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NEANDERTHALS OR EARLY MODERN HUMANS? A REVISED ^{14}C CHRONOLOGY AND GEOARCHAEOLOGICAL STUDY OF THE SZELETIAN SEQUENCE IN SZELETA CAVE (KOM. BORSOD-ABAÚJ-ZEMPLÉN) IN HUNGARY

The ongoing discussion of the Middle Paleolithic (MP) to Upper Paleolithic (UP) transition in Europe (c. 40 ka) centers around identifying their makers from two different human species: Neanderthals and Anatomically Modern Humans (AMH; Zilhão/d'Errico 2000; d'Errico 2003; Mellars 2005; Bednarik 2009; Mellars/French 2011; Dogandžić/McPherron 2013). At archaeological sites with a continuous MP to UP record, »transitional« industries are found intercalated between these archaeological industries. They are referred to as transitional because of the combination of traditional MP patterns and new UP concepts of manufacturing stone and bone tool types (Allsworth-Jones 1986; Adams 1998; Pelegrin/Soressi 2007; d'Errico/Boscato/Ronchitelli 2012; Moroni/Borgia/Ronchitelli 2013) as well as symbolic elements such as body ornamentation and art, all rarely applied or even unknown during the preceding MP (Zilhão et al. 2010). In this sense, European transitional industries include the Châtelperronian in Southwestern Europe, the Uluzzian in Southern Europe, and the leaf point complexes (Szeletian, Jerzmanovician, Lincombian) and the Bohunician in Northern and Central Europe (Allsworth-Jones 1986; Svoboda/Škrdla 1995; Pelegrin/Soressi 2007; Riel-Salvatore 2009; Flas 2011; but see Bordes/Teyssandier 2012).

While it is widely accepted that Neanderthals were responsible for the European MP record and AMH for the UP, the makers of the transitional industries are still unknown. One option is to see transitional industries as a technological adaptive response of late Neanderthal populations to the spread of AMH in Europe. An important question is whether this innovation process was influenced by coexistent AMH (Mellars 2005; Hublin et al. 2012) or if it represents an independent adaptive technological response by Neanderthals (d'Errico et al. 1998; d'Errico 2003). As for the Western European Châtelperronian, the claim for Neanderthal authorship has recently been reinforced (Hublin et al. 2012) despite ongoing debates concerning site taphonomy and the association between lithic artifacts, mobiliary artworks, and human fossils at relevant sites such as Arcy-sur-Cure (dép. Yonne/F) and Saint-Césaire (dép. Charente-Maritime/F) (Bar-Yosef/Bordes 2010; Mellars 2010). If Neanderthals indeed made the Châtelperronian, this does not indicate that they were also responsible for other MP-UP industries in other parts of Europe. Recently re-analyzed teeth from Grotta di Cavallo (prov. Apulia) in southern Italy suggest that AMH were the originators of the Uluzzian thereby casting doubt on other transitional industries (Benazzi et al. 2011; Higham et al. 2011; but see Zilhão et al. 2015). This in turn suggests a clear but short cohabitation of the latest Neanderthals and earliest AMH in Italy (Longo et al. 2012; Benazzi et al. 2014).

The Szeletian is another industry at the MP to UP interface that represents a phase of cultural innovation in the sense that new elements are added to an already existing body of technological traditions. In the Szeletian's case, it is the appearance of UP blade and bladelet technology found within a MP tradition of bifacial leaf point and flake production (Allsworth-Jones 1986; Adams 1998; Valoch 2000; Škrdla et al. 2014; Škrdla

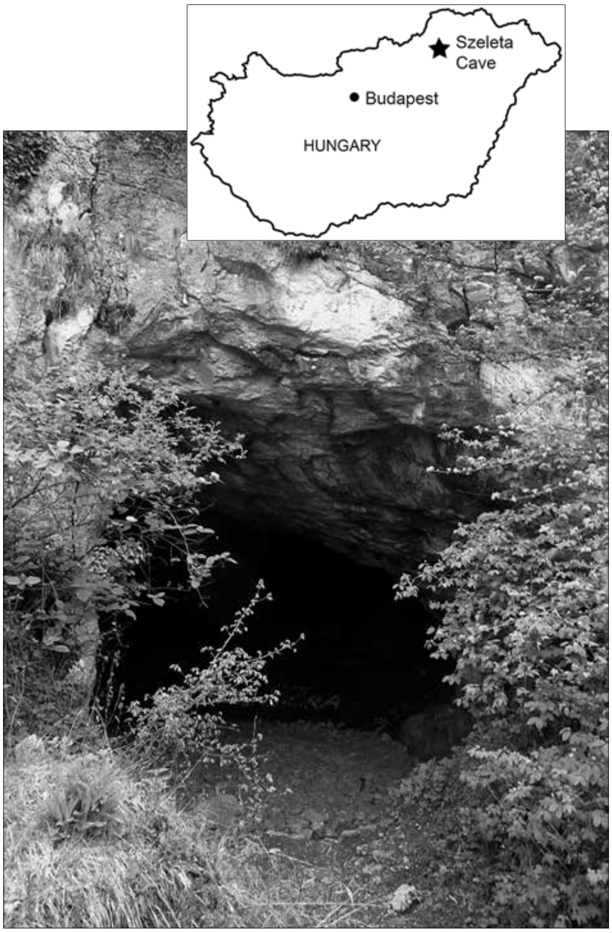


Fig. 1 Entrance of Szeleta Cave (Bükk Mountains, Kom. Borsod-Abaúj-Zemplén/H). – (Map and photo Th. C. Hauck).

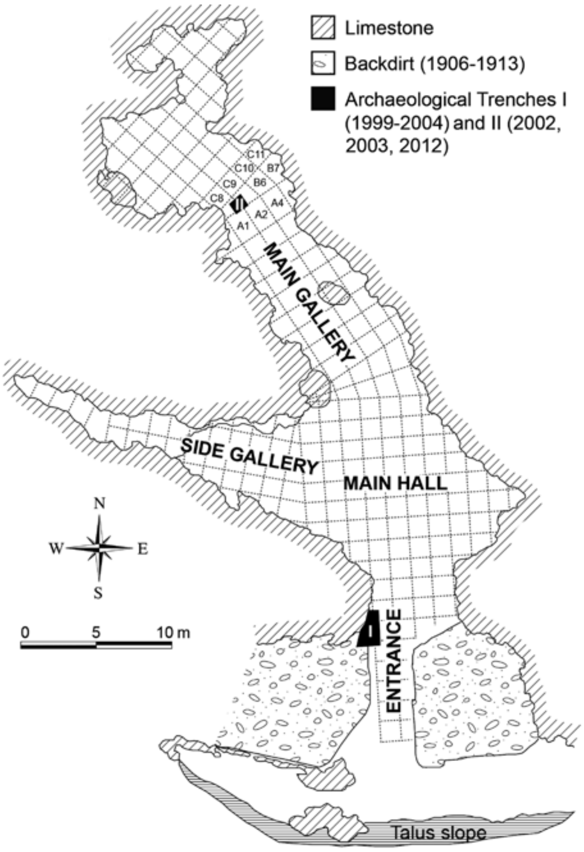


Fig. 2 Plan of Szeleta Cave modified after Kadić (1916) with the original excavation grid (2 m × 2 m). – The position of the 2012 sampling locations is shaded in black: Trench I (excavated between 1999 and 2003) and Trench II (excavated between 2002 and 2003). – (Illustration Th. C. Hauck).

in print). Determining the timing of this cultural innovation is of crucial importance for modeling the Neanderthal-AMH replacement process in Central Europe, even when human fossils are lacking.

In this respect, the stratigraphy of the Szeletian's type-site, Szeleta Cave (Kom. Borsod-Abaúj-Zemplén) in northeastern Hungary, is of special importance as it is the reference sequence for this critical time period (Allsworth-Jones 1986; Adams 1998; 2009). Outstanding stratigraphic and absolute dating ambiguities in this cave contribute to the current controversy of the cultural history and age of the Szeletian in Hungary (Svoboda/Simán 1989; Simán 1995; Ringer 2002; Lengyel/Mester 2008; Adams 2009). Due to the alleged presence of leaf points throughout the excavated sequence and erroneous dating results, the Szeletian and Aurignacian of Szeleta Cave were seen as synchronous cultural entities between 30 and 20 ka cal BP (Adams/Ringer 2004; Adams 2009). This view contradicted earlier dating results and geochronological estimations that set the beginning of the Szeletian at between 37 and 46 ka cal BP (Geyh et al. 1969; Vogel/Waterbolk 1972; Ringer 2000). Recent attempts at clarifying the Szeletian/Aurignacian chronology from Szeleta failed due to a lack of enough datable ^{14}C (Davies/Hedges 2008/2009).

In Central Europe, the time range of the MP-UP transition remains particularly ambiguous because researchers face two main obstacles: First, no well-dated human fossils are available for the critical time period. Second, the human remains from the late MP and the early UP contexts frequently lack stratigraphic control due to coarse excavation methods in the first half of the 20th century. Adding to this are large dating uncertainties due to contamination issues and limitations of conventional, decay counting ^{14}C dating techniques applied in several studies (Lengyel/Mester 2008; Neruda/Nerudová 2013). Therefore, it was not possible to identify the makers of the transitional leaf point-bearing assemblages.

