

Stratigraphy and Chronology of the Fossiliferous Layers from Križna jama (Slovenia)

by

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Zusammenfassung

Alle fossilen Faunenreste stammen aus Schichten, die durch fluviatile Umlagerungen geprägt sind, sie liegen also auf sekundärer Lagerstätte. Die Bärenreste der Križna jama haben radiometrische Alter zwischen rund 47.000 und 32.000 Jahren vor heute. Ein datierter Holzkohlerest zeigt an, dass Umlagerungen bis in die jüngste Zeit erfolgt sind.

Schlüsselwörter: Allochthone Sedimente, Križna jama, ¹⁴C-Daten

Abstract

All fossil remains originate from layers, which are dominated by fluviatile rearranging of the sediments, i.e. they are allochthonous. The cave bear remains from Križna jama are dated by means of ¹⁴C-dating to ages between 47 and 32 ka BP. There were also charcoal remains found and dated, showing that fluviatile transport of sediments took also place in historic times.

Keywords: allochthonous sediments, Križna jama, ¹⁴C-datings

Izvleček

Vsi fosilni živalski ostanki izhajajo iz vodno preloženih plasti in se nahajajo na drugotnem mestu. Radiometrična starost medvedjih ostankov iz Križne jame se giblje med 47.000 in 32.000 leti našega štetja. Datiran kos lesa dokazuje, da se je prelaganje plasti vršilo do novejšega časa.

Ključne besede: alohtoni sedimenti, Križna jama, ¹⁴C

1. Description

It was Ferdinand von HOCHSTETTER (1881:15) who realized that all the fossil bearing loams in Križna jama are situated in higher parts of the cave. He wrote: *“Was das Niveau dieser knochenführenden Ablagerung betrifft, so ist es sehr bezeichnend, dass es auch hier wieder die höchste Stelle des Höhlenarmes ist, in der wir den diluvialen Lehm mit den Bärenresten finden. Soweit es möglich war, dieses Niveau zu bestimmen, so liegt dasselbe 10 bis 12 Meter unter dem Höhleneingange, also in derselben Höhe, wie die knochenführenden Lehmterrassen in „Hochstetter’s Schatzkammer“.* Starting from these higher positions bones and teeth were washed out of the sediment and were relocated into lower areas by fluviatile and gravitational transport. This is a suitable explanation for the numerous bear remains, which were found on the surface of the loams around “Ölberg” and lake “Tiberias”. Nowadays there are only a few fossil remains in place, as for instance, a cranium fixed on the wall and a mandible of cave bear, which is situated underneath a huge slab and is frequently shown to visitors in the course of guided tours.

The excavations in the years 1999 and 2001 fully confirmed Hochstetter’s view. The fossil-bearing layer consists of dark and only slightly compacted loams, which contain vertebrate remains as well as rounded limestones. This layer lies transgressively above a layer of light-brown loams, which is partly up to 12 m thick. In “Hochstetter’s Schatzkammer” there is a thin layer of sinter positioned in between these two packets of loam, which is missing in “Kittls Bärenhöhle”.

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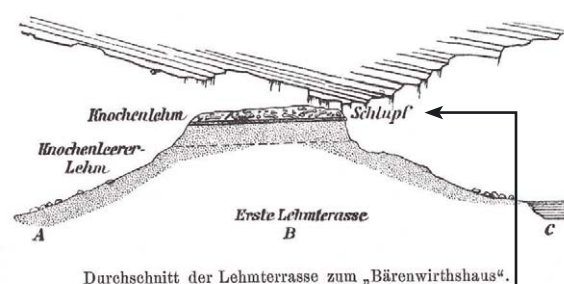
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Lab. No.	Sample No.	¹⁴ C-ages BP	1 σ		Material	Site	Calibrated Age
			+	-			
VERA-2187	KJ-170	740	35	35	Charcoal	Kittls Bärenhöhle	1210 AD–1300 AD
VERA-2189 *)	KJ-205	32.550	220	220	Cave bear bone	Kittls Bärenhöhle	37.877 BP (95.4%) 36.528 BP
VERA-1289	KJ-48B	44.800	1800	1400	Cave bear bone	Ölberg	***)
VERA-1289 repeated in 2011		47.000	2700	2000			
VERA-1291	KJ-43	45.000	1900	1600	Cave bear bone	Monumentenhügel	***)
VERA-2188	KJ-204	46.500	1200	1100	Cave bear bone	Kittls Bärenhöhle	***)
VERA-1287 **)	KJ-7B	46.700	2400	1800	Cave bear bone	Monumentenhügel	***)
VERA-1287 repeated in 2011		41.200	1400	1200			47.795 BP (95.4%) 42.963 BP

