

SCIENTIFIC STUDY OF AN 18TH CENTURY PORTUGUESE PAINTING ON CANVAS AND THEIR OLD RESTORATION: PROBLEMS OF DATE AND AUTHENTICITY OF THE CURRENT IMAGE

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Abstract

A Portuguese painting of the 18th century, from the collection of the National Library of Portugal, restored in 1864, was studied with the aim of better understanding the practice of restoration in Portugal in the late 19th and early 20th centuries. Initial observations suggested that it had been subjected to significant changes, due to the existence of an extensive decorative bar at the bottom of the painting and an inscription with calligraphy that seemed to suggest being of the 19th century. However, the scientific study carried out with the use of a set of analytical techniques leads to the conclusion that, essentially, the current image is consistent with the original image, although a thick layer of varnish and several localized repaints were observed. However, the inscription does not seem to be original.

Keywords: *Painting; Restoration; History; Dating; Authenticity.*

Introduction

In the collection of the National Library of Portugal, in Lisbon, there is a painting on canvas (inventory number 13479/BN; Figure 1) representing one of the classical writers of the Portuguese language – the Father Manuel Bernardes (1644-1710), author of several works of moralistic nature. In the painting, in front of a dark background, we see the portrayed, with religious habits, seated to write in a book placed on a table covered with a green cloth where a paper that identifies the portrayed is also painted. Behind Bernardes, on the right side of the observer, a bookcase and a crucifix are visible.

The painting, with 135cm height and 102cm width (without frame), has no known author and has no date, but its general stylistic characteristics are at the origin of the widespread assertion that it is a painting of the 18th century [1]. According to our research, the painting must have been based on an engraving of Father Manuel Bernardes (Figure 2a) made, after 1710, by the Italian artist Girolamo Rossi, the Young (1682-after 1762), who signed Hieronymus Rossi, or one of its copies [2], as well as on an engraving of the Spanish writer Benito Jerónimo Feijoo (1676-1764), made by Juan Bernabé Palomino in 1733-34 (Figure 2b), which, in turn, reproduces a painting today unknown, made on that time [3]. Obviously, this implies a date after 1734 for the painting under study. The fact that the painting combine motifs

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of two engravings suggests that the painting was based on the engravings and not that the Rossi engraving was based on that painting. Moreover, it is known that after the death of Manuel Bernardes, his portrait, with the caption presented by the engraving, was ordered by the Father António dos Reis (1690-1738) to an artist of Rome [4] - most likely being this portrait the engraving made by Rossi.



Fig. 1. The painting

The paper on the table, which reads “Padre Manuel Bernardes da Congreg. do Oratorio” (“Father Manuel Bernardes from the Congregation of the Oratory”), presents a calligraphy that suggests, at least, a 19th century date, something that is also suggested by the use of the form “Manuel” for the name (instead of the form “Manoel” employed in the 18th century, namely in the frontispiece of his books) [5].

These preliminary results, obtained in the framework of a study on the practice of restoration of paintings in Portugal in the late 19th and early 20th centuries [6], indicated the convenience of a detailed study in order to determine in detail what is original and what has resulted from a subsequent restoration. This question is even more justified when one considers what is known about the material history of this painting in the 19th century.

In fact, it is documented that this painting was subject to restoration in 1864, which was conducted by João António Gomes or António Costa Oliveira [1, 6]. The restoration work then carried out by these two restorers focused on a set of portraits, now part of the collection of the National Library of Portugal, which had been gathered, in Lisbon, in a depository of works drawn from the convents extinct in Portugal in 1834 [1]. The mission of that depository was to collect and to distribute books and artistic works from the convents — being this activity at the origin, for example, of the present National Museum of Ancient Art, in Lisbon —, but the bad storage conditions originated some damage in many paintings and the total destruction of others [7]. Although one might consider that the restoration carried out in the second half of the 19th century in that set of portraits and in many other paintings were intended to solve such

damages, it is unknown the extension and depth of each intervention, i.e., if were punctual and confined to the damaged areas or if they were generalized, affecting the whole works.



Fig. 2. Engravings where the painting was based: a - *Father Manuel Bernardes*, by Girolamo Rossi the Young; b - *Benito Jerónimo Feijoo*, by Juan Bernabé Palomino.

In this context, we proceeded to the scientific study of the Father Manuel Bernardes portrait. Initially we used techniques of non-invasive examination which showed the interest and the need for analysis with other techniques, including the use of cross-section samples. Because the results also seemed useful for the characterization of some technical aspects of the Portuguese painting in the eighteenth century about which very little is known, this paper equally discusses with detail the characteristics of the ground layer.

