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Compositional study of Byzantine glass bracelets discovered at the Lower Danube

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Abstract

Twenty three glass bracelets fragments of different colors and appearances excavated at Păcuiul lui Soare, Dobrogea, Romania and dated to the 10th-11th century AD were analyzed for their chemical composition using Particle-Induced X-ray Emission (PIXE) and Particle-Induced Gamma-ray Emission (PIGE) techniques at AGLAE accelerator of Centre de Recherche et de Restauration des Musées de France (C2RMF), Paris.

Analytical data showed that all bracelets are soda-lime-silica glass of intermediate recipes, with compositional patterns between the natron and plant ash ranges, indicating practices of extensive glass recycling. Păcuiul lui Soare glass bracelets turned out to be similar in composition with the ones found in other nearby coeval sites, but also with bangles discovered in more remote Byzantine sites. The analyses revealed that the same technological choices have been made to produce the bracelets, namely they have been produced in workshops that had access to vitreous artefacts of different compositions, i.e. produced using distinct types of fluxes. Recycling seem to be a characteristics for all glass bangles produced in the Byzantine Empire at the end of the first millennium AD, regardless of their finding place and dating.

As concerning the glass color, blue hues in Păcuiul lui Soare were induced by the presence of small amounts of cobalt (hundreds of ppm), while the green and black colors were

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