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FINDS OF SHAFT-HOLE COPPER AXES FROM THE TERRITORY OF SLOVAKIA IN THE CULTURAL-HISTORICAL CONTEXT OF CENTRAL EUROPE

Contribution to Metallurgy of Late and Final Eneolithic[1]

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I dedicate this study
to Prof. PhDr. Jozef Vladár, DrSc.,
on his significant life anniversary.

The study deals with the discovery of shaft-hole copper axes from the territory of Slovakia in the wider cultural-historical context of the Late and Final Eneolithic in Central Europe. In total, there are 13 exemplars of axes with a single cutting-edge from Slovakia which can be classified in three basic types – the Baniabic, Fajsz and Kozarac-Stublo types. They were common not only in the territory of Slovakia, but also in Central, Eastern and Southeastern Europe. Clay casting moulds document production of axes in the northern Carpathian environment as well – in the territory of today's Hungary and Southwestern Slovakia. Spectral analyses have shown that the shaft-hole axes from Slovakia were most probably made of copper from local sources. It is remarkable that both types of copper raw material, i.e. oxidative and sulphidic, were used. The article points to the important role of the Corded Ware culture bearers who brought artefacts and some elements of the burial rite originating in the area above the Black Sea in the Pit-Grave and Catacomb cultures not only to the territory north of the Carpathian arc, to the territory of today's Poland, but – through the central and upper Danubian basin – also to the western part of Central Europe, i.e. the region of today's Austria, Germany and Czechia.

Keywords: Central Europe, Slovakia, Late and Final Eneolithic, shaft-hole copper axes, cultural-historical context.

INTRODUCTION

Shaft-hole axes belong to important metal artefacts in the period of the Late and Final Eneolithic and in the beginning of the Bronze Age. The fact that they were used in an unusually wide area, i.e. Central, Southeastern and Eastern Europe, in the Caucasus and Middle East, emphasizes the above stated. It is not surprising that they raise a series of questions about their origin, function, dating, cultural influences, contacts, etc. It seems that they were an important medium allowing us to observe existence of intercultural contacts between cultures situated in the immediate vicinity as well as cultural areas far from each other. All the above-mentioned facts have inspired many researchers to deal with the topic.

M. Novotná was the first to deal with the finds of shaft-hole axes from the territory of Slovakia in her study published more than 65 years ago, i.e. in 1957 (*Novotná 1957*). In her work, she collected and complexly evaluated all five known shaft-hole axes known at that time. Apart from typological classification in three basic types, she brought – thanks to her cooperation with the Geological Institute of Dionýz Štúr in Bratislava – first metallographic analyses of the axes from Slovakia (*Novotná 1957*, 312). M. Novotná dealt with the topic also later, in 1970, in her monograph called *Die Äxte und Beile in der Slowakei*, which was published in the renowned edition of Prähistorische Bronzefunde (*Novotná 1970*). In the same year, the work by J. Vladár was published. It deals with the question of the chronological status of shaft-hole axes and the author was inspired by the new discovery of an axe from Dolný Pial, Levice district (*Vladár 1970*). The study's main contribution was cultural association of the shaft-hole axes from the territory of Southwestern Slovakia with the bearers of the Kosihy-Čaka-Makó culture and exemplars from the sub-Tatra environment were associated with the Late Eneolithic cultural complex. He considered the occurrence of first shaft-hole axes in the Carpathian territory to be a result of cultural influences from Eastern Europe, the environments of the Pit-Grave and Catacomb cultures (*Vladár 1970*, 8–14), which was eventually confirmed by subsequent investigations. In the following period

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of the 1980s and 1990s, several minor studies were written on the topic in Slovakia, presenting results of field surveys and excavations. Their great contribution was the discovery of a casting moulds for shaft-hole axes at settlements of the Kosihy-Čaka-Makó culture in Nevidzany (*Bátora 1982*) and Veľký Meder (*Hromada/Varsik 1994*). The casting mould from Veľký Meder is particularly important, as it was discovered in settlement feature 26/89 of the Kosihy-Čaka-Makó culture and, thus, it represents the first dated find associated with production of shaft-hole axes in the territory of Slovakia (*Hromada/Varsik 1994*, 56). Among other works, we can mention the study by Z. Farkaš from 1997. As part of processing individual finds of copper industry in Southwestern Slovakia, he published a remarkable result of spectral analysis of a fragment from a shaft-hole axe from Smolenice (*Farkaš 1997*, fig. 2: 4; 10; 12). The analysis, carried out by M. Longauerová and S. Longauer, showed an extremely high proportion of lead (Pb) in the sample – up to 35.1% (*Longauerová/Longauer 1997*, table I: 3).

In the beginning of the 21st c., more studies were written on the topic of shaft-hole axes from the territory of Slovakia. First, there was the study by Z. Farkaš and D. Ozdín dealing with the find of a copper axe of the Kozarac type which probably comes from Žitný ostrov territory in Southwestern Slovakia (*Farkaš/Ozdín 2002*, fig. 1) and the second was the work by Z. Farkaš and V. Plachá in which the authors bring information on a new discovery of a shaft-hole axe from Radimov, Senica district (*Farkaš/Plachá 2002*, 83, fig. 4: 1). In 2003, an extensive study was published by J. Bátora. As part of processing shaft-hole axes in Central, Eastern and Southeastern Europe, he partly deals with finds from the territory of Slovakia (*Bátora 2003*). J. Bátora dealt with this topic also in the following years, in association with investigation of the Pit-Grave and Catacomb cultures' bearers' arrival in the Carpathian and central European environments (*Bátora 2016*, 109; *2021*, 368; *Bátora et al. 2023*). Those populations caused transfer of multiple technologies and knowledge from the region of the Caucasus to Central Europe (*Bátora 2021*, 368).

As suggested above, a high number of researchers in Europe as well as Eurasian territory have been dealing with the topic of shaft-hole axes, with regard to their occurrence in a large geographical territory (see *Bátora 2006*, 13). The number of articles dealing with the processed topic has greatly increased since 2000. We can mention some of them – *Abels 2000*; *Antonović 2014*; *Born/Hansen 2001*; *Burtanescu 2002*; *Chernykh et al. 2002*; *Dani 2013*; *Dani et. al. 2016*; *Dani/Kis-Varga 2000*; *Dani/Kulcsár 2021*; *Dani/Szeverényi 2021*; *Dergachev 2018*; *2022*; *Dobeš 2013*; *Gedl 2000*; *Gogâltan 1999–2000*; *Hansen 2009*; *2011*; *2021*; *Harrison/Heyd 2007*; *Horváth 2001*; *Kadar 2002*; *Kaiser 2019*; *Klochko V. 2001*; *2020*; *2021*; *Klochko V. et al. 2020*; *Klochko V./Klochko I. 2013*; *Kośko/Wlodarczak 2018*; *Kövári/Patay 2005*; *Kulcsár 1999*; *2009*; *Maran 2001*; *Rezepkin 2012*; *Rysin 2007*; *2008*; *Soroceanu 2012*; *Szeverényi 2013*; *Tasca/Visentini 2009*.

The fact that shaft-hole axes occurred in an unusually wide territory from the Caucasus and the Volga River in the east to the Balkans and Central Europe in the west has brought many problems with their correct classification in individual types. With regard to this, we can mention that, e.g. in the neighbouring Hungary, we come across various opinions on classification of some exemplars of the Fajsz type. For example the axe from Nagy-Kunság in the Upper Tisza region is classified in the Baniabic type by *F. Kőszegi* (*1957*, tab. VI: 5) and, similarly, T. Kovács classifies the exemplar from Székesfehérvár in the same type (*Kovács 1996*, fig. 1: 11). Both axes, with regard to their rears offset from blades, should be classified in the Fajsz type (*Dani 2013*, fig. 2: 17, 23).

The persisting problem with shaft-hole axes was recently pointed to by V. A. Dergachev, who documents it on many contradictions caused by ignoring overlapping characteristic features of axes related to their proportions, dimensions, quality, metric, etc. (*Dergachev 2018*, 27; *2022*, 217). Here, we can remark that with the number of shaft-hole axes, which reaches several hundred today, it is not easy to verify various details of their design also with regard to sometimes insufficient drawings or photographs in publications, not to mention the limited possibilities to verify individual details by direct study in depositories of museums and scientific-research institutions.

Investigations by S. N. Korenevskiy have confirmed that the shaft-hole axes in the Caucasus region were principally used as new effective weapons for close fight in the second half of the 4th millennium BC (*Korenevskiy 1981*, 20). In 3000 BC, technological innovations, such as improved technique of casting and increased striking force, made the axes the dominant dangerous and effective metal weapon in a large geographical territory, including Slovakia. The above-mentioned technical innovations were mostly applied on the Kozarac type axes – the enlarged shaft hole was shifted to the back, the rear was elongated in form of a pipe-shaped socket and their weight gradually increased. Thanks to these properties, the axes became sought for weapons and a symbol of a new social class of warriors (*Hansen 2009*, 149). It is illustrated by the

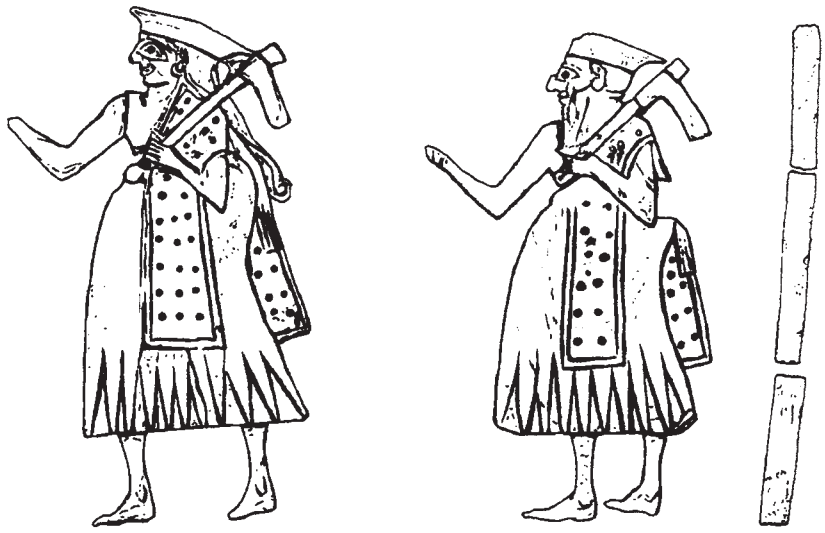

Fig. 1. Mari, Syria. On a detail from a mosaic plate from the first half of the 3rd millennium BC. Two dignitaries are bearing shaft-hole axes similar to the Kozarac type on their shoulders (according to *Born/Hansen 2001*).

depiction of shaft-hole axes on shoulders of two men-officers on a mosaic table in Mari, Mesopotamia, from the first half of the 3rd millennium BC (Fig. 1; *Hansen 2011*, 162, fig. 16).

Therefore, occurrence of shaft-hole axes brought expansion of a new type of a metal weapon as well as new important changes in the society. They were associated with occurrence of new special social classes represented by rich elites (*Harrison/Heyd 2007*, 193–203; *Heyd 2011*, 546) and craftsmen – metallurgists (*Dani/Kulcsár 2021*, 334; *Harrison/Heyd 2007*, 196). Both social classes are documented mainly in the Caucasus region, central Volga region and the Black Sea areas of Russia and Ukraine (*Bátora 2002*, 181–193; *2006*, 56–76). While shaft-hole axes in these territories occur mainly in rich burials of men, in the Balkan-Carpathian territory and Central Europe they are rare, and they are parts of depots. Shaft-hole axes occurred in rich male burials only rarely in these territories in the first two thirds of the 3rd millennium BC (e.g. Hauskirchen?, Mala Gruda, Szczytna). They were probably deposited in the burials to point to the exceptional status of the men by means of artefacts rare, foreign, or even exotic in the region; however, demonstration of alliance with leaders of remote communities cannot be denied either (*Szeverényi 2013*, 667). In association with this, we can mention an interesting observation from Eastern Europe, where burials with shaft-hole axes occur mainly in peripheral groups of the Pit-Grave culture.

This fact might be associated with a peculiar purposeful 'demonstration' of the size and strength of the Pit-Grave culture communities towards their foreign neighbours (*Bratchenko/Klochko V./Soltys 2000*, 12, 13).

TYPOLOGICAL-CHRONOLOGICAL ANALYSIS OF SHAFT-HOLE AXES FROM THE TERRITORY OF SLOVAKIA IN THE CONTEXT OF FINDS IN THE CENTRAL EUROPEAN, CARPATHIAN-BALKAN AND EASTERN EUROPEAN AREA

13 exemplars of shaft-hole axes are recently known from Slovakia. Three of them come from two depots (Žitavany-Opatovce – two axes, Nitra – one axe), others are individual finds. All the axes can be classified in three basic types widespread in Slovakia as well as Central, Eastern and Southeastern Europe. There are the Baniabic, Fajsz and Kozarac-Stublo types. With regard to the fact that most of the 13 shaft-hole axes lack details of find contexts, finds of analogous exemplars from nearby as well as more distant areas found in dated find contexts greatly contribute to their chronological classification. The three above mentioned shaft-hole axes from depots (Žitavany-Opatovce and Nitra), which were not archaeologically documented when they were found, are also important for their more specific chronological classification. The only stratified find immediately associated with the shaft-hole axes in Slovakia is represented by a fragment of a casting mould uncovered in settlement feature 26/29 of the Kosihy-Čaka-Makó culture in Veľký Meder (*Hromada/Varsik 1994*, fig. 1; 2: 6).

Fig. 2. Slovakia. Shaft-hole axes of the Baniabic type, variant 1. 1 – Dolný Pial, Levice district; 2 – unknown site from Southwestern Slovakia; 3 – unknown site from Trnava region (*Vladár 1970*; according to *https://www.lovecpokladu.cz/*).

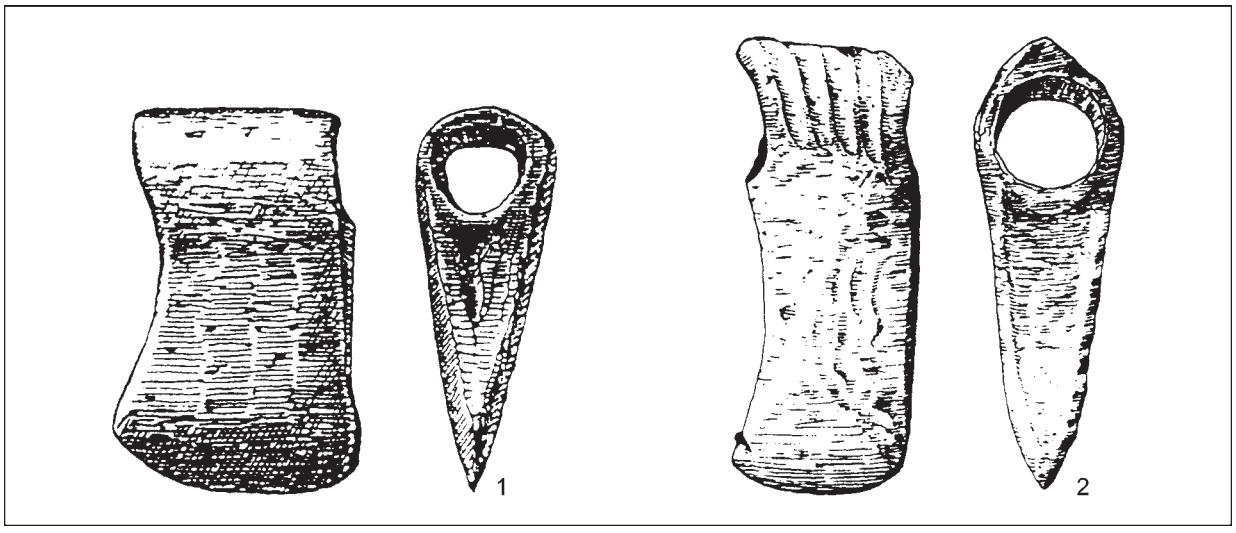

Fig. 3. Poland. Shaft-hole axes of the Baniabic type. 1 – Rudna Mała, Rzeszów district; 2 – Munina, Jarosław district (according to *Kunysz 1959*).

Axes of the Baniabic type

Similarly, to the neighbouring territories, the oldest exemplars of shaft-hole axes in Slovakia belong to the Baniabic type – they do not have offset sockets and, according to *A. Mozsolics* (*1967*, 14, fig. 1A), they can be identified as type A, variant Aa. Although they can be classified in this type, some differences are observable on the exemplars from Slovakia. Unlike the axes from the Baniabic depot, whose front parts of blades are straight, all exemplars from Slovakia have slightly rounded blades. The axe from an unknown site, which is deposited at Bratislava City Museum (Fig. 6: 3; *Novotná 1970*, 27, tab. 8: 39), has a longitudinally roof-edged rear, i.e. designed similarly to the Baniabic type axes as well as exemplars of the Maykop and Novosvobodnaya cultures in the North Caucasus, from where they expanded to Eastern, Southeastern and Central Europe (*Korenevskiy 1974*, fig. 6: 1, 2, 5; *Rezepkin 2012*, fig. 7: 8; 70: 3, 4).

According to their general design and size, the Baniabic type axes from the territory of Slovakia can be classified into two variants. The first variant with a massive wide rear, a rather short and slightly widening body without a distinctly suggested offset from the blade is close to the classical basic type and it might include the axe from Dolný Pial (Fig. 2: 1; *Vladár 1970*, 5, 6, fig. 1, 2) in the Lower Hron region as well as the exemplar from an unknown site in the region of Trnava (Fig. 2: 3) and the axe from an unknown site, probably in Southwestern Slovakia (Fig. 2: 2; *Novotná 1957*, tab. I: 3a, b; *Vladár 1970*, fig. 3: 4). In all exemplars, the

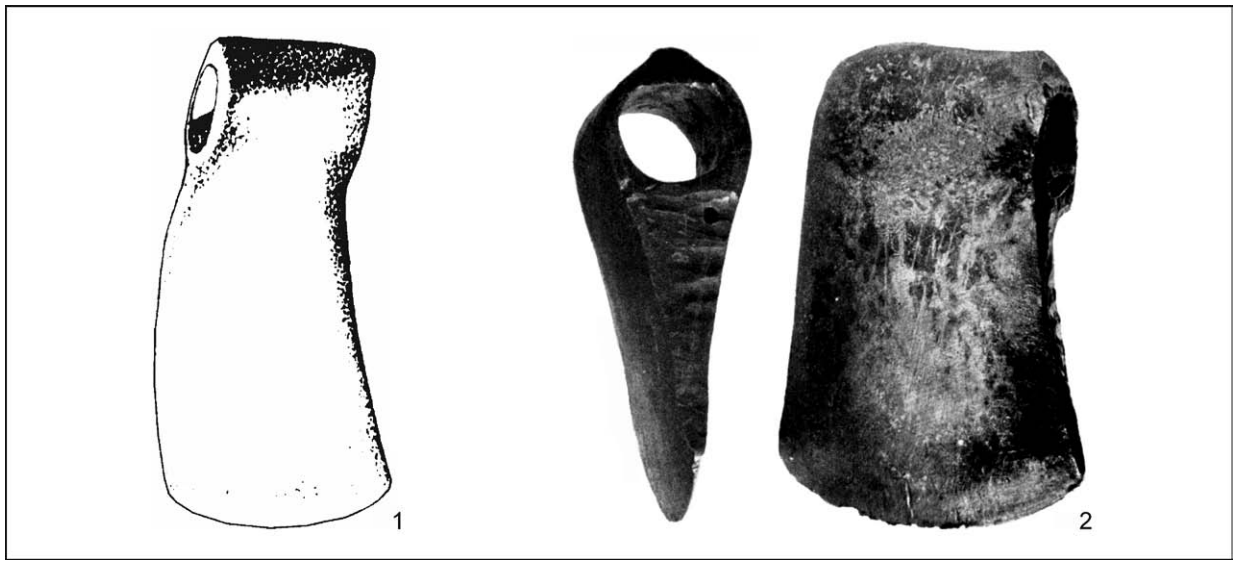

Fig. 4. Hungary. Shaft-hole axes of the Baniabic type. 1 – Keszthely-Alsódobogó, Zala county; 2 – Kisbér, Komárom-Esztergom county (according to *Bakay/Kalicz/Sági 1966*; *Novotná 1957*).

rear width varies between 44 and 52 mm, the shaft hole diameter is 24–26 mm, cutting edge width varies between 58–69 mm and their total length is up to 100–110 mm. We find close analogies to the above-mentioned axes in the North Caucasus, in the environment of the Maykop and Novosvobodnaya cultures, where axes are typologically close to the second group of shaft-hole axes, as specified by *S. N. Korenevskiy* (*1974*, fig. 6: 1, 2, 4, 11). It is documented by, e.g. the axe from the central burial under the tumulus in Nalchik, from the tumulus in Kyzburun III, the axe from an accidental find deposited in the museum in Krasnodar (*Munčaev 1994*, tab. 47: 7, 12, 13) and exemplars from the site of Klady (*Rezepkin 2012*, fig. 167: 4–6).

From the neighbouring areas, the axe from the site of Rudna Mała (Rzeszów district) in Southeastern Poland is close to both axes of the first variant of the Baniabic type with its robust design (Fig. 3: 1; *Gedl 2000*, fig. 2; *Żaki 1960*, fig. 2). The same applies to the axe found near Uzhhorod in Transcarpathian Ukraine (*Jankovich 1931*, 20, 21, fig. III: 3). It is a site located just at the eastern border of Slovakia and is also relatively near the site in Rudna Mała, where the above-mentioned axe was found. Similarity of design with the discussed variant of the Baniabic type can be found also on the exemplar from Kisbér (Komárom-Esztergom County) in the Transdanubian part of Hungary (Fig. 4: 2; *Novotná 1957*, tab. I: 2a, b) and an axe from an unknown site in Austria (Fig. 5: 1; *Mayer 1977*, tab. 4: 36).

Three axes from the immediate western vicinity, which can be classified as the Fajsz type, are also close to the Slovak axes with their robustness. Two axes were found in Moravia – Vlčnov in Eastern Moravia (Fig. 9: 1; *Říhovský 1992*, tab. 5: 34) and Stavenice in Central Moravia; however, this axe is typologically classified in the Corbasca type (Fig. 9: 4; *Dobeš et al. 2019*, fig. 4: 1; 21). The third axe is an exemplar from Hauskirchen in Lower Austria (Fig. 10: 4; *Ruttkay 1995*, fig. 30: 18), which is only 13 km far from the border with Slovakia. On their backs, the considerably long rears of all three axes are rather abruptly offset from wide trapezoidal blades with asymmetrical cutting edges. With their design, the axes seem to be hybrid exemplars on the interface of the Baniabic and Fajsz types. *J. Říhovský* (*1992*, 36) pointed to the similarity of the exemplar from Vlčnov to both types of axes. The Fajsz type axe from Proseč in Eastern Czechia is also close to these types with its design (Fig. 9: 5; *Frolík 1981*, fig. 1). Its special importance is emphasized by the fact that it is located near the road called 'Trstenická stezka' (Trstenice road) apparently connecting the territories of today's Czechia and Moravia as early as Prehistory (*Frolík 1981*). It can be assumed that it continued further eastwards, to the Carpathian area.

The second variant of the Baniabic type axes may include the first of the two exemplars in the depot from Žitavany-Opatovce (Fig. 6: 2; *Novotná 1957*, 309, tab. II: 2ab), the axes from Senica (Fig. 6: 1; *Kőszegi 1957*, 47) and the one from an unknown site in Slovakia, which is deposited at Bratislava City Museum (Fig. 6: 3; *Novotná 1970*, 27, tab. 8: 39). Unlike the exemplars of the first variant, which is close to the classical basic type, they are generally larger, have longer blades and narrower rear parts.

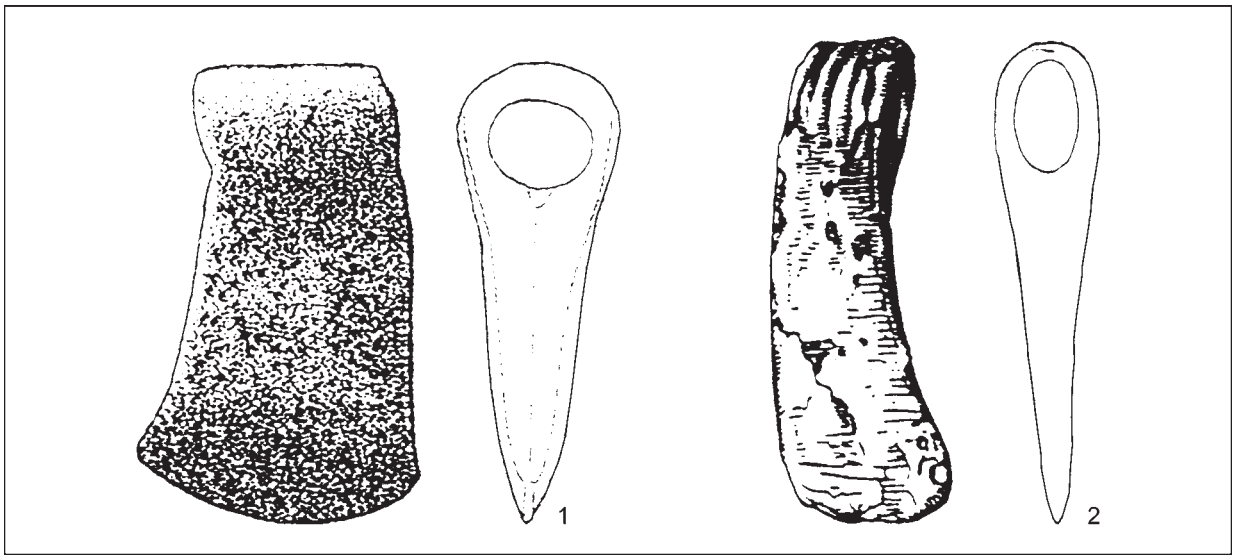

Fig. 5. Austria and Germany. Shaft-hole axes of the Baniabic type. 1 – unknown site in Austria; 2 – Eldagsen, Springe district, Germany (according to *Keiling 1999*; *Mayer 1977*).

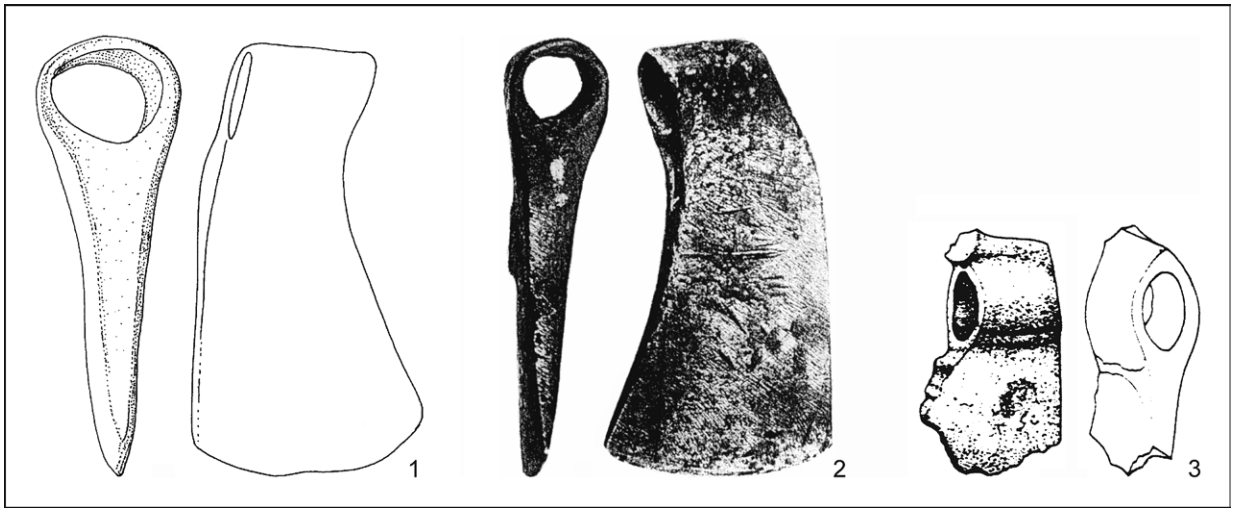

Fig. 6. Slovakia. Shaft-hole axes of the Baniabic type, variant 2. 1 – Senica, district; 2 – Žitavany-Opatovce, Zlaté Moravce district; 3 – unknown site (according to *Kőszegi 1957*; *Novotná 1957*; *1970*).

This makes them similar to the third group of the Maykop axes (*Korenevskiy 1974*, fig. 8: 1–5). The frontal part of the blade is also slightly rounded, but their inner part is similar to the exemplars from the eponymous site of Baniabic (Vilcele) in Romania (*Soroceanu 2012*, tab. 37–43). Their blades, which are not offset from the rear part, gradually widen from the hole towards the cutting edge. The edge is slightly rounded. Axes of this variant from Slovakia have the following dimensions: length 110–125 mm, rear width 31–33 mm, blade width 60–72 mm and circular shaft hole diameter 23–26 mm.

Similarly to the fist variant of the Baniabic type axes from Slovakia, the second variant has close exemplars found in nearby regions. As for the territory of Hungary, there is mainly the axe from Keszthely in the west (*Bakay/Kalicz/Sági 1966*, tab. 7: 13), whose design resembles the exemplars from Senica and Žitavany-Opatovce (Fig. 4: 1). The second axe from Karancslapujtő, which – according to F. Kőszegi – also belongs to the Baniabic type (*Kőszegi 1957*, tab. VI: 6), with its extreme massiveness and design greatly differs from the second variant of the Baniabic type axes from the territory of Slovakia as well as from the Baniabic type in general. Correctness of classification of the Karancslapujtő axe into the Baniabic type was doubted by V. Szeverényi, who thinks that its shape makes the exemplar closer

to the Veselinovo type (*Szeverényi 2013*, 663). In our opinion, the Caucasus type axe from the site of Koltubanka in the Volga region is close to it (*Bratchenko/Klochko/Soltys 2000*, fig. 4: 5; *Rysin 2007*, fig. 4: 2). This axe is dated to the Uspenski stage of the Middle Bronze Age in the northern Caucasus, when the tradition of Caucasian metallurgy first expanded in the whole territory of the Pit-Grave and Poltavkino cultures and later the Catacomb culture (*Rysin 2007*, 196).

