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Analytical Investigation on Archaeological Patina: A Tool to Shed Light on the Provenance of Ancient Bronze Coins

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The elemental composition of archaeological patina of ancient bronze coins is very complex and it results from the deterioration processes, generically named "corrosion", that occur during the centuries. The corrosion products covering the coins are strictly correlated to the environmental characteristics of the burial site. So the analysis of coins surfaces can be a useful tool for numismatists to verify the provenance of coins: a different surface composition of similar bulk materials could be probably due to different micro-environmental conditions[1,2,3]. The aim of this study was to verify whether a set of 117 ancient bronze coins of the Roman Empire period that was declared to be found during surveys on Cesén mountain (North-eastern Italian Alps) could be compatible with another set of 103 coins coming from the archaeological excavation carried out thereafter in the same area. To avoid the damage, non-destructive analytical techniques were used to characterize the surface of six coins taken blindly from the two sets in order to highlight similarities and differences between the samples. On the other hand, some soil samples collected in the archaeological site were analysed to verify whether the patina layer of all coins could contain chemical components compatible with the elemental composition of soil. The elemental analysis of the patinas was carried out by micro-X-ray fluorescence spectroscopy (μ-XRF). To better observe the morphology of corroded surface, scanning electron microscopy coupled to energy dispersive spectroscopy (SEM-EDS) was used. Then corrosion compounds covering the coins were identified recording ATR-FTIR (attenuated total reflectance-Fourier transform infrared spectroscopy) spectra. Soil samples were analysed without pre-treatment by means of XRF and, after acid digestion, by means of inductively coupled plasma atomic emission spectroscopy (ICP-AES). The bulk composition of coins was specific of different coinage periods, whereas some elements unexpected in the metal alloy were found only on the surface of two coins, in particular Ti and Mn that were also found in soil samples. This result, together with the morpho-chemical investigation, lead us to subdivide the six coins into two groups, each containing two and four coins: this grouping corresponded respectively to the set of coins coming from the archaeological site and the set of survey. The group of four coins seems not to show the characteristics of coins exposed to soil for long periods of time: patina and corrosion products could suggest a different provenance (restored finds or even a hoard). Analytical results of this study support numismatists who were not convinced of considering all coins coming from the same site on the basis of archaeological documentations. For this reason, they will not take into account all the coins to develop interpretive hypotheses but only those coming from archaeological excavations.

References
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