ANTHROPOLOGIA INTEGRA
15/2024/1
ČASOPIS PRO OBECNOU ANTROPOLOGII A PŘÍBUZNÉ OBORY
JOURNAL FOR GENERAL ANTHROPOLOGY AND RELATED DISCIPLINES

Isolated skeletal remains of anatomically modern humans from the Upper Palaeolithic of Central Europe

Vojtěch Zábojník

Department of Archaeology, Faculty of Arts, University of Hradec Králové, 500 03 Hradec Králové, Czech Republic
e-mail: zabojvo1@uhk.cz

Received 31st July 2023; accepted 15th May 2024

IZOLOVANÉ KOSTERNÍ NÁLEZY ANATOMICKY MODERNÍHO ČLOVĚKA Z MLADÉHO PALEOLITU STŘEDNÍ EVROPY

ABSTRAKT Příspěvek řeší problematiku izolovaných kosterních nálezů anatomicky moderního člověka (AMČ) z mladého paleolitu (MP). Cílem bylo přezkoumat ostatky AMČ a interpretovat nálezové okolnosti z lokalit, které se nachází na území Německa, Rakouska, Česka, Polska, Slovenska a Maďarska. Nálezy AMČ jsou často izolované a v některých případech i velmi fragmentované, proto je velmi obtížné interpretovat, které procesy zapříčinily tento stav. Nejčastější interpretace izolovanosti těchto nálezů se jeví biotičtí a abiotičtí činitelé, tedy geologické procesy, činnost šelem a člověka. Dále můžeme říci, že ze skeletálních nálezů AMČ jsou nejpočetnější fragmenty diafýz končetin. Pokud vezme v úvahu hustotu kostí na morfologii, pak je ale větší pravděpodobnost dochování kranio-dentálních prvků.

KLÍČOVÁ SLOVA Pohřební ritus; tafonomie; manipulace s lidskými těly; aurignacien; gravettien; magdalénien; fragmentárnost

ABSTRACT This research focuses on isolated skeletal remains of anatomically modern humans (AMH) dated to the Upper Palaeolithic (UP) in Central Europe. The review of AMH remains aims to interpret the circumstances of their discovery at paleoanthropological sites located in Germany, Austria, Czechia, Poland, Slovakia, and Hungary. These AMH remains are often isolated and, in some cases, highly fragmented, making it challenging to discern the processes responsible for their isolated status. Common interpretations of these findings point to both biotic and abiotic factors, including geological processes, carnivore activities, and even human actions. Notably, the diaphysis fragments of the limbs are the most numerous among AMH remains. However, when it comes to bone density and morphology, craniodental elements have a higher likelihood of preservation.

KEY WORDS Funeral rites; taphonomy; human body manipulation; Aurignacian; Gravettian; Magdalenian; fragmentation

INTRODUCTION

Isolated remains of AMH are infrequently described in comprehensive detail. Much of the scientific focus has traditionally centred on completely buried AMH individuals from the Upper Palaeolithic. Isolated cranial and post-cranial remains are often highly fragmented and are typically found in low quantities at archaeological and paleoanthropological sites. Exceptions exist, where a substantial accumulation of isolated remains has been discovered. Isolated remains are often documented upon discovery, but sometimes they are only identified during revisions of archaeological and archaeozoological collections, either in museums or scientific research institutions. Before and after the Second World War and in the 1960s and 1980s, extensive archaeological research was carried out, particularly when numerous human remains were unearthed. This led to the creation of systematic catalogues and databases containing fundamental information about these remains. However, as more remains were discovered and underwent new or refined dating, some were reclassified into different periods. This article utilizes specific analytical methods, such as aDNA or isotopic analyses, to enhance the understanding of AMH remains and to provide new insights into biotic and abiotic processes.

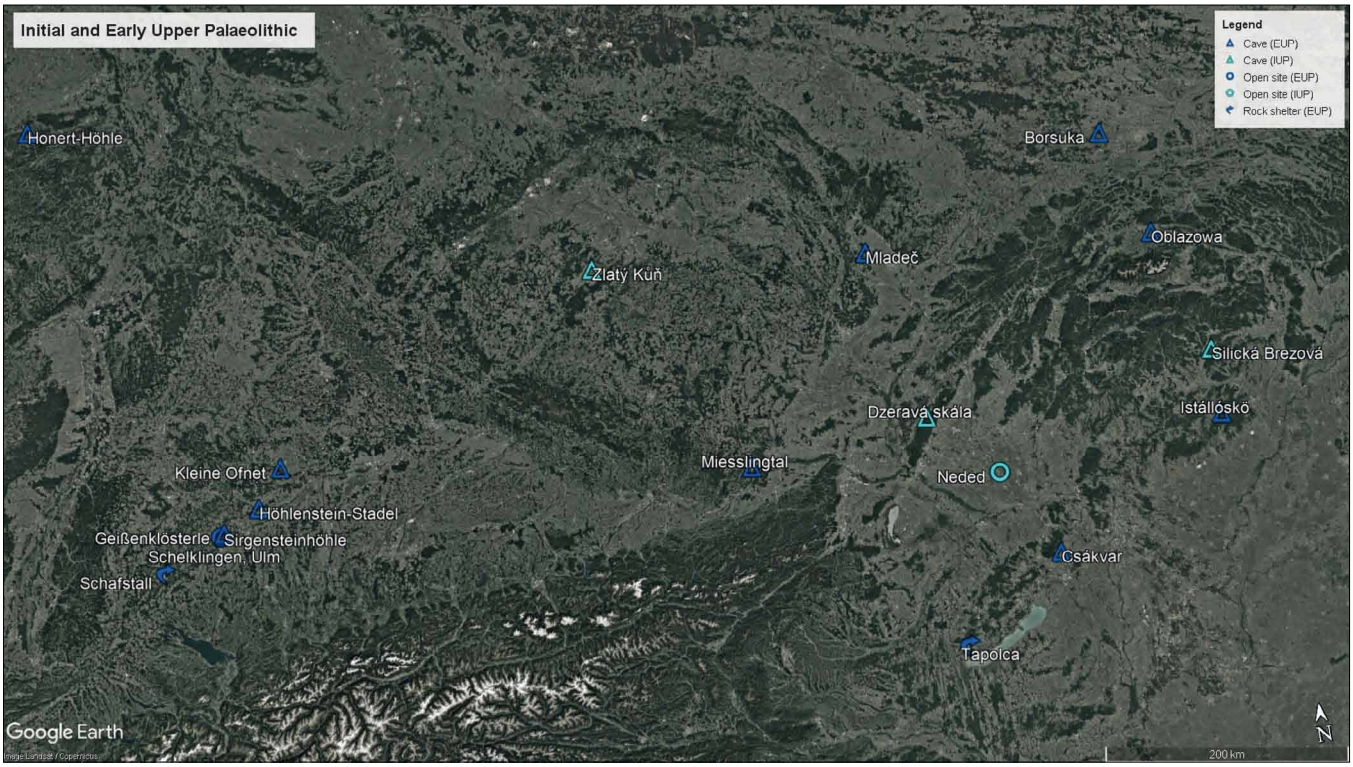

Fig. 1. Map illustrating key Initial (IUP) and Early Upper Palaeolithic (EUP) sites in Central Europe where fragmentary and isolated remains of anatomically modern humans have been found, including open-air, cave, and rock-shelter sites.

