

How X-rays can tell a story long fifteen centuries

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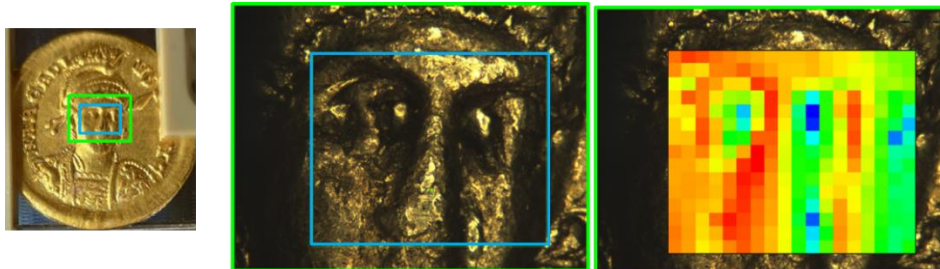
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X-rays are an excellent investigation tool for the study of ancient gold coins, as they can assess chemical information in a non-destructive way [1-5]. Synchrotron Radiation (SR) offers additional advantages over the laboratory sources, opening exciting possibilities for cultural heritage. Thanks to their high-intensity, SR beams can detect trace elements in the ppm range, enabling historians and numismatics to reconstruct not only the methodologies employed in ancient metallurgy, but also to gain details about the geographical location of the mines, coinage processes, and gold purification methods. The use of SR results into high-accuracy analyses: the sensitivity to small variations in the Au purity paves the way to the understanding of inflation or devaluation dynamics in the Ancient Coinage [e.g. Roman Empire and Byzantine Empire].

In this work, we analyzed four gold coins (3 solidi and 1 tremisse) minted from the IV to the V century, combining laboratory techniques with SR techniques available at the Elettra synchrotron in Trieste, Italy. Spatially-resolved techniques like Scanning PhotoEmission SpectroMicroscopy (ESCA Microscopy beamline), and XRF mapping (XRF beamline) were used to distinguish the composition of the alloy from that of successive deposits due to machinery/erosive processes. From a fine quantification analysis, the presence of trace elements like Pt, Pd, Ag, Hg, Cu, and Zn was assessed and quantified. In addition, on the basis of the XRF maps, different areas were selected for X-ray Absorption Spectroscopy (XAS) at the K-edges of Zn, Fe, and Cu, probing the oxidation states of these elements. Combining different SR techniques, we could assess the Au purity, as well as the chemical composition of the contaminants being the fingerprints of the geographical location of the Au mine, and yielding information on the Au purification processes, on the coining materials, and on the compounds deposited during burial periods.



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