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Edited by
Michal Filippi
Pavel Bosák

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Cover photos (some photos were adjusted/cropped)
Top left – José Bidegain, on his way for the recovery Marcel Loubens' body. Author unknown. For details see the paper by A.A. Cigna.
Top right – "Walking Mammoth" – a prehistoric drawing from the Kapova Cave, Russia. Photo by O. Minnikov. For details see the paper by Y. Lyakhnitsky et al.
Bottom left – "Astronaut" David Saint-Jacques (CSA) collecting microbiological samples for the scientific programme of the ESA CAVES course. Photo by V. Crobu. For details see the paper by Bessone et al.
Bottom right – The long-legged cave centipede Thereuopoda longicornis – a typical species of Lao caves. Photo by H. Steiner. For details see the paper by H. Steiner.

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FOSSIL ASSEMBLAGES FROM NEANDERTHAL SITES OF SLOVAKIA – PRELIMINARY RESULTS

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The environment of Neanderthals was distinctly changed during the Late Pleistocene in the whole area of their occurrence because of severe climatic changes. Differences found in the composition of fossil assemblages reflect that in the terrestrial envitronment. Based on the definition of the taxonomical diversity of extinct organisms, the palaeoenvironmental reconstruction, and the exact age determination of the fossil record, a definition of individual events is possible from the evolutionary-phylogenetic and the climatic-environmental viewpoints. The fossil record also represents an evidence of multiple immigrations, including also migration of Neanderthal hunting groups. The most important Neanderthal sites in Slovakia with the large quantity of fossil remains are as follows: Bojnice, Čertová pec, Gánovce, and Bešeňová.

1. Introduction

The Neanderthal Man (*Homo neanderthalensis*) is an object of the intensive worldwide research since the time of his discovery in 1856 in the Neanderthal Valley near Düsseldorf. This extinct human kind, occupying Europe and Near East almost over 200,000 years, left proofs enough of his presence, such as skeleton remains, stone tools, or game remains in caves or in open-air settlements. At present, the research of Neanderthals is focused not only on the study of their population history, living requirements, technology and social organization, but mainly on their phylogenetic position from the palaeogenetic viewpoint as well as on their environment, including also the study of their adaptive ability on climatic changes at the time of their existence (Koenigswald et al. 2006). From this viewpoint, the palaeontological remains of organisms from the Neanderthal sites have the greatest information value because many of them responded very sensitively to environmental changes and form an important source of proxy-data about palaeoenvironmental conditions (Wiśniewski et al. 2009).

The presence of Neanderthal Man in the territory of Slovakia is documented minimally at 31 sites from the Middle Palaeolithic Period (Kaminská 2005). Except for 2 sites with finds of Neanderthal anatomical remains (Gánovce and Šaľa), the rest of sites is mainly known by a record of stone industry connected with the Neanderthal population (Taubachian, Mousterian, and Micoquian). Only exceptionally, some sites represent a more continual settlement with the large palaeontological, or archaeozoological record respectively. The best-known sites are as follows: Bojnice, Čertova pec, Bešeňová, Hôrka-Ondrej, and Gánovce (Fig. 1). Apart from Hôrka-Ondrej (Kaminská (ed.) 2000), the fossil remains from the sites are only partly interpreted (Čertova pec, Gánovce) or they were so far not totally evaluated (Bojnice, Bešeňová). Fill "this niche", a new scientific project started in 2012, focused mainly on the definition of the taxonomical diversity and the palaeoenvironmental conditions in the territory of Slovakia during the Neanderthal period.

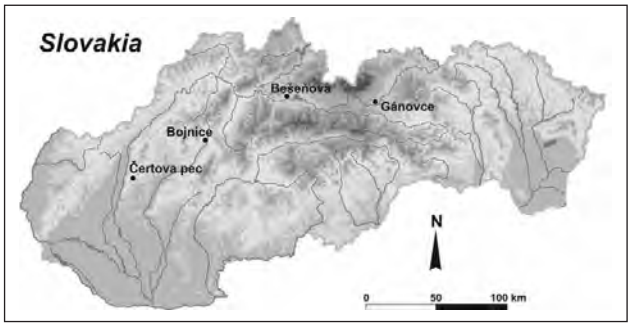

Figure 1. Location of Slovak Neanderthal sites under study.

