

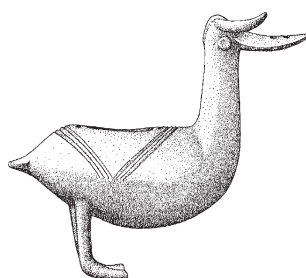
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RE-EXCAVATION OF DISCARDED DEPOSITS FROM ŠVÉDŮV STŮL CAVE (MORAVIAN KARST, CZECH REPUBLIC) AND THEIR ARCHAEOLOGICAL POTENTIAL

Petr Škrdla – Jaroslav Bartík – Ladislav Nejman – Antonín Přichystal –
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Many caves worldwide, including those with significant archaeological deposits, have attracted excavators since the end of the 19th c. This has often resulted in caves being partially, or entirely, emptied of sediments. The ‘coarse’ methodology used during earlier excavations has resulted in many finds being missed, which usually resulted in their discard onto nearby spoil heaps along with the sediments. Švédův stůl Cave, in the southern part of the Moravian Karst, is a typical example. It is also one of only three caves in Moravia that have yielded Neanderthal skeletal remains. Artefacts belonging to the Middle Paleolithic through to Medieval periods were recovered in Švédův stůl Cave during earlier excavations. The re-excavation of a tiny proportion of the discarded deposits outside the cave has produced a similar number of lithic artefacts as in all of the excavations added together. In addition, several specific artefacts, previously unknown from Švédův stůl Cave, were also discovered. The results of the re-excavation indicate a significant archaeological potential still hidden within the sediments dumped in the spoil heap outside the cave. These discoveries show promising potential for further research at this site.

INTRODUCTION

The sediments removed from caves during earlier excavations were often dumped close to the cave entrances, where they still survive. The potential of such deposits was documented, for example, at Vogelherd Cave (Conard/Janas/Zeidi 2015; Dutkiewicz 2015) and Feldhofer Cave (Schmitz *et al.* 2002) in Germany. The re-excavation of Vogelherd Cave yielded additional material (including portable art objects, ivory beads, lithic and bone artefacts, and faunal remains) missed during the original excavation by G. Riek’s team who emptied almost the entire cave of its sediments in 1931 (in a similar scenario to Švédův stůl Cave, they were dumped outside the cave entrance). At Feldhofer Cave, the re-excavation of dumped sediments yielded additional Neanderthal skeletal remains suitable for aDNA analysis including three fragments that fit directly on the femur and cranium of Neanderthal 1 individual recovered during the original excavation in 1856 (Schmitz *et al.* 2002). Paleolithic artefacts and faunal remains that were missed during the 1856 mining operations were also recovered during the re-excavation.

In Moravia, a re-excavation attempt of the Pekárna Cave spoil heap in front of the cave had demonstrated the potential of high resolution re-excavations of cave deposits removed from the cave during earlier excavations (Škrdla/Lázničková 1999). Švédův stůl Cave (Fig. 1: 1), as in the case of the nearby Pekárna Cave, was completely excavated over several excavation campaigns during the last two centuries (for details see Mlejnek *et al.* 2024). All the sediments (including limestone fragments and soil/loess sediments from both Pleistocene and Holocene periods) from Švédův stůl were removed during Kříž’s 1886–1887 and Klíma’s 1953–1955 excavations from the cave interior as well as the entrance plateau and they are currently deposited in a conical spoil heap in the front of the cave. B. Klíma (1962, 22) had reported that the spoil heap consists of 450 m³ of sediments. These sediments attracted amateur

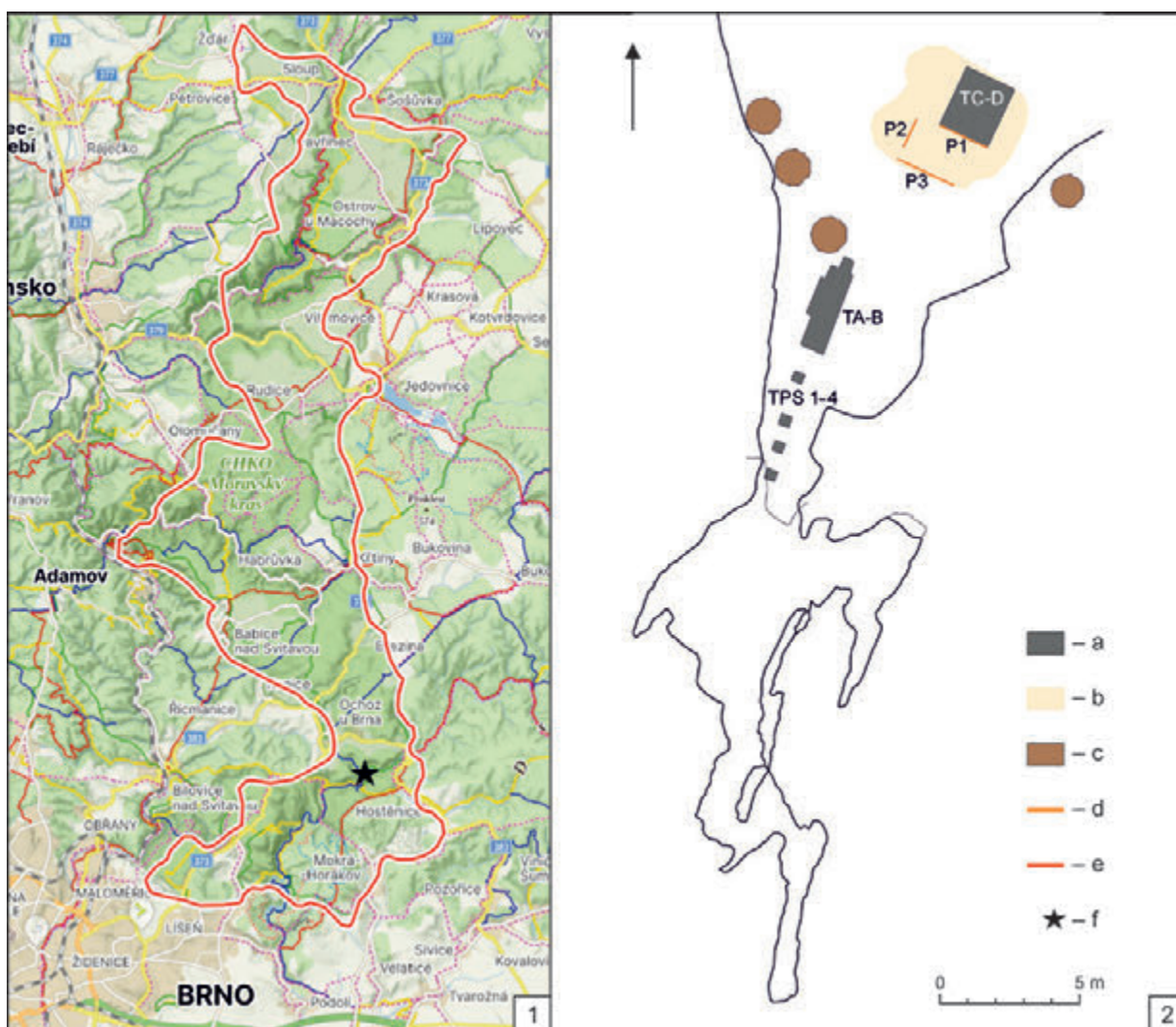


Fig. 1. 1 – location of Švédův stůl Cave in the Moravian Karst; 2 – location of trenches dug during 2019–2024. Legend: a – excavation 2019; b – excavation 2020 – 2024; c – trees; d – profiles; e – Moravian Karst; f – cave location. Author J. Bartík, map source: mapy.cz.

archaeologists who collected artefacts and faunal remains from the surface and they also re-excavated the uppermost part of spoil heap (to a maximum depth of ca. 80 cm; *Bartík et al. 2023*, 158, fig. 25; *Nejman et al. 2021*, 179, fig. 12). A small collection of Paleolithic artefacts was collected also by one of the authors during the 1990s – these artefacts are also included in the collection presented in this work. However, the most important finds were collected by *J. Vaňura (1965)* and his daughter, who discovered a Neanderthal tooth (for details see *Mlejnek et al. 2024*, 24). This find was one of the reasons that stimulated our research of the spoil heap. In order to evaluate the archaeological potential still hidden within the spoil heap we exploited and subsequently wet-sieved 16 m³ (which corresponds to ~3.5% of the total spoil heap volume; Fig. 1: 2) of sediments in several campaigns over the years 2019–2024 (*Bartík et al. 2023*; *Nejman et al. 2020*).

METHODS

Archaeological fieldwork in the Moravian Karst is complicated by its status as a Nature Reserve (necessity of obtaining permits and working under restrictions) and logistical problems – absence of water (ephemeral creek only) and lack of suitable roads to transport sediments for off-site sieving (outside



Fig. 2. Excavation methodology. 1 – digging sediments from the surface; 2 – wet-sieving in nearby dry river bed; 3 – transporting sediment in bags; 4 – off-site wet-sieving; 5 – documenting profile in deep trench. Photo by P. Škrdla, J. Bartík.

of the protected karstic area). The site itself is currently off the designated tourist trail and approximately 100 m from the nearest track. A narrow path that is often blocked by fallen trees leads to the cave from the road. Our method of re-excavation was continually adapted and improved over time (Fig. 2). It consists of several steps: 1. excavation of the spoil heap sediments; 2. carrying sediments in buckets or bags to a vehicle parked on the track; 3. transporting sediment bags to the wet-sieving station using a pick-up vehicle or a car trailer; 4. wet-sieving; 5. screening washed sediments in a laboratory. 2×2 mm mesh size sieves were used for the wet sieving. In the last campaign we enhanced our methodology by adding an extra step (labelled as 1.5 – i.e. an extra step between the first and second steps). This consists of dry sieving of sediment using a 10×10 mm mesh and washing of separated material (over 10 mm) in vats on-site in a nearby dry stream bed. This method saved water and was less time

consuming compared to wet-sieving of all sediments and allowed us to reduce the weight and the volume of the sediment (10 mm and smaller fractions) transported for off-site sieving. In addition, water brought to the site in barrels allowed cleaning of limestone boulder surfaces which made it possible to inspect them for potential anthropogenic marks. Off-site wet-sieving was realized using a combination of 3 mm and 2 mm mesh sizes and all sediment was carefully washed in order to remove all fine grained sediment (soil and loess). Two fractions > 3 mm and between 2–3 mm were sorted separately, dried and transported to laboratory for careful screening. The last step was the most time consuming operation.

While artefact raw materials were analyzed using a stereomicroscope with water as an immersion liquid, identification of the raw materials of heavy duty implements was realized only macroscopically.

Glass beads were surface-analyzed using X-Ray fluorescence (XRF) spectroscopy which allows rapid and non-destructive analysis of artefacts in terms of their elemental composition, ranging from sodium (Na) to uranium (U). A benchtop XRF spectrometer ElvaX Pro was used for the analysis under the following conditions: Ag anode, Fast SDD detector, Soils mode, Dual beam, acceleration voltage 8 and 35 kV, measuring time 120 + 120 seconds, focus spot 4 mm. Acquired results and accuracy of the analysis are primarily influenced by the surface nature of the analysis, as the weathered surface of archaeological glass finds often has a slightly different composition than the unweathered material. The surface layer is often depleted in sodium and typically exhibits partially altered coloration. Furthermore, the measurements were conducted without a helium flush, which affects the detection limits for lighter elements, particularly sodium and magnesium. For these reasons, the results should be considered as semi-quantitative at best. The interpretation of the obtained data is therefore limited to determining the basic characterization of bead raw material and potential additives acting as colorants. However, the results cannot be used to determine the provenance of the finds, or the precise characterization of the colorants and opacifiers.

RESULTS

Planigraphy and stratigraphy

Trench TC-D was located at the end of the cave entrance plateau where it slopes steeply into the river valley. The first trench was dug in 2019 and reached a depth of 2.2 m (Wright *et al.* 2021). At the conclusion of the excavation, the trench was back-filled for safety reasons and by agreement with the Nature Reserve management. A subsequent spoil heap excavation in 2020 proceeded from TC-D towards the cave entrance. During this excavation we removed the top part of the spoil heap and the trench was sloped in order to avoid deep holes when leaving the site. However, this part of the profile had been re-excavated by amateur archaeologists earlier, as documented by a homogenized layer in the profile, frequent presence of modern waste up to 80 cm in depth (Bartík *et al.* 2023, 158, fig. 25), and a smaller number of finds compared to the deeper (untouched) deposits. We therefore deepened the 2020 trench during the two campaigns that followed. In sum, we re-excavated an area of 17 m² reaching a depth of up to 2.2 m (Fig. 1: 2; 3).

High-resolution methodology using ED-XRF and Itrax was used during the first year for the TC-D trench sediments. This was an experimental attempt to separate individual depositional (secondary) horizons within a spoil heap (Wright *et al.* 2021). Considering the difficulties of applying this high-resolution method (a time consuming process), the additional mixing of the upper part of the spoil heap sediments by the actions of amateur archaeologists, and a low density of finds within the spoil heap sediments, we did not conduct geochemical analyses over the subsequent excavation campaigns. We can conclude that the upper ca. 80 cm portion of the spoil heap consists of sediments that have been further mixed by amateur archaeologists who re-excavated them during an earlier time (1970s–1990s) and who collected much of the archaeological material that had been present. Deeper part of the profile has a layered character where the layers of different thicknesses and colors (from yellow to black according to their geological age) alternate. While the above mentioned parts of the documented profile are composed of limestone scree consolidated by fine-grained sediments, the lowermost part of the documented profile is dominated by scree containing much smaller amounts of fine-grained sediments, and often with hollow cavities between individual rocks (Fig. 3: 3).

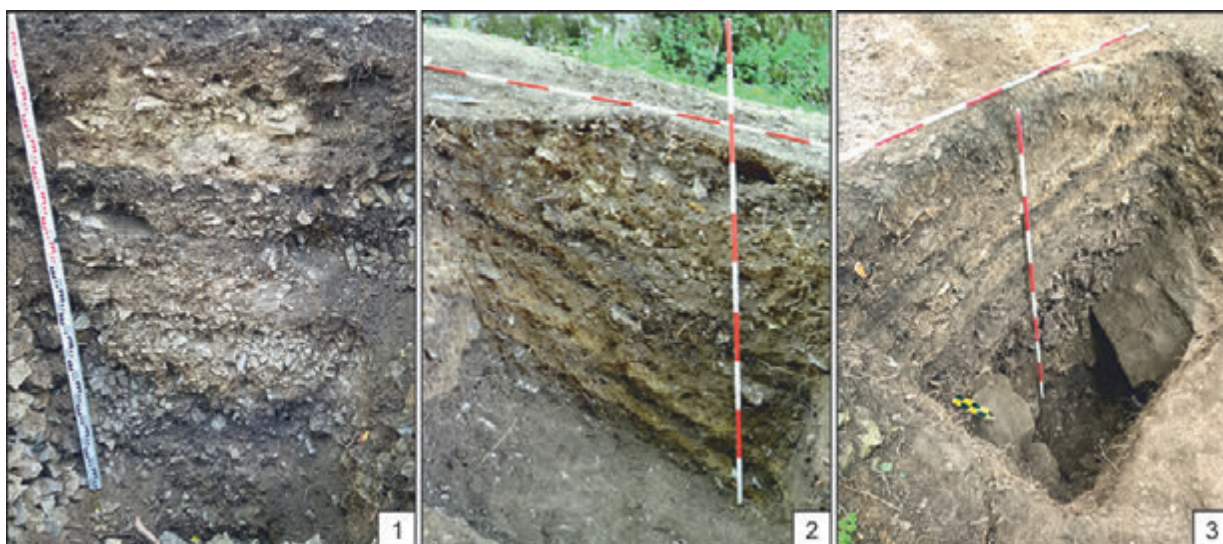


Fig. 3. Stratigraphic profiles in spoil heap sections (Profiles P1-P3, for location see Fig. 1: 2). Photo by J. Bartík, D. Wright.

Analysis of archaeological material

The stone artefacts (Fig. 4–6) from the Švédův stůl Cave spoil heap were divided into two basic categories: knapped artefacts made from siliceous rocks and heavy-duty implements made from coarse pebbles (including quartz) and manuports. Given the method used to recover this collection – from a secondary deposit that contains stratigraphically mixed sediments of late Pleistocene to Holocene ages – all of the recovered artefacts were analyzed as a whole without chrono-cultural subdivisions. The artefacts display a range of weathering surfaces, from unweathered to slightly patinated, to heavily patinated. In addition, only one unpatinated artefact can be reliably attributed to the Neolithic – Eneolithic period on the basis of its typology (trapeze – sickle blade, Fig. 4: 37) even though artefacts from both of these Holocene periods (mostly pottery) were documented during both earlier and recent excavations. On the other hand, some of the characteristically Magdalenian backed bladelets from the recent collection possess fresh-looking surfaces without any traces of patina. Similarly, as in the case of the knapped industry, the heavy duty implements and manuports made prevailingly from local gravels do not possess chronologically diagnostic characteristics – similar coarse forms were utilized in all prehistoric periods documented in this cave.

Knapped stone artefacts

Raw materials

Local and imported rocks were used to knap artefacts with the local sources used slightly more often. Imported raw materials include erratic flint (35.4%), radiolarite (6.5%), rare artefacts from Kraków-Czenstochova Jurassic and chocolate flints (one specimen of each). Other imported items are of more notable significance although again, only one of each has been found. These are rock crystal (light citrine) from the Bohemian-Moravian Highlands (Fig. 4: 26; 5), and spotted flint closely resembling a lithic raw material from Bavaria (Fig. 4: 27). The origin of this raw material is not entirely certain and it may have also originated in the Kraków-Czenstochova Jurassic formation. The most common local raw materials are Cretaceous spongolite chert from the Boskovice Furrow (27.1%) and Moravian Jurassic cherts (16.2%). Others include Moravian Jurassic cherts (not further specified), Krumlovský les-type chert (variety II – five items and variety III – one item) and a single specimen of (probably) Stránská skála-type chert. Five artefacts are made from Olomučany-type chert and several are made from quartzite collected in the local Kulmian gravels (Fig. 6: 3, 7), orthoquartzite from Drahany upland (sun boulder, Fig. 4: 25), schist from Devonian-Kulmian boundary (Fig. 6: 4), and a retouched limestone fragment (Fig. 4: 36).

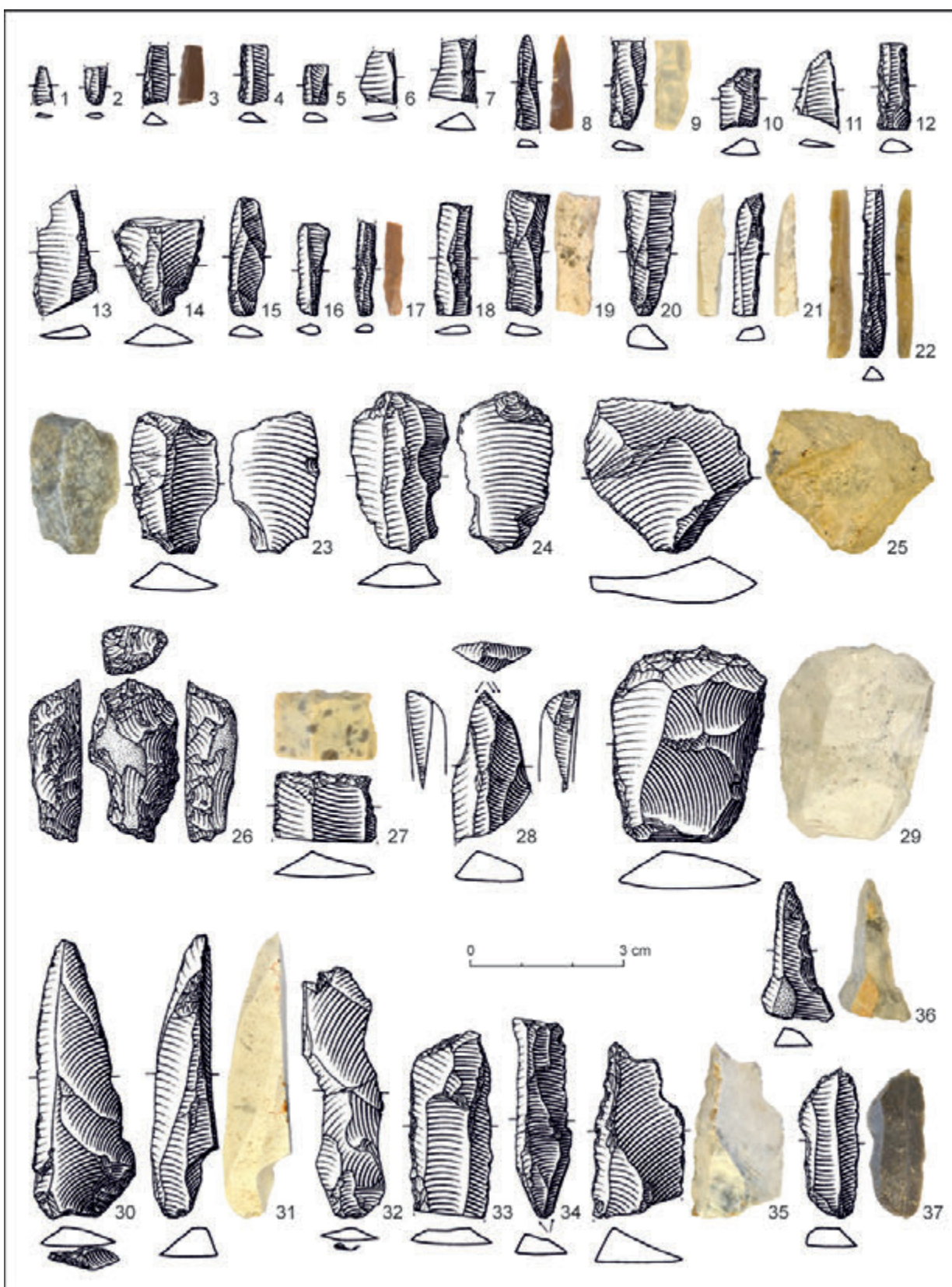


Fig. 4. Selected knapped artefacts. 1, 5, 20, 22, 32 – Cretaceous spongolite chert; 2, 10 – burnt; 3, 8, 17, 19 – radiolarite; 4, 11, 14, 16, 21, 24, 29–35 – erratic flint; 6, 7, 9, 12, 13, 15, 18, 23, 28 – Moravian Jurassic cherts; 25 – sun boulder; 26 – rock crystal/citrine; 27 – Bavarian spotted flint; 36 – limestone; 37 – Olomučany-type chert. Drawing by J. Brenner, photo by J. Bartík.

Technology

The collection of the recently obtained artefacts more than double the original Klíma's 1950s collection (229 versus 193 items), however, the artefacts differ in their modal size distribution – the new collection contains many smaller items compared to Klíma's collection. The most common technological category is small shatter including microchips, microfragments, and broken artefacts smaller than 1.5 cm (45%). The rest of collection consists of flakes (14%), an isolated core (Fig. 6: 4), blades (3.5%) and blade fragments (2.6%), bladelets (2.2%) and bladelet fragments (7.9%). One blade fragment and one bladelet fragment are partially retouched. Burin spalls compose 6.5% of assemblage (15 items). Three fragments of siliceous rocks complete the technological spectrum. There are 36 tools (15.7%) present in the collection. Eleven artefacts were burnt. A characteristic Magdalenian *en eperon* butt was documented in one instance (Fig. 4: 14).

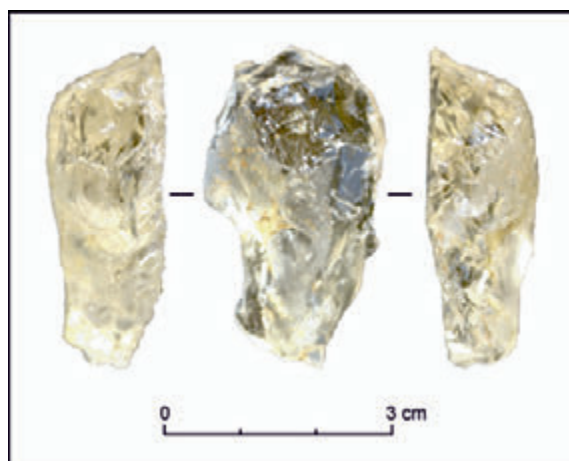


Fig. 5. Rock crystal/citrine endscraper. Photo by J. Bartík.

Typology

Small microlithic tools account for over half of the tools. Twelve items are simple backed bladelets (Fig. 4: 4–7, 10, 11, 16, 21, 22), two other backed bladelets have additional retouch on the opposed lateral edge (Fig. 4: 3, 12, 17), another two backed bladelets are truncated on one end (Fig. 4: 18, 19), one backed bladelet is pointed (Fig. 4: 1), and another pointed bladelet has partial retouch (Fig. 4: 8). Endscrapers include a simple endscraper (Fig. 4: 29), a double endscraper (Fig. 4: 23), and a steep endscraper with additional bilateral retouch (Fig. 4: 26). There are two dihedral burins (Fig. 4: 28, 34), one of them with scraper-like retouch on its tip (Fig. 4: 34). Four bladelets are retouched (Fig. 4: 2, 15). A retouched blade and two retouched blade fragments have a straight truncation (Fig. 4: 27), and a proximal blade fragment has bilateral retouch (Fig. 4: 14). Other tools are represented by a single item each – a borer (Fig. 4: 35), a splintered piece (Fig. 4: 24), and a retouched fragment (Fig. 4: 36). There is one post-Paleolithic specimen – a backed trapeze made from Olomučany chert (Fig. 4: 37).

Pottery

The prehistoric (post-Paleolithic) finds of pottery from our spoil heap excavation are of similar character to the pottery reported from the excavations of the intact sediments (cf. Klíma 1962). Most recovered pieces are small undecorated fragments. During the spoil heap excavation, we recovered 141 fragments of ceramic vessels with a total weight of 355 g. The pieces are highly fragmented and almost half of the shards fall into the category of small ground fragments not exceeding 3 cm². Only seven larger fragments between 5 and 7 cm² were found. There is one distinct difference between our finds and Klíma's collection – the smallest fraction of sherds is absent in Klíma's collection as his team did not utilize wet sieving. Given the origin of the material from relocated secondary and tertiary contexts, the absence of conjoinable specimens is not surprising. A similar situation has been found in the excavation of intact sediments, where only one almost completely reconstructed Linear Pottery culture globular vessel was recovered (Bartík 2020, 79; Klíma 1962, 86; Ondroušková 2011, 80).

A large proportion of the ceramic pieces (127 pieces, 90%) can be dated to the agricultural prehistoric period based on the nature of the ceramic mass, profiling, or decoration from a chronological point of view. The remaining 10% can be attributed to the High Medieval (gray thin-walled pottery), modern (beige to brick-orange pottery with yellow-green glaze) and sub-recent periods (porcelain, stoneware with brown glossy glaze). A small clay ball complements the ceramic finds from the modern period. The vast majority of the prehistoric pottery, which moreover consists mainly of undecorated ware, can only be dated tentatively without further chronological refinement. Only 16.5% of the prehistoric pottery show diagnostic features where cultural classification is possible. Thirteen pieces can be dated to the younger stage of the Linear Pottery culture and are characterized by finely floated matrix with

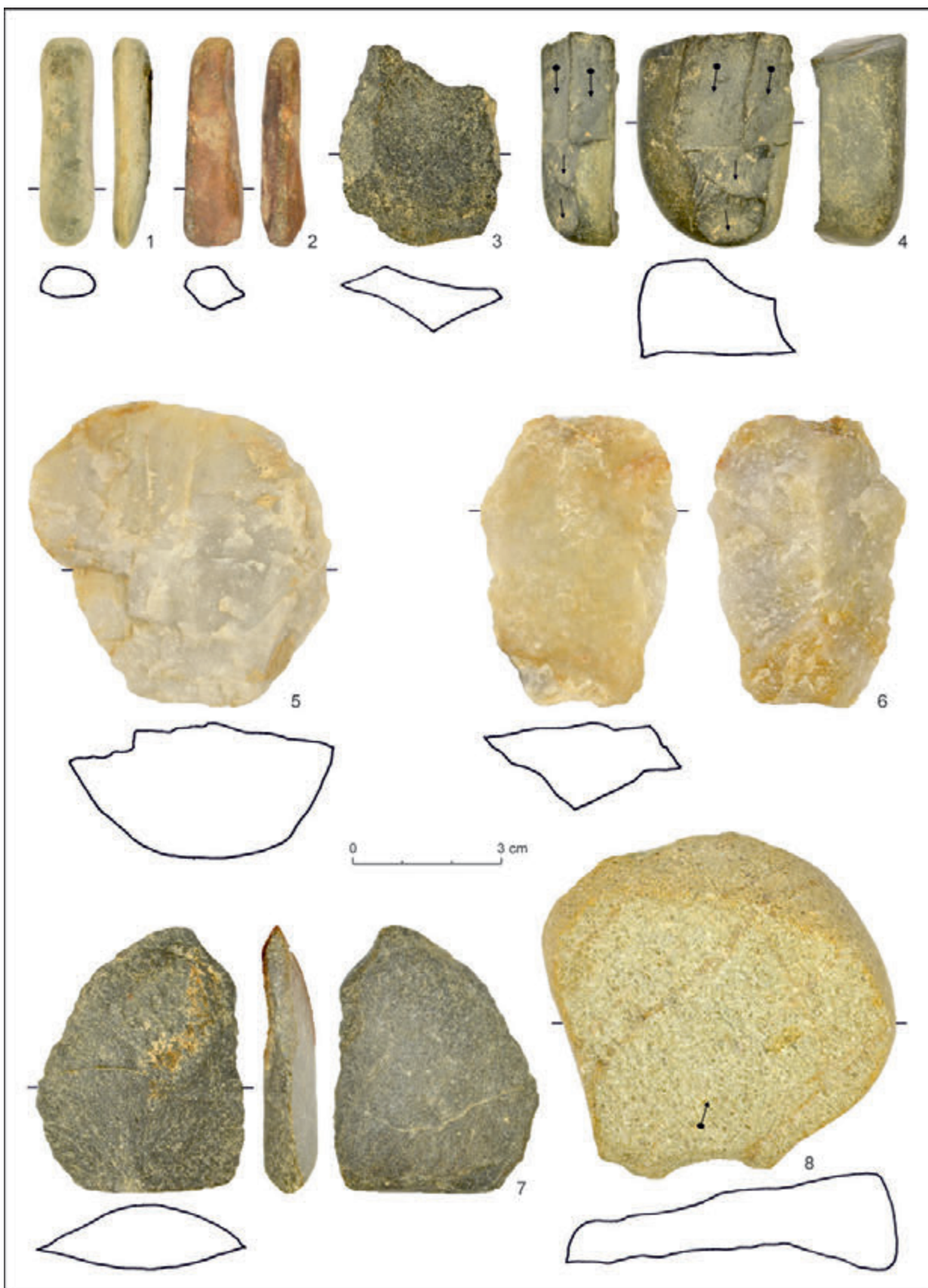


Fig. 6. Selected other stone artefacts. 1, 2 – Kulmian schist; 3, 7 – quartzite from Kulmian gravels; 4 – schist from Devonian-Kulmian boundary; 5, 6 – quartz; 8 – arkose sandstone. Drawing and photo by J. Bartík.



Fig. 7. Selected pottery finds. Drawing and photo by J. Bartík.

sandy or organic admixture. Very small proportion of fragments were identified morphologically. Two fragments were identified as base of a vessel. Four pieces were rim fragments of smaller globular vessels (Fig. 7: 1–4), one of which is decorated with a slightly oblique line of nail-like indentations at the transition to the body (Fig. 7: 3). A fragment of a spout of a medium-sized vessel with a plug-like protrusion (Fig. 7: 5) was identified in detail. Furthermore, five shards attributable to the Lengyel culture were obtained from the spoil heap excavation. These include a fragment depicting the greater part of the profile of a bowl with faint, slightly outwardly curved shoulders and a rounded rim (Fig. 7: 12), a fragment from a pedestal bowl (Fig. 7: 9), a fragment of a rounded handle with an oval cross-section (Fig. 7: 8) and two more rim shards from indeterminate vessel types (probably pots or beakers; Fig. 7: 6, 7).

Based on the character of the rim and a polished surface remnant, several remaining fragments can be dated to the younger agricultural prehistory, which was also identified during Klíma's research (cf. Klíma 1962). Within layer No. 3 human activities from the Early Bronze Age (Únětice culture; Ondroušková 2011, 81; Peška 2020, 116; Stuchlík 1981, 15, 16) and from the Early Iron Age (Horákov culture, Klíma 1962, 49; Ondroušková 2011, 81) were documented. The shard from the rim of a small vessel, which has a (repair?) hole (Fig. 7: 11), can also be dated probably to the younger prehistoric period.

Glass beads

As all of the excavated sediments were wet-sieved, small objects such as three glass beads were also discovered. The first two specimens can be described as small flat beads. One is dark blue (Fig. 8: 1; GB-1) and the other green in color (Fig. 8: 2; GB-2). Based on their potassium and magnesium contents, they can be characterized as mixed-alkali glasses with a low-magnesium content (LMHK type; Tab. 1). This type of glass appears in beads from the Middle Bronze Age, and probably earlier, with continuation into the Late Bronze Age (Henderson 2013, 90, 91). Copper, which is present in elevated amounts in both beads, serves as the primary colorant for green and less commonly, for dark blue glass (Purowski 2022). The green coloration in bead GB-2 was evidently achieved through an increased iron content. This bead also contains higher levels of lead and titanium. The last and largest of the beads (only one half remains) is made of light green faience, it is barrel-shaped and the surface is decorated with oblique grooves (Fig. 8: 3; GB-3). Glass bead GB-3, based on its composition, corresponds to natron glass, characterized by low magnesium and potassium contents (Tab. 1). Compared to GB-1 and GB-2, it has a higher content of silicon, tin, and barium. The peak production of natron glass occurred approximately between 800 BCE and 800 CE in Europe and the Near East (Henderson 2013, 92–97). In general, the identified beads correspond to the hitherto known findings of glass production (from graves and hoards) of the Bronze Age and Hallstatt period from Moravia (Čižmář/Čižmářová 2014; Golec et al. 2023; Kršová 2013; 2017).

Heavy-duty implements

The coarse tools and manuports are made from pebbles other than limestone and they are often fragmented. Some of them have pounding marks on their surfaces indicating their use as hammerstones utilized for knapping hard material, or traces of polishing indicating their use for powdering softer material. It was possible to find all these pebbles in primary and secondary geological deposits in close vicinity of the cave. As the similar artefacts were utilized during all periods identified in the cave, i.e. from the Paleolithic to the Early Medieval, a more refined chrono-cultural classification is not possible.

Other finds

The most important find in this category is an engraved limestone fragment. The limestone is similar to the limestone in the local environment, with the surface consisting of a smoothed part with engravings interpreted as horses and a broken surface without any engravings (Langley et al., submitted). The artefact is interpreted as a fragment of a bigger block or cave wall. Similar artefacts, fragments of limestone that probably spalled from cave walls, were reported from deposits of Hohle Fels Cave in Swabian Jura, Germany (Wolf et al. 2018). In the case of Hohle Fels Cave, the limestone fragments were painted with a red colorant.



Fig. 8. Glass beads. Scale: a – 1, 2; b – 3. Photo by K. Augustinová and M. Kmošek.

Tab. 1. Elemental composition of glass beads according to XRF analysis. (wt %; LE = Light Elements below Na).

Sample	GB-1	GB-2	GB-3
LE	45.1	45.05	56.44
Na	< 0.9	< 0.9	< 0.6
Mg	0.3	0.3	0.3
Si	13.2	10.4	22.8
P	0.4	0.8	0.1
S	0.1	0.2	0.1
Cl	13.9	12.2	5.5
K	7.4	6.0	< 0.03
Ca	16.0	20.3	11.9
Fe	2.1	3.1	1.3
Cu	2.9	2.8	0.9
Ti	0.2	0.5	0.1
Mn	0.1	0.1	0.0
Sn	< 0.01	0.01	0.22
Pb	0.08	0.29	0.01
As	0.03	0.04	0.00
Sr	0.19	0.23	0.02
Ba	< 0.15	0.6	1.5
Co	0.05	0.11	0.02
Ni	0.01	0.01	< 0.001
Zn	0.02	0.03	0.01
Cd	0.08	0.09	< 0.01
Sb	0.05	0.04	< 0.02
Bi	0.011	0.003	< 0.0006

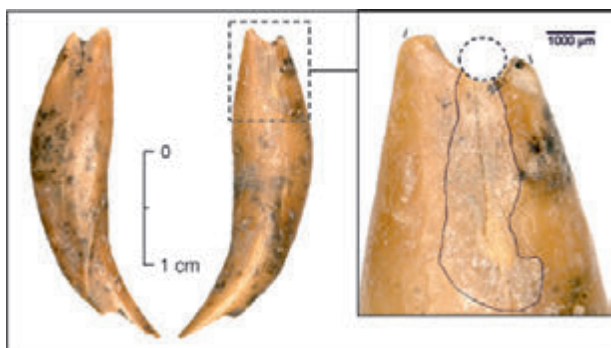


Fig. 9. Perforated fox tooth. Photo by Č. Fouček and J. Bartík.

An isolated fox tooth – a canine – shows traces of bifacial thinning in the root-end. There are visible cut marks in the direction of the long axis, however, the tooth is broken in the area of an expected hole (Fig. 9). As similar personal ornaments are known to have been used during various periods ranging from the Initial Upper Paleolithic to post-Paleolithic, the artefact was sampled for radiocarbon dating.

Two elongated, flat pebbles of Kulmian schist without cut marks, decoration, or other traces of utilization also represent important finds (Fig. 6: 1, 2). One of them has a reddish surface, but no red ochre was conclusively identified (Fig. 6: 2). These pebbles were brought to the cave from elsewhere, but their function remains unclear. Similar items were also described by B. Klíma (1974, fig. 27) in nearby Pekárna Cave.

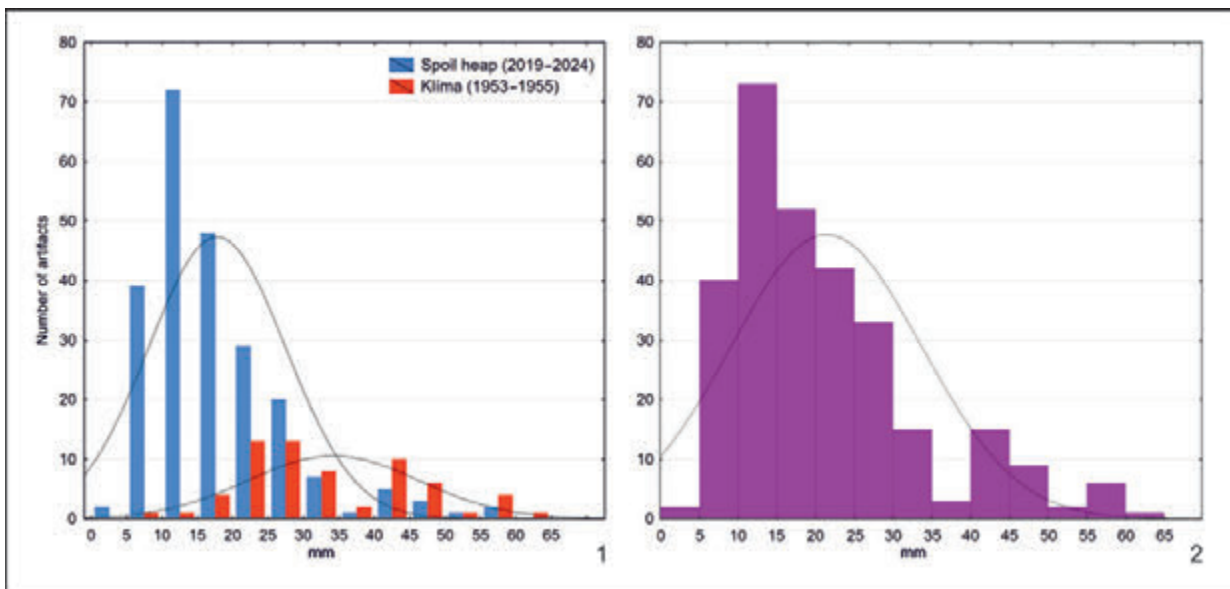


Fig. 10. Histograms comparing artefact maximum dimensions of B. Klíma's data and recent collections (1; provided by Z. Nerudová, Moravian Museum). Sum of both Klíma's and recent collections (2). Fits represent a normal distribution. Note that while B. Klíma excavated the entire cave, only 3.6% of the discarded sediments were re-excavated recently, i.e. a small fraction, prevailing in recent re-excavation, is significantly underestimated.

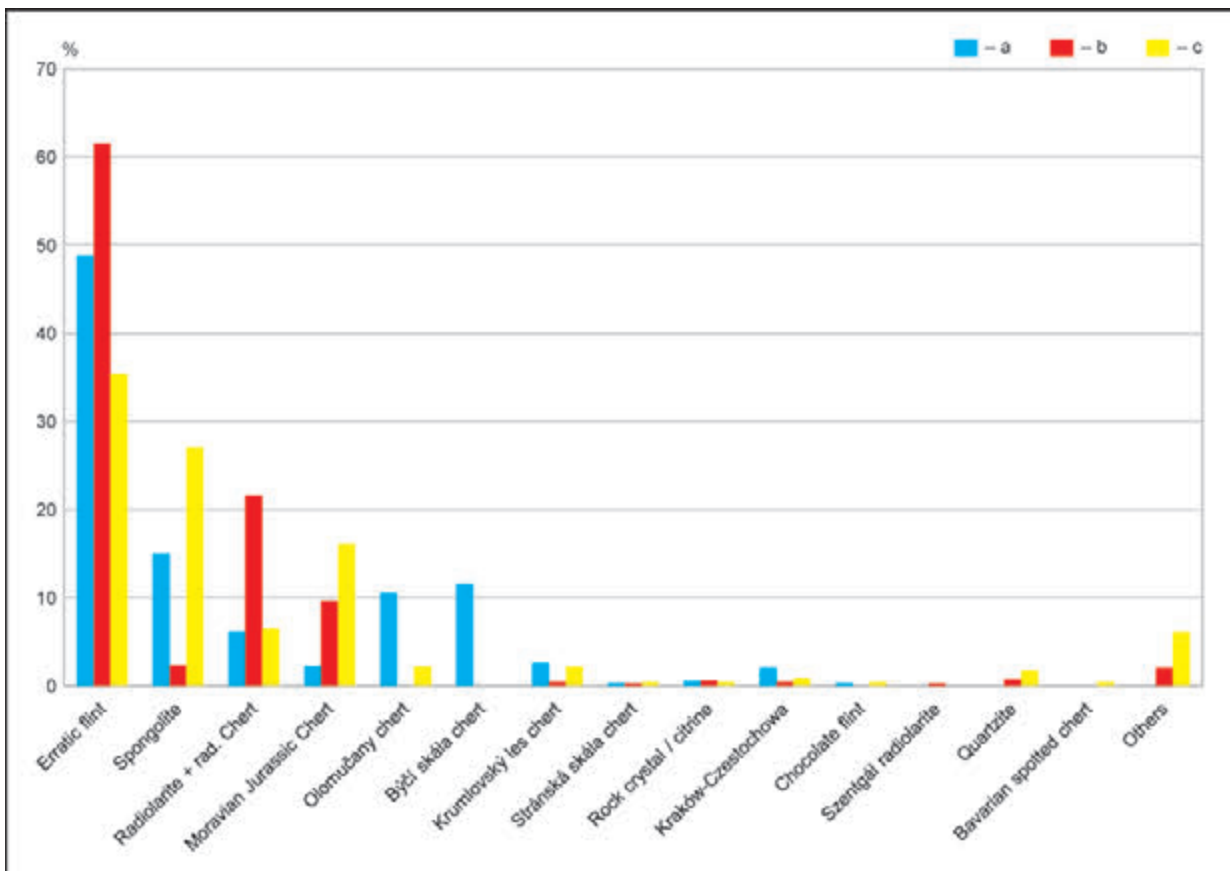


Fig. 11. Comparison of the raw material spectra within Magdalenian collections in the southern part of the Moravian Karst. Legend: a – Pekárna Cave (Voláková 2001); b – Ochozská Cave (Přichystal 2002); c – Švédův stůl Cave (new).

Variously shaped small lumps of yellow to brown ferric oxides with natural surfaces lacking any traces of their utilization are also present. This material may have been collected in the vicinity of the cave for ochre preparation, but we cannot exclude its origin within cave sediments (as weathering crust).

In addition, over 30 kg of faunal osteological material (mostly undiagnostic fragments belonging to both Pleistocene and Holocene periods) was collected and will be subject to detailed analysis in the future.

DISCUSSION

Recent re-excavation of cave sediments removed during Klíma's excavation of the cave permit a comparison of both excavation campaigns, that are separated by a period of almost 70 years. There were significant differences in excavation techniques – while the intact cave sediments were dug using heavy tools and were not sieved during Klíma's excavation, the sediments from Klíma's spoil heap were completely wet-sieved and screened during the recent re-excavation. The use of a 2 mm mesh and water for washing all screened material provided an opportunity to recover artefacts that were missed during the earlier excavation. The spoil heap artefacts are generally smaller compared to the earlier finds (knapped stone artefacts – cf. Fig. 10, pottery shards, beads), but the collection of new finds also consists of larger items including heavy-duty industry and an engraved limestone fragment (Fig. 10).

Most of the lithic artefacts can be classified as Magdalenian. Only several flakes from coarse raw materials (sun boulder – Fig. 4: 25, Kulmian-Devonian schist – Fig. 6: 3, 7) and quartz fragments (Fig. 6: 5, 6) suggest a Middle Paleolithic antiquity, however, it cannot be completely excluded that they belong to the Magdalenian period. Only single artefacts (including a rectangle made from Olomučany-type chert) can be linked to post-Paleolithic knapped industry. The raw material spectrum of the Švédův stůl knapped artefact collection slightly differs from previously analyzed collections from two (the only two analyzed by A. Přichystal in detail) neighboring sites – Pekárna Cave and Ochozská Cave plateau (Fig. 11). It is characterized by decreasing proportion of erratic flint and increased proportion of local materials including Cretaceous spongolite chert and Moravian Jurassic cherts. Surprisingly, other local materials including Olomučany-type chert and Býčí skála-type chert decrease in comparison to Pekárna Cave assemblage. Radiolarite is present in a similar proportion to Pekárna Cave but 3× lower than in Ochozská Cave plateau. The 18 backed bladelets (including truncated, laterally retouched, and pointed items) are the most typical of Magdalenian tools. Five of the bladelets are made from Moravian Jurassic cherts, four from spongolite, four from radiolarite, four from erratic flint and one specimen is burnt. A steeply retouched endscraper made from citrine has no analogy in other analyzed collections from the southern part of the Moravian Karst and neighboring areas (e.g. Brno Basin) with only one exception – a similar citrine artefact was reported from the Epigravettian site Stránská skála IV where other steeply retouched and carinated endscrapers (on other raw materials) were also described (Škrdl/Plch 1993). Possible Bavarian spotted flint, although only represented by one specimen, is an important raw material connecting the Moravian Karst with the Danube Route.

The Neolithic ceramic material presented here is consistent with the stratified finds from layer No. 4 and provides evidence of unspecified human activity during the Early/Middle and Late Neolithic periods (Klíma 1962, 26, 48). Švédův stůl Cave should not be considered a large residential cave like, for example, Pekárna Cave. Human activities had a rather short-term or seasonal character in the Neolithic. Of course, sacral and ritual use of caves is also predicted for this period (Bartík 2020; Peša 2014; Zajíček/Golec/Světlík 2019) and we can assume the same site function in the Bronze and Iron Ages.

CONCLUSION

The recent re-excavation, lasting for six years (2019–2024 – with interruptions caused by pandemic restrictions) was aimed at uncovering more details about human utilization of Švédův stůl Cave during prehistoric times. We have not identified any occupation phase previously not reported from this cave, however we have discovered categories of artefacts that have not been previously described from the earlier excavations. Citrine and Bavarian spotted flint increase the spectrum of lithic raw materials. A pierced tooth represents the presence of a personal ornament and an engraved stone represents non-utilitarian activity most probably from the Magdalenian period. Glass beads provide evidence of human activities during the Bronze and Iron Ages.

We can conclude that the relicts of intact sediments (lowermost part of the spoil heap profile) have been preserved within parts of the cave plateau (Nejman *et al.* 2020; Wright *et al.* 2021). The sediments deposited on the spoil heap that is located at the end of the cave plateau contain a substantial proportion of finds (artefacts and osteological material) that has produced more information pertaining to the utilization of the cave during prehistoric periods and it is desirable to continue these re-excavations. The re-excavation method developed for this cave can be used (especially in its improved form) for future works at this site. The spoil heap contains archaeological material representing a secondary archaeological site and therefore needs to be protected.

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Revizní výzkum sedimentů vyvezených z jeskyně Švédův stůl (Moravský kras, ČR) a jejich archeologický potenciál

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Souhrn

V letech 2019–2024 byl proveden revizní výzkum sedimentů z haldy, kterou B. Klíma deponoval před jeskyní Švédův stůl během jeho výzkumů v 50. letech minulého století. Zatímco B. Klíma podle jeho odhadu prokopával a vyvezl 450 m³ sedimentů, nově bylo prozkoumáno pouze 16 m³ těchto sedimentů, což představuje přibližně 3,6 % objemu Klímovy haldy (obr. 1; 3). Na rozdíl od původní výzkumné metodiky byly při revizním výzkumu veškeré sedimenty plaveny na sítích o rozměru oka 2 mm, což umožnilo získání i těch nejdrobnějších artefaktů (obr. 2).

Nově bylo získáno 229 artefaktů (oproti 193 artefaktům z výzkumu B. Klímy). Převážnou část nově získaných artefaktů štípané kamenné industrie lze klasifikovat jako magdalénien (obr. 4), pouze u několika úštěpů z hrubozrnných surovin (sluňák – obr. 4: 25, břidlice devon-kulm – obr. 6: 3, 7 a zlomky křemene – obr. 6: 5, 6) lze uvažovat i o středopaleolitické klasifikaci, ale nelze vyloučit, že patří taktéž k magdalénien. Ojedinelé artefakty umožňují i postpaleolitickou klasifikaci (srpová čepel z rohovce typu Olomučany – obr. 4: 37). Spektrum surovin nově získané kolekce se odlišuje od dřívě zdokumentovaných spekter z Pekárny a z plošiny před Ochozskou jeskyní (obr. 11). Oproti zmíněným kolekcím zejména klesá podíl eratického silicitu a naopak narůstá podíl křídového spongiového rohovce a moravských jurských rohovců. Za pozornost stojí i přítomnost ojedinelých artefaktů z křišťálu/citrínu (obr. 5) a kropenatého bavorského rohovce. Technologické spektrum je téměř z poloviny (45 %) tvořeno drobnými artefakty do velikosti 1,5 cm. Skupina nástrojů představuje 15,7 % souboru a z poloviny je tvořena mikrolitickými nástroji (obr. 4: 1–12, 15–22), které doplňují škrabadla (obr. 4: 23, 26, 29), rydla (obr. 4: 28, 34), retušované čepele a jejich zlomky (obr. 4: 2, 14, 15, 27), vrták (obr. 4: 35), odštěpovač (obr. 4: 24) a retušovaný zlomek (obr. 4: 36).

Nálezy keramických fragmentů odpovídají kulturním okruhům doloženým již výzkumem B. Klímy (obr. 7). Nově ale byly získány dva malé a zlomek jednoho většího skleněného korálku, které lze na základě prvkové analýzy datovat do doby bronzové a do doby železné (obr. 8).

Z dalších zajímavých předmětů pravděpodobně paleolitického stáří, které byly nově získány, lze zmínit zlomek vápence se stopami rytí, snad opad ze stěny jeskyně, který bude předmětem specializované studie (*Langley et al., submitted*), dva protáhlé valounky kulmské břidlice beze stop rytí (obr. 6: 1, 2; analogické artefakty pocházejí také z Pekárny, Klíma 1974, obr. 27), špičák lišky s poškozeným otvorem na zavěšení (obr. 9) a hrušky oxidů železa. Výše popsané nálezy doplňuje více než 30 kg fragmentů osteologického materiálu, které budou předmětem budoucího výzkumu.

Závěrem je možno konstatovat, že výzkum již jednou překopaných sedimentů má potenciál přinášet další poznatky o využívání jeskyně v různých obdobích pravěku a z tohoto důvodu máme v plánu v něm pokračovat. Současně je třeba konstatovat, že výsypka před jeskyní z našeho pohledu představuje sekundární archeologickou lokalitu a jako takovou je ji třeba chránit.

Obr. 1. 1 – lokalizace jeskyně Švédův stůl v Moravském krasu; 2 – lokalizace sond vykopaných v letech 2019–2024. Legenda: a – výzkum 2019; b – výzkum 2020–2024; c – stromy; d – profily; e – Moravský kras; f – poloha jeskyně. Autor J. Bartík, zdroj mapy: mapy.cz.

Obr. 2. Metodika výzkumu. 1 – kopání sedimentů na povrchu haldy; 2 – plavení v suchém korytu řeky; 3 – transport sedimentu v pytlech; 4 – plavení mimo lokalitu; 5 – dokumentace profilu v hloubkové sondě. Foto P. Škrdla, J. Bartík.

Obr. 3. Stratigrafie profilů v haldě (profily P1–P3, jejich lokalizace viz obr. 1: 2). Foto J. Bartík, D. Wright.

Obr. 4. Vybrané štípané artefakty. 1, 5, 20, 22, 32 – křídový spongiový rohovec; 2, 10 – přepáleno; 3, 8, 17, 19 – radiolarit; 4, 11, 14, 16, 21, 24, 29–35 – eratický silicit; 6, 7, 9, 12, 13, 15, 18, 23, 28 – moravské jurské rohovce; 25 – sluňák; 26 – křišťál/citrín; 27 – bavorský tečkovaný rohovec; 36 – vápenec; 37 – rohovec typu Olomučany. Kresba J. Brenner, foto J. Bartík.

Obr. 5. Škrabadlo z křišťálu/citrínu. Foto J. Bartík.

Obr. 6. Vybrané artefakty z ostatních surovin. 1, 2 – kulmská břidlice; 3, 7 – kvarcit z kulmských šterků; 4 – břidlice z rozhraní devon, kulm; 5, 6 – křemen; 8 – arkózový pískovec. Kresba a foto J. Bartík.

Obr. 7. Vybrané keramické nálezy. Kresba a foto J. Bartík.

Obr. 8. Skleněné korálky. Měřítka: a – 1, 2; b – 3. Foto K. Augustinová a M. Kmošek.

Obr. 9. Zub lišky s otvorem. Foto Č. Fouček a J. Bartík.

Obr. 10. Histogramy porovnávající maximální rozměry artefaktů z výzkumu B. Klímy a z nové kolekce (1; data poskytl Z. Nerudová, Moravské zemské muzeum). Klímova a nová kolekce dohromady (2). Křivky představují normální rozdělení. Pozn.: Zatímco B. Klíma prozkoumal celou jeskyni, pouze 3,6 % jeho haldy bylo nově proplaveno, tzn. že malá frakce, která v novém souboru převažuje, je výrazně podhodnocena.

Obr. 11. Porovnání surovinových spekter magdalénských souborů z jižní části Moravského krasu. Legenda: a – jeskyně Pekárna (*Voláková 2001*); b – Ochozská jeskyně (*Přichystal 2002*); c – jeskyně Švédův stůl (nové).

Tabela. 1. Prvkové složení skleněných korálků na základě XRF analýzy.

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UNDERSTANDING GRAVETTIAN SETTLEMENT DYNAMICS THROUGH LITHIC EVIDENCE¹

Case of Pavlov I – Southwest, area A

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The Upper Paleolithic Gravettian tradition, which dates from 34 to 24 kyr BP (Lengyel/Wilczyński 2018), is distinguished by advanced lithic technology and extensive cultural adaptations across Europe. The Pavlov I site (Klíma 1954), situated in the Moravian region of the southern Czech Republic, represents one of the most significant Gravettian settlements, characterised by a complicated spatial structure and an abundance of archaeological finds. This study analyses the lithic assemblages retrieved from Area A during the 2013–2015 excavations. The area, which has been identified as a settlement activity zone, yielded a total of 2,615 lithic artefacts, accompanied by a number of faunal remains, including mammoth bones and an almost complete wolf skeleton (Sázelová et al. 2020).

The research employs technological, typological, and spatial analyses to shed light on the lithic production processes and raw material economies of the area. Silicite, which is predominantly erratic flint, emerged as the dominant raw material, followed by radiolarite, chert, and other less frequently utilised varieties. The documentation of a complete lithic operational chain, encompassing core preparation, tool production, and waste management, serves to reinforce the area's significance as a centre for daily activities. The spatial analyses identified four distinct concentrations of artefacts, which were interpreted as zones for habitation, tool production, disposal, and specialised activity. These findings align with those of previous studies of Pavlov I, thereby reaffirming its importance in understanding Gravettian settlement dynamics, raw material utilisation, and technological sophistication. The results contribute to a comprehensive view of human adaptation and cultural organisation in Upper Paleolithic Central Europe.

INTRODUCTION

The Upper Paleolithic, spanning roughly 50,000 to 10,000 years ago, marks a transformative period in human prehistory, defined by advances in technology, social organization, and symbolic expression (Boyle/Gamble/Bar-Yosef 2010; Jochim 2002; Zilhão 2014). Among its cultural traditions, the Gravettian, emerging around 30,000 years ago, is notable for its sophisticated lithic technology and widespread distribution across Europe (Bicho et al. 2017; Kozłowski 2015; Otte 1981). Gravettian settlements, ranging from open-air sites to caves, reflect diverse adaptations and complex lifeways. Their characteristic lithic assemblages, provide key insights into these societies (Klaric 2007; Polanská 2020). Within this framework, the Moravian region stands out as one of the main focal points of Gravettian activity, mainly for its numerous large complex settlement sites (Svoboda et al. 2000; Svoboda 2020). The Pavlov I site, one of the largest and most complex Gravettian settlement agglomerations on the Pavlov Hills in the southern Moravia, has been known for decades (Svoboda 2020). The initial excavation of the site commenced in the 1950s (Klíma 1954) and has been subjected to further investigation during subsequent excavation seasons (1952–1958; 1960–1965; 1967–1971; Svoboda 1994; 1997; 2005). The most recent excavation of this site, conducted between 2013 and 2015, was prompted by the construction of Archeopark Pavlov museum building (Svoboda et al. 2016). This revealed several previously unexplored areas. One of these was area A, located

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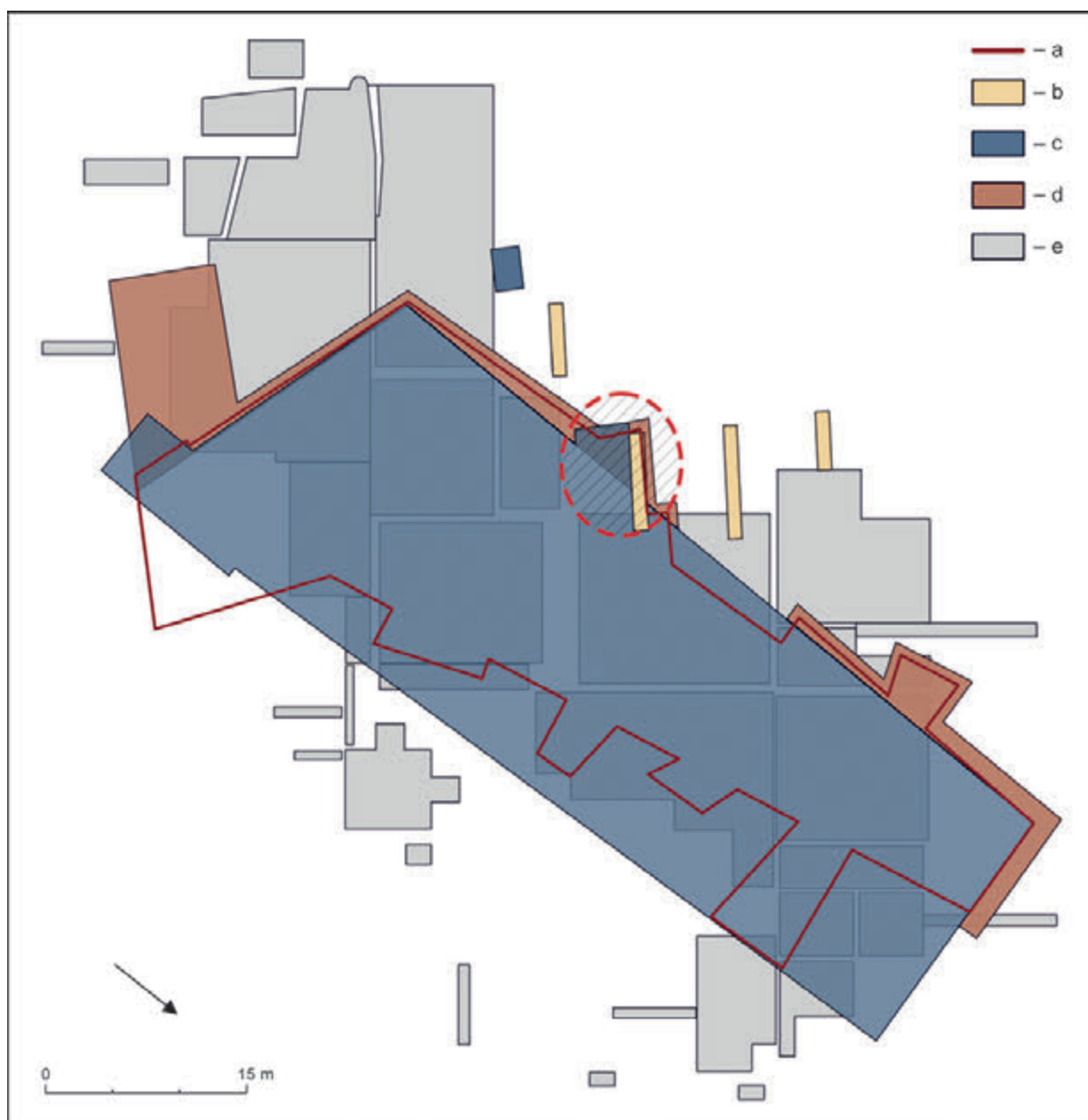


Fig. 1. General plan of the site showing the excavation of B. Klíma (1952–1972), the most recent excavation of J. Svoboda (2013–2015), and location of the analysed area A (hatched ellipse). Legend: a – building plan APP; b – excavation J. Svoboda (2013); c – excavation J. Svoboda (2014); d – excavation J. Svoboda (2015); e – excavation B. Klíma (1952–1972). Graphics O. Herčík, M. Novák.

in the south-western part of the site. The entire area comprises three trenches excavated separately in 2013, 2014, and 2015, covering a total of 42 m² (Fig. 1). It has the shape of a right triangle, which initially followed the construction plan of the Archeopark Pavlov museum building, with sides 9 and 7 m long. According to the character of the find situation, the area is considered a settlement activity zone with developed palimpsest microstratigraphy of the cultural deposit from 29 to 33 ka cal BP, consistent with the Middle and Early Gravettian (Svoboda *et al.* 2016). There were several hearths and depressions recorded in this area. Apart of these settlement structures and artefacts of lithic industry, bones of “*Mammuthus primigenius*” and distal parts of limbs of various carnivores were recorded as well. Apart from fragmented parts of carnivores, an almost complete skeleton of “*Canis lupus*” was uncovered in its anatomical position (Sázelová *et al.* 2020).

This article presents the results of technological, typological, raw material, and spatial analyses of lithic assemblage, that was recovered from this area. These results are then compared to those of previous analyses of the site (*Verpoorte 2005*). The main objective was to process all the investigated parts of the site in order to contribute to an overall picture of the site, while the attention was focused on the raw material and technological economy and possible identification of activity zones within the studied area.

MATERIAL AND METHODS

An assemblage of 3615 lithic artefacts was obtained in area A in total. The area is divided into 42 square sectors according to a unique 1m square grid with the squares labelled with numbers on the X-axis (1–9) and letters on the Y-axis (–A–F). The location of all archaeological findings (lithic artefacts, archaeozoological items and other objects) found during the excavation was recorded by the use of the coordinates in the unique local three-dimensional XYZ system through the use of a total station PENTAX W-825NX (in 2013 and 2014 excavation season) and by recording locations based on the square grid (in 2015). The finds discovered through the wet sieving of the excavated sediment were spatially documented within the corresponding sector and the relevant depth level. Although this may affect the analysis results to some extent, we exclude these finds in this study due to inconsistent wet-sieving excavation strategies in individual excavation seasons.

A detailed description of each lithic artefact was employed in the technological analysis of the assemblage, followed by the work of *Inizan et al. (1999)*. This process focused on characteristics that could provide information about technology and “chaîne opératoire” of the production process. The typology of the retouched tools was determined based on classification by *Sonneville-Bordes/Perrot 1953*, modified by *Klíma 1956*. The raw material description was based on a macroscopic determination using a comparison of reference raw materials with analysed artefacts, which was subsequently compared to the work of *Příchystal 2013*.

The spatial analysis presented here employs visual inspection of recorded spatial data (e.g. *Nigst/Antl-Weiser 2012*). To illustrate the distribution patterns of artefacts across the area, we created filled contour maps displaying the location and density of individual lithic assemblage categories within 0.5 × 0.5 m squares of the excavation area grid system. The spatial data was computerised using the grid-based contouring and surface mapping software Surfer in version 16 (*Golden Software 2018*), where the interpolation method of “kriging” (*Davis 1973*, 381–390; *Wheatley/Gillings 2002*, 183–200) with Surfer-predefined parameters (*Golden Software 2018*, 243–248) was used to create the density maps.

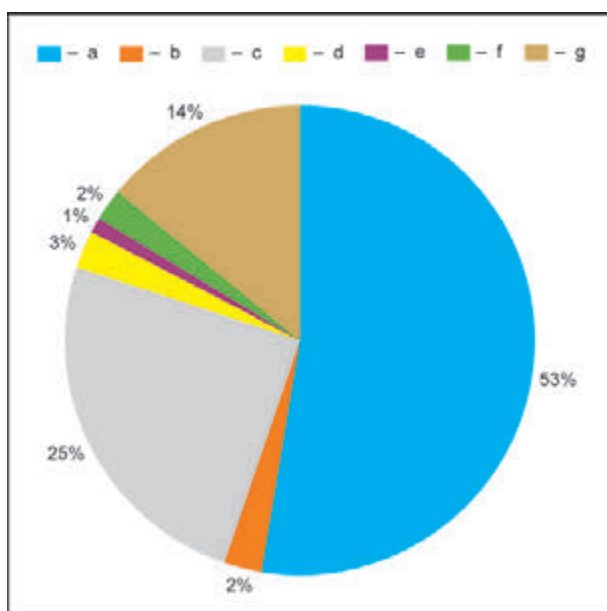


Fig. 2. Pavlov I, area A. Raw material composition of lithic assemblage as percentage. Legend: a – erratic flint; b – Krakow-Czenstochowa flint; c – silicite (not spec.); d – radiolarite; e – spongolite; f – hornstone; g – others.

RESULTS

Raw material composition

The macroscopic determination of the raw material composition of the assemblage indicates that silicite is the most dominant raw material, comprising 84% of the assemblage. As shown in the Fig. 2, the most dominant types are flint varieties, of which two different types were identified: erratic flint (53%) and Krakow-Czenstochowa Jurassic flint (2%). Nevertheless, the precise identification of either of the flint varieties in the assemblage was not possible in 25% of the cases due to the heavy surface patination. Other identified raw materials in the assemblage include radiolarite (3%) and hornstone varieties (2%), while the remaining raw materials are categorised as other/non-determinable.

Tab. 1. Pavlov I, area A. Artefact totals by raw material types as numbers and percentages of each type.

	Erratic flint	Jurassic flint	Silicite (not spec.)	Radiolarite	Chert	Spongolite	X	Total	%
Flakes	160	21	60	8	12	4	11	276	11
Blades	272	30	112	10	18	9	21	472	18
Retouched	55	5	21	19	2	0	4	106	4
Cores	5	2	0	1	0	0	1	9	0.3
Microlithics	41	3	20	1	0	1	1	67	2.6
Burin spalls	12	0	7	0	3	0	0	22	0.8
Raw material	0	0	0	1	1	3	0	5	0.2
Fragments	783	6	77	15	13	3	281	1178	45
Chips	34	1	33	1	4	2	14	89	3.4
Other waste	14	0	319	12	5	5	36	391	15
All	1376	68	649	68	58	27	369	2615	100
%	53	3	25	3	2	1	14	100	

Technology and typology

The lithic assemblage was divided into ten categories, as shown in Tab. 1. The majority of the assemblage comprises non-specified fragments and non-retouched blades. Following that, the next largest category is the group of knapping waste. However, although in significantly lower number, there are also retouched artefacts, microblades, burin spalls, cores and other types present as well. The clear presence of artefacts in all production stage categories indicates the existence of a complete lithic production chain. This chain begins with the storage of raw material and continues through core preparation to the production of final tools, even including the possibility of reshaping and repair during use. The finer division of every technological category has enabled the identification of more concrete stages of core reduction. For example, the decortical phase, the repair of the striking platform, and the repair and transformation of tools.

Cores

Cores are present in the examined assemblage in the smallest ratio (0.3%), occurring immediately after raw materials (0.2%). The raw material used for cores was predominantly erratic flint, although two of them were made from Krakow-Czestochowa flint and only one was made from radiolarite. One piece remains undetermined.

With regard to the “chaîne opératoire”, it can be stated that all cores were abandoned at an advanced stage of reduction or even completely exhausted (Fig. 3). However, the character of the cores varies. In three cases, it was possible to identify multiplatform cores, which were exploited for flakes and blades. Almost all of the unipolar and bipolar cores, with the exception of one, can be characterised as blade-like types. In general, the striking platform of the studied cores is flat. However, in one case, there are visible negatives of small flakes, which may indicate that the striking platform has been repaired. Some of the group has visible traces of abrasion or edge preparation. On six cores, it is possible to observe negatives of the so-called knapping failures, which resulted in the formation of hinged flakes or blades. All cores exhibiting knapping failures were made of erratic flint.

Non-retouched artefacts

The group of non-retouched artefacts represents the most numerous groups of this lithic assemblage. It includes intentionally created blank types as well as waste products from the whole knapping process, and unintentional pieces. The highest number in this group comprises unidentifiable fragments, where pieces differ greatly in size and shape and it is very difficult to identify the original blank type. However, the raw material analysis showed that the pieces are mostly made out of erratic flint. In contrast, the number of waste products is significantly lower. These include small chips and other types of waste.

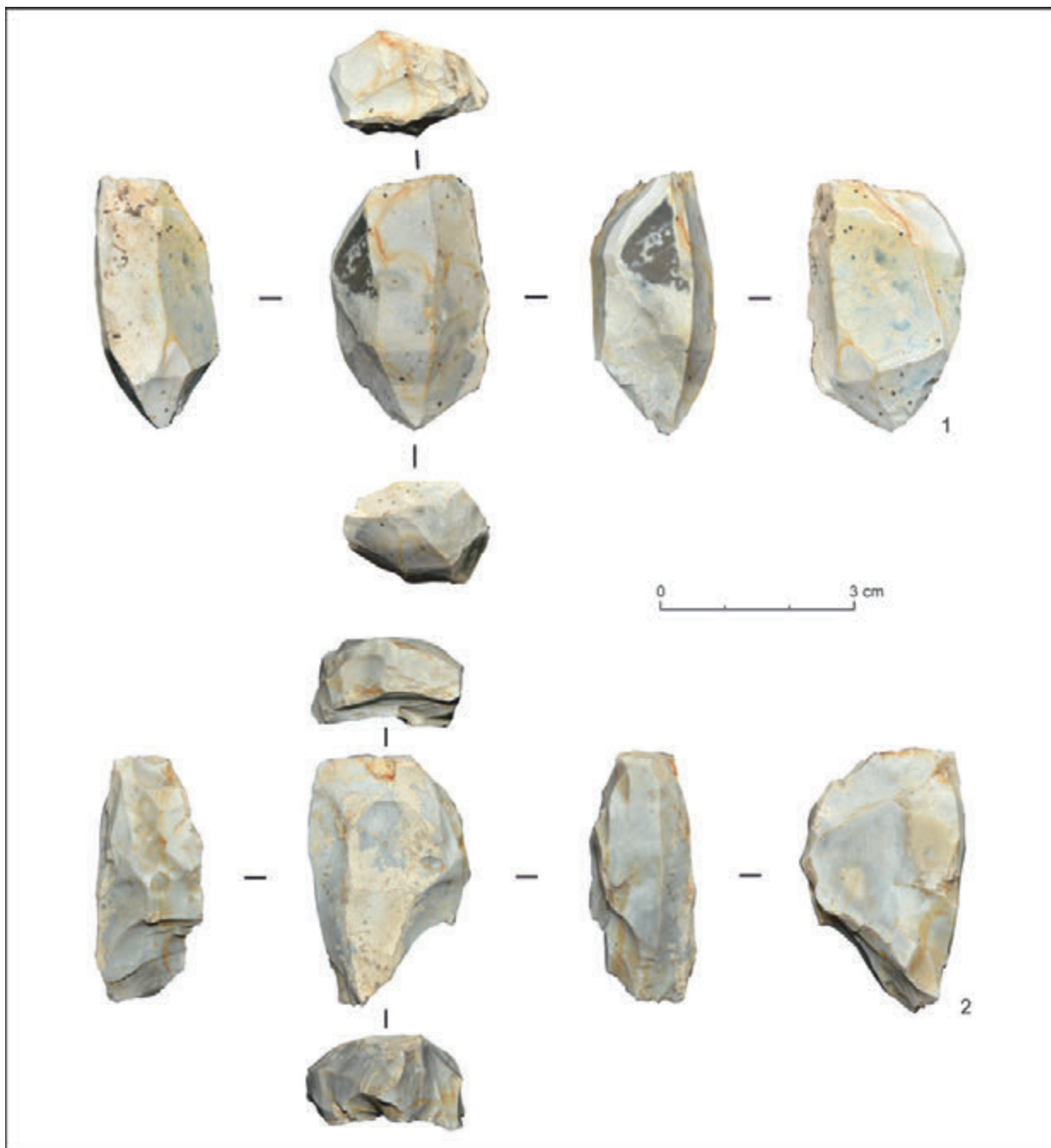


Fig. 3. Pavlov I, area A. Cores.

The flakes represent 11% of the assemblage. However, due to determinable features, it was possible to determine from which part of the knapping process they result (Tab. 2). The initial core preparation is demonstrated by cortical, or at least partially cortical flakes. This could indicate that the raw material was not modified elsewhere, but rather that the raw material in the form of undisturbed nodules was brought to the site to be worked. The stage of core preparation can be divided into at least two different stages based on the present flakes. First, the general preparation of the core surface can be assumed. Secondly, based on the presence of tablets, the preparation of the striking platform can be identified. However, the majority of the flakes could not be closely determined due to the scarce presence of relevant data. With regard to the percussion technique, based on the distinctive butt attributes (*Inizan et al. 1999*), it was possible to identify the use of predominantly organic, soft stone and hard stone hammers.

Tab. 2. Pavlov I, area A. Types of flakes as numbers and percentage.

Type	Total	%
Decortical	33	12
Reparational	87	32
Tablet	12	4
Plain debitage	3	1
Indeterminable	141	51
Total	276	100

Tab. 3. Pavlov I, area A. Types of blades as numbers and percentage.

Blade	Total	%
Plain debitage	272	58
Crested blade	15	3
Second crested blade	8	2
Side blade	7	1
Decortical	13	3
Reparational	49	10
Neo-crete	1	0
Indeterminable	107	23
Total	472	100

Tab. 4. Pavlov I, area A. Dorsal pattern of blades by type as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Unidirectional	175	1	–	1	2	50	14	243	51
Bidirectional	60	–	–	1	–	8	5	74	16
Transverse	9	7	4	1	2	11	19	53	11
Centripetal	2	1	–	1	–	–	1	5	1
Other	7	6	4	1	2	11	5	36	8
No negatives	1	–	–	1	4	1	–	7	1
Indeterminable	18	–	–	1	4	26	5	54	11
Total	272	15	8	7	14	107	49	472	100

Tab. 5. Pavlov I, area A. Butt of blades by type as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Cortical	1	–	–	–	3	1	–	5	1
Plain	83	1	1	1	3	17	19	125	26
Facette	1	–	–	–	–	3	–	4	1
Linear	23	–	2	1	–	4	5	35	7
Point	12	1	–	–	–	3	3	19	4
En éperon	4	1	–	–	–	1	2	8	2
Indeterminable	1	–	–	–	–	–	–	1	0
Fractured	14	1	1	–	–	3	5	24	5
Absent	133	11	4	5	8	75	15	251	53
Total	272	15	8	7	14	107	49	472	100

Tab. 6. Pavlov I, area A. Types of blade profile by type of blade as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Straight	166	7	1	3	5	25	9	215	46
Convex	76	6	5	–	5	8	23	124	26
Irregular	1	–	2	3	–	5	6	17	4
Indeterminable	29	2	–	1	4	69	11	117	25
Total	272	15	8	7	14	107	49	472	100

Tab. 7. Pavlov I, area A. Type of edge by type of blade as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Paralel	138	6	–	–	4	16	1	165	35
Convergent	42	6	5	1	–	5	2	61	13
Divergent	19	–	1	–	4	6	1	31	7
Oval	8	–	–	1	–	–	2	11	2
Irregular	21	1	2	3	–	8	18	53	11
Indeterminable	44	2		2	6	72	25	151	32
Total	272	15	8	7	14	107	49	472	100

Tab. 8. Pavlov I, area A. Type of cross section by type of blade as number and percentage.

	Plain debitage	Crested blade	Sous-crete	Side blade	Decortical	Indeterminable	Reparational	Total	%
Triangular	122	10	4	4	7	40	5	192	41
Trapezoidal	112	–	–	–	–	38	6	156	33
Polygonal	32	1	1	–	–	8	5	47	10
Irregular	5	4	3	3	2	4	30	51	11
Indeterminable	1	–	–	–	5	17	3	26	6
Total	272	15	8	7	14	107	49	472	100

Tab. 9. Pavlov I, area A. Dorsal pattern of bladelets as number and percentage.

	Total	%
Unidirectional	52	78
Bidirectional	3	4
Transverse	3	4
Other	3	4
No negatives	3	4
Indeterminable	3	4
Total	67	100

Tab. 10. Pavlov I, area A. Type of edge by type of bladelet as number and percentage.

	Total	%
Convergent	11	16
Divergent	3	4
Oval	3	4
Parallel	28	42
Irregular	9	13
Indeterminable	13	19
Total	67	100

Tab. 11. Pavlov I, area A. Type of hammer used for production of bladelets number and percentage.

	Total	%
HS	–	–
SS	5	7
OP	10	15
X	52	78
Total	67	100

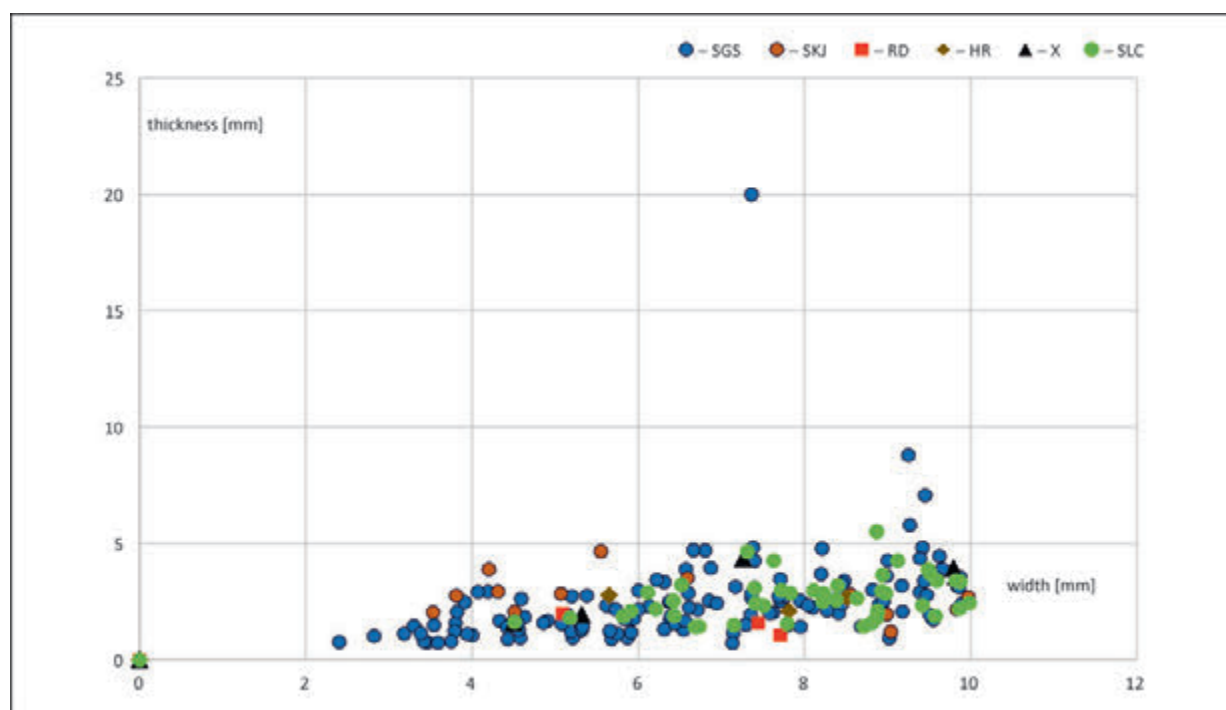


Fig. 4. Pavlov I, area A. Width to thickness ratio of blades by raw material. Legend: SGS – erratic flint; SKJ – Krakow-Czestochowa silicite; RD – radiolarite; HR – hornstone; X – indeterminable; SLC – indeterminable silicite.

The most prevalent type of blades and bladelets is “plain debitage” representing the final product of blank production (Tab. 3). In addition to this type of blades, blades resulting from core modification, either reparative or preparative, have been identified. However, they are relatively uncommon. The majority of these blades are crested, with some exhibiting a second crested morphology. In a very small percentage of cases, the decortical blade was also identified. In general, it can be stated that the majority of blades classified as “plain debitage” exhibit unidirectional (51%) or bidirectional (16%; Tab. 4) dorsal scar patterns, have absent (53%) or plain (26%) butt (Tab. 5). Their profiles are mostly straight (46%) or convex (26%; Tab. 6), they have parallel shape (35%; Tab. 7) and triangular cross section (Tab. 8). In 75% of cases, it was not possible to determine the hammer used, primarily due to the state of preservation or lack of determining features. However, in cases where it was possible to determine the hammer used (25%), it was found that organic hammers were used unequivocally (21%). In contrast, soft stone hammers were used only in 4% of cases. It is important to note that the use of hard stone hammer was certainly detected only in a single case.

With regard to the group of bladelets, it can be observed that they typically exhibit a unidirectional dorsal scar pattern (78%; Tab. 9), a parallel shape (28%; Tab. 10), and were created by an organic hammer (15%; Tab. 11). However, due to the state of fragmentation, it was not possible to determine the exact type of hammer used in the majority of cases.

According to a comparison of the width and thickness, there is no dividing line between blades and bladelets, and thus a continuous pattern can be observed. However, in Fig. 4, where only the morphometry of blades is being compared, a clear preference is visible in width of 10–15 mm and thickness of 0.2–5 mm, regardless of the raw material.

Conversely, when comparing the morphometry of bladelets (Fig. 5), the preferred width and thickness were 5.8–10 mm and 0.1–5 mm, respectively. These results indicate that bladelets and blades in general adhere to a thickness of 5 mm. There was no significant morphometric preference based on the raw material evident in this assemblage.

Retouched artefacts

The group of retouched artefacts represents only 4% of the total assemblage. However, it includes a variety of tools, as visible in the Tab. 12, including microliths and endscrapers. In general, erratic flint or silicite of Krakow-Czestochowa Jura is the dominant raw material in every category of tools.

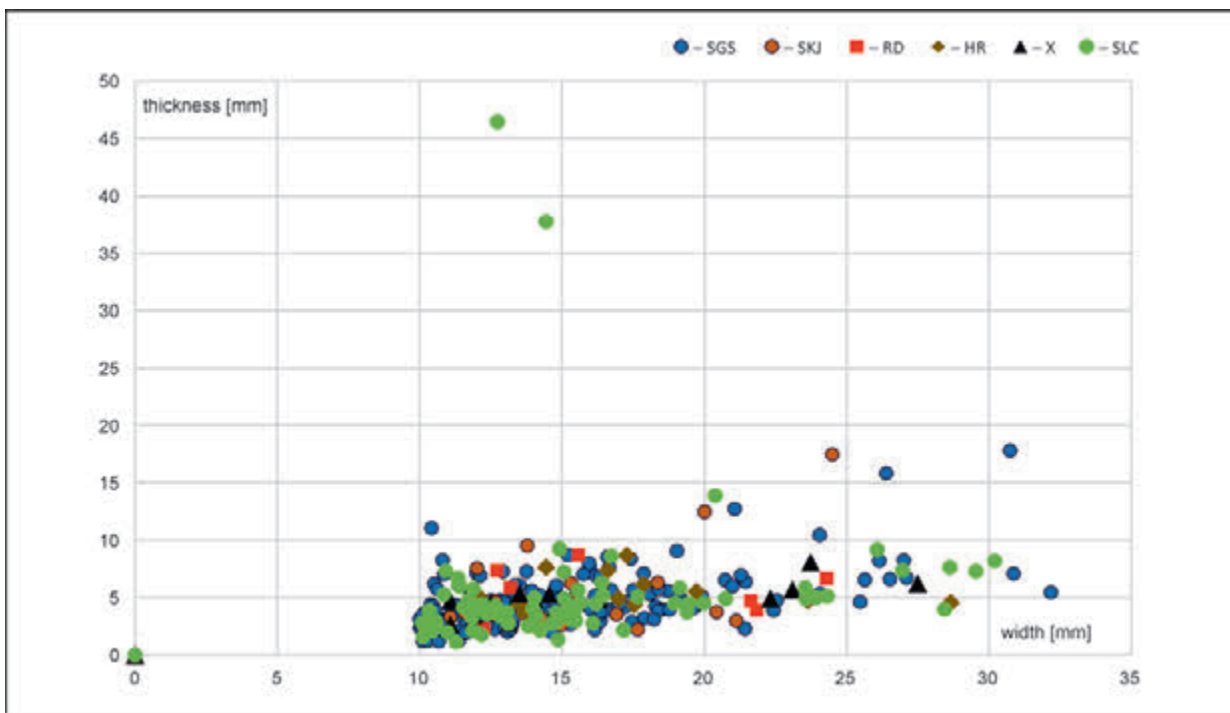


Fig. 5. Pavlov I, area A. Width to thickness ratio of bladelets by raw material. Legend: SGS – erratic flint; SKJ – Krakow-Czestochowa silicite; RD – radiolarite; HR – hornstone; X – indeterminable; SLC – indeterminable silicite.

Another raw material was almost entirely absent from the category of retouched artefacts. However, it is important to note that there is a visible preference for certain raw materials in relation to specific tool types. As illustrated in Tab. 12, radiolarite was almost exclusively used for retouched microliths (58%).

The most dominant type of retouched artefacts are microliths (31%). They vary greatly in typology, with five different types present. Backed bladelets (Fig. 6: 1), for which production was primarily based on erratic flint, account for 38% of retouched microblades. The second largest group is represented by so-called microgravettes, which account for 36%. By identifying different types of microgravettes, it was even possible to divide this group more finely, with examples from Milovice (Fig. 6: 2), Dolní Věstonice (Fig. 6: 3) and also so-called oval elements (Fig. 6: 4; *Polanská/Michalík 2015*). The total number of pieces is six, and the last dominant microlith type in this assemblage is microsaws, also known as denticulate pieces (18%; *Novák 2016*). Radiolarite was used for the oval elements and microgravettes (Tab. 13).

The second largest category among retouched artefacts is retouched blades (25%). The type of retouch among this category is variable, however, majority of retouched blades have been retouched only uniaxially and on one edge. In 88% of cases, they were made of silicite, although radiolarite (8%), chert (4%) and non-identifiable raw material were also detected.

Tab. 12. Pavlov I, area A. Retouched artefacts total by raw material types as numbers and percentages of each type.

Type	Flint (erratic + jurassic)	Radiolarite	Chert	Spongolite	Total	%
Retouched blades	23	2	1	–	26	25
Retouched microlithics	20	11	1	1	33	31
Burins	12	–	–	2	14	13
Scrapers	6	2	–	1	9	8
Partially retouched tools	11	–	–	–	11	10
Points	5	4	–	–	9	8
Combinations	4	–	–	–	4	4
Total	81	19	2	4	106	100

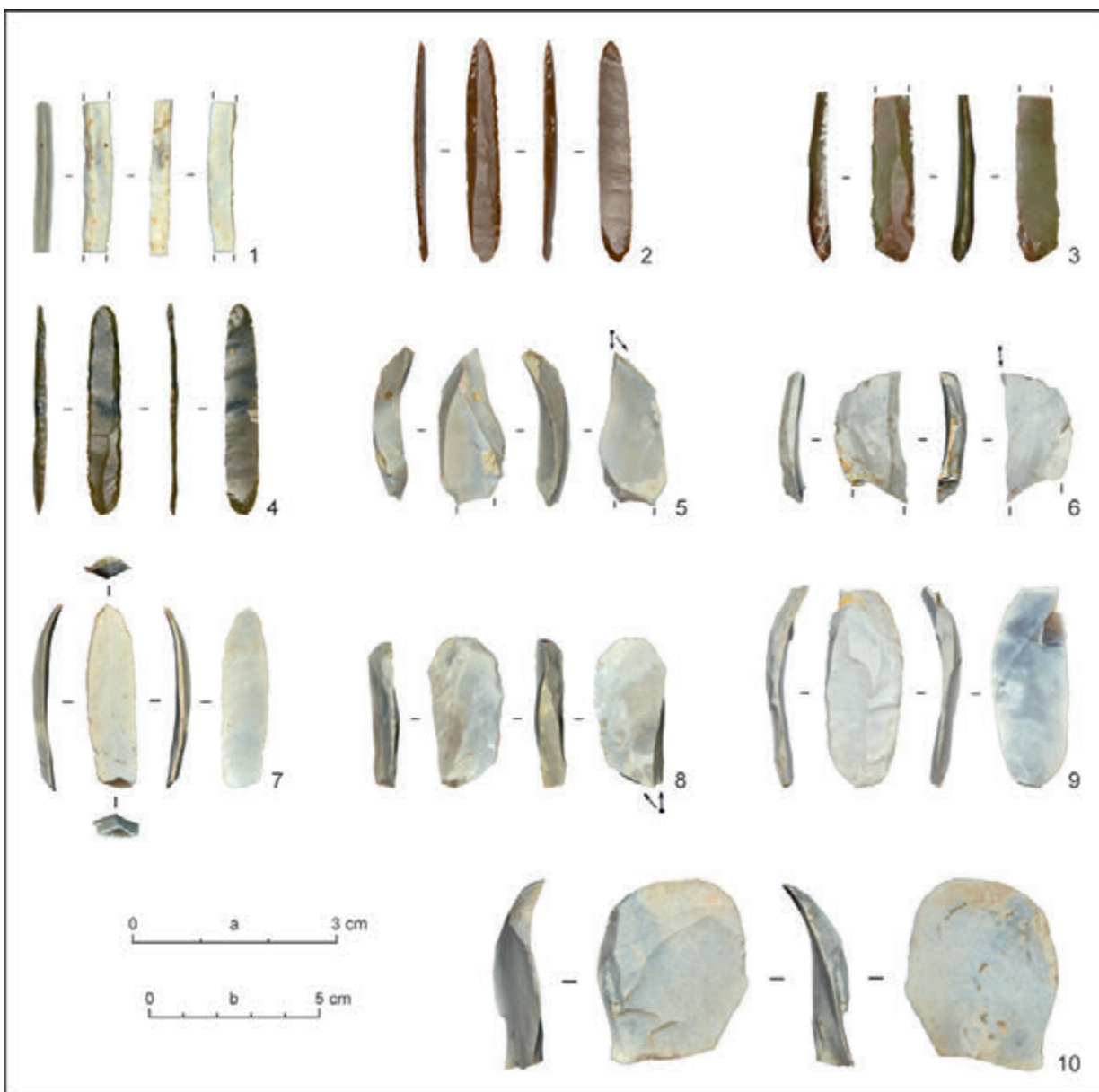


Fig. 6. Pavlov I, area A. 1 – backed bladelet; 2 – microgravette Milovice type; 3 – microgravette Dolní Věstonice type; 4 – oval element; 5 – dihedral burin; 6 – angle burin; 7 – point; 8 – combination tool; 9 – endscraper on blade; 10 – endscraper on flake. Scale: a – 1–4; b – 10–15.

Tab. 13. Pavlov I, area A. Types of microliths by raw material types by number and percentage.

Type	Silicite	Radiolarite	Total	%
Microsaws	6	–	6	18
Microgravettes	5	7	12	36
Backed bladelet	11	2	13	39
Oval elements	–	1	1	3
Other types	2	–	1	3
Total	24	10	33	100

Tab. 14. Pavlov I, area A. Burin types by raw material types as numbers and percentage.

Type	Erratic flint	Radiolarite	Total	%
Angle	5	–	5	36
Dihedral	6	1	7	50
Double	2	–	2	14
Total	13	1	14	100

Burins represent 17% of the retouched tools and occur in three distinct types. As shown in the Tab. 14, the majority of burins can be characterised as dihedral burins (50%; Fig. 6: 5) or angle burins (36%; Fig. 6: 6). In three cases, it was possible to identify double burins (14%). For all of the burins in this assemblage, except for one edge burin made of radiolarite, erratic flint was used as a raw material.

Other tool types, including endscrapers (8%), points (9%; Fig. 6: 7), combination tools (4%; Fig. 6: 8), and partially retouched artefacts (6%), were also present. The majority of endscrapers were made on blades (78%; Fig. 6: 9), with only two created on flakes (Fig. 6: 10). Interestingly, for one of them, which is also the only one, radiolarite was used as a raw material. Regardless of the specific type, endscrapers exhibit retouch at the distal end, which in most cases continues to one (or occasionally both) sides of the artefact. Combination tools are exclusively composed of erratic flint, and in all cases, they represent combinations of an endscraper and a burin. Exactly half of them were made on flakes, and the other half on blades.

Tool production debitage

A further category of importance is that of debitage, which is defined as the waste resulting from the production of specific tool types. Two different types of this kind of debitage were identified: firstly, burin spalls, which constituted 92% of this tool type category, and secondly, waste from the production of backed bladelets, which constituted only 8% of this tool type category.

Spatial distribution patterns

In general, the highest artefact density is located in the row A, specifically at 2–3 square (Fig. 7). However, although these squares contain the highest number of artefacts, together with also high concentrations in surrounding squares (B/3–4) they form a significant concentration of finds in the more or less central part of the area. On the other hand, there is a second significant concentration of artefacts that is divided from the rest of the part of the area by a complete absence of artefacts. This concentration is located in the most northern part of the area, in squares –A/6–8 and A/7.

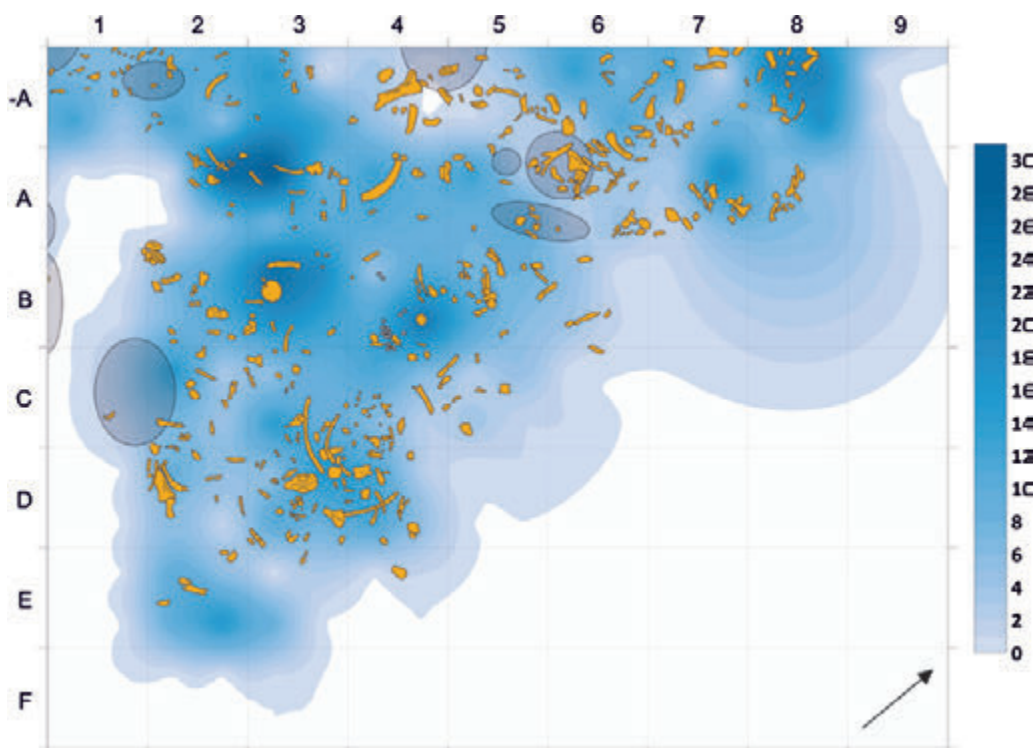


Fig. 7. Pavlov I, area A. General plan (excavation 2013–2015) and spatial distribution density map of 3-D recorded lithic artefacts. Hatched ellipse areas: hearths and charcoal concentrations; grey dots: *Dentalia* shells. Graphics O. Herčík and M. Novák, after the original plan of J. Svoboda.

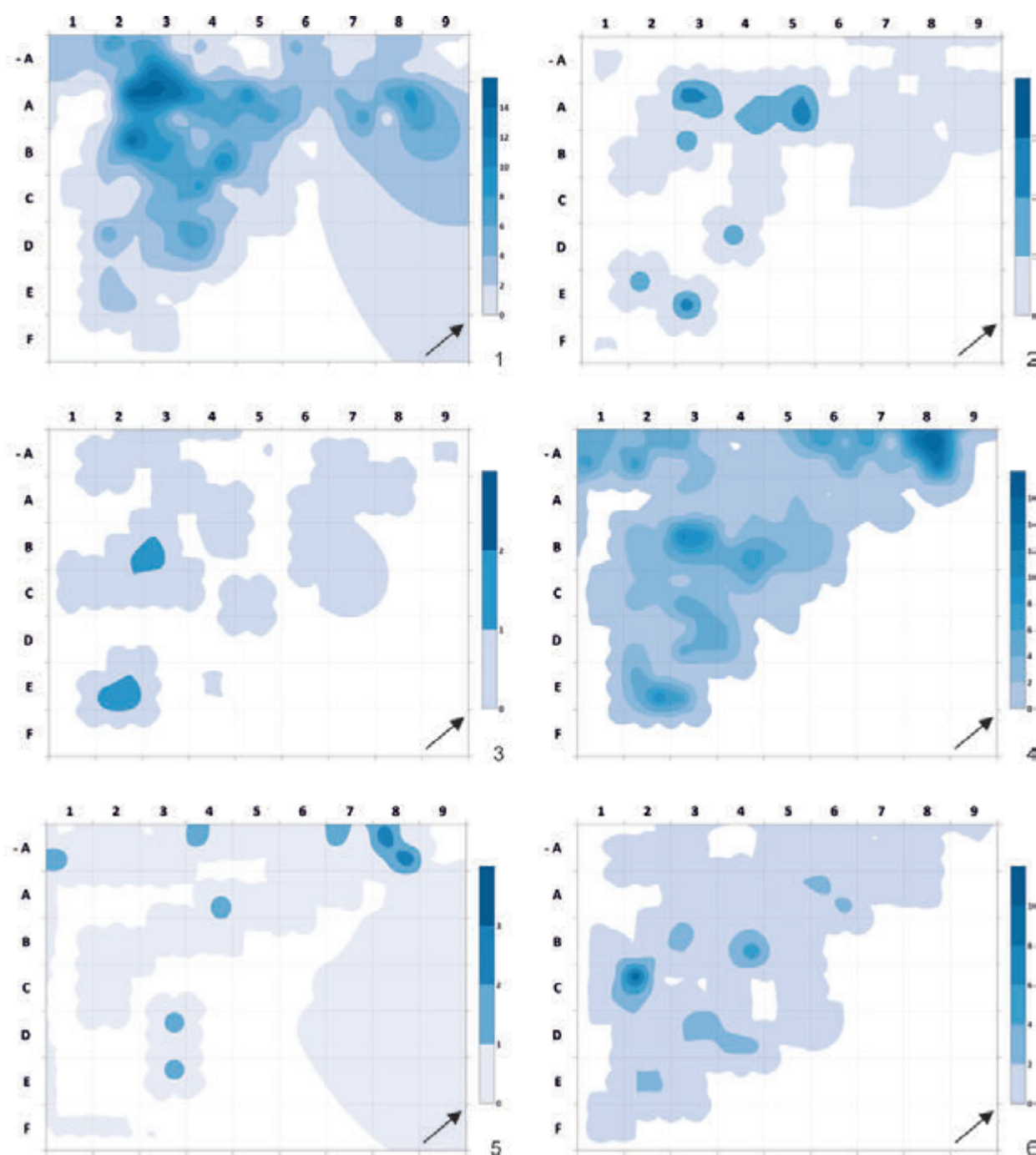


Fig. 8. Pavlov I – southwest, area A, excavation 2013–2015. Spatial distribution of the lithic artefacts in individual categories according to the raw materials. 1 – erratic flint; 2 – flint of Krakow Jurassic type; 3 – radiolarite; 4 – undetermined silicite; 5 – hornstone; 6 – undetermined raw materials.

Based on the individual raw material distribution maps (Fig. 8), it is possible to observe several points. It is not possible to observe any regularity in the spatial distribution of hornstone, as it was found in 7 different parts of the area A. However, its higher number is concentrated only in the square –A/9. Map of radiolarite spatial distribution is showing its concentration only in two squares of the whole area A, these squares being B/3 and E/2. Unidentifiable silicite and erratic flint, although with visible concentration, are distributed among the whole area A.

Spatial distribution of retouched artefacts shows, that tools are not dispersed throughout the whole area, but are rather concentrated at individual spots (Fig. 9). The most prominent concentration is lo-

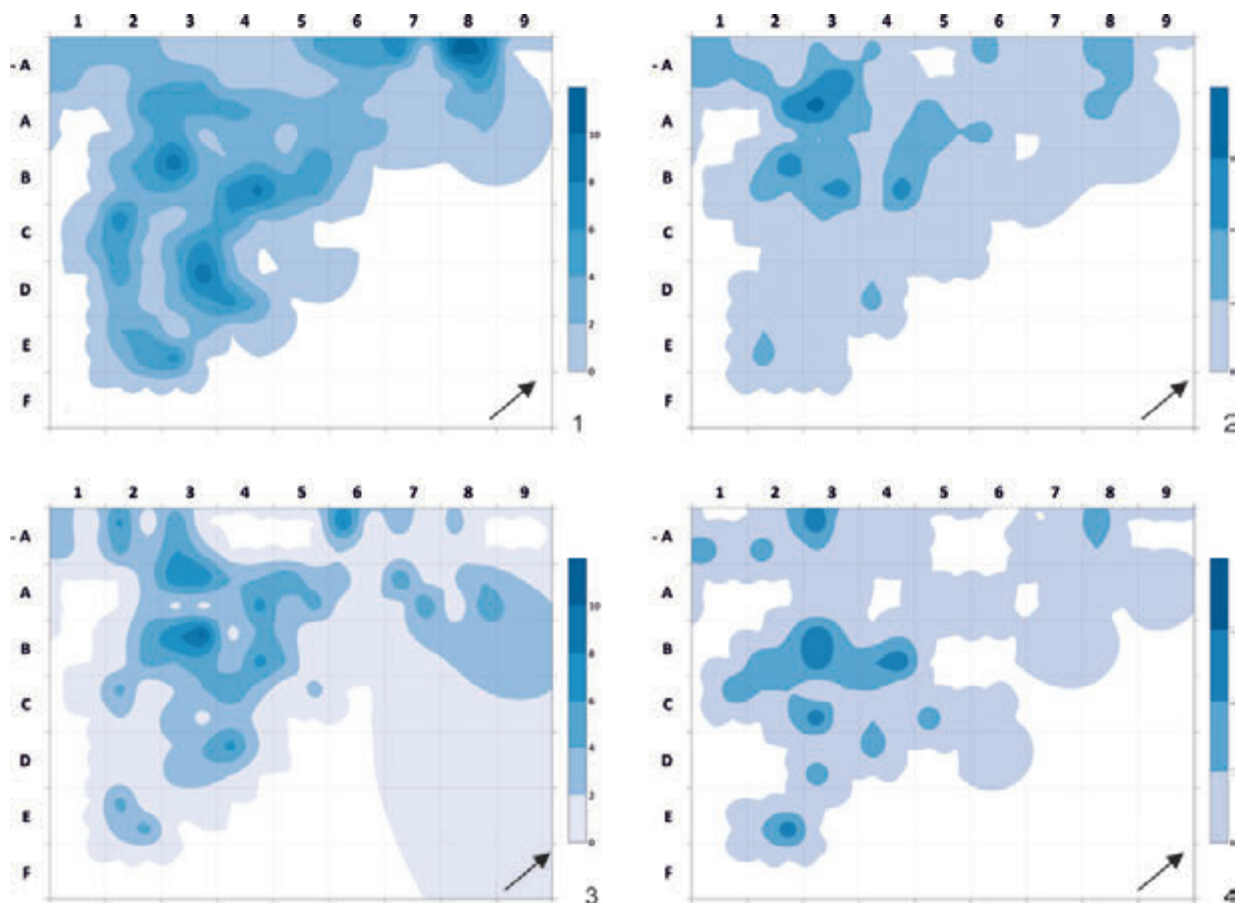


Fig. 9. Pavlov I – southwest, excavation 2013–2015. Spatial distribution of the lithic artefacts in individual categories according to the major technological groups. 1 – debris and fragments; 2 – flakes; 3 – blades; 4 – retouched tools.

cated in squares B/3–5. On the other hand, fragments, although also forming some concentrations, are dispersed throughout the whole area A. Blades are mainly concentrated in the “central” part of the area, mainly in squares B3 and A3, while to some extent matching the dispersion of flakes. These are concentrated in square B/2–3 but mainly in square A3.