Among the axes close to the second variant of the Baniabic type axes in Slovakia, the axe from Munina, Jarosław district in Southeastern Poland stands out – its rear part is decorated with longitudinal flutings and ribs (Fig. 3: 2; *Gedl 2000*, fig. 3; *Klochko V. 2001*, fig. 53: 3; *Kośko/Wlodarczak 2018*, fig. 5: 8; *Żaki 1960*, fig. 3). Exemplars with similar decoration of the rear are known mostly in the Northern Caucasus culture (*Korenevskiy 1981*, fig. 3: 5; *Markovin 1960*, fig. 6: 2). However, they occur even before the early stage of the Catacomb culture, as suggested by the casting mould from Krasnovka in the Pryazovske-Crimea territory, which was uncovered in burial 20 under tumulus 36 (*Bátora 2006*, fig. 42: 1). Their finished exemplars occurred in Ukraine, e.g. in Bilousivka and Smolyhiv (*Klochko V. 2001*, fig. 53: 6, 7). In the presented context, the find of an axe in Eldagsen, Springe district, Lower Saxony, in the northwestern part of Germany, can be regarded as particularly noteworthy (Fig. 5: 2; *Jacob-Friesen K. H./Jacob-Friesen G. 1963*, fig. 211). The axe is close to the Baniabic type axes with its design (*Gedl 2000*, 5) and on the rear, it is – like the above-mentioned axe from Munin in Southeastern Poland – decorated with plastic ribs. With regard to the fact that it is the westernmost currently known find of a shaft-hole copper axe in Europe, it is even more interesting that its design is similar to the axe from Bichkin-Buluk (burial 2, under tumulus 6) in the Volga-Ural region, which is dated to the end of the Pit-Grave or early stage of the Catacomb culture (*Bátora 2006*, fig. 10: 11; *Shilov 1985*, 18–20, fig. 3, 4). The difference between the two axes is, that the exemplar from Bichkin-Buluk does not have ribs on the rear and it was made of arsenical bronze.

We come across axes close to the first or second variant of the Baniabic type in Slovakia also in the Volga-Ural area and in the northern Pontic territory of Russia and Ukraine. Shaft-hole axes spread from the Northern Caucasus, the Maykop and Novosvobodnaya cultures, to the above-mentioned regions with settlement of the Pit-Grave and later Catacomb cultures. From the Volga-Ural environment, we can mention exemplars from the sites of Koltubanka (*Kachalova 1961*, 25), Zagornaya Selit'ba, Boltunovka and Sosnovaya Maza (*Chernykh et al. 2002*, fig. 6: 26, 28), Andrukovskaja and a unique find of an axe deposited at the museum of Chvalin (*Rysin 2007*, fig. 2: 10; 4: 1). According to M. B. Rysin, they are relics of the so-called Uspenski stage of metallurgy in northern Caucasus, which are synchronous with finds of the late Pit-Grave and Novotitarovskaya cultures, where they were widely used in the steppe zone (*Rysin 2007*, 186).

Axes of the Samara type from Ukraine can be mentioned as axes close to the second variant of the Baniabic type from the territory of Slovakia (*Klochko V. 2001*, 68; *Klochko V./Klochko L. 2013*, fig. 7; *Kovaleva 1979*, fig. 6; *1995*, 28). It is documented by, e.g. the axe uncovered under a tumulus of the Pit-Grave culture, in burial 2 in Hrechanyky (*Korenevskiy 1974*, 27) as well as individual finds from the site of Pistyn' in Ivano-Frankivsk region (*Kośko/Wlodarczak 2018*, fig. 5: 4) and from the region of Kyiv (*Klochko V. 2001*, fig. 28: 1; *Klochko V./Klochko L. 2013*, fig. 7: 8). In Crimea, a similar axe was discovered at the site of Dolinka, under the Kurhan-Bajram 1 tumulus, in the central burial 3 dated to the Kemi Oba culture (*Nechitaylo 1991*, 32, fig. 5: 1; *Toschev 2007*, fig. 28: 5). It is remarkable that it was made of pure copper of a non-Caucasian origin, i.e. it is not an import from the Caucasus but a local product. S. N. Korenevskiy assumes that local metallurgists might have been imitating shapes of the Maykop axes or manufactured similar variants (*Korenevskiy 1974*, 32). According to V. Klochko and L. Klochko, the Samara type axes are different from the oldest Maykop type axes in the Northern Caucasus, as they are longer and narrower. From the aspect of construction, the Samara casting moulds are close to the oldest currently known moulds of the Kura-Araxes culture in the Southern Caucasus. Nevertheless, the shape of the Samara type axes is different from the Kura-Araxes culture with less distinct rears and, thus, the origin of the oldest metal axes in the Caucasus and Ukraine remains insufficiently investigated (*Klochko V./Klochko L. 2013*, 55).

Axes of the first variant of the Baniabic type belong to the chronologically oldest shaft-hole axes and they can be most probably associated with one of the first waves of the Pit-Grave and Catacomb cultures bearers' arrival in the northern Balkan and Carpathian territory. Axes of the second variant of the Baniabic type are probably a little younger than the exemplars of the first type, which might have been associated with later immigration waves of bearers of the Pit-Grave and Catacomb cultures in the defined territory. The partly different design of the second variant was probably related to the adaptation process of the metallurgical production by bearers of the Pit-Grave and Catacomb cultures in the Volga-Ural as well as the Black Sea territories

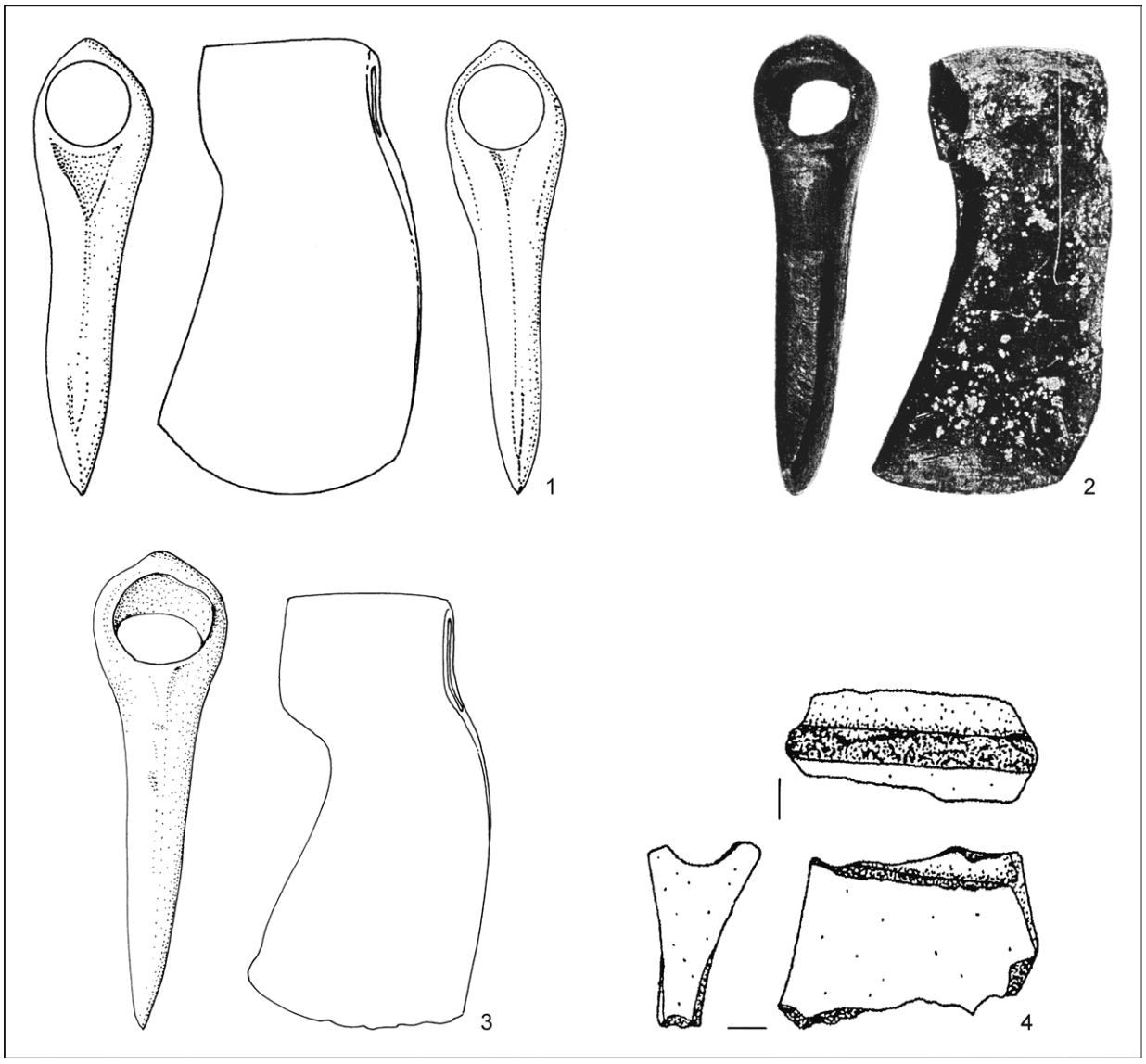

Fig. 7. Slovakia. Shaft-hole axes of the Fajsz type. 1 – Radimov, Senica district; 2 – Žitavany-Opatovce, Zlaté Moravce district; 3 – Veľký Slavkov, Poprad district; 4 – Smolenice, Trnava district (according to *Farkaš 1997*; *Farkaš/Plachá 2002*; *Novotná 1957*).

of Ukraine and Russia. Thanks to the rich raw material basis, it further developed autonomously in the Balkan and Carpathian environment.

Axes of the Fajsz type

The Fajsz type axes belong to other shaft-hole axes from Slovakia which were partly contemporary with the Baniabic type. According to *A. Mozsolics* (*1967*, 14, fig. 1A), they belong to type A, variant Ab. Unlike the Baniabic type axes, their blade is offset from the rear with the shaft hole – it is more distinct in the dorsal part that in the front. The blade, widening towards the slightly arcuate cutting edge, is similar to the younger variant of the Baniabic type. The above-described offset rear is the beginning of shaft holes elongated backwards, which is a sign of technological progress, giving the axes more striking power (*Hansen 2011*, 162). The Fajsz type axes from Slovakia have the following dimensions: length 110–120 mm, width of the rear with the socket 42–45 mm, blade width 55–65 mm and s haft-hole diameter 18–25 mm. In Slovakia, four exemplars are known (Fig 7; Radimov, Smolenice, Veľký Slavkov, Žitavany-Opatovce). The axe from Radimov is rather close to the first group of the Baniabic type axes with its design (*Farkaš/Plachá 2002*, fig. 4: 1), but its blade is slightly arcuately offset from the shaft hole in the rear (Fig. 7: 1). Similarly, the

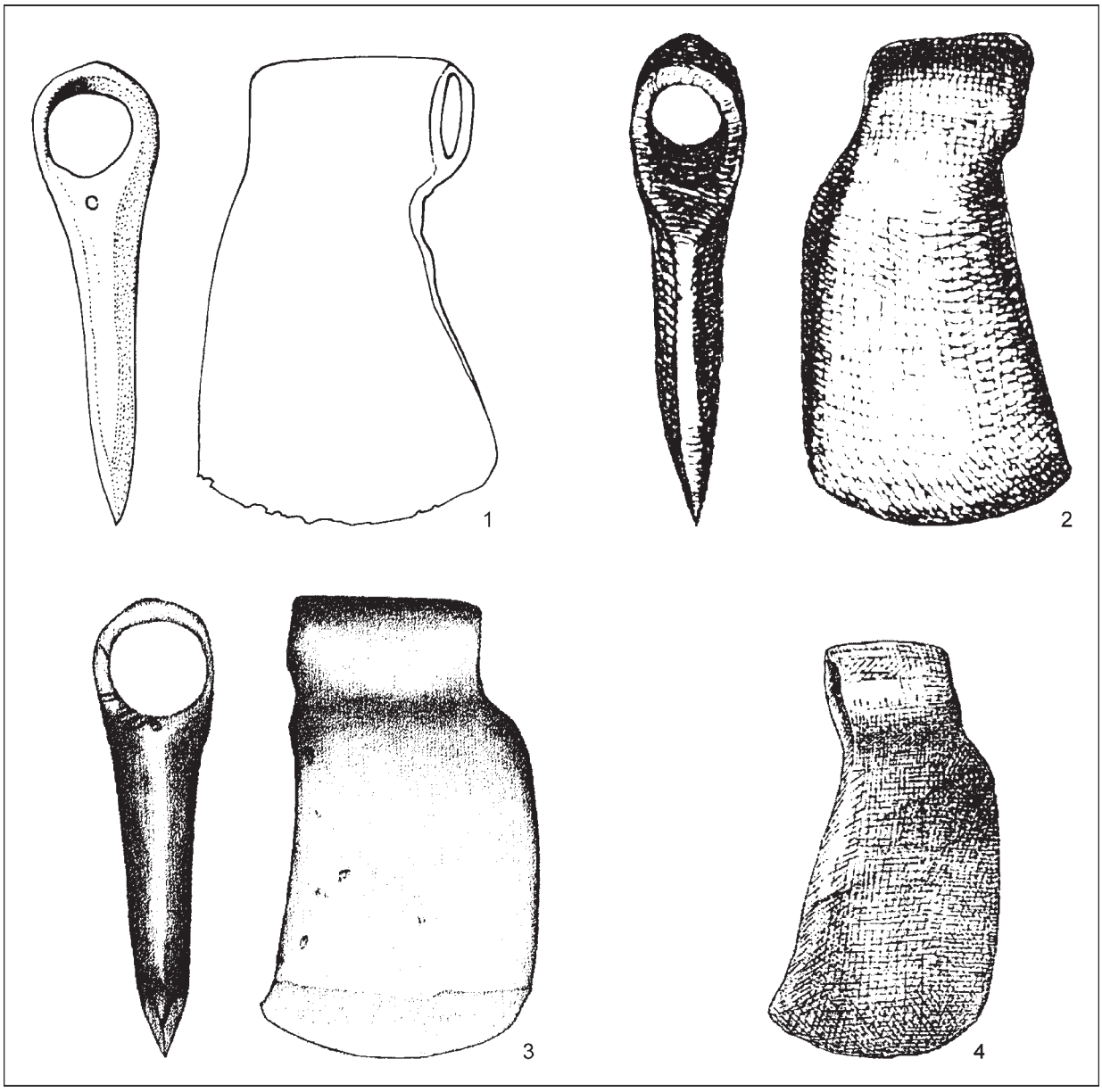

Fig. 8. Hungary. Shaft-hole axes of the Fajsz type. 1 – Kisbér, Komárom-Esztergom county; 2 – Székesfehérvár, Székesfehérvár district; 3 – Hajdúdorog-Szállásföldek, Hajdú-Bihar county; 4 – Hódmezővásárhely, Csongrád-Csanád county (according to *Dani/Kis-Varga 2000*; *Novotná 1957*; *Spöttl 1885*; *Szabó 1999*).

second axe from the depot from Žitavany-Opatovce, which resembles the Baniabic type axes of the second variant (*Novotná 1957*, tab. II: 1 ab), has the rear clearly offset from the blade, which creates a short socket (Fig. 7: 2). Both above-described axes stand at the beginning of the typological development of the Fajsz type with their hybrid design. Regarding this fact, it is important from the chronological point of view that the second exemplar from Žitavany-Opatovce was in the depot together with the axe of the younger variant of the Baniabic type (Fig. 6: 2; *Novotná 1957*, tab. II: 2 ab). Obviously, the Fajsz type axes, can be – like the Baniabic type axes – associated with the Late Eneolithic, but their use is documented also in the Final Eneolithic.

Such dating is supported by the discovery of the Fajsz type axe in Kisbér, in the Transdanubian part of Hungary, which was most probably found together with a Baniabic type exemplar (Fig. 8: 1; *Novotná 1957*, 311). However, it is more reliably documented by the depot from the hill-top settlement of Staré Zámky in Brno-Líšeň, South Moravia, which consisted of a shaft-hole copper axe of the Fajsz type (Fig. 9: 2), a flat axe, a chisel and an awl (*Benešová 1956*, fig. 1). The depot was discovered in the most recent Eneolithic cultural layer belonging partly to

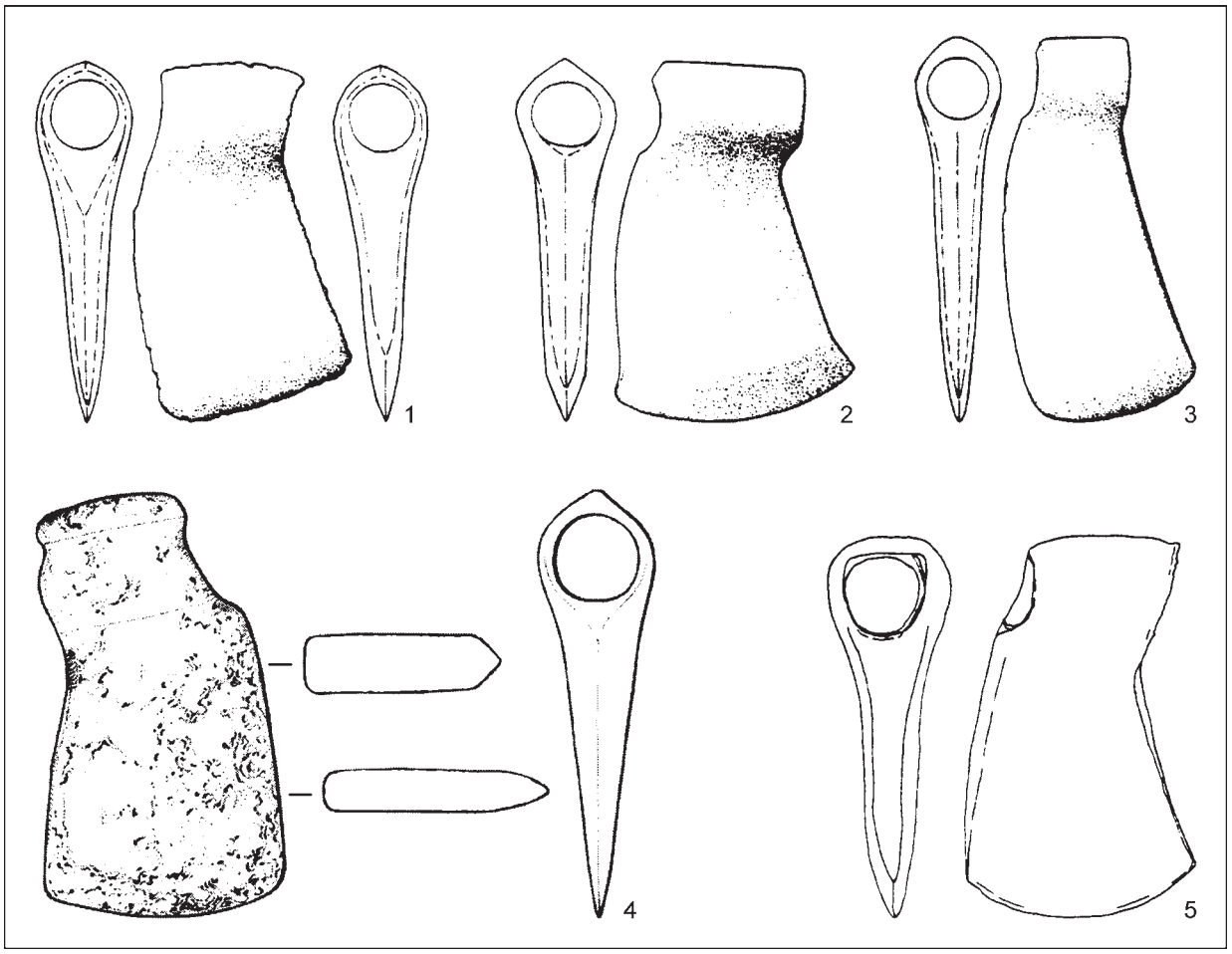

Fig. 9. Moravia and Czechia. Shaft-hole axes of the Fajsz type. Moravia: 1– Vlčnov, Uherské Hradiště district; 2 – Brno-Líšeň, Brno-město district; 3 – Vevčice, Znojmo district; 4 – Stavenice, Šumperk district; Czechia: 5 – Proseč, Chrudim district (according to *Dobeš et al. 2019*; *Frolík 1981*; *Říhovský 1992*).

stage Jevišovice C1, but mainly to stage Jevišovice B with material of the Vučedol culture, which is documented by multiple finds (*Benešová 1956*, 244).

As for the Fajsz type axes from Slovakia, their most typical representatives include the exemplar from Veľký Slavkov (Fig. 7: 3), which has very close analogies in Austria thanks to its elongated socket. The analogies include two axes from unknown sites (Fig. 10: 1, 3) and an exemplar from Ottilienkogel bei Glantschach in the region of the Alps (Fig. 10: 2; *Mayer 1977*, tab. 4: 37, 38; 5: 41) to which an axe from the neighbouring northeastern Italy, Col del Buson site near the town of Belluno in the Dolomites, is partly close (*Hansen 2021*, fig. 6: 2).

In association with the Fajsz type axes, special attention should be paid to the axe from Hauskirchen, which was found after removal of a 'hill in the terrain' at the site of Ried Reinberg (Fig. 10: 4; *Huysza 1990*). Such find context allows justified assumption that the mentioned 'hill in the terrain' was a tumulus from the Late Eneolithic.

There is a certain formal relation between the Fajsz type axes and the Fresach type axes, which, however, are considerably smaller. Until recently, they were known only from mountainous regions of Austria (three sites in Carinthia and one in Salzburg). Nevertheless, a new depot was added to them in 1998. It consisted of four axes and one copper awl (*Bátora 2006*, fig. 24). It was found during an archaeological excavation under the hanging rock called Pigloner Kopf, Pfatten site, in Southern Tyrol in the north of Italy (*Oberrauch 2000*, 481).

It is noteworthy that two axes close to the Fajsz type occurred also in the territory of Central Germany, Brachwitz and Zscheiplitz sites (Fig. 11: 1, 2; *Mildenberger 1950*, fig. 1; 2). The exemplar from Brachwitz is almost identical with the axe from Brno-Líšeň (Fig. 9: 2; *Benešová 1956*, 241, 242).

When discussing the Fajsz type axes in Moravia, we must mention another exemplar from the site of Vevčice, which is different from standard exemplars of this type with its narrowed rear (Fig. 9: 3; *Benešová*

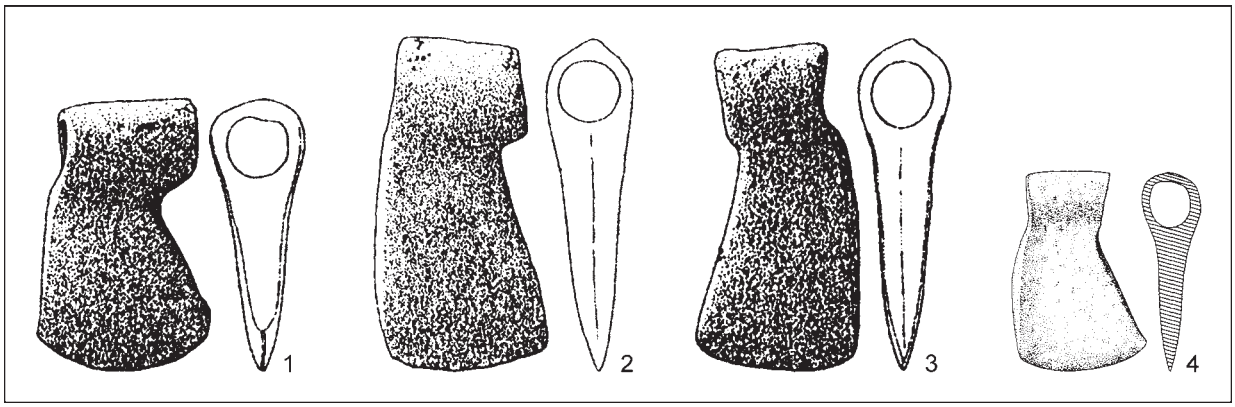

Fig. 10. Austria. Shaft-hole axes of the Fajsz type. 1 – unknown site; 2 – Ottilienkogel bei Glantschach, Sankt Veit an der Glan district; 3 – unknown site; 4 – Hauskirchen, Gänserndorf district (according to *Huysza 1990*; *Mayer 1977*).

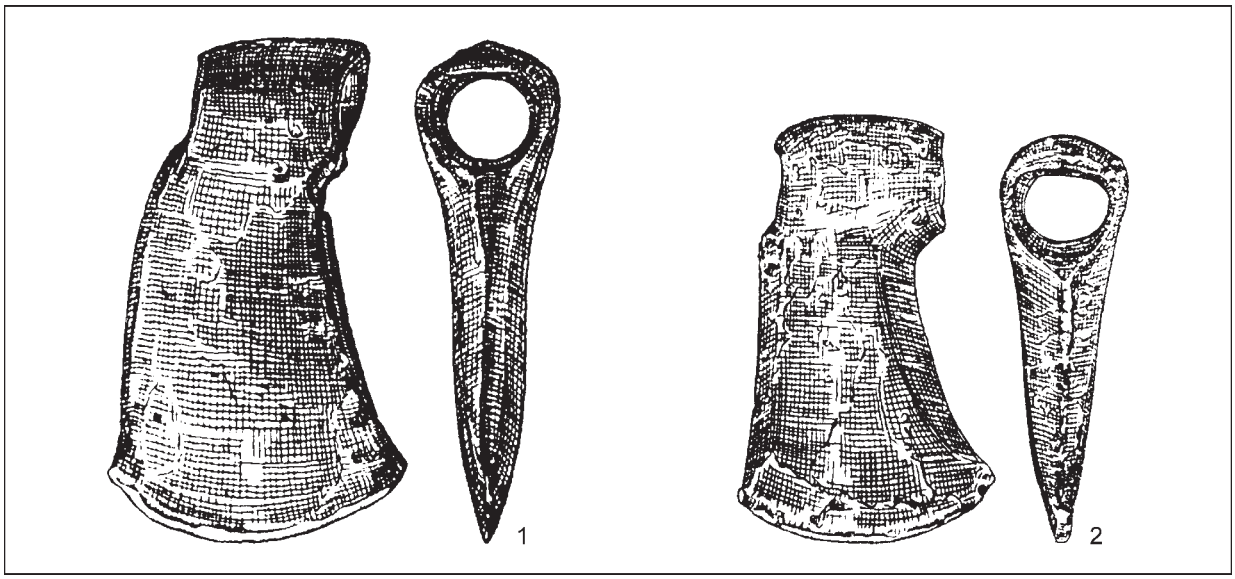

Fig. 11. Germany. Shaft-hole axes of the Fajsz type. 1 – Brachwitz, Saale district; 2 – Zscheiplitz, Querfurt district (according to *Mildenberger 1950*).

1956, fig. 3). With its overall design, the axe from Hódmezövásárhely in Hugary is close to it. It is also classified into the Fajsz type (Fig. 8: 4; *Szabó 1999*, fig 1: 1). It is remarkable that a very close analogy to the exemplar from Vevčice can be also found in the environment of the Kura-Araxes culture in the Southern Caucasus (*Chernykh 1978*, fig. 6: 5).

As far as Slovakia's neighbouring territories are concerned, the Fajsz type axes are most numerous in Hungary, where 14 exemplars have been found. Compared to the Baniabic type, their number is sevenfold and – unlike Baniabic axes – they occur in almost all regions of Hungary, including the Great Hungarian Plain. Besides complete exemplars of the Fajsz type axes, casting moulds for their production have been documented in Hungary (*Ecsedy 1982*, tab. XIV: 1, 2, 6).

In association with the Fajsz type axes, we can mention axes from the territory of right-bank Ukraine, Haisyn site (Vinnytsia region) and from Vinnytsia region, which have been classified into the Stublo type (*Klochko V./Klochko L. 2013*, fig. 14: 1, 2). However, their design makes them closer to the Fajsz type. Finally, the axe from Southern Ukraine, Veseloje site (Dnipropetrovsk region) can be added to them as well (*Dullo 1936*, fig. 18: 12). In the presented context, the depot of copper artefacts from the Catacomb culture period, which was discovered at the Crimean Peninsula, Velyke Sadove site (Bakhchysaraiskyi district), can be considered particularly important. Besides other artefacts, the depot contained four shaft-hole axes; one of them (*Klochko V./Klochko L. 2013*, fig. 15: 13) is identical with the Fajsz type axes in the depot from the

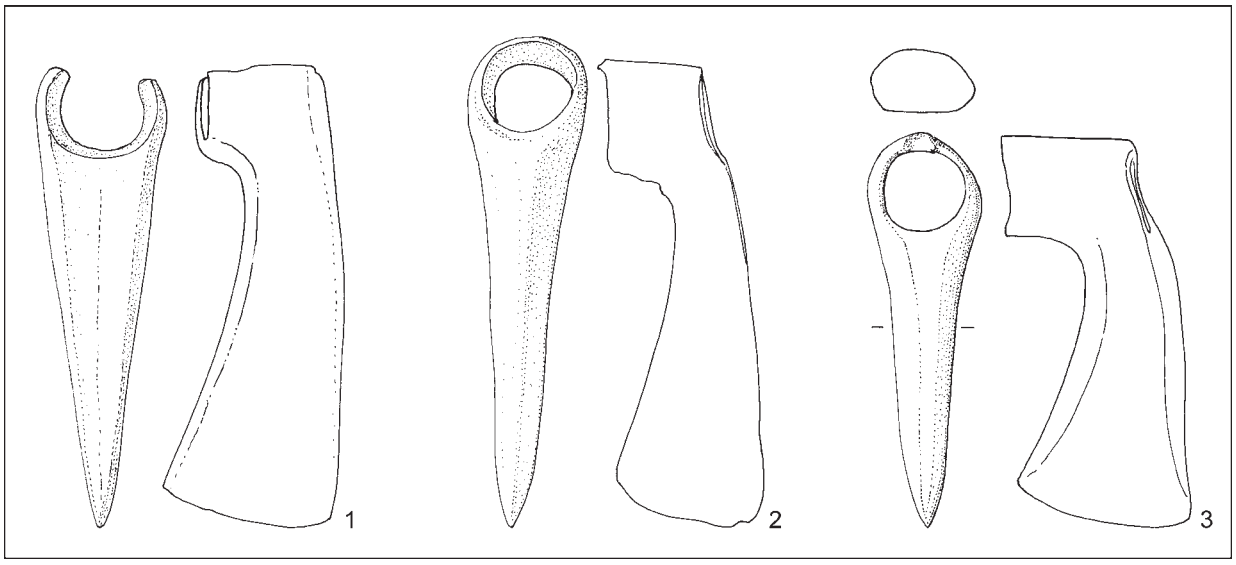

Fig. 12. Slovakia. Shaft-hole axes of the Kozarac type. 1 – Ožďany, Rimavská Sobota district; 2 – region of Poprad, Poprad district; 3 – Žitný ostrov (?; according to *Farkaš/Ozdín 2002*; *Novotná 1957*; *Paulík 1965*).

eponymous site in Hungary (*Roska 1956*, fig. 15: 1, 2; 16: 1–3) and with the axe from the site of Lipova (Arad district) in the Romanian part of the Tisza region (*Vulpe 1970*, tab. 3: 38).