Table 1: Radiocarbon datings of Križna jama. *) According to laboratory notes from 2001 the collagen yield of this sample was in the 0.1% range. The age of this sample has to be treated with caution and must be considered as minimum age. **) Collagen yield below 1% of the initial sample amount. ***) The calibrated time range exceeds the time range spanned by the IntCal09 calibration curve.

Figure 1: Right: Schematised cross-section through the sediments of the “Bärenwirthshaus” close to and above lake “Tiberias”. Illustration was taken from HOCHSTETTER (1881). **Explanation:** Knochenlehm – bone-bearing loam, Knochenleerer Lehm – sterile loam, Erste Lehmterrasse – first terrace of loam, Schlupf – narrow passage; Below: Photography of Lake Tiberias and the ascending path, which leads to the “Bärenwirthshaus”. The line indicates the position of the “Schlupf” on Hochstetter’s sketch in real life. Photography: Gerhard Withalm, 2009



The thickness of the fossil-bearing layer varies significantly: In former times, this layer was several meters thick in the area around “Bärenwirthaus”, nowadays it is completely missing, see Fig. 1. During the excavation in 1999 two quadrants, M10 and M11, were unearthed

in the area close to “Monumentenhügel” and a profile was drawn, see Fig. 2 and 3. The latter shows a very thin fossil-bearing layer with a thickness between 2 and 10 cm, which is intercalated between two layers of sinter. The intercalation of the fossil-bearing layer between the

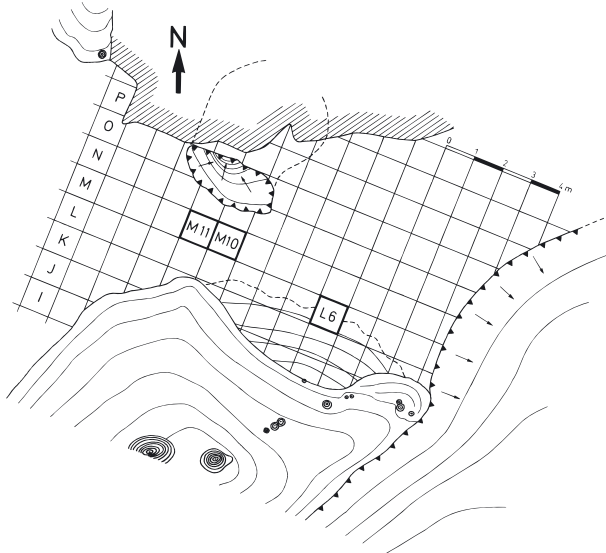


Figure 2: Map of the excavation area in 1999 close to “Bärenwirthaus”.

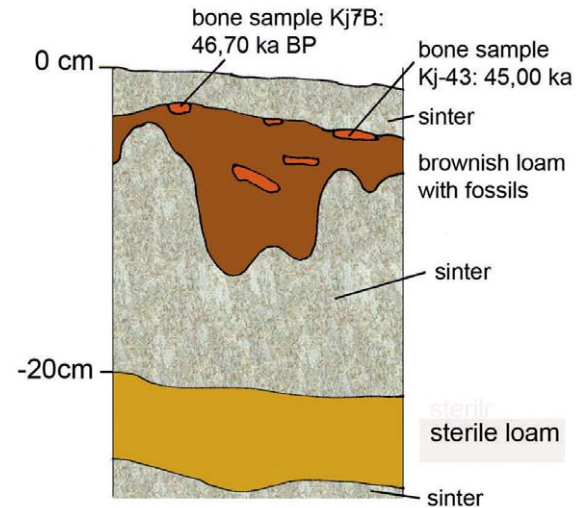


Figure 3: Profile taken during the excavation close to “Monumentenhügel”.

