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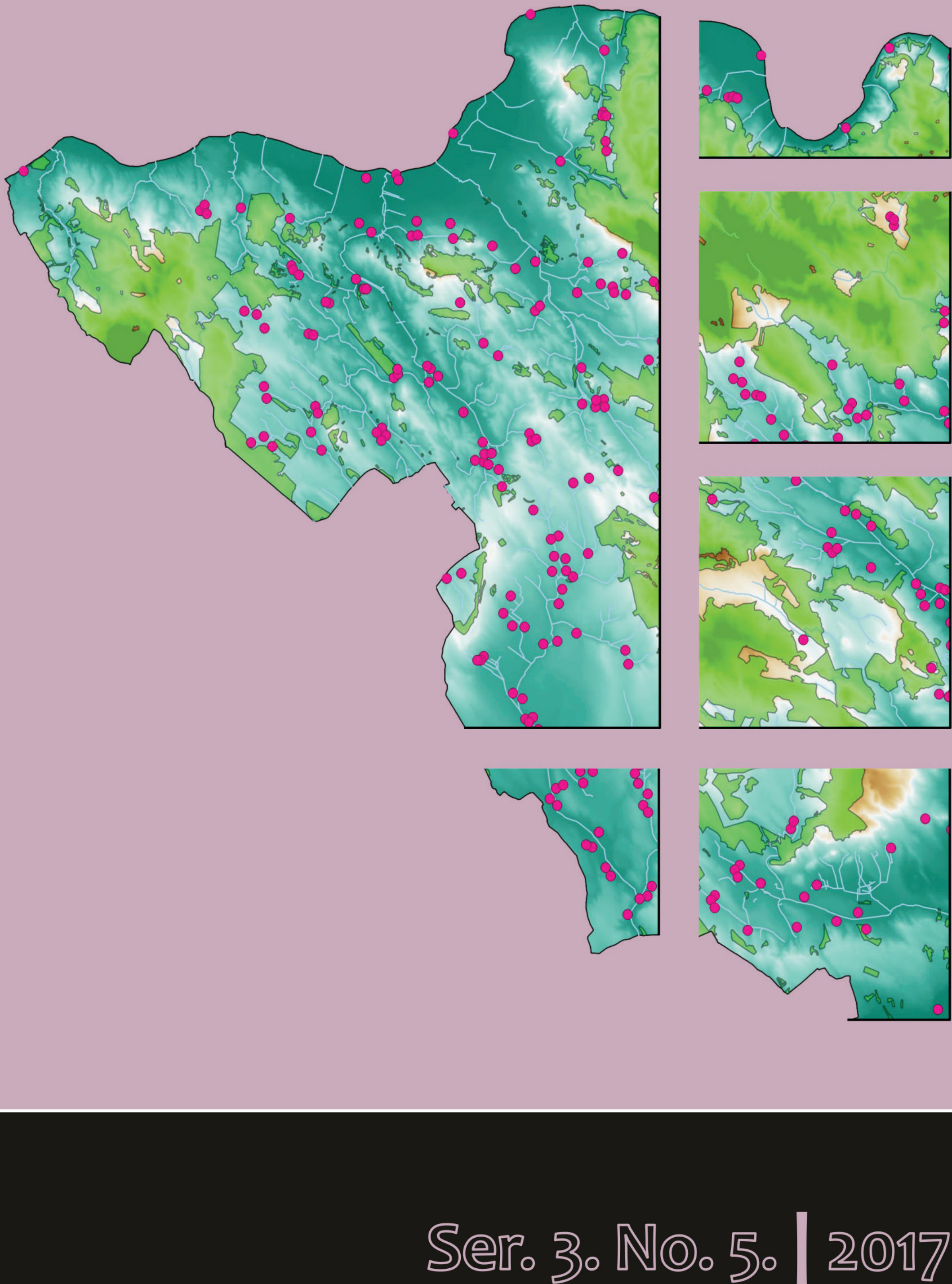

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The spread of the products and technology of metallurgy in the Carpathian Basin between 5000 and 3000 BC – Current questions

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Abstract
The origin of Neolithic and Copper Age copper finds could not be discussed independently from archaeological interpretation due to the lack of appropriate archaeometallurgical analyses from Hungary. The overall aim of our project is to provide new data about the sources of raw materials of copper finds. By the analysis of comparative geological samples, we are able to test the idea that considered the use of local sources as a basis of the wealth of metal in the Carpathian Basin during the Copper Age.

