



# On the origin of Goa Cathedral former altarpiece: Material and technical assessment to the work of Garcia Fernandes, Portuguese painter from 16th century Lisbon workshop

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## ABSTRACT

Goa Cathedral former altarpiece is one of the oldest set of paintings in India. The seven remaining paintings from the first altarpiece of Goa Cathedral, nowadays in the sacristy, are attributed by some art historians to Master Garcia Fernandes (act. 1514–1565), Portuguese painter from Lisbon workshop. The 16th century was the “Golden age” of Portuguese painting. In this context the Royal Lisbon workshop played a predominant role, where the activity of the painter Garcia Fernandes and his workshop can be distinguished. In this new approach, Goa paintings are being studied and compared with other works in Portuguese territory attributed to this same painter, as St. Bartholomew altarpiece from the chapel of Bartolomeu Joanes in Lisbon Cathedral.

The stratigraphic study allowed to compare ground layers, pigments and binders which, were characterized using complementary analytical and imaging techniques: (X-ray Fluorescence spectrometry (XRF), Infrared Reflectography (IRR), Infrared Photography (IRP), Macro Photography (MP), micro-X-ray Diffraction ( $\mu$ -XRD), Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM-EDS), Raman micro-spectroscopy ( $\mu$ -Raman), Fourier Transform Infrared micro-spectroscopy ( $\mu$ -FTIR), Pyrolysis gas chromatography mass spectrometry (PY-GC/MS). This work brought a new insight on the techniques and materials used in this Masterpiece and highlighted the conclusion that Goa Cathedral former altarpiece must be a Portuguese production.

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## 1. Introduction-pictorial corpus under study

Garcia Fernandes was apprentice in the workshop of his uncle Jorge Afonso, the main chief of Lisbon workshop and he was already considered a great painter at his time. His work is recognized by some art historians in the paintings that constituted the first main altarpiece devoted to Saint Catherine, made circa 1530 for the Goa Cathedral. This Cathedral was built after a promise of the Viceroy of Portuguese India, Afonso de Albuquerque, in 1510, being one of the oldest and largest cathedrals in Asia [1–8]. This episode occurred on Saint Catherine's day, marking the capture of the city of Goa by the Portuguese.

Goa Cathedral painted altarpiece was kept as the main altar in the church until the 17th century, being replaced at that time by a gold leaf carved altarpiece [9]. Nowadays, the former altarpiece is kept in the sacristy. Although, the iconographic and artistic importance of this altarpiece were considered by the next generation of Goan artists. The artists that made the gold leaf carved altarpiece respected the themes and iconography painted in the first Goa Cathedral altarpiece [9]. The themes represented in this altarpiece are Saint Catherine of Alexandria with martyr's palm (P1), the Assumption of St. Catherine of Alexandria (P2), the beheading of St. Catherine of Alexandria (P3), St. Catherine survival of death by a spiked wheel (P4), St. Catherine imprisonment by the Emperor (P5), the debate with pagan scholars and The Empress's visit and conversion. One of the most important of this set of seven paintings is Saint Catherine of Alexandria with martyr's palm (P1) since it represents the triumph of the martyr Saint Catherine over the pagan emperor (Fig. 1), being at the same time one of the paintings in worst state of conservation.

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**Fig. 1.** a) Detail of the face of Saint Catherine in the painting *Saint Catherine of Alexandria with martyr's palm* (P1) from Goa Cathedral former altarpiece, assigned to Portuguese painter Garcia Fernandes, c. 1530, in need of conservation and restoration (photo Vanessa Antunes, 2017); b) detail of the same painting in a miniature golden object of Saint Catherine belt, original in the right side, repainting in the left side (photo Vanessa Antunes, 2017); c) macrophotography of the previous detail showing the minutia's of the brush technique (photo Vanessa Antunes, 2017).

Garcia Fernandes collaborated with his father-in-law, the Flemish painter Francisco Henriques, having succeeded him in the post of headmaster of his workshop after the Master's death in 1518. He also worked in partnership (1533–34) with other renowned painters in Portuguese panorama, such as Cristóvão de Utreque and the two painters Gregório Lopes and Cristóvão de Figueiredo, thus being integrated in the circle of the masters of Ferreirim. He worked in several convents and churches having his work distributed in several Portuguese regions, such as the case of the panel of *Our Lady of the Assumption* (A2), church of Santa Maria of Sardoura, Castelo de Paiva, c. 1530 [5, 10] and Lisbon Cathedral St. Bartholomew's altarpiece on the chapel of Bartolomeu Joanes (A3), dating from 1537, a possible partnership between Garcia Fernandes, Cristóvão de Figueiredo and Diogo de Contreiras and probably with the assistance of other collaborators, all 16th century Portuguese Great Masters [11, 12].

