

**PATHOLOGICAL MODIFICATIONS ON BONES
OF CAVE BEARS FROM THE VEĽKÁ FATRA MTS.
(CENTRAL WESTERN CARPATHIANS)**

ANDREJ BENDÍK¹ - FRANTIŠEK ŠTULLER² - LUBOMÍR STRAKA²
- FRANTIŠEK NOVOMESKÝ² - LIBOR NEČAS³ - JURAJ STRECHA⁴
- MARTIN SABOL⁵

¹ Slovak National Museum in Martin, Museum of Andrej Kmeť, A. Kmeť Street 20, SK-036 01 Martin, Slovak Republic; andrej.bendik@snm.sk

² Institute of Forensic Medicine, Jessenius Faculty of Medicine, Comenius University, SK-036 01 Martin, Slovak Republic; stuller@jfmed.uniba.sk

³ Clinic of Orthopaedics and Traumatology, Teaching hospital, SK-036 01 Martin, Slovak Republic

⁴ Eurodent Medina s.r.o, SK-036 01 Martin, Slovak Republic

⁵ Department of Geology and Palaeontology, Faculty of Science, Comenius University, Mlynská dolina, SK-842 15 Bratislava, Slovak Republic; sabol@fns.uniba.sk

A. Bendík - F. Štuller - L. Straka - F. Novomeský - L. Nečas - J. Strecha - M. Sabol: Pathological modifications on bones of cave bears from the Veľká Fatra Mts. (Central Western Carpathians)

Abstract: Three pathologically modified bones (cranium, left mandible, and ilium) of cave bears have been found in the Last Glacial deposits of the Cave of Izabela Textorisová and the Biela Cave (the Veľká Fatra Mts.). The pathological change of the tooth bed, found in the right side of the cranium at the place of M1 is result of odontogenic purulent inflammation of soft tissues of tooth bed and surrounding bone. The found bone opening of left mandible was probably developed by natural connecting of two smaller openings. The ilium contains a pathological acetabulum with damaged and deformed osseous upper border, which could be a result of immoderate pressure of the head of femur, coinciding with the mineral disbalance (resulting in decalcification) or fracture of *limbus acetabuli* caused by injury.

Key words: Cave bears, Pathology, Last Glacial, Veľká Fatra Mts., Slovakia

INTRODUCTION

During the palaeontological research of the karst area within the Veľká Fatra Mts. (northern Slovakia), several pathologically affected bones of cave bears have been found. The fossil record is dated to the Last Glacial, probably to the period of OIS 3 (Bendík and Sabol, 2007).

Most of fossils under study come from the Cave of Izabela Textorisová (named as HJ-number) and the Biela Cave (named as JB-number). The Cave of Izabela Textorisová is situated in the Kónský dol Vale and the Biela Cave is situated in Vápenna Vale, both sites within the Gaderská Valley in the Tlstá National Natural Reservation near the village of Blatnica in the Martin district (Fig. 1). The Cave of Izabela Textorisová is a corrosional-cryogenic, over 100 m long cave with entrance at elevation of 754m. The Biela Cave with beautiful snow-white dripstones (therefore named as Biela (= White) Cave) is long only 43 m and its entrance is situated at elevation of 845 m (Bella et al., 2007).