DISCUSSION

The majority of the described raw materials originate from the northern and eastern regions, far from the site. The raw materials originate in the north from Pavlov I and include erratic flint, which is derived from Pleistocene glacial and fluvio-glacial sediments in Northern Moravia, Silesia and Southern Poland. Additionally, Krakow-Czestochowa Jurassic flint is present, which can be found in the Jurassic limestone in the Krakow area or in glacial sediments of South Poland as a secondary deposit (*Přichystal 1997*). The most probable origin of the radiolarite utilised in Pavlov I is the Carpathian Mountains, specifically the West Slovakian sources (*Verpoorte 2005*). The sources of the present cherts are the Miocene coastal sandy gravels in the Krumlovský les area (Krumlovský les chert), the dendation relic of Jurassic limestone in Brno (Stránská skála chert) and the Pleistocene gravels of the Svitava, Svatka and Dyje rivers (Spongolitic chert; *Přichystal 1997*). The results of the raw material description correspond with those of the Pavlov I assemblages previously studied, thereby confirming the preference for certain raw materials at complex Gravettian sites in South Moravia that had already been identified (*Svoboda 2005; Verpoorte 1997*).

In addition to the exploitation and utilisation of specific raw materials, it is also important to describe the raw material economy of each assemblage. As is widely known, the manner in which each raw material was worked can vary considerably even within a single assemblage, which was likely formed by

Tab. 15. Pavlov I, area A. General comparison between assemblages of different areas of Pavlov I site. 1954A, 1954B, 1956, 1963A, 1964 after *Verpoorte 2005*; 1958 after *Verpoorte 1997*.

	1954A		1954B		1956		1958		1963A		1964		Southcentral		Southwest	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Flakes	92	5.7	149	5.6	437	8.9	1317	7.6	465	14	36	11	10743	5.1	276	11
Blades	205	12.7	387	14.6	846	17.2	2173	12.5	957	28.7	74	22.7	15176	7.2	247	18.1
Cores	44	2.7	152	5.7	132	2.7	79	0.5	92	2.8	17	5.2	486	0.2	9	0.3
Tools	1169	72.4	1779	67.1	3097	62.8	689	4	1432	43.1	152	46.6	8506	4.1	106	4

Tab. 16. Pavlov I, area A. Typological comparison between assemblages of different areas of Pavlov I site. 1954A, 1954B, 1956, 1963A, 1964 after *Verpoorte 2005*; 1958 after *Verpoorte 1997*.

	1954A		1954B		1956		1958		1963A		1964		Southcentral		Southwest	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Endscrapers	100	8.6	127	7.1	167	5.4	48	7	96	6.7	9	6	575	6.8	9	8.6
Burins	222	19	372	20.9	591	19.1	163	23.4	339	23.7	44	29	1842	21.7	14	13.5
Microlithic elements	308	26.3	524	29.5	995	32.1	61	9	192	13.4	19	12.5	2071	24.3	33	31.2
Retouched blades	89	7.6	130	7.3	213	7	107	15.5	145	10	22	15.5	801	9.4	25	24
Points	37	3.2	43	2.4	87	3	33	5	23	1.6	4	2.6	256	3.1	9	8.6
Combinations	42	3.6	100	5.6	95	3	22	3.2	55	3.8	11	7.2	308	3.6	4	3.8

a single group. As shown in Tab. 1, erratic flint was used the most, and thus is also the most dominant raw material in each of the technological categories. It is notable that a considerable number of artefacts belong to the category of fragments or waste. This may indicate a somewhat lack of frugality in the utilisation of this specific type of raw material. Conversely, Krakow-Czestochowa flint is observed to have been employed for the production of non-retouched blades and flakes. A similar pattern can be observed in the category of chert and spongolite. These two raw materials were not particularly highly used, although a certain preference for technological types that can be characterised as semifinished products is visible. In contrast, radiolarite shows an opposite phenomenon, with the use focused on retouched tools, which based on the total number of artefacts in this technological category is also the highest ratio. Only in a relatively small number was it left in the semifinished stage of production. The presence of a considerable quantity of debitage within the assemblage may indicate that the artefacts were subjected to further processing, including reshaping and repair.

By looking at the techno-typological composition of the assemblage from studied area, there are some differences visible by comparison with other parts of Pavlov I. In case of general composition (Tab. 15), production of blades was focused in the areas 1963A, 1964 and Southwest. In contrast with Southcentral part of the site, where blades make up only 7.2% of the general composition. Interesting observation can be made in the category of cores, as they are generally a minor component, consistently below 6% across all areas. This may suggest that primary reduction was either minimal directly at the site or cores were removed after reduction. On the other hand, tools make up the largest percentage in most areas. However, in the area excavated in 1958 and Southcentral part they make up only 4%, which could indicate a focus on production rather than the use of tools. The stable percentages of endscrapers could indicate that they were a general-purpose tool that was used across different parts of the site (Tab. 16). Burins are present in the highest number in areas 1964 (28.9%), 1963A (23.7%) and Southcentral (21.7%), which suggest burin production and/or use was mostly focused here. On the contrary, Southwest area with only (13.5%) of burins may suggest focus on different activities. There are significant differences able to be observed in the number of microlithic elements across different areas of the site. This may indicate highly diverse shift in the use of different parts of the site, however, the excavation technique and consistency of wet sieving highly affect the ability to retrieve these types of artefacts from the sediment. This is logi-

cally mainly due to their size. Since different areas were excavated in different seasons, while it is expected that different approach could have been imploded, evaluation microliths in the comparison is not reliable enough. Nevertheless, even this basic comparison between assemblage compositions originating from different parts of the site shows a possible activity differentiation between areas.

Based on described spatial distribution patterns it is possible to observe four main concentrations in the area A. First one, also being the most significant, is located in the squares –A–B/2–4. There are retouched tools as well as blades and flakes heavily concentrated here. Moreover, this concentration is located directly in the middle between surrounding hearths. Based on these facts, it is possible to speculate that this area could have been used as a main part of the area A, used for daily activities. Second concentration is separated from the rest of the area by a complete absence of artefacts, located in the squares –A–A/6–8. In this concentration there is a high number of fragments, artefacts from unidentifiable silicite and bones. Moreover, this concentration is separated from others by a complete absence of artefacts (which are in fact hearths). This could indicate that this was a disposal part of the area A. Third concentration is located in squares C–D/3–4, and matches the location of *in situ* wolf skeleton. Last concentration, also the least visible, is located in squares E/2–3. It is not that significant in terms of number of artefacts, but nevertheless, it stands out on the map. However, there were concentrated mainly retouched artefacts, fragments and blades. The occurrence of other types of artefacts, for example bone fragments, was not as prevalent within this area.

CONCLUSION

The analysis of the lithic assemblage from Area A of the Pavlov I site offers valuable insights into the raw material economy, technological strategies and spatial organisation of the Gravettian inhabitants. The prevalence of erratic flint throughout the lithic production sequence highlights its pivotal role in the raw material economy of this region. The utilisation of other materials, such as radiolarite and Krakow-Czestochowa flint, is more specialised and often associated with specific tool types, including microliths. The high proportion of debitage and the evidence of complete lithic reduction chains indicate that on-site knapping activities were conducted, encompassing the preparation, production, and maintenance of tools.

The results of the spatial analysis indicate the presence of distinct activity zones within Area A. The concentration of artefacts in the vicinity of hearths indicates the existence of a primary zone for daily activities, including tool production and potentially other communal tasks. The northern concentration, which is isolated from other artefact clusters, is likely to have been a disposal or discard zone, thereby emphasising the differentiation of activities in terms of space. The proximity of the *in situ* wolf skeleton to lithic artefacts in the third concentration zone suggests the possibility of a symbolic or specialised activity area. Finally, the smaller concentration in the south-east, dominated by retouched artefacts and blades, may indicate the presence of a secondary or specialised production zone.

Comparisons with other areas of Pavlov I indicate a continuity in raw material preferences and technological practices, although based on the comparison of techno-typological composition between different areas, the site was very probably functionally divided. These results are thereby reinforcing the view of Pavlov I as a major Gravettian settlement with a complex spatial organisation tailored to diverse and specialised activities. This study of the area A contributes to a more detailed understanding of Gravettian lifeways and provides insights into the intersection between raw material economy and spatial organisation, and their role in supporting the needs of Upper Paleolithic communities. However, since this study presents only preliminary results of elemental techno-typological and spatial analysis, combination with others, more complex, analyses of this assemblage and incorporation of other types of artefacts from this site into the interpretation would make it even more relevant.

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Dynamika gravettienského osídlenia na základe kamennej industrie

Prípadová štúdia lokality Pavlov I – juhozápad, časť A

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Súhrn

Mladopaleolitická kultúra gravettien, datovaná medzi 34 a 24 tis. BP (Lengyel/Wilczyński 2018), je charakteristická pokročilou technológiou štiepanej kamennej industrie a extenzívnou kultúrnou adaptáciou naprieč Európou. Lokalita Pavlov I (Klíma 1954) reprezentuje jedno z najdôležitejších gravettienských sídelných lokalít, ktoré sa vyznačuje komplikovanou priestorovou štruktúrou a množstvom archeologických nálezov.

Táto štúdia prezentuje výsledky techno-typologickej a priestorovej analýzy, ako aj surovinového opisu súboru štiepanej kamennej industrie získaného z časti A počas terénneho výskumu v rokoch 2013–2015, s cieľom objasniť procesy výroby štiepanej kamennej industrie a surovínovej ekonomiky v tejto časti. Oblasť, ktorá bola identifikovaná ako zóna sídelnej aktivity (Svoboda et al. 2016), poskytla celkovo 2615 kusov štiepanej kamennej industrie, sprevádzanej množstvom zvieracích pozostatkov, vrátane mamutích kostí a takmer kompletnej kostry vlka (Sázelová et al. 2020).

Analýza štiepanej kamennej industrie z oblasti A, lokality Pavlov I, prináša cenné poznatky o hospodárení so surovinami, technologických stratégiách a priestorovej organizácii gravettienského obyvateľstva. Dominancia eratického silicitu v celom výrobnom reťazci podčiarkuje jeho kľúčový význam v surovínovej ekonomike tejto oblasti. Využívanie ďalších materiálov, ako je rádiolarit či krakovsko-čensterchovský pazúrik, sa javí ako špecializované a často sa spája s konkrétnymi typmi nástrojov, najmä mikrolitmi. Vysoký podiel odpadu z výroby spolu s dokladmi o celom redukčnom reťazci nasvedčujú, že na mieste prebiehala výroba nástrojov vrátane prípravy jadier, samotnej produkcie aj údržby nástrojov.

Priestorová analýza poukazuje na existenciu viacerých funkčne odlišných zón v rámci časti A. Koncentrácia artefaktov v okolí ohnísk poukazuje na primárnu zónu každodenných aktivít, ktorá pravdepodobne zahŕňala výrobu nástrojov i ďalšie spoločné činnosti. Severná koncentrácia, oddelená od ostatných klastrov artefaktov, bola pravdepodobne využívaná ako odpadová zóna, čo naznačuje priestorové oddelenie jednotlivých aktivít. Blízkosť takmer kompletnej kostry vlka ku kamenným artefaktom v tretej koncentrácii môže naznačovať špecifickú aktivitu. Menšia juhovýchodná koncentrácia, dominovaná retušovanými artefaktmi a čepeľami, môže predstavovať sekundárnu alebo špecializovanú výrobnú zónu.

Porovnanie s inými časťami lokality Pavlov I naznačuje kontinuitu vo výbere surovín a v technologických postupoch. Na základe techno-typologickej analýzy medzi rôznymi oblasťami sa však zdá, že lokalita bola funkčne rozčlenená. Tieto výsledky tak posilňujú interpretáciu Pavlova I ako významného gravettienského sídliska s komplexnou priestorovou organizáciou, prispôbenou rôznym špecializovaným činnostiam. Štúdia oblasti A prispieva k podrobnejšiemu pochopeniu spôsobu života gravettienských lovcov a poskytuje náhľad na prepojenie medzi surovínovou ekonomikou a priestorovou organizáciou, ako aj ich význam pre udržanie potrieb komún mladého paleolitu. Keďže však ide o predbežné výsledky základnej techno-typologickej a priestorovej analýzy, ďalšie komplexnejšie štúdie tohto súboru a zapojenie iných typov artefaktov z tejto lokality do interpretácie by významne obohatili výpovednú hodnotu výskumu.

Obr. 1. Pavlov I. Celkový plán lokality s vyznačením výskumu B. Klímu (1952–1972), posledného výskumu J. Svobodu (2013–2015) a polohy predmetnej analyzovanej plochy A (šrafovaná elipsa). Legenda: a – pôdorys stavby APP; b – výskum J. Svoboda (2013); c – výskum J. Svoboda (2014); d – výskum J. Svoboda (2015); e – výskum B. Klíma (1952–1972). Grafika O. Herčík, M. Novák.

Obr. 2. Pavlov I, plocha A. Percentuálne zastúpenie surovín v súbore kamennej štiepanej industrie. Legenda: a – nerovnomerný kremeň; b – krakovsko-čensterchovský kremeň; c – silicit (nešpecifikovaný); d – rádiolarit; e – spongolit; f – rohovec; g – ostatné.

Obr. 3. Pavlov I, plocha A. Jadrá.

Obr. 4. Pavlov I, plocha A. Pomer šířky a hrúbky čepelí podľa surovín. Legenda: SGS – eratický silicít; SKJ – silicít Krakovsko-Czestochowej jury; RD – rádiolarit; HR – rohovec; X – neurčené; SLC – neurčený silicít.

Obr. 5. Pavlov I, plocha A. Pomer šířky a hrúbky mikročepelí podľa surovín. Legenda: SGS – eratický silicít; SKJ – silicít Krakovsko-Czestochowej jury; RD – rádiolarit; HR – rohovec; X – neurčené; SLC – neurčený silicít.

Obr. 6. Pavlov I, plocha A. 1 – čepieľka s otupeným bokom; 2 – mikrograveta typu Milovice; 3 – mikrograveta typu Dolní Věstonice; 4 – oválny element; 5 – klinové rydlo; 6 – hranové rydlo; 7 – hrot; 8 – kombinácia; 9 – škrabadlo na čepeli; 10 – škrabadlo na ústepe. Mierka: a – 1–4; b – 10–15.

Obr. 7. Pavlov I, plocha A. Celkový plán (výskum 2013–2015) a mapa hustoty priestorového rozmiestnenia 3D zaznamenaných kamenných artefaktov. Šrafované elipsovité plochy – ohniská a koncentrácie uhlíkov; sivé body – schránky kelnatiek (Dentalium). Grafika O. Herčík a M. Novák, podľa pôvodného plánu J. Svobodu.

Obr. 8. Pavlov I – juhozápad, plocha A, výskum 2013–2015. Priestorová distribúcia štiepaných kamenných artefaktov podľa surovín. 1 – eratický silicít; 2 – silicít krakovsko-čenstochovskej jury; 3 – radiolarit; 4 – bližšie neurčený silicít; 5 – rohovec; 6 – ostatné neurčené suroviny.

Obr. 9. Pavlov I – juhozápad, výskum 2013–2015. Priestorová distribúcia štiepaných kamenných artefaktov podľa hlavných technologických skupín. 1 – fragmenty a triesky; 2 – úštep; 3 – čepele; 4 – retušované nástroje.

Tabela 1. Pavlov I, plocha A. Počty a percentuálne podiely artefaktov podľa surovín.

Tabela 2. Pavlov I, plocha A. Počty a percentuálne podiely typov úštepov.

Tabela 3. Pavlov I, plocha A. Počty a percentuálne podiely typov čepelí.

Tabela 4. Pavlov I, plocha A. Počty a percentuálne podiely dorzálnych negatívov čepelí.

Tabela 5. Pavlov I, plocha A. Počty a percentuálne podiely pätiiek čepelí.

Tabela 6. Pavlov I, plocha A. Počty a percentuálne podiely profilov čepelí.

Tabela 7. Pavlov I, plocha A. Počty a percentuálne podiely typov bokov čepelí.

Tabela 8. Pavlov I, plocha A. Počty a percentuálne podiely typov prierezov čepelí.

Tabela 9. Pavlov I, plocha A. Počty a percentuálne podiely dorzálnych negatívov mikročepelí.

Tabela 10. Pavlov I, plocha A. Počty a percentuálne podiely bokov mikročepelí.

Tabela 11. Pavlov I, plocha A. Počty a percentuálne zastúpenie druhov použitého otlákača na výrobu mikročepelí.

Tabela 12. Pavlov I, plocha A. Počty a percentuálne podiely retušovaných artefaktov.

Tabela 13. Pavlov I, plocha A. Počty a percentuálne podiely typov mikrolitov podľa surovín.

Tabela 14. Pavlov I, plocha A. Počty a percentuálne podiely typov rydiel podľa surovín.

Tabela 15. Pavlov I, plocha A. Všeobecné porovnanie súborov z rôznych častí lokality Pavlov I. 1954A, 1954B, 1956, 1963A, 1964 podľa *Verpoorte 2005*; 1958 podľa *Verpoorte 1997*.

Tabela 16. Pavlov I, plocha A. Typologické porovnanie súborov z rôznych častí lokality Pavlov I. 1954A, 1954B, 1956, 1963A, 1964 podľa *Verpoorte 2005*; 1958 podľa *Verpoorte 1997*.

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K VÝZNAMU PALEOLITICKEJ LOKALITY KAŠOV I (OKR. TREBIŠOV)¹

Predbežné výsledky analýzy štiepanej kamennej industrie

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On the importance of the Palaeolithic site Kašov I (Trebišov district). Preliminary results of the analysis of chipped stone industry

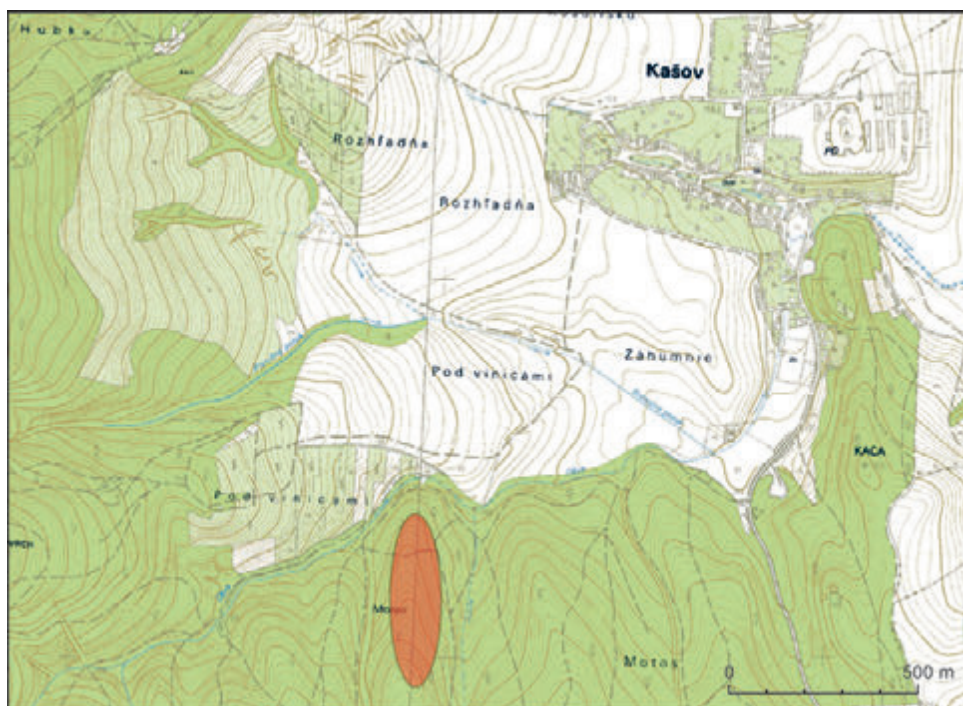
The Kašov I site contains archaeological records of occupation from the LGM period and just after, which is generally characterized in Central Europe by a decline in population due to deteriorating climatic conditions. Kašov I was systematically investigated by L. Bánész from 1967 to 1984. An area of about 5400 m² was surveyed and almost 44,000 finds were obtained. The site is considered a settlement with two cultural layers, the lower one was dated to 20,700 ±350 BP and the upper one to 18,600 ±390 BP (Gd-65699). In the context of Central Europe, these data are of great significance. Continuity between the Gravettian culture and the later development most often associated with the Epigravettian is not proved. The northeastern part of the Carpathian Basin, with its concentration of sites from the late Gravettian culture and the subsequent development into the late phase of the Upper Palaeolithic, may represent evidence of a glacial refugium with continuous occupation. The chipped stone industry from the Kašov I site has been only partially analysed. Results have been published mainly for the lower layer. This paper provides preliminary technology characteristics and typology from the upper layer. The sample comes from the 1968 research season, sectors 84, 85, 86a, 86b and 87. This part of the settlement represents the greatest concentration of finds. The importance of the site lies not only in its dating but also in the fact that most of the industry is made of local obsidian, making it possible to investigate the technological processes involved in working with this rather specific raw material. The analysis allows for a better understanding of the chipped stone industry in the currently little-known Late Upper Palaeolithic and opens up possibilities for comparison with other contemporaneous sites.

ÚVOD

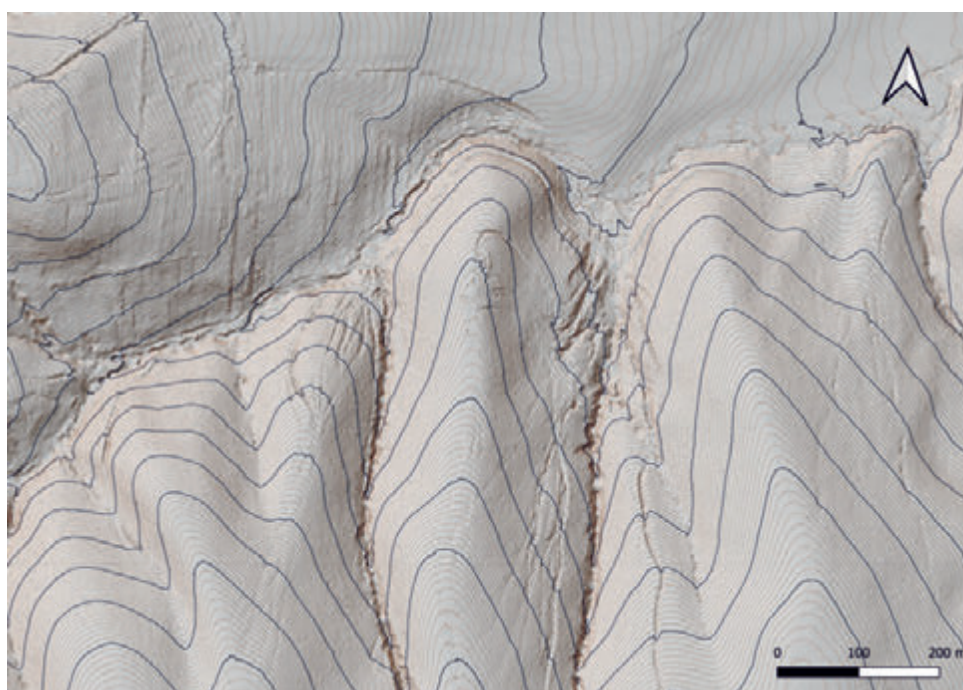
Paleolitická lokalita Kašov I sa nachádza približne 2 km juhovýchodne od obce Kašov (obr. 1), na severnom výbežku Zemplínskych vrchov. V odbornej literatúre je táto poloha známa pod názvom Spálenisko, pričom alternatívne sa uvádza aj pod názvom Motos. Nadmorská výška dosahuje približne 200 m. Severný okraj výbežku strmo klesá k toku potoka Ošva. Vrcholová časť výbežku je zarovnaná do plošiny, ktorá predstavovala výhodné miesto pre osídlenie, nakoľko ponúkala výhľad do nížiny a zároveň priamy prístup k vodnému zdroju (obr. 2).

Kašov I patrí do skupiny paleolitických sídlisk, ktoré sa koncentrujú v okolí zemplínskych zdrojov obsidiánu. Medzi ďalšie známe náleziská patria polohy v katastrálnych územiach obcí Cejkov, Kašov, Hrčeľ, Veľaty, Kysta a Zemplínske Jastrabie. Chronologicky spadajú do strednej a neskorej fázy mladého paleolitu. Väčšina z nich sú známe len z povrchových zberov. Daná oblasť však bola intenzívne osídlená aj v mladšom praveku, čo spôsobilo premiešanie artefaktov v jednotlivých súboroch (Kaminská 2014, 283–285).

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Obr. 1. Poloha lokality Kašov I na mape (<https://zbgis.skgeodesy.sk/>).



Obr. 2. Výbežok Zemplínskych vrchov s lokalitou Kašov I (<https://zbgis.skgeodesy.sk/>).

Cieľom príspevku je prezentovať predbežné výsledky analýzy hornej vrstvy lokality Kašov I, ktorá doposiaľ nebola publikovaná, s výnimkou čiastkových štúdií. V práci bola analyzovaná vzorka štiepanej kamennej industrie z výskumnej sezóny 1968.

VÝSKUM LOKALITY KAŠOV I

Prvé skúšobné výkopy uskutočnil na lokalite Š. Janšák v spolupráci s J. Skutilom v roku 1933 (Janšák 1935, 66, 67). Neskôr, v päťdesiatych rokoch, sa výskumu začali venovať F. Prošek a L. Bánesz. Terén skúmali nielen povrchovo, ale v roku 1954 vykonal aj výkop malého rozsahu. Podobne postupovali aj v ďalších rokoch 1958 a 1959, keď boli vyhlbené ďalšie sondy (Bánesz 1961). Keďže výsledky prvých výkopov z päťdesiatych rokov preukázali, že lokalita je bohatá na nálezy, začali sa prípravy na rozsiahlejší systematický výskum. Ten trval celkovo až 12 rokov a bol vedený L. Báneszom. Prvá etapa sa uskutočnila v rokoch 1966–1969 (Bánesz 1969). Po prestávke nasledovali sezóny v rokoch 1971–1972 a posledná etapa trvala od roku 1979 do 1984 (Bánesz 1985). Výskum sa postupne presúval od severnej časti výbežku k južnej. Skúmané sektory mali pravidelne rozmery 2×2 m. Hĺbka výkopov bola pomerne plytká, väčšinou do 80–100 cm. Počet sektorov dosiahol za 12 sezón vysoké číslo, a to 1324. Uvádzaná rozloha preskúmanej plochy je približne 5400 m². Postup pri odkrývaní je len veľmi málo známy. Artefakty sa mali objavovať pomerne plytko, väčšinou v hĺbke medzi 30–40 cm. Dokumentácia spočívala v zachytávaní horizontálnej polohy významnejších artefaktov, avšak spoľahlivosť je otázna. Overenie vertikálnej stratigrafie sa malo uskutočniť ešte v roku 1991 za účasti L. Bánesza, J. Hromadu a J. K. Kozłowského. Profil sídliska z miesta, kde boli zachytené dve kultúrne vrstvy, ako aj geologický rozbor vrstiev, boli publikované práve po tomto výskume (Bánesz et al. 1992). Lokalizácia danej sondy je však neznáma. Pedologický rozbor, ktorý vychádzal z posledného výskumu z roku 1991 rozlišoval päť vrstiev. Podložie tvorí zvetraný andezit. Stratigrafia bola opísaná nasledovne (Bánesz et al. 1992):

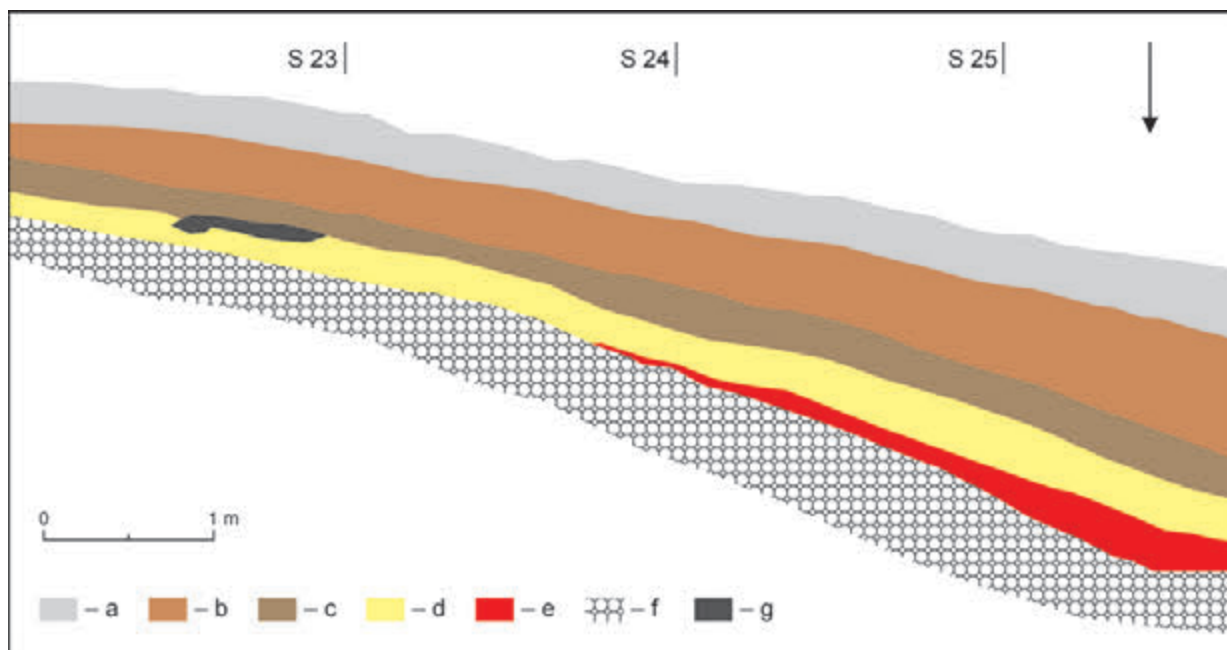
- 1 – svetložltá vrstva s rozsahom 20 cm, jemná hlina s vrchnou humusovou časťou;
- 2 – hnedá vrstva s rozsahom 11 cm, hlinitý sediment;
- 3 – tmavohnedá vrstva, rozsah 8–9 cm, hlinitý sediment s hranolovitou odlučnosťou;
- 4 – žltkastá vrstva s rozsahom 1–3 cm, jemnejší hlinitý sediment;
- 5 – tmavohnedá vrstva s rozsahom 20–30 cm, hlinitý sediment s hranolovitou odlučnosťou.

Problematika dvoch kultúrnych vrstiev

Z hľadiska stratigrafie je najdôležitejším poznatkom, že sídlisko má byť tvorené dvoma kultúrnymi vrstvami. Záznam o objavení staršej vrstvy pochádza však len z jedinej výskumnej sezóny, a to z roku 1967 (Bánesz 1967). V neskorších etapách sa pravdepodobne takáto situácia už nevyskytla. Celá plocha lokality, s výnimkou určitého úseku skúmaného v spomenutom roku, je považovaná za jeden nálezový horizont.

K existencii dvoch vrstiev možno mať viacero výhrad. Je však dôležité poznamenať, že dokumentácia dvoch vrstiev sa vykonávala už počas výskumu v roku 1967 (Bánesz 1967). Zachovaný mal byť kontrolný blok, pričom v nálezovej správe možno nájsť kresbu profilu s vyznačením dvoch úrovní nálezov. Zároveň sa v technickom denníku objavujú poznámky, ktoré odkazujú na túto nálezovú situáciu. Pre sektor číslo 25 sa napríklad uvádza: „Pri prehĺbení sektoru za účelom zistiť prípadné novšie stratigrafické údaje sme v hĺbkovom rozpätí 55–70 cm, t. j. asi po 10 cm sterilnej vrstve znovu začali nachádzať sílexy a to so zvýšeným podielom pazúrka a zmenšeným podielom obsidiánov. Zdá sa, že v tejto vrstve mierne narastajú aj rozmery nálezov.“ Pre obe vrstvy, hornú aj spodnú bol vytvorený plán horizontálneho rozloženia nálezov.

Otázkou však ostáva, do akej miery bol správne identifikovaný horný nálezový horizont a či sa staršie nálezy nenachádzali aj v iných miestach. Vzhľadom na to, že spodná vrstva bola dokumentovaná už na začiatku systematického výskumu L. Bánesza (obr. 3), teda v roku 1967, situácia nadobúda väčšiu dôveryhodnosť. L. Bánesz si už od začiatku uvedomoval možnosť existencie dvoch rôznych úrovní nálezov a pravdepodobne tomu venoval náležitú pozornosť. Pri viacerých sektoroch v nálezovej správe sezóny 1967 uvádza poznámku, že spodná vrstva sa už neobjavovala. Výsledkom bolo, že sa nachádzala len na menšej ploche v severnej časti lokality. Táto plocha mala mať rozmery približne 12×8 m a vrstva obsahuje 968 nálezov.



Obr. 3. Kašov I. Profil kontrolného bloku zo sezóny 1967 (podľa Bánesz 1967). Legenda: a – vrstva humusu; b – hnedožltý sediment s obsahom nálezov; c – hnedožltý sediment, hranica medzi hornou a spodnou vrstvou; d – hnedožltý sediment s obsahom nálezov; e – piesčitá červenkastá hlina; f – skalné podložie; g – ohnisko.

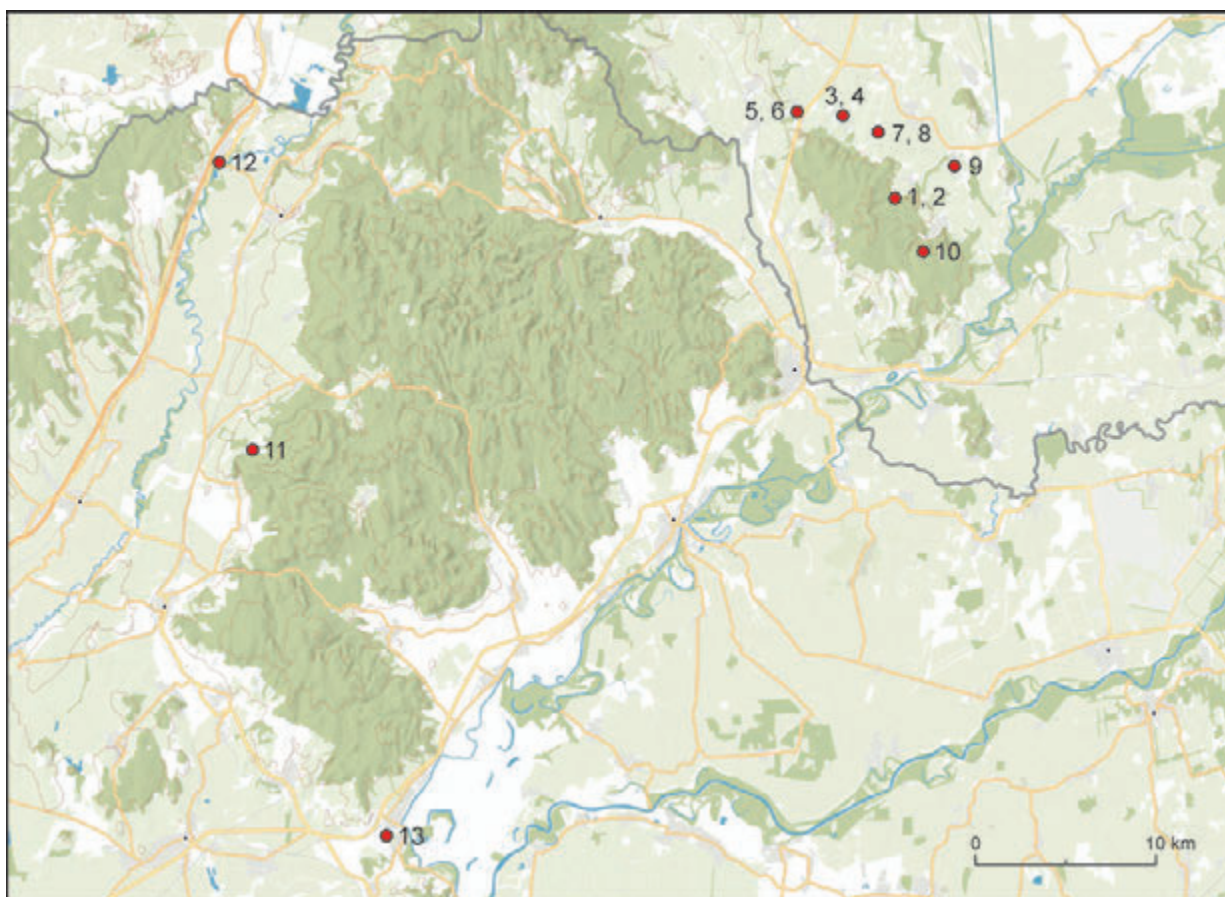
Význam lokality pre výskum posledného glaciálneho maxima (LGM)

Výsledok rádiokarbónového datovania (Bánesz 1992; 1993) získaný z uhlíkov medzi štiepanou kameninou industriou naznačuje, že pre spodný horizont prislúcha dátum $20\,700 \pm 350$ BP a pre horný horizont $18\,600 \pm 390$ BP (Gd-65699).

Horná vrstva lokality Kašov I patrí do obdobia neskorej fázy mladého paleolitu. Predchádzala jej stredná fáza, ktorú v Európe reprezentuje najmä kultúrny komplex gravettien. Už počas tejto fázy sa začína klimatická udalosť známa ako posledné glaciálne maximum (*Last Glacial Maximum*, LGM). Jej presné časové vymedzenie nie je štandardizované, často sa uvádza napríklad interval 26 500–20/19 000 cal BP (Clark *et al.* 2009). V užšom slova zmysle sa však LGM chápe ako vrchol týchto zmien a kladie sa do obdobia okolo 20 000 BP, resp. 24 000 cal. BP. Vo všeobecnosti LGM znamená výraznú klimatickú udalosť v podobe ochladenia a aridity. Hlavným faktorom zmien, ktoré tento vplyv spustili, nebola ani tak teplota, ako skôr spomenuté sucha a zvýšená intenzita prúdenia vzduchu. Tieto faktory mali zásadný dopad na vegetáciu, ktorá ovplyvňovala pohyb zvierat, čo viedlo k zmene mobility a stratégii prežitia ľudí. Dôležité je najmä regionálne hľadisko, keďže aj počas zhoršených podmienok existovali tzv. glaciálne refúgiá (Sommer/Nadachowski 2006). Postupný začiatok LGM zažívala už gravettienka kultúra, jeho vrchol (okolo 24 000 cal BP/20 000 BP) je v archeologickom chápaní prechodom medzi ňou a vznikom nových, z hľadiska technológie industrie viac nejednotných kultúr.

Plynulá nadväznosť gravettienkej kultúry s neskorším vývojom nie je v stredoeurópskom priestore doložená. Kašov I úzko súvisí so zodpovedajúcim datovaním k obdobiu posledného glaciálneho maxima (LGM). V literatúre je bežne uvádzané a naďalej preberané, že obsahuje horizont neskorej fázy gravettienkej kultúry, nasledovaný horizontom, ktorý dokumentuje vývoj priamo po tejto kultúre. Hornú vrstvu by sme mohli datovať na koniec najväčšej intenzity LGM, zatiaľ čo spodnú na samý začiatok jeho vrcholu. Skutočnosť, že sídlisko obsahuje záznam o takejto kultúrnej nadväznosti, zvyšuje jeho význam v kontexte osídlenia strednej Európy. Je však potrebné upozorniť, že datovanie hornej vrstvy nebolo dotiaľ verifikované novými analýzami.

Vzhľadom na absolútne datovanie Kašova I môžeme lokalitu hodnotiť z dvoch hľadísk. S príchodom zhoršujúcich sa podmienok mohol nastať zlom v osídlení, alebo možno v severovýchodnej časti Karpatskej kotliny rátať s kontinuitou sídlisk a ich refugiálnym charakterom. Sídlisko však nemožno jednoznačne zaradiť do jednej z týchto možností. Je veľmi pravdepodobné, že jeho materiálna kultúra je výsledkom



Obr. 4. Lokality strednej a neskorej fázy mladého paleolitu uvádzané v texte. 1 – Kašov I-LL; 2 – Kašov I-UL; 3 – Hrčel'-Nad baňou; 4 – Hrčel'-Pivničky; 5 – Veľaty I; 6 – Veľaty II; 7 – Kysta I; 8 – Kysta II; 9 – Zemplínske Jastrabie; 10 – Cejkov I; 11 – Arka; 12 – Hidasneméti; 13 – Bodrogkeresztúr (podkladová mapa <https://zbgis.skgeodesy.sk/>).

Cejkov I	24 – 23 000 BP	Arka ?	Cejkov II–V	Lokality bez C14
Bodrogkeresztúr	22 000 BP		Hidasneméti	
Kašov I-LL	20 700 BP	21 000 BP		
Kašov I-UL	18 600 BP	Cejkov I	Hrčel'-Nad baňou Hrčel'-Pivničky Veľaty I–II Kysta I–II	

Obr. 5. Chronologické zaradenie lokalít severovýchodnej časti Karpatskej kotliny.

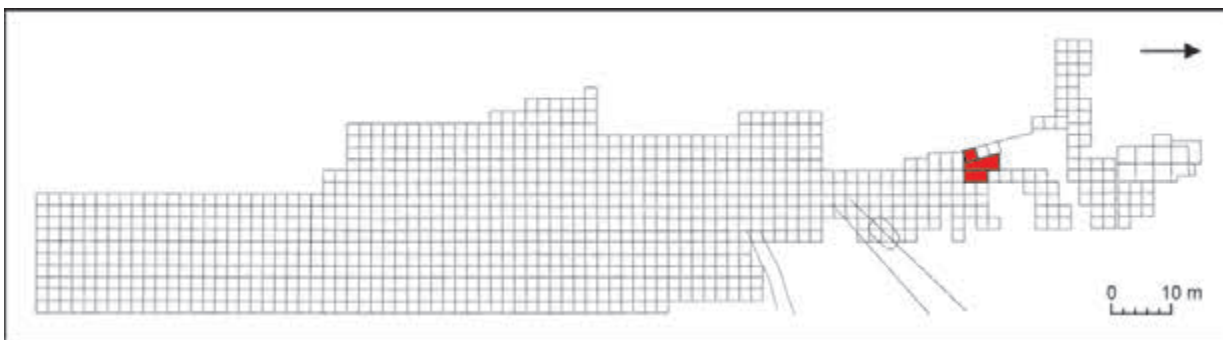
kombinácie rôznych faktorov a je výsledkom ako lokálneho vývoja, tak aj vplyvu nového kultúrneho vývoja po doznení vrcholu posledného glaciálneho maxima.

Dôvodom, prečo je severovýchodná časť Karpatskej kotliny takou dôležitou súčasťou výskumu dopadu LGM na vývoj osídlenia v strednej Európe a prečo je dôležitou otázkou skúmanie kontinuity, je koncentrácia a absolútny vek sídlisk (obr. 4; 5). Zastúpené sú tu lokality nielen mladšej fázy gravettien (Cejkov I–V, Hidasneméti, Bod-

rogkeresztúr), ale pravdepodobne aj jej neskorej fázy (Kašov I-spodná vrstva, Cejkov I – objekt 3), pričom ďalší vývoj dokumentuje práve horná vrstva v Kašove I s údajom 18 600 BP (Bánesz 1992, Gd-65699). Problematiku najviac limituje fakt, že mnohé lokality (Hrčel'-Pivničky, Hrčel'-Nad baňou, Veľaty I–II, Kysta I–II, polohy v katastri Zemplínskeho Jastrabia) sú povrchovo skúmané, resp. porušené a kultúrne premiešané s mladším pravekom, alebo je ich datovanie stále nejasné (Arka).

Štiepaná kamenná industria zo spodnej vrstvy v Kašove I

Zo spodnej vrstvy bolo počas výskumu v roku 1967 získaných 968 ks nálezov. Táto vrstva bola analyzovaná M. Novákom (2002), a nasledujúci popis vychádza z jeho výsledkov. Na rozdiel od hornej vrstvy, kde bol podiel pazúrika nižší, v spodnej vrstve predstavoval až 49 %, čím sa stal dominantnou surovinou.



Obr. 6. Kašov I. Plán skúmanej plochy s vyznačením analyzovanej časti (archív AÚ SAV, inv. č. 839).

Pôvodom má ísť o severský pazúrik, len v malom množstve volynský. Obsidián tvoril 33 %, limnosilit 9 %, rohovec 5 % a v malom množstve sa používal opál, jaspis, rádiolarit či kremeň. Väčšinu nálezov zo spodnej vrstvy tvoria úštepky a ich fragmenty (59 %). Podľa analýzy M. Nováka je v súbore 19 % neretušovaných čepelí (177 ks) a 18 % nástrojov (171 ks). Počet jadier je veľmi nízky, ich podiel je len 1 % (13 ks). I keď v kategóriách čepelí a nástrojov má jasnú prevahu pazúrik, takmer všetky jadrá okrem jedného sú z obsidiánu. Ťažené boli z jednej podstavy, v menšej miere sa objavili aj dvojpodstavové formy alebo so zmenenou orientáciou.

Celkový pomer retušovaných artefaktov v súbore je vysoký (17,8 %). Z typologického hľadiska majú byť v spodnej vrstve zastúpené rydlá (40 %), škrabadlá (13 %), kombinované nástroje (9 %), hroty (5 %), retušované čepele (23 %), čepielky (4 %) a iné. Medzi rydlami dominujú klinové rydlá stredné (18 ks, 74 % rydiel), po nich nasledujú klinové rydlá bočné (11 ks). Hranové rydlá na skrátených čepeliach sa objavili len štyri. Z ďalších typov sú to niekoľkonásobné klinové rydlá, klinové rydlá na zlomenej čepeli, viacnásobné zmiešané, oblúkovité kanelované či jadrové, všetky v rôznych menších počtoch. Na výrobu rydiel sa takmer vôbec nepoužíval obsidián. Škrabadlá (22 ks) sú väčšinou čepeľové s bočnou retušou alebo jednoduché čepeľové, formy na hrubších úštepoch sú zastúpené menej. Ojedinelým je čepeľové škrabadlo z pazúrika dlhé až 12,3 cm. V súbore sa ďalej objavuje zvýšený počet kombinácií škrabadlo-rydlo (11 ks). Uvádzaných je osem hrotov, sú však fragmentárne. V troch prípadoch ide o distálnu hrotito retušovanú časť s polostrmou retušou, v ďalších o proximálno-mesiálnu a proximálnu so strmou retušou. Zaradené sú medzi hroty typu La Gravette, žiadny spoľahlivý doklad sa však na lokalite neobjavuje. Z čepielkových hrotov sa uvádzajú dva hrotité kusy, v prvom prípade so strmou retušou v distálnej časti a v druhom v proximálnej. Okrem toho sa objavujú ďalšie štyri retušované čepielky, z jednej strany otupené strmou retušou. Z ostatných typov nástrojov sa uvádza ojedinele vrták, vrub, dláto či oškrabovače.

Materiál

Analyzovaná vzorka, vyčlenená pre získanie predbežných údajov o charaktere a typických znakoch industrie zo sídliska Kašov I, pochádza z hornej vrstvy odkrytej počas výskumnej sezóny v roku 1968 (Bánesz 1968). Zahŕňa sektory č. 84–87 (obr. 6), z ktorých bolo získaných celkovo 1485 artefaktov. Ide o väčšinu nálezov z rozsiahlej koncentrácie, ktorú však nie je možné jednoznačne vymedziť ani úplne spracovať ako ucelený súbor. Je to najväčšia koncentrácia štiepanej kamennej industrie v rámci plochy náleziska, obsahuje dostatok nálezov z každej technologickej skupiny a je vhodná pre rekonštrukciu postupov pri štiepaní. Orientačný rozmer plochy je 5 × 5 m. Časť koncentrácie nie je v analýze zahrnutá. Dôvodom je v prvom rade to, že okrajové časti presahujú do iných sektorov, v rámci ktorých ale začínajú už ďalšie, aspoň podľa dokumentácie horizontálnych polôh odlišiteľné koncentrácie. Artefakty sa však už v rámci sektorov nedajú presne rozlíšiť z hľadiska príslušnosti ku koncentrácii, je to možné len čiastočne, nakoľko významnejšie nálezy sa podľa priradeného čísla dajú na pláne dohľadať. Druhým dôvodom, prečo časť koncentrácie v analýze chýba je ten, že najmä zo západnej strany presahuje do sektorov, ktoré boli skúmané o rok skôr (nálezy nie sú k dispozícii). Cieľom je však poukázať na predbežné výsledky o podobe industrie.

Tabela 1. Kašov I. Zloženie analyzovaného súboru.

	Jadrá	Neretušované čepele	Retušované čepele	Neretušované ústepy a odpad	Retušované ústepy	N	%
Obsidián	59	188	82	610	56	995	69
Limnosilicit	11	28	10	155	10	214	15
Pazúrik	3	24	14	41	6	88	6
Rádiolarit	3	6	11	18	8	46	3
Rohovec	2	4	2	16	3	27	2
Jaspis	0	1	0	1	0	2	0
Opál	2	0	0	6	0	8	1
Silicifikovaný pieskovec	1	0	1	0	0	2	0
Kremenný porfýr	0	0	0	0	1	1	0
Kremeň	0	1	0	8	0	9	1
Neurčené	1	11	5	31	6	54	4
N	82	263	125	886	90	1446	100
%	6	18	9	61	6	100	

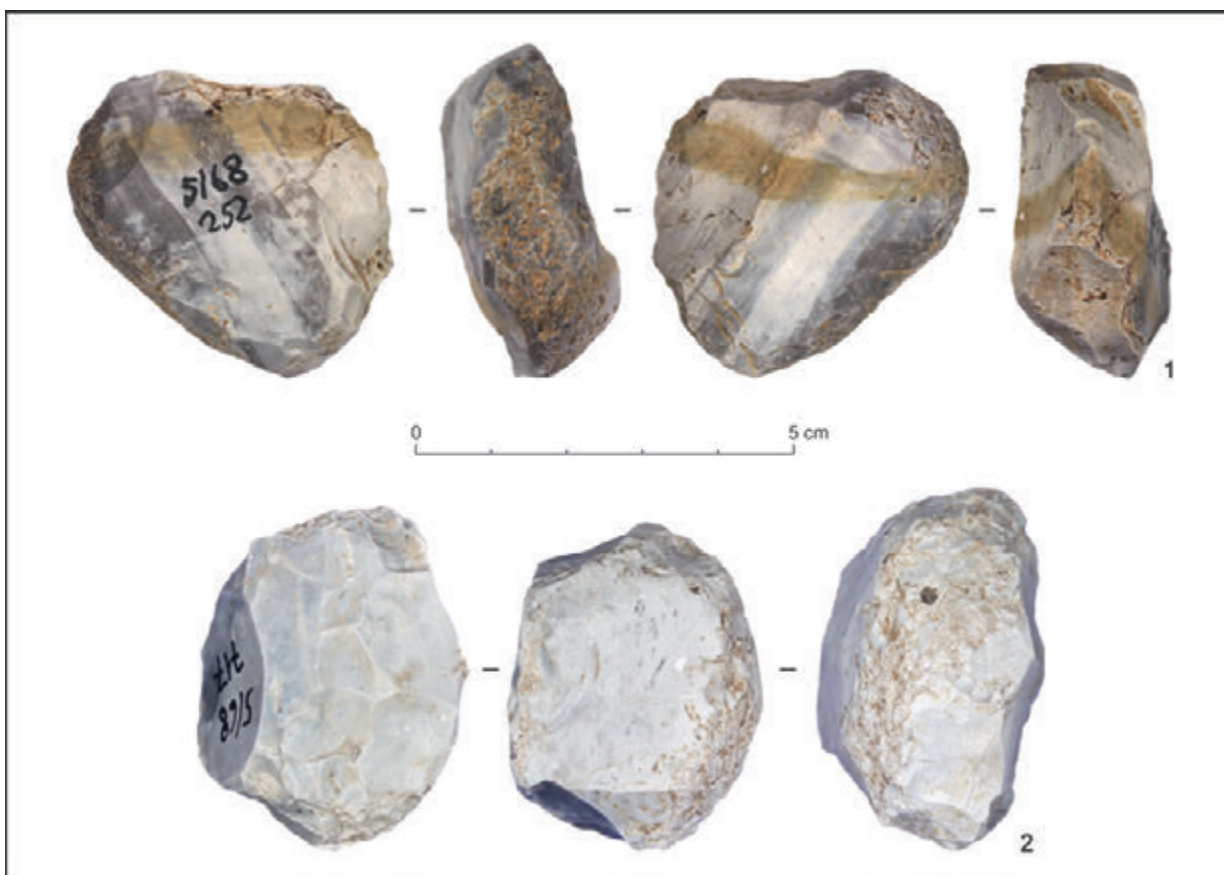
Horná vrstva – predbežné charakteristiky

Analyzovaná koncentrácia s počtom 1485 (z toho 1446 ks štiepanej kamennej industrie; tabela 1) nálezov obsahuje všetky fázy ťažby. Artefakty možno rozdeliť do kategórií nasledovne: jadrá tvoria 6 %, čepele 27 %, úštepy s odpadom 67 % a iné 3 %. Do poslednej patrí hrubotvará industria, hľuzy alebo iné kusy suroviny a oker. Do odpadu boli zaradené kusy, ktoré sa už nedali bližšie identifikovať a ich výpovedná hodnota bola veľmi nízka.

Analýza surovinového zloženia vychádza z makroskopického pozorovania. Neobsahuje presné zaradenie niektorých silicítov. Jedným z dôvodov je stupeň patinácie na artefaktoch. Využívané boli v prvom rade lokálne zdroje obsidiánu z okolia Zemplínskych vrchov. Tvoria 69 % (995 ks) súboru. Územie východného Slovenska a priľahlého Maďarska však poskytovali ďalšie suroviny ako limnosilicit (15 %, 214 ks), rádiolarit (3 %, 46 ks), rohovec (2 %, 27 ks), kremeň (9 ks), jaspis (2 ks), opál (8 ks), silicifikovaný pieskovec (2 ks) či kremenný porfýr (1 ks) a porcelanit (1 ks). Surovinu zo vzdialených oblastí predstavuje pazúrik (6 %, 88 ks). V súbore sa objavuje pokrytý modrastou alebo tmavomodrou patinou, na niektorých kusoch je viditeľná tmavohnedá hmota. Pravdepodobne ide z väčšej časti o volynský pazúrik z oblasti povodia Dnestra. Pomer eratického pazúrika alebo pazúrika z južného Poľska je pre silnú patináciu týchto artefaktov otázný. Zdroje limnosilicitu sú v rámci východného Slovenska najmä v Slanských vrchoch, na maďarskej strane v oblasti Tokajských a Bukových vrchov (*Kaminská 1991; Simán 1986*). Jaspis a opál sa vyskytuje v blízkom okolí Zemplínskych vrchov. Zdrojmi pre rohovec a rádiolarity, použité v Kašove I, môžu byť štrky východoslovenských riek (Laborec, Ondava), v ktorých sa objavujú v sekundárnej polohe z pôvodne severnejších oblastí bradlových a flyšových pásiem (*Kaminská 1991*). Zdroje silicifikovaného pieskovca sú dokumentované v pohorí Vihorlat (*Rácz 2013*). Prepálenie artefaktov sa objavuje u 3 %.

Technológia ťažby jadier

Jadrá získané zo sektorov 84, 85, 86a, 86b a 87 dokumentujú viaceré spôsoby narábania so surovinou. Analyzovalo sa 82 jedincov. Väčšina pochádza z obsidiánu s podielom 73 % (18 patinovaných). Okrem toho sa v skupine jadier vyskytuje 11 kusov (14 %) z limnosilicitu (väčšinou patinovaných), tri z patinovaného bližšie neurčeného pazúrika, tri z rádiolaritu, dva z rohovca, taktiež dva z opálu a jeden zo silicifikovaného pieskovca. Spolu so samotnými jadrami, ktoré poskytli cenné informácie o štiepaní na tejto lokalite, prispeli k analýze aj polotovary, nástroje a početné charakteristické úštepy. Medzi nálezmi sa nachádzajú aj celé nevyužité hľuzy obsidiánu.



Obr. 7. Kašov I. Jadrá z hornej vrstvy Kašova I využité sekundárne ako otlkače. 1 – limnosilicit; 2 – patinovaný pazúrik. Foto L. Debnárová.

Na spôsobe štiepania hľúz mal svoj podiel do určitej miery aj ich tvar. Aj keď najvhodnejšie boli pravdepodobne rôzne sférické tvary, ktoré sú práve pre obsidián bežné, využívali sa tiež rôzne nepravidelné kusy. Tri celé hľuzy v analyzovanom súbore (na celej lokalite je ich viac) sú nevelké, čo ale korešponduje s celkovou podobou jadier a debitáže, nakoľko sa výroba prevažne nesústreďovala na väčšie polotovary. Veľkosť pôvodných hľúz je možné rekonštruovať aj z preparačných úštepov či vrchlíkov jadier. Potvrdzujú však, že v analyzovaných sektoroch prevládalo používanie stredne veľkých kusov suroviny (preparačné úštepy majú do 6 cm). Naopak, limnosilicitová surovina bola o niečo väčšia.

V skupine jadier dominujú reziduálne formy (43 ks), ktoré častokrát limitujú získané informácie, ale možno nájsť tiež jadrá v dobrom stave zachovania a skôr pokročilej fáze ťažby (17 ks). Časť jadier bola zanechaná ešte v začiatkovej fáze. Takmer tretina jadier má na ťažobnej ploche pozostatok po technickej chybe, hlavne v podobe predčasného ukončenia úštepu z dôvodu prívelkej sily pri údere. Dôvodom zanechania jadra v pokročilej fáze sú aj rôzne narušenia správneho uhla medzi podstavou a ťažobnou plochou. Dostatok suroviny si nevyžadoval ich intenzívnejšie obnovovanie.

Na jadrách je v rôznej miere prítomná pôvodná kôra. Súvisí to s veľkosťou a tvarom hľúz, navyše kôra obsidiánu má častokrát charakter, ktorý nie je pri štiepaní a výrobe nástrojov väčšou prekážkou, v niektorých prípadoch sa nemusela odstrániť ani z podstavy ak bol tento povrch prirodzene rovný. Časť jadra, kde zostala kôra, ako aj jej celkový rozsah, sú rôznorodé.

Za častý možno považovať výskyt kôry na zadnej časti jadra, niekedy výlučne len na tomto mieste alebo v kombinácii s kôrou na jednom alebo oboch bokoch.

Pred samotnou hlavnou fázou štiepania boli v prvom rade využívané prirodzené hrany na hľuzách, vytváranie hrebeňa na začiatku ťažby muselo byť minimálne, vzhľadom na nízke zastúpenie týchto charakteristických kusov v súbore. Hrebeňových čepeli bolo identifikovaných len šesť kusov, polovica z nich je z obsidiánu. Na jadrách sa pozostatky po vytvorených hrebeňoch neobjavujú.

Celkový tvar jadier, ak je ho možné kvôli dominujúcemu reziduálnemu stavu vôbec určiť, sa dá charakterizovať najčastejšie ako prizmatický (30 ks). Značná časť je skôr nepravidelná (17 ks). Ihlanovitá forma sa objavila štyrikrát. Podstavy jadier boli vytvorené zväčša pomocou odbitia veľkého úštepú a počas ťažby sa ďalej upravovali len v malej miere pomocou odbitia dodatočných úštepov. Úprava hrany jadier sa častokrát nedá spoľahlivo určiť, na 13 je viditeľná, avšak čepele či úštepy dokladajú, že to bola bežná súčasť procesu štiepania. Obnova jadier prebiehala okrem rôznych reparačných úštepov prostredníctvom odbíjania vrchnej časti ťažobnej plochy alebo tabletov. Neúplné tablety však zároveň môžu byť pozostatkom po zmene orientácie jadra. Doklady odstraňovania vrchnej časti jadra, či len čiastočné alebo úplné, sa objavujú nezávisle od suroviny. Medzi ďalšie spôsoby úpravy jadra počas ťažby patrí tvorba sekundárneho hrebeňa, ktorý umožňuje rozšíriť ťažobnú plochu. Je však veľmi ojedinelá.

Cieľom výroby, na základe negatívov na jadrách, boli primárne čepele alebo čepielky. Na lokalite však možno pozorovať zvýšený počet čepeľových úštepov, ako aj úštepov opracovaných retušou. Medzi jadrami sa vyskytujú aj jedince, ktoré nevykazujú žiadne stopy po ťažbe čepelí a pravdepodobne slúžili výhradne na získanie úštepov. Takýchto jadier je 13, pričom ďalšie vykazujú stopy po čepeľových úštepoch. Niektoré z jadier slúžili po odbití čepelí aj na získavanie čepielok (3 ks). Drobné jadrá s negatívmi výlučne po čepielkach sú zastúpené v počte 17 kusov, čo percentuálne tvorí až 21 %. Negatívy na jadrách, i keď ide o ich záverečné fázy, neodrážajú väčšiu mieru pravidelnosti či už čepelí alebo čepielok. Súvisí to s používanou technikou štiepania, predbežne sa zdá, ako bližšie ukazuje nasledujúci rozbor čepelí, že dominoval mäkký kamenný otlkač. Tri z jadier boli sekundárne využité a majú stopy po otlkaní (obr. 7). Ako tvrdé kamenné otlkače mohli slúžiť pri odbíjaní úštepov.

Z hľadiska spôsobu ťažby analyzovaných jadier je najvhodnejšie rozdelenie na skupiny, čo odráža technologické vyhotovenie jadier a ich účel. Toto rozdelenie sa týka analyzovanej vzorky, upresnenie a doplnenie poskytne až rozbor väčšej časti industrie:

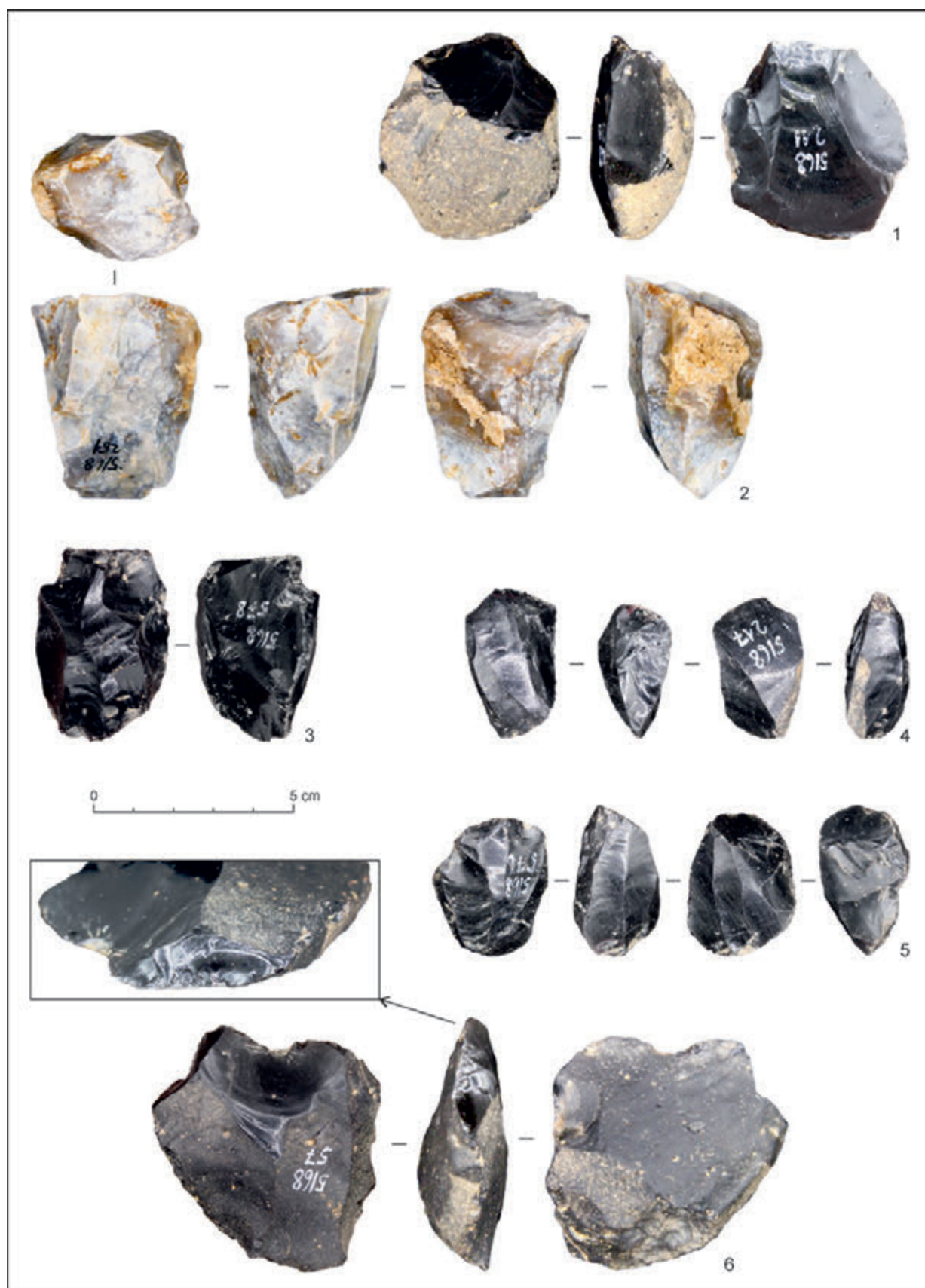
1. Čepeľové jadrá s jednou podstavou a jednou ťažobnou fázou
2. Jadrá so zmenenou orientáciou ťažby
 - a) ťažba v rámci jednej strany jadra
 - b) ťažba na viacerých stranách
3. Bipolárne ťažené jadrá
4. Čepielkové jadrá
 - a) zo zmenšujúceho sa čepeľového jadra
 - b) cielený výber drobnej hľuzy
 - c) úprava na jadro z hrubších úštepov
5. Úštepové jadrá
 - a) s vytvorenou podstavou
 - b) otáčanie jadra bez vytvorenia podstavy

Čepeľové jadrá s jednou podstavou sú najpočetnejšie (obr. 8: 1, 2; 9: 1, 2, 5). Spoľahlivo sa ich podarilo identifikovať v 20 prípadoch (pravdepodobne aj ďalších osem). Ťažba prebiehala počas jednej fázy, pričom neboli zistené jadrá, pri ktorých by sa z podstavy ťažilo najprv na jednej strane a neskôr na druhej. Tieto jadrá možno rozdeliť do menších skupín. Dominuje štiepanie jednej strany hľuzy a to hlavne širšej (14 ks). V iných prípadoch sa využili aj bočné strany a vznikla jedna konvexná ťažobná plocha (4 ks). Patria sem aj dva prípady, kedy sa jadrom na odťaženie čepelí stal veľký úštep. Nateraz nie je jasné, či je tento spôsob len ojedinelý alebo sa vyskytuje v celom súbore z Kašova pravidelne.

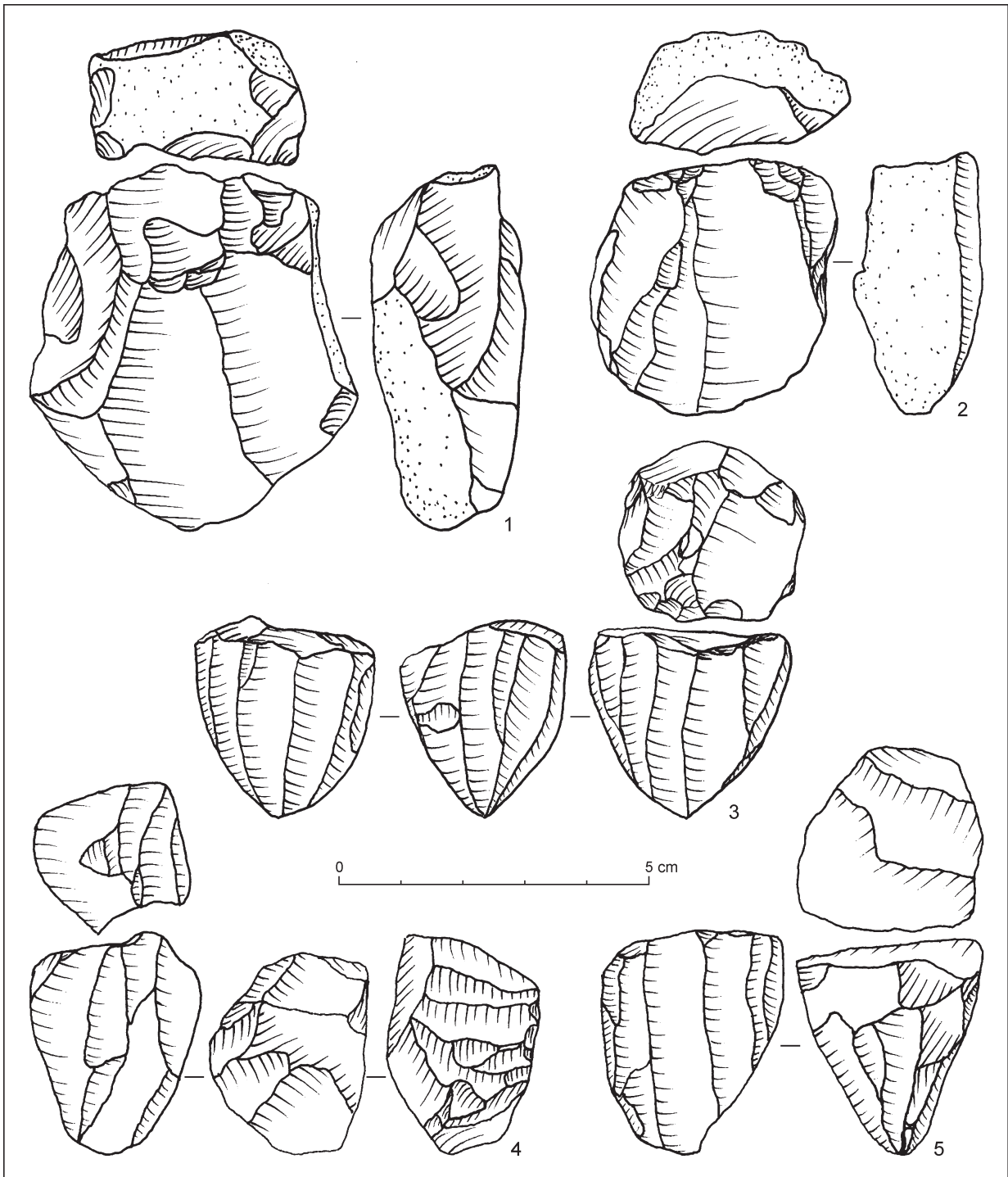
Zmena orientácie čepeľových jadier (obr. 8: 4, 5) sa objavila v predmetnom súbore štyrikrát. Rozpoznať možno typ, kedy boli využité dve protiľahlé strany jadra a ďalší, kedy sa ťažilo na rovnakej strane, iba sa zmenil smer ťažby.

Tri jadrá sa ťažili bipolárnym spôsobom na jednej strane, čo vytvára ďalšiu samostatnú skupinu. Ťažobné plochy týchto jadier sú však už v záverečnej fáze a negatívy pôvodných polotovarov ťažko sledovateľné (obr. 8: 3). Ide o malé jadrá s dĺžkou do 45 mm. Tento spôsob, kedy sa počas jednej ťažobnej fázy využívajú protiľahlé podstavy, bol viac využívaný pri čepielkových jadrách, ktoré sú opísané nižšie.

Nasledujú jadrá, z ktorých boli získavané čepielky. Aj keď samotné čepielkové nástroje sú zastúpené na lokalite minimálne, táto skupina jadier dokladá, že ich výroba bola systematická a dôležitá. Pre tento účel slúžilo v súbore 20 kusov, teda až 26 % skupiny. V rámci nich sa ale líši spôsob, akým bolo jadro

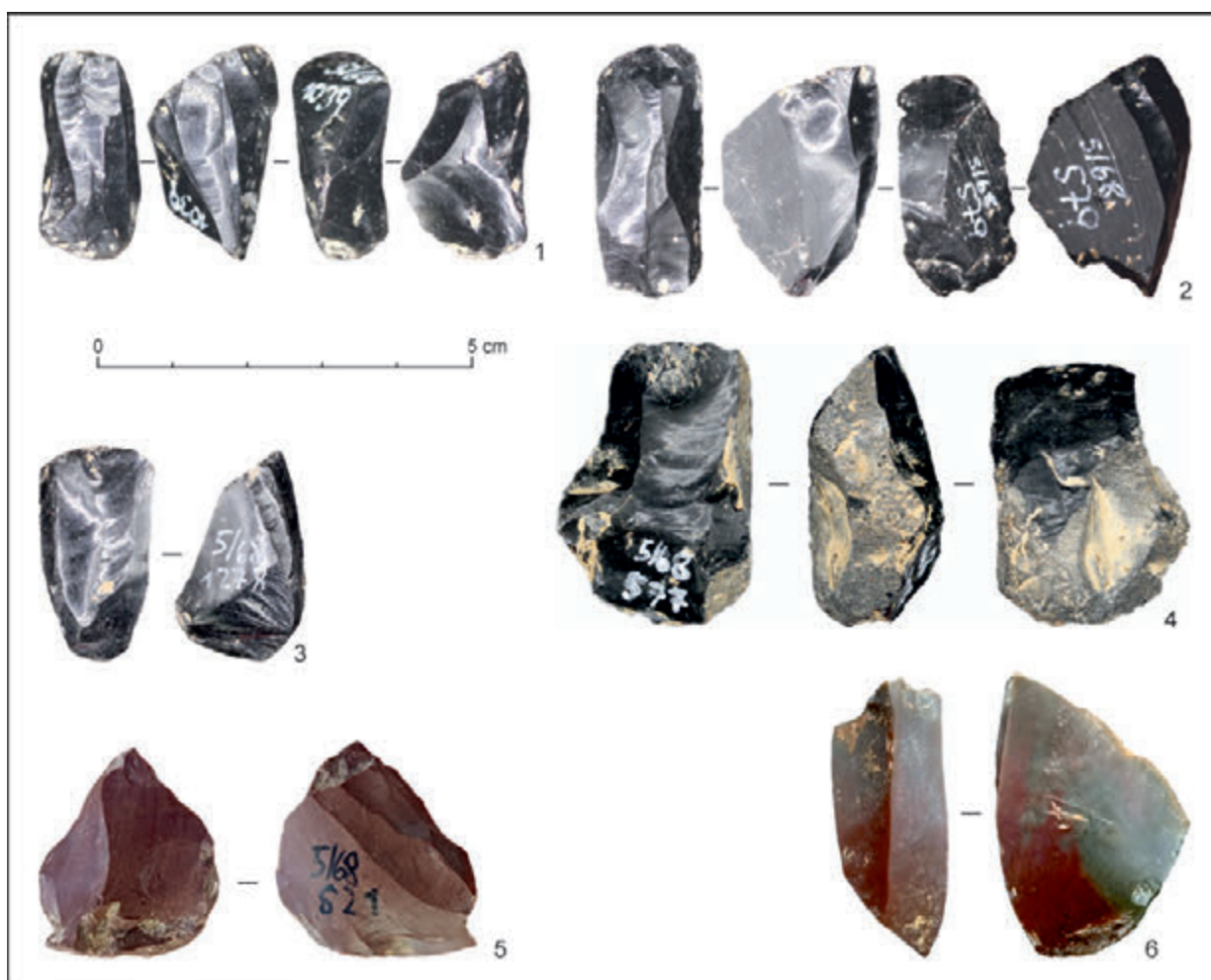


Obr. 8. Kašov I. Výber jadier z hornej vrstvy lokality Kašov I. 1, 3–6 – obsidián; 2 – limnosilicit. Foto L. Debnárová.



Obr. 9. Kašov I. Výber jadier z hornej vrstvy lokality Kašov I. Obsidián. Kresba L. Debnárová.

vytvorené. V desiatich prípadoch bol na získanie čepielok použitý hrubý úštep (obr. 10: 1–3, 5, 6). Zdá sa to ako jedna z dôležitých charakteristík súboru. Použitie vhodného úštepu umožňovalo napríklad možnosť lepšieho uchopenia jadra. Ide o skupinu, ktorá má typicky dozadu pretiahnutý a zužujúci sa tvar. Možno pozorovať aj technologicky totožne vytvorené kusy, i keď nie sú z rovnakej suroviny (rádiolarit, obsidián, limnosilicit). Vyznačujú sa tým, že ide o úštep odbitý z boku jadra a práve táto bočná strana, ktorá je hrubá, potom po otočení slúžila ako podstava. Ťažba prebiehala priečne na pôvodnú os úštepu (obr. 10: 5, 6). Iným prípadom je, keď čepielkové jadro vzniklo zmenšovaním pôvodne väčšieho jadra



Obr. 10. Kašov I. Výber jadier z hornej vrstvy lokality Kašov I. 1–4 – obsidián; 5, 6 – rádiolarit. Foto L. Debnárová.

(obr. 8: 4) určeného pravdepodobne na čepele alebo nie je jasné z akého kusu vzniklo, ale je prispôsobené a upravené na výrobu čepielok. Identifikovaných bolo šesť takýchto čepielkových jadier. Vyskytol sa aj ojedinelý prípad ihlanovitej formy jadra s ťažbou po celom obvode, viditeľne bolo pôvodne väčšie (obr. 9: 3). Čepielkové jadrá boli ťažené aj z dvoch protiahlých podstav, ako dokladajú štyri kusy (obr. 10: 1, 2). Napokon dôležitý je aj výskyt cieleného výberu drobných hľúz (obr. 10: 4), teda samostatných čepielkových jadier (3 ks). Ich štiepanie prebiehalo v jednom smere. Podľa negatívov na ťažobných plochách neboli čepielky vo vyššej miere pravidelné a v šandarizovanej forme. Samotné čepielky sú v súbore zastúpené minimálne.

Počet jadier s negatívmi úštepov a bez stôp po získavaní čepelí je 13 (16 %). Zdá sa, že nejde o druhotné využitie hľuzy po odťažení čepelí, úštepové jadrá mali na lokalite svoj vlastný účel. Väčšinu z nich (9 ks) možno charakterizovať ako jadrá s rôznymi smermi úderov bez vytvorenia podstavy, z ktorej by sa opakovane ťažilo (obr. 8: 6), a ktoré boli neskôr upravené miestnou retušou. Pre údery sa využívali rôzne vhodné plochy, vrátane negatívov po predchádzajúcich úštepoch. Iba dve jadrá možno označiť za jadrá s podstavou.

Priemerná dĺžka analyzovaných čepelových jadier je 39 mm a šírka 33 mm. Maximálne hodnoty sa týkajú jadier z limnosilicitu (najväčšie s dĺžkou okolo 71 mm a šírkou 67 mm). Jadrá, z ktorých boli ťažené čepielky, majú priemer dĺžok 24,8 mm a širok 17 mm.

Z hľadiska suroviny a charakteru jadier sa nepredpokladá, že na lokalite existovali osobité prístupy spracovávaní. Spôsob ťažby jadier skôr závisel od tvaru hľúz než od druhu materiálu.

Čepele a úštep

Súbor obsahuje 388 čepelí, čo predstavuje 27 % všetkých nálezov. Stopy po retušovaní sa nachádzajú na veľkej časti z nich, 125 kusov možno označiť za nástroje, pričom na ďalších 20 je viditeľná pracovná retuš. Spolu tvoria čepele upravené retušou na nástroje 32 % čepelí.

Väčšina čepelí nie je v úplnom stave, celé alebo skoro celé čepele predstavujú len 86 (obr. 11: 3–6). Z fragmentárnych čepelí dominujú mesiálne časti (98 ks), nasledujú mesiálno-distálne (57 ks), proximálno-mesiálne (50 ks) a proximálne (26 ks). K čepeliám zo začiatku ťažby, čo zahŕňa hrebeňové (6 ks) a preparačné čepele s veľkým podielom kôry, patrí 6 % (22 ks). Preparačné čepele sú väčšinou výsledkom odbitia vhodnej prirodzenej hrany. Podhrebeňových čepelí sa objavilo päť. Ďalších 5 % bolo určených ako reparačné kusy, sedem kusov z nich dokladá tvorbu sekundárnej hrany. Zo stredovej časti ťažobnej plochy pochádza 62 % z čepelí (229 ks) a z bokov jadra bolo identifikovaných 26 % (94 ks). Až 79 % (76 ks) čepelí z bokov ťažobnej plochy dokladá, že strany jadier boli bežne pokryté kôrou. Čo sa týka kôry v distálnej časti čepelí, je prítomná u 10 %.

Pätky boli na čepeliach zachované v 131 prípadoch. Potvrdzujú využívanie hladkej podstavy. Hladkých pätiiek bolo 57 kusov (44 %) a do väčšej miery sú zastúpené bodové (30 ks) s lineárnymi (28 ks), ktoré spoločne tvoria 44 %. V niektorých prípadoch sa pred odbitím miesto úderu mohlo mierne upraviť drobným úštepom, ale väčšinou k tomu nedochádzalo (šesť dihedrálnych a dve facetované pätky). Celkovo pätky na čepeliach charakterizuje to, že sú malé. Tvar pätiiek možno najčastejšie opísať ako úzky predĺžený (53 ks, 42 %) alebo ako bod (35 ks, 28 %), menej je tvarov šošovkovitých (19 ks) až oválnych (4 ks), niektoré sú nepravidelné (6 ks). Rímsa bola identifikovaná iba v 18 prípadoch, na zvyšných pätkách absentuje. Tretina čepelí, ktoré mali zachovanú pätku, nemala upravenú hranu medzi podstavou a ťažobnou plochou. Patria sem čepele, pri ktorých úprava nebola potrebná alebo ide o rôzne reparačné kusy. Typické pre cieľové čepele je, že sa hrana pred odbitím upravila. Približne rovnako sú zastúpené stopy po abrázii hrany (37 ks) ako len po odbití väčších previsov po predchádzajúcich čepeliach prostredníctvom drobných predĺžených odštiepkov (43 ks). Bulbus čepelí je nevýrazný (33 %) až neviditeľný (24 %), menej sa objavil výrazný (15 %) a časť bola odstránená negatívom (4 %). Na väčšine bulbov nie sú prítomné mikronegatívy, avšak ich výskyt možno označiť za zvýšený (33 %).

Častý výskyt bodovej a lineárnej pätky, ako aj menšie rozmery hladkých pätiiek a ich tvar, úprava hrany jadra, nevýrazný bulbus s vyšším zastúpením mikronegatívov ako aj celková morfológia čepelí môžu indikovať, že dominovalo štiepanie mäkkým kamenným otlákačom.

Podľa profilu boli čepele (281 určiteľných kusov) rozdelené na mierne zahnuté (54 %), rovné (24 %), výrazne zahnuté (9 %) a skrútené (6 %). Technická chyba, kedy sa odštiepila aj časť druhého konca jadra sa objavila v 7 %. Boky čepelí sú paralelné v 46 % prípadov, zvyšné sú zastúpené v podobnej miere, divergentný a nepravidelný oba v 20 % a konvergentný tvar bokov má 13 % čepelí.

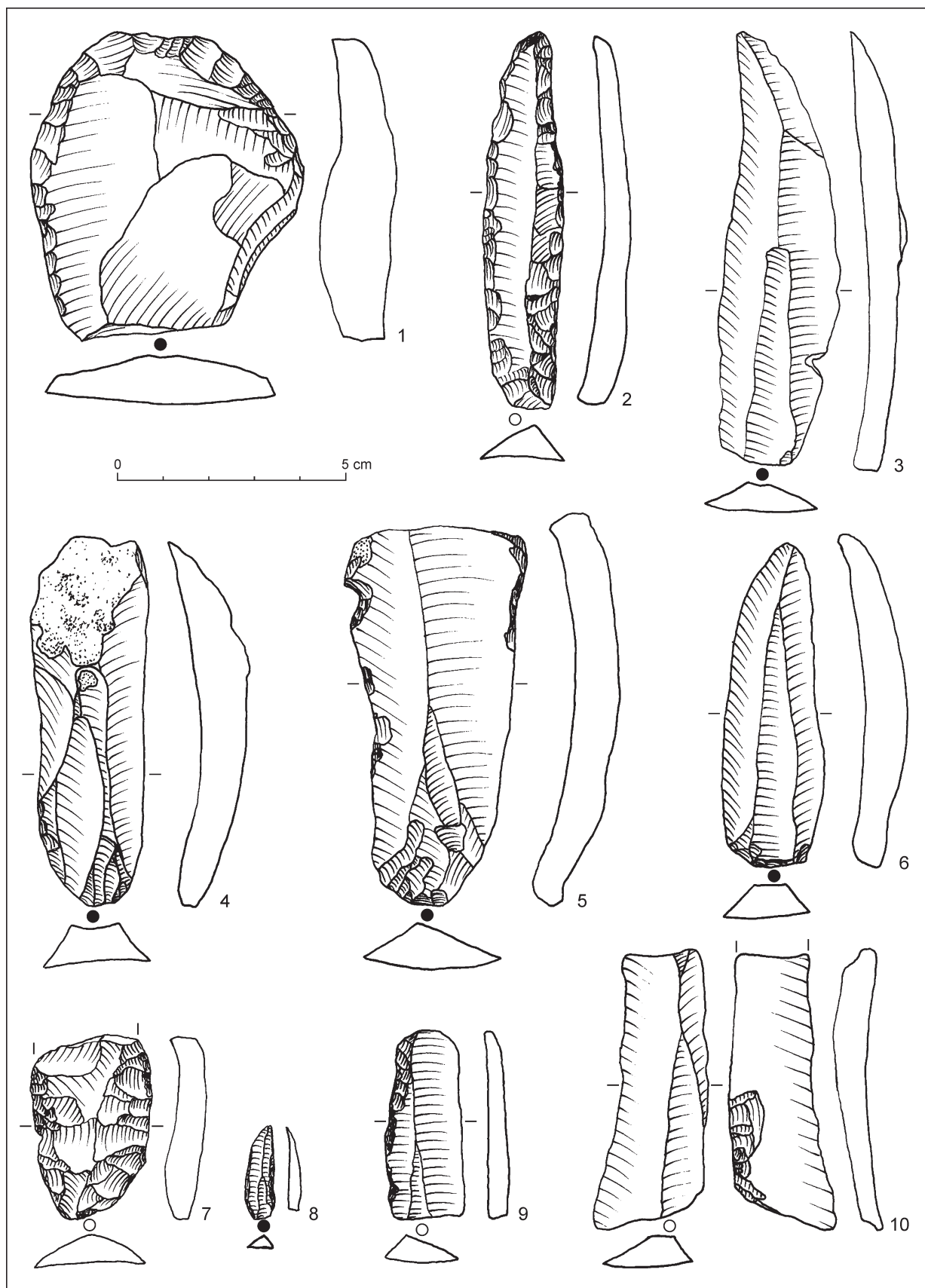
Tabela 2. Kašov I. Dĺžka, šírka a hrúbka celých čepelí.

	Dĺžka [mm]	Šírka [mm]	Hrúbka [mm]
Minimum	15,1	4,7	1,3
Maximum	81,1	39,5	23,2
Priemer	39,6	17,4	5,4
Medián	36,8	16,6	5,0
N	86,0	86,0	86,0

Metrické údaje celých čepelí (tabela 2) sú nasledovné: priemerná dĺžka je 39,6 mm (max. 81,1 mm; min. 15,1 mm; medián 36,8), priemerná šírka 17,4 mm (max. 39,5 mm; min. 4,7 mm; medián 16,6), priemerná hrúbka 5,4 mm (max. 23,2 mm; min. 1,3 mm; medián 5).

Úštepky prítomné v súbore sú z veľkej miery odpadového charakteru, hoci mnohé sa využili ďalej na nástroje (11 %). Rozdeliť sa dajú na úštepky z odstraňovania kôry, charakteristické úštepky, rôzne reparačné kusy a úštepky „cieľové“, resp. bez bližšieho zaradenia. Medzi jadrami sa nachádzajú jedince, z ktorých boli pravdepodobne ťažené len úštepky, čo znamená, že nemuseli byť získavané len ako vedľajšie produkty popri ťažbe čepelí.

Na mnohé nástroje, ako sú rydlá či škrabadlá, boli potrebné pevnejšie a hrubšie polotovary, najmä ak ide o obsidián. Úštepky kortikálne alebo subkortikálne, vznikajúce najmä na začiatku výroby, tvoria v skupine 15 % (121 ks). Typický je častý výskyt výraznejšieho bulbu a jaziev, pretože tieto úštepky boli odbíjané skôr pomocou tvrdého kameňa. Preparačné úštepky v danej vzorke nepresahujú 6 cm, priemer dĺžky je 33,4 cm, šírky 26,9 cm a hrúbky 8,4 cm. Medzi charakteristickými úštepami sú kusy z obnovy vrchnej časti jadra, rydlové triesky, úštepky zo zmeny orientácie, vrchlíky a ojedinele úštep z tvorby hrebeňa



Obr. 11. Kašov I. Výber nástrojov a neretušovaných čepelí z hornej vrstvy lokality Kašov I. 1, 2 – patinovaný pazúrik; 4–7, 9, 10 – obsidián; 6, 8 – rádiolarit. Kresba L. Debnárová.

či podhrebeňový. K obnove vrchnej časti jadier dochádzalo ako pri obsidiáne tak aj pri ostatných surovinách. Úštepý z nej (23 ks) tvoria dôležitú zložku, nakoľko dokumentujú podobu podstavy či hrany jadra a jej úpravu počas pokročilej fázy, na rozdiel od skupiny zväčša reziduálnych jadier. Medzi tabletmi (11 ks) sa častejšie objavujú neúplné formy, ktoré môžu predstavovať tiež pozostatky po zmene orientácie jadra. Jedinice z odstránenia vrchnej časti ťažobnej plochy dokladajú hladkú podstavu pri ťažbe a obrusovanie hrany jadra. Reparačných kusov bolo zastúpených 17 %, pričom ide iba o orientačný údaj pre úštepý, ktoré viditeľne slúžili na obnovu jadra. V skupine sa nachádzajú aj čepeľové úštepý. Ich zastúpenie je 6 % a dá sa predpokladať, že tieto kratšie formy „čepeli“ boli získavané aj systematicky. Počet rydlových triesok je 14, polovica z nich je sekundárna. Objavujú sa aj prípady, kedy bol rydlovým úderom odstránený retušovaný bok.

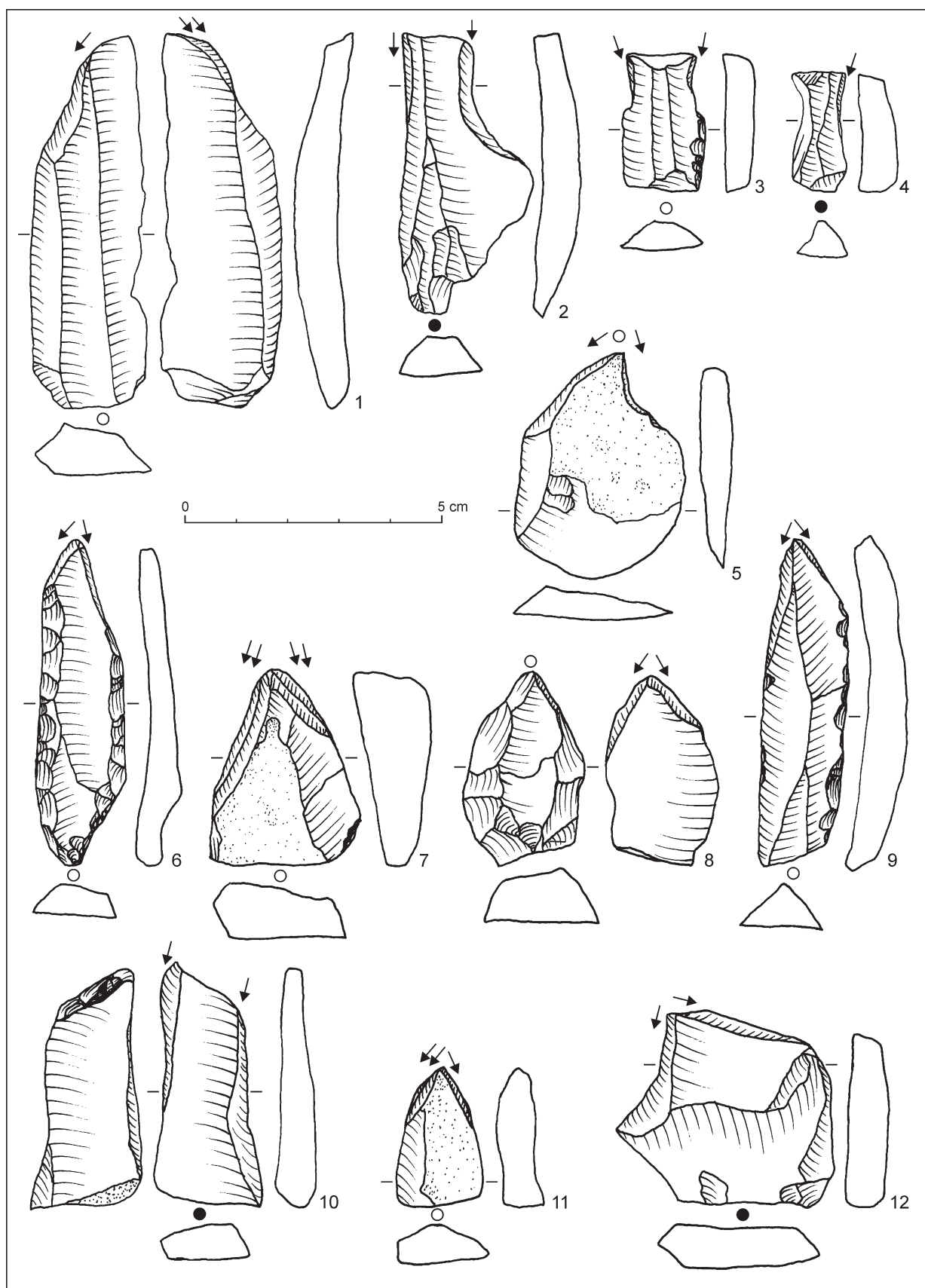
Polovica úštepov je bez kôry alebo je jej zastúpenie do 10 %. Od 20 do 50 % kôry má 9 % úštepov a od 50 do 75 % má 8 %. Viac ako 75 % kôry, teda pokrytú takmer celú alebo celú dorzálnu stranu, má 15 %. Medzi pätkami dominuje hladký typ (41 %), objavuje sa tiež bodová (15 %) a lineárna (13 %), ktoré spoločne tvoria 28 % z určených pätiiek. Kôrová päťka je zastúpená v 22 %. Dihedrálna či facetovaná sú ojedinelé. Z hľadiska celkovej morfológie pätiiek je dôležité, že typický je úzky predĺžený tvar, prítomný až u tretiny (33 %), po ktorom nasledujú bodové tvary. Šošovkovitý tvar pätky sa objavil u 14 %, v rovnakom pomere aj nepravidelný. Hrana medzi podstavou a ťažobnou plochou je viditeľne upravená v 33 %, väčšinou formou obrusovania. Rímsa na päťke je prítomná veľmi ojedinele (94 % bez rímsy). Polovica úštepov má výrazný bulbus (52 %), ako nevýrazný bol určený pri 32 % a neviditeľný pri 9 %. Časť úštepov má bulbus úplne odstránený negatívom (7 %). Mikronegativy na bulbe má 56 % úštepov. Z hľadiska celkového profilu sú približne rovnako zastúpené rovné a mierne zahnuté kusy (43 a 44 %). Výrazne zahnutých úštepov je 9 %. V malom množstve sa objavili skrútené profily a úštepý s druhým koncom jadra (*plunging flake*). Celkový obrys úštepov je skôr rôznorodý, divergentný (27 %). Paralelný (23 %) a nepravidelný tvar (23 %) sú zastúpené približne rovnako. Úštepý oválneho (14 %) a konvergentného tvaru (12 %) sa objavujú o čosi menej. Vzhľadom na často sa opakujúci úzky predĺžený tvar pätiiek, obrusovanie hrán a mikronegativy na bulbe možno predpokladať, že sa používal najmä mäkký kamenný otlkač.

Priemerná dĺžka úštepov je 30,4 mm (max. 75,8 mm; min. 10 mm), priemerná šírka 23,5 mm (max. 57,63 mm; min. 2,8 mm) a hrúbka 7,9 mm (max. 21,38 mm; min. 1,5 mm).

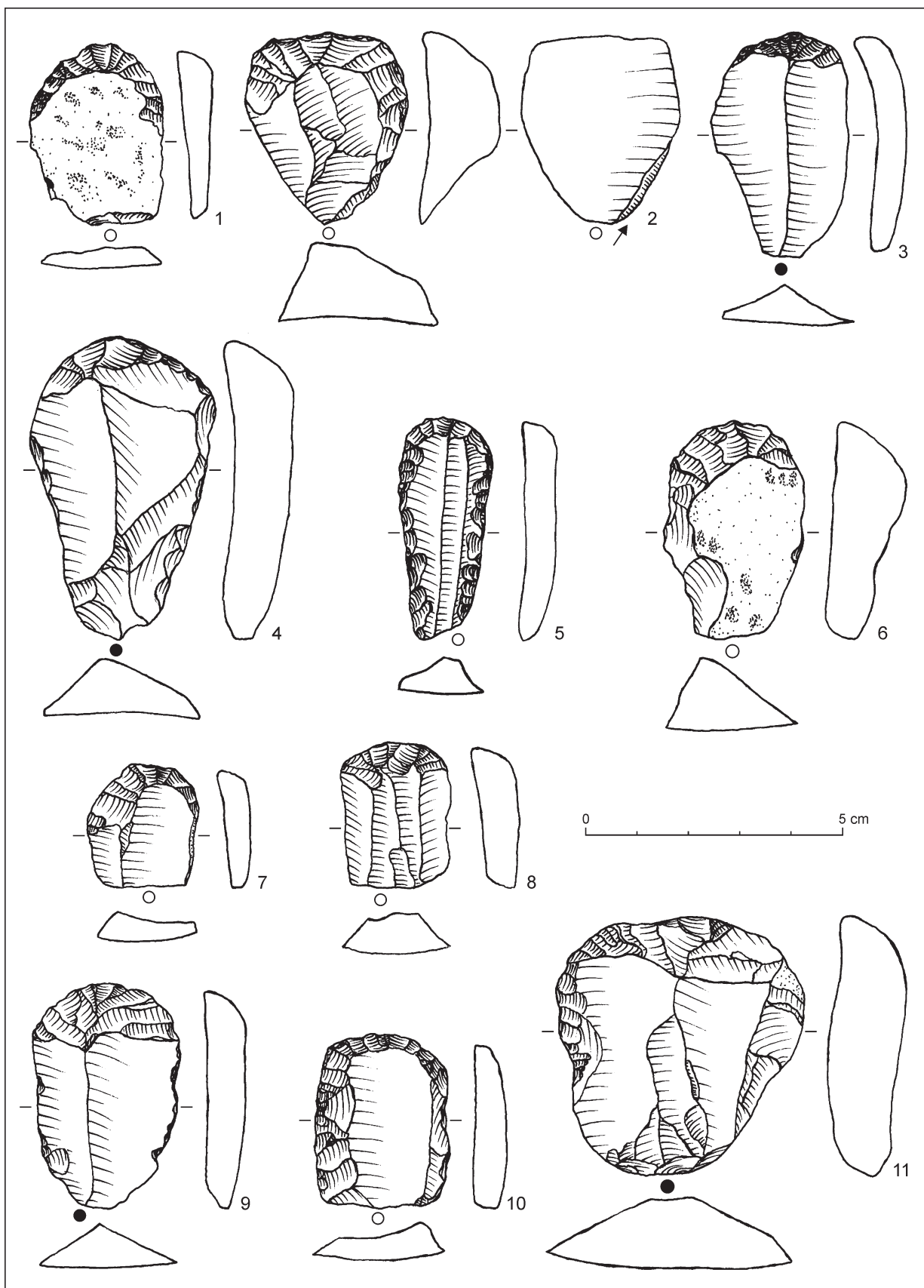
Typológia

Súbor nástrojov z Kašova I vykazuje všeobecne pomerne nízku diverzitu typov. Úprava retušou je prítomná na 215 kusoch, pričom ďalších 29 kusov má iba pracovnú retuš. Celkovo nástroje s retušou tvoria 15 % súboru. Dominujú nástroje vyrobené na čepeli, avšak nie vo výraznej miere. Za čepeľové nástroje bolo označených 125 kusov, ktoré tvoria 32 % tejto technologickej skupiny a za úštepové 90 kusov predstavujúcich 11 % úštepov. Najpočetnejšie sú laterálne retušované čepele (56 ks, 27 %), rydlá (43 ks, 21 %), škrabadlá (37 ks, 18 %) a retušované úštepý (34 ks, 17 %). V menšej miere sa objavujú vruby (19 ks, 9 %). Medzi nástroje s nízkym zastúpením možno zaradiť priečne (4 ks) a šikmo (3 ks) retušované čepele, kombináciu škrabadlo-rydlo (3 ks; obr. 9: 2), hroty (2 ks), fragment čepeľky s otupeným bokom a hrotito retušovanú čepeľku, čepele s retušovaným koncom (3 ks), oškrabovač (1 ks; obr. 11: 1) a dvojité driapadlo (1 ks; obr. 11: 7). Z hľadiska surovín tvorí obsidián až 64 %, percentuálne zastúpenie iných surovín je nasledovné, pazúrik 10 %, limnosilicít 9 %, rádiolarit 9 %, rohovec 2 %. Ojedinele sa objavuje silicifikovaný pieskovec a kremenný porfýr. Niektoré nástroje ostali po surovinovej stránke neurčené (12 ks).

Medzi rydlami (obr. 12) je viacero typov. Podľa početnosti sú to rydlá klinové stredné (15 ks), rydlá klinové na zlomenom ústepe/čepeli (9 ks; obr. 12: 2–4), rydlá klinové bočné (5 ks; obr. 12: 12), rydlá klinové viacnásobné (4 ks), rydlá priečne (4 ks), rydlá hranové na šikmo retušovanej čepeli (2 ks; obr. 12: 10), rydlo klinové zahnuté (1 ks; obr. 12: 5) rydlo hranové na priečne retušovanej čepeli (1 ks). V dvoch prípadoch ide o zlomený nástroj a typ rydla nie je možné určiť. V súbore najvýraznejšie dominujú stredné klinové rydlá, ktoré tvoria 37 % všetkých rydiel. V rámci skupiny rydiel sa prejavuje znížená miera využívania obsidiánu, ktorý bol použitý v tretine prípadov. Pokiaľ ide o použité polotovary, ich charakter je skôr variabilný. O niečo častejšie sa rydlá vyrábali na úštepoch (23 % z úštepových nástrojov, 19 % z čepeľových nástrojov). Platí to najmä pre klinové rydlá stredné a bočné. Ak bol použitý hrubší úštep, rydlo sa častokrát sformovalo pomocou viacerých rydlových úderov (obr. 12: 7, 11). Priemerná dĺžka rydiel je 35,6 mm, šírka 20,3 mm a hrúbka 7,8 mm. Celkovo tak ide o menšie nástroje. Výnimkou nie sú ani klinové rydlá na pravidelnej dlhšej čepeli. Dve majú totožnú dĺžku 62 mm a laterálnu retuš (obr. 12: 6, 9). Hranové rydlá sa v rámci analyzovanej vzorky vyrobili iba na čepeliach.



Obr. 12. Kašov I. Výber rydiel z hornej vrstvy lokality Kašov I. 1, 8 – rádiolarit; 2, 7, 9 – patinovaný limnosilicit; 3, 12 – rohovec; 5, 6, 10 – patinovaný pazúrik; 11 – obsidián. Kresba L. Debnárová.



Obr. 13. Kašov I. Výber škrabadiel z hornej vrstvy lokality Kašov I. 1, 6-9, 11 – obsidián; 2, 3, 5 – rádiolarit; 4 – kremenný porfýr; 10 – rohovec. Kresba L. Debnárová.

