Analysis of a gilded silver sheeted bridle from Hungary – preliminary results
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ABSTRACT
In this paper, I introduce the preliminary results of the archaeometrical investigation of fourth to fifth century AD harnesses of the Vor- und Frühgeschichte Museum in Berlin. The assemblage was originated from Hungary and included a pair of axe-shaped bronze/copper pendant from the bridle, covered with pressed, gilded silver plaque, as well as one piece of spoke-shaped horse bit with the similar type of ornamentation. This material was the subject of our investigation, focused on the way of the ornamentation, which can bring us closer to the problem of approximate determination of the analogies, provenance and the cultural effects that might have had an influence on the objects. To find out, we carried out a non-destructive element analysis with a Bruker’s XRF Tracer. According to the first results, some new information is available and a few earlier opinions can be refined.

KEYWORDS
Migration period archaeology; x-ray fluorescence analysis; horse harness; fire gilding; pressed sheet technique; Carpathian Basin

About the archaeological assemblage and the purpose of the investigation
The main topic of my research is to survey the late Antique and early Migration Periodic assemblages including horse harnesses. Some richly decorated horse harnesses can be found in the graves of the elite (both male and female) from the fourth to fifth centuries AD. They symbolize the former status of the dead in their social group. The pieces can be detected in partial or symbolic horse burials, in hoards or in funerary sacrifices. The presence of the later assemblages was typical phenomenon in the Carpathian Basin at that time (Piros 2015). This unique find, that secured in the Museum für Vor- und Frühgeschichte in Berlin, belongs to this category. We lack any information of the site where these objects were found, but a German collector acquired it from Hungary. It is common for an assemblage, originated from Hungary, to avoid the attention of both indigenous and foreign researchers. Fortunately, a German publication (Arbman 1959) contains information about it, so it is not completely forgotten. Today, the assemblage contains a pair of axe-shaped pendants and a bit (to which a wheel-shaped bit-ring was attached) and can be dated to the period referred above, based on its form and decoration (Figure 1).

The highlighted archaeological goals are:

- to find the analogies,
- to determine the way of decoration and motifs, and a possible area of origin,
- to perform the typochronological classification,
- to place the objects in a cultural-historical context.

Based on the analogies, it is likely to suggest a Crimean, an Eurasian steppe or a Caucasian origin and effect. In these area, the simpler type of the wheel-shaped bit-ring was frequent in the second to third centuries (Achmedov 2007), then later, in the third to fourth centuries they were decorated with gemstones and/or with precious metal plates (e.g. Komarow II, kurgan 8, in Zasetskaya and Sarov 2009).

The true emblematic objects of the set are the pair of axe-shaped copper pendants from the bridle, covered with pressed, gilded silver sheet; their closest analogies are well known from the Carpathian Basin. Their size and decoration are very similar to their European parallels: Dahmker (Geißlinger 1959–1961) and Gundremmingen (Bersu 1964) from Germany, Untersiebenbrunn (Kubitschek 1911) from Austria, Jakuszowice (Godłowski 1995) from Poland and Coșoveni de Jos (Harhoiu 1997) from Romania. But the origins of this form are also to be found on the Crimea and on the Eurasian steppe, where they – though in smaller size and with different kind of suspension – were in use in the second to fourth centuries (Piros 2015).

Due to the uniqueness of the objects in the Carpathian Basin, we felt that an archaeometrical examination could be useful to make a comparison among the pendants from different sites (e.g. Untersiebenbrunn – Austria) to confirm or exclude their linkage.

Thanks to a friendly contact developed during the ISA in 2014, we had a chance to perform a non-
destructive chemical analysis with a Bruker’s Tracer III SD. The primary and qualitative goals of the investigation were achieved: the determination of the elemental composition and the verification of the decoration technique. Because the examination is just a part of an ongoing research of a doctoral dissertation, this paper contains only preliminary results and analysis of the subject.

Methods

The main goal was the determination of the elemental composition and the character of the ornamentation technique of the assemblage. The valuable worth of the objects has set our limits, so it was compulsory to use non-destructive methods of analysis by a Bruker’s XRF Tracer.

We could not take any samples from the metal objects, the use of a non-destructive technique was necessary. As R. B. Scott draw attention to its usefulness in his work, HH-XRF is “highly mobile, affordable and easy to operate” (2016, 78).

The chosen device is equipped with an energy-dispersive Silicon Drift detector (resolution: 145 eV at 100,000 cps, Rh-anode X-ray tube). The measurement settings were 40 kV, 17.50 μA. During the measurements, the following major and minor elements were determined: Au, Ag, Cu, Hg, Ni. Since our aim was to make a qualitative measurement, we applied a standard filter in the instrument during measuring. Then, we used a general metal calibration pack to evaluate correct values from raw data. The spectral lines and the evaluation were produced by ARTAX 5.13.

