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NON-DESTRUCIVE TECHNIQUES FOR CULTURAL HERITAGE

Scientific study of the *bozzetto* of Murillo's painting "Moses and the water from the rock of Horeb"

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Abstract

With occasion of the "Murillo's year" (fourth centenary of his birth), the Andalusian Institute for Cultural Heritage (Instituto Andaluz de Patrimonio Histórico) received the request from a private collector for the restoration and authentication of a *bozzetto* of the Murillo´s painting entitled *Moses and the water from the rock of Horeb*. During the intervention, several studies on the materials employed were carried out—on the *bozzetto* and on the final large dimension painting, to characterize the different components of the paintings (ground layer, pigments and binders), as well as to confirm/reject the authenticity of the *bozzetto*. After a detailed general inspection using multispectral techniques (visible, UV, IRR) some *pentimenti* were discovered. In addition, Macro X-ray fluorescence (MA-XRF) scanning technique was performed, complemented by point XRF and stratigraphic analyses. The results show that the ground layers were prepared in the usual fashion of the artist, using earths, calcium carbonate, iron oxide pigments and white lead. MA-XRF mapping allowed determining the spatial distribution and the combination of these pigments along the surface of both paintings. Results show that canvas, priming, binders, pigments and painting techniques of the *bozzetto* are compatible with those of the original painting, so we can conclude that most likely this is the original Murillo's *bozzetto*.

Keywords Bartolomé Esteban Murillo · *Bozzetto* · Material analysis · Pigments · Support · OM · SEM–EDX · MA-XRF

1 Introduction

It is very rare that a *bozzetto* of an artwork remains preserved through time and even more difficult that it survives in relatively good conservation state. A so called *bozzetto* is an important part of a creative process of an artist, generally made by the master himself—in contrary of the final piece, carried out largely by a workshop. A *bozzetto*

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shows artist's talent in organizing the space and figures in a convincing composition, in his characteristic brushstroke and colour selection, but it can also reveal the changes in the painting before transported to the final support. Such an example was discovered not long ago and acquired in July 2017 by a German private collector. It is a *bozzetto* representing *Moses and the water from the rock of Horeb* (Fig. 1) that it is assumed to have been carried out by one of the most prestigious and recognised Spanish baroque painters Bartolomé Esteban Murillo (1618-1682), known by his genre scenes often included in sacral compositions (Angulo Íñiguez 1981; Navarrete Prieto 2017). With its small measures (32.8 cm × 75,.8 cm), this oil on canvas was prepared as a preparatory sketch for a large painting (320 cm × 530 cm) with the same title, that presents the miracle described in the Old Testament (Exodus 17-1-7) (Fig. 2). It relates how Moses stroke the rock Horeb to get water for thirsty people of Israel, while crossing the dessert, and save their lives. This painting is just one of six made by Murillo between 1667 and 1670 for the Church of the Charity Hospital (Hospital de la Caridad) in Seville, however, only two are still originals, while other four, taken away during the Frenchs invasion in the nineteenth century, were replaced by copies.

The German collector contacted Andalusian Institute for Cultural Heritage (Instituto Andaluz de Patrimonio Histórico—IAPH) to study and restore the *bozzetto*, which also opened the possibility to compare materials and painting techniques with the large Moses painting, in attempt to confirm the authorship of the *bozzetto* as well. The conservation state was generally good; however, several previous and not documented interventions were observed. The mounting and the framework made with conifer wood are not original and the canvas has been reinforced with the new one at some point, keeping a good adherence to the original support. Several lacunas in paint and preparation layers were detected, filled by *stucco* and repainted; most repaints were found on the lower border of the canvas, which obviously suffered larger damage. The painting surface was affected by the oxidation of the varnish, and consequently, darkening of the surface.

2 Objectives

The principal aim of this study was to characterise the materials and painting procedures used in the *bozzetto* in comparison to the final large format painting: (a) the support, (b)

Fig. 1 Bartolomé Esteban Murillo (attributed): *Moses and the water from the rock of Horeb,* (XVII. Century), *bozzetto* for a large format painting by Murillo. Private collection, Germany

Fig. 2 Bartolomé Esteban Murillo: *Moses and the water from the rock of Horeb* (1667–1670), Church of the Charity Hospital, Seville, Spain

ground and priming, (c) pigments and binders, (d) varnish, as well as (e) later interventions and (f) possible pigment changes. The results would identify Murillo's palette in both artworks, his way of painting, ground layer preparation, colour mixture and brushstrokes, and therefore offer the possibility of *bozzetto* authentication and the comparison of these paintings with other known Murillo's works. The information gathered would principally help curators and restorers to carry out the intervention in the best possible way, knowing which parts to eliminate and which to conserve or even retouch, if necessary.