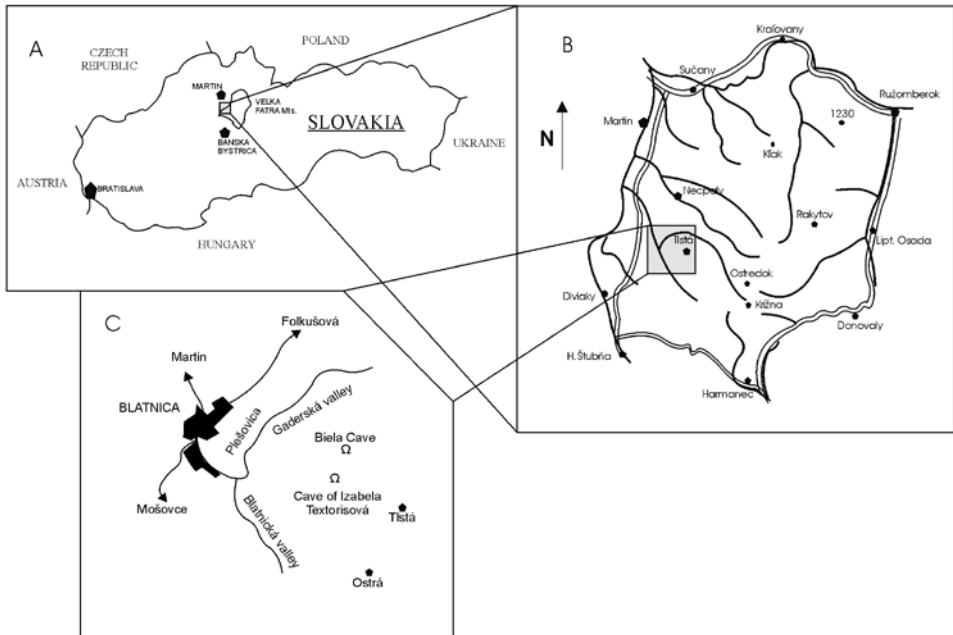


Fig. 1. Location of the Cave of Izabela Textorisová and the Biela Cave in the area of the Veľká Fatra Mts.
 Obr. 1. Lokalizácia Jaskyne Izabely Textorisovej a Bielej jaskyne na území Veľkej Fatry.

PATHOLOGICAL RECORD

Within the whole fossil record, the cranium (HJ-548), the left hemimandible (JB-21), the left humerus (HJ-834) and the ilium (HJ-626) belong among the most interesting findings from the view of pathological modifications. Since the left humerus (HJ-834) has been mentioned yet (Sabol et al., *in press*), the pathological phenomena of the other abovementioned bones are only described.

The cranium (HJ-548) belonged to an adult specimen. The skull does not reveal degenerative or growth abnormalities. There is, however, an evident difference between teeth on the right and the left side of the skull caused by mechanical wearing out. Right side teeth are mechanically worn out up to dentine of dark colour. Left side teeth with still present enamel are less mechanically worn out because of the presence of pathological change of the tooth bed in the site of the M1 (Fig. 2). The surrounding osseous alveolar process is reduced with tooth bed distended and with reduced alveolar bone belonging to the M2. There is a visible *canaliculus*, connecting the maxillary sinus with openings in the maxilla. On the outer area of the maxilla, an opening and the minute bone erosions (deperations) are present.

The fragment of left lower jaw (JB-21; Fig. 3a) contains a healing alveolar process developed after falling out of the teeth during the life of specimen, an opening for the canine, and healing remnants belonging to premolar tooth. A cavity at the posterior part of the mandible could be a residuum after the tooth fallen out after animal death. At the back border of a fragment, a smooth mandibular nerve canal can be seen. One big and one smaller opening are situated at the frontal outer area of the bone. While in a deeper part of the bigger opening can be seen smaller openings for branching of the nerve, smooth part of the bone ends close to the opening. Borders of the opening are round-shaped.

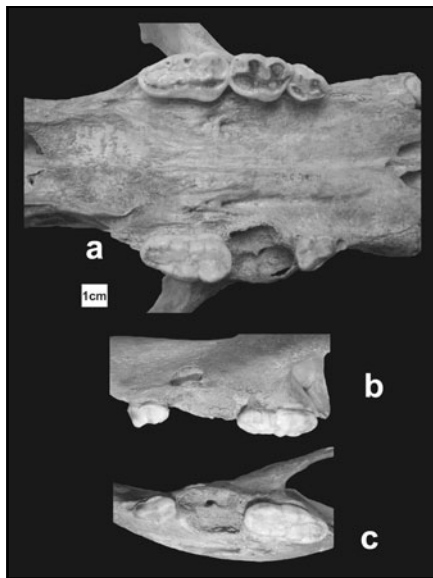


Fig. 2. Pathological fossils of cave bears from the Veľká Fatra Mts. a - detail occlusal view on the right (worn) and left tooth row of the cave bear cranium from the Cave of Izabela Textorisová (HJ-548); b, c - detail view on the pathological record at the place of M1 sin. within the skull under study. Obr. 2. Patologické nálezy medveďov jaskynných z Veľkej Fatry. a - detailný pohľad na žuvaciu plochu pravého (abradovaný) a ľavého zubného radu na lebke medveďa jaskynného z Jaskyne Izabely Textorisovej (HJ-548); b, c - detailný pohľad na patologické miesto zubného lôžka M1 sin. na skúmanej medveďej lebke.

