



A multi-analytical approach to reconstructing the 3rd century economy

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Nowadays, analytical chemistry is fundamental for the characterization of cultural heritage, the study of ancient metallurgical techniques and to support archaeometric studies. In this field, multi-analytical approaches combining non-destructive and micro-destructive techniques are preferred, in order to obtain a complete characterization of ancient samples. Often, multivariate analysis aids data processing, allowing the determination and the chemical mapping of unknown substances [1].

About 200 Denarii and Antoniniani (silver or silver alloy coins of the 3rd century) from a hoard found in the Balkan area, now kept in the Numismatics Laboratory of Department of Humanities (University of Trieste), were studied [2]. The approach used for the characterization of ancient coins included preliminary non-destructive analyses (SEM-EDX and ED- μ XRF), followed by micro-invasive analyses (ICP-AES and ICP-MS) of a representative sample of Denarii and Antoniniani. Non-destructive analyses highlighted the inhomogeneity of the coins' surfaces and revealed the presence of Ag, Cu, Pb, Ni, Fe, Ca, Si and Al. By drilling the edge of some coins, a few mg of bulk sample was taken, dissolved in a specific acid mixture and analysed by ICP-AES and ICP-MS. Micro-destructive analysis revealed an average bulk alloy percentage of 54% of Ag and 45% of Cu (RSD% <5%), with the exception of one coin that had 76% of Ag and 23% of Cu (RSD% <10%). The remaining 1% consisted of Pb, Sn, Ni, Zn, Bi and Fe.

The multi-analytical approach adopted proved to be very useful in obtaining the overall composition of the coins: in fact, especially in the case of ancient coins of binary alloy, such as the Denarii and Antoniniani under study, the surface is not similar to the bulk [3]. Only by combining several analytical techniques is it possible to determine enrichment/corrosion phenomena and to distinguish the elements that constitute the metal alloy from those that form the *patina*.

References

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