We supplement the series of lead isotope analysis carried out on copper artefacts from secure find contexts by AMS dating in the frame of complex sampling strategy. This makes us possible to reconsider the typochronological system that classifies copper finds into the same time horizons from the Balkans via the Carpathian Basin to Central Europe.

As results of the project, we can shed new light on social relations related to the spread of products and technology of metallurgy. We can find evidence for confirming, rejecting or refining some widely accepted topoi of the metallurgy in the Carpathian Basin.

Introduction

This article summarizes the current questions of how the products and the technology of copper metallurgy were spread in the Carpathian Basin from the Late Neolithic to the Late Copper Age. We have recently launched a new research project following a complex approach and it aims to address these questions using an interdisciplinary methodology.

Heavy copper tools, got into museums in considerable number in the 19th century, provided primarily the basis for distinguishing the independent Copper Age in the Carpathian Basin.[1] The traditional archaeology connected the beginning of the Southeast European Copper Age

1 Pulszky 1884.

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to the wide-scale distribution of these artefacts. Later the meticulous study of Neolithic sites throughout Southeast Europe and in the Carpathian Basin revealed such finds that suggested that the prelude of this sudden appearance of copper artefacts can be dated to several hundred or even thousand years earlier in the Neolithic. Processing of native copper, malachite and azurite can be dated as early as the Early Neolithic, and archaeological finds in Southeast Europe show every step of the metallurgical technological development.[2] The wealth of metal in Early and Middle Copper Age in the Carpathian Basin and Southeast Europe is only the peak of this technological evolution and series of innovations.

Study of the spread of metallurgy on typological grounds

The first stages of local extractive metallurgy can be dated to the Neolithic according to copper artefacts and archaeological finds related to metal processing found on archaeological sites in Serbia and Bulgaria.[3] The beginning of the use of copper ore mines can be traced back at least to the Middle Neolithic according to archaeological finds and radiocarbon dating.[4]

N. Kalicz classified the Neolithic and Copper Age metal finds in the Carpathian Basin into four horizons. The first horizon can be dated to the Neolithic. This is the period of the beginning of metallurgy in the Balkans when we can witness the process of innovations from the accidental usage to the conscious metallurgy.[5] Small copper items – primarily ornaments – were found in graves and tells in a greater amount during the Late Neolithic in the Carpathian Basin at first.[6] Kalicz considered these items as the products of Balkan metallurgy which arrived at the sites in Hungary via exchange. The second horizon is the appearance of heavy copper tools in the Tiszapolgár period in Early Copper Age. Based on their "concentration and geographical position" he also considered them as the products of the Southeast European metallurgical province.[7] The third horizon was the Bodrogkeresztúr period, Middle Copper Age as an organic continuity of the former horizon when the Carpathian Basin became the centre of production and the types of objects slightly changed.[8] Although researchers supposed that the centre of production was the Carpathian Basin from the beginning of the Middle Copper Age due to the sudden increase in the quantity of copper finds, any traces of this production was not found in the archaeological material. First traces of local metallurgy in archaeological sites in Hungary can be dated to the end of this period, then the number of copper finds drastically decreased. The fourth horizon is the period of Baden-complex representing by only a small number of copper finds. Kalicz considered the reason for this decrease in the exhaustion of easily accessible raw material sources.[9] This system became widely accepted in the Hungarian and international research, but now it is possible to considerably refine this view in the light of the new archaeometric and radiocarbon data.

2 Horedt 1976; Chapman – Tylecote 1983; Ecsedy 1990; Comşa 1991; Gale et al. 1991; Kalicz 1992; Antonović 2002; 2006; Šljivar 2006; Borić 2009; Radivojević et al. 2010; Siklósi 2013a, 210–223.

3 Šljivar 1996; 2006; Šljivar et al. 2006; Borić 2009; Radivojević et al. 2010.