Škrabadlá sú veľmi variabilné (obr. 13). Častejšie pochádzajú z úštepov (22 % z úštepových nástrojov, 15 % čepeľových), pričom využívané boli aj preparačné (obr. 13: 1, 6). Na výrobu sa používal najmä obsidián (68 % škrabadiel). Osem kusov je upravených aj laterálnou retušou a jeden kus je dvojitém škrabadlom. Celkovo ide o krátke formy škrabadiel s mierne rozšírenou hlavicou, ojedinele ide o škrabadlo na dlhšej čepeľi, maximálna dĺžka dosahuje 4,5 cm. Nie je možné určiť typický a pravidelnejšie sa opakujúci spôsob vyhotovenia škrabadla, variabilná je aj hrúbka použitých polotovarov (maximálne 15,6 mm). Šírky hlavice škrabadiel sa pohybujú rôznorodo od 15,3 mm do 41,6 mm.

Otázka hrotov v súbore je problematická. Medzi nástrojmi sa nachádzajú dve hrotito retušované čepele. V prvom prípade je retuš súvislá, bilaterálna, s plochým náklonom, avšak nepravidelná a boky sú poškodené používaním. Dĺžka nástroja je 71 mm, vyrobený je z pazúrika (obr. 11: 2). Ďalším je zlomený artefakt z limnosilicitu, retuš je nesúvislá a zle viditeľná pre patináciu. V analyzovanom súbore chýbajú ďalšie hrotito retušované čepele, ktoré by bolo možné označiť za hroty. Kolekcia obsahuje drobný fragment mesiálnej časti otupenej čepeľky so strmým náklonom retuše, ako aj celú bilaterálne retušovanú hrotitú čepeľku. Jej retuš je priama, polostrmá, ale nesúvislá (obr. 11: 8).

Pre skupinu čepeľí s laterálnou retušou je typické, že sa upravoval väčšinou len jeden bok. Bilaterálna retuš sa objavila v siedmich prípadoch. Retuš na čepeľiach je najmä priama (66 %), menej inverzná (26 %), len veľmi ojedinele protiľahlá, striedavá alebo bifaciálna. Súvislo retušované boky sa nevyskytujú často (26 %), prevahu má skôr miestna retuš (40 %), v malom množstve nesúvislá (4 ks). Náklon retuše je polostrmý (62 %), plochý (32 %), ojedinele strmý (2 ks). Dominuje krátke rozpätie retuše, prípadne sa objavuje dlhé (22 %; obr. 11: 10). Morfologicky patrí retuš na čepeľiach k šupinovitej (80 %), čiastočne paralelná alebo paralelná nie sú typické a vyskytujú sa v malom množstve.

ZÁVER

Slovenská lokalita Kašov I predstavuje pre obdobie LGM mimoriadne dôležitú lokalitu európskeho významu. V odbornej literatúre sa spomína často, aj keď informácie o nej sú fragmentárne. Pre neskorú fázu mladého paleolitu ide pritom o najväčšiu lokalitu v strednej Európe. Vzhľadom na rozsah lokality ju možno považovať za miesto opakovaných návratov loveckých skupín, čo bolo podmienené vhodnými a priaznivými podmienkami. Surovinové zloženie súboru preukázalo využívanie lokálnych zdrojov, ako aj vzdialenejšie kontakty smerom na východ.

V rámci analýzy boli zadané hlavné charakteristiky industrie z koncentrácie hornej vrstvy výskumnej sezóny 1968. Tá umožňuje sledovať spôsoby spracovávania lokálneho zdroja suroviny, obsidiánu. Industria neskej fázy mladého paleolitu z Kašova I sa javí ako svojrázna, zameraná na výrobu kratších čepeľí a čepeľok, vrátane častého využívania úštepov. V kolekcii dominujú menšie jednopodstavové jadrá, zatiaľ čo prizmatické dvojpodstavové jadrá, typické pre mnohé lokality gravettienskej kultúry absentujú. Z hľadiska techniky nadobudlo väčší, až dominantný význam využívanie mäkkého kamenného otlákača. V analyzovanej vzorke dominujú nástroje používané pri domácich aktivitách, ako škrabadlá a rydlá. K možným loveckým nástrojom možno zaradiť hrotito retušované čepele, fragment čepeľky s otupeným bokom či hrotitú čepeľku. Dôležitým znakom industrie je absencia otupovania čepeľí.

Súbor zo spodnej vrstvy sa zvyčajne spája s gravettienskou kultúrou, resp. jej neskorou fázou, avšak chýbajú jej všeobecne známe charakteristické znaky. Po typologickej stránke sa výrazne nelíši od hornej vrstvy. Dôležitým znakom je veľmi nízky výskyt otupovania nástrojov, ktoré by však bolo typické pre mladší gravettien. Významným a dobre pozorovateľným rozdielom medzi vrstvami je ich surovinové zloženie. Spodnú vrstvu môžeme interpretovať ako prechodný, malý tábor (Novák 2002), ktorý z hľadiska využívania surovín poukazuje na vzdialené kontakty. Hornú možno interpretovať ako pokračovanie osídľovania danej polohy, už však so zmenenou stratégiou mobility a s ňou súvisiacim využívaním zdrojov. Ak sa skupiny presúvali do nového územia, možno predpokladať, že si so sebou prinášali väčšie množstvo suroviny či nástrojov. Neskôr, pri zmene stratégie sa viac orientovali na lokálne zdroje. Posledné glaciálne maximum predstavovalo významný impulz pre na mnohé zmeny a prispôsobenie sa loveckých skupín, ktoré môže pozorovať práve na lokalite Kašov I.

Predmetom ďalšieho výskumu je upresnenie postavenia Kašova I a vývoja industrie v severovýchodnej časti Karpatskej kotliny prostredníctvom vzájomného porovnávania lokalít. Dôležité bude zamerať sa na technologické podobnosti, nakoľko obe vrstvy z Kašova I sú ťažko kultúrne definovateľné.

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On the Importance of the Palaeolithic Site Kašov I (Trebišov district)

Preliminary Results of the Analysis of Chipped Stone Industry

Lucia Debnárová

Summary

The Kašov I site is located approximately 2 km southeast of the village of Kašov on the northern elongated part of the Zemplín Hills. The altitude is around 200 m a.s.l. It belongs to the chain of Palaeolithic settlements concentrated around the Zemplín hills. Kašov I with its dating is closely related to the LGM period. The upper layer could be placed towards the end of the greatest intensity of the LGM, the lower one at the beginning of its peak. The fact that the settlement contains a record of such sequence emphasizes its importance in the context of the settlement of Central Europe.

The reason why the northeastern part of the Carpathian Basin is such an important part of the investigation of the impact of the LGM on occupation in Central Europe is the concentration and absolute dating of settlements. Sites not only of the late Gravettian (Cejkov I–V, Hidasneméti, Bodrogkeresztúr) but probably also of its final phase (Kašov I-LL, Cejkov I) are represented, with further development documented by the upper layer at Kašov I with a date of 18,600 BP (Gd-65699). This issue is most limited by the fact that many sites (Hrčel-Pivničky, Hrčel-Nad baňou, Veľatý I–II, Kysta I–II, sites in the Zemplínske Jastrabie cadastre) are known only from surface surveys or disturbed and mixed with the younger prehistoric period, or their dating is still unclear (Arka).

Thus, within a given territory, we are faced with two possibilities. With deteriorating conditions there could have been a break in the settlement, or, on the contrary, the continuity of settlements and refugial character can be assumed in the northeast of the Carpathian Basin.

The analyzed sample comes from the 1968 research season. It includes sectors 84 to 87 with 1485 finds. These are the majority of artefacts from the largest concentration of chipped stone industry within the area of the site. The aim is to highlight preliminary results on the characteristics of the industry, which have not yet been published, or only partially so.

The artefacts can be categorized as follows: cores make up only 6%, blades 27%, flakes together with debris 67% and others 3%. The last includes coarse industry, lumps or other pieces of raw material and ochre. Local sources of obsidian from the area around the Zemplín Hills were primarily used. However, other raw materials such as limnosilicite, radiolarite, jasper, opal, chert and felsitic porphyry were available from the surrounding area of eastern Slovakia and adjacent Hungary. Flint, especially Volhynian flint from the Dniester basin (250–300 km), is a raw material from distant areas.

The production aims were primarily blades or bladelets, but there is an increased number of elongated flakes as well as retouched flakes at the site. In terms of reduction of the analysed cores, groups are blade cores with one striking platform and one reduction phase; cores with changed orientation (reduction within one side of the core; reduction on multiple sides); bipolar reduced cores; bladelet cores (from an originally larger blade core; selection of a small lump; modification from thicker flake); flake cores (with a formed striking platform, rotating the core without forming the platform).

The tool assemblage from the Kašov I site generally has a relatively low diversity of types. Overall, tools with retouch make up 15% of the assemblage. Blade tools dominate, but not significantly. 125 pieces were identified as blade tools, making 32% of this technological group, and 90 flake tools representing 11% of the flakes. Laterally retouched blades (56 pieces, 27%), burins (43 pieces, 21%), endscrapers (37 pieces, 18%) and retouched flakes (34 pieces, 17%) are the most numerous. Notched pieces (19 pieces, 9%) occur to a lesser extent. Tools with low representation include straight (4 pieces) and obliquely (3 pieces) truncated blades, a combination of endscraper and burin (three pieces), backed bladelets (2 pieces), sidescraper (1 piece), and points (2 pieces).

The industry from the lower layer is usually classified as belonging to the Gravettian culture, or its late phase, but lacks its generally known characteristic features. Typologically, it is not very different from the upper layer. The very low evidence of tool blunting is important. However, a significant difference between the layers is their raw material composition. The lower layer can be seen as a transitional small camp that shows northward contacts in terms of raw materials. The upper layer can be seen as a following occupation of the location, but with a changed mobility strategy and associated use of resources. If a group was moving to a new territory, it probably brought a greater amount of raw material or tools; later, when the strategy changed, an orientation towards local resources or from other territories could be observed. The Last Glacial Maximum was the very reason for many changes, and the adaptation of hunting groups may be reflected at the site of Kašov I.

Fig. 1. Location of the Kašov I site on the map (<https://zbgis.skgeodesy.sk/>).

Fig. 2. The northern part of the Zemplín hills with the Kašov I site (<https://zbgis.skgeodesy.sk/>).

Fig. 3. Kašov I site. Profile of the control block from the 1967 season (after Báñez 1967). Legend: a – humic layer; b – brownish-yellow sediment with findings; c – brownish-yellow sediment, border between upper and lower layer; d – brownish-yellow sediment with findings; e – sandy reddish sediment; f – bedrock; g – hearth.

Fig. 4. Sites of the Middle and Late phase of the Upper Paleolithic mentioned in the text. 1 – Kašov I-LL; 2 – Kašov I-UL; 3 – Hrčel-Nad baňou; 4 – Hrčel-Pivničky; 5 – Veľatý I; 6 – Veľatý II; 7 – Kysta I; 8 – Kysta II; 9 – Zemplínske Jastrabie; 10 – Cejkov I; 11 – Arka; 12 – Hidasneméti; 13 – Bodrogkeresztúr (background map <https://zbgis.skgeodesy.sk/>).

Fig. 5. Chronology of the sites in the northeastern part of the Carpathian basin.

Fig. 6. Kašov I site. Plan of the excavated area with analyzed sectors (archive AÚ SAV, inv. no. 839).

Fig. 7. Kašov I site. Cores from the upper layer of the Kašov I site secondary used as stone hammers. 1 – limnosilicite; 2 – patinated flint. Foto L. Debnárová.

Fig. 8. Kašov I site. Cores from the upper layer of the Kašov I site. 1, 3–6 – obsidian; 2 – limnosilicite. Foto L. Debnárová.

Fig. 9. Kašov I site. Cores from the upper layer of the Kašov I site. Obsidian. Drawing L. Debnárová.

Fig. 10. Kašov I site. Cores from the upper layer of the Kašov I site. 1–4 – obsidian; 5, 6 – radiolarite. Foto L. Debnárová.

Fig. 11. Kašov I site. Tools and unretouched blades from the upper layer of the Kašov I site. 1, 2 – patinated flint; 4–7, 9, 10 – obsidian; 6, 8 – radiolarite. Drawing L. Debnárová.

Fig. 12. Kašov I site. Burins from the upper layer of the Kašov I site. 1, 8 – radiolarite; 2, 7, 9 – patinated limnosilicite; 3, 12 – chert; 5, 6, 10 – patinated flint; 11 – obsidian. Drawing L. Debnárová.

Fig. 13. Kašov I site. Endscrapers from the upper layer of the Kašov I site. 1, 6–9, 11 – obsidian; 2, 3, 5 – radiolarite; 4 – quartz porphyry; 10 – chert. Drawing L. Debnárová.

Tab. 1. Kašov I site. Composition of the analyzed assemblage.

Tab. 2. Kašov I site. Length, width, and thickness of complete blades.

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FINDS OF PREHISTORIC HAMMERS WITH GROOVES AND NOTCHES FROM THE TERRITORY OF SLOVAKIA¹

Contribution to the Beginnings of Mining and Exploitation of Non-ferrous Metals

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Keywords: Slovakia, Eneolithic, Bronze Age, stone hammers with grooves and notches, spectral and petrographic analyses, mining, metallurgy.

The study discusses finds of prehistoric stone hammers with grooves and notches from the territory of Slovakia, which are associated mostly with mining and exploitation of non-ferrous metals. More than 400 exemplars from 17 sites come from the territory of Slovakia. They can be classified into several basic types. Most of the above-mentioned hammers (almost 400 exemplars) come directly from Špania Dolina, Piesky site, in central Slovakia. Another rather rich group comes from its nearby surroundings in the region of Banská Bystrica (Banská Bystrica, Banská Bystrica-Kremnička and Horné Pršany). As for the remaining 13 sites, mostly located in SW Slovakia, away from the areas of non-ferrous metals exploitation, only 14 hammers were obtained from them. To identify the function of hammers in this area, four of them were submitted for X-ray fluorescence spectroscopy. It confirmed presence of traces of copper (Cu) on percussion ends on three exemplars. Obviously, some hammers – also outside the main area of copper ore exploitation in the central Slovak volcanic mountains – were used in metallurgy. With regard to the fact that hammers were primarily designed for striking, it can be assumed that some of them were used as multifunctional tools. The petrographic analysis of the hammers from Špania Dolina-Piesky showed that they were mostly made from silicite, less frequently from andesite, granodiorite, amphibolite and migmatite. The raw materials used for making hammers in other parts of Slovakia were only slightly different. Use of hammers for copper exploitation in Slovakia as early as the Early Eneolithic, the Epi-Lengyel period, was confirmed by the discovery of a hammer with a groove and notch in a Ludanice group settlement feature in Banská Bystrica-Kremnička. Use of hammers in the Early Bronze Age is documented by the hammer in the Nitra culture male burial in Čachtice in the central Váh river basin and the exemplar uncovered in a Hatvan culture settlement feature in Šahy in the lower Ipel' river basin.

INTRODUCTION

Despite the fact that in the territory of Slovakia, we encounter rare finds of stone hammers with grooves and notches associated with prehistoric mining as early as the first half of the 20th c. (Pečenice – beginning of the 20th c., Španie Pole – in 1937, Lontov – in 1938, Šurany-Nitriansky Hrádok – in 1949), the expert public started to pay attention to them in its second half. The discovery of 11 stone hammers found by Geologický prieskum company in 1964 was the impulse. The hammers were uncovered during processing of medieval piles of tailings carried out by Rudné bane company in Špania Dolina-Piesky (Liptáková 1973, 72). This fact considerably contributed to the subsequent archaeological excavation in 1971 and 1972 by A. Točík in Špania Dolina-Piesky and in the saddle between the sites of Piesky and Richtárová. The excavation resulted in discovery and localization of approx. 200 stone hammers in the area. Some hammers were found on the surface of the piles and some were uncovered in regular trenches in the layers of tailings. With regard to this, the excavation did not bring the expected result, i. e. specified chronological classification of the stone hammers. Nevertheless, it was detected from their distribution along a section of approx. 650 m that the assumed prehistoric exploitation in Piesky was concentrated mostly on the northern slope (Točík/Bublová 1985, 83, 84).

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With regard to the fact, that the excavation in Špania Dolina-Piesky did not chronologically fix the hammers with grooves or notches, results of the rescue excavation of the burial ground from the Early Bronze Age in Čachtice in the central Váh river basin seem to be extremely important. The excavation carried out by J. Batora in 1975 uncovered a burial of an adult male (burial 1) from the end of the Nitra culture and the beginning of the Únětice culture. It contained a stone hammer with a groove preserved in fragments. This discovery of the hammer represented not only the first, but also the only – for some decades – stratified find of such artifact in the territory of Slovakia (Batora 1976, 22).

P. Žebrák followed from the above-described activities of A. Točík in Špania Dolina-Piesky in 1985. He carried out a detailed surface survey at the site (Žebrák 1986, 256). The survey was initiated – apart from the recent deep hillwash grooves in loose arkoses caused by summer rain – mainly by new finds of stone hammers from the site of Piesky (Trgiňa 1986, 227, fig. 98: 1a, 1b). The survey repeatedly confirmed the largest concentration of fragments from prehistoric pottery and polished as well as chipped stone industry on the northern slopes of the piles in Piesky (Žebrák 1986, 256).

The results of the excavations and survey in Špania Dolina-Piesky were represented by A. Točík and P. Žebrák in 1989 in their synthetic study published in the then West Germany (Točík/Žebrák 1989, 71–78). Later, P. Žebrák presented them at an international conference on prehistoric metallurgy in southeastern Europe which took place in Donji Milanovac in Serbia in 1990 (Žebrák 1995, 13–19).

More than ten years later, in 2002, V. Furmánek and L. Illášová published a hammer with a groove discovered in 1937 in Stará Bystrica in the region of Kysuce, in northwest Slovakia. In their study, they pointed to an important fact that the hammer was discovered in the territory of the Kysucká Magura Mountains, where occurrence – even local – of copper is not assumed in terms of geology (Furmánek 2005, 16; Furmánek/Illášová 2002, 105–119).

In the same year, K. Marková was dealing with the topic of hammers with grooves in association with finds documenting metallurgic production at the fortified settlement from the Early Bronze Age in Malé Kosihy, Törökdomb site. She was following from the discovery of such hammer in the area of acropolis of the fortified settlement, in the Hatvan culture layer (horizon IIIA; Marková 2002, 205, 207, fig. 1: 5). She also pointed to the different situation in relation to occurrence of hammers with grooves in the Hatvan culture in the territory of Hungary, where – unlike in Slovakia – their finds are still absent (Marková 2002, 208).

After several years, studies dealing with grooved hammers occurred in Slovak archaeological literature again. T. Kolon published a new find of a hammer from Špačince in 2015. The site is located in the northern part of the Trnavská pahorkatina hills, i. e. outside the places of occurrence of copper deposits, similarly to the find of the hammer from Stará Bystrica. In spite of this, the author does not deny that the local prospectors and metallurgists might have travelled to the metalliferous areas of the nearby Little Carpathians (Kolon 2015, 14).

In the same year, the interdisciplinary work group around archaeologist M. Kvietok from Banská Bystrica was dealing with hammers in association with the topic of hammered-out copper in Slovak prehistory (Kvietok et al. 2015, 37–42). Then, in 2017, the team members focused on new, previously unpublished, 124 exemplars from Špania Dolina-Piesky. The new hammers were mostly collected on the surface of the local eroded piles and a few of them were found outside Špania Dolina, in the nearby villages, where they were imported as construction material. It is important that from the above-mentioned number of hammers, the authors were able to obtain basic data on the raw material, weight and dimensions of as many as 111 exemplars (Sitár/Kvietok/Jeleň 2017, 8–29).

An article by M. Solivajs, a member of the Mineralogical Society of Slovakia in Banská Bystrica, was added to the above-mentioned studies in 2021. It deals with about 60 exemplars of stone hammers and their fragments collected by amateurs in the area of Kremenica natural monument in the cadastral area of Horné Pršany, near Banská Bystrica. The hammers do not have grooves or there are only partial grooves, sometimes encircling grooves (Solivajs 2021, 1–3, fig. 1A).

The latest find of a hammer with a groove comes from Banská Bystrica-Kremnička, where it was uncovered in 2021, during the rescue excavation of the Midland Adventure company in the area of Logistický park company. Unlike the above-mentioned hammers from Horné Pršany, this exemplar was found in a settlement feature previously dated to the Piliny culture period on the basis of pottery (Fratričová/Miňo 2022, 1–5). After the following detailed evaluation of the pottery, it was found out that the feature can be dated to the Epi-Lengyel period and associated probably with the Ludanice group bearers.²

² I would like to thank M. Kvietok for the information.

TYPOLOGICAL ANALYSIS OF HAMMERS WITH GROOVES AND NOTCHES FROM THE TERRITORY OF SLOVAKIA

The first typology of stone hammers from the territory of Slovakia was elaborated by A. Točík and H. Bublová on the basis of results of the excavation in Špania Dolina-Piesky in 1985. In terms of typology, they divided the hammers into flat (*Točík/Bublová 1985*, fig. 26: 5, 6; 14: 6) and thick (*Točík/Bublová 1985*, fig. 28: 6; 29: 4; 36: 2). According to their shapes, they are divided into prismatic, cylindrical, conical and hoe-shaped. Prismatic hammers are most frequent (Fig. 1; *Točík/Bublová 1985*, fig. 18: 17; 19: 9, 19; 22: 4; 23: 15; 25: 1, 3; 34: 2), followed by cylindrical (Fig. 2; *Točík/Bublová 1985*, fig. 19: 18; 20: 6; 21: 2), conical (Fig. 3; *Točík/Bublová 1985*, fig. 20: 1; 22: 7; 23: 3, 13; 25: 6) and hoe-shaped (Fig. 4; *Točík/Bublová 1985*, fig. 18: 4; 20: 8; 26: 5). Among the cylindrical exemplars, ovoid hammers were recognized (Fig. 5; *Točík/Bublová 1985*, fig. 23: 4, 6, 12). A large group consists of transitional shapes of hammers which were hard to classify into any of the groups. It is noteworthy that all types of hammers from Špania Dolina-Piesky are more or less battered, which documents their use (*Točík/Bublová 1985*, 85, fig. 23: 4).

After a several decades lasting break, the typology of hammers was dealt with again in 2017 by Sitár/Kvietok/Jeleň (2017, 8–29). They followed from the typology elaborated by A. Točík and H. Bublová (*Točík/Bublová 1985*, 47–135) and they also developed it, using the potential of the many new finds of hammers from Špania Dolina-Piesky. From 107 exemplars, 60 were classified among hoe-shaped hammers, flat from both sides, often only 30 mm thick, with a distinct shallow or partial groove. According to the authors, this frequent type of hammers might have been well used in Špania Dolina-Piesky in the surface part of the copper deposit to exploit the metal from the sandy subsoil (*Sitár/Kvietok/Jeleň 2017*, 21). The authors distinguished other types of hammers – ovoid type (18 exemplars), spherical-globular (17 exemplars), prismatic (7 exemplars) and cylindrical (5 exemplars), which were much less frequently represented (*Sitár/Kvietok/Jeleň 2017*, 24). It must be noted that these four types of hammers do not represent their other new types, different from the types defined by A. Točík and H. Bublová (1985, 85), as the authors used modern terminology instead of their original names.

80% of the 107 stone hammers from Špania Dolina-Piesky had visible grooves, which allowed their attachment to hafts and 20% did not have grooves; it is an interesting finding. Among the above-mentioned 80% of hammers, 63 exemplars had distinct grooves, 20 exemplars had shallow grooves and 3 exemplars had incomplete grooves (*Sitár/Kvietok/Jeleň 2017*, 21, 24). Here, it should be mentioned that the typology of hammers with grooves from the area of exploitation of copper ore in Schwaz-Brixlegg in northern Tyrol is based mainly on the location and number of attachment grooves (*Rieser/Schrattenthaler 1998–1999*, 153, fig. 14).

Information on the weight of individual hammers can be considered important, as it was associated with the method and purpose of their use. A. Točík and H. Bublová classified the hammers from Špania Dolina into three categories depending on their weight: heavy – large (2500 g and more), medium (1000–2500 g) and light – small (max. 1000 g; *Točík/Bublová 1985*, 85). A. Sitár, M. Kvietok and S. Jeleň identified with this classification of hammers by weight in their analysis of the 108 exemplars from Špania Dolina and 2 exemplars from Banská Bystrica, Fortnička/Bystrica stream site. It is remarkable that most exemplars, i. e. 50, weighed between 1000 and 2500 g, 44 exemplars weighed less than 1000 g and 17 exemplars were heavier than 2500 g (*Sitár/Kvietok/Jeleň 2017*, tab. 1). If we compare the presented weights of the large number of hammers from Špania Dolina-Piesky with the area of prehistoric copper exploitation in Schwaz-Brixlegg, we find out that they are very similar. Weight of hammers with grooves in Špania Dolina-Piesky varied between 180 and 7300 g; in Schwaz-Brixlegg, it was between 200 and 7000 g (*Rieser/Schrattenthaler 1998–1999*, 152). Naturally, the weight of the hammers was closely connected with the raw material used for their production at a specific site. This fact – apart from the size and character of the surface – had a great influence on the general shape and location of the encircling groove. According to the findings of A. Točík and H. Bublová, the small and medium hammers from Špania Dolina-Piesky had relatively wide and deep grooves, located in the middle and well-balanced, which allowed good attachment to wooden hafts. For this reason, the authors agreed that such hammers were used for crushing the exploited ore and the strong hit was related to the flexibility of the wooden haft (Fig. 6; *Rieser/Schrattenthaler 1998–1999*, fig. 33). According to them, this function is also suggested by the considerably high number of fragments from small hammers (*Točík/Bublová 1985*, fig. 18: 11, 12, 15; 19: 7; 21: 3, 10, 17, 19). Similar information was confirmed by the analysis of the above-mentioned 107 hammers from Špania Dolina-Piesky; 43% of them bear traces of chipped-off parts (*Sitár/Kvietok/Jeleň 2017*, 21).

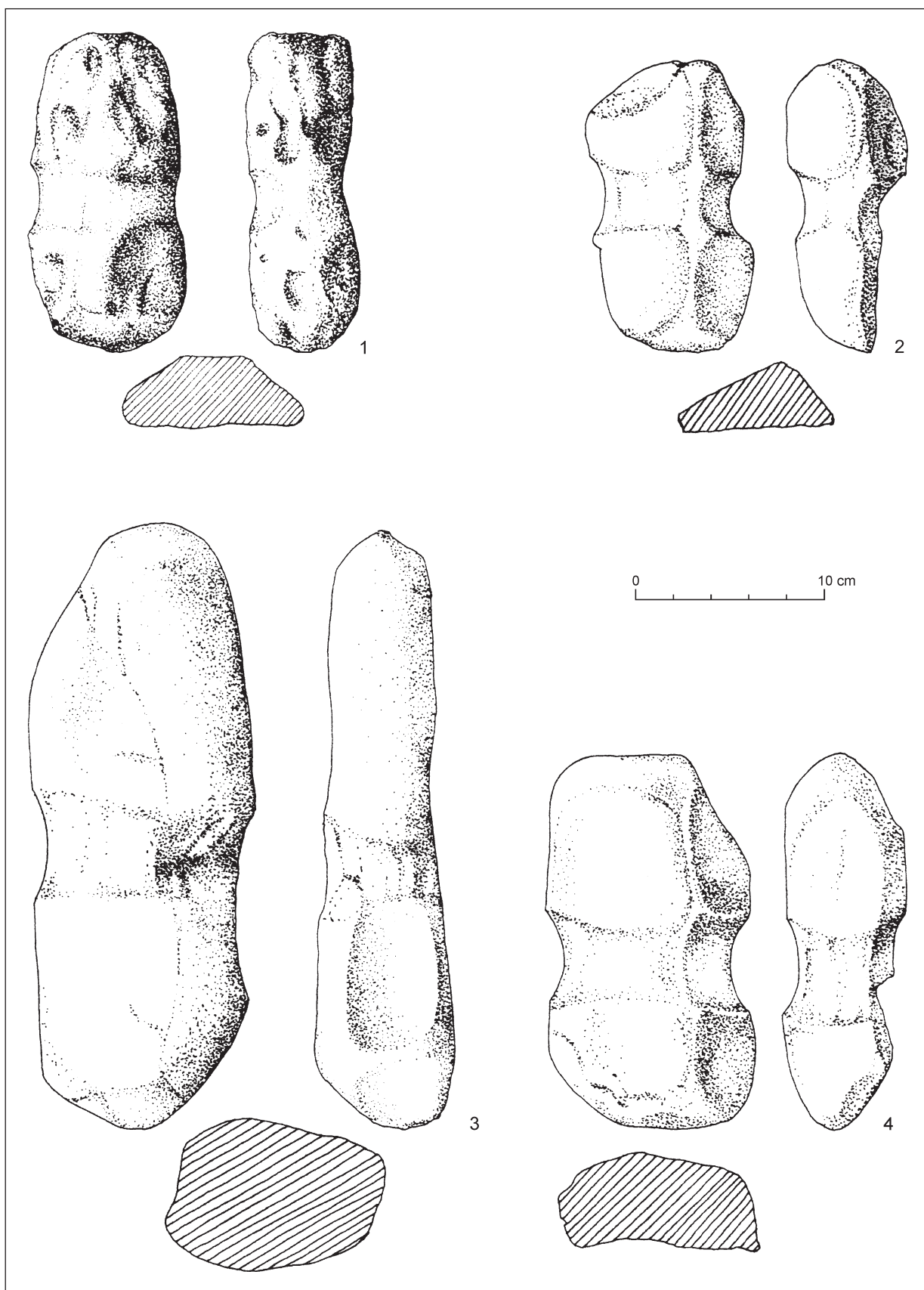


Fig. 1. Špania Dolina-Piesky, Banská Bystrica dist. Prismatic stone hammers with grooves (after *Točík/Bublová* 1985).

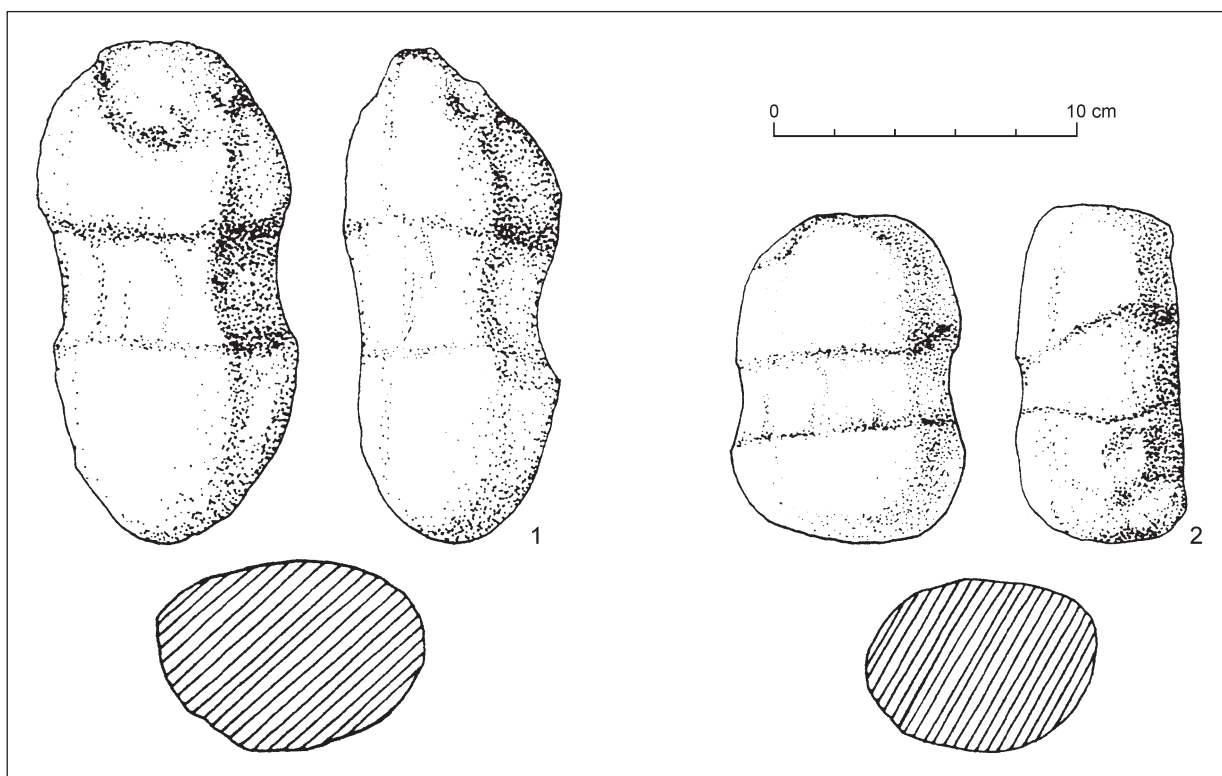


Fig. 2. Špania Dolina-Piesky, Banská Bystrica dist. Cylindrical stone hammers with grooves (after Točík/Bublová 1985).

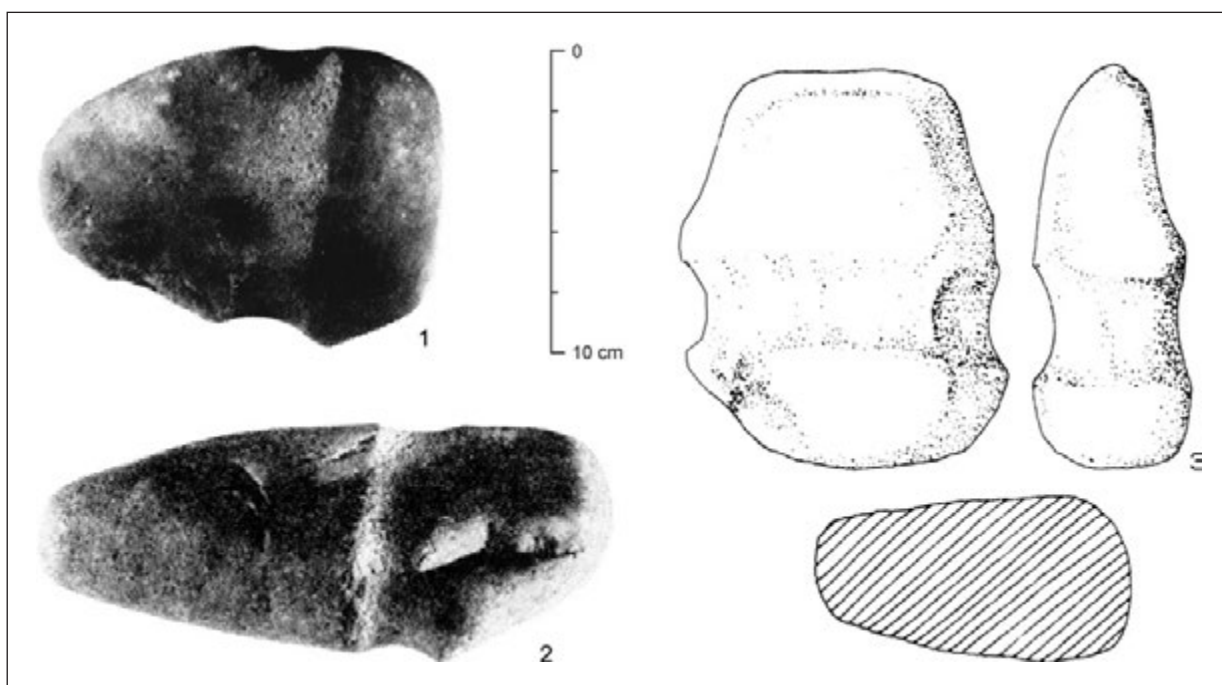


Fig. 3. Špania Dolina-Piesky, Banská Bystrica dist. Conical stone hammers with grooves. 1, 2 – without scale (after Točík/Bublová 1985).

As for the large and heavy hammers from Špania Dolina-Piesky with traces of battering, the encircling grooves are rather shallow and asymmetrical, which suggests that these exemplars were not attached to hafts and the grooves were used for better grip in both hands (*Sitár/Kvietok/Jeleň* 2017, fig. 8; *Točík/Bublová* 1985, fig. 22: 7; 29: 4; 36: 3). Some large and heavy hammers with smooth surface even had exceptionally two encircling grooves (Fig. 5: 3; *Točík/Bublová* 1985, fig. 36: 3).

Exemplars from 16 sites in the territory of Slovakia which were found outside the main area of their occurrence in Špania Dolina also fall to the above-described typology to a great extent. It occurred that most of them are cylindrical hammers (10 exemplars) in two variants – short (Fig. 7) and elongated (Fig. 8), followed by ovoid/spherical-globular (3 exemplars, Fig. 9) and prismatic (3 exemplars, Fig. 10). It is noteworthy that massive heavy hammers only occurred in central Slovakia, in Horné Pršany (Fig. 10: 2) located at the SW periphery of Banská Bystrica and in Španie Pole (Fig. 7: 5) situated on the southern foothills of Slovenské rudohorie hills, i. e. in areas with deposits of oxidation copper ores in the immediate vicinity. Thus, we can assume that they were used for exploitation or hammering of copper ore. In Horné Pršany, the hammers were

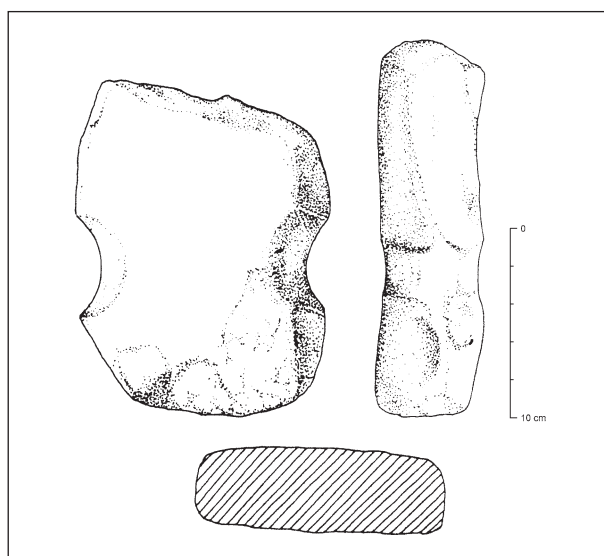


Fig. 4. Špania Dolina-Piesky, Banská Bystrica dist. Hoe-shaped stone hammer with notches (after *Točík/Bublová* 1985).

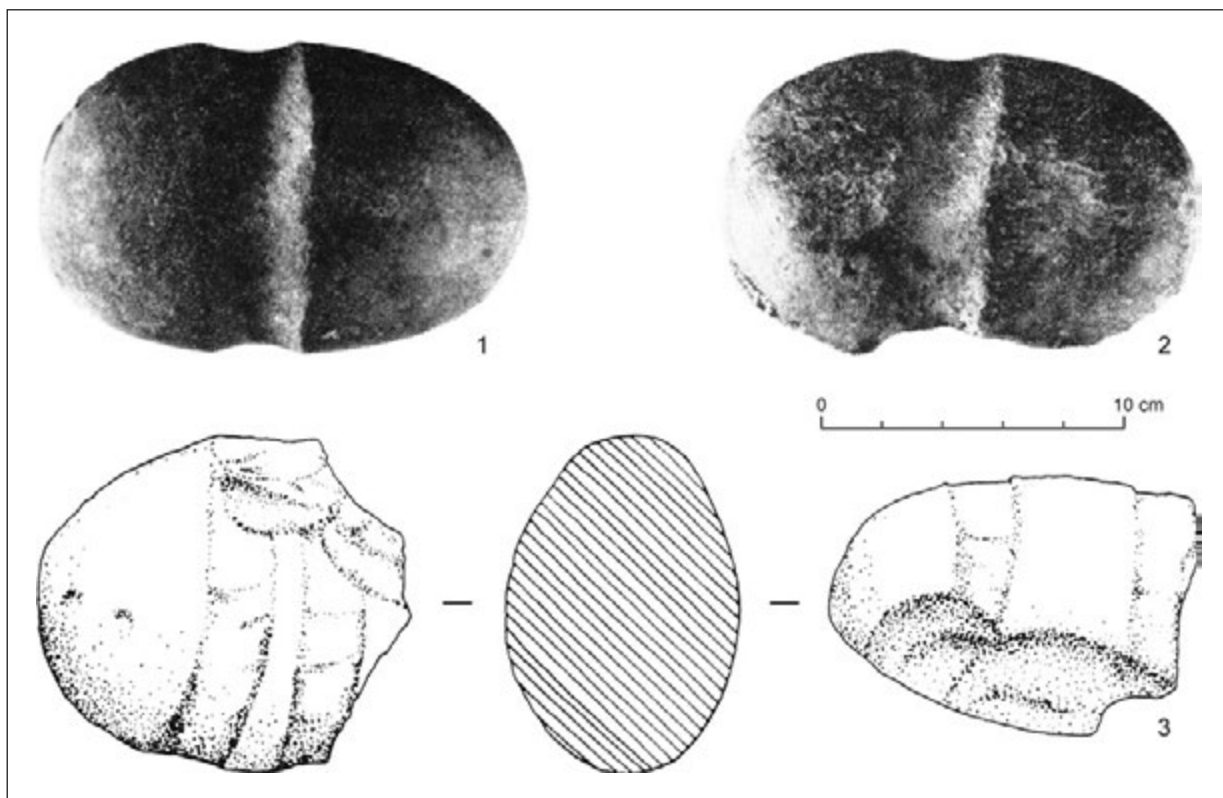


Fig. 5. Špania Dolina-Piesky, Banská Bystrica dist. Ovoid/spherical-globular stone hammers with grooves (after *Točík/Bublová* 1985). 1, 2 – without scale.

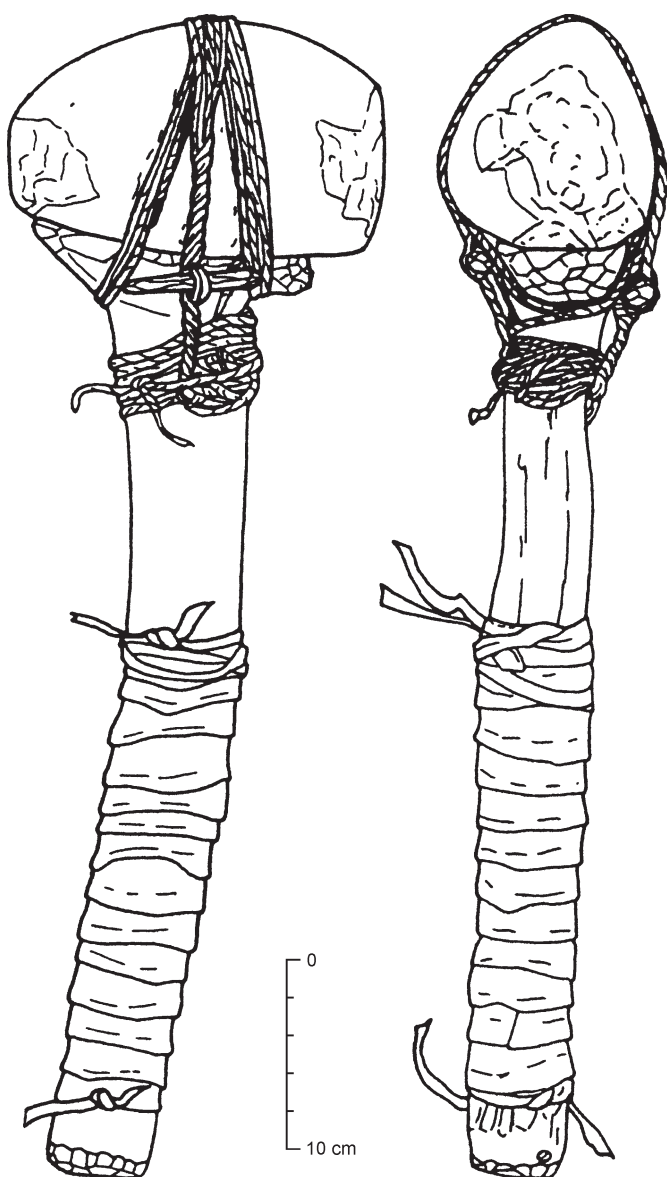


Fig. 6. Reconstruction of attachment of a stone hammer with a groove to a wooden shaft. Fixation of the hammer by a hemp cord and a shaft wrapped in a leather strap (after Rieser/Schratenthaler 1998–1999).

weighing 1556 g, represents hammers of medium weight (Kolón 2015, 13). Only the exemplar from Španie Pole in the south of central Slovakia, which weighs 3024 g, can be associated with heavy massive hammers (Furmánek 2004, 28).

A. Točík and H. Bublová assumed that exploitation at the site of Piesky in the Early Bronze Age was connected with processing of the ore, i. e. crushing and roasting, at the site. They followed from a small number of stone slabs with depressions for ore crushing which were found on terraces 7, 8 and 9 (Točík/Bublová 1985, 85). The depressions on the slabs had various sizes, which suggests that stone hammers of various sizes were used for crushing (Sitár/Kvietok/Jeleň 2017, 22). The increased number of stone slabs recorded meanwhile in the gossan area in Špania Dolina-Piesky together with the considerable increase of the number of hammers suggest that pure copper was hammered at the site, which allowed its easier transportation (Sitár/Kvietok/Jeleň 2017, 23).

obviously used for exploitation of silicite material with regard to the presence of its deposits at the site of Kremenica (Solivajš 2021, 1).

The typological analysis confirmed that hoe-shaped hammers with notches on both sides did not occur in the territory of Slovakia outside the area of Špania Dolina-Piesky. This might confirm the assumption that they were used only for exploitation of copper ore by digging in the sandy subsoil in the upper part of the deposit (gossan) at the site of Piesky (Sitár/Kvietok/Jeleň 2017, 21). In association with hoe-shaped hammers, it can be said that similar artifacts with two opposing notches were discovered at the Late Eneolithic settlement of the Kostolac group in Iža in southern Slovakia, which spreads on the left bank of the Danube river. However, these are interpreted as weights for fishing nets (Němejcová-Pavúková 1968, 361, 380, fig. 21: 9). Finally, we encounter similar interpretation of some grooved hammers in the territory of Sweden (Indreko 1956, 21, fig. 4).

Apart from grooved hammers, two hammers with notches also occurred outside Špania Dolina. There is a miniature exemplar from Šahy (Fig. 11: 1) with an ovoid shape, and a hammer from Vráble, Fidvár site (Fig. 11: 2), with a prismatic shape.

Comparison of weight of hammers from Špania Dolina-Piesky and its nearby surroundings (see this text above) with other exemplars from the territory of Slovakia brought interesting information. With the exception of the only exemplar from Špačince, other finds outside Špania Dolina weigh between 565.0 g and 738.6 g, so they are classified as light exemplars. The hammer from Špačince,

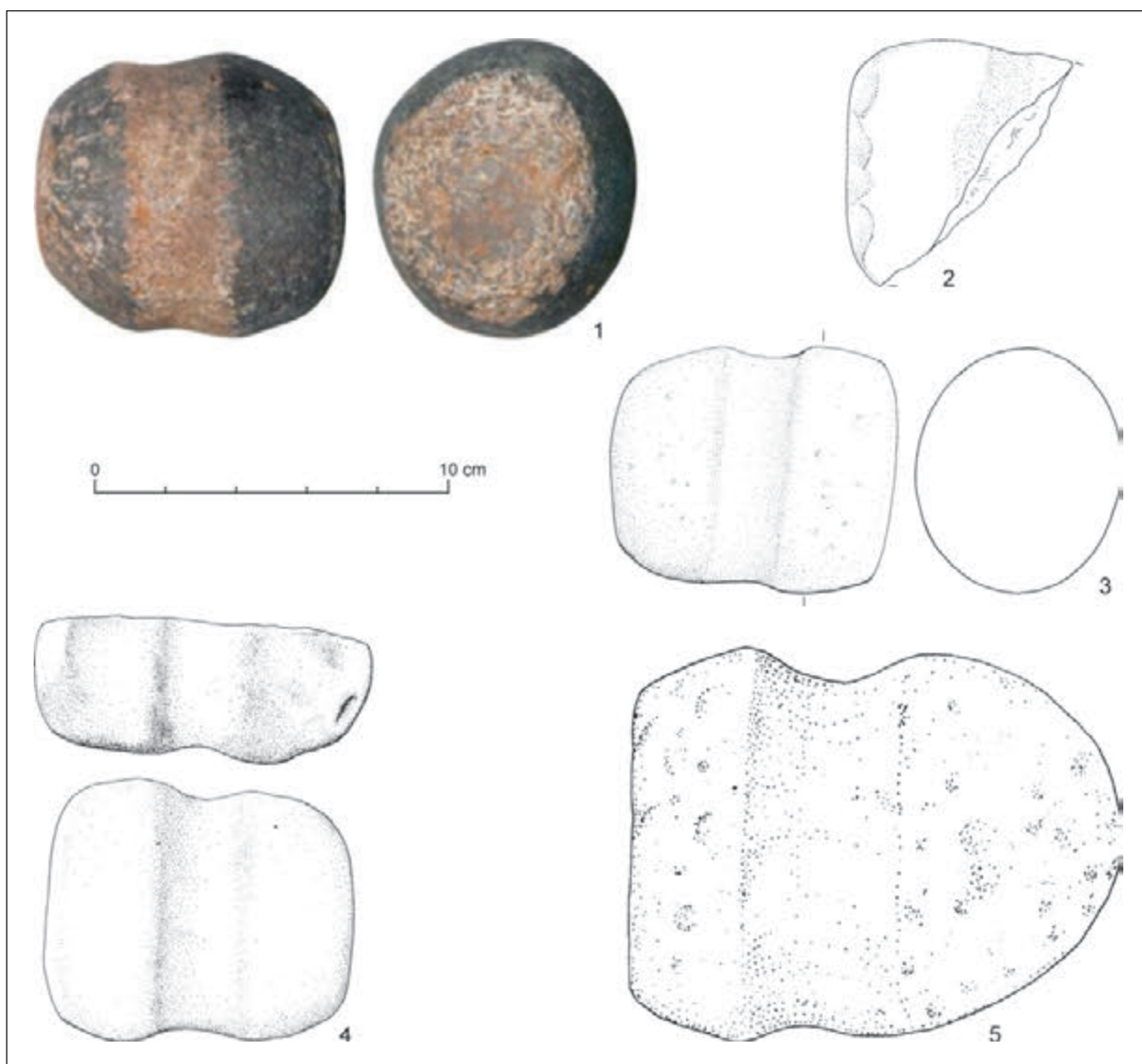


Fig. 7. Short cylindrical hammers. 1 – Banská Bystrica, part Kremnička, Banská Bystrica dist. (after *Fratričová/Mišo* 2022); 2 – Čachtice, Nové Mesto nad Váhom dist. (after *Bátora* 1976); 3 – Brhlovce, Levice dist.; 4 – Pečenice, Levice dist.; 5 – Španie Pole, Rimavská Sobota dist. (after *Furmánek* 2004).

MATERIAL FROM WHICH THE HAMMERS WERE MADE (RESULTS OF PETROGRAPHIC ANALYSES)

The petrographic analysis of the hammers discovered during the excavation in Špania Dolina-Piesky in 1971 and 1972, which was executed by L. Illášová, showed that they were made mostly from quartzite; this raw material was followed by andesite, granodiorite, amphibolite and migmatite. These rocks come from the territory of the Nízke Tatry Mountains and volcanic rocks from the Kremnické pohorie hills (*Illášová* 1986, 106). These results were later confirmed by the petrographic analysis of the 111 hammers obtained by the surface collection in Špania Dolina and its surroundings in 1982–2012 (*Sitár/Kvietok/Jeleň* 2017, 13).

Pebbles modified as hammers used in Špania Dolina came from the nearby surroundings, where they had been imported mostly from the Hron river bed or from the Starohorský potok stream and the Bystrica river (*Točík/Bublová* 1985, 85).

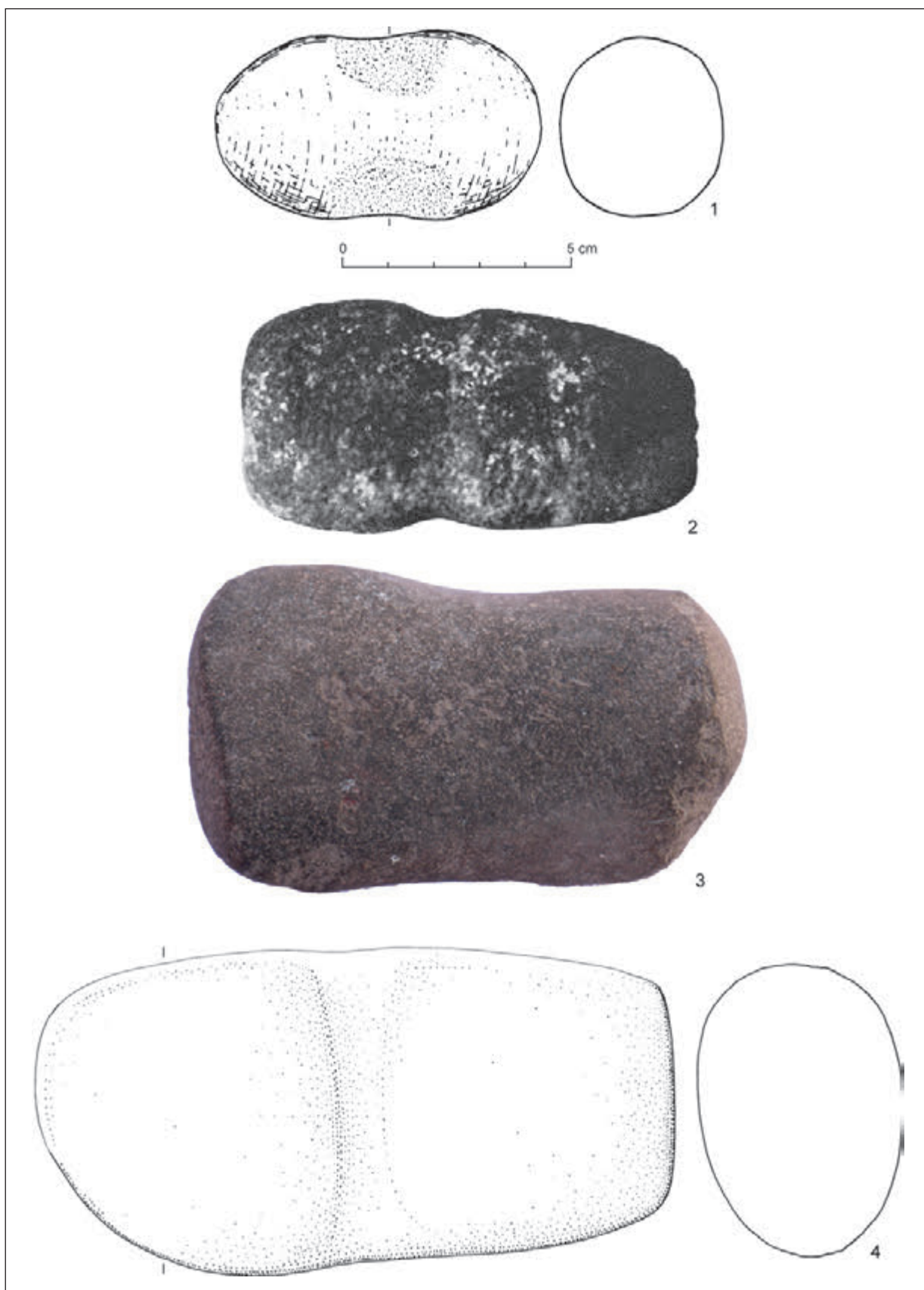


Fig. 8. Elongated cylindrical hammers. 1 – Šurany-Nitriansky Hrádok, Nové Zámky dist. (after *Hovorká/Illášová* 1999); 2 – Lontov, Levice dist. (after *Janšák* 1938); 3 – Pečenice, Levice dist.; 4 – Jur nad Hronom, Levice dist.

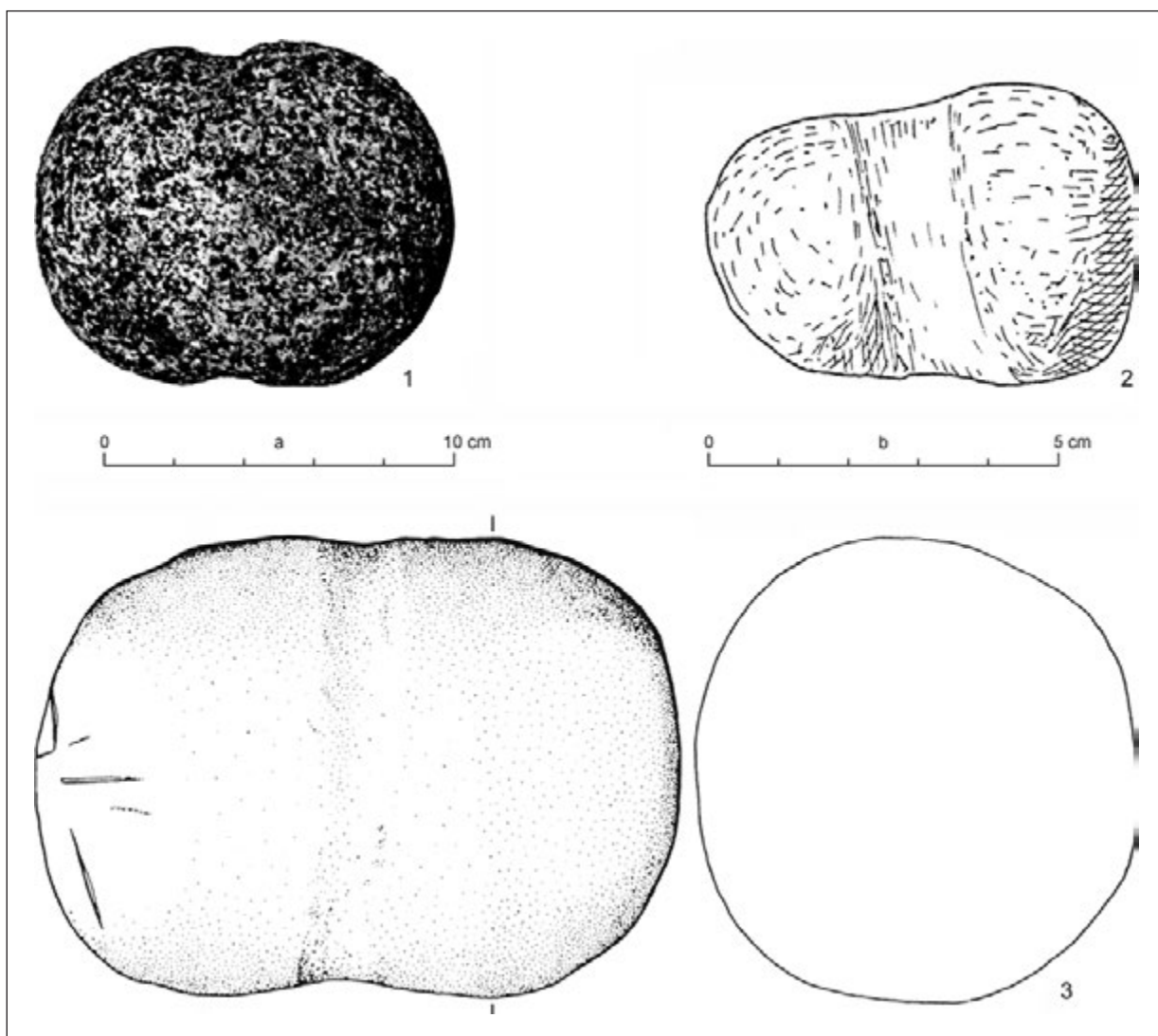


Fig. 9. Ovoid/spherical-globular hammers. 1 – Špačince, Trnava dist. (after Kolon 2015); 2 – Ipeľský Sokolec, Levice dist. (after Paulík 1982); 3 – Stará Bystrica, Čadca dist. (after Furmánek/Illášová 2002). Scale: a – 1; b – 3; without scale – 2.

A slightly different situation in terms of raw materials used for production of hammers was detected with the exemplars from other regions of Slovakia. Silicified sandstone was the considerably predominant raw material (7 exemplars; Banská Bystrica-Kremnička, Brhlovce, Čachtice, Jur nad Hronom, Pečenice – 2 exemplars, Stará Bystrica). It was followed by quartzite (3 exemplars; Horné Pršany – 2 exemplars, Vráble) and andesite (3 exemplars; Banská Bystrica-Fortnička/Bystrica river, Lontov, Malé Kosihy). Diorite (Špačince), limnic quartzite (Banská Bystrica-Fortnička/Bystrica river) and metaquartzite (Šurany-Nitriansky Hrádok) were represented by one exemplar each. The hammer from Špačince was made from diorite, whose deposits are probably located near Bratislava (Kolon 1995, 14).

DISTRIBUTION OF HAMMERS IN THE TERRITORY OF SLOVAKIA

As stated above, the highest number of hammers comes from the territory of central Slovakia, Špania Dolina, Piesky site (Fig. 12: 14). Almost 400 exemplars have been recorded from the site so far – complete or in fragments (Kvietok 2017, 160). Three new sites in the region of Banská Bystrica have been added in the last few years – Banská Bystrica-Fortnička/Bystrica river (Fig. 12: 1), Banská Bystrica-Kremnička (Fig.

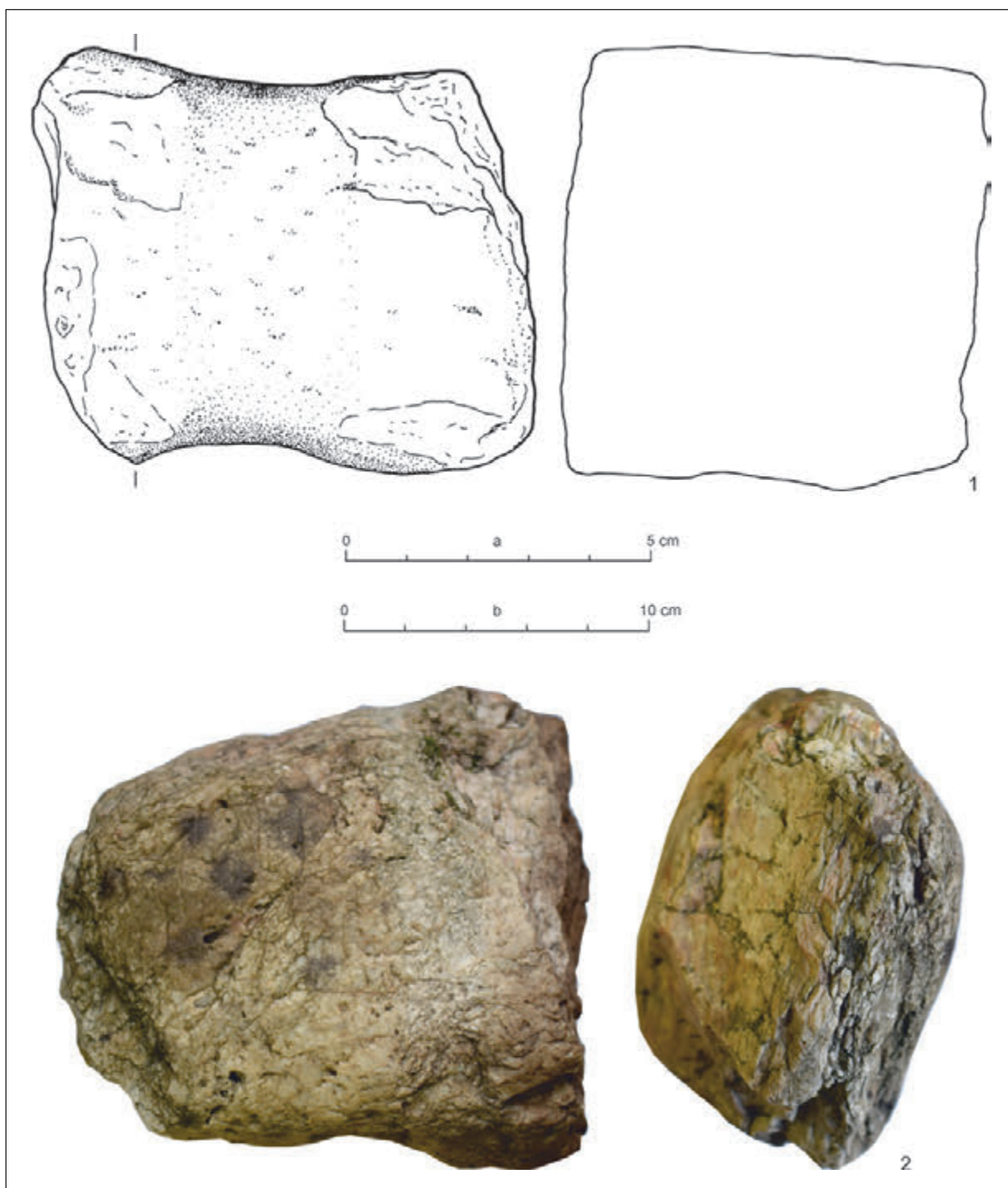


Fig. 10. Prismatic hammers. 1 – Malé Kosihy, Nové Zámky dist.; 2 – Horné Pršany, Banská Bystrica dist. (after Marková 2002; Solivajs 2021). Scale: a – 1; b – 2.

12: 2; Fratričová/Miňo 2022, fig. on p. 1) and Horné Pršany (Fig. 12: 5; Fratričová/Miňo 2022, 4, 5; Solivajs 2021, 1; Ušiak/Hrončiak 2000, 179, 180).

Apart from the region of Banská Bystrica, we find sites with hammers concentrated also in the regions of the lower Hron river basin and the Ipel river basin. It is remarkable that an X-ray fluorescence spectrometry showed presence of copper traces on the percussion ends of the hammers (see below), which suggests their possible use in activities associated with metallurgy. It is actually not very surprising,

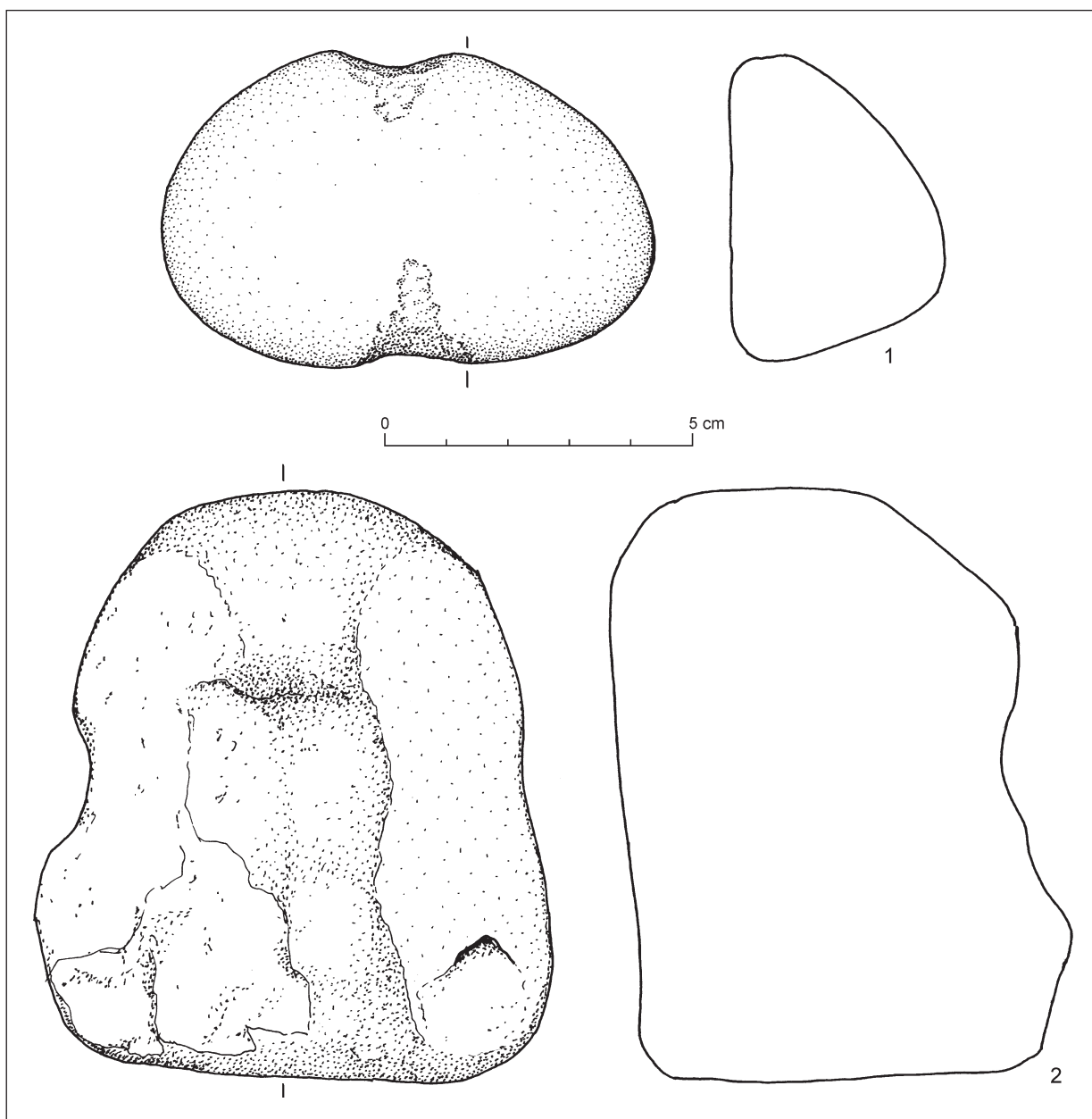


Fig. 11. Hammers with notches. 1 – Šahy, Levice dist. (after Bátor/Neumann/Pálinkás 2023); 2 – Vrable, Nitra dist.

as one part of sites with hammers is located on the foothills of the Štiavnické vrchy hills (Pečenice, Fig. 12: 10; Brhlovce, Fig. 12: 3) or in the forefield of their southern promontories (Jur nad Hronom, Fig. 12: 7) and another part of the sites with hammers is in the immediate northern vicinity of the Börzsöny hills (Ipeľský Sokolec, Fig. 12: 6; Lontov, Fig. 12: 8; Malé Kosihy, Fig. 12: 9; Šahy, Fig. 12: 12), situated in the territory of Hungary. As we know, both mountain ranges are of volcanic origin and are rich in deposits of non-ferrous metals (Schalk 1998, fig. 3).

Other sites with hammers are scattered mainly in southwestern Slovakia in the Dolnonitrianska (Šurany-Nitriansky Hrádok, Fig. 12: 16) and Žitavská niva floodplains (Vrable, Fig. 12: 17) and in the Trnavská (Špačince, Fig. 12: 13) and Podmalokarpatská pahorkatina hills (Čachtice, Fig. 12: 4).

One exemplar of a hammer is known from the Kysucká vrchovina hills in northwestern Slovakia (Stará Bystrica, Fig. 12: 11) and south of central Slovakia, in the southwestern part of the Slovenské rudohorie hills (Španie Pole, Fig. 12: 15) each. It is noteworthy that finds of grooved or notched hammers are still absent in the territory of eastern Slovakia.

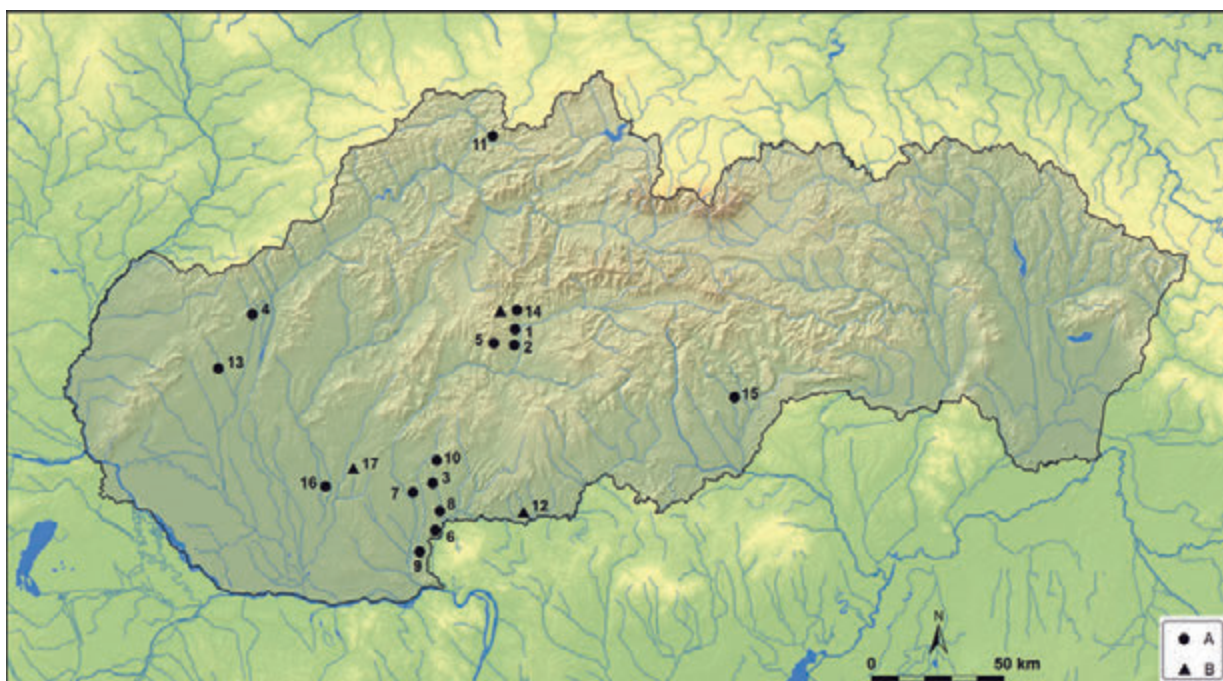


Fig. 12. Map of sites in the territory of Slovakia where prehistoric stone hammers with grooves and notches were discovered. Legend: A – hammers with grooves; B – hammers with notches. 1 – Banská Bystrica, Banská Bystrica dist.; 2 – Banská Bystrica, part Kremnička, Banská Bystrica dist.; 3 – Brhlovce, Levice dist.; 4 – Čachtice, Nové Mesto nad Váhom dist.; 5 – Horné Pršany, Banská Bystrica dist.; 6 – Ipeľský Sokolec, Levice dist.; 7 – Jur nad Hronom, Levice dist.; 8 – Lontov, Levice dist.; 9 – Malé Kosihy, Nové Zámky dist.; 10 – Pečenice, Levice dist.; 11 – Stará Bystrica, Čadca dist.; 12 – Šahy, Levice dist.; 13 – Špačince, Trnava dist.; 14 – Špania Dolina-Piesky, Banská Bystrica dist.; 15 – Španie Pole, Rimavská Sobota dist.; 16 – Šurany, part Nitriansky Hrádok, Nové Zámky dist.; 17 – Vráble, Nitra dist. (map created by M. Bartík based on materials by J. Bátora.)

HAMMERS AND DEPOSITS OF COPPER ORES IN SLOVAKIA

The excavation in Špania Dolina-Piesky has confirmed the connection between hammers and the areas of copper ore deposits (Fig. 13: 4, 5). However, their direct use for exploitation or processing the ore at the site (crushing and roasting) in prehistory has not been definitely confirmed. A lot has been suggested by the collected finds of stone polished industry, stone slabs and pottery of the Epi-Lengyel character (Točík/Bublová 1985, 83–87).

Certain progress in this aspect was brought by the trial excavation of the Early Eneolithic settlement in Slovenské Pravno, Prášnica site, in 1976. A considerably large volume of Epi-Lengyel pottery, which is similar to the pottery in Špania Dolina-Piesky, was found in three settlement features (Šalkovský 1977, 261, fig. 169: 10–15; Točík/Bublová 1985, 86). Moreover, destroyed remains of a roasting furnace with remains of copper slag and copper grains were probably uncovered in feature 1; in feature 4, a large volume of slag and fragments of a lingulate copper artifact were found (Točík/Bublová 1985, 86). The finds from Slovenské Pravno document not only spreading of the bearers of the Lengyel culture final stage to the higher-located mountain areas of central Slovakia, but also documents processing of tetrahedral copper ores exploited in the region of Špania Dolina, which is only 27 km ESE from the settlement in Nitrianske Pravno (Nevizánsky/Šalkovský/Zachar 2017, 44).

In association with the finds in Slovenské Pravno, it was rightly pointed out by A. Točík and H. Bublová that analogous Lengyel pottery was also discovered in the area of studios producing chipped industry in the upper Nitra river basin, e. g. in the cadastral areas of Brusno-Chrenovec, Ráztočno and Handlová, which are – with the exception of stream terraces – located in altitude of 700 m a. s. l., e. g. at the sites of Dlhovina, Pod Bralom, Horenovo, Zábava and Remata (Točík/Bublová 1985, 86). Obviously, exploitation of copper ore and silicite raw materials were associated with and carried out by prospecting groups mainly in the late Lengyel period (Točík/Bublová 1985, 87). The above stated is confirmed by the situation observed in the neighbouring central Hron river basin (see the text below).

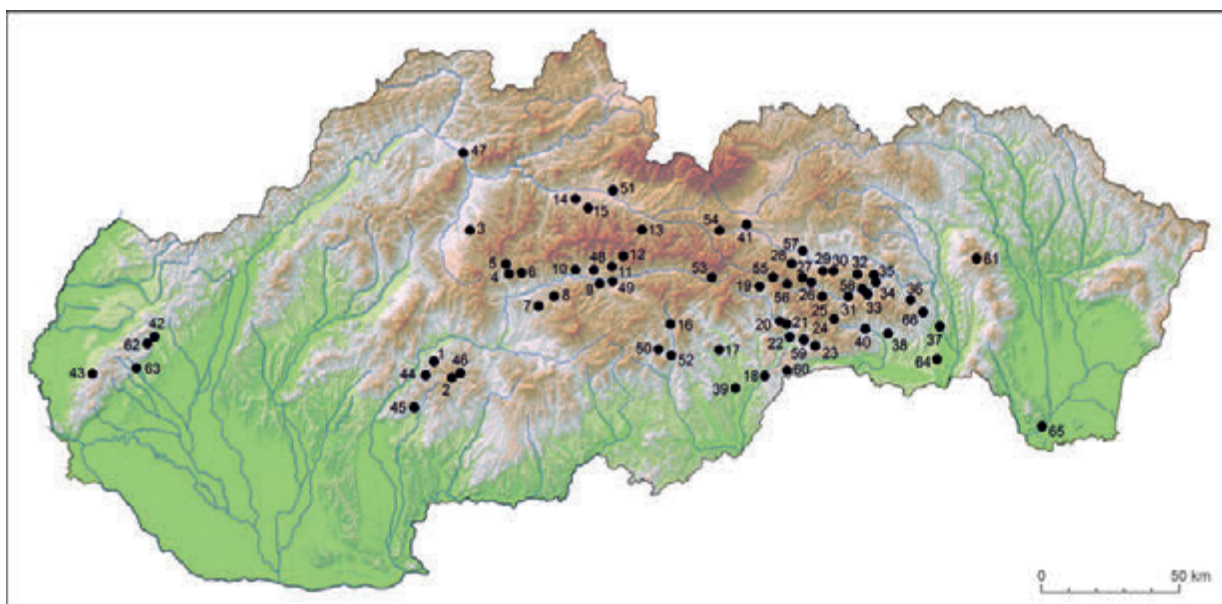


Fig. 13. Map of occurrence of oxide copper ores in Slovakia. 1 – Vyhne, Žiar nad Hronom dist.; 2 – Banská Štiavnica, Banská Štiavnica dist.; 3 – Blatnica, Martin dist.; 4 – Špania Dolina, Banská Bystrica dist.; 5 – Staré Hory, Banská Bystrica dist.; 6 – Baláže, Banská Bystrica dist.; 7 – Poniky, Banská Bystrica dist.; 8 – Ľubietová, Banská Bystrica dist.; 9 – Hronec, Brezno dist.; 10 – Jasenie, Brezno dist.; 11 – Mýto pod Ďumbierom, Brezno dist.; 12 – Jarabá, Brezno dist.; 13 – Malužiná, Liptovský Mikuláš dist.; 14 – Partizánska Ľupča, Liptovský Mikuláš dist.; 15 – Dúbrava, Liptovský Mikuláš dist.; 16 – Tisovec, Rimavská Sobota dist.; 17 – Nandráž, Revúca dist.; 18 – Ardovo, Rožňava dist.; 19 – Dobšiná, Rožňava dist.; 20 – Gemerská Poloma, Rožňava dist.; 21 – Betliar, Rožňava dist.; 22 – Rožňava, Rožňava dist.; 23 – Drnava, Rožňava dist.; 24 – Smolník, Gelnica dist.; 25 – Stará Voda, Gelnica dist.; 26 – Nálepokovo, Spišská Nová Ves dist.; 27 – Hnilčík, Spišská Nová Ves dist.; 28 – Spišská Nová Ves, part Novoveská Huta, Spišská Nová Ves dist.; 29 – Rudňany, Spišská Nová Ves dist.; 30 – Poráč, Spišská Nová Ves dist.; 31 – Mníšek nad Hnilcom, Gelnica dist.; 32 – Slovinky, Spišská Nová Ves dist.; 33 – Prakovce, Gelnica dist.; 34 – Gelnica, Gelnica dist.; 35 – Žakarovce, Gelnica dist.; 36 – Košická Belá, Košice-okolie dist.; 37 – Košice, Košice dist.; 38 – Rudník, Košice-okolie dist.; 39 – Gemerská Ves, part Šankovce, Revúca dist.; 40 – Medzev, Košice-okolie dist.; 41 – Poprad, part Kvetnica, Poprad dist.; 42 – Smolenice, Trnava dist.; 43 – Pernek, Malacky dist.; 44 – Hodruša-Hámre, Žarnovica dist.; 45 – Pukanec, Levice dist.; 46 – Banská Belá, Banská Štiavnica dist.; 47 – Strečno, Žilina dist.; 48 – Horná Lehota, Brezno dist.; 49 – Brezno, Brezno dist.; 50 – Klenovec, Rimavská Sobota dist.; 51 – Liptovský Mikuláš, part Mútnik, Liptovský Mikuláš dist.; 52 – Hnúšťa, Rimavská Sobota dist.; 53 – Šumiac, Brezno dist.; 54 – Vikartovce, Poprad dist.; 55 – Mlynky, Spišská Nová Ves dist.; 56 – Hnilec, Spišská Nová Ves dist.; 57 – Spišská Nová Ves, Spišská Nová Ves dist.; 58 – Helcmanovce, Gelnica dist.; 59 – Krásnohorské Podhradie, Rožňava dist.; 60 – Silica, Rožňava dist.; 61 – Zlatá Baňa, Prešov dist.; 62 – Lošonec, Trnava dist.; 63 – Častá, Pezinok dist.; 64 – Haniska, Košice-okolie dist.; 65 – Ladmovce, Trebišov dist.; 66 – Silica, Rožňava dist.; 67 – Košice-Bankov, Košice dist. (after Bátora 2018, fig. 267; Sedliak 2005, pl. III).

Much closer to Špania Dolina than Slovenské Pravno is located, on the NW periphery of Banská Bystrica, Moskovská ulica street, a feature with a thin cultural layer was uncovered. The layer contained fragments of Epi-Lengyel pottery as well as clusters of copper slag of malachite ore (Kvietok 2017, 165). Even more significant evidence of metallurgic activity was documented in Horná Mičíná, Hájny diel site, where the investigated settlement stretches on the interface of the Zvolenská pahorkatina hills and the Bystrická vrchovina hills, in the altitude around 542 m a. s. l. (Zachar et al. 2023, fig. 1). Excavations uncovered two extremely important features which were dated by ^{14}C method between 3968 and 3708 cal. BC and can be culturally associated with the bearers of the late stage of the Ludanice group (Zachar et al. 2023, fig. 7–9; tab. 2; 3). First feature was shaped like a storage pit sunken in the dolomite bedrock and contained pottery of the Epi-Lengyel character, polished and chipped industry, daub, animal bones and charcoals as well as a fragment of a metallurgic crucible and copper ore (Zachar et al. 2023, fig. 3; 4). The second feature was a furnace consisting of an oval metallurgic pit and a loading pit. The fill of the metallurgical pit consisted of smelted copper ore of approx. 10 kg, a fragment of a metallurgic crucible and charcoals (Zachar et al. 2023, fig. 5; 6). Spectral analysis of the copper ore, slag and smelted copper showed that tetrahedral copper was produced at the site; it is identical with the copper artifacts from the Early Eneolithic in the territory of today's Slovakia. It is

important that copper of this type is known also from the nearby deposits e. g. in Poniky (Fig. 13: 7; Zachar *et al.* 2023, 23).

The presented evidences of settlement by the bearers of the Epi-Lengyel groups in the territory of the Zvolenská kotlina basin can be considered a result of their migration from the south to the north along the Hron river, mainly through the Slovenská brána geomorphological unit in the area of Rybník and Tlmače. The shift of settlement to higher-located mountainous areas of the Hron river basin in the Early Eneolithic had been documented earlier in the territory of Žarnovica. There, on a high right-bank Hron river terrace, near the remote settlement of Zliechovci, southwest of Revište castle ruins, coarse-grained pottery was detected together with chipped tools from limnic silicite (Bárta 1986, 27). The shift of settlement northwards was obviously connected with the interest in the above-mentioned deposits of copper ore in central Slovakia, mainly in the region of Špania Dolina-Piesky (Fig. 13: 4), as well as the sources of silicites in the Žiarska kotlina basin. It can be supposed that mainly the inhabitants of the many Epi-Lengyel settlements were interested in them. The settlements were located in the corridor of the Slovenská brána unit (Tlmače-Hrádze, Kozárovce, Čaradice, Tekovské Nemce, Hronský Beňadik-Psiare) or its forefield (Rybník-village area, Čajkov-Osúchov kameňolom, Čajkov-Baranec-Kruhy, Čajkov-Deberča, Podlužany-Areál JRD, Hronské Kľačany, Nová Dedina-Gondovo, Tlmače-Lipník, Nový Tekov-EMO kanál, Nový Tekov-Marušová; Bátora 2009, fig. 8; 12).

Populations from several tens of the known Epi-Lengyel settlements from the neighbouring upper Žitava river basin most probably participated in exploitation of the above-mentioned raw materials (Bátora 1989, fig. 1). It is suggested by many finds of copper artifacts in the territory of the Slovenská brána unit and its forefield in the lower Hron river basin (Čajkov, Nový Tekov-Šándorhalma, Nová Dedina-Tekovská Nová Ves) and the upper Žitava river basin (Volkovce, Veľké Vozokany, Nevidzany, Tajná, Dolné Obdokovce, Koliňany, Neverice); the finds include massive axehammers of the Székely-Nádudvar, Jászladány and Szendrő types (Bátora 1989, fig. 12; 13; 2002, fig. 2; 3; 2009, fig. 12; 13). The assumption that copper artifacts from the upper Žitava river basin might have been made from the copper ore obtained in central Slovakia is supported by the spectral analysis of the copper axehammer of the Székely-Nádudvar type from Volkovce. The chemical composition of the axehammer showed that it was made of pure copper (Cu) with a minor share of nickel (Ni) and trace amounts of silver (Ag), iron (Fe), tin (Sn) and zinc (Zn; Págo 1989, 14, fig. 1). Such composition is close to the composition of Slovak copper (Págo 1968, 250–253; Schreiner 2007, 173, 174). Besides the spectral analysis, the local production of the axehammer is suggested by the fact that it is a raw cast – semi-finished product, which is documented by the distinct traces of casting on the surface (Bátora 1989, fig. 4; 7: 1; Págo 1989, 14). Local production is also suggested by the untreated surface of another axehammer of the Székely-Nádudvar type from Tajná in the upper Žitava river basin (Bátora 2002, fig. 2).

The fact that metallurgic production took place in the upper Žitava river basin in the Early Eneolithic is documented by the situation observed at the settlement of the Ludanice group of the Lengyel culture in Čierne Kľačany, where fragments of copper ore were discovered in foundation trenches of two houses and in a storage pit. They represented Cu minerals – malachite and azurite (Cheben I./Cheben M. 2015, 27). Moreover, miniature solids of copper in form of little balls or drops were found, confirming copper metallurgy and further processing (Cheben I./Cheben M./Chebenová 2019, 75, 76).

It can be supposed that a certain amount of raw material for the metallurgy in the territory of the lower Hron and upper Žitava river basins might have been provided for the Ludanice group bearers not only by the above-mentioned region of Špania Dolina-Piesky (Fig. 13: 4) but also the nearer situated polymetallic deposits in the Štiavnické vrchy hills with the largest concentration detected around Hodruša-Hámre, Banská Štiavnica, Vyhne, Banská Belá and Sklené Teplice (Fig. 13: 1, 2, 44, 46). It is also possible that the immediately located deposits in the southern periphery of the Štiavnické vrchy hills were used as well, e. g. near Voznica, Rudno nad Hronom, Brehy near Nová Baňa, Uhliská, Pukanec and Žemberovce (Bernard 1981, 353). Here, Pečenice can be mentioned. It is situated in the same region. At the local upland settlement at the site of Vtáčnik, two stone hammers with grooves were found together with Early Eneolithic pottery of the Epi-Lengyel character and fragments from the Late Eneolithic Kosihiy-Čaka-Makó culture (Novotný 1955, 20; pl. VII: 2). Thus, it is very probable that the bearers of both Eneolithic cultures participated in exploitation of the nearby deposits of copper ore as well as in its further processing in this region.

The association with the bearers of the Kosihiy-Čaka-Makó culture is greatly suggested by finds of copper axes with single blades of the Baniabíc and Fajsz types from the upper Žitava river basin (Žitavany-Opatovce; Bátora 2023, fig. 6: 2; 7: 2) and the Baniabíc type from the lower Hron river basin

(Dolný Pial; Batora 2023, fig. 2: 1). Spectral analyses of both axes from Žitavany-Opatovce confirmed that they were made from arsenical copper (Cu content varied between 96, 610% and 99,187%) contained in oxidation ores – malachite and pseudo-malachite. Their deposits in central Slovakia occur in the regions of Ľubietová and Špania Dolina (Schreiner 2007, tab. on p. 238).

Finally, the poly-quantitative evaluation of the content of individual trace elements in the axe from Dolný Pial showed that it was made from copper of eastern provenance, which includes the territory of Slovakia with its deposits (Žebrák 1995, 18, 19). The accordance of its chemical composition with the composition of the Slovak copper ore allows an assumption that the axe from Dolný Pial was made of copper obtained in this territory (Págo 1970, 20, 21).

It is noteworthy that we must consider a new actor – the Yamnaya culture bearers – in association with metallurgy in the territory of the lower Hron river basin in the Late Eneolithic. Their presence in the lower Hron river basin is suggested by several tens of tumuli located mostly in the inundation area on the right bank of the Hron river (Batora et al. 2023, fig. 31). It is also suggested by the spectral analysis of the axehammer from burial 7, uncovered under a tumulus of the Yamnaya culture in Sárrétudvar in the upper Tisza river basin in Hungary. The analysis confirmed that it was made from the copper raw material from the deposits located in the territory of today's Slovakia (Dani/Kulcsár 2021, 337). This find clearly shows that the Yamnaya culture bearers were attracted to the flat terrain of southwestern Slovakia and the Hronská tabuľa table in particular not only by pastures but also by deposits of non-ferrous metals, i. e. copper, gold and silver, which were located in the nearby mountain ranges of central Slovakia (Fig. 13).

The assumption of A. Točík and H. Bublová that the continuity in exploitation of copper ore in Špania Dolina-Piesky associated with further processing of the ore (local crushing and roasting) is more than probable in the Early Bronze Age (Točík/Bublová 1985, 87) was later confirmed by analyses of the stable lead isotopes ratio in the ore and in metal artifacts (Duberow/Pernicka/Krenn-Leeb 2009, 343–345, fig. 10–13).

The discovery of a bronze dagger with a lingulate handle (Peschiera type) on the dominant hill of Glezúr in the immediate vicinity of the assumed exploitation in prehistory documents that this area of copper exploitation was also known in the following period of the Middle and in the beginning of the Late Bronze Age. Based on the method of depositing, i. e. blade stabbed perpendicularly in the earth, the dagger can be culturally associated with the Pily culture bearers and dated to the interface of stags BC2–BD1 (Zachar/Struhár 2017, 53; 65, fig. 3; 4).

FUNCTION OF THE HAMMERS OUTSIDE THE MAIN EXPLOITATION AREAS OF NON-FERROUS METALS

The function of the few hammers with grooves or notches discovered in the territory of Slovakia outside the exploitation areas of non-ferrous metals in central and partly eastern Slovakia remains a question (Fig. 13). With the ambition to answer the question at least partially, four hammers were analysed by X-ray fluorescence spectrometry, which was executed by Niton XL3 XRF Analyzer device (I would like to thank Mgr. V. Mezey from IA SAS in Nitra for the analysis). The analysis on the percussion ends of two hammers with grooves with cylindrical shapes which were made from silicified sandstone confirmed presence of trace amounts of copper (Cu) with the same value of 0.003%. One hammer comes from the territory of the lower Hron river basin (Jur nad Hronom, Fig. 8: 4), another one comes from the lower Ipeľ river basin (Brhlovce, Fig. 7: 3). The analysis of the third exemplar with ovoid shape and notches

Tab. 1. Results of the analysis of stone hammers performed by the X-ray fluorescence spectroscopy method with the Niton XL3 XRF Analyser (author of the analysis V. Mezey from the Archaeological Institute of the SAS in Nitra).

Site	Roch [%]	Fe [%]	Cu [%]	Zn [%]	Pl [%]
Brhlovce	99.59	0.32	0.003	0.007	–
Šahy	93.14	6.00	0.005	0.012	0.003
Jur nad Hronom	98.53	1.43	0.003	0.007	–
Vráble	99.69	0.30	–	0.005	–

from Šahy in the lower Ipel' river basin (Fig. 11: 1) showed trace amounts of copper (Cu) – 0.005% (Tab. 1). These analyses suggest that some hammers – even outside the main area of copper ore exploitation in the volcanic mountain ranges of central Slovakia – might have been used in activities associated with metallurgy. With regard to the fact that the hammer from Jur nad Hronom as well as the one from Brhlovce had a regular flat or slightly concave smoothed surface on one of their ends, it cannot be denied that they were secondarily used as anvils for treatment of metals. The exemplar from Kiel-Wik, Forsteck in the northern German Schleswig-Holstein is an example of such use of a grooved hammer (Freudenberg 2009, fig. 4).

As for the hammers from Šurany-Nitriansky Hrádok (Fig. 8: 1) and Vráble-Fidvár (Fig. 11: 2) found in the areas of fortified settlements from the Early Bronze Age, their possible use in metallurgy – e. g. crushing of the metal ore – is supported by several finds as well as terrain observations. In Šurany-Nitriansky Hrádok, there are many casting moulds, clay nozzles and small solids of bronze material, which were concentrated mainly in the middle of the southern edge of the Maďarovce culture settlement, where metallurgic workshops were obviously located (Bartík 1999, 190, fig. 8). Besides several exemplars of casting moulds and clay nozzles, the site of Vráble-Fidvár provided fragments of roughly shaped pottery crucibles with remains of bronze material, which indicate presence of metallurgic workshops in several parts of the settlement (Bátora/Tóth/Rassmann 2015, 132, fig. 10: 1, 2; Sýkorjaková 2010, pl. II: 28; XV: 6, 7–10; XVI: 1, 2; 2012, pl. XXXIV: 190pk_1–4; XXXV: 108_73). The X-ray fluorescence spectrometry of the percussion ends of the hammer from Vráble-Fidvár – despite the above-mentioned evidence related to metallurgy – did not confirm presence of trace elements of copper. Thus, the local hammer with notches was clearly used for different purposes (see the text below).

Use of the hammer with a groove from Čachtice in association with metallurgy can be hypothetically considered, similarly to the hammers from Šurany-Nitriansky Hrádok and Vráble-Fidvár (Fig. 7: 2; Bátora 2018, fig. 272). Such use is supported by the local deposits of copper ore in the nearby Little Carpathians (Farkaš/Gregor 2013, 63). As for the unique find of the hammer from Špačince (Fig. 9: 1), its use in metallurgy is questionable despite the fact that it was found in the forefield of the Little Carpathians, since distinct traces of use are absent on both its percussion ends (Kolon 2015, 14).

Since hammers with grooves and notches were primarily used for percussion and they are also called mining hammers (Delgado-Raack/Risch 2017, 8), it can be assumed that mainly their exemplars from Slovakia discovered in areas far from deposits of non-ferrous metals were used as multifunctional tools for various activities. These might include so-called rough works e. g. during construction of fortifications, breaking stone, construction or destruction of unused construction features, etc. The settlement of Akrotiri on Thera in the eastern Mediterranean, which was destroyed around 1600 BC due to a volcanic eruption, is a good example; hammers with grooves were used there for demolition of damaged buildings (Michailidou 2013, fig. 4; 140). Finally, such multi-purpose use of stone hammers is assumed in the Únětice culture period in the neighbouring Moravia (Kamarád/Fojtík/Přichystal 2024, 63, 64).

DATING OF HAMMERS WITH GROOVES AND NOTCHES FROM THE TERRITORY OF SLOVAKIA

Although a high number of exemplars of stone hammers with grooves or notches was discovered during the excavation in Špania Dolina-Piesky in 1970–1972, the question of their precise dating and exact cultural classification remained open, despite the finds of fragments of Epi-Lengyel pottery from collections (Točík/Bublová 1985, 86). The assumption of A. Točík and H. Bublová that hammers were used for copper exploitation as early as the Early Eneolithic, the Epi-Lengyel period, has recently been proved right. It happened thanks to the results of the excavation in Banská Bystrica-Kremnička, where a hammer with a groove was found in a settlement feature dated to the Ludanice group period (Fig. 7: 1). This dating is also supported by the results of previous excavations with evidence of metallurgic activity in Slovenské Pravno (Šalkovský 1977, 261, fig. 169: 10–15), Banská Bystrica, Moskovská ulica street (Kvietok 2014, 8, 9), Čierne Kľačany (Cheben I./Cheben M. 2015, 27) and Horná Mičiná (Zachar et al. 2023, fig. 7–9; tab. 2; 3).

Using hammers in the Early Bronze Age has been documented by several stratified finds. Firstly, we can mention the discovery of the grooved hammer fragment from Čachtice in the central Váh river basin again. It was uncovered at the burial ground from the Early Bronze Age in a male burial (burial 1) dated to the end of the Nitra culture (Fig. 7: 2; Bátora 1976, 22; 2018, fig. 272). Another find is a notched hammer

from Šahy, which was uncovered in the area of a fortified settlement (feature 2) of the Hatvan culture (Fig. 11: 1; *Bátora/Neumann/Pálinkás 2023*, 18, 19).

In association with precise chronological classification of the discovered hammers, we can mention the exemplar from Malé Kosihy in the lower Ipel' river basin, which was also found in the area of a Hatvan culture fortified settlement, at the site of Törökdomb (Fig. 10: 1). It was uncovered in the Hatvan culture layer (horizon IIIA) located 180–160 cm deep (*Marková 2002*, 205, 207, fig. 1: 5; *Točík 1981*, 9, 236–245).

The massive hammer with a groove from Španie Pole located in the south of central Slovakia can be roughly dated to the Middle/beginning of the Late Bronze Age (Fig. 7: 5). Such dating is supported by the nearby settlement and burial ground of the Pily culture (*Furmánek 2004*, 27).

CONCLUSION

Stone hammers with grooves and notches belong to remarkable prehistoric artifacts which are associated mainly with mining and exploitation of non-ferrous metals. More than 400 exemplars from 17 sites are known from the territory of Slovakia. They can be classified into several basic types. Most of the above-mentioned hammers (almost 400 exemplars) come directly from Špania Dolina, Piesky site, in central Slovakia and another large group comes from its nearby surroundings in the region of Banská Bystrica (Banská Bystrica, Banská Bystrica-Kremnička and Horné Pršany). 14 exemplars of hammers come from 13 other sites, mostly located in SW Slovakia (Fig. 12), outside the non-ferrous metals mining areas. They include cylindrical hammers of two variants: short (Fig. 7) and elongated (Fig. 8). There are also ovoid/spherical-globular (Fig. 9) and prismatic (Fig. 10) hammers. Massive, heavy hammers occurred only in central Slovakia, in the areas with deposits of copper ores in the immediate vicinity. Thus, it can be assumed that they were used mainly to exploit or hammer out copper ore.

The petrographic analysis of the hammers discovered in Špania Dolina-Piesky showed that most of them were made from quartzite, some exemplars were made from andesite, granodiorite, amphibolite and migmatite. A partly different situation was detected with the exemplars from other parts of Slovakia, where silicified sandstone was predominant, followed by quartzite and andesite. Rarely, hammers were made from diorite, limnic quartzite and metaquartzite.

In the territory of Slovakia, we find a concentration of hammers not only in the region of Banská Bystrica, but also in the regions of the lower Hron and Ipel' river basins (Fig. 12). Other sites with occurrence of hammers are scattered mainly in the southwest of Slovakia, in the floodplains of the lower Nitra (Šurany-Nitriansky Hrádok, Fig. 12: 16) and Žitava rivers (Vráble, Fig. 12: 17), in the Trnavská pahorkatina hills (Špačince, Fig. 12: 13) and the Podmalokarpatská pahorkatina hills (Čachtice, Fig. 12: 4). Single exemplars of hammers are known from northwestern Slovakia – Kysucká vrchovina hills (Stará Bystrica, Fig. 12: 11) and the south of central Slovakia, from the southeastern part of the Slovenské rudohorie hills (Španie Pole, Fig. 12: 15). It is noteworthy that finds of hammers with grooves or notches are still absent in the territory of eastern Slovakia.

The excavations, mainly in Špania Dolina-Piesky and its nearby surroundings, showed a close connection between the stone hammers and the areas with deposits of copper ores. The fact that the hammers were used for exploitation of silicite raw materials as well was suggested by the survey of the deposit and exploitation site of limnic silicite in Horné Pršany, Kremenia site, near Banská Bystrica, where approx. 60 exemplars were obtained by a surface collection. The assumption that exploitation was also carried out in the Early Eneolithic is suggested by older finds of Epi-Lengyel pottery in the area of studios for production of chipped industry in the neighbouring upper Nitra river basin, e. g. in the cadastral areas of Brusno-Chrenovec, Ráztočno and Handlová.

The shift of the Epi-Lengyel groups bearers from SW Slovakia northwards was obviously associated mainly with their interest in the above-mentioned deposits of copper ore in central Slovakia, mainly the area of Špania Dolina-Piesky (Fig. 13: 4) as well as silicite deposits in the Žiarska kotlina basin and probably also the Zvolenská kotlina basin. It can be assumed that primarily the bearers of the Ludanice group were interested in the above-mentioned deposits. Their settlements were located in the lower Hron river basin as well as the corridor of the Slovenská brána geographical unit (Rybník, Kozárovce, Tlmače, Hronský Beňadik-Psiare) and its southern forefield. The population of the Ludanice

group from the nearby region of the upper Žitava river probably participated in exploitation of the raw materials as well. It is suggested – in addition to the spectral analyses of copper artifacts found at its settlements – by frequently occurring chipped industry from limnic quartzite which comes mostly from the Žiarska kotlina basin.

It is possible that a certain volume of the raw material necessary for metallurgic activity in the lower Hron and upper Žitava river basins was provided to the Ludanice group bearers by the nearer-located polymetallic deposits in the Štiavnické vrchy hills, where the highest concentration of them was detected near Hodruša-Hámre, Banská Štiavnica, Vyhne, Banská Belá and Sklené Teplice (Fig. 13: 1, 2, 44, 46). Finally, the deposits located in the immediate vicinity, in the southern peripheral part of the Štiavnické vrchy hill, e. g. near Voznica, Rudno nad Hronom, Brehy near Nová Baňa, Uhľiská, Pukanec and Žemberovce. In this context, we could mention the upland settlement of Vtáčnik in Pečenice, which is situated right in this territory. Apart from the Early Eneolithic pottery of the Epi-Lengyel character and pottery fragments of the Late Eneolithic culture of Kosihy-Čaka-Makó, two stone hammers with grooves were found in the settlement area. Thus, it is very likely that bearers of both Eneolithic cultures participated in exploitation of the nearby deposits of copper ore and its processing in this region. It is remarkable that in the Late Eneolithic, we must consider a new actor in association with metallurgy in the lower Hron river basin – probably bearers of the Yamnaya culture. Their presence in the lower Hron river basin is suggested by several tens of tumuli which are located mainly in the inundation area on the right bank of the Hron river. Results of the spectral analysis of the copper axehammer uncovered in a burial under a tumulus of the Yamnaya culture in Sárrétudvar, in the upper Tisza river basin in Hungary, pointed to the fact that the bearers of the Yamnaya culture were – apart from potential pastures – attracted to the flat terrain of southwestern Slovakia and the Hronská tabuľa table in particular also by deposits of non-ferrous metals located in the nearby central Slovak mountain ranges (Fig. 13).

Thanks to the X-ray fluorescence spectrometry of four hammers from southwestern Slovakia, the study brings new information on the function of the hammers also outside the main areas of exploitation of non-ferrous metals. In three cases, presence of trace elements of copper (Cu) on the percussion surfaces of the hammers was confirmed (Brhlovce, Jur nad Hronom and Šahy). Obviously, some hammers in the territories of the lower Hron river and the Ipel' river basins were used in activities associated with metallurgy. With regard to the fact that hammers were primarily used for percussing, we can assume that some of them were used as multifunctional tools. They might have been used mostly for rough works, e. g. in construction of fortification, cracking stones, building or destructing unused structures, etc.