Country	*Locality*	*Locality type*	*AMH remains*	*Culture*	*References*
Germany	Geißenklösterle	Cave	Deciduous tooth	Aurignacian	Street et al. 2006, pp. 563–567
	Höhlenstein-Stadel	Open site	Permanent molar	Aurignacian	Street et al. 2006, pp. 563–567
	Honert-Höhle	Cave	Cranium*, mandible*, 11 teeth*	Aurignacian	Street et al. 2006, pp. 563–565
	Kleine Ofnet	Cave	Tooth	Aurignacian	Street et al. 2006, pp. 563–567
	Schafstall	Rock shelter	Permanent incisor, clavicle, phalanx	Aurignacian	Conard et al. 2016, pp. 88–101
	Schelklingen, Ulm	Open site	Permanent molar and canine	Aurignacian	Street et al. 2006, pp. 563–567
	Sirgensteinhöhle	Cave	2 permanent incisors and molar	Aurignacian	Sala and Conard 2016, p. 280
Austria	Miesslingtal	Cave	Mandible	Aurignacian	Smith and Ahern 2013, pp. 178–179
Czechia	Zlatý Kůň	Cave	Cranium, 5 vertebrae, 3 ribs	Initial Upper Palaeolithic	Kuželka 1997, pp. 247–249; Prüfer et al. 2021, pp. 820–825
	Mladeč	Cave	Skull*, 6 craniums*, 17 cranial fragments*, 9 maxillae*, 4 mandibles*, permanent canine*, 2 permanent premolars*, permanent molar*, 3 vertebrae*, 5 clavicles*, 2 scapulae*, 25 ribs*, 3 hip bones*, 7 humeri*, 5 radii*, 3 ulnas*, 15 metacarpals*, 12 femurs*, 8 tibiae*, 7 fibulae*, talus, calcaneus*, 2 metatarsals*, 6 phalanxes*	Aurignacian	Teschler–Nicola 2007, pp. 1–490
Poland	Oblazowa	Cave	2 phalanxes	Aurignacian	Trinkaus et al. 2014, pp. 1–10
	Borsuka	Cave	2 deciduous incisors, 4 deciduous molars	Aurignacian/Gravettian	Wilczyński et al. 2016, pp. 151–160
Slovakia	Dzeravá skala	Cave	Deciduous molar	Initial Upper Palaeolithic	Šefčáková 2007, pp. 35–437
	Neded	Cave	Mandible	Initial Upper Palaeolithic	Šefčáková 2007, pp. 39–40
	Silická Brezová	Cave	Permanent molar	Initial Upper Palaeolithic	Šefčáková 2007, pp. 41–42
Hungary	Csákvár	Cave	Metatarsal	Aurignacian	Oakley et al. 1971, p. 225
	Istállóskö	Cave	Permanent molar	Aurignacian	Smith and Ahern 2013, pp. 175–180
	Tapolca	Rock shelter	Cranium fragment	Aurignacian	Oakley et al. 1971, pp. 227–228

**Some or all of AMH remains are missing or destroyed*

Tab. 1. Provides a comprehensive record of anatomically modern humans (AMH) dating from the Initial and Early Upper Palaeolithic period. The table includes details such as country of discovery, locality, type of locality, AMH remains identified, associated cultural context, and corresponding references.

MATERIAL AND METHODS

Anatomically modern human remains are rare across Eurasia, Africa, Australia, and North America. The scarcity of precisely dated human fossils plays a pivotal role in discussions about the appearance of modern humans and the extinction of Neanderthals. However, there is compelling evidence of a wide range of Upper Palaeolithic burial practices that likely encompassed diverse burial techniques. Most of the graves are preserved in pits, with additional body manipulation practices

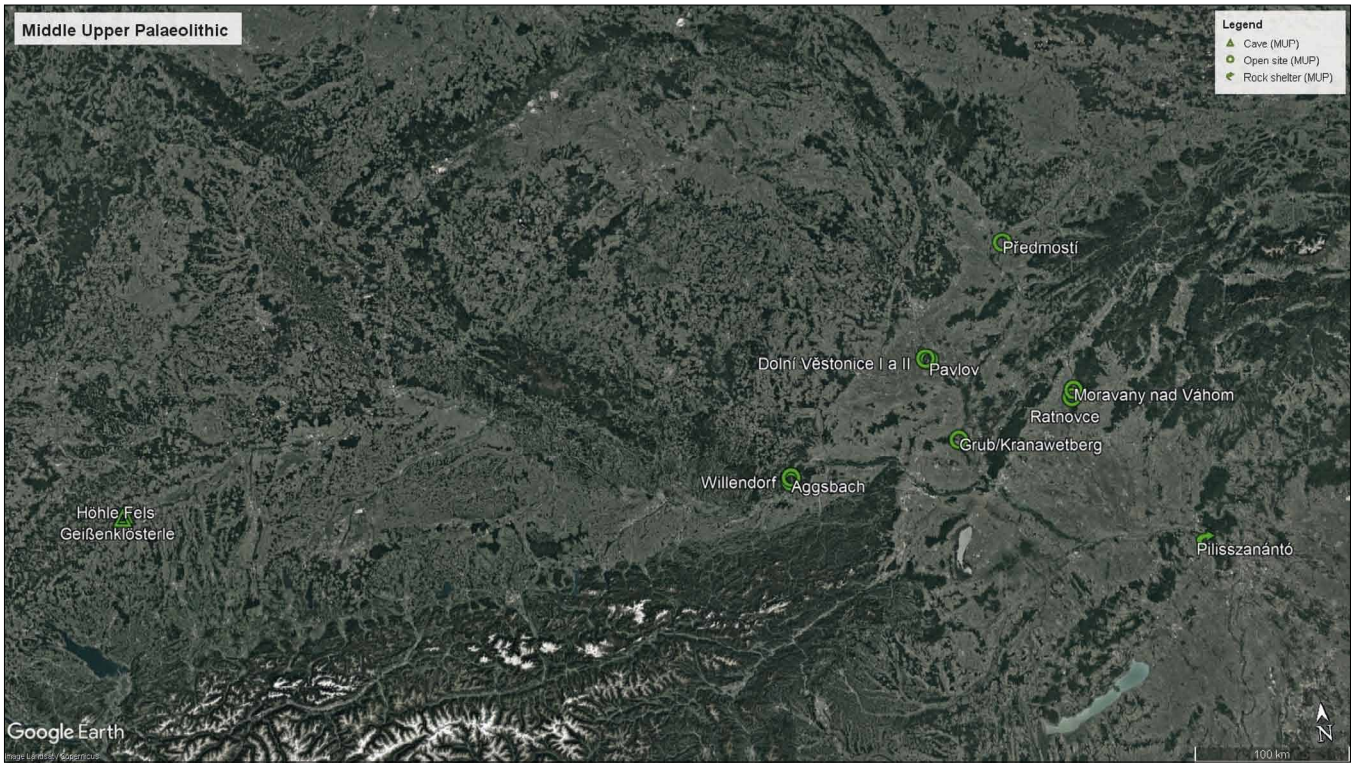

Fig. 2. Map illustrating key Middle Upper Palaeolithic (MUP) sites in Central Europe where fragmentary and isolated remains of anatomically modern humans have been found, including open-air, cave, and rock-shelter sites.

such as disarticulation, flesh removal, cannibalism, staining, and the transformation of skeletal and dental material into ornaments or vessels (Svoboda 2014, pp. 361–447; Svoboda 2016, pp. 19–20).

