

TITLE PAGE

Title: The archaeology of overburden: method within the madness at Švédův stůl, Czech Republic

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Highlights

- Identify intact contexts within a spoil heap outside an important Palaeolithic site in Czech Republic and compare materials and sediments with remnant deposits from earlier excavations at this site.
- Provide new archaeological insights into a site that is important for research relating to the Czech Palaeolithic.
- Demonstrate the powerful role played by high resolution XRF (ED-XRF and Itrax) analyses for unravelling complexities relating to sediment formation within these features.
- Provide a new methodology for excavating overburden including linking this in with results from previous site excavations.
- Draw attention to a 21st century archaeology phenomenon in which coarse-grained excavation of spoil occurs in search of artefacts missed by 19th and early 20th century archaeologists and suggest the pressing need to collect all surviving data before these features (like remnant deposits from associated Palaeolithic cave sites) are gone.

ABSTRACT
In the nineteenth and early to mid-twentieth centuries, a rush to better understand the European Palaeolithic led to the substantive removal of deposits from limestone caves. In the 21st century the situation has changed substantially. Many caves are now excavated, leaving behind a human-made environment of diminished cave sediments and large spoil heaps, with the latter now targeted by those searching for artefacts missed during the original excavations. In an age in which archaeologists are increasingly attempting to balance their roles as cultural heritage educators and destroyers, the question remains - how much do we know about the taphonomy of these features? In this paper we report results from the excavation of a large spoil heap outside Švédův Stůl Cave, in the Moravian Karst region of Czech Republic. Results show heterogeneous sediment formation (revealed primarily through their field characteristics and ED-XRF and Itrax geochemical analyses) and patterns in artefact distributions (evident through assessment of Iron Age, Neolithic and modern artefacts). This allows partial context to be provided for some artefacts and a methodology to be developed for excavation of overburden.

KEYWORDS: Archaeological Spoil; closed contexts; geoarchaeology; geochemical analyses; Czech Palaeolithic

1. INTRODUCTION

The role of the archaeologist as “creator or destroyer” has long been debated (Frankel 1993; see also Carver 2006, 2012; Lucas 2001: 35). Excavation is an “unrepeatable experiment”, with results and conclusions influenced by human subjectivities (e.g. Whiteley 2017). Technologies improve, potentially also methodologies, but will there be anything left to excavate? Conversely, archaeology reveals an important material inventory, which may inform protection of cultural heritage (Carver 2006; Frankel 1993; Lucas 2001). Archaeologists (perhaps paradoxically) may assume the role of stakeholders for protection of cultural heritage directing the public eye to regions that would otherwise go under the radar (e.g. Palmyra in Syria and Juukan Gorge and Burrup Peninsula in Western Australia; Baird and Zamash 2019; Davidson 2011; Wensing 2021).

As a destructive and creative process, archaeologists recognise that archaeological practice and stratigraphic complexities both require careful documentation (Carver 2012: 19; Roosevelt *et al.* 2015). Moreover, careful excavation and detailed analysis are considered vital for developing robust settlement histories, moving beyond empirically flawed classificatory systems and “phantom cultures” (Barton and Neeley 1996: 14). This is self-evidently important when it comes to *in situ* deposits, however what are our responsibilities when it comes to excavation of spoil or back-fill?

In recent years paucity of *in situ* deposits within European limestone caves has prompted some archaeologists to innovate, excavating adjacent overburden (e.g. Conard et al. 2015; Dutkiewicz 2015). An explicit aim of many of these studies is recovering artefacts overlooked by the original excavators (e.g. Conard et al. 2015). Excavation of discarded sediments at Vogelherd in southern Germany between 2005-2012, for example, resulted in the discovery of figurines, personal ornaments and stone artefacts (see Dutkiewicz 2015 for a review). At Feldhofer Cave (in western Germany), excavations in 1997 and 2000 yielding 62 human skeletal fragments and large quantities of Palaeolithic artefacts and faunal remains (Schmitz *et al.* 2002). Overburden at Fontana Nuova di Ragusa in southern Sicily also revealed human remains (a parietal, a frontal fragment, a talus, a left and right maxillary) (Chilardi *et al.* 1996).

The challenge for each study has been establishing cultural material chronology and provenance within deposits that have been substantially disturbed. To date studies have relied on artefact typo-chronologies and direct radiocarbon dating of organic materials (e.g. Conard and Bolus 2006; Martini *et al.* 2007). At Vogelherd Cave researchers attempted to assign faunal remains to their original cultural horizons. Middle Palaeolithic layers could be differentiated from younger material, according to these scholars, due to state of preservation. Fauna from the Mousterian layer (AH VII) tends to have rounded edges, abraded surfaces and often yellow staining (Niven 2006). Although variable preservation patterns were observed in the Aurignacian layer, standardised butchery practices were observed for horse and reindeer, allowing bones with these patterns to be assigned to the Upper/Middle Aurignacian horizons (i.e. AH IV/V) (Boger *et al.* 2014). At Feldhofer, a small piece of human bone (NN 13) was found to fit exactly onto the left side of the left lateral femoral condyle of the original type specimen Neandertal 1 (Schmitz and Thissen 2000) recovered in August 1856. In summary, both sites identified an unrealised potential for spoil heaps, linking materials between discard piles and previous *in situ* excavations.

Considerably less clear, and the subject of this paper has been whether coherent blocks of discarded cave sediments may survive within spoil heaps and whether these can be linked to deposits sampled during previous excavations. An implicit assumption within existing research has been that talus slopes are heterogeneous and completely disturbed. A single spoil heap may be the product of multiple excavations (including illegal/ amateur digging) over a long period, involving disposal of materials from multiple layers and areas across the site. Concurrently, Palaeolithic cave excavations often revealed considerable stratigraphic variation, associated with periods of cultural activity and hiatus (Conard and Bolus 2006; Nejman *et al.* 2018). Additionally, it was common practice during 19th and early 20th century to excavate by stratigraphic layer, dumping wheelbarrow loads of sediments on to a growing spoil heap (Nejman *et al*. 2020). In such cases it might be possible (although geoarchaeological studies are yet to test this) to observe single deposition events, a scenario already attested by careful geoarchaeological study and laboratory analysis of slag heap microstructure (Humphris and Carey 2016: 134). Because this study involved several methods of investigation the report is a summary of the methods and findings. Details of methods and their results are included in Supplementary Materials 1-5.

