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NEW RADIOCARBON DATINGS OF HUMAN FOSSILS FROM CAVES AND ROCKSHELTERS IN BOHEMIA (CZECH REPUBLIC)

ABSTRACT: As a part of a long-term project of radiocarbon dating of human fossils of Later Pleistocene/Early Holocene age from the Czech Republic, this paper presents dates of human fossil fragments from the St. Prokop's Cave (5–5.7 ky BP and 1.8 ky BP uncalibrated), a series of additional dates from the Prošek's Dome of the Koněprusy Cave (dated previously to 12.9 ky BP), and a new date from the Abri Pod Pradědem rockshelter (5.8 ky BP). In general, the newly obtained datings show that several modern human finds, previously listed as Early Upper Paleolithic in the literature, are to be redated as later (Koněprusy, Velika Pećina, Svitávka). On the other hand, these datings help to define more precisely a group of Holocene human burials in caves and rockshelters of this region.

KEY WORDS: Radiocarbon dating – Human fossils – Caves – Bohemia

INTRODUCTION

Following the human fossil lists, as included in the available catalogues and other reviews (Vlček 1971, Svoboda *et al.* 1996, Bräuer, Broeg 1998, Jelínek, Orvanová 1999, Wolpoff 1999, Churchill, Smith 2000), Bohemia and Moravia are relatively rich in anthropological recoveries of Later Pleistocene and Early Holocene age. However, the project of direct radiocarbon dating of the fossils or of their contexts, initiated a few years ago by the authors of this paper (Svoboda *et al.* 2002), changed somehow the traditional classification of some of these finds. The expected Early Upper Paleolithic (EUP) age of Mladeč (Aurignacian, around 34–35 ky BP uncalibrated) was confirmed, but Koněprusy was redated to the LUP (Magdalenian, 12.9 ky BP), Obříství, believed to be Mesolithic, provided in fact a Neolithic date (4.7 ky BP), and Svitávka, another potential Upper Paleolithic site, should now be cancelled from the prehistoric record (1.2 ky BP). At the same time, new datings are continuously being provided for the Gravettian human sample of Moravia (project of the Institute of Archaeology, AS CR, Brno, with Erik Trinkaus of the Washington University, Saint Louis) and for the Aurignacian sample from Mladeč, Moravia (project of Maria Teschler-Nicola of the Vienna Museum of Natural History).

In Bohemia, given the unfavourable condition of organic preservation at most of the open-air sites, human fossils of potentially early age are mainly found in caves and rockshelters. The limestone region of the Bohemian karst, Central Bohemia, provided three sites: St. Prokop's Cave in 1887 (Vlček 1951), Koněprusy Cave in 1951 (Prošek 1952, Prošek *et al.* 1952a, 1952b, Vlček 1952a–e, 1957a, b), and Bacín during the 1990s (9.5 ky BP; Matoušek 2002). In the pseudokarstic sandstone regions of Northern Bohemia, several rockshelters recently provided human fragments, mainly individual teeth, of Mesolithic age (Pod zubem, Šídelník, Vysoká Lešnice, Nízká Lešnice, 8–7 ky BP; Svoboda *et al.* 2003), and an important Neolithic burial in the Pod Pradědem rockshelter (Prostředník, Vokolek 1998).

This paper centers on newly obtained ^{14}C dates from three Bohemian sites: St. Prokop's Cave, Koněprusy Caves (additional datings of bones and calcites), and Pod Pradědem

