



## Calcium sulfate fillers and binders in Portuguese 15<sup>th</sup> and 16<sup>th</sup> centuries: Ground layers from a family painting workshop – Study by multianalytical spectroscopic techniques<sup>☆</sup>



Vanessa Antunes<sup>a,b,\*</sup>, António Candeias<sup>c,d</sup>, Maria José Oliveira<sup>c</sup>, Mercês Lorena<sup>c</sup>, Ana Isabel Seruya<sup>b</sup>, Maria Luísa Carvalho<sup>b</sup>, Milene Gil<sup>d</sup>, José Mirão<sup>d</sup>, João Coroado<sup>e</sup>, Virgínia Gomes<sup>f</sup>, Vitor Serrão<sup>a</sup>

<sup>a</sup> Instituto História da Arte da Faculdade de Letras da Universidade de Lisboa (IHA-FLUL), Alameda da Universidade, 1600-214 Lisboa, Portugal

<sup>b</sup> LIBPhys-UNL: Laboratory for Instrumentation, Biomedical Engineering and Radiation Physics, Departamento Física, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal

<sup>c</sup> Laboratório José de Figueiredo da Direcção-Geral do Património Cultural (LCR/JF-DGPC), Rua das Janelas Verdes 37, 1249-018 Lisboa, Portugal

<sup>d</sup> Laboratório HERCULES, Universidade de Évora, Rua Romão Ramalho 59, 7000-676 Évora, Portugal

<sup>e</sup> Instituto Politécnico de Tomar (IPT), Quinta do Contador-Estrada da Serra, 2300-313 Tomar, Portugal

<sup>f</sup> Museu Nacional de Machado de Castro, Largo Doutor José Rodrigues, 3000-236 Coimbra, Portugal

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### ABSTRACT

This study presents results on a developed methodology to characterize ground layers in Portuguese workshops. In this work a set of altarpieces of the 15<sup>th</sup> and 16<sup>th</sup> centuries, assigned to Coimbra painting workshop was studied, overall the masters Vicente Gil (doc. Coimbra 1498–1525), Manuel Vicente (doc. Coimbra 1521–1530) and Bernardo Manuel (act. c. 1559–94), father, son and grandson, encompassing from late gothic to mannerist periods. The aim of the study is to compare ground layers, fillers and binders of Coimbra workshop, and to correlate their characteristics to understand the technical evolution of this family of painters, using complementary microscopic techniques.

The cross-sections from the groups of paintings were examined by optical microscopy and the results were integrated through the analysis obtained by  $\mu$ -X-ray diffraction, scanning electron microscopy with energy dispersive X-ray Spectrometry,  $\mu$ -confocal Raman and occasionally with  $\mu$ -Fourier transform infrared spectroscopy imaging. Ground layers are of calcium sulfate, present as *gesso grosso* (mainly anhydrite with small amounts of gypsum) in the first and last phases of the workshop and *gesso mate* (mainly gypsum with small amounts of anhydrite) in an intermediate period. Binders have protein and oleic characteristics.

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### 1. Introduction – pictorial corpus under study

Formerly known as the workshop of the Master of Sardoal [1,2] it is known nowadays by historical documentation on the artists, as being Coimbra workshop, led by Vicente Gil (doc. Coimbra 1498–1525) and his collaborators, Manuel Vicente (doc. Coimbra 1521–1530) and Bernardo Manuel (act. c. 1559–94), father, son and grandson, with activity from the late 15<sup>th</sup> to late 16<sup>th</sup> centuries [3–5]. This family workshop is of crucial importance to understand the continuity practices of Portuguese painting and its influences of national and international context.

The pictorial corpus under study is composed by a set of panel paintings usually associated to Coimbra workshop, overall to the referred masters, encompassing from late gothic to mannerist periods (Table 1):

- Christ on the Cross, with no authorship defined, it has been lately linked to earlier works of Coimbra workshop, namely to *Santa Clara-a-Velha* altarpiece [6,7].
- *Santa Clara-a-Velha* altarpiece has no defined authorship, being previously associated to the work of Vicente Gil and Manuel Vicente, father and son. Formerly studied in a first multianalytical study published in 2010 on *Santa Clara-a-Velha* altarpiece, allowed to identify ground layers as calcium sulfate [6,8]. *Santa Clara-a-Velha* altarpiece is nowadays connected to Italian and Spanish gothic–renaissance influences [9] and consists of four paintings: Saint Clara and the miracle of Assisi, Agony in the Garden (file 20-08C), Lamentation of Christ (file 20-08A) and the predela Christ and the Apostles (file 20-08D). The analytical results of the three last paintings are presented here.

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\* Corresponding author at: LIBPhys-UNL: Laboratory for Instrumentation, Biomedical Engineering and Radiation Physics, Departamento Física, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal.

E-mail address: [vanessahantunes@gmail.com](mailto:vanessahantunes@gmail.com) (V. Antunes).

