DISCOVERING PATTERNS IN GIROLAMO TROPPA'S GROUNDS

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ABSTRACT As so little is known of the Italian baroque painter Girolamo Troppa, especially his painting technique and materials, this paper provides a thorough investigation into his use of grounds. The Statens Museum for Kunst, Copenhagen, holds a collection of eight paintings by Troppa, lending room for comparisons. All the paintings have been subject to both in-depth material analysis and overall technical investigations. The results show a clear pattern in the artist's use of double grounds, comprising the same build-up and raw materials, as well as a recurring and continuous use of exposed ground as a middle tone. A consideration of the 17th-century Roman art market provides an understanding of Troppa's practice. He was an artist with a large output, working on commissions both from wealthy patrons and churches, as well as producing a large number of genre paintings to be sold by the art dealer Pellegrino Peri. Comparisons with two other paintings signed/attributed by/to Troppa (belonging to the Nationalmuseum of Sweden and the Church of Santa Maria Novella in Bracciano), have made it possible to increase the number of case studies, which supports the presence of patterns in his technique. These patterns might be used as a marker for Troppa's specific workshop.

Introduction

The focus of this paper are eight easel paintings by the Italian baroque painter Girolamo Troppa (born 1637, died after 1710) in the Statens Museum for Kunst (SMK) collection: a group of *Philosophers*, namely *St John the Baptist*, *St Peter Penitent*, *Homer* and *Virgil* (Fig. 1); *The Penitent St Mary Magdalene* and *The Dream of Jacob* (Fig. 2); and two pendants with representations of *Mercury Killing Argus* and *Apollo Flaying Marsyas* (Fig. 3). The eight SMK paintings play a crucial role in understanding Troppa's oeuvre, since four are signed and six are known to have been bought in Rome as early as 1669.[1] Little is known about the artist's painting technique and even less about his materials. This paper aims not only to uncover his painting technique and his use of preparatory layers, but also to present all available information on the paintings from contemporary sources, to better understand Troppa as an artist working in a highly competitive art market.

Fig. 1 1 Girolamo Troppa, (a) *St John the Baptist*, signed on the red cross, oil on canvas, 98 × 73 cm, (b) *St Peter Penitent*, oil on canvas 98 × 72.5cm, (c) *Homer*, signed on the book, oil on canvas, 98 x 72 cm, (d) *Virgil*, signed on the book, oil on canvas, 98 x 73 cm, Statens Museum for Kunst, Copenhagen, inv. nos. KMSst141, KMSst155, KMSst139 and KMSst153. (Photos: Jakob Skou-Hansen/SMK.)

Fig. 2 Girolamo Troppa, (a) *The Penitent St Mary Magdalene*, oil on canvas, 64 × 48 cm, and (b) *The Dream of Jacob*, oil on canvas, 73 × 60.5 cm, Statens Museum for Kunst, Copenhagen, inv. nos. KMSsp120 and KMSst310. (Photos: Jakob Skou-Hansen/SMK.)

Fig. 3 Girolamo Troppa, (a) *Mercury Killing Argus*, signed on the rock, oil on canvas, 96 × 132 cm, and (b) *Apollo Flaying Marsyas*, oil on canvas, 96 × 132 cm, Statens Museum for Kunst, Copenhagen, inv. nos. KMSsp122 and KMSsp123. (Photos: Jakob Skou-Hansen/SMK.)

Provenance and acquisition of Troppa's paintings for the royal Danish collections

The Norwegian-born architect and painter Lambert van Haven (1630–1695) was sent on a Grand Tour and collecting expedition to Italy by the Danish king, Frederik III (ruled 1648–1670).[2] Van Haven acquired not only paintings, but also books for the king's library, as well as rare objects and mathematical instruments for the royal collections (*Kunstkammer*). Starting out from Copenhagen on 29 September 1668, he reached Rome (via Venice, Bologna and Florence), where he resided from 6 April 1669 to 15 June 1670. While in Rome, Van Haven acquired many paintings, including six works by Troppa: four half-figure paintings larger than life now identified as *St John the Baptist*, *St Peter Penitent*, *Homer* and *Virgil*, and a bust-length depiction of *The Penitent St Mary Magdalene* and *The Dream of Jacob*.

A series depicting four men is mentioned in a single entry in Van Haven's travel accounts (Fig. 4) and has been discussed elsewhere:[3] '4 *støcser aff gamble Philosopher, giort aff Girolamo Troppi* – a: 15 *scudi* – er 60 *scudi* (4 pieces of ancient philosophers, done by Girolamo Troppi – each: 15 *scudi*– total 60 *scudi*)'. He also identified the subject of Jacob: '*1 støche S. Jacobs drøm aff Do. Troppi . 24 scudi* (1 piece S.