The specimen HJ-626 represents a fragment of the hipbone with pathological acetabulum (Fig. 3b) and parts of bones arising from the acetabulum towards the wing of ilium and towards the pubic bone. It is a bone of an adult animal since all three parts forming the acetabulum are grown together. Well-developed tuberosities and tendon attachments are visible on the bone.

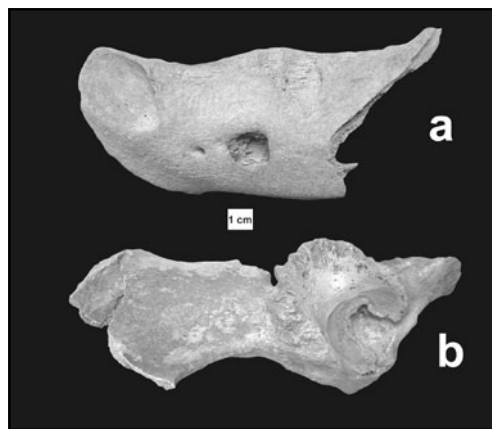


Fig. 3. Pathological fossils of cave bears from the Veľká Fatra Mts. a - mandible sin. from the Biela Cave (JB-21); b - cave bear ilium from the Cave of Izabela Textorisová (HJ-626). Obr. 3. Patologické nálezy medveďov jaskynných z Veľkej Fatry. a - ľavá vetva sánky z Bielych jaskyne (JB-21); b - patologická bedrová kosť medveďa jaskynného z Jaskyne Izabely Textorisovej (HJ-626).

DISCUSSION

The X-ray analysis of skull was not relevant for more detailed evaluation. The opening on the left skull side was developed by pathological process, so called odontogenic purulent inflammation of soft tissues of tooth bed and surrounding bone. Such pathological process caused the animal sharp tactile pain when biting food that was the reason why the affected animal tried to protect the left side teeth and used the right side teeth for biting. Curiously, the condylar processes of both hemimandibles and their articular surfaces in the skull display no asymmetrical morphology. It can be assumed, that when finding skeleton and skull remains, the tooth was located outside the tooth bed. Since there were found no pathological changes on enamel and dentine on the molar tooth adjacent to pathologically changed tooth bed (no deep-seated caries), it is probable that pathological changes could be developed after inflammation of periodontal apparatus of the tooth (paradentosis). Paradentosis could be caused e.g. by injury (with sharp infected splinter of animal bone pricked into the periosteum, etc.).

Based on the X-ray analysis of the bone fragment of mandible and its comparison to the mandible of other individual of the same biological species, the following can be stated: a) The opening is conjoined only with the mandible nerve canal. It is not conjoined with

opening (tooth bed) right above it. No markers of inflammatory changes or bone remodeling are present in surrounding bone; b) The opening was probably developed by natural development, by connecting of two smaller openings; c) The opening was not developed as a result of pathological cystic process; d) Postmortal changes of the bone and a reaction of surrounding bone tissue after death could contribute to enlargement of the opening; and e) The complete cure of alveolar process and supposed way of falling out of the molar tooth (with subsequent healing) suggest the higher age of specimen.

The pathological changes of the acetabulum are represented by damaged and deformed osseous upper border of acetabulum (*limbus acetabuli*). It occurred still during the life of the animal as a result of two possible causes: a) Immoderate pressure of the head of femur, coinciding with the mineral disbalance (resulting in decalcification) or b) Fracture of *limbus acetabuli* caused by injury. Regardless of primary cause of the warping of acetabulum, the hip joint was subsequently biomechanically deformed – the head of femur was displaced out of the acetabulum slightly outwards and upwards. Reduced articulation area for the head of femur can be seen on damaged acetabulum. On the other hand, above this area, in the site of original acetabular margin, there is present an evident smoothing out of the iliac bone that had been caused by direct contact and pressure of the head of femur when moving the affected limb. Right above this smoothed area, the osteophytes are present. They are developed by chronic inflammatory process and by degenerative inflammatory changes of the cartilage and the bone. The head of femur could be also damaged and/or underwent afterwards morphologic changes into so-called “double bubble” shape. The respective thighbone, however, has not been found. The animal with described pathological changes in hip joint must have suffered from long-term pain both in rest and motion. Similar anatomical deformations can occur in people with imperfect development of hip joint leading to its luxation (*luxatio coxae congenita*), in some posttraumatic conditions, or chronic degenerative processes (coxarthrosis, chronic degenerative damage resulting from hormonal and mineral disbalance – osteoporosis).

