

Micro-Analytical study of a rare papier-mâché sculpture

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“Papier-mâché” is a term which has been applied to three-dimensional objects having a paper core [1, 2]. In Portugal there are very few examples of paper objects either in architectural decoration or in isolated objects such as sculptures [3]. The studied sculpture was an opportunity to learn more about a rather unknown and rare art form. Several questions were addressed such as the study of the support and pigments in order to establish a possible timeline for its production. For these purposes samples from the sculpture were observed under microscope and analyzed by the complementary micro X-ray Fluorescence (μ -XRF) and Raman techniques. The number of samples obtained from the sculpture was limited to its state of conservation.

Observation of cross-sections under microscope revealed two polychrome layers, most likely from different periods. These layers often present the same color palette, nevertheless the use of μ -XRF and Raman techniques enabled the differentiation of coloring materials used in both polychromies. The cross-section analysis of the flesh-tones also revealed the presence of two layers with similar colour. Both were achieved admixing zinc white and vermilion pigments. The presence of lead white - only found in the pink overpaint - allowed the distinction of the two layers. The original brown color of the tunic consisted on iron and manganese based pigment, likely umber while the brown overpaint was obtained admixing vermilion, carbon black and calcium carbonate pigments. Elemental mapping obtained using μ -XRF technique revealed similar gilding techniques layers (Fig. 2): the gold leaf was applied on a red iron based layer, likely red ochre. Brown coloring material was then applied over the gold and then carefully scrapped in order to let the gold visible and to create different patterns like the texture of the tunic or the leaf decoration in the lower part of the vest – “estofado” technique. Raman technique revealed the use of calcium carbonate in the ground layer of both polychromies and among paper fibers, possibly used as paper filler [4]. Paper fibers were examined with an optical microscope and were identified as textiles fibers.

The identified coloring materials lead us to believe that the sculpture was produced out in the 19th century, being overpainted in the first half of 20th century [5]. This conclusion is based on the identification in both polychromies of zinc white, which is a pigment that was only manufactured throughout Europe after 1850. Furthermore the fasten decrease of vermilion use after the manufacture of cadmium red after 1919 leads us to believe that the overpaint layer is from late 19th or beginning of the 20th century.

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Figure 1. “Papier-mâché” sculpture depicting Saint Anthony.

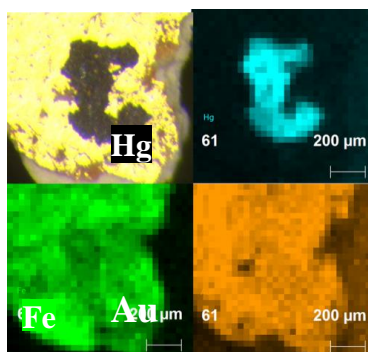


Figure 2. Photograph and X-ray fluorescence elemental mapping obtained for Hg, Fe and Au in original the gilding obtained at 100 ×.