In this paper, we present the results of a geoarchaeological study of the Szeletian sequence of Szeleta Cave and a new set of AMS data from a recent sampling campaign in 2012 covering the period in question. The dated samples are from cave bear bones and teeth and one charcoal fragment discovered in a recently opened trench inside Szeleta Cave. Despite the fact that most of our ^{14}C dates are derived from bear bones and not from anthropogenic material, our detailed geoarchaeological study shows that the new age model can be reliably correlated with Szeletian artifact assemblages that came to light during earlier excavations. Therefore, we are now able to improve the age model for the Szeletian, which has so far been based on conventional and AMS ^{14}C measurements of bones and two charcoal samples with large age uncertainties (Adams/Ringer 2004; Lengyel/Mester 2008). Our new results point to an age range for the Szeletian of 41.5-44 ka cal BP. This is in agreement with the idea of Szeletian-Aurignacian contemporaneity and of a short duration of the Szeletian cultural unit. Finally, we explore the consequence of these new results for modeling the replacement of Neanderthals and the appearance of modern humans in Central Europe.

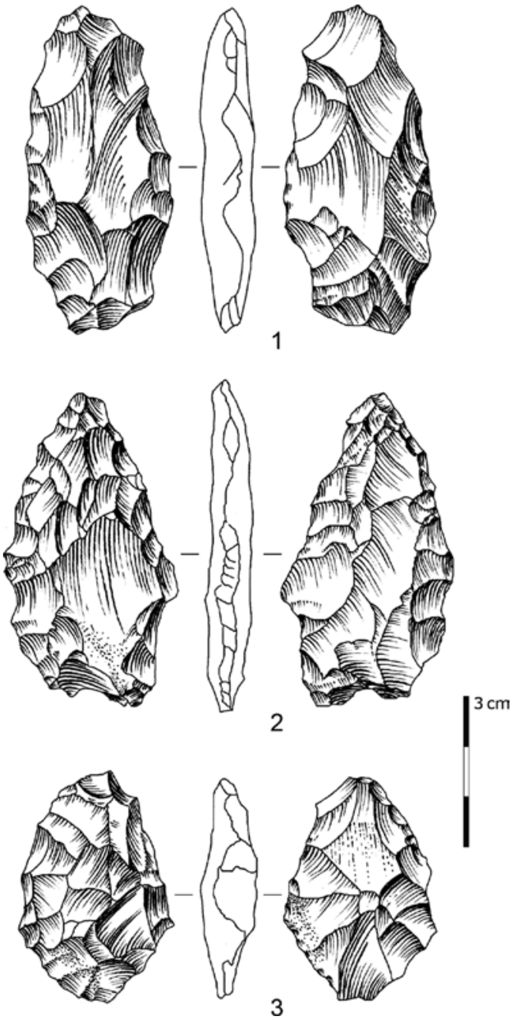


Fig. 3 Bifacially shaped tools from Szeletian deposits discovered during the first excavations between 1906 and 1913 (redrawn after Kadić 1916). – Note that all artifacts found in the lower part of the Szeleta Cave sequence suffered severe edge damage due to site formation processes: **1** leaf point. – **2** bifacially shaped piece (side-scraper?). – **3** leaf point. – 1-2 were found in the main gallery in unit 2 (our layers 1-2) and unit 5 (our layer 7) respectively; 3 was found in the main hall in Kadić's unit 5 (our layer 7). – (Illustration Th. C. Hauck). – Scale 2:3.

SZELETA STRATIGRAPHY

Szeleta Cave is situated in northeastern Hungary in the Bükk Mountains formed in the limestone escarpment of the Szinva Valley at 345 m a.s.l. and 100 m above the village Felsö-Hámor. The cave is 60 m long and opens to the south (**fig. 1**). The present-day entrance leads to the main hall from which two corridors, the main gallery and the lateral gallery branch off. At the end of the main gallery, a small cavity with stalagmites marks the deepest part of Szeleta Cave (**fig. 2**).

Following the start of archaeological research in 1906, a long succession of fieldwork events organized by different researchers and institutions ensued that continues to this day (summarized in Simán 1995; Mester 2002; 2014). Ottokár Kadić and Jenö Hillebrand carried out the initial systematic excavations between 1906 and 1913 where a significant part of the cave deposits were removed and the current stratigraphy was established (Kadić 1916). This was followed by intermittent small-scale interventions until a systematic excavation and dating program was started in 1999 (Ringer 2002; Adams/Ringer 2004; Lengyel/Mester 2008; Adams 2009; Davies/Hedges 2008/2009).

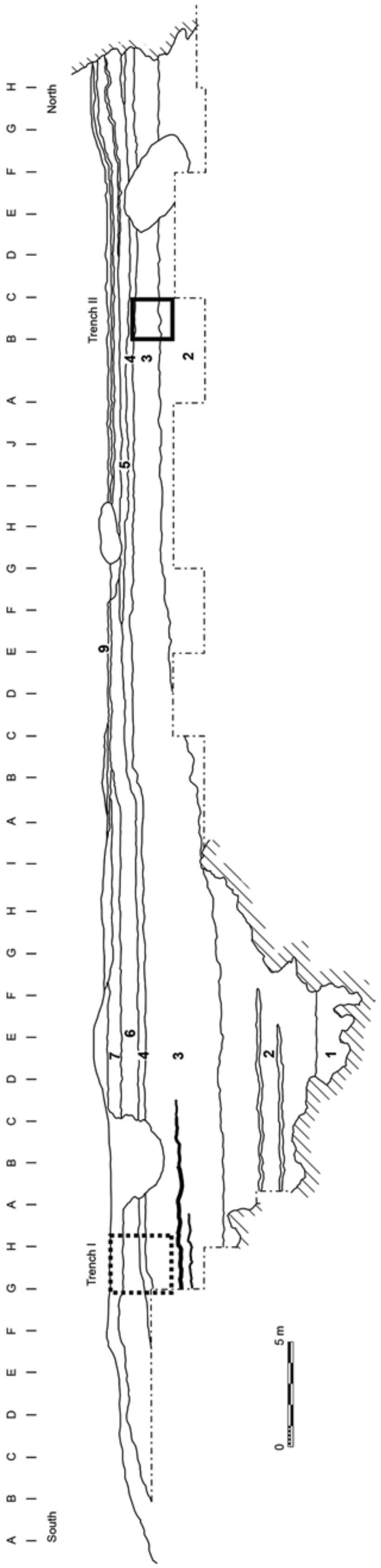


Fig. 4 Longitudinal section of the Szeleta Cave sequence (redrawn after Kadić 1916, pl. XV). – The location of the Trench I and Trench II section is shown. Numbers mark the stratigraphic units defined by Kadić. – Note that the Trench I profile is located at the western cave wall at least 5 m off the longitudinal section and for this reason does not match Kadić's 1916 stratigraphy. Note that the upper part of the sequence (units 4-9) was completely removed during the 1906-1913 excavations. – (Illustration Th. C. Hauck).

Szeleta Cave is remarkable for its bifacially manufactured leaf points (**fig. 3**). Before the Second World War, these leaf points were taken as Eastern European counterparts of the UP Solutrean points of Western Europe, and hence were labeled as *Proto-*, *Früh-*, *Hoch-* and *Spätsolutréen* (Kadić 1916). In 1953, the industry was termed Szeletian by František Prošek (1953) and then based on Kadić's stratigraphy, subdivided into an Early (unit 3), Transitional (unit 4) and Late Szeletian (units 5 and 6).

In 2012, a small trench previously excavated in 2002 and 2003 in the rear of the main corridor was re-opened providing the opportunity to investigate the remaining sediments in the cave (Adams/Ringer 2004). The trench is situated in squares B/4-5 of Kadić's grid system and covers an area of 4 m^2 to a depth of about 1.5 m (**fig. 2**). In 1908, O. Kadić excavated the upper part of the cave infill in the main corridor to a depth of approx. 1 m below the original surface and went further down to a depth of around 5 m in its eastern half (Kadić 1916; Mester 2002). The 2012 trench was cut into the deposits remaining in the lower western part of the main corridor. The sequence covers units 2-4 of Kadić which he documented along the entire Szeleta sequence from the entrance to the back wall (**fig. 4**). Eight different layers were distinguishable in our western profile and it is this part of the sequence where sediment and micromorphology samples were taken for geoarchaeological analysis and faunal material as well as charcoal samples were taken for dating (**fig. 5**).

MATERIALS AND METHODS

Our study faces some major problems that are in no way special to Szeleta Cave but to every re-investigation of large cave sites excavated a long time ago. Firstly, in Szeleta and in other prominent cave sites, most archaeological evidence was removed by the early 20th century excavations coupled with insufficient documentation and publication. Secondly, compared to the large size of Szeleta Cave that covers approximately more than 235 m^2 and more than 14 m of sediment depth at its deepest part, the small test trenches investigated in this study are only a small window into the Szeletian sequence of this cave.

