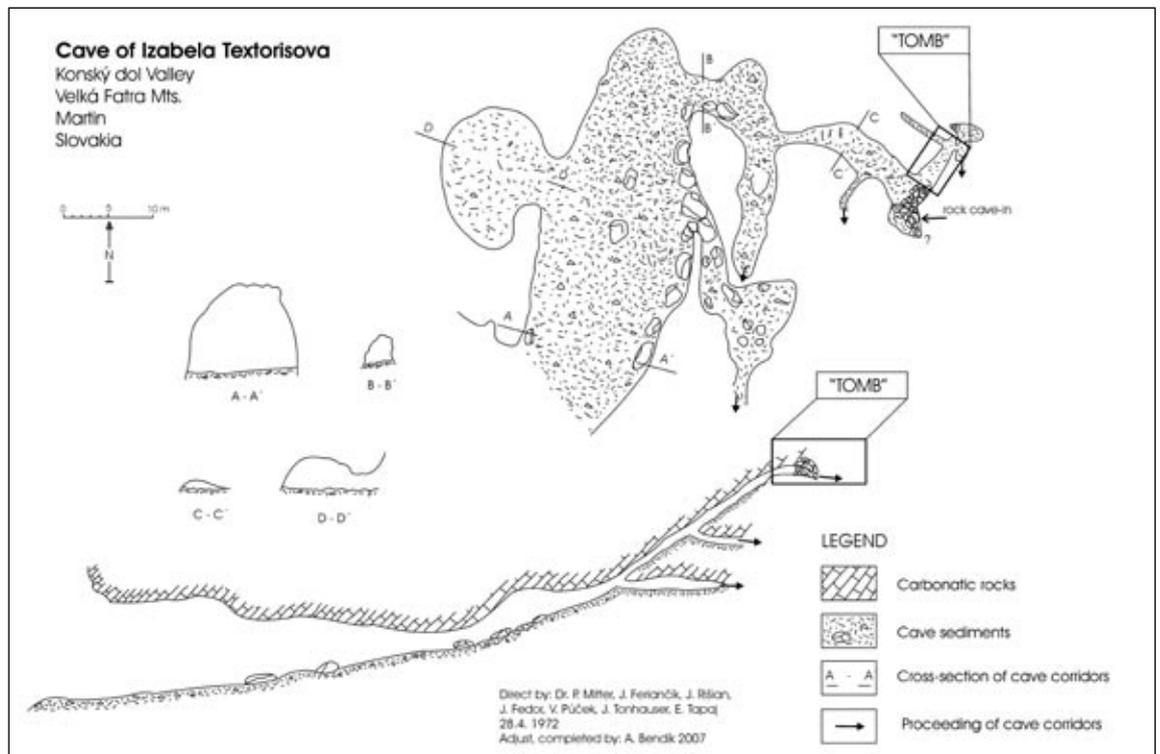


Fig. 2: The Cave of Izabela Textorisova.

Fig. 2: La grotte Izabela Textorisova.

Abb. 2: Die Izabela Textorisova-Höhle.



end of one tectonically steep inclined corridor in the cave section named as “Sien” (Hall). This corridor is closed by a cave-in (or collapse), which probably obstructed the original access path for bears. The sedimentary sequence in the cave section named “Hrobka” consists of overlying gravel accumulation (covered by 2cm thick layer of white sinter), a loamy layer with larger clasts (from 2cm up to 8cm) and scattered rocks (up to 40cm in size), and with a thick underlayer of light-grey clay (Fig. 3). The bear fossils have been found mainly in depth from 30 to 80cm above a wet clayey layer. In the same depth, more or less complete skeletons of four to nine cave bears also have been discovered *in situ* position.

## Fossil Record

Based on the first report about the fossil record from the Cave of Izabela Textorisova (BARTA 1963), new palaeontological research began at the site in 2004 (BENDIK 2005, 2007; BENDIK & SABOL 2007, 2008). So far, more than 1400 bones and fragments of minimally 25 individuals from the time of/before the Moershoofd Interstadial (> 45,000 BP; BENDIK & SABOL 2007) have been found in the cave, and are currently housed in the Slovak National Museum – Museum of Andrej Kmet in the town of Martin. Among the fossil record found in the fossiliferous cave deposits, the find of some cave bear skeletons is the

most important. They belong to four to nine individuals of various sex and age, with the dominance of young adult females (preliminary result), showing some pathological modifications. One of the most interesting finds is represented by a female skeleton (K4/PZ-99) with the pathological left upper arm bone (*humerus sin.*, HJ/834) (Fig. 4).