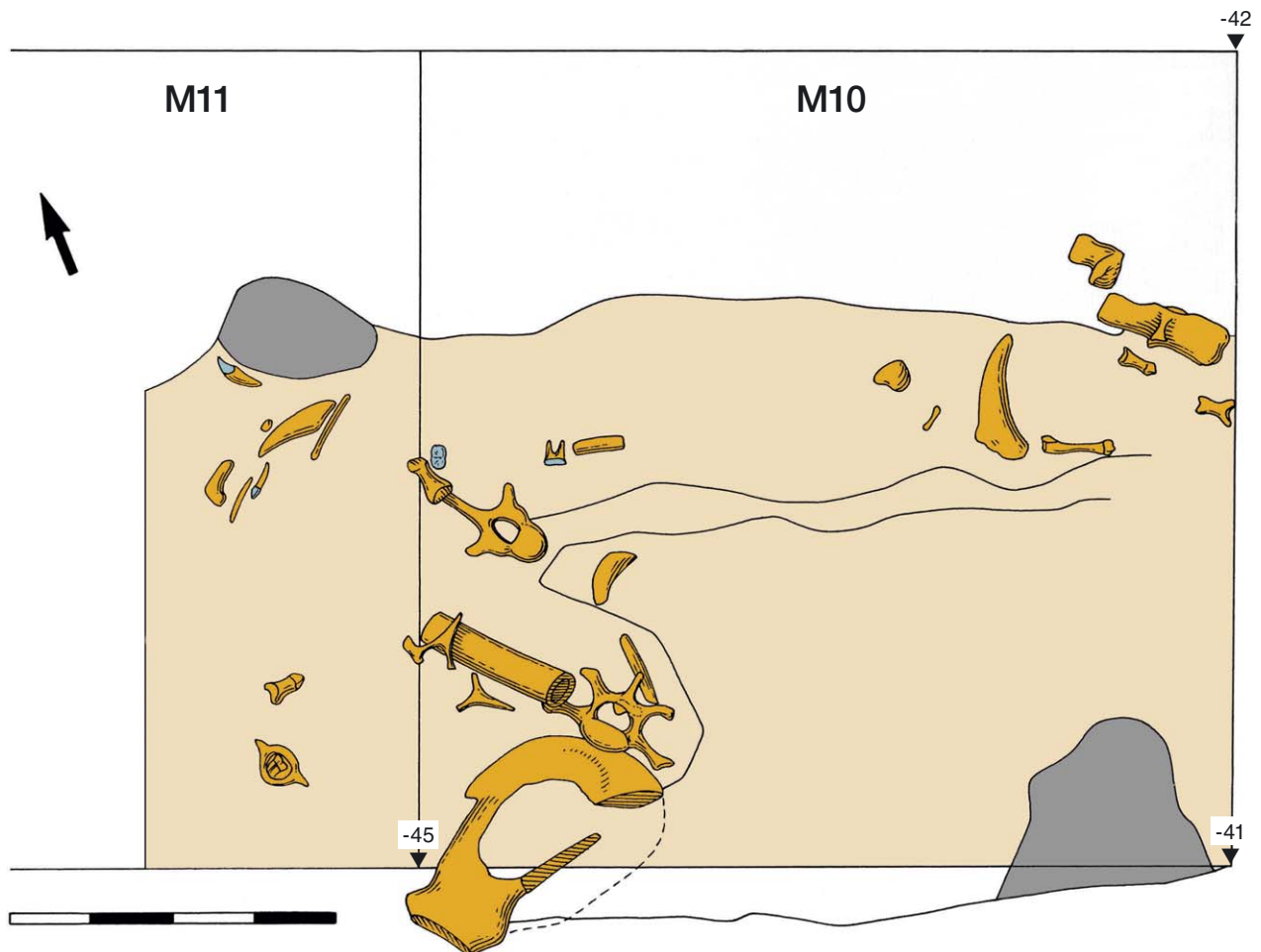


Figure 4: Sketch of quadrants M10 and M11 close to “Monumentenhügel” drawn during the excavation in 1999. Depth indications in cm below NN.

