Ground layers in Portuguese Baroque polychrome wooden sculptures: analytical results versus documentary sources

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According to technical treatises such as *Arte da pintura, symmetria e perspectiva* (1615) by Filipe Nunes, contractual documents and other documentary sources (Pacheco 1649; Brandão 1984–87; Alves 1989; Seruya 2002), grounds for Portuguese Baroque polychrome sculptures should be applied in several layers, often 10 or more. The first layer (*gesso grosso*) should be composed of anhydrite or calcium sulphate hemi-hydrate, and the later ones (*gesso fino*) of gypsum, the dihydrate form of calcium sulphate. As application in so many layers must have been a very slow process, it is possible that these recommendations were not always strictly followed.

To address this issue, two groups of four sculptures each were analysed, the first being high-quality pieces of conventional iconography (E1–E4) and the second (P1–P4) being interpretations made by less skilled craftsmen (Fig. 1). They were produced in northern Portugal during the last quarter of the 17th century and the first half of the 18th century. Identification of materials and characterisation of techniques were undertaken using energy-dispersive X-ray fluorescence spectroscopy (EDXRF), optical microscopy (OM), polarised light microscopy (PLM), scanning electron microscopy with energy-dispersive X-ray analysis (SEM–EDS), Fourier transform infrared (FTIR) spectroscopy and microchemical tests.

All the pieces have similar grounds in terms of the composition and the number of layers (Table 1). The main component is gypsum, in agreement with both previous analytical studies and documentary sources. However, the use of both types of *gesso* appears only in one conventional and one local work. Furthermore, aluminosilicate minerals were also detected in one conventional piece and lead white was found as an additive in two conventional and two local pieces. Although this mixture was not identified in previous studies, its use is mentioned in the Spanish treatise of Francisco Pacheco (Pacheco 1649: 406–7) as a means of reducing the number of layers. The impurities in the calcium sulphate indicate a material of poor quality, as is the case with most Portuguese gypsum. Some of the mixtures detected might have been made with the intention of improving the optical properties of the ground.

The number of identified layers varies between one and three in high-quality works and between one and two in the others. Although it is possible that some samples are incomplete, it is not likely that this occurred in every example. Therefore, it seems that the number of layers is in fact significantly smaller than one would expect from the documentary sources, something that could be related to the intention of preserving the carving details.

Table 1 Ground layers in the eight sculptures.

Sculptures		Ground layer characteristics		
Code	Subject	No. of layers	Colour	Composition
E1	St Dominic	1 to 3	brownish	*gesso fino*; carbonates; iron impurities
E2	St Francis Xavier	1 to 2	brownish	Flesh: *gesso fino* + lead white; aluminosilicate minerals Garments: *gesso fino*; iron impurities
E3	St Paul Martyr	1	white	*gesso fino*; carbonates; clay impurities
E4	St Andrew	1 to 2	brownish	*gesso grosso* + *gesso fino* + lead white; clay impurities
P1	St Stephen	1 to 2	white	*gesso fino*; carbonates; clay and iron impurities
P2	Virgin of the Annunciation	1 to 2	brownish	*gesso fino*; carbonates; clay impurities
P3	St John Evangelist	1	white	*gesso fino*; carbonates
P4	Jesus Christ after the Flagellation	1	brownish	*gesso grosso* + *gesso fino* + lead white; carbonates and clay impurities

Figure 1 The two groups of sculptures (Portuguese Catholic University; reproduced with permission). (See Plate 88 in the colour plate section.)

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Plate 88 The two groups of sculptures (Portuguese Catholic University; reproduced with permission). (See Fig. 1, p. 201.)