2. Studied sites

The Neanderthal settlement from the **Bojnice** area (48°46' N 18°34' E) near Prievidza is well documented mainly in two locations – the Prepoštská Cave (Bojnice I) and the Hradná priekopa (Bojnice III). The Prepoštská Cave, representing an abri with 8 metres long cave space within the travertine heap, is known since 1926 (Medvecký 1927). The researches of Prošek (1952) and Bárta (1966) here demonstrated one of the most important Neanderthal settlements in Slovakia with Early Mousterian culture. The last dating by ^{14}C method places this settlement to the period before 40000 BP, corresponding with Moravian Micoquian sites of Kůlna (layer 7a) and Šípka (Kaminská and Neruda 2010). The location Hradná priekopa has been identified in 1964 close to entrance gate of the Bojnice castle. The subsequent research in 1966 to 1969 shows the presence of 11 cultural layers with Taubachian stone tools, disrupted fireplaces, animal bones and gastropods from the end of the Eemian to the beginning of the Weichselian (Bárta 1972). In spite of the discovery of large quantity of fossil remains of malacofauna (Prošek and Ložek 1951) as well as of

vertebrates (Hokr 1951, Prošek 1952, Fejfar ex Bárta 1972), indicating an organized hunting of relatively small Neanderthal group (Bárta 1972), the whole fossil record has so far been not studied in details from the taxonomical, taphonomical, palaeoecological, and biostratigraphical viewpoints.

The **Čertova pec** site is situated in the Považský Inovec Mts. near Radošina village (48°33' N 17°54' E). It is 27 metres long cave with two opens. The first excavation at the site has been realized by L. Zotz in 1937, later by F. Prošek in 1950 (Hokr 1951, Musil 1996). During the last research of the cave in 1958–1961, headed by J. Bárta, three Palaeolithic layers with stone industry of Gravettian, Szeletian, and Mousterian have been found. A find of fireplace within the layer 4 with Szeletian stone tools yielded a datum 38320 ±2480 BP (Bárta, *unpubl. manuscript*), whereas ^{14}C dating of found cave hyena remains yielded the age older than 50000 BP (Nagel, *pers. comm.*). Although Musil (1996) partly evaluated a fossil record from the cave, a part of found fossils from the time of Bárta's research, recently housed at the Department of Geology and Palaeontology, Faculty of Natural Sciences, Comenius University in Bratislava, was so far not studied yet.

The best known and the the most important of mentioned Neanderthal sites in Slovakia is the travertine mound of **Gánovce-Hrádok** (49°01' N 20°19' E) with the sedimentary record from the Saalian termination up to the Holocene. A scientific research at the site was realized since 1880s, but the complex systematic research was realized only during 1955–1960, conditioned by the famous record of Neanderthal braincase in 1926. The research results have been published in the final report (Vlček et al. 1958) and within a monograph (Vlček 1969). The basic analysis of palaeontological findings of mammals was realized by Fejfar (in Vlček et al. 1958), who divided them into 6–7 groups, providing together with fossil molluscs (V. Ložek) and plants (V. Kneblová) a basic picture on both the climate and the palaeoenvironment in the vicinity of Gánovce during the formation of the travertine mound. Apart from remains of mammals, birds (Petrbok 1937, 1939), and reptiles (Štěpánek 1934), the most important record at the site is represented by fossils of Neanderthal Man. The age of the place, where Neanderthal fossils have been found, was determined as 105000 BP (Jäger 1989). Recently, the datum is, however, called into question (Rabeder, *pers. comm.*). Also, the whole palaeontological record from the site, unlike the palaeoanthropological (Vlček 1969) and archaeological one (Bánesz 1990), was so far also not evaluated in details, including so far not studied fossils housed in the Podtatranské Museum in Poprad (Bekessová 2007, Bekessová and Mlynárčiková 2009).

Travertine heaps near **Bešeňová** (49°06' N 19°26' E) are next promising site, where no archaeological and also no systematic palaeontological research was realized up to now, although J. Kovanda found a flint artefact in the location of "Skalie" in 1960 (Kaminská 2005). Also, remains of the Pleistocene fauna from the location of "Báňa" are known since the period of travertine exploitation before the Second World War. In spite of reference to gastropod fauna and isolated finds of small mammals (Vaškovský and Ložek 1972), the substantial part of faunal record from the site (except of fossil remains of lions; Sabol 2011) is not evaluated yet.