The bone belongs to a young adult (diaphyses and epiphyses are already fused), more robust animal (the measurements of the bone are as follows, measured according to GONZÁLES 2003): maximum anteroposterior diameter of the head is 83.8 mm, maximum anteroposterior diameter of the proximal epiphysis is 98.6 mm, maximum transversal diameter of the head is 63.8 mm, maximum transversal diameter of the proximal epiphysis is 73.6 mm, transversal diameter of the diaphysis (distal) is 35 mm, and transversal diameter of the diaphysis (proximal) is 38.2 mm), probably of female sex (based on the measurements of teeth, mainly of small canines, and the absence of *os penis*).

The bone under study is robust and long, with more pronounced protuberances for muscle insertion. In the area of the head (*caput humeri*) near the apposition of the cartilage, a more rugose superficial area is situated, corresponding to exposed spongiosis. Its presence is caused by the natural mechanical bone abrasion, adequate to the aging process of the animal.

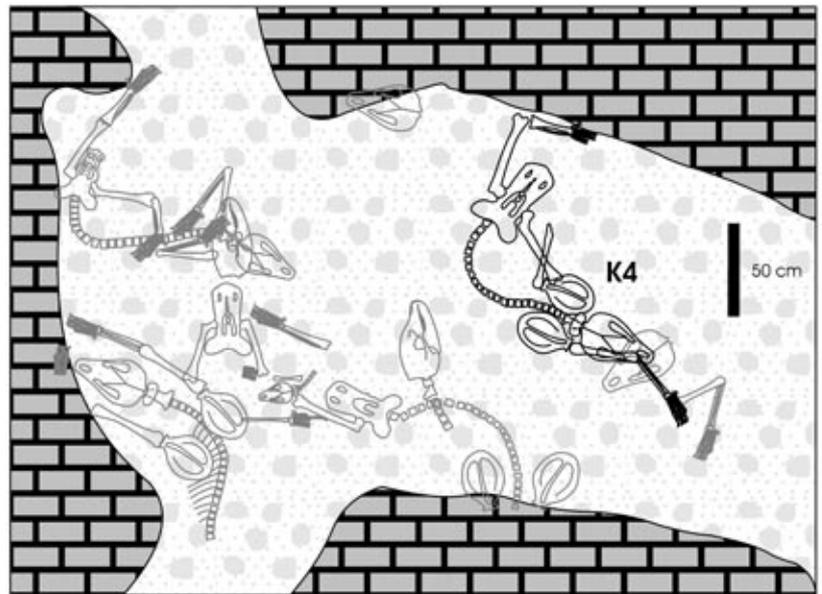
The distal end of the bone is positively pathologically modified. Originally, this part of the humerus formed a moveable connection of the arm with the forearm bones – so called elbow joint. The joint is a “weight-bearing” one for quadrupedal (moving on all fours) animals. In this case, the pathological modification appears to be a result of chronic degenerative changes affecting the distal bone edge, while the radial condyle and lateral epicondyle are missing. Predominantly the posterior aspect of the inferior bone margin is formed by hyperostoses and irregular osseous granulations. The triangular area of the olecranon fossa is nearly completely disappeared. The medial epicondyle is only partly preserved, formed by hyperostoses and exostoses.

## Discussion and Conclusion

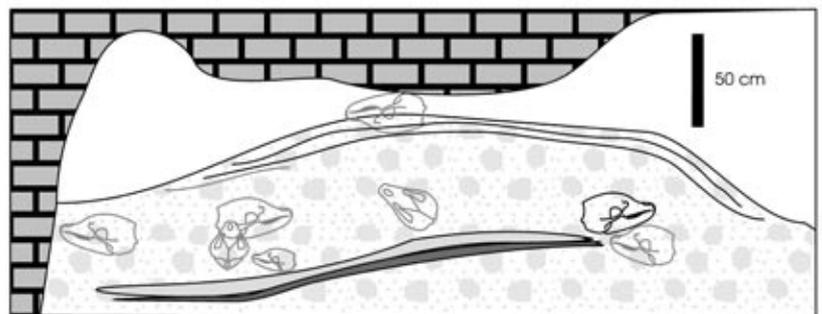
The pathological modifications at the distal end of the upper arm bone point to chronic inflammatory process, probably caused by the chronic osteomyelitis, which resulted in bone disintegration and the decrease of bone mass density. It was followed by productive inflammation, leading to proliferation of insufficient bone tissue. Exostoses arose as a result of the pulling of muscular and ligament attachments.