The above-mentioned finds of axes from Ukraine suggest that the Fajsz type axes might have been a result of contacts with Eastern Europe and, thus, justify the opinion of F. Kőszegi, who connected their origin with the Caucasus, from where they arrived in the Carpathian basin by migration of the Pit-Grave culture population (*Kőszegi 1957*, 52, 56–59). *A. Mozsolics* (*1967*, 14, 15) and *N. Kalicz* (*1968*, 46–49) later identified with this opinion. Kőszegi's assumption is supported by the finds of shaft-hole axes in the depots from Brno-Líšeň in Southern Moravia and Fajsz in Central Hungary, which were accompanied by copper chisels very close to the exemplars from the Maykop (the principal burial in Maykop; *Hančar 1937*, tab. XVI; XXXVI: 12, 13) and Novosvobodnaya cultures in the Northern Caucasus (*Rezepkin 2000*, tab. 53: 5, 7; *2012*, fig. 172: 9–11). The assumption is also in accordance with the finding of Ukrainian researchers *S. N. Bratchenko, V. I. Klochko and O. B. Soltys* (*2000*, 13), who suppose that development of production of metal shaft-hole axes in the Lower Danube region as well as the central Dnieper region was a result of strong mutual cultural connections. Even their production in both areas and in the central Volga region was carried out parallelly for some time (*Bratchenko/Klochko V./Soltys 2000*, 13).

As shown by the finds of casting moulds for production of the Fajsz type axes from the territory of Southwestern (Nagyárpád-Dióstetö, Zók-Várhegy) and Northern Hungary (Domony) as well as Eastern Croatia (Vinkovci-Tržnica; *Bátora 2006*, fig. 17: 8), the territory of the Carpathian basin was not only a passive zone of their adaptation in the period of the Vučedol and Kosihy-Čaka-Makó cultures. It was an active innovative centre of their production. Also, thanks to exploitation of the local copper raw material and the increasing production of shaft-hole axes, the Carpathian zone played an important role in the further expansion of metallurgical production in Western and Southern Europe (*Dani 2013*, 207).

Axes of the Kozarac-Stublo type

The third typologically most recent type of shaft-hole axes occurring in the territory of Slovakia in the end of the Eneolithic are the Kozarac type axes, which – according to *A. Mozsolics* (*1967*, 15, fig. 1B) – belong to type B, variant Ba. Like *J. Dani* (*2013*, 207), we agree with researchers, such as A. Durman, F. Gogâltan, L. A. Horváth and T. Kovács, who classify the Kozarac, Dunakömlőd, Dumbrăvioara/Sáromberke and Stublo axes in the same type. Therefore, it is most appropriate to consider the above-mentioned axes local variants of the same type occurring in a large geographical area (*Durman 1983*, 64, 65; *Gogâltan 1999–2000*, 233, 234; *Horváth 2001*, 53; *Kovács 1996*, 115). Here, we can mention the finding by M. Roska that *'in the place of their origin, exemplars of axes are found in the most harmonic form and the more distant to this place the finds are, the more provincial their shape becomes'* (*Roska 1956*, 46).

We know them from four sites in Slovakia – Nitra, Ožďany, the regions of Poprad and Žitný ostrov (Fig. 12; *Farkaš/Ozdín 2002*, 131, fig. 1; *Jelínek/*

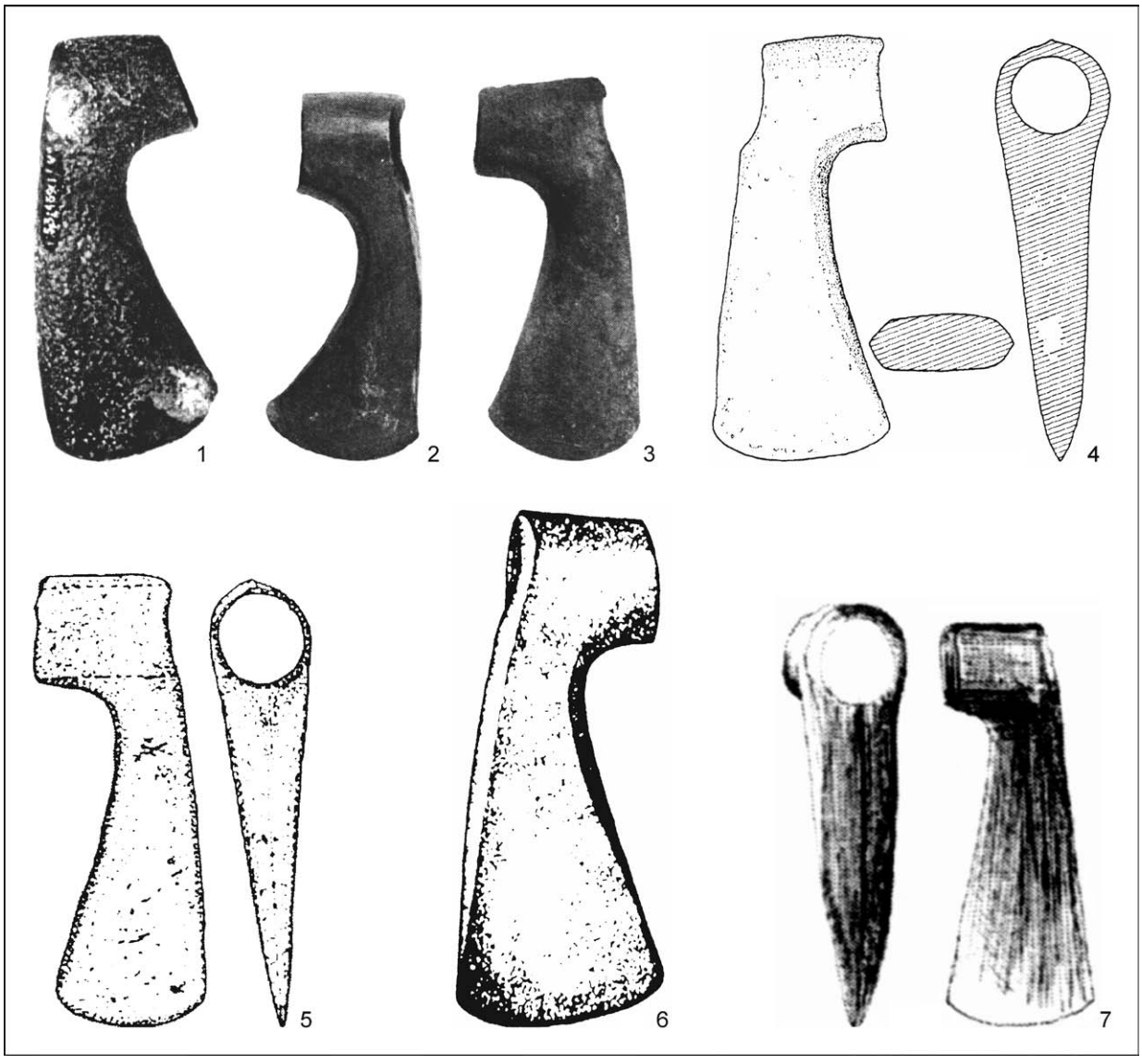

Fig. 13. Hungary. Shaft-hole axes of the Kozarac type. 1 – Szihalom, Heves county; 2 – Érd, Pest county; 3 – Budapest-Óbuda, City District III; 4 – Majs, Baranya county; 5 – Lickóvadamos, Zala county; 6 – Emőd-Nagyhalom, Borsod-Abaúj-Zemplén county. Axe of the Dumbrăvioara type (?): 7 – Szabolcs county (according to *Dani 2013*; *Ecsedy 1983*; *Horváth 2001*; *Kalicz 1968*; *Koós 1993*; *Kőszegi 1957*).

Horáková 2019; *Novotná 1957*, 310, tab. II: 4 ab; *Paulík 1965*, 37, tab. I: 6). According to their design, the Kozarac type axes from Slovakia can be classified into two variants. The first variant is represented by an axe with a considerably short cylindrical socket offset only in the dorsal part, while the frontal non-offset part continues fluently in the almost straight front part of the blade, which is gradually widened to the slightly arcuate cutting edge (Fig. 12: 1; Ožďany). The second variant is represented by exemplars with shorter (Fig. 12: 2; Poprad region) or longer (Fig. 12: 3; Žitný ostrov) cylindrical sockets offset from blades. In the frontal part, the offset is milder, and, in the back, it is more distinct. The frontal as well as dorsal parts of the blade are slightly bent and gradually widening towards the arcuate cutting edge. This type of axes from Slovakia has the following dimensions: length 115–125 mm, width of the rear with the socket 30–45 mm, cutting edge width 40–56 mm, shaft-hole diameter 25–27 mm. As the Kozarac type axes had distinctly cylindrically elongated parts – sockets, their striking power increased significantly, compared to the Baniabic and Fajsz types (*Hansen 2011*, 162).

Besides Slovakia, the Kozarac type axes occur in the neighbouring regions. Most exemplars (18 pcs) have been recorded in Hungary. The axe of the

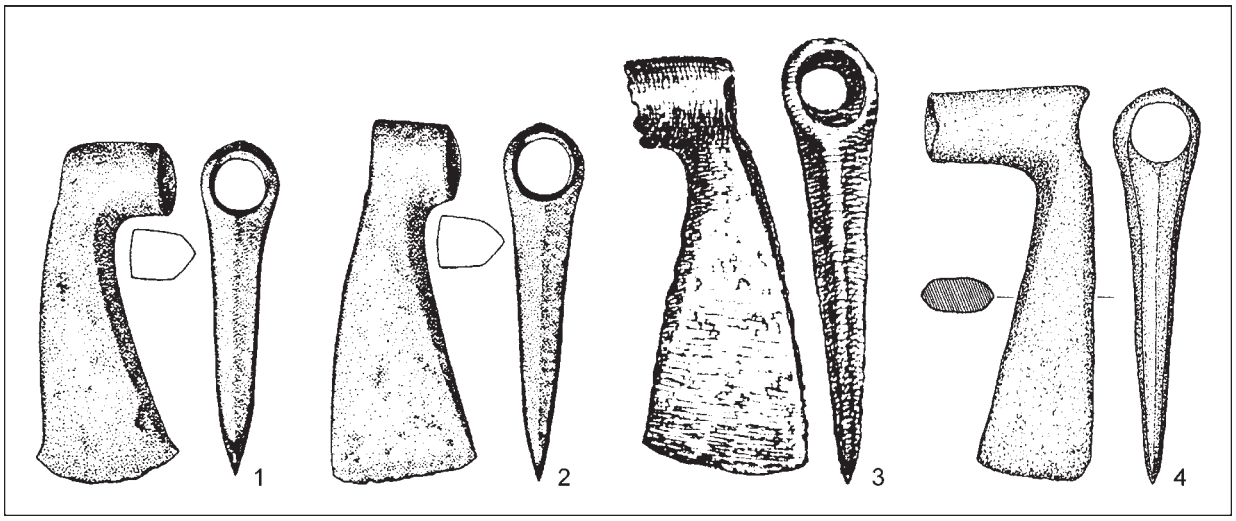

Fig. 14. Hungary. Shaft-hole axes of the Kozarac type. 1, 2 – Tápé, Csongrád-Csanád county; 3 – Acsád, Vas county; 4 – Nagyvejke, Tolna county (according to *Kovács 1996*; *Kulcsár 1999*; *Spöttl 1885*).

first variant of the Kozarac type from Ožďany in the south of Central Slovakia is very close to the axes in the neighbouring Tisza regions, the sites of Emőd-Nagyhalom (Fig. 13: 6; *Koós 1993*, tab. I: 2) and Szihalom (Fig. 13: 1; *Kalicz 1968*, tab. I: 2; *Müller-Karpe 1974*, tab. 522: 2). Its design is similar to the two axes from the depot in Dunakömlőd (*Roska 1957*, 13, fig. 1; 4) and the exemplar from Lickóvadamos (Fig. 13: 5; *Horváth 2001*, fig. 2: 1a–e), which were discovered in the Transdanubian part of Hungary. One of the exemplars of axes in the depot in Tápé in the Tisza region (Fig. 14: 1; *Kovács 1996*, fig. 2: 1) and rare finds from the sites on the right bank of the Danube – Budapest-Óbuda (Fig. 13: 3; *Kőszegi 1957*, tab. VI: 1) and Majs (Fig. 13: 4; *Ecsedy 1990*, fig. 11) are very close to the axe of the second variant of the Kozarac type from Žitný ostrov. As for the axe from the region of Poprad, the second exemplar from the above- mentioned depot from Tápé is very close to it, mainly with the design of the rear part (Fig. 14: 2; *Kovács 1996*, fig. 2: 3).

It is interesting that as many as six exemplars of shaft-hole axes were found in the depot from Dunakömlőd; three of them have typical features of the Kozarac type axes (*Roska 1957*, fig. 1; 4; 8), other two with extremely massive rears are very close (*Roska 1957*, fig. 5; 6) and one exemplar is different – it does not have the rear extended backwards (*Roska 1957*, fig. 3). The two exemplars with massive rears have their analogies in Western Ukraine, e.g. in Mushkativka and Ternopil region (*Klochko V. 2020*, fig. 3: 2, 11). The different exemplar with the obliquely cut frontal part of the rear is only partly similar to the lower mentioned axes of the Nyírtass subtype from the Upper Tisza region (*Dani 2013*, fig. 7: 2). Similar design can be seen on the axe from Dereviane in Podolia, in the region of Ukraine near the Carpathians (*Svieshnykov 1974*, fig. 18: 4). Its design also resembles axes with one cutting edge from the Fatyanovo culture in the Upper Volga region (*Bátora 2006*, fig. 52: 1, 11; *Svieshnykov 1974*, 67), which belongs to the sphere of the Corded Ware culture. It should be noticed that this exemplar from Dunakömlőd was made of arsenical copper and the axe from Dereviane was made from an alloy of arsenic and tin. Such alloy is not very usual in axes from the northern Black Sea territory, and it is very rare in the studied period or artefacts from the Northern Caucasus. Thus, it is probable that the axe from Dereviane was cast in the Balkan-Carpathian metallurgical environment (*Korenevskiy 1974*, 25).

In the territory of Northeastern Hungary, along the upper Tisza River stream, there were three exemplars of shaft-hole axes (Balkány-Abapuszta, Kisvárda region and Nyírtass), which J. Dani considers a subtype within the Kömlőd-Kozarac type and indicates them as Nyírtass subtype (*Dani 2013*, 209, fig. 4: 1, 24, 44). However, it can be stated that only the axe from Nyírtass is more considerably different from the Kozarac type with its more distinct shaft hole (obliquely cut frontal and dorsal parts), which makes it partly similar to the Kolontaiv type axe from the depot of Kyrylivsky vysoty in Kyiv (*Klochko V. 2020*, 323, fig. 6: 3). As we know, the Kolontaiv type of axes is associated mainly with the Catacomb culture bearers. Another axe from Bálkány-Abapuszta is similar to the axe of the Kozarac type from the site of Szihalom in the upper Tisza region with the obliquely cut dorsal part of the shaft hole (*Kalicz 1968*, tab. I: 2). In association with the above-mentioned axes

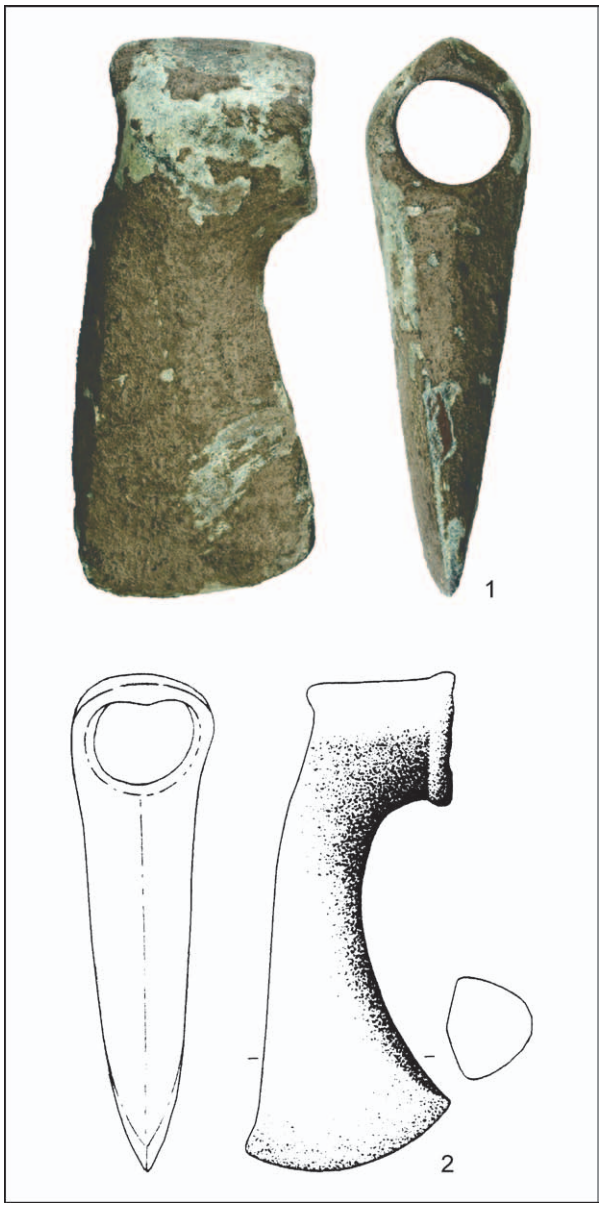

Fig. 15. Czechia and Moravia. Shaft-hole axes of the Kozarac type. 1 – Otvovice, Kladno district, Czechia; 2 – unknown site, Moravia (1 – unpublished find deposited at the Central Bohemian Museum in Roztoky u Prahy, inv. no. AS 15/24/, photo by A. Hůlka; 2 – according to *Říhovský 1992*).

from Northeastern Hungary, we can mention the exemplar from the county of Szabolcs (preserved only in form of an illustration by A. Jósa) classified into the Kömlőd-Kozarac type (Fig. 13: 7; *Dani 2013*, fig. 9: 1). However, with the design of the frontal part of the blade, which is straight, it is close to the Dumbrăvioara type of axes. Regarding the three mentioned axes, it is important that they come from the territory where the Nyírség-Zatín culture reaching Southeastern Slovakia and Transcarpathian Ukraine was spread. Together with the Balkan-Carpathian Vučedol culture, steppe influences from Eastern Europe were an important element in formation of the Nyírség-Zatín culture. It is suggested by, e.g. occurrence of corded ware at several of its settlements in Eastern Slovakia (*Bátora 1983*, fig. 5–7). Therefore, it is not surprising that its metallurgic products include such hybrid exemplars of shaft-hole axes.

West of Slovakia, the Kozarac type axes are not as numerous as in Hungary. From Moravia, we know about a single exemplar of an axe from an unknown site (Fig. 15: 2; *Říhovský 1992*, tab. 5: 37), which is special due to the fact that several direct analogies to it can be found in Western Ukraine among the Stublo type exemplars, e.g. in Vanchykivtsi (Chernivtsi district) and Kamianets (now Kamianets-Podilskyi; *Klochko V. 2020*, fig. 1: 1, 4). Like in Moravia, there is a single axe of the Kozarac type from Czechia, which was found in Otvovice (Kladno district; Fig. 15: 1).[2]

From Austria, two exemplars of the Kozarac type have been documented from unknown sites (Fig. 16: 1, 2; *Mayer 1977*, tab. 5: 39, 40, 42) and they are both close to the above-mentioned axe from the region of Poprad (Fig. 12: 2) with their design. More numerous analogies are known from the territory of the Northern Balkans, e.g. Osnič site in Eastern Serbia (*Antonović 2014*, tab. 38: 348), Brekinjska in Croatia (*Durman 1983*, tab. 10: 1) and from the Western Balkans, e.g. Vranoviči in Montenegro (*Durman 1983*, tab. 11: 1).

We should notice that a shaft-hole axe of the Kozarac type occurred also in Germany, Northern Bavaria, in Waischenfeld-Breitenlesau, Bayreuth district (Fig. 16: 3; *Abels 2000*, 36, fig. 25; 26). Although it is a unique find, B.-U. Abels dates the axe to the Corded Ware culture on the basis of several finds of flat copper axes from Northern Bavaria. He considers its occurrence in the area an import from the east of the Carpathian basin by means of the road along the Danube River (*Abels 2000*, 36, 37).

North of Slovakia, in the territory of Poland, we also encounter the Kozarac type axes. All exemplars were discovered in the western part of Poland (Ósno, Radzików and Strzelin; Fig. 17: 1–3; *Gedl 2000*, 6–8, fig. 4–6) and it is highly probable that their occurrence can be associated with the territory of Eastern Europe in association with the arrival of the Corded Ware culture in the western direction above the Carpathian arch to the lowland

[2] Unpublished find deposited at the Central Bohemian Museum in Roztoky u Prahy. Inv. no. AS 15/24/1, photo A. Hůlka. Here, we would like to thank Mgr. Jana Klementová and Mgr. David Daněček from the museum for providing the find for publishing.

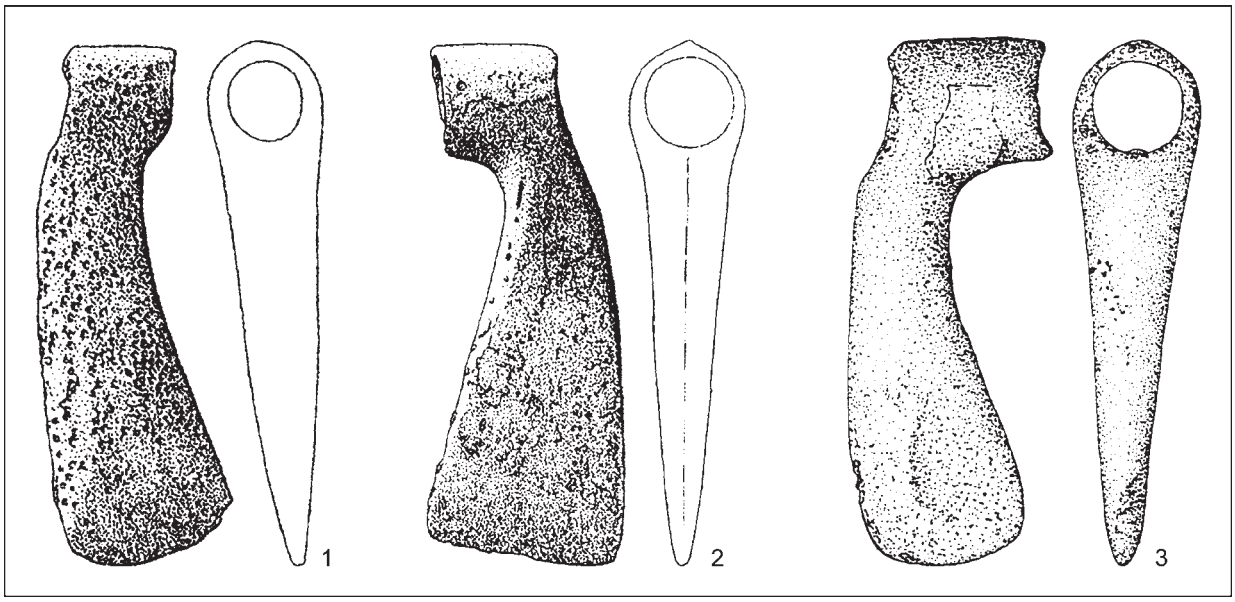

Fig. 16. Austria and Germany. Shaft-hole axes of the Kozarac type. 1, 2 – unknown sites, Austria; 3 – Waischenfeld-Breitenlesau, Bayreuth district, Germany (according to *Abels 2000*; *Mayer 1977*).

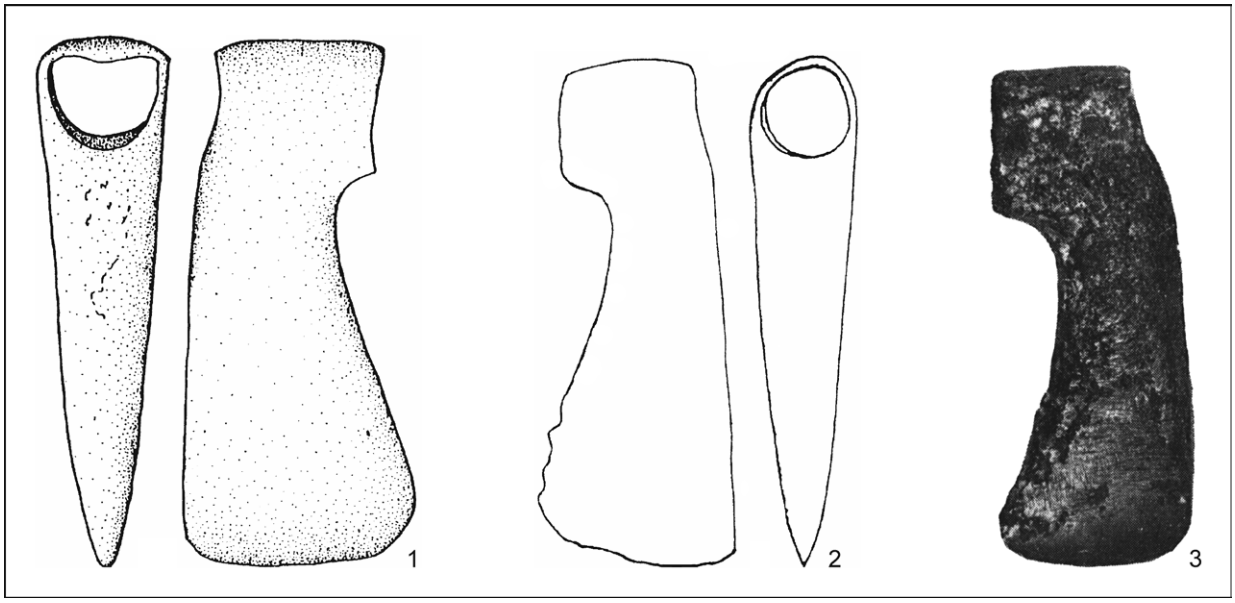

Fig. 17. Poland. Shaft-hole axes of the Kozarac type. 1 – Strzelin, Brzeg district; 2 – Radzików, Wrocław district; 3 – Ośno, Alexandrów district (according to *Gedl 2000*; *Kostrzewski 1964*).

area of Greater Poland and its Baltic drainage area. We know that the culture bearers were strongly influenced by the contacts with the Black Sea Pit-Grave and Catacomb cultures (*Klochko V. 2020*, 323). A. Kośko even admits a possibility that groups of people arrived right from their territory (*Kośko 2014*, 64).

It is noteworthy that apart from the Kozarac type axes, there were also three shaft-hole axes, which – according to M. Gedl – can be classified into the Dumbrăvioara type (Fig. 18: 1–3; Kwieciszewo, Leszno and an unknown site in Greater Poland; *Gedl 2000*, 6, fig. 4). Nevertheless, we can say that the exemplars classified in the Dumbrăvioara type are very close to the Kozarac type, which is confirmed by, e.g. the axe from Topolie in Central Dalmatia (*Durman 1983*, tab. 10: 5). A new exemplar from the site of Szczytna in the southeastern part of Poland, which was uncovered together with other extremely rich inventory burial 4 of the Corded Ware culture

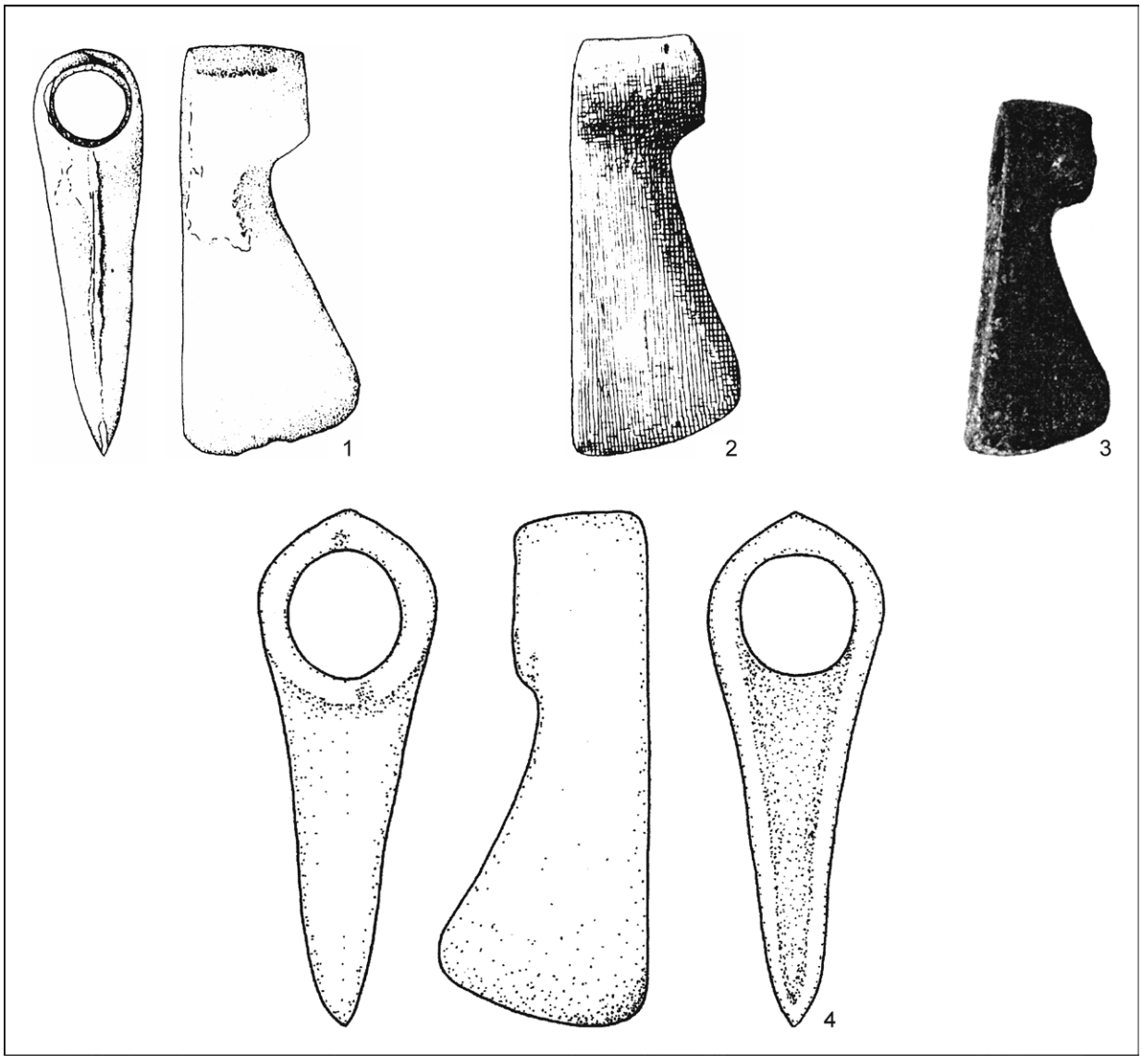

Fig. 18. Poland. Shaft-hole axes of the Dumbrăvioara type. 1 – Kwieciszewo, Mogilno district; 2 – unknown site from Greater Poland; 3 – Leszno, Leszno district; 4 – Szczytna, Jarosław district (according to *Gedl 2000*; *Kossina 1917*; *Kostrzewski 1955*; *Kośko/Wlodarczak 2018*).

at site 6, was added to the axes of the Dumbrăvioara type from Greater Poland in 2010 (Fig. 18: 4; *Hozer/Machnik/Bajda-Wesolowska 2017*, fig. 24–26; 48: 1, photo 35: 1, 2). As far as Szczytna is concerned, it is the first find of a shaft-hole copper axe in a burial of the Corded Ware culture in Central Europe (*Hozer/Machnik/Bajda-Wesolowska 2017*, 96).