Initial (IUP) and Early Upper Palaeolithic (EUP) (46 – 32 ky BP)

The IUP anatomically modern human remains in Central Europe were found at Zlatý Kůň (Czechia) and likely at Dzeravá skala (Slovakia). The EUP cultures unified Europe culturally and yielded significant paleoanthropological findings at sites like Mladeč (Czechia), Oblazowa (Poland), and others (Fig. 1; Tab. 1). Due to their fragmented and isolated nature, it is challenging to definitively classify them as ritualized burials. No complete skeleton has been discovered from this period. Nevertheless, the preserved isolated skulls from the Czech site of Mladeč provide insights into the physical characteristics of EUP hunters. These individuals were characterized by their height and robust build, well-suited to the African climate (Smith and Ahern 2013, pp. 179–182; Svoboda 2014, pp. 364–378; Prüfer et al. 2021, pp. 820–825).

Middle Upper Palaeolithic (MUP) (32 – 22 ky BP)

The MUP cultures extended its influence across Eurasia, likely from Central Europe to Siberia. During this period, large-scale cave and open-air settlements were established in cold regions of Europe. These archaeological sites yielded isolated human skeletal fragments and teeth alongside relatively complete skeletons of MUP hunters (Fig. 2; Tab. 2). Due to the frozen ground during winter months, burial was typically delayed until spring when the soil thawed and became more workable. This practice of temporarily leaving the deceased exposed or in shallow pits in open environments likely contributed to the current fragmentary and isolated nature of the remains. Such open environments exposed the bodies to various external agents, including carnivores, other biotic factors, and geological or abiotic processes, which may have contributed to fragmentation (Wilson et al. 2007, pp. 6–16). Ritual practices may have driven purposeful human selection, leading to anthropogenic changes in the bones. In some cases, the presence of cut marks from stone tools raises the possibility of cannibalism, although careful examination is needed to distinguish these marks from other taphonomic processes. Among the modified human remains perforated human teeth are sometimes observed. Notably, isolated remains typically lack burial gifts and show no evidence of colouring with ochre (Trinkaus et al. 2000, pp. 1130–1131; Velemínská and Brůžek 2008, pp. 28–33; Smith and Ahern 2013, pp. 178–213; Sázelová and Hromadová 2020, pp. 1–2, 11–12).

Late Upper Palaeolithic (LUP) (22 – 14 ky BP)

The LUP cultures had its origins in the Cantabrian Mountains and eventually spread to western Russia. Knowledge of body manipulation practices during this period is limited, with known ritual burials primarily in France. The remains

Country	*Locality*	*Locality type*	*AMH remains*	*Culture*	*References*
Germany	Geißenklösterle	Cave	2 deciduous molars	Gravettian	Street et al. 2006, pp. 563–567
	Höhle Fels	Cave	Cranium, deciduous molar	Gravettian	Street et al. 2006, pp. 565–571
Austria	Aggsbach	Open site	Deciduous molar	Gravettian	Antl–Weiser 2000, pp. 275–282
	Grub/Kranawetberg	Open site	Deciduous incisor and molar	Gravettian	Teschler–Nicola et al. 2004, pp. 229–238
	Willendorf	Open site	Femur, mandible	Gravettian	Teschler–Nicola and Trinkaus 2001, pp. 452–463
Czechia	Dolní Věstonice I	Open site	12 crania*, deciduous incisor*, deciduous canine, deciduous molar, 3 permanent incisors*, 2 permanent premolars*, 7 permanent molars, tooth, femur	Gravettian	Sládek et al. 2000, pp. 10–134; Trinkaus and Svoboda 2006, pp. 27–29
	Dolní Věstonice II	Open site	Cranium, 4 cranial fragments, 2 deciduous incisors, 3 deciduous molars, permanent incisor, 4 permanent molars, clavicula, 2 ribs, humerus, 2 radii, ulna, 3 metacarpals, scaphoid, 2 femurs, 3 fibulae, 4 metatarsals, calcaneus, navicular, 4 phalanxes	Gravettian	Sládek et al. 2000, pp. 10–134; Trinkaus et al. 2000, pp. 1116–1131; Trinkaus and Svoboda 2006, pp. 27–29; Trinkaus et al. 2010, pp. 645–667
	Pavlov	Open site	8 cranial fragments, maxilla, 2 mandibles, 4 deciduous incisors, 3 deciduous canine, 9 deciduous molars, 8 permanent incisors, 2 permanent premolars, permanent premolar/molar, 2 permanent molars, 6 metacarpals, capitate, 2 trapeziums, 2 patellae, 4 tali, 4 calcanei, 4 naviculars, 2 cuboids, 15 metatarsals, 8 phalanxes	Gravettian	Trinkaus and Svoboda 2006, pp. 27–29; Trinkaus et al. 2010, pp. 645–667; Trinkaus et al. 2017, pp. 73–87; Trinkaus et al. 2019, pp. 71–82
	Předmostí u Přerova	Open site	6 skulls*, 3 craniums*, 7 cranial fragments*, 13 mandibles*, permanent incisor*, permanent canine*, molar*, clavicula*, 2 scapulas*, 3 hip bones*, 8 humeri*, 6 radii*, 9 ulnas*, 2 carpals, 9 metacarpals*, 15 femurs*, patella, 11 tibiae*, 10 fibulae*, 2 tali, 2 calcanei, 6 tarsal bones, 6 metatarsals, 2 phalanxes, fragments of long bones*, 2 parts of hand bones*	Gravettian	Velemínská and Brůžek 2008, pp. 21–112
Slovakia	Ratnovce	Open site	Permanent molar, permanent premolar	Gravettian	Šefčáková 2007, pp. 40–41
	Moravany nad Váhom	Open site	Maxilla	Gravettian	Šefčáková 2007, pp. 38–39
Hungary	Pilisszanántó	Rock shelter	Phalanx	Gravettian	Oakley et al. 1971, p. 226

**Some or all of AMH remains are missing or destroyed*

Tab. 2. Provides a comprehensive record of anatomically modern humans (AMH) dating from the Middle Upper Palaeolithic period. The table includes details such as country of discovery, locality, type of locality, AMH remains identified, associated cultural context, and corresponding references.