The important question of dating and specified cultural classification of the prehistoric hammers with grooves and notches from the territory of Slovakia remained open for a long time, despite the finds of fragments from Epi-Lengyel pottery during the excavation in Špania Dolina-Piesky in 1970–1972. It was the recent excavation in Banská Bystrica-Kremnička revealing a hammer with a groove in a settlement feature dated to the Ludanice group period (Fig. 7: 1) which confirmed the previous assumption that hammers were used for copper exploitation as early as the Early Eneolithic. Such dating is supported by the results of previous excavations in Slovenské Pravno, Banská Bystrica-Moskovská ulica street, Čierne Kľačany and Horná Mičiná, which had brought significant evidence of metallurgic activity at Epi-Lengyel settlements.

In the following period of the Early Bronze Age, use of hammers is documented by several old as well as new stratified finds. First, we can mention the discovered fragment of a hammer with a groove in Čachtice, in the central Váh river basin, which was uncovered at the burial ground of the Early Bronze Age, in a male burial (burial 1) dated to the end of the Nitra culture (Fig. 7: 2). Another hammer with notches from Šahy in the lower Ipel' river basin was uncovered in a feature of the Hatvan culture (feature 2) in the area of a fortified settlement (Fig. 11: 1). Another exemplar of a hammer also discovered in the area of a fortified settlement comes from the lower Ipel' river basin, Malé Kosihy in particular. It was found in the layer of the Hatvan culture (horizon IIIA, Fig. 10: 1).

The massive hammer with a groove from Španie Pole in the south of central Slovakia (Fig. 7: 5) can be roughly dated to the period of the Middle/beginning of the Late Bronze Age. Such dating is supported by the settlement and burial ground of the Piliny culture located near the site of the hammer discovery.

CATALOGUE OF THE SITES WITH HAMMERS WITH GROOVES AND NOTCHES FROM THE TERRITORY OF SLOVAKIA

1. Banská Bystrica, Banská Bystrica dist.

In the urban area of the town, in the borough of Fortnička, a stone hammer with a groove – 1 (inv. no. 281/31) was found in the river of Bystrička in 2005. In 2012, another exemplar of a hammer with a groove – 2 (inv. no. 610/31) was found at the same site.

Description:

1. Axe-shaped hammer with a groove. Dimensions: L 160 mm, thickness 100 mm, groove W 100 mm. Weight: 2790 g. Material: andesite.
2. Square-shaped hammer with a groove, unfinished. Dimensions: L 132 mm, thickness 65 mm, groove W 85 mm. Weight: 1096 g. Material: limnic quartzite.

Deposited at: Naše múzeum medi (Our Museum of Copper), Herrengrund Miners Fraternity, Špania Dolina.

Bibliography: *Sitár/Kvietok/Jeleň 2017*, tab. 1: 11; 18.

2. Banská Bystrica-Kremnička, Banská Bystrica dist.

During the rescue excavation by the Midland Adventure company, a shallow feature – a refuse pit – was uncovered in the area of the Logistické centrum company. Its fill contained fragments of pottery as well as a hammer with a groove. The feature was originally dated to the Piliny culture period. Revision of the pottery material showed that the feature could be dated to the Epi-Lengyel period (I would like to thank Martin Kvietok from the Midland Adventure company in Banská Bystrica for the information).

Description: The hammer has a cylindrical shape, rounding towards both ends with distinct percussion ends. An encircling groove made by gradual percussing is located in its central part. Dimensions: L 87 mm, W 72 mm, H 79 mm, groove W 26 mm. Weight: unknown. Material: silicified sandstone? (Fig. 7: 1).

Deposited at: Spoločnosť Midland Adventure Banská Bystrica company.

Bibliography: *Fratričová/Mišo 2022*, fig. on p. 1.

3. Brhlovce, Levice dist.

The assemblage of finds provided by the Tekovské múzeum in Levice to the Institute of Archaeology SAS in Nitra for processing and documenting included a stone hammer with a groove. The hammer had been brought to the museum by local pupil Slaný, who had found it in a farm building on his grandfather's property in Brhlovce. The exact site of discovery of the hammer has not been identified, in spite of the personal meeting of J. Batora and Mr Slaný – currently living in Levice-Kalinčiakovo – in 2017.

Description: The hammer has a cylindrical shape, slightly narrowing and rounding towards both ends with percussion ends. In its central part, there is a continuous encircling groove created by gradual percussing. Dimensions: L 80 mm, width 57 mm, H 70 mm, groove W 20 mm. Weight: 565.0 g. Material: silicified sandstone (Fig. 7: 3).

Deposited at: Institute of Archaeology SAS in Nitra.

Bibliography: *Habovštiak 1962*, 2

4. Čachtice, Nové Mesto nad Váhom dist.

During the rescue excavation carried out in 1975 by J. Batora from IA SAS in Nitra in the cadastral area of the village, part of a burial ground from the end of the Nitra culture and the beginning of the Únětice culture was investigated at the site of Močiar. In burial 1, where a man was buried, crouched on the right side, a fragment of a hammer with a groove was found in front of his bent right leg.

Description: Fragment of a half of a hammer with cylindrical shape with one preserved percussion end bearing distinct traces of use and with remains of a groove, which was probably located in its middle part. Dimensions: preserved L 62 mm, preserved W 70 mm. Material: silicified sandstone (Fig. 7: 2).

Deposited at: Institute of Archaeology SAS in Nitra.

Bibliography: *Batora 1976*, 22; *2018*, fig. 272.

5. Horné Pršany, Banská Bystrica dist.

During the surface survey at the deposit and exploitation area of limnic silicite, P. Ušiak and R. Hrončiak discovered a fragment of a hammer with an encircling groove (1) in the cadastral area of the village, at the site of Kremená, in 1998. Later, in the beginning of the 21st c., a surface collection carried out by amateurs from the Slovak Mineralogic Association from Banská Bystrica obtained approx. 60 exemplars of stone hammers and their fragments – some of them had no encircling grooves, some of them had partial grooves and some of them had complete encircling grooves (2).

Description:

1. Fragment of a large prismatic hammer with a preserved encircling groove in the middle part (?) has an almost diamond-shaped cross-section. The front part of the hammer fragment is gradually narrowing. Dimensions: preserved L 162 mm, W 98 mm, H 155 mm. Weight: unknown. Material: quartzite (Fig. 10: 2).

Bibliography: *Fratričová/Mišo 2022*, 4, 5; *Ušiak/Hrončiak 2000*, 179, 180.

2. A massive cylindrical hammer with narrowed and rounded ends, clearly made from a smooth pebble. Approx. in the middle, there is a rather shallow encircling groove. Dimensions and weight: unknown. Material: quartzite?

Deposited at: Stredoslovenské múzeum Banská Bystrica.

Bibliography: *Solivaĵs 2021*, 1, fig. 1: A.

6. Ipeľský Sokolec, Levice dist.

During the trial excavation carried out by J. Paulík in 1981, a part of a fortified Hatvan and Čaka culture settlement was examined at the site of Staré pieskovisko (Staré vinohrady). A hammer with a groove was discovered; its classification into one of the cultures is unclear.

Description: Both percussion ends of the small ovoid hammer with a centrally located groove are rounded. Dimensions, weight and material: unknown (Fig. 9: 2).

Deposited at: Archaeological Museum SNM in Bratislava.

Bibliography: *Paulík 1982*, 218, fig. 121: 6.

7. Jur nad Hronom, Levice dist.

Doctoral student P. Tóth submitted a hammer with a groove obtained from a local inhabitant during a surface collection in the cadastral area of the village to the Institute of Archaeology in 2014.

Description: The hammer has a long cylindrical shape and oval cross-section. One end is rounded, without traces of percussing, the other is narrowed and bears a flat percussion surface of 40 × 30 mm. The 15 mm wide encircling groove is not in the exact middle of the hammer – it is slightly shifted to the wider rounded part. Dimensions: L 145 mm, W 40–50 mm, H 65–70 mm. Material: silicified sandstone. Weight: 738.6 g (Fig. 8: 4).

Deposited at: Institute of Archaeology SAS in Nitra.

Bibliography: unpublished.

8. Lontov, Levice dist.

1.5 km east of Lontov, right of the road from Kubáňovo to Ipeľský Sokolec and the river of Ipeľ, a stone hammer with a groove was discovered at a polycultural prehistoric site in the 1930s. The site can be most probably identified with the site of U Litaša, where a fortified settlement of the Hatvan culture was detected by a geophysical survey in the end of the second decade of the 21st c.

Description: The long cylindrical hammer has an approx. elliptical cross-section. It is slightly narrowing and rounding towards both ends with flat percussion surfaces. The circumferential groove is not located in the middle; it is shifted to the wider part of the tool. Dimensions: L 100 mm, W 35 mm, H 50 mm. Weight: unknown. Material: andesite (Fig. 8: 2).

Deposited at: Ethnographic Museum SNM in Martin.

Bibliography: *Cheben/Chebenová 2019*, 202–204, fig. 2; pl. V; *Janšák 1938*, 77–79, pl. XXIX: 1.

9. Malé Kosihy, Nové Zámky dist.

In the course of the archaeological excavation at the fortified settlement from the Early Bronze Age, which was carried out by A. Točík in 1956 in the cadastral area of the village, at the site of Törökdom, a fragment of a hammer with a groove was discovered in the area of the acropolis of the fortified settlement, in trench I/8, in the Hatvan culture layer (horizon IIIA).

Description: The fragment of an angular hammer with both ends considerably damaged (chipped-off). The cross-section of the hammer is almost square. There is an encircling groove in the middle part of the hammer. Preserved dimensions: L. 86 mm, max. W. 67 mm. Weight: 580 g. Material: fine-grained amphibolic andesite (Fig. 10: 1).

Deposited at: Institute of Archaeology SAS in Nitra.

Bibliography: *Marková 2002*, 205, 207, fig. 1: 5; *Točík 1981*.

10. Pečenice, Levice dist.

In the beginning of the 20th c., Mr Michal Kočíš, inhabitant of Pečenice and colleague of A. Kmeť, discovered two hammers with grooves (1 and 2) in the cadastral area of the village, Vtáčnik site. Together with these hammers, M. Kočíš found sherds from the Epi-Lengyel period and a fragment of a bowl on stem (square-shaped) which can be dated to the Kosihy-Čaka-Makó culture. It is noteworthy that several decades later, at the same site, V. Budinský-Krička obtained a fragment of another bowl on stem with engraved checker decoration on the interior surface filled with white incrustation.

Description:

1. Fragment of about a half of a cylindrical hammer with slightly rounded percussion surfaces on its ends. In the middle part, there is a continuous encircling groove made by gradual percussing (groove W 20–25 mm). Dimensions: L 83 mm, preserved W 35 mm, H 63–70 mm. Weight: unknown. Material: silicified sandstone (Fig. 7: 4).
2. Long cylindrical hammer with oval cross-section and percussion surfaces with distinct traces of workwear on both ends. A wide shallow groove is situated in the middle. Dimensions: L 122 mm, W 63–70 mm. Weight: unknown. Material: Silicified sandstone (Fig. 8: 3).

Deposited at: property of Mr. Beňa, heir of Michal Kočíš, a long-standing co-worker of A. Kmeť, in Pečenice.

Bibliography: *Bátovská 2012*, 2, 18; *Budinský-Krička 1947*, pl. VII, 2; *Novotný 1953*, pl. VII: 2.

11. Stará Bystrica, Čadca dist.

According to the information from a letter from Karol Andel sent to the Institute of Archaeology SAS in Nitra in 1953 (letter deposited with the Department of Documentation of IA SAS under no. 178/53), a stone hammer with a groove was found in the cadastral area of the village, at the site of Blato.

Description: An ovoid/spherical-globular stone hammer has a circular cross-section and rounded percussion surfaces on both ends. The encircling fixation groove is located in its middle part. Dimensions: L 91 mm, W 68 × 65 mm.

Weight: 565.0 g. Material: sandstone strongly saturated with iron oxide (Fig. 9: 3).

Deposited at: Ethnographic Museum SNM in Martin (inventory no. 4302).

Bibliography: *Furmánek/Illášová 2002*, 105, 106, fig. 1, 2.

12. Šahy, Levice dist.

In the course of the excavation by the Institute of Archaeology SAS in Nitra and the Hontianske múzeum a Galéria F. Simonyiho in Šahy in 2017, a hammer with a groove was uncovered in trench G, feature 2. The feature contained typical pottery of the Hatvan culture and a sherd with incised decoration of the Kisapostag culture.

Description: Fragment of a stone hammer with approx. ovoid shape, partly damaged by a split-off in the upper half. Dimensions: L 80 mm, preserved W 35 mm, H 50 mm. Approximately in the middle part of the hammer (perpendicular with its longitudinal axis), a 5 mm deep and 16 mm wide notch is situated; in the lower part, there is a shallow depression – 16 mm long and 2–3 mm deep. The space between the notch in the upper part and the depression in the lower part was not connected by a continuous encircling groove. Weight: 140 g. Material: unknown (Fig. 11: 1).

Deposited at: Hontianske múzeum a Galéria F. Simonyiho in Šahy.

Bibliography: *Bátora/Neumann/Pálinkás 2023*, 18–20.

13. Špačince, Trnava dist.

V. Zachar discovered a stone hammer with a groove north of the village, at the site of Peňažité, in 2014. He submitted it to the Archaeological Museum SNM in Bratislava.

Description: A completely preserved ovoid/spherical-globular stone hammer with a groove. There is a shallow encircling groove approx. in the middle. The hammer is slightly narrowing from the rounded head part. No distinct traces of damage are visible on the surface. Dimensions: L 117 mm, diameter at the groove 93–83 mm, groove W 18 mm, diameter of the front part 95 × 78 mm, head diameter 98 × 91 mm. Weight: 1556.6 g. Material: diorite, probably from the surroundings of Bratislava (Fig. 9: 1).

Deposited at: Archaeological Museum SNM in Bratislava.

Bibliography: *Kolon 2015*, 11–13, fig. 3.

14. Špania Dolina-Piesky, Banská Bystrica dist.

Almost 400 hammers come directly from Špania Dolina. Most of them were discovered in the course of the archaeological excavations by A. Točík in 1971 and 1972 in the saddle between the sites of Piesky and Richtárová. In 2017, 124 exemplars were added to them. In terms of shapes, prismatic, cylindrical, conical, ovoid and hoe-shaped exemplars are most frequently represented. A large group consists of transitional hammer shapes which can hardly be classified into any of the above-mentioned types. In terms of weight, they can be classified into three categories: heavy – large (2500 g and more), medium (1000–2500 g) and light – small (up to 1000 g). The petrographic analysis showed that they were made mostly from quartzite; fewer exemplars were made from andesite, granodiorite, amphibolite and migmatite. These rocks come from the territory of the Low Tatras and from the volcanic rocks of the Kremnické pohorie mountains. Pebbles modified into hammers were brought to Špania Dolina-Piesky from the nearby surroundings, mainly from the Starohorský potok stream, the Bystrica river and the Hron riverbed (Fig. 1–5).

Deposited at: Institute of Archaeology SAS in Nitra; Naše múzeum medi (Our Museum of Copper), Herrengrund Miners Fraternity, Špania Dolina.

Bibliography: *Sitár/Kvietok/Jeleň 2017*, tab. 1: 11; 18; *Točík/Bublová 1985*, 47–135.

15. Španie Pole, Rimavská Sobota dist.

A stone hammer with a groove was found in 1937 in the cadastral area of the village, at the site of Rézbanya (from the Hungarian expression for copper mine).

Description: A short massive cylindrical hammer with an oval cross-section, has one rounded end and one slightly narrowed end with a large flat percussion surface. The encircling fixation groove with W 40 mm is not in the middle of the hammer; it is slightly shifted towards the flat percussion surface. Dimensions: H 156 mm, max. diameter 132 mm. Weight: 3.24 kg. Material: amphibolic-pyroxene andesite (Fig. 7: 5).

Deposited at: Ethnographic Museum SNM in Martin.

Bibliography: *Furmánek 1987*, 48, fig. 12; 2004, 28: kat. no. 11.

16. Šurany-Nitriansky Hrádok, Nové Zámky dist.

A stone hammer of a collection character was discovered by A. Točík during the excavation in the area of the fortified settlement of the Lengyel and Maďarovce cultures in 1949.

Description: An elongated cylindrical hammer with a circular cross-section, one rounded and one slightly pointed end. In the middle, there are indistinct depressions on both sides but they do not make up a continuous encircling groove. Dimensions: H 75 × 42 × 40 mm. Colour: grey. Material: metaquartzite (Fig. 8: 1).

Deposited at: Institute of Archaeology SAS in Nitra.

Bibliography: *Hovorka/Illášová* 1999, fig. 8. 1.

17. Vrábľe, Nitra dist.

During the raster surface survey carried out by experts from the IA SAS in Nitra, RGK DAI Frankfurt am Main, University in Bamberg and the Institute of Geography of Heidelberg University, a hammer with fixation notches was discovered in sector × – O 10.

Description: The hammer has prismatic shape and triangular cross-section. In the middle of each of the three rounded sides of the triangle, there is a fixation notch (depth of notches varied from 4 to 8 mm, their width was between 20 and 30 mm). One part is flat and the second is rounded with distinct traces of percussing. Dimensions: L 95 mm, flat part W 70 × 77 mm, rounded part W 65 × 65 × 65 mm. Weight: 796.5 g. Material: quartzite (Fig. 11: 2).

Deposited at: Institute of Archaeology SAS in Nitra.

Bibliography: *Falkenstein et al.* 2008, 39–50.

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Nálezy pravekých kamenných mlatov so žliabkom a s vrubmi z územia Slovenska

Príspevok k počiatkom baníctva a ťažby farebných kovov

J o z e f B á t o r a

Súhrn

Kamenné mlaty so žliabkom a s vrubmi patria k pozoruhodným artefaktom v praveku, ktoré sú spájané najmä s baníctvom a ťažbou farebných kovov. Z územia Slovenska je známych viac ako 400 exemplárov, ktoré pochádzajú zo 17 nálezísk a možno ich zaradiť do niekoľkých základných typov. Z uvedeného počtu prevažná väčšina mlatov (takmer 400 ks) pochádza priamo zo Španej-Doliny, z polohy Piesky, na strednom Slovensku a ďalšia početnejšia časť z jej blízkeho okolia v bansko-bystrickej oblasti (Banská Bystrica, Banská Bystrica-Kremnička a Horné Pršany). Zo zvyšných 13 nálezísk, ktoré sa prevažne nachádzajú na juhozápadnom Slovensku (obr. 12), mimo ťažobných oblastí farebných kovov, pochádza iba 14 kusov mlatov a sú medzi nimi taktiež zastúpené exempláre cylindrické v dvoch variantoch: krátke (obr. 7) a pozdĺžne (obr. 8), ďalej mlaty ovoidné až sféricko-gulovité (obr. 9) a prizmatické (obr. 10). Masívne, ťažké mlaty sa vyskytli iba na strednom Slovensku, v oblastiach, v ktorých sa v bezprostrednej blízkosti nachádzajú ložiská medených rúd a tak oprávnené možno predpokladať, že slúžili najmä na ťažbu, resp. na vytĺkanie medenej rudy.

Petrografická analýza mlatov nájdených v Španej Doline-Pieskoch ukázala, že boli zhotovené prevažne z kremenca, potom nasledovali exempláre vyrobené z andezitu, granodioritu, amfibolitu a migmatitu. Čiastočne odlišná situácia v tomto smere bola zistená u exemplárov pochádzajúcich z ostatných oblastí Slovenska, kde dominoval silicifikovaný pieskovec, potom nasledoval kremenec a andezit. Iba výnimočne boli mlaty zhotovené z dioritu limnokvarcitu a metakvarcitu.

S koncentráciou výskytu mlatov na území Slovenska sa okrem Banskobystrickej oblasti stretávame aj v regióne dolného Pohronia a Poiplia (obr. 12). Ich ďalšie náleziská sú roztrúsené najmä na juhozápadnom Slovensku v Dolnonitrianskej (Šurany-Nitriansky Hrádok, obr. 12: 16) a Žitavskej nive (Vráble, obr. 12: 17), v Trnavskej (Špačince, obr. 12: 13) a v Podmalokarpatskej pahorkatine (Čachtice, obr. 12: 4). Po jednom exemplári sú mlaty známe zo severozápadného Slovenska z Kysuckej vrchoviny (Stará Bystrica, obr. 12: 11) a z juhu stredného Slovenska, z juhovýchodnej časti Slovenského rudohoria (Španie Pole, obr. 12: 15). Pozoruhodné je, že doteraz absentujú nálezy mlatov so žliabkom, resp. s vrubmi z oblasti východného Slovenska.

Výskumy najmä v Španej doline-Pieskoch a v blízkom okolí preukázali úzku väzbu kamenných mlatov na priestor ložísk medených rúd. To, že mlaty boli využívané aj na exploatáciu silicitových surovín naznačil prieskum ložiska a miesta ťažby limnosilicitu v Horných Pršanoch, v polohe Kremenca, neďaleko Banskej Bystrice, kde sa podarilo pri povrchovom zbere získať približne 60 exemplárov. Na predpoklad, že aj táto exploatácia bola uskutočňovaná v staršom eneolite, poukazovali už dávnejšie nálezy epilengyelskej keramiky v priestore ateliérov na výrobu štiepanej industrie v susednom hornom Ponitří, napr. v katastroch Brusna (časť Chrenovec), Ráztočna a Handlovej.

Aj posun osídlenia nositeľov epilengyelských skupín z juhozápadného Slovenska severným smerom zrejme súvisel najmä so záujmom o uvedené ložiská medenej rudy na strednom Slovensku, predovšetkým v oblasti Španej doliny-Pieskov (obr. 13: 4), ako aj o ložiská silicitov v Žiarskej kotline a pravdepodobne aj vo Zvolenskej kotline. Možno oprávnené predpokladať, že záujem o uvedené ložiská mali v prvom rade nositelia ludanickej skupiny, ktorých sídliská sa v pomerne veľkom počte rozprestierali na dolnom Pohroní v koridore Slovenskej brány (Rybník, Kozárovce, Tlmače, Hronský Beňadik, miestna časť Psiare), ako aj v jej južnom predpolí. Na exploatácii uvedených surovín sa s veľkou pravdepodobnosťou podieľala aj populácia ludanickej skupiny z blízkeho horného Požitavia. Na to poukazujú nielen spektrálne analýzy medených predmetov nájdených na jej sídliskách, ale aj početne zastúpená štiepaná industria z limnokvarcitu, ktorá pochádza najmä zo Žiarskej kotliny.

Nie je vylúčené, že nositeľom ludanickej skupiny mohli určité množstvo suroviny na metalurgickú činnosť v oblasti dolného Pohronia a horného Požitavia poskytovať aj bližšie ležiace polymetalické ložiská v Štiavnických vrchoch, kde ich najväčšia koncentrácia bola zistená v okolí Hodruše-Hámrov, Banskej Štiavnice, Vyhiň, Banskej Belej a Skelných Teplíc (obr. 13: 1, 2, 44, 46). Napokon mohli byť využívané aj bezprostredne ležiace ložiská v južných okrajových častiach Štiavnických vrchov, napr. v okolí Voznice, Rudna nad Hronom, Brehov pri Novej Bani, Uhlísk, Pukanca a Žemberoviec. V tejto súvislosti možno spomenúť výšinné sídlisko Vtáčnik v Pečeniciach, ktoré sa nachádza priamo v tejto oblasti. V areáli sídliska sa okrem staroeneolitického keramického materiálu epilengyelského charakteru a zlomkov keramiky neskoroeneolitickej kultúry Kosiň-Háka-Makó našli aj dva kamenné mlaty so žliabkom. Je preto veľmi pravdepodobné, že nositelia oboch eneolitických kultúr sa podieľali aj v tomto regióne na exploatácii neďalekých ložísk medenej rudy, ako aj na jej následnom spracovaní. Pozoruhodné je, že v období mladého až neskorého eneolitu v súvislosti s metalurgiou v oblasti dolného Pohronia je potrebné počítať aj s novým aktérom, ktorým zrejme boli nositelia jamovej kultúry. Ich prítomnosť na dolnom Pohroní naznačuje niekoľko desiatok mohylových násypov, ktoré sa nachádzajú prevažne v inundačnom území, na pravom brehu rieky Hron. Výsledky spektrálnej analýzy medenej

sekeromlatu, ktorý bol odkrytý, v hrobe pod mohylou jamovej kultúry v Sárrétudvare, v hornom Potísi v Maďarsku poukázali na to, že nositeľov jamovej kultúry popri potenciálnych pastviskách, do rovinatého terénu juhozápadného Slovenska a špeciálne na Hronskú tabuľu, priťahovali aj ložiská farebných kovov nachádzajúce sa v neďalekých stredo-slovenských pohoriach (obr. 13).

Štúdia vďaka röntgen fluorescenčnej spektrometrickej analýze, ktorej boli podrobené štyri mlaty z juhozápadného Slovenska prináša nové poznatky týkajúce sa funkcie mlatov aj mimo hlavných ťažobných oblastí farebných kovov. Tá v troch prípadoch potvrdila prítomnosť stopových prvkov medi (Cu) na úderových plochách mlatov (Brhlovce, Jur nad Hronom a Šahy; tabeľa 1). Evidentne tak časť mlatov, aj v oblasti dolného Pohronia a Poiplia, bola využívaná pri činnostiach spojených s metalúrgiou. Vzhľadom na to, že mlaty boli primárne určené na udieranie možno predpokladať, že niektoré z nich slúžili ako multifunkčné nástroje. Mohli byť využívané najmä pri tzv. hrubých prácach, ako napr. pri stavbe opevnení, lámaní kameňa, budovaní, alebo deštrukcii nefunkčných stavebných objektov a pod.

Dôležitá otázka datovania a bližšieho kultúrneho zaradenia pravekých mlatov so žliabkom a s vrubmi z územia Slovenska zostávala, napriek nálezom zlomkov epilengyelskej keramiky počas výskumu v Španej Doline-Pieskoch, v rokoch 1970–1972, dlhšiu dobu otvorená. Až nedávny výskum v Banskej Bystrici-Kremničke, kde sa našiel mlat so žliabkom v sídliskovom objekte datovanom do obdobia ludanickej skupiny (obr. 7: 1), potvrdil správnosť dávnejšieho predpokladu, že mlaty boli využívané na ťažbu medi už v staršom eneolite. Uvedené datovanie podporujú aj výsledky predchádzajúcich výskumov v Slovenskom Pravne, v Banskej Bystrici na Moskovskej ulici, v Čiernych Kľačanoch a v Hornej Mičinej, ktoré priniesli výrazné doklady metalurgickej činnosti na epilengyelských sídliskách.

V nasledujúcom období staršej doby bronzovej je používanie mlatov doložené viacerými staršími i novšími stratifikovanými nálezmi. Ako prvý možno uviesť nález fragmentu mlatu so žliabkom z Čachtíc, na strednom Považí, ktorý bol odkrytý na pohrebisku zo staršej doby bronzovej, v hrobe muža (hrob 1), datovanom do záveru nitrianskej kultúry (obr. 7: 2). Ďalší mlat s vrubmi zo Šiah na dolnom Poipli bol odkrytý v objekte hatvanskej kultúry (objekt 2) v areáli opevneného sídliska (obr. 11: 1). Z dolného Poiplia, z Malých Kosiň, pochádza aj ďalší exemplár mlatu, ktorý bol nájdený taktiež v priestore opevneného sídliska, vo vrstve hatvanskej kultúry (horizont IIIA, obr. 10: 1).

Iba rámcovo možno do obdobia strednej až počiatku mladšej doby bronzovej datovať masívny mlat so žliabkom zo Španieho Poľa na juhu stredného Slovenska (obr. 7: 5). Za takéto datovanie hovorí aj skutočnosť, že neďaleko nálezmu mlatu sa rozprestiera sídlisko a pohrebisko pilinskej kultúry.

Obr. 1. Špania Dolina-Piesky, okr. Banská Bystrica. Kamenné mlaty so žliabkom hranolovitého/prizmatického tvaru (podľa Točík/Bublová 1985).

Obr. 2. Špania Dolina-Piesky, okr. Banská Bystrica. Kamenné mlaty so žliabkom valcovitého/cylindrického tvaru (podľa Točík/Bublová 1985).

Obr. 3. Špania Dolina-Piesky, okr. Banská Bystrica. Kamenné mlaty so žliabkom kužeľovitého tvaru. 1, 2 – bez mierky (podľa Točík/Bublová 1985).

Obr. 4. Špania Dolina-Piesky, okr. Banská Bystrica. Kamenný mlat s vrubmi motykovitého tvaru (podľa Točík/Bublová 1985).

Obr. 5. Špania Dolina-Piesky, okr. Banská Bystrica. Kamenné mlaty so žliabkom vajcovitého/sféricko-guľovitého tvaru (podľa Točík/Bublová 1985). 1, 2 – bez mierky.

Obr. 6. Rekonštrukcia pripevnenia kamenného mlatu so žliabkom na drevenú rukoväť. Fixácia mlatu konopnou šnúrkou a rukoväť ovinutá koženou páskou (podľa Rieser/Schrattenthaler 1998–1999).

Obr. 7. Krátke mlaty cylindrického tvaru. 1 – Banská Bystrica-Kremnička, okr. Banská Bystrica (podľa Fratričová/Mišo 2022); 2 – Čachtice, okr. Nové Mesto nad Váhom (podľa Bátora 1976); 3 – Brhlovce, okr. Levice; 4 – Pečenice, okr. Levice; 5 – Španie Pole, okr. Rimavská Sobota (podľa Furmánek 2004).

Obr. 8. Pozdĺžne mlaty cylindrického tvaru. 1 – Šurany-Nitriansky Hrádok (podľa Hovorka/Illášová 1999); 2 – Lontov, okr. Levice (podľa Janšák 1938); 3 – Pečenice, okr. Levice; 4 – Jur nad Hronom, okr. Levice.

Obr. 9. Mlaty vajcovitého/sféricko-guľovitého tvaru. 1 – Špačince, okr. Trnava (podľa Kolon 2015); 2 – Ipel'ský Sokolec, okr. Levice (podľa Paulík 1982); 3 – Stará Bystrica, okr. Čadca (podľa Furmánek/Illášová 2002). Mierka: a – 1; b – 3; bez mierky – 2.

Obr. 10. Mlaty hranolovitého/prizmatického tvaru. 1 – Malé Kosiň, okr. Nové Zámky; 2 – Horné Pršany, okr. Banská Bystrica (podľa Marková 2002; Solivajs 2021). Mierka: a – 1; b – 2.

Obr. 11. Mlaty s vrubmi. 1 – Šahy, okr. Levice (podľa Bátora/Neumann/Pálinkás 2023); 2 – Vrable, okr. Nitra.

Obr. 12. Mapa nálezísk pravekých kamenných mlatov so žliabkom a s vrubmi na území Slovenska. Legenda: A – mlaty so žliabkom; B – mlaty s vrubmi. 1 – Banská Bystrica, okr. Banská Bystrica; 2 – Banská Bystrica, časť Kremnička, okr. Banská Bystrica; 3 – Brhlovce, okr. Levice; 4 – Čachtice, okr. Nové Mesto nad Váhom; 5 – Horné Pršany, okr. Banská Bystrica; 6 – Ipel'ský Sokolec, okr. Levice; 7 – Jur nad Hronom, okr. Levice; 8 – Lontov, okr. Levice; 9 – Malé Kosiň, okr. Nové Zámky; 10 – Pečenice, okr. Levice; 11 – Stará Bystrica, okr. Čadca; 12 – Šahy, okr. Levice; 13 – Špačince, okr. Trnava; 14 – Špania Dolina-Piesky, okr. Banská Bystrica; 15 – Španie Pole, okr. Rimavská Sobota; 16 – Šurany, časť Nitriansky Hrádok, okr. Nové Zámky; 17 – Vrable, okr. Nitra (mapu vyhotovil M. Bartík podľa podkladov J. Bátora).

Obr. 13. Mapa výskytu oxidačných rúd medi na Slovensku. 1 – Vyhne, okr. Žiar nad Hronom; 2 – Banská Štiavnica, okr. Banská Štiavnica; 3 – Blatnica, okr. Martin; 4 – Špania Dolina, okr. Banská Bystrica; 5 – Staré Hory, okr. Banská Bystrica; 6 – Baláže, okr. Banská Bystrica; 7 – Poniky, okr. Banská Bystrica; 8 – Ľubietová, okr. Banská Bystrica; 9 – Hronec, okr. Brezno; 10 – Jasenie, okr. Brezno; 11 – Mýto pod Ďumbierom, okr. Brezno; 12 – Jarabá, okr. Brezno; 13 – Malužiná, okr. Liptovský Mikuláš; 14 – Partizánska Ľupča, okr. Liptovský Mikuláš; 15 – Dúbrava, okr. Liptovský

Mikuláš; 16 – Tisovec, okr. Rimavská Sobota; 17 – Nandráž, okr. Revúca; 18 – Ardovo, okr. Rožňava; 19 – Dobšiná, okr. Rožňava; 20 – Gemerská Poloma, okr. Rožňava; 21 – Betliar, okr. Rožňava; 22 – Rožňava, okr. Rožňava; 23 – Drnava, okr. Rožňava; 24 – Smolník, okr. Gelnica; 25 – Stará Voda, okr. Gelnica; 26 – Nálepko, okr. Spišská Nová Ves; 27 – Hnilčík, okr. Spišská Nová Ves; 28 – Spišská Nová Ves, časť Novoveská Huta, okr. Spišská Nová Ves; 29 – Rudňany, okr. Spišská Nová Ves; 30 – Poráč, okr. Spišská Nová Ves; 31 – Mníšek nad Hnilcom, okr. Gelnica; 32 – Slovinky, okr. Spišská Nová Ves; 33 – Prakovce, okr. Gelnica; 34 – Gelnica, okr. Gelnica; 35 – Žakarovce, okr. Gelnica; 36 – Košická Belá, okr. Košice-okolie; 37 – Košice, okr. Košice; 38 – Rudník, okr. Košice-okolie; 39 – Gemerská Ves, časť Šankovce, okr. Revúca; 40 – Medzev, okr. Košice-okolie; 41 – Poprad, časť Kvetnica, okr. Poprad; 42 – Smolenice, okr. Trnava; 43 – Pernek, okr. Malacky; 44 – Hodruša-Hámre, okr. Žarnovica; 45 – Pukanec, okr. Levice; 46 – Banská Belá, okr. Banská Štiavnica; 47 – Strečno, okr. Žilina; 48 – Horná Lehota, okr. Brezno; 49 – Brezno, okr. Brezno; 50 – Klenovec, okr. Rimavská Sobota; 51 – Litovský Mikuláš, časť Mútnik, okr. Litovský Mikuláš; 52 – Hnúšťa, okr. Rimavská Sobota; 53 – Šumiac, okr. Brezno; 54 – Vikartovce, okr. Poprad; 55 – Mlynky, okr. Spišská Nová Ves; 56 – Hnilec, okr. Spišská Nová Ves; 57 – Spišská Nová Ves, okr. Spišská Nová Ves; 58 – Helcmanovce, okr. Gelnica; 59 – Krásnohorské Podhradie, okr. Rožňava; 60 – Silica, okr. Rožňava; 61 – Zlatá Baňa, okr. Prešov; 62 – Lošonec, okr. Trnava; 63 – Častá, okr. Pezinok; 64 – Haniska, okr. Košice-okolie; 65 – Ladmovce, okr. Trebišov; 66 – Silica, okr. Rožňava; 67 – Košice-Bankov, okr. Košice (podľa *Bátora 2018*, obr. 267; *Sedliak 2005*, pl. III).

Tabela 1. Výsledky analýzy kamenných mlatov uskutočnenou metódou röntgen fluorescenčnej spektroskopie prístrojom Niton XL3 XRF Analyser (autor analýzy V. Mezey z Archeologického ústavu SAV, v. v. i.).

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METAL FINDS AND OTHER SMALL ARTEFACTS FROM THE LATE AND FINAL BRONZE AGE FORTIFIED HILLTOP SETTLEMENT AT THE DESERTED CASTLE IN ZVOLEN, CENTRAL SLOVAKIA¹

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The study evaluates the selected metal and other small findings from the Late and Final Bronze Age fortified hilltop settlement at the Deserted Castle, Upper castle in Zvolen (central Slovakia). This was part of a network of hillforts built at strategically advantageous locations in the Slovenské stredohorie mountains at the end of the Bronze Age. The studied assemblage of the artefacts comes from the 2016–2023 systematic excavation and is supplemented by some significant earlier discovered finds. Its diversity evidences the people's intense presence, movements, and activities at this hillfort during the Urnfield culture period. The evaluation of the finds complements the analysis of the ceramic material. It confirms the habitation phases of the site from the Late Bronze Age (stage HA1) to the beginning of the Hallstatt period (stage HC1), or roughly from the 12th to the 8th century BC.

INTRODUCTION

Situated in the Javorie hills, above the confluence of the Hron River and the Slatina stream in Central Slovakia, the National Cultural Monument Pustý hrad in Zvolen, also known as the Deserted Castle, spans two peaks of the hill bearing the same name. The site's fame stems mostly from the remnants of the great stone castle (Fig. 1) built there in the High Middle Ages by Hungarian rulers of the Árpád dynasty. The Upper castle was constructed on the hilltop plateau (571 m a. s. l.) with an area of 3.5 ha, and the Lower castle (476 m a. s. l.) with an area of 0.7 ha (newest *Beljak et al. 2021*, 137–168).

The Deserted Castle hill is ideally situated with a strong strategic position and an appealing perspective over the Zvolenská kotlina basin and its surrounding areas. Therefore, it should not be surprising that this location has appealed to settlers since prehistoric times. The earliest known habitation dates to the Final Stone Age, when an upland settlement from the final phase of the Baden culture was established, mostly at the location of the Lower castle (*Beljak et al. 2014*, 80–106; *Beljak Pažinová/Niklová/Beljak 2015*).

In the framework of the submitted paper, we will present selected metal finds and other small artefacts (jewellery, weapons, tools) from the Late and Final Bronze Age hillfort at the Zvolen-Deserted Castle, Upper castle site. These artefacts are essential for clarifying cultural-chronological questions about the residents' behaviours on the site since they indicate everyday household activities on the hillfort. Above all, we present the excavation results of the fortified settlement conducted in the Upper castle from 2016 to 2023 (Fig. 2). In addition, we considered important past discoveries in this regard, only some of which have been published so far.

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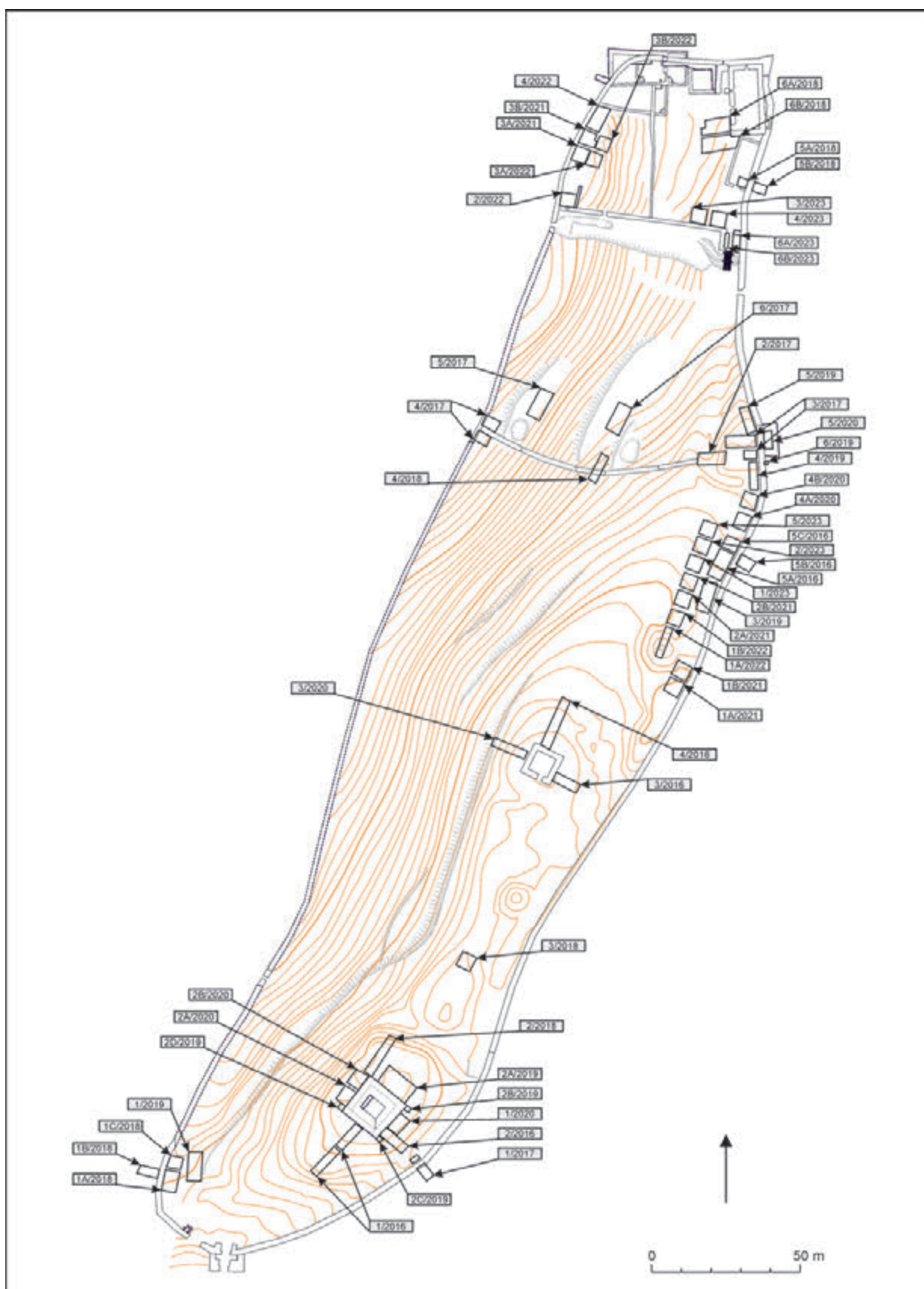
Fig. 1. Zvolen-Deserted Castle, Upper castle. Aerial view of the hilltop from the northeast. Author J. Beljak.

THE FIRST DISCOVERIES AT A PREHISTORIC HILLFORT

It was long assumed in archaeological literature (e.g. Balaša 1946, 95; Furmánek 1983, 31, fig. 2: 16; Labuda 1981, 120) that the Deserted Castle site was an ancient hillfort. First documented in a report by local lawyer and amateur antiquarian J. Thomka (1891, 297), the prehistoric settlement at the site is also mentioned a little later in the notes of polyhistorian A. Kmeť, who reportedly discovered “Lusatian-Silesian sherds” there (Eisner 1933, 158; Medvecký 1924, 200, note. 1). Nonetheless, the site gained recognition among expert archaeologists only in the middle of the 20th c. due to the publication of bronze artefacts from the looted and dispersed hoard found in 1944 when digging military trenches beneath a 12 m high cliff on the western flanks of the castle hill (Balaša 1946, 90–95). Also, in the first post-war monograph on the prehistory of Slovakia, the Deserted Castle site was mentioned again as a hillfort associated with the Lusatian culture (Budinský Krička 1947, map VII). Archaeologists paid greater attention to the site after other metal artefacts from the mentioned hoard discovered at the end of WWII were published in the 1970s and 1980s (Furmánek/Kuka 1973, 603–614; Novotná/Ratimorská 1981, 200, 201). The remaining part of this large treasure was uncovered in 2001 when the discovery location was precisely identified. After completion, it is known to have contained ceramic bowl and at least 244 bronze artefacts (axes, sickles, spiral-armlets, pendants, anvil, patches, wires) typical of Piliny culture metallurgy of the so-called Ožďany deposit horizon (according to Novotná 1970a), which can be synchronised in Zvolenská kotlina basin to the stages² BC2–BD (further details Beljak 2002, 37, 38; Beljak et al. 2014, 19; Zachar 2018, 32, 33, 151–159).

The Lower castle area excavations conducted between 2009 and 2014 brought the first clear indications of Urnfield period occupation at the site (Beljak et al. 2014, 107–125). A stone-earth rampart from the Bronze Age was also documented, and it was discovered beneath the western and southeastern lines of the Lower castle’s mediaeval walls. However, compared to the Upper castle’s findings, this site’s archaeological material is of considerably lesser quality, and its informative value is quite low (Beljak et al. 2014, pl. IX–XIII). On the other hand, the discovery of a solitary cremation grave in the saddle behind the medieval residential tower of the Lower castle was unexpected (Beljak et al. 2014, fig. 68). It was represented by a find of heavily fragmented ceramic barrel-shaped urn, which was

² A Central European chronological system for the Bronze Age Urnfield period (developed by H. Müller-Karpe) is used in this study (Mitáš/Furmánek 2016, 358–374; with further references).



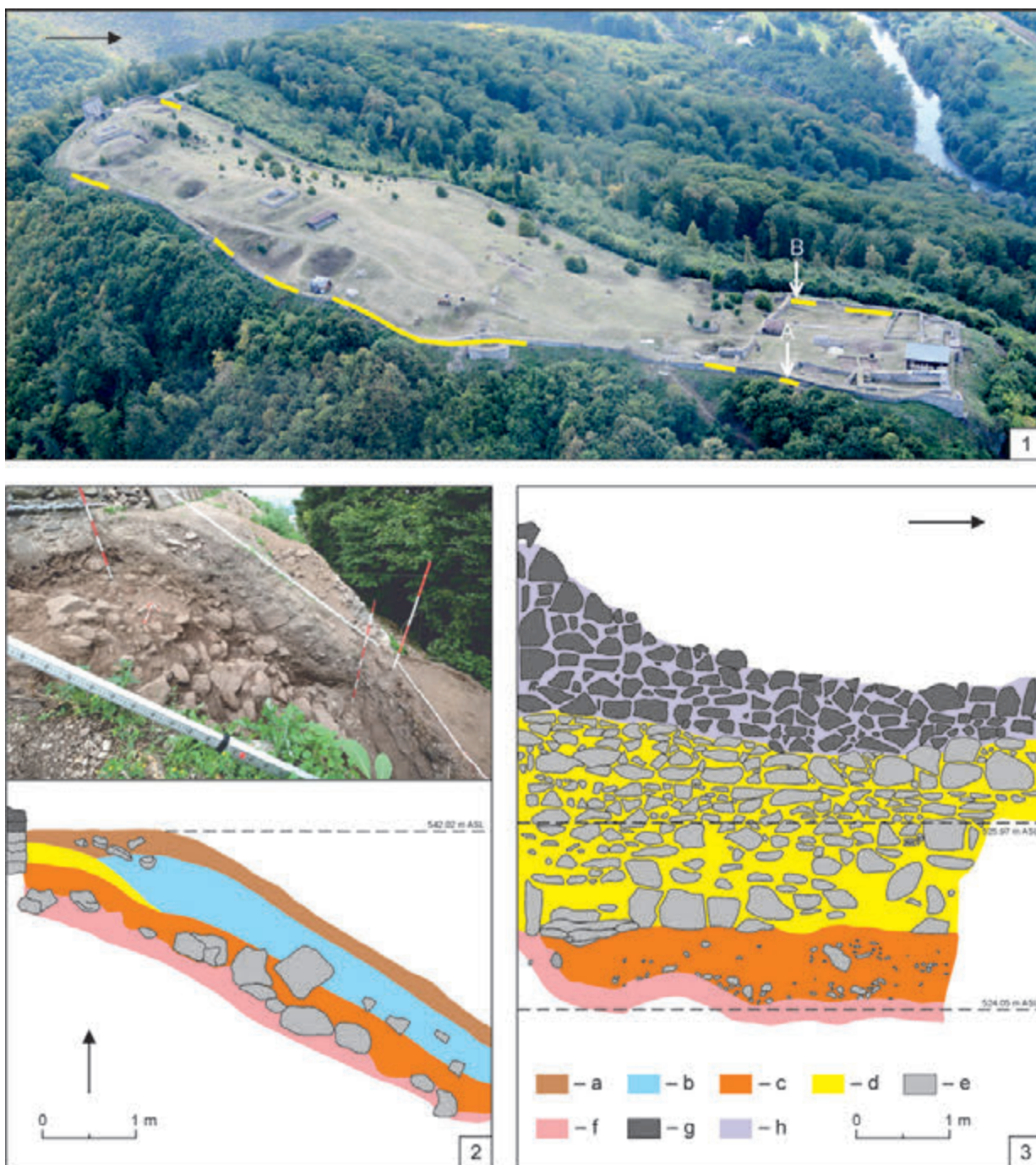


Fig. 3. Zvolen-Deserted Castle, Upper castle. 1 – aerial view of the hilltop with prehistoric rampart remnants documented under the mediaeval wall (marked with yellow line; A – position of trench 5B/2018; B – position of trench 2/2022); 2 – northern profile of trench 5B/2018; 3 – western profile of trench 2/2022. Legend: a – topsoil (forest humus); b – destroyed remains of the medieval defensive wall; c – prehistoric wall (red-dish soil and quarry stones); d – layer of earth and mortar; e – mediaeval defensive wall (original); f – bedrock (andesite); g – non-original stone masonry; h – mediaeval defensive wall (restored). Authors J. Beljak, J. Godiš, N. Beljak Pažinová.

most likely covered with a bowl. Numerous severely charred (temperature of glow 800–1000 °C) and broken (weight 338 g) human bones from an adult were found among the sherds. The burial dates to the late site's habitation phase in the Final Bronze Age (end of stage HB). The grave's placement on this high elevation offers an exceptional mystery. Nonetheless, archaeologist V. Hanuliak, who had previously conducted long-term excavations on the site identified the remnants of a likely another

cremation urn grave at a depth of around 1.4 meters in the so-called Donč's castle at the Upper castle site (information details from the 2000 excavation season catalogue; reported by V. Hanuliak under add. no. 11/2000). His excavation campaign on Upper castle lasted between 1992 and 2008, from which only a few prehistoric finds were published (*Hanuliak 1993, 49; 2002, 62*). Despite the abundance of Bronze Age artefacts from these excavations, they have not been properly processed and presented to the scientific community.

THE CURRENT STATE OF RESEARCH ON THE PREHISTORIC HILLTOP SETTLEMENT

The Upper castle's archaeological excavation has been restored since 2015 (*Beljak et al. 2022; Beljak/Beljak Pažinová 2016; Beljak/Beljak Pažinová/Šimkovic 2018, 56, 57*). Subsequent seasons of excavation yielded a wealth of information on prehistoric habitation of the site (layers and stratigraphic sequences) in various areas of the castle area (*Beljak/Beljak Pažinová/Putško 2022, 85–104; Beljak/Beljak Pažinová/Šimkovic 2018, 11–18*).

In addition to the many tens of thousands of artefacts (ceramic sherds), there is evidence that the Upper castle's mediaeval fortification includes remnants of a prehistoric defensive structure, most likely a stone-earthen rampart (Fig. 3: 1). As early as 1994, the rampart was first documented near the eastern line of the mediaeval wall in the castle's centre (*Malček 1996, 129*). The path of an older stone-earthen rampart under its floor was verified during the 1996–1998 and 2020 excavations of the mediaeval prism-shaped tower on the fortification's eastern line. Numerous Late and Final Bronze Age pottery fragments were found in the rampart backfill.

More poorly preserved traces of the rampart were documented on the hilltop plateau south of the prism-shaped tower in the eastern line of the mediaeval fortification during season 2016. The thickness of the Bronze Age cultural layer was more than 1.2 m. It contained heavy rocks, as remains of a destroyed drystone rampart, mixed with black loam containing pottery finds from the Final Bronze Age. In the rampart vicinity, a contemporary dwelling was identified with remains of an orange-charred earthen floor with an irregular ground plan. A tragedy probably happened there at the end of the Bronze Age, as a toddler skeleton was found impiously lying in the northwestern part of the floor (Fig. 4; *Beljak/Beljak Pažinová/Putško 2022, 95–99; Beljak/Putško/Beljak Pažinová 2021*). It was impossible to determine the cause of death. Its dating to the Final Bronze Age (10th–9th c. BC) has been confirmed by a radiocarbon analysis.

Other parts of the Bronze Age rampart and a dark loam layer on which the mediaeval wall was built were also identified in seasons 2018 and 2021 on the hilltop plateau along or under the eastern line of the mediaeval fortification. The prehistoric cultural layer in this area is rather thick (max. 1.2 m) and reaches down to the andesite bedrock. A reddish layer of loam with traces of strong heat and pottery from the Urnfield culture period was documented almost everywhere in the mass of the rampart, above the bedrock level (*Beljak/Beljak Pažinová 2018, 223*).

During the 2017 season, it was confirmed that the terraces in the bailey of the so-called Donč's castle date back to the Late or Final Bronze Age. There were structures of arranged stones that might have been base walls of log houses. A sunken feature with a regular rectangular ground plan of approx. 1.7 × 3.4 m was also detected there and contained Bronze Age artefacts. The features' function could not be determined.

In season 2018, new segments of the prehistoric stone-earthen rampart with a red-charred clay layer were uncovered in the southern line of the mediaeval fortification of the Upper castle and the so-called Donč's castle near the eastern line of the fortification (Fig. 3: 2).

Season 2020 brought an unexpected discovery at the western wall of the tower at the county castle situated at the highest point of the Upper castle area (570 m a. s. l.). An assemblage of pottery vessels (mostly cups) and clay spindle whorls – probably deposited in a large clay storage vessel from the Late–Final Bronze Age (*Beljak et al. 2022, fig. 45*) – was discovered under the mediaeval mortar floor and stone debris in the lower part of the examined trench.

Season 2022 confirmed the presence of a 0.5 m thick cultural layer from the Bronze Age at the lower terrace of the so-called Donč's castle near the western line of mediaeval fortification. The remains of an older rampart (Fig. 3: 3) were also detected. It was originally built on the hill's andesite bedrock.

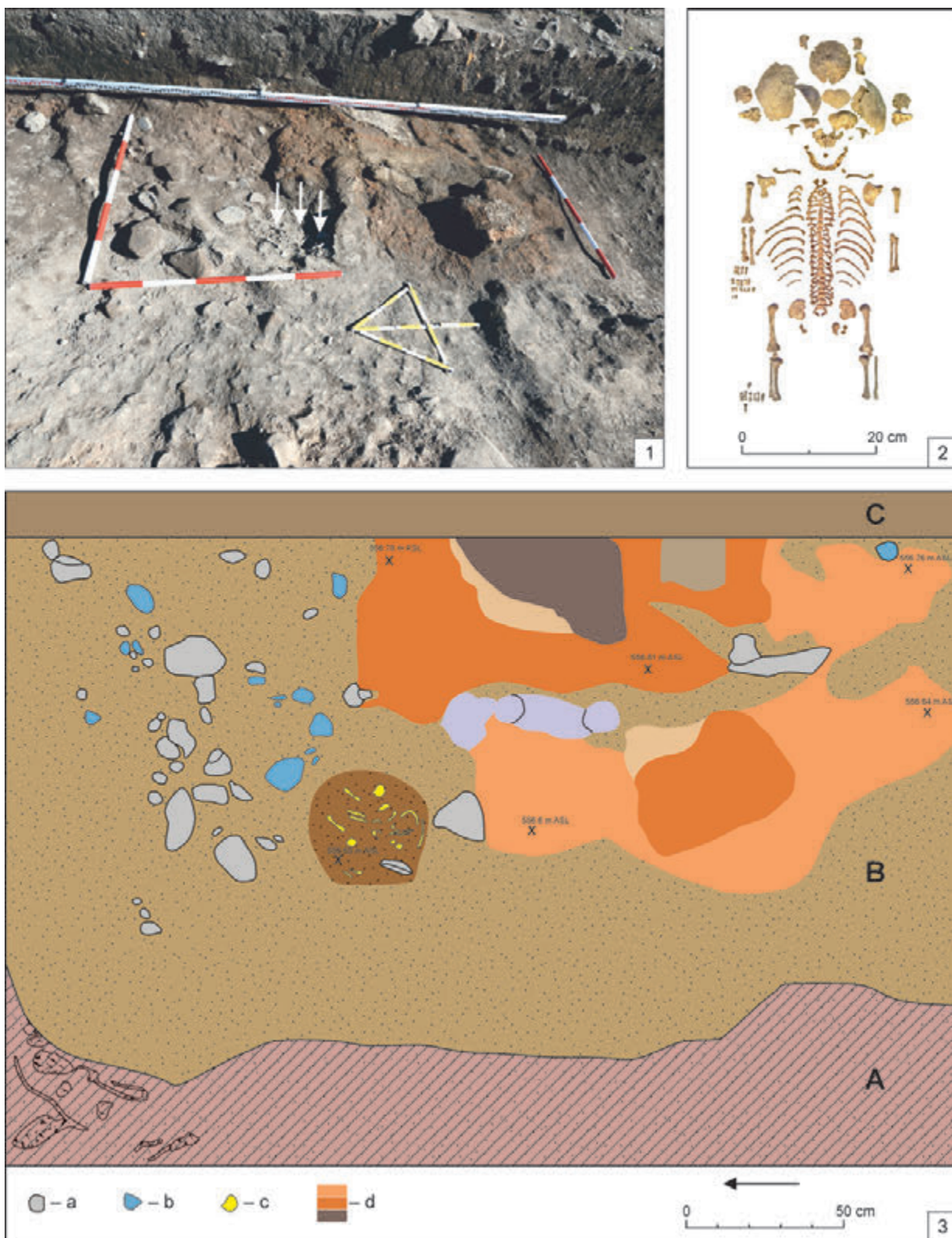


Fig. 4. Zvolen-Deserted Castle, Upper castle. 1 – remnant of the burned dwelling's clay floor with the discovery of the skeletal remains of an infant dated to the Late Bronze Age in trench 5A/2016 (terrain photo: J. Beljak); 2 – preserved skeletal remains of an infant found in trench 5A/2016 (photo: M. Putško); 3 – section of the trench 5A/2016 groundplan. Legend: A – stable andesite rock; B – cultural layer from the Bronze Age; C – mediaeval wall; a – remnants of the pre-historic rampart; b – pottery sherds from the Bronze Age; c – infant skeleton; d – burnt floor and ash layer. Authors J. Godiš, N. Beljak Pažinová.

RELATIVE DATING OF THE PREHISTORIC SETTLEMENT

It is possible to discern three primary habitation stages of the hilltop settlement at the Zvolen-Deserted Castle, Upper castle site based on the stylistic study of ceramic sherds from the 2016–2021 seasons (*Beljak Pažinová/Godiš/Beljak 2023*). They encompass the period roughly from the 12th to the 8th c. BC, from the Late Bronze Age (stage HA1) to the beginning of the Hallstatt period (stage HC1). The current state of research indicates, that when the communities of the Piliny culture began infiltrating the southern Zvolenská kotlina basin at the end of stage BC2, no permanent settlement was established on this upland site (*Zachar/Malček 2011*, 33–36, fig. 10). It is possible to say that the hilltop settlement's formation occurred at the earliest during stage HA1 when the Lusatian culture³ rapidly spread from the regions of Liptov, Turiec, and upper Nitra valley to the Zvolenská kotlina basin (*Beljak Pažinová 2018*, 19, with further references; *Kujovský 1994*, 307, map 1; 2015, 180; *Zachar/Malček 2011*, 36, 37). It is also possible that the communities of the Lusatian culture and the Piliny enclave already existing in the area would coexist briefly (*Zachar/Mitáš 2012*, 419–421). This is argued mainly by the evaluation of the ceramic material from the Lower castle (*Beljak et al. 2014*, 119) and the oldest burial horizon known to exist at the Zvolen-Balkán cemetery, which dates to the beginning of stage HA1 or the transition stages BD/HA1 (*Bátora 1979*, 78; *Zachar 2010*, 54).

The Upper castle pottery analysis revealed a considerable stylistic overlap between the Lusatian and Kyjatice ceramic traditions (*Beljak Pažinová/Godiš/Beljak 2023*). The rampart at the Upper castle was most likely built during the cohabitation of Lusatian and Kyjatice cultures in the Zvolen microregion. It was discovered along the mediaeval defensive wall's eastern, southern, and western boundaries. A notable decline of this settlement is documented at the very end of the Bronze Age (the transition between stages HB and HC) when the alleged settlement crisis (depopulation?) struck the wide territory in the northern Carpathian Basin.

ABSOLUTE DATING OF THE PREHISTORIC SETTLEMENT

Currently, 14 absolute data are available from the Deserted Castle – two date the features in the Final Bronze Age, and the others are associated with the High Middle Ages. The first comes from the rib of a child skeleton discovered near the burnt floor in a dwelling from the Final Bronze Age (Fig. 4). The second is collagen extracted from a bone awl. Measurements were done using the AMS (Accelerator Mass Spectrometry) method in the laboratory in Poznań. To determine the age of the samples, we used

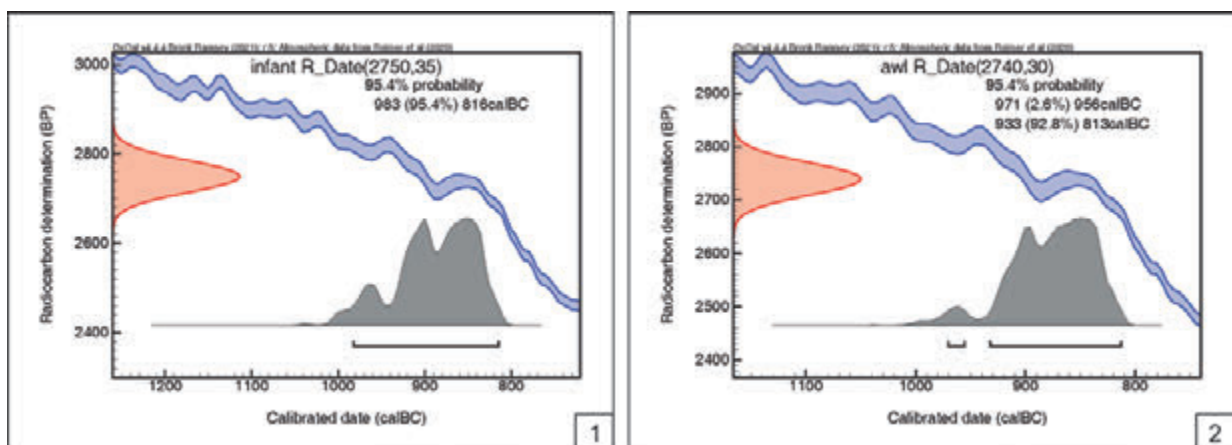


Fig. 5. Zvolen-Deserted Castle, Upper castle. Results of radiocarbon dating of two samples. 1 – infant's rib from trench 5A/2016; 2 – bone awl from trench 3A/2019. Graph plot generated by Calib 8.1.0. <http://calib.org/calib/> [20. 12. 2024].

³ The earliest evidence of the "first colonization wave" of the Lusatian culture infiltrating in the territory of the Slovenské stredohorie mountains are evidenced as early as stage BD and in the beginning of stage HA1 (Mikušovce horizon according to L. Veliačik). It is documented mainly by grave goods from some cremation graves at the sites of Zvolen-Podborová, Sliač, Zvolenská Slatina (*Beljak Pažinová 2018*, 19; *Zachar/Malček 2011*, 36, 37).

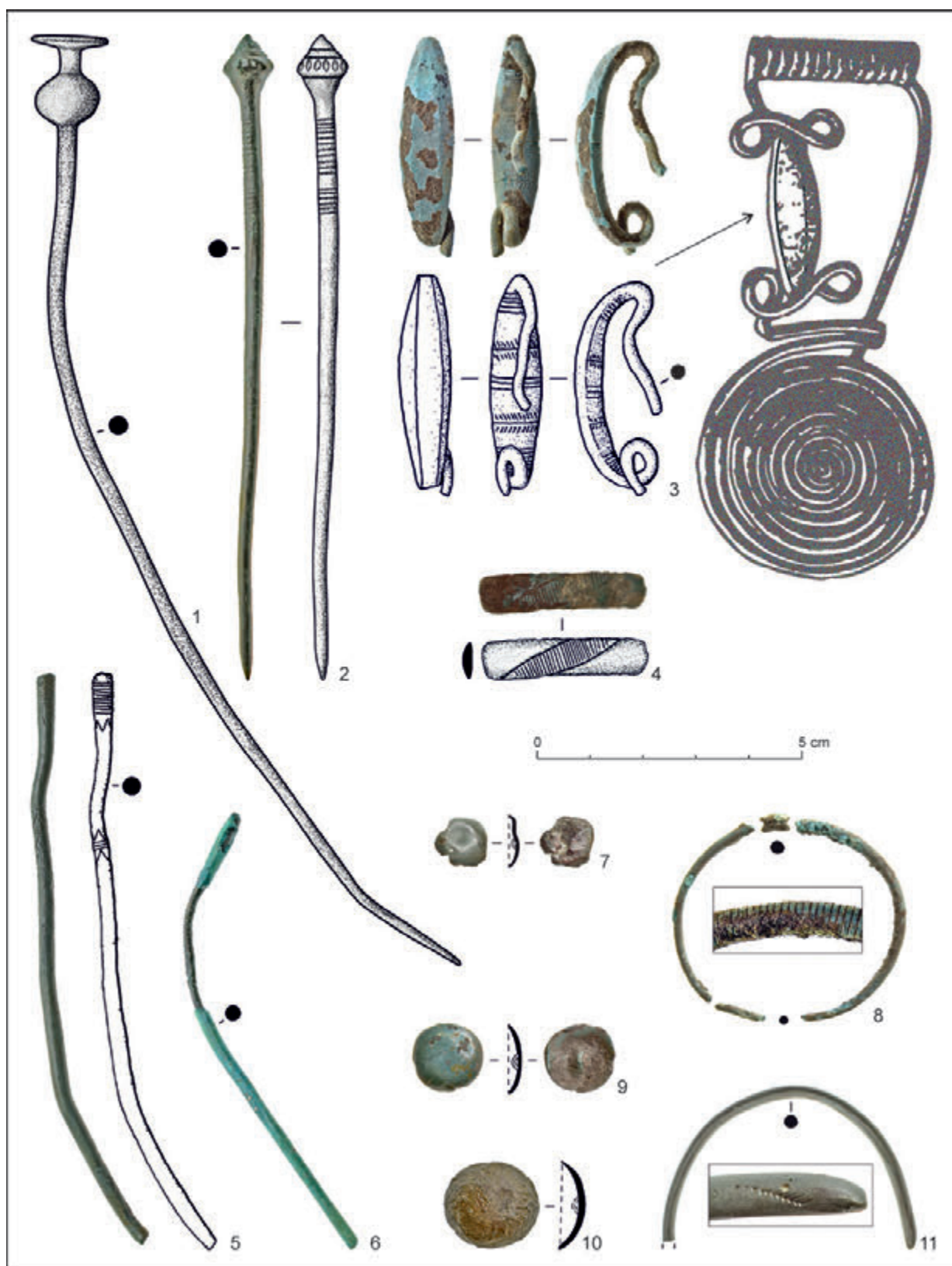


Fig. 6. Zvolen-Deserted Castle, Upper castle. Selected metal findings from the Late and Final Bronze Age. 1, 2, 5 – pins; 3 – fibula; 4, 8, 11 – bracelets; 6 – pin (?); 7, 9, 10 – patches. 1 – trench 3/2007; 2 – trench 5A/2016; 3 – trench 3A/2022; 4 – trench 1C/2018; 5 – trench 3B/2021; 6 – trench 6/2017; 7 – trench 4/2020; 8 – trench 3/2019; 9 – trench 4/2019; 10 – trench 5C/2016; 11 – trench 1A/2021. Authors J. Godiš, I. Látečková.

the OxCal 4.4 calibration program with a radiocarbon calibration curve, IntCal20, for terrestrial samples from the Northern Hemisphere (*Bronk Ramsey 2021; Reimer et al. 2020*).

Samples came from the prehistoric cultural layer identified on the hilltop plateau, near the prism-shaped tower at the eastern line of the mediaeval castle fortification. They were discovered 0.9–1.2 meters below the present-day surface of the landscape. Both samples, the infant's rib (983 [95.4%] 816 cal BC) and the bone awl (933 [92.8%] 813 cal BC),⁴ date to the end of the 10th and 9th c. BC (Fig. 5). Due to these results, it is possible to date also the stone-earthen rampart to the Final Bronze Age because of the dating of the child's skeleton discovered on the burned earthen floor of a destroyed dwelling that was constructed directly on the andesite rock at close quarters to the rampart.

SELECTED SMALL COPPER-ALLOY ARTEFACTS

Pins

One of the best-preserved so far found prehistoric metal finds from the area of the fortified upland settlement at the Upper castle is a bronze pin with a biconical head, whose upper part is decorated with engraved encircling lines, which resembles a step-like design (Fig. 6: 2). The head is in its widest dimension emphasized by a ring and decorated by short vertical flutings (grooves) along the circumference, which creates a so-called cogwheel motif. On the neck are two separate bands with bunches of dense horizontal encircling lines that continue as a straight, smooth pin with a circular cross-section. The find from Zvolen can be classified in the group of pins with biconical, densely horizontally grooved, or step-like designed heads; during their typological development, their heads became smaller, and they were used from the beginning of stage BD to stage HB1 (*Novotná 1980, 134, 135; Říhovský 1979, 123*). Analogies with richly decorated heads in the territory of the early Urnfield culture in Slovakia were found in the settlement layer in Pobedim (*Studeníková/Paulík 1983, 131, pl. XLVII: 8*) or in cremation grave from Diviaky (grave 14; *Pivovarová 1959, pl. II: 9*). Some pins close to the Banka type (according to *Novotná 1980, 132, 133*) from the urnfield burial ground in Ilava (graves 21 and 133; *Benediková et al. 2016, 146, fig. 41*) and the find (with a thickened neck) from the Liptovský Mikuláš-Liptovská Ondrášová with a similarly shaped head (grave I/III; *Veliachík 1975, 26, fig. 10: 19*) suggest earlier dating. The closest shape parallels with decoration are found in southern Moravia (Tetčice – a settlement find) and in the northeastern part of Lower Austria (Petronell – a stray find), which are roughly dated to the Late and Final Bronze Age as they do not come from closed features (*Říhovský 1958, fig. 104: 1; 1979, 120–123, pl. 36: 726, 742*). The decorated pin with a biconical head from the Upper castle can be dated to the transition of the stages BD/HA1; nevertheless, considering the previously analysed ceramic material from the site, stage HA1 is most likely.

Another complete find of a bronze pin with a large vase-shaped head and a long, arcuately bent (probably partly deformed) smooth needle with a circular cross-section (Fig. 6: 1) was found in 2007 during excavation by V. Hanuliak. Despite many discussions on the chronological sensitivity of this type of pins, several researchers in the past agreed on the parallel use of variants with large as well as small heads during the whole Final Bronze Age (*Novotná 1980, 78; Podborský 1970a, 130; Říhovský 1979, 203–207; 1983, 50*).

Further documentation indicated that pins featuring bigger, frequently ornate heads may have appeared earlier in the Middle Danube area, during the transition of stages HA2/HB1. In the Eastern Alps, variations of pins with both big and small heads coexist as late as stage HB1 (*Erbach 1995, 310, fig. 3; Nebelsick 1994, 324, 325*). Presently, it is hypothesised by some that throughout the latter part of the Final Bronze Age, these pins were replaced by designs featuring little vase-shaped heads (*Stegmann-Rajtár 1994, 322–324*). The presence of both types of cloth fasteners in hoards from the end of the Bronze Age (HB2–HB3) in the region of Transdanubia shows that the question of their finer dating has not been solved (see also *Kalicz/Váczi 2010, 266*). The greatest similarities to the head shape of the pin from Zvolen are observed on a stray old find from Ladzany (*Novotná 1980, pl. 43: 967*), a pin from the burial ground in Dolný Kubín II (grave 492; *Čaplovič 1977, fig. 33: 10*), or another specimen from Zemianske Podhradie (*Budinský-Krička 1947, pl. XXI: 10*). They all come from the Lusatian cultural milieu in the Final Bronze Age and the Early Hallstatt period.

⁴ The infant's rib – trench 5A/2016: 2750 ±35 BP. The bone awl – trench 3A/2019: 2740 ±30 BP.

The exact typological identification of another pin (Fig. 6: 5) remains a question. Only the needle decorated with bunches of horizontal lines lined with a zigzag motif on the neck and below it has been preserved. The neck's decorative design implies that the pin's head may have been shaped and had a larger diameter than the needle itself. It might be a pin with a biconical or vase-shaped head, depending on the composition of the ornamentation and similar parallels. Close exemplars were found, e.g. among numerous bronzes from the settlement in Pobedim (*Studeníková/Paulík 1983*, pl. XLVII: 8) or from a famous upland hillfort and supra-regional centre of metallurgy in Velemszentvid, Hungary (*Říhový 1983*, pl. 22: 535; 24: 547–577, 579, 593, 602). Nevertheless, most of them are unstratified finds. The specific decoration with zigzag lines on the neck also occurred on other types of pins from the entire Urnfield culture period (e.g. pins with club-shaped or trumpet-shaped heads; see e.g. *Novotná 1980*, pl. 41: 924; 44: 1019B), which disallows proper typological and chronological classification of the find from Zvolen. Here, we must mention a similar (?) find of a pin from the rescue excavation carried out in 1999–2000 at the site of Zvolen-Haputka below the northern slope of the Deserted Castle; it had a decorated profiled (?) neck (and possibly a broken-off head), and it was dated – also concerning the associated pottery close to the Kyjatice culture style – to the Final Bronze Age (*Malček/Mihok 2001*, 145, fig. 74: 5).

A deformed (?) bar-shaped bronze artefact with a thick coating of noble patina may also be found among clothing fasteners (Fig. 6: 6). The item seems like a basic, undecorated variant of pins with club-shaped heads, which are uncommon for the Early Hallstatt period and mostly characteristic of the Late Bronze Age (in stages BD–HA1; *Novotná 1980*, 141, 142; *Říhový 1979*, 151, 152). If the artefact is not a pin, it can only be categorised with the group of unidentified, circular-cross-sectioned, differently distorted fragments of bronze wire from the hillfort area.

Fibula

A more recent rare find is a fragment of a bronze “Carpathian” saddle-shaped fibula (Bükkszentlászló type; according to *Novotná 2001*, 31–35), more exact, its diagnostical part – i.e., the cast “saddle” with a longitudinally edged back and a part of a deformed winding (Fig. 6: 3). On the bottom or interior part of the artefact, there is preserved engraved so-called branch decoration (Fig. 6: 3). Archaeological literature reports the discovery of saddle-shaped fibulae at two other locations in Zvolen. While attribution of the find of an 8-shaped winding from the burial ground at the site of Zvolen-Balkán (grave 21; *Bátora 1979*, 77; *Zachar 2008*, 30, pl. XI: 9) to the above-mentioned type of fibulae is problematic, two other fragmentary finds from the site of Zvolen-Borová hora are – regarding the preserved characteristic parts – undisputable (*Zachar/Mitáš 2012*, fig. 2: 4, 5). Other saddle-shaped fibulae rarely occurred in the wide area of central Slovakia. Among them, the completely preserved finds from the hoard discovered in Plešivec stand out (*Furmánek 2015*, fig. 255, 302; *Paulík 1965a*, 40, pl. VIII: 1, 3, 7, 9). Fragments of another fibula come from another metal deposit discovered at the foot of the Holík elevation in the cadastral area of the village of Počúvadlo (*Budinský-Krička 1948–1949*, 272; *Ožďáni/Žebrák 2017*, pl. IX: 7), more fragments were reportedly found in a cremation grave excavated by A. Kmeť at the end of the 19th c. in Domaníky (*Budinský-Krička 1947*, pl. XXI: 5; *Novotná 2001*, 31, pl. 4: 39).

Only a handful of the mentioned finds had decorations on the underside of the “saddle.” The fibulae from Zvolen-Borová hora, the example from Počúvadlo, and the fully preserved stray find of fibula from the vicinity of Levice (*Novotná 2001*, pl. 4: 40, 43) show a similar parallel to the composition of ornamentation on the find from the Deserted Castle. Saddle-shaped fibulae are a chronologically sensitive type of artefacts that occurred in the territory of Slovakia at the very end of the Bronze Age, i.e., in stage HB3 (*Novotná 2001*, 31). Nevertheless, some finds from the territory of northern Hungary or Moravia indicate their possible occurrence as early as stage HB2 (*Betzler 1974*, 85, 90; *Kemenczei 1996*, 261; *Podborský 1970a*, 126). Their geographical distribution in the northern part of the Carpathian basin also suggests that the territory occupied by the Kyjatice culture might have been one of the production centres manufacturing this functional adornment of a complex construction (*Novotná 2001*, 34, pl. 27). In addition to the relatively high amount of Kyjatice-style pottery discovered in the material from the present-day Zvolen territory (*Beljak Pažinová/Godiš/Beljak 2023*, 101, pl. I: 1–14), the discovery of saddle-shaped fibulae from the Upper castle and the Zvolen-Borová Hora site serve as another important evidence of contacts with the southeast in terms (not just) of the metal goods distribution.

Annular adornments

The small group of annular ring adornments from the site includes a subtle open bracelet made from a bar with a circular cross-section and pointed ends decorated by bunches of fine transversal lines in separate fields on the outside (Fig. 6: 8). Another exemplar is approximately half of a little thicker bar bracelet made of copper alloy with flattened and rounded ends. Near its end, an unfinished (?) miniature ornament in the form of an oblique band of narrow cuts is observable, while the rest of the artefact surface is smooth (Fig. 6: 11).

No analogies to the mentioned finds are currently known from the Zvolenská kotlina basin or the wider region of central Slovakia. Regarding their interior diameter (approx. 4 cm), they can be identified as wrist decorations (bracelets). On the contrary, their specified chronological classification in the Urnfield period is difficult, as this type of simple adornment does not show considerable and visible changes in time.

A different fragment comes from another bracelet made from a bronze strap bar with a D-shaped cross-section and with decoration in the form of two oblique grooves whose interior surface (approx. 0.5 cm wide) is filled with crosswise cuts or shading (Fig. 6: 4). Exact analogies in ornamentation are currently unknown. A comparable as well as geographically close find is a bracelet (most probably from the Hallstatt period) from the upland hillfort in Horná Lehota with a similar, i.e., diagonal, scheme of decoration, which has bands filled with a grid ornament arranged in intervals on the outside (*Benediková 2014*, 28; *Pieta/Mosný 2002*, 161, fig. 110: 11). When the relatively simple decoration on the subtle fragment from Zvolen is contrasted with the intricate decoration on older variants of bracelets⁵ with plano-convex cross-sections made from massive bronze bars in the Urnfield period (see mainly *Podborský 1970a*, fig. 24; *Salaš 2005*, 85–89), its younger (proto-historical) chronological classification appears more likely.

Garment ornaments

Metal garment decorations are represented by a few pieces of semi-globular bronze plate patches (so-called hat-shaped caps) with inside loops (Fig. 6: 7, 9, 10). Several exemplars of patches of this variant were represented, e.g. in the well-known metal deposit from below the Deserted Castle; the hoard contained – among other artefacts – about 170 pieces (and its fragments) of such metal plate ornaments with two opposing holes for sewing and with no loop on the inside (*Balaša 1946*, 93, 94, fig. 3: 40; *Zachar 2018*, 68, pl. 18: 15). Regarding the chronological classification of the patches from the hillfort in Zvolen, we can consider the loop as well as their smaller diameter (13–18 mm), which indicates their dating to the older or middle Urnfield culture period, i.e., stages BD–HA (*Salaš 2005*, 117). They cannot be dated more precisely, as they were used unchanged until the end of the Bronze Age (*Veliačik 1983*, 55). Similar examples found near the contemporary highland hillfort in Detva-Kalamárka should be brought up in this context (*Šalkovský 2001*, 52, fig. 14: 1–7). Although they may have been used to adorn military armour, waggons, or even horse harnesses, it is generally considered that they mainly ornamented clothing.

The prehistoric origins of other circular or oval items crafted from thin copper alloy sheet metal (Fig. 7: 2, 3) remain unverified, and their incorporation into the studied assemblage is solely dependent on the find context, which is presumed to be linked to previous habitation at prehistoric times. The artefacts may be interpreted, albeit with some uncertainty, as semi-finished products for the metal sheet manufacturing activities at the site. Similar plates were found, for instance, in the hoard from Liptovská Sielnica-Liptovská Mara (*Veliačik 1983*, 53, 54, 148, pl. XXXIV: 20, 22) classified in stage HA1. Prehistoric provenance can also be doubted in the closed bronze ring made from a bar with a circular cross-section covered with a layer of noble patina (Fig. 7: 9), whose function cannot be identified either. In the final stages of the Bronze Age and at the beginning of the Hallstatt period, similar items occur mainly as parts of other more complex artefacts, such as hanging jewels or even on bronze vessels (e.g. situle or buckets).

⁵ Analogous decoration occurs on some bracelets of this type, but the transversally grooved band is basically zigzagged (*Bartík/Farkaš/Jelínek 2019*, pl. 5; *Salaš 2005*, tab. 355: 21; 379: 7).

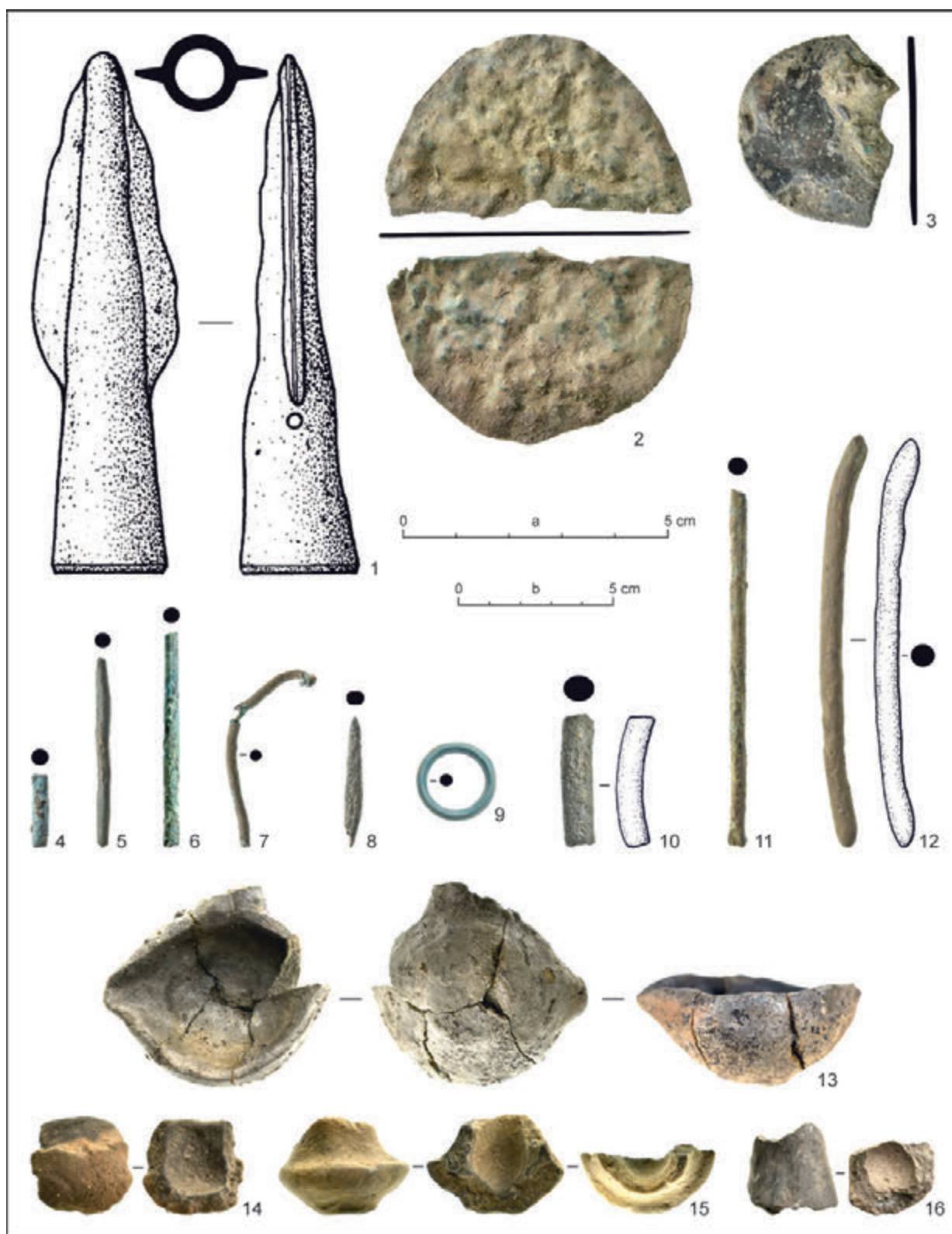


Fig. 7. Zvolen-Deserted Castle, Upper castle. Selected metal findings and other small artefacts from the Late and Final Bronze Age. 1 – spear point; 2, 3 – metal sheets; 4–7, 10–12 – metal bars; 8 – metal awl (?); 9 – metal ring; 13 – ceramic crucible with a spout; 14–16 – thick-walled ceramic vessels. 1 – sector 10/F, 1997; 2, 3 – trench 4/2019; 4 – trench 4B/2020; 5 – trench 1A/2021; 6 – trench 5C/2016; 7 – trench 3/2019; 8 – trench 4A/2020; 9 – trench 3B/2021; 10 – trench 2/2021; 11 – trench 3/2019; 12 – trench 1A/2022; 13 – trench 5A/2016; 14 – trench 5C/2016; 15 – trench 5C/2016; 16 – trench 3/2019. Scale: a – 1; b – 2–16. Authors J. Godiš, I. Látečková.

Axes

In 2005, V. Hanuliak discovered the sole fully intact bronze axe with an asymmetrically carved socket opposite the loop during the excavation of the so-called Donč's castle's courtyard. The expanded edge of the mouth is flanked on either side by two curved ribs that run parallel to the almost rectangular, rounded axe body (Fig. 8: 1). These types of finds occurred in a wider time, from the early Urnfield culture to its late development stage; some of them were present in Final Bronze Age contexts (Novotná 1970b, 73–79; Říhovský 1992, 187; Salaš 2005, 38). As a result, it is difficult to classify them precisely chronologically without corresponding, relevant artefacts. Similar axes were found, e.g. in Komjatná as a representative of hoard horizon from stage HA2 (Novotná 1970a, 77; 1970b, pl. 31: 548, 552; Veliačik 1983, pl. XXXVI: 16). Other morphologically close finds are known, e.g. from Horné Strháre and Žitavany (Novotná 1970b, pl. 31: 542, 555). The find from the Deserted Castle can be associated with two similar axes (with symmetrically cut socket mouth) from the hoard discovered at the nearby site of Zvolen-Krivá Púť – Balkán⁶ in 2005 (Oždáňi/Ušiak/Zachar 2007, 169, fig. 5: 2a–d; 6: 1a–d), which is – as a (probably incomplete assemblage) whole – dated to the beginning of the Final Bronze Age (stage HB1). Because of the plastic ribs behind the socket mouth, the axe from Deserted Castle can be dated to the stages HA2–HB1.

Apart from the above-described artefacts, only fragments of other bronze axes are known from the upland hillfort at the Deserted Castle. Their condition indicates they were damaged (destroyed) most probably due to long-term usage. There is a fragment of a slightly rounded edge of a massive axe (Fig. 8: 2) with a socket (?) and a miniature fragment from the socket mouth of another small axe (or a chisel) that was decorated with longitudinal and transversal plastic ribs (Fig. 8: 3). A small fragment of another, presumably socket-like unidentifiable artefact can also be included to this group (Fig. 8: 4). Due to the absence of further diagnostic features, these items may only be roughly dated between stages HA and HB, during which the communities of the Urnfield cultural complex frequently manufactured socketed tools and weapons of various types (Furmánek 2015, 227; Novotná 1970b, 72–98).

Sickle

The usage of metal tools in agricultural production at the site and its catchment area in the Late Prehistory is documented by the discovery of a sickle-blade tip with a longitudinal rib and a thicker back (Fig. 8: 5). Its typological categorisation is difficult since it lacks a handle, which is one of the crucial attributes. A partial indication may be found in the two tens of sickles and their fragments found in the hoard beneath the Deserted Castle in 1944 (Balaša 1946, 90–95; Furmánek/Novotná 2006, pl. 47; Zachar 2018, pl. 15; 16: 1–7). In addition to a few particular – likely local – forms of sickles, the most numerous in the collection were the pieces with tangs and grip tongues. The chronological presence of the entire typological group of bronze sickles in the Zvolen hoard varies between stages BC2–HA1 (Furmánek/Novotná 2006, 106; see also Zachar 2018, 51–54). Based on the Upper castle's ceramic material, the sickle fragment from the hillfort may be dated to the Late Bronze Age (stage HA1) or perhaps later.

Spear point/lance point

The only specialized type of weapon from the Bronze Age at the Upper Deserted castle so far is represented by a bronze socketed point discovered in 1996, as a stray find on the surface of sector 10/F discovered during the removal of invasive vegetation (Fig. 7: 1; Mosný 1997, 135, fig. 95). Its length of only about 10.5 cm suggests that it was most probably a point from a throwing weapon – a lance with an almond-shaped leaf point. A considerably analogous spear/lance point from the territory of the Lusatian culture in Slovakia comes from the hoard found in Rosina near Žilina, which is classified in stage HA2 (Veliačik 1983, 45, pl. XLIV: 6). Similar exemplars were also discovered in the similarly dated metal hoards from Trenčianske Bohuslavice, Bešeňová, or Žaškov (Petrikovich 1904, pl. I: 3, 11; Novotná 1970a, pl. XXIII; XXV; Veliačik 1983, pl. XL: 3, 5; XLII: 16; with further references). As for the milieu of the Middle Danube

⁶ Another hoard dated to the stage BD/HA1 was discovered at this site in 1964. It contained a ceramic jug and about 133 bronze hat-shaped caps, which were seemingly wrongly interpreted as a wooden shield component (Paulík 1965b, 17–32; Zachar 2015, 187–198, fig. 2).

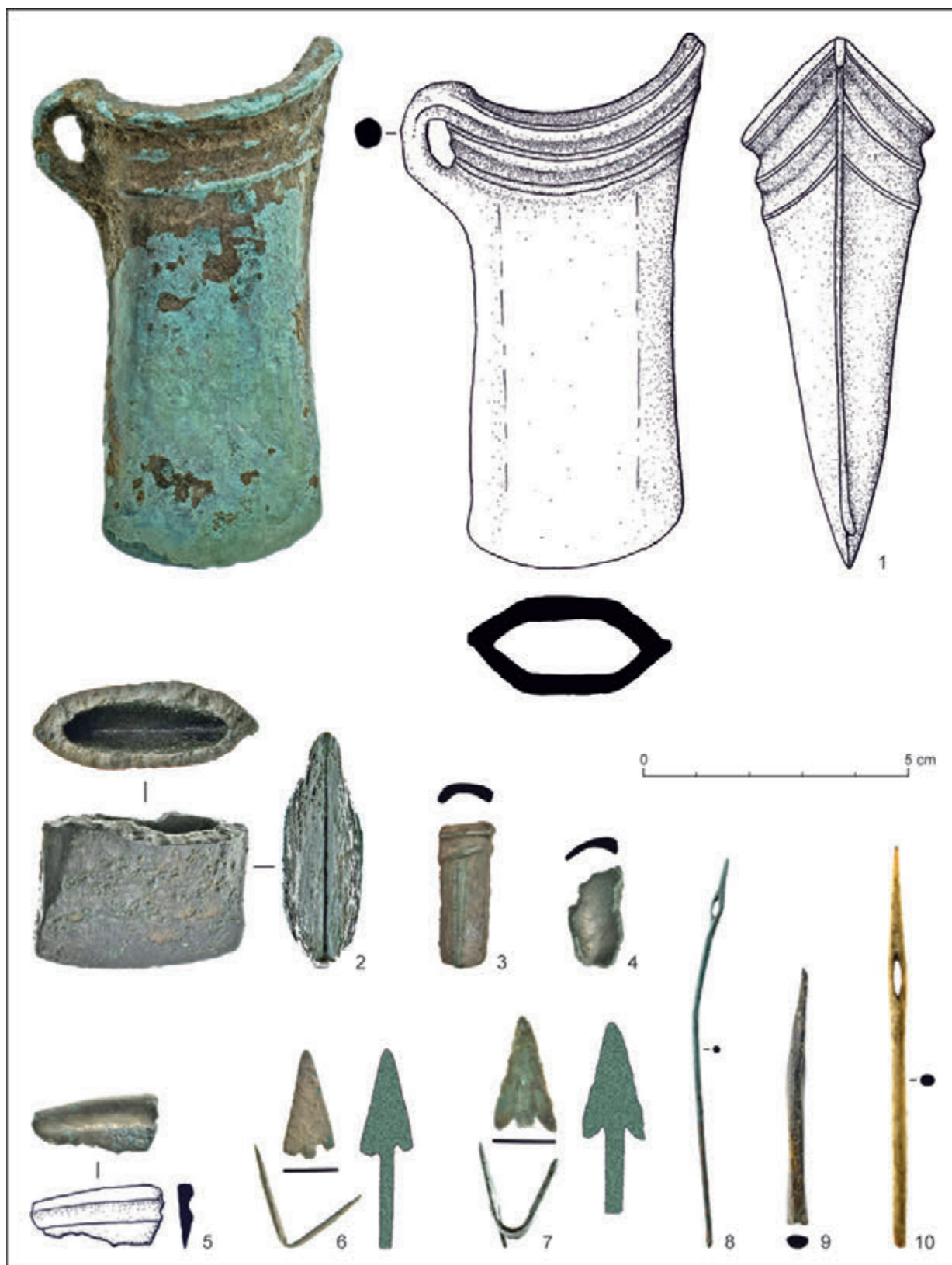


Fig. 8. Zvolen-Deserted Castle, Upper castle. Selected metal and other findings from the Late and Final Bronze Age. 1–4 – axes; 5 – sickle; 6, 7 – arrow heads; 8 – metal needle; 9 – bone awl; 10 – bone needle. 1 – trench 2/2005; 2 – trench 3/2017; 3 – trench 1C/2018; 4 – trench 1A/2021; 5 – trench 5/2020; 6 – trench 3/2019; 7 – trench 3/2017; 8 – trench 5B/2016; 9 – trench 5/2016; 10 – trench 5B/2016. Authors J. Godiš, I. Látečková.

Urnfield culture in Slovakia, we have parallels to the find from Zvolen, e.g. from the Šintava or Galanta region, which are dated to stages BC2/BD–HB1 (Mitáš *et al.* 2018, 235, fig. 3; pl. II: 5). A suitable analogy also occurred in the hoard from Egyek in northeastern Hungary dated to stage HB1 (Kemenczei 1984, pl. CXCI: 8; *Mozsolics* 2000, 43, pl. 28: 2). In general, typological-chronological classification of this group of artefacts, as well as identification of their function, is usually complicated (*Mozsolics* 1985, 20; *Novotná* 2004, 399). The indistinct morphology of the find from Zvolen does not allow its exact chronological classification within the Urnfield culture period (Zachar 2018, 51). Therefore, its association with the Piliny culture communities, earlier infiltrating into this microregion cannot be ruled out with certainty (see Zachar/Malček 2011, 35). To complement the type, another – much older – find of a spear/lance point from the stray find collection at the site of Zvolen-Borová hora must be mentioned. It has traces of fire damage and is dated to the Ožďany horizon, i.e. to the stages BC2–BD (Zachar/Mitáš 2012, 417, fig. 2: 1).

Arrowheads

Simple flat triangular bronze arrowheads extended at their base to side barbs and a long narrow rectangular tang, which come from the area of the Upper castle, are still rare finds in the milieu of the Urnfield culture in Slovakia (Fig. 8: 6, 7). Small sizes and the generally subtle character of their design in comparison with much more robust and numerous socketed exemplars make us think about their practical use in fight or hunting (Lauermann/Mödlinger 2021, 220, fig. 08_07; *Novotná* 2004, 402–406). The nearly identical deformations of tangs in both discovered exemplars (unless caused by post-deposition processes) indicate that it could be caused when the projectile struck a hard surface and was already partially deflected off the axis of the arrow's wooden shaft. The bronze arrowheads from the Deserted Castle are evidence of the local use of mechanical long-range weapons – bows. In terms of chronology, their occurrence appears to be limited to the contexts from the Final Bronze Age to the Early Hallstatt period. It is documented, e.g. by an unstratified find from the settlement in Pobedim (Studeníková/Paulík 1983, 128, pl. XXXV: 12); another similar find comes from the hillfort in Klentnice in southern Moravia (Říhorský 1996, 130, 132, pl. 28: 458) and by their representation among the goods from the tumuli of the Horákov culture (Podborský 1970b, fig. 21: 15–17, 19). The state of the published source material from the Bronze Age indicates that this flat arrowhead was relatively uncommon in the milieu of the Urnfield culture within the territory of Slovakia.

Artefacts associated with textile production

The small-sized artefacts from the site that are not relevant for clarifying cultural-chronological questions due to minimum changes in their morphological development in the Late Prehistory (and later) but reflect everyday household activities taking place at the hillfort include a subtle bronze needle with an eye (Fig. 8: 8) and another similar specimen made from a bone (Fig. 8: 10). Both findings are classified as utility tools common at settlements from the Final Bronze Age, such as the previously mentioned Pobedim and Prašník (Novák 2011, 64, pl. 36: 494; *Studeníková/Paulík* 1983, 127, pl. XXI: 12; XXXVIII: 6–9, 12–14). A partly damaged bronze artefact with a pointed end (a tip) and a shank with a rectangular cross-section and rounded edges, which is thickened in the middle, might also represent a massive type of metal awl (Fig. 7: 8), as well as the other find made from bone (Fig. 8: 9).

Finds of the above-mentioned metal and bone needles and awls, together with clay spindle whorls – especially disc- and conical-shaped (Fig. 9: 11, 14, 17–19) – and fragments of weaving weights document the past existence of textile production⁷ at the hillfort (a weaving workshop). Some researchers also link this kind of manufacture to tiny clay spools (Fig. 9: 20–23) for winding the yarn, but sometimes these are wrongly interpreted as figure feet or miniature pottery stands. However, the Upper castle is unquestionably the place of the interesting discovery of an artefact moulded from fine clay in the shape of a robust human (?) lower limb with a modelled foot (Fig. 9: 16). Regarding the chronological classification of this artefact, its archaic character as well as much earlier traces of settlement at the site in the Final Stone Age should be taken into consideration. A remarkably similar find suggesting possible connections comes

⁷ Artefacts related to the textile production of the Piliny and Kyjatice cultures in Slovakia have recently been summarized and discussed by V. Mitáš (2023a; 2023b; 2024; with further references).



Fig. 9. Zvolen-Deserted Castle, Upper castle. Selected clay artefacts from the Late and Final Bronze Age. 1 – trench 5/2016; 2, 3 – trench 4/2019; 4 – trench 1/2016; 5 – trench 1/2016; 6 – trench 5A/2016; 7 – trench 5A/2016; 8 – trench 5/2016; 9 – trench 4/2019; 10 – trench 5/2016; 11 – trench 5C/2016; 12, 13 – trench 5A/2016; 14 – trench 1/2016; 15, 16 – trench 4/2019; 17–19 – trench 3/2019; 20, 21 – trench 4/2019; 22 – trench 5A/2016; 23 – trench 3/2019. Author J. Godiš.

from excavations at the Lower castle. However, its dating is also uncertain as it is not typical of the Baden culture either (Beljak *et al.* 2014, 89, 90, fig. 57). As for similar Bronze Age finds from central Slovakia, we can mention here more archaic leg/foot fragments from the multi-cultural settlement in Včelince (Marková 2001, 361, fig. 4: 6, 8, 10). From the Lusatian culture milieu in Slovakia, clay artefacts modelled as a human foot, very similar to finds from Zvolen, were found in settlement site Dolný Kubín III (Čaplovič 1987, pl. LXVIII: 6–11). Other plastics of this type are known from settlements in Detva-Kalamárka (Šalkovský 2001, fig. 11: 10), Ponická Huta (Kvietok 2014, pl. IX: 6) or Žiar and Hronom-Ladomerská Vieska (Žebrák 1987, 113, fig. 69). Some of them are perforated so they could be used as pendants. In addition, their shape suggests that they could be more likely a representation of an animal's foot (water bird). In the context of the Urnfield period, more completely preserved anthropomorphic figurines are documented rather exceptionally not only in the local (Lusatian) but also in the geographically much larger territory of the Central Europe. If they occur, the specimens found in the northern Carpathian Basin have the form of flat idols following from the Early and Middle Bronze Age traditions (see e.g. Guba 2020; Šlusarska 2023). From the northern Lusatian culture region, such as the Gliniany (eastern Poland), there comes a clay male figurine, found among grave goods, which has similarly sculpted legs as the finds from Zvolen (Jankowska/Wojciechowska 1973; Kaletyn 1971). Currently, it can only be stated that the question of the chronological classification of the figurine from the Upper Deserted castle remains open. Lastly, another fragment of a subtle foot (?) from the site that is different from other spool findings (associated with textile production) and has a thickened circumference like a seal or stamping instrument (Fig. 9: 15), could perhaps be associated to a figurine.

Besides common pyramidal ceramic weights with rounded angles on the hillfort (Fig. 9: 1), there was also a fragment with an engraved cross symbol (Fig. 9: 2). This weight's marking has parallels both in Lusatian and Kyjatice cultures, e.g. the finds from lowland settlements at Hájna Nová Ves (feature 128; Wiedermann 2013, fig. 162: 2) and Radzovce (feature 76/79; Furmánek 2019, 66, pl. LXXII: 1) or at hillfort in Szilvásvár (Matuz/Nováki 2002, fig. 136: 2). From the area of the Eastern Hallstatt culture in western Slovakia (stages HC–HD1), we should mention the important discovery of a weaving workshop at the settlement in Dunajská Lužná-Nové Košariská, where several weights with identical marks were found (Čambal 2015, pl. XXII: 2, 19, 20; XXIII: 7–9, 13, 14, 20).

The markings that appear in nearly similar forms from the Bronze Age to the Roman period have been interpreted in a variety of ways; some researchers believe that they are the marks of their owners or makers. Given their extensive geographical and chronological distribution, the most plausible explanation currently appears to be that they were designed to make it easier to identify weights on clusters of threads when adorning a fabric with a distinct pattern weft (Grömer 2010, 116; Mitáš 2023a, 46, with further references; Štolcová/Zajonc 2014, 62, 63).

Notable is also a piece from another kind of flat ceramic weight (?) with rounded sides and a circular opening in the upper section, bordered with beam-like bunches of engraved lines (Fig. 9: 3). The motif's asymmetrical arrangement encourages us to think about the possibility that it was a sort of "technical" mark on the artefact that was connected to its role in the textile production process rather than decoration.

Robust, flattened clay discs with a central circular hole whose occurrence rapidly increases at settlements from the Final Bronze Age and the beginning of the Hallstatt period might also be directly associated with textile production (Fig. 9: 4–6, 9, 10). Various diameters and thicknesses of this group of toroid artefacts support the interpretation that they could have been used as effective weights with a small weaving loom (Hlavenková 2010, 41; Lochner 1991, 257; Mitáš 2023b, 45; Paulík 1976, 136; Vávra/Bača 2016, 115). There were also some pieces decorated or marked on the surface with bunches of parallel engraved lines (Fig. 9: 5).

Artefacts associated with metallurgy

A fragment of a bronze wire and thick bronze bars with circular or oval cross-section with cut-off or broken-off ends (Fig. 7: 4–7, 10–12) found in various parts of the hillfort area do not show any diagnostic features, so it is not possible to make a definite statement regarding their function or dating. Because they come from the late prehistoric contexts (settlement layers) and some of them are damaged, they might be manufacturing waste from the local metallurgical or smithing workshop. These small fragments might be leftover raw materials meant for further recycling. In association with this, the find of

a small copper “cake” of probably prehistoric origin, which comes from the area of the Lower castle should be mentioned (Beljak *et al.* 2014, 79, fig. 50).

The discovery of a well-preserved ceramic crucible with a spout and broken handle (Fig. 7: 13) suggests a prehistoric metallurgic workshop at the Zvolen upland settlement, in addition to previously stray finds of sandstone moulds⁸ and amorphous bronze solids (Pančíková 2008, 126, 135). In the territory of Slovakia, technical pottery of this type is known, e.g. from excavations at the Late and Final Urnfield culture settlements at the sites of Bratislava-Devín (Plachá/Paulík 2001, 51, fig. 6), Pobedim (Studeníková/Paulík 1983, 245, pl. XXXIII: 2), or feature 31/78 interpreted as a metallurgic workshop in Radzovce (Furmánek 2019, 37, pl. XXXIII: 5). Bronze manufacturing is likely linked to the miniature thick-walled ceramic vessels (Fig. 7: 14, 16), particularly the biconical specimen (Fig. 7: 15), which has similarities at the settlement from the Final Bronze Age in Hájna Nová Ves (Wiedermann 2013, fig. 144: 3) and in the previously mentioned Radzovce, where traces of copper were confirmed on the surface of the local artefacts using exact chemical analyses (Furmánek/Cengel/Mihok 1982, 205, fig. 1: 1, 3).