3. Preliminary results

3.1. Bojnice I – Prepoštská Cave

So far (October 2012), the detailed morphometric analysis of vertebrate fossils (more than 350 remains) from the site (Bárta's pit III) shows relatively large animal diversity. The whole up to the moment studied assemblage consists of frogs (Anura indet.), birds (cf. *Anas querquedula*, cf. *Falco* sp., Aves indet.), hares (*Lepus* sp.), rodents (*Arvicola terrestris*, *Microtus* cf. *agrestis-arvalis*, Rodentia indet.), canids (*Canis lupus*, *Vulpes* sp., *V.* cf. *lagopus*), ursids (*Ursus* sp., *U.* ex gr. *spelaeus*), mustelids (cf. *Martes* sp.), cave hyena (*Crocuta crocuta spelaea*), cave lion (*Panthera spelaea*), woolly rhino (*Coelodonta antiquitatis*), horse (*Equus* cf. *germanicus*), cervids (*Rangifer tarandus*, Cervidae indet.), bovids (*Bos primigenius – Bison priscus*, Bovidae indet.), and woolly mammoth (*Mammuthus primigenius*) (Figs. 2 and 3).

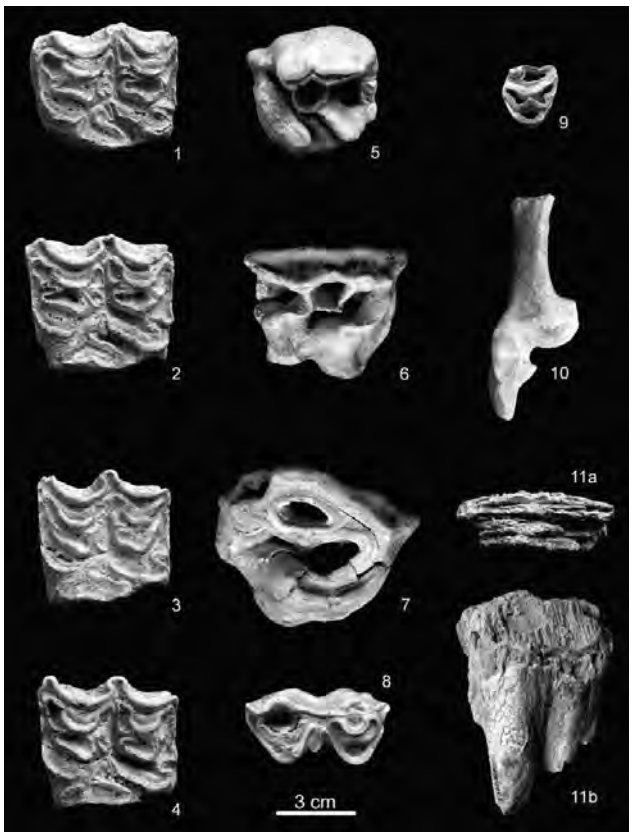

Figure 2. Fossils of mammals from the Prepoštská Cave. 1–4: Equus ferus cf. germanicus (1 – P3 sin., 2 – P4 sin., 3 – M1 sin.,4 – M2 sin.), 5–7: Coelodonta antiquitatis (5 – P2 sin., 6 – M1 dext.,7 – M3 dext.), 8: Bovidae indet., m2 sin., 9–10: Rangifer tarandus (9 – P2 sin., 10 – calcaneus dext.), 11: Mammuthus primigenius (molar fragment).

Based the taxonomical determination and the sedimentary record, found taxa represents an assemblages that lived probably in open Late Pleistocene environment with the presence of a water area or source (a travertine lake – hot travertine spring[-s]) in the near vicinity.

Figure 3. Fossils of mammals from the Prepoštská Cave. 1: Panthera spelaea, m1 sin., 2–3: Crocuta c. spelaea (2 – p4 sin., 3 – C sin.), 4: Canis lupus, ulna sin., 5–6: Vulpes sp. (5 – C dext., 6 – Mt III sin.), 7: Lepus sp., humerus dext., 8: Arvicola terrestris, mandible dext., 9: Aves sp. I, tarsometatarsus dext., 10: Aves sp. II, tarsometatarsus dext. Scale A (1–6), scale B (7–10).

From the viewpoint of the quantification of studied mammalian fossils, remains of carnivores (42 %) and perissodactyls (26 %) dominate, althought the largest quantity of fossils (228 bone remains) is undeterminabled (Mammalia indet.) because of their fragmentation. Many of these fragments, however, display marks of biotic agents, such as hyena (bitting, gnawing, and chewing marks) or ancient man (cutting marks and fragmentation due to marrow). Some bone fragments were also attacked by fire with the temperature moving in the range from 300 °C to 550 °C (based on the colour of bone fragments).