Materials and Methods

At first, the painting was observed through non-invasive techniques, namely surface micro-examination, radiography and ultraviolet (UV) fluorescence and infrared (IR) photography. The surface micro-examination was done with binocular loupe Leica M32; the radiograph was made with Kodak Industrex AA 400 film and an X-ray tube Art-Gil operated with a tension of 34 kV, current intensity of 5mA and exposure time of 1 min; the UV and the IR photographs were done with a Mamiya 645 AFD II camera equipped with a back digital Phase One P21+ and a Lee 1B UV Absorber filter in the first case and the color correction filters CC50M and CC30Y in the later.

In a second stage, 13 samples were collected near lacunae, having the central part of the painting been avoided. The samples were mounted in an acrylic resin, and after polishing, the cross-sections were analyzed by optical microscopy (OM) [8], both with visible (OM-Vis) and UV radiation (OM-UV), and scanning electron microscopy coupled with X-ray energy dispersive spectrometry (SEM-EDS). A microscope Leica DM2500P and a microscope Leica DM2500M were used for OM-Vis and OM-UV, respectively, both equipped with a digital camera Leica MC170HD. The SEM-EDS equipment consists of a Hitachi 3700N microscope

coupled with an X-ray energy dispersive spectrometer Bruker Xflash 5010 and was operated in the variable pressure mode (40Pa) at 20kV. The samples were analyzed directly, without metallization, and the elementary semi-quantification was performed using the software Quantax through the PB-ZAF method.

In the case of two samples, only a part was mounted in the resin and the other part was used for Fourier transform infrared spectroscopy (FTIR). A spectrometer Bruker Hyperion 3000 with a MCT detector cooled with liquid nitrogen was used. The spectra were collected in transmission mode in the $4000\text{-}650\text{cm}^{-1}$ region, with 4cm^{-1} spectral resolution, using 32 scans and a diamond compression cell.

Samples of the canvas and the paper glued on the reverse were also collected for fibers identification. This was done through OM and the use of Herzberg and Lofton-Merritt reagents.

Results and discussion

Conservation state and detected changes

At first sight, the painting appears to be in good condition. However, in some areas, a detailed observation allows the detection of a deep network of craquelures, which, in addition to these marks, originated detaching problems that caused small lacunae (Figure 3a). In some areas, these craquelures of age seem to have been favored by the contraction of a thick organic layer that lies on the surface, which, in some areas, consists of several strata (Figure 4). The application of these organic strata, due to trespassing, should be at the origin of the craquelure pattern visible on the reverse side of the canvas.

It should be noted that, according to Portuguese documentary sources of the 19th century, the application of thick layers of varnish to paintings by antiquarians was common [9] and, in addition, the restore of a painting could be informally described as to apply a little of varnish (“dar uma envernizadela”) [10].

In the upper part of the samples analyzed by FTIR, especially in a sample with a thick organic surface layer, an oxidized oil was detected and possibly also a polysaccharide [11]. The first may be due to the use of an oil varnish, but for the presence of the second was not found any explanation.



Fig. 3. Networks of craquelures: a - craquelures of age, in the sleeve over the chair;
b - premature craquelures, in the green cloth, at the bottom.

In some areas, the layer of varnish was left with a very uneven surface, being distinctly observed the brush marks — and, occasionally, some brush’s hairs (Fig. 5).

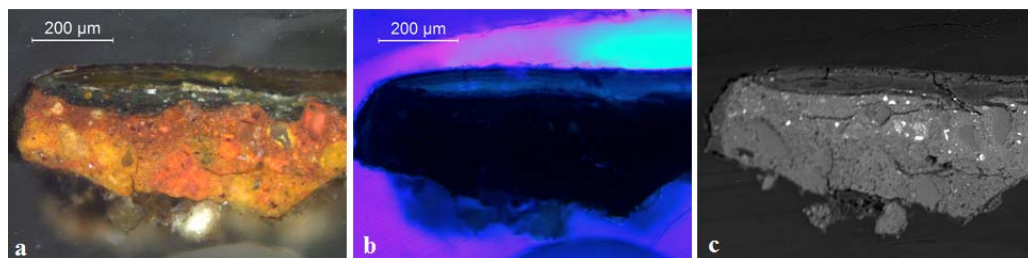


Fig. 4. Cross-section of a sample taken from the green cloth over the table, slightly below the inkpot:
a) OM-Vis; b) ON-UV; c) SEM-EDS, image of backscattered electrons.