3 Experimental

The *bozzetto* and the painting were analysed in situ in the restoration hall and all portable analytical equipment was transported there. Both artworks were analysed principally by non-invasive techniques such as ultraviolet photography (UVF), infrared reflectography (IRR), X-ray fluorescence (XRF) and macro X-ray fluorescence (MA-XRF), however from several doubtful areas also small samples were extracted and analysed by optical microscopy (OM), scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM–EDX), Fourier-transformed infrared spectroscopy (FTIR) and gas chromatography with mass spectrometry (GC–MS) after necessary preparation for each technique. 11 samples of primer and colour layers were taken from the large painting, but only one sample was allowed by the owner to be extracted from the *bozzetto* in an area hidden behind the frame, since no defects or lacunas were visible on the painting surface.

3.1 UVF and IRR

UVF and IRR are two of the most used techniques in the analysis of artworks. The first one offers information on later interventions such as overpaintings, new varnishes, even false signatures, based on visible fluorescence of the materials applied and knowing that aged materials fluorescence differently as new ones (Matteini and Moles 1994; Aldrovandi and Picollo 2003; Cosentino 2015). On the other hand, IRR can reveal possible underdrawings hidden under colour layers of the painting and *pentimenti* (changes in composition or figures), carried out by infrared non-reflective material (Matteini and Moles 1994; Aldrovandi and Picollo 2003; Asperen and de Boer 1968; Miller 1994). IRR can even identify certain pigments based on different hues of grey (Casini et al. 1999). For UVF, Wood lamps were used to obtain the UV fluorescence of irradiated materials on the surface. The visible effect was captured with a Nikon D3X camera. For IRR images, Xenics Xeva-XS 512 with InGaAs detector was applied, offering the resolution of 320 × 256 pixel and a 16 mm F/I.4 Pentax lens. For both artworks, the camera was mounted on a 2D robotic platform by Optimind, which smoothly moves the camera in X and Y directions in a range of about 1 m × 1.5 m. The working distance can be manually set and then adjusted using a 200 mm linear stage motor from OWIS. The movement can be controlled from the computer and the images are captured automatically following the previous precise setup. To obtain IRR images, two halogen SDI lamps of 800 W were used. When the object is illuminated with a proper light source, the IR radiation interacts with the surface and underlayers of the painting, transmitting in-depth information about the materials used—pigments and possible changes in the composition or preparatory drawing (Fig. 3).

3.2 Portable XRF spectrometer for point analyses

This technique was used only in the study of the large format painting of *Moses and the rock of Horeb*, but not in the analysis of the *bozzetto* due to the limited time available for the study. It offers identification of chemical

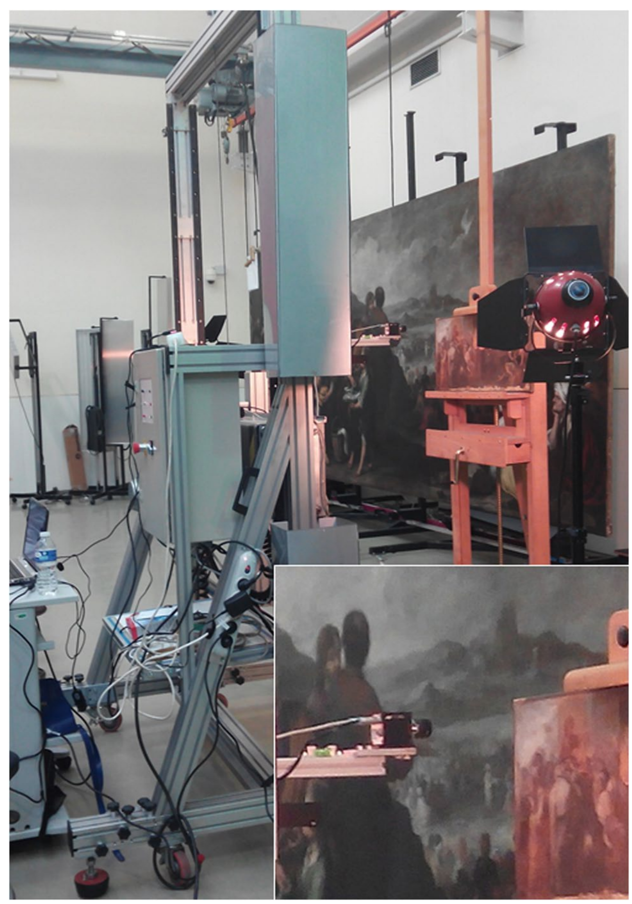

Fig. 3 In situ IRR analysis of the *bozzetto* and a close up of the camera and support