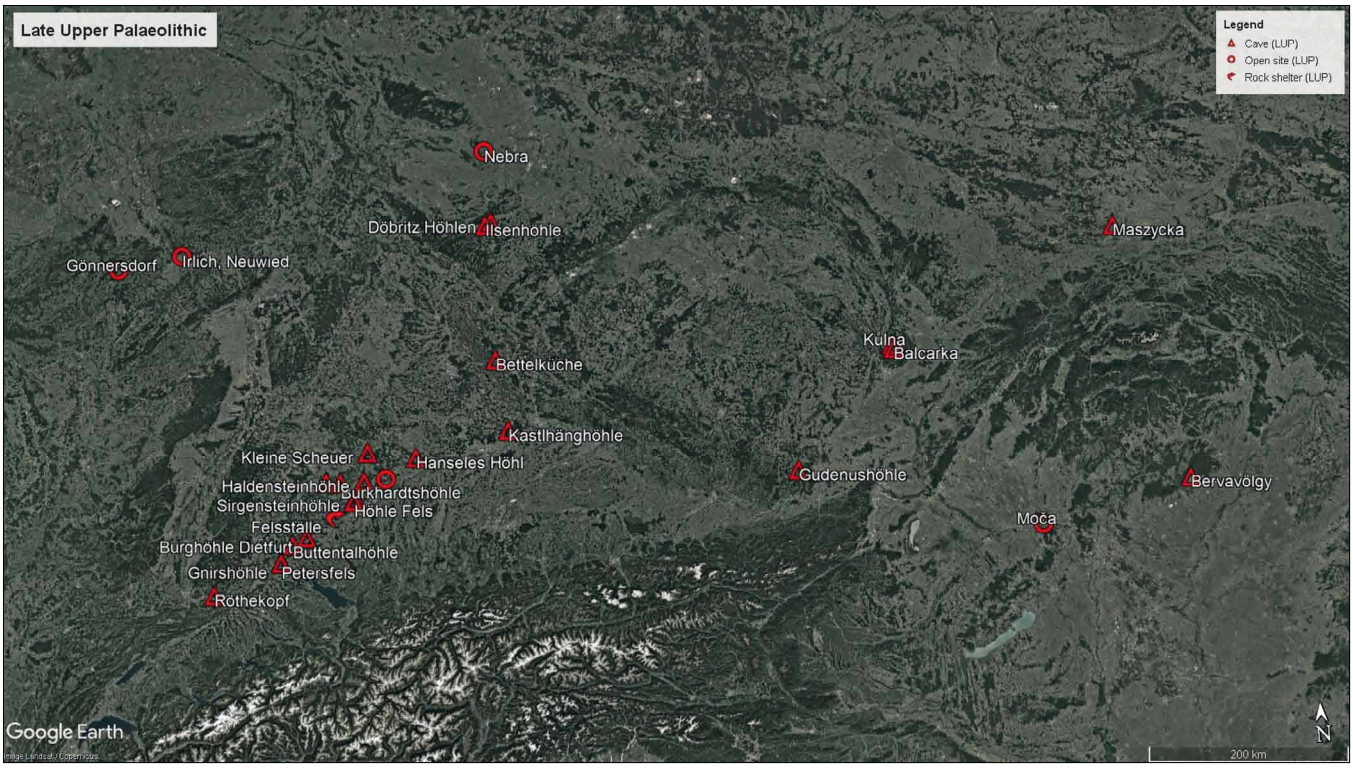

Fig. 3. Map illustrating key Late Upper Palaeolithic (LUP) sites in Central Europe where fragmentary and isolated remains of anatomically modern humans have been found, including open-air, cave, and rock-shelter sites.

are often isolated and fragmented, usually originating from caves and rock shelters (Fig. 3; Tab. 3) (Svoboda 2014, p. 437). The scarcity of complete burials suggests that fully buried individuals were not a prominent feature of burial rites during this period. An interesting fact is that burials do not have incisions made by stone artefacts, as is the case with isolated and fragmentary human remains, which may indicate a different relationship to the buried individual (Orschiedt 2013, pp. 117–120; Orschiedt et al. 2017a, pp. 435–437).

Isolated bone and tooth fragments in LUP cultures are often

Country	Locality	Locality type	AMH remains	Culture	References
Germany	Bamberghöhle	Cave	Cranium	Magdalenian	Götze 2011, pp. 119–121
	Brillenhöhle	Cave	Skull, cranium, 5 cranial fragments, 2 maxillae, mandible, deciduous incisor, permanent incisor, permanent canine, permanent molar, 2 vertebrae, clavicula, 2 scapulae, 9 ribs, 2 humeri, radius, ulna, trapezoid, hamate, metacarpal, fibula, 11 phalanxes	Magdalenian	Orschiedt 2002, pp. 4–18
	Burghöhle Dietfurt	Cave	3 cranial fragments, maxilla, 4 permanent incisors, 2 permanent canines, 4 permanent premolars, 2 permanent molars, 4 phalanxes	Magdalenian	Gietz 2001, pp. 465–472
	Burkhardtshöhle	Cave	Cranium	Magdalenian	Sala and Conard 2016, pp. 291–292
	Buttentalhöhle	Cave	Ulna	Magdalenian	Hahn 1995, pp. 19–80
	Döbritz Höhlen	Cave	Mandible, humerus, clavicula, phalanx	Magdalenian	Street et al. 2006, pp. 568–570
	Felsställe	Rock shelter	Deciduous molar	Magdalenian	Street et al. 2006, pp. 569–571
	Gnirshöhle, Engen	Cave	Femur	Magdalenian	Götze 2011, pp. 293–295
	Gönnersdorf	Open site	Tooth	Magdalenian	Street et al. 2006, p. 569
	Haldensteinhöhle	Cave	Radius, patella	Magdalenian	Street et al. 2006, p. 569
	Höhle Fels	Cave	2 femurs, fibula	Magdalenian	Street et al. 2006, pp. 565–571
	Höhlenstein-Lonetalaue	Open site	Permanent incisor	Magdalenian	Bolus et al. 1998, pp. 40–47
	Ilsenhöhle	Cave	Mandible	Magdalenian	Heberer 1939, pp. 77–80
	Kastlhänghöhle	Cave	2 mandibles	Magdalenian	Street et al. 2006, p. 572
	Kleine Scheuer	Cave	2 permanent incisors*, permanent premolar*	Magdalenian	Oakley et al. 1971, p. 204
	Nebra	Open site	Deciduous molar	Magdalenian	Grünberg 2002, pp. 25–51
	Petersfels	Cave	2 maxillae*, mandible, deciduous incisor, 2 permanent molars*, scapula, humerus, tibia, fibula	Magdalenian	Götze 2011, pp. 166–170
	Röthekopf	Cave	Cranium	Magdalenian	Street et al. 2006, pp. 562–572
	Sirgensteinhöhle	Cave	2 vertebrae, 3 unidentified bones	Magdalenian	Götze 2011, pp. 175–180
	Bettelküche	Cave	Permanent canine	LUP	Street et al. 2006, p. 569
	Hanseles Höhl	Cave	Permanent premolar and molar	LUP	Götze 2011, pp. 145–238
	Irlich	Open site	Cranium, 2 cranial fragments, deciduous molar, vertebra, 5 ribs, hip bone, ulna, trapezium, 2 femurs	LUP	Orschiedt et al. 2017b, pp. 203–216
Austria	Gudenushöhle	Cave	Permanent canine*	Magdalenian	Antl-Weiser 2000, p. 276
Czechia	Balcarka	Cave	Mandible, 2 teeth	Magdalenian	Svoboda 2014, p. 442
	Kůlna	Cave	Mandible, permanent incisor, permanent canine	Magdalenian	Valoch 1988, pp. 278–283
Poland	Maszycka	Cave	37 cranial fragments, 3 mandibles, permanent molar, tooth, vertebra, 3 claviculae, scapula, rib, phalanx, unidentified bone	Magdalenian	Orschiedt et al. 2017a, pp. 426–437
Slovakia	Moča	Open site	Cranium	LUP	Šefčáková 2007, pp. 37–38
Hungary	Bervavölgy	Cave	Mandible	Magdalenian	Oakley et al. 1971, p. 224

