The employment of pXRF analysis for the qualitative study of Hellenistic and Roman terracottas from the House of Orpheus in Nea Paphos

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In recent years, portable X-Ray Fluorescence (pXRF) has become one of the most commonly used analytical tools for determining, both qualitatively and quantitatively, the chemical composition of a variety of materials of archaeological and historical significance. The term “qualitative” refers to the characterisation of materials based on some quality or characteristic, rather than on some quantity or measured value, as in the case of a “quantitative” research, which relates to values of measurements.
In the framework of the interdisciplinary study of the Hellenistic and Roman terracottas from the House of Orpheus in Nea Paphos, pXRF was employed for a qualitative, preliminary study of compositional uniformity or diversity among the assemblage. The employment of pXRF was considered a time- and cost-effective way for the fast recognition of potential patterns among the figurine assemblage before proceeding with sample selection for undertaking more expensive and time-consuming methods of analysis. Specifically, pXRF was employed as a complimentary method to the typological and stylistic analysis of the figurines, and to their quantitative, chemical characterisation using Neutron Activation Analysis.

Taking into account the limitations of the pXRF technique, this first step of the study attempted to address compositional variability among the figurines, using a non-destructive analytical method, which requires no sample preparation, while offering a vast corpus of analytical data in a relatively short period of time. It was anticipated that the patterns observed could provide the guidelines for sample selection for the subsequent Neutron Activation Analysis.

The 281 terracotta figurines or fragments of recorded at the time of our investigation were analysed. The elemental analysis provided a medium for grouping together ceramic samples made with the same or similar raw materials, coming from the same geological region, or for distinguishing between groups of ceramics, noting ceramic variability within the sample. In addition to the 281 terracotta figure specimens, 19 fragments from clay hot-water bottles were also included in the analysis. The latter specimens provided a counterpart to the analysis of the terracotta figurines and a reference point for fabric diversity among contemporary but differing types of ceramic artefacts.

The initial picture depicted, applying Hierarchical Cluster Analysis to the dataset, suggested the presence of at least two large groups, both of which can be further divided into smaller inner clusters. Overall the presence of these clustering patterns suggests that the terracotta figurine assemblage from the House of Orpheus is characterised by a certain degree of fabric variability, enabling us to suggest that these
were produced by different workshops, using different ceramic fabrics; that is different clay mixtures and/or different practices in clay processing.

In order to investigate further the compositional and technological variability within the figurine assemblage, in a second stage of data processing, we decided to present the analytical results in terms of two ratios Potassium (K)/ Silicon (Si) and Calcium (Ca)/ Iron (Fe); the first being of mineralogical, and the second of chemical significance. In the generated scatterplot, there is a central cluster of specimens that is composed by the majority of the analysed samples. In addition there are specimens which deviate from the central cluster, creating smaller groupings or being dispersed as outliers.

A more interesting picture is illuminated if we try to mark the terracotta figurines according to their thematic representation. For the sake of simplicity, we have applied the codes animal and human, according to the theme represented. In those cases, where a more detailed identification was feasible, we added Anteros, Aphrodite, Dionysus, Eros, the so-called Maltese spitz or terrier dogs, Tyche and Mask. A small number of figurines bearing an inscription are coded as inscribed – even though these may belong to any of the above categories. A large number of fragmentary and unidentifiable examples were simply marked as unspecified. Many of these are the bases of lost representations. Finally a range of bases, altars or columns, obviously parts of more complex compositions were coded as architectural features.

Overall, it seems that the largest number of terracotta figurines from the house is made at the same production center, or adjacent workshops located within the same geological region, while another, smaller group comes from other production centres, from within or outside Cyprus. This argument is justified by all different methods of data processing. It is suggested, thus, that the inhabitants of the House of Orpheus did not use exclusively only one source for obtaining their terracotta figurines but rather that they, or their supplier’s, addressed their needs to different workshops or production complexes, one of which was their main source of supply.

Dendrogram

The pXRF analysis of the terracotta figurine assemblage from the House of Orpheus in Nea Paphos has offered us the possibility of addressing a number of issues related to the production and distribution of these artefacts. It allowed us to identify general
patterns within the entire terracotta figurine assemblage, provided guidance during sampling for NAA and offered the ground for the development of arguments using a combination of typological, stylistic, and compositional observations. It is anticipated that in the near future the correlation of the pXRF results with macroscopic, microscopic, and digital documentation acquired through hand-modelling techniques will provide the ground for the technologically authentic reconstruction of the terracotta figurines that will account for all aspects of their *chaîne opératoire*, from raw materials production to post-firing treatments. We hope that we have managed to convince of the significance of the pXRF technique in the future development of coroplastic studies. Evidently the establishment of similar projects in other areas in Cyprus and the wider Mediterranean region will add to the number of research comparanda for enhancing our understanding of the production and distribution of these extraordinary artefacts!

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