Based on X-ray analysis (Fig. 4C) and morphologic evaluation of the bone, the following results can be noted: a) the chronic degenerative process of the bone was presumably preceded by an injury of the animal (probably an open splintered fracture); b) the injured animal survived for a longer period and consequential alterations resulted in the changes of bone trabeculae structure in the side close above the joint; c) the osteolysis (bone softening) and the sequestration (expelling of released bone splinters), probably caused by a suppurative process of pyosis, following the bone injury; and d) afterward, the

## Group-plan of “Hrobka”



## Cross-section of “Hrobka”



## Legend

-  Carbonatic rocks
-  Sand layer
-  Clay layer
-  Cave sediments – gravel, sandy gravel, in upper part amalgamated by sinter
-  Osteological remains of cave bear

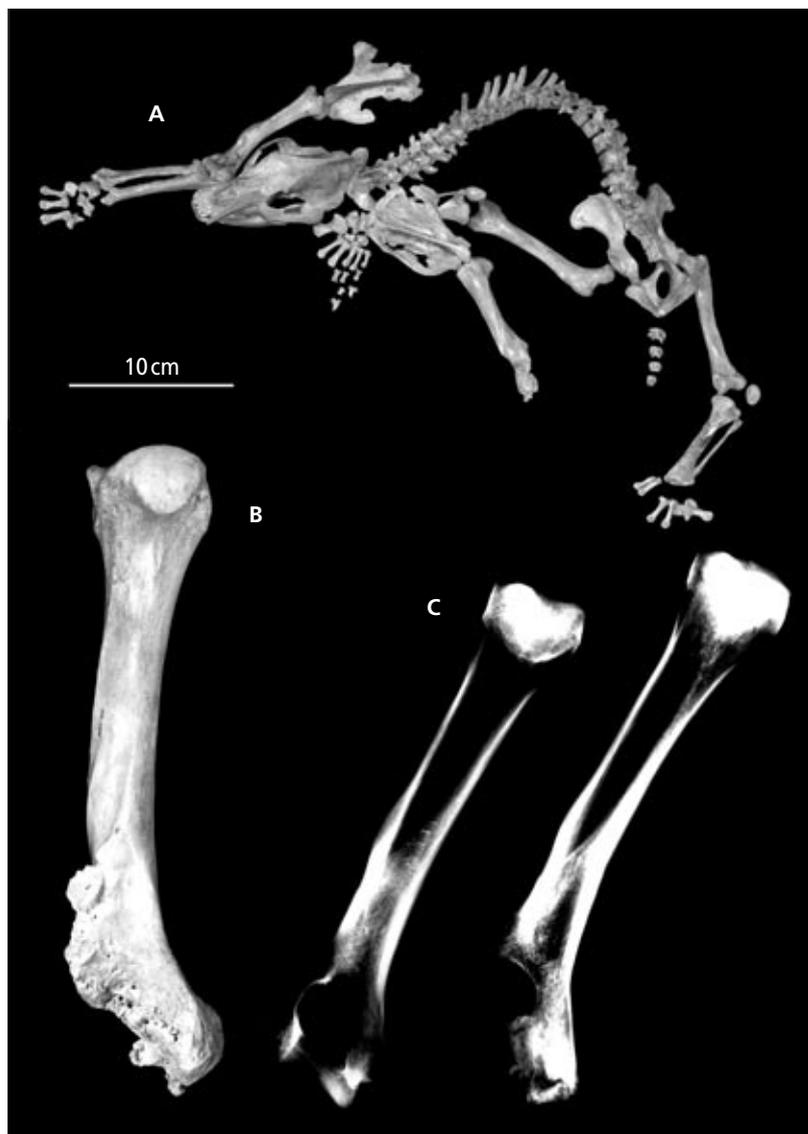
Fig. 3: The “Hrobka” cave section with its sedimentological and palaeontological contents.

Fig. 3: La salle «Hrobka» avec son contenu sédimentologique et paléontologique.

Abb. 3: Der Höhlenteil «Hrobka» mit seinem sedimentologischen und paläontologischen Inhalt.

repair process of the affected bone eventually resulted in the bone proliferation. Although morphologically very similar changes can also develop in the case of specific bone inflammation (such as bone tuberculosis), it is a strong probability that the pathological phenomenon under study arose by fracture injury, which could be primarily caused by another large carnivore too.

The injury had resulted in the reduced mobility of the animal and in its permanent instability. The female cave bear probably had problems with locomotion of the affected forelimb particularly in decreased spectrum of



**Fig. 4:** Three-legged female cave bear from the Cave of Izabela Textorisova. A. reconstruction of skeleton in found position, B. pathologically modified left humerus, C. X-ray comparison of humerus under study (right) with normal one (left).

**Fig. 4:** L'ours des cavernes femelle à 3 pattes de la grotte Izabela Textorisova. A. Reconstruction du squelette dans la position de découverte. B. Humérus gauche à modification pathologique. C. Comparaison radiographique de l'humérus étudié (droit) avec un humérus normal (gauche).