CONCLUSION

During palaeontological research of the karst area within the Veľká Fatra Mts. (northern Slovakia), several pathologically affected bones of cave bears have been found in the Last Glacial deposits of the Cave of Izabela Textorisová and the Biela Cave. The most interesting pathological record is represented by the cranium (HJ-548), the left mandible (JB-21), and the ilium (HJ-626).

The pathological change of the tooth bed, found in the right side of the cranium at the place of M1 is result of odontogenic purulent inflammation of soft tissues of tooth bed and surrounding bone. The X-ray analysis of left mandible shows no pathological cystic process and the found bone opening was probably developed by natural connecting of two smaller openings. The ilium contains a pathological acetabulum with damaged and deformed osseous upper border, which could be a result of immoderate pressure of the head of femur, coinciding with the mineral disbalance (resulting in decalcification) or fracture of *limbus acetabuli* caused by injury.

Pathological phenomena under study are a source of our knowledge on the cave bear populations in the Slovak territory of the Western Carpathians Mts.

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 Slovak National Museum in Martin.

REFERENCES

- BELLA, P. – HLAVÁČOVÁ, I. – HOLÚBEK, P. 2007. Zoznam jaskýň Slovenskej republiky (stav k 30. 6. 2007). Slovenské múzeum ochrany prírody a jaskyniarstva – Správa slovenských jaskýň – Slovenská speleologická spoločnosť, Liptovský Mikuláš, 1–364.
- BENDÍK, A. – SABOL, M. 2007. Cave Bears from the Cave of Izabela Textorisová (the Veľká Fatra Mts., Slovakia) – a state of the art. Scripta Facultatis Scientiarum Naturalium Universitatis Masarykianae Brunensis, Geology, 35, 150–156.
- SABOL, M. – BENDÍK, A. – ŠTULLER, F. – NOVOMESKÝ, F. – NEČAS, L. 2009. A record of three-legged cave bear female from the Cave of Izabela Textorisova (the Veľka Fatra Mts., northern Slovakia). Stalactite, *in press*.

PATOLOGICKÉ ZMENY NA KOSTIACH MEDVEĎOV JASKYNNÝCH Z POHORIA VEĽKÁ FATRA (CENTRÁLNE ZÁPADNÉ KARPATY)

Zhrnutie

Počas paleontologického výskumu krasovej oblasti v pohori Veľká Fatra (severné Slovensko) sa našlo niekoľko patologicky postihnutých kostí medveďov jaskynných. Nálezy pochádzajú z jaskynných sedimentov Jaskyne Izabely Textorisovej a Bielej jaskyne (obr. 1), datovaných do obdobia posledného zaľadnenia, pravdepodobne do kyslíkového izotopového štádia OIS 3 (Bendík a Sabol, 2007). Jaskyňa Izabely Textorisovej sa nachádza v údolí Kónský dol, zatiaľ čo Biela jaskyňa vo Vápennej doline, bočných dolinách Gaderskej doliny v Národnej prírodnej rezervácii Tlstá. Spomedzi nájdených fosílií sú z patologického hľadiska najzaujímavejšie nálezy lebky (HJ-548), sánky (JB-21) a bedrovej kosti (HJ-626).

Patologická zmena zubného lôžka, vyskytujúca sa na pravej strane skúmanej lebky medveďa jaskynného (obr. 2a-b) v mieste M1 je výsledkom hnisavého zápalu tkaniva zubného lôžka a okolitej kosti. Keďže na samotnom zube (M1) neboli zistené žiadne patologické zmeny, je pravdepodobné, že patologické zmeny sa mohli vyvinúť až po zápale periodontálneho aparátu zuba (paradentóza). Paradentóza mohla byť spôsobená napríklad aj zranením (napr. infekciou triesky zvieracej kosti, zapichnutej do periosteá a pod.). Röntgenová analýza ľavej sánky (obr. 2c) nepreukázala žiadny patologický cystický proces a odhalený väčší otvor na kosti vznikol pravdepodobne prirodzeným spojením dvoch menších bradových otvorov (?). Skúmaná bedrová kosť (ilium; obr. 2d) má patologické acetábulum s poškodeným a deformovaným horným kosteným okrajom, čo pravdepodobne vzniklo nadmerným tlakom hlavice stehnovej kosti v súčinnosti so stratou minerálnej rovnováhy v kosti (vyúsťiacej do dekalifikácie) alebo so zlomeninou *limbus acetabuli*, spôsobenou zranením.