4 Chernykh 1978a; Jovanović 1982; Borić 2009.

5 Kalicz 1992, 8–9.

6 Kalicz – Raczky 1987, 124; Horváth 1987, 43; Raczky et al. 1996; Zalai-Gaál 1996; Kalicz 2013; Siklósi et al. 2015.

7 Kalicz 1992, 10.

8 Kalicz 1992, 10.

9 Kalicz 1992, 10.

Copper Age copper items from the Balkans and the Carpathian Basin were collected and typologically classified in the second half of the 20th century.[10] H. Todorova suggested that the nearest raw material sources were used in the case of typologically similar objects of certain regions.[11]

Study of the spread of metallurgy on archaeometric grounds

Scientific, archaeometallurgical analyses started in the 1960-70s which aimed to determine the raw material sources of artefacts based on their composition.[12] E. Chernykh distinguished three metallurgical provinces in Southeast Europe based on the composition of copper finds, from which he supposed to work with the centre of the already known Rudna Glava, Ai Bunar and an unknown centre in the territory of the Carpathians.[13] This idea harmonized well with Todorova's typology based suggestion.

It was a milestone in the research of copper finds in the 1980s when the methodology of lead isotope analysis was first used on copper artefacts.[14] It was clear that the composition of copper finds is not enough to localize the raw material sources, but complemented with lead isotope analysis it has already been possible to exclude some regions. As archaeologically documented copper ore mines were already known in the Balkans when this method was invented, this territory provided an ideal laboratory for testing the new method. Due to these researches, there are comprehensive series of lead isotope data of geological sources in Serbia and Bulgaria, and series of Neolithic–Early Bronze Age archaeological finds.[15] These researches disproved the former archaeological assumptions that early copper finds were prepared from native copper collected on the surface and they proved that the overwhelming majority of copper finds were smelted from copper ores even from the Middle Neolithic.[16] Contrary to H. Todorova's suggestion, these studies showed that the copper items made of raw materials from different sources were distributed on a large geographical area and typologically different objects were also made of the same raw material. According to these researches copper ores were carried to settlements close to the mines and they were smelted on these sites, not in the territory of mines.[17]

Series of lead isotope data of Southeast European Neolithic and Copper Age copper artefacts unquestionably proved the use of copper ore deposits in the Balkans. Not only evidence for the use of Ai Bunar mine was found, but further deposits were quite probably used according to their lead isotope fingerprints, however, their use has not proven archaeologically yet.[18] These analyses are able to demonstrate the sources of raw materials used for the preparation of copper items independently from archaeological interpretation, and based on these results indirect social interactions can be drawn.

10 Novotná 1970; Vulpe 1975; Todorova 1981; Patay 1984; Antonović 2014.
11 Todorova 1981.
12 E.g. Junghans et al. 1960; 1968.
13 Chernykh 1978b.
14 Gale – Stos-Gale 1982; Stos-Gale – Gale 2009; Villa 2009; Pernicka 2014. Lead isotopes and their usefulness in raw material provenance studies (together with other, e.g. copper isotopes) were recently reviewed by Mozgai et al. 2016.
15 Gale et al. 1991; 2000; 2003; Pernicka et al. 1993; 1997; Stos-Gale et al. 1998.
16 Gale et al. 1991; 2000; 2003; Pernicka et al. 1993; 1997.
17 Gale et al. 2000; 2003; Radivojević et al. 2010.
18 Gale et al. 1991; 2000; 2003; Pernicka et al. 1993; 1997.

Although large series of analyses of Serbian and Bulgarian copper artefacts showed the negligible amount of native copper used, a smaller series of chemical analyses carried out on Romanian copper items suggested that some copper axes were made of native copper.[19] Larger series of lead isotope measurement combined with chemical analysis is missing from the territory of Romania, except for the site Pietrele,[20] which would support the wide range of use of native copper and their sources. These early results suggest that the emergence of local metallurgy adapted to local geological circumstances has to be taken into consideration in the territory of Romania as well.