Despite these limitations, the corpus of data published by O. Kadić (1916) is sufficient to allow a correlation of old and

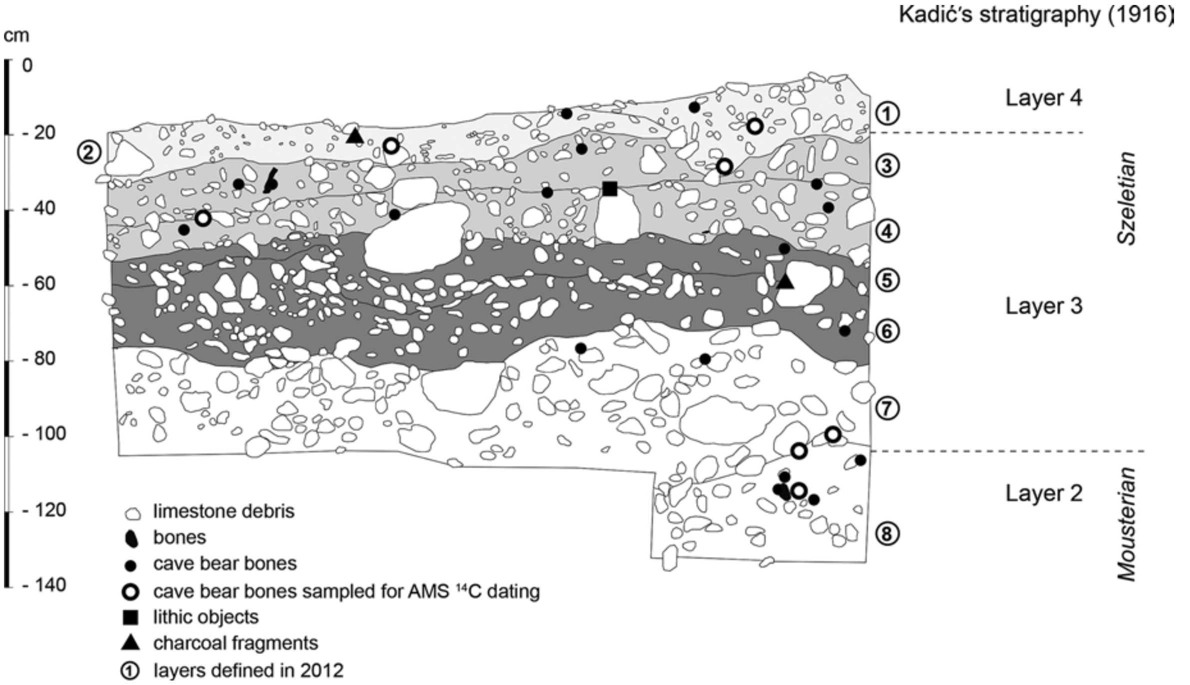


Fig. 5 Szeleta Cave. The investigated sequence in Trench II (2012) and its correlation with the stratigraphy recorded by Kadić in 1916. – (Illustration Th. C. Hauck).

2012 stratigraphy	description	1916 stratigraphy	description (Kadić 1916, 208)
layer 1	gray-brown loam	layer 4	»lichtbrauner Höhlenlehm« [light brown loam]
layer 2	pale brown loam		
layer 3	reddish brown loamy silt	layer 3	»dunkelbrauner Höhlenlehm« [dark brown loam]
layer 4	reddish brown loam		
layer 5	blackish brown loam		
layer 6	dark reddish brown loam		
layer 7	reddish brown loam		
layer 8	dark reddish loam	layer 2	»plastischer Lehm« [plastic loam]

Tab. 1 Stratigraphical correlation of the 2012 sequence defined in the western section of Trench II and the sequence published by Kadić (1916) for the main corridor of Szeleta Cave.

new stratigraphies (**fig. 4**). Admitted that Kadić's stratigraphy is simplistic to some degree, it nevertheless represents a coarse-grained but reliable sequence model. The correlation of old and new stratigraphies is based on the alignment of spatial coordinates of Trench II (2012) and the sequence therein with the ones published by Kadić (1916) and reproduced in Mester (2002). Furthermore, the height of the original cave floor was marked with a tar line. The base of the 2012 section is 160 cm below this line. Apart from the spatial congruence of basic sediment units, the features that Kadić describes for his excavation units 2-4 were equally identified in the 2012 section (**tab. 1**). Our study agrees with the following observations made by Kadić in the main corridor:

1. Chemical weathering is increasing towards the bottom of the sequence and is strongest in Kadić's unit 2 (our layer 8).
2. Varying density and size of limestone debris and their degree of mechanical weathering.

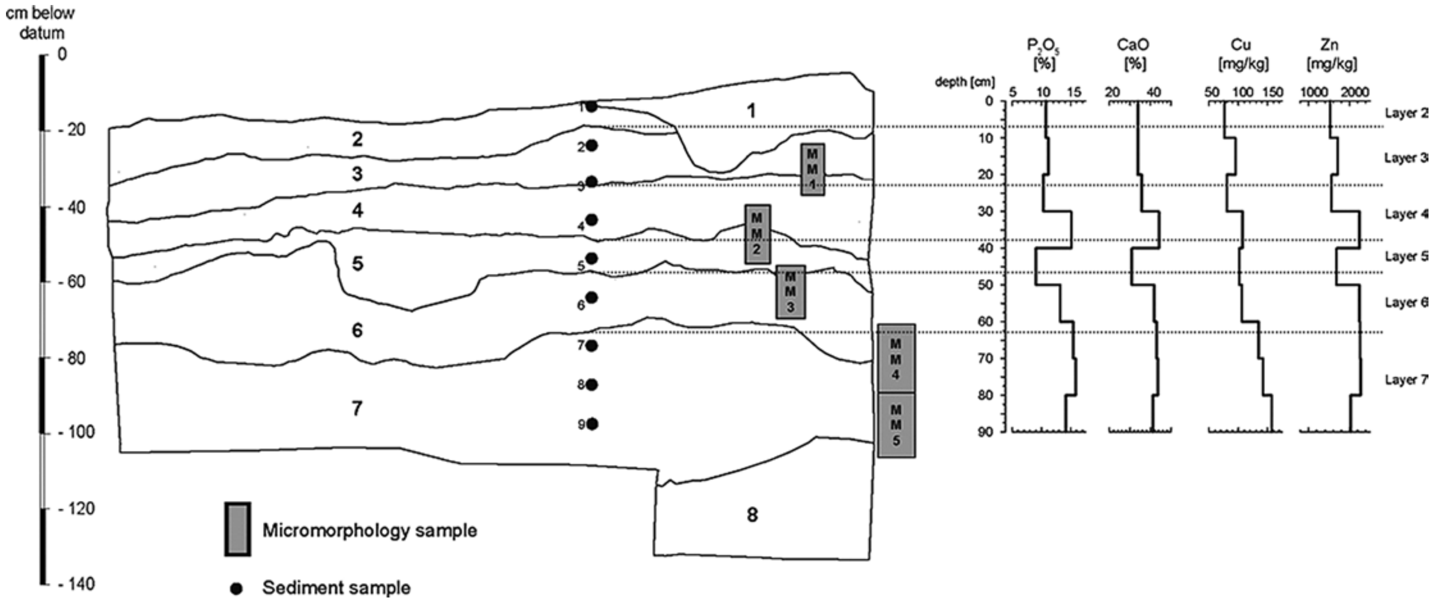


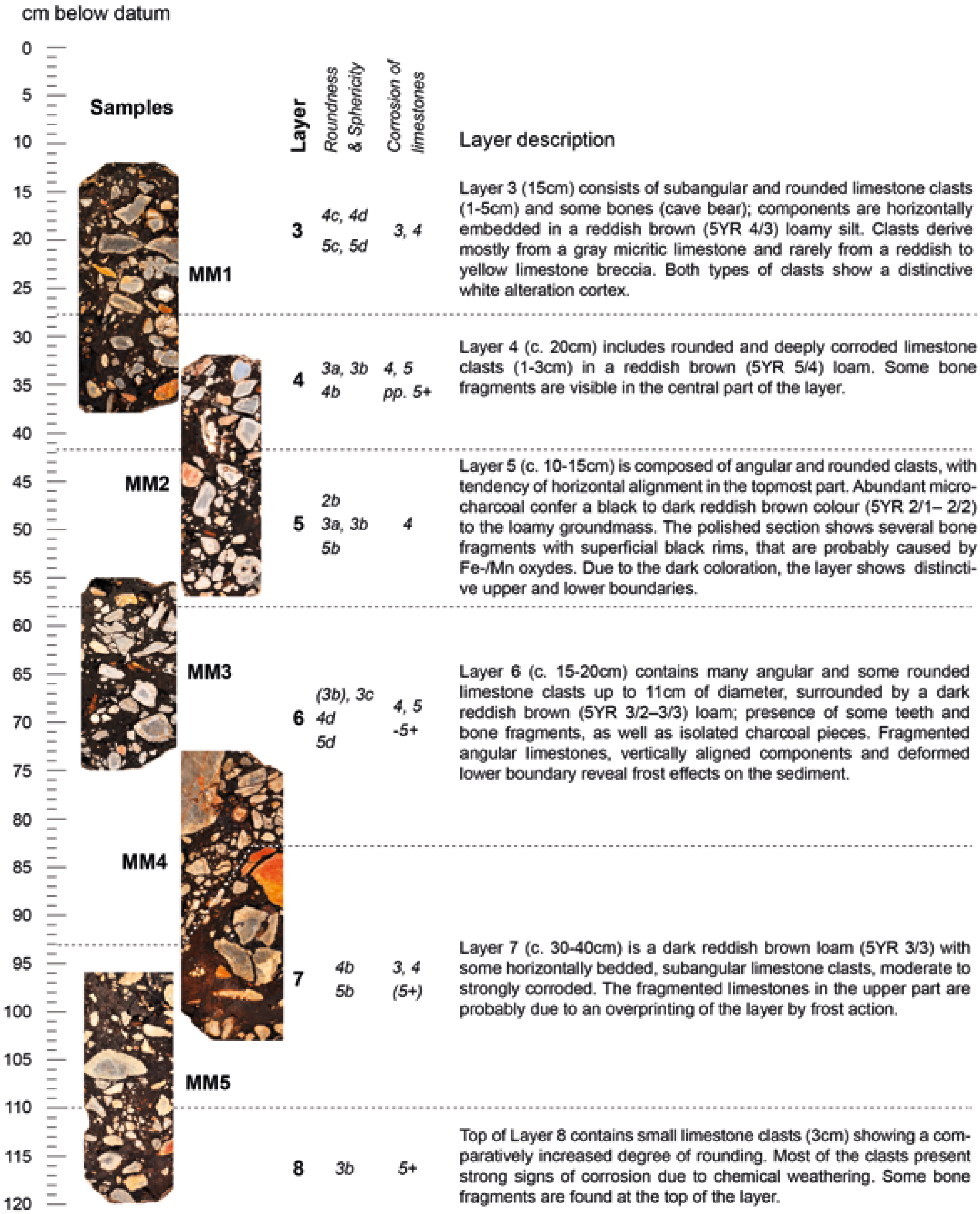
Fig. 6 Szeleta Cave, Trench II section: location of micromorphology samples (MM1 to MM5) and sediment sampling column. The frequency distribution for geochemical markers that indicate human and/or animal presence for phosphor oxide (P_2O_5), calcium oxide (CaO), copper (Cu) and zinc (Zn). – (Illustration Th. C. Hauck / Ph. Schulte).

