

Neutron investigation of an exceptional zinc lamp from the Academia Georgica Treiensis archaeological collection (Italy)

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The Academia Georgica Treiensis is one of the oldest Italian Academies, created in the XV century for the main interests of poetry and literature. In the XVIII century, influenced by the Enlightenment ideas, the Academy decided to renovate its interests “encouraging rational and practical studies to improve agriculture and industry and to honour sciences, literature and arts”[1]. The Archaeological Collection of Academia Georgica Treiensis was put together by the noble family of Teloni, Counts in Treia, Italy, between the end of the XVIII and the end of the XIX century. The Collection has been recently reorganized and inventoried: it is composed of about 517 pieces (e.g. armours, table-ware, jewels, ceramics and varied tools), mostly of unknown origin but belonging to prehistoric and ancient periods, nevertheless it is not excluded that some objects are earlier [2, 3].

A few metallic objects from this collection have been selected for a neutron based archaeometric investigation. The primary goal of the analyses was to advance the accurate technological and material description of the objects providing scientific data for a further and more comprehensive comparative analysis also covering the find material from the close archaeological sites [4, 5]. The involved complementary techniques are Prompt Gamma Activation Analysis (PGAA), Time-of-Flight Neutron Diffraction (TOF-ND) and Neutron Radiography (NR). The neutron investigations allowed us to determine the bulk composition, also providing a qualitative and quantitative assessment of the phase composition and the structural properties of the constituents, as well as radiographic images, finally to identify possible manufacturing techniques. An additional examination, carried out by external beam particle induced X-ray emission (PIXE) spectroscopy, provided a quantitative analysis of major and trace elements and supplied data on the near-surface elemental composition complementary to the results characteristic for the bulk.

The present case study is focussing on one of the investigated objects, a not common, so called polilicnes lamp, which proved to be unique in several aspects drawing more attention to its production and dating. The lamp is characterised with six ogive-shaped projections of which three are decorated with different bearded faces. Based on the type of the artefact as well as its supposed bronze material, it was considered as an ancient product from the Imperial Roman period. The obtained results, however, showed surprisingly that it is mainly made of metallic zinc. It raises several questions, since this material is not to be expected from the classical antiquity. Because of the high volatility of metallic zinc and the reactivity of the zinc vapour, producing zinc metal was a technological challenge before the industrial discoveries of the early modern period. Considering the few relevant historical and archaeological sources about the ancient and medieval metallurgical processes, metallic zinc could be available until the beginning of the XIX century only as a by-product of the zinc-rich lead ores smelting [6, 7]. The gained zinc, however, could be of a very small amount practically insufficient for manufacturing large objects.

With respect to metallic artefacts from archaeological periods, the presence of zinc among the alloying components (both in brass and zinc objects) is of great significance as the way of its use may indicate the possible earliest date of the production. In the case of the polilicnes lamp the identified elemental and phase composition, i.e. the high pureness of the zinc material, opens different hypotheses about its origin querying its ancient production and genuineness. With the archaeological interpretation of the analytical results we aimed to clarify and reconstruct the context and history of this peculiar piece belonging to the investigated collection.

References

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