elements in an irradiated point and, based on that, characterization of pigments and other inorganic materials applied in an artwork. It brings a quick first sight in the palette of an artist, without touching the piece of art (Navarrete Prieto 2017; Aldrovandi and Picollo 2003; Seccaroni and Moioli 2004; Deming Glinsman 2005). In the study of Murillo's painting, the XRF point analysis was performed with a portable spectrometer developed by EIS. It is composed of an X-Ray generator RX38 with a W anode, 35 kV maximum voltage and 0.35 mA maximum current, filtered with 1 mm thick Al foil, and an Amptek SDD detector with an energy resolution of 140 eV at Mn-Kα line. For keeping the measuring distance fixed (approximately 1 cm from the irradiated surface), two lasers are coupled to the measuring head, which can be switched on/off as necessary. For each analysed point, the same conditions were used to be able to compare the spectra obtained: 33.4 kV, 80 µA and 200 s. The identification of the pigments is done by a semi-quantitative estimation of the elemental concentrations, calculating the areas of XRF peaks in counts per second. Those pigments are characterized by the same major chemical element, such as lead or copper pigments, but they cannot be identified with certainty due to the lack of molecular information and also the organic materials, such as colorants, binders, varnish, composed of light elements ($Z < 14$, silicon), cannot be detected by XRF. This information could be improved by the addition of a helium flow at the exit of the measuring head, but this feature is not available in our equipment.

3.3 Mobile MA-XRF scanner for real-time elemental imaging of large dimension paintings

Both artworks, the *bozzetto* and the large format painting, were analysed by means of this novel technique (Fig. 4). The MA-XRF device used allows a real-time imaging and is suitable for small and large dimension artworks (Romano et al. 2017; Santos et al. 2018). This device can perform a precise surface scan, analysing on its way the entire painting surface. But the biggest advantage is the elaboration of a map with the distribution of chemical elements present in the analysed work, which reveals the distribution of pigments, their mixtures and impurities. This data can even reveal changes in the composition if the author applied different pigments in the process.

The MA-XRF scanner used in this study was developed at the LANDIS laboratory of CNR-IBAM and INFN-LNS in Catania (Italy). The equipment is composed of a microfocus X-ray tube (30 W power, 50 kV and 0.6 mA tube parameters, Rh anode) focused with a polycapillary with a 50 µm spot diameter at 1.5 cm distance and 2 SDD detectors operating simultaneously in a time-list event mode. The presence of the polycapillary for focusing the primary beam allows to integrate in the same instrument both MA-XRF and micro-XRF. MA-XRF scanning is performed by placing the sample out of focus, where the beam spot is some hundreds of microns in diameter. For micro-XRF imaging, the sample is placed in the focus position where the primary beam reaches its minimum size. The device offers a continuous scanning of a 110×70 cm^2 area at the maximum speed of 100 mm/s. Thanks to the unique real-time capabilities available in the

Fig. 4 *Bozzetto* and the large format painting analysed by MA-XRF, in situ at IAPH

instrument, the deconvoluted elemental distribution images of the pigments are available already during the scanning. Both artworks of the present study were measured with a resolution of 1 mm per pixel with a corresponding dwell time of 10 ms. The total scanning time for the large painting was 30 h, and less than 1 h for the *bozzetto*. The *bozzetto* was scanned entirely, while in the large painting only the most relevant figure groups in the pictorial composition were scanned, again, due to the lack of time to measure the entire large surface.

3.4 OM and SEM–EDX

In areas where the results of previously applied non-invasive techniques were not conclusive, small samples of pigments, colour layers and ground layers were extracted and studied in the laboratory by other analytical techniques. Since only one sample was obtained from a corner of the *bozzetto*, the results are very limited when compared to 11 samples from the large final painting, with a much wider selection of pigments. Most samples were prepared as cross-sections, embedded in an acrylic resin and polished for their study under OM and SEM–EDX. The optical microscope was a Leica DM4000M, which has also the possibility of UV light, crucial to distinguishing retouches and identifying some pigments. This technique offers an insight into the sequence and thickness of colour layers, their composition and pigment granulometry, important for understanding the painting procedure and materials used by the artist (Matteini and Moles 1994; Volpin and Appolonia 2020). The elemental analysis was carried out with SEM equipment developed by JEOL 5600 LV with EDX by Oxford, Inca X-sight, coating the samples previously with a thin gold layer for improved imaging. In addition to a much larger SEM magnification, it can also be used to identify inorganic and organic pigments, which includes light elements with $Z < 14$, thus complementing the XRF technique (Matteini and Moles 1994; Volpin and Appolonia 2020; Artioli 2010).

3.5 FTIR and GC–MS

For molecular identification, very useful for the characterization of organic materials, FTIR and GC–MS were used. The first one can identify chemical compounds such as silicates, carbonates, oils, resins etc. and can work in transmission or absorption mode. The samples can be analysed as cross-sections or prepared as KBr pallets. On the other hand, GC–MS needs more complicated preparation of the sample which makes possible the separation of all compounds and can identify the material studied very precisely (Matteini and Moles 1994; Volpin and Appolonia 2020; Artioli 2010). Both techniques were used only for few samples of the large painting, but not in the sample of the *bozzetto*.

4 Results

Murillo was admired for his painting technique already by his contemporaries; he used small number of pigments and achieved unlimited resources for an extraordinary chromatic harmony (Angulo Íñiguez 1981; Navarrete Prieto 2017). The present publication concentrates on the results of the *bozzetto* and its material and technical comparison to the large painting of *Moses and the water from the rock Horeb* (Kriznar et al. 2019), in order to confirm its attribution.