It is accepted that the core of occurrence of the Dumbrăvioara type axes lies in Transylvania, where they can be dated to the Schneckenberg B culture, Jigodin culture and Rosia group (*Dani 2013*, 208). They occur south of the Carpathian arch, in the mountainous part of Oltenia, where they are associated with the Glina culture and its Runcuri stage (*Dani 2013*, 208; *Vulpe 1970*, 31, 32, tab. 44B). This fact allows an assumption that the axe from Szczytna comes from this region. It could be supported by the fact that the axe was made of arsenic copper (it contained 0.45% of arsenic; *Hensel/Pawlicka 2017*, table I, no. 17239; *Kośko/Wlodarczak 2018*, 273), which occurs also in the Transylvanian copper sources (*Kadar 2002*, 12, 13).

In relation to the studied topic, we can mention several axes of the Stublo type from Western Ukraine which are considered the most recent variant of the Kozarac type axes (*Klochko V. 2020*, fig. 4: 2, 3, 9, 16, 23, 24). Among them, we can point to the exemplars from depots, e.g. from the eponymous site of Steblivka (Stublo) in Volhynia (*Svieshnykov 1974*, fig. 50: 26) and from Mezhyhirtsi

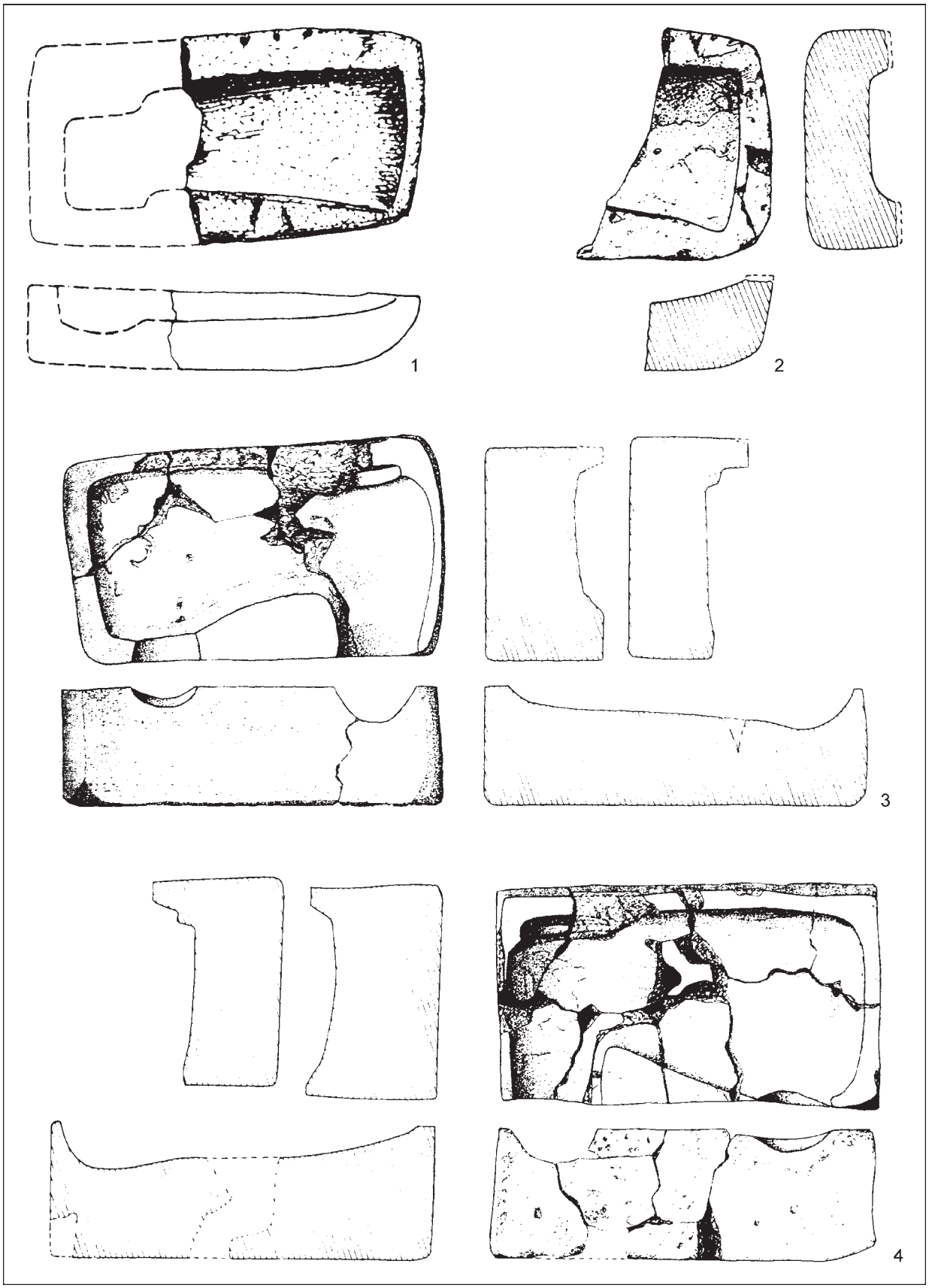

Fig. 19. Hungary. Clay casting moulds for shaft-hole axes. 1 – Domony, Pest county; 2 – Pécs- Nagyárpád-Dióstetö, Baranya county; 3, 4 – Zók-Várhegy, Baranya county (according to *Ecsedy 1983*; *Kalicz 1984*).

in the region of Ivano-Frankivsk (*Klochko V./Tkačuk 1999*) as well as unique finds from the region of Vinnytsia, Mohyliv-Podilskyi district, Lviv and Vinnytsia (*Klochko V. 2020*, fig. 4: 1, 2, 3, 8). To some of the above-mentioned Ukrainian exemplars, we can find analogies in Central Europe as well as the Northern Balkans (*Klochko V. 2020*, 325). With regard to this, V. Klochko also mentions a small silver axe from the region of Vinnytsia (*Klochko V. 2020*, fig. 6: 7) similar to the silver axe from the burial under the tumulus in Mala Gruda in Montenegro (*Hansen 2009*, fig. 8).

In association with the axes close to the Kozarac-Stublo type from the Dnester region in Ukraine, V. Klochko has recently brought a new view of the production technique and he indicates them as the Vanchykivtsi variant. He assumes that, unlike 'classical' Kozarac-Stublo type axes, they were not cast in reusable bipartite casting moulds; they were made in single-use moulds made of wax, i.e. by means of a technique used in the region earlier – in the Cucuteni- Trypillia culture (*Klochko V. 2020*, 317). He considers axes of the Vanchykivtsi variant an early form of the Kozarac-Stublo type axes, which can be dated to the final 4000 and early 3000 BC. He associates them with existence of a Carpathian-Volhynian metallurgical centre, where later, in the beginning of the Bronze Age, production of willow-leaf industry developed (*Klochko V. 2020*, 321). According to V. Klochko's hypothesis, evolution of the Kozarac-Stublo type axes started in the central Dniester region in Ukraine as early as the late phase of the Trypillia culture and their exemplars were brought to Central Europe by the Corded Ware culture bearers. However, the author of the hypothesis also admits that this topic is still open and requires further detailed investigation (*Klochko V. 2020*, 325).

Nevertheless, it must be added to the above mentioned that investigations so far show that the Kozarac type axes, including individual variants, originate in the South Carpathian/Northern Balkan region and, therefore, their production started there (*Dani 2013*, 207). This is suggested not only by the geographical concentrations of the sites of their occurrence and the highest number of depots with axes of this type in the territory of today's Croatia, Serbia, Montenegro and Bosnia-Herzegovina (*Dani 2013*, 207), but mainly the high number of casting moulds from the classical stage of the Vučedol culture uncovered at the sites in Croatia (*Durman 1984*) and in the southwestern part of Hungary (*Ecsedy 1982*, 84, 85). Axes of the Kozarac-Stublo type were used in a long period, i.e. from the first quarter of the 3000s BC at the latest (*Born/Hansen 2001*, 33) until the beginning of the Bronze Age.

EVIDENCE OF PRODUCTION OF SHAFT-HOLE AXES IN CENTRAL EUROPE

The fact that the Baniabic type axes were cast in bipartite clay casting moulds with open central part like their models in the Northen Caucasus in the Maykop and Novosvobodnaya cultures and in the eastern European Pit-Grave culture has not been documented directly by finds of casting moulds. Nevertheless, it is confirmed by triangular depressions in their central part detected, e.g. on the exemplar from Žitavany-Opatovce in Southwestern Slovakia (Fig. 6: 2; *Novotná 1957*, 309, 310, tab. II: 2ab) and Rudna Mała in Lesser Poland (Fig. 3: 1; *Żaki 1960*, fig. 1: 1). A longer period of use of this casting technique is suggested by the axe from Radimov in Western Slovakia (Fig. 7: 1), which represents the transitory type between the Baniabic and Fajsz types and, also has a similar depression in the central part. The second exemplar from the depot from Žitavany-Opatovce also confirms that this casting method was used for typologically younger Fajsz type axes (Fig. 7: 2; *Novotná 1957*, 310, tab. II: 1a, b). Finds of casting moulds in the region of Eastern Europe, in Pryshyb in Luhansk region (*Klochko V. 2001*, fig. 37: 1) and in Krasnovka in Pryazovske-Crimean region (*Bátora 2006*, fig. 42: 1) confirm that this archaic casting method was used as late as the Catacomb culture. In relation to the production technology of the Fajsz type axes, we can also mention the fact that the exemplar from Brno-Líšeň was finished by warm forging (Fig. 9: 2; *Benešová 1956*, 238).

It is important that production of the Fajsz type axes in the region of the South Carpathians and the Northern Balkans is documented by finds of several bipartite clay casting moulds at settlements of the Vučedol culture. From the immediate surroundings of Slovakia, we can mention the finds at the settlements in Zók-Várhegy (feature 36/77) and Pécs- Nagyárpád-Dióstetö in Southern Hungary (Fig. 19: 2–4; 20; *Ecsedy 1982*, tab. XII: 1, 2; XIII: 1). The fragment of a casting mould from settlement feature B2 of the Kosihy-Čaka-Makó culture at the site of Domony in Northern Hungary was probably used for their production as well (Fig. 19: 1; *Kalicz 1968*, tab. X: 1; *1984*, tab. XXIII: 6). Special casting holes in the central parts (*Bátora 2006*, fig. 16: 1, 10; 17: 2, 8) and exceptionally in the edges of casting moulds (*Bátora 2006*, tab. 17: 1, 3) document very early use of such advanced casting technique in the South Carpathian-Balkan region, i.e. as early as the Late Eneolithic.

In this territory, there are also the oldest exemplars of the Kozarac type axes from the Vučedol

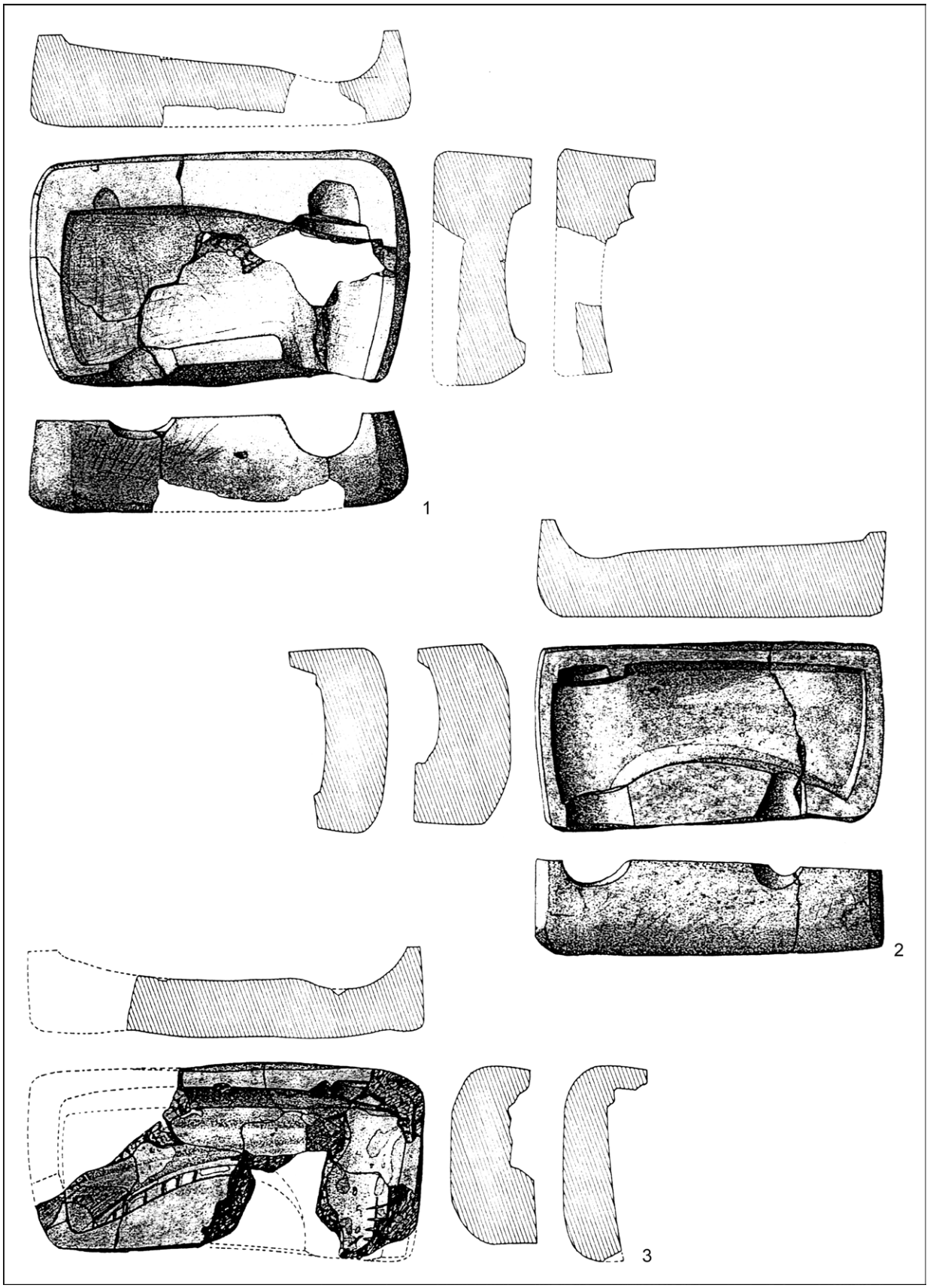

Fig. 20. Zók-Várhegy, Baranya county, Hungary. Clay casting moulds for shaft-hole axes (according to *Ecsedy 1983*).

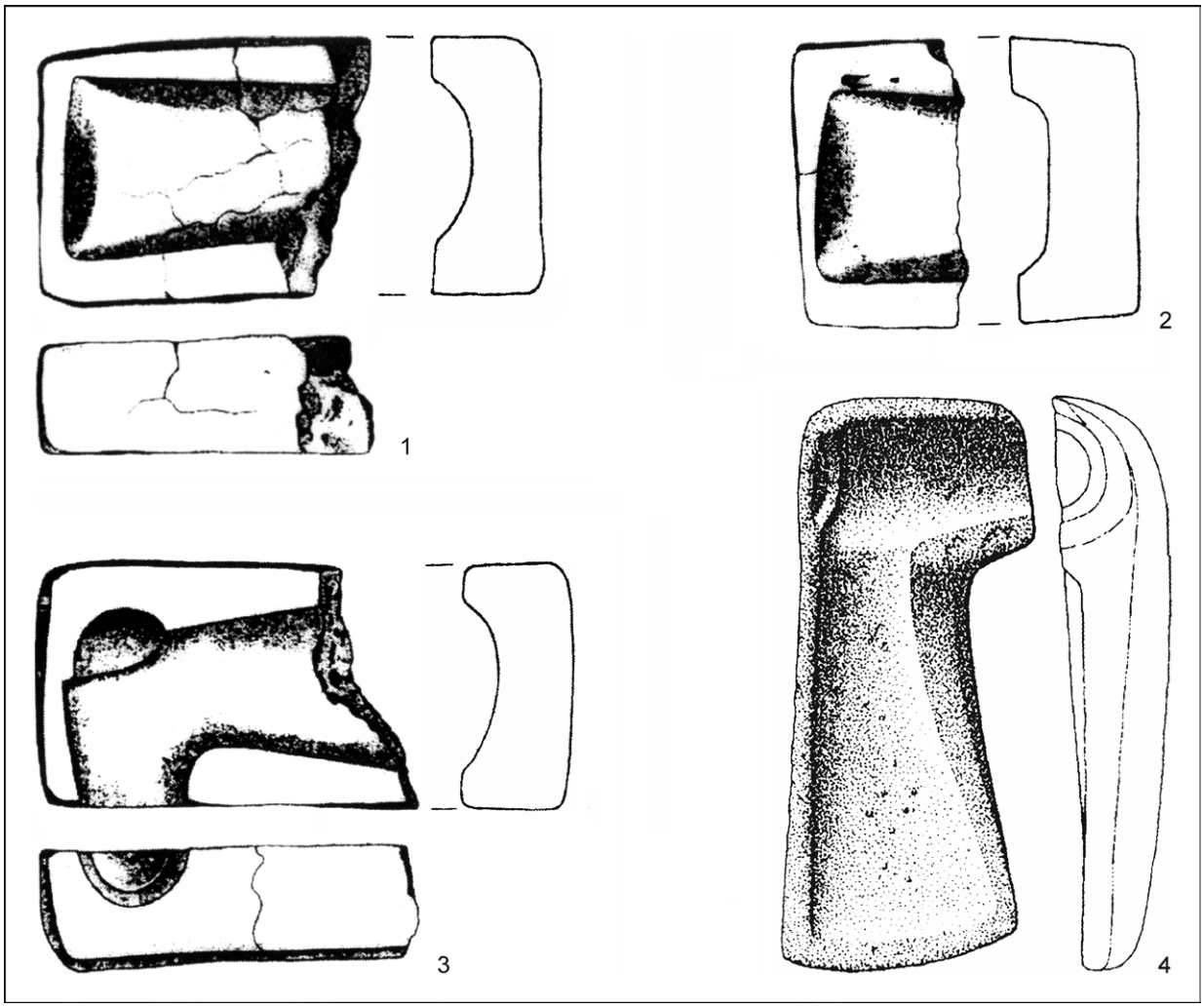

Fig. 21. Hungary and Austria. Clay casting moulds for axes of the Kozarac type. 1–3 – Kaposújlak, Somogy county, Hungary; 4 – Salzburg-Reinberg, Salzburg district, Austria (according to *Hell 1943*; *Somogyi 2004*).

culture, whose production is documented by several bipartite closed casting moulds from the region of Lubljansko barje in Slovenia, from Croatia (Vinkovci-Tržnica) and Southwestern Hungary (Fig. 20: 3; Zók-Várhegy). Thanks to the advanced metallurgy of the Vučedol culture, production of the Kozarac type axes continued in the region by the following Somogyvár-Vinkovci culture, which is confirmed by, e.g. three casting moulds from Kaposújlak (Fig. 21: 1–3; *Somogyi 2004*, fig. 14–16) and one exemplar from Döbrököz- Tűzköves (*Kulcsár 2009*, pl. 43: 2). Besides Southwestern Hungary, their production in the Somogyvár-Vinkovci culture is documented also in its northwestern part by the finds of casting moulds in Ravazd-Villibald domb (*Figler 1985*) and Hidegség-Templom domb (Fig. 22; *Gömöri 1992*; *Ilon 2022*, fig. 4).

In the Final Eneolithic, we come across documents of production of the Kozarac type axes also in the region of the Northern Carpathians, in the territory of today's Southwestern Slovakia, where it is documented by finds of two casting moulds. One of them was uncovered in settlement feature 26/89 of the Kosihy-Čaka-Makó culture in Veľký Meder in Southern Slovakia (Fig. 23: 2; *Hromada/Varsik 1994*, fig. 1; 2: 6). The other exemplar from Nevidzany (Zlaté Moravce district) in the upper Žitava region was found in the course of a surface survey in the area of the Kosihy-Čaka-Makó culture (Fig. 23: 1; *Bátora 1982*, fig. 1). Production of the Kozarac type axes in the Kosihy-Čaka-Makó culture is well documented also in the northern part of Central Hungary by a bipartite casting mould discovered in feature 5605 in Üllő near the southeastern periphery of Budapest (Fig. 24: 1, 2) together with other casting moulds for various tools (*Kövári/Patay 2005*, fig. 19). Production of the Kozarac type axes is rarely documented west of the Carpathian basin.

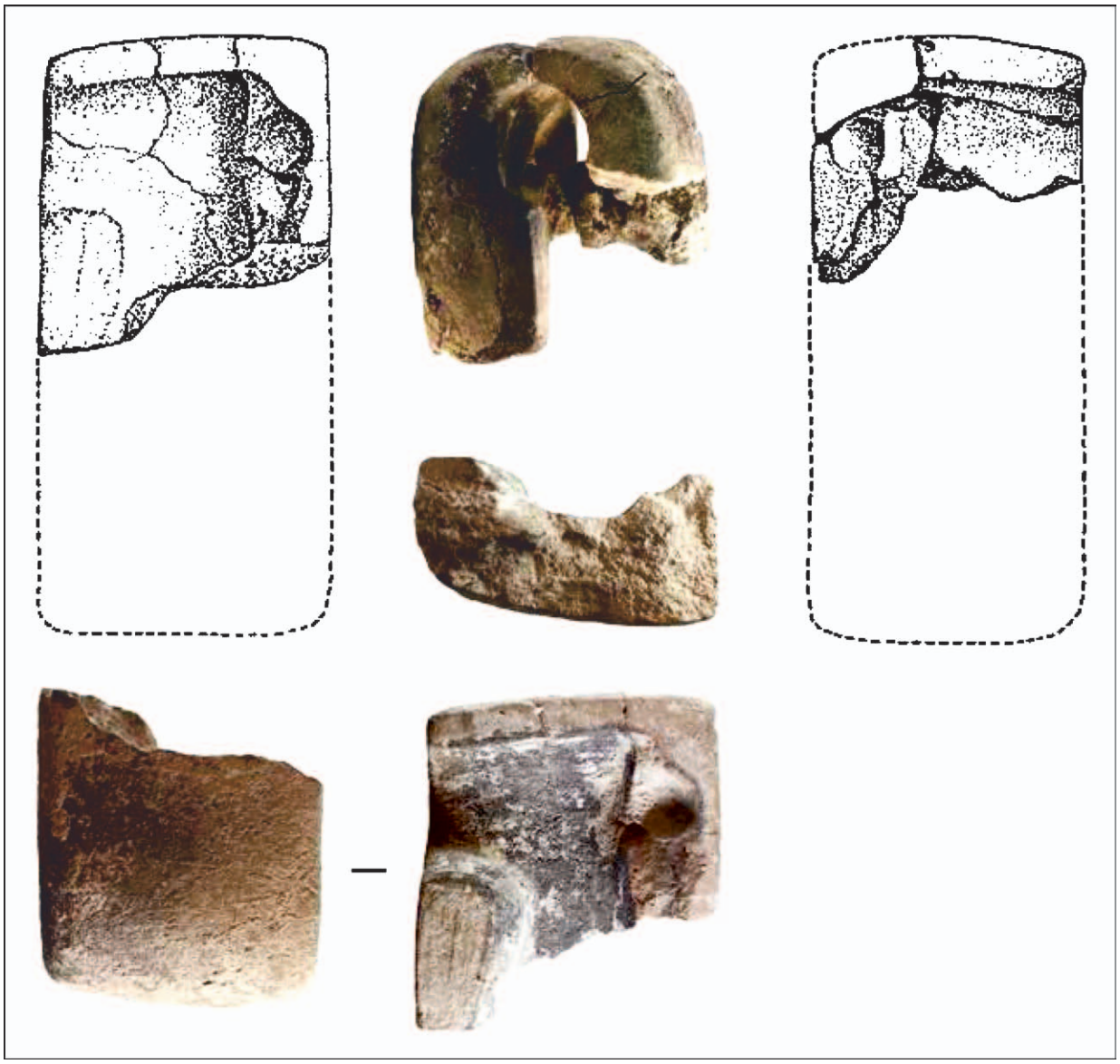

Fig. 22. Hidegség-Templom domb, Győr-Moson-Sopron county, Hungary. Clay casting mould for axes of the Kozarac type (according to *Ilon 2022*).

The evidence includes the find of a casting mould in the Late Eneolithic cultural layer in the hill-top settlement in Salzburg-Rainberg in the region of Northern Alps in Western Austria (Fig. 21: 4; *Hell 1943*, 56, fig. 1: 1). Concentration of a higher number of casting moulds for shaft-hole axes, mainly the Kozarac type, in the Southern Carpathian-Balkan region suggests that there was a metallurgical production centre from which production obviously expanded to the northwestern part of the Carpathian basin (Southwestern Slovakia) and the region of the Northern Alps in Western Austria, as documented by the above-mentioned finds of casting moulds. Existence of production centres of the Kozarac type axes is supported by the fact that sources of oxide and sulphide copper ore were found in their nearby as well as further surroundings.

RESULTS OF METALLOGRAPHIC ANALYSES OF SHAFT-HOLE AXES FROM THE TERRITORY OF SLOVAKIA

Most of the shaft-hole axes from Slovakia were spectrally analysed. As for the Baniabic type, axes from Dolný Pial, Senica and Žitavany-Opatovce were analysed, the Fajsz type was represented by exemplars from Smolenice, Veľký Slavkov and Žitavany-Opatovce and the Kozarac type was

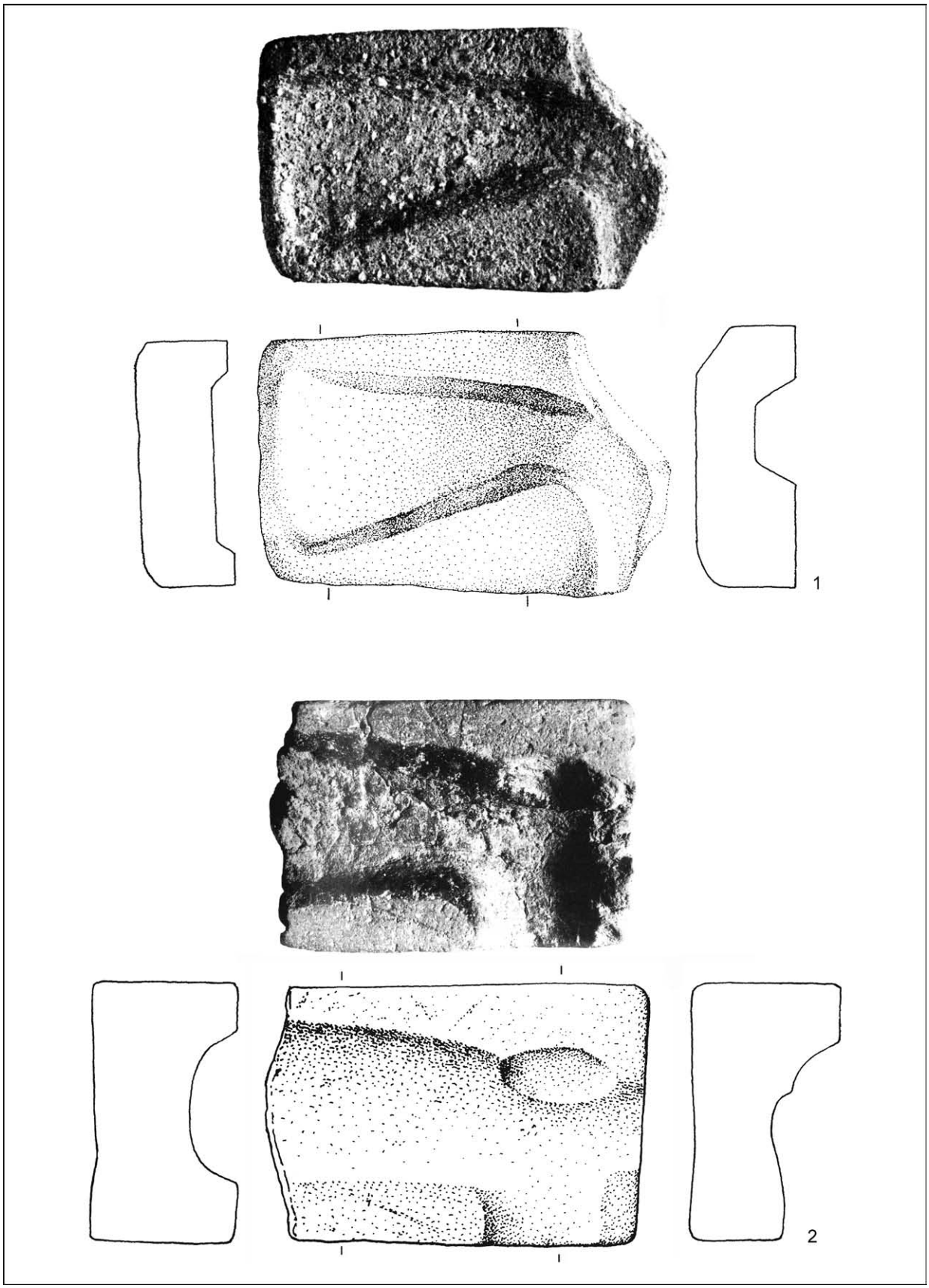

Fig. 23. Slovakia. Clay casting moulds for shaft-hole axe of the Kozarac type. 1 – Nevidzany, Zlaté Moravce district; 2 – Veľký Meder, Dunajská Streda district (according to *Bátora 1982*; *Hromada/Varsik 1994*).