3. The density of anthropogenic elements and animal remains is highest in Kadić's unit 3 in the mid part of the section (our layers 3-7); anthropogenic features found in Trench II are charcoal accumulations in our layers 5 and 6 and two lithic debris, one made of flint and one of obsidian in our layer 4.
4. Kadić mentions several fireplaces in his unit 3 at various locations throughout the cave and the charcoal concentration in our layer 5 are clearly remnants of such a feature.

The layers are horizontally bedded in the western profile of Trench II in the main corridor of Szeleta Cave, about 50 m away from the entrance. Boundaries between layers were clearly identifiable in the field except for the diffuse transition between layers 7 and 8 at the bottom of the sequence. A common feature of all layers is the high amount of limestone debris surrounded by a loamy matrix.

Microstratigraphy

The deposits were roughly described in the field and five micromorphological samples (MM1 to MM5) were taken for a more refined description under laboratory conditions. For technical reasons it was not possible to sample the uppermost layers 1 and 2. The samples' position in the Trench II sequence is shown in **figure 6**. The five monoliths (21-32 cm high) were encased in plaster at the site, then air-dried and impregnated with an acetone-diluted epoxy resin. After polimerisation, samples were cut with a diamond saw. Polished blocks were examined optically on a binocular microscope (using magnification of up to 80×) in oblique-incident light. Samples were described according to Bullock et al. (1985) and Courty et al. (1989). Shape and corrosion classes of the limestone components were specified using the classification of Braillard et al. (2004). The description of layers is given in **figure 7**. Microscopic investigation of the samples confirmed the macroscopic documentation made in the cave. Post-depositional modification by frost action, chemical weathering and cave bear/human activity affected all layers but did not result in a major distur-



Layer	Roundness & Sphericity	Corrosion of limestones	Layer description
3	4c, 4d 5c, 5d	3, 4	Layer 3 (15cm) consists of subangular and rounded limestone clasts (1-5cm) and some bones (cave bear); components are horizontally embedded in a reddish brown (5YR 4/3) loamy silt. Clasts derive mostly from a gray micritic limestone and rarely from a reddish to yellow limestone breccia. Both types of clasts show a distinctive white alteration cortex.
4	3a, 3b 4b	4, 5 pp. 5+	Layer 4 (c. 20cm) includes rounded and deeply corroded limestone clasts (1-3cm) in a reddish brown (5YR 5/4) loam. Some bone fragments are visible in the central part of the layer.
5	2b 3a, 3b 5b	4	Layer 5 (c. 10-15cm) is composed of angular and rounded clasts, with tendency of horizontal alignment in the topmost part. Abundant micro-charcoal confer a black to dark reddish brown colour (5YR 2/1– 2/2) to the loamy groundmass. The polished section shows several bone fragments with superficial black rims, that are probably caused by Fe-/Mn oxydes. Due to the dark coloration, the layer shows distinctive upper and lower boundaries.
6	(3b), 3c 4d 5d	4, 5 -5+	Layer 6 (c. 15-20cm) contains many angular and some rounded limestone clasts up to 11cm of diameter, surrounded by a dark reddish brown (5YR 3/2–3/3) loam; presence of some teeth and bone fragments, as well as isolated charcoal pieces. Fragmented angular limestones, vertically aligned components and deformed lower boundary reveal frost effects on the sediment.
7	4b 5b	3, 4 (5+)	Layer 7 (c. 30-40cm) is a dark reddish brown loam (5YR 3/3) with some horizontally bedded, subangular limestone clasts, moderate to strongly corroded. The fragmented limestones in the upper part are probably due to an overprinting of the layer by frost action.
8	3b	5+	Top of Layer 8 contains small limestone clasts (3cm) showing a comparatively increased degree of rounding. Most of the clasts present strong signs of corrosion due to chemical weathering. Some bone fragments are found at the top of the layer.

Fig. 7 The 2012 stratigraphy in the main corridor of Szeleta Cave recorded in Trench II. The five monolith sections (MM1 to MM5) cover layers 3-8. It was not possible to cut a micromorphology sample into layers 1 and 2. Roundness, sphericity and corrosion classes are defined after Braillard et al. (2004, 350-351). – (Illustration Th. C. Hauck / Ph. Rentzel).

bance of the overall sequence (e. g. mixing of layers). Frost action resulted in vertically aligned components and heavily cracked limestone debris. Such evidence for intensive frost action inside caves is rare and must be correlated with a very cold climatic phase. A comparable case is the Remouchamps Cave (prov. Liège) in Belgium with evidence for permafrost deep inside the cave system (Pissart et al. 1988). The eastern Bükk region was periodically affected by permafrost during the Weichselian period (Van Vliet-Lanoë / Magyari /

Meilliez 2004), and therefore, frost action in Szeleta Cave likely occurred several times, at least during very cold climatic phases, such as Heinrich events 5 and 4. Our age model for the Szeletian sequence identifies Heinrich 4 as the most probable period of permafrost action.

Geochemical analysis

The geochemical analysis allows for a reconstruction of the weathering history of the cave sequence. Furthermore, a comparison of chemical element frequencies in the cave with those of a nearby open-air archive allows for a rough differentiation of autochthonous from allochthonous sedimentation processes. Eight sediment samples for geochemical analysis were taken along the western sequence of Trench II thereby covering layers 1-7 (**fig. 6**). Sampling occurred continuously in 10 cm intervals to guarantee that each sediment unit is represented by at least one sample. To compare the geochemical signal from the interior part of the cave with the chemical element composition in deposits close to the drip line, we analyzed six samples taken in Trench I at the entrance of Szeleta Cave (**fig. 2**). This trench was cut by A. Ringer and B. Adams in 2002 as an extension of an older test excavation done by L. Vértes in 1966 (Adams / Ringer 2004; Vértes 1968). In contrast to earlier sequence models, our stratigraphical observations suggest a re-deposition of colluviated deposits at this part of the cave combined with an anthropogenic modification of these sediments in more recent times. This explains the awkwardly young ^{14}C ages obtained for the supposed Szeletian sequence in this part of the cave (Adams / Ringer 2004). The third test case is a sample set (n = 4) taken at the open-air loess sequence of Malyi, some 17 km away from Szeleta Cave. At the Malyi-Öreghegy quarry (Kom. Borsod-Abaúj-Zemplén / H) archaeological excavations were carried out in 1991 and 1998 on several square meters in a depth of 1.8-3.8 m below the surface (Adams 2000). Middle Paleolithic artifacts were found within a soil formation the age of which remains unclear up to now. The sediment samples reported in this paper were taken in 2012 in a 3 m long loess section that is located several meters away from the former surface excavations and in a stratigraphically higher position. It covers a complex of probable MIS 3 soils and an upper pleniglacial loess cover directly below the recent top soil. One sample (Malyi – 1) was taken in the LGM loess, the other three within the MIS 3 loess-paleosoil sequence.

For the determination of element concentrations in the fine-grained fractions of all 15 sediment samples from Szeleta Cave (Trenches I and II), the < 63-µm fraction was sieved out and dried at 105 °C for 12 h. From this, 8 g of the sieved material were mixed with 2 g of Fluxana Cereox, homogenized and pressed to a pellet under a pressure of 20 t for 120 s. All samples are measured twice with the XRF device. Mean values are determined from the two measurements (according to SPECTRO 2007). The concentration of eight major elements is presented in **table 2**. The deposits in Szeleta Cave show high concentrations of phosphor oxide (P_2O_5), calcium oxide (CaO), copper (Cu) and zinc (Zn) compared to the open-air loess section at Malyi. A reversed pattern is visible for silica (SiO_2), titanium dioxide (TiO_2), aluminium oxide (Al_2O_3) and iron oxide (Fe_2O_3) which are significantly lower in the Trench II sequence than within the sediments of Trench I and the Malyi section. As Trench II is least exposed to aerial conditions, this pattern nicely reflects the exposure gradient of different parts of the cave system to external influences. However, the amount of allochthonous input in the inner part of the cave fluctuated over time as is shown by higher SiO_2, TiO_2 and Al_2O_3 concentrations within layers 3, 4, 6 and at the bottom of layer 7 (**fig. 6**).