Fig. 5. Marks and hair left by the brush on the varnish surface in the area of the paper with the inscription. The inscription was applied over these marks.

The detailed observation of the surface also uncovered the existence of numerous small repaints. Many occur associated with lacunae and, probably, were made on different occasions, since they are noticeable, at least, three types: some repaints limited only to the central part of the lacunae and consist of a very thin and discontinuous layer of fluid paint (Fig. 6a); others correspond to a thick layer of paint that completely fills the lacunae without going outside of these (Fig. 6b); there are also cases where the repaints goes far beyond the limits of the lacunae (Fig. 6c). As shown by the reduced fluorescence in the UV and by the stratigraphic observations, these repaints are over the organic superficial layer. The technique used in these repaints is very poor, succeeding that, even in repaints confined to lacunae, it was not used any filling material. In some of these repaints was not even minimally accomplished the chromatic integration. Moreover, since they are extremely simple interventions, they were probably made at different times by library staff without any experience or activity in the restoration area.

An even more detailed observation allows the detection of repaints of different type in other locations. They are more extensive, not visible on the radiograph not even on the UV photograph, they are under the surface organic layer, chromatically integrated and detected only by changing of the craquelure pattern (Fig. 7). In other places, especially at the bottom, these repaints are at the origin of premature craquelures (Fig. 3b). In general, they were technically well executed and probably were made in 1864.

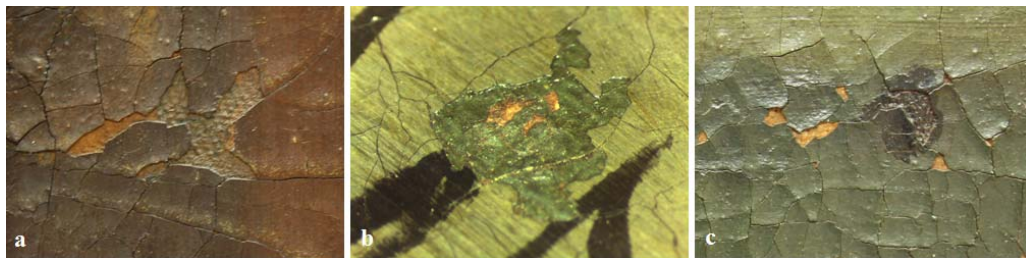


Fig. 6. Three types of localized repaints:
a) minimal, at the extreme left, in the chair; b) limited to the lacunae, in the area of the inscription;
c) beyond the limits of the lacunae, in the green cloth near the inkpot.



Fig. 7. Old repaint, detected by change of the pattern of craquelures, in the green cloth below the paper with the inscription.



Fig 8. Painting radiograph. The rectangular marks result from the assembly of several sheets of film.



Fig. 9. UV fluorescence photograph.

On the contrary, the radiograph shows the existence of two features that significantly affect the overall image (Fig. 8): on one hand, the elongated marks, scattered throughout all the painting, resulting from the application of the ground layer with a spatula; on the other hand, a bar with a decorative cutout in the bottom of the painting. That bar, which might have been designated for the placement of an inscription, significantly affects the visibility of the craquelures network and is located in an area that presents reduced UV fluorescence (Figure 9). However, the limit of this area, which reflects the differences in the superficial layers, does not coincide with the bar.

More localized changes are also visible in the radiograph: one is the correction of the left hand, initially painted in a slightly higher position; the other was observed in the paper on the table, which was initially extended until the hand, under the same. These changes may be related to any difficulties that the painter had to complete the scene visible in the engraving that must have served as a model (Fig. 2a).

Canvas and stretcher

The fabric is woven linen in taffeta, with a density of 11 threads by 16 threads per square centimeter, relatively open, that occasionally let pass the ground material or allows seeing it, as it is common in paintings from the 17th and 18th centuries with colored ground. The fabric is laid vertically, presents the two selvages and has a width that is in agreement with one of the widths of the fabrics generally used in paintings from the 17th and 18th centuries (about 110 cm in Portugal) [12].

The canvas is fixed on a wooden inextensible stretcher, as it was usual until the 19th century. In some areas, especially at the upper limit, the radiograph shows the canvas distortion caused by the fixation to the stretcher and also shows the coincidence of these points of greater stress with the nails position (Figure 10). These, according to the shapes visible on the radiographs and directly on painting, seem to be handmade nails [13] that, consequently, can be original. These data suggest that the stretcher is also original.



Fig. 10. Detail of the radiograph showing the canvas distortion and the old nails (along with recent bent nails). For better visibility, the radiograph negative is presented.