Lead isotope data of copper artefacts from Austria, Slovakia and Germany showed that the raw material of earliest copper items derived from the Balkan mines and the use of local deposits started only considerably later.[21] The earliest slag was found in the Copper Age settlement, Brixlegg and was believed to prove the use of local sources. Contrary to this assumption, lead isotope and chemical analyses showed that this copper ore derived from Serbia and local sources started to be extracted only in the Early Bronze Age.[22] The raw material of the earliest copper objects in Slovakia derived also from Serbia. Several different types of raw materials were distinguished in the case of Early–Middle Copper Age objects, raw material derived from local deposits is supposed to be among them.[23]

The chemical composition of copper artefacts from Hungary was studied by several researchers, but these analyses were generally isolated, non-systematic measurements except for the SAM project. The use of different raw materials can be suggested even in the case of nearly contemporary sites located close to each other (e.g. Late Copper Age artefacts from Sármellék-Égenföld were prepared from copper with arsenic content,[24] but the diadem from Vörs was made of pure copper[25]). Crucibles from Tiszalúc-Sarkad dated to the end of the Middle Copper Age contained remains of high purity copper ore,[26] but in the lack of lead isotope analysis, it is a further question from where this copper ore derived.

The Carpathian Basin, remarkably missing from the picture that can be drawn from the results of lead isotope analyses, provides a natural link between Southeast and Central Europe not only because of its geographical location but based on the distribution of copper artefacts, too. This means not only an important link in exchange systems, but it might have had a major role in the spread of the technological knowledge.

Large series of lead isotope analyses are missing even now which would be able to determine the raw material sources of copper artefacts from Hungary. The first results of lead isotope analyses carried out on copper finds of Late Neolithic sites Polgár-Csőszhalom and Berettyóújfalu-Herpály on the Great Hungarian Plain have been recently published.[27] These results suggested that the raw materials of some items derived from the copper mines in Serbia or Bulgaria, but there are further lead isotope ratios which cannot be matched to any

19 Kadar 2002.
20 Hansen et al. 2007; 2008.
21 Niederschlag et al. 2003; Höppner et al. 2005; Schreiner 2007.
22 Höppner et al. 2005.
23 Schreiner 2007.
24 M. Virág 1999; in press.
25 Bondár 2015.
26 Patay 2005, 107.
27 Siklósi et al. 2015.

other known fingerprints. On the one hand, these results certainly prove that raw materials derived from several different deposits that suggest wide-range of social interactions of the inhabitants of these settlements. On the other hand, we have to take into consideration the use of further unknown sources. We found very similar results in the case of the copper items from the Copper Age cemetery in Rákóczifalva-Bivaly-tó site 1/c.[28]

Our project primarily aims to complement this lack after that we will be able to objectively connect the Carpathian Basin into the network between Southeast and Central Europe. Furthermore, the analysis of samples from geological deposits will make us possible to test the archaeological assumption that local sources were used from the Late Neolithic or the beginning of the Copper Age.[29]

The distribution of copper artefacts in the light of radiocarbon dating

The end of the Late Neolithic on the Great Hungarian Plain can be dated ca. 4550–4450 BC.[30] Comparing this date with the dating of Vinča sites[31] and the cemetery of Varna[32] in the Balkans we have to re-evaluate the formerly generally accepted typological dating. Namely, such a time horizon can be seen according to these sites when tiny copper ornaments were used on the Great Hungarian Plain and the early – e.g. Pločnik – types of heavy copper hammer axes were used in the Balkans contemporary. This overthrows the system which was based on the typology of copper artefacts and classified into the same time horizons typologically similar find materials from the Balkans via the Carpathian Basin to Central Europe.

Bayesian modelled AMS data dated Bodrogkeresztúr burials surprisingly early, from 4350 BC.[33] As archaeological research connects the distribution of heavy copper artefacts to this period, it has serious consequences for the dating of the spread of metallurgy and copper artefacts. Comparing with the formerly generally accepted dating of 4000 BC, the appearance of these heavy copper artefacts on the Great Hungarian Plain can be dated considerably earlier that makes it necessary to re-evaluate the interregional relations as well.