There are multiple ways by which minerals accumulate in cave sediments. Szeleta Cave is formed in limestone bedrock that predominantly consists of calcite and aragonite minerals. In addition, the cave deposits contain silicate minerals such as quartz and several clay minerals which are rather indissoluble. Accumulation of these minerals occurred after the solution of carbonate minerals. Apart from this, it is possible that

sample no.	depth (cm)	Al_2O_3	CaO	Cu	Fe_2O_3	P_2O_5	SiO_2	TiO_2	Zn
Szel. Tr.I – 1	0	4.61	28.96	15.60	2.70	0.47	15.26	0.37	113.25
Szel. Tr.I – 2	–30	5.56	26.02	22.60	3.07	0.60	16.98	0.41	153.10
Szel. Tr.I – 3	–55	6.30	22.70	28.65	3.50	0.90	19.73	0.47	191.75
Szel. Tr.I – 4	–102	4.72	32.30	28.65	2.53	1.97	12.12	0.32	326.45
Szel. Tr.I – 5	–180	4.67	30.37	39.20	2.60	2.98	13.45	0.34	472.70
Szel. Tr.I – 6	–260	3.64	33.44	61.45	2.36	6.23	10.27	0.27	865.05
Szel. Tr.II – 1	0	3.40	33.93	75.95	2.27	10.72	8.86	0.23	1531.00
Szel. Tr.II – 2	–10	3.72	33.75	94.85	2.56	11.20	9.00	0.24	1710.50
Szel. Tr.II – 3	–20	2.39	35.69	80.30	1.94	10.28	6.51	0.18	1564.50
Szel. Tr.II – 4	–30	3.05	44.06	107.15	2.45	15.06	8.47	0.24	2246.50
Szel. Tr.II – 5	–40	3.63	30.91	101.60	3.14	9.08	8.71	0.25	1685.00
Szel. Tr.II – 6	–50	4.33	41.79	106.40	2.89	13.16	10.48	0.25	2240.00
Szel. Tr.II – 7	–60	3.02	42.88	135.05	2.47	15.42	8.47	0.20	2256.00
Szel. Tr.II – 8	–70	2.63	43.58	142.55	2.27	15.87	7.89	0.19	2269.50
Szel. Tr.II – 9	–80	3.91	41.11	157.10	2.56	14.12	9.69	0.24	2028.00
Malyi – 1	–40	11.00	0.80	20.85	5.11	0.09	38.05	0.75	72.35
Malyi – 2	–120	10.98	1.01	22.60	5.06	0.16	38.07	0.77	78.40
Malyi – 3	–240	11.16	1.03	20.15	5.04	0.05	36.94	0.74	74.70
Malyi – 4	–320	11.27	1.05	18.90	4.75	0.08	37.18	0.73	76.95

Tab. 2 Chemical elements identified in the deposits of Trench I and Trench II of Szeleta Cave and in the open-air loess sequence of Malyi.

some cave deposits are of external origin and entered the cave through eolian or fluvial processes or as a result of human and animal activity. However, the most common process of sedimentation in the cave is the *in situ* formation of specific kinds of minerals. Ions dissolve in the surrounding bedrock and percolate in the cave sediments where they precipitate and cause the transformation and neoformation of carbonates and phosphates. These authigenic processes are often associated with the occurrence of bone ashes or excreta (Weiner/Goldberg/Bar-Yosef 2002; Goldberg/Macphail 2006). The most probable agents responsible for the element frequency distribution shown in **figure 7** are humans and animals who occupied the cave periodically. Their presence is reflected by the increase of P_2O_5, CaO and Zn in layer 2 to a distinct peak at the top of layer 5 and at the bottom of the sequence. Contrarily, their absence is marked by a frequency drop of the same elements at the transition from layer 5 to layer 6. The decrease of phosphor oxide, calcium oxide and zinc probably corresponds to a phase of natural sedimentation. In general, the P_2O_5 and CaO values are significantly higher in the Trench II sequence than in Trench I and in the loess deposits of Malyi (**tab. 2**). They are also higher compared to the values measured in other cave deposits (e. g. Forbes/Bestland 2007; Miko/Kuhta/Kapelj 2001). We therefore suggest that the inner part of Szeleta Cave is a chemically buffered environment that is much less affected by solution weathering compared to open-air terrestrial archives (Torres/Ortiz/Cobo 2003).

A much more comprehensive sampling in Szeleta Cave and the immediate surroundings is needed for a more precise identification of the agents that caused the chemical weathering signal. Geochemical activity depends on many endogenous and exogenous factors, such as the pH-value, grain-size-distribution, mineral association, availability of water, degradation of organic matter and clay minerals. These factors play a crucial role in the formation of cave sediments and their weathering history and affect the preservation of organic remains. It is thus difficult to decide whether a lack of organic matter is simply due to the absence of animals and humans or whether geochemical weathering caused their total destruction (Goldberg/Macphail 2006).

COL no.	bone samples	layer (2012)	depth (cm)	C content (%)	N content (%)	C/N ratio
1986.1.1	incisivus	1	–17	10.8	2.9	3.7
1978.1.1	metatarsus	1	–28	8.1	2.0	4.1
1992.1.1	metacarpus	2	–23	4.6	1.0	7.3
1995.1.1	incisivus (juvenile)	2		5.3	1.0	5.5
1996.1.1	phalanx 2	4	–32	7.4	1.6	4.6
1982.1.1	incisivus	4	–42	9.1	2.4	3.8
1989.1.1	radius (right)	7/8	–104	10.8	3.0	3.5
1997.1.1	caninus	8	–114	6.7	1.2	5.4

Tab. 3 Szeleta Cave. Carbon and nitrogen contents of the new bone and teeth samples of *Ursus spelaeus*.

Atomic Mass Spectrometer (AMS) ^{14}C dating

AMS ^{14}C dating was done with eight out of 42 recovered faunal remains and one charcoal from layer 5 in Trench II. Our main sampling criteria were (1) a consistent distribution of samples across the sequence and (2) a good bone surface preservation. The low find density in Szeleta Cave is a problem common to all caves of the Bükk Mountains and explains why the new Szeletian age model is largely built on cave bear bones. The faunal samples were well-preserved hard bone fragments (N = 5) and teeth (N = 3) derived from *Ursus spelaeus*. The teeth had large roots that were easily sampled. The faunal samples were mechanically cleaned under an optical microscope and then ultrasonically cleaned in a bath of MilliQ water. Carbon and nitrogen contents of the whole bone material (including inorganic and possibly exogenous carbon), which give a rough indication of the bone quality, were determined using a Vario Micro Cube elemental analyzer (Elementar, Germany). The bone fragments were crushed into small pieces and the collagen fraction was extracted using 1 mg HCl (20 min) for demineralization of the inorganic matrix followed by filtration of the hot solution through glass fiber filters, and freeze drying of the collagen fraction (Brock/Bronk Ramsey/Higham 2007). As a test, ultrafiltration was applied to two samples using ultrafilters cleaned with hot water (70 °C) in an ultrasonic bath (Sartorius Vivaspin 15) with a molecular cut-off value of 30 kDa following Brock et al. (2007) and Svyatko et al. (2012). The charcoal sample was treated with standard methods including microscopic inspection and removal of contaminant and acid-alkali-acid extraction (Rethemeyer et al. 2013). All glassware and filters used for sample processing were precombusted (450 °C, 4 h) to remove contaminants. The purified samples were combusted in an elemental analyzer (Vario Micro Cube, Elementar, Germany) coupled to a graphitization system where CO_2 was trapped on a zeolite trap and, after thermal desorption, reduced to graphite with hydrogen and iron catalysts (Rethemeyer et al. 2013). Sample sizes were between 0.7 and 1.0 mg of carbon. The AMS measurement at CologneAMS was performed with a 6MV tandetron AMS (Dewald et al. 2013).

Dated samples show C/N ratios between 3.5 and 7.3 which are close to the suggested limit ($\gg$4; Van Klinken 1999; Dewald et al. 2013) indicating no serious contamination or strong degradation (**tab. 3**). The extracted collagen fraction had carbon contents of 35-43 % and C/N ratios between 2.7 and 3.1, which are well in the range indicative for good collagen quality (% C: c. 44, C/N: 2.6-3.9; Van Klinken 1999; **tab. 3**). Because of increased possibilities of sample contamination by ultrafiltration resulting from incomplete removal of the glycerine coating and more handling steps, we decided not to include this step in the bone treatment protocol. New results by Brock et al. (2007) support our decision, as it is not clear what sub-

lab no.	material	layer Kadić 1916 and (2012)	depth (cm)	C/N	^{14}C age (yrs BP)	± (1σ)	age cal BP	standard deviation
COL-1986.1.1	bone	4 (1)	–17	2.8	36430	330	41620	310
COL-1978.1.1	bone	4 (1)	–28	2.8	36640	330	41730	310
COL-1992.1.1	bone	3 (2)	–23	2.9	36850	200	41830	290
COL-1995.1.1	bone	3 (2)		2.8	38240	210	42530	320
COL-1996.1.1	bone	3 (4)	–32	2.8	40090	450	43670	530
COL-1982.1.1	bone	3 (4)	–42	2.8	39520	430	43300	480
COL-1969.1.1	charcoal	3 (5)	–43	–	40540	810	44050	750
COL-1989.1.1	bone	2 (7/8)	–104	2.7	44040	660	47130	1140
COL-1997.1.1	bone	2 (8)	–114	2.8	46250	850	49450	1440
previous radiocarbon ages								
GrN-6058	bone	2			43000	1100	46240	1740
GrN-5130	bone	6?			32620	400	37000	980
GXO-197	bone	3			>41700			
Beta-178808	bone	3			37260	760	42060	630
ISGS-4464	bone	2/3			42960	860	46080	980
ISGS-A-0189	charcoal	3			26000	180	30920	390
ISGS-4460	bone	3			>25200			
ISGS-A-0128	bone	3			11760	62	13680	70
ISGS-A-0129	bone	3			13890	71	17050	60
ISGS-A-0131	bone	6a			22110	130	26470	310

Tab. 4 List of new CologneAMS dates (COL) and previous ^{14}C ages for the Szeletian sequence of Szeleta Cave. For the Cologne dates, sample depth and the C/N ratios of bone collagen is known. – Calibrated ages were calculated by using CalPal 2007 (Weninger/Jöris 2008; Weninger/Jöris/Danzeglocke 2010). – (Data from Vogel/Waterbolk 1972; Geyh et al. 1969; Ringer 2002; Adams/Ringer 2004; Adams 2002).

stances are removed by ultrafiltration. Furthermore, the fraction removed differs depending on bone quality and preservation.