An inscription in a small paper glued on the reverse side of the canvas, which reads “Necessid.^{es} N. 43”, suggests that the painting, with the number 43, came from the convent of Nossa Senhora das Necessidades [14], in Lisbon, precisely a convent of the Congregation of the Oratory to which Manuel Bernardes belonged. The analysis of the fibers showed that the paper was made from rags (linen) and, therefore, may date from the time when the painting was taken from the convent.

Ground layer

The ground layer is made up of two strata both with brown color. The lower is slightly lighter than the upper stratum, but the separation between the two, in general, is not clear (Figure 4a). This ground layer system consisting of two strata of dark color was common in European painting of the 17th and 18th centuries, namely in French, Italian and Northern Europe [15], but is virtually unstudied in Portugal, unlike what happens with the white grounds used in

previous centuries. A different aspect regarding the general situation observed in European paintings is the reversal of the brightness of the strata (usually the upper strata is lighter) [15].

With regard to composition, the FTIR analyses only allow the detection of kaolinite and an oil — the expected binder in a colored ground. The SEM-EDS results show that the two strata essentially consist of ochre (iron compounds) mixed with associated minerals or fillers, pigments of lead and black pigments.

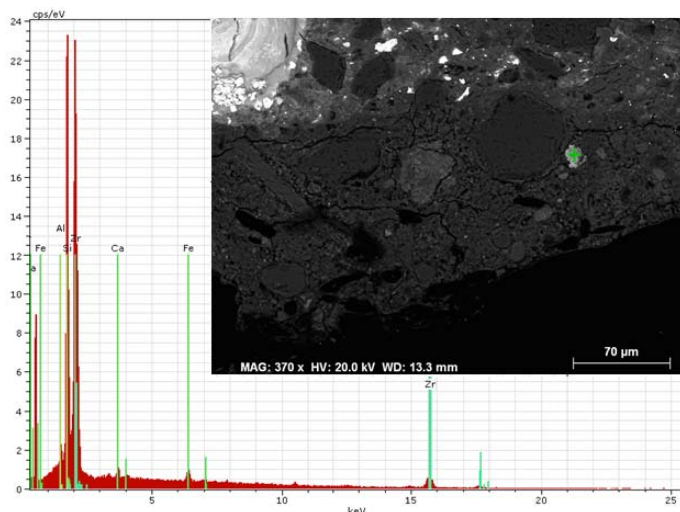


Fig. 11. Mineral particle identified as zircon ($ZrSiO_4$) by SEM-EDS in the ground layer of a sample taken from Bernardes right hand using X-ray spectrum on area in backscattered electron image.

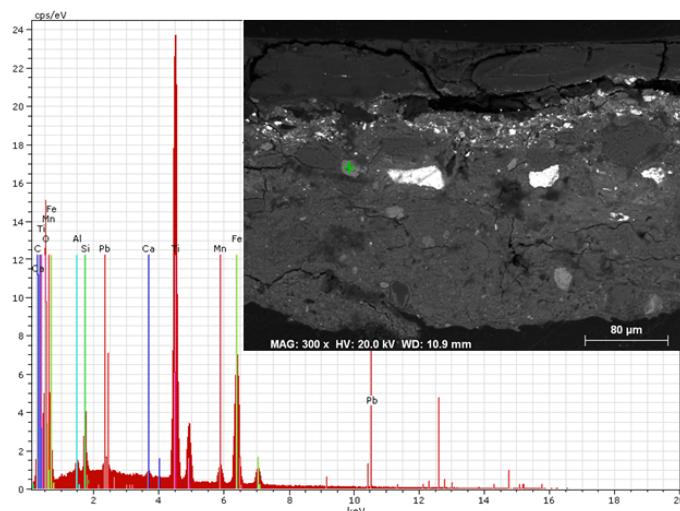


Fig. 12. Mineral particle identified as ilmenite ($FeTiO_3$) by SEM-EDS in the ground layer of a sample taken from the back of the chair using X-ray spectrum on area in backscattered electron image.

In the matrix ochre, the atomic ratio between the major elements is approximately 1:4:2 for Fe:Si:Al, but that proportion shows some significant deviations. The atomic ratio of 2:1 for Si:Al seems to suggest that the aluminosilicate fraction mainly consists of clays of 2:1 type, but considering the existence of compounds of Si without Al, such as quartz (see below), the ratio Si:Al in clays is actually lower. In fact kaolinite, a 1:1 type clay, was the only clay mineral detected by FTIR. This composition is in line with the typical composition of the ochre.