Social archaeological interpretation of the spread of metallurgy

C. Renfrew argued for the emergence of social hierarchy and elite at the beginning of Copper Age based on the extreme wealth of the Varna cemetery. He considered the sudden appearance of heavy copper tools and gold ornaments not only as a reflection but as a stimulator of social changes as well.[34] Leaders or chiefs were considered to conduct and organise the long-distance exchange of copper artefacts. The spread of the metallurgical technology was the result of this centralised authority.[35] But the wealth of the Varna cemetery remained unique in whole Europe until now, therefore some authors argued that it is not correct to extrapolate its characteristics and its consequences to further regions of Europe. Thus T. Kienlin refused the social

28 Siklósi et al. 2012.
29 Ecsedy 1990; Kalicz 1992; M. Virág in press.
30 Raczky – Anders 2009; 2016; Yerkes et al. 2009.
31 Borić 2009; 2015.
32 Higham et al. 2007; in press; Krauss et al. 2017.
33 Csányi et al. 2010; Raczky – Siklósi 2013.
34 Renfrew 1978; 1986.
35 Hansen 2013.

stratification when he carried out metallographic analysis of copper axes and he suggested the spread of metallurgy in frames of kinship organized societies that do not necessitate the assumption of ruling elite.[36] A complex communication network and integration process can be supposed behind the spread of the metallurgy.[37] Although S. Scharl discussed some important aspects of these integrational processes, it remains just a theoretical model and sole assumption without archaeometric measurements.

Current questions

Where did the raw material of copper artefacts in the Carpathian Basin derive from?

The main goal of our project is to determine the potential raw material sources of copper artefacts in the Carpathian Basin. This has an utmost importance for proceeding social and archaeological interpretation of early metal artefacts. This is the first step forward studying the spread of the technology during the period of early metallurgy.

Several researchers had earlier suggested – based on the distribution of earliest copper finds, but particularly of heavy copper tools – that prehistoric communities living in the present-day territory of Hungary used local deposits even from the Late Neolithic or Copper Age. The decisive argument was the concentration of malachite and copper finds in the Late Neolithic Lengyel sites in Southeast Transdanubia,[38] but archaeometric analyses that would be able to support this assumption have not been carried out so far.

It is indispensable to test the potentially used sources in the Carpathian Basin for the reconstruction of social networks based on the distribution of copper finds and for modelling the spread of the metallurgy. The evidence for the use of local deposits would be the first step forward understanding the emergence of local metallurgy. Or the lack of this evidence would suggest that the well-known Balkan deposits were used long ago.

As copper artefacts were not alloyed during the period to be analysed, the lead isotope fingerprint in the object certainly reflects the geological deposit of copper. The broader geographical regions of the Hungarian sites had already been measured by lead isotope analysis. Larger series of measurements are known from Serbia, Bulgaria and Austria,[39] but smaller series have already been published from Slovakia[40] and a few numbers of data are also available from Romania.[41]

Except for our former measurements carried out on artefacts from Polgár-Csőszhalom, Berettyóújfalu-Herpály[42] and Rákóczifalva-Bivaly-tó site 1/c,[43] lead isotope data are missing from the Hungarian Neolithic and Copper Age. Therefore, publications about the sources of copper artefacts in Hungary remain only mere assumptions. Determination of potential geological deposits has a key importance for integrating Carpathian Basin into the network ranging from Southeast to Central Europe. This has a special importance in the regions – as e.g. the Great

36 Kienlin 2010.
37 Hansen 2013; Scharl 2016.
38 Ecsedy 1990; Kalicz 1992.
39 Pernicka et al. 1993; 1997; 2016a; Gale et al. 2000; 2003; Höppner et al. 2005; Radivojević et al. 2010.
40 Schreiner 2007.
41 Marcoux et al. 2002; Pernicka et al. 2016b.
42 Siklósi et al. 2015.
43 Siklósi et al. 2012.

Hungarian Plain – where local sources obviously missing due to its geographical characteristics but based on the distribution of artefacts it is still considered as a central area.

We will sample ore for analysis from potential deposits and indications from the Carpathian Basin, e.g. Rudabánya, Mátra and Mecsek, which are suggested potential sources in the archaeological literature.[44]

The potential ore sources suggested by the archaeological literature are those which could have provided copper minerals collected from the surface in ancient times. These sources mainly provide native copper; however, malachite and azurite also occur, although not in high amount and not in massive form.