Sword (long dagger) from below the Upper castle hill

We ought to highlight the important earlier stray find of almost a complete short bronze sword (preserved length 28.4 cm) found at the site of Červený medokýš near the Teplý potok stream flowing into the Hron River near the western foot of the Upper castle hill. The sword⁹ (Fig. 10: 1) is characterised by a smooth, symmetrical blade narrowing up to the point, which has a slightly offset blade edge and a suggested central longitudinal rib running from the hilt towards the tongue-profiled grip with straight edge plates and a damaged (incomplete) end. The flanged shoulders of the trapezoidal hilt arms are almost straight, and slightly rounded, with circular rivet holes on each side. In the place where the blade is tapered from the handle, just under the rivet openings, symmetrically curved grooves on both sides are visible indicating the direction in which the blade is smoothly offset from the blade-edge down to its tip. The sword with the tongue-shaped grip is considered as a rare find from the mountainous areas of the Lusatian culture in Slovakia (see Veliačik 1999, fig. 3). The nearest comparable (stray) finds of this sword-type are documented only from Dolná Mičiná (Kemenczei 1988, 76, pl. 47: 416); then there is also an exemplar deposited in the so-called Evans' collection, which allegedly comes from the Orava region (Čaplovič 1987, 163, note. 150; pl. XIX: 3); and, finally, there is a sword from Podlužany (Veliačik 1999, 149–154, fig. 2). Nevertheless, the mentioned swords are classified in the Reutlingen type (according to Schauer 1971, 132–148) and dated to the interface of the Middle and Late Bronze Age (BC2–BD); their occurrence is more typical of the territory of southeastern Urnfield cultures. The damaged end of the handle (tang), the trapezoidal shape of the interface (a plate) without any trace of cutouts on the sides, and especially the unusually short length do not allow clear typological-chronological classification of the exceptional find from Zvolen. The sword shares many characteristics with short swords with tongue-shaped handles from the late and final stages of the Middle Bronze Age (compare e.g. Rataje, surroundings of Trnava, Alsónémedi, Nagyhalász; Kemenczei 1988, 51, 52, pl. 25: 244, 245; Novák 1975, 19, 28, pl. 11: 73; 20: 135). Regarding the current state of research on the settlement in the Zvolen microregion, dating of the sword from the site of Červený medokýš to the beginning or advanced Late Bronze Age¹⁰ seems most probable (stage BD–HA1). The question remains, whether the sword might have been ritually deposited in water (votive artefact), i.e., it was not an accidental loss – according to the information on the reported site of the discovery (see Novotná 2018, 256). Such an option cannot be denied if we consider previously

⁸ M. Novotná (1982, 365, note. 20) mentions an older find from the site – a mould for “casting needles” (?) that is deposited in the collection of the local Forestry and Timber Museum in Zvolen. In 1999, V. Hanuliak discovered a fragment of a stone with relief modification near the southern defensive wall of the so-called Donč's castle (sector CX2, 190 cm deep). It was originally interpreted as a mould for casting arrowheads or spear points. However, re-evaluating the photographic documentation of the find suggests, that it is more likely a medieval architectural element.

⁹ The find was spectrally analysed by the Delta ED-XRF spectrometer, which measured the final values of its chemical composition: Cu 80.93% ($\pm 0.17\%$); Sn (18.08%); Zn (0.65%); Ni (0.33%). Concerning this, an above-average share of tin in the alloy appears, considerably increasing the hardness of the artifact (compare the chemical composition of swords from the Bronze Age, e.g. Bartík 2008, 46; Longauerová/Longauer/Makarius 1999, 78). The high measured value of tin might also result from corrosion changes on the surface of the artefact (Gyöngyösi *et al.* 2023, 177).

¹⁰ In association with this, we must point to an analogous rare find of a sword from Králov brod in western Slovakia (Novák 1975, 21, 22, pl. 13: 89) classified in the Nenzingen type and dated to the early stage of the Urnfield culture (stage BD).

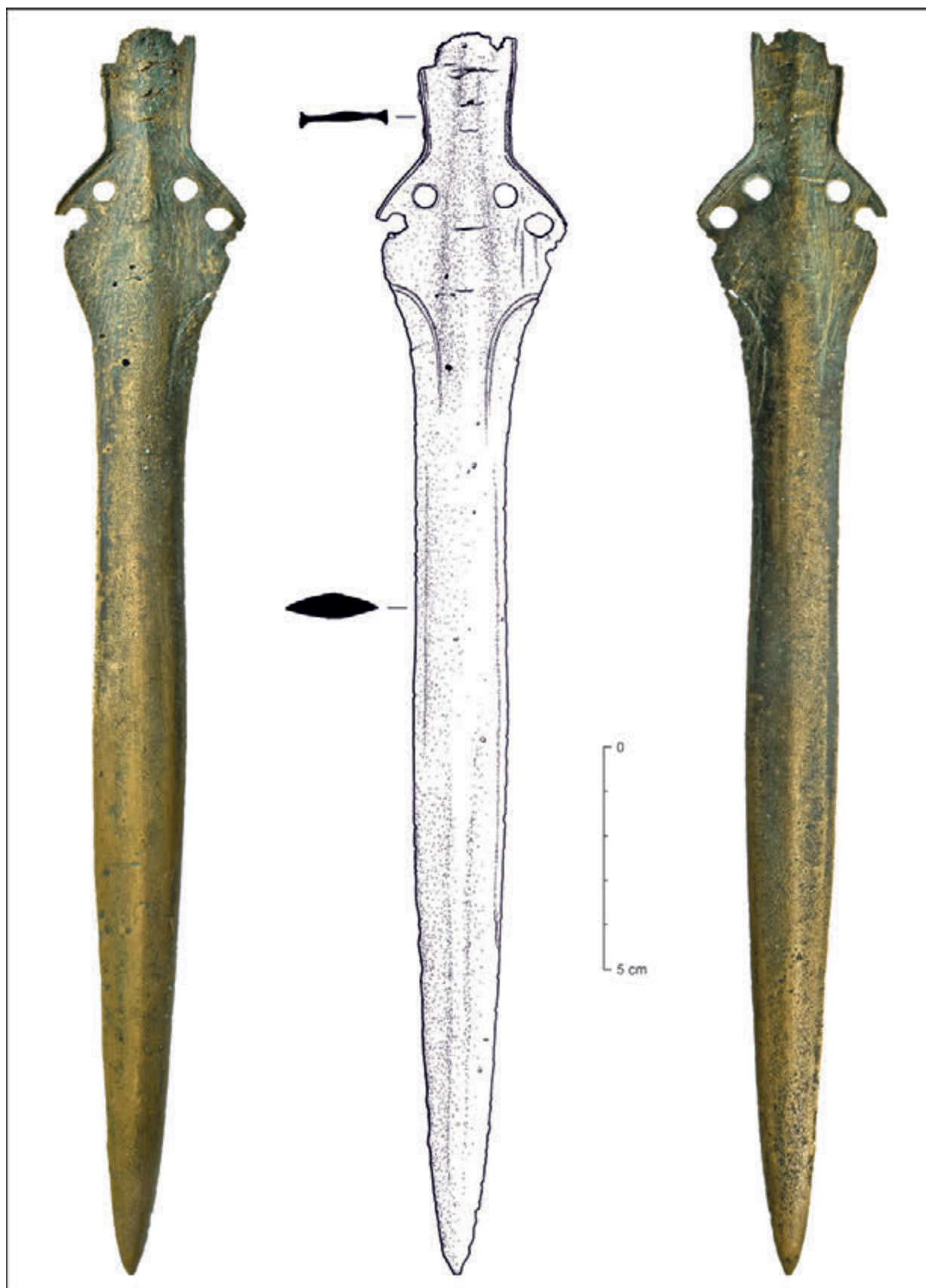


Fig. 10. Zvolen-Červený medokýš site. Grip-tongue sword/long dagger from below the Upper Castle Hill near the Teplý potok stream flowing into the Hron River. Stray find. Authors J. Godiš, I. Látečková.

known artefacts from the Urnfield culture period discovered in a well-known small lake on the top of the travertine heap and its surroundings at the site of Zvolen-Borová hora, which is situated approx. 6 km northwest (see Malček 2006, 66; Zachar/Mitáš 2012, 419–422).

Concerning the above-stated, we should mention one more important find of a different type of sword from Zvolen, which was part of the metal deposit (hoard III) discovered in 1962 at the Haputka (Krivá púť) site situated below the northeastern slope of the castle of Pustý hrad. It contained six bronze solid-hilted swords close to the Högl type (according to Novotná 2014, 66) and almost forty bracelet-shaped bronze ingots (Kuka 1965, fig. 209–211), while other similar swords were reportedly found near the stated site in the past (Novotná 2014, 9, 47, 67). These artefacts are interpreted as products of a local metallurgical workshop from stages HA2–HB1, i.e., when the Bronze Age upland settlement at the Deserted Castle was already fully established.

CONCLUSION

The publication and basic evaluation of metal and other small artefacts from the Upper Deserted Castle is another step that enriches our knowledge about the late prehistoric settlement in the Zvolen micro-region. Along with the ceramic material obtained over decades of systematic excavations, the analysed artefacts extend information on various activities at this strategic upland site during the Urnfield period. Many of these finds are badly damaged and lack diagnostic features, which prevents their basic functional identification and thus more accurate dating. On the other hand, the presented artefacts clearly document – directly or indirectly – e.g. agricultural (sickle), textile (weights, spindle whorls, awls, spools), or metallurgical (crucibles) production taking place in the prehistoric upland settlement. There are also finds of tools used to obtain and process timber (axes), for hunting animals or protection of the hillfort (spear/lance, arrowheads). Another group of artefacts helps us picture how locals ornamented their clothing in the Bronze Age and expressed their individuality within the community of which they were a part (pins, fibula, bracelets, patches).

The functional metal jewellery (pins, fibulae) in the studied assemblage are the most chronologically sensitive artefacts and hence best exemplify several habitation phases of the Upper castle prehistoric settlement. Recent evaluation of ceramic material suggests a distinction of three phases, spanning from the advanced Late Bronze Age to the onset of the Hallstatt period (Beljak Pažinová/Godiš/Beljak 2023, 98). The first phase, roughly synchronised with stage HA, is reflected in the find of a bronze pin with a biconical step-like designed head. Further development took place around the first half of the final Bronze Age, as evidenced by the large pin with a vase-shaped head when the material from the site reflects intense contact between the local Lusatian settlement enclave and the Kyjatice cultural region (stages HB1–HB2). Regarding metal finds, the final phase is exemplified by a fragment from a saddle-shaped fibula characteristic of the very end of the Bronze Age (stage HB3). It should be noted here that the long-term systematic excavation at the Deserted Castle in Zvolen has not yet yielded representative metal artefacts, which could be reliably dated to the beginning of the Hallstatt period (stage HC1). On the contrary, the ceramic assemblage from the site evaluated so far contains finds typical for this chronological period¹¹, like at the adjacent cremation burial ground at the site of Balkán situated just under the hillfort on the right bank of Hron River. A future task remains the processing and evaluation of the abundant ceramic material from the excavation campaign led by V. Hanuliak in 1992–2008. After all, it will also be necessary to incorporate new terrain discoveries and artefacts from the next excavation seasons planned at this remarkable upland archaeological site.

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Bartík 2008

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¹¹ From the site of Zvolen-Borová hora comes an old find of a unique equinomorphic bronze bridle sidebar from a horse harness dated to the transition of stages HB3/HC1, which refers to contacts with a territory as far as the Apennine Peninsula (Farkaš 1984, 55–81; Hampel 1892, 171, 172, pl. LX: 5; see also Zachar 2010, 79–85, fig. 2).

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Kovové nálezy a ďalšie drobné predmety z opevneného výšinného sídla z mladšej a neskorej doby bronzovej na Pustom hrade vo Zvolene, stredné Slovensko

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Súhrn

Národná kultúrna pamiatka Pustý hrad vo Zvolene na strednom Slovensku sa nachádza na juhozápadnom okraji mesta na rovnomennom kopci (obr. 1). Je známa výstavbou rozsiahleho hradného komplexu vo vrcholnom stredoveku, ktorú iniciovali panovníci z dynastie Arpádovcov (Beljak et al. 2021, 137–168). Najstaršie doložené osídlenie lokality pochádza z neskorej doby kamennej, keď na mieste tzv. Dolného hradu bola vybudovaná výšinná osada badenskej kultúry (Beljak et al. 2014, 80–98). Predpoklad o existencii pravekého hradiska na susednej polohe, tzv. Hornom hrade, sa objavuje v odbornej literatúre už od polovice minulého storočia (napr. Balaša 1946, 95; Furmánek 1983, 31, obr. 2: 16; Labuda 1981, 120). Prvý skromný súbor artefaktov z doby bronzovej, nájdených počas moderného archeologického výskumu na lokalite, publikoval V. Hanuliak (1993, 49; 2002, 62). Jednoznačné hnutelné aj nehnuteľné doklady osídlenia lokality Pustý hrad období kultúry popolnicových polí priniesol až výskum areálu Dolného hradu v rokoch 2009–2014 (Beljak

et al. 2014, 107–125). Aktuálny výskum Horného hradu, realizovaný každé leto od roku 2016 (obr. 2), priniesol súbor nálezov z mladšej a neskorej doby bronzovej, pozostávajúci z niekoľkých desiatok tisíc kusov, z ktorých najväčšiu časť prirodzene tvoria fragmenty keramiky (Beljak Pažinová/Godiš/Beljak 2023). Predložený príspevok prezentuje vybrané kovové predmety a ďalšie drobné nálezy z mladšej a neskorej doby bronzovej, objavené na Pustom hrade – Hornom hrade v rokoch 2016 až 2023, pričom sú doplnené aj o niektoré významné artefakty z výskumov V. Hanuliaka. Ich zverejnenie je dôležité nielen pre riešenie základných kultúrno-chronologických otázok ale aj ako doklad rôznych každodenných činností pravekých obyvateľov výšinného sídla nad Zvolenom.

Pri systematickom archeologickom výskume boli na Hornom hrade pod stredovekou hradbou na viacerých miestach identifikované zvyšky pravekého kamenno-zemného valu (obr. 3: 1). Tento val bol prvýkrát zaznamenaný už v roku 1994 (Malček 1996, 129), pričom jeho priebeh sa postupne potvrdil aj pozdĺž východnej línie opevnenia na vrcholovej plošine, v južnej časti opevnenia a napokon aj pod stredovekou hradbou tzv. Dončovho hradu (obr. 3: 2, 3). Výskumom sa dosiaľ zistilo, že najmasívnejšia kultúrna vrstva z doby bronzovej sa zachovala na vrcholovej plošine, v strednej časti hradného areálu pri východnej línii stredovekého opevnenia. V niektorých úsekoch dosahuje mocnosť až 1,2 m. V tejto oblasti sa podarilo identifikovať aj pozostatky ohňom zničeného obydlia nepravidelného pôdorysu s podlahou tvorenou hlineným výmazom, ktorá bola spálená do oranžova. Na nej bol objavený nepietne ležiaci skelet novorodenca (obr. 4; Beljak/Beljak Pažinová/Puškáš 2022, 95–99). Rádiouhlíkové datovanie rebra dieťaťa (obr. 5: 1) potvrdilo predpokladaný vek kontextu, spadajúci do obdobia medzi 10. a 9. storočím pred Kr. (2750 ±35 BP; cal BC 983; 95,4 %; cal BC 816). Tento údaj je v súlade aj s výsledkom absolútneho datovania kosteného šidla (obr. 5: 2), nájdeného na mieste vrcholovej plošiny (2740 ±30 BP; cal BC 933; 92,8%; cal BC 813).

Analýzovaný súbor pravekých artefaktov z Horného hradu, vyrobených zo zliatiny medi, je pomerne rôznorodý. Tvoria ho hlavne šperky a iné ozdoby odevu, ale aj pracovné nástroje a zbrane. Viaceré predmety sa pre svoju fragmentárnosť nepodarilo presnejšie identifikovať (drôty, tyčinky). Ojedinele sa objavili kompletne zachované exempláre, ako napríklad bronzová ihlica so zdobenou dvojkónickou hlavicom (obr. 6: 2) typická pre staršiu a strednú fázu doby popolnicových polí. Ďalším významným nálezom je celistvá bronzová ihlica s veľkou vázičkovitou hlavicom (obr. 6: 1), ktorá predstavuje kovovú industriu mladšej až neskorej fázy doby popolnicových polí.

Vzácnym novším nálezom z areálu hradiska na Hornom Pustom hrade je diagnostický fragment z bronzovej „karpatskej“ sedlovitej spony (obr. 6: 3), charakteristického šperku z obdobia záveru doby bronzovej. Zachovalo sa z nej iba liate „sedlo“ s pozdĺžne hraneným chrbtom a časťou drôteného vinutia, pričom zospodu je na ňom rytá vetvičkovitá výzdoba (obr. 6: 3).

K malej skupine kruhových ozdôb vyrobených zo zliatiny medi patrí subtilný, otvorený tyčinkovitý náramok so zašpicatými koncami, zdobený zväzkami priečných línii (obr. 6: 8). Ďalším príkladom je približne polovica, o niečo hrubšieho, hladkého tyčinkovitého náramku so splošteným, zaobleným koncom, pri ktorom je viditeľná nedokončená (?) jemná výzdoba šikmými pásmi zásekov (obr. 6: 11). Odlišný charakter má fragment pásikového náramku s plan-konvexným prierezom a výzdobou v podobe dvoch šikmých rýh, ktorých vnútorná plocha je vyplnená priečnymi zásekmi, resp. šrafovaním (obr. 6: 4). Pri niektorých z uvedených nálezov však nie je možné s istotou potvrdiť, že naozaj pochádzajú z mladšieho praveku. Bronzové ozdoby odevu zastupuje niekoľko kusov polgulovitých plechových nášiviek rôzneho priemeru s vnútorným uškom (obr. 6: 7, 9, 10).

Zo systematického výskumu na Hornom hrade poznáme aj nálezy, prevažne fragmenty bronzových sekier (obr. 8: 2–4) a kosáka (obr. 8: 5). Spôsob ich poškodenia indikuje (lomý na zlomkoch), že k nemu prišlo najskôr pri pracovnej činnosti. Na terasách tzv. Dončovho hradu však bola objavená aj jedna celkom neporušená zdobená sekerka s asymetricky (zobákovite) vykrojenou tuľajkou oproti ušku (obr. 8: 1), ktorú možno datovať do konca mladšej a na začiatok neskorej doby bronzovej (stupne HA2–HB1). K nezvyčajným nálezom z lokality patria ploché kovové hroty šíпов so spätnými krídelkami a zdeformovaným, dlhým obdĺžnikovitým trňom (obr. 8: 6, 7). Z areálu Horného Pustého hradu pochádza aj solitérny nález bronzového hrotu s mandľovitým tvarom listu a tuľajkou, ktorý bol objavený ešte v roku 1996 (obr. 7: 1; Mosný 1997, 135, obr. 95). Jeho malá dĺžka (10,5 cm) naznačuje, že nešlo primárne o kopiju, ale skôr o hrot vrhacej zbrane, teda oštep.

Pri príležitosti spracovania pravekých artefaktov zo zliatiny medi z lokality Pustý hrad sme sa rozhodli zverejniť aj významný starší, ojedinelý nález, takmer úplne zachovaný krátky bronzový meč (obr. 10) s dĺžkou viac než 28,4 cm. Objavený bol pod hradným kopcom, v polohe Červený medokýš, konkrétne pri Teplom potoku, ktorý sa vlieva do rieky Hron. S ohľadom na jeho typologické črty, relatívne krátku čepeľ, ale tiež aktuálny stav poznatkov o osídlení zvolenského mikroregiónu v mladšom praveku, sa jeho vznik najpravdepodobnejšie datuje na začiatok mladšej doby bronzovej.

Rozmanitý súbor artefaktov z obdobia kultúr popolnicových polí, objavený na Hornom hrade, ďalej poodhaľuje intenzívnu prítomnosť, pohyb a aktivity ľudí na tejto strategickej výšinnej polohe. Mnohé z analyzovaných predmetov sa však našli značne poškodené, resp. iba ich malé fragmenty, často bez diagnostických znakov, bez čoho ich nie je v zásade možné identifikovať. Artefakty, ktoré však bolo možné určiť, sú dôležitým svedectvom napríklad o existencii poľnohospodárskej (kosák; obr. 8: 5), hrnčiarskej (do kruhu obrúsené črepy), textilnej (záväžia, prasleny, šidlá, cievky; obr. 8: 9; 9) či metalurgickej produkcie (kruhové pliešky; tégly; obr. 7: 2, 3, 13–16) v areáli hradiska. O každodenných aktivitách obyvateľov lokality ďalej vypovedajú pracovné nástroje, ktoré boli späté so získavaním a spracovaním dreva (sekery; obr. 8: 1–4), ako aj militárie, využívané pri love zvierat alebo obrane sídla (oštep, hroty šíпов; obr. 7: 1; 8: 6, 7). Nálezy funkčných šperkov nám zároveň umožňujú utvoriť si predstavu o tom, aké typy ozdôb tvorili kraj, ktorý reflektoval príslušnosť k miestnej komunite, ale tiež môžu naznačiť, aké boli požiadavky na ich estetickosť (ihlice, spona, náramky, nášivky; obr. 6).

Jednotlivé etapy vývoja osídlenia na Hornom Pustom hrade v mladšom praveku boli nedávno rámcovo zadefinované na základe vyhodnotenia keramického materiálu do troch fáz (Beljak Pažinová/Godiš/Beljak 2023, 98). Tieto etapy pokrývajú vývoj od pokročilej mladšej doby bronzovej (stupeň HA1), cez neskorú dobu bronzovú (stupeň HB1–2), až po začiatok doby halštatskej (stupeň HC1), čo zodpovedá približne obdobiu od 12. až po 8. storočie po Kr. Z hľadiska tu analyzovaných kovových nálezov sú prvé dve etapy adekvátne reprezentované nálezmi ihlíc a spony, keďže ide o relatívne chronologicky najcitlivejšiu skupinu artefaktov. Predmety, ktoré by boli typické pre počiatok doby železnej zatiaľ v areáli hradiska nie sú evidované.

Doteraz sa na Pustom hrade nepodarilo zistiť stopy po trvalejšom osídlení, ktoré by tam bolo založené už v čase infiltrácie pilinskej kultúry do južnej časti Zvolenskej kotliny, ku ktorej došlo najskôr od záveru stupňa BC2 (Zachar/Malček 2011, 33–36, obr. 10). Vznik výšinnej osady vo vrcholovej časti Pustého hradu možno bezpečne spájať až so stupňom HA1, keď sú v archeologickom prameni zreteľné výrazne stopy po expanzii lužickej kultúry z regiónu Liptova, Turca a horného Ponitria do Zvolenskej kotliny a jej rýchlemu etablovaniu sa v tomto priestore (Beljak Pažinová 2018, 19, tam ďalšia literatúra; Kujovský 1994, 307, mapa 1; 2015, 180; Zachar/Malček 2011, 36, 37). V tejto súvislosti nemožno vylúčiť ani krátkodobú koexistenciu nositeľov lužickej kultúry s už skôr prítomnou enklávou pilinskej kultúry (Zachar/Mitáš 2012, 419–421), na čo poukazujú aj výsledky analýzy materiálu z Dolného hradu (Beljak et al. 2014, 119). Pri celkovom hodnotení pravekých hnutelných nálezov z Pustého hradu je potrebné osobitne zdôrazniť charakter keramiky z neskorej doby bronzovej, v ktorej sa súčasne vyskytujú prvky typické pre hrnčiarsky štýl lužickej aj kyjatickej kultúry. Zadefinovať presnejšie ich vzájomný podiel výskytu nie je z objektívnych dôvodov možné, avšak svojrázna keramika kyjatickej kultúry je na lokalite nepochybne zastúpená v tak výraznej miere, že je možné predpokladať jej lokálnu produkciu. Praveká kamenno-hlinitá fortifikácia na Hornom hrade bola pravdepodobne vybudovaná práve počas tejto fázy osídlenia (stupeň HB1–2). Aktuálny stav výskumu naznačuje, že stopy po sídelných aktivitách sa v závere doby bronzovej a na počiatku doby železnej (na prelome stupňov HB/HC) z lokality postupne vytrácajú. V tejto súvislosti sa vo všeobecnosti uvažuje, že vtedy došlo k určitej spoločensko-kultúrnej kríze, ktorá zasiahla rozsiahle územie severnej časti Karpatskej kotliny a mohla do istej miery viesť až k čiastočnej depopulácii niektorých regiónov.

Na základe doteraz získaných poznatkov možno konštatovať, že návršie Pustého hradu nad sútokom meandrujúcich riek Slatiny a Hrona sa už v priebehu mladšej doby bronzovej stalo vyhľadávaným miestom, kvôli jeho strategickej polohe poskytujúcej kontrolu nad priľahlým okolím. Výšinná osada sa následne po vybudovaní fortifikácie podľa všetkého transformovala na dôležité regionálne mocensko-správne centrum so silným hospodárskym zázemím, ktoré nadviazalo kultúrno-obchodné kontakty s oblasťami ďaleko presahujúce Zvolenskú kotlinu.

Obr. 1. Zvolen-Pustý hrad, Horný hrad. Letecká snímka areálu vrcholovej plošiny zo severovýchodu. Autor J. Beljak.

Obr. 2. Zvolen-Pustý hrad, Horný hrad. Skúmané archeologické sondy v rámci sezón 2016–2023. Autori J. Beljak, N. Beljak Pažinová.

Obr. 3. Zvolen-Pustý hrad, Horný hrad. 1 – letecká snímka areálu vrcholovej plošiny s vyznačením dokumentovaných zvyškov pravekého valu pod stredovekou hradbou (značené žltou líniou; A – umiestnenie sondy 5B/2018; B – umiestnenie sondy 2/2022); 2 – severný profil sondy 5b/2018; 3 – západný profil sondy 2/2022. Legenda: a – pôdny kryt (lesný humus); b – deštrukcia stredovekej hradby; c – praveký val (červenkastá hlina a lomové kamene); d – vrstva hliny a malty; e – stredoveká hradba (pôvodná); f – skalné podložie (andezit); g – nie pôvodné kamenné murivo; h – stredoveká hradba (rekonštrukcia). Autori J. Godiš, N. Beljak Pažinová, J. Beljak.

Obr. 4. Zvolen-Pustý hrad, Horný hrad. 1 – pozostatok prepálenej hlinenej podlahy obydla s nálezom kostrových pozostatkov dieťaťa z neskorej doby bronzovej v sonde 5A/2016 (foto terénu J. Beljak); 2 – zachované kostrové pozostatky dieťaťa v sonde 5A/2016 (foto skeletu: M. Putško); 3 – časť pôdorysu sondy 5A/2016. Legenda: A – skalné podložie (andezit); B – kultúrna vrstva z doby bronzovej; C – stredoveká hradba; a – pozostatky pravekého opevnenia; b – črepy z doby bronzovej; c – kostra dieťaťa; d – spálená podlaha a popolovitá vrstva. Autori J. Godiš, N. Beljak Pažinová.

Obr. 5. Zvolen-Pustý hrad, Horný hrad. Výsledok absolútneho datovania dvoch vzoriek. 1 – dieťa zo sondy 5A/2016; 2 – kostené šidlo zo sondy 3A/2019. Vizualizácia Calib 8.1.0. <http://calib.org/calib/> [20. 12. 2024].

Obr. 6. Zvolen-Pustý hrad, Horný hrad. Vybrané kovové nálezy z mladšej a neskorej doby bronzovej. 1, 2, 5 – ihlice; 3 – spona; 4, 8, 11 – náramky; 6 – ihlica (?); 7, 9, 10 – nášivky. 1 – sonda 3/2007; 2 – sonda 5A/2016; 3 – sonda 3A/2022; 4 – sonda 1C/2018; 5 – sonda 3B/2021; 6 – sonda 6/2017; 7 – sonda 4/2020; 8 – sonda 3/2019; 9 – sonda 4/2019; 10 – sonda 5C/2016; 11 – sonda 1A/2021. Autori J. Godiš, I. Látečková.

Obr. 7. Zvolen-Pustý hrad, Horný hrad. Vybrané kovové nálezy a iné drobné artefakty z mladšej a neskorej doby bronzovej. 1 – hrot oštetu; 2, 3 – kruhové pliešky; 4–7, 10–12 – kovové tyčinky; 8 – kovové šidlo (?); 9 – kovový krúžok; 13 – keramický téglík s výlevkou; 14–16 – hrubostenné keramické nádoby. 1 – sektor 10/F, 1997; 2, 3 – sonda 4/2019; 4 – sonda 4B/2020; 5 – sonda 1A/2021; 6 – sonda 5C/2016; 7 – sonda 3/2019; 8 – sonda 4A/2020; 9 – sonda 3B/2021; 10 – sonda 2/2021; 11 – sonda 3/2019; 12 – sonda 1A/2022; 13 – sonda 5A/2016; 14 – sonda 5C/2016; 15 – sonda 5C/2016; 16 – sonda 3/2019. Mierka: a – 1; b – 2–16. Autori J. Godiš, I. Látečková.

Obr. 8. Zvolen-Pustý hrad, Horný hrad. Vybrané kovové a iné nálezy z mladšej a neskorej doby bronzovej. 1–4 – sekery; 5 – kosák; 6, 7 – hroty šípov; 8 – kovová ihla; 9 – kostené šidlo; 10 – kostená ihla. 1 – sonda 2/2005; 2 – sonda 3/2017; 3 – sonda 1C/2018; 4 – sonda 1A/2021; 5 – sonda 5/2020; 6 – sonda 3/2019; 7 – sonda 3/2017; 8 – sonda 5B/2016; 9 – sonda 5/2016; 10 – sonda 5B/2016. Autori J. Godiš, I. Látečková.

- Obr. 9. Zvolen-Pustý hrad, Horný hrad. Vybrané hlinené predmety z mladšej a neskorej doby bronzovej. 1 – sonda 5/2016; 2, 3 – sonda 4/2019; 4 – sonda 1/2016; 5 – sonda 1/2016; 6 – sonda 5A/2016; 7 – sonda 5A/2016; 8 – sonda 5/2016; 9 – sonda 4/2019; 10 – sonda 5/2016; 11 – sonda 5C/2016; 12, 13 – sonda 5A/2016; 14 – sonda 1/2016; 15, 16 – sonda 4/2019; 17–19 – sonda 3/2019; 20, 21 – sonda 4/2019; 22 – sonda 5A/2016; 23 – sonda 3/2019. Autor J. Godiš.
- Obr. 10. Zvolen-Červený medokýš. Meč/dlhá dýka s jazykovitou rukoväťou spod Horného Pustého Hradu pri Teplom potoku vlievajúcim sa do toku Hrona. Ojedinelý nález. Autori J. Godiš, I. Látečková.

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BRONZE SPEAR/JAVELIN HEADS FROM THE HOMELAND MUSEUM IN HLOHOVEC¹

Use-Wear Analysis, XRF Measurements and Radiocarbon Dating

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This paper presents a detailed analysis of a set of bronze spear/javelin heads from the Urnfield cultures, stored in the Homeland Museum in Hlohovec (Vlastivedné múzeum v Hlohovci). Altogether, six artefacts originating from various archaeological sites in the Váh river basin are studied, most of them characterized by strongly curved blades. The authors provide a typo-chronological, use-wear, and XRF analyses of these artefacts. In one particular case, a radiocarbon date from remnants of a wooden shaft preserved in the spearhead socket is published, highlighting a remarkable fact – the secondary reuse of this weapon in the Early Modern period. The paper also acknowledges that the distribution of the analysed types of spear/javelin heads extends beyond not only the museum's collecting area but also Slovakia's borders. Detailed studies of similar weapon assemblages from museum collections, including isolated Bronze Age finds, provide valuable insights into their usage and subsequent histories.

INTRODUCTION

A wide array of prehistoric weapons is stored in the archaeological collections of Slovak museums. Some of these have not yet been analysed in detail or published. One reason for this is that many are single finds with unclear discovery circumstances. Nevertheless, we believe that if typologically similar archaeological finds are part of a museum collection, publishing them in a comprehensive manner is worthwhile. Collections of this kind may (and generally do) originate from the museum's own collecting region and thus at least reflect the regional specifics of the artifacts under study and the issues in question. This also applies to the set of bronze spear/javelin heads from the Urnfield cultures deposited in the Homeland Museum in Hlohovec (Vlastivedné múzeum v Hlohovci).

In total, these are six artefacts from various archaeological sites in the Váh River basin, mostly spearheads with strongly curved blades. The aim of this contribution is to present a typological-chronological analysis, XRF analyses, and use-wear analyses of the items in question, and, in one case, to publish ¹⁴C data from the wooden shaft fragment preserved in one of the sockets. At the same time, we must not overlook the fact that the distribution of these bronze spear/javelin heads extends beyond not only the collecting region of the Homeland Museum in Hlohovec, but also beyond the borders of Slovakia. The purpose of the analyses presented here is to deepen our knowledge of these types of specialized Urnfield culture weapons housed at the above-mentioned museum (Mitáš *et al.* 2018, 229–233) and to shed light on their broader archaeological context within Central Europe.

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Tab. 1. Metric measurements of the analysed spear/javelin heads.

Site	Max. length [mm]	Max. width [mm]	Length of the socket [mm]	Outer diameter of the socket [mm]	Inner diameter of the socket [mm]	Max. diameter of the rivet holes [mm]	Distance between rivet holes and base of the leaf [mm]	Weight [g]
Banka	243	37	85	27	24	5	36	171.6
Hlohovec I	270	39	88	26	24	5	38	218.3
Hlohovec II	139	26	66	27	21	3	–	78.7
Madunice	170	34	35	19	13	–	–	94.6
Piešťany	235	41	76	25	23	5	33	193.4
Šintava	154	29	54	26	22	5	46	98.8

SPEAR/JAVELIN HEADS FROM THE HOMELAND MUSEUM IN HLOHOVEC

Six spearheads from the collection of the Homeland Museum in Hlohovec were made available for study. Below is a description of these objects along with the context of their discovery. Drawings, or in some instances photographs of these spearheads, together with catalogue of spearheads from the area of the Váh river valley were published in *V. Mitáš et al. (2018)*. Metric measurements of each are presented in Tab. 1. As the differentiation between spear and javelin heads is quite troublesome (*Mitáš et al. 2018, 238*), we will refer to significantly larger examples (longer than 20 cm; Banka, Hlohovec I, Madunice, Piešťany) as spearheads, to the smallest from Hlohovec II as javelin head, and to specimen from Šintava as spear/javelin head (as it is intermediate in weight and length).

1. Spearhead from Banka

(Inv. no. A-78; reg. no. 119/65; Pl. I: 1)

Found in either 1903 or 1914, most likely at Osvaldova tehelná in Banka. According to the publication *História Banky (Klčo/Krupa 2004, 13)*, the spearhead was discovered at Osvaldova tehelná in 1914 by Š. Osvald. His son, J. Osvald, donated it to the museum in 1965. However, the inscription *Talalt 1903* (Hungarian for found in 1903) is engraved on the piece, contradicting this information (*Mitáš et al. 2018, 232, 233*). The spearhead has a strongly curved blade with a stepped profile. The tip is broken, the blade is slightly bent, and there are numerous damage marks along the edges, some of them covered with patina. The casting seams have been removed. A preserved fragment of an oak (*Quercus sp.*) shaft remains inside the socket (*Mihályiová 2016; Mitáš et al. 2018, 238*). Most of the surface is covered with a well-preserved dark green patina, though it is missing in certain sections, particularly along parts of the edges and the exposed fracture surface where the break occurred near the tip.

2. Spearhead from Hlohovec

(Hereinafter referred to as Hlohovec I; inv. no. A-8, reg. no. 56/64; Pl. II: 1)

No information is available regarding the circumstances and context of its discovery. It was found before 1964, as indicated by the date of its entry into the museum inventory. The spearhead has the same flame-shaped blade and stepped profile as the previously described specimen. It is significantly bent, and numerous damage marks are present along the edges. The midrib is cracked at the midpoint of the spearhead's total length. The casting seams have been removed. The surface retains a dark grey to black patina, particularly on the socket and the lower part of the blade. However, in many areas, the underlying colour of bronze is exposed. Minor traces of corrosion are visible along the edges, especially in small section of the lower, widened part of the blade.

3. Javelin head from Hlohovec

(Hereinafter referred to as Hlohovec II; inv. no. A-198, reg. no. 126B/76; Pl. II: 2)

According to the museum catalogue, this is a single find from 1976. The spearhead has a triangular blade shape with no profilations on either the socket or the blade. Casting seams have been removed. It is covered by a very thick layer of dark grey patina. The socket is broken, with the fracture surface also covered in patina. Minor damage is visible along the edge, particularly on one side of the blade.

4. Spearhead from Madunice

(Inv. no. A-9, reg. no. 57/64; Pl. I: 2)

According to the museum catalogue, the spearhead was found in 1960 by D. Tomeček. No further information regarding the finding circumstances or context is available.

The spearhead has a strongly curved blade with a stepped profile. The casting seams have been removed. Its surface is covered with a dark grey to black patina, but in many areas – especially near the edges of the blade – the colour of bronze is exposed. The edges are heavily corroded and also show marks of mechanical damage. The socket is broken, with the fracture surface at its end covered in patina. It was broken above the rivet holes, which are therefore not preserved. Three modern drilled holes are present in the lower part of the blade. The tip is asymmetrical.

5. Spearhead from Piešťany

(Inv. no. A-318, reg. no. 570/85; Pl. III: 1)

Discovered in 1985 during the extraction of gravel from the Váh riverbed in the locality of Lido, where a ford was once located. A bronze sword was also found at this site (*Pastorek 1986, 180*). Additionally, a total of four swords (including previously mentioned) and two spearheads have been reported from this locality. Two swords have been assigned chronologically – one can be dated to the end of the Middle Bronze Age, while the other belongs to the Older Urnfield Period (*Bartík 1997, 421–423*). The spearhead has the same strongly curved blade with a stepped profile as the previously described specimens. It is well-preserved, with a relatively thin patina in a light brown colour, partially also covered with a grey to nearly black patina. There are relatively few signs of mechanical damage, though the tip is bent and cracked. Modern damage is visible on the midrib, likely caused by the use of heavy machinery during excavation work in the Váh riverbed. The patina is worn off on one side of the socket and near the edges. The bevels are not visible.

6. Spear/javelin head from Šintava

(Inv. no. A-460, reg. no. 26/18; Pl. III: 2)

A single find discovered in 2014 in the “Nad Mostom” locality, found in a plough furrow or wheel rut in a field. The object was delivered to the museum by the finder (*Mitáš et al. 2018, 229–232*). Spearhead features a laurel-shaped blade, has a midrib with three ribs that merge approximately 2 cm under the tip. The central rib terminates 1 cm above the blade base, while the lateral ribs extend onto the socket, curving approximately 0.5 cm below the blade base and creating a thickening along the sides. Two rivet holes are present below the leaf. A preserved fragment of the wooden shaft remains inside the socket, archaeobotanical analysis indicates the presence of silver fir (*Abies alba*) wood (*Mihályiová 2015; Mitáš et al. 2018, 238*). Significant damage is visible on one side, where the midrib is cracked, part of the blade is crushed, and a portion is missing. The socket is noticeably bent. These distinct damages can be linked to agricultural activity, most likely resulting from the spearhead being crushed by farming machinery. Few use-wear marks are visible on the preserved edge. Partial cleaning after discovery resulted in a surface unevenly covered with a blue-green patina, with most of the original patina preserved on the socket. Slight corrosion marks can be observed on the blade's surface (*Mitáš et al. 2018, 231, 232, 235; 2020, 112, 113*). The radiocarbon dating of the wood from the socket indicates the secondary use of the object in the Early Modern period, in the 16th–17th c. AD.

TYPOLOGICAL AND CHRONOLOGICAL CONSIDERATIONS

Bronze spear/javelin heads have so far been classified according to typologies proposed by various authors, which often differ considerably from each other (a detailed overview is provided in *Bader 2006*). In this chapter, we have primarily decided to utilize the typology proposed by *T. Bader (2015)*, as it covers the Central European area of interest and represents one of the most recent approaches.

Within the mentioned spearheads, three types can be distinguished. The spearheads from Banka, Hlohovec I, Madunice, and Piešťany share a number of common features and will therefore be discussed together. The spear/javelin head from Šintava and javelin head from Hlohovec II have been classified separately. The typological classification within selected typologies is presented in Tab. 2.

Tab. 2. Classification of the spear/javelin heads within in selected typologies.

Site	<i>Furmánek 1977</i>	<i>Říhovský 1996</i>	<i>Gedl 2009</i>	<i>Óivecky 2010</i>	<i>Vasić 2015</i>	<i>Bader 2015</i>
Banka	type IIIb; flame-shaped spearhead with flame-like profilation	socketed spearhead, belonging to group with profiled leaf and smooth socket, main form (Grundform) C (flame-shaped), medium-wide form with maximum width in the lower part of the blade; variant with free socket shorter than half the total length	spearhead with stepped leaf, flame-shaped variant	spearhead with a smooth socket and a profiled leaf, flame-shaped, large variant	spearhead with curved leaf, variant 2 (leaf with stepped profile)	group B (with profiled leaf), spearhead with strongly curved leaf, variant b1 or b2 (with stepped profilation of the leaf and semi-circular or pointed cross-section of the midrib)
Hlohovec I	type IIIb; flame-shaped spearhead with flame-like profilation	socketed spearhead, belonging to group with profiled leaf and smooth socket, main form (Grundform) C (flame-shaped), medium-wide form with maximum width in the lower part of the blade; variant with free socket shorter than half the total length	spearhead with stepped leaf, flame-shaped variant	spearhead with a smooth socket and a profiled leaf, flame-shaped, large variant	spearhead with curved leaf, variant 2 (leaf with stepped profile)	group B (with profiled leaf), spearhead with strongly curved leaf, variant b1 or b2 (with stepped profilation of the leaf and semi-circular or pointed cross-section of the midrib)
Hlohovec II	–	closest to socketed spearhead, belonging to group with smooth leaf and smooth socket, main form (Grundform) B (rounded leaf), narrow form with maximum width in the lower part of the blade; variant with a free socket constituting half the total length	most similar to some examples assigned as medium-sized and small spearheads with laurel-shaped blades	most similar to spearhead with a smooth leaf and smooth socket, with a laurel-shaped leaf, small variant, subvariant with a slender leaf and an extremely long socket	closest to spearhead with willow-leaf shaped leaf	group A (simple, plain spearheads, with smooth leaf and smooth socket), with triangular or rhombic leaf
Madunice	type IIIb; flame-shaped spearhead with flame-like profilation	socketed spearhead, belonging to group with profiled leaf and smooth socket, main form (Grundform) C (flame-shaped), medium-wide form with maximum width in the lower part of the blade; variant with free socket shorter than half the total length	spearhead with stepped leaf, flame-shaped variant	spearhead with a smooth socket and a profiled leaf, flame-shaped, large variant	spearhead with curved leaf, variant 2 (leaf with stepped profile)	group B (with profiled leaf), spearhead with strongly curved leaf, variant b1 or b2 (with stepped profilation of the leaf and semi-circular or pointed cross-section of the midrib)
Piešťany	type IIIb; flame-shaped spearhead with flame-like profilation	socketed spearhead, belonging to group with profiled leaf and smooth socket, main form (Grundform) C (flame-shaped), medium-wide form with maximum width in the lower part of the blade; variant with free socket shorter than half the total length	spearhead with stepped leaf, flame-shaped variant	spearhead with a smooth socket and a profiled leaf, flame-shaped, large variant	spearhead with curved leaf, variant 2 (leaf with stepped profile)	group B (with profiled leaf), spearhead with strongly curved leaf, variant b1 or b2 (with stepped profilation of the leaf and semi-circular or pointed cross-section of the midrib)
Sintava	similar to type Ib; broad spearhead with rounded leaf and profiled socket	socketed spearhead, belonging to group with smooth leaf and profiled socket, main form (Grundform) B (rounded leaf), medium-wide form with maximum width in the lower part of the blade, variant with free socket shorter than half the total length	spearhead with ribbed socket (or socket extension, Tüllenverlängerung)	spearhead with profiled socket and a smooth leaf, almond/laurel shaped leaf, large variant	spearhead with profiled socket (mit profilerter Blatttülle)	group C (with profiled midrib, with two lateral ribs extending below the blade base), variant e (trapezoidal cross-section of the midrib, with three ribs and gaps between them)

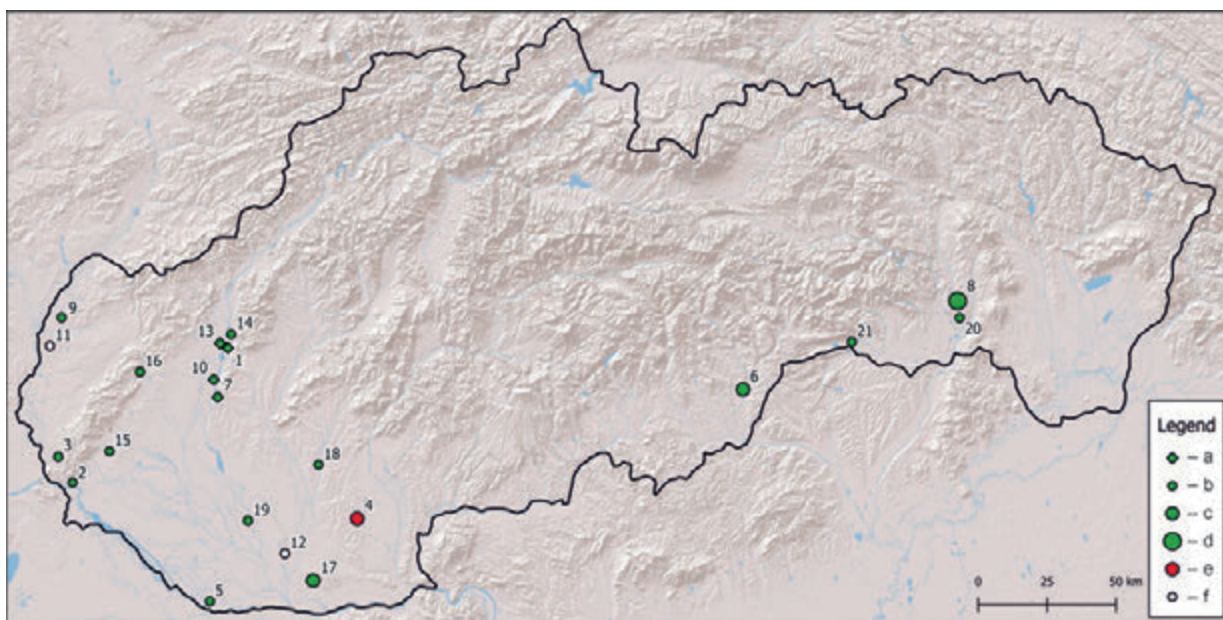


Fig. 1. Map of analogies for spearheads with strongly curved blade and step-like profilation on the leaf. 1 – Banka; 2 – Bratislava; 3 – Bratislava-Záhorská Bystrica; 4 – Čaka; 5 – Čičov; 6 – Gemer; 7 – Hlohovec I; 8 – Košické Olšany; 9 – Kúty; 10 – Madunice; 11 – Moravský Svätý Ján; 12 – Nesvady; 13 – Piešťany; 14 – Piešťany (Ducové); 15 – Slovenský Grob; 16 – Smolenice; 17 – Svätý Peter; 18 – Vajka (Lúčnica nad Žitavou); 19 – Vlčany; 20 – Vyšná Hutka; 21 – Zádiel. Legend: a – the spearheads discussed in this article; b – finds of spearheads from Bader's Group B, variant 6 (one specimen); c – finds of spearheads from Bader's Group B, variant 6 (two specimens); d – finds of spearheads from Bader's Group B, variant 6 (three specimens); e – finds of spearheads from Bader's Group B, variant 7 (two specimens); f – possible finds of spearheads with strongly curved blade and step-like profilation on the leaf. Author J. Wójcik.

Spearheads with profiled leaf and strongly curved blades (Banka, Hlohovec I, Madunice, Piešťany)

A characteristic feature of these four spearheads (respectively Pl. I: 1, 2; II: 1; III: 1) is their strongly curved blade shape (sometimes also referred to as flame-like or pear-shaped) and the presence of profiling on the blade in the form of a step, resembling leaf contour. All are of large dimensions – three well-preserved examples exceed 20 cm in length, while the fourth (from Madunice), if complete, would also be longer. In *T. Bader's* typology (2015), these spearheads can be classified as belonging to Group B (with a profiled leaf), variant 6 (spearheads with a strongly curved blade). The examples from Banka, Piešťany, Hlohovec, and Madunice fall into subvariant b (featuring step-like profiling on the blade). Within this subvariant, the author distinguishes three possible cross-sections of the midrib: semi-circular (b_1), pointed (originally dachförmig; b_2), and trapezoidal (b_3). The described spearheads correspond most closely to the first two subvariants. Distribution of analogical spearheads in Slovakia is presented in Fig. 1.

Among Slovak finds, T. Bader classifies as in this type the single finds from Vajka (now part of Lúčnica nad Žitavou; *Veliačik* 1975, 112, fig. 98) and Bratislava, as well as two spearheads from a collection of Late Bronze Age artefacts from Dolný Peter (now Svätý Peter), which *J. Paulík* (1963, 314, fig. 44) interpreted as part of a grave inventory. However, it is worth noting that one of the spearheads from this site, judging from the drawing, does not have a stepped profiling on the blade (*Novotná* 2007, fig. 2).

This group also includes a specimen from the Zádiel hoard, which exhibits identical typological features – strongly curved blade outline, step-like profiling on the leaf, and large dimensions – but differs in its trumpet-shaped socket ending. This hoard is dated to the Late Bronze Age (BrD–HaA; *Gašaj* 1994, 29). Three of the five spearheads from the Košické Olšany hoard belong to this type. The fourth spearhead, although also featuring a strongly curved blade, appears to lack step-like profiling; additionally, unlike the others, it has a profiled socket, as inferred from the published photographs. *E. Miroššayová* (1998/1999, 127, 128, fig. 2; 11; 1999, 142, 143) dated the hoard to the older Urnfield Period, corresponding to phases BrD–HaA1 in P. Reinecke's chronology. A somewhat similar spearhead appears in the Vyšná Hutka hoard, though it has a much slimmer, narrower, and thinner blade with a more angular lower section.

This hoard was classified by M. Novotná within the Oždany horizon, dating to the transition between phases BrC2 and BrD (Novotná 1959, 1, fig. 3: 5; 1970, 30, 31, 34).

A spearhead in this style was likely discovered in Vlčany (Farkasd), described by J. Hampel as being found at a settlement alongside other Bronze Age artefacts during river regulation work on the Váh (Hampel 1892, pl. CXXXI). Other, single finds include specimens from Kúty (Pichlerová 1957, 65, 66, pl. I: 3), Smolenice (Molpír site; Ōlvecký 2010, 43), and Bratislava-Záhorská Bystrica (Novotná 1987, 79, 136, fig. 35), as well as a fragment from Slovenský Grob (Bartík 2011, 45, 46). Two additional spearheads, possibly found in Gemer, display all the aforementioned typological characteristics (Hampel 1886, pl. CXV: 4, 5; Márton 1904, 444, 445). Additional examples include a spearhead from Čičov (Barta/Willvonseder 1934, 11, fig. 1: 5) and from surroundings of Piešťany (possibly from the Ducové settlement? Bača/Krupa 1998, 85, pl. LXXXVIII: 1488). The group may also include a single find from Moravský Svätý Ján, though it is only schematically illustrated (Paulík 1972, 13, pl. IX: 9), as well as a spearhead from Nesvady, now lost, which was possibly part of a richly furnished grave (containing gold artefacts) and is very schematically represented in a find report (Szőke 1953).

Two specimens come from unknown locations: one, damaged, is housed in the Balneological Museum in Piešťany (Bača/Krupa 1998, 57, pl. XXXVII: 328), while the other, well-preserved but unpublished, is in the Slovak National Museum in Martin.

A related variant in Bader's typology, described as spearheads with a slightly flame-shaped blade, includes the specimen from grave II at Čaka, which also exhibits step-like profiling on the leaf. The second, smaller spearhead from the same grave likely belongs to this type as well, although it is heavily damaged. Grave II from Čaka is dated to phases BrD and HaA. (Točík/Paulík 1960, 74, 75, 93).

For some Slovak spearheads, an exact typological or chronological classification was not possible. This applies particularly to the spearhead found in the barrow in Očkov. It exhibits step-like profiling on the blade, but the fragment is too small to determine the overall shape of the leaf (Paulík 1962, fig. 27: 2). Additionally, G. Jacob-Friesen (1967, 371, tab. 112: 1) locates a flame-shaped spearhead with a profiled blade in Sása (originally recorded in the R. G. Z. M. catalogue as "Szaska, Northern Hungary").

To summarize, well-dated Slovak specimens mainly appear in the early and older phases of the Urn-field Period, in BrD and HaA (Novotná 2007, 162). If we consider the somewhat different specimen from Vyšná Hutka, then the transition between phases BrC (C2) and D should also be taken into account as the earliest occurrence of the type. Taking into account the dating of analogies from other regions, the overall chronological range can be estimated to cover phases BrB1–HaB1, with the highest number of finds in BrD and HaA1, as discussed below.

This spearhead type extends across a broad area, with the most numerous examples found in Hungary, Slovakia, Romania, Croatia, and Serbia. To a lesser extent, they also appear in Austria, Bohemia, Switzerland, and northern Germany (Říhovsky 1996, 80). Their northernmost occurrence is a find from the grave in southern Sweden (Köpinge, Skåne), dated to Bronze Age Period II or III (Gedl 2009, 67; Jacob-Friesen 1967, 223; Tarot 2000, 12). In Poland, they are rare and mark the north-eastern boundary of their distribution, with find from Pomerania (Suchostrzygi, now part of Tczew), and are dated to the Periods III and IV of the Bronze Age (Gedl 2009, 66, 67). Only a few examples have been found in Switzerland, reaching its western part (Cheseaux-sur-Lausanne, canton Vaud) and they are dated to BrD and HaA phases. A typologically similar spearhead, particularly in blade form and profiling, was found in St. Jean de Maurienne, south-eastern France, though it is very small, only 8 cm long (Tarot 2000, 11, 55). This spearhead variant is also found in north-eastern Italy, specifically in Alto Adige/Südtirol and Friuli-Venezia Giulia, where is dated to the Recent Bronze Age in Italian chronological system (Bruno 2012, 117, 118, 122). To the south, they appear in the northern Balkans, in Croatia, Serbia, Romania, and Bosnia and Herzegovina, mainly in the regions of Banat, Syrmia, Bačka, Mačva, eastern Serbia, and Transylvania. The North Balkan specimens are dated from the BrD to HaB1 periods. (Bader 2015, 382–384; König 2004, 31; Vasić 2015, 59, 60). To the east, they are distributed in Transcarpathia, examples of variants b₁ and b₂ appear within the hoards assigned to Lazy I, Kriva, and Suskovo series (BrD–HaA2; Bader 2015, 383, 384; Kobal 2000, 33–35).

The earliest known example of this spearhead type comes from the Úzd hoard (modern Sárszentlőrinc), which belongs to the Koszider hoard horizon (variously dated; BrB1–B2/C1 or BrB2). Notably, no examples of this type have been recorded in Hungary during the subsequent Forró phase, and they reappear, in a relatively small number, in the Ópályi hoard horizon (BrC2/D). They continue to be relatively scarce in the Aranyos horizon (BrD–BrD/HaA1), however, the Kurd phase (HaA1) brings the largest number of finds (Bader 2015, 383; Mozsolics 1967, 174).

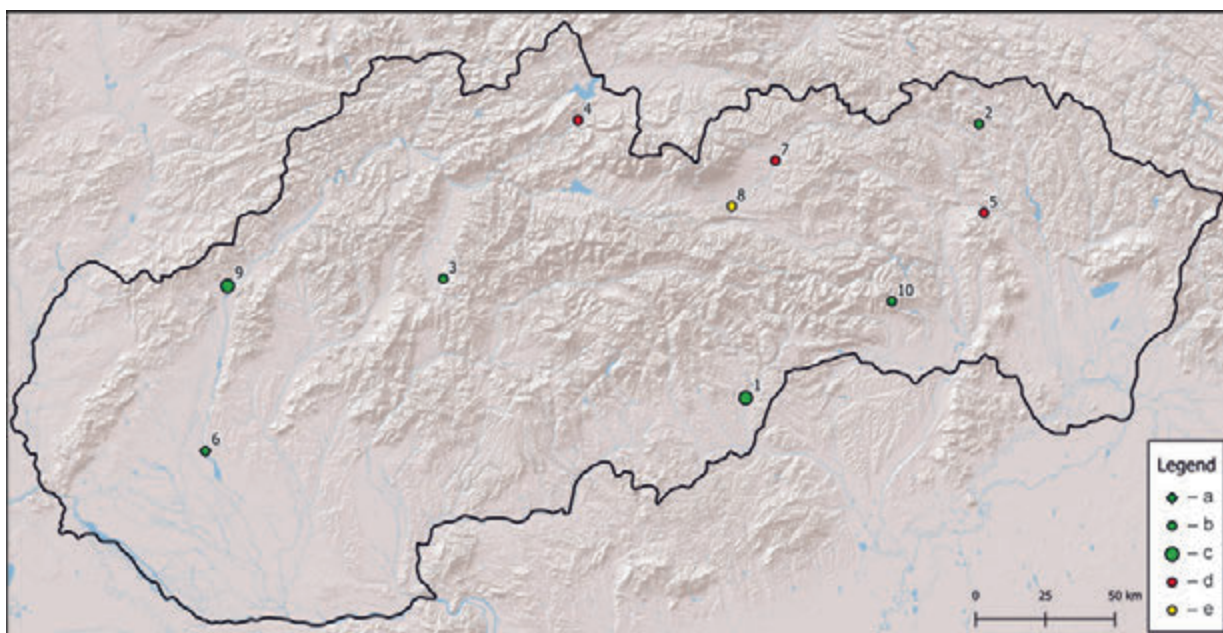


Fig. 2. Map of analogies for spearhead from Šintava. 1 – Gemer; 2 – Hažlín; 3 – Horná Štubňa; 4 – Nižná; 5 – Pavlovce; 6 – Šintava; 7 – Spišská Belá; 8 – Spišská Teplica; 9 – Trenčianske Bohuslavice; 10 – Zlatá Idka. Legend: a – spearhead from Šintava; b – finds of spearheads from Bader's Group C, variant e (one specimen); c – finds of spearheads from Bader's Group C, variant e (two specimens); d – finds of spearheads from Bader's Group C, variant d (one specimen); e – finds of spearheads from Bader's Group C, variant f (one specimen). Author J. Wójcik.

In the case of Bohemia, the oldest find of this type comes from the Varvažov hoard, which *O. Kytlicová* (2007, 108, 109) assigns to the Plzeň-Jíkalka horizon (BrC2–BrD). These spearheads appear primarily in the Lažany (end of BrD) and the Suchdol (HaA1) phases, with the latest example occurring in the Jenišovice phase (HaA2–HaB1). In Moravia, the earliest finds are slightly later than the oldest ones from Bohemia and they are dated to Blučina phase (BrD). They also appear in two subsequent horizons, Drslavice and Přestavlky. The majority of them occur in the early and continue into the older Urnfield Period (BrD–HaA; *Říhovský* 1996, 79, 80). Spearheads with a strongly curved blade and step-like profilation are the most numerous spearheads type in Moravian hoards during the Late Bronze Age (*Salaš* 2005, 71).

Austrian specimens from Waldviertel are dated by *M. Lochner* (1991, 208, 211, 215) to the older Urnfield Period.

Spear/javelin head with profiled socket/midrib, with three ribs and gaps between them (Šintava)

The specimen from Šintava (Pl. III: 2) can be generally classified as a spear/javelin head with a smooth blade and a profiled socket. In Bader's typology, it falls under Group C (with a profiled midrib, with two lateral ribs extending below the blade base), specifically variant e (trapezoidal cross-section of the midrib, with three ribs and gaps between them). Distribution of analogical spearheads in Slovakia is presented in Fig. 2.

Among Slovak finds, T. Bader classifies two smaller spearheads from the Trenčianske Bohuslavice hoard within this variant, one of which has a more heart-shaped blade. This hoard is dated to HaA2 (*Novotná* 1970, 120, 121, pl. XII; *Veliačik* 1983, 247, pl. XL: 2, 5). He also includes two spearheads from the probable Gemer V hoard, actually a collection of bronze objects acquired by the Gemersko-malohontské múzeum in Rimavská Sobota in 1927, dated to the Ópályi horizon, BrC (C2)/D (*Mozsolics* 1973, 174) or to HaA (*Furmánek* 1977, 270, 272, pl. XX: 7, 8; *Paulík* 1965, 57, pl. V). At least one such spearhead was found in the hoard from Hažlín, an assemblage of bronze artefacts, part of which was purchased by the Regional Museum in Prešov in 1953 and the other part by the Bardejov Museum in 1956. This hoard is dated to

phase HaB, as noted by V. Budinský-Krička, specifically to its older phase, which allows it to be classified in HaB1 (Budinský-Krička 1967, 82, pl. II: 10; Novotná 1970, 95, 96).

The Horná Štubňa hoard also contained a spearhead classified by T. Bader in this group, though it differs significantly from the others, featuring an exceptionally broad blade and distinct contouring of the lateral ribs near the blade base. The second spearhead from the same hoard exhibits a different, rhomboidal blade shape and unique, wide ribs flanking the midrib. L. Veliačik dates the hoard from Horná Štubňa to BrD, or possibly to the beginning of HaA1 (Eisner 1937, 101, 102; Novotná 1970, 96; Veliačik 1983, 44, tab. 35: 6).

A spearhead of this type was found in the hoard from Zlatá Idka (Novotná 1970, 124; Spöthl 1886, 59).²

Similar examples, with three ribs on the socket, though less distinctly separated (variant d in T. Bader's typology; Bader 2015, 385, 386), also occur in Slovakia, including one in the Nižná hoard, assigned to phase HaA1 (Novotná 1970, 108; Veliačik 1983, 44, tab. 37: 8), another one in the Spišská Belá hoard, dated to HaA2 (Novotná 1970, 117) and a single find from Pavlovce (Jenčová 1993, 67, 157, fig. 28; Tarbay 2015, 334). The single find from Spišská Teplica represents T. Bader's variant f, also characterized by three ribs, with the lateral ones doubled under the base of the blade (Soják 1998, 155, 282, fig. 110: 6).

In summary, the appearance of this type in Slovakia is most likely dated from phase BrD, with the chronology of the oldest examples depending on the varying datings of the Gemer V hoard, while its presence is attested until phase HaB1. Considering finds from other regions, this variant exhibits a broad chronological range, spanning from phase BrD to HaB3, as will be discussed in the following paragraphs (Bader 2015, 386).

J. G. Tarbay (2015, 313, 314) devotes significant attention to this type of spearhead in his study on the reanalysis of the hoard from Gyermely, where he proposes a revised dating of the mentioned hoard to HaB1 while also noting the difficulties in distinguishing phase HaA2 in the Carpathian Basin. This hoard contained two similar spearheads, which can be classified in T. Bader's typology as variants d and e. A nearly identical specimen to the one from Šintava is the spearhead catalogued as No. 5, though it should be noted that its socket is broken. The author delineates the distribution range of analogous spearheads, extending west to Saxony (Zerbst), north to Greater Poland (a single find), east to western Moldavia (Ilișeni) in Romania, and south to Varna region in Bulgaria (Bozveliysko; Tarbay 2015, 314, 333, liste 1).

The largest number of finds of this variant comes from the area of present-day Hungary, with most discovered in hoards. The earliest Hungarian finds of variant e are dated to the Aranyos horizon (BrD/HaA1). They subsequently appear in the Kurd, Gyermely, and Hajdúböszörmény horizons (HaA1–B1), with the highest concentration in the Kurd phase. In the case of the few Croatian contexts containing this variant, they are classified within phases HaA1 and HaB1. Hoard finds from Serbia are chronologically classified into Stage II of the Urnfield period. In the case of Transylvanian finds, the majority originate from hoards associated with the Cincu-Suseni horizon (HaA1), with fewer occurrences in the subsequent Jupalnic-Turia stage (HaA2). The latest examples still appear in the hoard from Ghirișu Român, belonging to the Șomartin-Vetiș phase, dated to HaB3. Among Polish finds, the most typologically similar examples include single finds from Nowy Sącz-Biegonice and Greater Poland, as well as a grave find from Sobótka, and are dated to Bronze Age Period IV. In the Carpathian Ukraine, J. Kobaľ assigned the hoard find from Boržavskoe to the Lazy I phase, corresponding to HaA1 (Bader 2015, 386; Gedl 2009, 70; Kobaľ 2000, 76). In the case of Moravian finds, the spear/javelin head from Šintava strongly resembles one of the spearheads from the Drslavice I hoard, dated to the "older phase of the Older Urnfield Period" (approximately BrD). However, as J. Říhový (1996, 65) points out, the profilation on the socket of this spearhead is only reconstructed based on inventory documentation.

Unprofiled javelin head with triangular/rhombic blade (Hlohovec II)

In the case of the javelin head Hlohovec II (Pl. II: 2), a distinctive triangular blade shape is evident. The object does not feature any profiling, either on the socket or the blade. The classification of this specimen presents certain challenges, as such blade shape is extremely rare among Slovak examples from the Bronze Age. Entire javelin head is covered by a thick layer of patina, which prevents detailed documentation of any potential traces that might indicate whether the blade's shape was remodelled. Additionally,

² The authors would like to thank Mag. Dr. G. Tiefengraber for providing photographs of this spearhead, stored at the NHM Wien, which facilitated its typological classification.

the socket is damaged, making it impossible to assess its original length. Several factors suggest that the current shape of the javelin head's leaf is unlikely to be a result of corrosion. The preserved symmetry of the blade and the relatively straight edge outline, with only minor corrosion pits on one side, indicate that the blade's shape is intentional rather than a by-product of material degradation.

The total length of this javelin head is nearly 14 cm, despite being incomplete. This makes it longer than the javelin heads classified by J. Říhovský, who defines them as not exceeding 10 cm in length. However, it still fits within the older definition proposed by J. Szombathy, according to which such objects are identified as javelin heads when the blade (excluding the socket) is shorter than 8 cm (Říhovský 1996, 88).

In T. Bader's typology, the closest parallels to this object are possibly those classified under Group A (plain, simple spearheads without profilation on the leaf or on the socket), variants with rhombic or triangular blades. However, within the latter, he assigns Slovak finds with significantly broader blades than the example from Hlohovec. Among them, he lists spearheads from the hoards of Lesné and Spišská Belá – the first broadly dated, to the periods HaA and HaB1, while the second belongs to the Trenčianske Bohuslavice hoard horizon, corresponding to P. Reinecke's HaA2 (Bader 2015, 377; Novotná 1970, 46, 47, 103, 117, pl. XXXVI; 1991, 23). The closest Slovak analogy in terms of blade shape is a find from Gemer, which R. Žľvecky (2010, 27) classifies together with the spearhead from Horná Streda – the latter featuring a flame-shaped blade outline – into the subvariant of spearheads with a short, slender blade and an extremely long socket. Both of these artifacts are single finds, specimen from Horná Streda is only broadly dated to the Late Bronze Age (Novotná 1968, 40, pl. XII: 1; Žľďání 1988, 104, 165, fig. 30).

Considering finds from neighbouring areas, classification of similar spear or javelin heads varies significantly. The closest parallel in Moravia, in terms of the narrow blade shape, midrib cross-section and lack of profiling, albeit slightly different in the rounded lower part of the blade, is the specimen from Źeranovice. In J. Říhovský's typology, it is classified as a rounded form, medium-wide with maximum width in the lower part of the blade; variant with socket shorter than half of the total length. It is a single find, examples of this variant are dated from BrA2 up to the younger Urnfield period (Říhovský 1996, 39–41). In terms of blade shape, the javelin head from Hlohovec II is also close to some javelin heads from Moravia, which are classified in a group with a rounded blade. They are dated to the older Urnfield period (BrD–HaA1); however, the Northern European analogies are assigned to Period V of the Bronze Age, corresponding to phases HaB2–B3 (Říhovský 1996, 92–94, cat. no. 227–231). In the case of Polish finds, the closest in terms of the triangular blade shape is the single find from Mielno Pyrzyckie, classified in M. Gedl's typology within the group of medium-sized and small spearheads with laurel leaf-shaped blades. The dating of the entire variant spans from the Middle Bronze Age to the beginning of the Iron Age (Gedl 2009, 38–40, cat. no. 70). The blade shape also resembles some specimens of the type classified by G. Jacob-Friesen as Lüneburg Type I, particularly the find from Katzien in Lower Saxony (Jacob-Friesen 1967, cat. no. 1183). However, it should be noted that one of the defining features of this type is a long socket, a characteristic that cannot be determined for the spearhead from Hlohovec. Additionally, the spearhead from Katzien has a damaged blade on one side. This type is dated to Periods III and IV of the Bronze Age, which can be correlated with BrD–HaB1. In R. Vasić's typology (Vasić 2015, 39, 41), specimens with an extremely narrow, triangular blade without profiling (Vasić 2015, cat. no. 67–71) are classified in the group of willow leaf-shaped spearheads. However, as the author notes, the majority of these analogies have damaged blades. The rather diverse group of willow leaf-shaped spearheads is largely dated to Stage II, corresponding to the period from the end of BrD to the beginning of HaA2 (Vasić 2015, 7).

Overall, numerous spearheads described as having a severely damaged blade bear some resemblance to the examined piece (e.g., Tarot 2000, 28, cat. no. 283). It is possible that the leaf shape of the spearheads we regard as analogous did not originate from intentional design but rather resulted from damage, repairs made during their use-life, or post-depositional processes. As a result, we do not attempt to define its distribution area or precise dating. It can only be suggested that this spearhead may have been in use from phase BrA2 up to the early Iron Age.

OBSERVATIONS ON USE-WEAR AND MANUFACTURING TRACES

In order to determine the damage and production traces on the spear/javelin heads, photographs were taken using a Levenhuk DTX 90 digital microscope. The terminology applied to describe individual damages is based on articles written by Gentile/van Gijn 2019 and Gentile/van Dijk/Ter Mors 2024, and to a lesser extent by Hermann et al. 2020.

All the spearheads described in this article are finished objects with their casting seams removed. The presence of bevels and grinding striations was found only on the spearhead from Banka.

Mechanical damage was observed on all spearheads, varying in intensity. Combination of locations of observed wear marks along the edges and sockets from spearheads from Banka, Hlohovec I and Piešťany, is presented on Fig. 3. In the literature, the distinction between damage from the Bronze Age and damage of post-recovery character is generally made based on whether or not it is covered by a patina layer corresponding to the patina on the rest of the artifact (*Knight 2021*, 50, 59). However, when examining the patina in detail, it can be seen that only spearhead from Banka and javelin head from Hlohovec II displays a well-developed patina, forming a thick layer covering most of the artifact. On this second spearhead, the patina layer is so thick that it may obscure any potential manufacturing and use-wear traces, a phenomenon also noted on other bronze artifacts (*Sych et al. 2020*, 10–12). In the case of the spearhead from Piešťany, it is only partially covered with a dark grey to black patina, which may be associated with its deposition in a watery environment. The absence of patina on part of this spearhead may be due to the abrasive action of debris carried by the river current, which aligns with similar observations on a sword discovered in Horné Zelenice, also recovered from the Váh River (*Bartík 1997*, 419). The spearhead from Hlohovec I is only partially covered by a nearly black, thin patina layer. Regarding the spear/javelin head from Šintava, it is confirmed that its finder removed the patina. The original, dark green layer remains to some extent on the socket, and on its entire surface there are signs of “bronze disease” in the form of light green spots. Additionally, as radiocarbon dating shows, it was reused in the 16th–17th c., and in the authors’ view, it is impossible to distinguish damage that might have occurred in that period from marks dating to the Bronze Age. The spearhead from Madunice is heavily corroded; in many places, an orange-light brown colour of the bronze is visible. A slightly thicker patina layer, dark grey to black in colour, occurs only on the socket.

Moving on to the observed damage, it is undoubtedly the spearhead from Banka that exhibits by far the most instances. The entire spearhead is slightly bent along its axis (Pl. IV: 3). The tip is broken, and although the fracture surface is devoid of patina, its rounded edges make it appear not to be a recent break (Pl. IV: 6). Practically the entire cutting edge is covered with damage in the form of symmetrical and asymmetrical dents; in some places, flattening also occurs (Pl. IV: 4). None of these dents show a burr (displaced metal around the damage marks). It should be noted, however, that the patina is absent in

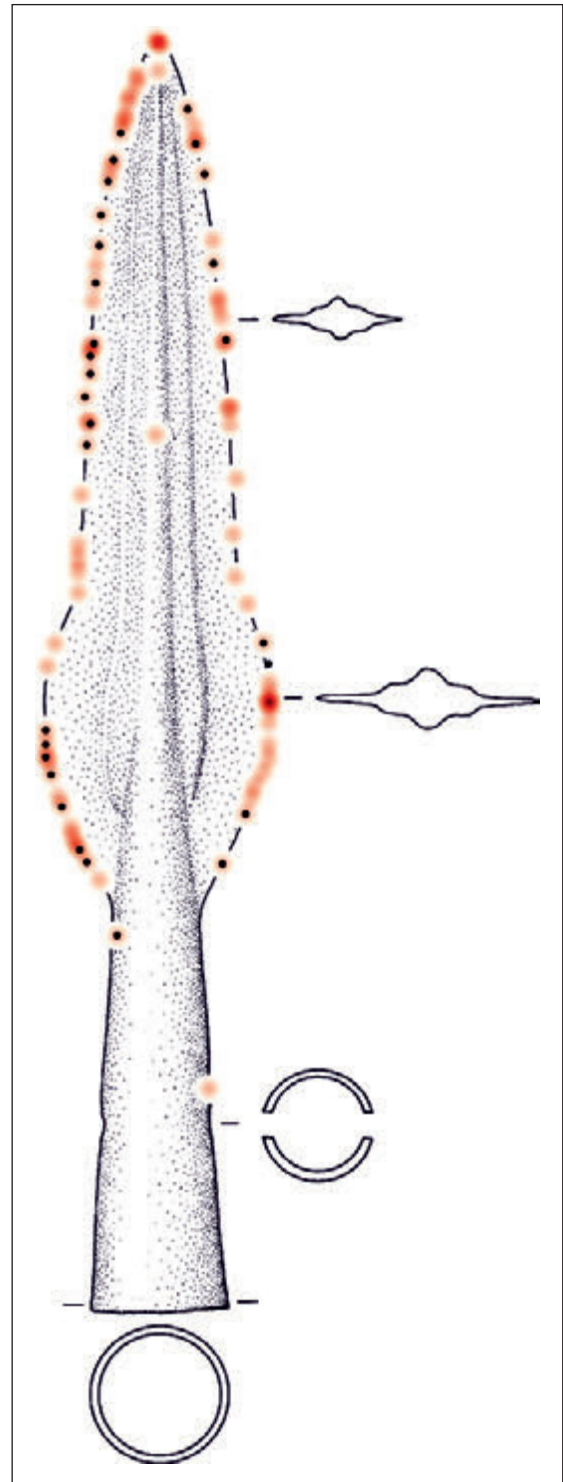


Fig. 3. Location of damage on three spearheads with strongly curved blade (Banka, Hlohovec I, and Piešťany) – more intense red colour indicates a higher frequency of damage in a given section of the spearhead; black dots indicate damage beneath the patina observed on the spearhead from Banka.

certain edge sections; yet in some of these areas, patina remains inside the dents, these are interpreted as Bronze Age damage (Pl. IV: 1, 2).

Slightly before the blade begins to flare at the lower portion, V-shaped notches can be seen (two on each side of the spearhead). The patina layer around them is disrupted, suggesting a modern origin. On one side of the spearhead near these notches, there are irregular damage marks resembling asymmetrical dents, but with heavily “chipped” interiors and sharply outlined edges. They do not match experimental analogies and are unpatinated. Numerous symmetrical and asymmetrical dents, in one case with a trail, appear on the lower, widened part of the blade. Some are covered by patina; others show breaks in the patina layer (Pl. IV: 5, 7).

It appears that a part of the blade was modified in modern times. A small section shows partial grinding of the edge, free of patina and forming a secondary, narrow bevel. The original Bronze Age bevel is mainly visible near the blade base and on one side of the blade’s middle portion; elsewhere, it was destroyed by damage and probable edge repairs. Much of the blade edge is uneven, exhibiting a “wavy edge” characteristic, interpreted as evidence of repairs (*Horn/von Holstein 2017, 93*).

A rather distinctive damage is found on the socket, about 0.5 cm below the blade base: a deep, oval depression with straight scratches oriented perpendicular to its outline, entirely covered in patina. This suggests contact with a metal object having a relatively oval central cross-section and thin edges – possibly the tip of another spearhead (Pl. IV: 8). The entire flat surface of the spearhead shows multiple scratches beneath the patina, parallel or oblique to the axis of symmetry.

A set of scratches appears on the socket, likely a decorative feature, consisting of oblique lines, chevrons and multiple arcs. They run along a narrow band of about 0.5 cm in width, starting just below the blade, following the socket. These scratches are intersected by a blow mark that is entirely covered by patina. Additionally, modern traces were identified on the socket, including blow marks perpendicular to the axis of symmetry of the spearhead that clearly cut through the patina, as well as the inscription Talalt 1903 incised in the patina.

In the case of the spearhead from Hlohovec I, it is visibly bent, forming an S-shaped profile (Pl. V: 3). The midrib is cracked in the central part of the blade, revealing a dark grey patina inside the fracture (Pl. V: 7). Although the edge damage is not as extensive as on the spearhead from Banka, it similarly occurs not only around the tip but also on the lower sections of the blade.

Near the tip, there is a notable concentration of damage in the form of U-shaped vertical notch and two symmetrical dents on one side, covered by patina (Pl. V: 1, 2). On the other side, slightly lower than these notches, a single bowing dent was observed. In the middle part of the blade, on the same side as the bowing dent, there is a cluster of various damage types – bowing, bowing dent, and symmetrical notch – all unpatinated (Pl. V: 5, 6). Below them is a very large, nearly 2 cm wide bowing, with displaced material curled outward and showing cracks along its edges. The dark patina does not cover this damage; a clear boundary separates the patinated area below it from the unpatinated surface around it. Both this feature and the sharply defined edges of the damage suggest a modern origin (Pl. V: 10, 11). On the opposite side of the blade’s midpoint, a U-shaped vertical notch was recorded, accompanied by a micronotch nearby (Pl. V: 4). Pronounced damage also appears at the blade’s lower widening, in the form of U-shaped vertical notches, micronotches, and symmetrical and asymmetrical dents on both sides (Pl. V: 8, 9). Some of these are covered by patina, and show signs of corrosion. Small symmetrical dents were additionally noted on the socket rim, not covered by patina.

The third spearhead with a strongly curved blade – the specimen from Piešťany – displays significantly fewer documented marks. There is visible slight blunting of the tip, which is also bent and cracked about 2 mm from its end (Pl. VI: 2). Nearly all other damages on the spearhead cluster within the first quarter of its length, measured from the tip. On one side, there is a rather distinctive damage that appears to be a combination of an experimentally observed asymmetrical dent and a U-shaped vertical notch, along with an oblique trail. Grey patina is visible inside this trail (Pl. VI: 5, 6). On the same side, a single symmetrical dent was noted (Pl. VI: 3). On the opposite side, several symmetrical dents and a micronotch were recorded (Pl. VI: 4). In the widened section at the lower part of the blade, a linear, straight crack begins at the edge and extends toward the midrib, perpendicular to the axis of symmetry (Pl. VI: 7). A round depression was also found on the socket, close to one of the peg holes, and it is free of patina (Pl. VI: 1). The midrib exhibits pronounced flattening and grinding on one side, which we consider modern (Pl. VI: 8).

In the case of the last spearhead with a strongly curved blade, found in Madunice, its surface has been severely damaged by corrosion, making a precise assessment of the damage problematic. The tip

is asymmetric (Pl. VII: 1). Slightly below the tip, a group of three symmetrical dents was observed on one side (Pl. VII: 3). Further along, before the blade begins to flare, two very conspicuous damage marks lie close together, each nearly 0.5 cm wide. These resemble experimentally produced dents, but they are considerably wider and deeper (Pl. VII: 4). Additionally, there are two marks resembling bowing dents close together, at this spot the edge is clearly displaced to the side (Pl. VII: 5, 6). Two marks close to each other at the widened, lower part of the blade – a symmetrical dent and a U-shaped notch (Pl. VII: 8). Other recorded damages appear likely to result from corrosion, judging by their irregular form.

The spearhead's socket was broken above the rivet holes, and the entire fracture is coated with a relatively thick layer of dark grey/black patina, suggesting this break dates back to the Bronze Age (Pl. VII: 2). In the lower part of the blade, three through-holes approximately 1.5 mm in diameter were noted, displaying a visible drilling burr along its edges (Pl. VII: 7). Although experiments confirm that copper and bronze objects (with 4% tin content) can be drilled using a bow-drill and flint bits (*Bell 2016*, 21–25), indications that the drill bit was fluted suggest the use of a modern drill.

The spear/javelin head from Šintava shows very pronounced damage on one side – almost half of the blade is broken off, and the socket is crushed and markedly bent near the base of the blade. No hammering marks were noted in the damaged area, so we assume it resulted from a single application of significant force to the side of the spearhead, most likely when it was run over by agricultural machinery (Pl. VIII: 5, 6).

Older damage associated with the spearhead's use is minimal. Slightly below the tip, there is a small flattening, and the tip itself is slightly blunted (Pl. VIII: 1). On the side opposite the major break, just below the tip, there is an asymmetrical dent with a burr (Pl. VIII: 2). Symmetrical dents and micronotches occur on the same side in three places: at about one quarter of the blade's length from the tip, around its widest point, and near the blade base (Pl. VIII: 3). A round depression was found on the socket, slightly above the rim, covered with patina.

A piece of wood was discovered inside the socket, and a sample was taken for radiocarbon analysis (Pl. VIII: 4). The results showed that the spearhead was reused in the Early Modern period. Since the observed crushing of the socket would have made it impossible to mount the spearhead on a shaft, this damage must be more recent than the 16th–17th c., fitting our initial interpretation that it does not date to the Bronze Age. Regarding the remaining damage, it is impossible to determine whether it occurred during the Bronze Age or during its secondary use in the Early Modern period. The patina was partially removed, and even if we had identified damage beneath the patina, the 400–500 years it spent in the ground would have been sufficient for it to become re-patinated.

The javelin head from Hlohovec II is covered by a very thick layer of patina, which significantly affects how its damage is identified. The tip appears to be blunted, and just below it there are fairly shallow symmetrical and asymmetrical dents (Pl. VIII: 8). A cluster of what are likely asymmetrical dents occurs about halfway along the blade on one side (Pl. VIII: 7).

This javelin head's socket was broken; the fracture line is concave, and the socket is slightly flattened. In one spot, a triangular piece of metal is missing, with an additional crack running toward the blade (Pl. VIII: 9). The entire fracture surface is covered by a thick patina layer, indicating that this break dates to the Bronze Age.

All of the examined spear and javelin heads show signs of use. In the case of those from Banka, Madunice, and Hlohovec II, some of the damage can be interpreted as dating to the Bronze Age, given that it is covered by a substantial patina layer. When analysing the types of damage in detail, symmetrical and asymmetrical dents are the most frequently observed features on every examined piece. Together with notches, they also were noted in some studies as most frequent. For instance, a study of Early Bronze Age spearheads from Sweden (a sample of 63 specimens) revealed that such damage appeared on 61% of the investigated items (*Horn 2015*, 204). Dents together with flattening traces predominated also in one of the experimental studies (*Gentile/van Dijk/Ter Mors 2024*, 10, 11), in the other blow marks were the most common (*Hermann et al. 2020*, 93, 94).

All the analysed spearheads exhibited damage in the tip area. In one case, the tip is completely broken (the spearhead from Banka, though the fracture is not covered by patina), and in another, it is significantly cracked (Piešťany). Studies on Bronze Age spearheads show considerable variation in this respect. In the previously mentioned research on Swedish spearheads, a broken tip was identified in as many as 41% of cases (*Horn 2015*, 204). By contrast, in a study of northern British spearheads, mechanical tip damage connected to use was noted in only 3% of cases (the sample included 89 spearheads; *Anderson 2011*, 599, 600).

In experimental studies (*Hermann et al. 2020*, 89–92), breaking of the tip was not achieved despite subjecting spearheads to challenging tests – strikes against wooden and bronze shields. However, from the Bronze Age, there are examples of human bones with a broken spear tip embedded in them, such as at Tormarton (*Knight et al. 1972*, 15), indicating that a broken tip need not necessarily result from the intentional destruction of a weapon but could also occur in combat. The tip pressure noted by Horn in 30% of cases (and, importantly, impossible to identify on many of the broken-tip spearheads in that study) was observed in our sample on the spear/javelin head from Šintava and spearhead from Piešťany. In experimental trials, tip bending and tip pressure occurred after thrusts against bronze and wooden shields and strikes against another spear's shaft (*Gentile/van Dijk/Ter Mors 2024*, 8; *Hermann et al. 2020*, 90, 91, 94).

On three spearheads with strongly curved blades – those from Banka, Hlohovec I, and Madunice – the edge is clearly damaged in the lower, widened section of the blade. Moreover, on the spearhead from Banka, some of these damages are covered by patina, and they occur near the blade base, below the blade's widest point. This suggests that the mentioned spearhead was likely used for more than thrusting attacks, indicating a more complex mode of use, employing also the lower section of the spearhead's blade. According to *K. Anderson (2011, 599)* and *C. Horn (2014, 104; 2015, 210)*, Bronze Age spearheads were mounted on a short shaft and used in combat for both cutting and thrusting attacks, in a manner similar to swords. However, experiments conducted by *K. Anderson (2011, 603)* showed that to strike effectively with the blade's lateral edges, a slashing motion is needed. Cutting did not inflict particularly pronounced injuries on the test animal carcasses, and it frequently caused the short shaft to break. Additionally, as *P. Schauer (1979, 74)* and *M. Salaš (2016, 218)* suggest, some of the spearheads – particularly those with a distinct ricasso – may have been used in a manner similar to later polearms, mounted on a long shaft, held with both hands, and used for both thrusting and cutting/slashing.

On the other hand, the spearhead from Piešťany presents an entirely different case. First, it has no bevels, indicating that its edge was not sufficiently sharpened for slashing attacks. Second, most of its damage is concentrated near the tip, suggesting that thrusting attacks – if these damages date to the Bronze Age – were more prevalent.

Marks similar to round depressions, visible on the sockets of the spear/javelin head from Šintava, and spearheads from Banka, and Piešťany were produced in experiments simulating violent collisions against an opponent's socket or shaft (*Gentile/van Dijk/Ter Mors 2024*, 8). However, interpreting these marks is quite problematic. In the first specimen, the damage is located beneath the patina, but in the case of this spearhead, patina may not be a reliable indicator for dating the damage, as was mentioned before. In the second specimen, the damage exhibits a rather unique form: it appears deeper than that shown in *Gentile et al.'s work (Gentile/van Dijk/Ter Mors 2024, fig. 8: D)* and features additional scratches along its edges. The damage on the third specimen, on the other hand, is not covered by patina, so we cannot attribute it with certainty to the Bronze Age usage.

X-RAY FLUORESCENCE ANALYSIS OF BRONZE SPEAR/JAVELIN HEADS

The chemical composition of the discussed spear/javelin heads' alloys was examined using X-ray fluorescence analysis (XRF). It is a non-destructive method based on measuring the characteristic X-ray radiation induced by irradiating the object under examination.

Its main advantages are that it is fast, accurate, repeatable, does not require sample preparation and does not damage the analysed object. Entire item can be examined, making it suitable for analysing the composition of historical artefacts, which can aid in their dating, determining their origin, and verifying their authenticity. XRF is primarily suitable for analysing major elements and, in some cases, certain trace elements. It is a relative analytical method, as the measured quantity must be related to the sample composition through calculations or comparisons with standards. The actual measurement is performed on the surface of the examined object, where the spectrometer determines the concentration values (Wt % – weight percentages) of specific elements.

The analyses of the spear/javelin heads were performed using a handheld XRF spectrometer, DELTA CLASSIC+ by Olympus, USA. This device is designed for non-destructive quantitative analyses of archaeological artefacts, precious metals, and their alloys. The analyser determines the percentage content of up to 29 elements (Au, Pd, Ag, Pt, Ir, Rh, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, As, Zr, Nb, Mo, Hf, W, Re, Pb, Sn, Bi, and Sb) without leaving any traces on the examined objects.

Tab. 3. Results of XRF analysis.

Object	Cu	Sn	Ni	Ag	As	Sb	Pb	Fe	Zn	Bi
Banka – 1a	90.04	8.45	0.44	ND	0.5	0	ND	ND	0.58	ND
Banka – 1b	88.07	10.24	0.42	ND	0.66	0	ND	ND	0.61	ND
Banka – 1c	62.68	33.99	0.69	ND	1.97	0	ND	ND	0.67	ND
Banka – 2a	87.2	10.25	0.39	ND	0.82	0.81	ND	ND	0.53	ND
Banka – 2b	87.1	11.07	0.43	ND	0.91	0	ND	ND	0.5	ND
Banka – 2c	69.08	27.73	0.48	ND	2.15	0	ND	ND	0.55	ND
Hlohovec I – 1a	88.56	9.43	0.54	ND	0.47	ND	0.25	0.23	0.52	ND
Hlohovec I – 1b	88.45	9.6	0.51	ND	0.49	ND	0.23	0.23	0.49	ND
Hlohovec I – 1c	80.89	13.61	0.36	ND	0.62	ND	0.41	3.58	0.53	ND
Hlohovec I – 2a	88.1	9.68	0.52	ND	0.51	ND	0.25	0.46	0.49	ND
Hlohovec I – 2b	88.2	9.6	0.53	ND	0.52	ND	0.28	0.36	0.51	ND
Hlohovec I – 2c	85.92	11.06	0.44	ND	0.61	ND	0.36	1.05	0.56	ND
Hlohovec II – 1a	70.81	12.32	ND	5.09	6.39	2.1	ND	1.58	0.7	1
Hlohovec II – 1b	71.59	12.34	ND	5.05	6.73	2.12	ND	0.3	0.55	1.32
Hlohovec II – 1c	70.33	10.93	ND	5.46	1.35	2.31	ND	9.62	0	0
Hlohovec II – 2a	76.57	9.51	ND	4.41	6.19	1.59	ND	0	0.61	1.11
Hlohovec II – 2b	75.23	10.25	ND	4.59	6.59	1.68	ND	0	0.61	1.05
Hlohovec II – 2c	71.29	12.28	ND	5.46	6.04	2.08	ND	1.29	0.6	0.96
Madunice – 1a	90.46	7.95	0.4	ND	0.35	ND	0.28	ND	0.57	ND
Madunice – 1b	89.62	8.73	0.43	ND	0.31	ND	0.4	ND	0.52	ND
Madunice – 1c	88.85	9.33	0.43	ND	0.39	ND	0.28	ND	0.72	ND
Madunice – 2a	88.73	9.6	0.34	ND	0.42	ND	0.43	ND	0.48	ND
Madunice – 2b	89.41	8.9	0.33	ND	0.41	ND	0.51	ND	0.43	ND
Madunice – 2c	90.6	7.54	0.41	ND	0.41	ND	0.47	ND	0.57	ND
Piešťany – 1a	90	8.44	0.52	ND	0.25	ND	0.27	0	0.51	ND
Piešťany – 1b	88.5	9.72	0.48	ND	0.28	ND	0.21	0.19	0.61	ND
Piešťany – 1c	88.6	9.85	0.47	ND	0.29	ND	0.23	0	0.56	ND
Piešťany – 2a	89.68	8.94	0.43	ND	0.23	ND	0.21	0	0.5	ND
Piešťany – 2b	89.21	9.12	0.46	ND	0.25	ND	0.23	0.22	0.51	ND
Piešťany – 2c	89.45	8.97	0.49	ND	0.26	ND	0.25	0	0.59	ND
Šintava – 1a	89.41	8.39	0.2	0	0.43	0.96	0.12	0	0.49	ND
Šintava – 1b	85.61	11.14	0.22	0.35	0.72	1.28	0.19	0	0.49	ND
Šintava – 1c	78.73	16.71	0.15	0.34	1.15	1.95	0.24	0	0.74	ND
Šintava – 2a	89.95	7.8	0.2	0	0.47	0.94	0.13	0	0.52	ND
Šintava – 2b	89.62	8.12	0.21	0	0.53	0.94	0.16	0	0.42	ND
Šintava – 2c	77.22	17.81	0.2	0	0.84	1.87	0.37	0.8	0.89	ND

Technical specifications of the device are as follows: DELTA CLASSIC+ is an energy-dispersive XRF spectrometer; it features a 4-watt X-ray tube with a current of up to 200 μA , a Si-PIN detector, and an integrated full VGA camera. It allows narrowing the X-ray beam from 9 mm to 3 mm, enabling the analysis of small objects or heterogeneous materials.

The DELTA CLASSIC+ measures only the surface of the examined material, and therefore it does not guarantee the homogeneity of the chemical composition throughout the entire volume of the material. It provides information solely about the composition of the surface layer of the object at the specific examined location, with the penetration depth of the X-ray beam determined by the chemical composition of the material.

This makes the selection of the analysis location on the examined object critically important. If the material is gold-plated, clad, or otherwise surface-treated, or if it is affected by corrosion, the chemical composition will not correspond to the weight percentages of the entire volume but rather to the weight percentages of the surface layer at the specific measurement location. For objects with a spherical or rounded shape, the positioning of the object can influence the results. Therefore, it is essential to select an appropriate geometry for such samples.

Results of Spectral Analysis Measurements

The results of the XRF analysis are presented in Tab. 3. Each artefact was measured six times: three times each on the leaf and on the socket. The measurements are marked in the table as follows: 1a, 2a – measurements on a cleaned surface; 1b, 2b – repeated measurements on a cleaned surface; 1c, 2c – measurements without surface cleaning. The table displays the average weight percentages (Wt %) of ten elements (Cu, Sn, As, Sb, Ag, Ni, Pb, Fe, Zn, and Bi). Following the table is a description of the composition of the examined alloy as determined by the XRF analysis.

Spearheads with a strongly curved blade (Banka, Hlohovec I, Madunice, Piešťany) are characterized by a similar chemical composition, and therefore, the results obtained for them are discussed together. The copper content in these artefacts ranges between 90% and 87%, while the level of tin varies between 8% and 11%. They also exhibit relatively high levels of arsenic (0.23% to 0.91%) and nickel (0.33% to 0.54%). The silver content was below the detection level in all measurements. The same applies to antimony, except for a single measurement of a spearhead from Banka (2a). However, the zinc level in these artefacts is relatively high, ranging from 0.43% to 0.61%. Differences in the chemical composition of this type of spearheads are observed only in the case of two elements: lead and iron. The lead content was below the detection level in the specimen from Banka, ranged from 0.21% to 0.28% in the spearheads from Hlohovec I and Piešťany, and reached the highest values in the artefact from Madunice, ranging from 0.28% to 0.51%. Regarding iron, its content was below the detection level in the objects from Banka and Madunice, as well as in two measurements from Piešťany (1a and 2a). In the remaining measurements from the last object, it was approximately 0.2%, while in the specimen from Hlohovec I, lead had the highest values, ranging from 0.23% to 0.46%.

The spear/javelin head from Šintava differs from the spearheads with a strongly curved blade described above in terms of trace element content. It should also be noted that one of the measurements (1b) clearly deviates from the others. The levels of copper and tin are similar to that of the spearheads with a strongly curved blade (85–89% and approx. 8%, respectively). The arsenic content is also at a similar level (0.43–0.72%). Silver is below the detection level, except for measurement 1b, where it has a value of 0.35%. However, the antimony content is significantly higher than in the previously described spearheads (above 0.9%), while the nickel level is lower (approx. 0.2%). The content of lead is also relatively low (0.12–0.19%). On the other hand, the zinc content is similar to that recorded in the spearheads with a strongly curved blade (0.42–0.52%).

The javelin head from Hlohovec II noticeably differs from the other analysed artefacts in terms of the results obtained. In this case, the copper content is considerably lower (70.81–76.57%), while the tin is only slightly higher (9.51%–12.34%). However, the levels of arsenic (approximately 6%), silver (approximately 4.5–5%), antimony (approximately 1.5–2%), and bismuth (above 1%) are remarkably high. In contrast, the levels of nickel and lead were below the detection limit. The zinc content was the only element similar to the values obtained for other spearheads (0.55–0.7%). There are significant variations in iron content between individual measurements – in two cases (2a and 2b), it was below the detection limit, while in measurement 1b, it was recorded at 0.3%, and in measurement 1a, it reached as high as 1.58%.

The exceptionally high levels of trace elements, particularly arsenic and silver, in this spearhead may indicate either intentional addition or insufficient cleaning of the surface from corrosion. Comparative studies using XRF and OES methods have shown that arsenic and silver exhibit significant surface enrichment when measured by pXRF (Pollard *et al.* 2018, 75). This theory is further supported by the minor differences in tin content between measurements taken on the cleaned (a and b) and uncleaned surfaces (c). The only other artefact with well-preserved patina – the spearhead from Banka – showed approximately three times higher concentrations of that element when measuring from the patina compared to the cleaned surface.

Comparison with other XRF results from Slovakia

Other artefacts dated to the Late and Final Bronze Age and discovered in present-day Slovakia have also been subjected to chemical composition analysis using the XRF method. The results obtained in this study were therefore compared with those from artefacts found at Buková (Bartík/Farkaš 2021, 96), Horné Srnie (Ondrkál/Peška 2024, 387), Nitrianska Blatnica (Bartík/Jelínek/Gábriková 2022, 80), Málinec (Makarová/Rusko/Čambal 2023, 66), Stakčín (Makarová/Harčar 2022, 62), Svätý Jur (Zachar/Bartík/Farkaš 2019), and from sites at Nižná-Lazy, Dolný Kubín II, and Krásna Hôrka (Danielová 2018, 81). The comparative group encompassed a total of 55 measurements from 45 artefacts (two-arm pickaxes, sickles, spearheads, dagger, ornaments and parts of costume). Fragments of ingots were excluded from comparison. In all these cases, measurements were taken on surfaces cleaned of patina. Results of the comparison are presented on Diagram 1.

The copper content in the objects from this group ranges between 43.74% and 97.068%, with the non-outlier range falling between 76.852% and 97.068%. Thus, the results obtained for the artefacts analysed in this study fall within this range, except for the javelin head from Hlohovec II, which has slightly lower values. The tin content in the comparative group exhibited a wide variation, ranging from 2.129% to as high as 54.077%, while the non-outlier range was between 6.512% and 12.879%. The analysed spearheads, containing between 8% and 12% tin, therefore fall within the characteristic range for other bronze artefacts from Slovakia, dated to the Late and Final Bronze Age. The results also indicate that ornaments and elements of costume generally have lower copper and higher tin content (average Cu 81.667%, Sn 15.926%) compared to tools and weapons (average Cu 88.29%, Sn 7.946%).

The antimony content in the comparative group ranged from 0% to 4.247%, with the non-outlier range falling between 0% and 1.392%, indicating significant variability in the presence of this element. This variation is also evident in the artefacts analysed in this study. In the spearheads with a strongly curved blade, antimony levels are generally below the detection limit, whereas in the two other objects, they are significantly higher. In the Šintava spear/javelin head, antimony falls within the upper part of the given non-outlier range (0.94–1.28%), while in the specimen from Hlohovec II, it exceeds this range, with values between 1.59% and 2.12%.

In most artefacts from the comparative group, the levels of arsenic, silver, and zinc are below the detection limit. Regarding silver, this result aligns with the findings for the spear/javelin heads analysed in this study, except for one measurement from Šintava and the results for the javelin head from Hlohovec II. However, there is a notable difference in arsenic and zinc levels. In all measurements of the analysed spearheads, these elements were detected at concentrations of 0.23–0.91% for arsenic (and above 6% in the case of the Hlohovec II specimen) and 0.42–0.7% for zinc. The presence of arsenic and zinc in the alloy therefore clearly distinguishes the spearheads analysed in this study from other artefacts found in Slovakia. However, it must be considered that this difference may be attributed to the equipment used for analysis or its calibration (Pollard *et al.* 2018, 75). Additionally, in many measurements where arsenic was not detected, relatively high lead content was recorded. This could be related to the known difficulty in measuring arsenic in the presence of lead due to spectral overlap (Pollard *et al.* 2018, 77). As for zinc, comparative studies of measurements obtained using XRF and ICP-OES methods have shown that the former often fails to detect this element, in cases where ICP-OES identified zinc at levels ranging from 0.002% to 0.183% (Zachar/Bartík/Farkaš 2019, 106).

In the comparative group, nickel content ranged from 0% to 1.142%, with the same range for non-outlier values. These figures indicate significant variability in level of nickel in objects from the Late and Final Bronze Age in Slovakia. For the spearheads with a strongly curved blade, nickel content falls around the median obtained for the comparative group (0.33–0.54%). In the Šintava specimen, the level is

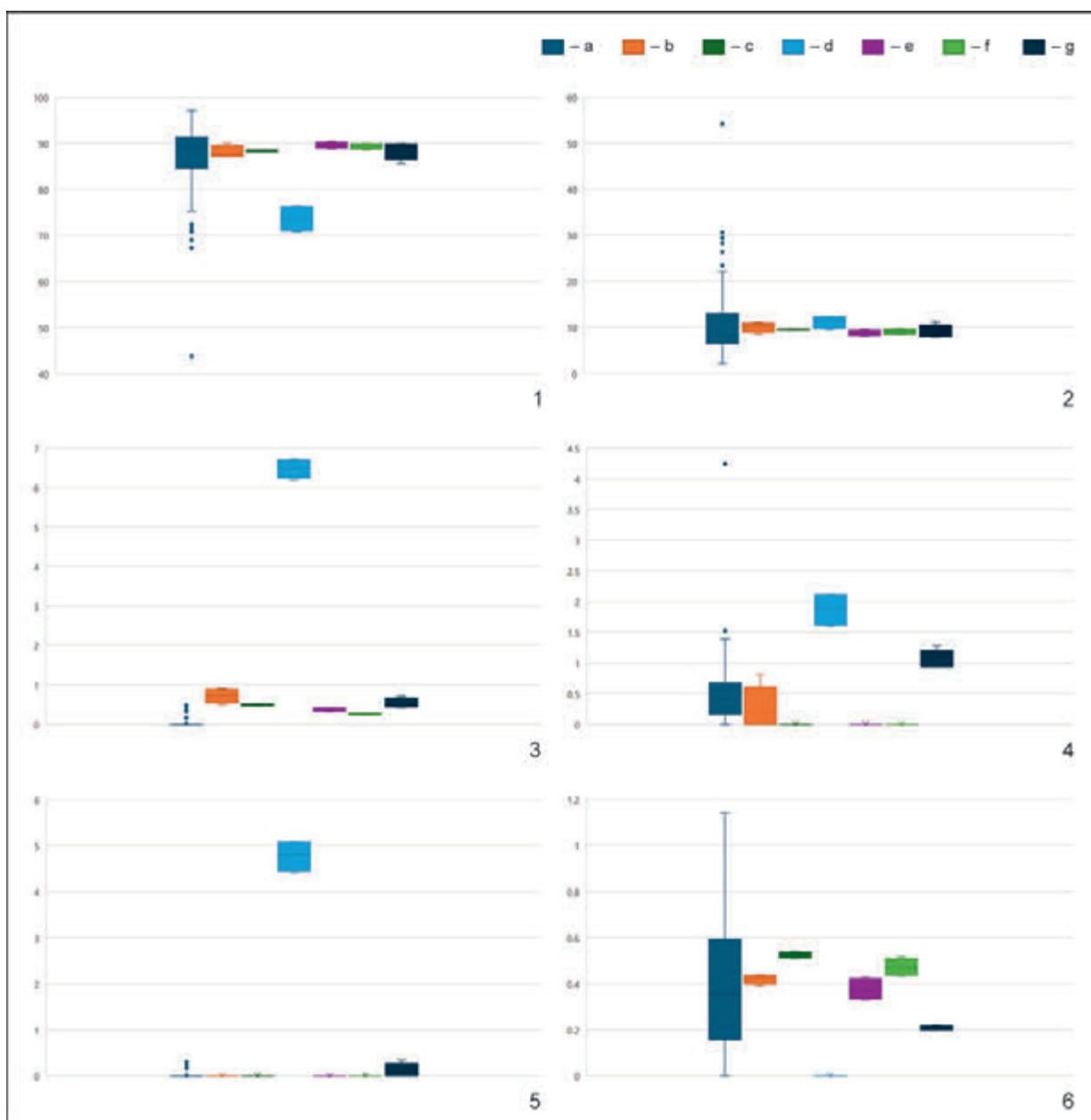


Diagram 1. Comparison of chemical composition of discussed spear/javelin heads with comparative group (XRF analyses of 45 Late and Final Bronze Age artefacts from Slovakia). 1 – copper (Cu); 2 – tin (Sn); 3 – arsenic (As); 4 – antimony (Sb); 5 – silver (Ag); 6 – nickel (Ni). Legend: a – comparative group; b – Banka; c – Hlohovec I; d – Hlohovec II; e – Madunice; f – Piešťany; g – Šintava.

below this median ($\sim 0.2\%$), while in the Hlohovec II javelin head, no nickel was detected at all. Nevertheless, all these values fall within the non-outlier range of the comparative group.