*Some or all of AMH remains are missing or destroyed

Tab. 3. Provides a comprehensive record of anatomically modern humans (AMH) dating from the Late Upper Palaeolithic period. The table includes details such as country of discovery, locality, type of locality, AMH remains identified, associated cultural context, and corresponding references.

interpreted as secondary burials. These human remains frequently display deliberate signs of manipulation, particularly cut marks. Among these fragmentary remains, craniodental elements dominate (Orschiedt 2013, p. 117). The most common are cutting injuries observed on cranial vaults and jaws, affecting individuals of all age groups and both sexes. Notably, many of the cut marks on the remains indicate a meticulous removal of flesh from the bone. Notches on the skull suggest separation from the cervical vertebrae and scalping of the skin. The cranial vaults may have served as ritual cups. Many researchers lean towards the belief that part of these secondary rites may have involved cannibalism, which was likely a regular and culturally supported activity. Convincing evidence of cannibalism lies in the damage caused by human chewing, driven by factors such as lower mobility, higher population density, and reduced food sources within a specific territory (Bello et al. 2011, pp. 1–10; Orschiedt 2013, pp. 117–120; Orschiedt et al. 2017a, pp. 435–437).

The human body and its remains, particularly the skull and teeth, held great significance for the LUP people. Human remains were transformed into pendants that individuals wore throughout their lives. While the exact meaning of these pendants remains unclear, they likely symbolized a reverent relationship between the pendant owner and the deceased person. They could also have served as victory trophies obtained from defeated enemies or simply functioned as ornaments (Orschiedt 2013, p. 127; Sázelová and Hromadová 2020, pp. 11–15).

Methodology

This paper relies on an extensive review of Czech and international literature, with key references including *Catalog of Fossil Hominids. Part II* by K. P. Oakley, B. G. Campbell and T. Molleson (1971), *A critical review of the German Paleolithic hominin record* by M. Street, T. Terberger and J. Orschiedt (2006) and *The origins of modern humans: biology reconsidered* by F.H. Smith and J.C. Ahern (2013). These publications provide invaluable insights into anatomically modern humans from the Upper Palaeolithic on both regional and global scales. At the same time, the gathered information underwent continuous review and was cross-referenced with publications related to discoveries, re-discoveries, and methodological advancements, including genetic and isotopic analyses, as well as revisions of archaeological contexts.

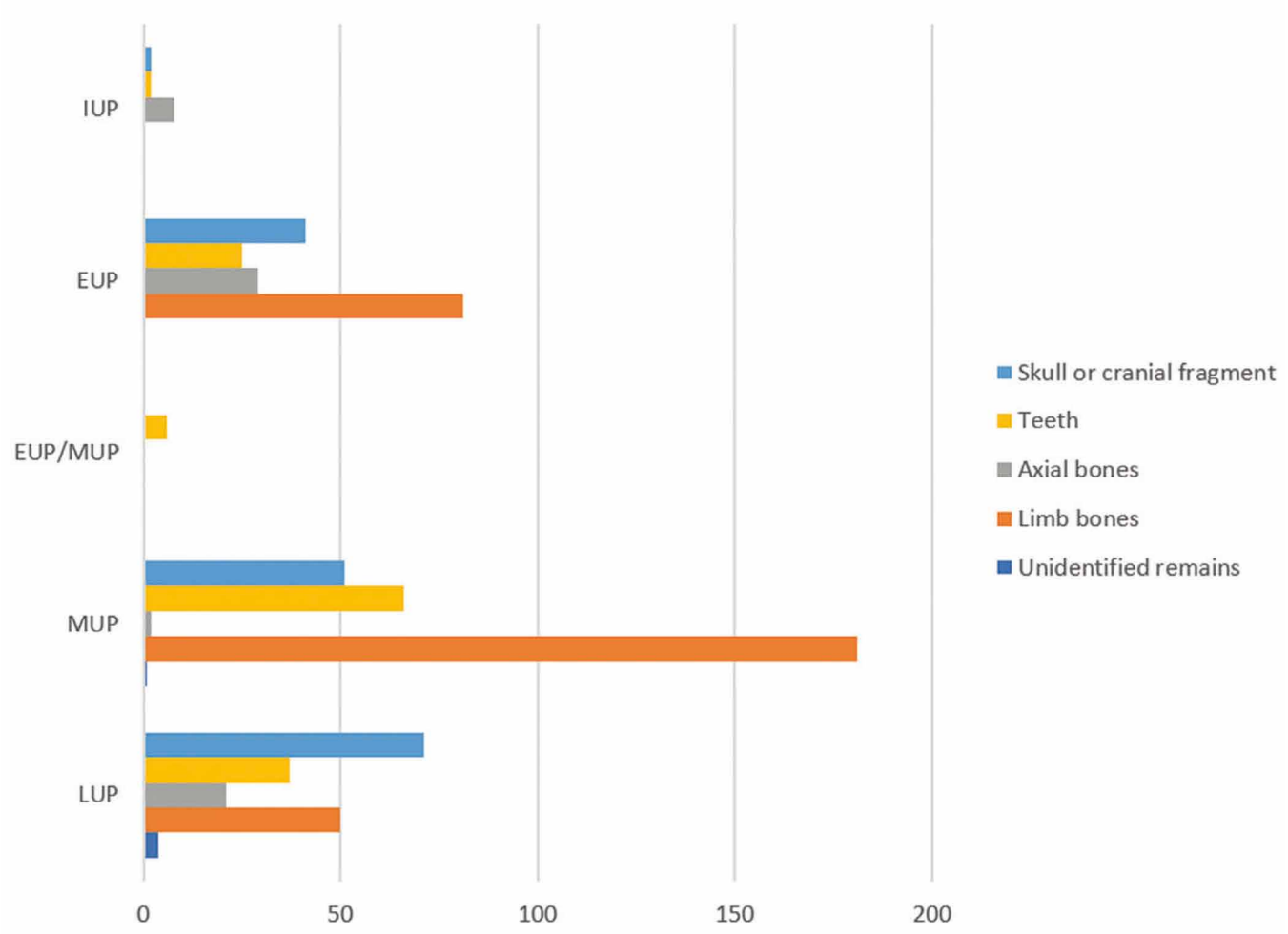

Fig. 4. Summary of AMH remains from the Upper Palaeolithic period. The graph displays the total number of skulls or cranial fragments, teeth, limb bones, axial bones, and unidentified bones discovered for each period.

