



Applications of Instrumental Analysis and Chemometrics to Old Roman Mortars and Stuccoes

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Abstract

Small quantities of roman mortars and stuccoes from the Theatre of Marcellus and Porticus of Octavia were subjected to different instrumental techniques, thermogravimetric analysis (TG, DTG), inductively coupled plasma emission spectroscopy (ICP), X ray diffraction (XRD). The instrumental characterisation and chemometry allowed to distinguish easily the stucco samples from the mortar samples.

Introduction

Following restoration and consolidation work carried out in recent years at the Theatre of Marcellus in Rome on the white stuccoes decorating the central area of the under vault of the auditorium, small samples of the smoother and more external stucco work became available, together with mortar fragments from the layer immediately below the stucco. Analogously since the consolidation work involved also the wall remains of the porticus dedicated to Octavia, which replaced the Porticus of Metellus during the Augustean age and was built on the foundations of the latter, samples of interstitial mortar from the bricks and the grid wall structure became available, together with a sample of wall stucco of this ancient structure. All the samples were characterised using instrumental analysis.

Materials & Methods

Small quantities of these finds (10-50 mg) from the above cited archaeological sites (fig.1) were subjected to different instrumental chemical tests to characterise and differentiate them according to their composition [1, 2]: thermogravimetric analysis and, after acid attack in microwave ovens, ICP analysis. All the samples were also subjected to powder XRD analysis, which detected practically, albeit in various degrees, calcite, quartz, pyroxene, analcine, diopside. Moreover, also traces of gypsum and calcium oxalate were found, particularly in the stucco samples.

Data are collected directly from instruments without pre treatment, the matrix is build on Louts spreadsheet [3] and the multivariate analysis was performed with Tanagra [4] and with MVSP [5] software.



Fig. 1, one site originating of analysed samples

Results

Results show that both the mortars and the stuccoes are composed essentially of calcium and magnesium carbonate (bonding agent) deriving by natural means from the carbonation of the original mortar, of which several small traces have probably been conserved, and of inert material, probably pozzolanic in nature, as it is mostly composed of quartz, pyroxenes, diopside and analcime, as evidenced by X ray diffraction powder.

In no case were any significant amounts of gypsum found, as shown by the diffraction data.

Conclusions

In conclusion, what clearly distinguishes the stucco samples from the mortar samples is the appreciably higher percentage of bonding agent (calcium and magnesium carbonate) contained in the former, and of inert material, in the latter, as result from TG and ICP data. In addition, also the percentage of water contained in the mortars is approximately double or more that found in the stuccoes. All this was quantitatively determined via thermogravimetric analysis.

These results still show, as once pointed out in previous researches [1, 2], the great importance of thermal data for the classification of mortars, frescoes, stuccoes and graffiti.

References

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