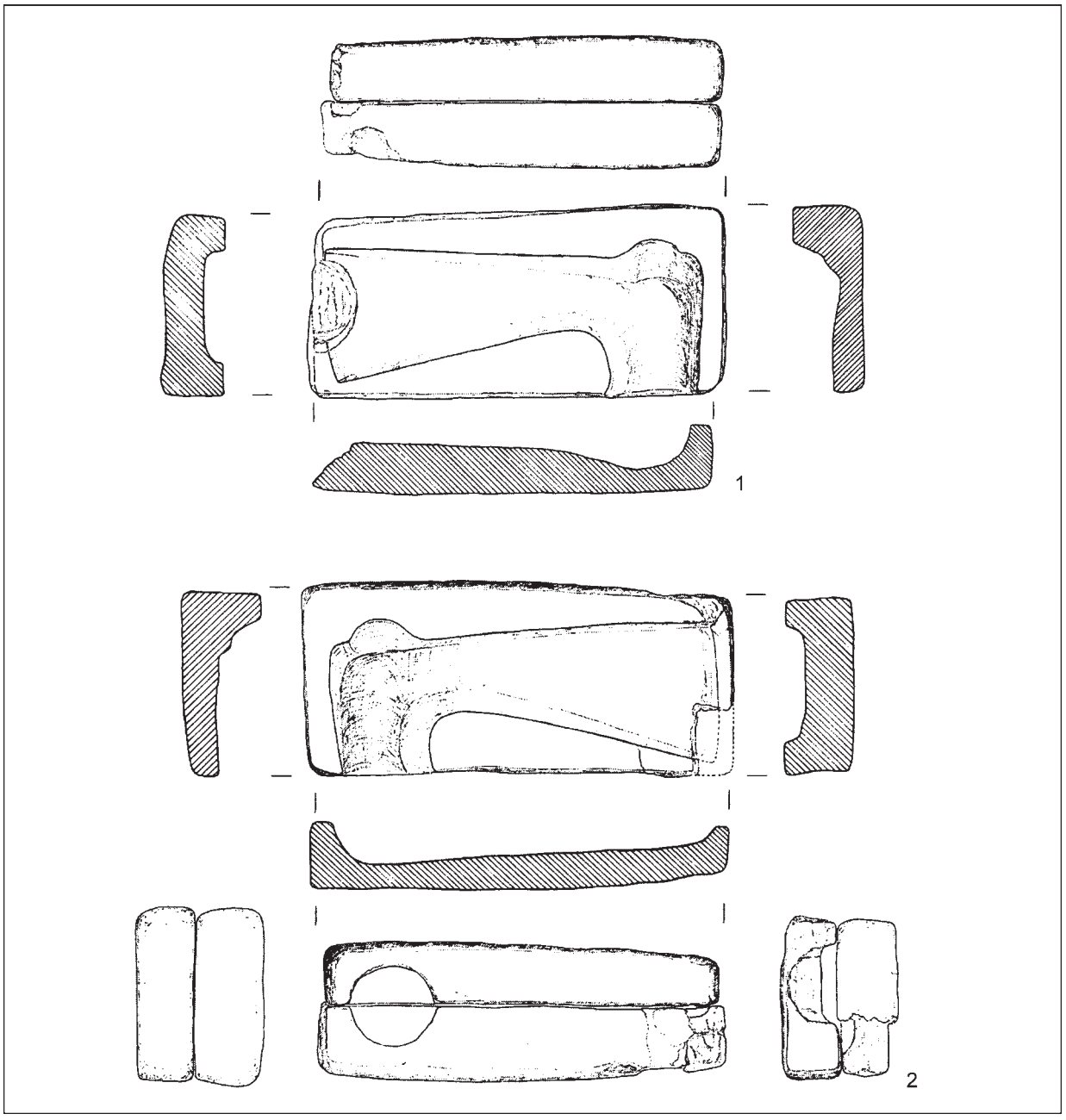

Fig. 24. Üllő, Pest county, Hungary. Clay casting moulds for shaft-hole axes of the Kozarac type (according to *Kövári/Patay 2005*).

represented by axes from Ožďany, Poprad region and Žitný ostrov. Analyses of chemical composition and content of isotopes, which was the basis for classification of axes into as many as five clusters, confirmed use of various types of copper ores from several sources. This supports the thesis that each exemplar might have been custom made and, thus, shaft-hole axes were not serially produced in large numbers (*Schreiner 2007*, 153, 172; *Schreiner/Heyd/Pernicka 2008*, 232). In this regard, it should be noticed that spectral analysis of axes showed that individual material groups differing from each other by higher contents of elements are located mainly in northern mountain ranges of the Carpathian basin, i.e. in the territory of today's Slovakia, Hungary, and Moravia (*Schreiner 2007*, 151).

All exemplars of shaft-hole axes from Slovakia were made of copper, except for the exemplar of the Fajsz type from Smolenice (Fig. 7: 4; *Farkaš 1997*, 10, fig. 2: 4), which contained only 58.4% copper (Cu) and was up to 35.1% lead (Pb) was added in the alloy (*Farkaš 1997*, 10, 15; *Farkaš/Plachá 2002*, 78). Thus, this

axe was made of lead bronze (*Longauerová/Longauer 1997*, 24). Such difference from other exemplars of axes can be considered evidence of metallurgists experimenting with quality of metal in the end of the Eneolithic (*Farkaš 1997*, 15).

L. Págo (*1970*, 19) earlier pointed to the fact that various types of used copper material can be an important chronological criterion. However, modern spectral analyses of shaft-hole axes have not confirmed this assumption, as some of their chronologically older exemplars (Baniabic and Fajsz types) were made not only from the identical kind of raw material but probably also from the raw material exploited from the same sources as their younger exemplars (Kozarac type). Axes from Senica (Baniabic type), Žitavany-Opatovce (Baniabic type) and Žitný ostrov (Kozarac type) are good examples of the above mentioned. All three exemplars were made of arsenic copper (Cu made up between 98.724% and 99.865%), which is contained in oxidized ores – malachite and pseudomalachite, whose sources in Central Slovakia occur in the area of Ľubietová and Špania dolina (*Schneider 2007*, tab. on p. 236–238). Nevertheless, we can also consider some sources in the Spišsko-gemerské rudohorie mountains, e.g. Smolník, Gelnica, Nandraž (*Farkaš/Ozdín 2002*, 133).

The above mentioned is confirmed also by the Kozarac type axes from Ožďany and Poprad region, where they were made of antimony copper (Cu made up between 90.889% and 98.587%), which is contained in sulfidic ores – tetrahedrite and chalcopyrite with sources also in Špania dolina, Poniky-Farbište deposit, Banská Štiavnica and Hodruša-Hámre (*Schneider 2007*, 159). These alloys of copper (Cu) with arsenic (As) and antimony (Sb) brought improvement of mechanical properties of shaft-hole axes as they made their quality similar to tin bronzes (*Longauerová/Longauer 1997*, 24).

Such variability of copper raw materials of which shaft-hole copper axes in Slovakia were made is confirmed by the Fajsz type axes from Veľký Slavkov and the second axe from Žitavany-Opatovce. They were both made of copper sulphide (cuprite) and copper share varied from 96.8% to 96.61% (*Schneider 2007*, 234).

From older analyses carried out in the 1960s, we can present results of the spectral analysis of the Baniabic type axe from Dolný Pial. Semiquantitative evaluation of individual trace elements' proportions showed that the axe was made of copper of eastern provenance, where Slovakia with its deposits belongs (*Žebrák 1995*, 18, 19). The accordance of its chemical composition with the chemical composition of the Slovak copper ore allows us to assume that the axe from Dolný Pial was made of copper obtained in this territory (*Págo 1970*, 20, 21).

All the presented analyses show that shaft-hole axes from Slovakia were most probably made of copper ore from local deposits. It is supported by the assumption of J. Dani and M. Kis-Varga, who think that the axes discovered in the western and northern parts of the Carpathian basin were made of copper from Slovak mountain ranges and raw material for the exemplars found east of the Tisza River was probably obtained in Transylvania (*Dani/Kis-Varga 2000*, 28). Eventually, spectral analyses have confirmed that the axe-hammer from burial 7 uncovered under the tumulus of the Pit-Grave culture in Sárrétudvari in the upper Tisza region in Hungary was made of copper ore from deposits located in Slovakia (*Dani/Kulcsár 2021*, 337). This discovery also implies that the Pit-Grave culture bearers were attracted to the plain terrain of Southwestern Slovakia and the Hronská tabuľa plain in particular by potential pastures but mainly by deposits of non-ferrous metals, i.e. copper, gold, and silver, which were situated in nearby mountains of Central Slovakia (*Bátora et al. 2023*, 12, 13). In association with shaft-hole axes, it is important that both types of copper raw materials, i.e. oxidative and sulfidic, were used as early as the classical stage of the Vučedol culture in the Northern Balkan-Southern Carpathian region (*Durman 1983*, 82).

OCCURRENCE OF SHAFT-HOLE AXES IN SLOVAKIA

Most shaft-hole axes were discovered in Southwestern Slovakia, two exemplars were found in Northern Slovakia and only a single axe was found in the south of Central Slovakia. Also, both casting moulds for such axes were found in Southwestern Slovakia (Fig. 25). In Southwestern Slovakia, axes and casting moulds occurred in various geomorphological environments – in the Chvojnická pahorkatina hills (Radimov, Senica), Little Carpathians (Smolenice), Podunajská rovina plain, Žitný ostrov (Veľký Meder – a casting mould), Tribeč (Nitra), Žitavská niva (Žitavany-Opatovce – two exemplars), Pohronská pahorkatina hills (Nevidzany – a casting mould) and Hronská tabuľa plain (Dolný Pial). In Northern Slovakia, two axes were discovered in the Popradská kotlina basin (Poprad region, Veľký Slavkov) and in the south of Central Slovakia, one axe was found in the Lučenská kotlina basin (Ožďany). As for the above-mentioned territories, the greatest concentration of axes is located in the northeastern part of Southwestern Slovakia, in the area between the central Nitra river

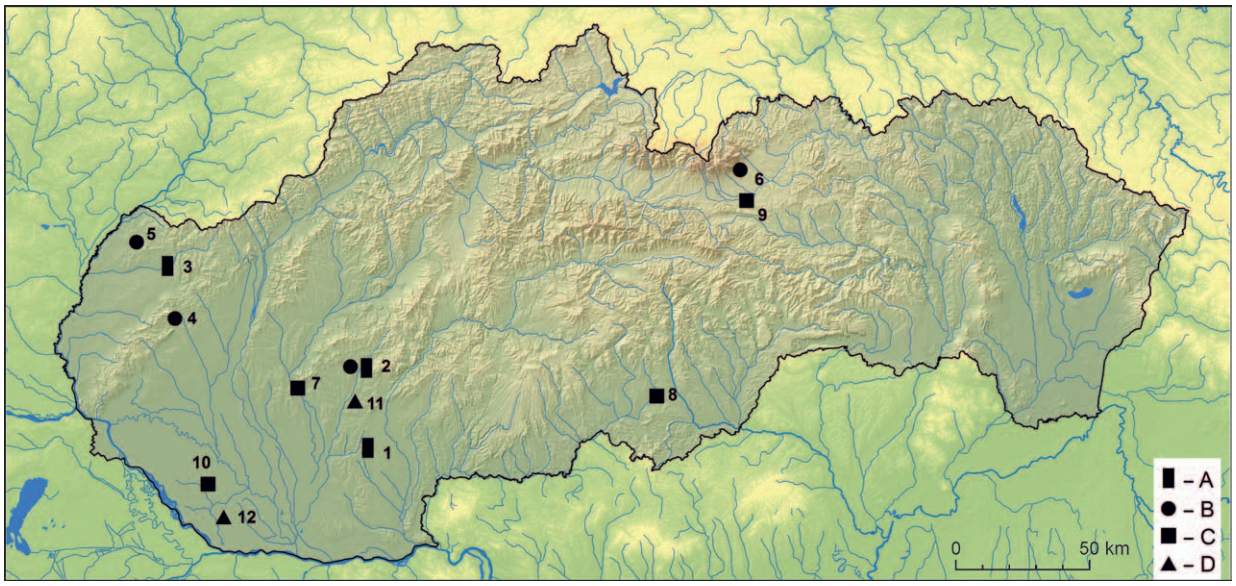

Fig. 25. Map of sites with individual types of shaft-hole axes and casting moulds from the territory of Slovakia. A – type Baniabic: 1 – Dolný Pial, Levice district; 2 – Žitavany-Opatovce, Zlaté Moravce district; 3 – Senica, Senica district; B – type Fajsz: 4 – Smolenice, Trnava district; 5 – Radimov, Senica district; 6 – Veľký Slavkov, Poprad district; C – type Kozarac: 7 – Nitra, Nitra district; 8 – Ožďany, Rimavská Sobota district; 9 – the vicinity of Poprad, Poprad district; 10 – Žitný ostrov (?); D – moulds for casting of the Kozarac type: 11 – Nevidzany, Zlaté Moravce district; 12 – Veľký Meder, Dunajská Streda district (two unknown sites and the site from the Trnava region are not indicated on the map – all three brought axes of the Baniabic type). Map by M. Bartík according to J. Batora's documents.

basin, upper Žitava river basin and the lower Hron river basin, i.e. in the area in the immediate vicinity of the ore-bearing mountains of Central Slovakia. Therefore, it is not surprising in this context that all three types of shaft-hole axes occurred in this region (Fig. 25: 1, 2, 7, 11).

If we have a look at the expansion of shaft-hole axes in Slovakia from the aspect of their individual types, we get the following picture – all the Baniabic type exemplars were found exclusively in Southwestern Slovakia, the Fajsz type axes also come mainly from Southwestern Slovakia and only a single exemplar was discovered in Northern Slovakia (Veľký Slavkov); the Kozarac type axes were also found mostly in Southwestern Slovakia and only single exemplars were found in Northern Slovakia (Poprad region) and in the south of Central Slovakia (Ožďany). Both exemplars of casting moulds were found in Southwestern Slovakia as well (Fig. 26: 1, 2; Nevidzany and Veľký Meder). These facts allow us to assume that the territory of Southwestern Slovakia was one of the metallurgical centres producing the Kozarac type copper axes in the Late and Final Eneolithic.

DISTRIBUTION OF SHAFT-HOLE AXES IN THE CULTURAL-HISTORICAL CONTEXT OF THE LATE AND FINAL ENEOLITHIC IN CENTRAL EUROPE

Apart from Slovakia, shaft-hole axes occur in Central Europe not only in the countries bordering it, i.e. Poland, Czech Republic, Austria, Hungary, Transcarpathian Ukraine; they occur also in Croatia, Slovenia, and Northern Italy. Naturally, their occurrence continues outside Central Europe, south-eastwards, to other countries – Romania, Serbia, Bosna-Hercegovina, Montenegro, Albania, Macedonia, Bulgaria and Greece (*Kalicz-Schreiber/Kalicz 1998*, fig. 3).

Hungary

Among the countries in the immediate neighbourhood of Slovakia, the highest number of shaft-hole axes and casting moulds for their production was found in the territory of Hungary (Fig. 26; 33). It is not surprising, as even more shaft-hole axes are

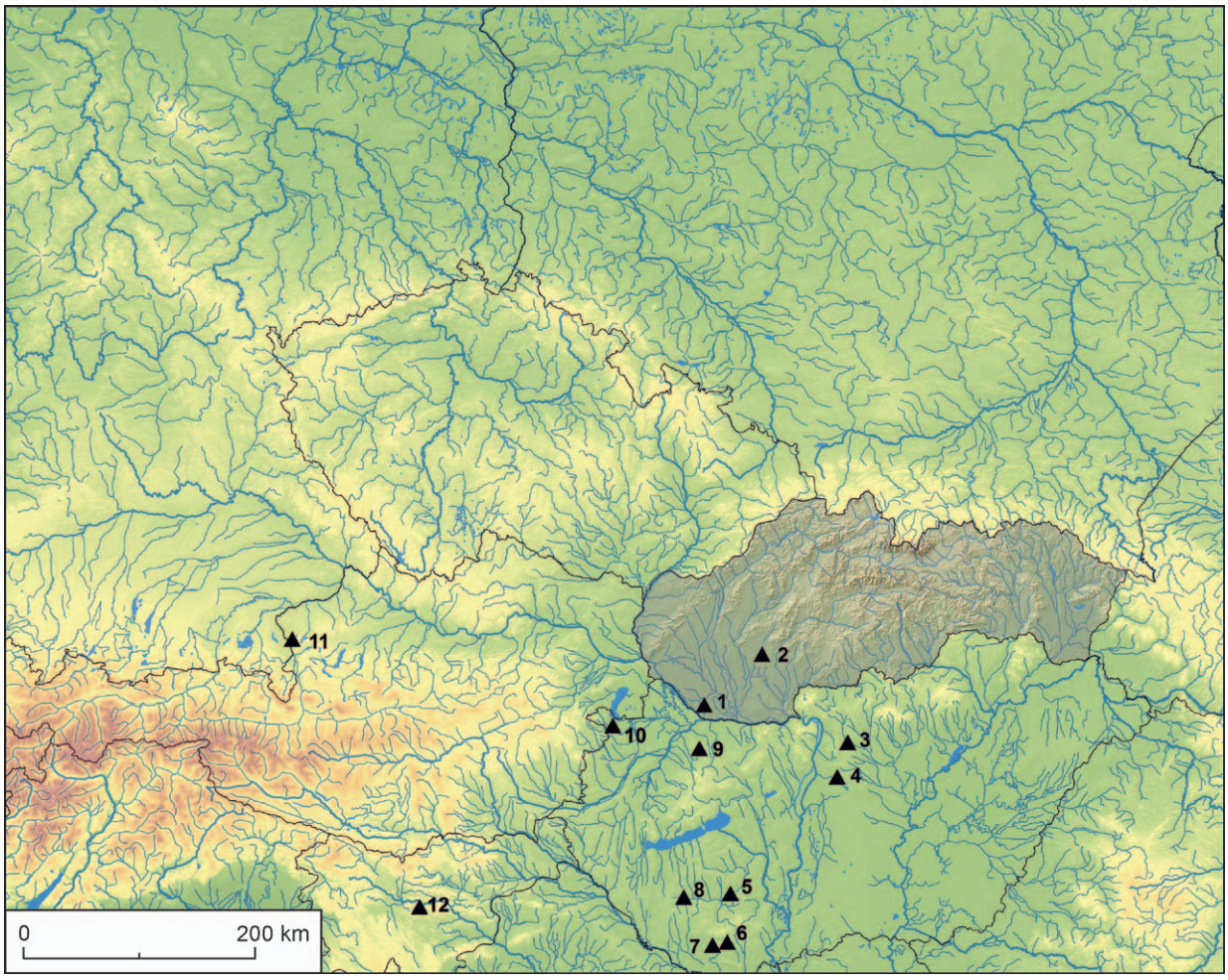

Fig. 26. Map of sites with casting moulds for shaft-hole axes in Central Europe. Slovakia: 1 – Veľký Meder, Dunajská Streda district; 2 – Nevidzany, Zlaté Moravce district; Hungary: 3 – Domony, Pest county; 4 – Üllő, Pest county; 5 – Döbrököz-Tűzköves, Tolna county; 6 – Pécs-Nagyárpád-Dióstetö, Baranya county; 7 – Zók-Várhegy, Baranya county; 8 – Kaposújlak, Somogy county; 9 – Ravazd-Villibald domb, Győr-Moson-Sopron county; 10 – Hidegség-Templom domb, Győr-Moson-Sopron county; Austria: 11 – Salzburg-Reinberg, Land Salzburg district; Slovenia: 12 – Ljubljana -Ljubljansko barje, Ljubljana district. Map by M. Bartík according to J. Batora's documents.

found in the countries south and southeast of Hungary. In Hungary, the typologically oldest shaft-hole axes of the Baniabic type occurred only in its western Transdanubian part (Fig. 27: 7, 8). Their absence in the eastern part, where the Great Hungarian Plain is situated, is surprising (*Kovács 1996*, 116), because, as we know, these axes originate in the Caucasus, in the Maykop and Novosvobodnaya cultures and they arrived in Central Europe with bearers of the Pit-Grave culture, whose presence in the eastern part of Hungary is confirmed by a high number of tumuli (*Ecsedy 1979*).

The map of sites with typologically more recent Fajsz type axes shows that most of them were found – unlike the Baniabic axes – in the eastern part of Hungary (Fig. 28; *Dani 2013*, fig. 2). However, we can note that only some of them are situated in the Great Hungarian Plain because other sites, including the depot from the eponymous site of Fajsz, are located near the left bank of the Danube. Two exemplars found in the Romanian part of the Tisza region can be added to the number of the Fajsz type axes in the Hungarian part of the Tisza basin (Fig. 28: 21, 22; *Vulpe 1970*, pl. 44A). It can be supposed that the highest concentration of the Fajsz type axes in the area east of the Danube and in the Tisza region suggests their possible connection with bearers of the Pit-Grave and Catacomb cultures, who infiltrated in the above defined area in the Late Eneolithic (*Ecsedy 1979*, fig. 3).

Sites with typologically youngest Kozarac type axes are – compared to the previous two types – more evenly spread in the whole area of Hungary

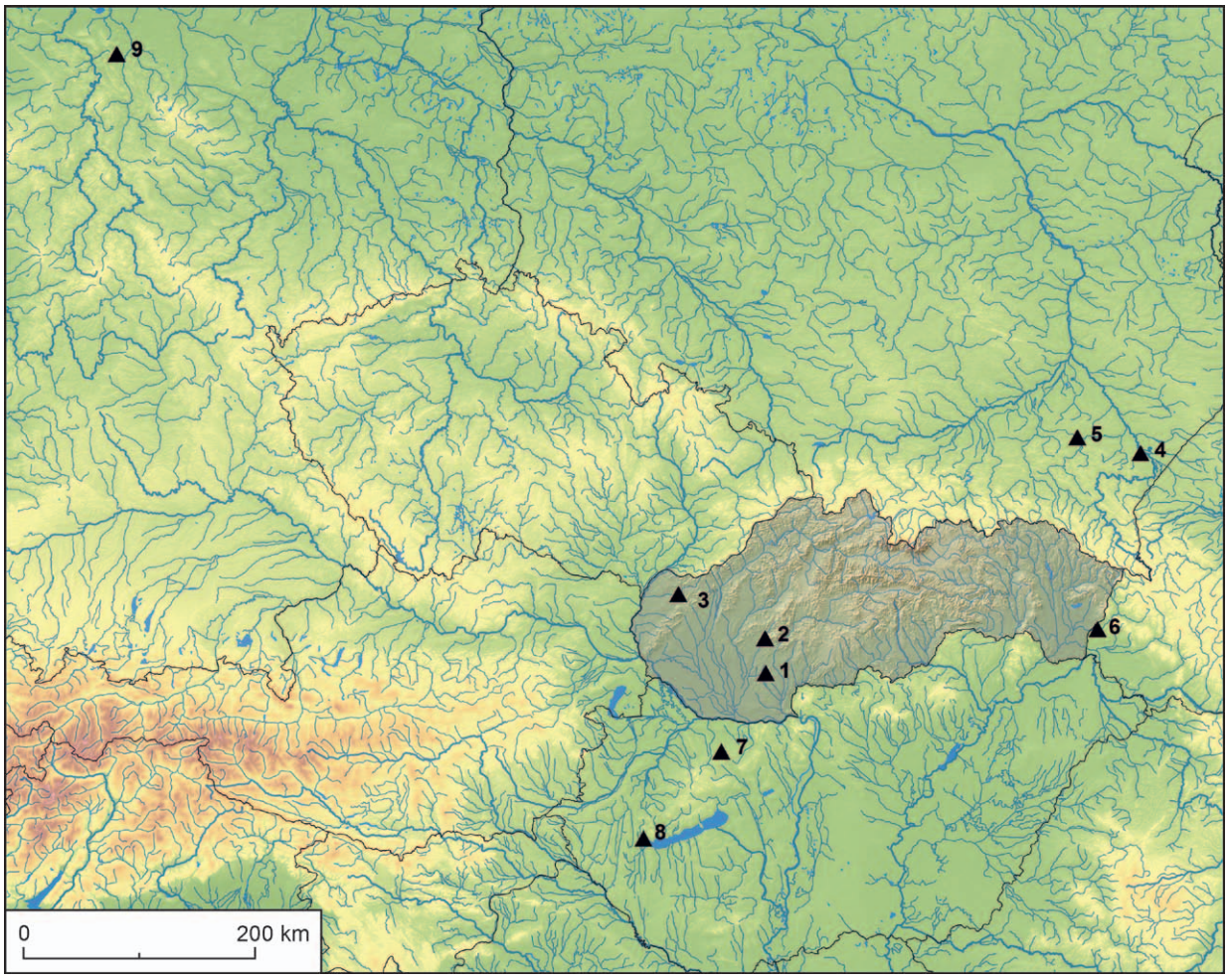

Fig. 27. Map of sites with shaft-hole axes of the Baniabic type in Central Europe. Slovakia: 1 – Dolný Pial, Levice district; 2 – Žitavany-Opatovce, Zlaté Moravce district; 3 – Senica, Senica district; Poland: 4 – Munina, Jarosław district; 5 – Rudna Mała, Rzeszów district; Transcarpathian Ukraine: 6 – the vicinity of Uzhhorod, Uzhhorodskyi district; Hungary: 7 – Kisbér, Komárom-Esztergom county; 8 – Keszthely-Alsódobogó, Zala county; Germany: 9 – Eldagsen, Springe district (three unknown sites from Slovakia and one unknown site from Austria are not indicated on the map). Map by M. Bartík according to J. Batora's documents.

(Fig. 29). Nevertheless, their concentration along the right (western) bank of the Danube is remarkable. In association with distribution of shaft-hole axes (all three types), in the territory of Hungary, we can say that most sites with finds of casting moulds for the Fajsz as well as Kozarac types are located in its western Transdanubian part (Fig. 26).

Poland

Another country bordering Slovakia where multiple exemplars of shaft-hole axes were found is Poland. Axes of the Baniabic type were found at two sites in the southeastern part of the country (Fig. 27: 4, 5; *Gedl 2000*, fig. 1–3; *Żaki 1960*, fig. 1: 1, 2). With regard to its geographical proximity, we can mention the individual find of axe of this type from Transcarpathian Ukraine, Uzhhorod region (Fig. 27: 6; *Jankovich 1931*, 20, 21, fig. III: 3), i.e. the region at the eastern border of Slovakia. Finds of typologically younger axes of the Fajsz type from the territory of Poland have not been documented yet, but typologically most recent exemplars of the Kozarac and Dumbrăvioara types are represented by multiple finds. As we have already said, the Kozarac type axes were found exclusively in the western part of Poland (Fig. 29: 6–8) and the Dumbrăvioara occurred in the western as well as southeastern parts of Poland (Fig. 29: 9–11).

Like in Germany (see below), in the lowland areas in the southern drainage basin of the Baltic Sea (Kujawy and Pomerania provinces) in Poland, there were several burials with bodies lying on

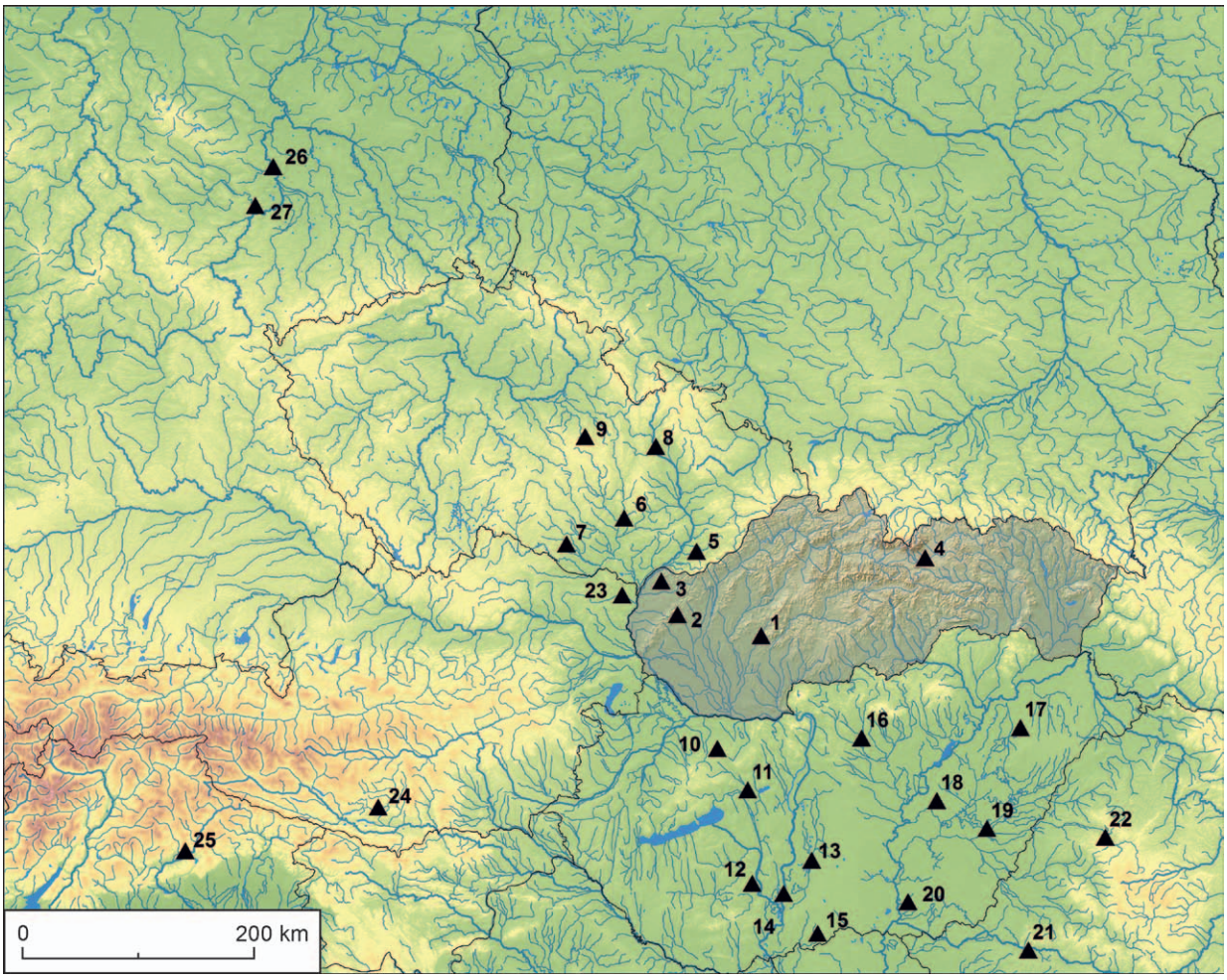

Fig. 28. Map of sites with shaft-hole axes of the Fajsz type in Central Europe. Slovakia: 1 – Žitavany-Opatovce, Zlaté Moravce district; 2 – Smolenice, Trnava district; 3 – Radimov, Senica district; 4 – Veľký Slavkov, Poprad district; Moravia: 5 – Vlčnov, Uherské Hradiště district; 6 – Brno-Líšeň, Brno-město district; 7 – Vevčice, Znojmo district; 8 – Stavenice, Šumperk district; Czechia: 9 – Proseč, Chrudim district; Hungary: 10 – Kisbér, Komárom-Esztergom county; 11 – Székesfehérvár, Székesfehérvár county; 12 – Tolna county; 13 – Akasztó, Bács-Kiskun county; 14 – Fajsz, Bács-Kiskun county; 15 – Bácsalmás, Bács-Kiskun county; 16 – Hatvan, Heves county; 17 – Hajdúdorog-Szállásföldek, Hajdú-Bihar county; 18 – Nagykunság (Mirha-Gád), region in Jász-Nagykun-Szolnok county; 19 – Szeghalom-Varjas-major, Békes county; 20 – Hódmezővásárhely, Csongrád-Csanád county; Romanian part of the Tisza region: 21 – Lipova/Lippa, Arad county; 22 – Vadul Crișului, Bihar county; Austria: 23 – Hauskirchen, Gänserndorf district; 24 – Ottilienkogel bei Glantschach, Sankt Veit an der Glan district; Northeastern part of Italia: 25 – Col de Buson, provincia di Belluno; Germany: 26 – Brachwitz, Saale district; 27 – Zscheiplitz, Querfurt district (two unknown sites with axes from Austria and two unknown sites with axes from Hungary are not indicated on the map). Map by M. Bartík according to J. Batora's documents.

the back in the so-called frog position in burials of the Corded Ware culture (burial 1 in Żuków; *Marciniak 1960*, fig. 7; burial 2711 in Kietrz; *Machnik 1979*, fig. 218 B; Krusza Zamkowa 3, Pikutkowo 6; *Kośko 2014*, fig. 9B; 10) and in a burial of the Bell Beaker culture (Samborzec; *Kamieńska/Kulczycka-Leciejewiczowa 1970*, fig. 12). Here, we can mention catacomb burials known from the Złota culture as well as the Corded Ware culture in Lesser Poland (*Wlodarczak 2014*, fig. 7). According to A. Kośko and P. Wlodarczak, there is numerous evidence in the local Corded Ware culture communities from the period of 2550–2400 BC confirming reception of the Black Sea burial customs from the late Pit-Grave and Catacomb cultures (*Kośko/Wlodarczak 2018*, 281).