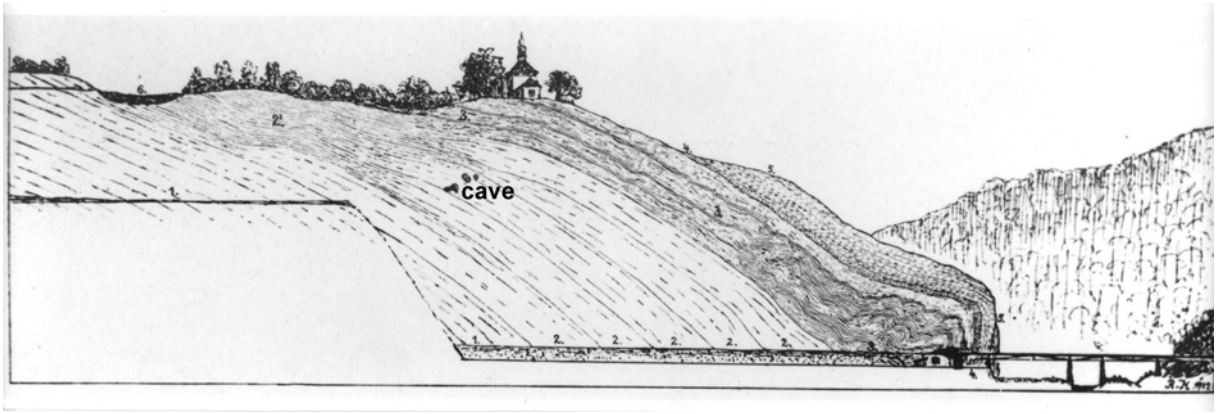

FIGURE 1. St. Prokop's valley. Geological section through the quarry, after R. Kettner. "Cave" marks the relicts of the cave.

rockshelter *(Tables 1, 2 and 3)*. The ^{14}C dates (reported in BP) are calibrated to calendar ages (calBC or calAD), using the Groningen calibration program (van der Plicht 1993). The numbers are rounded off to the nearest 5; the errors are 1-sigma. The stable isotope ratios ($\delta^{13}C$, ‰) and carbon content (C%) of the bone collagen are also shown. These properties are considered as general quality indicators for ^{14}C dates. The $\delta^{13}C$ (‰) values should be in the range –19 to –21 ‰ , and the carbon content for ideal bone collagen should be 45–50 % (Mook, Waterbolk 1985). Impurities result usually in lower $\delta^{13}C$ (‰) values.

St. PROKOP'S CAVE

This smaller cave was located in the middle part of the Svatý Prokop valley in the southwestern part of the city of Prague (Prague 5 – Hlubočepy). It was an important place of religious pilgrimage and hermitage *(Figures 1* and *2)*, but in 1887 the major part of it was blasted during limestone quarrying. Only the relicts of the innermost parts of the cavity – a fissure filled with sediments – were still visible in the quarry wall before 1900 *(Figure 3)*. Especially in 1883–1888, the paleontological and anthropological content of the remaining sediments was saved by several Prague scientists such as the geographer J. Kořenský, and partly by the owner, the duke Schwarzenberg (and this part was later studied by J. Woldřich). The evidence concerning this important site was summarized and published by Vlček (1951) and supplementary archaeological data were resumed by Sklenář and Matoušek (1994).

Given the presence of Pleistocene fauna in the filling of the karstic fissure, the whole site was presumed and still is being republished as an EUP one (Bräuer, Broeg 1998, Churchill, Smith 2000). However, the site also provided a few sherds of the Neolithic Linear pottery and Hallstatt cultures, and a bone fragment with intensive surface polish (Sklenář, Matoušek 1994).

From the hitherto inedited letter of Kořenský to K. J. Maška (May 18, 1888, Archive of the Institute of Archaeology, Dolní Věstonice; *Figure 3*) we quote the following:

> "My friend Frič went there a few days ago and brought back a hyena mandible. Myself, I got a full bag of breccia – lots of human bones melted together with charcoal. This breccia fills a very narrow fissure. Nothing was found in