RESULTS

A pivotal issue of our study is the match between the 1916 stratigraphy recorded by O. Kadić and the sequence investigated in 2012. On the basis of common reference points as well as similar sedimentological and archaeological features it is possible to insert our sampling section into the much more extended 1916 stratigraphy (**fig. 4**). Kadić's layer descriptions are reproducible in the new section although we arrived at a much more detailed stratigraphy that subdivides Kadić's excavation units 2-4 into eight different layers (**fig. 5; tab. 1**). This stratigraphical congruence allows to assign the 2012 sequence to the Szeletian cultural phase as Kadić found leaf points in the main corridor in his unit 4 (our layers 1 and 2) and at the bottom of his unit 3 (our layer 7) (**fig. 3**). Use of the cave by humans but also animal dwelling activity is reflected by the geochemical signal for layer 3 and the lowest part, from layer 5 to the bottom. Decisive here is a marked increase of phosphor oxide (P_2O_5), calcium oxide (CaO), zinc (Zn) and copper (Cu) in these layers.

The geoarchaeological study and the new AMS ^{14}C measurements from CologneAMS confirm the integrity of the Szeletian sequence, at least in the main corridor of the cave (contra Lengyel/Mester 2008). The new results indicate a gradual accumulation of deposits (**fig. 5**). No abrupt change in the sedimentation process is visible and no unconformities or hiatuses are recorded between the layers except for the transition between layers 8 and 7. Furthermore, the degree of weathering gradually increases from top to bottom. Common to all layers is a high density of limestone debris surrounded by a loamy matrix. Differences occur in color, weathering degree, size and orientation of limestone clasts as well as in the presence or absence of charcoal. In sum, cryoturbation and cave bear activity clearly modified the texture of individual layers but did not result in disturbances cross-cutting the entire sequence. This agrees well with the continuous age increase from layer 1 at the top to layer 8 at the bottom of Trench II (**tab. 4**). The two oldest dates of 49 450 ± 1440 and 47 130 ± 1140 yrs cal BP (COL-1997 and COL-1989) set the minimum age for the MP in this cave as the dated bone samples likely belong to the top of the MP deposit. It is possible that a depositional hiatus occurred between Kadić's units 2 and 3 (our layers 8 and 7) and we therefore assume that the AMS ^{14}C date of 44 050 ± 750 yrs cal BP (COL-1969) for layer 5 reflects the beginning of the Early Szeletian. The latest dates of 41 730 ± 310 and 41 620 ± 310 yrs cal BP obtained for layer 1 mark the end of the Szeletian occupation phase in Szeleta Cave.

DISCUSSION

The original age reconstruction of the Szeletian at Szeleta Cave was based on three conventional radiocarbon measurements of bone samples (GrN-6058, GrN-5130, and GXO-197), which limited the chronological scope of its early and developed phase to between 37 and 46 ka cal BP (Geyh et al. 1969; Vogel / Waterbolk 1972; **tab. 4**). This age range and the co-occurrence of MP and UP artifact types in the Szeleta assemblages confirmed the prevailing assumption that the Aurignacian and Szeletian were contemporaneous cultural units in the Bükk Mountains (Allsworth-Jones 1986; Svoboda / Simán 1989). However, later AMS ^{14}C ages of bone samples published by Adams and Ringer in 2004 suggested an awkwardly long time range for the Szeletian at Szeleta Cave (**tab. 4**). In this case, the Szeletian would last from at least 46 ka cal BP to the Last Glacial Maximum or even beyond. Consequently, one age model argues for a long lasting existence of the leaf point complex in the Bükk Mountains running parallel to and being influenced by the Aurignacian and Gravettian cultures in other parts of Central Europe (Ringer / Kordos / Krolopp 1995). In contrast, an alternative model takes the alleged stratigraphic co-occurrence of Szeletian and Aurignacian artifacts in some parts of Szeleta Cave and their overlapping ^{14}C ages as evidence for one single cultural unit which lasted from 37 to 26 ka cal BP (Adams 2009). The existence of the Szeletian as a discrete cultural unit is denied. Artifacts previously thought to be typical for the Szeletian are now considered as parts of an »Aurignacian with leaf points«, which is exclusively related to the presence of AMH in the Bükk Mountains. Equating this model with the AMS ^{14}C age series presented in this paper would shift back the presence of early modern humans in the Bükk Mountains to at least 44 ka cal BP.

This conflict between different age models for the Szeletian at the eponymous site is caused by several factors:

1. Some of the dated samples lack precise information about their provenience within the sediment unit. For example, this is the case for the Groningen (GrN) radiocarbon samples (**tab. 1**). Besides, most if not all previously dated samples may have been affected by contamination and by incomplete contamination removal for ^{14}C dating, and the conventional ^{14}C measurements may include larger uncertainties than AMS analyses.
2. Secondly, it is highly likely that the complex taphonomic history of the cave is responsible for the inconsistency of previous dating results (Lengyel / Mester 2008; Mester 2014). This is especially true for the

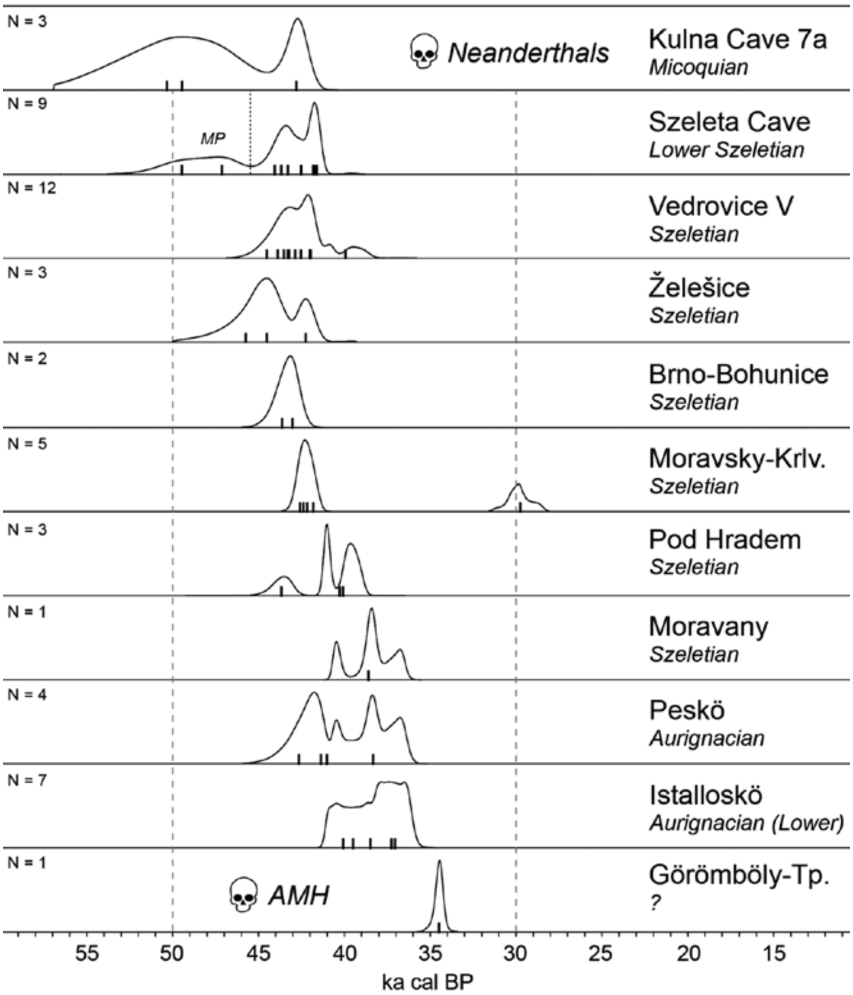


Fig. 8 Multiplot of calibrated ages for selected Late MP (Micoquian), Szeletian and Early UP sites in Central Europe. – The rather young date of 29725±692cal BP (GrN-28451) obtained for one of th e charcoal samples from Moravsky Krumlov IV Layer 0 is to be seen as an outlier due to unknown reasons. – (Data taken from Valoch et al. 1993; Davies/Nerudová 2009; Haesaerts et al. 2013; Neruda/Nerudová 2013; Škrdla et al. 2014; Škrdla in print; calibrated ages were calculated by using CalPal 2007: Weninger/Jöris 2008; Weninger/Jöris/Danzeglocke 2010).

entrance area where a major disturbance, mixing of archaeological layers and an infiltration of recent material occurred during the course of section collapses after the 1906-1913 excavations. Furthermore, the horizontal displacement of ash indicates disturbance of former hearths probably due to hydraulic flow.

3. Finally, the weathered and abraded surfaces of limestone debris, bones and lithic artifacts in all parts of the cave are the result of intense frost action and chemical weathering.