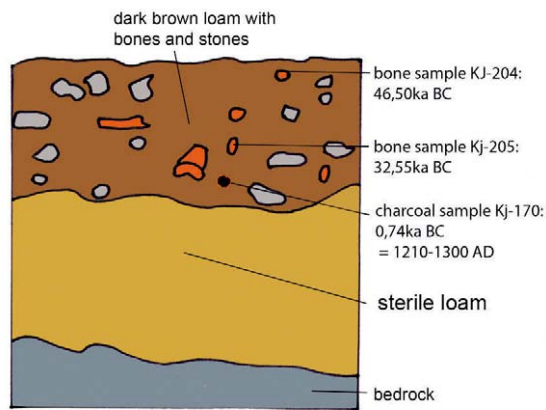


Figure 5: Schematised profile in “Kittl’s Bärenhöhle” drawn during the excavation in 2001.

uppermost sinter layer and the surface of the second sinter layer speaks in favour of an allochthonous position of the fossils. Two fragments of cave bear bones situated directly underneath the thin, upper layer of sinter were dated by means of ^{14}C -dating and showed reliable ages between 47 and 45 ka BP, see Tab. 1. A sketch drawn during the excavation in 1999 shows the bony fragments and teeth in a position, which are typical for transport by water, see Figs. 3 and 4.

The profile excavated in “Kittl’s Bärenhöhle” during the excavation campaign in 2001, shows the circumstances of sedimentation even better, see Fig. 5.

2. Conclusion

The fossil-bearing layer is situated directly, i.e. without any intercalations above the layer of sterile loam, which is – in turn – situated directly on the solid bottom of the cave. In this part of the cave the thickness of the fossil-bearing layer is between 40 and 50 cm. The fact that all fossil long bones are in allochthonous position is clearly shown by their similar orientation, compare to POHAR (this volume). The cave bear remains from this layer show radiometric ages between 47 and 32 ka BP and are intermingled with Late Holocene charcoal, a fact that clearly shows that relocation and transport of fossil material lasted at least until the medieval. During periods of flood water level the water rose unto the highest parts of the cave, destroyed the original sediments and reshipped cave bear bones and extant charcoal remains together. A relocation of the fossil remains can also be expected for the thick fossil-bearing layer in the “Bärenwirtschaus” of which HOCHSTETTER (1881:17) was convinced that the cave bear remains were auto- and not allochthonous. Based on several observations he concluded: *“In der Kreuzberghöhle liegen die Bärenreste nicht auf sekundärer, sondern aufursprünglicher primärer Lagerstätte.”*. The same altitude of the fossil-bearing layer and the similarity of stratigraphy in “Kittl’s Bärenhöhle” speak in favour of Hochstetter’s assumption, see Figs. 7 and 8.



Figure 6: Look up the wall nearby the path towards “Bärenwirtschaus” close to “See Tiberias”. Photo: Gerhard Withalm, 2009