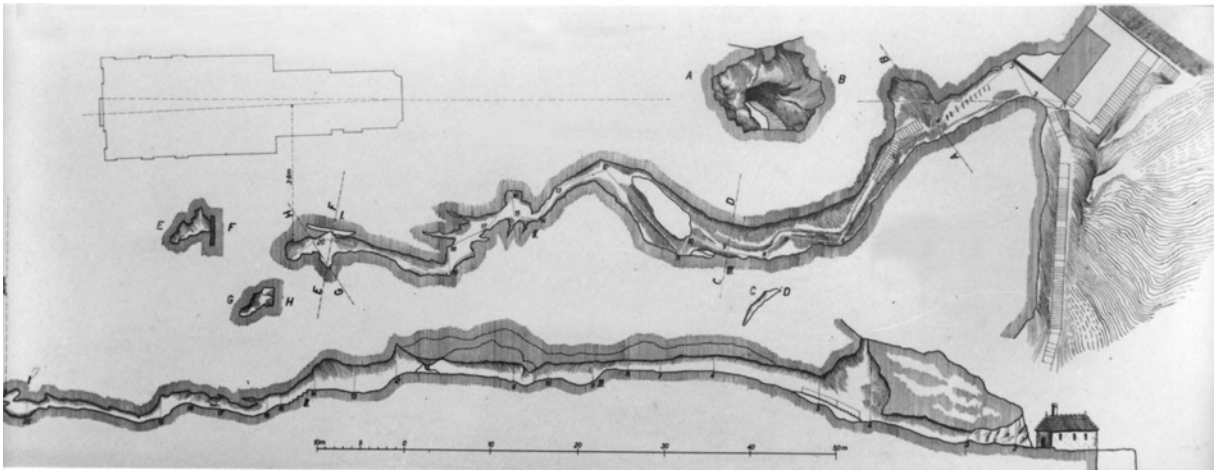

FIGURE 2. St. Prokop's Cave, reconstruction of plan and section by J. Benda (in Vlček 1951), based on earlier plans of K. Ebner and F. Špatný from 1845.

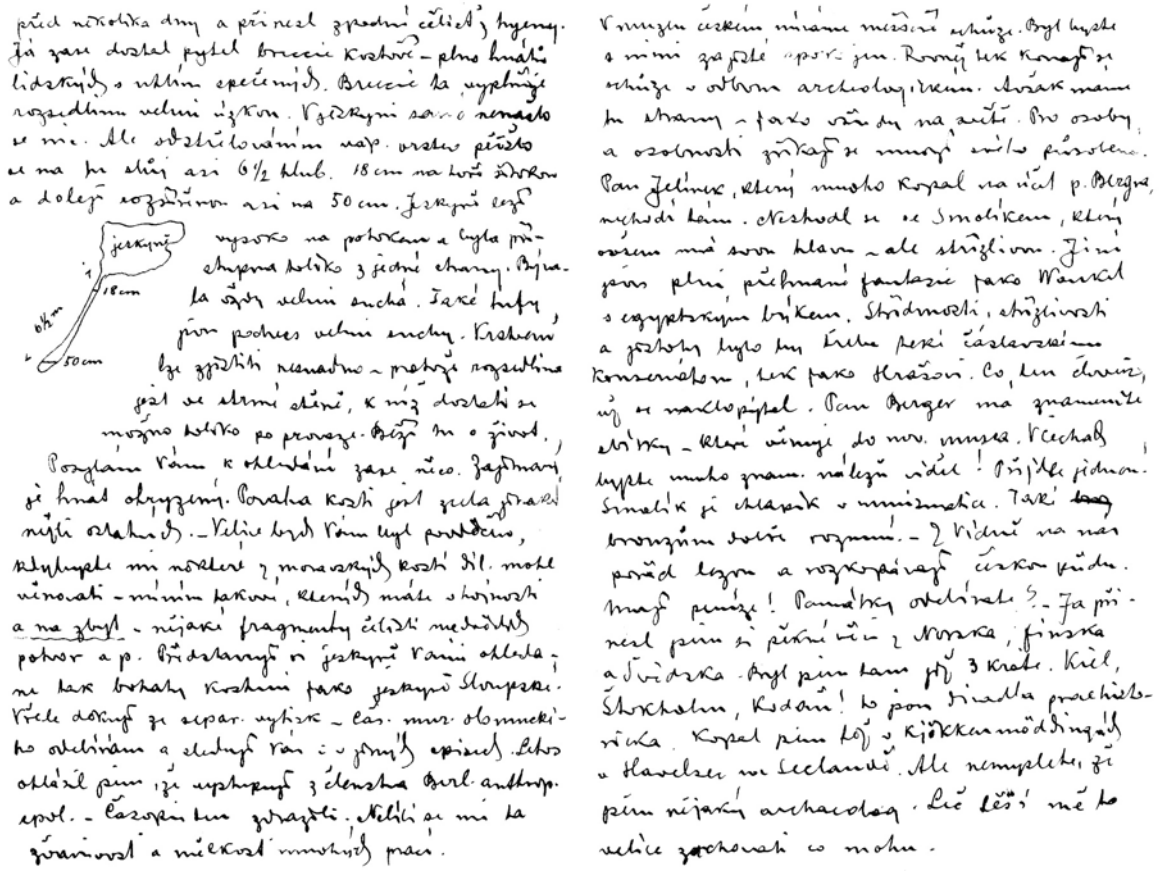

FIGURE 3. St. Prokop's Cave. J. Kořenský's sketch section of the cave remains and the underlying, 6.5 m deep fissure, as seen in the quarry wall in 1888. Letter to K. J. Maška, Archives of the Institute of Archaeology, AS CR, Dolní Věstonice.

the cave itself. But during blasting of the sediments, this cavity was found, 6.5 m deep and 18 cm wide in its upper part, and enlarged to the width of 50 cm in its lower part. The cave lies high above the brook and was accessible from one side only. It always was very dry. Also the tuffs are very dry until today. Stratification of the filling is difficult to recognize, because the cavity is in a very steep rock wall, to be reached only with a rope. It is a question of life."