4.1 Changes in the composition

At a glance, several changes between the *bozzetto* and the large painting can be observed (Fig. 5a, b): (a) the feminine figure drinking water on the left side of the rock was changed to a masculine one; (b) several jars and cups have different form and are made of different material on the final painting (ceramics vs. metal), (c) the hat of a man depicted from

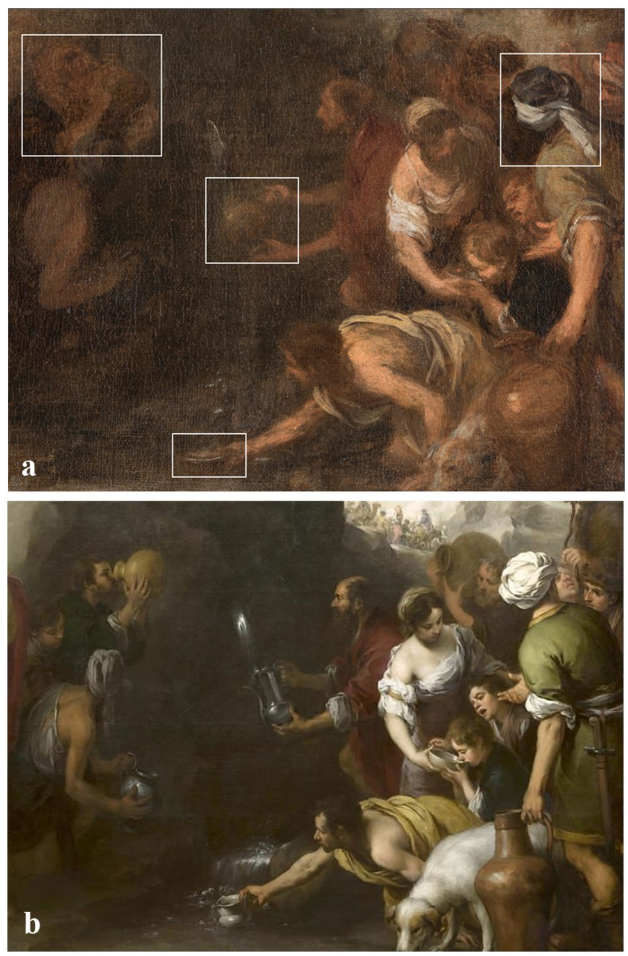

Fig. 5 *Bozzetto* (a) vs. final painting (b): several changes in the depicted forms can be observed

his back on the right side of the painting got a turban, (d) several smaller changes in the vestments of different figures, etc. Other changes were made to the composition already on the *bozzetto*, some of them are observed with the naked eye (for example, the position of Moses's hands and head or the child's head), while others can be detected only with the help of IRR (Fig. 6). Among the most relevant ones are (a) the modified position of horse's front legs (Fig. 7) or the size of the jar held by the horse rider, as well as the position of his head (Fig. 8). These details can help us understand why

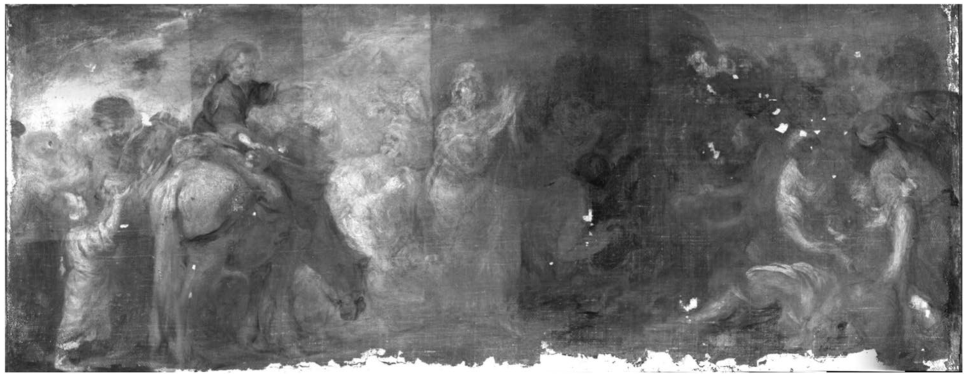

Fig. 6 IRR image of the *bozzetto*. Different hues of vertical strips correspond to canvas stripes of the support