In Rudabánya native copper and secondary copper minerals (malachite, azurite, cuprite, etc.) occur in the upper oxidation-cementation zone of the primary ore mineralisation, which was formed in Triassic carbonates. Native copper is quite common in the area; it appears in cavities and veins and sometimes as specimens of several kilograms. Malachite occurs as needles or tabular crystals, not in massive, cryptocrystalline form.[45]

In the Mátra Mountains, copper can be found in two completely different mineralisations. In the ravines around the Báj Creek in the Mátra Mountains, native copper appears in nodular, more rarely in laminar form, from few grams to even 17 kilograms in size. The copper mineralisation occurs in Cretaceous diabase. The native copper from the area is chemically very pure and shows granular structure. In addition, malachite, more rarely azurite appears in calcite veins and amygdules filled with carbonates.[46]

In the Lahóca Hill (at Recsk in the Mátra Mountains) native copper and the disseminated secondary copper minerals (malachite, azurite, cuprite, chalcocite, covellite, etc.) are the products of the upper cementation zone of the primary ore mineralisation. Native copper appears in dendritic form, as coating or in veins.[47]

Traces of copper ore mineralisation can also be found in the Mecsek Mountains, in the Kozár limestone quarry. Disseminated malachite and azurite appear both in crystalline and earthy form, as the result of the weathering of the primary ore minerals.[48]

Was there a connection between the typological changes of copper artefacts and the beginning of the use of new raw material sources?

Several major changes happened in the forms, sizes and functions of copper artefacts during the 2000 years spanned from the Late Neolithic to the Late Copper Age. Archaeological research connects the Early-Middle Copper Age Carpathian Basin to two main metallurgical provinces.[49] It was supposed that the appearance of new types of metal finds in the Middle

44 Kalicz 1992; Czajlik 2012.

45 Papp 1933, 8–11; Kertai 1935, 21–30; Koch 1939, 868–874; Pantó 1948, 77–106; Koch et al. 1950, 2–27; Tokody 1950, 156–167; Pantó 1956, 327–490; Csalagovits 1973, 61–90; Nagy 1982, 45–58; Fügedi 2010, 105–114; Fügedi et al. 2010, 81–88.

46 Mezősy – Grasselly 1949, 44–45; Kiss 1958, 27–41; Baksa et al. 1981a, 59–66; Molnár et al. 2015, 59–76.

47 Baksa et al. 1981b, 337–349; Baksa 1983, 87–97; 1984, 335–348; Molnár et al. 2003, 1205–1208; 2008, 99–128; Molnár 2007, 226–240; Földessy et al. 2008, 129–143.

48 Tokody 1952, 263–269; Várszegi 1965, 437–438; Jáger 1998, 19–22.

49 Kalicz 1982; Raczky 1999; M. Virág 2010.

Copper Age in Transdanubia were the products of metallurgy in the Eastern Alpine region,[50] but there has not been any evidence for this assumption yet.[51] On the contrary, metal finds on the Great Hungarian Plain were traditionally considered to be the products of Southeast European metallurgy. This distinction based primarily on typology.[52] In the lack of scientific analyses of raw materials of copper artefacts from the Carpathian Basin, it is not possible either to support or reject this idea. The series of lead isotope measurements performed in this project would be able to answer this question.

It is important to study the crucibles found in settlements in both Transdanubia and the Great Hungarian Plain in the period of the second half of the Middle Copper Age (e.g. Tiszalúc-Sarkad,[53] Zalavár-Mekenye[54]) for understanding the spread of the technological knowledge of metallurgy. Where did the raw material smelted in these sites derive from? Whether different sources were used in the case of Transdanubia and the Great Hungarian Plain? It is possible, based on examples from Austria,[55] that in spite of these traces of local metal processing, they continuously relied on Balkan deposits. Therefore, it is very interesting to test whether local smelting is connected to the use of closer deposits or this followed only the local processing considerably later.