2. REGIONAL SETTING OF ŠVÉDŮV STŮL CAVE AND HISTORY OF EXCAVATIONS

In this paper, we examine the archaeological potential of a large spoil heap outside Švédův Stůl Cave, 11 m above Říčka Creek in the Moravian Karst region of the Czech Republic and assess how this may inform comparable archaeological studies into overburden (Figure 1). Formed in Devonian limestone of the Vilémovice Formation, this site has been occupied episodically by people since ancient times (as detailed in Nejman *et al.* 2020).

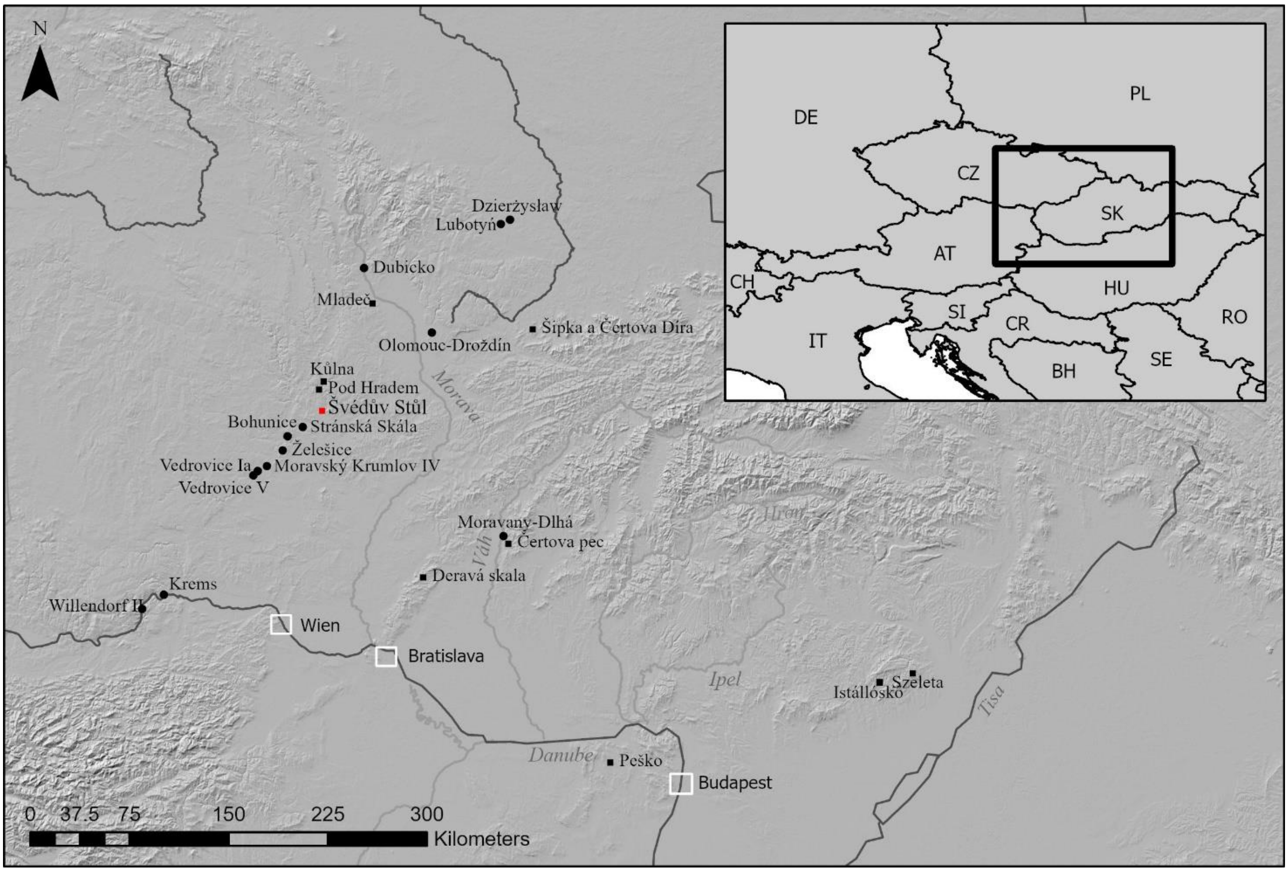

Figure 1: Map of the Švédův Stůl and other M-UP sites in Czech Republic)

The archaeological potential of this site has been recognised since at least the late nineteenth century with the first published description of its deposit by Koudelka (1883) followed by major archaeological excavations by Kříž in 1886 and 1887 (see Valoch *et al.* 2002). The cave received archaeological notoriety following the discovery in 1905 by a geology student (Karl Kubasek) of part of a human mandible, subsequently confirmed to be Neanderthal (Rzehak 1906; Oliva 2017). Multiple field-seasons involving large-scale excavations were conducted in 1953–1955 and several smaller excavations in the 1960s and 1980s (e.g. Klíma 1962; Vaňura 1965, 1981; Oliva 2017). An additional Neanderthal tooth was recovered from the spoil heap by Vaňura´s daughter in 1964 (Vaňura 1965). Detailed information was published in a lengthy monograph with Palaeolithic cultural materials classified as Mousterian, Aurignacian and Magdalenian based on artefact typologies and stratigraphic observations (Klíma 1962; Figure 2).

Excavations systematically removed virtually all the sedimentary deposit which had filled the cave (e.g. Klíma 1962: Figures 3-5). The 1950s excavations also removed a large amount of deposit which had accumulated outside the mouth of the cave (Klíma 1962: Figure 6), including spoil which had been dumped on the surface of the deposit during excavations inside the cave. Spoil from these excavations was discarded in wheelbarrow loads over a low cliff beyond the mouth of the cave and this produced a large conical spoil heap (Figures 3 and 4).