**Abb. 4:** Das dreibeinige Höhlenbär-Weibchen aus der Izabela Textorisova-Höhle. A. Rekonstruktion des Skelettes in Fundlage; B. Der pathologisch veränderte linke Oberarmknochen; C. Röntgenaufnahmen und Vergleich des untersuchten Oberarmknochens (rechts) mit einem normalen Oberarmknochen (links).

## Acknowledgements

This work was supported by the Slovak Research and Development Agency under the contact No. APVV-0280-07 and LPP-0362-06. The research was also realized within the Research Project VVU-PrV-B4 of the Slovak National Museum in Martin. Authors' thanks to Dr. Hubert Poláček Jr. (University Hospital in Martin) for correction of special medical expressions. ■

## References

- BARTA J., 1963: Desat rokov speleoarcheologickej cinnosti Archeologickeho ustavu SAV (Ten years of speleo-archaeological activities of the Archaeological Institute of Slovak Academy of Science). *Slovenský kras*, IV, Liptovský Mikuláš, 87-97. (in Slovak)
- BENDIK A., 2005: Nove osteologicke nalezky medveda jaskynneho (*Ursus spelaeus*, ROSENMÜLLER & HEINROTH) vo Velkej Fatre (New osteological finds of cave bear (*Ursus spelaeus*, Ros.-HEIN.) in the Velka Fatra Mts.). *Zbornik Kmetianum*, X., Martin, 226-231. (in Slovak)
- BENDIK A., 2007: Zachovanie kostier medveda jaskynneho (*Ursus spelaeus* ROSENMÜLLER, 1794) v jaskyni Izabely Textorisovej vo Velkej Fatre (The preservation of cave bear skeletons (*Ursus spelaeus*, Rosenmüller, 1794) from the Cave of Izabela Textorisova in the Velka Fatra Mts.). *Slovensky kras*, XLV, Liptovský Mikuláš, 219-230. (in Slovak)
- BENDIK A. & SABOL M., 2007: Cave Bears from the Cave of Izabela Textorisova (the Velka Fatra Mts., Slovakia) – a state of the art. *Scripta Facultatis Scientiarum Naturalium Universitatis Masarykianae Brunensis*, Geology, Vol. 35, Brno, 150-156
- BENDIK A. & SABOL M., 2008: Swang song of a three-legged bear-female. 14<sup>th</sup> International Cave Bear Symposium, *Abstract book*, Appenzell, 3-4.
- GONZALES F. L., 2003: Paleontology and taphonomy of Pleistocene macromammals of Galicia (NW Iberian Peninsula). *Laboratorio Xeoloxico de Laxe, serie Nova Terra*, O Castro, 323.
- HERAN I. & SLADEK J., 1971: Neobvykly pripad deformace kosti predni končetiny rysa ostrovida (*Lynx lynx* L.) (Abnormal case of the deformation of forelimb bones of lynx [*Lynx lynx* L.]). *Lynx*, 12, Praha, 25-32. (in Czech)
- RESENDAHL W., DÖPPES D. & MAYRHOFFER E., 2007: A pathologically interesting ulna of *Ursus deningeri* REICHENAU, 1904 from the Middle Pleistocene Mosbach Sands, Hesse/Germany. *Scripta Facultatis Scientiarum Naturalium Universitatis Masarykianae Brunensis*, Geology, Vol. 35, Brno, 141-144.
- WITHALM G., 2004: Pathologies of Cave Bear Bones from Potocka zijalka (Slovenia). In: PACHER, M., POHAR, V. & RABEDER, G. (eds.), POTOCKA Zijalka. Palaeontological and Archaeological Results of the Campaigns 1997-2000. *Mitteilungen der Kommission für Quartärforschung der Österreichischen Akademie der Wissenschaften*, Band 13, Wien, 183-196.

joint movement and nonunion formation, since the affected elbow articulation remained markedly degeneratively regressively changed.

The presented results could be further specified by analysis of other bones of the left zeugopodium (*ulna* sin. and *radius* sin.). However, they have not been found in the fossil record and so their (violent?) removal during the life of animal is not excluded.

Secondary changes, however, are manifested in the morphology of other bones. They are mainly evident on the right ulna and radius, where conspicuous tuberosities are present together with their lateral curvature as a result of straining of the right forelimb. Other changes are also distinguishable on right metacarpals or on the both right and left thigh bones (*femur* dext. et sin.).

After the healing of this serious injury, the female cave bear could have lived probably only one to two years longer (?). It presumably died around the sixth year (or somewhat later) of its life as indicated by the worn stage of its teeth.

Although various pathological bone modifications (caused by internal or external factors) of cave bears are known from many sites (e. g. WITHALM 2004, ROSENDAHL et al. 2007), the similar case of injury as mentioned has so far been documented only in one female of recent West Carpathians lynx (HERAN & SLADEK 1971).