By taking all these factors into account and by setting the new AMS ^{14}C ages into their proper geoarchaeological context, we propose a much more accurate and reliable age model for the Szeletian at Szeleta Cave. This model confirms and renders more precisely the lower age limit of the Szeletian at around 44 ka cal BP, also proposed by earlier dating results (Geyh et al. 1969; Vogel/Waterbolk 1972; Ringer 2002). It is now also possible to define the upper age limit of the Early Szeletian to 41 ka cal BP thereby excluding the much younger ages obtained by Adams and Ringer (2004) from further discussion. Our new series of AMS ^{14}C dates implies that the Early Szeletian of Szeleta Cave is contemporaneous with the earliest Aurignacian occupations in the lowest layers of the neighboring Peskő Cave (Kom. Borsod-Abaúj-Zemplén/H) that ranges from 38 to 43 ka cal BP (Davies/Hedges 2008/2009). This in turn implies that the proposed co-occurrence of the Early Aurignacian and the Szeletian is a valid scenario at the time of the transition from the MP to UP in the Bükk region of Hungary (**fig. 8**). The new age model for Szeleta Cave is also consistent

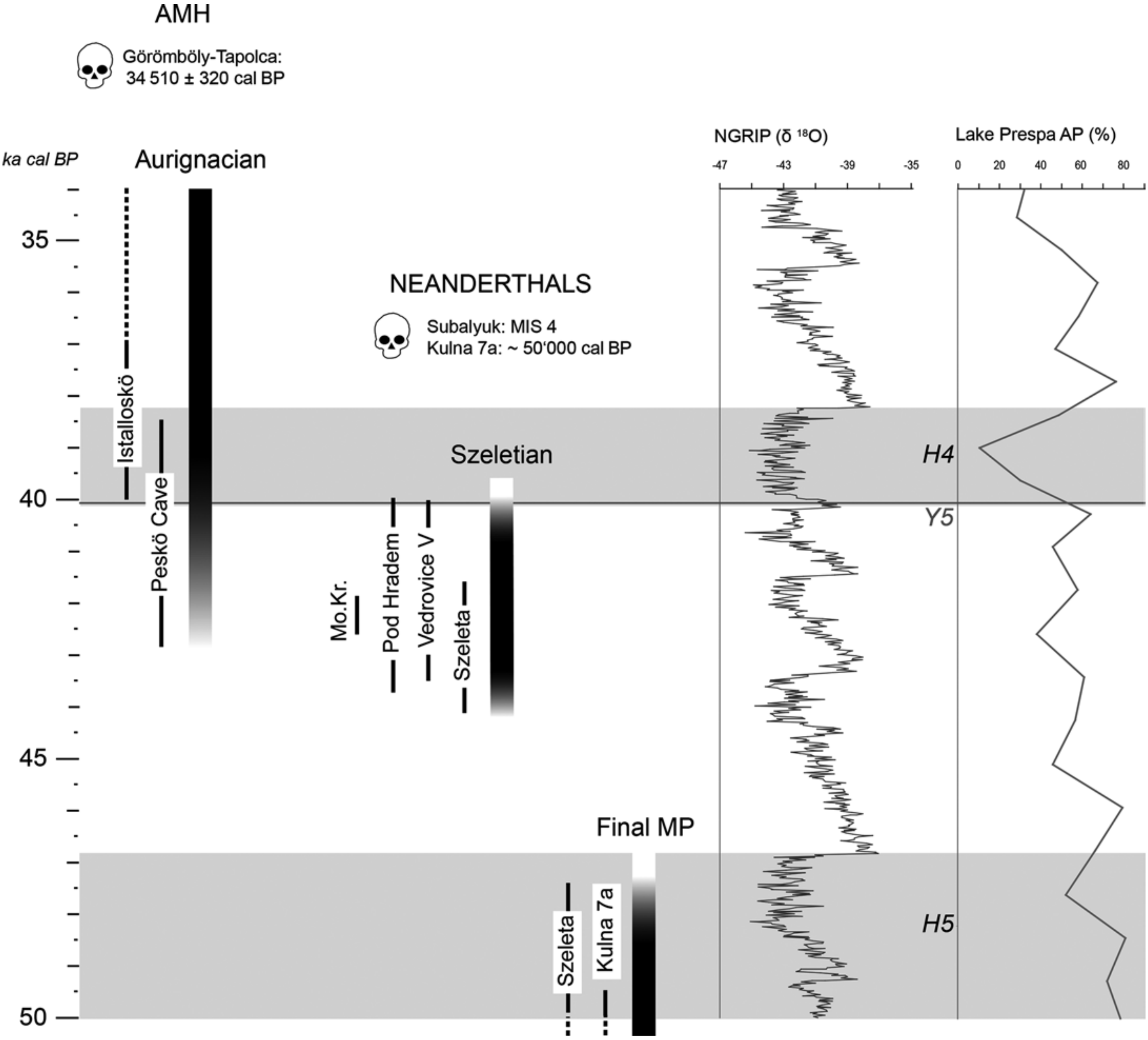


Fig. 9 New age model for the MP to UP transition in Central Europe based on calibrated radiocarbon ages for Early Aurignacian, Szeletian and late Middle Paleolithic deposits as well as human fossils. The Szeletian cultural unit seems to disappear shortly before the deposition of the Y5 tephra chronological marker and the following cold climatic event of Heinrich 4 (H4) as evidenced by the NGRIP δ ^{18}O record and the pollen record core (Co1215) of Prespa Lake (Panagiotopoulos et al. 2014). – The present Szeletian age model does not include the Moravsky Krumlov radiocarbon date of 27 775 ± 692 cal BP (GrN-28451) that is considered too young due to unknown reasons. The same holds true for the date of 42 840 ± 860 cal BP (GrN-6024) for layer 7a in Kůlna Cave that is considered too young for a final MP context. – (Illustration Th. C. Hauck).

with the time range of the Szeletian in Moravia which equally seems to begin at 44 ka cal BP and to end at 40 ka cal BP at sites such as Brno-Bohunice II (okr. Brno-město/CZ), Moravsky Krumlov IV (okr. Znojmo/CZ), Pod Hradem (okr. Brno-město/CZ), Vedrovice V (okr. Znojmo/CZ) and Želešice III (okr. Brno-venkov/CZ) (**fig. 8**; Valoch et al. 1993; Davies/Nerudová 2009; Haesaerts et al. 2013; Neruda/Nerudová 2013; Škrdla et al. 2014; Škrdla in print).

The Szeletian-Aurignacian contemporaneity leads to the question of what this means in terms of human replacement processes at the MP to UP transition in Central Europe. Anthropological reasoning has to proceed indirectly by considering the latest evidence of Neanderthals and the earliest presence of AMH as cornerstones. Despite its richness in caves and rock-shelters, the Hungarian Bükk Mountains delivered only a scarcity of human bones. Important are the finds from Istállóskő Cave (Kom. Heves/H) and Görömböly-Tapolca rock-shelter (Kom. Borsod-Abaúj-Zemplén/H). At Istállóskő, a lower right second molar of a 9-year-old child was discovered in one of the hearths in the lower Aurignacian layer (Vértes 1955). Whether the tooth can be undoubtedly affiliated with AMH or not is a subject of debate (Malán 1954; Tillier et al. 2006). Of similar age but unfortunately lacking archaeological context is the occipital bone from Görömböly-Tapolca that belongs to a modern human (Thoma/Vertés 1971; Davies/Hedges 2008/2009). These two discoveries prove that AMH frequented the Bükk Mountains at least 35 000 years ago and can therefore be seen as the makers of the Early UP. Considering however the earliest dates for the Aurignacian at Peskő Cave, it is reasonable to assume that AMH were already present in the region at least 8 ka earlier. Given this evidence, the fossil gap between the latest MIS 3 Neanderthals and earliest AMH spans more than 15 ka (**fig. 9**). It can be reduced to around 10 ka by including the earliest AMH remains from Mladeć (okr. Olomouc/CZ) and Peştera cu Oase (jud. Caraş-Severin/RO) into the model (Teschler-Nicola 2006; Zilhão et al. 2007).

However, it is still not known who exactly produced the Central Europe leaf-point industries. Until unequivocal evidence is given for the human species responsible for this transitional industry and regarding technological parameters (Richter 1997; Uthmeier 2004; Tostevin 2007), we follow the hypothesis that Neanderthals are the most likely candidates. This implies that two different human sub-species, Neanderthals and AMH, synchronously occupied the Bükk region between 45 and 40 ka.

CONCLUSION

Renewed geoarchaeological research in Szeleta Cave shows that certain parts of the cave are intact whereas others are seriously modified by post-sedimentary disturbance. Focusing archaeological research on the well-preserved sequences makes a formulation of new and more reliable age models possible for important cultural units. One such unit is the Szeletian for which Szeleta Cave is the eponymous site. The new AMS ^{14}C data for the Szeletian sequence have implications for the modeling of population replacements during the MP to UP transition in Central Europe. The new dates lend support to the model that Neanderthals were the makers of the final MP and the Szeletian in various Central European sites. The Early Aurignacian is instead related to the appearance of modern humans in the same area. If the latest Central European MP overlaps in age with the earliest UP, the co-existence of both human types is a valid scenario. The CologneAMS ^{14}C dates show that the final phase of the Bükk Mountain Szeletian in Hungary chronologically overlaps at least 3000 years with the Aurignacian in the same area. This in turn implies that the acculturation model is a possible explanation for the embedment of UP technology in a MP technological tradition (Allsworth-Jones 1986; Hublin et al. 2012). In this respect, the Szeletian, which may have its roots in the local Micoquian, may be the latest cultural manifestation of Neanderthal populations that adopted UP innovations such as blade and bladelet technology as well as bone tool production. Consequently, the Szeletian can no longer be designated as »transitional« as the transition to the UP occurred elsewhere and there is no local evolution from the MP to the UP. A similar phenomenon seems to be observable in other parts of Europe as well between 50 and 40 ka.