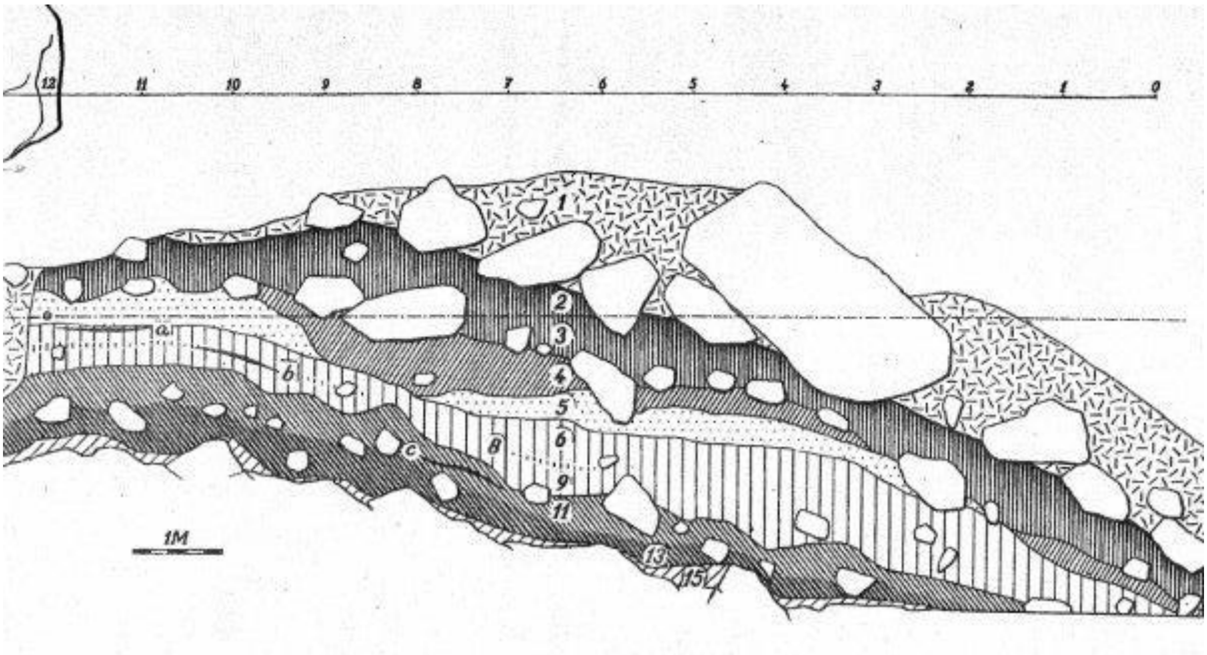

Figure 2: Klíma (1962: Figure 6) stratigraphic drawing, which references 1 - fill/backfill/dumped overburden; 2 – black loam; 3 – grey loam; 4 - brown loamy rendzina soil; 5 – white loamy travertine; 6 – loess; 7 – limestone debris; 8 - weakly developed brown earth; 9 – loess; 10 - finely bedded loamy; 11 – brown loam; 12 - grey brown loam with (limestone) rubble; 13 - brown phosphatic loam; 14 - grey phosphatic loam; 15 - ochre coloured loam. These were interpreted as belonging to various occupation phases including: a – Magdalenian, b – Aurignacian, c – Mousterian. SUs 15-6, span the late Pleistocene. SUs 5-2, of Holocene age, had been completely removed in the 1953-55 excavations.

Figure 3: Excavating by layer at Švédův Stůl Cave in 1955: note hand sorting and use of a wheelbarrow to transport sediment to the spoil heap (photo from the archives of Bohuslav Klíma, now held by Bohuslav František Klíma Jr).

Figure 4: Švédův Stůl spoil heap in 2019. Arrow pointing to backfilled Trench C-D (photo DW)

In 2019, a Czech-Australian team excavated both shallow remnant deposits of late Pleistocene age with archaeological materials and a rich faunal assemblage immediately outside the entrance to the Švédův Stůl Cave (Trench A-B) (Nejman et al. 2020) and a second area (Trench C-D) targeting the highest point of the adjoining spoil heap (Figures 4-6). The primary aim for the latter excavation was cultural recovery (e.g. Conard et al. 2015), also testing whether stratigraphic anomalies occur within overburden. In 2020, a Czech team returned to excavate a 3.5 x 4m area immediately adjacent to Trench C-D.

3. METHODOLOGY

Trench C-D cut a 2 m wide and 2.2 m deep wedge into the apex and steeply sloping centre of a large conical spoil heap (Figures 5 and 6). It was anticipated that this upper portion on the slope would preserve features, should they exist, rather than substantially redeposited areas further down slope.

Developing methods identified by Humphris and Carey (2016), discontinuities may be identified through visible units within the stratigraphic section, distributions of material culture and faunal remains (Palaeolithic through to modern) or differing chemical signals in the form of key 'trace' elements or element ratios. The spoil heap preserved discernible variations in colour and texture, especially the character and proportions of limestone rubble, which allowed it to be divided into stratigraphic units, referred to hereafter as Units. All cultural materials (including modern, Medieval and Palaeolithic) were retained, with each Unit collected and bagged separately before excavated materials were wet sieved using a 2 mm mesh (further details in Supplementary Materials 1). Cultural materials and faunal remains were sorted by XU and Stratigraphic Unit at a field camp near Ochoz u Brna.

Geochemical analyses were undertaken using energy dispersive X-ray diffraction (ED-XRF) and multi-function rapid core scanning (Itrax). These were used to define the nature of the spoil heap sediments, to compare geochemical elemental patterns within and between Units and to compare the geochemistry of sediments from Trench C-D with those from the 2019 excavation of the remnant cave deposit and with samples from Klima's excavations. For ED-XRF 20 samples, and for Itrax 16 samples were taken from the southern section of Trench C-D. Additionally, eight sediment samples from Klíma's excavation in the 1950s retained in the Moravian Museum were analysed by ED-XRF for comparison with the Trench C-D samples. The 1950s samples all came from the lower half of the original archaeological deposit (below SU6 in Figure 2), dated to the late Pleistocene. Ca/Si ratio was used as a complementary evaluation method for both Itrax and ED-XRF analyses because they are the two main indicator constituents within the sediments.

In 2020, a shallow (depth = 400-600 mm) excavation was completed during two field seasons to test methodology developed in 2019. Initially this involved re-excavation of Units 1-2 deposits observed in 2019 (Figure 6), at which point sediment was peeled back from the horizontal shelf to locate Unit 3 sediments and any additional stratigraphic anomalies. These could then be sampled using hand-trowels and brushes.

4. RESULTS

4.1. FIELD CHARACTERISTICS (TRENCH C-D)

The spoil heap consists of sediments composed of limestone rubble ranging in size from very fine gravel to small boulders mixed with weak sand sized aggregates (Supplementary Materials

2). The field texture of the <2 mm matrix throughout the remnant deposit in Trench A-B and in the spoil heap was uniform, mostly consisting of slightly to very slightly sandy silt with crushed material consisting of fine powdery clasts and sand-sized, quartz aggregates.