RESULTS AND INTERPRETATIONS

A total of approximately 678 isolated AMH bones and teeth were identified (Fig. 4), sourced from 38 cave sites, 4 rock shelters, and 16 open sites. While Czechia has the highest concentration of isolated bone and teeth remains, it's important to consider the data in a broader geographical context, transcending recent national borders.

Limb bones were found at 46% of the studied sites, followed by skull bones and isolated teeth, which were found in approximately 65% of the locations. Approximately 10% of the studied remains show anthropogenic influences, such as perforation, colouring, incisions, or modifications, primarily on craniodental remains from the LUP period. The fragmentary nature and isolation of human remains can be attributed to a variety of factors (Fig. 5). Gradual degradation of soft tissues leads to the loss of anatomical integrity within the skeleton. Consequently, bones disarticulate and become spatially separated. These conditions result from taphonomic processes, which encompass both abiotic and biotic factors. It's worth noting that the specific type of locality where human remains are discovered plays a crucial role, as taphonomic processes have distinct effects in open and cave environments (Lyman and Lyman, 1994, p. 160).

Abiotic processes that could have contributed to the isolation and fragmentary condition of the human remains include various factors. For instance, continuous thawing and freezing of the soil, as observed in sites like Dolní Věstonice and Pavlov, can lead to soil erosion. The displacement of sediments and layers due to the pressure of overlying geological formations is another factor to consider. Seasonal fluctuations in soil pH levels may impact the preservation of bones and teeth, with lower pH values increasing the likelihood of bone deterioration, particularly in children's bones (e.g., Borsuka). Furthermore, temperature variations, soil moisture levels, proximity to water sources, exposure to wind, and subsequent weathering can lead to the peeling of outer bone and tooth layers (Gordon and Buikstra 1981, pp. 569–570; Nielsen–Marsh et al. 2007, pp. 1523–1530; Wilson et al. 2007, pp.14–16; Pilloud et al. 2016, pp. 1–7).

Biotic processes, on the other hand, encompass various influences. Bioerosion, often attributed to microbes, contributes

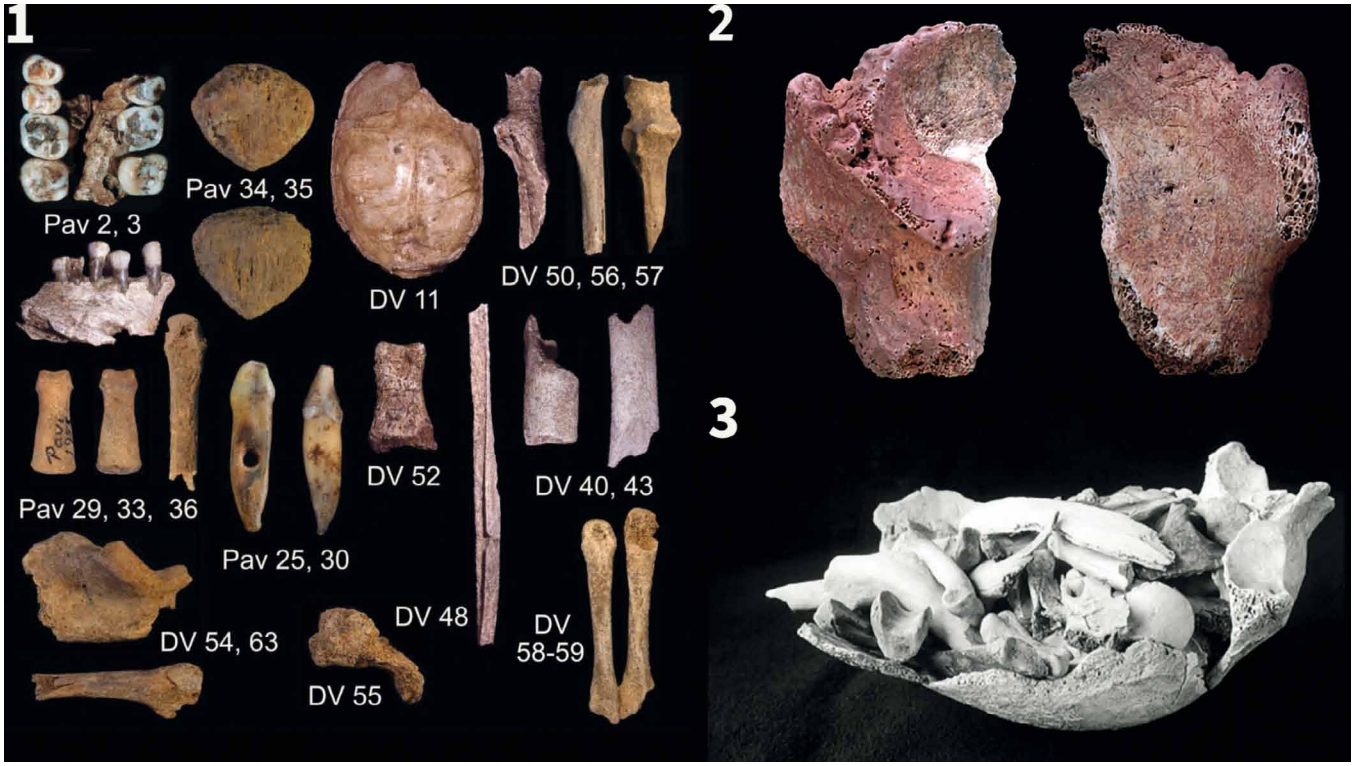

Fig. 5 Depicts a compilation of fragmented remains attributed to anatomically modern humans (AMH) from the Upper Palaeolithic period. The illustration showcases: 1. Instances of isolated AMH remains recovered from the MUP open sites Dolní Věstonice II and Pavlov (Trinkaus et al. 2017, p. 78); 2. Fragments of coloured os ischii retrieved from the LUP open site Irlich (Orschiedt et al. 2017b, p. 211); 3. Fragmentary AMH skull cup along with isolated remains originating from the LUP cave site Brillenhöhle (Orschiedt 2002, p. 15).

to bone destruction. Microorganisms create tunnels within bones, increasing their porosity and susceptibility to decay. Plant roots from the local flora can also have a corrosive effect, disrupting the outer surface of bones. Additionally, insects, scavengers, and larger animals can significantly impact the remains. These agents may disturb the primary deposition of remains, scattering them throughout the area, or even transporting them into their dens, resulting in an artificial accumulation of human remains. Furthermore, the deliberate selection of bones and teeth as part of funeral rituals by humans could have played a role in the isolation of these remains (e.g., Brillenhöhle, Maszycka) (Sorg and Haglund 1996, pp. 375–378; Trueman and Martill 2002, pp. 378 –381; Orschiedt 2013, pp. 123–127).