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Zusammenfassung / Summary / Résumé

Neandertaler oder frühe moderne Menschen?
Ein neues ^{14}C-Altersmodell und geoarchäologische Ergebnisse für die Schichtenabfolge des Szeletien in der Szeleta-Höhle (Kom. Borsod-Abaúj-Zemplén) in Ungarn

Die Szeleta-Höhle nahe Miskolc ist der namengebende Fundort für das Szeletien. Dieser Technokomplex erscheint zur Zeit der letzten Neandertaler in Mitteleuropa und wird oft als »Übergangsindustrie« bezeichnet, da die Artefaktinventare eine Kombination mittelpaläolithischer und jungpaläolithischer Elemente aufweisen. Aus diesem Grund ist ein verlässliches Altersmodell für das Szeletien entscheidend für das Verständnis der Zeit des Verschwindens der Neandertaler und des Aufkommens anatomisch moderner Menschen und ihre mögliche Gleichzeitigkeit in Mitteleuropa. Bisher erschwerten Ungenauigkeiten in der Datierungsmethodik und das Fehlen stratigraphischer Kontrolle bei der Probenentnahme eine genauere Altersbestimmung für das Szeletien in der Szeleta-Höhle. Aus diesem Grund blieb auch die Positionierung dieser wichtigen archäologischen Sequenz in Modellen, die den Übergang vom Neandertaler zum frühen modernen Menschen beschreiben, unklar. Wir erstellten deshalb ein neues Altersmodell für die Schichtenabfolge des Szeletien in Kombination mit geoarchäologischen Untersuchungen. Die neue Chronologie auf Basis von AMS ^{14}C-Daten, gemessen an *in situ* gefundenen Höhlenbärenknochen und Holzkohlen, zeigt, dass das Szeletien nicht an den Übergang zum frühen Jungpaläolithikum zu stellen ist, sondern gleichzeitig zu diesem existierte. Das Szeletien datiert in den gleichen Zeitraum wie das frühe Aurignacien in der Region. Während das Aurignacien dem frühen anatomisch modernen Menschen zugeschrieben wird, verbinden wir die Blattspitzen des Szeletien, die als wichtige kulturelle Erzeugnisse am Übergang vom Mittel- zum Jungpaläolithikum gelten, mit den späten Neandertalern.

Neanderthals or Early Modern Humans?
A Revised ^{14}C Chronology and Geoarchaeological Study of the Szeletian Sequence in Szeleta Cave (Kom. Borsod-Abaúj-Zemplén) in Hungary

Szeleta Cave near Miskolc is the eponymous site for the Szeletian technological group thought to reflect the last occurrence of Neanderthals in Central Europe. Because the Szeletian lithic industry contains both Middle Paleolithic and Upper Paleolithic elements, it is usually regarded as a »transitional« industry. As such, the development of a precise age model for the Szeletian would add substantial information to a period of population replacements in Europe. This concerns the timing of Neanderthal disappearance and their possible cohabitation with Anatomically Modern Humans in Central Europe. Previous age models for the Szeletian either suffered from deficiencies of dating methods and/or poor stratigraphic control of the dated samples. Therefore, population replacement models based on the key archaeological sequence of Szeleta Cave remain ambiguous. For this reason, we developed a new age model for the Szeletian sequence of this cave combined with a geoarchaeological investigation. Our new radiocarbon chronology, based on AMS ^{14}C dating results of *in situ* bone and charcoal samples, lends support to the argument that the Szeletian does not represent a transition towards, but rather contemporaneity with the Early Upper Paleolithic. The Szeletian now appears to be of the same age as the Early Aurignacian in the region which is linked to the early Anatomically Modern Humans. Consequently, Neanderthals are the likely authors of the famous Szeletian leaf points – bifacially shaped implements that are important cultural markers for the Middle to Upper Paleolithic transition.

Néandertal ou premier hommes modernes? Une nouvelle modélisation ^{14}C et des résultats géoarchéologiques sur les résultats de la stratigraphie du Szélétien de la grotte de Szeleta (Kom. Borsod-Abaúj-Zemplén) en Hongrie

La grotte de Szeleta près de Miskolc est le site éponyme du Szélétien. Ce techno-complexe apparaît à l'époque des derniers néandertaliens en Europe central et est souvent considéré comme un site de transition dans la mesure où l'inventaire des artefacts montre une combinaison d'éléments du Paléolithique moyen et final. C'est la raison pour laquelle un modèle chronologique fiable est décisif pour la compréhension de la période de la disparition des derniers néandertaliens et l'apparition d'hommes modernes et leur possible coexistence en Europe. Jusqu'alors les imprécisions de la méthode de datation et l'absence de contrôle de la stratigraphie de la grotte lors des prélèvements compliquaient une détermination plus précise du Szélétien de la grotte de Szeleta. Pour ces mêmes raisons, le positionnement de cette séquence archéologique importante pour la modélisation du passage de Néandertal aux premiers hommes modernes restait également peu claire. C'est pourquoi nous avons mis en place un nouveau modèle de datation pour la stratigraphie du Szélétien en combinant ces données avec des études géo-archéologiques. La nouvelle chronologie repose sur des datations ^{14}C AMS, mesurées sur des ossements d'ours des cavernes et des charbons *in situ*, elle montre que le

Szélétien n'est pas à placer à l'interface du Paléolithique récent mais lui est contemporain. Le Szélétien date de la même période que l'Aurignacien ancien de la région. Alors que l'Aurignacien est rattaché aux premiers hommes modernes, les feuilles de laurier du Szélétien étaient considérées comme d'importantes réalisations culturelles lors du passage entre Paléolithique moyen et récent pour les derniers néandertaliens. Traduction: L. Bernard

Schlüsselwörter / Keywords / Mots clés

Ungarn / Paläolithikum / ^{14}C-Altersmodell / Geoarchäologie / Neandertaler / moderne Menschen
Hungary / Paleolithic / ^{14}C age model / geoarchaeology / Neanderthals / modern humans
Hongrie / Paléolithique / modèle de datation ^{14}C / géo-archéologie / néandertaliens / hommes modernes

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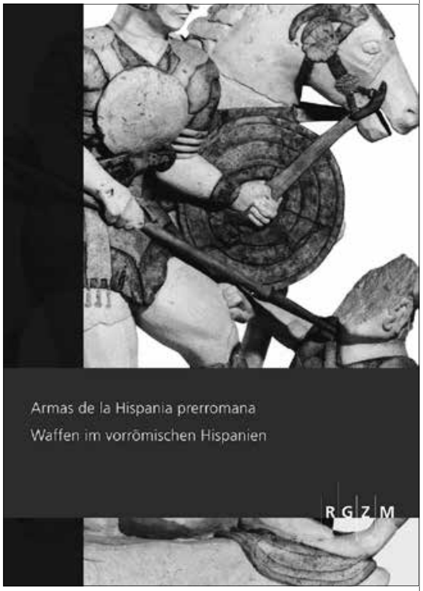

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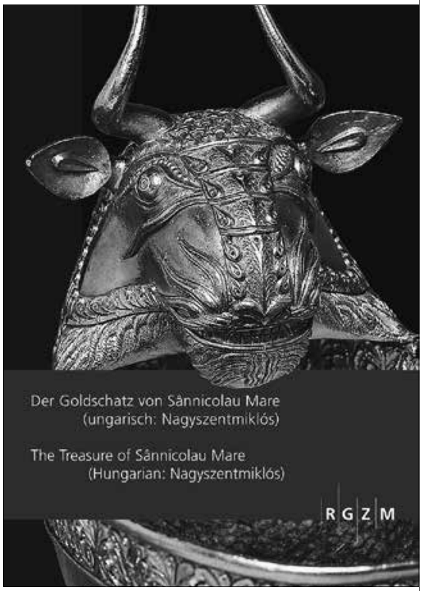

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Der Goldschatz von Sânnicolau Mare (ungarisch: Nagyszentmiklós)

Im Jahr 1799 wurde nahe dem Dorf Nagyszentmiklós (damals Königreich Ungarn, heute Sânnicolau Mare, Rumänien) einer der bedeutendsten Goldschätze des europäischen Frühmittelalters entdeckt. Er besteht aus 23 Goldgefäßen, insgesamt wiegen die Gegenstände fast 10 kg. Was den Schatz jedoch besonders wertvoll macht, sind die hohe Qualität der Verarbeitung, die exotische Schönheit einiger der Gefäße und vor allem, dass er eine einzigartige Quelle für die Erforschung von kulturellen Verbindungen zwischen der mediterranen Welt und den nomadischen Gesellschaften Eurasiens darstellt. Dazu haben das RGZM und die Antikensammlung des Kunsthistorischen Museums 2010 in Wien eine Tagung veranstaltet, deren Ergebnisse in teils stark erweiterter Form hier vorgestellt werden. Die Artikel befassen sich mit allgemeinen Fragen zum gegenwärtigen Forschungsstand, den Ergebnissen aus goldschmiedetechnischen Untersuchungen und Materialanalysen, den möglichen Zusammenhängen zwischen dem Schatz und der sasanidischen Kultur und den Inschriften des Goldschatzes im byzantinischen Kontext.

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