The field colour of the sediments was variable, with most units being greyish to brownish (7.5YR to 10Y/R) due to the presence of large amounts of greyish limestone rubble, as well as the influence of surface organic staining and variable moisture content. In contrast the dry colour of the <2 mm component, predominantly silt, was generally redder (5YR) and more uniform in colour (Figures 5 and 6). The uppermost units (1-4) were generally thinner, finer-textured and more densely packed than the lower units. Unit 3 represents an inclusion of pale coloured material within Unit 2 horizon. The break between the paler Units 2 and 3 and the underlying dark grey Unit 4 was sharp (Figure 5). In addition, the lower layers (Units 5-9) were irregular in shape, discontinuous across the excavation, more porous and contained large amounts of poorly-sorted limestone rubble. Units 7 and 8 were especially coarse and loose, containing virtually no fine matrix.

Figure 5: East wall of the 2019 excavation showing the sharp contrast in sediment content and colour (see Figure 6 for south wall stratigraphy)

4.2 ITRAX ANALYSES

Comparison of the Itrax elemental signatures of 46 samples from the remnant deposit is presented in Supplementary materials 3. This focused on trace minerals including rare earths and persistent 'gemstone' minerals, reinforcing field observations that the matrix of the remnant deposit was predominantly loess, with cave earth derived from limestone the other major sediment component. An important result was substantive variation in the Ca/Si ratio at multiple points within the stratigraphy of both remnant deposit and the spoil heap. At the rear of Trench A-B the ratio averaged 39, then decreased progressively to 16 at the front of the trench. This progressive decrease frontwards indicates a progressive increase in the proportion of loess in the matrix.

Itrax analysis of 18 samples from Trench C-D (Figure 6) showed that the element counts for the key metals and rare earths were similar to remnant archaeological deposit, but very different from nine samples from reworked Miocene marine sediments (Nejman et al 2020: 17) underlying that deposit. This confirmed that the non-calcareous component of the spoil heap deposit matrix was derived from a single source, i.e. loess.

The Ca/Si ratios were highly variable throughout the spoil heap deposit, ranging from 10 to 53 (Figure 6). In Unit 2b the ratio in two samples either side of Unit 3 was 53, indicating the proportions in the matrix of $CaCO_3$ derived from limestone and loess were similar across this horizontal band of spoil and proportion of the former was relatively high. Visibly distinctive Unit 3a also contained strikingly similar Ca/Si ratios for the two samples (46 and 47) and a similar value of 42 for 3b. In Unit 6 the ratios in three samples ranged from 31 to 37, again indicating the proportions of $CaCO_3$ and loess were similar, with a lower proportion of the former. The homogeneity of the Ca/Si ratio in these two units might indicate that they were from a very constrained part of the original deposit and were dumped rapidly.

In contrast, Unit 4a contained three samples with ratios varying from 51 to 23 and 24. This suggests the unit consists of spoil excavated from two or more different parts of the original deposit, although the thin and continuous nature of the layer nevertheless suggests it was dumped rapidly. In Unit 9, with three samples, the uppermost Ca/Si ratio was low (10), whereas the lower samples were higher at 28 and 33. Again this indicates the spoil was excavated from two or more different parts of the original deposit.

Overall the Itrax results show that the Ca/Si ratio decreases with depth. They also indicate that some units are geochemically heterogeneous, while others are homogenous. This is suggestive in some cases of sediment admixture, presumably from different parts of the original deposit, but in others that there are intact deposits from constrained areas of the original deposit. The results give little indication as to which portion of the original deposit is represented within this spoil heap.

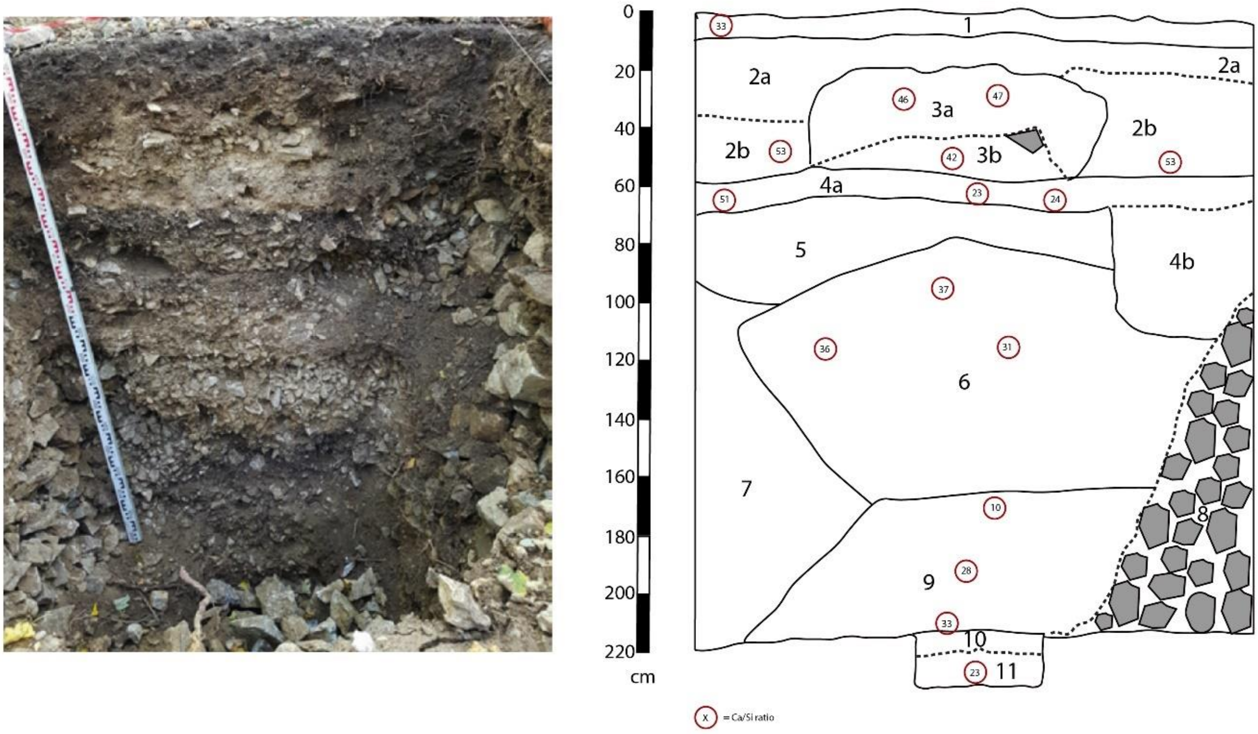

Figure 6: Photograph and stratigraphic drawing of the southern face of Trench C-D

4.3 ED-XRF ANALYSES

In Trench C-D some Units are geochemically homogenous while others are highly variable. The Ca/Si ratios (Figure 8) are most tightly clustered in Units 1, 2b and 3a, and the single sample from 3b is close to these clusters. Other Units are more heterogeneous. The Unit 6 and 9 samples form loose clusters, each with one outlier. The two samples from Unit 5 are very different from each other. The PCA (Figure 7), for 18 elements, shows similar albeit more diffuse patterns. Overall the Ca/Si ratio decreases with depth (Figure 8), and the ED-XRF and Itrax data show similar trends.