The diaphyses of long bones are predominantly found due to their higher preservation rate, which results from the greater mineral density in the cortical tissue. In contrast, the distal and proximal parts of long bones consist of spongy bone tissue, which is more porous and less resistant to external influences (Lyman and Lyman 1994, pp. 72–78; Sorg and Haglund 1996, pp. 295–315, 375–376). Teeth exhibit a high degree of preservation, primarily due to their significant inorganic component. The isolation of teeth may occur when soft tissues no longer firmly anchor them within the jaw alveoli, where they are attached by ligaments. Single-rooted teeth and those with incomplete roots are particularly prone to falling out. In the case of children, spontaneous loss of teeth during puberty might occur (e.g., Felsställe, Geißenklösterle). For permanent teeth, factors such as medical procedures, injury, and natural ageing can also contribute to their isolation (Lyman and Lyman 1994, pp. 79–81; Sorg and Haglund 1996, pp. 375–376, 383–384; Sázelová and Hromadová 2020, pp. 1 –12). Skulls often exhibit fragmentation, as sutures can loosen and anatomical parts may disintegrate after death. Within the anatomical parts of the skull, jaws are frequently preserved because of their higher mineralization and hardness, which makes them more resistant to decay (e.g., Miesslingtal, Willendorf). Additionally, brain parts and facial bones of the skull, being flat bones, better withstand pressure (Lyman and Lyman 1994, pp. 97–100; Sorg and Haglund 1996, pp. 328–332, 383–384).

DISCUSSION

Consequently, each archaeological site bearing paleoanthropological remains is unique, and potentially affected by a range of taphonomic processes. This diversity makes it challenging to make a general determination of the specific factors or influences responsible for the isolation and fragmentation of these remains. To arrive at a more accurate understanding of why a particular tooth or bone is isolated or fragmented, it is essential to undertake systematic research at each location and conduct a detailed analysis of each tooth and bone. This meticulous examination can help shed light on the underlying

causes of isolation and fragmentation, offering insights into why complete individuals are rarely found on a larger scale. It is crucial to consider the interplay of various taphonomic processes, both biotic and abiotic, in this assessment (Sorg and Haglund 1996, pp. 328–384; Nielsen–Marsh et al. 2007, pp. 1523–1530).

Additionally, one often overlooked factor that may contribute to the isolation and fragmentation of remains is the method of finding and excavating these relics. The research methods employed could have a notable impact on the isolation and fragmentary nature of the bones and teeth. In some cases, remains may not be discovered through systematic research. During excavation, layer mixing may occur due to the influence of researchers or geological factors, making it challenging to accurately classify the remains into specific Upper Palaeolithic cultural periods. The extent of research conducted also plays a role, as varying research objectives can result in methodological disparities, leading to specific incompatibilities within the collected evidence. Furthermore, there's the possibility that some remains have been mistakenly identified as faunal rather than human remains (Sázelová and Hromadová 2020, pp. 1 –12).

CONCLUSION

Isolated bones and teeth of anatomically modern humans from the Upper Palaeolithic abound. These remains originate from a variety of sources, including rock shelters, caves, and open sites. Among the skeletal elements, the anatomical parts of the limbs, particularly diaphyses, are the most prevalent. Their relatively robust structure contributes to better preservation. Isolated teeth and skull bones also constitute a substantial proportion of findings in most of the surveyed locations. It remains a complex challenge to definitively determine whether deviations from the burial practices of completely interred individuals occurred, primarily due to the unknown histories of individual bones and teeth. Notably, isolated bones and teeth do not exhibit the presence of dye or ornaments. Interestingly, the discovery of dye and ornaments in caves near isolated human remains could suggest the presence of potential memorial altars.

ACKNOWLEDGEMENTS

This study is based on the diploma thesis by Zábojník (2021). The author would like to express gratitude to Sandra Sázelová and the colleagues from Dolní Věstonice for their invaluable guidance and helpful insights.

REFERENCES

Antl-Weiser, W. (2000): Die menschlichen Zahnfunde von der Gravettienfundstelle Grub/Kranawetberg bei Stillfried an der March, Niederösterreich. *Archaeologia Austriaca*, 84: 199–212. https://www.researchgate.net/publication/273057954_Der_menschliche_Zahn_aus_der_Gravettien–Fundstelle_von_Aggsbach_Niederosterreich_–_eine_Revision

Bello, S. M. – Parfitt, S. A. – Stringer, Ch. B. (2011): Earliest directly–dated human skull–cups. *PLoS One*, 6(2): 1–12. https://doi.org/10.1371/journal.pone.0017026

Götze, J. J. (2011): Tote im Bauch der Erde–Steinzeitliche Menschenreste aus Höhlen und Abris Südwestdeutschlands und angrenzenden Gebieten. https://publikationen.uni-tuebingen.de/xmlui/handle/10900/46919

Gordon, C. C. – Buikstra, J. E. (1981): Soil pH, bone preservation, and sampling bias at mortuary sites. *American Antiquity*, 566–571. https://doi.org/10.2307/280601

Kuželka, V. (1997): The postcranial skeletal remains of Pleistocene man from Zlatý kůň near Koněprusy (Bohemia). *Anthropologie (1962–)*, 247–249. https://www.jstor.org/stable/26295770

Lyman, R. L. – Lyman, C. (1994): *Vertebrate taphonomy*. Cambridge University Press.

Nielsen–Marsch, Ch. M. – Smith, C. I. – Jans, M. M. E. – Nord, A. – Kars, H. – Collins, M. J. (2007): Bone diagenesis in the European Holocene II: taphonomic and environmental considerations. *Journal of Archaeological Science*, 34(9): 1523–1531. https://doi.org/10.1016/j.jas.2006.11.012

Oakley, K. P. – Campbell, B. G. – Molleson, T. (1971): *Catalogue of fossil hominids. Part II*. London, Trustees of the British Museum (Natural History).