A further question is whether there is a correlation between the drastic decrease in the quantity and size of copper artefacts in the Late Copper Age and change of access to raw material sources. Furthermore, which sources were used for preparing the small, new type artefacts in the Late Copper Age? Whether was there a correlation between the use of new sources and the modification of social networks suggested on the basis of other archaeological finds? Can the re-use of former copper artefacts be detected?

A comprehensive series of chemical analysis (using LA-ICP-MS in combination with lead isotope analysis) will be performed which forms the basis for further analysis. Even these analyses can provide us information about what kind of raw materials were used in different phases of the period to be analysed. Our former results do not support the topos that Neolithic copper finds were made of native copper by cold-working and hammering. On the contrary, we found that high purity copper ores were used for preparing copper artefacts during the Late Neolithic.[56] However, Serbian and Bulgarian analyses showed the wide-scale use of oxidic copper ores, sulphide ores in a smaller number[57] and native copper in Romania[58] were also distinguishable. The use of fahlore also appeared beside pure copper in a smaller amount in Slovakia during the Early–Middle Copper Age, furthermore antimony and arsenic content was seldom detected.[59] Therefore, it is a question from what kind of raw material copper artefacts in Hungary were made of, from where the raw materials were derived and whether there were any differences in the periods and regions to be investigated.

50 Kalicz 1992, 10; Raczky 1999, 28; M. Virág 2010; in press.
51 M. Virág in press.
52 Kalicz 1982; M. Virág 1986; Raczky 1999; M. Virág 2010; in press.
53 Patay 2005, 107.
54 Kalicz 1982.
55 Höppner et al. 2005.
56 Siklósi et al. 2015.
57 Ryndina et al. 1999.
58 Kadar 2002.
59 Schreiner 2007.

It was suggested in the case of some copper artefacts in Transdanubia that their raw material derived from Slovakia on the basis of their composition,[60] while the composition of copper finds from Zalavár-Basasziget was various even in one site.[61] Other copper finds from Transdanubia were different due to their silver content.[62] All of these suggest that we have to take into consideration different kinds of raw materials used during the studied period in the present-day territory of Hungary.

How can the Copper Age copper artefacts of the Carpathian Basin be integrated into the social networks between Southeast and Central Europe?

It is necessary to date the finds as precisely as we can for modelling and understanding the changes. As it was earlier mentioned, typochronological dating cannot be further maintained in the case of interregional social networks. Therefore, it is indispensable that artefacts deriving from known find context will be analysed and they would be dated by AMS measurements. This independent dating will provide the basis for the reconstruction of social networks beyond the spread of the products and technology of metallurgy.

In the 21st century, Bayesian modelled AMS dating provides the chronological frame of prehistory. The Copper Age in Hungary is poorly dated in this respect. Comparing with other regions and other periods there is only an infinitesimal number of reliable radiocarbon dates.[63] These measurements clearly prove that the former typochronological system cannot be fully maintained anymore; therefore, it is necessary to date precisely and independently from typology the archaeological context of every analysed finds. This is the only way for modelling the temporal dynamics of the spread of metallurgy.

What kind of social interactions can be reconstructed from the raw material sources of copper artefacts? How can we model the spread of the products and technology of metallurgy?

The first step forward modelling the spread of the copper artefacts (via social interactions) and the transmission of technological knowledge, the learning processes is the determination of potential raw material sources of artefacts. It is possible to draw complex networks based on the origin of the raw material, typology and context of artefacts. Archaeological interpretation of these social networks can lead us to model the types of social interactions and transmission of knowledge. According to our current knowledge, the spread of the products considerably preceded the transmission of metallurgical technology.

We can suppose that social networks, social interactions changed several times during the 2000 years that our project aims to study. Whether did the changes in use of different deposits correlate to these changes? How can we interpret them?

The lack of the lead isotope data from the Carpathian Basin prevented that the research can proceed beyond the mere assumption when it tries to interpret the spread of copper artefacts from Southeast to Central Europe. Carpathian Basin is a natural link between the two regions due to its geographical location and the distribution of copper finds also shows that it might have played a crucial role in this process.