Strikingly, the eight samples from Klíma´s excavations show substantial heterogeneity with ranges even greater that in Trench C-D. Samples S1 and S8, the oldest and youngest, have the lowest Ca/Si ratios and S6 and S7 the highest. The closest correlations are between the samples from Units 2 and 3 and Klima's tightly clustered samples S3-S5 which might indicate that these spoil heap sediments were derived from the late Pleistocene, potentially post-dating the Magdalenian, the age attributed to S3-S5. As discussed below, however, other evidence indicates that spoil heap Units 2 and 3 were probably from later excavations inside the existing cave, not from Klima's excavations outside. It is possible that the stratigraphic units from which Klima's S3-S5 were taken could have extended back inside the cave to the area subsequently excavated by Vaňura or others who had dug inside the cave and discarded their spoil over Klima's spoil. The records from those previous excavations however are not adequate to confirm what must remain as speculation.

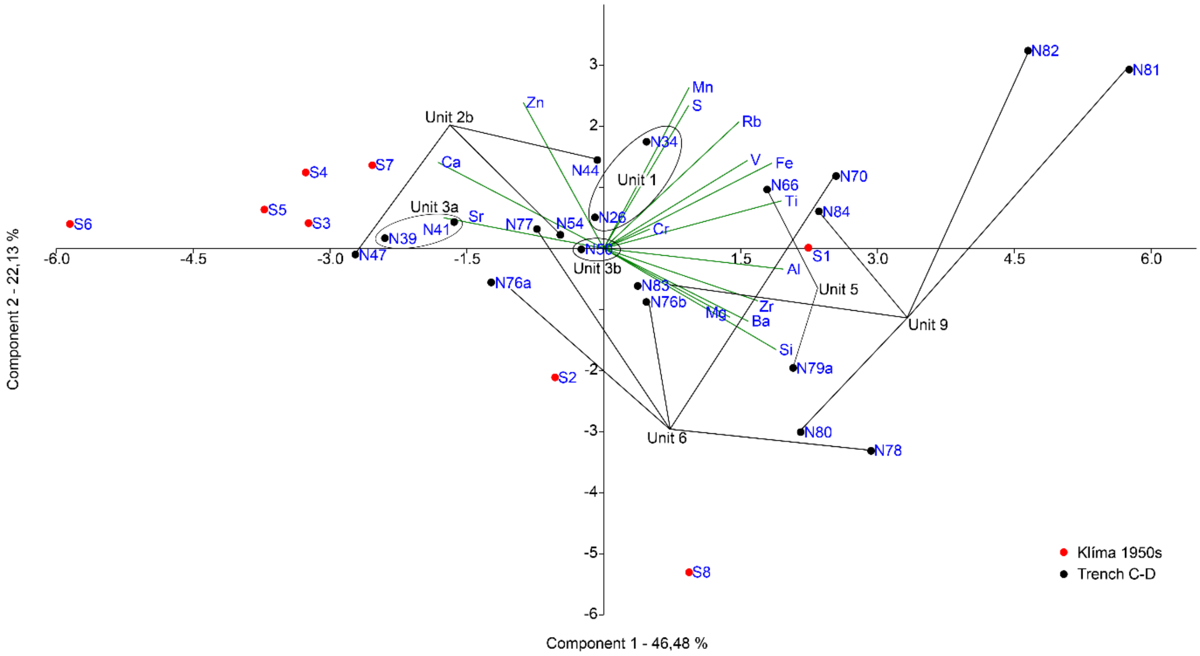

Figure 7: Scatter plot of PCA analysis of ED-XRF results. Selected elements (P, K and Na) excluded as being primarily of biogenic origin so biasing data derived from the mineral components.