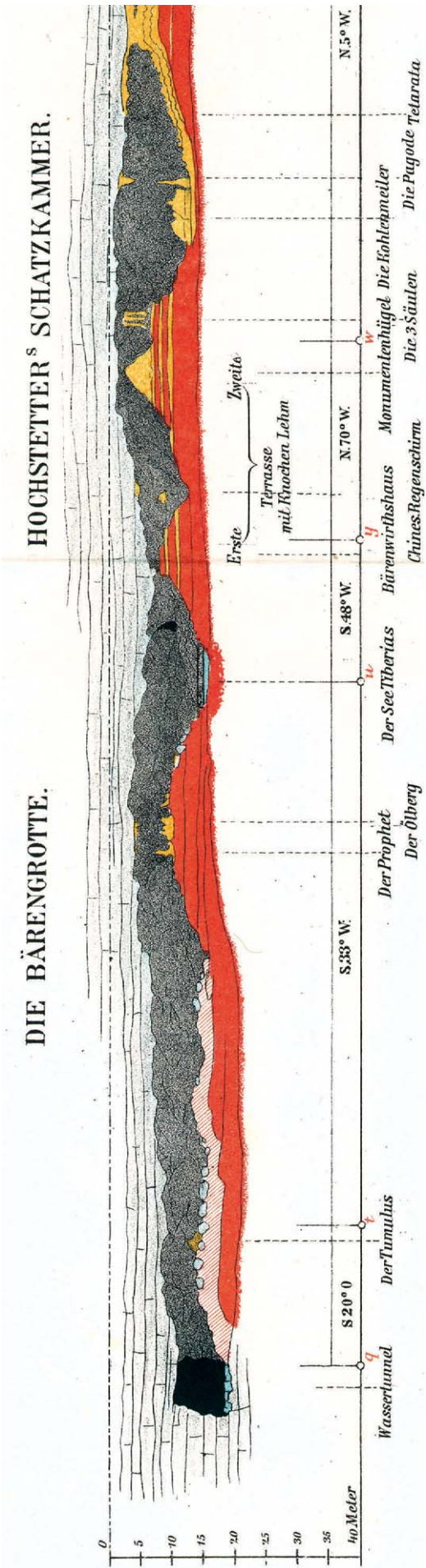


Figure 7: Longitudinal section through a part of Križna jama: Höchstetter's Schatzkammer and Seitengrotte E, illustrating the equal levels of fossil-bearing loams in the "Bärenwirthshaus" and "Kittl's Bärenhöhle", compare to Fig. 8. Graphics taken from HOCHSTETTER (1881), survey: J. Szombathy

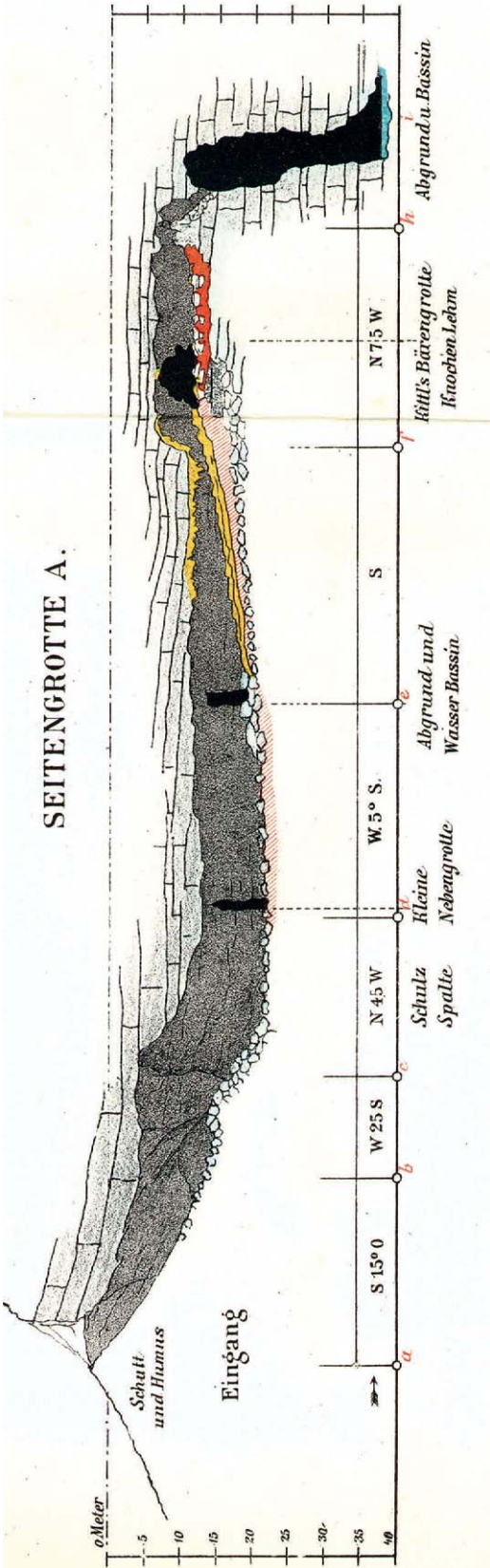


Figure 8: Longitudinal section through a part of Križna jama: Seitengrotte A, illustrating the equal levels of fossil-bearing loams in the "Bärenwirthshaus" and "Kittl's Bärenhöhle", compare to Fig. 7. Graphics taken from HOCHSTETTER (1881), survey: J. Szombathy

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