**Table 1**  
Set of studied paintings.

Title	Dating	Assignment	Location	File sample numbers	Inventory number
Christ on the Cross	Late 15th century	Anonymous, Coimbra workshop	Church of São Silvestre de Unhos, Sacavém	16–81	–
Santa Clara-a-Velha altarpiece	Late 15th century	Anonymous, Coimbra workshop (?)	Museu Nacional de Machado de Castro (MNMC)	20-08 (A to D)	inv. MNMC2521 to MNMC2524; P8
S. <i>Simão</i> triptych	early 16th century	Anonymous, Coimbra workshop	Museu de Aveiro (MA)	113-11	MA4/A; MA4-1/A; MA4-2/A
Assumption of the Virgin	1510–1520	Vicente Gil	MNMC	32-13	MNMC2520; P50
S. Bartholomew	1515–1520	Vicente Gil and Manuel Vicente	MNMC	11-10E	MNMC2608; P42
<i>Montemor-o-Velho</i> polyptych	1515–1520	Manuel Vicente	Holy House of Mercy of <i>Montemor-o-Velho</i>	12-75 and 33-76	–
<i>Celas</i> polyptych	1515–1520	Manuel Vicente	MNMC	31-13 (A to F)	MNMC 2543 to MNMC2548; P1 to P6
polyptych assigned to Bernardo Manuel	1570–1580	Bernardo Manuel	MNMC	119-12 A and B	MNMC2526; P26

- S. *Simão* triptych, assigned to the same workshop, integrates paintings of different manufacture, which are distinguished from the support, to the preparatory layer and pictorial technique. S. *Simão* triptych consists of five paintings: the Central Panel, The Savior (PC), right front leaf the Apostle St. Simon (DF) and in the verso the Coat of arms of Noronha (DV), left front leaf St. James the Lesser (EF), and verso Coat of arms of Almeida and Silva (EV). We integrate in this study the analytical results of the five paintings.
- The painting Assumption of the Virgin, assigned to Vicente Gil, is a work of circa 1510–1520. Being transferred from Santa Clara-a-Velha monastery this painting is part of an original altarpiece donated by Queen D. Leonor to this monastery. Its support is made on Baltic oak (Fig. 1a).
- S. Bartholomew, painted circa 1515–1520, also assigned to Vicente Gil and Manuel Vicente's work, was also transferred from *Santa Clara-a-Velha* monastery and is associated by some authors to the previous altarpiece [10]. Nevertheless, material and technical evidences show different patterns when compared to the previous painting being the support made of chestnut wood and the ground layer of a different type [11,12].
- *Montemor-o-Velho* polyptych, of circa 1515–1520, belongs to a second phase of Coimbra workshop and is usually assigned to Manuel Vicente work [4,13]. Possibly from the private chapel of Montemor-o-Velho hospital, the polyptych is nowadays in the Holy House of Mercy. The polyptych of *Montemor-o-Velho*, or of the Life of Christ, consists on the following paintings: Nativity, Adoration of the Magi, Lamentation over the Dead Christ, St. Peter (Annunciation in verso leaf), St. John the Baptist (Angel Gabriel in verso leaf) and the predela, with sixteen busts of saints.
- *Celas* polyptych, of about 1515–1520, is assigned to Manuel Vicente work to the Monastery of Santa Maria de Celas, Coimbra. Is a

polyptych of six paintings: Ascension of Christ, Assumption of St. Mary Magdalene, Incredulity of St Thomas, St. Catherine of Alexandria, Pentecost (file 31-13A) and Adoration of the Magi (file 31-13B) (Fig. 1b). We present the integrated data of these two last paintings.

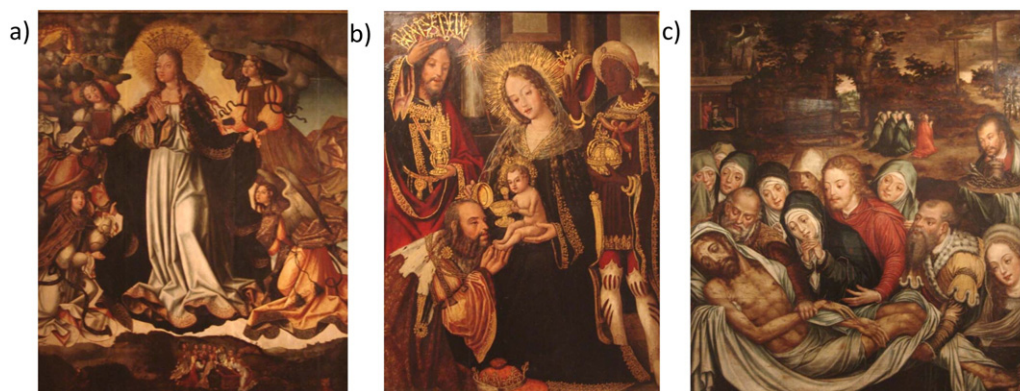
- The paintings Lamentation and Apparition of Christ to the Virgin (files 119-12 A and B) (Fig. 1c) are part of a polyptych assigned to Bernardo Manuel painted circa 1570–1580. This group was crucial to understand the technical evolution of this family workshop of painters. Integrated in mannerist period this work belongs to a set of four remaining paintings. The other paintings of the set have the thematic of the Annunciation and the Holy Trinity.

The studied paintings of Coimbra Workshop were analyzed through different techniques with the purpose of identifying ground layer specificities. By comparing ground layers of Coimbra workshop it was possible to recognize technical evolution of this family workshop of painters, using complementary microscopic techniques.

## 2. Material and methods

### 2.1. Sample collection and preparation

An interdisciplinary approach was followed on the methodology for analysis of the paintings ground layers. The collection of samples was carried out after an exhaustive inspection of the paintings by the naked eye and other techniques, such as infrared photography, to analyze the state of conservation of the paintings and choose the best place to collect them. After collection, the samples were assembled on specific supports and polished. For the selection of the samples, some



**Fig. 1.** a) Assumption of the Virgin (file 32-13, MNMC) assigned to Vicente Gil, c. 1510–1520 (photo Vanessa Antunes, 2013); b) Adoration of the Magi, *Celas* polyptych (file 31-13, MNMC) assigned to Manuel Vicente, c. 1515–1520 (photo Vanessa Antunes, 2013); c) Lamentation (file 119-12 A, MNMC) assigned to Bernardo Manuel, c. 1570–1580 (photo Vanessa Antunes, 2013).

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