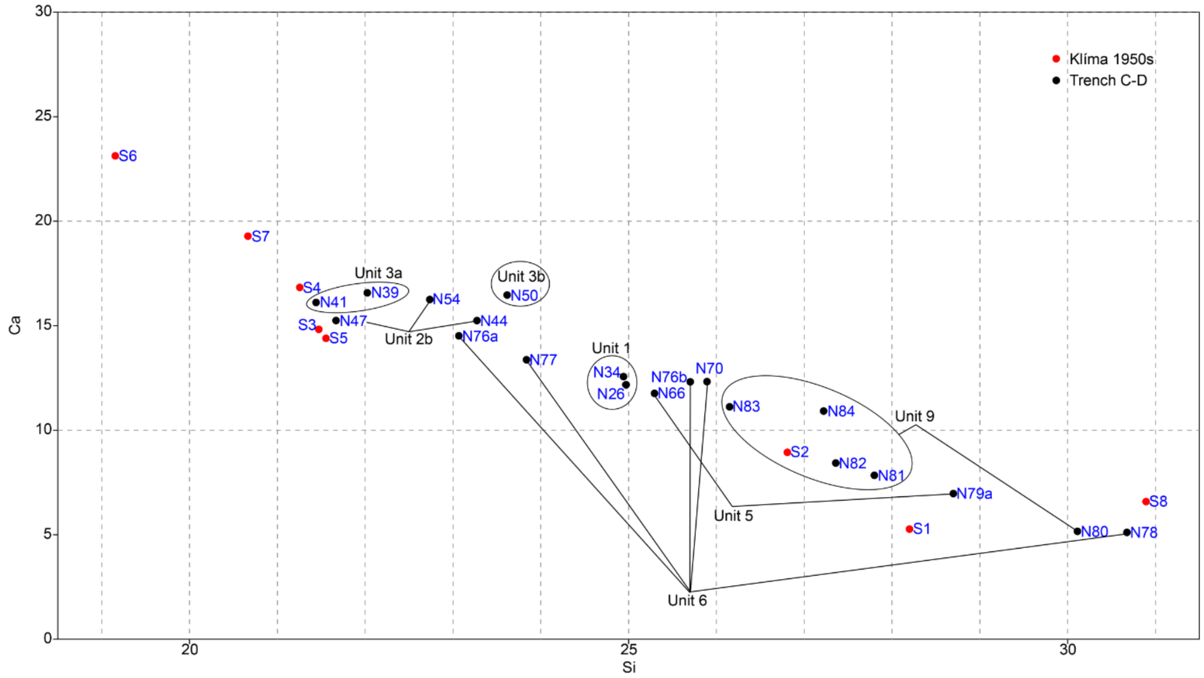

Figure 8: XY graph of Ca-Si ratio of ED-XRF results

4.4 CULTURAL AND ZOOARCHAEOLOGICAL MATERIAL

Distinctive patterns were noted in the artefact distribution (Supplementary Materials 4, Figures 9 and 10). Several units contained artefacts from different periods, while other units retained a higher degree of temporal integrity. Modern cultural materials were found in all units except 3a and 3b, both of which appear to display high spatio-temporal integrity. Most of these modern materials date from the second half of the 20 C, although a few older items were also recovered.

A cluster of Medieval pottery was found in Units 5, 6 and 7, indicating a certain amount of stratigraphic integrity/contemporaneity. Units 6 and the top half of Unit 7 also contained prehistoric material and all three of Units 5, 6 and 7 contained modern materials. The high percentage of ‘modern’ may suggest ‘rubbish’ accruing during excavation field seasons became incorporated during the dumping. This includes, in Unit 5, a 10 Heller coin from the Hapsburg Empire that dates to 1893 and another dating to 1944 (alongside a WW2 bullet). These dates correlate with the various excavation phases occurring at this site (e.g. Klíma 1962; Valoch *et al.* 2002).

Trench C-D contained large quantities of Palaeolithic cultural materials including stone and bone artefacts and considerable quantities of faunal remains. The sourcing of raw materials of lithic artefacts lends independent support to homogeneity of at least some of the units portrayed in Figure 10. For example, raw materials of lithic artefacts recovered from 3a and 9 are dominated by long-distance imports such as SGS chert – a high-quality chert that was collected from glacial moraines approximately 80–120 km north of the site, and most commonly associated with the Late Palaeolithic period. Unit 3b, likely belongs to the Middle Palaeolithic period as all the artefacts are local (Krumlovian Forest chert, spongolitic chert and quartz). Mixtures of local and imported materials were noted in most layers (e.g. Units 4a, 4b and 6), with lithic artefacts present throughout the deposit (with the exception of Units 1 and 5).

Zooarchaeology results provide evidence for homogeneity and heterogeneity, with Unit 2a and 3a consisting entirely of Holocene to recent fauna (Supplementary Materials 5). Units 4a, 9, 10 and 11 comprise entirely Pleistocene fauna, while Units 5, 6 and 7 incorporated a mixed assemblage dating from both periods. A striking paucity, or absence, of faunal remains was noted in Units 1, 2b, and 8.

The excavations in 2020 revealed a similarly mixed deposit including primarily modern and medieval artefacts but also small quantities of Palaeolithic artefacts and faunal remains. For example, Samples 2, 5 and 6 revealed a combination of modern fauna (including domestic cattle, fox etc) and artefacts (e.g., glass fragments) but also Palaeolithic fauna (e.g., cave bear, cave lion) and two stone artefacts. A strikingly different situation exists for two vertical lenses (sample 1 and 4) of light-coloured sediment that contained no modern artefacts. Sample 4 contained two SGS chert micro flakes consistent with Magdalenian imports reported elsewhere. An additional vertical lens was filled with dark sediment and contained a liver pate metal can from 1980s (at 600 mm below the surface), also glass and bone belonging to cave bear and rodent.