The lead content in the comparative group ranges from 0% to 4.205%, with the non-outlier range falling between 0% and 1.841%. Higher lead values (above 1%) may indicate intentional addition, although some studies suggest that copper ores can naturally contain up to 2% lead (Ondrkál/Peška 2024, 385). Among the artefacts considered here, this threshold is exceeded in only two cases – an axe and a bracelet from the Stakčín site (2.71% and 4.205%, respectively). Therefore, only these instances clearly indicate the intentional addition of lead. In all the spear/javelin heads analysed in this study, lead levels remain below the median for other artefacts from Slovakia. The maximum recorded value is 0.51% in the spearhead from Madunice, while in the remaining cases, it is either between $\sim 0.1\%$ and $\sim 0.3\%$ (Hlohovec I, Piešťany, Šintava) or below the detection limit (Banka, Hlohovec II).

The iron content in the group of artefacts used for comparison ranges from 0% to 1.619%, with the non-outlier range falling between 0% and 0.863%. Most of the measurements from spearheads analysed in this study fall within this range. Only in the case of the Hlohovec II specimen does one measurement show a higher iron level – 1.58%. Such high concentrations of this element are very rare in the material from Slovakia. In fact, only five other objects showed iron levels exceeding 1% – four from the hoard in Nitrianska Blatnica and one from Buková I.

In approximately half of the artefacts from the Late and Final Bronze Age in Slovakia, bismuth content is below the detection limit. In the remaining artefacts, it is present at low levels, with a maximum of 0.12%. A similar pattern is observed in the objects analysed in this study – except for the javelin head from Hlohovec II, where bismuth levels exceed 1%.

In conclusion, the chemical composition of the analysed spearheads generally aligns with Late and Final Bronze Age artefacts from Slovakia, except for certain anomalies in Hlohovec II (notably high arsenic, silver, antimony and bismuth levels). Only differences in arsenic and zinc levels clearly distinguish analysed spearheads from other artefacts, though these variations may be influenced by analytical methods.

When comparing XRF analysis results obtained by different researchers, caution should be exercised, as studies by *Heginbotham et al. (2015)* and *Heginbotham/Sole 2017* have shown that the reproducibility of results between laboratories is relatively low (*Pollard et al. 2018, 69*). The results are largely dependent on the instrument used, the calibration methodology, and the degree to which the surface has been cleaned (*Pollard et al. 2018, 75*).

Additionally, studies comparing XRF results with those obtained through other methods (ICP-MS/ICP-OES) have revealed discrepancies between measurements. Researchers point to the lower reliability of the XRF method due to the fact that it only analyses the composition of the object's surface (or metal near the surface), and because of the detection limits, it cannot reliably measure certain important chemical elements (*Zachar/Bartík/Farkaš 2019, 104*).

Worthy of mention in this context is the chemical composition analysis carried out with the EDX method on the spearhead from Pavlovce, previously mentioned in the chapter addressing analogies to the spear/javelin head from Šintava (*Bogušová/Pribulová 2006, 3*). With a copper content of 92.9%, this artifact falls within the standard range documented for archaeological finds from Slovakia. The recorded tin content (5.7%) is lower compared to the analyzed spearheads from the Homeland Museum in Hlohovec and falls within the outlier range established for the comparative group. The only additional element detected in the chemical composition of this spearhead is sulfur (0.5%), an element not identified in any spearheads from the Homeland Museum in Hlohovec. However, as ICP-MS/ICP-OES analyses have shown, sulfur concentrations measured by ICP methods at levels up to almost 1% were sometimes undetectable using the XRF method, applied to the same artefacts (*Zachar/Bartík/Farkaš 2019, 106*).

Regarding the possible origin of the ore (or ores) used in the production of the analysed artefacts, based on the ratio of Ni to Ag, it can be concluded that the spearheads with a strongly curved blade (Banka, Hlohovec I, Madunice, Piešťany) are closer to the characteristics of the chalcopyrite deposits from the Eastern Alps (regions of Mitterberg, Kitzbühel, and Viehofen). These deposits are characterized by high arsenic and nickel content, while antimony and silver levels remain low (*Pernicka/Lutz/Stöllner 2016, tab. 4*). Other studies also suggest that metal from these sources was present in Slovakia during the Late and Final Bronze Age (*Ondrkál/Peška 2024, 388; Zachar/Bartík/Farkaš 2019, 111–114*). The Šintava spear/javelin head exhibits a different elemental composition, with the proportions of key elements following the pattern: Sb > As > Ni/Ag. The high levels of antimony would tend to indicate characteristics similar to the deposits from the Slovak Ore Mountains, however, they are also known to have higher levels of silver, which in the case of this specimen was only confirmed in one of the measurements (*Ondrkál/Peška 2024, 390, fig. 5*).

Going somewhat beyond the scope of this chapter, it is worth drawing attention to XRF analysis projects conducted in the 1990s on objects primarily from Bohemia, and to a lesser extent Moravia and Austria (*Frána et al. 1995; 1997*). Among the studied items were 41 spearheads, dated from the Middle to the Final Bronze Age. The tin content in these spearheads ranges from 1.58% (specimen from Hradec Králové-Slezské Předměstí; HaB3) up to 52.15% (spearhead from Dýšina-Nová Huť; Middle Bronze Age), with the non-outlier range of 1.58% to just below 20%. All of the spear and javelin heads from the Homeland Museum in Hlohovec also fall within this range. One possible explanation for

the particularly low tin content in the Hradec Králové–Slezské Předměstí spearhead, as suggested by J. Frána *et al.* (1997, 72), is a regional tin shortage in eastern Bohemia toward the end of the Bronze Age, also reflected in the tin levels of other bronze objects from nearby sites. The unusually high tin content from the Dýšina – Nová Huť spearhead is interpreted by M. Salaš (2016, 213) as possibly skewed due to corrosion products.

Arsenic, as noted earlier in this chapter, is rarely detected in Slovak bronze objects (though it was found in all the spearheads from the Homeland Museum in Hlohovec), but was present in the majority of the spearheads in the aforementioned studies. Only in one from Rýdeč and one from Sipbachzell arsenic was not detected. The highest arsenic content, around 1.5%, was found in two spearheads from Rataje nad Sázavou (HaB3), although this is still far below the level recorded in the Hlohovec II javelin head (approx. 6.5%).

The silver content in most cases did not exceed 0.3% in the spearheads from these studies, with a maximum of 0.54% in one spearhead from Rataje nad Sázavou. These results correspond closely with the values observed in the spear and javelin heads from the Homeland Museum in Hlohovec – again with the notable exception of Hlohovec II (approx. 4.5–5%).

Antimony levels in the spearheads from J. Frána *et al.* (1995; 1997) range from 0 to 1.27% (the highest in a spearhead from Světec; HaB3), with non-outlier values between 0 and 0.83%. The spear/javelin head from Šintava slightly exceeds this range (0.94–1.26%), while the Hlohovec II javelin head clearly surpasses it (1.59–2.12%).

Nickel content in the cited studies ranges from 0 to 1.27%, with non-outlier values between 0 and 0.5%. Only the measurements for Hlohovec I spearhead slightly exceeds this threshold (0.51–0.54%).

In the case of lead, the range of non-outlying values in the aforementioned study falls between 0 and 1.09%. Only for six spearheads can the intentional addition of lead, above 2%, be suggested: five from the site of Rataje nad Sázavou and one from the site of Světec. Additionally, all items from the former site are dated to HaB3, while most objects from the latter are also dated to HaB3, but some date as early as HaA1 (Frána *et al.* 1995; 139, 141, 142). The objects from the Homeland Museum in Hlohovec fall within the non-outlier range, with the highest lead content found in the spearhead from Madunice, ranging between 0.28% and 0.51%.

RADIOCARBON DATING – FRAGMENT OF A SHAFT FROM THE SOCKET OF THE SPEAR/JAVELIN HEAD FROM ŠINTAVA

As mentioned earlier, two of the examined spear/javelin heads – those from Banka and Šintava – had preserved fragments of their shafts inside the socket (Mitáš *et al.* 2018, 238, 239). In the case of the latter, a sample was taken from the end of the preserved section and sent to the Poznań Radiocarbon Laboratory for dating. Rather unexpectedly, the dates obtained via the AMS method are as follows: 285 ±30 BP, which at the 1 sigma level (68.3% probability) corresponds to 1524–1655 AD, and at the 2 sigma level (95.4% probability) corresponds to 1500–1794 AD.

As noted in previous sections, the Šintava spear/javelin head has close analogies to other Bronze Age spearheads discovered in datable contexts. Its chemical composition also aligns with that of other Bronze Age artifacts from Slovakia. We therefore assume it was produced in the Bronze Age. Hence, we interpret the discrepancy between the radiocarbon dating of the shaft and the typological dating of the spearhead as a result of the spearhead's discovery, removal from its original depositional context, and subsequent remounting on a shaft in the Early Modern period. Such practices are known in the context of Slovak finds, as many marks observed on swords and spearheads are modern, although this may represent one of the earliest examples of reusing an archaeological artifact. A similar case concerns for example a bronze sword from unknown locality, which, after discovery in modern times, was significantly shortened (Novotná 2014, cat. no. 105).

Radiocarbon dating has thus shed light on one of the chapters in the “life story” of this spearhead. At the same time, these results highlight that, when the exact find context is unknown, it must be considered that traces of use – or even certain typological features – could have been altered at a later time. Thus, the way an artifact appears today may not always reflect the intentions of its original maker or its usage in the Bronze Age. This also raises the question of whether, in other cases where a piece of shaft has been preserved, it truly dates to the Bronze Age or is a more recent addition.

CONCLUSIONS

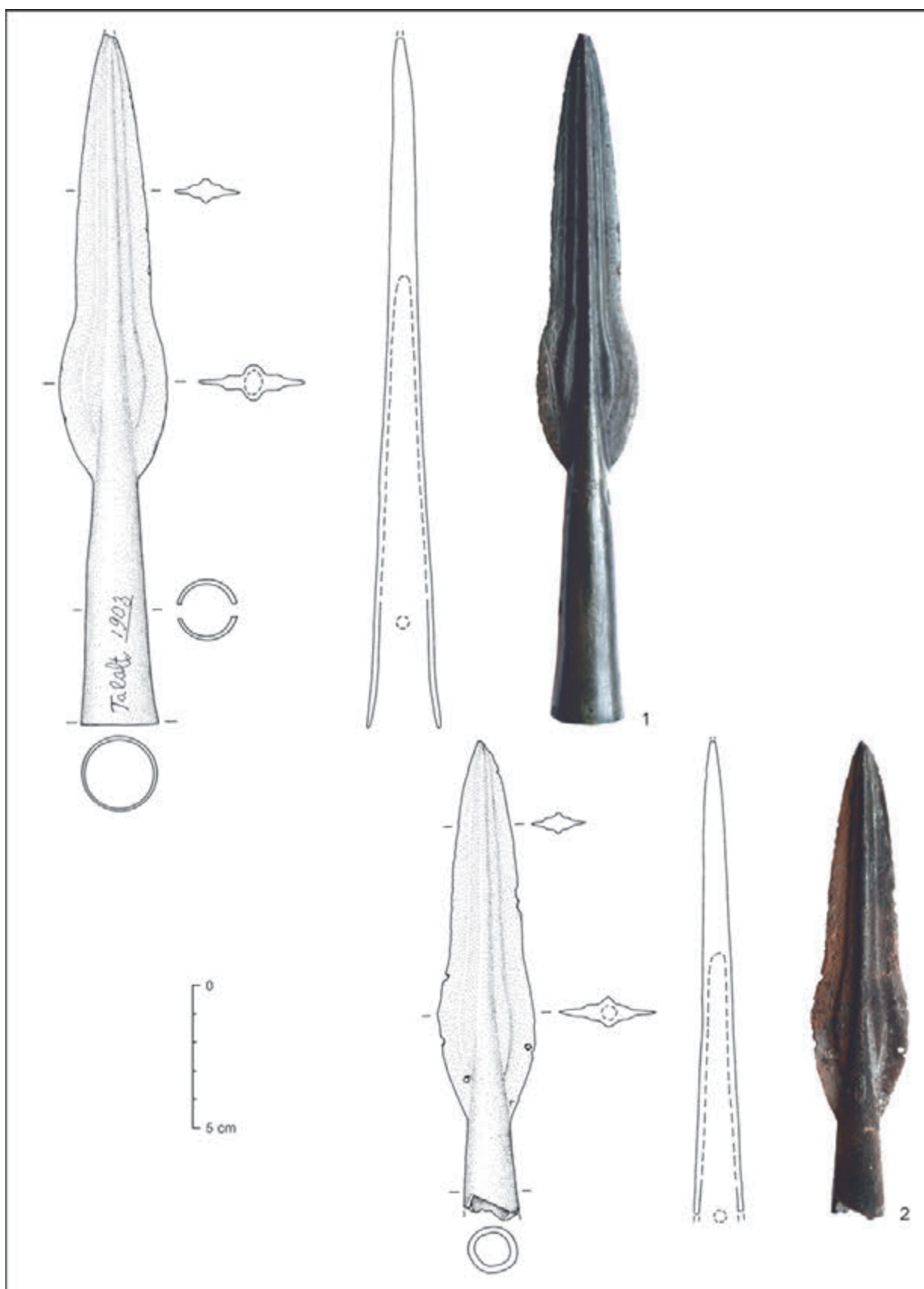
A detailed analysis of six artifacts, typically overlooked as single finds, was undertaken. Bronze spear/javelin heads from the Homeland museum in Hlohovec were classified typologically and chronologically, not only according to Slovak systems but also within the broader context of Central Europe. Use-wear analyses documented damages, likely originating from the Bronze Age (particularly evident on the spearhead from Banka), as well as later modifications and damage – grinding of the edge at Banka specimen, drill-holes on the spearhead from Madunice, grinding and flattening of the midrib in the example from Piešťany, possible modern damage marks on the spearhead Hlohovec I, modern crushing possibly by agricultural machinery in case of Šintava specimen.

Chemical composition analyses revealed significant differences. In one instance, these differences appear to be related at least to some extent, to thick layer of patina on the javelin head from Hlohovec II. In the remaining cases, the analyses allowed for the distinction of a group comprising the spearheads from Banka, Hlohovec I, Madunice, and Piešťany with the trace elements composition close to the Alpine ores. Spear/javelin head from Šintava exhibits a different trace element composition, especially in the amount of antimony. This dichotomy corresponds with the differences in typological classification.

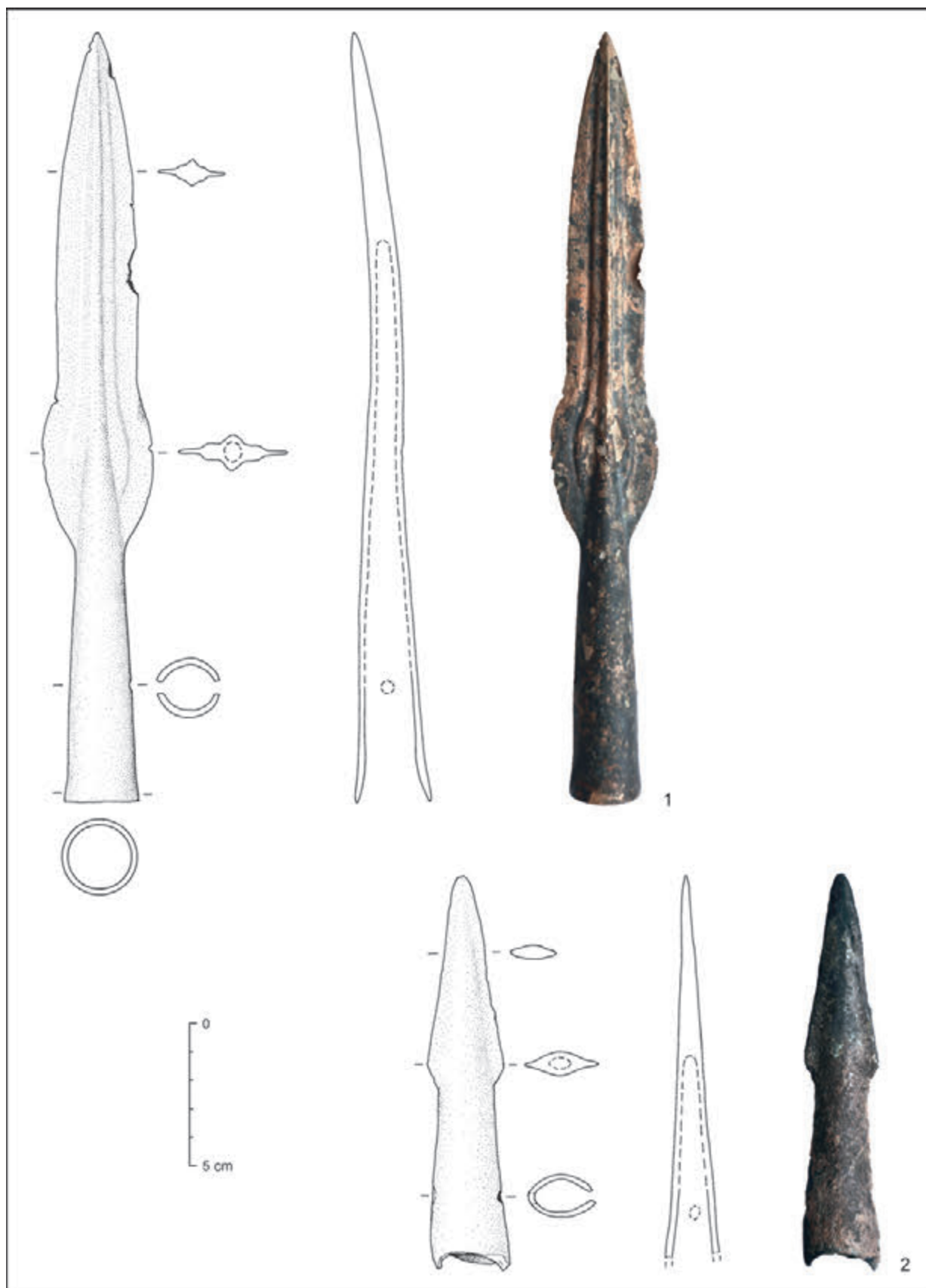
Comparison with the chemical composition of other objects from Slovakia dating to the Late and Final Bronze Age indicates that, in most measurements, analysed spear/javelin heads (with the exception of the one from Hlohovec II) fall within the normative range for Bronze Age objects, although certain discrepancies – most notably in arsenic content, one of key elements in interpretation of Bronze Age metallurgy – are evident. In these spearheads, arsenic was consistently detected, whereas in other studies it was more often undetected, possibly due to differences in analytical equipment and calibration.

Furthermore, radiocarbon dating of a fragment of the wooden shaft from the socket of the spear/javelin head from Šintava revealed its secondary use in the Early Modern period – a finding that would have remained unnoticed without application of this method. This prompts the question of how often spear/javelin heads – and other bronze artefacts – have been removed from their original contexts and re-deposited, thereby affecting our understanding of artefacts distribution, chronology, and depositional practices.

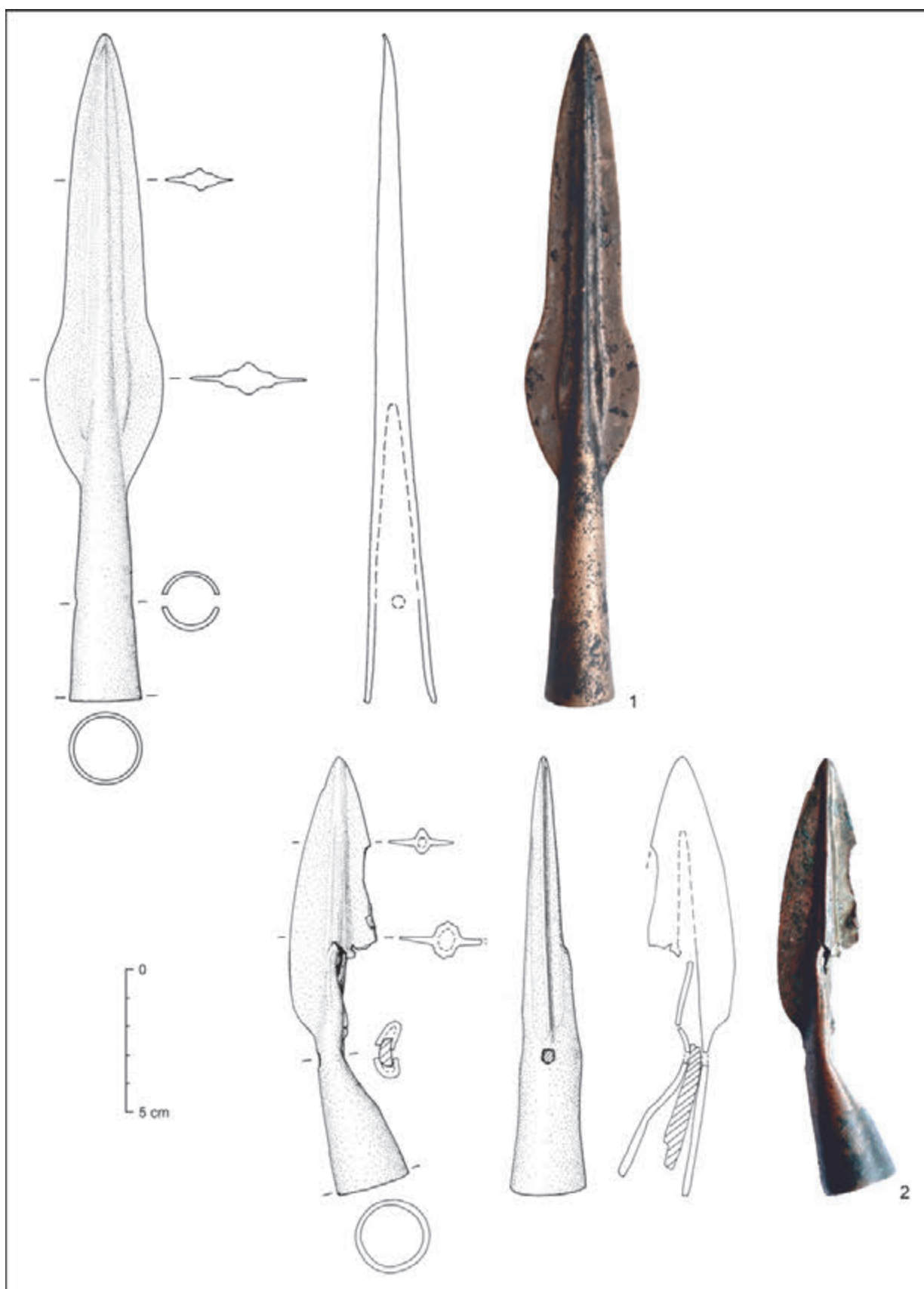
This study demonstrates that detailed analyses, even of single finds discovered out of context, can yield valuable insights into the use of weaponry in the Bronze Age and their subsequent fate.



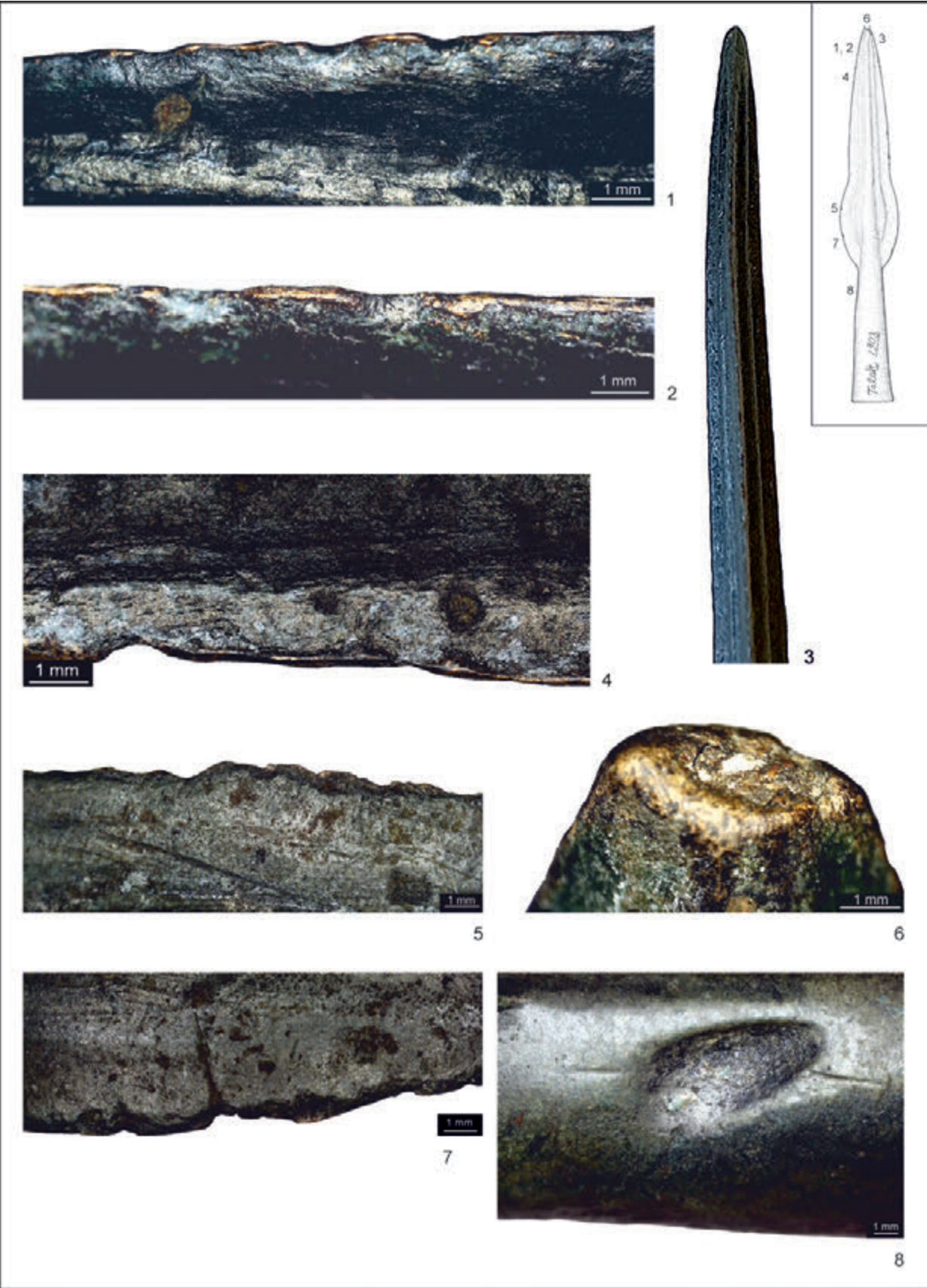
Pl. I. 1 – spearhead from Banka; 2 – spearhead from Madunice. Photos V. Mitáš, drawings Z. Nagyová.



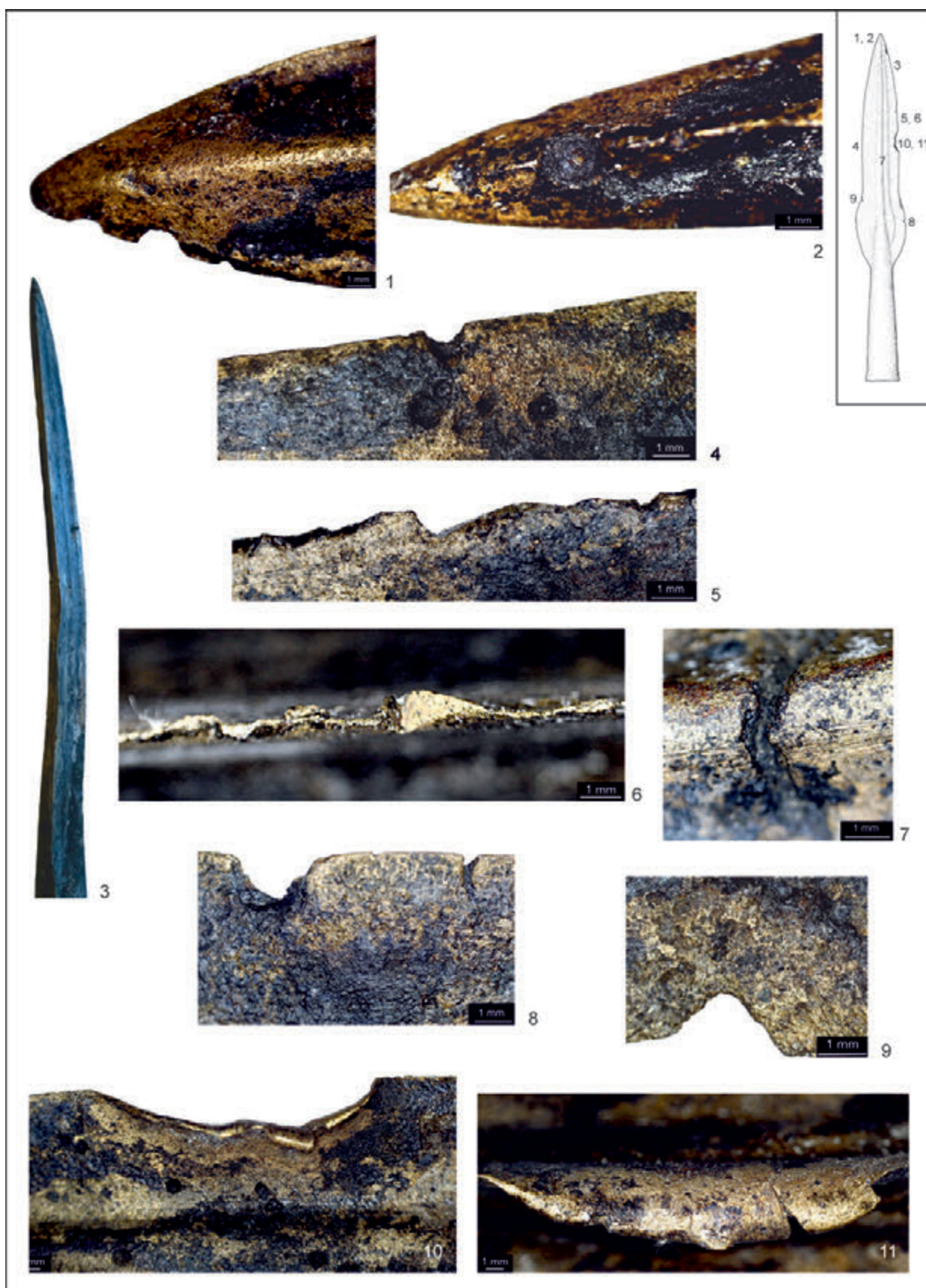
Pl. II. 1 – spearhead from Hlohovec I; 2 – javelinhead from Hlohovec II. Photos V. Mitáš, drawings Z. Nagyová.



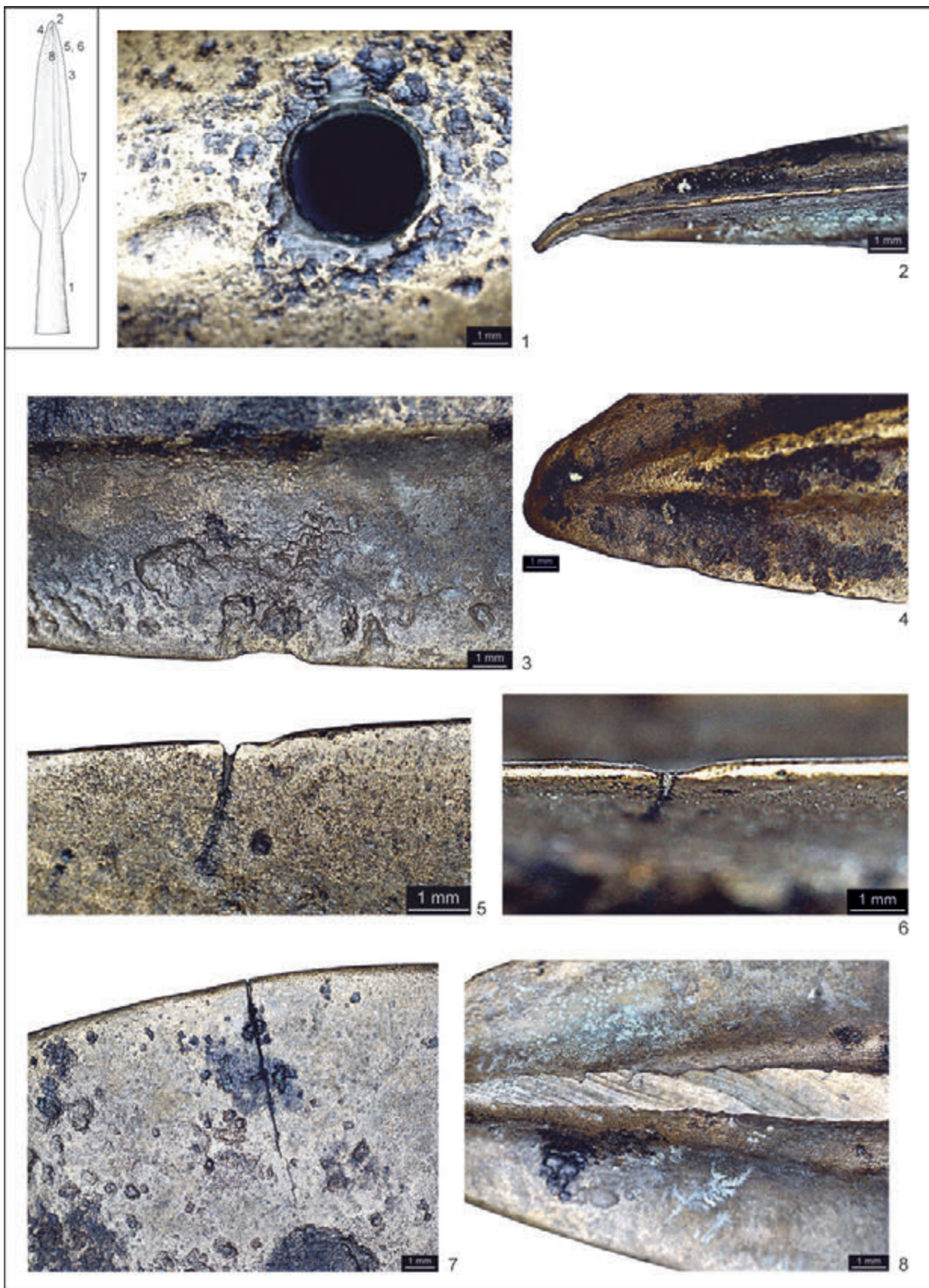
Pl. III. 1 – spearhead from Piešťany; 2 – spearhead from Šintava. Photos V. Mitáš, drawings Z. Nagyová.



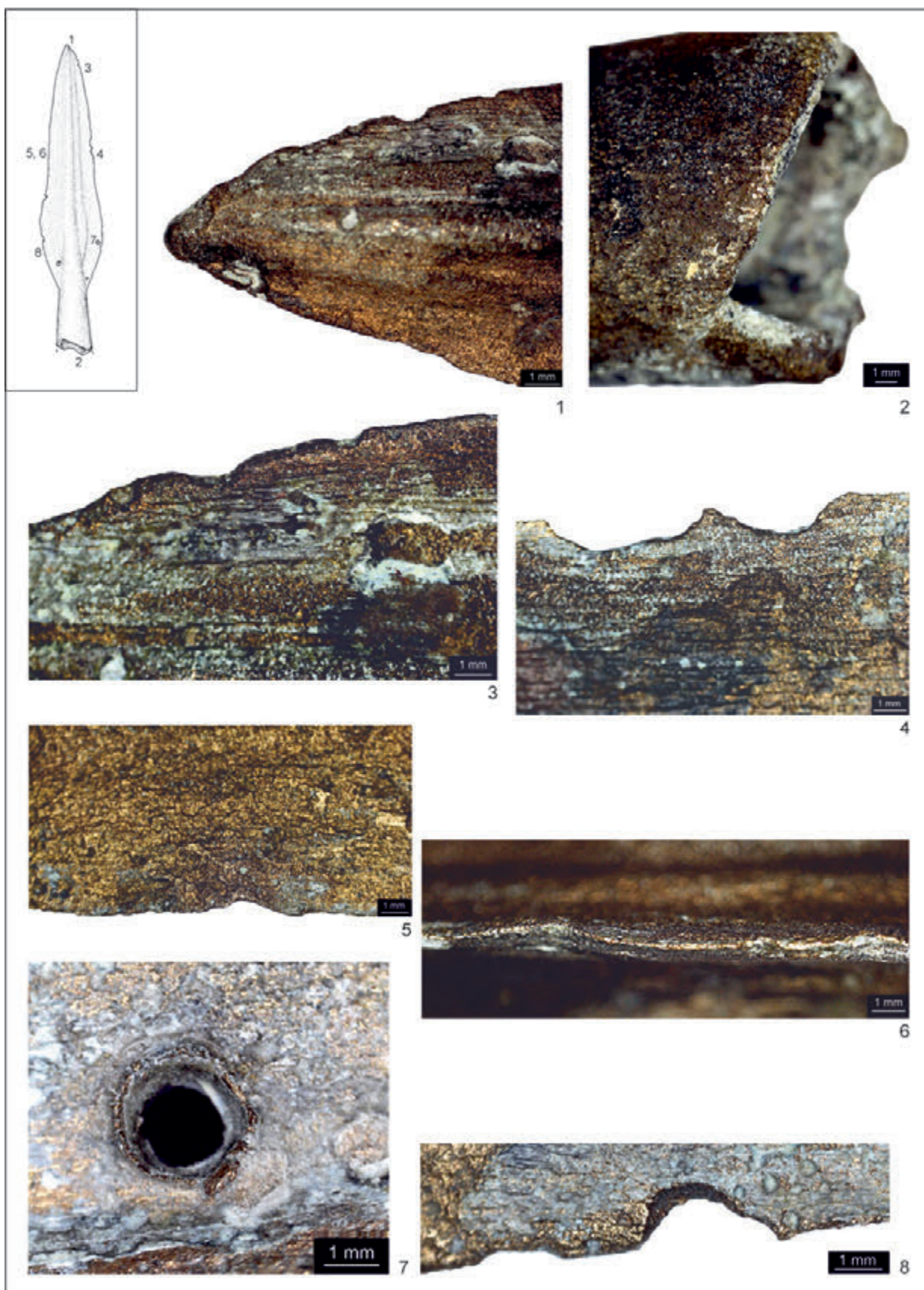
Pl. IV. Selected marks on the spearhead from Banka. Author J. Wójcik.



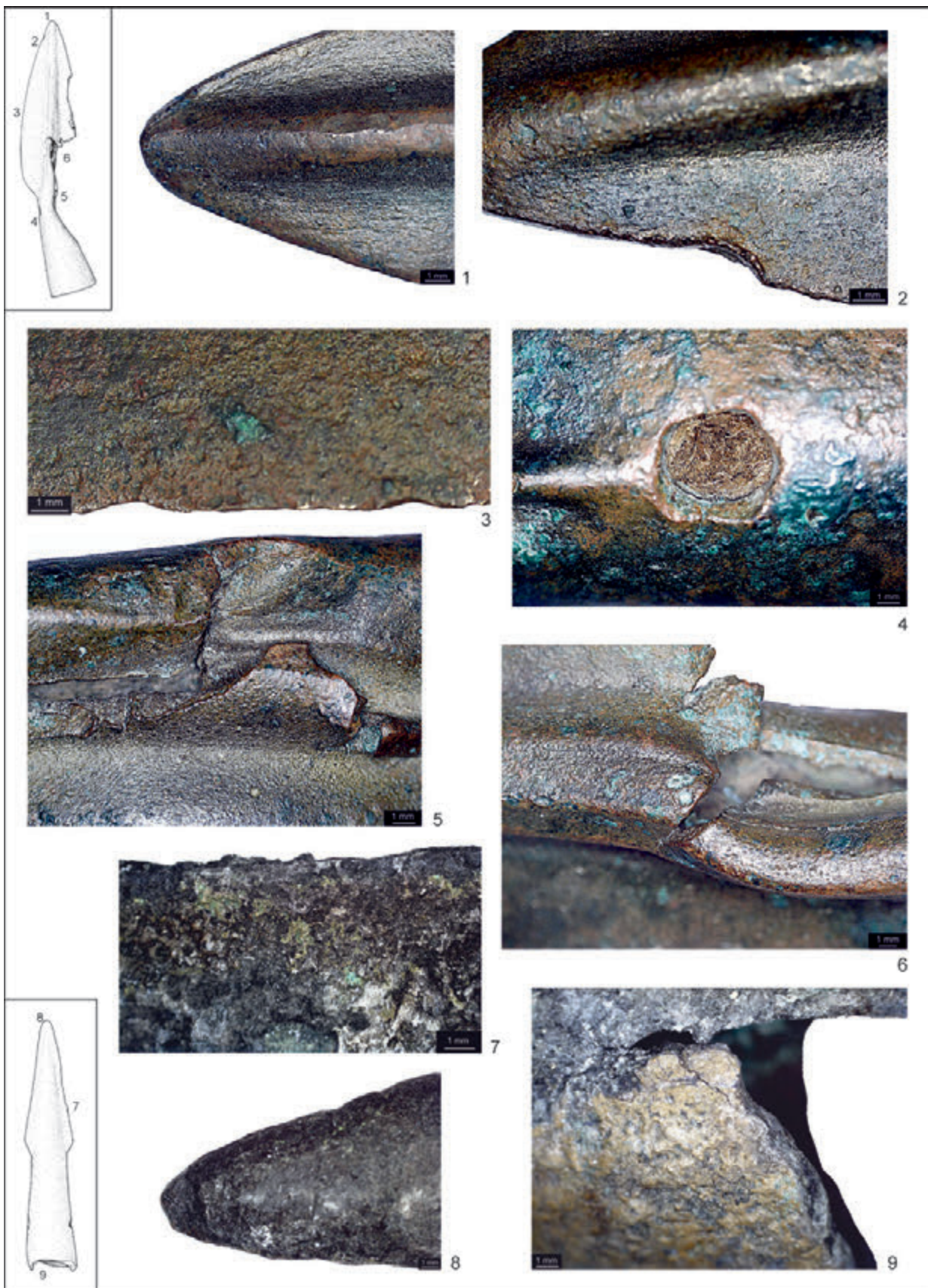
Pl. V. Selected marks on the spearhead from Hlohovec I. Author J. Wójcik.



Pl. VI. Selected marks on the spearhead from Piešťany. Author J. Wójcik.



Pl. VII. Selected marks on the spearhead from Madunice. Author J. Wójcik.



Pl. VIII. Selected marks on the spearheads from Šintava (1–6) and Hlohovec II (7–9). Author J. Wójcik.

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Bronzové hroty kopijí/oštepov z Vlastivedného múzea v Hlohovci

Analýza stôp používania, XRF analýza a rádiokarbónové datovanie

Jarosław Wójcik – Vladimír Mitáš – Ján Tirpák –
Jozef Urminský

Súhrn

V príspevku je predložená detailná analýza súboru bronzových hrotov kopijí/oštepov, ktoré sú deponované vo Vlastivednom múzeu v Hlohovci. Celkovo bolo analyzovaných šesť artefaktov z rôznych archeologických lokalít v povodí rieky Váh na západnom Slovensku, prevažne ide o hroty s výrazne zahnutými listami. Hroty boli klasifikované typologicky a chronologicky nielen podľa slovenských systémov, ale aj v širšom stredoeurópskom kontexte. Na celý súbor sa aplikovala analýza stôp používania a XRF analýza.

Skúmanie opotrebovania artefaktov odhalilo poškodenia, ktoré sú pravdepodobne už z doby bronzovej (obzvlášť evidentné na hrote z Banky), ale zistili sa aj neskoršie úpravy a poškodenia (zabrúsenie ostria exemplára z Banky, vyvrtané otvory na hrote z Maduníc, obrúsenie a sploštenie strednej časti ostria exemplára z Piešťan, možné novodobé poškodenia na hrote Hlohovec I či moderné zdeformovanie exemplára zo Šintavy, pravdepodobne spôsobené poľnohospodárskou činnosťou).

Chemické zloženie artefaktov umožnilo identifikovať výrazné odlišnosti medzi hrotmi. Zatiaľ čo hrot evidovaný ako Hlohovec II vykazuje odlišnosti pravdepodobne spôsobené silnou koróziou, skupina hrotov z lokalít Banka, Hlohovec I, Madunice a Piešťany vykazuje zloženie stopových prvkov blízke alpským rudám. Porovnanie chemického zloženia s ďalšími objektmi zo Slovenska datovanými do mladšej a neskorej doby bronzovej ukázalo, že analyzované hroty (s výnimkou exemplára Hlohovec II) vo väčšine prípadov zodpovedajú chemickému zloženiu, typickému pre predmety z doby bronzovej, hoci isté odchýlky – predovšetkým stabilná prítomnosť arzenu – sú pozorovateľné. Arzén, ktorý je dôležitým indikátorom metalurgie doby bronzovej, bol stabilne detegovaný na všetkých analyzovaných artefaktoch, zatiaľ čo v iných štúdiách často zaznamenaný nebol, pravdepodobne v dôsledku diferencií v analytických prístrojoch či v ich kalibrácii.

V jednom prípade sa realizovala aj rádiokarbónová analýza zvyšku drevenej násady z tuľajky hrotu (Šintava), ktorá preukázala jeho sekundárne využitie vo včasnom novoveku. Bez aplikácie uvedenej metódy by táto skutočnosť zostala nepovšimnutá. To otvára otázku, ako často boli hroty kopijí/oštepov, ale aj iné bronzové predmety premiestňované zo svojho pôvodného kontextu a opätovne využité, čo môže výrazne ovplyvniť naše vnímanie distribúcie artefaktov, ich chronológie či depozičných praktík.

Táto štúdia ukazuje, že detailné analýzy aj ojedinelých nálezov (a všeobecne artefaktov bez ich pôvodného kontextu) môžu významne prispieť tak k lepšiemu chápaniu využitia bronzových zbraní v dobe bronzovej, ako aj k osvetleniu ich ďalších osudov.

Obr. 1. Mapa analógií hrotov kopijí plameňovitého tvaru so stupňovitou profiláciou listu. 1 – Banka; 2 – Bratislava; 3 – Bratislava-Záhorská Bystrica; 4 – Čaka; 5 – Čičov; 6 – Gemer; 7 – Hlohovec I; 8 – Košické Olšany; 9 – Kúty; 10 – Madunice; 11 – Moravský Svätý Ján; 12 – Nesvady; 13 – Piešťany; 14 – Piešťany (Ducové); 15 – Slovenský Grob; 16 – Smolenice; 17 – Svätý Peter; 18 – Vajka (Lúčna nad Žitavou); 19 – Vlčany; 20 – Vyšná Hutka; 21 – Zádiel. Legenda: a – hroty kopijí diskutované v tomto článku; b – nálezy hrotov kopijí zo skupiny B podľa Badera, variant 6 (jeden kus); c – nálezy hrotov kopijí zo skupiny B podľa Badera, variant 6 (dva kusy); d – nálezy hrotov kopijí zo skupiny B podľa Badera, variant 6 (tri kusy); e – nálezy hrotov kopijí zo skupiny B podľa Badera, variant 7 (dva kusy); f – možné nálezy hrotov kopijí plameňovitého tvaru so stupňovitou profiláciou listu. Autor J. Wójcik.

Obr. 2. Mapa analógií hrotu kopije zo Šintavy. 1 – Gemer; 2 – Hažlín; 3 – Horná Štubňa; 4 – Nižná; 5 – Pavlovce; 6 – Šintava; 7 – Spišská Belá; 8 – Spišská Teplica; 9 – Trenčianske Bohuslavice; 10 – Zlatá Idka. Legenda: a – hrot kopije zo Šintavy; b – nálezy hrotov kopijí zo skupiny C podľa Badera, variant e (jeden kus); c – nálezy hrotov kopijí zo skupiny C podľa Badera, variant e (dva kusy); d – nálezy hrotov kopijí zo skupiny C podľa Badera, variant d (jeden kus); e – nálezy hrotov kopijí zo skupiny C podľa Badera, variant f (jeden kus). Autor J. Wójcik.

Obr. 3. Lokalizácia poškodení na troch hrotoch kopijí s výrazne zahnutými listami, so stupňovitou profiláciou listu (Banka, Hlohovec I a Piešťany). Intenzívnejšia červená farba označuje vyššiu frekvenciu poškodení v danej časti hrotu; čierne bodky označujú poškodenia pod patinou pozorované na hrote z Banky.

Diagram 1. Porovnanie chemického zloženia diskutovaných hrotov kopijí/oštepov s porovnávacou skupinou (XRF analýzy 45 artefaktov z mladšej a neskorej doby bronzovej zo Slovenska). 1 – meď (Cu); 2 – cín (Sn); 3 – arzén (As); 4 – antimón (Sb); 5 – striebro (Ag); 6 – nikel (Ni). Legenda: a – porovnávací skupina; b – Banka; c – Hlohovec I; d – Hlohovec II; e – Madunice; f – Piešťany; g – Šintava.

Tabela 1. Metrické údaje k analyzovaným hrotom kopijí/oštepov.

Tabela 2. Klasifikácia hrotov kopijí/oštepov v rámci vybraných typológií.

Tabela 3. Výsledky XRF analýzy.

Tab. I. 1 – hrot kopije z Banky; 2 – hrot kopije z Maduníc. Foto V. Mitáš, kresby Z. Nagyová.

Tab. II. 1 – hrot kopije z Hlohovca I; 2 – hrot oštepu z Hlohovca II. Foto V. Mitáš, kresby Z. Nagyová.

Tab. III. 1 – hrot kopije z Piešťan; 2 – hrot kopije zo Šintavy. Foto V. Mitáš, kresby Z. Nagyová.

Tab. IV. Vybrané stopy na hrote kopije z Banky. Autor J. Wójcik.

Tab. V. Vybrané stopy na hrote kopije z Hlohovca I. Autor J. Wójcik.

Tab. VI. Vybrané stopy na hrote kopije z Piešťan. Autor J. Wójcik.

Tab. VII. Vybrané stopy na hrote kopije z Maduníc. Autor J. Wójcik.

Tab. VIII. Vybrané stopy na hrotoch kopijí zo Šintavy (1–6) a z Hlohovca II (7–9). Autor J. Wójcik.

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ARCHEOLOGICKÉ NÁLEZY Z DOBY BRONZOVEJ Z ÚZEMIA SLOVENSKA V ZBIERKE TEODORA LEHOCKÉHO¹

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Keywords: Slovakia, Bronze Age, collection of T. Lehocký.

Archaeological Finds from the Bronze Age from the Territory of Slovakia in the Collection of Teodor Lehocký.

The article brings information about finds from the Bronze Age from the territory of Slovakia, which were acquired in the 19th century by T. Lehocký, a lawyer and scholar from Mukachevo (UA), and which are currently stored in museums in Ukraine, especially in the Transcarpathian Museum of Local History named T. Lehocký (Uzhhorod). The collector kept a manuscript diary about the acquisitions, the information from which was the basis for the authors to evaluate, or in some cases re-evaluate these artefacts. These are bronze ring-ingots from the former Bratislava (Požož) County, a sword of the Liptov type and a hoard containing, in addition to the well-known zoomorphic bronze vessel, also an socketed axe and a tanged sickle from Čičarovce, Michalovce district, bronze arrowhead and fragments of pottery from Nesvady, Komárno district and bronze spiral ornaments from Pucov, Dolný Kubín district.

ÚVOD

V múzeách Ukrajiny sa nachádzajú archeologické artefakty zo zbierky Teodora Lehockého, ktoré sa ešte v 19. stor. našli na území súčasnej Slovenskej republiky. Odbornej verejnosti na Slovensku buď neboli vôbec známe, alebo informácie o nich boli mylné či skreslené. Týmto príspevkom chceme prezentovať a sprístupniť nálezy datované do doby bronzovej z Lehockého zbierky spolu s údajmi o nich zo zberateľovho rukopisného denníka (*Lehoczky 1860–1894; 1894–1899*), ktorý je uložený v Zakarpatskom regionálnom vlastivednom múzeu v Užhorode nesúcim meno T. Lehockého.

KTO BOL TEODOR LEHOCKÝ?

Teodor Lehocký, maďarsky Lehoczky Tivadar, ukrajinsky Tyvodar Lehockyj (obr. 1), bol vzdelaný právnik, ktorý v druhej polovici 19. a začiatkom 20. stor. stál pri počiatkoch archeologickej vedy v Uhorsku (*Böhm 1933a*, 249; *Filip 1969*, 695; *Kobaľ 1990; 1995; 2006; Kobaľ/Kobaľ 2015; Kobáľy 2002; Szinnyei 1900*, 978–985), čím prirodzene zohral istú úlohu aj pri začiatkoch štúdia dávnej minulosti územia dnešného Slovenska (*Polla 1996*, 190–195). Bol to človek s veľmi širokým spektrom záujmov, ktoré zahŕňali históriu, genealógiu, etnografiu,



Obr. 1. Teodor Lehocký (Lehoczky Tivadar), 1830–1915. Podľa *Lehoczky 1907*.

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folklór a najmä archeológiu (Kobal' 1990; 1995). Pôsobil ako člen mnohých vtedajších uhorských vedeckých inštitúcií, o. i. bol aj členom Národnej archeologickej a antropologickej spoločnosti v Budapešti a čestným členom Tiszafüredskej archeologickej spoločnosti. Zhromaždil veľkú archeologickú zbierku obsahujúcu viac ako 7000 predmetov. Exponáty z tejto, svojho času najväčšej súkromnej zbierky v celom Rakúsko-Uhorsku, boli v roku 1876 prezentované na 8. medzinárodnom archeologickom kongrese v Budapešti. V roku 1907 zorganizoval T. Lehocký v Mukačeve múzejnú spoločnosť a vo vlastnom dome vytvoril zárodok prvého múzea histórie a života regiónu na Zakarpatsku. V medzivojnovom období, keď bolo Zakarpatsko pod názvom Podkarpatská Rus súčasťou Československa, bolo v roku 1929 v Mukačeve oficiálne otvorené Zemské múzeum pomenované po T. Lehockom, ktoré existovalo do roku 1946. Neskôr bola Lehockého zbierka prevezená do Zakarpatského regionálneho vlastivedného múzea v Užhorode, ktoré od roku 2015 nesie jeho meno (Kobal'/Kobal' 2015, 13–15).

T. Lehocký sa narodil 5. októbra 1830 vo Fužine (Chorvátsko), kde jeho otec Ján Lehocký, pôvodom Slovák, pracoval ako lesník. Ľudovú školu a šesť ročníkov gymnázia absolvoval v Ružomberku, filozofické štúdiá v Rožňave. V roku 1847 začal študovať na právnickej akadémii v Košiciach. Rok nato bol nútený štúdium prerušiť kvôli nástupu na vojenskú službu. V rokoch 1848–1849 sa zúčastnil maďarskej revolúcie. Po rozpustení vojenského zboru v roku 1849 pokračoval v štúdiu na právnickej akadémii, ktorú ukončil v roku 1851. O tri roky neskôr (1854) sa usadil v Mukačeve (dnes Zakarpatská oblasť, UA), kde žil až do svojej smrti 25. novembra 1915 a kde je aj pochovaný v krypte rímskokatolíckeho kostola sv. Martina. Najprv pôsobil ako asistent na súde, neskôr ako prednosta okresu Bereg a od roku 1865 až do odchodu do dôchodku ako hlavný právnik v službách grófa Schönborna v Mukačevsko-činadovskom panstve, jednom z najväčších v Uhorsku (Kobal'/Kobal' 2015, 3, 4).

Prácu súdneho úradníka a neskôr prokurátora intenzívne spájal s výskumnou prácou. Ovládal niekoľko jazykov (latinský, nemecký, slovenský, maďarský, ukrajinský), prekladal ľudové piesne zo slovenčiny a ukrajinčiny do maďarčiny (Lehoczky 1864; Szeberenyi/Lehoczky/Török 1866). Výsledky svojich výskumov prezentoval v 11 monografiách (z toho dve boli viacväzkové) a asi 300 článkoch o dejinách Zakarpatska od najstarších čias až po začiatok 20. stor. Písal najmä po maďarsky, ale tiež po nemecky. Popri publikovaných dielach zanechal obrovské rukopisné dedičstvo. Okrem archeológie sa venoval výskumu sociálno-ekonomického rozvoja Zakarpatska, duchovnej kultúry tohto regiónu, účasti jeho obyvateľov v protihabsburských vojnách v 17.–18. stor. a v revolúcii 1848–1849. Pôsobil aj ako folklorista, znalec zvykov a obradov rôznych národností Zakarpatska.

Archeologickým pamiatkam je venovaná jedna dvojväzková monografia (Lehoczky 1892; 1912), viac ako 80 článkov a štvorväzkový rukopisný denník (obr. 2). Denník, ako súčasť múzejného fondu Zakarpatského regionálneho vlastivedného múzeu v Užhorode, mal k dispozícii jeden z autorov príspevku, dlhoročný archeológ tohto múzea. Medzi nálezmi opísanými v rukopise je aj súbor predmetov nájdených na území súčasného Slovenska, ktoré pochádzajú z asi 20 polôh s chronologickým záberom od neolitu po stredovek. Pomerne malá, ale zaujímavá je zbierka artefaktov z doby bronzovej. Lokalizované, alebo približne lokalizované nálezy prezentujeme v tomto príspevku. Pamiatkam, ktorých lokalita je určená len ako Užská župa (čo môžu byť nálezy z územia dnešného Slovenska i Ukrajiny) sa budeme venovať na inom mieste.

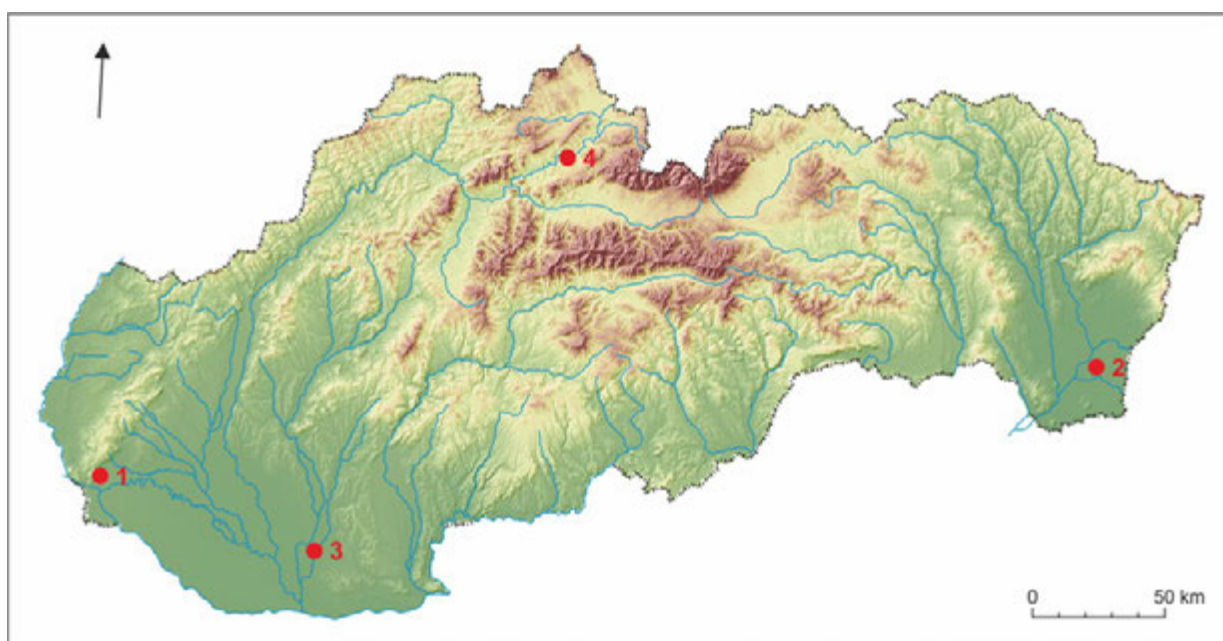
OPIS NÁLEZOV Z DOBY BRONZOVEJ ZO SLOVENSKA V ZBIERKE T. LEHOCKÉHO

Opis archeologických nálezov zo zbierky T. Lehockého, ktoré pochádzajú z územia Slovenska a chronologicky patria do doby bronzovej, je usporiadaný v abecednom poradí lokalít. Ide o tieto náleziská: Bratislava-okolie; Čičarovce, okr. Michalovce; Nesvady, okr. Komárno a Pucov, okr. Dolný Kubín (obr. 3).

Bratislava-okolie – bývalá Bratislavská (Požňanská) župa

(obr. 3: 1)

18. apríla 1886 dostal T. Lehocký poštou balík z Budapešti od Lipóta Szuka s desiatimi "starými kovovými krúžkami". Ako píše Lehocký, našli sa v „Požňanskej župe“ spolu so 125 ďalšími exemplármi, ktoré sa dostali do Maďarského národného múzea v Budapešti.



Obr. 3. Označenie lokalít na mape SR. 1 – Bratislava-okolie; 2 – Čičarovce; 3 – Nesvady; 4 – Pucov. Úprava M. Kotorová Jenčová.

1. Nákrčníkovitá hrivna z odliatej bronzovej (?) tyčinky so srdcovitým prierezom, so sploštenými a do očíek zahnutými koncami. Povrch je miestami nerovný, so stopami opracovania tepaním. Patina je zelená, niekde čierna. Jeden z koncov je poškodený (tab. I: 1).
Rozmery: priemer hrivny 14,9 × 13,1 cm, hrúbka tyčinky 1,2 cm, hmotnosť 218 g.
Uloženie: Zakarpatské regionálne vlastivedné múzeum pomenované po T. Lehockom v Užhorode (ZRVM), inv. č. B3-59/1.
2. Nákrčníkovitá hrivna z tyčinky s nerovným povrchom a stopami po tepaní, podobná ako predmet 1 (tab. I: 2).
Rozmery: priemer hrivny 15,9 × 13,1 cm, hrúbka tyčinky 1,2 × 1,1 cm, hmotnosť 197 g.
Uloženie: ZRVM, inv. č. B3-59/3.
3. Nákrčníkovitá hrivna podobná ako predchádzajúce, len jej povrch je hladký, bez stôp po dodatočnom opracovaní. Predmet je v súčasnosti rozložený na dve časti (tab. I: 3).
Rozmery: priemer hrivny 15,5 × 13,7 cm, hrúbka tyčinky 1,2 × 1,1 cm, hmotnosť 210 g.
Uloženie: ZRVM, inv. č. B3-59/9.
4. Nákrčníkovitá hrivna podobná ako predchádzajúce. Povrch tyčinky je nerovný so stopami opracovania (tab. I: 4).
Rozmery: priemer hrivny 15,7 × 12,8 cm, hrúbka tyčinky 1,3 × 1,1 cm, hmotnosť 230 g.
Uloženie: ZRVM, inv. č. B3-59/5.
5. Nákrčníkovitá hrivna podobného tvaru. Na povrchu tyčinky sú stopy opracovania (tab. II: 1).
Rozmery: priemer hrivny 16 × 13,5 cm, hrúbka tyčinky 1,7 × 1,6 cm, hmotnosť 203 g.
Uloženie: ZRVM, inv. č. B3-59/8. V roku 1951 bol predmet prevezený do Černivského regionálneho vlastivedného múzea (Černivci, UA), kde je v súčasnosti uložený pod inv. č. ChKM 8094-II-491.
6. Nákrčníkovitá hrivna s hladkým povrchom (tab. II: 2).
Rozmery: priemer hrivny 15 × 12,7 cm, hrúbka tyčinky 1,2 × 1 cm, hmotnosť 156 g.
Uloženie: pôvodné v ZRVM, inv. č. B3-59/2. Dnes je predmet uložený vo Vynohradivskom múzeu miestnej histórie (Vynohradiv, Zakarpatská oblasť, UA).
7. Nákrčníkovitá hrivna z tyčinky s nerovným povrchom a poškodenými (odlomenými) koncami (tab. II: 3).
Rozmery: priemer hrivny 14,6 × cca 8,3 cm, hrúbka tyčinky 1,1 × 0,9 cm, hmotnosť 159 g.
Uloženie: ZRVM, inv. č. B3-59/10.
8. Nákrčníkovitá hrivna z tyčinky s kruhovým prierezom a jedným poškodeným koncom (tab. II: 4).
Rozmery: priemer hrivny 16,5 × 13,3 cm, hrúbka tyčinky 1,0 cm, hmotnosť 204 g.
Uloženie: pôvodné v ZRVM, inv. č. B3-59/7, v súčasnosti je predmet uložený vo Vynohradivskom historickom múzeu (Vynohradiv, UA). Inv. č. nepoznáme.
9. Nákrčníkovitá hrivna podobná predchádzajúcej. Povrch tyčinky je nerovný, nesie stopy opracovania. Jeden z koncov je poškodený (tab. II: 5).
Rozmery: priemer nákrčníka 16,7 × 13,3 cm, hrúbka tyčinky 1,1 × 1 cm, hmotnosť 200 g.
Uloženie: ZRVM, inv. č. B3-59/6.

10. Nákrčníkovitá hrivna podobná predchádzajúcim, vyhotovená z tyčinky so srdcovitým prierezom.

Rozmery: priemer hrivny 15,7 × 13,2 cm, hrúbka 1,2 × 1 cm, hmotnosť 212 g.

Uloženie: pôvodné v ZRVM, inv. č. B3-59/4. V roku 1956 bol predmet prevezený do Ivano-Frankivského historického múzea (Ivano-Frankivsk, UA). Inv. č. nepoznáme.

Nepublikovaný prameň: *Lehoczky 1860–1894*, 157, č. 516.

Čičarovce, okr. Michalovce – depot

(obr. 3: 2)

V roku 1882 našli drevorubači v lese pri Čičarovciach bronzový poklad. Okrem iného údajne obsahoval bronzovú zoomorfnú nádobu, sekerku a kosák. Tieto predmety boli zakúpené v rôznom období a dostali sa do zbierky starožitností T. Lehockého (sekerku T. Lehocký kúpil 8. augusta 1882, nádobu 5. mája 1884 a dátum nákupu kosáka bol označený iba rokom 1884). 13. septembra 1905 T. Lehocký podľa zápisu v denníku daroval známu zoomorfnú nádobu Maďarskému národnému múzeu v Budapešti. J. Hampel však uvádza, že nádobu múzeum kúpilo (*Hampel 1906*, 78). V Lehockého zbierke zostali zvyšné dva predmety, ktoré sú dnes uložené v Zakarpatskom regionálnom vlastivednom múzeu v Užhorode.

1. Bronzová tepaná zoomorfná nádoba v tvare vodného vtáka s rohmi na hlave. Na chrbte nádoby je okrúhly otvor s dvoma pármí malých otvorov na zavesenie. Rovnaké dva otvory sú aj na zobáku vtáka, ktorého krídla sú na oboch stranách tela označené trojitými čiarami (tab. III: 1).
Rozmery (podľa T. Lehockého): výška 14,5 cm, šírka 14 cm, priemer otvoru na zadnej strane 4 cm, priemer otvorov na zobáku 0,3 cm, hmotnosť 540 g.
Uloženie: Maďarské národné múzeum Budapešť, inv. č. 63.1905.
Literatúra: *Furmánek et. al. 2015*, 247, obr. 261; *Novotná 1991*, 66, 67, tab. 12: 62.
Nepublikovaný prameň: *Lehoczky 1860–1894*, 102, 103, č. 393.
2. Bronzová sekerka s tuľajkou a uškom. Okraj rovno ukončenej tuľajky je zosilnený, telo je zdobené plastickým rebrovaním v kombinácii so štyrmi vertikálne usporiadanými plastickými výstupkami na dvoch širších stranách. Ostrie je mierne zaoblené (tab. III: 2).
Rozmery: dĺžka 10 cm, šírka ostria 4,5 cm, hmotnosť 135 g.
Uloženie: ZRVM, inv. č. B3-95.
Literatúra: *Bernjakovič 1960*, 372, č. 207, tab. II: 7 (tu nesprávne uvedené miesto a čas nálezu); *Lehoczky 1887*, 178, obr. 2.
3. Polkruhový bronzový kosák s plastickou rukoväťou s rebrom a pravouhlým otvorom. Chrbát a spevňovacie rebro na rukoväti sú zdobené šikmými zárezmi. Na širokej čepeľi je oválny otvor, čepeľ má poškodený (mierne zdeformovaný a odlomený) hrot, sledované sú stopy používania. Stopy po odlievaní sú začistené, patina je zelená, hrubá (tab. III: 3).
Rozmery: dĺžka 11,1 cm, max. šírka čepele 4 cm, šírka rukoväte 2,3 cm, hmotnosť 74 g.
Uloženie: ZRVM, inv. č. A-213/104.
Literatúra: *Bernjakovič 1960*, 371, č. 182, tab. I: 6 (tu nesprávne uvedené miesto nálezu); *Lehoczky 1892*, 155.

Čičarovce, okr. Michalovce – ojedinelý nález meča

(obr. 3: 2)

9. decembra 1898 kúpil T. Lehocký od užhorodského medenára fragment bronzového meča, ktorý sa údajne našiel neďaleko obce Čičarovce v lese Nagyerdő. Niektorí bádatelia neskôr označili ako miesto nálezu meča „okolie Užhorodu“ (J. Jankovich) a „Užhorod“ (K. Bernjakovič). Autori považujú údaje T. Lehockého za autentickéjšie a domnievajú sa, že náleziskom meča je kataster obce Čičarovce. Či meč patrí k nejakému väčšiemu celku – depotu – alebo je samostatným ojedinelým nálezom, je otázne.

- Fragment meča liptovského typu. Rukoväť a čepeľ sú odliate samostatne a spojené dvoma nitmi. Rukoväť je v priereze oválna s tromi vodorovnými plastickými rebromi zdobenými šikmými zárezmi. Polia medzi nimi sú zdobené rytými líniami tvoriacimi kosoštvorce. Horná časť rukoväte končí deformovaným kotúčom s výstupkom vo forme zrezaného kužela. Čepeľ je rovná, kosoštvorcového prierezu a mohla byť pôvodne poškodená. Po objavení meč prerobili na dýku. Patina je svetlozelená (tab. III: 4).
Rozmery: dĺžka 23,5 cm, dĺžka rukoväte 8,5 cm, šírka čepele 3,5–4 cm, hmotnosť 250 g (podľa T. Lehockého) a 351 g (podľa K. Bernjakoviča).
Uloženie: ZRVM, inv. č. B3-114. V roku 1964 už bol predmet stratený.
Literatúra: *Bernjakovič 1960*, 373, č. 232, tab. VII: 2; *Jankovich 1931*, 50, tab.V: 2; *Lehoczky 1912*, 30.
Nepublikovaný prameň: *Lehoczky 1894–1899*, 295, č. 1119.

Nesvady, okr. Komárno

(obr. 3: 3)

V rokoch 1872–1873 sa do zbierky T. Lehockého dostali nálezy z doby bronzovej z Nesvad. Niektoré z predmetov mu priniesol jeho príbuzný, miestny zemepán a kuriálny sudca Lipót Jamnický, iné si T. Lehocký osobne vyzdvihol na mieste nálezu.

Podľa správy T. Lehockého videl v dome L. Jamnického veľkú hlinenú urnu (výška asi 45 cm) so štyrmi výčnelkami na tele. Nádoba, ktorá sa našla v roku 1872 východne od Nesvad, obsahovala ľudskú lebku a bronzovú ihlicu. T. Lehocký pripísal nález dobe bronzovej.

V roku 1872 dostal T. Lehocký z Nesvad bronzový hrot šípu. Presná lokalizácia a okolnosti nálezu nie sú známe.

- Hrot šípu s tuľajkou, trojuholníkovitým listom a dvoma dlhými krídelkami. Tuľajka a hrot jedného krídelka sú čiastočne poškodené. Patina je hladká, zelenej farby (tab. IV: 1).
Rozmery: dĺžka 3,3 cm, šírka 1,5 cm, priemer tuľajky 0,3 cm.
Uloženie: ZRVM, inv. č. B3-120.
Nepublikovaný prameň: *Lehoczky 1894–1899*, 35, č. 165.

V dňoch 11.–12. júna 1873 zbieral T. Lehocký v okolí mesta Nesvady na pozemkoch L. Jamnického archeologické materiály (úlomky keramiky, kovové predmety, zvieracie kosti, lastúry mušlí) z rôznych období. Väčšinu keramických zlomkov, ktoré sa dostali do jeho zbierky a uchovali sa dodnes, našiel na jednom mieste. Išlo o nízku pieskovú dunu východne od mesta smerom na Bajč. Podľa T. Lehockého je šírka vyvýšeniny, v jeho dobe porastenej akáciami, asi 100 krokov. V piesku a na jeho povrchu zbieral mukačevský právnik rôzne úlomky keramiky, vrátane mnohých fragmentov úch a črepov zdobených rytými líniami, ako aj rôzne panciere korytnačiek a kly diviakov.

Fragmenty keramiky sú uložené v ZRVM, väčšina pod inv. č. A-303. Niektoré sú bez inventárneho čísla, boli však označené číslom denníka T. Lehockého, čo umožnilo ich identifikáciu.

1. Fragment z hrdla a pliec nádoby (amfory?), silne prepálený. V keramickej hmote je prímes piesku, povrch črepu je tmavosivý (tab. IV: 2).
Rozmery: 9 × 8,5 cm, hrúbka 0,7 cm.
2. Fragment z hrdla a pliec nádoby (amfory?). Zloženie keramickej hmoty, vypaľovanie a farba sú podobné fragmentu opísanému vyššie. Na hrdle je okrúhly (reparačný?) otvor (tab. IV: 3).
Rozmery: 7,8 × 6,5 cm, hrúbka 0,4–0,5 cm.
3. Fragment z tela hrubostennej nádoby, zdobený plastickou jamkovanou lištou. Keramická hmota obsahuje prímes piesku a šamotu. Črep je silne vypálený, povrch svetlohnedý a sivý (tab. IV: 4).
Rozmery: 4,5 × 4,5 cm, hrúbka 1,4 cm.
4. Fragment z tela nádoby s plastickou lištou zdobenou šikmými zárezmi. Keramická hmota obsahuje prímes jemnej drte. Črep je silne vypálený, povrch zvnútra čierny, zvonku svetlohnedý (tab. IV: 5).
Rozmery: 4,5 × 5 cm, hrúbka 0,7 × 0,8 cm.
5. Fragment z tela hrubostennej nádoby s plastickou lištou zdobenou prstovaním. Keramická hmota obsahuje prímes piesku a šamotu. Črep je silne vypálený, povrch hladký, farba v strede svetlohnedá, zvonku tmavosivá (tab. IV: 6).
Rozmery: 4,7 × 4,5 cm, hrúbka 1,3 cm.
6. Fragment z tela nádoby so subkutálnym uchom. V keramickej hmote je prímes piesku. Črep je silne vypálený, povrch tmavosivý (tab. IV: 7).
Rozmery: 4 × 4 cm, priemer otvoru ucha 0,6 cm.
7. Fragment z tela nádoby s uchom. Charakteristika črepu je podobná predchádzajúcemu (tab. IV: 8).
Rozmery: 3,5 × 3 cm, priemer otvoru ucha 1,2 × 0,7 cm.
8. Fragment z tela nádoby s uchom. Charakteristika črepu je podobná predchádzajúcim (tab. IV: 9).
Rozmery: 3 × 3,5 cm, priemer otvoru ucha 0,8 × 0,5 cm.
9. Fragment z tela nádoby so strechovitým uchom. Technológia výroby, zloženie hmoty, vypaľovanie a farba sú podobné vyššie uvedeným črepom (tab. IV: 10).
Rozmery: 4,5 × 8 cm, priemer otvoru ucha 0,5 × 0,6 cm, hrúbka 0,5 cm.
10. Fragment spodnej časti nádoby, zdobený skupinami zvislých a šikmých paralelných línií. V keramickej hmote je prímes piesku. Črep je silne vypálený, povrch tmavosivý, na dotyk hrboľatý (tab. IV: 11).
Rozmery: 5 × 4,5 cm, hrúbka 0,5 cm.
11. Fragment okraja hrubej nádoby, zdobený zvrchu hlbokým jamkovaním. V keramickej hmote je prímes šamotu. Črep je stredne vypálený, povrch hladký, jemný na dotyk, svetlohnedej farby (tab. IV: 12).
Rozmery: 5,5 × 3,4 cm, hrúbka 1,2 cm.

12. Fragment misy kónického tvaru so širokým, ostro von vyhnutým okrajom. V keramickej hmote je makroskopicky pozorovaná šamotová prímes. Črep je nerovnomerne vypálený, povrch je pokrytý tenkou vrstvou sivej engoby (tab. IV: 13).
Rozmery: 5,5 × 5,5 cm, hrúbka 0,7 cm.
13. Fragment z tela nádoby, zdobený dvoma paralelnými rytými líniami. V keramickej hmote je minerálna prímes. Črep je silne vypálený, povrch je pokrytý vrstvou svetlohnedej engoby (tab. IV: 14).
Rozmery: 3,8 × 4 cm, hrúbka 0,6 cm.
14. Fragment z tela tenkostennej nádoby (šálky). Rytá výzdoba tvorí špirálovitý motív. V keramickej hmote je prímes jemnej drte bielej farby. Výpal je nerovnomerný, na povrchu je hnedá engoba (tab. IV: 15).
Rozmery: 3 × 3,2 cm, hrúbka 0,2–0,3 cm.
16. Fragment z tela nádoby, zdobený tromi rytými líniami. V keramickej hmote je prímes šamotu. Črep je silne vypálený, farba povrchu hnedá (tab. IV: 16).
Rozmery: 3 × 2 cm, hrúbka 0,7 cm.
15. Fragment z lomu tela nádoby. Rytú výzdobu tvorí rastlinný ornament („dubový list“?). V keramickej hmote je prímes drte. Črep je silne vypálený, povrch hnedý (tab. IV: 17).
Rozmery: 3,5 × 5 cm, hrúbka 0,7 cm.
Nepublikovaný prameň: Lehoczky 1860–1894, 35, č.138.

V záznamoch T. Lehockého je aj informácia, že „12. júna 1872 osobne prezrel polohu Rókalyuk na severnom okraji mesta“ a našiel tam veľa črepov, zvieracích kostí a jednu bronzovú sponu. Kde sa tieto nálezy nachádzajú dnes, nie je známe (*Lehoczky 1873, 247–249*).

Pucov, okr. Dolný Kubín

(obr. 3: 4)

V roku 1875 sa za neznámych okolností našiel poklad bronzových predmetov, ktorý pozostával minimálne z deviatich špirálových ozdôb. Časť predmetov si ponechal miestny kováč. Neskôr sa nálezy dostali do zbierky M. Kubínyho. V tom istom roku tri predmety z tohto pokladu získal T. Lehocký.

1. Bronzová okrasa z dvoch nerovnako veľkých kopovitých ružíc spojených špirálkou s dvoma vinutiami, vyrobená z pevného drôtu s okrúhlym prierezom. Veľká špirála má 13 vinutí, malá šesť. Predmet je bez patiny, povrchová úprava je hrubá (tab. V: 1).
Rozmery: priemer veľkej špirály 11,5 cm, priemer malej špirály 2,5 cm, hrúbka drôtu 0,3–0,4 cm.
Uloženie: ZRVM, inv. č. B3-143.
2. Bronzová okrasa, tvarovo podobná predchádzajúcej, s hustejším a viacpočetným vinutím ružice, čiastočne poškodená (chýba malá ružica). Predmet je bez patiny, povrch je kvalitne upravený. Zachovaná ružica má 26 vinutí (tab. V: 2).
Rozmery: priemer ružice 10,8 cm, výška predmetu 4,6 cm, hrúbka drôtu 0,3–0,4 cm.
Uloženie: pôvodné ZRVM, inv. č. B3-144. V roku 1951 bol predmet prevezený do Černivského regionálneho historického múzea, kde je uložený pod inv. č. 8090-II-487.
3. Bronzová okrasa – veľká ružica so 16 vinutiami. V inventároch T. Lehockého nie sú žiadne iné údaje o ďalších parametroch predmetu.
Uloženie: V roku 1954 bol predmet prenesený do Národného múzea v Kyjeve.
Literatúra: *Eisner 1933, 125; Hampel 1886, 92, tab. XXXV: 2; 1892, 120; Novotná 1970, 113.*
Nepublikovaný prameň: Lehoczky 1860–1894, 53, č. 204/1–3.

VYHODNOTENIE

Opísané artefakty zo zbierky T. Lehockého, pochádzajúce z územia Slovenska, sú dnes uložené v rôznych múzeách Ukrajiny.² Väčšina z nich sa nachádza v múzeu nesúcom meno T. Lehockého v Užhorode. Geograficky tieto artefakty pochádzajú z lokalít rozprestierajúcich sa od západného po východné Slovensko (obr. 3) a chronologicky sa zaraďujú do obdobia od staršej po neskorú dobu bronzovú.

Medzi najstaršie hodnotené nálezy z uvedenej zbierky patria kruhové, resp. oválne nákrčníkovité hrivny (*Ringbarren*) z depotu z Bratislavy-okolia (tab. I; II). Už *J. Eisner (1931, 11)* uvažoval o týchto nálezočoch v kontexte staršej doby bronzovej a únětickej kultúry. Bronzové hrivny z tohto depotu, uložené

² Až na bronzovú zoomorfnú nádobu z Čičaroviec, ktorá je v Maďarskom národnom múzeu v Budapešti.

v Maďarskom národnom múzeu v Budapešti, priradila aj A. Mozsolicsová do staršej doby bronzovej – stupeň BII, resp. horizont depotov Kömlöd-Ercsi (*Mozsolics 1967*, 71, 155). Hrivny podobné našim sa podľa M. Novotnej nachádzajú najmä na juhozápadnom Slovensku a chronologicky zodpovedajú klasickej fáze únětickej kultúry (*Novotná 1984*, 23, 26). Považujú sa za polotovary, formu suroviny, prípadne sa označujú ako ekvivalent výmeny (*Bátora 2018*, 177). Sú spájané s klasickou fázou únětickej kultúry do tej miery, že ich výskyt v oblasti Turca (*Novotná 1984*, 20), Oravy (*Novotná 1984*, tab. 32: 200; 33: 201, 202) a na Spiši (*Novotná 1984*, tab. 5: 33; 12: 198; 32: 199), teda mimo priamu oikumenu nositeľov únětickej kultúry, je vnímaný ako prejav putovania „obchodníkov“ únětickej kultúry na východ a sever (*Bátora 2018*, 119, 372) a v takom kontexte sa funkcia týchto predmetov ako ekvivalentu výmeny javí logickým funkčným určením.

Vo všeobecnosti boli hrivny staršej doby bronzovej distribuované z oblasti dnešného Švajčiarska do Maďarska (*Lenerz-de Wilde 2002*, 4, mapa 3), no najviac depotov s hrivnami bolo zaznamenaných na úpätí Álp, odkiaľ sa med' dostávala do okolitých oblastí (*Junk/Krause/Pernicka 2001*, 354, 361). Predpokladá sa, že tieto výrobky boli rozdelené do určitých hmotnostných skupín, napríklad 180–190 g a 200–220 g (*Junk/Krause/Pernicka 2001*, 354), alebo 40–50 g, 85–100 g, 175–200 g, 200–210 g (*Lenerz-de Wilde 2002*, 3, 4) a mohli byť použité aj ako prvok „peňažného systému“ ako všeobecný ekvivalent výmeny (*Junk/Krause/Pernicka 2001*, 356; *Lenerz-de Wilde 2002*, 18, 22; *Pare 2013*, 513, 514).

Z desiatich artefaktov, ktoré sa nedostali spolu s ostatnými nálezmi nákrčníkov a hrivien z „okolí Bratislavy“ do NM v Budapešti a zachovali sa v zbierke T. Lehockého, je šesť, resp. sedem (siedmy je poškodený) vyhotovených z tyčinky so srdcovitým prierezom (tab. I; II: 1–3), dva majú prierez tyčinky kruhový (tab. II: 4, 5). Stopy po opracovaní sledujeme na piatich (tab. I: 1, 2, 4; II: 1, 5). Rozmery sa pohybujú od 14,6 × asi 8,3 cm (tab. II: 3) po 16,7 × 13,3 cm (tab. II: 5), hmotnosť od 156 g (tab. II: 2) po 230 g (tab. I: 4). Dve hrivny majú hmotnosť 156 g a 159 g, štyri oscilujú okolo hmotnosti 200 g (197–204 g) a štyri v rozmedzí 210–230 g.

S prihliadnutím na veľkosť, hmotnosť a spracovanie desiatich hrivien zo zbierky T. Lehockého ich môžeme priradiť k nákrčníkovitým hrivnám (azda pôvodnému „platidlu“), ktoré možno datovať do obdobia BA1b (*Furmánek et. al. 2015*, 24; *Pare 2013*, 513).

Súbor archeologických nálezov z Nesvad (tab. IV) pozostáva z bronzového hrotu šípu (tab. IV: 1) a z keramických zlomkov. Ich vzájomnú súvislosť dnes nie je možné jednoznačne doložiť. Najväčšiu pozornosť si zaslúžia fragmenty keramiky. Skladajú sa z dvoch skupín. Do prvej, ktorú možno nazvať miestnou, patria fragmenty nádob vyrobených najmä s prímiesou piesku. Sú dobre vypálené a väčšinou sivastej farby. Túto keramiku môžeme zaradiť len všeobecne do doby bronzovej (tab. IV: 2–12). Kultúrne asi nie je rovnorodá, časť azda patrí do okruhu mohylových kultúr.

Druhá skupina keramických fragmentov (tab. IV: 13–17), ktorú predbežne nazývame cudzorodá, je vyrobená s prímiesou šamotu alebo bielej drte a je prevažne hnedej farby. Podľa všetkých znakov (technológia výroby, tvary a výzdoba) patria tieto zlomky kultúre Suciú de Sus. Súdiac podľa črepu zo zalomenej vydutiny s rytým ornamentom (tab. IV: 17), tieto fragmenty keramiky z Nesvad možno priradiť k staršiemu stupňu vývoja kultúry Suciú de Sus (BB2–BC1). Na území Slovenska je rozšírenie tejto kultúry komplexu juhovýchodných popolnicových polí dobre zaznamenané na východnom Slovensku (*Demeterová 1984*; *Furmánek et. al. 2015*, 187–189). Importy kultúry Suciú de Sus z obdobia BB1 sú známe aj mimo oblasti jej rozšírenia, v prostredí otomanskej kultúry – v Nižnej Myšli či v Spišskom Štvrtku (*Furmánek 1997*, 156, 157, obr. 4). Geograficky najbližšie k nálezom keramiky Suciú de Sus z Nesvad sú však importy tejto kultúry na juhozápadnom Slovensku (*Furmánek et. al. 2015*, obr. 148) – amfora zo sídliska poklasickej fázy maďarovskej kultúry v Šuranoch-Nitrianskom Hrádku (*Furmánek 1997*, 156, obr. 1; 2), keramika z Nitry (*Březinová 2010*, 31) a Rybníka, okr. Levice (*Bátora/Rassmann 2008*). Importy kultúry Suciú de Sus, najmä z druhej fázy jej vývoja, sú známe tiež v severnom Maďarsku na lokalitách skupiny Egyek karpatskej mohylovej kultúry (*Igrici-Matata; Kalicz 1960*, 6, tab. IV: 2a, b), pilinskej kultúry (*Méra; Kemenczei 1984*, 111, tab. XXXVI: 17) a mohylovej kultúry (*Tiszafüred-Majoros-halom*, hrob 181; *Kovács 1975*, 25, tab. 18: M181: 2).

Bronzový hrot šípu z Nesvad (tab. IV: 1) možno dať do súvisu s hrotmi s tuľajkou stredodunajskej mohylovej kultúry (napríklad Smolenice; *Dušek 1980*, tab. VIII: 11–19; XII: 3), ktorá existovala od začiatku strednej doby bronzovej (BB1) po začiatok mladšej doby bronzovej (BD; *Furmánek 1973*, 109, 110). Chronologicky sa teda nevylučuje jeho spojenie s keramikou.

Špirálovité ozdoby z pucovského depotu (tab. V) sa pripisovali dobe bronzovej už v 19. stor. (*Hampel 1886*, 92). Ich chronológia bola neskôr upresnená (*Eisner 1933*, 125) a určená stupňom HA (*Novotná 1970*, 74), stupňom BIVa, horizontom depotov Forró (*Mozsolics 1973*, 170), resp. mladším obdobím kultúry

popolnicových polí až do počiatku stupňa HB (Furmánek 1980, 41, 42, tab. 28: 791–794; Makarová 2008, 93, 176, 179, 180; Veliačik 1983, 83). Ozdoby typu Pucov sa kladú v absolútnej chronológii do obdobia 1200–1000 pred Kr. (Furmánek 2004, 85, 86; Furmánek/Kujovský 2005, 103). Podobné ružicové okrasy sa na základe pokladu z Košických Olšian (Miroššayová 1998/1999; 1999) datujú do stupňov BD–HA1 (Miroššayová 1998/1999, 126, 128, obr. 8), resp. k roku 1100 pred Kr. (Furmánek/Kujovský 2005, 105). Funkčné určenie týchto okrás sa hypoteticky vidí v ženskom kroji ako ozdoba prs (Furmánek 1980, 41; Furmánek et. al. 2015, 283; Makarová 2008, 116, obr. 21: a).

Bronzový meč z Čičaroviec (tab. III: 4), aj keď je sekundárne spracovaný a nie je úplne zachovaný, jednoznačne patrí do veľkej skupiny mečov s plnou liatou rukoväťou a tromi zosilneniami na nej, označovaných ako meče liptovského typu (Bader 1991, 128; Kemenczei 1991, 32; Kobaľ 2000, 32; Mozsolics 1985, 12, 13; Müller-Karpe 1961, 22; Novotná 1970, 48–53 a i.). Nález uvádza J. Eisner (1933, 103, pozn. 40) a tiež, hoci s nesprávnymi údajmi, K. Bernjakovič (1960, 337, tab. VII: 2). Presné analógie rukoväte a jej výzdoby sa nepodarilo nájsť, preto datovanie meča možno určiť len v širšom chronologickom rozmedzí stupňov HA1–HA2, prípadne HB1.

Najzaujímavejším nálezom v Lehockého zbierke je bronzová nádoba v podobe vodného vtáka (kačice?/šabliarky?) s rohmi na hlave (tab. III: 1) známa v literatúre od 19. stor. (Böhm 1933b, obr. na s. 5, dole; Hampel 1886, 67, tab. LXVII: 3a, b; Ilon 2002, 128; Kossak 1954, 52, tab. 5: 11; Kovács 1977, 98, obr. 69; Novotná 1991, 66, 67, tab. 12: 62; Szatmári 2003, 56, obr. 38). V odbornej literatúre sa táto unikátna nádoba často označovala ako ojedinelý nález (Furmánek/Veliačik/Vladár 1991, 267; Novotná 1991, 66), hoci už od 19. stor. písal sám T. Lehocký (1892, 155), ale aj J. Hampel (1886, 43) o depote. Mnohé z bronzových tepaných nádob majú neznáme nálezové okolnosti a sú evidované ako „ojedinelé nálezy“. Možno však predpokladať, že boli súčasťou väčších celkov (Furmánek et. al. 2015, 247). Vďaka informáciám z rukopisného denníka T. Lehockého sa domnievame, že aj túto ornitomorfnú nádobu možno zaradiť do kontextu s ďalšími dvoma nálezmi, bronzovou sekerkou (tab. III: 2) a kosákom (tab. III: 3; Kobaľ 2006, obr. 6).

Dodnes je z územia bývalého Uhorska známa len jedna podobná, nie však totožná, bronzová nádoba bez konkrétneho miesta nálezu (Hampel 1886, tab. LXVIII: 5a, b; Novotná 1991, 67). Pokiaľ ide o datovanie nádoby z Čičaroviec, názory bádateľov sa rozchádzali. Niektorí ju zaradili do staršej doby železnej, stupeň HC (Novotná 1991, 67), iní do záveru doby bronzovej, do 10. stor. pred Kr. (Furmánek/Veliačik/Vladár 1991, 267; Szatmári 2003, 56).

K objasneniu chronologického zaradenia môže prispieť analýza ďalších dvoch predmetov – sekerky s tuľajkou a kosáka – ktoré s vysokou pravdepodobnosťou patrili do toho istého nálezového celku ako zoomorfná nádoba. Prvý z týchto predmetov predstavuje sekerku s tuľajkou a uškom, s plochou čepeľou a tzv. „pseudokrídlami“, vytvorenými pomocou plastických rebrier (tab. III: 2). Táto pomerne vzácna forma je rozšírená v Zadunajsku a východnej časti Karpatskej kotliny, pričom sa v prevažnej miere datuje do stupňa HB1, v niektorých prípadoch aj do stupňa HB2 (Tarbay 2022, 37, 38). Sekerka z Čičaroviec sa však od štandardnej podoby odlišuje tým, že má na dvoch plochých stranách štyri ihličkovité výbežky (max. výška 0,5 cm). Možno slúžili na upevnenie nejakých organických ozdôb (kosť, rohovina a pod.) alebo drevenej rukoväte (Bernjakovič 1960, 331, tab. II: 7). Sekerky s takýmito prvkami nám v blízkom regióne nie sú známe. Podobnú výzdobu mala sekerka s tuľajkou a vejárovito rozšíreným symetrickým ostrím, ktorá bola súčasťou depotu z Málinca, okr. Poltár. Depot je z prostredia juhovýchodných popolnicových polí a je datovaný do stupňov HB1–HB2 (Makarová/Rusko/Čambal 2023, 68, 73, obr. 6: 2a–c). Za vzdialenejšie analógie možno považovať niekoľko sekeriek s vertikálne usporiadanými plastickými výčnelkami na ploche pseudokrídel (Spelnace I, Rumunsko; Dietrich 2021, tab. 616: 2672; Petrescu-Dîmbovița 1977, tab. 326: 6; Miesce, Poľsko; Blajer 2013, tab. 40: 2), alebo závesných oblúkov (Somotor, depot A; Novotná 1970, 119, tab. XLVI: 14). Depoty, ktorých boli uvedené nálezy sekier súčasťou, sú datované do HB1 (Blajer 2013, 33; Pare 1998, 360, 361).

Kosák z Čičaroviec (tab. III: 3) patrí ku kosákom s plastickou rukoväťou s otvorom na upevnenie a širokou, silne zahnutou čepeľou s dvoma dlhými rebrami – typ Josani 1 podľa M. Petrescu-Dîmbovița (1978, 44, 45), typ Boskovice podľa M. Primasovej (1986, 148, 149), alebo skupina V, typ 4, variant a podľa J. Říhovského (1989, 81, 82). Areál rozšírenia tohto typu výrobkov je mimoriadne rozsiahly, siaha od Francúzska na západe a Talianska na juhu po Rumunsko na východe a Poľsko na severe (Petrescu-Dîmbovița 1978, 45; Primas 1986, 163). Napriek tomuto širokému geografickému rozpätiu sa ich výskyt koncentruje predovšetkým v dunajskej oblasti strednej Európy, osobitne vo východoalpskej oblasti, v Maďarsku, Rumunsku (Sedmohradsko) a na Slovensku (Říhovský 1989, 88). V bezprostrednom geografickom okolí Čičaroviec však podobné nálezy zatiaľ nie sú zaznamenané vo väčšom počte (Blajer 2013, tab. 14: 3; Furmánek/

Novotná 2006, 19, tab. 30: 477–479; 31: 479, 480; *Kemenczei 1984*, tab. CXVIIb: 1–5; *Kobal' 2000*, tab. 87: C: 1; *Mozsolics/Schalk 2000*, tab. 105: 12).

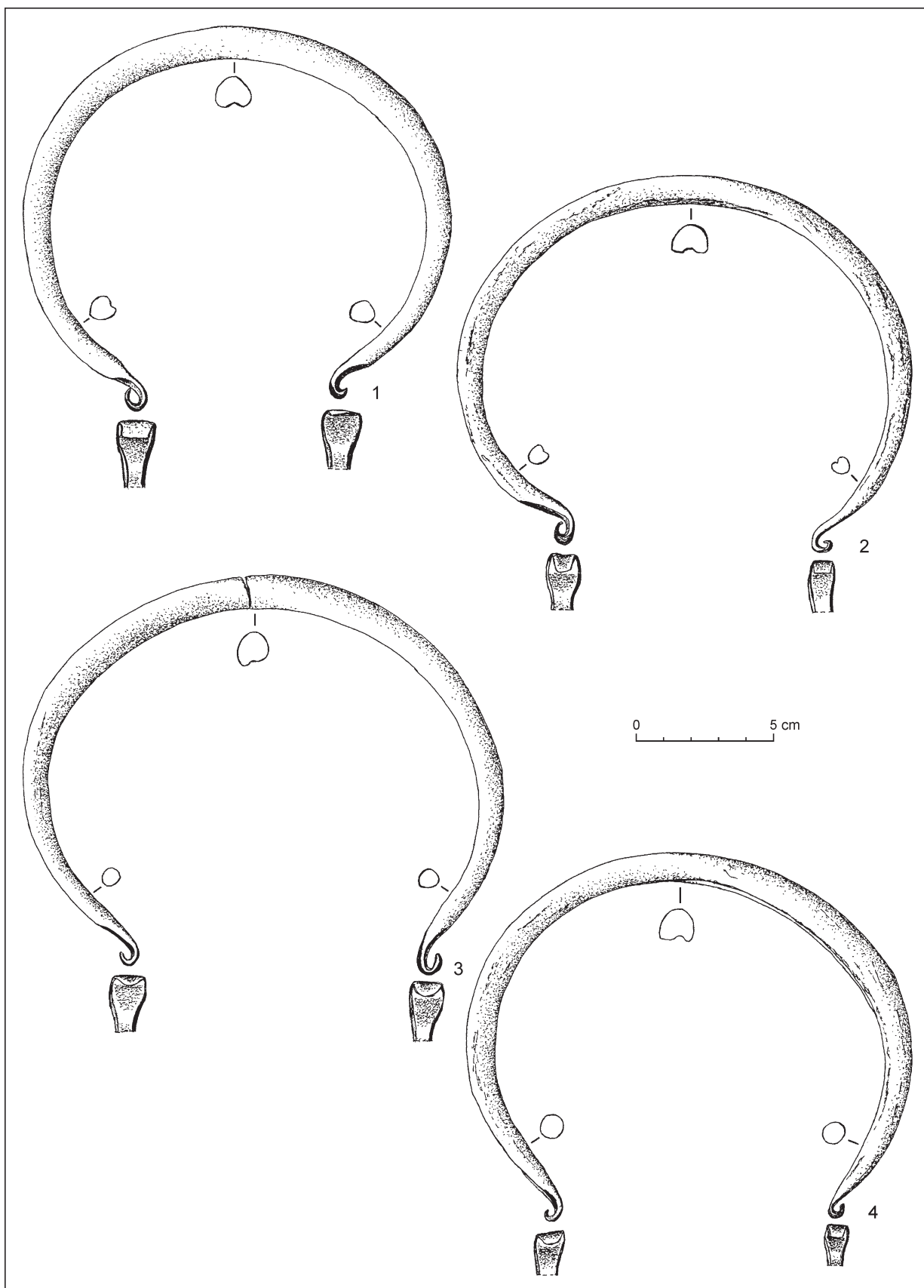
Podľa M. Primasovej sa kosáky boskovickej skupiny, do ktorej patrí aj náš exemplár, začali vyrábať v počiatočnom štádiu neskorej doby bronzovej strednej Európy (HB1) a rané exempláre sa koncentrujú vo východnej časti ich areálu (*Primas 1986*, 162, 163). Patria k nim napríklad kosáky z pokladov Cornesti, Salard I a prípadne Gida v Rumunsku (*Petrescu-Dîmbovița 1978*, tab. 230: 29; 239: 15–20; 259: C18) a Tiszaéslár v Maďarsku (*Mozsolics/Schalk 2000*, tab. 105: 12), ktoré sa vzťahujú k stupňu HB1 (*Pare 1998*, 361). Väčšina takýchto kosákov je však datovaná do záverečnej fázy doby bronzovej (*Primas 1986*, 162) alebo do mladších kultúr popolnicových polí (*Říhovsky 1989*, 88), teda stupňov HB2–HB3. Kosák z Čičaroviec patrí na základe šikmých zárezov na rebrách pravdepodobne do ranej skupiny kosákov vyššie uvedeného typu, a preto sa domnievame, že spolu so sekerkou môžeme datovať aj aviamorfnú nádobu do stupňa HB1.

ZÁVER

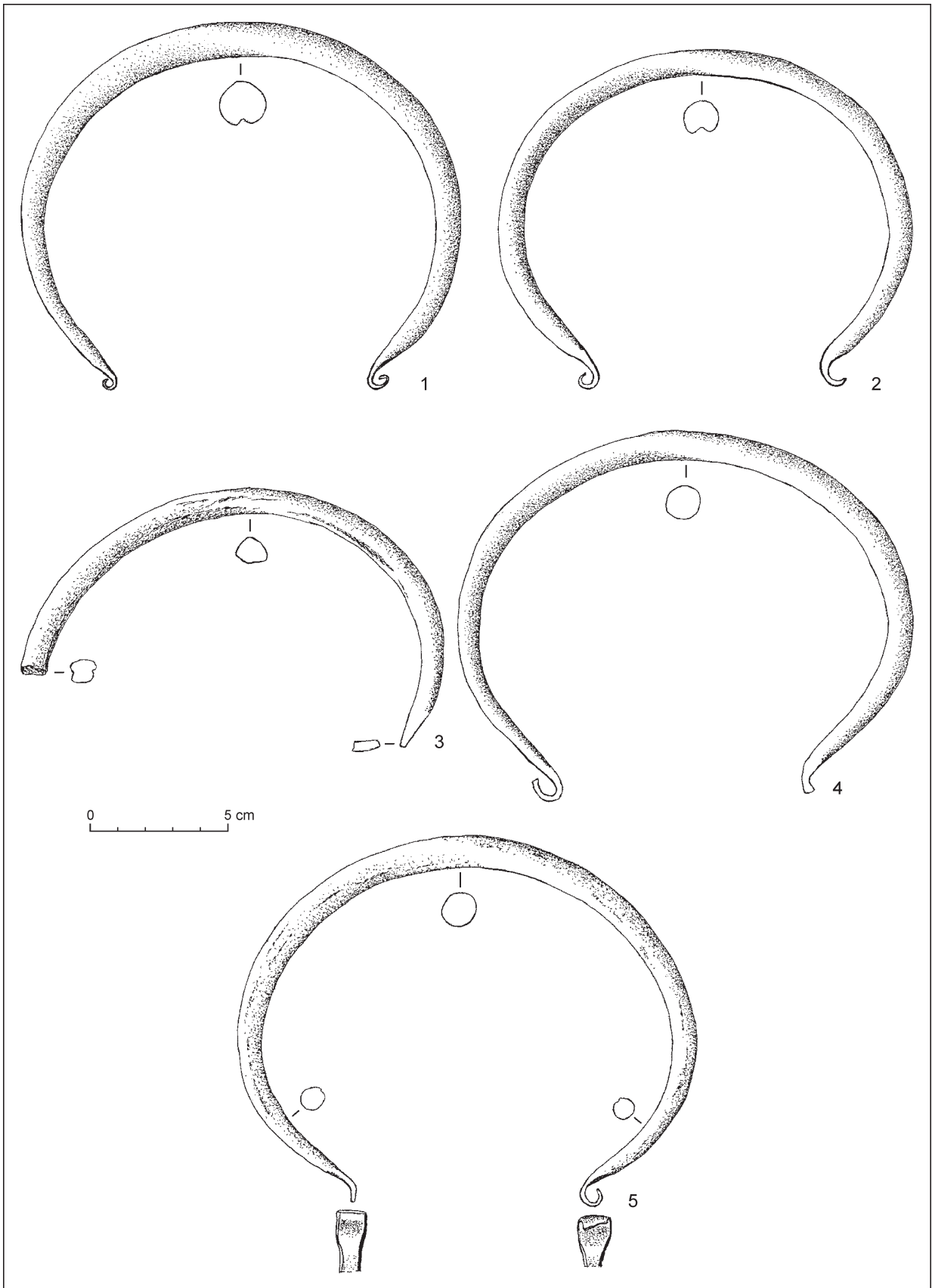
Nálezy z doby bronzovej, pochádzajúce z rôznych oblastí Slovenska, ktoré už v 19. stor. získal do svojej zbierky T. Lehocký, vzdelanec a zberateľ pôsobiaci v Mukačeve, predstavujú cennú súčasť pravekého osídlenia Slovenska. Dôležité informácie o týchto artefaktoch si zaznamenal vo svojom rukopisnom denníku (*Lehocký 1860–1894; 1894–1899*), čím významne prispel k poznaniu kontextu jednotlivých nálezov.

