Contribution ID: **483** Type: **Oral report**

PROVENANCE OF METAL ARTEFACTS OF THE LATE BRONZE AGE FROM THE SOSNOVAYA MAZA HOARD BY MC-ICP-MS LEAD ISOTOPE ANALYSIS

Monday, October 12, 2020 5:25 PM (25 minutes)

Lead isotope analysis (LIA) is widely applied by archaeologists as a method for provenance studies of metal artifacts [1, 2]. Nevertheless, there are several issues complicating LIA interpretation of archaeological artefacts, including following [2]: 1) ore deposits can have identical or overlapping isotope compositions, even when they are geographically far apart; 2) the recycling of scrap metal has also to be taken into account, and the isotope pattern resulting from such processes cannot be compared with the original ore source; 3) the assignment of metal artefacts to a raw material source could be hindered further if ores from different sources had been smelted together [2].

The hoard found near the village of Sosnovaya Maza (Saratov region, Russia) in 1901 is the second largest hoard of the Bronze Age in Eastern Europe with its total weight of 22.5 kg. It is composed of sickles and their fragments, daggers and their fragments, and some other metal artefacts [3].

The aim of the work is to assess the homogeneity/heterogeneity of the ore base used when smelting the sickles of the Sosnovo-Mazinsky hoard and to determine the probable ore resource base or several sources of ore used for metal smelting.

The lead isotope composition of copper alloys of items from the Sosnovaya Maza hoard and bronze items of a comparative samples from the archaeological sites of the Urals and Kazakhstan was studied.

A Perkin Elmer ELAN DRC-e quadrupole ICP mass-spectrometer was used to obtain lead isotope ratios according to the methodology proposed by [4]. For Pb isolation, an extraction chromatographic column containing Pb-selective PBA052316 100-150 mm resin was used.

The comparative analysis of obtained data with the lead isotopic analysis of copper ores from ancient and modern mines of the Cis- and Trans-Urals regions allowed an assumption to be made about the probable use of several types of deposits –copper-pyrite of the Southern Urals; Late Permian oxidized ores of the Urals from the Sakmara-Samara mining and metallurgical region; the ore of the third type, characterized by highly radiogenic $^{208}Pb/^{204}Pb$, probably comes from the deposits of northern Kazakhstan. The variability of the lead isotopic composition of the hoard items confirms the use of several ore deposits and the re-melting of bronze scrap.

The work was supported by RFBR grant No. OFI-M 17-29-04176.

References:

1. A. Hauptmann. The archaeometallurgy of copper: evidence from Faynan, Jordan. Springer Science & Business Media, 388 p. (2007).

2. E. Pernicka *et al.*, Jb Röm-German Zentralmuseum **31**(2), 533 (1984).

3. N. Shishlina *et al.*, Sickles from the Sosnovaya Maza hoard of the Late Bronze Age from the Lower Volga region: technological analyses, experiments and chronology (in press).

4. D. De Muynck, C. Cloquet, F. Vanhaecke, Journal of Analytical Atomic Spectrometry **23**, 62 (2008).

Primary authors: SHISHLINA, N.I. (State Historical museum, Moscow, Russia); KISILEVA, D.V. (A.N. Zavaritsky Institute of Geology and Geochemistry UB RAS, Ekaterinburg, Russia); LOBODA, A.Yu. (National Research Center "Kurchatov Institute", Moscow, Russia); ISMAGULOV, A.M. (National Research Center "Kurchatov Institute", Moscow, Russia); VASHCHENKOVA, E.S. (National Research Center "Kurchatov Institute", Moscow, Russia; IREA-National Research Center "Kurchatov Institute", Moscow, Russia); RETIVOV, V.M. (National Research Center "Kurchatov Institute", Moscow, Russia; IREA-National Research Center "Kurchatov Institute", Moscow, Russia); TERESCHENKO, E.Yu. (National Research Center "Kurchatov Institute", Moscow, Russia; Shubnikov Institute of crystallography FSRC "Crystallography and Photonics"Russian Academy of Sciences, Moscow, Russia)

Presenter: SHISHLINA, N.I. (State Historical museum, Moscow, Russia)

Session Classification: Section 9. Nuclear-physical methods in the study of cultural heritage objects

Track Classification: Section 9. Nuclear-physical methods in the study of cultural heritage objects.