A group of four paintings from about 1535–1540 is also assigned to this painter: *Preaching of St. Anthony to the fishes* (inv.1768 MNA), *Annunciation* (inv. 1769 Pint MNA), *Pentecost* (inv 1770 Pint Museu Nacional de Arte Antiga (MNA)), and *Testimony of St. John the Baptist with the priests and Levites of Jerusalem* (A4) (inv. 1771Pint, MNA) (A4), being this last one studied in terms of the technique and materials used for its making [13, 14].

This painter stands out from its coeval Portuguese artists not only for his highlighted pictorial technique but also as one of the few painters to be known for having produced works to India, as confirmed by his own testimony in 1540 during his petition to the Crown, reporting on several works made by him, which included working for India [14–16].

The importance of this painter in Portuguese panorama lead to different analytical studies on some works assigned to him. These previous studies were made by micro-X-ray diffraction ( $\mu$ -XRD) and Fourier Transform Infrared micro-spectroscopy ( $\mu$ -FTIR). This is the case of the painting *Our Lady of the Assumption* (A2) [15–17], of Lisbon Cathedral altarpiece of the chapel of Bartolomeu Joanes (A3) [18–20], and of the painting *Testimony of Saint John the Baptist with the priests and Levites of Jerusalem* (A4) [13, 21–23]. These studies can be compared to the results of Goa Cathedral former altarpiece (A1).

Other studies were made on the paintings of Gregório Lopes and Cristóvão de Figueiredo and the pigments used: lamp black, lead white, azurite, goethite, lead-tin yellow type I, red lead, hematite, vermilion, as well red madder dye and indigo were similar to those used by Garcia Fernandes in his works. Calcium carbonate grains were found as fillers in certain colors, such as the Virgin's mantle blue. Ground layers had a mixture of gypsum and chalk [24, 25].

The study of Goa Cathedral former altarpiece (A1) aimed to compare the materials and techniques with the previous studied works of Garcia Fernandes workshop, bringing novelties and answering the question: can it be a Portuguese work? With the use of non-invasive techniques, of major importance for the preservation of cultural heritage, energy dispersive X ray fluorescence (EDXRF), infrared reflectography (IRR) and macro photography (MP) it was possible to identify the key-elements of the pigments, underdrawing and the overlapping technique of several painting layers for each color, respectively. Other

complementary techniques were used by sampling the painting *Saint Catherine of Alexandria with martyr's palm* (P1) when it was necessary to further understand the involved pigments, and identify the artist's palette, and identify the specific type of ground layer, to compare it with the characteristic ground layers of Lisbon workshop;  $\mu$ -Raman to identify crystalline and amorphous compounds;  $\mu$ -X ray Diffraction ( $\mu$ -XRD) allowed to confirm the previous technique in the identification of the ground layer phases, complemented with the morphological characterization and elemental distribution maps brought by SEM-EDS; micro Fourier Transform Infrared ( $\mu$ -FTIR) and pyrolysis gas chromatography mass spectrometry (PY-GC/MS) were used to analyze the organic binders in ground and painting layers [26]. The obtained results will be compared to ground layers and pigments composition of the previous studies of Garcia Fernandes.

## 2. Material and methods

### 2.1. Sample collection and preparation

Samples were collected and parts of them were embedded in an Epofix resin with hardener. Micro-mesh abrasive cloths with sequentially finer grades were used to dry polish the samples.

### 2.2. Description of the analytical techniques

#### 2.2.1. Infrared Reflectography (IRR), infrared photography (IRP), macro photography (MP)

Examination by IR photography, raking light and UV light was carried out with a digital camera (SONYDSC-F828), 7 Mega Pixels, to photograph and register.

Macro-photographs of the chromatic layers were captured with a mobile microscope 3 "LCD 8.5 Mega Pixels 20–500 $\times$ , Digital LCD with VGA, Micro SD card storage and a Micro Capture Pro software.

Infrared reflectography was performed with a high resolution infrared reflectography camera (Osiris) with an InGaAs detector allowing a wavelength response from 900 to 1700 nm, and equipped with a 16  $\times$  16 tile system which enables an image size of 4096  $\times$  4096 pixels. The camera is equipped with a long-pass filter Schott RG850, allowing to transmit infrared wavelength and block the undesired shorter wavelength until 850 nm. Reflectograms were recorded with a working distance (front of body camera to painting) of 125 cm, and focus (front of body camera to lens) of 28 cm, an f/11 aperture and diffuse illumination at 1000 lx by reflectors with 2  $\times$  1000 W Tungsten Halogen VC – 1000Q Quartz Light. The final image, composed by several reflectograms, was ensemble in Photoshop CS5, with the Photomerge tool. All the images had a small treatment, adjusting levels and increase contrast. The reflectograms were performed for 60  $\times$  60 cm<sup>2</sup> of painting area [27].

#### 2.2.2. Portable energy dispersive X-ray fluorescence spectroscopy (EDXRF)

Portable EDXRF technique was initially used to provide significant data on the painting materials. The determination of pigments elemental composition and trace elements was achieved with an XRF portable

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