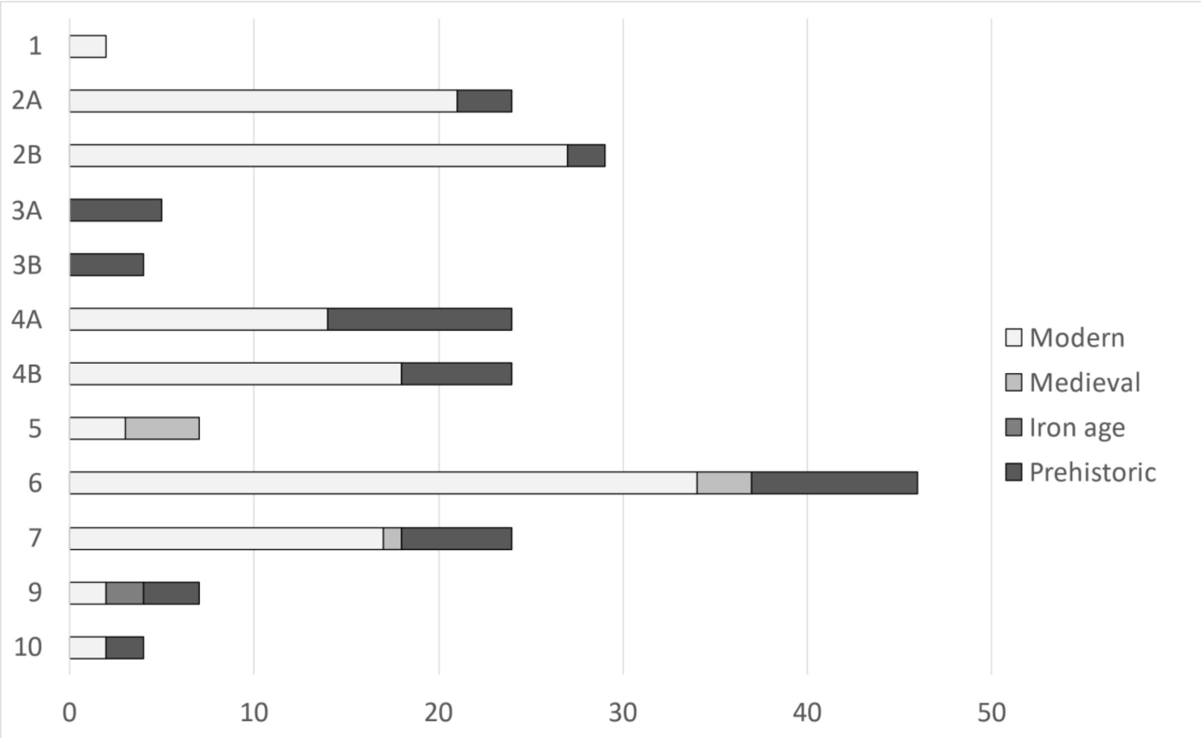

Figure 9: Count of objects by period in each excavation unit

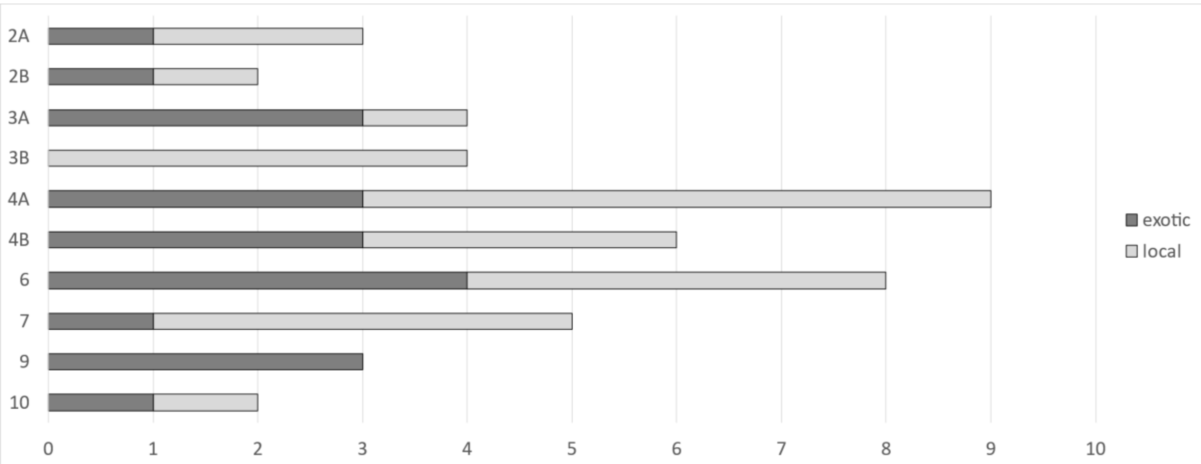

Figure 10: Count of imported (exotic) and local stone artefacts by excavation unit

5. DISCUSSION

Collating all available evidence, a plausible scenario can now be sketched for spoil heap formation, the details of which are presented in Supplementary Materials 6.

Excavation of the Švédův Stůl spoil heap confirms extensive mixing as identified by textural, colour and geochemical variations and the presence in most layers of mixtures of modern, pre-modern and Palaeolithic artefacts and faunal remains. Conversely, pockets of compact, near-identical sediments were identified through visual examination and geochemical analyses supporting single deposition events. These units were further distinguished through an absence (or paucity) of modern or pre-modern cultural materials and intriguing distributions of stone artefacts and faunal remains. Raw material analysis of artefacts in Units 3a and 3b, revealed heterogeneity with the former containing a high proportion of exotic (imported) stone and the latter only local stone. This included exotic SGS chert, known to occur in outcrops in northern Moravia/southern Poland. Previous research has shown this material was utilised extensively for manufacturing tools during the mid and late Upper Palaeolithic periods (especially by Gravettian and Magdalenian cultures i.e. 30-27 ka or later). This scenario is supported by an apparent link between sediments from Unit 3a and Klíma's Layers S3-S5. Prominence of local raw materials (as was the case for Unit 3b) is characteristic of artefacts utilised by the local Neanderthals, although modern humans also took advantage of these resources. Minor mixing may occur at the interface between layers as demonstrated by a Holocene aged horse molar recovered from Layer 3a.

Results suggest that some layers consisted of spoil dumped from a narrow range of archaeological contexts from original excavations at this site. Analysis of Units 3a and 3b, showed those sediments, with higher Ca/Si ratios, contain more limestone-derived matrix than Units 6-9 which comprise highly variable mixtures of cave earth and loess. While it is possible that spoil may have been associated with excavations earlier than Klíma's inside the cave this seems unlikely. Archival research suggests spoil heaps from the initial excavations were placed immediately outside the Švédův Stůl Cave, on top of what we were able to identify (in Trench A-B) as remnants of the original archaeological deposits. Klíma described digging through this overburden (his layer 1) to expose *in situ* SUs 2-15 (Klíma 1962). It is likely that much of this material was subsequently dumped downslope, attested by nineteenth century artefacts (including an 1893 10 Heller coin that was likely lost during an early phase of excavation at this site).

The 2020 excavations revealed far fewer discrete stratigraphic features or Pleistocene artefacts/fauna. It is plausible that most deposits from this shallow excavation had been substantially disturbed through illegal re-excavations of upper spoil heap deposits known to have occurred in the 1980s, echoed by a 1980s metal can. The exception was a comparable stratigraphic feature, in terms of sediment and cultural deposits, to Unit 3.

5.1. WHAT CAN BE SAID ABOUT SPOIL HEAP FORMATION PROCESSES?

Stratigraphic observations allow us to partially reconstruct processes occurring during formation of this spoil heap (see Supplementary Materials 7 for details). Deposits of large cobbles and small boulders, forming Units 5-6, and 9-11, apparently accumulated at the same time as Units 7 and 8. The 1893 10 Heller coin in Unit 5, most likely derived from Klíma's layer 1, the overburden from the 19th C excavations. Medieval pottery, but no prehistoric artefacts suggest dumping of materials from Klíma's Medieval-aged layer of 'black earth' (Layer 2). Unit 6, which contains Medieval pottery alongside Middle and Late Palaeolithic artefacts is suggestive of at least two of Klíma's 'periods'.

