9th International Conference on NDT of Art, Jerusalem Israel, 25-30 May 2008
For more papers of this publication click: www.ndt.net/search/docs.php3?MainSource=65

DETERMINATION OF STRONTIUM CONCENTRATIONS IN CALCIUM-BASED GROUNDS WITH XRF & ICP-MS

Carole Namowicz, Marc Walton, Karen Trentelman
1200 Getty Center Drive, Suite 700, Los Angeles, CA 90049-1684, USA
Correspondence: CNamowicz@getty.edu, Fax: 310-440-7711

Non-invasive *in-situ* analysis of paintings by X-ray fluorescence (XRF) spectroscopy allows inference of the general class of ground present (*i.e.*, calcium- or lead-based), but the concentrations of individual elements are difficult to assess based on XRF data alone. For calcium-based grounds, strontium (not associated with strontium-based pigments) is frequently detected, and the determination of its concentration may prove valuable in assisting attribution studies. While the strontium concentration can be accurately measured using inductively coupled plasma mass spectrometry (ICP-MS), this technique requires the removal, and destruction, of small samples. In this paper, we describe the development of a methodology to calibrate the response of XRF to strontium in calcium-based grounds as a means to better understand the relative abundance of strontium without subjecting samples to ICP-MS.

In reviewing XRF data produced from rhenium and rhodium target XRF spectrometers, it was found that calcium-based grounds demonstrated strontium peaks with high intensities relative to the calcium peaks. This may be misinterpreted as an abnormally high concentration of strontium within the ground material. However, the same samples analyzed via ICP-MS revealed only trace amounts of strontium. To rationalize these contradictory results, a study was undertaken to determine the detection sensitivities of XRF and ICP-MS to calcium and strontium.

A series of pressed pellets designed to mimic the bulk composition of a gesso painting ground (containing 0.001 - 10% strontium in a calcium sulfate matrix) were prepared and analyzed using both instrumental techniques. Preliminary results indicate that the XRF spectrometers used in this study are extremely sensitive to strontium and have indicated concentrations as low as 10ppm. These results will be compared to those obtained by ICP-MS to develop a correlation between the techniques, thereby allowing better estimates of strontium concentrations to be assessed from XRF data.

This work is the first step in a larger project that will apply trace element analysis and the determination of strontium isotopic ratios by ICP-MS to the analysis of gesso painting grounds. This may serve to support attribution studies by determining possible relationships between paintings or identifying the geologic source of the ground material.