However, other aluminosilicate and other silicon compounds were also detected, even if only occasionally: potassium feldspar (KAlSi_3O_8), sodium feldspar ($\text{NaAlSi}_3\text{O}_8$), quartz (SiO_2), zircon (ZrSiO_4) (Fig. 11) and ilmenite (FeTiO_3) (Fig. 12).

These minerals are expected in pigments obtained from earths like the ocher, as are also expected compounds such as titanium dioxide and manganese dioxide, equally identified in small concentration. Although the SEM-EDS analyzes that led to these identifications only provide elemental data, in these case the identification of compounds was possible because it is based on atomic ratios calculated from spectra obtained for individual particles.

It should be noted that, in this context, the titanium compounds are part of the ocher [16] and do not correspond to titanium white pigment — in case this happens, it would put into question the date of the painting, since this pigment has begun to be used only about 1920.

Besides the elements present in the mentioned compounds, the ground layer has also significant calcium content, which, for the most part, corresponds to calcium carbonate that was mixed with ocher. Also mixed in the ground, two black and two lead-based pigments were found: black with vegetable origin, animal black, white lead and red lead. The simultaneous detection of two black pigments was not expected in such layer. The presence of lead pigments, namely those identified, are common in colored grounds and may result from the intention to adjust the color of the layer or from the intention to facilitate the drying process of the oil used as a binder [16].

Another compound was also identified in the ground layer, though it is unexpected and may create some doubts about its origin: barium sulfate. This compound, in its artificial form, is common in paintings since the 19th century, being used as filler, especially mixed with expensive pigments. Before that, it is rare. However, it has been detected, in its natural form (barite), in the ground layer of French paintings from the 17th and 18th centuries — although, as far as we know, this has succeeded only in one study [16]. As in the present case the circumstances seem to be similar, the barium sulfate should also correspond to filler — but, because the used ochre does not seem to have an exceptional quality and corresponding price, it is not clear why it was employed this mixture. However, it is possible that the barium sulfate presence, as well the relative diversity of pigments identified in the ground, is due to addition of old colors to the earths, i.e. painting material removed from the palette and brushes, as advised by the Spanish painter Antonio Palomino at the beginning of the 18th century [17].

It is interesting to note that, according to the data obtained in the study already cited, based on a significant number of paintings, the occurrence of barite in grounds is much more frequent in the 17th century than in the 18th century [16]. Moreover, that usage has decreased very quickly throughout the 18th century and was not detected after 1760. We do not know, however, if what happened in France occurred at the same time in other countries.

Contrary to the usual, at least in some of the samples cross-sections, the ground layer presents a very irregular surface with unevenly spaced protrusions or bumps (with distances between them starting from $100\mu\text{m}$) (Fig. 4a and Fig. 13). Some of these rounded protrusions are similar to the protrusions, often observed in old paintings, resulting from the reaction between the oil and some lead pigments and consequent formation of lead carboxylates agglomerates [18]. However, the failure to observe both the lamellar structure and the ultraviolet fluorescence characteristics of the carboxylates agglomerates lead to the conclusion that the situation is different. Moreover, as can be concluded from the shape and arrangement of the chromatic strata over the ground layer, these protrusions already existed when the painting was done — unlike the carboxylates protrusions, which are developed after that occasion. So, in this case, the protrusions should result from a problem associated with how the ground layer was applied and from the lack of proper polishing — an operation, done with a pumice stone, that should be subject the ground layer according to the Spanish and the French technical texts of the 18th century, such as those of Palomino (1724) and Léonard Defrance (1788) [17, 19].

Regarding to problems related to the ground, it should be noted that the radiograph shows another one, but in a different scale, as mentioned above.

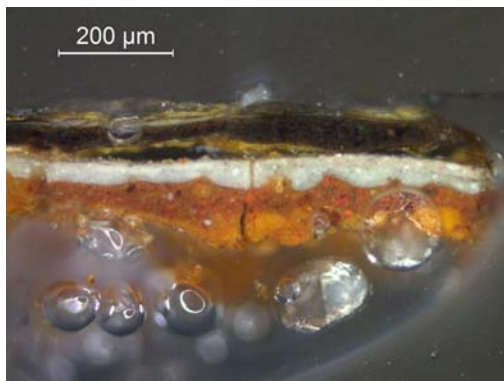


Fig. 13. Cross-sample, observed by OM-Vis, of a sample taken from the chair, at the bottom.

Painting materials and painting technique

According to the samples' cross-sections, the number of chromatic strata is relatively small, both in areas that appear to be original and areas of repaint (Figure 4a and Figure 13). Regarding to the original areas, this is consistent with the economy of material that was common in Portuguese painting made over brown colored grounds [12].

