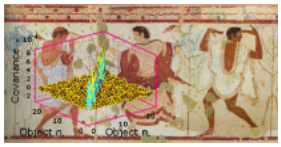

A Physical and Chemical Multi-Method Approach to Study and Characterise Fragments of Renaissance Pottery

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Introduction

The analytical characterization was performed of six separate 15-16th century pottery fragments found in the "Chancery" excavations in Rome. On the basis of the find site and the available historical evidence, it is likely that they were not exclusively of local manufacture but also originated in other neighbouring zones. Typological-style analysis enabled us to identify at least three different types of artefact: Roman production (fragments numbers 2 and 4), Roman production influenced by Montelupo (fragment number 6) and Deruta production (fragment number 3); samples numbers 1 and 2 apparently come from fragments that cannot be attributed with certainty to any of the three types. One further distinction may be made concerning the use to which these artifacts were put: samples no. 1 and 2 were terracotta objects in common use, while the other samples, fragments of enameled plates, had a more sophisticated use. For these reasons it was reasonable to assume that they also had a different mineralogical composition due to the use of raw materials that different at least partially from one sample to the next.

Materials & Methods

The test samples consisted of six separate fragments of renaissance potsherds (RP) (Fig.1) obtained from the excavations in the "Chancery" in Rome and dating to the 15-16th century. They were subjected to several different instrumental chemical analyses, in particular thermogravimetric (TG and DTG) analysis and differential thermal analysis (DTA), as well as to X-ray powder diffractometric analysis. Further data were obtained via porosimetric, thermomechanical (TMA) and emission spectroscopic (ICP) analysis.

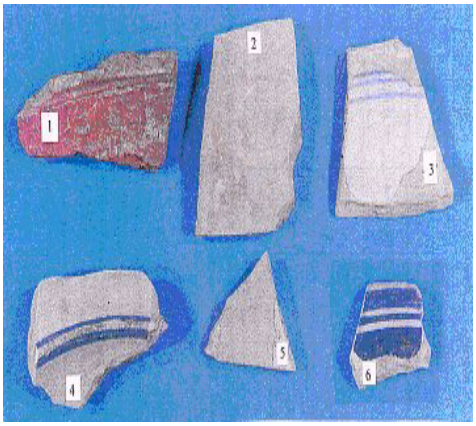

Fig.1; Renaissance pottery samples

Results

The X-ray diffraction spectra reveal a considerable degree of differentiation in the mineralogical composition of the test samples. The most significant differences among the samples were obtained for calcite, gypsum and the feldspars, which are not always present in all samples.

In the case of gypsum and calcite, both ICP analysis and thermogravimetric analysis confirm a clear-cut difference related to the presence and concentration of these substances in the various samples. The DTG and DTA curves point to the presence of calcium carbonate, above all in sample no. 2 and, in much smaller percentages, in samples nos. 3, 5 and 6. On the other hand the presence of a non negligible quantity of "water of constitution" from interleave hydroxyl groups seems likely in sample no. 4 and of water of crystallization in sample no. 1. The porosimetric curves of several of the samples tested also display a degree of differentiation according to the sample although all these

curves usually display a very uniform distribution of pore sizes: about 80% of the total volume consists of pores having a radius of between 7000 and 750 Å. On the other hand, the thermomechanical curves point to "equivalent firing temperatures" usually around 750 °C, except in the case of sample no. 2, for which a definitive value has yet to be determined by TMA for the equivalent firing temperature.

The data obtained using the various instrumental techniques described, principally via thermal analysis and X-ray diffractometry, confirm the different nature of these samples.

It is apparent that sample no. 2, which contains approximately 9% of carbonates originating from calcite, must be deemed to have been fired at a lower temperature than the other samples, which present a lower carbonate content. A possible recarbonation process would not indeed justify the high quantity of $CaCO_3$ contained in sample no. 2, even in view of the fact that all the samples were subjected to the same conservation treatment.

That all the other samples were fired at a relatively high temperature (around 750°C) is also demonstrated by the porosimetric analysis.

Conclusions

In conclusion, stylistic-typological analysis had already allowed at least three different types of artefact to be identified: of Roman production, Montelupo influence and Deruta production. The information obtained using the above-mentioned experimental techniques (mainly by means of thermal analysis, diffractometric analysis and ICP) provided a sufficiently exhaustive picture of the chemical and mineralogical composition [1, 2] and confirmed the diversity of these samples. The differences may actually be attributed to their different origin since they have all been kept in the same place and have all undergone the same type of conservation.

The firing temperature, estimated by means of thermomechanical analysis (TMA) using the Tite method [3], it believed to be around 750 °C for five of the six samples while it is probably lower for the sixth. This estimate is in sufficiently good agreement with the porosimetric curve even though the information provided by this technique is mainly qualitative in nature.

References

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