The above-mentioned reception does not apply only to burial customs but also grave goods in burials of the Corded Ware culture, also from the territory of Poland (Kujawy-Pomerania Province). In association with this, we can mention an older find of a probably wooden composite bow from Bożejewice 8, feature 32 (*Kośko 2014*, fig. 8) and

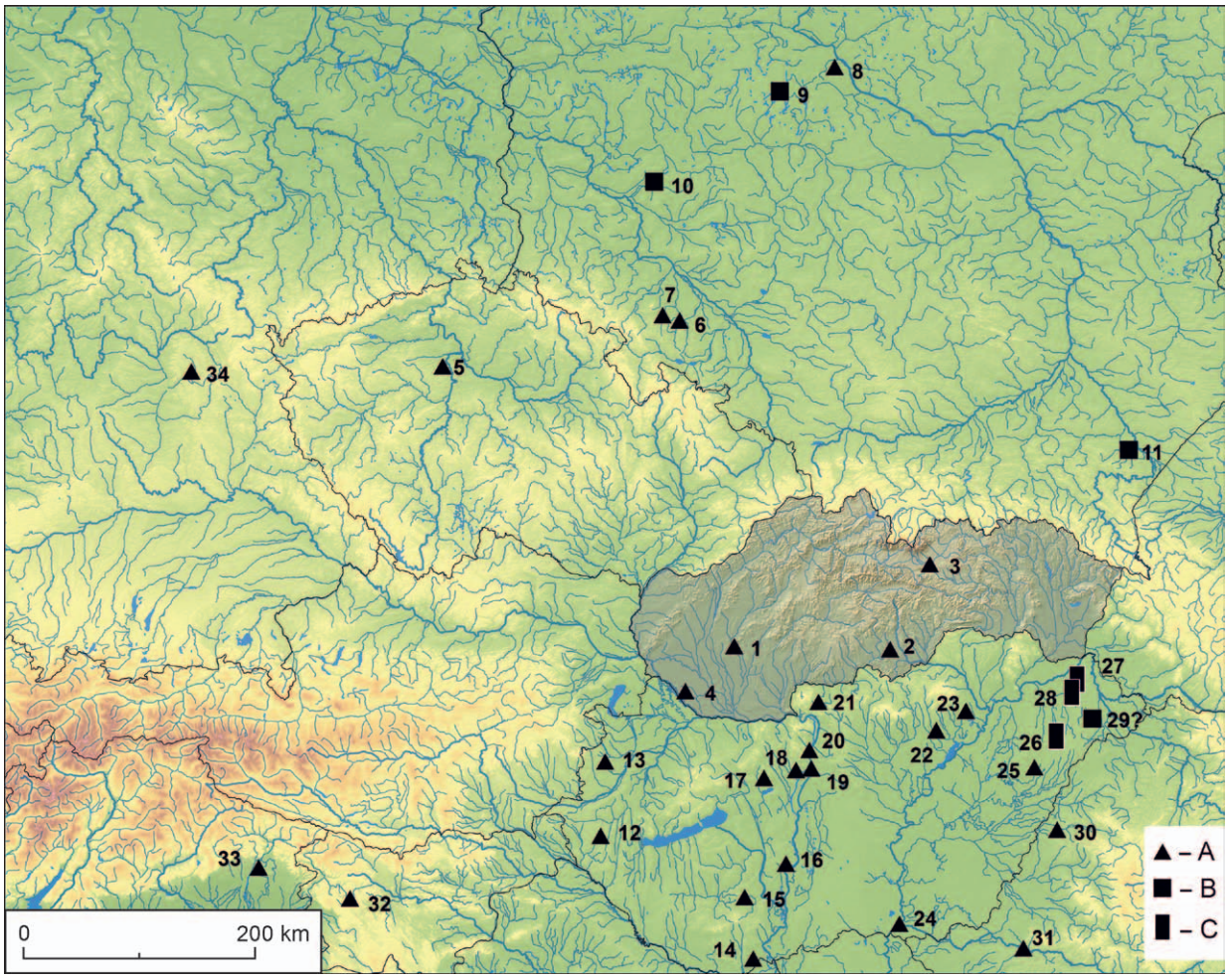

Fig. 29. Map of sites with shaft-hole axes of the Kozarac and Dumbrăvioara types in Central Europe. Slovakia: 1 – Nitra, Nitra district; 2 – Ožďany, Rimavská Sobota district; 3 – the vicinity of Poprad, Poprad district; 4 – Žitný ostrov (?); Czechia: 5 – Otvovice, Most district; Poland: 6 – Strzelin, Brzeg district; 7 – Radzików, Wrocław district; 8 – Ośno, Alexandrów district; 9 – Kwieciszewo, Mogilno district; 10 – Leszno, Leszno district; 11 – Szczytna, Jarosław district; Hungary: 12 – Lickóvadamos, Zala county; 13 – Acsád, Vas county; 14 –Majs, Baranya county; 15 – Nagyvejke, Tolna county; 16 – Dunakömlőd, Tolna county; 17 – Lovasberény, Fejér county; 18 – Érd, Pest county; 19 – Budapest-Csepel, City District XXI.; 20 -– Budapest-Óbuda, City District III.; 21 – Tolmács, Nógrád county; 22 – Szihalom, Heves county; 23 – Emőd-Nagyhalom, Borsod-Abaúj-Zemplén county; 24 – Tápé, Csongrád-Csanád county; 25 – Debrecen, Hajdú-Bihar county; 26 – Bálkány-Abapuszta, Szabolcs-Szatmár-Bereg county; 27 – Kisvárda region, Szabolcs-Szatmár-Bereg county; 28 – Nyírtass, Szabolcs-Szatmár-Bereg county; 29 – Szabolcs county; Romanian part of the Tisza region: 30 – Oradea, Bihar county; 31 – Paulis, Arad county; Northern part of Slovenia: 32 – Ljubljana-Ljubljansko barje, Ljubljana district; Northeastern part of Italia: 33 – San Daniele del Friuli, provincia Udine; Germany: 34 – Waischenfeld-Breitenlesau, Bayreuth district (one unknown site with an axe from Moravia, two unknown sites with axes from Austria and one unknown site from Hungary are not indicated on the map – they all brought axes of the Kozarac type; one unknown site from Poland with an Dumbrăvioara axe is not indicated either). A – Kozarac type axes; B – Dumbrăvioara axes; C – hybrid exemplars axes of the Kozarac type – Nyírtas subtype (C – according to *Dani 2013*). Map by M. Bartík according to J. Batora's documents.

several exemplars of bone pins with hammer-shaped heads (Biskupiec, Biskupiec-Dojlidy and Gromowo; *Kośko 2014*, fig. 11: 1–3). In this context, the find of a shaft-hole axe of the Dumbrăvioara type from Szczytna in the southeastern part of Poland is particularly important. It was discovered in burial 4 of the Corded Ware culture (Fig. 18: 4; *Hozer/Machnik/Bajda-Wesolowska 2017*, 96, fig. 48: 1).

Probable cultural context of the Popradská kotlina basin in northern Slovakia and southeastern Poland with Transylvania (?)

Regarding the finds of two shaft-hole axes in the Popradská kotlina basin in Northern Slovakia (Fig. 7: 3; 12: 2), we encounter the opinion that they might originate in the area of Transylvania in today's Ro-

Fig. 30. Gánovce, Poprad district, Slovakia. 1 – flat metal axe with side protuberances; 2–4 – pottery (according to *Novotný/Kovalčík 1977*).

mania (*Novotný/Kovalčík 1977*, 9; *Novotný/Novotná/Kovalčík 1991*, 27). The authors arrived at this assumption thanks to the mountainous environment as well as observation of several similarities in the material culture. The territory of Transylvania was settled by bearers of the Schneckenberg culture and in the Popradská kotlina basin, Gánovce, pottery with several similarities with the pottery from the eponymous site of Schneckberg was discovered. This pottery includes, e.g. a simple cup (Fig. 30: 2; *Novotný/Kovalčík 1977*, tab. XIII, no. 1404), which is almost identical with the cups from the site of Schneckenberg, i.e. from stage B of the Schneckenberg culture (*Prox 1941*, tab. XXI: 4, 5) as well as a jugs of the Nagyrév character (Fig. 30: 3, 4; *Novotný/Kovalčík 1977*, tab. XIII, no. 1613; 3410), which are very close to jugs from the above mentioned site (*Prox 1941*, tab. XXIV: 4, 5).

Besides the already mentioned pottery vessels, both territories are connected by the unusually high number of miniature animal figurines made of clay. They are mainly figurines of sheep, goat, and cattle. The question is what it might mean. One possible explanation is that part of this material arrived in the Popradská kotlina basin from Transylvania with migrating shepherds when they were searching for better pastures for their herds of sheep, goat or cattle. Therefore, it cannot be ruled out that it might be a specific form of transhumance within the East Carpathian arch (*Novotná 2006*, 8). Even Polish investigators admit a certain form of rotational shepherding in the Kańczucka upland in Southeastern Poland in association with the Corded Ware culture burial grounds in Szczytna and Mirocin (*Machnik/Jarosz/Mazurek 2019*, 129, 130), In this context, it is also possible that the Dumbrăvioara axe might have arrived in Szczytna in Southeastern Poland with the assumed migrations from Transylvania along the massive of the Carpathians. Naturally, such hypothetical mobility of shepherds with herds in the Late and Final Eneolithic might be definitely confirmed by strontium and oxygen isotope analyses of animal bones (mainly teeth) from small ruminants and bovine from both discussed Carpathian regions.

Finally, evidence of migrating population of the Livezile cultural group (which is a result of mixing the local Coţofeni culture substrate with elements of the Glina-Schneckenberg culture) from Western Transylvania to the upper Tisza region in Hungary, where presence of the Pit-Grave and Catacomb cultures is documented, is proved by paleogenetic analyses (*Gerling/Ciugudean 2013*, 181, 182). As for the topic of shaft-hole copper axes, results of the excavation of the tumulus in Šurany in Southwestern Slovakia can be considered important (*Novotná/Paulík 1989*, 368). They suggest that migration from the territory of the Livezile group in Transylvania reached further to the north in the Carpathian territory than previously assumed. In the central burial of the Šurany tumulus, which was secondarily opened, fragments of pottery were found bearing traces of the Danube-Balkan complex of the Early Bronze Age, which is close mainly to the

Somogyvár-Vinkovci, on the one hand (*Novotná/Paulík 1989*, 368–373) and on the other hand, close analogies in the western part of Transylvania can be identified in the pottery. Pottery similar to that from Šurany exists in the mounds of the Livezile group in Ampoița-Peret (tumuli II and IV; *Ciugudean 1991*, fig. 22: 8; 23: 5, 20) and Livezile-Deaul Sarbului (*Ciugudean 1996*, fig. 21: 12). In this pottery, we can – like in the Sárrétudvari-Őrhalom tumulus in the upper Tisza region – observe also a domestic element represented by pottery close to the Kosihy-Čaka-Makó culture (*Kulcsár/Szeverényi 2013*, fig. 6: 1, 2). This information brings us to a justified assumption that the situation in the tumulus in Šurany might evidence mobility similar to the mobility detected by means of analyses of strontium and oxygen in the population of the Livezile group and the Pit-Grave and Catacomb cultures buried in the Sárrétudvari tumulus in the Great Hungarian Plain (*Gerling/Ciugudean 2013*, 181, 182).

In association with the finds of shaft-hole axes of the Fajsz and Kozarac types in Northern Slovakia, in the Popradská kotlina basin, we can point to the unusual find of a flat axe with protuberances on both sides from Gánovce (Fig. 30: 1; *Novotný/Kovalčík 1977*, tab. XV, no. 3457). H. J. Hundt observed a similarity between this find from Gánovce and narrow chisels from Asia Minor and the Caucasus, which arrived in Central Europe in the final stage of the Eneolithic, corresponding with the Vučedol cultural complex (*Hundt 1970*, 343). It might have been a cultural stream bringing multiple technical innovations in the Carpathian-Balkan territory and Central Europe. This is supported also by the fact that a narrow chisel with side protuberances occurred in the depot from the Fajsz site in Hungary as well (*Kalicz 1968*, tab. I: 17), where it was accompanied by three exemplars of shaft-hole axes of the Fajsz type and another chisel of the Caucasus type (*Kalicz 1968*, tab. I: 16, 19–21) found, e.g. in the depot from Brno-Líšeň (*Benešová 1956*, fig. 1: 2).

Although this type of axes with side protuberances has not occurred in the Caucasus before, a casting mould for their production was found in the bottom cultural layer (layer C1) at the settlement of the Kura-Araxes culture in Kvacchelebi, which is evidence of local production (*Rysin 2008*, 202, 203, fig. 12: 2). An axe with side protuberances similar to the exemplar from Gánovce comes from, e.g. Tureng Tepe in Northeastern Iran and from Altyndepe in Turkmenistan (*Rysin 2008*, fig. 12: 3, 4). This type of axes was spread also in the eastern Mediterranean territory from Palestine to Central Anatolia and was made only in the 3rd millennium BC (*Wesse 1990*, map 3; 5; 19).

Moravia and Czechia

It can be logically assumed that shaft-hole axes of the Fajsz and Kozarac types arrived in the territory of the northeastern part of Lower Austria and in Southern, Eastern and Central Moravia with bearers of the Kosihy-Čaka-Makó culture, whose settlement has been documented in both areas (*Medunová-Benešová 1981*, fig. 1; *Ruttkay 1983*, fig. 70). The axes were most probably made in metallurgical centres in the western part of Hungary, or in the territory of the neighbouring Southwestern Slovakia, i.e. the regions intensely settled by the Kosihy-Čaka-Makó culture bearers (*Beljak-Pažinová/Beljak 2014*, fig. 1; *Kalicz 1968*, fig. 3).

The question is how shaft-hole axes arrived west of Moravia, to the territory of today's Czechia. As we have mentioned before, the so-called Trstenická stezka road seems to be the most easily passable place in the terrain. Its possible use was pointed to by *J. Frolík* (*1981*, 317), in association with the find of the Fajsz type axe from Proseč in Eastern Czechia (Fig. 28: 9). It is also suggested by finds of the Bošáca culture in Eastern Czechia (*Kalferst/Prostředník 1998*, fig. 1) which are clearly a result of its bearers' arrival from Moravia through the Svitavská pahorkatina hills as far as the territory of the Východolabská tabule plain. With the current state of investigation, it is hard to say whether the Trstenická stezka road was later used by bearers of the Kosihy-Čaka-Makó culture and the Corded Ware culture who might have participated in the transfer of the Fajsz type axe to Proseč, Chrudim district, in Eastern Czechia and the Kozarac type axe to Otvovice, Kladno district, in Central Czechia (Fig. 29: 5). The possibility that it could have been bearers of the Vučedol cultural complex is supported by finds of the so-called Slavonic bowls on stems, or bowls of the Ljubljana type, in Eastern, Central and Northwestern Czechia (*Novotný 1955*, 48–50, map 1). In this context, the fact that bowls occur at settlements of the Řivnáč culture is not necessarily a problem (*Turek 1997*, 30). Both cultures existed parallelly for some time in the beginning of 3000 BC. While the Řivnáč culture demises around 2800 BC (*Zápotocký/Zápotocká 2008*, fig. 142), the classical stage of the Vučedol culture begins around 2900 BC (*Durman/Obelić 1989*, tab. 1). The findings of bowls of the Schönfeld culture (widespread in central Germany) at burial sites of Corded Ware culture in Moravia (Vyškov-Nosálovice; *Mikulková 1998*, 212; Slížany; *Chleborád 1934*, 18) evidently points also to the possible use of Trstenicka stezka road by bearers of Corded Ware culture. It is worth mentioning that while we encounter remarkable presence of artefacts and elements of the burial rite from Eastern Europe,

i.e. the Pit-Grave and Catacomb cultures in Poland and Germany, such expressions are much rarer in Czechia. Paradoxically, elements from Eastern Europe were more intense in Czechia as late as the early stage of the Únětice culture. In the burial rite, it is documented by, e.g. burials with bodies in the so-called frog position (e.g. Cerhenice, burial 15; *Dvořák 1932*, 12; Kbely u Prahy; *Stocký 1926*, 16; Kolín; *Dvořák 1931*, tab. II: 13) and among finds, there were e.g. staff-shaped pins made of antler whose models were found in pins with hammer-shaped heads (e.g. Blšany, burial 38; *Pleinerová 1960*, fig. 21; Hradenín; *Dvořák 1931*, fig. 1: 1, 2).

Austria and Northern Italy

It can be supposed that exemplars of axes close to the Fajsz and Kozarac types arrived in the Alpine region of Austria and Northern Italy from the Vučedol-Zók metallurgical centre in the Southern Carpathian-Northern Balkan territory. It is documented by finished exemplars from Austria (Fig. 28: 24; Ottilienkogel bei Glantschach; *Mayer 1977*, tab. 5: 41) and Northeastern Italy (Fig. 28: 25; Col de Buson, near Belluno; *Hansen 2021*, fig. 6, map 4: 33; San Daniele del Friuli and Aquilea; *Tasca/Visentini 2009*, fig. 1; 2: 8, 9; 3: 1, 32). Local production of the Kozarac type axes is evidenced by the casting mould from Salzburg-Reinberg (Fig. 26: 11; *Hell 1943*, fig. 1: 1a, b).

Germany

In association with the westernmost expansion of shaft-hole copper axes in Europe in Germany, a question arises how the Baniabic type axes (Eldagsen; Fig. 27: 9), Fajsz type axes (Braschwitz, Zcheiplitz; Fig. 28: 26, 27) and Kozarac/Stublo type axes (Waischenfeld-Breitenlesau; Fig. 29: 34) arrived so far to the west. Certain indices for the answer to this difficult question are suggested by several facts related to the material as well as the burial rite. In Central Germany, near the sites (Braschwitz, Zcheiplitz), a pit with a hammer-shaped head made of antler occurred in a burial with corded ware in Egeln-Nord (former Bleckendorf; *Kaiser 2019*, fig. 143); at the burial ground in Profen, where bearers of the Bell Beaker and Únětice cultures were buried, imitations of this type of pins made of antler were discovered as well (*Kaiser 2019*, 260).

Pottery material close to the Kosihy-Čaka-Makó culture occurred at another burial ground of the Bell Beaker culture in Schweta in Saxony (between today's Dresden and Leipzig). According to M. Conrad and S. Conrad, burials with such material are so-called syncretic burials with various mixed elements also associated with pottery (*Conrad M./Conrad S. 2015–2016*, 33). Thus, they consider possible mobility of small groups of people from the territory of Czechia or Southeastern Europe to the region of today's Saxony (*Conrad M./Conrad S. 2015–2016*, 34). In relation to this, certain signs of expansion of the Kosihy-Čaka-Makó culture bearers along the Danube, westwards to several sites in Lower Austria, can be considered noteworthy. The site of Zelking-Matzleinsdorf (near Melk) is the westernmost (*Lenneis/Neugebauer-Maresch/Ruttkay 1995*, 194). Another important fact is that in the same area in the western part of Lower Austria, mainly in the Traisen river valley, settlement of the Corded Ware culture was detected. It is represented by a considerably high number of burials (*Neugebauer 1994*, 23–35). Therefore, we should suppose that bearers of both cultures were in the immediate touch in this region. With regard to evidence of the Corded Ware culture settlement further to the west of Germany, it is most probable that the pottery close to the Kosihy-Čaka-Makó culture arrived to today's Saxony with its bearers. Moreover, it seems that it was not only pottery, but also metallurgical products of the Vučedol-Zók cultural complex, which enriched the inventory of the Corded Ware culture people, mainly in its younger stage of development. It is attested by the find of a copper knife in a burial of the Corded Ware culture in Kösching in Upper Bavaria (*Tillman/Pernicka/Ruthenberg 1996*, fig. 3: 5) with an analogous exemplar from a burial of the Kosihy-Čaka-Makó culture in Šaľa, Southwestern Slovakia (*Vladár 1967*, fig. 92). In this context, it is important that the knife from Kösching is close to Western Balkan copper artefacts from the Late Eneolithic with its chemical composition (*Tillman/Pernicka/Ruthenberg 1996*, 378). We should also remember the above mentioned unique find of Kozarac type copper axe from the site of Waischenfeld-Breitenlesau in Bavaria (*Abels 2000*, fig. 25; 26).

Bearers of the Corded Ware culture were probably mediators of individual elements of the burial rite originating in the Black Sea territory of the Pit-Grave and Catacomb cultures. In this context, we can mention arranging the dead in the so-called frog position occurring at the burial ground of the Proto-Únětice culture at the site of Nohra also located in Central Germany (*Schmidt-Thielbeer 1955*, 108). Similar position of the dead was found at the burial ground of the Corded Ware culture in Lauda-Königshofen in the west of Germany (Baden-Württemberg), in burial 15 (*Oeftinger 1999*, fig. 38), which is approximately 100 km far to the west from

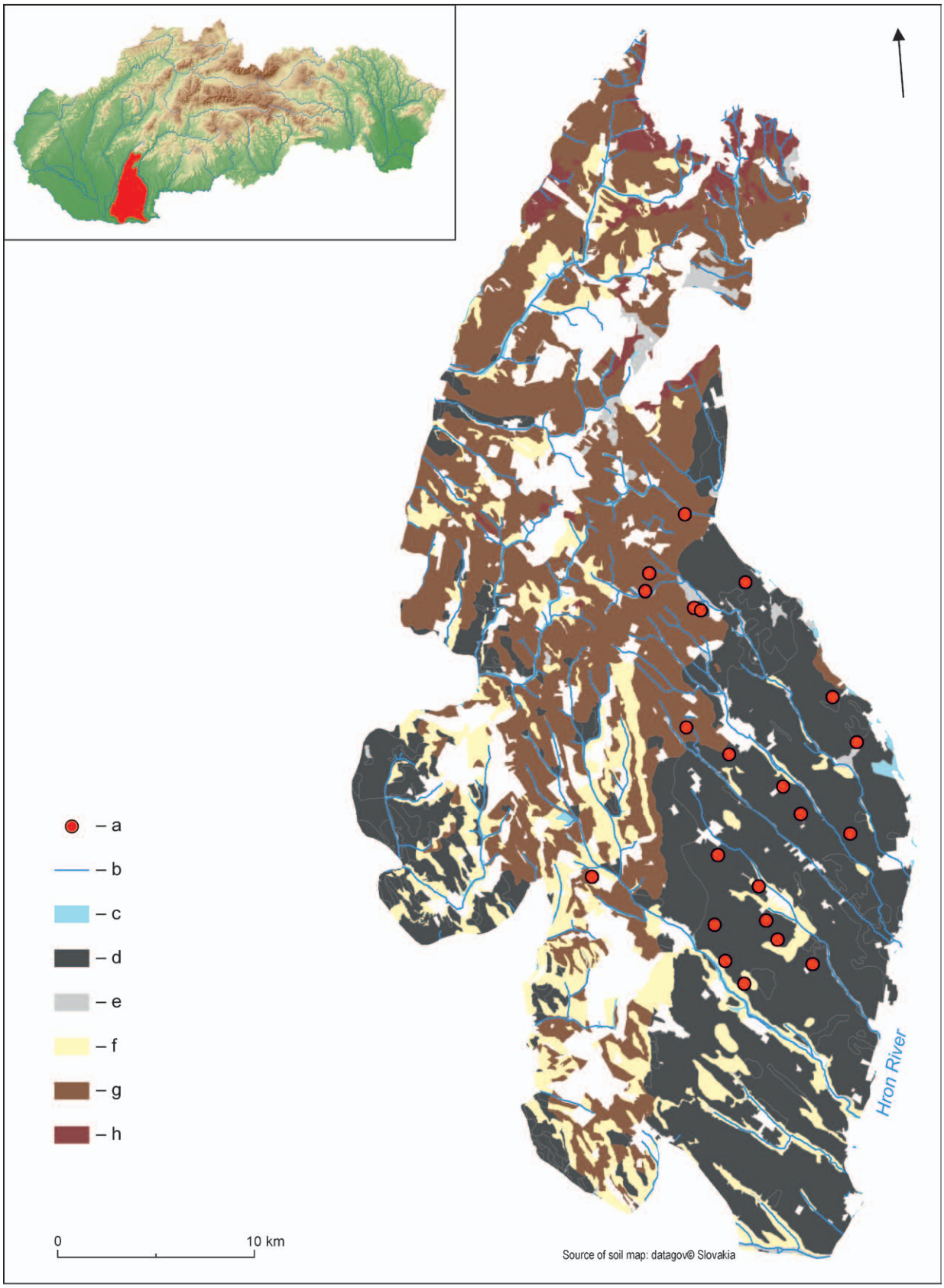

Fig. 31. Soil map of Hronská tabuľa/SW Slovakia with sites of barrows probably of the Yamnaya culture (according to *Bátora et al. 2023*). Legend: a – mounds; b – streams; c – fluvisols; d – chernozems; e – gleysols; f – regosols; g – brown soils (luvisols); h – cambisols.

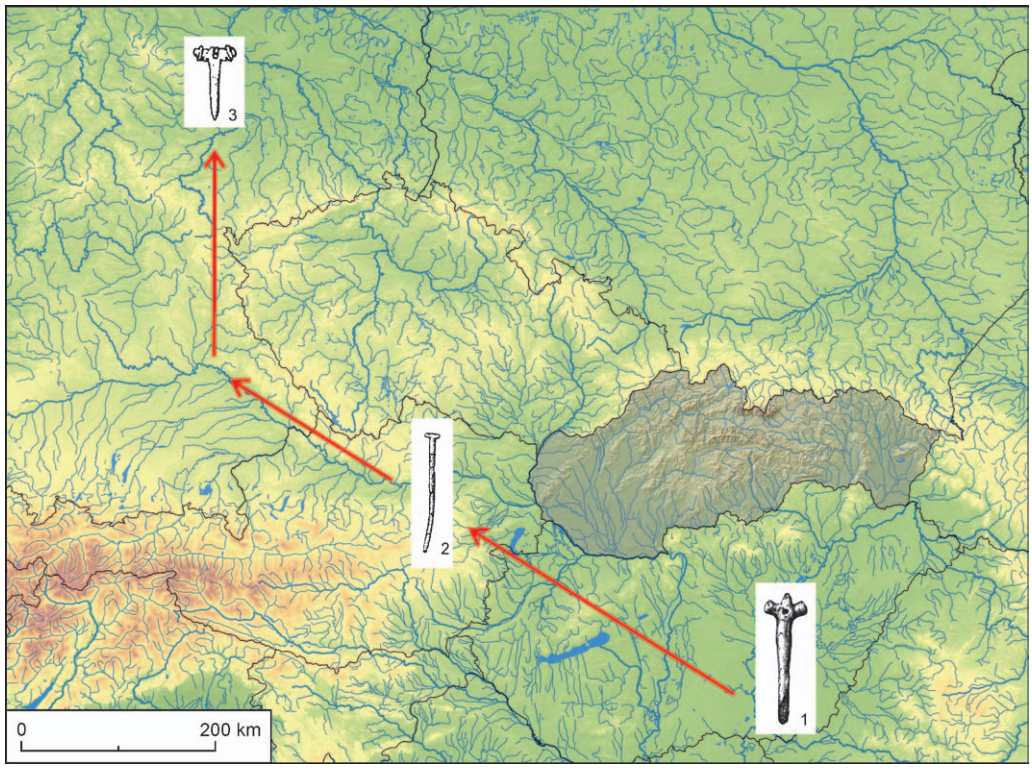

Fig. 32. Map of three sites with antler pins with the hammer-shaped head. 1 – Szarvas, Békes county/Hungary; 2 – Franzhausen, St. Pölten district/Austria; 3 – Egeln-Nord (former Bleckendorf), Salzland district/Germany (according to *Gessner* 2005; *Kalicz 1968*; *Neugebauer 1994*).

the site of discovery of the Kozarac-Stublo axe in Waischenfeld-Breitenlesau.