Klíma (1962) may have sorted large rocks and discarded these down slope at two locations, while at the same time transporting finer, unsorted sediments to the edge where they were dumped between these accumulating cones of large rocks. Rock rubble, with increasing amounts of fine sediment, continued to be dumped at Unit 7 after Unit 5 had accumulated, extending the spoil heap outwards. This suggests that accumulation of all these units occurred over a period of days rather than weeks. Rapid accumulation would also explain why voids in the Unit 8 rock pile and, to a lesser extent in the older component of Unit 7, did not fill with finer sediment. In the subsequent (post 1960s) phases of spoil heap formation, generally finer-textured spoil progressively was dumped across the entire area covered by the 2019 excavation to form Units 1, 2 and 4, extending the spoil heap further out. The presence of artefacts post-dating 1980 in Units 1 and 2 suggests that spoil from illegal excavations may have been discarded (as Unit 2a) over pre-existing yellowish soils (Unit 3) from Vaňura's excavations. This may also explain similar patterns observed in sediments and cultural materials during the 2020 field season. Unit 3 resulted from localised dumping of spoil with a distinctive pale colour and palaeolithic artefact signature. The nature of the sharp break between the paler coloured Unit 2 and the even paler Unit 3 within it and the underlying darker coloured units indicates that organic staining which characterises the lower units occurred at or before the time they accumulated and is not post-depositional.

No definitive links can be made between sediment samples from Klíma's excavations and those collected from Trench C-D although there are some strong similarities with the latter. The closest correlations from the ED-XRF analyses of Ca/Si were between Klíma's S3-S5 and Units 2b and 3a (Figure 7). Other evidence however suggests these two units may have been derived from Vaňura's later excavations inside the cave. No correlation was evident between S3-S5 and the sediments sampled from Trench A-B (Lisá *et al.* in prep.). The layers from which S3-S5, and by inference S6-S8 higher in Klíma's sequence, had been collected were subsequently removed by him from above the remnant deposits excavated in Trench A-B. In contrast several samples from Trench A-B were similar to S1 and S2, the oldest of Klíma's samples, as were all the samples from Unit 9 and one each from Units 5 and 6 in Trench C-D (Figure 7). All of these samples could have been derived from the oldest layers in the original deposit.

5.2. TOWARDS AN ARCHAEOLOGY OF OVERBURDEN

Archaeological excavations of spoil outside Feldhofer and Vogelherd Caves demonstrated that important Palaeolithic discoveries may still be made by excavating these features (Boger *et al.* 2014; Niven 2006; Schmitz and Thissen 2000; Schmitz *et al.* 2002). Moreover, archaeological excavation of comparable slag heaps suggested complex deposition histories might be unpacked through "a different [and potentially more cautious] excavation and sampling strategy" (Humphris and Carey 2016: 134). These results, also an observed tendency shown by some archaeologists to excavate these discard features as bulk samples simply to retrieve important artefacts, suggests that a new methodology is required to realise the full excavation potential of overburden.

The authors suggest a staged process, starting with acceptance that some sedimentary structure inherited from the original deposit may survive within spoil heaps. Beyond excavated features that display clear heterogeneity, contextual information may endure within layers that show some admixture. At Švédův stůl, for example, Layers 9-11 contained modern and Paleolithic artefacts, concurrently with an entirely Pleistocene faunal assemblage. Considering subtle breaks in stratigraphy, as demonstrated through geochemical analyses, it is likely that these patterns identify partial admixture that vares depending on the size and nature of cultural materials.

Acceptance of this potential has implications for all research stages including initial planning. Archival study is required in order that a predictive model may be developed based on sediment/archaeological descriptions and analyses provided by original excavators. Stratigraphic variation observed within the original excavations may be further tested through geochemical analyses of sediment samples (e.g. through pXRF and/or Itrax analyses). The various datasets can then be used as a template to guide subsequent excavation.

Using methods identified in this study, it may be possible to isolate visible discontinuities during excavation. Caution is required so as not to miss boundaries delineating closed contexts that do not continue across the excavation. Uniformity in colour and texture of units cannot on their own be used to distinguish the source from within the original deposit. Colour can be indicative when both the field colour of the bulk deposit and the dry colour of the <2mm are considered together. Geochemical testing can assist in making these stratigraphic decisions. At the end of the initial excavation phase, a cleaned vertical sediment/soil section is likely to provide a further opportunity to examine these anomalies. Once identified, it is anticipated that these may be traced into the section wall, with the excavated materials wet sieved and analysed as separate entities.

Despite the limitations imposed by the removal of most of the original deposit at this site, this study has demonstrated the usefulness of geochemical analyses in potentially identifying the sources from within the original deposit of discarded sediments in the spoil heap. Under different circumstances, especially in a site where a more complete sequence of the original *in situ* sedimentary stratigraphy could be identified, it appears likely that a rapid Itrax scan (or comparable methods e.g. pXRF) using key elements would make it possible to match layers of original deposit with chunks/lenses of sediment in the site spoil heap. Although not tested during this study, it may further be possible to geochemically test sediment adhering to distinctive artefacts. While this may be compromised after contact with admixed sediment within the spoil heap, it is possible that original sediment can be extracted from the interior of bones and/ or crevices within art objects and lithic artefacts.

Following Carver (2012:19) careful sampling and documentation strategies are necessary to retain control over excavation data. Sampling strategy must include retention of all cultural materials (including modern 'rubbish') to recognise disturbance while also identifying artefact associations with original excavations.

6. CONCLUSION

In the nineteenth and early to mid-twentieth centuries, well-preserved deposits within limestone caves were targeted by archaeologists interested in the European Palaeolithic. Although leading to remarkable discoveries, as a destructive and creative process, this also meant important archaeological information was lost, some of which was to reappear eroding out of archaeological discard piles. Ironically, a similar situation is occurring as archaeologists look towards spoil heaps as repositories for future Palaeolithic discoveries. In this paper and following pioneering research at Feldhofer and Vogelherd Caves (Boger *et al.* 2014; Niven 2006), we suggest that important, and as yet unrealised, potentials exist within these sites.

The main results of presented research can be summarised as follows:

1) Single layers were observed within a Palaeolithic spoil heap, differing in colour, sediment composition, faunal remains and material culture. These retain clear boundaries suggesting single deposition events.
2) Both Itrax and ED-XRF provide powerful methods for identifying variation within overburden features. Both methods have the potential to allow comparison between the original deposit and the spoil where documented samples from the former have been retained
3) Geochemical analysis proved to be of some use in distinguishing possible sources in the original deposits.
4) A methodology is provided for the application to geoarchaeological studies of overburden features more broadly.

Combined, the Švédův stůl case study identifies a need to refine the archaeology of these important features before they, like the remnant cultural deposits from whence they came, are gone.

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Declarations of interest – none.