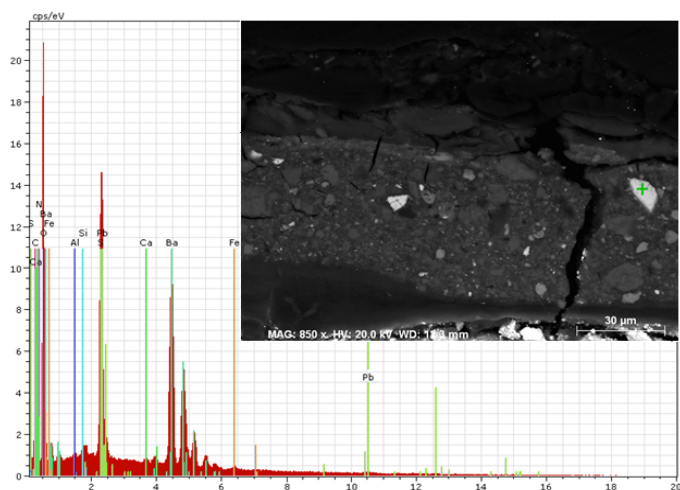


Fig. 14. Mineral particle identified as barite (BaSO_4) by SEM-EDS in the chromatic layer of the sample showed in figure 13 using X-ray spectrum on area in backscattered electron image.

The pigments detected by SEM-EDS are few and correspond to traditional materials, both in the original and in the later strata: lead white, ocher, vermilion, red lead, red lacquer not identified, black with vegetable origin and animal black. In the area of the green towel, it was not detected any pigment with this color and, so, the tone should be due to an organic dye — not detected with the technique employed. The small number of identified pigments results, in part, from the reduced range of tones observed in the painting. Calcium carbonate, barium sulfate and gypsum were also detected, as fillers or compounds associated with the pigments. It should be noted that all these materials were available in the 18th and 19th centuries and, in

addition, we did not detect any modern pigment, appeared in the 19th or the 20th century, that unequivocally results from a repainting. As in ground, the barium sulfate detected must correspond to the natural form, because it appears in large particles (Fig. 14). Associated with ocher, besides iron compounds and clays (in some cases, unequivocally of type 1:1), were detected, in low concentration, manganese dioxide, quartz and titanium compounds.

Regarding the execution technique, there are two aspects that should be noted. Firstly, the radiograph revealed the existence of two different procedures for painting of small motifs. In some cases, the small motif was painted over the background, such as the extremity of the pen over the book or, as would be expected, the letters on the book and the letters on the paper. On the contrary, in other cases the small motifs do not overlap the background: for example, the inkwell and the book do not overlap neither the table or the paper sheet; and the fingers of both hands do not overlap the book (Fig. 8). However, this does not mean that small motifs were painted first and only after the background: as is evident in the case of the right hand, the book was painted first, leaving the space in reserve for the fingers, and only at the end these were painted. This way of painting can result from the intention to take advantage of the ground color for the build up of the various motifs [20].

A second thing to note about the execution technique has to do with the painting of areas of shadow and areas of light. As one might expect in a work done over a colored ground, the painting develops from midtones, with the areas of light painted after the areas of shadow, with no overlap of strata with different brightness [20, 21]. In fact, the radiograph clearly shows that the strata of shadow do not overlap the strata of light in areas like the shadow of the nose, eyelids, shadow of the inkwell (which does not overlap even the paper) or shade of the inner part of the pages of the book (Figure 8).

These technical features, as well the other features previously described, are compatible with a pre-19th century painting, regardless of more or less localized repaints.

The hidden bar at the bottom and the inscription

The decorative bar at the bottom of the painting, according to the cross-sections, consists of three strata: the bottom, slightly yellowish white; the intermediate, light pink color; and the top, white, which appears only in some areas. Except some unique situation as mentioned below, the lower stratum is firmly attached to the ground layer and, on the other hand, was not dry enough when the second stratum was applied because a line separating these two strata is not noticeable by OM (Figure 13) or SEM-EDS. On the contrary, the upper stratum, the finest of the three, is separated from the other two by an organic layer, which in some areas is very thin (suggesting that it is a varnish), but in others very thick (suggesting that it is an adhesive or a consolidant).

In terms of chemical composition, the three strata consist mainly of white lead. In much smaller concentration, the lower stratum contains calcium sulfate and ocher and the intermediate calcium carbonate and ocher. This, in both cases, corresponds to a mixture of iron compounds and a 1:1 type clay. In the intermediate stratum was also used a red dye, responsible for the pink tone, while in the upper stratum some particles of vermilion were detected.

