

Testing the capabilities of 3 MV accelerator: detection of Sn traces in gold artifacts and low Z elements (Na, Mg, Al, Si) in ancient glass shards

The gold of prehistoric artifacts is mainly alluvial, containing as traces cassiterite (tin oxide) micro-grains from the placers. The presence of cassiterite can authenticate the objects. Sn traces detection in Au matrix is difficult because of Ag presence (Sn X-ray K-alpha and Ag X-ray K-beta rays have practically the same energy) and because of high Au background. Previously we performed such measurement at AGLAE-Louvre accelerator using a 70 microns copper filter which strongly reduced the Au background. The results for micro-samples from Dacian gold spiraled bracelets are published in [1].

Our intention is to perform a similar micro-probe experiment in Bucharest – both in vacuum and in air - on micro-samples previously analyzed at AGLAE to test the capability to measure small (e.g. beads) – in vacuum - and big (e.g. brooches) – in air – items. If the experiment will be successful, we intend to analyze gold artifacts from Sarasau hoard recently acquired by the National History Museum of Romania.

To characterize ancient glass the identification of low Z elements is essential for the technique used: Na means the use of Natron (mineral from Egypt) as flux, K means the use of ash from plants or wood – an alternative for Natron when the commercial contacts with Egypt were not possible. Mg and Al also can give information on used technology and consequently on workshops provenance. Until now we used a combination PGAA (Prompt Gamma Activation Analysis) at Budapest reactor and milli-PIXE at KFKI old linear accelerator – see [2].

Our intention is to determine if at our 3 MV accelerator is possible to measure in vacuum light elements (Si, Al, Mg, Na) from ancient glass shards (Byzantine and Medieval) previously analyzed in Budapest. If the experiment will be successful we intend to measure fragments of Byzantine glass bracelets found in settlements along Danube in South Muntenia and in Dobroudja.

[1] SR-XRF and micro-PIXE studies on ancient metallurgy of thirteen Dacian gold bracelets - B. Constantinescu, A. Vasilescu, M. Radtke, U. Reinholz, Claire Pacheco, L. Pichon - Applied Physics A 109, Issue 2 (2012), 395-402

[2] PIXE and PGAA – Complementary methods for studies on ancient glass artefacts (from Byzantine, late medieval to modern Murano glass) – B. Constantinescu, Daniela Cristea-Stan, Z. Szoekfalvy-Nagy, I. Kovacs, Z. Kasztovszky, Ildiko Harsanyi – Nucl. Instr. Meth.in Phys. Res. B (2017) – <http://dx.doi.org/10.1016/j.nimb.2017.07.017>