Migration of the Corded Ware culture is also suggested by paleogenetic analyses with high values of strontium isotopes as well as the high negative value of oxygen isotopes detected with one of the females buried at the burial ground in Lauda-Königshofen. From the aspect of genetics, these values probably indicate her eastern origin (*Sjögren/Price/Kristiansen 2016*, fig. 3: 13; 14). Possible validity of this result of the paleogenetic analysis from Lauda-Königshofen for the studied period also in the wider region of Central Europe is confirmed by elements of the Pit-Grave and Catacomb cultures in the burial rite as well as grave goods from other regions of Central Europe as well (*Bátora 2006*, fig. 134). New paleogenetic data confirm that at least 75% of the Corded Ware culture population was genetically close to the Pit-Grave culture (*Haak et al. 2015*).

The above-described process of the mediating role of the Corded Ware culture might have taken place as early as the first half of 3000 BC, when presence of the bearers of the Pit-Grave and Catacomb cultures is distinctly documented in the Hungarian part of the Tisza river valley (*Ecsedy 1979*, fig. 3) with numerous burials under tumuli. Nevertheless, there are multiple signals that bearers of both cultures might have occurred also in Southwestern Slovakia, mainly its eastern part – the lower Hron river valley and the Žitava river valley (Fig. 31; *Bátora 2021*, fig. 11–14; *Bátora et al. 2023*, fig. 3). Thus, the distance between the relevant territories was probably not too long for mediation of elements of Eastern European character by the Corded Ware culture population.

Possible use of the road along the Danube from the Carpathian basin westwards for mediation is supported by traces of settlement by the Corded Ware culture not only in the territory of Lower Austria but also in Southern and Northern Bavaria, Baden-Württemberg, etc. (*Buchvaldek 1998*, fig. 1). Some artefacts also suggest this direction of transfer – the above-mentioned hammer-headed antler pins occurring in Eastern Hungary, Szarvas site (*Kalicz 1968*, tab. CXII: 21), as well as in the western part of Lower Austria, in Franzhausen-Mitte (*Neugebauer 1994*, fig. 6: 1) and in the above-mentioned sites in Central Germany – Egeln-Nord (former Bleckendorf) and Profen (Fig. 32; *Kaiser 2019*, fig. 143; 260).

These findings indicate that similar cultural-historical processes took place in the territory of the central and upper Danube regions – in association with the Corded Ware culture and its reception and transfer of material and burial customs of the final

stage of the Pit-Grave and Catacomb cultures – and in the territory north of the Carpathian arch in today's Poland (*Kośko/Wlodarczak 2018*, 281). However, there was a difference. The Corded Ware culture settled north of the Carpathian arch was – with regard to the geographical location – in a much closer contact with the Black Sea region, which was the primary territory of the Pit-Grave and Catacomb cultures, than bearers of the Corded Ware culture in the central and upper Danube region. They obviously had only an indirect contact with the territory mediated by bearers of the final stage of the Pit-Grave and Catacomb cultures, who arrived in the Balkan and Carpathian environment from the Black Sea region along the Danube. Moreover, we must assume presence of cultures of the Vučedol-Zók cultural complex, whose individual cultures survived in a considerably long period – from the developed Late Eneolithic to the beginning of the Bronze Age (according to the classification used in Slovakia) and in the whole FB I stage and partly in FB II stage of the Early Bronze Age in Hungary (*Bartík/Elschek/Varsik 2013*, 37; *Kalicz 1998*, 14; *Kulcsár 2002*, 441). Therefore, its existence chronologically corresponds with the period approximately between 2800/2700 BC and 2400/2300 BC (*Stadler/Ruttkay 2007*, fig. 8).

These facts were naturally reflected in the various intensity of reception of elements from the final stage of the Pit-Grave and Catacomb cultures in both above mentioned regions, in favour of the Northern Carpathian territory. Thus, it can be stated that bearers of the Corded Ware culture play an important role in the expansion of shaft-hole axes in Northwestern Europe during the Final Eneolithic.

DATING OF SHAFT-HOLE AXES

For objective reasons, evidence for absolute dating of shaft-hole copper axes is absent in Slovakia, thus, we can rely only on data from nearby areas for more exact dating of the axes. However, it must be stated that there are not direct data on absolute dating of the typologically oldest axes of the Baniabic type in Central and Eastern Europe. Their ancient origin is suggested by their typological similarity with groups 2 and 3 of axes of the Maykop and Novosvobodnaya cultures in the Northern Caucasus (*Korenevskiy 1974*, 24), where their origin is searched. From the large number of excavated burials, we can mention the axes discovered at the tumulus ground of Klady, in tumulus 30, burial 1, and tumulus 31, burial 5, which are dated to the last third of the 4th millennium BC at the latest (*Bátora 2016*, 15, fig. 2: 16; *Hansen 2009*, 147, fig. 12: 3, 4).

Dating of the Baniabic type axes in Central Europe relies mainly on data of relative chronology. In this context, the stratigraphy documented at the hill-top settlement of the Jevišovice culture called Staré Zámky in Brno-Líšeň appears to be particularly important. A depot of copper artefacts containing a shaft-hole axe of the Fajsz type, a flat axe, a chisel and an awl was discovered in the most recent settlement layer I, belonging partly to stage Jevišovice C1, but mainly to stage Jevišovice B with material of the Vučedol culture (*Benešová 1956*, fig. 1). New ^{14}C data suggest that older layers III and II in Brno-Líšeň come from 3360–3250 BC, so we can rely on existence of stage Jevišovice B in Moravia since 3100 BC (*Furholt 2013*, 89). For this reason, we must consider dating of the shaft-hole axe from the upper layer in Brno-Líšeň to the end of 4000 BC, although ^{14}C data from layer I are still absent. According to S. Hansen, the presented indices admit occurrence of unsectioned shaft-hole axes as early as the second half of the 4th millennium BC. However, he adds that relevant evidence for chronological definition of use of individual types of axes is absent (*Hanssen 2009*, 148). Here, we can present several hybrid exemplars of axes with features of the Baniabic as well as Fajsz types (see above) which clearly confirm the above stated – that both types were produced simultaneously for some time (*Dani/Kis-Varga 2000*, 28; *Hansen 2009*, 148). In this context, we should mention the fact that axes of the Baniabic type were found in settlement areas of the Kosihy-Čaka-Makó culture in Dolný Pial and Žitavany-Opatovce (eastern part of Southwestern Slovakia) in depots together with a Fajsz type axe. Pottery material represented by fragments of bowls on stems with chip-carved decoration filled with white incrustation comes from both sites (*Bátora 1975a*, fig. 5: 1).

These observations indicate what was later confirmed by excavations at settlements from the classical stage of the Vučedol culture in Zók-Várhegy in Southwestern Hungary and in Vinkovci-Tržnica in Croatia, where casting moulds for the Fajsz type axes (*Ecsedy 1982*, tab. XIV: 1, 2, 6) and the Kozarac type axes (*Dimitrijević 1982*, 8; *Durman 1984*, fig. 2–4; *Ecsedy 1982*, tab. XIV: 3) were found together in features.

As far as casting moulds are concerned, we can mention the exemplars from the final stage of the Vučedol cultural complex, i.e. Kosihy-Čaka-Makó culture, from Veľký Meder and Nevidzany in Southwestern Slovakia. While the mould from Veľký Meder confirms production of the Kozarac type axes, the older type with convex upper parts (*Durman 1983*, 86; *Hromada/Varsik 1994*, fig. 1; 2: 6),

the exemplar from Nevidzany indicates casting of exemplars of their younger variant.

It is noteworthy that the casting mould from Nevidzany was also found in a settlement area of the Kosihy-Čaka-Makó culture, where sherds included a fragment of a bowl with white inlaid inner surface decoration (*Bátora 1975b*, fig. 4: 1–3). Here, we should mention absolute dating of the typologically younger exemplar of the Kozarac type axe from the burial under the tumulus in Mala Gruda in Montenegro. *M. Primas* (*1996*, 154) dated this axe to 2800–2700 cal. BC, following from the absolute dating of the nearby tumulus of Velika Gruda, which is only 250 m far. This dating actually corresponds with the dating of the classical stage of the Vučedol culture from the settlement in Gomolava (stage 3b) to 2910–2699 cal. BC (*Durman/Obelić 1989*, tab. I). It is not in contradiction with dating of feature 34 with Vučedol-Zók material at the site of Zók-Várhegy to 2875–2501 cal. BC (*Novotná 1998*, 351). This dating is important also for another reason – production of the Kozarac type axes as artefacts typical of the Vučedol culture expanded from the Balkan-Southern Carpathian territory to the northern part of the Carpathian basin and the Alpine region.

Dating of the Kozarac type axes in the first half of the 3rd millennium BC is supported by the depot from the site of Petralona in Central Macedonia in northern Greece, which contains – among others – three axes of this type (*Maran 2001*, 275, 276, fig. 1: 1–4). According to J. Maran, the depot can be dated – within the chronological system of Central and Southern Greece – in the late Early Helladic stage I (FH I), or the early Middle Helladic stage (FH II), i.e. to 2900–2500 BC in absolute chronology (*Maran 2001*, 278).

It is worth mentioning that finds of the Kozarac-Stublo type axes in Eastern Ukraine (Kyiv, Velyke Sadove) are dated very similarly to the Northern Greece in absolute chronology, i.e. in 2800–2500 BC, when the Catacomb culture in its classical stage was present there (*Bratchenko 2003*, 207; *Klochko V./Klochko L. 2013*, 64, 65, fig. 15; *Telegin/Pustovalov/Kovaljuk 2003*, 183). On the other hand, depots of the Kozarac-Stublo (Steblivka) type axes from Western Ukraine (e.g. Mezhyhirtsi, Stublo) are younger and culturally associated with the early stage of the Epi-Corded Ware Strzyźów culture (*Machnik/Tkačuk 2003*, 484–486; *Svieshnykov 1974*, 137, fig. 50). In absolute chronology, they can be dated to the beginning of the Bronze Age, i.e. 2300–2200 BC. This long period of use of the Kozarac-Stublo type axes, i.e. from the first quarter of the 3rd millennium BC to the beginning of the Bronze Age, has been noticed before (*Born/Hansen 2001*, 13).

In discussion on dating of shaft-hole axes, we can mention a particularly important source for their dating. It is the shaft-hole axe of the Dumbrăvioara type uncovered in burial 4 of the Corded Ware culture at site 6 in Szczytna, in the southeastern part of Poland (*Kośko/Wlodarczak 2018*, fig. 5: 1). It is an axe with a design close to the Kömlőd-Kozarac type (*Dani 2013*, 208). The burial from Szczytna can be dated – in absolute chronology – to 2550–2400 BC (*Kośko/Wlodarczak 2018*, 281).

In association with the above-mentioned depots of the Kozarac-Stublo type axes in the Strzyźów culture in Western Ukraine, it is interesting that their exemplars have not been documented in other related Epi-Corded Ware cultures, i.e. in the Mierzanowice culture in Lesser Poland, the Nitra culture in Southwestern Slovakia and Eastern Moravia, and in the Košťany culture in Eastern Slovakia (*Bátora 2018*, 71–85). Their probable existence in the Carpathian basin in the beginning of the Bronze Age is indicated by the Kömlőd-Kozarac type axe from Emőd-Nagyhalom in the upper Tisza region in Hungary, which was found by a surface survey together with pottery in the area of a fortified settlement of the Hatvan culture (*Koós 1993*, 5–9, tab. I: 2). The fact that bearers of the Hatvan culture followed from the Eneolithic metallurgical tradition of shaft-hole axes is suggested by finds of casting moulds or finished exemplars of the Tószeg type axes, which have been documented at several settlements of a tell character in the Tisa region, in Hungary (*Bóna 1992*, 50). Their production in the early stage of the Hatvan culture also in the territory of today's Slovakia is confirmed by the find of a casting mould in the area of the fortified settlement in Santovka (former Maďarovce) in the lower Ipeľ river basin (*Marková 2000*, fig. 1).

CONCLUSION

Shaft-hole axes belong to important metal artefacts in the Late and Final Eneolithic and in the beginning of the Bronze Age. It is emphasized by the fact that they were spread over an extremely large area, i.e. Central, Southeastern and Eastern Europe, the Caucasus, and Asia Minor. It is not surprising that they are associated with a whole range of questions related to their origin, function, dating, cultural influences, contacts, etc. It seems that they were an important medium allowing us to observe existence of intercultural contacts not only between immediately neighbouring cultures, but also contacts between distant cultural areas.

We have recorded 13 exemplars of shaft-hole axes from the territory of Slovakia. They can be classified

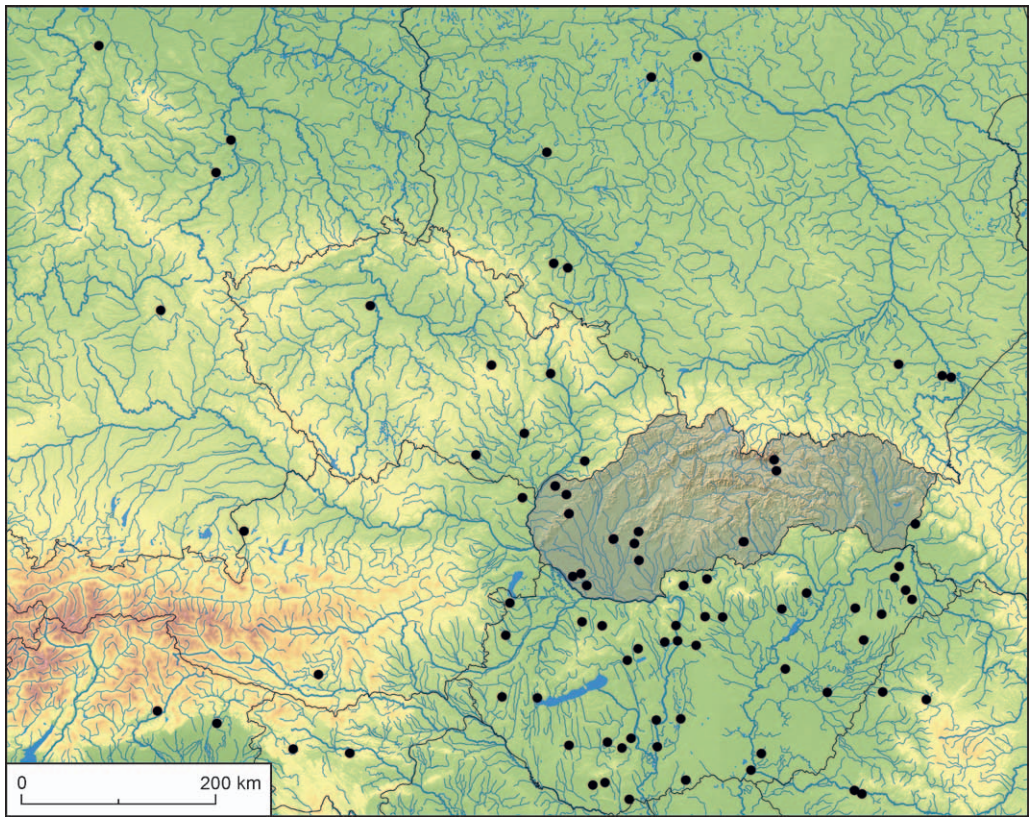

Fig. 33. Map of sites documenting distribution of shaft-hole copper axes regardless of the type in Central Europe. Map by M. Bartík according to J. Batora's documents.

into three basic types – the Baniabic, Fajsz and Kozarac-Stublo types. These types of axes were widespread in Slovakia as well as in the territories of Central, Eastern and Southeastern Europe. Apart from them, the Dumbrăvioara type axes occurred in Central Europe, the territory of Poland.

Direct evidence of production of the typologically oldest Baniabic type axes in form of casting moulds is still absent in Slovakia as well as the whole Central European territory. Casting moulds prove production of typologically younger axes of the Fajsz and Kozarac types. In the immediate neighbourhood of Slovakia, production of the Fajsz type axes has been documented by casting moulds at settlements of the Vučedol culture in Southern (Nagyárpád-Dióstetö, Zók-Várhegy) and Northern Hungary (Domony). Production of the Kozarac type axes has been documented in these regions, but – by casting moulds – also in Western (Döbrököz-Tűzköves, Kaposújlak) and Central Hungary (Üllő), in Southwestern Slovakia (Nevidzany, Veľký Meder) and the northern Alpine region of Western Austria (Salzburg-Reinberg). Concentration of casting moulds suggests that metallurgical centres for production of the Kozarac type axes were located in the above-mentioned regions.

Most of the shaft-hole axes from Slovakia have been spectrally analysed. Metallographic analyses confirmed that both types of copper raw material were used for their production – oxidative (malachite and pseudomalachite) and sulphidic (tetrahedrite and chalkopyrite), whose deposits are situated in Central Slovakia, in the area of Ľubietová, Špania dolina, Poniky, Banská Štiavnica, Hodruša-Hámre and in the Spišsko-gemerské rudohorie ore mountains (Gelnica, Nandráž, Smolník). Therefore, the analyses point to the fact that shaft-hole axes from Slovakia were most probably made using the copper ore from domestic deposits.

We have recorded more than 90 exemplars of shaft-hole axes from Central Europe (Fig. 33). The fewest of them belong to the typologically oldest Baniabic type and most of them are typologically most recent, i.e. the Kozarac type. If we have a look at the numbers of individual types of axes, we can see considerable differences – the Baniabic type is represented by 13 exemplars, the Fajsz type is represented by 33 exemplars, 41 exemplars represent the Kozarac type and four of them belong to the Dumbrăvioara type. These numbers suggest how incredibly dynamically – even in leaps – metallurgy of individual types of shaft-hole axes developed

in Central Europe. It can be definitely considered a result of the rather fast adaptation of their production – starting with the Fajsz type in the Northern Balkan-Carpathian territory. Geographically close deposits of copper ore might have contributed to this process and dynamics to a great extent.

The study pays special attention to the geographical distribution of shaft-hole axes in the context of the cultural-historical development of the Late and Final Eneolithic in Central Europe. We were studying how individual types of copper axes arrived in the regions of Central and Central-Western Europe. We paid particular attention to the westernmost expansion of shaft-hole copper axes in Europe, i.e. in the territory of today's Germany (Braschwitz, Waischenfeld-Breitenlesau, Eldagsen, Zcheidenplitz). The answer to this question was partly suggested by the information and observations associated with the material (e.g. antler pins with hammer-shaped heads, pottery) as well as the burial rite (e.g. arranging the dead in the so-called frog position) discovered during the excavations at burial grounds of the Corded Ware culture in Saxony (Egeln-Nord, former Bleckendorf), Baden-Württemberg (Lauda-Königshofen) and the Bell Beaker culture also in Saxony (Profen, Schweta). Numerous analogies to the above-mentioned pins and frog-position burials are known from the Pit Grave and Catacomb cultures spread in the Black Sea regions of Ukraine and Russia. Analogies to the pottery from several burials at the Bell Beaker culture burial ground in Schweta are known in the Kosihy-Čaka-Makó and Somogyvár-Vinkovci cultures in the Carpathian territory.

With regard to the fact that settlement of the Corded Ware culture has been documented in the central and upper Danube River basin, including the territory of Germany, we can assume that mostly its bearers contributed to the process of mediation of material and elements of the burial rite of the east European character. Migration of eastern origin, in the population of the Corded Ware culture, is indicated by the paleogenetic analyses of one of the females buried at the burial ground in Lauda-Königshofen in Baden-Württemberg. New paleogenetic data also confirm that at least 75% of the population of the Corded Ware culture were genetically close to the Pit Grave culture.

The above-described process of mediation by the Corded Ware culture might have taken place as early as the first half of the 3rd millennium BC, when presence of the Pit Grave and Catacomb cultures in the Tisza region in Eastern Hungary is clearly documented by numerous burials and tumuli. However, there are multiple signals that both cultures' bearers should be expected also in Southwestern Slovakia, mainly in its eastern part – the lower Hron river basin and the Žitava river basin. Thus, the distance of the areas from which the mediation of Eastern European elements by the Corded Ware culture population to the current Central and Eastern Germany started is not necessarily long.

The presented findings suggest that a similar cultural-historical process took place in the central and upper Danube River basin in association with the Corded Ware culture and its reception and transfer of material and burial customs of the late stage of the Pit Grave and Catacomb cultures westwards, like north of the Carpathian arch, in the territory of today's Poland. Nevertheless, the difference is that the Corded Ware culture settled north of the Carpathian arch was – with regard to its geographical location – much closer to the Black Sea region, which was the area of primary occurrence of the Pit Grave and Catacomb cultures, than bearers of the Corded Ware culture in the central and upper Danube River basin. Moreover, we must take presence of the Vučedol-Zók cultures in the central Danube River basin into consideration. Its individual cultures lasted for a considerably long period, from the developed Late Eneolithic to the beginning of the Bronze Age, i.e. approximately between 2800/2700 and 2400/2300 BC. These facts were naturally reflected in the various intensity of reception of elements from the late stage of the Pit Grave and Catacomb cultures in both above mentioned regions in favour of the Northern Carpathian area. Thus, we can state that the Corded Ware culture bearers played an important role in the distribution of shaft-hole axes in the area of central Western Europe in the Final Eneolithic.

The study also brings information on dating of shaft-hole copper axes. From this aspect, new ^{14}C data from Brno-Líšeň seem very important, suggesting that it will be possible to date the depot of copper artefacts containing also a Fajsz type shaft-hole axe in the end of the 4th millennium BC. It is essential information suggesting that unsectioned shaft-hole axes represented by the Baniabic type might have occurred in the area of Central Europe as early as the second half of the 4th millennium BC. In this context, absolute dating of feature 34 with Vučedol-Zók material at the site of Zók-Várhegy to 2875–2501 cal. BC is important. It is noteworthy also due to the fact that production of the Kozarac type axes, i.e. artefacts typical of the Vučedol culture, spread to the territory of the northern Carpathian basin and the Alpine territory as well. We should notice that finds of the Kozarac-Stublo type axes in depots from Eastern Ukraine (Kyjiv, Velyke Sadove) are dated very similarly in absolute chronology, i.e. 2800–2500 BC, when the Catacomb culture in

its classical stage was present there. On the other hand, depots of the Kozarac-Stublo type axes from Western Ukraine (Mezhyhirtsi, Stublo) are younger and culturally associated with the early stage of the Epi-Corded Ware Strzyźów culture and in absolute chronology, they can be dated to the beginning of the Bronze Age, i.e. 2300–2200 BC.

The axe from Emőd-Nagyhalom in the upper Tisza region in Hungary, which was discovered together with pottery in the area of a fortified settlement of the Hatvan culture, suggests that the Kozarac-Stublo type axes existed also in the Carpathian basin in the beginning of the Bronze Age. Finds of casting moulds or finished exemplars of the Tószeg type axes from several settlements of a tell character in the Hungarian Tisza region indicate that the Hatvan culture bearers followed from the Eneolithic metallurgical tradition of production of shaft-hole axes. Their production in the early stage of the Hatvan culture also in the territory of today's Slovakia is confirmed by the find of a casting mould in the fortified settlement in Santovka (former Maďarovce) in the lower Ipeľ river basin.

CATALOGUE OF SITES WITH SHAFT-HOLE AXES AND ASSOCIATED CASTING MOULDS FROM THE TERRITORY OF SLOVAKIA

Axes

1. Dolný Pial, Levice district

In the cadastral area of the village, at the Badice site, a shaft-hole copper axe of the Baniabic type was discovered in 1965 during land cultivation on the former property of L. Lukáč. The axe has a massive rear part with a circular hole. The rear is only slightly offset from the front part with the blade. The cutting edge is wide and rounded in a fan shape. Dimensions length 106 mm, cutting edge width 69 mm, rear width 51 mm, shaft-hole diameter 26 mm; weight 815 g (Fig. 2: 1).
Deposited at: Institute of Archaeology SAS, Nitra.
Reference: *Vladár 1970*, 5, 6; fig. 1; 2

2. Nitra, Nitra district

In 2016, a depot from the Late Eneolithic was discovered on the hill of Zobor. It contained a shaft-hole axe of the Kozarac type, flat axes, a dagger with a triangular blade and lingular handle and fan-shaped ingots. The find represents the first depot of this type in Slovakia from the end of the Eneolithic, from the second half of the 3rd millennium BC.
Deposited at: private collection.
Reference: *Jelínek/Horáková 2019*

3. Ožďany, Rimavská Sobota district

In the Gemersko-malohontské museum in Rimavská Sobota, a fragment of a shaft-hole copper axe of the Kozarac type is deposited (inv. no. 2282). The rear part of a short cylindrical socket, which was distinctly offset from the bent body widening towards the arcuate cutting edge, is broken off.
Dimensions: preserved length 107 mm, cutting edge width 40 mm (Fig. 12: 1).
Deposited at: Gemersko-malohontské museum in Rimavská Sobota.
Reference: *Paulík 1965*, 37, tab. I: 6

4. Poprad, Poprad district

A shaft-hole axe of the Kozarac type, which was found near Poprad (in Poprad, Veľká or Gánovce), at an unspecified site, is deposited in the Podtatranské museum in Poprad. The axe has a short cylindrical socket distinctly offset from the bent body, widening towards the arcuate cutting edge. The rear extends to a blunted edge, which might be a remaining part of a casting seam.
Dimensions: length 115 mm, cutting edge width 40 mm, rear width 30 mm, shaft-hole diameter 25 mm (Fig. 12: 2).
Deposited at: Podtatranské museum in Poprad.
Reference: *Novotná 1957*, 310, tab. II: 4 a, b

5. Radimov, Senica district

In the cadastral area of the village, at the Unínsky les site, a shaft-hole copper axe with a roof-tipped rear was discovered in the gate of a small undated fortification. With its overall design, it is a hybrid exemplar with features of the Baniabic as well as Fajsz types. With regard to the suggested offset socket, it is closer to the Fajsz type (*Farkaš/Plachá 2002*, 83). Dimensions: length 120 mm, cutting edge width 62 mm, rear width 42 mm, shaft-hole diameter 22 mm (Fig. 7: 1).
Deposited at: private collection.
Reference: *Farkaš/Plachá 2002*, fig. 4: 1

6. Senica, Senica district

A shaft-hole copper axe of the Baniabic type is deposited in the Hungarian National Museum in Budapest. The rear of the axe with a circular hole continues as a gradually widening blade. The cutting edge is rounded in a fan shape.
Dimensions: length 110 mm, cutting edge width 60 mm, rear width 31 mm, shaft-hole diameter 23–26 mm (Fig. 6: 1).
Deposited at: Hungarian National Museum in Budapest.
Reference: *Kőszegi 1957*, 47

7. Smolenice, Trnava district

In the area of the princely hillfort from the Hallstatt period, at the site of Molpír, a fragment of a shaft-hole axe of the Fajsz type was found – probably with a metal detector – in 1993. Part of the body lowering and widening towards the partly preserved hole has been preserved.
Dimensions: 55 × 35 mm, shaft-hole diameter approx. 18 mm, weight 120 g (Fig. 7: 4).
Deposited at: private collection.
Reference: *Farkaš 1997*, 10, fig. 2: 4

8. Veľký Slavkov, Poprad district

A shaft-hole copper axe of the Fajsz type was found in the cadastral area of the village in the past. The axe has a fan-shaped rounded cutting edge, and its rear is roof-shaped. On the bottom side, it is distinctly offset from the rear.

Dimensions: length 110 mm, cutting edge width 55 mm, rear width 43 mm, shaft-hole diameter 25 mm (Fig. 7: 3).
Deposited at: Podtatranské museum in Poprad.
Reference: *Novotná 1957*, 310, tab. II: 3ab

9. Žitavany-Opatovce, Zlaté Moravce district

In the cadastral area of the village (part Opatovce), at the Na vŕškoch site next to the so-called Očkaj's vineyard, J. Poliak discovered two shaft-hole copper axes in a gravel pit. One of them belongs to the Baniabic type and the second one is a representation of the Fajsz type. As both were found together in one place, the discovery can be considered a depot. The rear of the Baniabic type axe with a circular hole gradually continues as a widening blade; the cutting edge is fan-shaped, rounded.
Dimensions: length 125 mm, cutting edge width 65 mm, rear width 33 mm, shaft-hole diameter 23 mm (Fig. 6: 2). The second axe of the Fajsz type has the rear clearly offset from the blade by a narrowing, which creates a short socket. The blade is irregularly widened and arcuate. Dimensions: length 120 mm, rear width 45 mm, cutting edge width 55 mm, shaft-hole diameter 20 mm (Fig. 7: 2).
Deposited at: Zlaté Moravce City Museum.
Reference: *Novotná 1957*, 309, tab. II: 1ab; 2ab

10. Žitný ostrov?