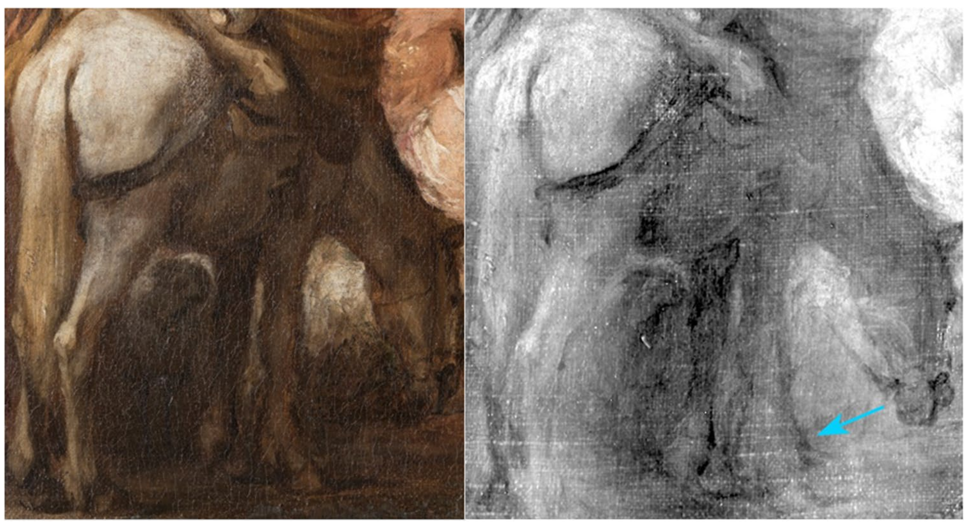

Fig. 7 Comparison of a detail of the *bozzetto* and the corresponding IRR image: changes in the composition of horse's front legs

Fig. 8 Comparison of a detail of the *bozzetto* and the corresponding IRR image: changes in the position of the head and the size of the jar

in the large size paintings only few modifications can be found; Murillo obviously studied his works very thoroughly before transmitting them to the final support. These observations eliminate the hypothesis that the *bozzetto* was a later anonymous copy.

4.2 Materials study

The results obtained from invasive and non-invasive techniques show similar painting materials as found in other Murillo's works (Durán et al. 2010; Bray 2013; Tomlinson et al. 2011). Correlation between pigments and grounds of the *bozzetto* and the large painting can be deduced. Several later retouches and filled lacunas, results of non-documented historic interventions were observed under the UV light and some of them were confirmed also by IRR. With the help of these images, material analysis could be carried out mostly on original areas of both artworks, to obtain information on the original Murillo's palette. However, also some retouched areas were analysed to confirm later interventions and to identify the pigments used.

4.2.1 Support, ground and priming

The support was identified by SEM–EDX as linen canvas. In all points analysed by XRF and MA-XRF, the presence of Ca, Fe and Pb can be observed, which points toward the hypothesis that these elements come from the ground layer; however, it is impossible to separate them clearly from the overlaying colours. Nevertheless, the OM images of the cross-section (Fig. 9) reveal two preparatory layers, a thick ground (around 200–260 μm) and a quite thick primer layer (50 μm). The basic material in both layers is the so called "tierra de Sevilla" (Seville's earth), a very famous earth clay obtained from the river Guadalquivir in this city, composed principally of iron oxides and aluminosilicates, to which Murillo added calcite, carbon black and lead white. The primer has a similar composition of red earths, lead white, carbon black and calcite, but in different proportion, which results in a darker hue. As binder, linseed oil was used, confirmed by GC–MS. Comparable results were obtained from the large painting sample cross-sections (Fig. 10), revealing also two thick preparatory layers with almost the same composition, but slight differences—the upper layer contents more lead white and a mixture of different pigments, as if the artist had used pigment leftovers from his palette; also remains of vermilion and lead–tin yellow were found, which are not common in a painting preparation and were not discovered in the *bozzetto*. Murillo's preparatory layers have a dark, brownish-greyish tone, being the top one generally darker. In the large painting another observation can be pointed out: the hue of the top preparatory layer varies along the surface of the painting, it is darker under dark areas, and brighter under light colours, which helped the artist to model the colours quicker. This tone variation of the preparatory layer could not be confirmed in the *bozzetto* with only a single sample.

4.2.2 Pigments, colourants and binders

XRF analysis identified several principal chemical elements present in both artworks: Ca, Fe, Co, Cu, Hg, Pb, and some trace elements, such as Mn, As, Sn, Ti, Zn. Based on these results, inorganic pigments can be identified. Some doubtful

