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P48 - Micro-PIXE and micro-XRF applied to ancient coins

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High-tech replication technology combined with old-school craftsmanship raise new questions on the authentication of ancient coins. As such, numismatists are aware that the traditional methods used to determine coin' s authenticity, like visual inspection, are often insufficient, and look for different approaches that may give a conclusive answer.
Particle Induced X-ray Emission (PIXE) or X-ray Fluorescence (XRF) are becoming common analytical techniques applied to cultural heritage artefacts, including coins, and that may help to distinguish a true coin from a modern fake.
Surface inhomogeneities (thickness and composition) created by centuries of corrosion growth in the most varied environments may hinder the results obtained by these techniques. However, if a micro beam is used it is possible to select small regions with different degrees of corrosion in the coin surface, and to decouple the corroded from the uncorroded volumes.
This work presents the results obtained by micro-PIXE and micro-XRF for two copper and two silver XVI century Portuguese coins. A comparison in terms of trace elements detected and quantified by both techniques is very important as they can give information about the ores provenance or purification processes used. Micro-PIXE spectra were acquired using 1.0 and 2.0 MeV proton beams from the nuclear microprobe (resolution 3⊠4 ⊠m2) located at the Laboratory of Accelerators and Radiation Technologies at CTN (Sacavém - Portugal). The used 80 mm2 Link X-ray detector has a 145 eV energy resolution and it is positioned at 135o to the beam direction. As for the XRF spectra, they were acquired using a M4 Tornado micro-XRF spectrometer fitted with a Rh-tube (Bruker AXS) and a X-Ray poly-capillary optic offering a spot size down to 25 µm combined with high excitation intensity. Detection of fluorescence radiation was performed by an energy dispersive Silicon-Drift-Detector with 30 mm² sensitive area and energy resolution of 142 eV for Mn-Kα.

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