Cieľom nášho príspevku bolo sprístupniť tieto informácie odbornej verejnosti a zároveň sa pokúsiť o chronologické zaradenie jednotlivých nálezov. Prezentované sú nálezy od nákrčníkovitých hrivien klasickej fázy únětickej kultúry z okolia Bratislavy (BA1b), cez artefakty z prostredia mohylových kultúr, vrátane importov kultúry Suciú de Sus z Nesvad (BB2–BC/BD), až po mladobronzové nálezy kopovitých ružicových okrás z Pucova (BD–HA, resp. počiatok HB), sekundárne upravený meč liptovského typu z Čičaroviec (HA1–HA2/príp. HB1), ako aj známa aviamorfná nádoba. Na základe rukopisných poznámok T. Lehockého k nej možno priradiť aj sekerku s tuľajkou a uškom a kosák s plastickou rukoväťou, datované s najväčšou pravdepodobnosťou do počiatku neskorej doby bronzovej (HB1).

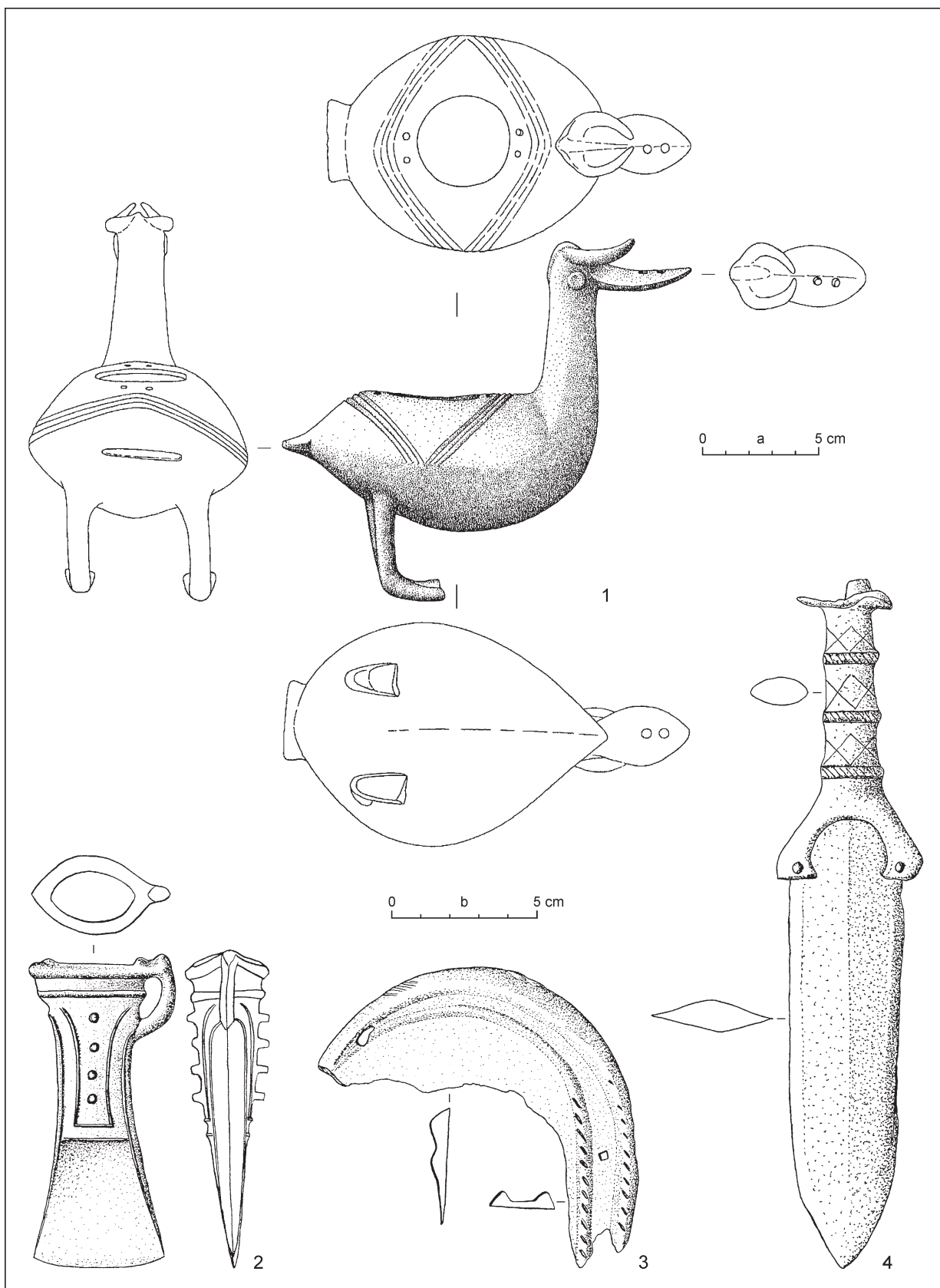
Príspevok poukazuje na možnosť nachádzať zaujímavé informácie nielen prostredníctvom súčasného moderného archeologického bádania v teréne, laboratóriách či odborných publikáciách, ale aj v rukopisoch starých zberateľov a v depozitároch múzeí, často s medzinárodným presahom.



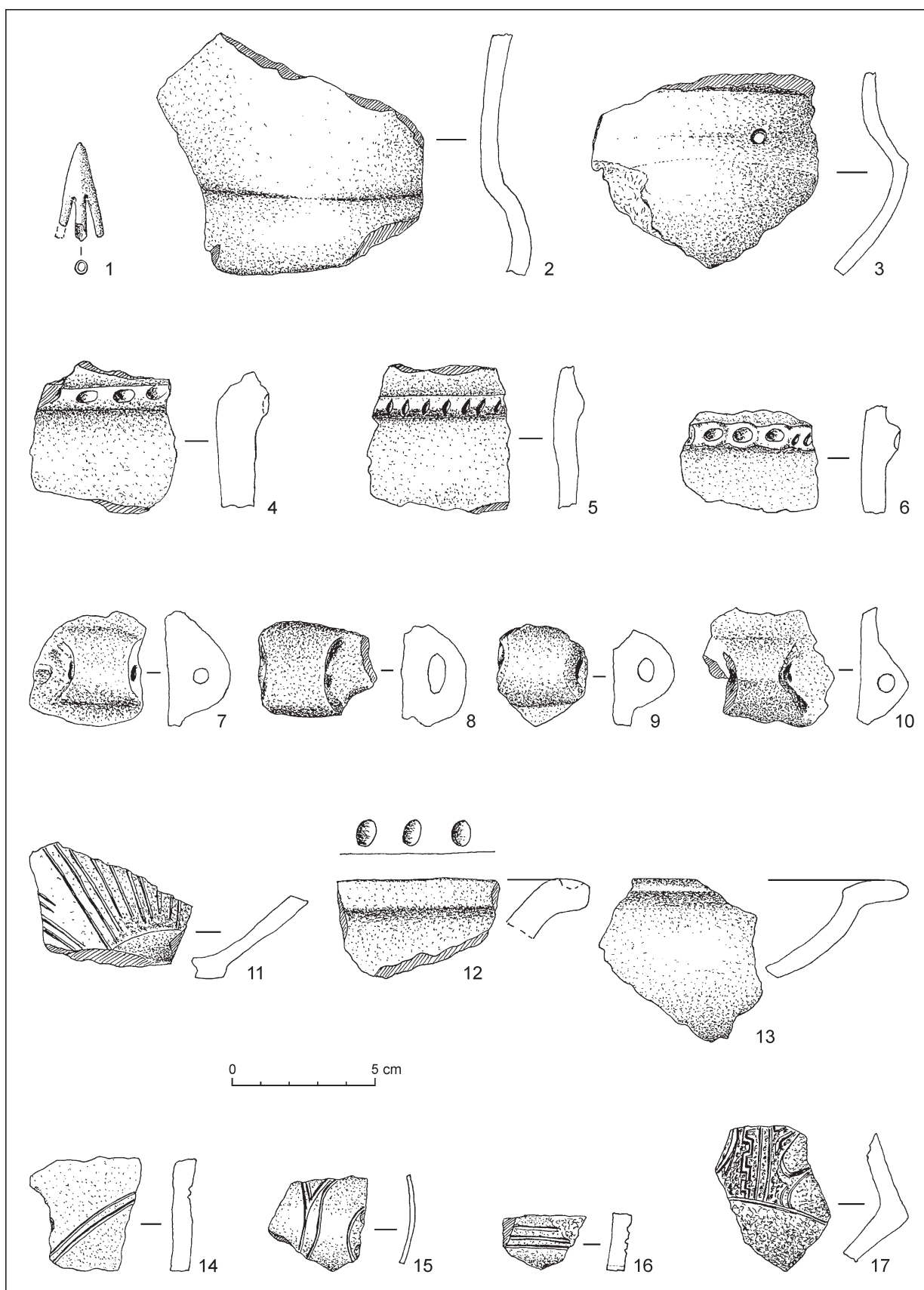
Tab. I. Bratislava-okolie. Nákrčníkové hrivny. Kresba J. V. Kobaľ.



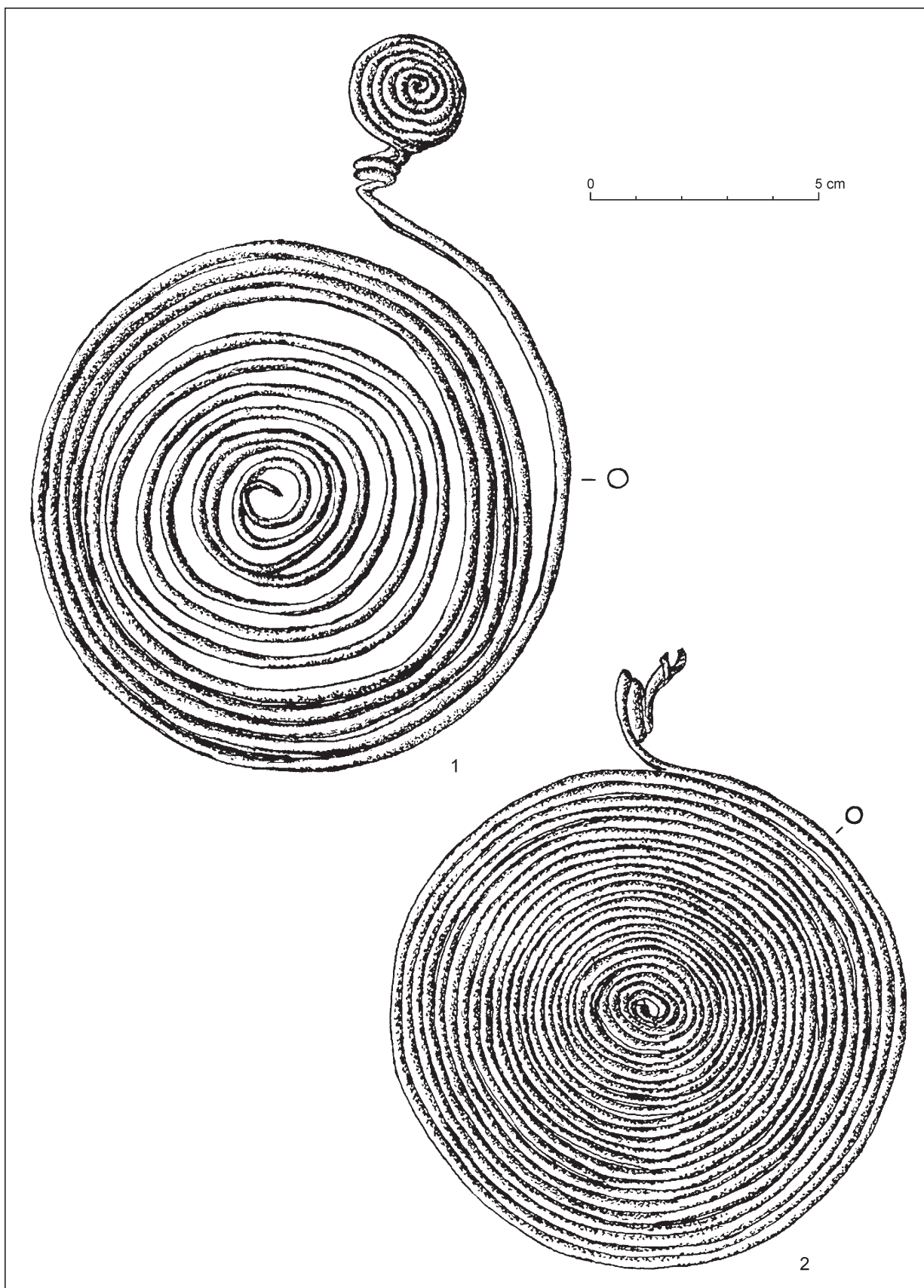
Tab. II. Bratislava-okolie. Nákrčníkové hrivny. Kresba J. V. Kobaľ.



Tab. III. Čičarovce, okr. Michalovce. 1–3 – depot (?) bronzových predmetov: aviomorfná nádoba, sekerka s tuľajkou a uškom, kosák; 4 – sekundárne upravený meč liptovského typu (1 – podľa Novotná 1991, tab. 12: 62; 2–4 – kresba J. Kobaľ). Mierka: a – 1; b – 2–4.



Tab. IV. Nesvady, okr. Komárno. 1 – bronzový hrot šípu; 2–12 – fragmenty keramiky karpatskej mohylovej kultúry (?); 13–17 – fragmenty keramiky Suciu de Sus. Kresba J. V. Kobaľ.



Tab. V. Pucov, okr. Dolný Kubín. Bronzové kopovité ružice. Kresba J. V. Kobaľ.

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Archaeological Finds from the Bronze Age from the Territory of Slovakia in the Collection of Teodor Lehocký

Josyp V. Kobaľ – Mária Kotorová Jenčová

Summary

Teodor Lehocký (Hungarian Lehoczky Tivadar, Ukrainian Tyvodar Lehockyj; Fig. 1) was an educated lawyer who stood at the beginnings of archaeological science in Hungary in the second half of the 19th and the beginning of the 20th century, which naturally played a role even at the beginning of studies of the prehistoric past of the territory of today's Slovakia. He collected a large archaeological collection, at one time the largest in the Austro-Hungarian Empire, containing more than 7000 objects. Among them were also finds from the territory of Slovakia. They come from about 20 sites with a chronological shot from the Neolithic to the Middle Ages. The collection of Bronze Age artefacts is relatively small, but interesting. The collector kept a diary about the acquisitions (Fig. 2), which is stored in the Transcarpathian Museum of Local History named of T. Lehocký (Uzhhorod). The information from this manuscript source was the basis for the authors to evaluate, or in some cases re-evaluate, finds from the Bronze Age, found in Slovakia in the 19th century, today in the vast majority stored in Ukrainian museums, especially in the Transcarpathian Museum of Local History in Uzhhorod. They come from four sites (Fig. 3), chronologically they are from the Early to the Late Bronze Age.

The oldest evaluated findings from the above-mentioned collection include ten circular or oval ring-ingots (*Ringbarren*) from the hoard from Bratislava- surroundings (Fig. 3: 1; Pl. I; II), a substantial part of which is stored in the Hungarian National Museum in Budapest. They are considered semi-finished products, a form of raw material, or are referred to as the equivalent of commercial exchange. Chronologically, they correspond to the classical phase of Únětice culture (BA1b).

The set of archaeological finds from Nesvady, Komárno district (Fig. 3: 3; Pl. IV), consists of a bronze arrowhead and ceramic fragments, between which it is possible to distinguish two groups – a local one, probably belonging to the Carpathian Tumulus culture (?), and a foreign one, which the authors attribute to the Suciú de Sus culture, the second phase of its development (BB2–BC). Chronologically, the bronze arrowhead can also be associated with pottery.

In the collection of T. Lehocký there were also three spiral ornaments from the hoard in Pucov, Dolný Kubín district (Fig. 3: 4; Pl. V). This hoard probably originally contained about nine such ornaments. Ornaments of the Pucov-type are placed in absolute chronology in the period 1200–1000 BC. Similar rosette ornaments date back to the period of BD–HA1, or to 1100 BC, based on a hoard from Košické Olšany.

There were two finds in Lehocký's collection from Čičarovce, Michalovce district (Fig. 3: 2) – a secondarily modified sword of the Liptov type (Pl. III: 4) and three objects, which, according to the records of T. Lehocký, most likely represented one hoard. It contained a well-known bronze vessel in the form of a waterfowl with horns on its head (Pl. III: 1), an bronze axe (Pl. III: 2) and a bronze sickle (Pl. III: 3). The socketed axe with a flat blade and so-called “pseudowings” formed by ribs has four needle-like protrusions on two flat sides. This relatively rare form is widespread in Transdanubia and the eastern part of the Carpathian Basin and dates in the vast majority to the HB1 grade, less to HB2. The tanged sickle belongs to the Boskovice group of sickles (according to M. Primas), which began to be produced in the early stage of the Late Bronze Age of Central Europe (HB1), but most are dated to the final stage of the Bronze Age, or to the younger cultures of the Urnfields, i.e. HB2–HB3. However, the sickle from Čičarovce, according to the oblique notches on the ribs, apparently belongs to the early group of sickles of the above-mentioned type, which would also allow, with a reserve, the dating of a known aviamorphic vessel to the beginning of the Late Bronze Age (HB1).

Archaeological finds from the Bronze Age from the four above-mentioned sites from the territory of Slovakia were either not known to the professional public at all, or information about them was erroneous or distorted. The paper is an effort to present these findings, or to supplement the data on them on the basis of T. Lehocký's manuscript diary and an attempt to evaluate them professionally.

Fig. 1. Teodor Lehocký (Lehoczky Tivadar), 1830–1915. According to *Lehoczky 1907*.

Fig. 2. Sample from T. Lehocký's handwritten diary. Photo by J. V. Kobaľ.

Fig. 3. Marking of locations on the map of the Slovak Republic. 1 – Bratislava-surroundings; 2 – Čičarovce; 3 – Nesvady; 4 – Pucov. Edited by M. Kotorová Jenčová.

Pl. I. Bratislava-surroundings. Ring-ingots. Drawing by J. V. Kobaľ.

Pl. II. Bratislava-surroundings. Ring-ingots. Drawing by J. V. Kobaľ.

Pl. III. Čičarovce, Michalovce dist. 1–3 – hoard (?) of bronze objects: aviamorphic vessel, socketed axe and sickle; 4 – secondary modified sword of the Liptov type (1 – according to *Novotná 1991*, tab. 12: 62; 2–4 – drawing by J. V. Kobaľ). Scale a – 1; b – 2–4.

Pl. IV. Nesvady, Komárno dist. 1 – bronze arrowhead; 2–12 – pottery fragments of the tumulus culture (?); 13–17 – pottery fragments of the Suci de Sus culture. Drawing by J. V. Kobaľ.

Pl. V. Pucov, Dolný Kubín dist. Bronze spiral ornaments. Drawing by J. V. Kobaľ.

Translated by authors

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GOING ROUND AND ROUND – COMPASS DECORATION IN THE LA TÈNE PERIOD OF THE LOWER TRAISEN VALLEY, LOWER AUSTRIA

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This article presents new discoveries from the Iron Age cemetery of Franzhausen, focusing on two ceramic bowls with exceptional interior decorations (ornaments), created and executed directly using a compass. The designs consist of intersecting semicircular arcs and swirling arms encircling the omphalos. Both patterns were incised directly into the surface using a compass, with the swirl additionally enhanced by stamped impressions. The study aims to reconstruct the compass-based design process and to find comparative examples within and beyond the cultural sphere. The finds raise the question of whether the mathematical and geometrical knowledge necessary for such constructions was introduced, directly or indirectly, into early La Tène culture and how it was put into practice. It further highlights the advanced and complex knowledge of the craftsmans of the earliest La Tène culture north of the Alps.

INTRODUCTION

Since the 1980s, rescue excavations in the Lower Traisen Valley in Lower Austria have uncovered extensive areas of prehistoric and historic settlements and cemeteries (*Neugebauer 1992; Ramsel 2012a*). As part of the FWF research project CATA “Celts Across The Alps”¹, several ceramic vessels featuring compass-drawn decorations or patterns were discovered in the La Tène period cemetery at Franzhausen. This article presents and analyses the examples (including previously published – *Ramsel 2024*), which appear on a wide variety of materials. Additionally, the compass-based designs will be examined within a broader context, exploring their origins, the geometric possibilities and use in Iron Age cultures north of the Alps (Fig. 1).

THE LOWER TRAISEN VALLEY, LOWER AUSTRIA

In the study of the La Tène culture, the Traisen Valley in central Lower Austria stands out as an archaeologically rich region, characterized by a high probability for the detection of archaeological sites for Central Europe. Its strategic location near important trade routes – such as the east-west corridor along the Danube and the north-south passage through the Traisen and Kamp valleys – provided ideal economic conditions for diverse communities. In this valley with its extensive terraced landscapes, discoveries of all periods have been made. For the Early Bronze Age and later for Early La Tène period many settlements and cemeteries were excavated by L. Karner, J. Szombathy, A. Zündel and J. Bayer, who can be called pioneer researchers. Later on, the research was successfully continued by the Department of Heritage under the direction of J.-W. Neugebauer in the 1990’s (summarized in *Neugebauer 1992; 1993; Ramsel 2012a* and in several „Fundberichte aus Österreich“). During the construction of the motorway S 33 and gravel extraction in the surrounding area, the most important discoveries of the Lower Austrian Central Area

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Fig. 1. Map of the sites mentioned in the CATA Project, incl. Logo (graphics L. Kohl, Th. Koch Waldner; Kartengrundlage EU-DEM).

were uncovered. Of particular interest is the fact that in several settlements and cemeteries a continuum from (at least) the Late Hallstatt period to the La Tène period can be discovered (e.g., the necropolis of Franzhausen is running from HAC to the early La Tène period). The most important Iron Age cemeteries are located at Kuffern (*Urban 2012a*), Oberndorf in der Ebene (*Ramsl 2012b*; *Ramsl, in preparation*), Ossarn (*Urban 2012b*), Gemeinlebarn (*Preinfalk A./Preinfalk F. 2014*; *Ramsl 2012c*), Herzogenburg-Kalkofen (*Urban 2012c*), Inzersdorf-Walpersdorf (*Ramsl 2012d*), Inzersdorf (*Urban 2012d*) and Getzersdorf (*Ramsl 2012e*), Reichersdorf (*Urban 2012e*), Franzhausen (*Ramsl 2012f*) and Pottenbrunn (*Ramsl 2002*). Of particular interest are the tumuli at Rassing in the Perschling valley, which were excavated during the construction of the high-speed railway (HLAG) of the Austrian Federal Railways (ÖBB; Fig. 2; *Preinfalk 2005*).

The compass decorated ceramics in the cemetery of Franzhausen, Lower Austria

As part of a research project funded by the Austrian Science Fund (FWF), the Iron Age cemeteries of Walpersdorf (1997/1998), Gemeinlebarn, and Franzhausen were analyzed. Therefore, a table with the pieces found in the Lower Traisen Valley and the adjacent Kamp valley to the north is included here to provide a brief overview (Tab. 1).

This article focuses on ceramics from the Franzhausen cemetery that feature compass-drawn decoration. The graves containing these decorated pieces are listed below, followed by an analysis of their significance.

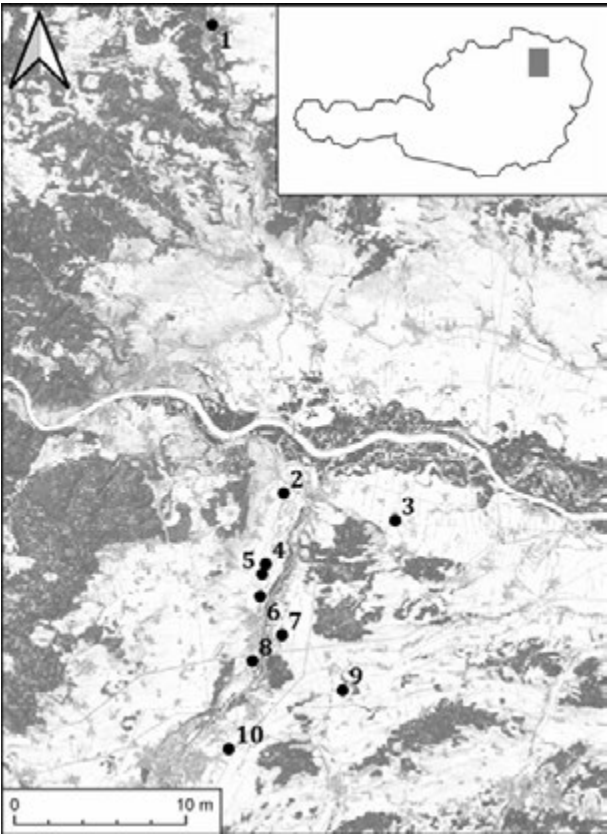


Fig. 2. Map of the Lower Traisen Valley with mentioned sites. 1 – Gars-Thunau; 2 – Franzhausen; 3 – Gemeinlebarn; 4 – Inzersdorf; 5 – Walpersdorf; 6 – Herzogenburg; 7 – Ossarn; 8 – Oberndorf/Ebene; 9 – Rassing; 10 – Pottenbrunn (graphics P. Urban; basics: www.basemap.at).

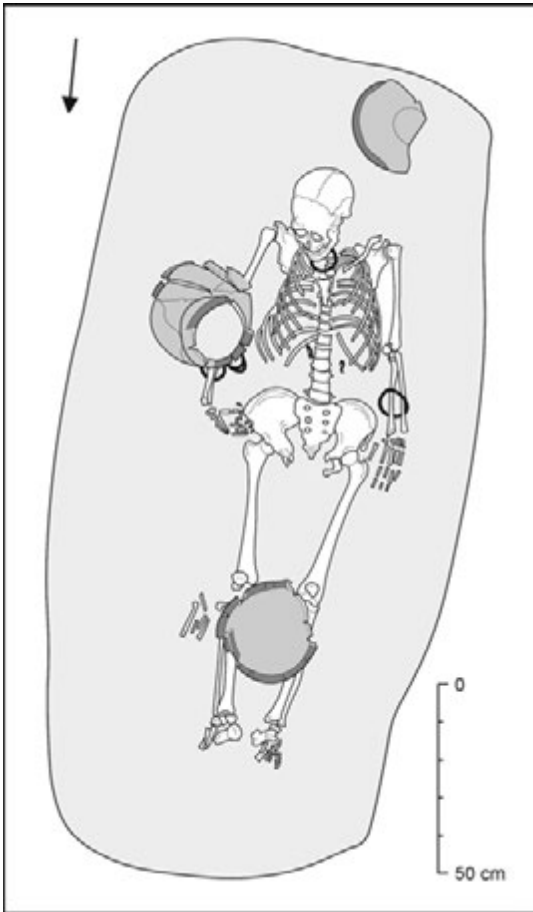


Fig. 3. Franzhausen (FH), Grave 23 (graphics L. Kohl, A. Gattringer).

Grave no. 23 – La Tène A (Fig. 3)

Female inhumation (20–25 years old), surrounded by the square enclosure no. 89. Burial shaft: rectangular with rounded corners, L 2.37 m, W 1.31 m, on the first documentary level. Burial: Skeleton in an extended supine position in the centre of the burial pit, oriented S – N. Grave goods: Iron necklace (fn. 2), two bronze fibulae under the ribcage, to the left and right of the spine (fn. 3–4). Bronze bracelets on the

Tab. 1. Compass decorated pieces (Lower Traisen valley and Kamp valley). All La Tène.

Site	Grave/settlement	Artefact	Kind of decoration	Material	Bibliography
Franzhausen	grave 23/10	bowl	frieze of halfcircles	ceramic	unpublished
Franzhausen	grave 24/6	bowl	Swirl	ceramic	unpublished
Gemeinlebarn	grave 94/13	Linsenflasche	complex ornamentation	ceramic	<i>Neugebauer 1994</i> , fig. 13 (FÖ33)
Gars-Thunau	no. 57353	Linsenflasche	complex ornamentation	ceramic	<i>Karwowski 2006</i> , fig. 32
Inzersdorf-Walpersdorf	feature 1843	bowl	frieze of halfcircles	ceramic	<i>Ramsl 1998</i> , tab. 108: 1043
Inzersdorf-Walpersdorf	feature 1636	sherd	frieze of halfcircles	ceramic	<i>Ramsl 1998</i> , tab. 102: 939
Inzersdorf-Walpersdorf	feature 76	handle	circles with leaves	bone	<i>Ramsl 1998</i> , tab. 31: 54
Oberndorf	grave 1982/9–16	bowl	friezes of halfcircles	ceramic	unpublished
Ossarn	grave 1984/17–10	bowl	Swirl	ceramic	<i>Neugebauer 1992</i> , fig. 12: 10
Ossarn	stray find	belthook	circles with leaves	bronze	<i>Neugebauer 1992</i> , fig. 27: 7
Pottenbrunn	grave 1930/1–55.230	pot	frieze of circles with leaves	ceramic	<i>Ramsl 2002</i> , tab. 22: 55.230

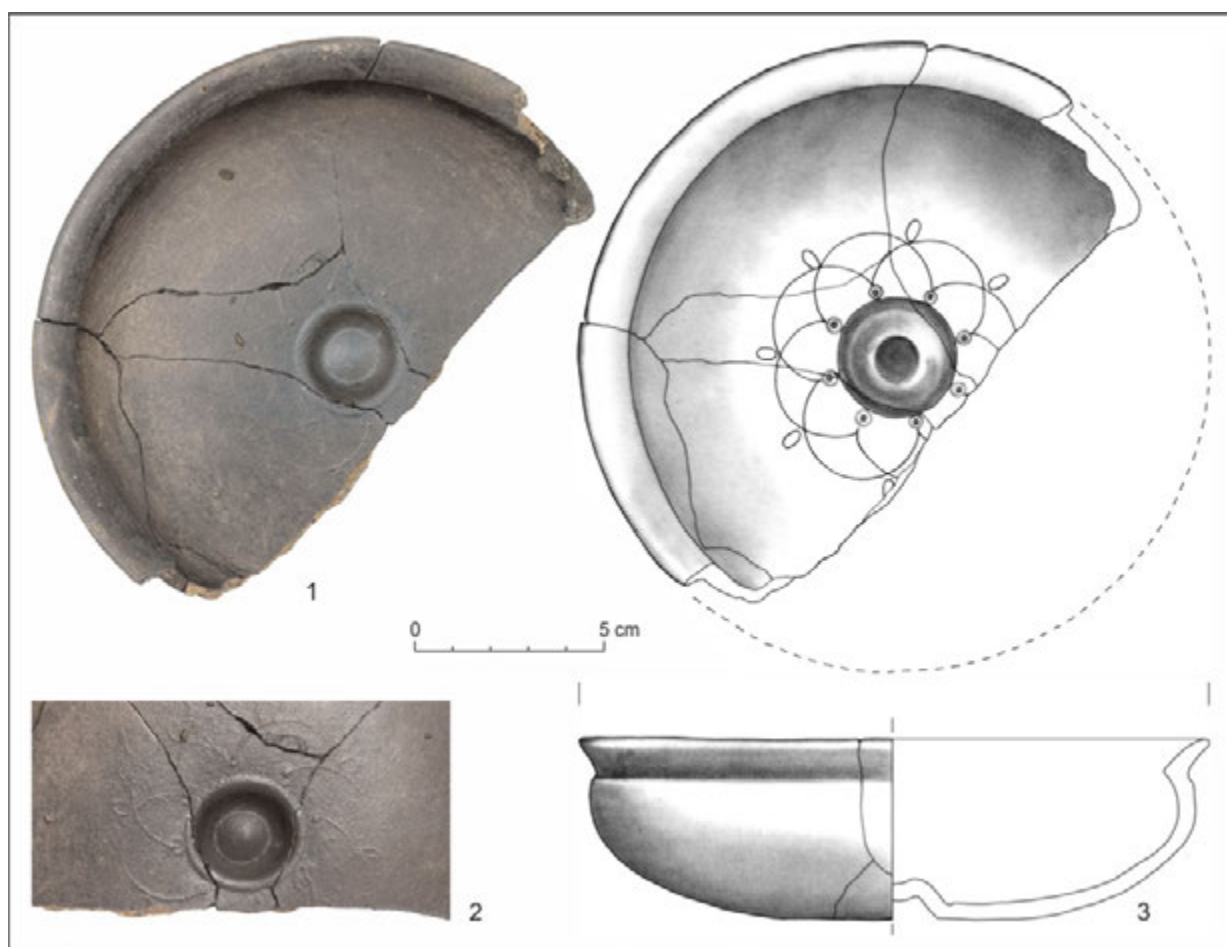


Fig. 4. Bowl from grave FH 23/10 (photo Chr. Bieber, UHA; drawing M. Mayrhofer).

forearms (fn. 5–6). Two iron rings between the right arm and the waist (fn. 7). Bowl fragment south of the head (fn. 8). A large vessel next to the right arm, containing a bowl and fragments of burnt bone (fn. 9–10, 14). Bowl on the lower legs, animal bones to the east (fn. 11–12), further pottery fragments (fn. 13).

Enclosure ditch around grave 23, almost square ditch, oriented S–N, south-western area not preserved, at the level of the documentation level, L 5.5–6 m, D 0.1–0.25 m, u-shaped cross-section, W 0.4–0.6 m.

The bowl no. 10 (Fig. 4)

Description of the bowl: calotte-shaped, inwardly thickened rim, bevelled rim with shoulder heel („Schulterabsatz“) on the outside, precisely crafted omphalos (bowl-like lowered inside) with smoothed frame and outer circular incision, strong/medium graphite-containing clay, dm 16 cm, Ws 0.3–0.4 cm, omphalos 2.3 cm.

Description of the decoration: Frieze of eight (8) semi-circular arches carved around the central omphalos (with smoothed framing and compass scratching) with another dm of 2.8 cm, which is also the dm of the arches; circular eye stamps on the compass puncture, oval stamps above the intersection of the compass arches.

Grave no. 24 – La Tène A (Fig. 5)

Indifferent (female?) inhumation (30–50 years old), surrounded by a rectangular enclosure no. 25. Grave shaft rectangular with rounded corners L 2.12 m, W 2.64 m at the documentation level. Burial: disturbed by ancient grave robbery, skeleton displaced, oriented SW – NE. Skeletal remains, pottery, bronze hollow-ribbed fragment and animal bone from grave filling (fn. 2–5). Small bowl within the bowl with large vessel located in the north-east corner of the grave shaft (fn. 6–8).

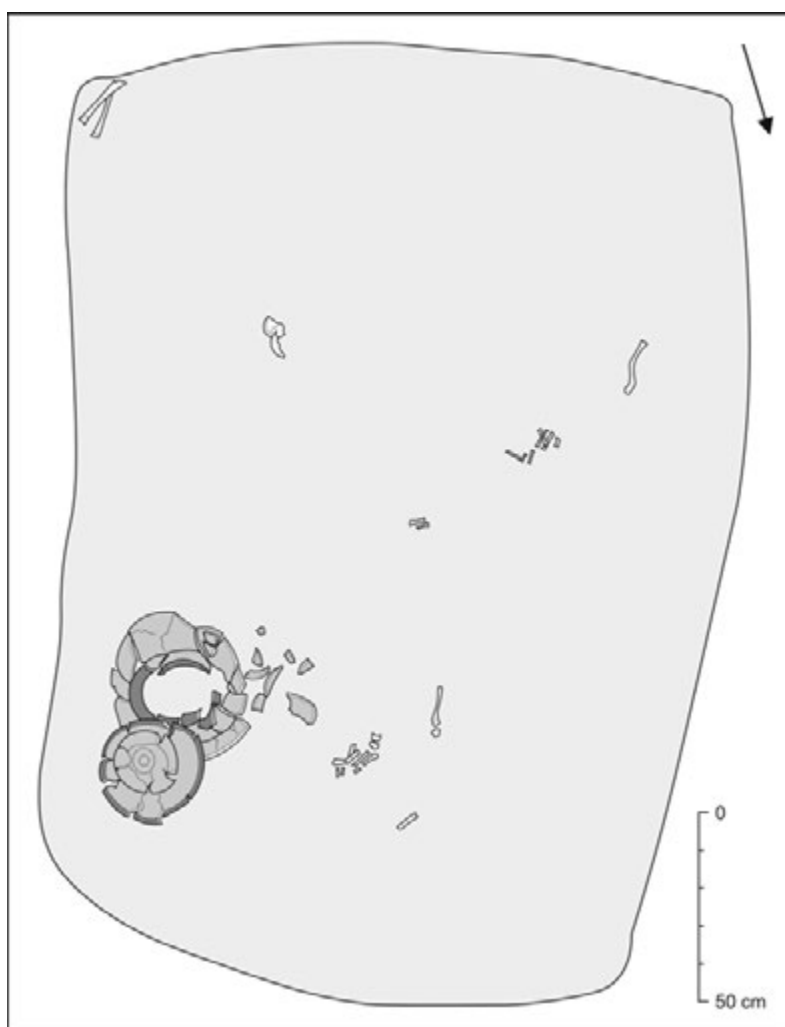


Fig. 5. Franzhausen, Grave 24 (graphics L. Kohl, A. Gattringer).

Enclosure ditch around grave 24, nearly square ditch, nearly orientated S – N, small entrance in the NE-corner, L 5.5–6 m, D 0.1–0.25 m, cross section u-shaped, W 0.4–0.6 m.

The bowl no. 6 (Fig. 6)

Description of the bowl: calotte-shaped, bevelled rim with shoulder heel („Schulterabsatz“) on the outside, precisely worked omphalos (bowl-like lowered inside) with smoothed frame and outer circular incision (?), strong/medium graphite-containing clay, dm 25.5 cm, Ws 0.5 cm, omphalos dm (out) 3.5 cm (inner) 1.75 cm.

Description of the decoration: precisely crafted omphalos (bowl-like lowered inside) with smoothed frame and outer circular incision (?), seven (7) swirl arms (clockwise rotating, open to the left) formed by 2 grooves (stamps?) converging at the top, at the beginning and end one circular eye stamp impression each. It may be interesting to note that the diameter of the inner part of the omphalos is about half the diameter of the outer part, from which the compass construction starts.

Technique of applying decorations

It is notable that, on the one hand, there are incisions of compass strokes (as shown above in the examples from Franzhausen) and circles, while on the other hand, there are also those with blunt tips, i.e. quasi smoothing. These appear as large circles, as in Modrá (Goláňová 2018, fig. 67: 4, 9), but also as small circles, as in Inzersdorf-Walpersdorf, (Walpersdorf Nord 73) obj. 1363, no. 861 (Ramsl 1998, fig. 23; tab. 97: 861) or Chlum-Bezdědovice (Eisner 1914, fig. 3: 2). These ‘smoothings’ were apparently applied in the middle of the drying phase of the pottery in a ‘leather-hard’ („lederhart“) condition.

It is reasonable to assume – and this has been demonstrated experimentally – that the exact moulding and the decorations were carried out or applied in the above-mentioned ‘leather-hard’ condition after a drying phase of 1–2 days. The exact shaping includes the repeated turning of the surface to create a slight faceting (Fig. 7: 1), as can also be seen in Strebersdorf (Burgenland; Fig. 7: 2). The inside and outside of the omphalos were also precisely shaped in this state (Fig. 7: 3). Fine and wider grooves (Fig. 7: 4) on the outside are as much a part of this as the exact execution of various bulges. The insides (and of course the outside) of bowls and flask-shaped ceramics were decorated with numerous motifs and compositions such as stamps, star-shaped semicircles and swirls.

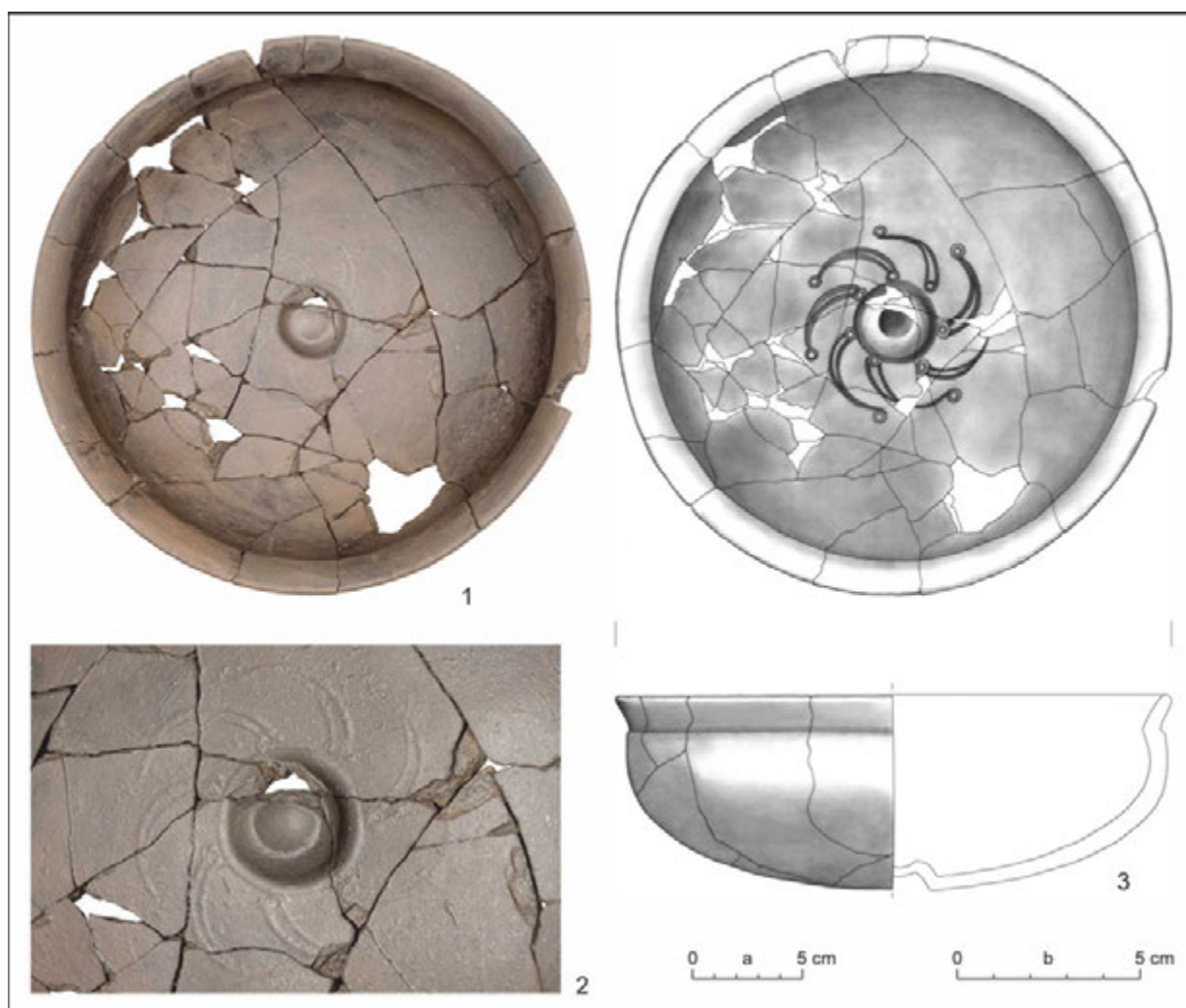


Fig. 6. Bowl from grave FH 24/6 (photo Chr. Bieber, UHA; drawing M. Mayrhofer). Scale: a – 1, 3; b – 2.

Different motifs and ornamentations

The specimens examined in this study, along with the nearby comparative examples, feature the following decorative motifs: 1. Frieze of intersecting semi-circular arches (Fig. 8: 1).

2. Circular eyes with connecting floral motifs (two-dimensional; Fig. 8: 2).

3. Circular eyes with connecting floral motifs (circular; Fig. 8: 3).

4. Swirl with seven arms (Fig. 8: 4).

Swirl patterns represent a special type of decoration and they occur in different forms on the inside of bowls, e.g. in Ménfőcsanak, tombs 16 and 18 (Győr, Hungary; *Uzsoki 1987*, pl. XIX: 1; XX: 1), in addition to the above-mentioned most comparable piece from Ossarn (Lower Austria). Simple vertebral patterns with three arms (triskele) are known, for example, from Milovice (Břežlav dist., Moravia; *Schwappach 1973b*, fig. 38: 1) or Leitzersdorf (Lower Austria; *Goláňová 2018*, fig. 63: 50). These are to be followed by those from Schwabsburg (Rheinland-Pfalz, Germany) and Somme-Tourbe (Marne dist., France; *Frey 1992*, fig. 12: 2, 3).

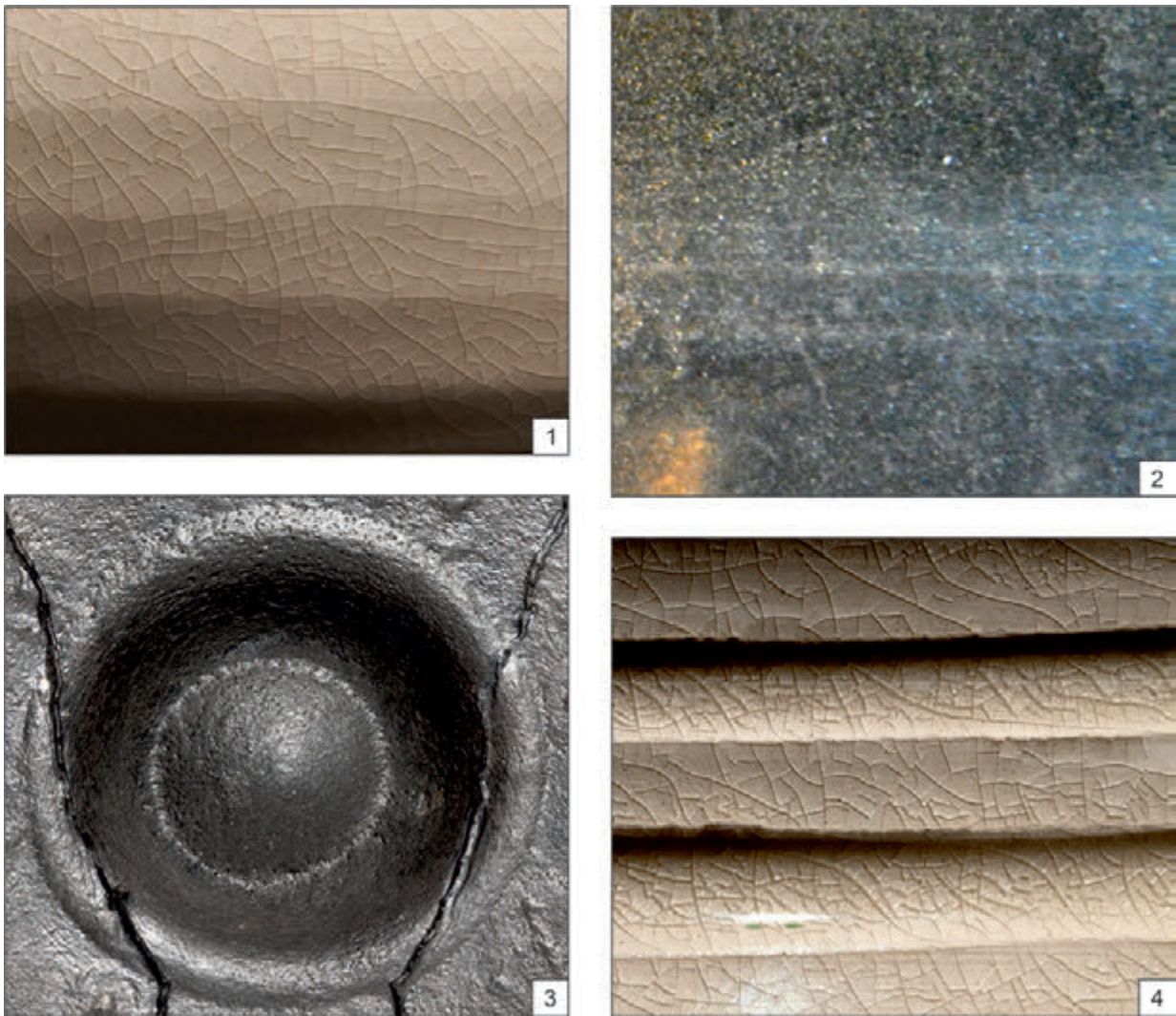


Fig. 7. 1 – surface with slight faceting; 2 – surface with slight faceting (ceramics from Strebersdorf/Bgld.); 3 – omphalos from a bowl (FH, UHA); 4 – grooves of/on ceramics (photo P. C. Rams, Chr. Bieber).

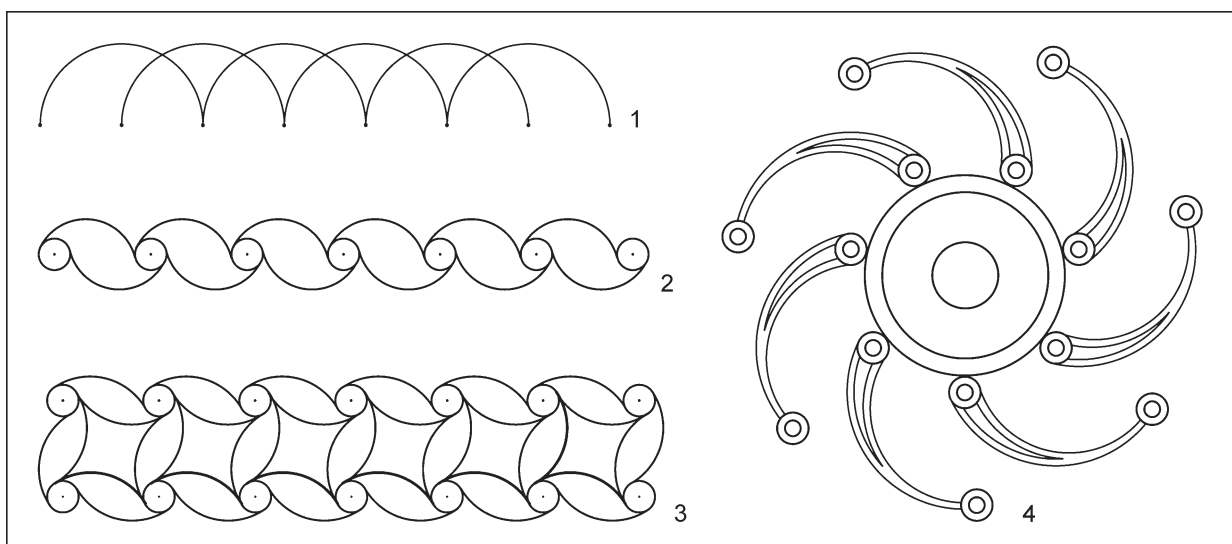


Fig. 8. Motives of mentioned decorations (drawing L. Kohl).

The construction of the motifs in Franzhausen

In principle, working with a compass and dividing a circle etc. requires a certain basic knowledge of mathematics and geometry. Geometric principles such as the golden ratio (*sectio aurea*) were already known to the Greeks (as well as the Egyptians) around 500 BC. The golden ratio and the division of the circle into three and five parts were already known. The most famous mathematicians were Euclid, Pythagoras and Hippasos (*Lenerz-De Wilde 1977, 16, 17*). The use of a ruler was likely possible, as evidenced by the patterns on the interior of bowls of Greek origin. (*Lenerz-De Wilde 1977, 77*).

Inside the bowl Franzhausen 23/10 (Fig. 9), we have the division of a circle into eight (8) parts. This can be done by dividing the circle once from the circle itself once by a diagonal (1 = 3 compass strokes, 1 straight line) and then construct a right angle on the circle, also by making compass strokes from the intersection points of the diagonal with the circle (2 = 2 compass strokes, 1 straight line). Finally, this 90-degree angle is divided in half by compass strokes through the intersections of the 2 diagonals (3 = 2 compass strokes, 1 straight line). This process is either continued along the entire circle or the distance of the 45-degree angle is taken from the circle and transferred to the rest (4 = 4 compass strokes, 2 straight lines).

Examples with the division of a circle into five parts include the phalerae from Ville-sur-Retourne (Ardennes dist., France; *Jacobsthal 1969, no. 194*), the fibula from Dürrenberg (Salzburg, Austria; *Penninger 1972, tab. 40A: 1*) and a phalerae from Mainz (Rheinland-Pfalz, Germany; *Jacobsthal 1969, 187, no. 190*).

In the bowl from grave 24 (fn. 6), a circle is divided into 7 parts (Fig. 10). This is a geometrically much more difficult task and requires a deep knowledge of geometry. For this reason, authors who have dealt with it in the archaeological field doubt that it is a construction, but rather an approximation and a 'trial and error' (*Bacault/Flouest 2003; Lenerz-De Wilde 1977, 18*). A seven-point division of a circle works as follows: a circle is first divided by its diameter (1 = 3 compass strokes, 1 straight line), then a line is drawn from the intersections (A, C) of an inner arc of the circle with the main circle, which is at right angles to the diagonal and

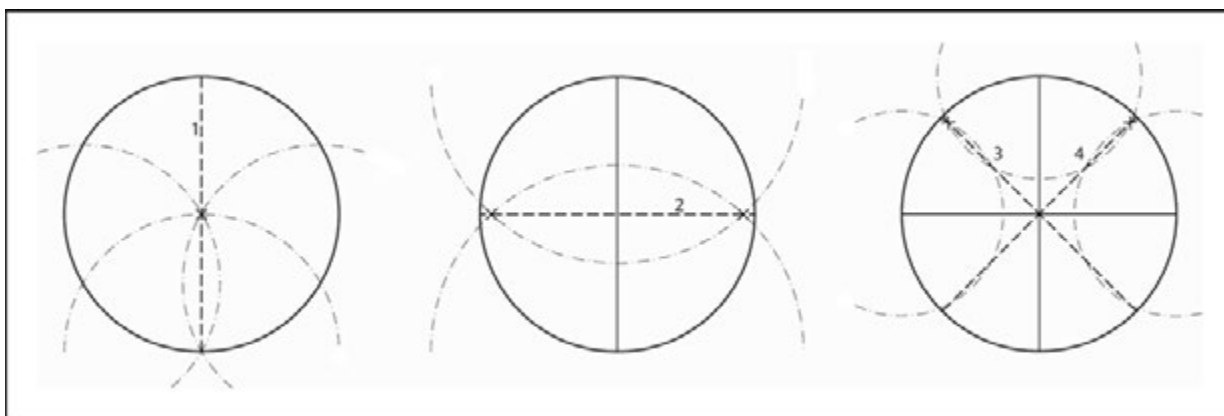


Fig. 9. Construction of the decoration FH 23/10 (drawing L. Kohl).

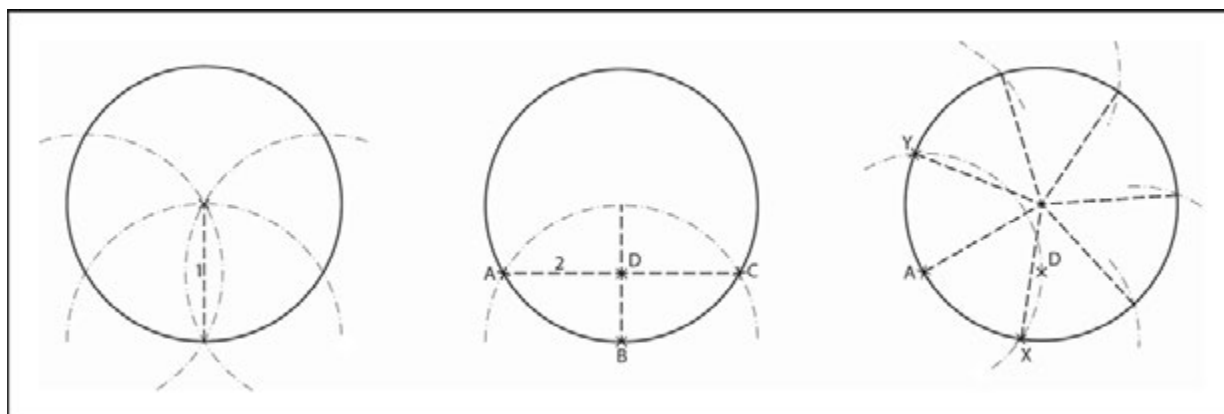


Fig. 10. Construction of the decoration FH 24/6 (drawing L. Kohl).

intersects it (D; 2 = 1 straight line). Finally, an arc with the radius is drawn from the insertion point A to the intersection point D and an arc is drawn to the intersection points with the main circle (X, Y – 1 circle). The distances AX and AY are now the seventh of a circle and can be plotted on it (another 4 compass strokes).

Examples with the division of a circle into seven parts are known, for example, on a fitting from Somme-Bionne (France) and the phalere from Langenhein (Hessen, Germany; *Lenerz-De Wilde* 1977, 26, 27).

M. Lenerz-De Wilde, as well as M. Bacault and J.-L. Flouest, question whether the division of a circle into five or seven parts was achieved using a compass (*Bacault/Flouest* 2003, 156; *Lenerz-De Wilde* 1977, 17, 18).

COMPARABLE PIECES IN THE UPPER TRAISEN VALLEY AND THE SURROUNDING AREAS

The most comparable examples for the bowl Franzhausen 23/10 with a frieze of halfcircles are a small bowl no. 9 in grave no. 16 (1982) at the cemetery of Oberndorf/Ebene (Upper Traisen vally; Fig. 11: 1; unpublished; *Ramsl, in preparation*) as well as a fragmented bowl out of a pit (Walpersdorf-Nord 73) no. 1843 (*Ramsl* 1998, fig. 108: 1043) and a sherd out of (Walpersdorf-Nord 73) no. 1636 (Fig. 11: 2; *Ramsl* 1998, fig. 102: 939) of the settlement Inzersdorf-Walpersdorf. The swirl (constructed with a compass) inside the bowl Franzhausen 24/6 with a swirl can be directly compared with the piece no. 10 from grave no. 17 from Ossarn in the Lower Traisen valley (Fig. 11: 3; *Megaw J. V. S./Megaw M. R./Neugebauer* 1989, fig. 6: 10; *Neugebauer* 1992, fig. 12: 10). Another compass decoration (with handmade leaves and stamps) can be found at the flask from Pottenbrunn 1930/1 (Fig. 11: 4; former „Ratzersdorf“: *Engelmayer* 1963, fig. 4; *Ramsl* 2002, tab. 22; *Schwappach* 1973b, fig. 14: 5).

Other compass decorations in Lower Austria include the bronze belt fitting from the cemetery of Ossarn (Fig. 11: 5; as a stray find, *Engelhardt* 1976, fig. 9: 7; *Ramsl, in preparation*), where the circular eyes are connected by floral motifs, and the same motif-combination on the turned bone handle from the settlement of Inzersdorf-Walpersdorf (Inzersdorf 72 – no. 76; Fig. 12: 1; *Ramsl* 1998, fig. 17; tab. 31: 54). The open-work bronze band from grave 18 of Oberndorf/Ebene (excavation 1982), which was also constructed with compasses, should not be forgotten here (*Neugebauer* 1992, fig. 10: 35; *Ramsl, in preparation*). Slightly more complex compass patterns with incisions (row of circular eyes with leaf-shaped motifs placed between them on the shoulder of lentil bottles) can be found at Gemeinlebarn (*Neugebauer* 1994, fig. 9: 13) and at Gars-Thunau (Fig. 12: 2; *Karwowski* 2006, fig. 32; *Ramsl* 2014, pl. 5: 6). Here, too, there are inaccuracies, as the end points of the arches sometimes miss each other.

At this point I would like to list some appropriate comparisons from some important find regions in the neighbourhood to illustrate the spread and concentration (workshops?) of this technology (no claim is made to completeness).

Starting with Moravia (where this topic was discussed in detail by P. Goláňová, see *Goláňová* 2012), which represents the natural geographical continuation of north-eastern Lower Austria (Weinviertel) to the north (as seen from the other side). Here, direct compass decorations (confirmed by puncture holes) can also be found on various materials. The decorations on pottery in Polešovice (*Goláňová* 2018, fig. 66: 3, 3a), Modrá (*Goláňová* 2018, fig. 67: 4, 9; see also the photo on the book cover) and Lešany (*Goláňová* 2018, fig. 66: 9) should be mentioned here. From metal, I would like to mention the piece from Pavlov-Děvín (*Goláňová/Navrátil* 2017, fig. 4: 13).

A special status has the unique site of Dürrnberg in Salzburg (with the associated salt mine), which can be seen as one of the other innovation centres of the La Tène culture in what is present-day Austria. So far, compass decorations have mainly been discovered on metal objects here. One exception is the Linsenflasche from grave 39/2 (*Penninger* 1972, pl. 36: 10), where an arched frieze runs below the shoulder moulding (cf. also *Schwappach* 1976, 67, fig. 3d). Compass ornaments with clear engravings can be found, for example, on the bronze flask from grave 44/2 (*Penninger* 1972, tab. 46: 34), on the bronze fibula from grave 59 (*Moosleitner/Pauli/Penninger* 1974, tab. 122: 2; *Schwappach* 1973a, fig. 7: 1) or on the bronze fitting from grave 29 (*Penninger* 1972, tab. 27: 10). Also noteworthy is the disc brooch from grave 42/1, which was at least constructed using a compass (*Penninger* 1972, pl. 40A: 1). If we turn to Bohemia, where also many very early La Tène culture finds have been discovered, making it one of the core regions. Here, too, mainly metal artefacts have been found, with the engravings of a compass in the decorations. Ceramic vessels or fragments or vessels, on which the compass constructions could be seen, come from Hlubyně (*Filip* 1956, fig. 53; pl. XIV; *Schwappach* 1975, pl. II: 5), Hostomice (*Schwappach* 1973a, fig. 12: 1), Tuchoměřice (*Sankot* 2007; *Schwappach* 1973a, fig. 10: 3), Počerady (*Koutecký* 1972, feat. 1/67; *Schwappach* 1973a, fig. 8: 2)

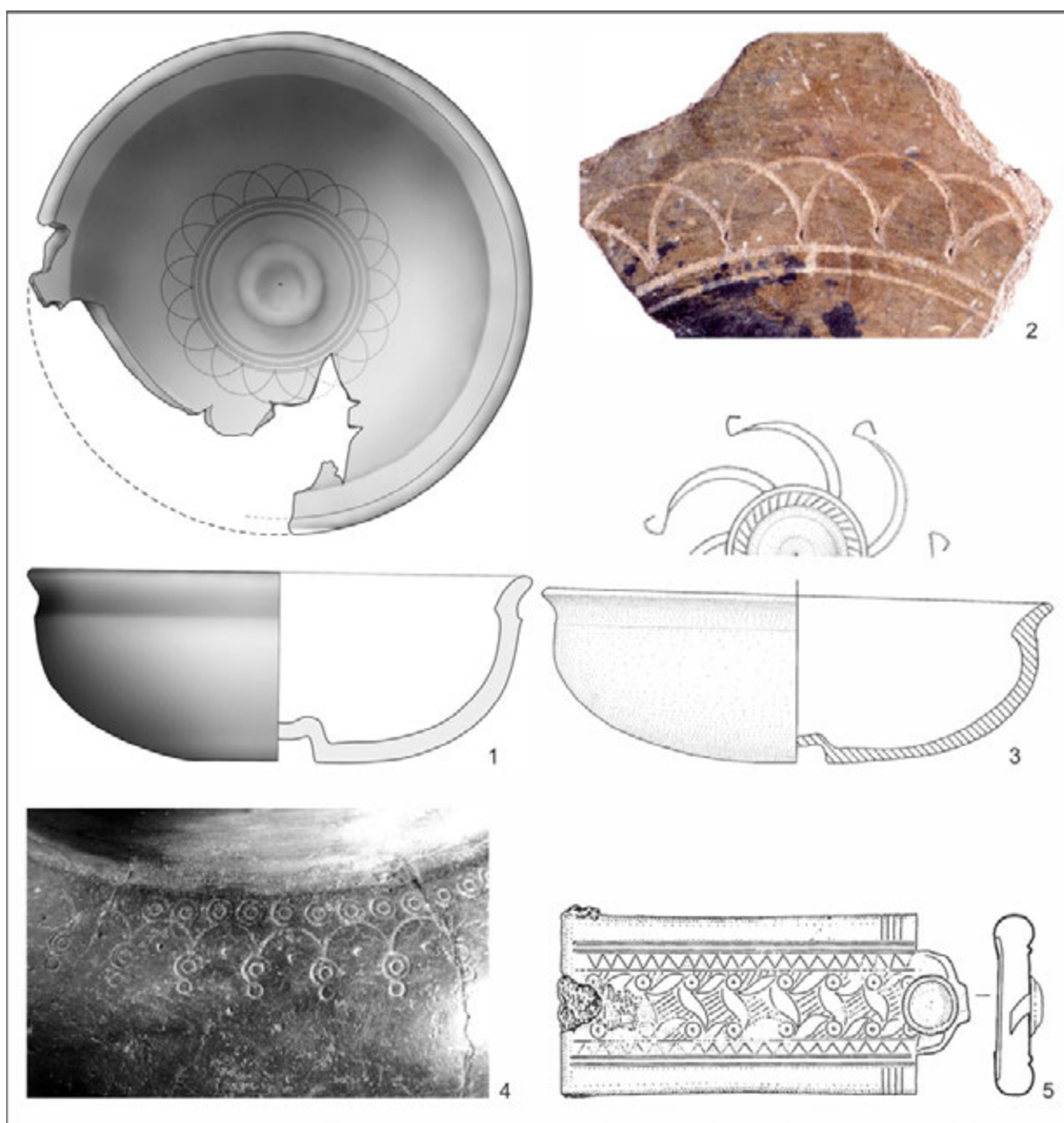


Fig. 11. Comparable pieces in Lower Austria. 1 – Oberndorf 1982, grave 9/16; 2 – Inzersdorf-Walpersdorf, pit 1636/939; 3 – Ossarn 1984, grave 17/10, 4 – Pottenbrunn 1930, grave 1; 5 – Ossarn 1966, Stray find (photos and drawing M. Mayrhofer, A. Schumacher, M. Imam, A. Schumacher, K. Engelhardt).

and Chlum-Bezdědovice (Eisner 1914, fig. 3: 2; 4: 7) and possibly Manětín-Hrádek (Cabanillas de la Torre/Goláňová 2020, fig. 5c). In terms of metal artefacts, I would like to highlight prominent finds such as the bronze sleeve/can from Chlum-Bezdědovice (Filip 1956, fig. 76: 2), the bronze phalerae from Nevěšice (Sankot 2002) and the beaked flagon from Hradiště (Písek dist.; Schwappach 1973a, fig. 13). The latter is described as ‘Etruscan’, leaving it uncertain whether the compass decoration was part of the original design or added later in the destination region (which is to discuss).

Several significant artifacts featuring compass decoration have also been discovered in France², though so far, based on published findings, only on metal. Notable examples are the dagger sheaths from Châtil-

² The examples from Brittany, presented exemplarily by Gadea Cabanillas de la Torre (e.g. in: Cabanillas de la Torre/Goláňová 2020), should not be included here.

lon (*Schwappach 1973a*, fig. 19: 1) and Bussy-le-Château (*Charpy 1991*, 65) with their friezes of semi-circular arches. Particularly interesting is the small disc from Molinons „Les Graisses“ with a similar frieze (*Baray 1999*, fig. 11: 8). Additionally, the openwork discs from Cuperly (*Jacobsthal 1969*, tab. 115: 185) and Somme-Bionne (*Jacobsthal 1969*, tab. 113: 180), for example, were also constructed with a compass.

In Germany, one notable example is the casket-shaped belt fitting from Mühlacker (*Schwappach 1973a*, fig. 1), which features floral ornamentation incorporated alongside an arched frieze. Further examples with arched friezes appear on the bronze application from Laumersheim (*Schwappach 1973b*, fig. 6: 5) and the bronze lid from the ‘Fürstengrab’ in Bad Dürkheim (*Schwappach 1973b*, fig. 7: 1). Individual circles with a central incision were discovered on the jug from Reinheim (*Echt 1999*, tab. 23), while compass marks on pottery can be observed on the fragment from Römhild (*Schwappach 1973a*, fig. 12: 5).

All in all, it can be said that the discussed decorated bowls from the Lower Traisen Valley fall well within the time horizon HaD3/LtA, which is also shown by the comparative pieces from the other innovation areas.

THE ORIGIN AND THE USE OF THE COMPASS AND THE COMPASS NORTH OF THE ALPS

It is noteworthy that many objects are crafted in a precise circular shape yet show no visible traces of compass strokes or engravings. This suggests that wax models for molds could have been created using compasses or turned on a lathe, a technique known since at least the 8th c. BC (*Armbruster 2003*). Examples include the shoe fittings (discs) from Gemeinlebarn, grave 66 (*Neugebauer 1994*, fig. 6: 5–7) or the drum fibula from Oberndorf, grave 121 (*Neugebauer 1992*, fig. 24: 1; *Ramsl, in preparation*). The wax model of the shoe buttons from Oberndorf 1982, grave 31/2–4 (*Ramsl, in preparation*) also appears to have been turned, or the finished bronze piece reworked with a compass. In general, the compass seems to have had a certain connection with the lathe as mentioned above. In her article ‘*Technologie und Transfer von Wissen in der prähistorischen Feinschmiedekunst Südwesteuropas*’ (*Armbruster 2003*), Barbara Armbruster discusses the possibilities of technology transfer with the lathe, among other things. The lathe is one of the earliest devices with rotary motion that was used in both metal and wood technology (*Armbruster 2003*, 67). The bone handle from Inzersdorf-Walpersdorf (Fig. 12: 1) and the depiction of turned furniture from the situla from Kuffern (*Urban 1999*, 199) as well as the amber-made handle from Inzersdorf (*Neugebauer 1996*, tab. 19: 6; 37: 2) are further evidence of its use in the Early La Tène Period in Lower Austrian Traisen Valley. Armbruster cites, among others, the necklace from Vix (Côte-d’Or). Here, several elements (including the discs on the pear-shaped ends) were cast from wax models made on a lathe. Bracelets with parallel structures, such as those from the late Hallstatt grave of Saint-Colombe (Côte-d’Or), are also indirectly related to the lathe. Turned wooden models served as a base into which the gold foil was pressed (*Armbruster 2003*, 73). In general, it is the attempt to get an exact circle or rounding.

It will never be possible to determine with certainty when and where a particular tool first appeared and in what form – whether north or south of the Alps. Rather, it depends on the state of research to be able to narrow down certain areas. As an example – a type of ‘wooden compass’ with a ‘rivet-like axis’ (*Stöllner 2015*, fig. 9) was excavated in the Nordstrecke of the Bronze Age mining area of the Arthurstollen (Mitterberg region, Salzburg). It may have been used there as a surveying tool but shows that the principle was already in use north of the Alps at this time.

In the Mediterranean area, from where many important impulses came to Middle and Central Europe, the northern Italian area with its ‘Etruscan’ colonisation, where many Greek imports also inspired ceramic decorations, should also be considered. Patterns incised with a compass appear on Greek black-figure ware from the 7th c. BC onwards, for example on an amphora (*Olivier-Trottenberg 2014*, 32, 33, tab. 12: 3). Examples of Etruscan wares include a ‘plate with high foot’ from Poggio Colla (*Perkins 2022*, fig. 6c), a cotyle(s) from Medio Valdarno (*Cappuccini 2022*, fig. 1a) or three examples from the tumulus of Montefortini a Comeana (*Bettini 2022*, pl. XII: b–e; XIII: a, b) as well as a bronze stamnos lid from Bad Dürkheim (*Bardelli 2017*, tab. 24: 2, 3; *Jacobsthal 1969*, no. 397, 203, tab. 262: 23). M. Lenerz-De Wilde believed that “overlapping half-arches drawn with a compass” appear only occasionally in Greek art (*Lenerz-De Wilde 1977*, 64; what is to be discussed), though they are frequently a dominant ornament in Etruscan art.

The origin of stamp-decorated Iron Age pottery in Central Europe probably lies somewhere between Bavaria and Transdanubia (*Goláňová 2018*, 127). There have been repeated speculation about inspiration from regions outside the region. Impressions of rotating motifs such as triskels and circles seem to have appeared in the area of the Vekerzug group from the Late Hallstatt period onwards.



Fig. 12. Comparable pieces in Lower Austria. 1 – Inzersdorf-Walpersdorf, pit 76/54; 2 – Gars-Thunau, Fnr. 57353 (photos and drawing A. Schumacher, P. C. Ramsel, B. Lethmayer).

CONCLUSION

This article presents two bowls from the Late Iron Age cemetery of Franzhausen, both decorated on the inside with compass and swirl patterns. These patterns were incised directly onto the surface with a compass and, in the case of the swirl, covered with stamps based on the many examples of compass-decorated artefacts, we observe a concentration of this technique in the Lower Traisen valley in Lower Austria. This could be an early indication of independent workshops in the region. Other materials such as bronze and bone, may also have been used, as demonstrated by the aforementioned turned handle from Walpersdorf (Fig. 12: 1) and the bronze belt fitting from Ossarn (Fig. 11: 5). This raises important questions about when and how knowledge of such compass designs spread north of the Alps and what influences facilitated their adoption. It also underscores the fact that even complex mathematical and geometric knowledge was present and utilized within the La Tène culture. Finally, it is important to emphasise once more that the Lower Traisen Valley is increasingly emerging as an independent regional center (or innovation area) during the Early La Tène Period, existing at the crossroads of tradition and innovation.

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Cesta v kruhu – výzdoba kružnicami v dobe laténskej na dolnom toku rieky Traisen, Dolné Rakúsko

P e t e r C . R a m s l

Súhrn

Prezentované misky s kruhovou výzdobou z pohrebiska vo Franzhausene prinášajú cenné poznatky o keramickej produkcii doby železnej na dolnom toku rieky Traisen. Autor analyzuje techniku a spôsob ich výroby, pričom sa porovnáva s podobnými nálezmi z blízkeho aj vzdialenejšieho okolia.

Dolný tok rieky Traisen je archeologicky bohatý región, ktorého výnimočné postavenie vyplýva zo strategickej polohy na severojužnej osi, sledovanej tokmi riek Traisen a Kamp a oblasťou Weinviertelu, ako aj na východozápadnej osi, ktorá zabezpečuje prepojenie významných sídelných a hospodárskych oblastí. Túto ideálnu polohu podporujú úrodné pôdy v bohatej terasovitej krajine.

Okrem starších nálezov z konca 19. a začiatku 20. storočia zohrali v poznaní regiónu zásadnú úlohu predovšetkým rozsiahle záchranné archeologické výskumy, ktoré od 80. rokov 20. storočia prebiehali pod vedením J.-W. Neugebauera, ako aj A. Gattringera, Chr. Blesla a ich tímov. Tieto systematické výskumy viedli k objaveniu viacerých sídlisk a početných pohrebísk z doby železnej, napríklad na lokalitách Inzersdorf/Walpersdorf, Franzhausen, Gemeinlebarn a Pottenbrunn. Výsledky týchto výskumov boli podrobne zhrnuté v prácach Neugebauer 1992; 1993; Ramsl 2012a, ako aj v príspevkoch vo „Fundberichte aus Österreich“.

Mimoriadne zaujímavým poznatkom je kontinuita osídlenia, ktorá je doložená na viacerých sídliskách a pohrebiskách regiónu – od neskoršej doby halštatskej až po obdobie včasnej doby laténskej. Výrazným príkladom je pohrebisko vo Franzhausene, ktoré vykazuje nepretržité využívanie od stupňa HaC až po začiatok laténskeho horizontu.

Predmetom štúdie sú dve misky z pohrebiska vo Franzhausene, konkrétne hrob 23 (číslo nález 10) a hrob 24 (číslo nález 6), ktoré sa vyznačujú nezvyčajnou ornamentálnou výzdobou na vnútornej stene, vyhotovenou pomocou kružidla. Ide o zložité vzory, ktoré zahŕňajú pretínajúce sa polkruhovité oblúky a pravotočivý sedemramenný vír okolo omfala. Tieto výzdoby boli vyryté do povrchu pomocou kružidla, pričom vrchol výzdoby bol dodatočne ukončený kolkom, vytvárajúcim sústredené krúžky. Podobné nálezy sú známe z lokalít v blízkom okolí, konkrétne z Inzersdorfu/Walpersdorfu, Gemeinlebarnu, Gars-Thunau, Pottenbrunn a Ossarnu.

V tomto príspevku je detailne popísaný a graficky znázornený postup výroby kruhovej výzdoby, ktorý sa vykonáva v niekoľkých krokoch (pozri obr. 9 a 10). Tento proces predstavuje zložitú geometrickú úlohu, ktorú dokázal výrobca úspešne zvládnuť už v dobe laténskej.

Uvedené artefakty možno porovnať s podobnými nálezmi z bezprostredného okolia, napríklad z Dolného Rakúska. Kruhový ornament sa vyskytuje nielen na keramike, ale je známy predovšetkým na kovových predmetoch. Vyskytuje sa na celom území výskytu včasnotaténskeho nálezov ako napr. Dürrenberg, Morava, Čechy, Champagne, južné Nemecko a Porýnie.

Predmetom diskusie je aj forma prevedenia výzdoby. Z techník sú použité ryhy kružidlom (ako v prípade Franzhausenu), ako aj stopy po vyhladzovaní povrchu. Tento typ výzdoby sa vyskytuje napríklad v Modreji (Goláňová 2018, obr. 67: 4, 9), v Inzersdorfe-Walpersdorfe (Walpersdorf Nord 73, obj. 1363, č. 861 – Rams 1998, obr. 23; tab. 97: 861) alebo v Chlum-Bezďedoviciach (Eisner 1914, obr. 3: 2).

Toto „vyhladzovanie“ vzniklo pravdepodobne počas procesu sušenia keramiky. Experimentálne bolo dokázané, že presné tvarovanie včasnotaténskej keramiky a aplikovanie výzdoby prebiehalo po fáze schnutia trvajúcej 1 až 2 dni. Tvarovanie zahŕňalo opakované otáčanie predmetu, pričom v tomto štádiu sa súčasne presne formovali aj vnútorné a vonkajšie steny stredu nádoby, označovaného ako omfalos (pozri obr. 7).

Dve zdobené misky podnecujú diskusiu o úrovni matematických a geometrických poznatkov v období včasnej laténskej kultúry. Zároveň poukazujú na vysokú úroveň remeselnej zručnosti ich tvorcov, ktorá presahovala rámec dolného toku rieky Traisen.

Obr. 1. Mapa lokalít zahrnutých do projektu CATA, vrátane loga (grafika L. Kohl, Th. Koch Waldner; mapový podklad EU-DEM).

Obr. 2. Mapa dolného toku rieky Traisen s príslušnými lokalitami. 1 – Gars-Thunau; 2 – Franzhausen; 3 – Gemeinlebarn; 4 – Inzersdorf; 5 – Walpersdorf; 6 – Herzogenburg; 7 – Ossarn; 8 – Oberndorf/Ebene; 9 – Rassing; 10 – Pottenbrunn (grafika P. Urban; podklady: www.basemap.at).

Obr. 3. Franzhausen (FH), hrob 23 (grafika L. Kohl, A. Gattringer).

Obr. 4. Misa z hrobu FH 23/10 (foto Chr. Bieber, UHA; kresba M. Mayrhofer).

Obr. 5. Franzhausen, hrob 24 (grafika L. Kohl, A. Gattringer).

Obr. 6. Misa z hrobu FH 24/6 (foto Chr. Bieber, UHA; kresba M. Mayrhofer). Mierka: a – 1, 3; b – 2.

Obr. 7. 1 – povrch s miernym fazetovaním; 2 – povrch s miernym fazetovaním (keramika z Strebersdorf/Bgld.); 3 – omfalos z misy (FH, UHA); 4 – žliabky v/na keramike (foto P. C. Rams, Chr. Bieber).

Obr. 8. Motívy použitej výzdoby (kresba L. Kohl).

Obr. 9. Štruktúra výzdoby FH 23/10 (kresba L. Kohl).

Obr. 10. Štruktúra výzdoby FH 24/6 (kresba L. Kohl).

Obr. 11. Analógie v Dolnom Rakúsku. 1 – Oberndorf 1982, hrob 9/16; 2 – Inzersdorf-Walpersdorf, jama 1636/939; 3 – Ossarn 1984, hrob 17/10; 4 – Pottenbrunn 1930, hrob 1; 5 – Ossarn 1966, Náhodný nález (foto a kresba M. Mayrhofer, A. Schumacher, M. Imam, A. Schumacher, K. Engelhardt).

Obr. 12. Analógie v Dolnom Rakúsku. 1 – Inzersdorf-Walpersdorf, jama 76/54; 2 – Gars-Thunau, č. nález 57353 (foto a kresba A. Schumacher, P. C. Rams, B. Lethmayer).

Tabela 1. Nálezy s kruhovou výzdobou (dolný tok rieky Traisen a údolie Kampu). Všetky datované do doby laténskej.

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MEDZI BRONZOM A MOSADZOU – ZÁVESKY S KRÍŽOVÝM RÁMOM Z GERMÁNSKÝCH POHREBÍSK V OČKOVE A SEKULIACH¹

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Between Bronze and Brass – Banded Pendants from Germanic Cemeteries in Očkov and Sekule

This study examines banded pendants discovered in the Germanic cemeteries of Očkov and Sekule, focusing on their material composition. This type of pendants come from the Przeworsk culture and is found only rarely in western Slovakia during the Roman period, mainly in the graves of women and children. Banded pendants, typically crafted from copper-based alloys, are most commonly made of bronze. The core filling of the pendants contain decorations made from various other materials, such as organics and shells, pebbles or glass beads. The paper includes an analysis of metal parts of banded pendants using X-ray fluorescence spectrometry (XRF). The results of the XRF analysis confirmed the presence of copper alloys with varying proportions of tin and zinc, indicating that the pendants were manufactured from different types of bronze and brass. These findings provide new insights into the material diversity and resource utilization in the production of banded pendants within the Germanic cultural context.

ÚVOD

Prelom staršej a mladšej doby rímskej v stredodunajskom barbariku je definovaný výraznými zmenami, ktoré výrazne ovplyvnili kultúrny a sociálny vývoj tejto oblasti. Pre mladšiu dobu rímsku je v hroboch na území západného Slovenska typický výskyt artefaktov s pôvodom v przeworskej a wielbarskej kultúre. Archeologické nálezy poukazujú na to, že počas markomanských vojen dochádzalo k migrácii ľudu przeworskej kultúry smerom na juh. Medzi nálezmi zo severných oblastí mimo územia stredodunajských Germánov v dobe rímskej na území Slovenska dominujú najmä spony tvaru Almgren 43, ako aj ďalšie bronzové predmety, napr. kaptorgovitá a vedierkovitá závesky či závesky s krížovým rámom, ktoré sú predmetom tohto príspevku.

Charakteristickým znakom tejto formy závesku sú kovové krížové rámy, ktoré pozostávajú z dvoch pásov usporiadaných kolmo na seba. V hornej časti sú spojené do závesného očka. Závesné očko sa niekedy nachádza aj v spodnej časti závesku, kde mohla byť upevnená ďalšia ozdoba, napr. polmesiacovitého tvaru, ako to dokladá nález z hrobu 17 vo Veľkom Cetíne (Ruttkayová 2009, 572). Samotný rám závesku, býva prevažne zhotovený z bronzu, no vyskytujú sa aj závesky z iného materiálu ako striebro, mosadz alebo železo. Vnútri závesku sa nachádzala ozdoba tvoriaca jadro, ktorá mohla byť vyrobená z rôznych materiálov, napr. zo sklenených korálikov, hornín či organických látok, ako sú vlašské orechy, kôstky alebo ulity mušlí rodu *Cypraea* (Quast 2000). V žiarových hroboch sa často zachováva iba kovová časť závesku, zatiaľ čo organické časti alebo roztavené sklo sa dochovávajú len výnimočne. Závesky s krížovým rámom sa najčastejšie objavujú v ženských a detských hroboch, ojedinele sú známe aj z nálezov na sídliskách, napr. zo sídliskovej vrstvy v Cífer-Páci (Varsik/Kolník 2021, 176).

V minulosti sa v súvislosti s výskytom týchto záveskov na sarmatských pohrebiskách predpokladal ich sarmatský pôvod. Najstaršie exempláre však pochádzajú z územia przeworskej kultúry a sú

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datované už do stupňa B1. Závesky sa najdlhšie udržali vo wielbarskej kultúre, odkiaľ boli importované do ďalších oblastí (Stanek 1999, 331, 341).

Tento príspevok sa zameriava na skúmanie materiálov použitých pri výrobe záveskov s krížovým rámom. Súčasťou štúdie je aj analýza krížových rámov záveskov z germánskych žiarových pohrebísk v Očkove a Sekuliach, ktorá bola vykonaná pomocou röntgenovej fluorescenčnej spektrometrie (XRF). Cieľom analýzy je overiť hypotézu, že okrem bronzových rámov sa v nálezoch vyskytujú aj exempláre zhotovené z mosadze, a zároveň zhodnotiť variabilitu výplní jadier záveskov.

HISTÓRIA BÁDANIA

Na začiatku 20. stor. ako prvý systematicky spracoval závesky s krížovým rámom E. Blume (1912). Jeho práca sa sústredila na kategorizáciu nálezísk a vytvorenie typológie záveskov na základe obsahu, resp. výplne krížového rámu, ktoré tieto závesky obsahovali. Vytvoril tri skupiny podľa toho, či sa v závesku nachádzala mušľa, sklenený korálik alebo jadro z organického materiálu.

V druhej polovici 20. stor. závesky skúmala H. Schach-Dörge (1969) v kontexte pohrebiska Wilhelmsaue (Brandenburgsko). Vo svojej práci kládla dôraz najmä na pôvod mušlí využívaných ako jadro záveskov. Obaja autori datovali tieto artefakty do stupňov B2–C doby rímskej.

Aktuálnu typológiu záveskov a katalógový súpis nálezov zo stredoeurópskeho barbarika spracovala K. Stanek (1999), pričom táto typológia tvorila základ aj pre hodnotenie nálezov analyzovaných v tomto príspevku. K. Stanek rozlišuje východnú a západnú skupinu záveskov s krížovým rámom. K západnej skupine patrí len niekoľko príveskov omotaných drôtom a nálezy pochádzajú najmä z územia severozápadného barbarika. Závesky východnej skupiny sa objavujú v celom stredoeurópskom barbariku a na základe konštrukčných vlastností K. Stanek rozlišuje štyri typy (I–IV; Stanek 1999, 331–341).

Problemátike proveniencie, obchodných kontaktov a sociálneho statusu nositeľov záveskov sa podrobnejšie venoval taktiež D. Quast (2000). Podľa jeho výskumu majú závesky pôvod vo wielbarskej kultúre a rovnako ich datoval do stupňov B2–C. D. Quast zároveň vytvoril katalóg a zmapoval aktuálny stav a počet známych nálezov.

A. Kokowski (2001) rozlišuje dva typy záveskov s krížovým rámom, v ktorých sa nachádzajú mušle rodu *Cypraea*. Podľa neho závesky zo sarmatského a gótskeho prostredia, ako aj exempláre južne a západne od wielbarskej kultúry, majú kovovú os s navlečenou mušľou umiestnenú v strede. Naproti tomu vo wielbarskej a luboszyckej kultúre tento prvok chýba (Kokowski 2001, 206).

PRAMENNÁ BÁZA

Tento príspevok sa venuje podrobnej analýze nálezov záveskov s krížovým rámom, ktoré boli objavené na germánskych pohrebiskách v Očkove a Sekuliach (tabela 1). Artefakty pochádzajú často z hrobov, ktoré sa vyznačujú nadštandardnou hrobovou výbavou, čo poukazuje na ich osobitný význam v rámci germánskeho pohrebného rítu. Hroby z mladšej doby rímskej sú vo všeobecnosti charakteristické skrom-

Tabela 1. Typologické zaradenie a hrobový kontext analyzovaných záveskov s krížovým rámom.

ID	Lokalita	Hrob	Typ podľa Stanek 1999	Pohlavie podľa hrobovej výbavy	Vek	Datovanie
1	Očkov	69	IIIB	žena	Juvenis	C1
2	Očkov	117	IIIA	?	Juvenis	C1a
3	Očkov	124	IA	?	Infans II–III	C1
4	Očkov	150	IIIA	žena	Infans I–II	C1–C3
5	Očkov	236	IA	?	Adultus <	C1–C3
6	Sekule	2	IIIA	muž	?	B2–C1
7	Sekule	21	IA	žena	?	C1
8	Sekule	40	IC	žena	?	B2/C1

nejšou prítomnosťou hrobových príloh. Avšak niektoré hroby, v ktorých boli objavené tieto závesky, sa z tohto pravidla vymykajú a sú pozoruhodné svojou bohatou výbavou, čo podčiarkuje ich výnimočnosť aj v rámci skúmaných pohrebísk.

Žiarové pohrebisko v Očkove

Pohrebisko v Očkove (okr. Nové Mesto nad Váhom) leží severozápadne od obce, nachádza sa v severnej časti výbežku Podunajskej nížiny pri úpätí malých Karpát, na pravom brehu rieky Váh. Doposiaľ je to najväčšie známe kvádske pohrebisko z mladšej doby rímskej na západnom Slovensku a je datované do stupňov B2/C1–C3 doby rímskej (Kolník 1956). Závesky s krížovým rámom z Očkova neboli doposiaľ publikované, aj keď niektoré exempláre sa objavili v katalógových spracovaniach záveskov (Quast 2000, 291; Stanek 1999, 352). V Očkove sa ako súčasť hrobového inventára nachádzali v hroboch 69, 117, 124, 150 a 236.

Inventár hrobu 69 tvoril závesok s krížovým rámom typu IIIB (obr. 1: 6), črepy urny, zlatý hruškovitý závesok Müller typ II/III, železný vedierkovitý závesok typu AII podľa Beilke-Voigt, fragmenty roztavených bronzových predmetov (pravdepodobne spôn), zlomky kosteného viacdielného jednostranného hrebeňa s trojuholníkovým chrbtom a železnými nitmi, zliatky a kusy roztaveného skla, železný nôž, železné kovania hákovite zahnuté a lopatkovito rozšírené, hrudky živice, uhlík a pazúrik. Datovanie hrobu spadá do stupňa C1 doby rímskej.

V hrobe 117 sa nachádzal závesok typu IIIA (obr. 1: 2), črepy urny, jednodielna železná spona, bronzová pracka opasku typ Madyda-Legutko D21 a obdĺžnikové kovanie s pravouhlým výrezom uprostred a peltovite prelamovanou výzdobou na kratších stranách a s otvormi na nity, obdĺžniková platnička s motívom kráčajúceho leva, a závesné kovanie s krúžkom, bronzová obdĺžnikovitá doštička, bronzová ataša z nádoby zdobená reliéfnou ženskou tvárou pravdepodobne z nádoby Eggers 29, bronzové kovanie v tvare T, zlomok bronzovej obdĺžnikovitej doštičky s vyobrazením leva, železný nožík s krátkym oblúkovite vyklenutým ostrím, železné šidlo s postranným uškom, masívna železná platnička, železná šípka so spätnými krídelkami a tuľajkou, nákončie picieho rohu typu F.2 podľa Andrzejowského so zosilenou hornou časťou a kovania picieho rohu, bronzové fragmenty štítovej puklice pravdepodobne typ H podľa Zielinga a štítového kovania typu A podľa Zielinga, fragmenty bronzovej nádoby Eggers typ 44–49, bronzové klinčeky zo štítu, železné kovanie, hrudka živice, zliatok korálika, zlomky bronzového plechu a kostenej ohňom deformovanej doštičky. Na základe sprievodných nálezov je hrob datovaný do stupňa C1a.

V hrobe 124 sa okrem závesku s krížovým rámom typu IA (obr. 1: 7) nachádzali črepy urny tvaru stlačenej misy, fragmenty roztaveného zeleného skla a hrudka živice. Pravdepodobné datovanie hrobu spadá do stupňa C1.

Hrob 150 obsahoval závesok typu IIIA (obr. 1: 1), črepy vázovitej urny, železný nožík, bronzový krúžok, bronzový krúžok s dvomi zavesenými tyčinkami ozdobenými priečnymi a šikmými ryhami, drobné kovania, fragmenty kosteného trojvrstvého jednostranného hrebeňa a železný fragment ihlice. Na základe hrobových príloh je hrob datovaný do stupňov C1–C3.

V hrobe 236 bol závesok s krížovým rámom typu IA (obr. 1: 5), črepy urny, hrudka živice a ďalšie črepy z iných nádob. Datovanie hrobu spadá do stupňov C1–C3.

Žiarové pohrebisko v Sekuliach

Pohrebisko v Sekuliach (okr. Senica) sa nachádza na vyvýšenine východne od obce, západne od Malých Karpát, na ľavej strane rieky Moravy. Počiatky pochovávaní na pohrebisku v Sekuliach možno na základe hrobových nálezov datovať do polovice 1. stor. po Kr., pričom hlavné obdobie pochovávaní spadá do stupňa B2/C1 doby rímskej. Doposiaľ boli výsledky výskumu publikované len čiastkovo. Závesky s krížovým rámom pochádzajú z troch hrobov, konkrétne z hrobu 2/2008, 21/2014 a 40/2017. Z nich boli hrobové celky 21/2014 a 40/2017 už spracované a publikované (Iván/Ölvecký/Rajtár 2019; Rajtár et al. 2019).

V hrobe 2/2008 sa našiel závesok s krížovým rámom pravdepodobne typu IIIA (obr. 1: 3), železná trúbkovitá spona so striebornými drôtikmi, strieborná trúbkovitá spona so železnou oskou vinutia, železná pravouhlá pracka, železný nôž ohnutý, železný nôž s nitom, polmesiačikovitá železná britva, fragmenty žliabkovaného bronzového vedra, tri bronzové fragmenty ataše kanvice, fragmenty bronzovej naberačky,



Obr. 1. Závesky s křížovým rámem z Očkova: 1 – hrob 150; 2 – hrob 117; 5 – hrob 236; 6 – hrob 69; 7 – hrob 124. Závesky s křížovým rámem zo Sekúl: 3 – hrob 2; 4 – hrob 40; 8 – hrob 21 (úprava P. Červeň).

päť fragmentov okutia štítu, malé bronzové fragmenty, zlomok kosteného hrebeňa a dve hrudky živice. Rámcové datovanie pohrebu spadá do stupňov B2–C1 doby rímskej.²

Hrob 21/2014 bol silne poškodený a okrem závesku s krížovým rámom variantu IA (obr. 1: 8) tvorili hrobovú prílohu dve železné spony. Jedna zo spôn patrí k Almgrenovej 11. sérii, druhá spona patrí k zriedkavému variantu železných rímsko – provinciálnych trúbkovitých spôn. Ďalej k hrobu prislúchajú zlomky kostenej ihlice a hrebeňa, kónický bronzový praslen, fragmenty bronzového plechu, asi z vedra a roztavené zlomky skla. Pravdepodobne ženský hrob, datovaný do stupňa C1 (*Iván/Ölvecky/Rajtár 2019*, 238–240).

Z hrobu 40/2017 sa okrem závesku s krížovým rámom typu IC (obr. 1: 4) zachovali črepy urny, fragmenty bronzového vedra zo železným držadlom, roztavené zliatky masívnej bronzovej nádoby, fragmenty naberačky a cedidla, poškodené železné nožnice, dva nožíky, päť kľúčov typu A podľa Kokowského a veľká hruda živice. Neďaleko urny sa našli tiež železné klnce, kovania drevenej skrinky, jedna strieborná spona Almgren 41, variant Y podľa J. Schustera a jedna bronzová spona Almgren 43, časti strieborného hruškovitého závesku typu II alebo III podľa A. von Müllera, strieborný prsteň tvaru 3 skupiny 1 podľa Beckmanna, tri strieborné zápinky, z toho dve patria k skupine A a jedna k skupine C podľa von Müllera, železný vedierkovitý závesok variant 1 typ I podľa Kaczanowského, dva bronzové kapslovité závesky skupina 1 podľa Beckmanna, kovanie so záveskom, plechová objímka, kozmetický nástroj, jedna ohnutá a zlomok inej ihly alebo ihlice, zlomky ďalšej kostenej ihlice IIb–c podľa Beckmanna a fragment hrebeňa typu A I podľa Thomas a zliatky skla. Podľa hrobovej prílohy bol hrob identifikovaný ako ženský, datovaný do stupňa B2/C1, s vplyvom przeworskej kultúry (*Iván/Ölvecky/Rajtár 2019*, 241–247).

VÝPLNE JADRA

D. Quast (2000, 286–294) vo svojej práci spracoval súpis záveskov s krížovým rámom z rozsiahleho európskeho priestoru. Rozdelil ich podľa kategórií výplne jadra závesku. Tento súpis je rozčlenený do dvoch hlavných kategórií. Prvá kategória zahŕňa závesky z obdobia rímskeho cisárstva a merovejovské závesky, kde ako výplň jadra slúžia orechy alebo ovocné kôstky. Druhá kategória pokrýva obdobie rímskeho cisárstva a sťahovania národov (do polovice 5. stor.). Táto kategória zahŕňa širšiu škálu ozdôb, medzi ktoré patria orechy a ovocné kôstky, fosílie ježoviek, mušle rodu *Cypraea*, kamene, sklenené koráliky a guľičky alebo horský krištál. V niektorých prípadoch výplň závesku chýba. Tu je možné predpokladať, že sa v závesku pôvodne nachádzala ozdoba z organického materiálu.

Podľa D. Quasta (2000, 282–283) sa mohla výplň identifikovať aj na základe veľkosti závesku. V exemplároch s veľkosťou približne 2 cm sa zvyčajne nachádzala čerešňová kôstka, sklenený korálik alebo iný drobný predmet. Väčšie kusy, s rozmermi okolo 8 cm, obsahovali mušľu, sklenenú guľku alebo korálik.

Pomerne často sa objavuje ako výplň závesku horský krištál, čo je vlastne druh kremeňa s vysokou priehľadnosťou. V Sekuliach sa závesok s horským krištálom našiel v hrobách 21 a 40. Z územia západného Slovenska sa bronzový závesok s jadrom z horského krištálu objavil v sídliskovej vrstve v Cíferi-Páci, ten však kvôli poškodeniu nebolo možné typologicky zaradiť (*Varsik/Kolník 2021*, 176). Krištál z tohto závesku bol skúmaný Ramanovou spektroskopiou, na základe získaných dát bol identifikovaný kremeň (*Varsik/Illášová/Štubňa 2021*, 84, 85, obr. 11). Rovnakou metódou boli skúmané aj minerály zo záveskov v Sládkovičove a Závode. Na pohrebisku v Závode bol ako zberový nález objavený bronzový závesok vyplnený jadrom z horského krištálu. V tomto závesku bol podobne ako v predchádzajúcom prípade identifikovaný kremeň, zatiaľ čo v závesku zo Sládkovičova je namerané Ramanove spektrum charakteristické pre kalcit (*Bazovský et al. 2022*, 205; *Hladíková/Jelínek/Lalinská-Voleková 2024*, 244–246, obr. 5; 6). Je dôležité poznamenať, že zvyčajne je horský krištál identifikovaný len makroskopicky. Závesok zo Sládkovičova je príkladom toho, že presná identifikácia je často možná len s využitím prírodovedných metód.

Na očkovskom pohrebisku sa v hrobe 69 a 236 nachádzali v záveskoch sklenené koráliky. V oboch prípadoch boli značne poškodené žiarom. V závesku z hrobu 69 sa nachádzalo roztavené biele sklo z korálika a v závesku 236 bol uložený pravdepodobne tmavozelený korálik alebo sklenená guľôčka. Sklenené ozdoby sa v záveskoch vyskytujú pomerne často, dva závesky so skleneným korálikom sú známe napr. z pohrebiska przeworskej kultúry v Kamieńczyku. V hrobe 201b sa nachádzal závesok vyplnený bezfarebným čírym korálikom, pričom v tom istom hrobe bol uložený ešte jeden závesok s krížovým rámom s kamienkom v jadre. Zvyšky koráliku z červeného skla sa zachovali aj v hrobe 209 (*Dąbrowska 1997*, 48, 49).

² Ústna informácia od J. Rajtára.

Ulity mušlí rodu *Cypraea* sú doložené v záveskoch z územia Dánska, Nemecka, ale aj Poľska. Z územia Slovenska sa drobný úlomok mušle rodu *Cypraea pantherina* zachoval vo vnútornej časti rámu závesku z hrobu 150 z Očkova (Kolník 1964, 229).

V prípade záveskov, ktorých rám nebol poškodený, no výplň rámu sa nezachovala, môžeme predpokladať, že jadro tvorila ozdoba z organického materiálu. Pravdepodobne by to mohol byť prípad závesku z hrobu 124 z Očkova. Výplň jadra vlašským orechom je doložený napr. v striebornom závesku z inhumáčného hrobu zo Žiželíc (Blažek 1995, 150, 151).

Na pohrebisku wielbarskej kultúry vo Wekliciach bola v hrobe zistená fosília ramenonožca (*Brachio-pod*), ktorý sa mohol vyskytnúť sekundárne v kvartérnych sedimentoch. Tie pravdepodobne priniesol ľadovec zo severu, ale možný je aj pôvod na juhu Poľska (Skóra/Natuniewicz-Sekuła/Bitner 2021, 373, 378). Pôvodne bol nález označený ako kôstka broskyne *Prunus persica* (L.) a interpretovaný bol ako jadro závesku s krížovým rámom (Natuniewicz-Sekuła/Okulicz-Kozaryn 2011, 58, tab. LXVI/hrob 161: 5).

KRÍŽOVÉ RÁMY

Krížové rámy záveskov sú naprieč celým Barbarikom, až na nepočetné výnimky, vyrobené z bronzu. Menej početne sa vyskytujú strieborné a železné varianty. Strieborný závesok je známy z bohato vybaveného inhumáčného hrobu zo Žiželíc, vnútri krížového rámu sa nachádzal vlašský orech. Hrob je datovaný do stupňa C3 (Blažek 1995, 150, 151, 156, 161). Na pohrebisku wielbarskej kultúry vo Wekliciach sa v inhumáčnom hrobe 277 objavil závesok s krížovým rámom vyrobeným zo železa. Typologicky sa radí k typu Stanek II a vnútri kovového rámu sa nachádzalo svetlozelené sklo v tvare guľôčky. Hrob je datovaný do stupňa IIB wielbarskej kultúry, čo zodpovedá stupňu B2b–B2c doby rímskej (Natuniewicz-Sekuła/Okulicz-Kozaryn 2011, 81).

Metodika

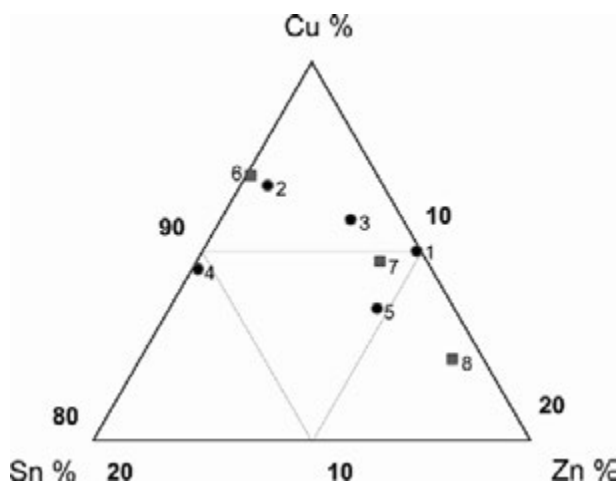
Kovové rámy záveskov boli podrobené analýze chemického zloženia s cieľom rozlíšenia bronzových a mosadzných artefaktov. Bronz a mosadz sa vizuálne odlišuje na základe farebných rozdielov, textúry a lesku.

Nálezy záveskov z Očkova však neboli zachované v ideálnom stave, pričom na kvalite materiálu sa podpísala aj konzervácia z minulého storočia. Z tohto dôvodu sme pristúpili k analýze materiálu pomocou röntgenovej fluorescenčnej spektrometrie (XRF). Výsledky ukázali, že nie všetky závesky sú vyrobené z bronzu – niektoré boli zhotovené z mosadze. Na základe výsledkov boli zahrnuté do analýzy aj rovnaké druhy nálezov z pohrebiska v Sekuliach za účelom overenia chemického zloženia materiálu.

Chemické zloženie predmetov bolo určené röntgenovou fluorescenčnou spektrometriou (XRF). Údaje o hmotnostných percentách jednotlivých prvkov boli namerané prístrojom Niton XL3 XRF Analyzer. Pred meraním bol povrch predmetov očistený od oxidov, drobnej korózie a mastnoty. Prípravu nálezov a samotné merania uskutočnil V. Mezey (AÚ SAV, v. v. i.).

Výsledky

Analýza chemického zloženia skúmaných materiálov jednoznačne potvrdila, že hlavným prvkom vo všetkých analyzovaných zliatinách záveskov je meď. Významný obsah cínu bol identifikovaný vo viacerých vzorkách záveskov (ID 2, 4, 6), čo nepochybne indikuje, že ide o artefakty vyrobené z bronzu. Na druhej strane, u ďalších záveskov (ID 1, 3, 5, 7, 8) bola zistená vyššia koncentrácia zinku v porovnaní s obsahom cínu. Chemický pomer ukazuje, že



Obr. 2. Percentuálne zastúpenie medi, cínu a zinku v zliatinách, z ktorých boli krížové rámy analyzovaných záveskov vyrobené. Legenda: □ – Sekule; ○ – Očkov.

Tabela 2. Výsledky XRF analýzy chemického zloženia záveskov s krížovým rámom z Očkova a Sekúl.