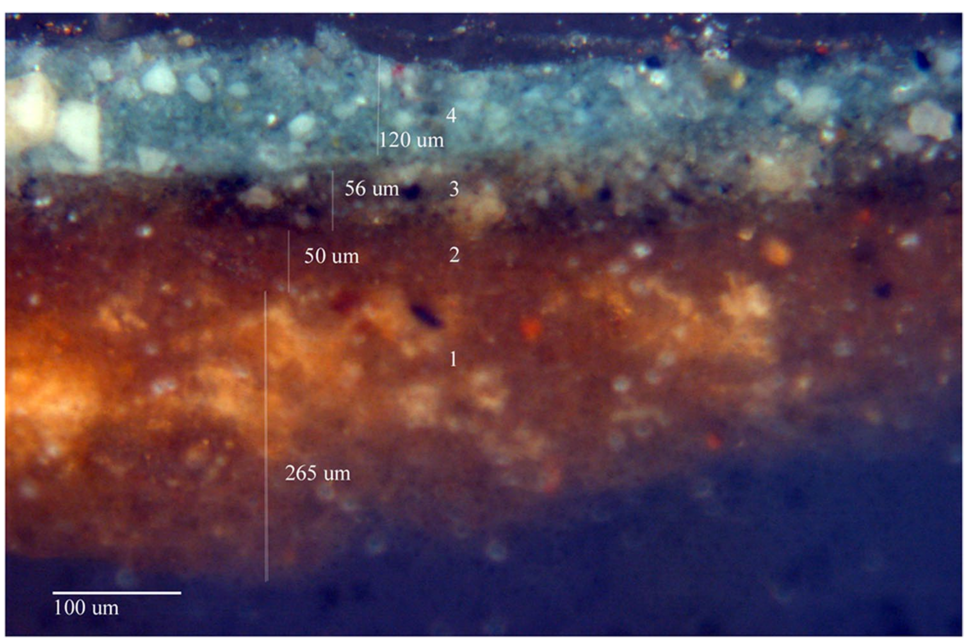

Fig. 9 OM image of a cross-section of a sample extracted from the *bozzetto*. On a thick reddish ground (1), a darker primer is observed (2). On top, two colour layers, grey underpainting (3) made with carbon black and lead white and a blue colour layer (4) of smalt and lead white were applied

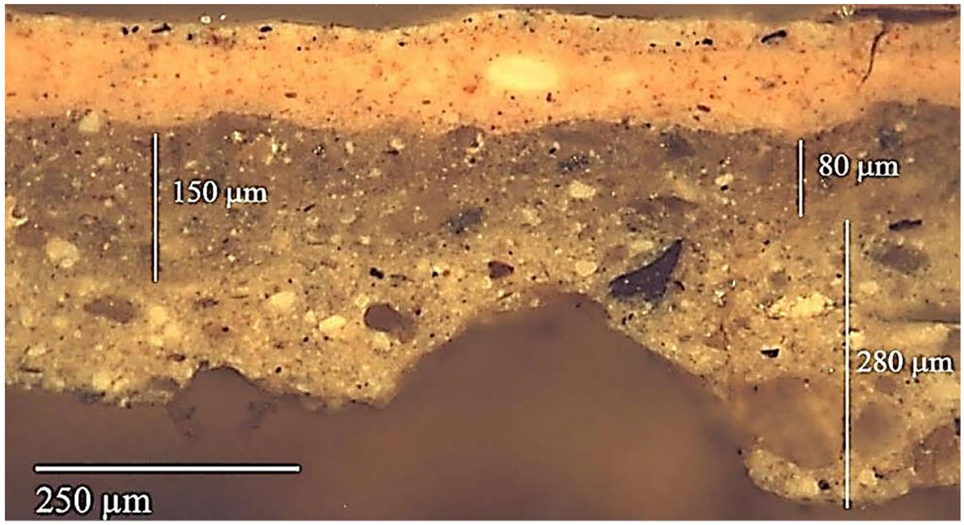

Fig. 10 OM image of a cross-section of a sample extracted from the large format painting. As in the *bozzetto*, thick ground (280 µm) and a primer (80–150 µm) can be observed under two pink colour layers, made of lead white, vermilion, earths and umber

results were successfully confirmed by OM and SEM–EDX analysis. The pigment palette in both paintings is very similar and the results show that Murillo's palette and painting techniques are very close to his other works, especially from the same period (Durán et al. 2010; Bray 2013; Tomlinson et al. 2011).

The artist used pigments generally applied in the seventeenth century (West Fitzhugh et al. 2012; Kühn et al. 1997; Bruquetas Galán 2002). For white colour, lead white (Pb) was applied, for yellow, ochre (Fe) and lead–tin yellow (Pb, Sn) were combined. Red colour was obtained with a combination of iron oxides (Fe), vermilion (Hg) and red lake (Ca), while for blue hues, azurite (Cu) and smalt (Co, Ni, As) were selected. For shades and darker tones umber (Mn, Fe) and carbon black pigment (C) were applied. The red lake was only hypothesized by XRF results on the basis of high Ca presence, but it was then confirmed by OM and SEM–EDX analysis which showed high amounts of calcite in the analysed dark red areas, being calcium carbonate the solid charge for the liquid lake. The black pigment was analysed by SEM–EDX; the characteristic form of carbon observed under SEM and the high presence of C identifies the black pigment as carbon black. An important revelation was found regarding green pigments; XRF and MA-XRF detected significant Cu peaks, which could be interpreted as a copper based green pigment, possibly verdigris or copper resinate corresponding to the seventeenth century palette. However, the study of extracted samples under SEM–EDX proves that Murillo did not use a green pigment, but a mixture of blue azurite (Cu), yellow ochre (Fe) and lead–tin yellow (Pb, Sn) for green tones. Unfortunately, this result was obtained only from the large Moses painting, but not from the *bozzetto*, where only one sample from the blue sky was extracted. On this sample, OM image (Fig. 9) revealed that under the blue colour layer, a grey underlayer was applied, a typical painting procedure to obtain a more intensive blue tone (Kühn et al. 1997; Bruquetas Galán 2002). With SEM–EDX it was possible to identify the composition of both layers; the grey one is a mixture of carbon black (C), lead white (Pb) and calcium carbonate (Ca), while the blue one is made with smalt (Al, Si, Co) and lead white (Pb). This was confirmed also with MA-XRF measurements. Murillo generally prepared mixtures of pigments, as it can be observed on carnations where principally lead white was used for a whiter skin colour, while for reddish flesh tones, more vermilion was added (observed as higher relative Hg content). On the other hand, for shades and modelling, a relative higher content of Fe, Mn, and Ca are found, revealing the use of ochre, umber and calcite, together with carbon black.