Reportedly, at an unspecified site in the eastern part of Žitný ostrov, a shaft-hole copper axe of the Kozarac type was discovered. The axe has a cylindrical socket, distinctly offset from the bent body widening towards the arcuate blade. The rear continues in a blunted edge, which is probably a remaining part of a casting seam. The rough cast of the axe was modified by smithing, grinding, and polishing.
Dimensions: length 125 mm, cutting edge width 56 mm, socket length 45 mm, shaft-hole diameter 26–27 mm, weight 525 g (Fig. 12: 3).
Deposited at: SNM – Archaeological Museum.
Reference: *Farkaš/Ozdín 2002*, 131, fig. 1

11. Trnava Region (Western Slovakia)

Probably in 2015, an unknown finder with a metal detector discovered a shaft-hole copper axe of the Baniabic type at an unspecified site in Trnava region, 10 cm below the surface. The axe has a massive rear with a circular hole. The frontal part of the blade starts with a hole and gradually transforms into the cutting edge in a slight semiarc. The dorsal part of the blade is slightly offset from the shaft hole and gradually widens towards the fan-shaped cutting edge.
Dimensions: length 110 mm, maximum cutting-edge width 65 mm, rear width 52 mm, shaft-hole diameter 25 mm (Fig. 2: 3).
Deposited at: unknown.
Reference: *https://www.lovecpokladu.cz/*

12. Unknown site

In the Slovak National Museum in Martin, there is a shaft-hole copper axe of the Baniabic type. It comes from an unknown site in Southwestern Slovakia.
Dimensions: length 100 mm, cutting edge width 58 mm, rear width 44 mm, shaft-hole diameter 24 mm (Fig. 2: 2).
Deposited at: SNM – Ethnographic Museum in Martin.
Reference: *Novotná 1957*, 310, tab. I: 3ab

13. Unknown site

In the Bratislava City Museum, there is a severely damaged exemplar (torso) of a shaft-hole axe of the Baniabic type with preserved upper part. On the rear, there are traces (protuberances) of casting. It was an obviously unfinished exemplar, which might suggest its domestic production.
Dimensions: unidentified (Fig. 6: 3).
Deposited at: Bratislava City Museum.
Reference: *Novotná 1970*, 27; tab. 8: 139

Casting moulds

14. Nevidzany, Zlaté Moravce district

In 1967, J. Bátora and J. Borkovič (employed by the Mestské múzum in Zlaté Moravce) discovered a fragment of the right part of a casting mould for shaft-hole axes of the Kozarac type during a surface survey in the cadastral area of the village, Konopniská site. The clay casting mould is rectangular. It is broken in the section for casting of the rear. It was made of fired clay containing a considerable volume of coarse-grained sand. Its colour is pale brown, or grey at some spots (Fig. 23: 1).
Dimensions: length 116 mm, width 70–75 mm, thickness 30 mm.
Deposited at: Zlaté Moravce City Museum.
Reference: *Bátora 1982*

15. Veľký Meder, Dunajská Streda district

A casting mould for shaft-hole axes of the Kozarac type was discovered during a rescue excavation in the cadastral area of the town, Vámostelek/Vámošovo, in feature 26/89, which was dated to the period of the Kosihy-Čaka-Makó culture by the associated goods. The mould is made of clay, and it was used for casting the right half of the axe with a cylindrically elongated socket in the rear. It is rectangular. The mould is broken in the place for casting the cutting edge and the rear part is also slightly damaged. Above the shaft hole, there is a dome-shaped depression for the core of the socket. The upper part of the mould from the socket to the assumed cutting edge is convexly bent. The fired clay contains sand and small grains of slate. Its colour is orange-brown with grey-black stains, there is a grey-black core on the break. The edge of the mould is burnt black. The pouring basin was located in the rear part (Fig. 23: 2).
Dimensions: preserved length 97 mm, width 65 mm, thickness 38 mm.
Deposited at: Institute of Archaeology SAS, Nitra.
Reference: *Hromada/Varsik 1994*, 50, fig. 2: 6

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Nálezy medených sekeriek s otvorom v tyle z územia Slovenska v kultúrnohistorickom kontexte strednej Európy

Príspevok k metalurgii mladého a neskorého eneolitu

Jozef Bátora

SÚHRN

Sekerky s otvorom v tyle patria k dôležitým kovovým artefaktom v období mladého a neskorého eneolitu a na počiatku doby bronzovej. Fakt, že boli rozšírené na mimoriadne rozsiahlom území, t. j. v strednej, juhovýchodnej a východnej Európe, na Kaukaze a v Prednej Ázii, uvedenú skutočnosť ešte zvýrazňuje. Nie je prekvapujúce, že sa s nimi spája celý rad otázok, ktoré sa týkajú ich pôvodu, funkcie, datovania, kultúrnych vplyvov, kontaktov a podobne. Ukazuje sa, že boli dôležitým médiom, ktoré umožňuje sledovať existenciu interkultúrnych kontaktov nielen medzi kultúrami ležiacimi v bezprostrednom susedstve, ale aj kontaktov medzi vzdialenými kultúrnymi oblasťami.

Z územia Slovenska je doteraz známych 13 exemplárov sekeriek s otvorom v tyle, ktoré možno zaradiť do troch základných typov: Baniabic, Fajsz a Kozarac-Stublo. Uvedené typy sekeriek boli rozšírené nielen na území Slovenska, ale aj v oblasti strednej, východnej a juhovýchodnej Európy. Okrem nich sa v rámci strednej Európy, na území Poľska, vyskytli aj sekerky typu Dumbrăvioara.

Priame doklady výroby typologicky najstarších sekeriek typu Baniabic v podobe odlievacích foriem doteraz absentujú nielen na Slovensku, ale v celom stredoeurópskom priestore. Priamo je doložená až produkcia typologicky mladších sekeriek typu Fajsz a Kozarac. Z bezprostredného susedstva Slovenska je výroba sekeriek typu Fajsz dokumentovaná kadlubmi na sídliskách vučedolskej kultúry v južnom (Nagyárpád-Dióstetö, Zók-Várhegy) a severnom (Domony) Maďarsku. Produkcia sekeriek typu Kozarac už nie je doložená iba v týchto regiónoch, ale je dokumentovaná nálezmi kadlubov aj v západnom (Döbrököz-Tűzköves, Kaposújlak) a strednom (Üllő) Maďarsku, na juhozápadnom Slovensku (Nevidzany, Veľký Meder) a v severoalpskej oblasti západného Rakúska (Salzburg-Reinberg). Koncentrácia nálezov kadlubov naznačuje, že sa v uvedených oblastiach nachádzali metalurgické centrá na výrobu sekeriek typu Kozarac.

Zo sekeriek s otvorom v tyle z územia Slovenska bola prevažná časť spektrálne analyzovaná. Metalografické analýzy potvrdili, že na ich vyhotovenie boli použité oba druhy surovín medi, t .j. oxidačné (malachit a pseudomalachit) i sulfidické (tetraedrit a chalkopyrit), ktorých ložiská sa vyskytujú na strednom Slovensku v oblasti Ľubietovej, Špánej doliny, Poník, Banskej Štiavnice, Hodruši-Hámrov a taktiež v Spišsko-gemerskom rudohorí (Gelnica, Nandraž, Smolník). Analýzy poukazujú na to, že sekerky s otvorom v tyle z územia Slovenska, boli s najväčšou pravdepodobnosťou vyrobené z domácich ložísk medenej suroviny.

Z priestoru strednej Európy je doteraz známych vyše 90 exemplárov sekeriek s otvorom v tyle. V rámci tohto počtu najmenej exemplárov patrí typologicky najstarším sekerkám typu Baniabic a najviac typologicky najmladšiemu typu Kozarac. Ak sa pozrieme na počty jednotlivých typov, tak vidíme medzi nimi výrazné rozdiely: typ Baniabic je zastúpený 13 exemplármi, typ Fajsz 33 exemplármi, typ Kozarac 41 exemplármi a typ Dumbrăvioara štyrmi exemplármi. Aj tieto číselné údaje naznačujú, ako mimoriadne dynamicky, takmer až „skokovo", sa rozvíjala aj v strednej Európe metalurgická výroba jednotlivých typov sekeriek s otvorom v tyle. Evidentne to možno považovať za výsledok pomerne rýchlej adaptácie ich výroby, najneskôr počnúc typom Fajsz v severobalkánsko-karpatskom priestore. Zrejme k uvedenému procesu a dynamike výraznou mierou prispeli aj geograficky blízke ložiská medenej rudy.

V štúdii bola osobitná pozornosť venovaná geografickému rozšíreniu sekeriek s otvorom v tyle v kontexte kultúrnohistorického vývoja mladého a neskorého eneolitu v strednej Európe. Zaujímalo nás, ako sa do jednotlivých regiónov strednej a stredozápadnej Európy dostali jednotlivé typy. Osobitne sa to týkalo najzápadnejšieho rozšírenia medených sekeriek s otvorom v tyle v Európe, t. j. na území dnešného Nemecka (Braschwitz, Waischenfeld-Breitenlesau, Eldagsen, Zcheiplitz). Odpoveď na túto otázku do určitej miery naznačili poznatky a pozorovania týkajúce sa tak materiálu (napr. ihlice s kladivkovitou hlavicou z parohoviny, keramika), ako aj pohrebného rítu (napr. uloženie mŕtvych v tzv. žabej polohe), ktoré boli zistené pri výskume pohrebísk kultúry so šnúrovou keramikou v Sasku (Egeln-Nord, predtým Bleckendorf), v Bádensku-Württembersku (Lauda-Königshofen) a kultúry zvoncovitých pohárov taktiež v Sasku (Profen, Schweta). K uvedeným ihliciam a k pochovaniu v tzv. žabej polohe sú početné analógie známe z jamovej a katakombovej kultúry, rozšírenej v čiernomorskej oblasti Ukrajiny a Ruska. Ku keramike z niekoľkých hrobov na pohrebisku kultúry zvoncovitých pohárov v Schweta sú blízke analógie známe v kultúre Kosihy-Čaka-Makó a Somogyvár-Vinkovci v Karpatskej oblasti.

Vzhľadom na to, že osídlenie kultúrou so šnúrovou keramikou je doložené na území stredného a horného Podunajska, vrátane územia Nemecka, oprávnene možno predpokladať, že na procese sprostredkovania materiálu a prvkov pohrebného rítu východoeurópskeho charakteru sa podstatnou mierou podieľali najmä jej nositelia. Napokon, na migračné pohyby východného pôvodu (populácie kultúry so šnúrovou keramikou) poukazujú aj paleogenetické analýzy u jednej zo žien pochovaných na pohrebisku

v Lauda-Königshofen v Bádensku- Würtembersku. Aj nové paleogenetické dáta potvrdzujú, že minimálne 75 % populácie kultúry so šnúrovou keramikou bola geneticky blízka jamovej kultúre.

K uvedenému procesu sprostredkovateľskej úlohy kultúry so šnúrovou keramikou mohlo dochádzať už v priebehu prvej polovice 3. tisícročia pred n. l., keď je prítomnosť nositeľov jamovej a katakombovej kultúry výrazne doložená v Potisí vo východnom Maďarsku početnými hrobmi pod mohylami. Sú však viaceré signály, že s nositeľmi oboch kultúr možno počítať aj na juhozápadnom Slovensku, najmä v jeho východnej časti v Dolnom Pohroní a Požitaví. Vzdialenosť východiskových území pre sprostredkovanie prvkov východoeurópskeho charakteru populáciou kultúry so šnúrovou keramikou až do dnešného stredného a východného Nemecka nemusela byť až tak veľká.

Uvedené zistenia naznačujú, že v oblasti stredného a horného Podunajska došlo k podobnému kultúrno-historickému procesu v súvislosti s kultúrou so šnúrovou keramikou a jej recepciou a transferom materiálu a pohrebných zvyklostí neskorej fázy jamovej kultúry a katakombovej kultúry v smere západnom, ako v oblasti severne od Karpatského oblúka, na území dnešného Poľska. Rozdiel bol však v tom, že kultúra so šnúrovou keramikou, sídliaca v oblasti severne od karpatského oblúka, bola vzhľadom na geografickú blízkosť s Čiernomorskou oblasťou, ktorá predstavovala primárnu oblasť rozšírenia jamovej a katakombovej kultúry, v oveľa bezprostrednejšom kultúrnom kontakte, ako nositelia kultúry so šnúrovou keramikou v oblasti stredného a horného Podunajska. Navyše, v oblasti stredného Podunajska je potrebné počítať aj s prítomnosťou kultúr vučedolsko-zógskeho kultúrneho komplexu, ktorého jednotlivé kultúry trvali pomerne dlhé obdobie, od rozvinutého mladého eneolitu až po počiatok doby bronzovej, t. j. približne medzi rokmi 2800/2700 až 2400/2300 pred n. l. Uvedené skutočnosti sa prirodzene prejavili v rozdielnej intenzite recipovania prvkov neskorej fázy jamovej a katakombovej kultúry v oboch vyššie uvedených regiónoch v prospech severokarpatskej oblasti. Teda možno konštatovať, že nositelia kultúry so šnúrovou keramikou zohrávali v súvislosti s rozšírením sekeriek s otvorom v tyle do oblasti stredozápadnej Európy v období neskorého eneolitu významnú úlohu.

Štúdia prináša aj poznatky týkajúce sa datovania medených sekeriek s otvorom v tyle. V tomto smere sa ako dôležité ukázali nové dáta ^{14}C z Brna-Líšne, ktoré naznačili, že depot medených predmetov, v ktorom sa našla aj sekerka s otvorom v tyle typu Fajsz, bude možné datovať do záveru 4. tisícročia pred n. l. Ide o dôležitý poznatok, naznačujúci, že nečlenené sekerky s otvorom v tyle, ktoré reprezentuje typ Baniabic, sa v oblasti strednej Európy mohli objaviť už v druhej polovici 4. tisícročia pred n. l. V uvedenom kontexte možno za dôležité považovať absolútne datovanie objektu 34 s vučedolsko-zógskym materiálom na lokalite Zók-Várhegy do obdobia 2875–2501 cal. BC. Toto datovanie je významné aj z toho dôvodu, že z balkánsko-juhokarpatskej oblasti sa výroba sekeriek typu Kozarac ako artefaktu charakteristického pre vučedolskú kultúru, rozšírila i do oblasti severnej časti Karpatskej kotliny a do alpskej oblasti. Pozoruhodné je, že nálezy sekeriek typu Kozarac-Stublo v depotoch z východnej Ukrajiny (Kyjiv, Velyke Sadove) sú datované v absolútnej chronológii veľmi podobne, t. j. do obdobia 2800–2500 BC, kedy tam bola rozšírená katakombová kultúra v jej klasickom stupni. Naproti tomu depoty sekeriek typu Kozarac-Stublo zo západnej Ukrajiny (Mežigirci, Stublo) sú mladšie a kultúrne spojené už s včasnou fázou epišnúrovej strzyżowskej kultúry, a v rámci absolútnej chronológie ich možno datovať na počiatok doby bronzovej, t. j. 2300–2200 BC.

To, že s existenciou sekeriek typu Kozarac-Stublo na počiatku doby bronzovej možno s veľkou pravdepodobnosťou počítať aj v Karpatskej kotline, naznačuje sekerka z Emőd-Nagyhalom v hornom Potisí v Maďarsku, ktorá sa našla spolu s keramickým materiálom v priestore opevneného sídliska hatvanskej kultúry. Na to, že nositelia hatvanskej kultúry nadviazali na eneolitickú metalurgickú tradíciu výroby sekeriek s otvorom v tyle, poukazujú aj nálezy kadlubov, resp. hotových exemplárov sekeriek typu Tószeg, ktoré pochádzajú z viacerých sídlisk tellového charakteru v maďarskom Potisí. Ich výrobu už v staršom období hatvanskej kultúry aj na území dnešného Slovenska potvrdzuje nález kadlubu v areáli opevneného sídliska v Santovke-Maďarovciach na dolnom Poiplí.

Obr. 1. Mari, Sýria. Na detaile z mozaikovej tabule z prvej polovice 3. tisícročia pred Kr. nesú dvaja hodnostári na pleciach sekerky s otvorom v tyle blízke typu Kozarac (podľa *Born/Hansen 2001*).

Obr. 2. Slovensko. Sekerky s otvorom v tyle typu Baniabic, variant 1. 1 – Dolný Pial, okres Levice; 2 – neznáme nálezisko z juhozápadného Slovenska; 3 – neznáme nálezisko z Trnavského kraja (*Vladár 1970*; podľa *https://www.lovecpokladu.cz/*).

Obr. 3. Poľsko. Sekerky s otvorom v tyle typu Baniabic. 1 – Rudna Mała, okres. Rzeszów; 2 – Munina, okres Jarosław (podľa *Kunysz 1959*).

Obr. 4. Maďarsko. Sekerky s otvorom v tyle typu Baniabic. 1 – Keszthely-Alsódobogó, župa Zala; 2 – Kisbér, Komárňansko-ostrihomská župa (podľa *Bakay/Kalicz/Sági 1966; Novotná 1957*).

Obr. 5. Rakúsko a Nemecko. Sekerky s otvorom v tyle typu Baniabic. 1 – neznáme nálezisko v Rakúsku; Nemecko: 2 – Eldagsen, okres Springe (podľa *Keiling 1999*; *Mayer 1977*).

Obr. 6. Slovensko. Sekerky s otvorom v tyle typu Baniabic, variant 2. 1 – Senica, okres Senica; 2 – Žitavany-Opatovce, okres Zlaté Moravce; 3 – neznáme nálezisko na Slovensku (podľa *Kőszegi 1957; Novotná 1957; 1970*).

Obr. 7. Slovensko. Sekerky s otvorom v tyle typu Fajsz. 1 – Radimov, okres Senica; 2 – Žitavany-Opatovce, okres Zlaté Moravce; 3 – Veľký Slavkov, okres Poprad; 4 – Smolenice, okres Trnava (podľa *Farkaš 1997*; *Farkaš/Plachá 2002*; *Novotná 1957*).

Obr. 8. Maďarsko. Sekerky s otvorom v tyle typu Fajsz. 1 – Kisbér, Komárňansko-ostrihomská župa; 2 – Székesfehérvár, župa tá istá; 3 – Hajdúdorog- Szállásföldek, Hajdúcko-biharská župa; 4 – Hódmezővásárhely, Čongrádsko-čanádska župa (podľa *Dani/Kis-Varga 2000*; *Novotná 1957*; *Spöttl 1885*; *Szabó 1999*).

Obr. 9. Morava a Čechy. Sekerky s otvorom v tyle typu Fajsz. Morava: 1 – Vlčnov, okres Uherské Hradiště; 2 – Brno-Líšeň, okres Brno-město; 3 – Vevčice, okres Znojmo; 4 – Stavenice, okres Šumperk; Čechy: 5 – Proseč, okres Chrudim (podľa *Dobeš et al. 2019*; *Frolík 1981*; *Říhovský 1992*).

Obr. 10. Rakúsko. Sekerky s otvorom v tyle typu Fajsz. 1 – neznáme nálezisko; 2 – Ottilienkogel bei Glantschach, okres Sankt Veit an der Glan; 3 – neznáme nálezisko; 4 – Hauskirchen, okres Gänserndorf (*podľa Huysza 1990*; *Mayer 1977*).

Obr. 11. Nemecko. Sekerky s otvorom v tyle typu Fajsz. 1 – Brachwitz, okres Saale; 2 – Zscheiplitz, okres Querfurt (podľa *Mildenberger 1950*).

Obr. 12. Slovensko. Sekerky s otvorom v tyle typu Kozarac. 1 – Ožďany, okres Rimavská Sobota; 2 – okolie Popradu, okres Poprad; 3 – Žitný ostrov (?; podľa *Farkaš/Ozdín 2002*; *Novotná 1957*; *Paulík 1965*).

Obr. 13. Maďarsko. Sekerky s otvorom v tyle typu Kozarac. 1 – Szihalom, Hevešská župa; 2 – Érd, Peštianska župa; 3 – Budapest-Óbuda, III. Mestký obvod; 4 – Majs, Baranská župa; 5 – Lickóvadamos, Zalianska župa; 6 – Emőd-Nagyhalom, Boršódsko-abovsko-zemplínska župa; sekerka typu Dumravioara (?) 7 – Szabolčská župa (podľa *Dani 2013*; *Ecsedy 1983*; *Horváth 2001*; *Kalicz 1968*; *Koós 1993*; *Kőszegi 1957*)

Obr. 14. Maďarsko. Sekerky s otvorom v tyle typu Kozarac. 1, 2 – Tápé, Csongrádsko-Csanádska župa; 3 – Acsád, Vašská župa; 4 – Nagyvejke, Tolnianska župa (*podľa Kovács 1996; Spöttl 1885; Kulcsár 1999*).

Obr. 15. Čechy a Morava. Sekerky s otvorom v tyle typu Kozarac. 1 – Otvovice, okr. Kladno/Čechy; 2 – neznáme nálezisko z Moravy (1 – nepublikovaný nález uložený v Stredočeskom *múzeu v Roztokách u Prahy*, inv. č. AS 15/24/, foto A. Hůlka; 2 – podľa *Říhovský 1992*).

Obr. 16. Rakúsko a Nemecko. Sekerky s otvorom v tyle typu Kozarac. 1, 2 – neznáme náleziská/Rakúsko; 3 – Waischenfeld-Breitenlesau, okres Bayreuth/Nemecko (podľa *Abels 2000*; *Mayer 1977*).

Obr. 17. Poľsko. Sekerky s otvorom v tyle typu Kozarac. 1 – Strzelin, okres Brzeg; 2 – Radzików, okres Vroclav; 3 – Ośno, okres Alexandrów (podľa *Gedl 2000; Kostrzewski 1964*).

Obr. 18. Poľsko. Sekerky s otvorom v tyle typu Dumbrăvioara. 1 – Kwieciszewo, okres Mogilno; 2 – neznáme nálezisko z Veľkopoľska; 3 – Leszno, okres Leszno; 4 – Szczytna, okres Jarosław (podľa *Gedl 2000*; *Kossina 1919*; *Kostrzewski 1955*; *Kośko/Wlodarczak 2018*).

Obr. 19. Maďarsko. Hlinené kadluby na odlievanie sekeriek s otvorom v tyle. 1 – Domony, Peštianska župa; 2 – Pécs-Nagyarpád-Dióstetö, Baranská župa; 3 – Zók-Várhegy, Baranská župa (podľa *Ecsedy 1983*; *Kalicz 1984*).

Obr. 20. Zók-Várhegy, Baranská župa, Maďarsko. Hlinené kadluby na odlievanie sekeriek s otvorom v tyle (podľa *Ecsedy 1983*).

Obr. 21. Maďarsko a Rakúsko. Hlinené kadluby na odlievanie sekeriek typu Kozarac. 1–3 – Kaposújlak, Šomoďská župa/Maďarsko; 4 – Salzburg-Reinberg, okres Salzburg/Rakúsko (podľa *Hell 1943*; *Somogyi 2004*).

Obr. 22. Hidegség-Templomdomb, Rábsko-mošonsko-šopronská župa, Maďarsko Hlinený kadlub na odlievanie sekeriek typu Kozarac (podľa *Ilon 2022*).

Obr. 23. Slovensko. Hlinené kadluby na odlievanie sekeriek s otvorom v tyle typu Kozarac. 1 – Nevidzany, okres Zlaté Moravce; 2 – Veľký Meder, okres Dunajská Streda (podľa *Bátora 1982; Hromada/Varsik 1994*).

Obr. 24. Üllő, Peštianska župa, Maďarsko. Hlinené kadluby na odlievanie sekeriek s otvorom v tyle typu Kozarac (podľa *Kövári/Patay 2005*).

Obr. 25. Mapa lokalít jednotlivých typov sekeriek s otvorom v tyle a kadlubov na ich odlievanie na území Slovenska. A – typ Baniabic: 1 – Dolný Pial, okres Levice; 2 – Žitavany-Opatovce, okres Zlaté Moravce; 3 – Senica, okres Senica; B – typ Fajsz: 4 – Smolenice, okres Trnava; 5 – Radimov, okres Senica; 6 – Veľký Slavkov, okres Poprad; C – typ Kozarac: 7 – Nitra, okres Nitra; 8 – Ožďany, okres Rimavská Sobota; 9 – okolie Popradu, okres Poprad; 10 – Žitný ostrov (?); D – kadluby na odlievanie typu Kozarac: 11 – Nevidzany, okres Zlaté Moravce; 12 – Veľký Meder, okres Dunajská Streda (na mape nie sú vyznačené dve neznáme náleziská a nálezisko z Trnavského kraja – vo všetkých troch prípadoch ide o sekerky typu Baniabic). Mapa M. Bartík na základe podkladov J. Bátoru.

Obr. 26. Mapa nálezísk kadlubov na odlievanie sekeriek s otvorom v tyle v strednej Európe. Slovensko: 1 – Veľký Meder, okres Dunajská Streda; 2 – Nevidzany, okres Zlaté Moravce; Maďarsko: 3 – Domony, Peštianska župa; 4 – Üllő, Peštianska župa; 5 – Dobroköz-Tüzköves, Tolnianska župa; 6 – Pécs-Nagyarpád-Dióstetö, Baranská župa; 7 – Zók-Várhegy, Baranská župa; 8 – Kaposújlak, Šomoďská župa; 9 – Ravaszd-Villibald domb, Rábsko-mošonsko-šopronská župa; 10 – Hidegség-Templom domb, Rábsko-mošonsko-šopronská župa; Rakúsko: 11- Salzburg-Reinberg, okres Salzburg; Slovinsko: 12 – Ľubľana-Ljublansko barje, okres Ľubľana. Mapa M. Bartík na základe podkladov J. Bátoru.

Obr. 27. Mapa lokalít sekeriek s otvorom v tyle typu Baniabic v strednej Európe. Slovensko: 1 – Dolný Pial, okres Levice; 2 – Žitavany-Opatovce, okres Zlaté Moravce; 3 – Senica, okres Senica; Poľsko: 4 – Munina, okres Jarosław; 5 – Rudna Mała, okres Rzeszów; Zakarpatská Ukrajina: 6 – okolie Užhorodu, okres Užhorod; Maďarsko: 7 – Kisbér, Komárňansko-ostrihomská župa; 8 – Keszthely-Alsódobogó, Zalianska župa; Nemecko: 9 – Eldagsen, okres Springe (na mape nie sú vyznačené tri neznáme náleziska sekeriek zo Slovenska a jedno neznáme nálezisko z Rakúska). Mapa M. Bartík na základe podkladov J. Bátoru.

Obr. 28. Mapa lokalít sekeriek s otvorom v tyle typu Fajsz v strednej Európe. Slovensko: 1 – Žitavany-Opatovce, okres Zlaté Moravce; 2 – Smolenice, okres Trnava; 3 – Radimov, okres Senica; 4 – Veľký Slavkov, okres Poprad; Morava: 5 – Vlčnov, okres Uherské Hradiště; 6 – Brno-Líšeň, okres Brno-město; 7 – Vevčice, okres Znojmo; 8 – Stavenice, okres Šumperk; **Čechy:** 9 – Proseč, okres Chrudim; Maďarsko: 10 – Kisbér, Komárňansko-ostrihomská župa; 11 – Székefehérvár, župa tá istá; 12 – Tolnianska župa; 13 – Akasztó, Báčsko-malokumánska župa; 14 – Fajsz, Báčsko-malokumánska župa; 15 – Bácsalmás, Báčsko-malokumánska župa; 16 – Hatvan, Hevešská župa; 17 – Hajdúdorog-Szállásföldek, Hajdúcko-biharská župa; 18 – Nagykunság (Mirha-Gád) – región v župe Jász-Nagykun-Szolnok; 19 – Szeghalom-Varjas-major, Békešská župa; 20 – Hódmezővásárhely, Čongrádsko-čanádska župa; rumunská časť Potisia: 21 – Lipova/Lippa, župa Arad; 22 – Vadul Crisului, župa Bihar; Rakúsko: 23 – Hauskirchen, okres Gänserndorf; 24 – Ottilienkogel bei Glantschach, okres Sankt Veit an der Glan; severovýchodné Taliansko: 25 – Col de Buson, provincia Belluno; Nemecko: 26 – Brachwitz, okres Saale; 27 – Zscheiplitz, okres Querfurt (na mape nie sú

vyznačené dve neznáme náleziská sekeriek z Rakúska a dve neznáme náleziská sekeriek z Maďarska). Mapa M. Bartík na základe podkladov J. Bátoru.

Obr. 29. Mapa lokalít sekeriek s otvorom v tyle typu Kozarac a Dumbrăvioara v strednej Európe. Slovensko: 1 – Nitra, okres Nitra; 2 – Ožďany, okres Rimavská Sobota; 3 – okolie Popradu, okres Poprad; 4 – Žitný ostrov (?); Čechy: 5 – Otvovice, okres Most; Poľsko: 6 – Strzelin, okres Brzeg; 7 – Radzików, okres Vroclav; 8 – Ośno, okres Alexandrów; 9 -Kwieciszewo, okres Mogilno; 10 – Leszno, okres Leszno; 11 – Szczytna, okres Jarosław; Maďarsko: 12 – Lickóvadamos, Zalianska župa; 13 – Acsád, Vašská župa; 14 -Majs, Baranská župa; 15 – Nagyvejke, Tolnianska župa; 16 – Dunakömlőd, Tolnianska župa; 17 – Lovasberény, Stoličnobelehradská župa; 18 – Érd, Peštianska župa; 19 – Budapest-Csepel, XXI. mestský obvod; 20 – Budapest-Óbuda, III. Mestský obvod; 21 – Tolmács, Novohradská župa; 22 – Szihalom, Hevešská župa; 23 – Emőd-Nagyhalom, Boršodsko-abovsko--zemplínska župa; 24 – Tápé, Csongrádsko-Csanádska župa; 25 – Debrecen, Hajdúcko-biharska župa; 26 – Bálkány-Abapuszta, Sabolčsko-satmársko-berežská župa; 27 – Kisvárda region, Sabolčsko-satmársko-berežská župa; 28 – Nyírtass, Sabolčsko-satmársko-berežská župa; 29 – župa Szabolcs; rumunská časť Potisia: 30 – Oradea, župa Bihar; 31 – Paulis, župa Arad; severná časť Slovinska: 32 – Lublana-Ljublansko barje, okres Lublana; severovýchodné Taliansko: 33 – San Daniele del Friuli, provincia Udine; Nemecko: 34 – Waischenfeld-Breitenlesau, okres Bayreuth (na mape nie je vyznačené jedno neznáme nálezisko sekerky z Moravy, dve neznáme náleziská sekeriek z Rakúska a jedno neznáme nálezisko z Maďarska – vo všetkých prípadoch ide o sekerky typu Kozarac; taktiež nie je vyznačené jedno neznáme nálezisko z Poľska sekerky typu Dumbrăvioara). A – sekerky typu Kozarac; B – sekerky typu Dumbrăvioara; C – hybridné exempláre sekeriek typu Kozarac, subtyp Nyírtas (C – podľa *Dani 2013*). Mapa M. Bartík na základe podkladov J. Bátoru.

Obr. 30. Gánovce, okres Poprad, Slovensko. 1 – plochá kovová sekerka s bočnými výčnelkami; 2-4 – keramika (podľa *Novotný/Kovalčík 1977*).

Obr. 31. Pôdna mapa Hronskej tabule s náleziskami mohýl pravdepodobne jamovej kultúry (podľa *Bátora et. al. 2023).* Legenda: a – mohyly; b – vodné toky; c – fluvizeme; d – černozeme; e – gleje; f – regozeme; g – hnedozeme (luvizeme); h – kambizeme.

Obr. 32. Mapa s tromi náleziskami ihlíc z parohoviny s kladivkovitou hlavicou. 1 – Szarvas, Békešská župa/Maďarsko; 2 – Franzhausen, okres St. Pölten/Rakúsko; 3 – Egeln-Nord (predtým Bleckendorf), okres Salzland/Nemecko (podľa *Gessner* 2005; *Kalicz 1968*; *Neugebauer 1994*).

Obr. 33. Mapa lokalít, ktorá dokumentuje rozšírenie medených sekeriek s otvorom v tyle bez ohľadu na typ v strednej Európe. Mapa M. Bartík na základe podkladov J. Bátoru.