

Preliminary physicochemical studies in a shield handle originating from the Przeworsk culture cemetery located in Czersk

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The motivation for the analysis of the shield handle from the Przeworsk culture cemetery located in Czersk, a unique ancient metal object, was the possibility of gathering information which enabled understanding of ancient metallurgy processes. Elemental composition and structural variations that were evident visually in the shield handle were studied. The results were compared with tests carried out for the two fibulas on the areas that visually appeared silvered (in the bow). The following analysis is only the preliminary phase of the study. Because of the unique character of the object physico-chemical analyzes are planned and comparison with experimental smelting including chemical vapor deposition of specific bronze and silver corrosion layers will be performed. The analysis was carried using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) and neutron imaging (NI) techniques with preliminary imaging with scanning electron microscopy coupled to energy-dispersive X-ray analysis (SEM/EDS).

LA-ICP-MS provided information about the elemental composition of the alloy (Figures 1 and 2).

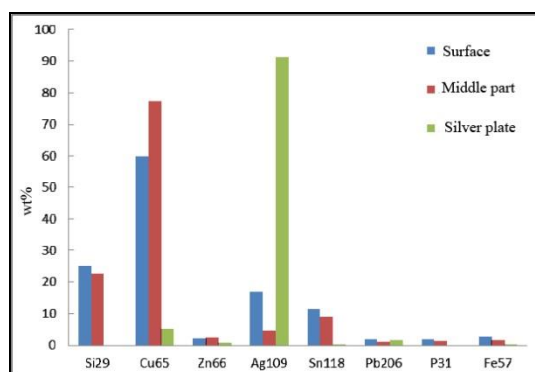


Figure 1. Results of the quantitative polled analysis of the elemental composition of the main isotopes comprising three representative sampling points.

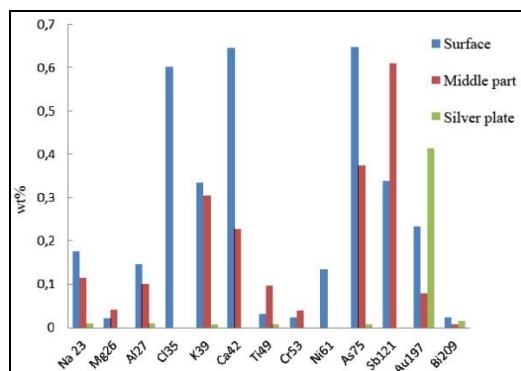


Figure 2. Results of the quantitative polled analysis of the elemental composition of trace isotopes comprising three representative sampling points.



New techniques for the non-invasive investigation of the surface and subsurface structure of heritage objects

The base metal alloy of the object, onto which the silvered surface was applied, was interpreted as a bronze.

Elements responsible for the corrosion processes were detected, such as Cl and S (chloride corrosion and sulfide corrosion) and this fact can influence the shape of the surface silver ornamentation today, assuming the ancient preparation technique called fire silvering has been used.

In order to interpret the material layers the neutron imaging technique was used. Neutronography photos are shown in Figure 3 and 4.

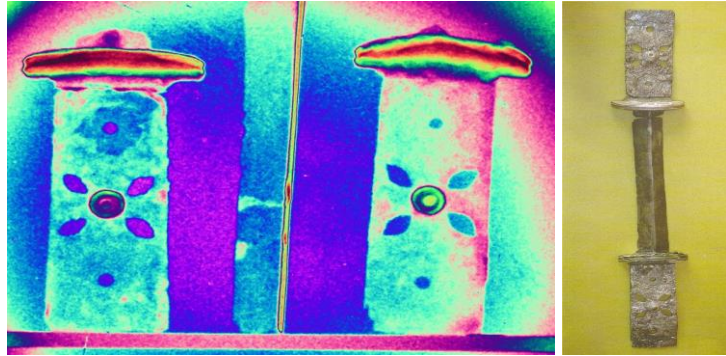


Figure 3. NI photos of silver pieces of the handle (right and left side of photo) and for the central component, front view. On the right is a normal photograph of the object

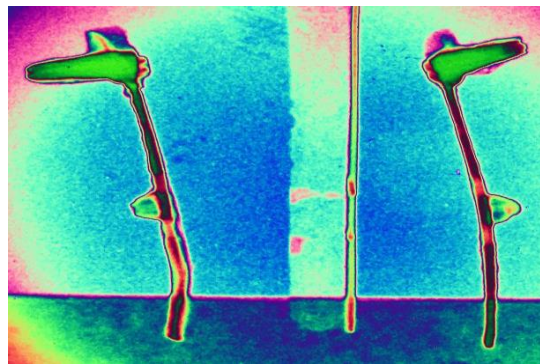


Figure 4. NI photos of silver pieces of the handle, side view.

Darkening of the image in this case is mainly due to the thickness of the irradiated layer. Inhomogeneities are visible within the silver plated areas, possibly associated with the degree of corrosion and heterogeneous object texture and with the thickness of the silver layer.

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