The deposit with Upper Pleistocene fauna (mammoth, cave bear, lion, hyena, rhinoceros, reindeer, horse, musk-ox, after Kořenský and Woldřich) was certainly related to the lower part of the filling of the fissure, whereas the calcite breccia with the human fossil finds probably formed the upper part, and thus do not belong to the faunal assemblage. Three human bones were directly dated.

The earliest ^{14}C dating was provided by the sample of a human metacarpal from the calcite breccia, the same which also included a human mandible, and both are Neolithic. Another postcranial remain was a femur head with remains of loess still attached on the surface. Therefore, Pleistocene age has been supposed by G. J. Kukla (Vlček, pers. comm.) and others, but our dating provides a similar result as for the metacarpal – the Neolithic. On the other hand, a cranial fragment of human occipital bone is considerably younger, and the calibrated age points to the Roman Period.

In conclusion, the dating of the human bones from calcites to the Middle Holocene is not surprising because a warm and wet period is optimal for their formation, especially in areas not too far from the cave entrances. The pattern of a long-term duration of depositing human bodies in caves, as suggested by the later cranial specimen, is encountered and documented in other caves in the region as well, like at Bacín (Matoušek 2002).

TABLE 1. Dates from the St. Prokop's Cave.

Sample No.	Sample description	Result BP	$\delta^{13}C$ (‰)	C %	Calibrated	Comment
GrA 23099	Human femoral head	5020 ± 50	–21.80	31.1	3935–3860, 3805–3710 BC	Neolithic
GrA 22864	Human metacarpal (breccia)	5710 ± 50	–20.00	41.9	4615–4460 BC	Neolithic
GrA 23100	Human cranial fragment	1760 ± 45	–21.80	27.9	235–345, 370–380 AD	Protohistoric

THE KONĚPRUSY CAVES, SUPPLEMENTARY DATINGS

The karstic system of the Zlatý kůň Hill, including the Koněprusy Caves, is a multi-floor cave site, with skeletal remains of a female individual found in one of the deep cavities (the Prošek's Hall), on the surface of a debris cone under a vertical chimney. The human body and a few associated artifacts were deposited during terminal stages of the accumulation of the debris cone (Prošek 1952, Prošek *et al.* 1952a, 1952b, Vlček 1952a–e, 1957a, b, Fridrich, Sklenář 1976, Kuželka 1997, Figures 2 and 3 In: Svoboda 2000a). Thus, both the site and the context of the anthropological find resembled several analogical situations, as the one previously recorded at the Aurignacian site of Mladeč, and both the cave complexes were intuitively dated to the EUP. However, the supporting evidence for Koněprusy was scarce: stratigraphically, the human remains were deposited on or just below the surface of the debris cone, the associated lithic artefacts were culturally undiagnostic, and the presumed bone projectile fragment (Mladeč-type) later appeared to be just a fragmented bone. In addition, the glacial fauna from the upper layers of the debris cone might be older than the human fossils.

For the first dating, V. Kuželka selected a fragment of 4×2 mm in size, most probably from the cranial base of the buried individual. The first result suggested rather a Magdalenian age: 12870 ± 70 BP (GrA-13696; Svoboda *et al.* 2002). This seems logical, because the region of the Bohemian karst has a predominantly Magdalenian occupation and no significant EUP site has been proved in the vicinity (Svoboda 2000b). An important Magdalenian living site, the Děravá Cave (undated), opens in marginal rock walls of the same Zlatý kůň Hill (Fridrich, Sklenář 1976). The nearby site of Hostim, which probably represents an open-air living-site of central role within the Bohemian Magdalenian, is dated to 12420 ± 470 BP (Ly 1108; Vencl 1995).

In order to support this first result by a series of dating, two additional bone samples were selected: a human postcranial bone (rib fragment), and an associated rhinoceros bone. In addition, we sampled the last generation of solid calcites, as preserved on the walls of the Prošek's Hall. The results are summarized in *Table 2*.