Results of the examination of the elemental composition

The first important information was obtained when we measured the base plate of the objects (Figure 2). The mentioned publication from the 50’s, H. Arbman wrote about the sheet: "Von der Pferdeaustattung sind außerdem noch zwei beilförmige Bronzeanhänger mit vergoldeten Silberblechen erhalten" (Arbman 1959, 9). However, the examination showed that the plate contains copper and no alloying elements, which was already presumed after the macroscopical and slight mechanical observation of the objects (Figure 3).

The trace of Ni may refer to the provenience of Cu, but for a more accurate determination, it is necessary to enquire the elemental composition of the Eurasian analogies, which are not yet available. This result may require the analysis of the finds that may have been misdocumented in the twentieth century or earlier. Older documentations should not be accepted without
further investigation because it may have happened that only the archaeologists’ eyesight was the instrument to specify the exact material.

By measuring the gilded silver sheets of pendants A and B (Figure 4), we were not only looking for the ingredients, but also for those elements that could indicate how the pressed plate was decorated. Studying the
method of gilding can bring us one step closer to the demonstration of the periodization based on the analogies. Consequently, we can determine the provenance, respectively, the cultural influences on the creation of the individual objects. Both the pressed sheets (Pressblechtechnik) and the fire gilding technique were popular in the Antiquity, so the people connecting with Greco-Roman areas, who later settled in the Carpathian Basin could have acquire this knowledge in the western area of the Eurasian steppe (e.g. Crimea) (Carnap-Bornheim and Ilkjær 1996) (Figure 5). The presence of Hg still supports the idea that we had already emerged before. Here I have to draw attention to the problem we faced during our studies. Since we only measured the plate for 30 sec, Hg was first below the detection rate so it did not appear on the spectrum. On my request, we also performed a 90 sec measurement that conducted the detection of Hg presence. We suggest that the presence of the mercury refers to the application of fire gilding technique. However, it is more than just possible, we need more investigations to answer this question properly.

There were no significant differences between the values of the pressed sheets and the pendants and the bit. In view of the fact that the assemblage got in the museum in the 1930s, allegedly they used some kind of chemical cleansing, which could have caused some undeterminable contamination. These have not been marked on the spectrum. Furthermore, K and L lines are indicated on the depicted spectrums.

From an archaeological aspect, it was important to study profoundly the pressed and chased pattern of the two pendants, not just the central motif of them. Comparing the two sheets of pendants A and B, it can be seen, that small, insignificant differences appear (e.g. the bunch of grapes were composed from different number of grapes) (Figure 6). It seemed interesting whether this difference reflects in the material composition or not. The phenomenon is, in fact, common in the Migration Period. It can be observed on several already studied pendants from horse harnesses (e.g. Untersiebenbrunn, Austria). For this reason, it would be so important to answer these questions. Were these objects made using the same pressmould? Were they made at the same time or later, after one of them had been damaged? Maybe, they made a copy of the original object.

By comparing the projection of the spectrums, all of this can be clarified (Figure 7). There are no significant elemental differences, so it is possible that the press-mould was equal, but either two goldsmith have decorated them or only the central ornament was important, and the goldsmith and his apprentice freely decorated the other parts.

**Conclusions, long-term goals**

Presumably, the assemblage came to the Carpathian Basin with one of the Eastern people fleeing from the Huns – perhaps with the Alans – but it is possible that an Eastern descanted goldsmith made them here after his arrival to the Carpathian Basin. Now, it is not fully cleared whether the artisan or just the technology (goldsmithing and decoration style) reached Central-Europe.

Which we certainly know is that:

- the analogies and the ornamentation are likely to be of Eastern origin,
- the style of the decoration, the use of materials and the time of the possible burial can be determined (AD. 350–400).

It was successfully approved, how important it is to revise and verify the description of previously documented objects. In archaeology, it is vital to pose the right questions, and to find proof through elaborated verification and precision.
Our goals of the archaeometrical investigation were essentially fulfilled. We determined the elemental composition (Au, Ag, Cu, Hg) and the technique of the ornamentation (fire gilding). In our planned future comparisons, the analysis of material composition will have a key role, particularly in case of determining provenances.

Disclosure statement

No potential conflict of interest was reported by the author.

Notes on contributor

Réka Á. Piros (University of Szeged) is a Ph.D. student in the Department of Archaeology, University of Szeged.

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