The preliminary results allow to characterize the site mainly as a hyena den that was occasionally used by small groups of Neanderthals during their migrations, probably in a warmer period (interstadial) of the Last Glacial.

3.2. Bešeňova travertine quarry

Fossil record from fissures of the Bešeňova travertine quarry consists mainly of remains of large mammals that have been found during the exploitation in 1920s and 1930s. The largest portion of fossils comes from rhinos (Rhinocerotidae indet., probably *Coelodonta antiquitatis*) (36 %), showing also gnawing marks at some bones. Originator of these taphonomic characters could be hyenas (absent in the fossil record) or a lion-like felid (*Panthera* sp. – *Panthera* cf. *leo*), although fossils of ursid (*Ursus* sp.) are also known from the sedimenetary fillings of the travertine fissures. The rest of the found mammalian remains belongs to caballoid horses (*Equus* sp.), cervids (*Cervus elaphus*, *Megaloceros giganteus*, Cervidae indet.), and bovids (*Bos primigenius* and/or *Bison priscus*, Bovidae indet.).

So far, the exact age of Bešeňova fossil assemblage(-s) is unknown. Although the mid-Pleistocene (Holsteinian?) age of the Bešeňova-Báňa travertine is assumed (Gradziński et al. 2008), vertebrate fossil record found in the "rusty karst loam" from travertine fissures is younger. Its preliminary analysis indicates a possible existence of minimally two temporal different faunal assemblages – the former one probably from the Last Interglacial period and the latter one from the Last Glacial period (maybe from an Interstadial?). The thanatocoenosis of the lower red loam corresponds to a warm humid climate, which was a little colder than at present. Fossils of *Clethrionomys* and *Apodemus* (Fejfar in Vaškovský and Ložek 1972) indicate a development of mixed forest. From this viewpoint as well as on the basis of found flint artefact, the Bešeňová is assumed to be a potential (Middle) Palaeolithic site with the presence of ancient (Neanderthal) man. It could be supported also by a record of partly polished cervid antler with possible cutting marks(?) (Fig. 4).

Figure 4. Detailed view on the cervid antler part with possible cutting marks produced by an ancient man(?).

3.3. Čertova pec and Gánovce

As abovementioned, the fossil record from the both sites have been previously evaluated either only in the form of basic palaeontological analysis (Fejfar in Vlček et al. 1958) or only as a part of the whole collection (Musil 1996).

From this viewpoint, a repeated complex evaluation of the fossil record from both these sites is required, using modern taxonomic, taphonomic, isotopic, and dating methods. It will be opened in 2013. On the other hand, a new field research of the Čertova pec Cave could yield more exact data on the faunal composition, environment, and climate in the time of existence of the last Neanderthal communities in the Central Europe.

4. Conclusions

The state of the art of Neanderthal palaeoenvironment during the Late Pleistocene in the territory of Slovakia is more or less limited only on basic data from archaeological researches, realized mainly in 1950s to 1970s. Based on

new scientific approaches and achieved knowledge in connection with data from other scientific fields as well as research methods (taphonomy, forensic (palaeo-anthropology, isotopic analyses, and radiometric dating), the solution of some unanswered questions will be important (e. g. What did species live in Slovak territory at the time of the presence of Neanderthals? Which of them did form a forage and material basement of Neanderthals? What was a relationship between Neanderthals and large predators (such as lions, bears, or hyenas; see also Rosendhal and Darga 2004)? How did single phases of the Late Pleistocene in the Slovak Carpathians differ from the viewpoint of climate, palaeotemperature, or composition of faunal assemblages? What were migration paths of fauna and ancient people? etc.). From this viewpoint, the main objectives of the new project are focused on (1) the specification of the Late Pleistocene biodiversity at selected sites, (2) the determination of biotic and abiotic taphonomic agents at selected sites, (3) the reconstruction of climatic-environmental conditions at the Slovak territory during the Late Pleistocene, (4) the specification of the stratigraphical position of Neanderthal sites selected in the Slovak Carpathians, and (5) the definition of geophysical characteristics of the sedimentary environment and its changes caused by human activity. It can also stimulate a new interdisciplinary field research of prospective localities, such as Čertova pec or Bešeňová.

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