The human rib (sample GrA-23102) is considered not reliable, following the standards as mentioned in the introduction. The second bone sample (not numbered), taken from a rhinoceros bone from a similar context, contained no collagen at all; thus this sample was not datable.

The dating of solid calcite layers brought previously meaningful results in the Mladeč Cave, where the uppermost calcite coverage was directly connected with the human fossils. Both Szombathy and Smyčka mentioned these deposits in their stratigraphic descriptions (Szombathy 1925), and portions of the calcite are still preserved on some of the fossils; our dates of 34–35 ky BP support this relationship. The situation was different in the Koněprusy Caves. Suchý *et al.* (2001) published a series of radiocarbon and U/Th datings of calcites, mainly from the massive deposit called "Tumulus" at the foot of the debris cone, and from the corroded "rose-like" concretions on the walls, all of which predate 21 ky BP. Following K. Žák, the calcites in the caves correspond to several generations, starting from the Plio/Pleistocene to the Middle Pleistocene (Žák, pers. comm.). Early Middle Pleistocene age is supposed for the "Tumulus", which also displays clear frost disturbances on the surface.

Since the surface of the debris cone was largely deformed after the excavation during the 1950s, our samples *(Table 1)* centered on the uppermost calcite coverages as preserved today on the walls of the Prošek's Hall. The first two measurements (calcite 1) are from the upper part of the Dome, below the lower entrance of the main chimney, and the other two (calcite 2) are from the wall in the lower part of the Dome. In both cases, the age is earlier than that of the deposits related to the human fossil find.

In conclusion, the first Magdalenian date remains the primary evidence for the age of the human fossils from this cave (Svoboda *et al.* 2002). The additional datings of bones, both human and animal, were unsuccessful because of the poor quality of the bone collagen, whereas the dating of calcites from the walls shows that their formation preceded considerably the deposition of the upper part of the debris cone.

TABLE 2. Dates from the Koněprusy Caves.

Sample No.	Sample description	Result BP	$\delta^{13}C$ (‰)	C%	Calibrated BC	Comment
GrA 13696	Human cranial fragment	12 870 ± 70 BP	–21.40	29.6	13000–13500	Magdalenian
GrA 23102	Human rib (fragment)	4 900 ± 70 BP	–23.10	8.0	3765–3640	Low carbon content. Unreliable
GrN 27512	calcite 1 outside	> 41 300 BP				Preceding human intervention
GrN 27522	calcite 1 inside	> 45 000 BP				Preceding human intervention
GrN 27513	calcite 2 outside	> 39 800 BP				Preceding human intervention
GrN 27523	calcite 2 inside	45 500 +2800–2000 BP				Preceding human intervention

TABLE 3. Date from the Pod Pradědem rockshelter.

Sample No.	Sample description	Result BP	$\delta^{13}C$ (‰)	C%	Calibrated BC	Comment
GrA 23571	Fragment of a child's skeleton	5790 ± 50	–20.42	38.6	4710–4555	Neolithic

POD PRADĚDEM ROCKSHELTER

Excavations of the pseudokarstic rockshelters in Northern Bohemia are currently in progress in several areas of sandstone "rock-cities" formations (Svoboda *et al.* 2003). The most complete human fossil discovery, a child's burial, was made in the Pod Pradědem rockshelter (Prostředník, Vokolek 1998) in the sandstone region of "Český ráj" (Bohemian Paradise). Stratigraphically, there were a few Mesolithic artifacts at the base, followed by a Neolithic and later prehistoric sequence. The burial was dated to the Neolithic Stroked Pottery culture. The ^{14}C dating confirms the expected Neolithic age of the situation, and it is well comparable with one of the Neolithic dates from the St. Prokop's Cave.

CONCLUSION

The new datings from eastern Central Europe show that several modern human finds, previously listed as Early Upper Paleolithic or "Aurignacian" in the literature, are to be redated as later: Velika Pećina (5 ka B.P. – Holocene, Smith *et al.* 1999), Zlatý kůň at Koněprusy (12.9 ka B.P. – Magdalenian, Svoboda *et al.* 2002), Svitávka (1.2 ka B.P. – Holocene, Svoboda *et al.* 2002) and St. Prokop's Cave (5–6 ka B.P. and 1.8 ka B.P. – Holocene). On the other hand, some of these datings help to define more precisely a group of Holocene human burials in caves and rockshelters of this region. Comparable results have been obtained for German fossils, namely from Vogelherd (Conard *et al* 2004).

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