At first sight, the organic layer between the second and third strata suggests that what lies above it is a repaint. In this case a large area of the painting would be a repaint, but it is not visible any discontinuity between the possible repainted area and the other area (original). This suggests that either the whole surface painting is a repaint or, alternatively, that the bar is not associated with a repaint but corresponds only to a change that occurred during the painting of the portrait. The complete repaint, something that happens quite often though especially in the case of panel paintings [22], could explain the doubts raised by the calligraphy of the inscription on the paper, but does not agree with the fact that, besides the bar, none underlying paint was detected on the radiographs. It also disagrees with the technique employed in the painting, characteristic of a time when colored grounds were used, a technique incompatible with the 19th

century painting, executed over white grounds. Therefore, this suggests that the changes observed in the lower part of the painting occurred during the execution of the picture and not after it is concluded.

How did this happen, it does not seem easy to explain. One possible explanation is to consider that the decorative bar would be the start of another work which soon after has been abandoned. Later, the canvas was reused for the portrait of Father Manuel Bernardes and, as was customary in the 18th century, a layer of an adhesive, as a priming or *imprimatura* or as isolating layer [23], has been applied in that area. This material eventually penetrates into places where the paint, meanwhile, had been detached, filling the voids (Figure 15). Obviously, this layer is not exactly limited to the painted bar and may correspond to the area of reduced UV fluorescence visible in Figure 9. This description, however, is only a hypothesis, and, although it seems in accordance with the analytical results, may not be the true explanation.

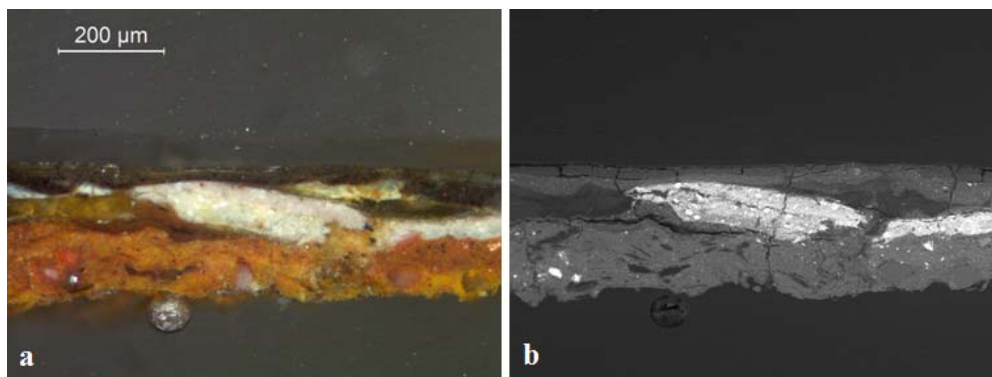


Fig. 15. Other portion of the sample showed on figure 13, where it is seen that strata of the bar were consolidated by an adhesive: a) MO-Vis; b) SEM-EDS backscattered electron image.

As for the paper with the calligraphy that seems fairly recent, a paper that does not exist in any of the two engravings that have been identified as at the origin of this painting, none of the results actually suggests that it is not original. On the contrary, as already mentioned, the paint technique used for this motif, particularly in the shadow, is characteristic of 17th and 18th centuries technique of painting over a colored ground, being very unlikely that such a motif was painted this way in the 19th century. However, the inscription was applied over a layer of varnish with irregular marks (Figure 5) and, therefore, is not original. Considering the calligraphy, it should be of the 19th century, when the name “Manuel”, instead of “Manoel”, became common. Possibly, it may have been added in 1864.

Conclusions

Contrary to what the initial results suggested, the painting figuring the Father Manuel Bernardes presents an image that, with the exception of the disturbance created by the network of craquelures and the inevitable darkening of the surface layer, seems in accordance with the original image. It is an 18th century work, with the technique commonly employed in paintings with colored or dark grounds, still in its original stretcher — something that is relatively rare.

The restorations appear to have been limited, on the one hand, to the application of varnish, probably at different times, and, on the other hand, to some repaints somewhat localized. The most recent are easily detectable, but the older, probably made in 1864, were made according to an illusionist approach and executed with technical mastery. The inscription on the sheet of paper over the table, which identified the portrayed, must have been added in the 19th century, even though the paper appears to be original.