ID	Lokalita	Hrob	Cu [%]	Sn [%]	Zn [%]	Sb [%]	Pb [%]	Stopové prvky
1	Očkov	69	89,35	0,21	9,71	0,27	0,23	0,23
2	Očkov	117	92,73	5,24	1,24	0,09	0,32	0,38
3	Očkov	124	89,54	2,34	5,80	0,10	1,94	0,28
4	Očkov	150	88,42	10,59	0,28	0,21	0,32	0,18
5	Očkov	236	86,37	3,51	9,42	0,21	0,23	0,26
6	Sekule	2	93,49	5,75	0,20	0,12	0,11	0,33
7	Sekule	21	88,63	2,15	8,29	0,07	0,08	0,78
8	Sekule	40	83,81	1,43	14,18	0,15	0,21	0,22

tieto predmety sú vyrobené z mosadze, čo je zliatina medi a zinku (obr. 2). Obsah olova bol vo väčšine prípadov zanedbateľný, pričom jeho koncentrácia sa nachádzala na úrovni stopových množstiev, ktoré pravdepodobne nemali výrazný vplyv na vlastnosti zliatin. Výnimku predstavuje len jeden závesok (ID 3), u ktorého bola zaznamenaná mierne vyššia koncentrácia olova. Aj napriek tomu však obsah olova v tomto prípade zostáva na relatívne nízkej úrovni, čo naznačuje, že jeho prítomnosť bola buď náhodným dôsledkom technologického spracovania, alebo pochádzala z nečistôt v použitých surovinách (tabela 2).

DISKUSIA

XRF analýza záveskov s krížovým rámom z Očkova a Sekúl ukázala, že medzi skúmanými artefaktmi sa nachádzajú nielen bronzové, ale aj mosadzné závesky. Na základe výsledkov atómovej absorpčnej analýzy (AAS) vytvoril J. Riederer (1998, tab. 20) klasifikáciu antických zliatin medi. Podľa tejto klasifikácie môžeme zaradiť k cínovému bronzu so stredným obsahom cínu závesok z hrobu 2 zo Sekúl (ID 6) a k cínovému bronzu so stredným až vysokým obsahom cínu závesok z hrobu 150 z Očkova (ID 4). K mosadzi so stredným až vysokým obsahom zinku môžeme zaradiť závesok z hrobu 69 z Očkova (ID 1), k cínovej mosadzi s nízkym obsahom zinku závesky z hrobov 117 a 236 z Očkova (ID 2, 5) a závesok z hrobu 21 zo Sekúl (ID 7). Závesok z hrobu 40 zo Sekúl (ID 8) patrí k cínovej mosadzi s vysokým obsahom zinku a závesok z hrobu 124 z Očkova (ID 3) je zložený z olovnato – cínovej mosadze s nízkym obsahom zinku.

Antická mosadz (*aurichalcum*) predstavovala vysoko cenenú komoditu, predovšetkým pre svoj vzhľad a lesk pripomínajúci zlato. V oblasti Stredomoria bola využívaná už v 1. stor. pred n. l., pričom jej rozšírenie výrazne podporili rímske mosadzné mince. Mosadzné sestercie a dupondie boli razené za vlády Augusta a ďalších rímskych cisárov (Droberjar 2002a, 33; Plínius St. 34,4).

O výrobe mosadze v období rímskej ríše sa zmieňuje Plínius Starší v diele *Naturalis Historia* (34,4). Podľa jeho opisu sa mosadz vyrábala pridaním zinkovej rudy kalamínu k zmesi granulovanej medi a dreveného uhlia. Analýzy predmetov rímskej proveniencie ukazujú, že obsah zinku v rímskej mosadzi dosahoval maximálne 28 %, pričom zliatiny obsahovali len minimálne alebo žiadne množstvo cínu a olova. To potvrdzuje výrobu mosadze cementačným procesom. Analýzy zároveň potvrdzujú, že rímska mosadz spravidla obsahovala menej ako 22 % zinku a menej než 5 % cínu či olova. Dôležitou vlastnosťou mosadze je jej náchylnosť na oxidáciu a následnú redukciu, čo pri opakovanom tavení spôsobovalo pokles obsahu zinku v zliatine približne o 10 % (Craddock 1978, 10, 11). Ak sa pri výrobe použila matrica z iného kovu, napr. z medi zmiešanej s cínom alebo olovom získanou zo šrotového bronz, absorpcia zinku počas cementácie sa znížila v dôsledku nižšieho bodu tavenia medi. Konečný obsah zinku preto závisel od faktorov, ako sú dosiahnutá teplota, trvanie procesu, kvalita téglia a hrúbka vrstvy dreveného uhlia (Rehren 1999, 252). Analýzy potvrdzujú aj fenomén postupného poklesu obsahu zinku v rímskej mosadzi od 1. k 4. stor., pričom súčasne klesal podiel zliatin s obsahom viac ako 4 % zinku (Craddock 1978, 14).

Postupne preniklo používanie mosadze aj medzi germánske kmene. Predpokladá sa, že germánske výrobky z mosadze vznikali prevažne recykláciou, konkrétne pretavovaním rímsko-provinciálnych

nádob a ďalších kovových artefaktov (Drescher 1957, 93). Proces recyklácie a zároveň výskyt záveskov s krížovým rámom v mladšej dobe rímskej by mohli objasniť relatívne nízky obsah zinku zaznamenaný v mosadzných záveskoch z pohrebísk v Očkove a Sekuliach.

Problematika významu mosadze na rímskych a germánskych pohrebiskách, založená na analýze českých nálezov z obdobia staršej doby rímskej, bola podrobne skúmaná E. Droberjarom a J. Fránom (2004). Podľa ich výskumu sa mosadzné predmety na území Čiech vyskytujú prevažne v staršej dobe rímskej, konkrétne v horizonte B1a, ako aj v horizonte českých spôn s očkami (B1b). Zaujímavý a ojedinelý nález predstavuje polotovár vo forme mosadznej doštičky objavenej v hrobe 202 v Třebusiciach. Chemická analýza tohto artefaktu odhalila vysoký obsah zinku dosahujúci až 31,3 % (Droberjar/Motyková 2023, 49, tab. 42). Medzi najrozšírenejšie mosadzné artefakty germánskeho pôvodu patria spony s očkami typu Almgren 45, 48 a 54b, ktoré boli vyrábané v miestnych dielňach a svedčia o rozvinutej lokálnej remeselnej výrobe (Droberjar/Frána 2004, 445). Tieto spony, vyhotovené z mosadze, sú známe aj z územia Poľska. Ich chemické zloženie poukazuje na rôzne typy mosadzí s odlišným obsahom zinku, čo naznačuje rozmanité technologické postupy alebo rôznorodosť zdrojov surovín (Łuczkiwicz *et al.* 2022, 274). Tieto zistenia podčiarkujú význam mosadze ako materiálu nielen v kontexte germánskych dielní, ale aj v širšom geografickom a kultúrnom rámci.

ZÁVER

Závesky s krížovým rámom majú svoj pôvod pravdepodobne v prostredí przeworskej kultúry a v germánskych hrobách na území stredodunajského barbarika sa vyskytujú len sporadicky. Sú považované za prejav kultúrnych vplyvov z oblasti severne od stredodunajského priestoru, ktoré dokladajú existenciu kontaktov medzi týmito kultúrnymi okruhmi v dobe rímskej. Tieto závesky sa zvyčajne objavujú v hrobových kontextoch, zatiaľ čo ich výskyt na sídliskách je ojedinelý. Väčšina nálezov pochádza zo ženských hrobov, v detských hrobových celkoch sa objavujú zriedkavejšie. Ich chronologický výskyt je v rámci przeworskej a wielbarskej kultúry datovaný od stupňa B1 doby rímskej. Na území západného Slovenska sa pravdepodobne vyskytovali počas stupňov B2 až C3, pričom najintenzívnejší výskyt sa predpokladá v stupni C1.

V tomto príspevku bola zhodnotená analýza materiálov použitých pri výrobe záveskov s krížovým rámom pochádzajúcich z lokalít Očkov a Sekule. Cieľom bolo preskúmať variabilitu výplní jadier týchto záveskov a charakterizovať ich kovové rámy. Napriek obmedzenému počtu analyzovaných exemplárov sa podarilo zdokumentovať takmer všetky druhy výplní známe z obdobných artefaktov aj z iných kultúrnych okruhov. Medzi identifikované materiály patria horský krištál, sklenené koráliky a ulity mušlí rodu *Cypraea*. V prípade prázdnych záveskov s neporušeným rámom sa predpokladá prítomnosť organických výplní, ktoré sa v dôsledku procesov rozkladu nezachovali.

Kovové rámy záveskov boli podrobené analýze pomocou röntgenovej fluorescenčnej spektrometrie (XRF), ktorá umožnila overiť hypotézu, že popri bronzových exemplároch existujú aj artefakty vyrobené z mosadze. Analýza významne prispela k lepšiemu pochopeniu materiálovej rozmanitosti v danom období. Tieto závesky tak predstavujú dôležitý prvok poznania kultúrnych interakcií a materiálových technológií v germánskom prostredí.

Analýza chemického zloženia kovových rámov potvrdila, že jednotlivé artefakty boli vyrobené zo zliatin medi s rôznymi pomermi cínu a zinku. Na základe zistených hodnôt boli identifikované rámy vyrobené z bronzu, resp. cínového bronzu (závesok z hrobu 2 zo Sekúl a z hrobu 150 z Očkova), mosadze (závesok z hrobu 69 z Očkova), cínovej mosadze (závesky z hrobov 117 a 236 z Očkova a závesky z hrobu 21 a 40 zo Sekúl) a v jednom prípade z olovnato-cínovej mosadze (závesok z hrobu 124 z Očkova).

Nízky obsah zinku v analyzovaných mosadzných exemplároch naznačuje, že surovina na výrobu týchto mosadzných predmetov bola získavaná prostredníctvom pretavovania rímsko-provinciálnych výrobkov, prípadne kombinovaná so sekundárne spracovaným bronzom. Tento poznatok poukazuje na význam recyklácie materiálov v germánskom prostredí a na prepojenie s rímskou obchodnou a materiálnou sférou.

Získané výsledky významne prispievajú k rozvoju interdisciplinárneho výskumu zameraného na materiálovú analýzu. Štúdiá odhaľuje značnú materiálovú diverzitu zliatin medi, ozrejmujú technologické aspekty a ponúka širšie uplatnenie zistení pri skúmaní obdobných archeologických nálezov. Je možné dôvodne predpokladať, že v rámci početných nálezov záveskov s krížovým rámom rozšírených naprieč celým európskym barbarikom, sa vyskytujú zliatiny medi s rôznymi pomermi cínu a zinku. Vzhľadom

na chýbajúce údaje o chemickom zložení väčšiny publikovaných záveskov by nebolo vypracovanie štatistických analýz v súčasnosti efektívne a mohlo by viesť k zavádzajúcim záverom. Relevantné výsledky je možné získať až po vypracovaní rozsiahlejšej databázy materiálových analýz.

Tento výskum podčiarkuje význam detailnej materiálovej analýzy pri rekonštrukcii technologických a sociokultúrnych aspektov minulosti, pričom otvára nové otázky pre budúce štúdie a prehľbuje naše porozumenie interakcií medzi rôznymi kultúrnymi okruhmi.

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Between Bronze and Brass – Banded Pendants from Germanic Cemeteries in Očkov and Sekule

Anna Kalapáčová

Summary

Banded pendants probably originated in the Przeworsk culture and are only sporadically found in Germanic graves in the Middle Danubian Barbaricum. They are considered a manifestation of cultural influences from the northern region, which attest to the existence of contacts between these cultural circles during the Roman period. These pendants are often found in grave contexts, while their occurrence in settlements is rare. Most of the finds come from women's graves, while they appear more rarely in children's graves. Their chronological occurrence within the Przeworsk and Wielbark cultures is dated from stage B1 of the Roman period. In the territory of western Slovakia, they probably occurred during stages B2 to C3, with the highest frequency likely occurring during stage C1.

This paper focuses on the analysis of materials used in the production of banded pendants from the Očkov and Sekule sites. The aim was to examine the variability of these pendants core fillings and characterize their metal parts. Despite the limited number of specimens analyzed, nearly all types of fillings known from comparable artifacts and cultural contexts were documented. The identified materials include rock crystal, glass beads, and *Cypraea* shells. In the case of empty pendants with undamaged metal parts, the presence of organic fillings is assumed, which were not preserved due to decomposition processes.

The metal parts of the pendants were subjected to analysis using X-ray fluorescence spectrometry (XRF), which made it possible to verify the hypothesis that, in addition to bronze specimens, there are also artifacts made of brass. This analysis significantly contributed to a better understanding of the material diversity in the given period. These pendants thus represent an important contribution to the knowledge of cultural interactions and material technologies in the Germanic environment.

Analysis of the chemical composition of the metal parts confirmed that the individual artifacts were made of copper alloys with different ratios of tin and zinc. Based on the values found, pendants made of bronze (tin bronze), brass, tin brass, and in one case lead-tin brass were identified.

The low zinc content in the analyzed brass specimens indicates that the raw material for producing these brass objects was obtained through the remelting of Roman provincial products, possibly also combined with secondarily used

bronze. This finding points to the importance of material recycling in the Germanic environment and the connection with the Roman commercial and material sphere.

The obtained results will contribute to the development of interdisciplinary research focused on material analysis. The study reveals a significant material diversity of copper alloys, clarifies technological aspects, and offers a broader application of the findings in the study of archaeological finds.

It is possible to assume that within the numerous finds of banded pendants spread across the entire European Barbaricum, alloys with different tin and zinc ratios occur. Due to the lack of data on the chemical composition of the main published pendants, it would not be possible to statistically evaluate them effectively at present which could lead to misleading conclusions. Relevant results can only be obtained after the development of a more extensive database of material analyses.

This research underlines the importance of detailed material analysis in reconstructing technological and sociocultural aspects of the past while opening new questions for future studies and deepening our understanding of interactions between different cultural circles.

Fig. 1. Banded pendants from Očkov: 1 – grave 150; 2 – grave 117; 5 – grave 236; 6 – grave 69; 7 – grave 124. Banded pendants from Sekule: 3 – grave 2; 4 – grave 40; 8 – grave 21 (edited by P. Červeň).

Fig. 2. The percentage of copper, tin and zinc in the alloys from which the metal parts of the analyzed pendants were made. Legend: □ – Sekule; ○ – Očkov.

Tab. 1. Typological classification and grave context of the analyzed banded pendants.

Tab. 2. Results of XRF analysis of the chemical composition of the metal parts of banded pendants from Očkov and Sekule.

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PRODUCTION, TRADE AND DISTRIBUTION OF AMPHORAS AND PITHOS IN SYRIA AND CILICIA IN LATE ANTIQUITY

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Since the Bronze Age, the provinces of Cilicia and Syria have exhibited dynamic commercial activity, particularly in ceramic production and exportation. This vitality continued into the Late Antique period. This study examines in detail the regional commerce, potential production centers, and distribution areas of ceramics – specifically amphorae and pithoi – produced in these regions during Late Antiquity. We evaluate amphorae types specific to Cilicia, including Agora M 239, Late Roman (LR) 1, Zemer 40, and Zemer 41 (Agora G 199). For Syria, we assess LR 4, LR 5/6, and Agora M 334 (LR 9/Beirut) amphorae. The pithoi discussed are vessel forms that have remained unchanged since early periods. Analogous evaluations were conducted with vessels from many settlements in Anatolia, as well as in Syria and Cilicia during the Late Antique period. These amphorae were predominantly used in maritime trade, exporting products like olive oil and wine to numerous settlements across the Mediterranean. While they were preferred for sea trade due to their ease of transport, pithoi were more commonly used in land trade. Amphorae were primarily produced in coastal production centers, whereas pithoi were produced in both coastal and inland settlements. Both containers were essential during the Late Antique period for storage, preservation, and commercial functions. Their widespread discovery throughout the Mediterranean region provides concrete evidence of active trade networks.

INTRODUCTION

This study examines various forms of amphorae and pithoi produced in the regions of Cilicia and Syria during the Late Antique period. These vessels were primarily used for the trade and storage of olive oil and wine, key products of the region. Amphorae and pithoi manufactured in local ceramic workshops were distributed to various parts of the Mediterranean through interprovincial trade networks. Through typological and analogical analysis, the study seeks to reconstruct this trade network – largely facilitated by amphorae – along with its commercial potential and the associated maritime and overland trade routes. By mapping the distribution areas of the amphorae, the study aims to identify the export destinations of the goods they once contained. Pithoi, on the other hand, were generally utilized in rural contexts where large-scale storage was required. The analysis of their distribution patterns seeks to determine not only where these vessels were used, but also the nature and location of the storage facilities. The study aims to highlight the economic roles of amphorae and pithoi within broader trade systems by examining their production and distribution networks. It also investigates their connections to both urban centers and rural areas. Furthermore, it explores shifts in trade dynamics in response to political, social, and economic transformations during the Late Antique period. Ultimately, this research aims to assess the role of regional ceramic production centers in shaping the economic landscape of Anatolia, with particular emphasis on their contributions to interstate trade and patterns of distribution.

Cilicia and Syria Province

Although the exact origin of the term “Cilician Region” remains uncertain, Egyptian sources suggest that the region was referred to as “Kedi” or “Kode” in the 12th c. BC (Koçak-Yaldir 2002, 4). Assyrian sources from the 8th c. BC indicate that Rough Cilicia was known as “Hilakku” and Lowland Cilicia as “Que” (Tekocak 2006, 4). According to Herodotus, the area was temporarily called “Hypachoea” before

it eventually became known as Cilicia, named after Cilix, the son of the Phoenician king Agenor, who is said to have settled there (*Hdt. VII, 91*). During this period, Cilicia fell under successive control by the Hittites, Assyrians, Persians, Greeks, and Romans (*Koçak-Yaldir 2002, 4*). The geographical boundaries of Cilicia shifted until the Roman Imperial Period (*Tekocak 2006, 4*). Before the Roman Imperial Period, the borders of the Cilicia Region initially extended over a wide area from the Kızılırmak (Halys) River in the north to Egypt in the south. Later, before the Roman Imperial Period, it is known that the borders of the Cilicia Region extended from the Manavgat (Melas) River, which was a more limited area, to the Amanus Mountains. In antiquity, based on geological features, Cilicia was divided into two regions: Rough Cilicia (Tracheia, Aspera, or Tracheiotis) and Lowland Cilicia (Pedias and Campestris; *Strabon 2000, 5*). These areas were separated by the Lamas (Limonlu) Stream (*Tekocak 2006, 4, 5*). Rough Cilicia extended from Koraksion (Alanya) to Soli Pompeipolis (Viranşehir), while Plain Cilicia stretched from Soli Pompeipolis to Alexandreia kat Isson (Iskenderun; *Koçak-Yaldir 2002, 4*). During the Roman period, Cilicia's boundaries encompassed the area from Cape Rhosus (Hızır) in the east to the Pyramus (Ceyhan) River, the Gulf of Issus, the Melas River in the west, the Mediterranean Sea to the south, and the southern slopes of the Bolkar Mountains to the north (*Tekocak 2006, 4*). The term "Syria" first appears in cuneiform inscriptions and hieroglyphs as early as the 3rd millennium BC. In Ugaritic literature, it is referenced as "Şıryan", while in Hebrew texts, it appears as "Siryon". The Greeks later defined the borders of Syria, encompassing an extensive area from the Taurus Mountains in the north to the Sinai Peninsula in the south, the Mediterranean in the west, and the Badiye Desert in the east (*Alalı 2017, 1*).

ORIGIN, PRODUCTION AND USE OF AMPHORAE AND PITHOI

Amphora

Ceramics, composed primarily of terracotta, have been crafted in diverse forms and types throughout human history to meet various needs and aesthetic preferences. These materials have been favored for their ease of production from widely available clay, making them economical and accessible (*Soydan 2023, 37*). Among the various ceramic forms, amphorae hold particular significance. They serve as tangible evidence of commercial activity, mobility, and the economy in the Ancient Period (*Bezdan 2023, 34; Bilir 2014, 91*). From this evidence, we understand that commercial amphorae were widely used in both land and maritime trade (*Keser 2019, 19*). Excavations in ancient cities, shipwrecks, and port sites have revealed amphorae in hundreds of different forms, illustrating the extensive commercial and cultural exchanges across the Aegean, Mediterranean, and Black Sea regions (*Öniz 2016, 3*). The term "amphora" originates from the Greek word *amphoreus* (ἀμφορέυς) or *amphiphoreus* (ἀμφιφορέυς). It derives from *amphi*, meaning "on both sides" or "mutual" and *pherein*, meaning "to carry" (*Bayrak 2011, 9; Bettles 2003, 21; Zemer 1977, 1*). The term describes a vessel designed to be carried by gripping it from two sides. The earliest reference to the word "amphora" appears on a Mycenaean clay tablet from the Achaeans – ancestors of the Greeks – dating to the latter half of the 2nd millennium BC. The tablet, inscribed with the Linear B syllabary, reads a-pi-po-re-we, which corresponds to *amphoreus* or *amphiphoreus* in Greek (*Doğer 1991, 7*). This syllabary is symbolized by a figure resembling a double-handled jug, underscoring the characteristic form of the amphora (*Dündar 2012, 14*).

The term "amphora" first appears in written sources in Homer's *Odyssey*, where Homer describes Telemachus storing wine in amphorae during his journey from Ithaca to Pylos (*Grace 1979, 9*). Amphorae were continuously produced from the Late Bronze Age through to the Byzantine Period, particularly in regions such as Western Anatolia and the Levant (*Yaman 2018, 288*), though they were known by various names over time. During the Roman period, they were referred to as *amphoras*, as *kouphon* in the Early Christian Period, and as *megarikon* or *magarikon* in the Byzantine Period (*Firat 2011, 99*). Despite these changes in terminology, their primary function remained consistent: amphorae served as commercial vessels, commonly referred to as commercial amphorae (*Akkurnaz 2016a, 45*). Commercial amphorae were integral to both the Greek and Roman worlds, primarily designed for the transport and sale of liquids and dry goods, although they were also utilized for storage purposes (*Firat 2011, 99*).

While commercial amphorae transported various liquid and dry goods, they primarily carried essential commodities like olive oil, wine, and fish oils, which were central to daily life in the Roman world and grew in significance within both production and trade (*Peacock/Williams 1986, 31*). Other items transported in amphorae included lamp oil, lard, butter, gum oil, milk, cheese, beer, vinegar, honey and

resin (Öniz 2016, 10). Additionally, terebinth resin, amber beads (Pulak 1991, 295), glass beads, turpentine resin, dried fruits, cereals, legumes, nuts, hazelnuts, almonds, walnuts, sesame, bitter almond (Öniz 2016, 10), pine nuts, pomegranates, figs, wheat, barley, coriander, black cumin, sumac, capers (Pulak 1995, 220, 221), olives (Keser 2019, 24), and meat were among the diverse goods transported. Fish products such as fish sauce, pickled fish, dried fish, smoked birds, and kipper were also included, along with items like poultry, ointments, eye paints, Arabic glue (Öniz 2016, 10), myrrh (a type of incense), various spices, fragrances (Grace 1979, 6, 7) and liquid pitch (Dündar 2012, 15). Apart from their commercial role, amphorae also served as funerary vessels. Larger amphorae were sometimes used for burial, particularly for infants and children, a practice that continued until the Early Byzantine Period. This custom may have been inspired by the vessel's resemblance to a mother's womb (Doğer 1991, 64). Additionally, amphorae were often used as grave goods; Homer, in the *Iliad*, describes how Achilles placed amphorae filled with olive oil and honey in the tomb of Patroclus (Doğer 1988, 22).

Beyond their role in wine fermentation, amphorae had numerous additional functions. They served as water carriers, flower pots, money storage containers, coolers, lime carriers, and even boundary markers. An unusual use of amphorae was as urinals for sanitation purposes; in Rome and Pompeii, amphorae were placed at street intersections and filled with urine, which blacksmiths then used – a practice noted by Pliny. Amphorae also served as makeshift toilets in military garrisons in Britain (Doğer 1991, 64). Broken amphora fragments were repurposed in various ways. They were used to fill abandoned wells and cisterns, line the walls of baths, ovens, and stoves for heat retention, and construct the walls of public buildings like theaters and stadiums. Fragments also served as flooring material for forums, roof tiles in buildings, infrastructure for sewage pipes within and outside cities, and as military decoys. According to Herodotus, amphora pieces were placed upright in trenches during wartime to break the legs of enemy horses falling into these traps (Doğer 1991, 65).

Pithos

In scholar literature, large vessels with wide or narrow mouths, swollen bodies, and substantial capacities are referred to as pithoi. During the Roman period, these containers were known as *dolium* (Hilgers 1969, 58). These vessels, which lack a neck, could have either narrow or wide mouths, and their characteristic swollen shape classifies them as a type of standing jar (Akkurnaz 2016a, 50). Pithoi are generally categorized as rough-made vessels, often with thick walls and second-class workmanship, and their clay contains high amounts of coarse inclusions (Aydin 2019, 189, 190). These large and thick-walled containers often feature coarse stone and abundant lime inclusions within their paste structure, with some examples incorporating straw or grass fibers. These organic additives facilitated slight permeability, enabling the pithoi to “sweat” and thus keep the contents cool (Mimaroğlu 2011, 141). Potters who specialized in making these vessels were known as *doliarii*, and the earlier term for these vessels, *calpar*, predates *dolium* (Akkurnaz 2016a, 50). The mouths of pithoi were sealed with stone or terracotta lids to preserve freshness and protect the contents, a practice referenced by the ancient writer Pollux (Akkurnaz 2016a, 59).

Since some pithoi were made with no base or with pointed bottoms, they were either buried in the ground or supported on three legs to provide stability (Akkurnaz 2016a, 59). Additionally, the bases of pithoi vary in design; some are wide and flat, while others are disk-shaped (Sezgin 2017, 43). Certain terracotta pithoi have capacities reaching approximately 790 liters and can stand up to 3 meters in height. The ancient writer Varro describes these large vessels, known as *dolium* (or pithos), as being used for wine storage (Akkurnaz 2016a, 50). Smaller pithoi are referred to as *pitharion* (Akkurnaz 2016a, 59). In the Roman Period, the Latin term for these vessels was *dolium* (singular), with the plural form *dolia* (Fidanci 2016, 5; Tekçam 2007, 177). During the Byzantine (Eastern Roman) Period, they were referred to as pithos in the singular and pithoi (πίθος, πίθοι) in the plural (Fidanci 2016, 5; Tekçam 2007, 177). The peak production and use of *dolia* occurred during the Roman Imperial period, driven by increased production, expanding trade networks, and the Roman Empire's dominance over the Mediterranean. From the 2nd to the 4th c. AD, *dolia* were actively traded across coastal settlements in Anatolia, mainland Greece, Italy, and Spain.

Although Late Roman ceramics declined with the Arab raids of the 7th c. AD, the trade of *dolia* and amphorae persisted, continuing into the middle Ages. Researcher Lane referred to the transport of pithoi during this period as the “Container Revolution” (Lane 1964, 213). Throughout the Byzantine Period, both large and small pithoi remained in use. Large pithoi served as tankers, water tanks, or cisterns, while smaller pithoi were used for everyday purposes, such as demijohns. In this period, pithoi became

smaller and adopted a more spherical shape compared to the Roman period, reflecting the reduced trade capacity of Byzantium in contrast to Rome. During the Byzantine Period, pithoi were widely employed in rural and agricultural areas for efficient storage and preservation. Transfers of goods from large to small pithoi were common in these regions, indicating localized rural production (*Fidanci 2016, 21, 22*). Pithoi were also used for water and grain storage in agricultural areas, where the water stored within was employed for irrigation. Notably, these pithoi were often rented seasonally by their owners to meet agricultural needs (*Giannopoulou 2010, 45*).

In the middle Ages, pithoi used by Armenian merchants, who played an active role in trade, were referred to as *karasy* (*Fidanci 2016, 5*). Spanish merchants of the period called these vessels *tinaja* (*Bişkin 2019, 14*), while Middle Eastern sources used the term *zir* (*Cytryn-Silverman 2010, 103*). In Modern Greek, pithoi are known as *pitharia*, and in Turkish, they are called *cubes*, a term derived from Arabic (*Blitzer 1990, 677*). Throughout history, pithoi have served a variety of purposes, primarily as storage containers, with their use documented extensively in publications. These vessels were generally employed to store, preserve, and protect both dry and liquid foods, or to transport them for trade (*Tekocak 2006, 84*). In antiquity, pithoi contained a wide range of products, including wine, olive oil, vinegar (*Akkurnaz 2016a, 50, 51*), olives, figs, grains, dried foods, honey (*Akkurnaz 2016a, 59*), flour, wheat, fruit, water (*Kowarska/Lenarczyk 2012, 643; Tekocak 2006, 84*), and a type of brine made from water and salt. They were also used to preserve items like cheese, meat, and fish by soaking them in brine. In addition to storage, pithoi were crucial for the fermentation of wines; during this process, the inner surfaces of the pithoi were often coated with pitch to prepare them for wine storage. This technique extended their utility to storing grains, brine, and various liquid substances (*Akkurnaz 2016a, 50, 51*).

Pithos were used as a refrigerator, keeping especially liquid products cool, thanks to their thick walls that contain a large amount of various additives (*Hürmüzli 1995, 20; Mimaroglu 2011, 141, 142*). An additional, lesser-known use of pithoi was as a game board for playing nine men's morris; a pithos found at Kadikalesi/Anaia bears scratched markings for the game, created with a pointed tool (*Fidanci 2016, 6*). Pithoi also served as water storage tanks, a function that continues in some areas today. In another use, fragments of thick-walled pithoi, particularly those broken during the Late Roman Period, were repurposed in wall construction (*Fidanci 2016, 12–18; Giannopoulou 2010, 34*). In addition to olive oil, wine, and vinegar, pithoi were used to store and preserve various foods, including olives, figs, grains, dried foods, and honey (*Akkurnaz 2016a, 59, 60*). Wine fermented in large, immovable pithoi was transferred to amphorae using kitchen tools like the *kyathos* (ladle) and *khone* (funnel), allowing for convenient consumption at the table and facilitating commercial transport to other regions. This data highlights the role of pithoi and amphorae in ancient production and trade systems (*Kızıllarslanoglu 2016, 48*). Remarkably, the form of these vessels changed very little over thousands of years, from the Bronze Age through Late Antiquity.

Moreover, the functions, socio-economic roles, symbolic significance, sizes, shapes, and decorations of pithoi have remained remarkably consistent over time. Examining the architectural characteristics and locations where pithoi – primarily used for storage – were found offers insights into local socio-economic structures. By analyzing these storage areas in conjunction with the presence of pithoi, we can gain critical information regarding the economic foundations of the city (*Sezgin 2017, 43, 44*). Unlike thinner-walled ceramics, pithoi were constructed in segments due to their size, which made them incompatible with traditional potter's wheels. Clay rolls, 3–5 cm in diameter, were formed into rings and shaped on the wheel. At this stage, the shoulder and upper body, the lower body, and the base were each prepared separately and then joined with binding clay. The mouth and handles were added afterward, allowing for the creation of both large and small pithoi (*Sezgin 2017, 43*). Pithoi were commonly used for storage in *villa rustica* farm settlements during the Roman Imperial and Late Roman Periods. Given their critical role in rural settlements, the production of pithoi was both more labor-intensive and costly than that of finer ceramics. The Roman Emperor Diocletian issued an edict in 301 AD, at the onset of the Late Antique Period, which set the price of a single pithos at 1,000 denarii – equivalent to more than five weeks of wages for a rural farmer (*Akkurnaz 2016b, 69; Mimaroglu 2011, 141, 142*).

Evidence regarding the price of pithoi suggests that individuals involved in grain production and storage in rural areas, such as landowners and olive oil merchants, could typically afford only two or three pithoi in their lifetime. This underscores the high economic value of pithoi and their substantial cost. As a result, pithoi were reused multiple times over many years. Artisans specializing in pithos production – a significant branch of ancient pottery – were known as *doliarii* (*Akkurnaz 2016b, 69; Mimaroglu 2011, 141, 142*). This specialized production continued into the Late Roman Period. Although pithoi from the Late Roman Period retained their traditional forms, their improved craftsmanship makes them easier to distinguish com-

pared to earlier examples. Additionally, slight variations in pithos design may be observed, reflecting the influence of local master potters and the specific characteristics of regional workshops (*Witnther-Jacobsen 2005*, 290, 291). The trade of pithoi began to be conducted systematically during the Late Roman and Early Byzantine Periods, specifically in Late Antiquity (*Lightfoot 2007*, 278). Manuscript evidence also indicates that pithoi were donated to monasteries in the Early Byzantine Period (*Figuera 1995*, 434). Given their high cost – valued at 1,000 denarii – pithoi represented a substantial economic asset. For instance, Theodosius, a priest from the Oboda (Avdat) Monastery in Israel, sent pithoi filled with wine or olive oil to a monastery in the city of Negev. In this period, the gifting of a large pithos between monasteries was not only a gesture of goodwill but also a symbol of political power and prestige (*Fidanci 2016*, 11).

PRODUCTION AND DISTRIBUTION CENTERS OF AMPHORAS AND PITHOI IN CILICIA AND SYRIA

Production Centers of Amphoras

During the Roman Imperial Period, Christianity was established as the official state religion. As Christianity spread further during the Late Imperial and Early Byzantine periods, interest in the Holy Lands grew, leading to an increase in pilgrimage journeys. These pilgrimages facilitated the transfer of products such as olive oil, wine, and sesame oil from the Levant to Roman provinces via commercial amphorae. This growing demand prompted an increase in both agricultural output and amphora production in the region (*Yaman 2018*, 288). In addition to the Levant, the Cilicia region was a major producer of olive oil, wine, and grain. The storage and distribution of olive oil, in particular, required a developed commercial infrastructure supported by amphora production. These goods were transported by land and sea to Rome in commercial amphorae (*Soydan 2023*, 36). Amphora production in Cilicia and Syria thus expanded in tandem with agricultural production, reflecting the regions' importance in supplying the Roman Empire.

In the Late Antique Period, amphora production sites emerged in various settlements. Four primary factors influenced the establishment of amphora kilns. First, agricultural lands were necessary for cultivating products like olives and grapes (*Öniz 2016*, 26). Second, because olive oil and wine were predominantly transported in commercial amphorae, production facilities needed to be close to areas where these products were processed, allowing for efficient bottling of liquid goods. Third, suitable clay deposits were essential for producing high-quality amphorae (*Doğer 1991*, 65–67). Finally, access to a port was critical for the distribution and marketing of the filled amphorae. In the Cilicia region, these four factors were particularly influential in kiln placement (*Öniz 2016*, 26). The wine and olive oil trade, which flourished during the Roman Imperial Period, continued into Late Antiquity. As a result, amphora kilns were constructed in Rough Cilicia at locations such as Syedra, Bıçkıcı, Anemurium, Antiocheia and Cragum, and along the Delice Stream; in Lowland Cilicia, they were established in Elaiussa Sebaste, Soli-Pompeipolis, Aigeai, Seleucia, Tarsus, and Kazanlı (*Öniz 2016*, 30). The expansion of agricultural production in both Rough (Cilicia Trachea) and Lowland Cilicia (Cilicia Pedias) created a need to export surplus goods, fostering the development of amphora production in the region (*Bilir 2014*, 92).

The rapidly expanding olive oil and wine industries in the region spurred the need for amphora production workshops to support international trade (*Öniz 2016*, 26). As a result, amphora kilns were established throughout Cilicia, becoming a significant revenue source for the Roman economy (*Bilir 2014*, 92). Excavations conducted by J. Russell in the city of Anemurium in Rough Cilicia uncovered an amphora kiln (*Williams 1989*, 91–95), while three additional kilns were discovered near Gazipaşa. In the far west of the region, the Syedra Kiln Site (SKS) is situated on a sand dune at the mouth of the Yeşilöz Stream, while the Bıçkıcı Kiln Site (BKS) lies at the mouth of the Bıçkıcı Stream. The Antioch Kiln Site (AKS) was identified adjacent to a school building in the southern village of the ancient city of Antiocheia ad Cragum (*Autret/Rauh 2010*, 111). In the vicinity of these three kilns, archaeologists identified mortaria used for crushing olives and lever press beds for extracting oil, suggesting the presence of integrated production complexes in these areas (*Autret/Rauh 2010*, 115, 116). Additional amphora production sites in Cilicia Pedias include Delice Çay, located about 2 km north of the Bıçkıcı Stream (*Autret 2012*, 254), and Elaiussa Sebaste, which hosts six amphora kiln sites in various parts of the city. There are kiln ruins to the east of Elaiussa Sebaste, along with another kiln site on a 5 meter-high hill about 500 meters west of the port. At Soli Pompeipolis, an LR 1 amphora bothros was found, and remnants of an amphora kiln were discovered in the ancient city of Aigeai, located in the Yumurtalık district of Adana (*Empereur/Picon 1989*, 237, 241).



Fig. 1. Map of the Eastern Mediterranean. Finds of amphora kilns in Cilicia, Syria, and Cyprus. Drawing author.

In Adana's Antioche du Pyrame (Karataş) settlement, a workshop was identified near the harbor entrance, where LR 1 amphorae and thin-walled ceramics were produced (Empereur/Picon 1989, 237). It is also believed that an amphora kiln existed around Şeytan River in Korykos (Öniz 2016, 35). In the ancient city of Tarsus, three amphora kilns were identified: one located along the Berdan (Cyndus) Stream and two outside the city limits (Autret 2012, 254). Additionally, an amphora dump site, used as a bothros, and a probable amphora workshop were found in Kazanlı, a settlement 10 km east of Mersin and 16 km southwest of Tarsus (Öniz 2016, 36). Numerous ceramic production centers also existed in the Syrian province. In Seleucia Pieria, located in the Gulf of İskenderun (Alexandretta ad Issum), an amphora kiln was identified (Empereur/Picon 1989, 236, 237). Another site at the beginning of the Northern Levant region is Rhusus, where an amphora kiln was discovered among the city's ruins. This kiln was first documented through surface research conducted by Jean-Yves Empereur and Maurice Picon in 1989 (Demesticha 2013, 70).

The production site in Beirut, known as BEY015, was active in ceramic production from the 2nd c. BC until the 7th c. AD (Reynolds 2005, 569). In Syria, Ras al-Bassit is situated to the north, with Latakia to the south, and the Orontes River mouth and Seleucia Pieria further north. During Paul Courbin's excavations from 1971 to 1984, Late Antique ceramic workshops were discovered in this area (Mills/Beaudry 2007, 745). Amphora production also took place in Amrit and Tartus, coastal settlements in the Northern Levant region of Lebanon (Reynolds 2005, 568, 594, pl. 7; fig. 46–54). In Jiyeh, ceramics were produced continuously from the 1st c. BC until the 7th c. AD (Wicenciak 2016, 628). Additionally, at the so-called "7th workshop" in Akko, a coastal settlement in the Eastern Levant, ceramics were produced from the 3rd to the 7th c. AD (Wicenciak 2016, 626, 627). Cyprus, adjacent to the Cilicia and Syrian provinces in the Eastern Mediterranean, was a significant center for maritime trade in antiquity and held a key geopolitical position in politics and art. Archaeological excavations on Cyprus have identified production sites for LR 1 amphorae, specifically in Zygi-Petrini, Paphos, Amathous, and Kourion (Fig. 1; Demesticha 2013, 270, 271; Taner 2022, 36).

Types of Amphorae in the Study Area

In Late Antiquity, unique amphora types were produced in Cilicia and Syria, distributed across the Mediterranean via both maritime and land trade routes. This study examines several amphora types specific to the Cilician province, including Agora M 239, LR 1, Zemer 40, and Zemer 41 (Fig. 2). The first of

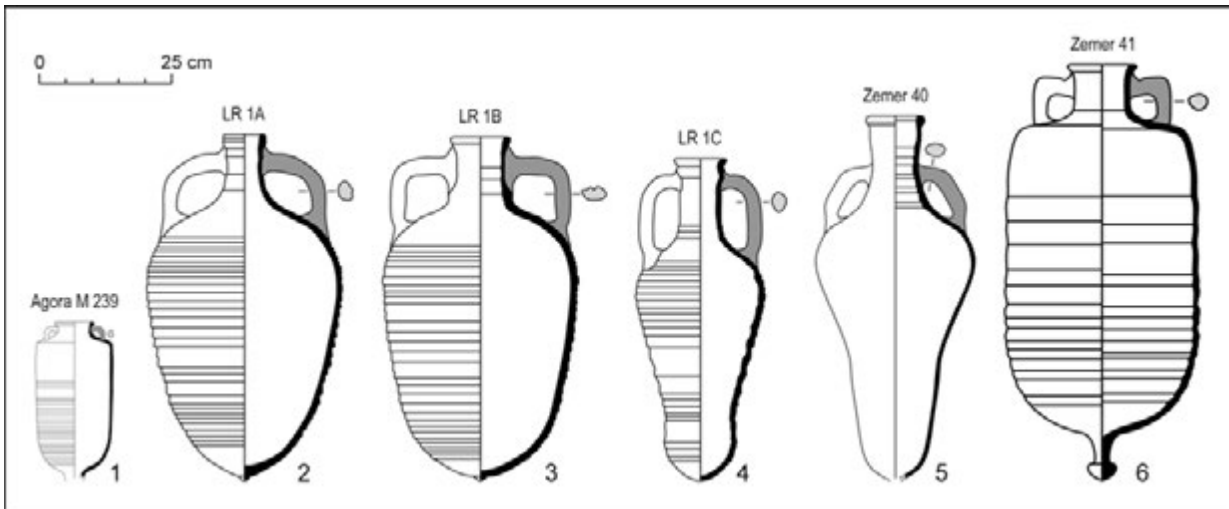


Fig. 2. Typology of Cilician amphorae. After Akkaş 2020, 373, fig. 3.5.6; Alkaç 2013, 114, fig. 8; Söğüt 2023, 25, fig. 3.6; Tekocak/Zoroğlu 2013, 138, fig. 9.

these, the Agora M 239 amphora, features an everted rim with a rounded and triangular profile, a wide, short neck, and a thick, oval handle that extends from the middle of the neck to the shoulder. Its body is grooved, and it has a conical base with a central hollow (Bilir 2014, 101). Produced extensively from the 1st to the 4th c. AD, these amphorae have been found not only in Cilician cities but also in diverse locations such as Beirut, the Sinai Peninsula, Egypt, Ephesus, Tomis, Pompeii, Athens, and Corinth (Alkaç 2013, 113). Samples of Agora M 239 amphorae were unearthed from Cnidus and date back to between the end of the 4th and the beginning of the 5th c. AD (Sözel 2023, 273, 274, 1070–1073, pl. 261–264; kat. no. 815–819).

Agora M 239 Amphorae

Similar examples of Agora M 239 amphorae in Silifke Museum (Alkaç 2013, 113, 114, fig. 8) and İçel Museum (Şenol/Kerem 2000, 96; pl. 18; kat. no. 20) in Cilicia Region. Also another examples were unearthed in Anemurium (Reynolds 2005, 564, 588, fig. 5), Phaselis (Orhan 2023, 581, kat. no. 682), Türkler (Çaylak-Türker 2014, 271, 272, 277, fig. 2: 1), Kızılcaşehirkalesi (Çaylak-Türker 2014, 271, 272, 277, fig. 2: 12), Naula, Elikesik, Akkale and İncekum (Çaylak-Türker 2014, 271, 272, 277, fig. 3: 1) in Pamphylia Region.

LR 1 Amphorae

The second amphora type specific to the Cilicia region is the LR 1 amphora, characterized by its rounded mouth, an oval, grooved handle extending from below the lip to the shoulder and merging with the body, an ovoid body, and a simple protruding base (Çibuk 2019, 59). In Cilicia, LR 1 amphorae were produced in locations such as Elaiussa Sebaste, Soloi, Karataş Aigai, Tarsus and Yumurtalık Bay, while in Syria, they were manufactured in Seleukeia Pieria. Production also occurred on the island of Cyprus in settlements like Amathous, Kourion, Zygi-Petrini, Paphos, and Panayia Ematouse (Alkaç 2012, 325, 326). Dominique Pieri and Andrei Opait classified LR 1 amphorae into three subtypes: A, B, and C (Öniz 2016, 31), a division further refined by Demesticha. According to Demesticha, LR 1A amphorae date to the 4th and 5th c. AD, LR 1B to the late 5th and 6th c. AD, and LR 1C to the 7th c. AD (Demesticha 2013, 172–176).

Samples of LR 1A amphorae were unearthed in Saraçhane (Hayes 1992, 64, 167, fig. 47; kat. no. 156, 157), Tripolis (Katırcı 2020, 44, 270, kat. no. 29–34; pl. 7) and Parion (Akkaş 2020, 399, kat. no. 253, 254) in Bithynia, Smyrna (Karcı-Ağlar 2015, 304, 305, 307, kat. no. 291–293, 295), Kyzikos (Erdem 2023, 98, 114, fig. 4: 2, 3), Klazomenai (Gürbüzer 2018, 145, 176, fig. 15: 59, 60), Erythrai (Kırkanlı 2022, 113, 164, fig. 5: 30) and Phokaia (Fırat 2023, 83, 84, 102, fig. 3: 6) in Asia, Myra (Tomay 2023, 334–349, kat. no. 107–134) in Lycia, Knidos (Doksanaltı 2020, 394, 415, fig. 8: 45–47) in Caria, Phaselis (Orhan 2023, 582, 583, kat. no. 683–685) and Syedra (Şengül 2023, 50, 51, 128, 129, kat. no. 120, 121, 150; fig. 12: 120, 121) in Pamphylia, Elaiussa Sebaste (Ferrazzoli/Ricci 2010, 817, 823, fig. 4: 20; 21), Kelenderis (Tekocak/Zoroğlu 2013, 119–121, 139, fig. 12–27), Mersin Museum – 34. Street Excavations (Söğüt 2023, 40, 91, 92, kat. no. 6–9), Anemurium

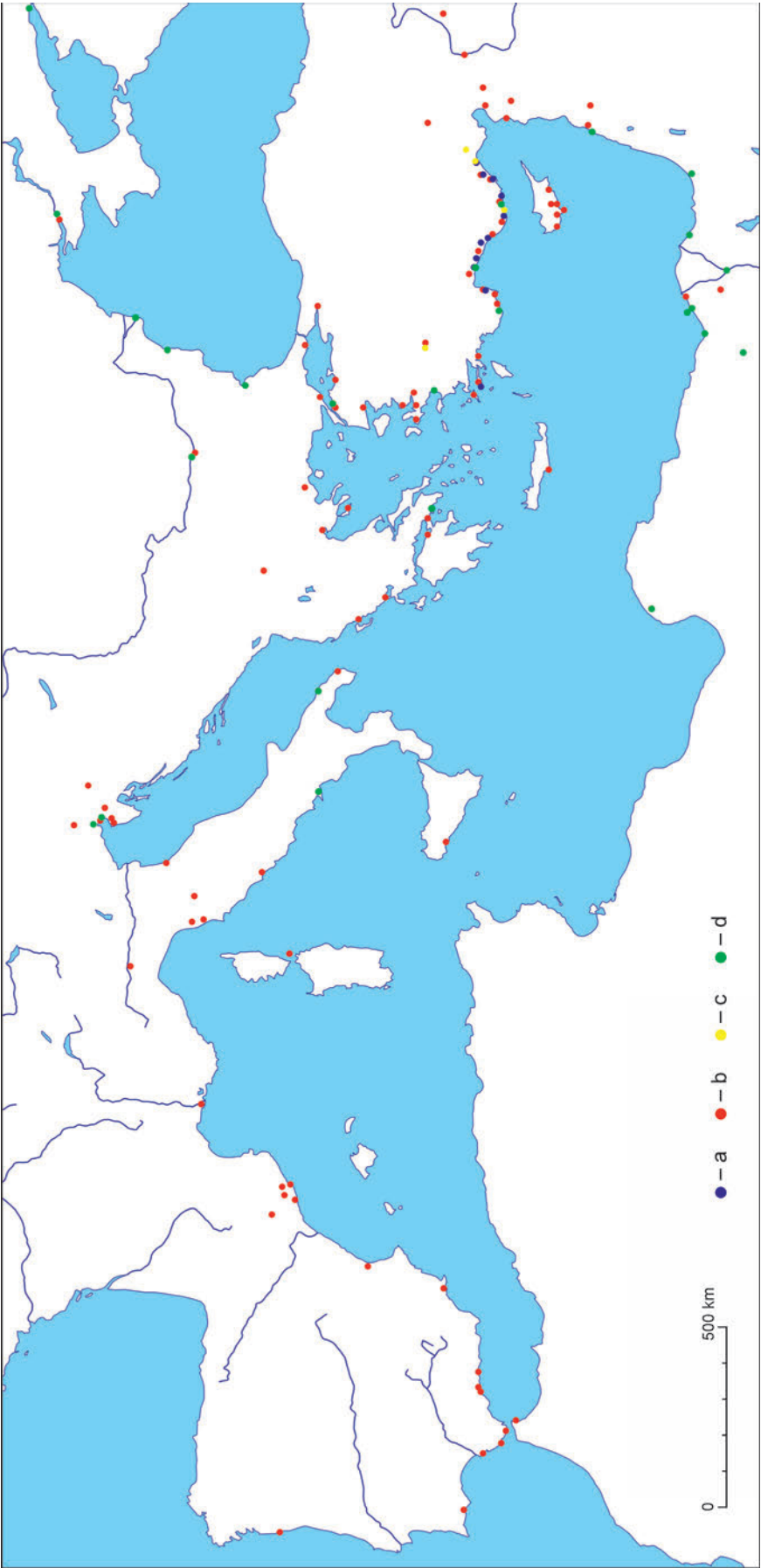


Fig. 3. Distribution map of Cilician amphorae in the Mediterranean. Drawing author. Legend: a – Agora M 239; b – LR 1 Amphorae; c – Zemer 40; d – Zemer 41.

(Reynolds 2005, 566, 567, 591, pl. 4; fig. 31; 32) and Soli-Pompeipolis (Autret/Yağcı/Rauh 2010, 205, 206, fig. 6) in Cilicia, Zeugma (Reynolds 2013, 100, 102, 139, 142), Antiocheia-Tayfur Sökmen Campus Excavation (Kılınçoğlu 2019, 213, kat. no. 129, 130; pl. 24), Dara (Tosun 2020, 218, 219, LR AMP 1; FORM 1, 2; kat. no. 84, 85), Ras Al-Bassit (Mills/Reynolds 2014, 134, 138, fig. 4: 11, 12) Beirut (Reynolds 2010, 110, fig. 7: u, v) and Damascus (Trégliat/Berthier 2010, 867, 868, 871, fig. 3: 8) in Syria, Akrotiri Bay (Leidwanger 2013, 182, fig. 1) in Cyprus, Alexandria (Şenol 2000, 313, 317, kat. no. 58–66, 180–182, 214, 215, 319–335, 369, 370, 386, 450–458) and Wadi Natrun (Konstantinidou 2010, 956, fig. 4: 1–3) in Egypt.

Samples of LR 1B amphorae in Kocaeli Museum (Çibuk 2019, 131, 136, kat. no. 24–29), and some examples were unearthed in Tripolis (Katırançı 2020, 44, 270, kat. no. 35–53; pl. 8–10), Yayabaşı Village (Bilgin-Kopçuk 2022, 230, pl. 10; kat. no. 141), Parion (Akkaş 2020, 400–408, kat. no. 254–266, 269, 270) and Antandros (Açar 2017, 123–127, kat. no. 71–73) in Bithynia. Some examples are in İzmir Archaeology Museum (Sezgin/Şenol/Cankardeş-Şenol 2022, 140–147, kat. no. 102–109) and another examples were unearthed in Smyra (Karcı-Ağlar 2015, 309, kat. no. 299), Klazomenai (Gürbüzer 2018, 145, 176, fig. 15: 61) and Erythrai (Kırkanlı 2022, 113, 164, 165, fig. 5: 31; 6: 32, 33) in Asia, Knidos (Doksanaltı 2020, 394, 415, fig. 8: 48–51) and Miletos (Lüdorf 2006, tab. 16A: 109) in Caria, Myra (Tomay 2023, 349–378, kat. no. 135–190) and Limyra (Çömezoğlu 2014, 667, 674, fig. 8a; Vroom 2004, 294–296, fig. 3) in Lycia, Phaselis (Orhan 2023, 583–585, kat. no. 686–689), Side (Alanyalı/Erkoç 2019, 3, fig. 2: 6) and Syedra (Şengül 2023, 50, 51, 129, 135, kat. no. 122–131, 150–152; fig. 12; 13; 14: 122–131) in Pamphylia, Kelenderis (Tekocak/Zoroğlu 2013, 121, 122, 140; fig. 28–34), in Silifke Museum (Alkaç 2013, 114, 115, fig. 9), Elaiussa Sebaste (Ferrazzoli/Ricci 2007, 677, fig. 2a), Soli-Pompeipolis (Autret/Yağcı/Rauh 2010, 206 fig. 7; 8) and Korykos (Alkaç 2012, 333, 334, 341–344, fig. 4–14) in Cilicia.

Also, in Anemurium (Korkmaz/Tekocak 2023, 29, 38, pl. 5: 20), Mersin Museum-34. Street Excavation (Söğüt 2023, 45, 93–126, kat. no. 10–111), in İçel Museum (Şenol/Kerem 2000, 94, pl. 17, kat. no. 17) and Şarköy (Körsulu 2011, 262–266; pl. LVIII–LVIX; kat. no. 229–231) in Cilicia, Antiokheia-Tayfur Sökmen Campus Excavation (Kılınçoğlu 2019, 214, kat. no. 131; pl. 24), Zeugma (Reynolds 2013, 100; 142), Dara (Tosun 2020, 218, 219, LR AMP 1 FORM 3-4, kat. no. 86–105), Ras Al-Bassit (Mills/Beaudry 2010, 863, fig. 4a A32, A1.2.), Sergilla and Qal'at Sem'an (Pieri 2005, 586, 594, fig. 7: 39–50) and Beirut (Pieri 2007, 315, 316, fig. 3; 4) in Syria, Panayia Ematousa (Jacobsen 2005, 626, 634, fig. 7), Amathous (Empereur 2018, 183–185, fig. 1–3), Kourion (Demesticha 2013, 172, 173, 176, fig. 1–3), Paphos (Gabrielli/Jackson/Kaldelli 2007, 793, 800, fig. 4: 6), Akrotiri Bay (Leidwanger 2013, 183, fig. 4) and Cape Zevgari shipwreck (Leidwanger 2013, 185, fig. 10) in Cyprus, Alexandria (Şenol 2000, 371, 401, 458–464, kat. no. 183, 336–349, 401) and Wadi Natrun (Reynolds 2005, 567, 591, fig. 34; pl. 4) in Egypt.

Similiar samples of LR 1C amphorae were unearthed in Knidos (Sözel 2023, 281, 282, 1082–1085, pl. 273–276; kat. no. 862–869) in Caria, Myra (Tomay 2023, 378–383, kat. no. 191–200) in Lycia, Naula (Antalya) and Gazipaşa (Antalya; Çaylak-Türker 2014, 273, 277, fig. 2: 3, 4) in Pamphylia, Mersin Museum-34. Street Excavation (Söğüt 2023, 46, 127, kat. no. 112, 113) and in Silifke Museum (Alkaç 2013, 115, fig. 10) in Cilicia, Zeugma (Reynolds 2013, 100, 132) in Syria, Amathous (Empereur 2018, 182, 183–185; tab. 1) and Limassol (Demesticha 2013, 173, 177, fig. 4) in Cyprus.

Zemer 40 Amphorae

The third amphora type specific to Cilicia, the Zemer 40, features a rounded mouth projecting outward, a long conical neck that widens from the rim to the shoulder, and a grooved, oval handle positioned between the lower neck and shoulder. Its body is conical with a hollow, pointed base, and these carrot-shaped amphorae were commonly used for transporting wine (Bilir 2014, 102). Similar examples of Zemer 40 amphorae in the Mersin Museum (Bilir 2014, 102) and İçel Museum (Şenol/Kerem 2000, 93, pl. 17; kat. no. 16) in Cilicia. Also another examples were unearthed in Tripolis (Katırançı/Duman 2022, 341, 360, pl. 3: 17) in Bithynia and Kelenderis (Tekocak/Zoroğlu 2013, 114–116, 138, fig. 8–10) in Cilicia.

Zemer 41 Amphorae

The fourth type, the Zemer 41 (Agora G 199) amphora, has an everted rim and a short, cylindrical handle descending sharply from the neck to the shoulder, with the handles vertically separated from the center to each side. This amphora has a cylindrical body with a mushroom-shaped base (Karcı-Ağlar 2015, 300, 301). Samples of this amphora type were unearthed in Parion (Akkaş 2020, 369, 370–372, kat. no. 241, 242, 244–246) in Bithynia, Myra (Tomay 2023, 383–406, kat. no. 201–246) in Lycia, Side (Alanyalı/Erkoç 2019, 3, 4, fig. 2: 21, 22) in Pamphylia, Kelenderis (Bilir 2014, 98; Tekocak/Zoroğlu 2013, 113, 114, 137, fig. 4–7) in Cilicia and Alexandria (Şenol 2000, 448–450, kat. no. 315–318) in Egypt (Fig. 3).

Syrian and Levant Amphora Types

LR 4, LR 5/6 and Agora M334 amphoras are amphora types specific to the Syrian region evaluated within the scope of this study (Fig. 4). The LR 4, LR 5/6, and Agora M 334 amphorae were produced in Syria and Southern Palestine (Yaman 2018, 351). LR 4 amphorae are characterized by a slightly everted, rounded rim, a long cylindrical body, and a grooved conical base. They feature short, oval, vertically oriented handles on the shoulder that resemble small ears (Yaman 2018, 352). In 2005, D. Pieri classified LR 4 amphorae into types A and B, with further subdivisions into A1, A2 and B1, B2, B3 (Akkaş 2020, 410). Evidence from ceramic kilns and bothroi indicates that LR 4 amphorae were produced in various locations outside Gaza, including the region between Pelesium and the Negev on Palestine's southern coast, as well as in Ashdod, the Nile Delta, south of El Arish, and areas like Mefalsim, Bohu, H. Pattish, and Giv'at Amon (Karcı-Ağlar 2015, 322, 323). LR 4 amphorae were produced from the 1st c. until the mid-7th c. AD, with Gaza as a prominent production center from the 4th c. onward. As their commercial use expanded from the 4th c., these amphorae were exported to regions including the Eastern Mediterranean, the Western Black Sea coast, Southern France, and Italy.

Although found in limited quantities in Black Sea region settlements, these amphorae were among the most commonly used during the Late Antique period. They are known to have contained Gaza wine, sesame oil (Alkaç 2013, 115), fish sauce, and fish remains (Kızırlarslanoğlu 2016, 198). Gaza white wine is referenced in ancient sources by terms such as Vinum Gazetum, Gazetine, and Gazeticum, with „Gaza“ itself becoming synonymous with wine in the 5th and 6th c. AD. The renown of this wine, produced in Gaza, spread across the Mediterranean, leading to its widespread export. The rise of Christianity and the growth of the population in Palestine during this period drove an increase in both the production and consumption of wine, further boosting wine production and trade from Gaza (Kızırlarslanoğlu 2016, 197).

LR 4 Amphorae

Samples of LR 4 amphorae were unearthed in İstanbul Yenikapı Excavation (Wohmann 2016, 70, fig. 1–17; pl. 1; 12), İstanbul-Saraçhane (Hayes 1992, 67, 68, 167, fig. 47; kat. no. 168, 169), Bathonea (Kara 2021, 80, 81, fig. 10), Tripolis (Katırcı 2020, 50, 274, kat. no. 54–61; pl. 11) and Parion (Akkaş 2020, 421–426, kat. no. 271) in Bithynia, Erythrai (Kırkanlı 2022, 115, 165, fig. 6: 35, 36), Phokaia (Fırat 2023, 85, 86, 102, fig. 4: 8) and in İzmir Archaeology Museum (Sezgin/Şenol/Cankardeş-Şenol 2022, 137, kat. no. 101) in Asia, Knidos (Sözel 2023, 288–291, 1096–1099, pl. 287–290; kat. no. 908–916) in Caria, Arykanda (Yaman 2018, pl. 69; 70; kat. no. 460–468), Myra (Tomay 2023, 407, 408, kat. no. 248–250) and Patara (Korkut 2007, 164, 165, fig. 11: 662–664) in Lycia, Phaselis (Orhan 2023, 588, kat. no. 696) in Pamphylia, Mersin Museum-34. Street Excavation (Söğüt 2023, 57, 58, 130, 131, kat. no. 123, 124), in Silifke Museum (Alkaç 2013, 116, fig. 11) and in İçel Museum (Şenol/Kerem 2000, 90, pl. 16; kat. no. 10) in Cilicia. Zeugma (Reynolds 2013, 100, 103, 127, 139, 142, 154, 157), Beirut (Pieri 2007, 318, fig. 6), Horvat Uza (Reynolds 2005, 574, 606, fig. 149) and in Haifa National Museum (Zemer 1977, 61, pl. 18; kat. no. 50), in Syria, Amathous (Empereur 2018, 183, 187, 188, fig. 4: 5) and Avdimou Bay (Leidwanger 2013, 187, fig. 13; 14) in Cyprus, Caesarea (Reynolds 2005, 574, 606, fig. 140–144), Ostrakine (Gabrielli/Jackson/Kaldelli 2007, 793, 800, fig. 4: 4), Wadi Natrun (Konstantinidou 2010, 957, fig. 5: 7–12) and Alexandria (Şenol 2000, 336–339, kat. no. 109–115, 244, 385–389, 404, 483–486) in Egypt.

Also, in Barcelona (Dominguez 2005, 153, 161, fig. 3; kat. no. 9–13), Palau Requesens (Monfort/Millet 2005, 165, 175, fig. 5), Bracara (Braga; Morais 2005, 57, 66, fig. 3; kat. no. 14–17) and Ilesso (Guissona, Lleida; Uscatescu/Jimenez 2005, 84, 85, 100, fig. 3; kat. no. 46). Marseille (Bien 2005, 292, 297, fig. 3; 8; kat. no. 1, 3–5), Lyon (Vallet/Lemaitre/Schmitt 2010, 216, fig. 7: 17), Notre Dame Chapel (Sciallano/Sibella 1991, 104), Otranto (De Mitri 2005, 414, 421, fig. 6; kat. no. 7), Trentino (Maurina/Capelli 2007, 482, 486, fig. 6: 8, 9), Domus Tibertiana (Carboni 2010, 418, 424, fig. 9: 5), Tergeste (Degrassi et al. 2010, 580, 584, fig. 5: 21), Classe (Cirelli 2014,

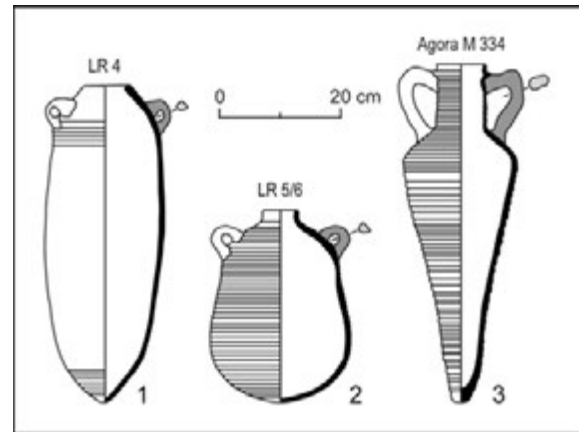


Fig. 4. Typology of amphorae from Syria and the Levant. After Akkaş 2020, 411, 427, fig. 3.6.2; 3.6.4; De Vingo 2005, 353, fig. 3.

552, fig. 9), Koper (*Perko/Zupancic* 2005, 523, fig. 7; 8; kat. no. 5, 6, 7–9), Tonovcov Grad (*Modrijan* 2010, 687, 691, fig. 3: 2), Thessaloniki (*Akrivopoulou/Slampeas* 2014, 288, 293, fig. 3), Megara (*Korosis* 2014, 305, 310, fig. 9), Tanais (*Sazanov* 2007, 813, fig. 5: 1), Chersonesos (*Sazanov* 2007, 813, fig. 5: 2–10, 15–17, 20–26), Novae (Bulgaria; *Klenina* 2010, 1007, 1014, fig. 7: 3), Tsibilium (*Sazanov* 2007, 813, fig. 5: 11–14), Ilichovka (*Sazanov* 2007, 813, fig. 5: 18, 19), Butrint (Albania; *Reynolds* 2010, 96), Tomis (Romania; *Opait* 2021, 84, fig. 2a, b), Murighiol (Romania; *Philippi – Greece; Opait* 2021, 84, fig. 4a, b; *Zachariadis* 2014, 706, 707, 711, 712, fig. 9; 12), Kanistro (Greece; *Vasiliou/Tsigarida* 2014, 724, 735, fig. 5; 10: 10, 11) and Athens (*Opait* 2021, 84, fig. 1a, b).

LR 5/6 Amphorae

LR 5/6 amphorae were produced from the 1st to the 9th c. AD. Also known as “Bag-Shaped” amphorae, they are characterized by a rounded, high mouth profile, lack of a neck, double ear-shaped handles, a bag-like body, and frequent horizontal grooves running from below the neck to the base. Riley’s study of amphorae from the Caesarea Hippodrome categorized these examples separately as LR 5 and LR 6. In 1977, Egloff classified these amphorae into five types, a categorization that Pieri later refined and expanded upon in greater detail (*Tomay* 2023, 88). Samples of LR 5/6 amphorae were unearthed in Tripolis (*Katıranlı* 2020, 56, 276, kat. no. 72–76; pl. 13) and Parion (*Akkaş* 2020, 436–438, kat. no. 282–287) in Bithynia, Erythrai (*Kırkanlı* 2022, 116, 117, 165, fig. 6: 37) in Asia, Myra (*Tomay* 2023, 409–412, kat. no. 251–257) and Limyra (*Marksteiner/Schuh* 2008, 45, fig. 6) in Lycia, Naula (*Çaylak-Türker* 2014, 273, 277, fig. 2: 6) in Pamphylia, Anemurium (*Williams* 1989, 98, 99, fig. 60; 61; kat. no. 577, 578) and Elaiussa Sebaste (*Ferrazzoli/Ricci* 2007, 679, fig. 4: 4, 5) in Cilicia, Antakya Hippodrome Excavations (*Pamir* 2016, 306, 307, fig. 5), Zeugma (*Reynolds* 2013, 100, 103, 132, 137, 142, 146, 148, 154, 157, fig. 13), Dara (*Tosun* 2020, 216, 217, LR AMP 5/6 FORM 1; kat. no. 81) and Beirut (*Reynolds* 2018, fig. 3; kat. no. 9, 10) in Syria, Caesarea (*Gabrielli/Jackson/Kaldelli* 2007, 793, 800, fig. 4: 7) and in Haifa National Museum (*Zemer* 1977, 69, pl. 20; kat. no. 56) and Amathous (*Empereur* 2018, 183, 188, 189, fig. 5) in Cyprus, Alexandria (*Şenol* 2000, 344–347, kat. no. 128–133, 398, 399, 490, 491) and Wadi Natrun (*Konstantinidou* 2010, 957, fig. 5: 16) in Egypt. Also, in Iesso (*Uscatescu/Jimenez* 2005, 85, 100, fig. 3; kat. no. 47), Marseille (*Bien* 2005, 292, 297, fig. 3; 8; kat. no. 4, 6–8), Via de Castellani (*Pecci/Salvini/Cantini* 2010, 363, 366, fig. 1: 91, 92), Domus Tiberiana (*Carboni* 2010, 418, 424, fig. 9: 6), Tergeste (*Degrassi et al.* 2010, 580, 584, fig. 5: 20), Classe (*Cirelli* 2014, 552, fig. 9), Tonovcov Grad (*Modrijan* 2010, 687, 691, fig. 3: 7–9), Gortina (*Portale* 2014, 479, 489, fig. 16: 12), Tanais (*Sazanov* 2007, 814, fig. 6: 1), Novae (*Klenina* 2010, 1007, 1014, fig. 7: 5), Dichin (*Swan* 2007, 841, fig. 3: 17), Chersonesos (*Klenina* 2010, 1007, 1014, fig. 7: 6), Panticapaeum (*Opait* 2021, 85, fig. 1a, b), Ilichovka (*Sazanov* 2007, 814, fig. 6: 3), Capidava (*Opait* 2021, 85, fig. 2a, b), Butrint (*Reynolds* 2010, 96), Philippi (*Zachariadis* 2014, 706, 707, 711, 712, fig. 9; 14) and Pefkochori (*Vasiliou/Tsigarida* 2014, 724, 734, 735, fig. 8: 30; 10: 39).

Agora M 334 Amphorae

The Agora M 334 amphorae are characterized by a rounded, necked mouth profile, a cylindrical neck, oval vertical handles curving from the mouth to the shoulder, and a grooved body tapering from the shoulder to the bottom, giving them a carrot-like shape with a hollow base (*Yaman* 2018, 292). These amphorae are categorized into three types: the most common is carrot-shaped; another has an oval body with a flat profile; and a third type has a spherical body with a rounded bottom (*Karçı-Ağlar* 2015, 333). Agora M 334 amphorae are identifiable by shoulder seals bearing the inscriptions “COLONIA BERYTUS” or “BER” (*Akkaş* 2020, 439). Petrographic and clay analyses indicate that these amphorae were manufactured in settlements such as Akko, Tyre, Ptolemais, Horvat Masref, and Horvat Eitayim. Dominique Pieri further divided these amphorae into three subtypes based on variations in mouth profiles. Produced between the 4th and 7th c. AD, these commercial amphorae were widely exported to the Eastern and Western Mediterranean, Anatolia, and coastal areas of mainland Greece, primarily for wine transport (*Yaman* 2018, 292). In Eastern Mediterranean trade during the Roman era, particularly under the Pax Romana, the renowned wines of Beirut were frequently shipped in these amphorae (*Tomay* 2023, 90).

Samples of Agora M 334 amphorae were unearthed in Tripolis (*Katıranlı* 2020, 52, 62–71, kat. no. 275; pl. 12), Parion (*Akkaş* 2020, 445–447, kat. no. 288–293), and İstanbul (*Reynolds* 2005, 603, fig. 121; pl. 16) in Bithynia, Pompeiopolis (*Opait* 2021, 85, fig. 8) in Paphlagonia, in İzmir Archaeology Museum (*Sezgin/Şenol/Cankardeş-Şenol* 2022, 132, kat. no. 98) in Asia, Arykanda (*Yaman* 2018, kat. no. 469; pl. 70) and Myra (*Tomay* 2023, 412, kat. no. 258) in Lycia, Elaiussa Sebaste (*Ferrazzoli/Ricci* 2007, 678, fig. 3: 1–3) and Anemurium (*Korkmaz/Tekocak* 2023, 29) in Cilicia, Zeugma (*Reynolds* 2013, 103, 154), Dara (*Tosun* 2020,

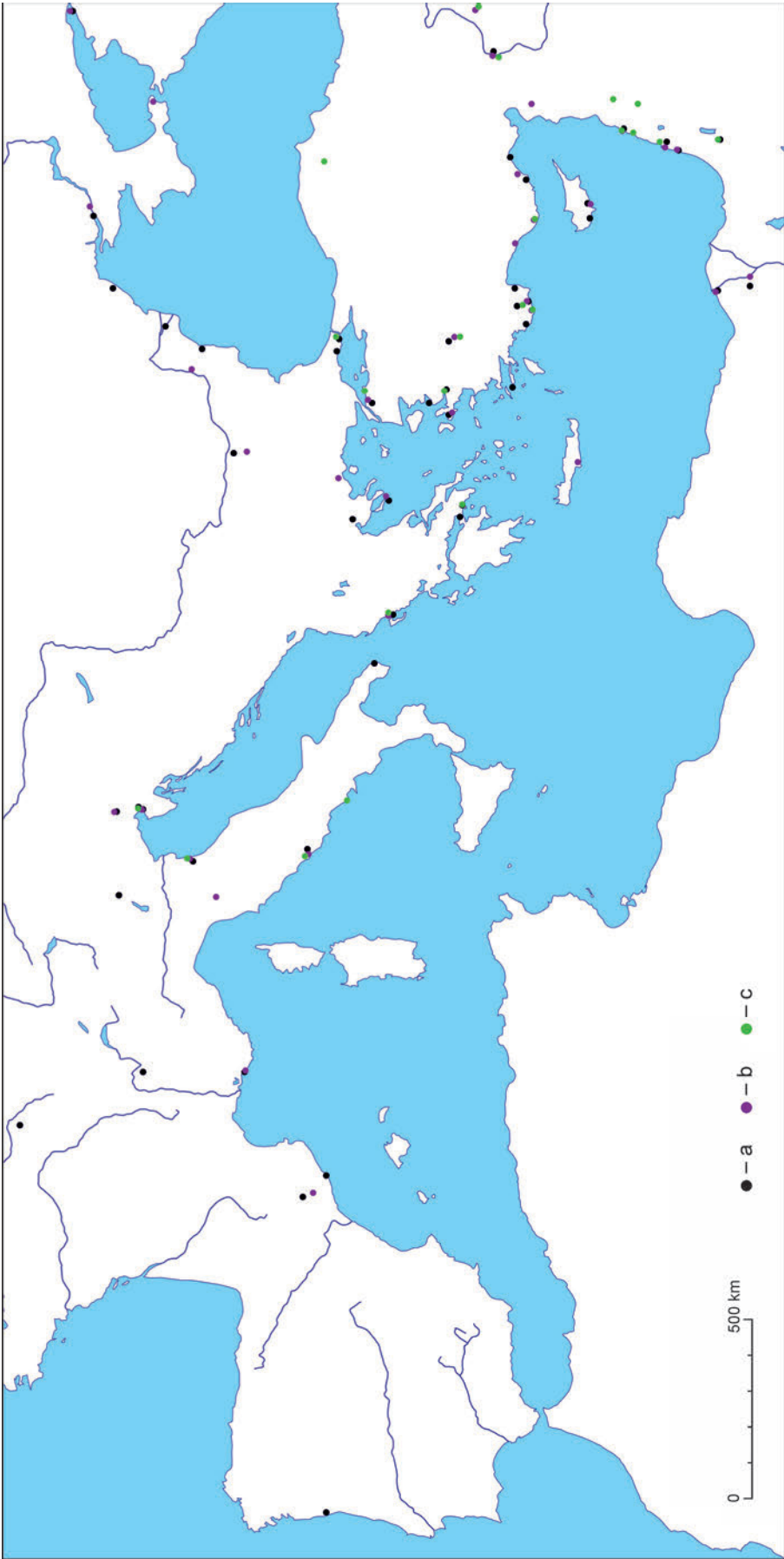


Fig. 5. Distribution map of amphorae from Syria and the Levant. Legend: a – LR 4 Amphorae; b – LR 5/6 Amphorae; c – Agora M 334. Drawing author.

211, 213, LR AMP 9 FORM 1–5; kat. no. 63–80), Damascus (*Tréglia/Berthier* 2010, 867, 868, 871, fig. 3: 1–7), Akko (*Reynolds* 2005, 602, fig. 104–113; pl. 15), Chhim (*Reynolds* 2005, 603, fig. 117; 118; 120; pl. 16), Beirut (*Pieri* 2007, 321, fig. 9), Baalbek (*Hamel* 2010, 882, fig. 11) and Horbat Uza/Khirbet Aiyadiya (*Wicenciak* 2016, 630, 632, fig. 2; kat. no. 2a, b) in Syria Domus Tiberiana (*Carboni* 2010, 418, 424, fig. 9: 8), Tergeste (*Degrassi et al.* 2010, 580, 584, fig. 5: 19), Neapolis (*Carsana/Del Vecchio* 2010, 459, 460, 467, fig. 4: 16), Classe (*Cirelli/Cannavici* 2014, 963, 968, fig. 4: 1–3), Butrint (*Reynolds* 2010, 96) and Athens (Fig. 5; *Kouveli* 2014, 751, 758, fig. 21).

Production Centers of Pithoi

Research initially identifies various parameters for ceramic production workshops. Pithoi production workshops were structured for seven distinct purposes. First, there were individual workshops where artisans produced ceramics solely for household needs and limited local distribution. Second, larger dispersed workshops catered to local distribution on a broader scale. Third, autonomous workshops engaged in small-scale industry-based production aimed at regional consumption, offering specialized products tailored to community needs. Fourth, large regional workshops produced ceramics not only for local communities but also for wider regional markets. Fifth, some workshops operated seasonally, with craftsmen producing ceramics specifically to meet the administrative needs of a feudal lord or elite group. Sixth, elite-focused workshops employed full-time craftsmen to create goods exclusively for an elite clientele or for specific administrative uses. Finally, large, specialized workshops staffed by full-time artisans and skilled personnel produced items for select customers and high-level administrative purposes (*Giannopoulou* 2010, 51).

These workshops were designed to serve various needs and operated in different forms. The first type was the simple workshop, typically a roofed structure located in or near local settlement areas. In some of these workshops, ceramics were produced on a potter's wheel, while others relied on non-wheel techniques. These areas often included a secure storage space or warehouse to keep prepared clay accessible near the kiln area (*Giannopoulou* 2010, 52). The second type was the open-air workshop, which operated seasonally in designated spaces.

Initially, master potters traveled to different locations, but later, permanent workshops were established. These hut-like structures allowed potters to shape and produce orders, often called *pactone*, directly on the wheel. While most orders were given verbally, some written agreements also existed (*Giannopoulou* 2010, 52, 53). The third type of workshop involved itinerant masters who produced pithoi in small, individual workshops. These traveling craftsmen established workshops in areas where raw materials and agricultural production were accessible, tailoring production to local needs. This localized approach reduced the logistical challenges of transporting large pithoi over long distances, as pithoi were made directly in the regions where they were needed (*Giannopoulou* 2010, 53). Fragments of the mouth or body of these pithoi, dating to the Late Antique period, are commonly recovered. In some cases, nearly complete vessels have been found buried in situ. The pithoi can be classified into several types based on the shape of their bodies, including pear-shaped, egg-shaped, and inverted pear-shaped forms (Fig. 6; *Fidanci* 2016, 26)

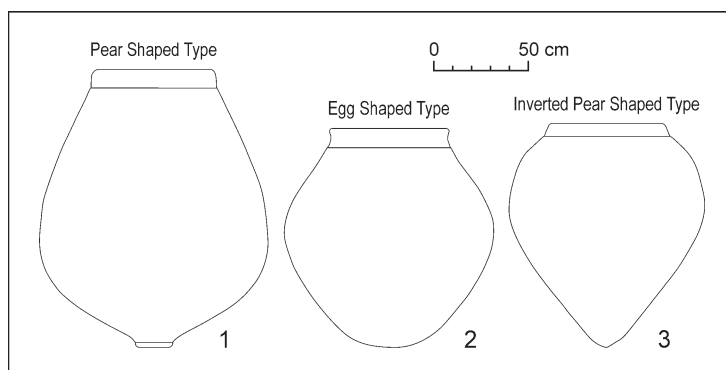


Fig. 6. Different types of pithoi according to body shape. Drawing author.

Distribution Areas of Pithoi

Pithoi have been documented in numerous settlements across Cilicia dating to the Late Antique Period. At Kelenderis, rim and base fragments of pithoi uncovered in excavations date between the 5th and 7th c. AD (*Tekocak* 2006, 84, 85, pl. 57; 58; kat. no. 301–305). Surface research conducted around Alanya,

including at the settlements of Kızılcaşehir Castle, Akkale, and Elikesik, also revealed pithos rims dating to the 5th–7th c. AD (Çaylak-Türker 2009, 215, 216). In the Toslak (Augai) region of Alanya, unglazed pithos rims and lids used for storage were unearthed. These coarse and crudely made pieces are considered to be locally produced and are attributed to the Early Byzantine Period (Doğan 2008, 389, 390). As part of the Göksu Archaeology Project, an extensive surface survey was conducted in the area between Mut and Karaman. Here, 403 pithos fragments were discovered within a 10-square-meter area near Church Hill in the Kıravga settlement, indicating that the church may have served as a storage site. All ceramics from this survey are dated to the Roman and Early Byzantine periods (Elton 2006, 332). In Syedra, Late Roman Period pithos samples, likely of local origin, were uncovered in workshop areas alongside vessels such as amphorae, mortaria, and kardopoi. The presence of locally produced pithoi near an amphora kiln suggests that pithos production was also undertaken within the city (Kızıllarslanoğlu et al. 2017, 245).

Numerous pithos fragments have been unearthed in various locations within the theater of the Ancient City of Diocaesarea, a mountainous settlement in Cilicia. A total of 18 pithos fragments were analyzed, classified into three types, and dated to between the 5th and 7th c. AD (Uçar 2022, 75–77, 246–253, kat. no. 290–305). Pithoi from both the theater area and the monastery in the Olba Ancient City were similarly dated to the 6th–7th c. AD (Aydın 2019, 190, 191, 464–478, kat. no. 218–231; pl. 109–116). In Olba, pithoi (or dolia) were discovered within the monastery complex, located near northern agricultural zones. The presence of a designated cellar, along with olive oil and wine workshops and these pithoi, suggests that the building was used for storing agricultural produce. This finding is significant for understanding the role of agriculture in the social life of the city (Aydın 2019, 78). A workshop area was also uncovered on the eastern hill of the Olba monastery. Given Olba's climate, which is less conducive to olive cultivation, it is likely that the workshop focused on wine production, with pithoi found nearby supporting this assumption (Yeğin 2016, 211, 216, pl. 6). In the Ancient City of Anemurium, Williams classified three pithos samples as storage containers, dating them to the 6th–7th c. AD. based on their context (Williams 1989, 487–489, fig. 48; 49). In the Işıkkale area near Silifke, surface surveys revealed a predominance of pithoi and jars, mostly dating to the Early Byzantine Period. This inland settlement yielded few fine ceramics but numerous storage containers, indicating local production for practical use (Varinlioğlu 2010, 207).

Additionally, surface surveys on Boğsak Island, near the Holmoi (Taşucu) port and close to Silifke, have expanded knowledge of pithos use in the region (Varinlioğlu 2012, 174, 175). Excavations by Goldman at Tarsus Gözlükule uncovered a pithos with an oval body and a grooved, slightly outward-rounded mouth; this half-preserved pithos dates to between the 3rd and 7th c. AD (Goldman 1950, 278, kat. no. 835). Excavations at the Tarsus Donuktaş Temple also yielded numerous ceramics, including lids from small-sized pithoi, attesting to the use of storage containers. These covers are dated to between the 4th and 7th c. AD (Baylan 2001, 60, 65, pl. 51; kat. no. 17–19). In the necropolis area of Çokça Tepe, located 1.7 km north of Çeralan Village within the Saimbeyli District of Adana, Late Roman and Early Byzantine pithoi graves and ceramics were found. Similarly dated ceramics were discovered at Dımışkırık (Cereli), 1.4 km north of Kocaharman in Karadut Locality, Saimbeyli, and at Taşoluk, 2.1 km northeast of Avcıpınar Village in the same district (Girginer 2005, 161–163). At Gündoğan (Hurşidiye) Village, approximately 25 km southeast of Ceyhan, Roman-period pithos fragments were unearthed in a rocky area near the Topraklı settlement, 1 km northeast of the village (Kaplan 2015, 138). Additionally, in Taşgediği (Leğengediği), another Ceyhan-area settlement, pithos fragments from the Roman and Byzantine periods were documented. Workshop remains in this area suggest that pithoi may have been used in the production of olive oil and wine (Girginer 2008, 391, 392).

Numerous pithos fragments unearthed from various settlements in Syro-Palestine, within the Levant region, attest to the regional production of pithoi in Late Antiquity. Surface surveys on the Kuseyri Plateau, near Antiocheia, revealed pithos rims in the villages of Çabala, Sungur, and Sürütme in Yayladağı, dating them to the 3rd–4th c. AD (Kereci 2019, 26, pl. 7; kat. no. 69–72). Additional examples were unearthed in Hisarcık, Kulaç, and Topraktutan villages of Yayladağı date between the 4th and 7th c. AD (Kereci 2019, 43, 44, pl. 15; kat. no. 158–166). Another Early Byzantine pithos from Kulaç Village in Yayladağı further supports local production in this area, given the high quantity of locally-produced pithoi across different sites (Kereci 2019, 55, pl. 20; kat. no. 231). A Late Roman pithos rim was also found in spaces 2B, 2C, and 2D of Tell Atchana, within the Antiocheia borders (Casana/Gansell 2005, 157). In the Amik Valley, surface surveys revealed pithos fragments in multiple mounds and settlements. Among ceramics from Akpınar Höyük, one pithos dated to the Byzantine period was identified (Casana/Wilkinson 2005, 214,

264, fig. A.6; AS 52), while another pithos from the Roman period was found at Çolaktepe (Akgöl Farm; *Casana/Wilkinson 2005*, 224, 266, fig. A.8; AS 112). A Roman villa rustica was identified at the Tayfur Sökmen Campus, near Antiocheia, offering insights into rural life and production. Storage areas within this building yielded a variety of ceramics, including eight pithos rims dating to the 4th–7th c. AD (*Kılınçoğlu 2019*, 57–59, pl. 23; kat. no. 121–128) and six pithos bases from different parts of the structure (*Kılınçoğlu 2019*, 81, pl. 37; kat. no. 229–234).

During excavations conducted by Princeton University in the central area of Antakya, ceramics were found in the residential sector 16-O, near the Habibi Neccar Mosque. According to the chronology of Antiocheia, these ceramics, including pithoi, date to the Early Islamic Period (Early Byzantine Period), specifically the 7th c. AD (*De Giorgi/Eger 2021*, 263, 264, fig. 5.9). A pithos rim from the Late Antique Period was also unearthed at the Halak Tepe (Halaq) settlement (*Casana/Wilkinson 2005*, 229, 266, fig. A.8; AS 134). Another rim, dating to the Late Roman Period, was found at Beşarslan (Tell Hamda; *Casana/Wilkinson 2005*, 231, 267, fig. A.9; AS 143), and two pithos rims from the Roman Period were uncovered in Uluca Kuzey (*Casana/Wilkinson 2005*, 249, 265, 266, fig. A.7–8; AS 235). At Zeugma, a worn pithos base dating to the early 6th c. AD was identified as part of a storage container (*Kenrick 2013*, 66; pl. 37, PT594). Another pithos base from Zeugma, dated to the 5th c. AD and likely of local production due to its specific additives, was also documented (*Abadie-Reynal/Martz/Cador 2007*, 185, fig. 11). The Dede Ruins in Gaziantep's Oğuzeli District, a rural settlement from the Late Antique Period, revealed numerous workshops and ceramic artifacts from the same era. In wine workshop number 4, a nearly complete pithos used as a collection chamber was discovered (*Kozbe/Güngör/Caner 2022*, 31, 32, fig. 3.32). Additional storage jars resembling pithoi in form were found in various parts of the building (*Kozbe/Güngör/Caner 2022*, 92, 93, kat. no. 17; pl. 17: 1–8). A pithos rim with a rounded, grooved profile from the Ras Al-Bassit settlement, now within Syria, appears to be of local production and dates to between the 4th and 7th c. AD (*Mills/Beaudry 2007*, 752, fig. 9, D.34.5).

Numerous mouth fragments, known as dolia or pithos, were excavated from the Ras Al-Bassit settlement, all identified as locally produced. These findings provide compelling evidence of local pithos production in the city, supported by clay analyses on pithoi and other ceramics. Based on the context, these ceramics are dated to between the 5th and 7th c. AD (*Mills 2014*, 21–34). A pithos rim with a rounded profile was uncovered during surface surveys in and around the Homs (Emasa) settlement in Syria. This rim, believed to be produced in Amrit (Tartus), is dated to between the late 5th and 6th c. AD. Given the close proximity of Amrit (Tartus) to Homs (Edasa), its presence as an imported item in the area is unsurprising (*Reynolds 2014*, 59, fig. 6d). In the city of Dura-Europos, located in eastern Syria, evidence of occupation persisted until the mid-3rd c. AD. Pithos fragments were found in the E8 house of the residential quarter, a district largely inhabited by retired soldiers. It is believed that part of this house served as a storage space, with pithoi used during the early Late Roman Period (*James 2019*, 139–141). In Lebanon, pithos mouths thought to have been used for storage in the Beirut settlement were likely imported from Ras Al-Bassit. These wide-mouthed amphora-like pithoi date from the 3rd to the 4th c. AD (*Mills/Reynolds 2014*, 134, fig. 5: 19–21). Samples from the Chhim settlement, also in Lebanon, date to between the 5th and 7th c. AD (*Kowarska/Lenarczyk 2012*, 646, fig. 3: 7; 2014, 128, fig. 3: 5–15). Studies in Chhim identified ceramic pieces with inwardly rounded and flattened rims, double-grooved handles, and bodies categorized as Group I, believed to originate from Amrit/Tartus. These pieces suggest that both imported and locally produced ceramics were present in the region (*Kowarska/Lenarczyk 2014*, 127).

Studies in rural settlements around the Baalbek/Heliopolis Ancient City have uncovered ceramics dating from the Early Roman Imperial Period to the Late Roman Period. Among these finds are storage jars, classified as storage containers and identified in the literature as small pithoi, dating between the 1st and 4th c. AD (*Fischer-Genz 2014*, 84, 85, fig. 7: 5–8). Chemical analyses confirm that some pithoi, believed to be produced in Lebanon's Bekaa Valley, date to the Late Antique Period (*Wicenciak 2021*, 77). In the Jabal Harun settlement in Jordan, numerous pithos rims were found across various structures. Four rims were uncovered in layers from different phases in the West Building area, and one was found in the southern part of Room 30. Although the forms vary, all date between the 6th and 8th c. AD (*Gerber 2016*, 136, 142, 147, 158, 160, fig. 7: 86–87; 16: 182; 28: 315; 30: 342). In the Nesher Ramla settlement in Israel, a pithos rim with a double-grooved rim and a grooved body was unearthed, dating to the Byzantine and Early Islamic Periods, specifically the 6th to 7th c. AD (*Vincenz 2015*, 112, 158, 159, fig. 20: 40). Another pithos example, dating between the 4th and 7th c. AD, was found among storage containers at the Khirbet El-Hawarit settlement in the Golan region of Israel (*Hartal/Hudson/Berlin 2008*, 133, 134, 146, fig. 12: 9). In the Upper Galilee Region, pithos samples lacking decoration on

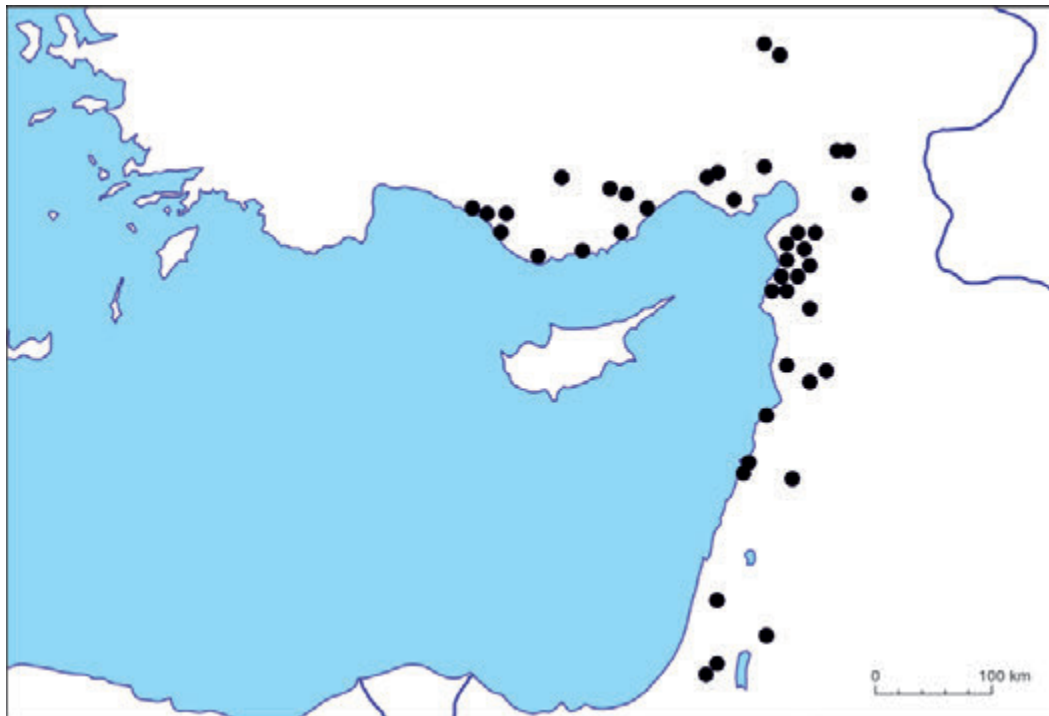


Fig. 7. Distribution of Late Antique pithoi in Cilicia and Syria. Drawing author.

the mouth and body sections were discovered. However, these pithoi feature single or double grooves on the neck and date to the Late Byzantine-Early Islamic Period, between the 6th and 7th c. AD (*Frankel et al.* 2001, 66, 67, fig. 3.11: 13, 18–21; 6) We can see this pithos samples from South of Levant Area to Western Cilicia (Fig. 7).

CONCLUSIONS

Analysis of amphoras and pithoi from various Late Antique settlements in Cilicia and Syria reveals their extensive use in both regions. Amphoras, in particular, serve as key artifacts for understanding the Late Roman economy (*Mitchell* 2016, 67). With the onset of the Roman Imperial Period, ceramic production and trade intensified along the western and southern coasts of Anatolia, the Levant, and Cyprus, resulting in the establishment of numerous ceramic workshops and port-adjacent residential areas in these regions. This economic growth paralleled advancements in agricultural organization, leading to significant increases in olive oil and wine production. Cities and their surrounding territories were outfitted with architectural infrastructure to support agricultural activities, fostering urban development. Amphoras and pithoi became essential for the trade and storage of these agricultural products throughout the Mediterranean region. Amphora types from Western Anatolia, Cilicia, Syria, and the Levant began production during the Roman Imperial Period, with production continuing through the Late Antique Period, after which these amphoras were widely exported across Roman provinces. Notably, the Agora M 239, LR 1, Zemer 40, and Zemer 41 amphoras were produced in Cilicia, while the LR 4, LR 5/6, and Agora M334 (LR 9/Beirut) amphoras originated from Syria and the Levant.

This study identified Cilician amphoras in 66 distinct settlements and Syrian amphoras in 111 settlements, while pithoi were documented in 45 settlements across Cilicia and Syria. A detailed examination of these sites reveals that multiple amphora and pithos types were commonly found together in major settlements such as Alexandria, Amathous, Anemurium, Beirut, Butrint, Classe, Dara, Elaiussa Sebaste, Erythrai, Kelenderis, Myra, Naula, Parion, Phaselis, Tergeste, Tripolis, Wadi Natrun, and Zeugma. The recovery of amphoras and pithoi from a total of 131 settlements across the Mediterranean and Black Sea regions highlights the intensity and sophistication of trade during the Late Antique Period (Fig. 8). The presence of these amphora types in both port and rural settlements, spanning from the westernmost to

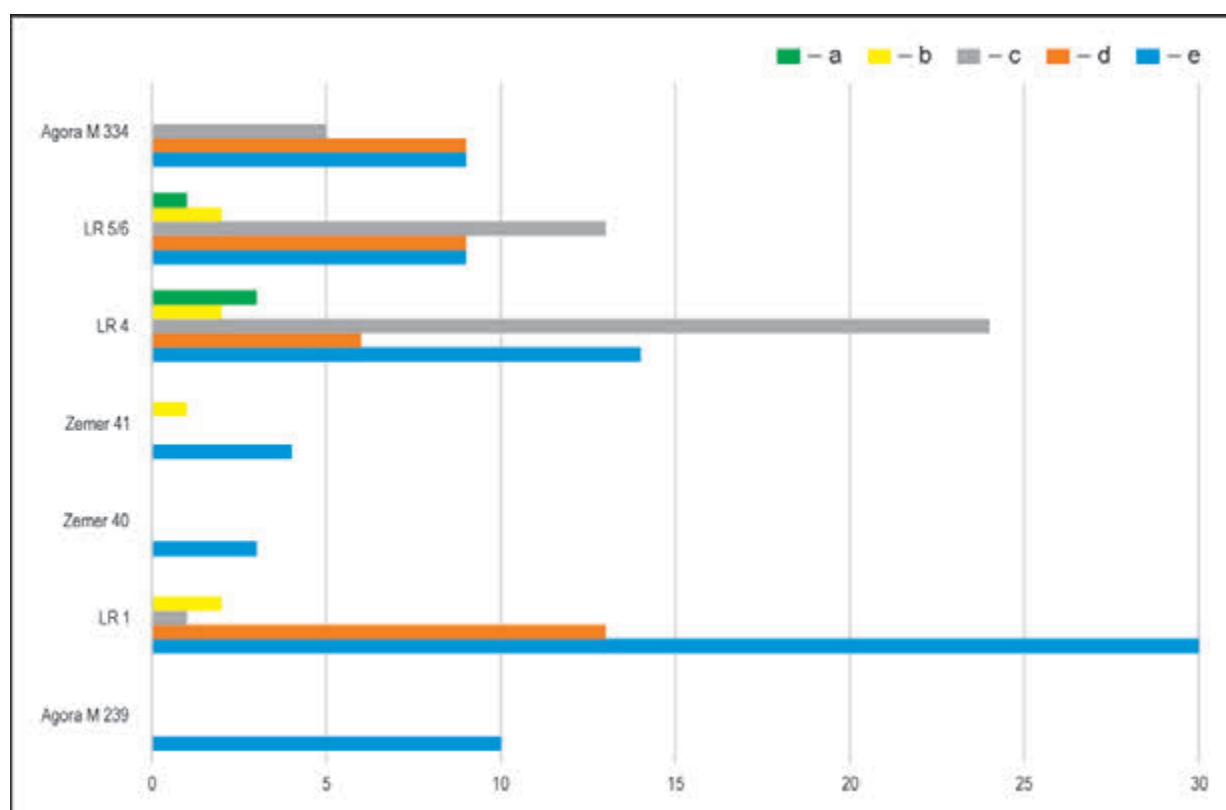


Fig. 8. Distribution of Cilician and Syrian amphorae by settlement and region. Legend: a – Black see; b – Afrika; c – Europe; d – Syria; e – Anatolia. Drawing author.

the easternmost parts of Cilicia, provides valuable insights into the vessels' usage, trade routes, and distribution patterns in the Late Antique period. The widespread detection of Cilician and Syrian amphorae in Mediterranean coastal settlements underscores the advanced commercial network that flourished during this era.

Pithoi, primarily used for storage and trade, played a role in both land and maritime commerce, though less frequently than amphorae. Evidence of pithoi in maritime trade comes from rare examples recovered from shipwrecks, where they were sometimes transported alone or alongside amphorae. While amphorae were more prevalent in sea trade, pithoi were equally common in land trade. Pithoi were produced in various settlements, including those in port areas, nearby coastal settlements, and inland regions. Rural economies, often centered on agriculture, prioritized olive oil and wine production. These products were initially stored in pithoi before being transferred to amphorae for trade, underscoring the importance of both vessel types. Beyond their commercial role, pithoi were essential in rural life due to their versatile storage functions, further emphasizing their significance. Amphora production was typically concentrated in workshops near coastal areas, whereas pithoi were primarily crafted in rural settlements by local or itinerant artisans. As agricultural output increased in both rural and coastal settlements, the demand for storage vessels such as amphorae and pithoi also grew. The intensity of agricultural production reflects the commercial potential of the region, creating a demand for numerous ceramic workshops to produce necessary storage vessels. Consequently, most ceramic workshops in the area served as local production sites. In addition, itinerant artisans could produce pithoi across settlements, an economical solution given the number and density of rural settlements, which facilitated rapid production.

Several key factors shaped this organized agricultural and ceramic production system. First, a structured approach to agricultural production emerged to support both farming and ceramic production. Second, facilities such as olive oil and wine workshops, particularly *mola olearia*, were constructed. Third, the need for ceramic workshops to store products led to increased ceramic production. Fourth, these products were initially stored in pithoi, then transferred to amphorae to prepare them for trade. Fifth, designated areas were established to display products ready for sale. Finally, trading stations were

constructed in ports and commercial centers. Each stage in this interconnected sequence was essential for maintaining the trade network, with any missing element potentially disrupting commerce. When each stage functioned cohesively, the entire process contributed significantly to the region's economy. This organized system began with rural production and culminated in the distribution of goods to other provinces across the empire, thus enhancing commercial activity and interregional exchange. This continuous development fostered growth among provinces and states alike. Given the favorable geographical and climatic conditions in Cilicia and Syria, these provinces led the Mediterranean in olive and grape production. The fertile lands available for agriculture in these provinces further supported this productivity. Consequently, the trade of surplus agricultural goods and the region's economic expansion became inevitable during the Late Antique Period.

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Súhrn

Nálezy amfor a pithoi z neskoriantických sídlisk v Kilíkii a Sýrii poukazujú na ich významnú úlohu v obchodovaní a skladovaní poľnohospodárskych produktov, ktoré tvorili základ hospodárstva tejto doby. Amfory slúžili ako kľúčové nádoby na prepravu olivového oleja a vína, pričom ich rozšírenie poskytuje cenné informácie o obchodných sieťach a organizácii hospodárstva v Stredomorí. Rozmach výroby keramiky a obchodu počas cisárskeho obdobia úzko súvisel s rastom poľnohospodárskej produkcie a rozvojom infraštruktúry, najmä na západnom a južnom pobreží Anatólie, Levanty a Cypru. Vidiecke usadlosti a mestá boli vybavené lismi na olej a víno, ktoré umožňovali spracovanie a skladovanie veľkých objemov týchto produktov, aby sa mohli následne prepravovať ďalej. Štúdia sa zaoberá distribúciou a využitím amfor a pithoi, pričom osobitnú pozornosť venuje ich úlohe v obchode a ich významu pre regionálne aj medzinárodné hospodárstvo. Zahŕňa tiež identifikáciu výrobných lokalít, typov nádob a obchodných trás na základe archeologických nálezov. Produkcia amfor bola koncentrovaná hlavne v pobrežných dielňach, zatiaľ čo pithoi sa vyrábali vo vidieckych oblastiach, často putujúcimi remeselníkmi, ktorí pružne reagovali na miestny dopyt. Amfory zo západnej Anatólie, Kilíkie, Sýrie a Levanty boli vyrábané od raného cisárskeho obdobia až po neskorú antiku a ich rozšírenie pokrývalo celé Stredomorie. Typy ako Agora M 239, LR 1, Zemer 40 a Zemer 41 sa vyrábali v Kilíkii, zatiaľ čo LR 4, LR 5/6 a Agora M 334 (LR 9/Beirut) pochádzali zo Sýrie a Levanty. Tieto nádoby sa našli v rôznych centrách, ako sú Alexandria, Bejrút, Dara, Elaiussa Sebaste, Myra či Zeugma, kde sa často objavovali v kombinácii s nálezmi pithoi. Nálezy amfor a pithoi boli potvrdené na 131 lokalitách, pričom kilíkijské amfory boli identifikované na 66 a sýrske na 111 osídleniach. Pithoi, ktoré sa používali predovšetkým na skladovanie, plnili dôležitú úlohu nielen v suchozemskom, ale aj v námornom obchode, hoci menej často než amfory. Zriedkavé dôkazy o pithoi v námornom obchode pochádzajú z nálezov lodných vrakov, pričom sa niekedy prepravovali spolu s amforami alebo samostatne. Produkty ako olivový olej a víno sa pôvodne skladovali v pithoi, odkiaľ sa prelievali do obchodných amfor, čo zdôrazňuje dôležitosť oboch typov nádob v neskoriantickom hospodárstve. Identifikácia výrobných lokalít a distribučných vzorcov odhalila prepojenie medzi poľnohospodárskou produkciou, výrobou keramických nádob a obchodnými aktivitami. Umiestnenie dielní v blízkosti pobrežia umožňovalo efektívne zapojenie amfor do obchodných sietí, zatiaľ čo pithoi sa vyrábali v menších dielňach vo vidieckych oblastiach, čo odrážalo špecifické potreby miestnych komunít. Tieto procesy boli podporené priaznivými geografickými a klimatickými podmienkami, ktoré umožnili Kilíkii a Sýrii stať sa významnými producentmi olivového oleja a vína, čím sa stali kľúčovými aktérmi v stredomorskom obchode.

Obr. 1. Mapa východného Stredomoria. Nálezy pecí na výrobu amfor v Kilíkii, Sýrii a na Cypre. Kresba autor.

Obr. 2. Typológia kilíkijských amfor. Podľa Akkaş 2020, 373, obr. 3.5.6; Alkaç 2013, 114, obr. 8; Söğüt 2023, 25, obr. 3.6; Tekoçak/Zoroğlu 2013, 138, obr. 9.

Obr. 3. Distribučná mapa kilíkijských amfor v Stredomorí. Legenda: a – Agora M 239; b – LR 1; c – Zemer 40; d – Zemer 41. Kresba autor.

Obr. 4. Typológia amfor zo Sýrie a Levanty. Podľa Akkaş 2020, 411, 427, obr. 3.6.2; 3.6.4; De Vingo 2005, 353, obr. 3.

Obr. 5. Distribučná mapa amfor zo Sýrie a Levanty. Legenda: a – LR 4; b – LR 5/6; c – Agora M 334. Kresba autor.

Obr. 6. Rôzne druhy pithoi podľa tvaru tela. Kresba autor.

Obr. 7. Distribúcia pithoi z neskorej antiky v Kilíkii a Sýrii. Kresba autor.

Obr. 8. Distribúcia kilíkijských a sýrskych amfor podľa osídlení a regiónov. Legenda: a – Čierne more; b – Afrika; c – Európa; d – Sýria; e – Anatólia. Vyhotoval autor.

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