60 Somogyi 2002.
61 M. Virág 1986; 1987.
62 M. Virág in press.
63 See Wild et al. 2001; Siklósi 2009; Yerkes et al. 2009; Oross et al. 2010; Fábián 2013; Raczky – Siklósi 2013.

Therefore, the series of lead isotope measurements would provide us evidence with the types of relations between Southeast and Central Europe and by their archaeological interpretation we will be able to better understand the spread of the metallurgy.

By the analysis of copper finds from known find context we will be able to model the transmission of knowledge among generations. It will be possible to date the beginning of the use of new raw material sources and transformations of social interactions. Discovery of new sources necessarily correlated with that the local communities learned to mine and the technology of smelting and metal processing. The comprehensive study of potential geological deposits, finds related to metal processing and copper artefacts can form a basis for modelling the technological process from the raw material to the final artefacts.

How can we interpret the social roles of copper artefacts in certain periods from a social archaeological point of view?

Not only the technological development of metallurgy can be witnessed during the studied 2000 years, but this was supposedly accompanied by the transformation of social roles of copper artefacts. While these artefacts were prestige goods during the Late Neolithic in Hungary,[64] it was suggested that practical function completed this social role from the Copper Age.[65]

A considerable ratio of heavy copper artefacts derived either from unknown find context or unknown site, therefore it is not possible to date and interpret them precisely. The source value of these finds is negligible from respect of social archaeological interpretation or the study of social networks. Our project aims the study of such artefacts which derives from known archaeological context. The comprehensive contextual analysis of these objects can lead us not only to the better understanding of technological processes but the interpretation of their social role in the past communities.

Archaeological contexts of copper finds are remarkably different in Transdanubia and on the Great Hungarian Plain during the Early–Middle Copper Age that can partially be explained by the lack of burials in Transdanubia. But the question emerges what could cause these differences? Is it possible that the artefacts had different roles or functions in the two regions? Had this difference connection to the use of different raw material sources? If we consider the whole period to be analysed how we can explain the changes of archaeological context of copper finds? What kind of complex processes could be beyond the sudden decrease of the amount of copper artefacts at the end of the Middle Copper Age?

Smaller series of bioarchaeological isotope (Sr, N, O, C) measurements were carried out solely in some Late Neolithic, Tiszapolgár and Bodrogkeresztúr burials on the Great Hungarian Plain,[66] but the results have already suggested an increased mobility in the case of Bodrogkeresztúr burials. As heavy copper artefacts are known from Bodrogkeresztúr context in a greater number, we suppose that it might have been a correlation between the increased mobility and the spread of metallurgy.

64 Kalicz 1992, 9; Siklósi 2004; 2013a, 210–223; 2013b; Siklósi – Csengeri 2011.
65 Kalicz 1992, 10.
66 Giblin 2009; Hoekman-Sites – Giblin 2012; Giblin et al. 2013; Giblin – Yerkes 2016.

Summary

Our complex approach will affect several long-held views of archaeological research that were not possible either to support or reject due to the lack of appropriate archaeometric measurements. Due to our comprehensive series of sampling covering the period from the Late Neolithic to the Late Copper Age, we will be able to discuss several such kinds of topoi from the beginning of the metallurgy to the appearance of bronze artefacts.

We may be able to answer the question whether there was any correlation between the appearances of Late Neolithic malachite and copper ornaments in Southeast Transdanubia and the use of local deposits. We may find evidence whether the copper artefacts on the Great Hungarian Plain were the products of the Southeast European metallurgical province and the copper artefacts in Transdanubia were the products of the Eastern Alpine metallurgical province during the Early–Middle Copper Age.

The results of our project may be the first in the case of Copper Age in Hungary which will be able to find evidence for the use of local raw material sources by comparing lead isotope fingerprints of archaeological finds and copper ores.

We will find evidence for types of raw materials used for the production of copper artefacts found in Transdanubia and on the Great Hungarian Plain. Furthermore, we will be able to answer the question whether the drastic decrease in the amount of copper artefacts was in connection to the changes of access to raw material sources, the transformations of social networks or other causes. According to our former results, we suppose that we will find a much more complex network of correlations than it was assumed by earlier researches.

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