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References

- [1] R.M. Rodrigues, Personal Communication, Faculdade de Letras da Universidade de Lisboa, 2013.
- [2] E. Soares, **História da Gravura Artística em Portugal. Os Artistas e as Suas Obras**, 2nd ed., Livraria Samcarlos, Lisboa, 1971.
- [3] J. González Santos, *Iconografía dieciochista del padre Feijoo. Un estudio del mercado editorial y su incidencia en la difusión de la imagen del sabio beneditino*, **Feijoo Hoy** (Editor: I. Urzainqui Miqueleiz), Fundación Gregorio Marañón, Madrid, 2003, pp. 159-224.
- [4] D.B. Machado, **Bibliotheca Lusitana**, vol. 3, Lisboa, 1752.
- [5] J.C. Matos, Personal communication, Instituto Politécnico de Tomar, 2014.
- [6] C.M. Soares, R.M. Rodrigues, A.J. Cruz, C. Rego, *Historical and material approach to the paintings at the Portugal National Library: contributions to the history of conservation and restoration of easel painting in the 19th century*, **International Journal of Heritage in the Digital Era**, 1(S1), 2012, pp. 283-288.
- [7] C.M. Soares, R.M. Rodrigues, A.J. Cruz, C. Rego, *Conservação e destruição de pinturas dos conventos extintos em Portugal durante o século XIX*, **ECR - Estudos de Conservação e Restauro**, 4, 2012, pp. 231-248.
- [8] R. Maltieira Morais, A. Calvo, J. Cunha, *Painting on canvas-three sample preparation approaches for fibres optical microscope identification*, **International Journal of Conservation Science** 4(S1), 2013, pp. 681-684.
- [9] M. Macedo, **Restauro de Quadros e Gravuras**, David Corazzi Editor, Lisboa, 1885.
- [10] A.J. Cruz, *Em busca da imagem original: Luciano Freire e a teoria e a prática do restauro de pintura em Portugal cerca de 1900*, **Conservar Património**, 5, 2007, pp. 67-83.
- [11] C. Miguel, *Relatório técnico provisório da caracterização por μ -FT-IR de amostras de pinturas de D. Afonso Henriques e Padre Manuel Bernardes*, Unpublished Report, Laboratório Hercules, Évora, 2014.
- [12] A.J. Cruz, **Da Sombra para a Luz - Materiais e Técnicas da Pintura de Bento Coelho da Silveira**, IPPAR, Lisboa, 1999.
- [13] L.H. Nelson, **Nail Chronology as an Aid to Dating Old Buildings**, American Association for State and Local History, Nashville, 1968.
- [14] P.J.S. Barata, **Os Livros e o Liberalismo. Da Livraria Conventual à Biblioteca Pública. Uma Alteração de Paradigma**, Biblioteca Nacional, Lisboa, 2003.
- [15] M. Stols-Witlox, *Grounds, 1400-1900, The Conservation of Easel Paintings*, Routledge, (Editors: J.H. Stoner, R. Rushfield), Abingdon, 2012, pp. 161-185.

- [16] A.R. Duval, *Les préparations colorées des tableaux de l'Ecole Française des dix-septième et dix-huitième siècles*, **Studies in Conservation**, **37**(4), 1992, pp. 239-258.
- [17] Z. Veliz (ed.), **Artists' Techniques in Golden Age Spain. Six treatises in translation**, Cambridge University Press, Cambridge, 1986.
- [18] A. Higgitt, M. Spring, D. Saunders, *Pigment-medium interactions in oil paint films containing red lead or lead-tin yellow*, **National Gallery Technical Bulletin**, **24**, 2003, pp. 75-95.
- [19] L. Defrance, **Les Broyeurs de Couleurs, Leur Métier et Leurs Maladies**, Éditions du Céfal, Liège, 2005.
- [20] J. Kirby, **Techniques of Painting**, National Gallery Company, London, 2011.
- [21] J. Stephenson, **The Materials and Techniques of Painting**, Thames and Hudson, London, 1989.
- [22] A.J. Cruz, *Imagens perdidas, imagens achadas: pinturas reveladas pelos raios X no Instituto José de Figueiredo*, **Actas do Simpósio Comemorativo do Centenário da Descoberta dos Raios X** (Editor: H.V. Ramos), Universidade de Coimbra, Coimbra, 1996, pp. 83-103.
- [23] E. O'Donoghue, R. Romero, J. Dik, *French eighteenth-century painting techniques, Painting Techniques. History, Materials and Studio Practice. Contributions to the Dublin Congress* (Editors: A. Roy and P. Smith), IIC, London, 1998, pp. 185-189.
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