Orschiedt, J. (2002): Secondary burial in the Magdalenian: the Brillenhöhle (Blaubeuren, southwest Germany). *PALEO. Revue d'archéologie préhistorique*, 14: 241–256. https://doi.org/10.4000/paleo.1504

Orschiedt, J. (2013): Bodies, bits and pieces: burials from the Magdalenian and the Late Palaeolithic. *Pleistocene Foragers: Their Culture and Environment: Festschrift in honour of Gerd–Christian Weniger for his Sixtieth Birthday*, 117–132. https://www.academia.edu/3676838/Bodies_bits_and_pieces_Burials_from_the_Magdalenian_and_the_Late_Palaeolithic

Orschiedt, J. – Schüler, T. – Połotowicz – Bobak, M. – Bobak, D. – Kozłowski, S. K. – Terberger, T. (2017a): Human Remains from Maszycka Cave (woj. małopolskie/PL): the Treatment of Human Bodies in the Magdalenian, 423–439. https://doi.org/10.5281/zenodo.1208071

Orschiedt, J. – Kierdorf, U. – Schultz, M. – Baales, M. – Von Berg, A. – Flohr, S. (2017b): The Late Upper Paleolithic human remains from Neuwied-Irlich. A rare find from the Late Glacial of Central Europe. *Quartär*, 64: 203–216. https://doi.org/10.7485/QU64_9

Pilloud, M. A. – Megyesi, M. S. – Truffer, M. – Congram, D. (2016): The taphonomy of human remains in a glacial environment. *Forensic science international*, 261: 1–8. https://doi.org/10.1016/j.forsciint.2016.01.027

Prüfer, K. – Posth, C. – Yu, H. – Stoessel, A. – Spyrou, M. A. – Deviese, T. – Mattonai, M. – Ribechini, E. – Higham, T. – Velemínský, P. – Brůžek, J. – Krause, J. (2021): A genome sequence from a modern human skull over 45,000 years old from Zlatý kůň in Czechia. *Nature Ecology & Evolution*, 5(6): 820-825. https://doi.org/10.1038/s41559-021-01443-x

Sala, N. – Conard, N. (2016): Taphonomic analysis of the hominin remains from Swabian Jura and their implications for the mortuary practices during the Upper Paleolithic. *Quaternary Science Reviews*, 150: 278–300. https://doi.org/10.1016/j.quascirev.2016.08.018

Sázelová, S. – Hromadová, B. (2020): Human teeth pendants from the Mid–Upper Paleolithic sites Pavlov I and Dolní Věstonice I, Czech Republic. *Archaeological and Anthropological Sciences*, 12(2): 41. https://doi.org/10.1007/s12520-019-01008-x

Sládek, V. – Trinkaus, E. – Hillson, S. W. – Holliday, T. W. (2000): *The people of the Pavlovian. Skeletal catalogue and osteometrics of the Gravettian fossil hominids from Dolni Vestonice and Pavlov*. Dolni Vestonice Studie, Svazek 5.

Smith, F. H. – Ahern, J. C. (2013): *The origins of modern humans: biology reconsidered*. John Wiley & Sons.

Sorg, M. H. – Haglund, W. D. (1996): *Forensic taphonomy: the postmortem fate of human remains* (ed.). CRC Press.

Street, M. – Terberger, T. – Orschiedt, J. (2006): A critical review of the German Paleolithic hominin record. *Journal of Human Evolution*, 51(6): 551–579. https://doi.org/10.1016/j.jhevol.2006.04.014

Svoboda, J. A. (2014): *Předkové. Evoluce člověka*. Academia.

Svoboda, J. A. (2016): *Dolní Věstonice–Pavlov*. Academia.

Šefčáková, A. (2007): Pleistocénne Antropologické nálezy z územia Slovenska. *Acta Rer Natur Mus Nat Slov*, 53: 26–45. https://www.academia.edu/3134897/Pleistoc%C3%A9nne_antropologick%C3%A9_n%C3%A1lezy_z_%C3%BAzemia_Slovenska_Pleistocene_anthropological_finds_from_the_territory_of_Slovakia_

Teschler-Nicola, M. E. (2007): *Early modern humans at the Moravian Gate: The Mladec caves and their remains* (ed.). Springer Science & Business Media, 2007.

Trinkaus, E. – Svoboda, J. A. – West, D. L. – Sládek, V. – Hillson, S. W. – Drozdová, E. – Nývltová Fišáková, M. (2000): Human remains from the Moravian Gravettian: Morphology and taphonomy of isolated elements from the Dolní Věstonice II site. *Journal of Archaeological Science*, 27(12): 1115–1132. https://doi.org/10.1006/jasc.1999.0501

Trinkaus, E. – Svoboda, J. A. (2006): *Early modern human evolution in central Europe: the people of Dolní Věstonice and Pavlov* (ed.). Oxford University Press on Demand.

Trinkaus, E. – Svoboda, J. A. – Wojtal, P. – Nývltová Fišáková, M. – Wilczyński, J. (2010): Human remains from the Moravian Gravettian: morphology and taphonomy of additional elements from Dolní Věstonice II and Pavlov I. *International Journal of Osteoarchaeology*, 20(6): 645–669. https://doi.org/10.1002/oa.1088

Trinkaus, E. – Wojtal, P. – Wilcyński, J. – Sázelová, S. – Svoboda, J. A. (2017): Palmar, patellar, and pedal human remains from Pavlov. *PaleoAnthropology*, 73–101. https://doi:10.4207/PA.2017.ART106

Trinkaus, E. – Sázelová, S. – Svoboda, J. (2019): Pieces of people in the Pavlovian: Burials, body parts and bones in the earlier Upper Palaeolithic. *Human Remains and Violence: An Interdisciplinary Journal*, 5(1): 70–87. https://doi.org/10.7227/HRV.5.1.6

Trueman, C. N. – Martill, D. M. (2002): The long–term survival of bone: the role of bioerosion. *Archaeometry*, 44(3): 371–382. https://doi.org/10.1111/1475-4754.t01-1-00070

Valoch, K. (1988): Die Erforschung der Kůlna Höhle 1961–1976. Anthropos. *Studies in Anthropology, Paleoethnology, Palaeontology and Quaternary Geology*.

Velemínská, J. – Brůžek, J. (2008): *Early Modern Humans from Predmosti near Prerov, Czech Republic: A new reading of old documentation*. Prague Academia.

Wilczyński, J. – Szczepanek, A. – Wojtal, P. – Diakowski, M. – Wojenka, M. – Sobieraj, D. (2016): A mid Upper Palaeolithic child burial from Borsuka Cave (southern Poland). *International Journal of Osteoarchaeology*, 26(1): 151–162. https://doi.org/10.1002/oa.2405

Wilson, A. S. – Janaway, R. C. – Holland, A. D. – Dodson, H. I. – Baran, E. – Pollard, A. M. – Tobin, D. J. (2007): Modelling the buried human body environment in upland climes using three contrasting field sites. *Forensic science international*, 169(1): 6–18. https://doi.org/10.1016/j.forsciint.2006.07.023

Zábojník, V. (2021): *Izolované kosterní nálezy anatomicky moderního člověka z mladého paleolitu*. Brno. Diplomová práce. Masarykova Univerzita. https://is.muni.cz/auth/th/tbd4v/Diplomova_prace_Bc_Vojtech_Zabojnik.pdf