

CULTURAL HERITAGE ARTIFACTS AS BOUNDARY OBJECTS BETWEEN ART AND SCIENCE – THE ROLE OF COMPOSITIONAL ANALYSES

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The analysis of art materials (from metals, glass, ceramics to pigments) has a more and more important role in authentication, provenance studies and choosing appropriate conservation procedures. Some applications of three X-ray based elemental analysis methods – X-Ray Fluorescence (XRF), Proton Induced X-ray Emission (PIXE) and Synchrotron Radiation XRF (SR-XRF) are presented:

The authentication of thirteen Dacian gold exhibited at the National History Museum of Romania, Bucharest. The multi-spiraled bracelets (armbands), made of compact gold, belong to the classical period of the Dacian civilization (2nd century B.C. - 1st century A.D.). The bracelets were recovered (2006-2011) from the international market of antiquities through a common effort undertaken by Romanian authorities in collaboration with French, German and USA authorities.

The compositional analysis and chasing tools fingerprints demonstrated the common provenance (same workshop and probably same silver-“master”) of four valorous Thracian silver artifacts from USA (New York and Detroit museums) and from Romania (Bucharest National History Museum of Romania).

The role of non-destructive atomic analytical techniques for art objects “in situ” studies (directly in museums and galleries using portable spectrometers) is highlighted.

Dacian bracelets – modern detective story

In January 2007, after a long series of investigations of the Romanian authorities collaborating with the Interpol, four spiral-shaped gold bracelets were recovered and returned to Romania from France and the USA. A fifth gold bracelet was recovered thanks to the co-operation between the Romanian and French judiciary authorities, while the sixth bracelet was recovered by the Romanian Border Police in June 2007 from a member of a criminal group. Three more bracelets were repatriated in August 2007 from collectors from Switzerland and the USA, while two more bracelets were bought back from the USA in December 2008. The last two bracelets recovered until now were brought to Romania in July 2009 and May 2011. Approx. 450 Dacian gold coins (“Koson”-type staters) were also recovered from treasure hunters in the last 10 years. To authenticate these precious items, modern X-ray-based analytical methods were used.

X-Ray based studies on ancient gold metallurgy

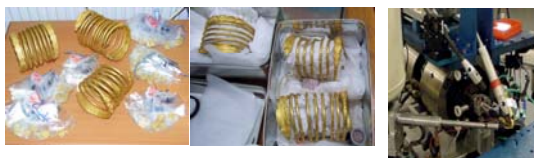
We analyzed 40 micro-samples (1-2 mg) from Dacian gold items - “Koson”-type staters and spiraled bracelets - by micro-PIXE at AGLAE accelerator, Paris and by micro-SR-XRF at BESSY Synchrotron, Berlin. Their elemental compositions featuring relatively large Ag amounts (10-20%) and small Cu amounts (1-2%), fit native gold pattern, showing a inhomogeneous structure because the manufacturers didn't used an advanced technology - a mixture of gold nuggets and gold dust was melted down without being perfectly homogenized. Cold working and sintering of gold concentrates conserved in the final product mechanical impurities (isolated minerals, micro-inclusions). Copper concentration in artifacts is higher than in Transylvanian native gold, related to the presence of chalcopyrite (CuFeS₂) “fool's gold” and pyrite (FeS₂) - due to probably confusion made by Dacian “miners” and to primitive processing of raw material. The micro-PIXE and micro-SR-XRF measurements on the gold spirals and “Koson” coins determined compositions that were consistent with the ones of natural panned gold that has not been deliberately alloyed or purified, mixed with primary gold.

Thracian silver Helmet – Detroit Institute of Arts Thracian silver Cup - Metropolitan Museum of Art New York

Meyers, Pieter, "Three Silver Objects from Thrace: A Technical Examination," Metropolitan Museum Journal, vol. 16, 1982, pp 49-54

Agighiol Hoard Helmet and Cup – National History Museum of Romania, Bucharest

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Dacian gold spiraled bracelets and gold coins



Dacian Koson with monogram



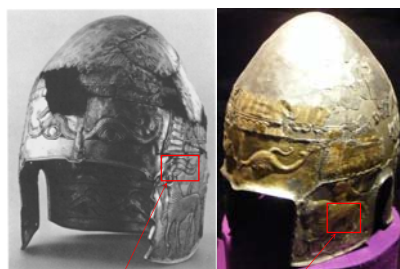
Dacian Koson without monogram



Sarmizegetusa Regia – The Sacred Zone



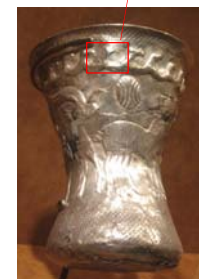
Gold Dacian Helmet



Thracian Helmet - Detroit

Thracian Helmet - Agighiol Hoard - Bucharest

Same chasing tool – same workshop



Thracian Cup – Metropolitan Museum of Art – New York



Thracian Cup – Agighiol Hoard - Bucharest

Same chasing tool – same workshop

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