MA-XRF revealed the distribution of chemical elements and therefore pigments in the large format painting and in the *bozzetto* (Fig. 11). Principally, Fe, Co, Cu, Hg and Sn were detected, showing the distribution of iron oxide pigments, smalt, copper based green pigment, vermilion and lead–tin yellow all over the painting surface. The expensive azurite was not used for the *bozzetto* but the much cheaper blue smalt was chosen. It was common to use expensive pigments only in the final works to lower the costs. An important discovery was made on the *bozzetto*, precisely on the face of the boy on the horse, confirming the suspicion that originally his face was painted in half profile and was later on turned towards the spectator, as it can be observed on the final painting. As seen on the MA-XRF images, the first position was made using vermilion (Hg), while the change was carried out with a red iron oxide pigment (Fe) (Fig. 12). The same change of the head position can be observed also on IRR images, although not so clearly.

The binder used in the large painting was identified by GC–MS and FTIR as linseed oil, but it was not possible to analyse the binder used in the *bozzetto*. The only sample

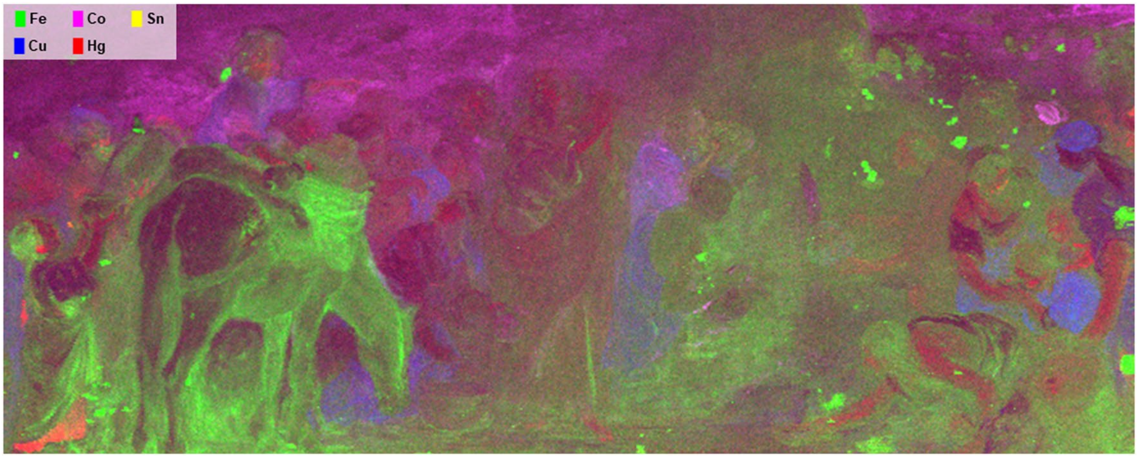

Fig. 11 MA-XRF image of the distribution of chemical elements on the *bozzetto*; Fe, Co, Cu, Hg and Sn can be well observed

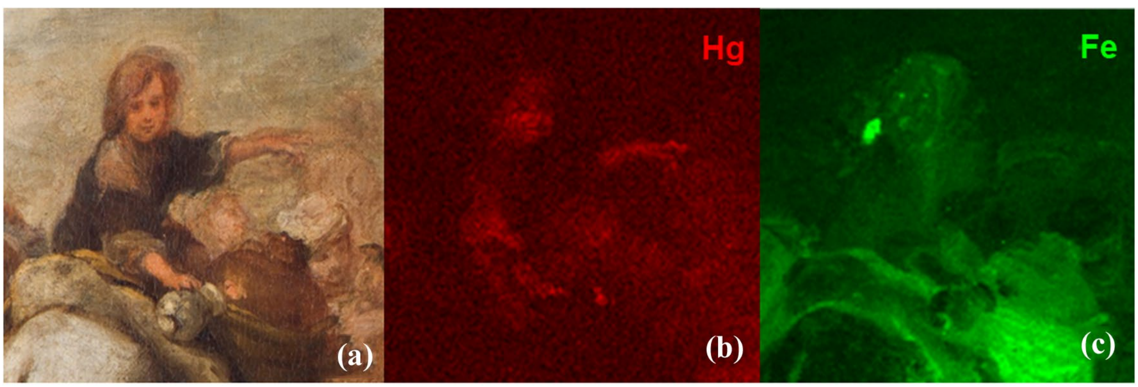

Fig. 12 MA-XRF image of the detail of a boy on the horse shows that Murillo used different pigments on his face: **a** detail of the *bozzetto*, **b** distribution of vermillion (Hg) for the first position of the head in the sketch; **c** distribution of iron oxide pigment (Fe) for the second position of the head in the sketch

extracted was prepared as a cross-section and, consequently, it could not be processed by GC–MS or any precise binder identifying technique. However, staining the stratigraphy with acid fuchsin revealed the use of oil as binder.

4.2.3 Later interventions

UVF and IRR images already showed the location of later interventions and therefore the XRF analysis only confirmed their existence and allowed to identify the pigments used for those retouches. They are all of modern origin: zinc white (Zn) put on the market at the end of the nineteenth century, titanium white (Ti) in use from around 1920 on, while Prussian blue (Fe) was known already from the eighteenth century (Tomlinson et al. 2011; West Fitzhugh et al. 2012). The use of the latter one has been confirmed also by sample analysis under OM and SEM–EDX. The results show that probably several interventions were carried out in different times.

4.3 Painting technique

The meticulous study of materials and the painting surface of both artworks revealed wide brushstrokes for backgrounds and vestments, while thin and precise ones for faces and details. The texture is smooth, flat, except in very bright areas and those with many details, where some thickness of colour layers can be observed. In the *bozzetto* several technical and material characteristics stand out, which are distinctive for Murillo. On the basic greyish-brownish tone, obtained already with preparatory layers as explained above, he modelled using a brush charged with colour, performing precise strokes to obtain a desired optical effect. This tonality is precisely the decisive element that strategically influences the final result. With a reduced selection of pigments, as confirmed by the material analysis, he obtains unlimited resources for an extraordinary chromatic harmony. The same procedures can be observed in his other final works (Durán et al. 2010; Bray 2013; Tomlinson et al. 2011; West Fitzhugh et al. 2012). His brushstrokes show high sureness and easiness, applying the colour with great intuition and facility. Murillo captures the essence of what he represents. The *bozzetto* is a clear exponent of his genius, able to gather volume, light, atmosphere, spatial dimensions and colour with fast brushstrokes. The final effect of the *bozzetto* does not achieve the perfection and smoothness of his final works, being just a preparatory painting, however his way of work is so particular that it is quite certain that the *bozzetto* is his work and not only some anonymous copy.

5 Conclusions

The analysis of the *bozzetto* and the large format painting, both depicting *Moses and the water from the rock of Horeb*, revealed the materials and painting technique used by Bartolomé Esteban Murillo, one of the most important artists of the Siglo de Oro (Golden Age of the seventeenth century). Although his palette is reduced, he achieved great optical effects combining wide and thin brushstrokes on a toned preparation. As preparatory layers he used a thick ground and primer layers, made of "tierra de Sevilla", lead white, calcite and carbon black in different proportions; in the final large format work also a very low amount of vermilion and lead–tin yellow were added to the primer, which changes the hue depending on a darker or lighter parts of the painting. The pigments found in the paintings were common in the seventeenth century and also known from other Murillo's *ouvre*: lead white (Pb), yellow ochre (Fe), lead–tin yellow (Pb, Sn), iron oxide red (Fe), vermilion (Hg), red lake (Ca), azurite (Cu), smalt (Co, Ni, As), umber (Mn, Fe) and carbon black (Ca), as well as a mixture of blue and yellow pigments for green colour, mostly characterised by XRF and in some cases also with OM and SEM–EDX, which identified the linen canvas as support too. According to FTIR and GC–MS analyses, the binder used in the large format painting is linseed oil and also some type of oil was used in the *bozzetto* as the staining procedure showed in this case. Several changes in the composition of the *bozzetto* and also between the *bozzetto* and the final Moses painting were confirmed by IRR and MA-XRF, which also revealed the use of different pigments in some of these changes (the face of the riding boy, for example). The elemental maps obtained by MA-XRF show the distribution of inorganic pigments applied in both artworks. They are quite similar and therefore it can be concluded that both artworks were made by the same artist with high probability.

These results also helped the restorers to carry out a proper intervention on the *bozzetto* and the final painting, based on the conservation and maintenance, instead of restoration. First, frames were removed to expose the entire surface of the painting, which was carefully but still thoroughly cleaned, as well as the reverse of both paintings. Secondly, older *stuccos* were preserved because of the good state, although some new *stuccos* were added. Thirdly, because of several losses in the preparatory and colour layers, several retouches in *regatino* (applying dots) were carried out, using an aqueous painting technique, easily recognisable at a closer look. Finally, several varnish layers were applied for painting surface protection.

In conclusion, the most relevant result of this research is that the *bozzetto*, a valuable record of an artist's procedure, was carried out by Murillo himself with high certainty and it is not a copy, especially when his brushstrokes and colour layering are compared with other known works by this famous Sevillian master.

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