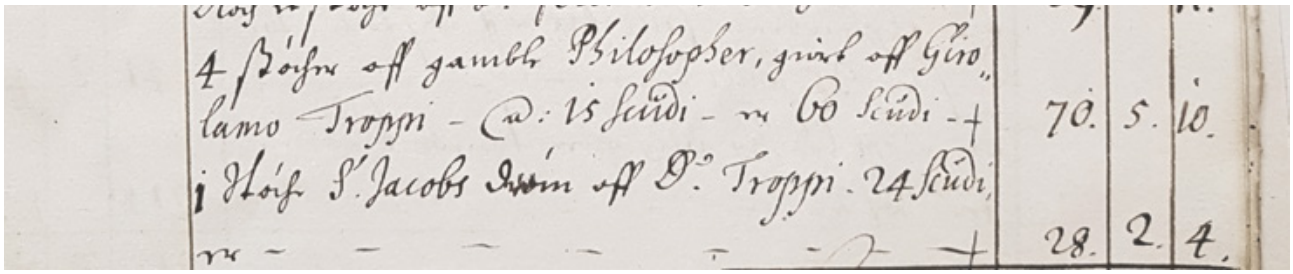

Fig. 4 Relevant entry in Van Haven's travel accounts, Danish National Archives, Copenhagen. (Photo: Eva de la Fuente Pedersen.)

Jacobs Dream, by Do. Troppi. 24 *scudi*)'. Thus far, no information on how or where he purchased these six paintings has been found. Since Troppa was active in Rome at that time, Van Haven could have bought them directly from the artist or from Roman art dealers.[4]

A hundred years later, two additional Troppa paintings were purchased for the royal Danish collections in the time of King Frederik V (ruled 1746–1766), who in 1763 sent his art expert and keeper of the royal *Kunstkammer*, Gerhard Morell, to Amsterdam. Morell returned with many paintings, among them *Mercury Killing Argus* and *Apollo Flaying Marsyas* (referred to as Apollo/Mercury pendants) bought at an auction.[5] It is known that these pendant pieces were auctioned in Amsterdam as early as 1699 and 1707.[6]

Troppa's life and work

No contemporary biography exists for Troppa: the first biographical and archival records were published by Antonino Bertolotti as late as 1885.[7] Giancarlo Sestieri published further biographical information and a list of documented and known works in 1994.[8] Recently, more biographical information has been published by scholars including Erich Schleier, Zsuzsanna Dobos and Francesco Petruzzi, while Richard Spear and Philip Sohm have made important contributions to the construction of an oeuvre.[9]

Knowledge about Troppa's life can be written in very few words. He was born in 1637 in the small village of Rocchette near Rieti in the Sabine Hills of Lazio in Italy. In 1656, the 19-year-old painter lived in Rome where he also died at an unknown date, but after 1710. A census dated 1656 reveals that Troppa lived in Campo Mazio, a Roman neighbourhood popular with many artists: it classified Troppa's household as 'poor'. At the time, all artists' households were registered as either 'poor' (65%) or 'comfortable' (28%). This was a broad classification: at this time 'poor' meant someone who did not own property but instead lived off an income.[10] In addition, in 1656 Troppa is known to have married Elisabetta de Stefani, in 1657 their daughter Giovanna was baptised, and in 1661 their son Pietro was born. In 1664 Troppa was admitted to the Accademia di San Luca and in 1666 he hired an assistant.

There is no precise information on Troppa's training, but the style of the works from the 1660s suggests that he was part of a circle around Pier Francesco Mola (1612–1666). All eight SMK paintings date to this early period.[11] Moreover, his technique borrows from Guido Reni (1575–1642) in the swiftness of execution, hatched paint strokes for the flesh tones and use of a stiff bristle brush for painting hair and beards. By 1686 at the latest, he was awarded a knighthood, indicating that he was well regarded in his time. However, like many other artists, he has vanished into obscurity today.[12]

Troppa was a very productive artist throughout his entire career, and many of his commissions took him around Lazio as well as to Umbria, Ferrara and elsewhere. He worked as a fresco painter, an easel painter and draughtsman, with churches and patrician families as his principal patrons. It is known, for instance, that Troppa was commissioned to paint a ceiling mural with an Ovidian story of Flora and Zephyr for Cardinal Chigi at his Roman residence Palazzo Odescalchi in 1668, the same year he painted two religious compositions for the Church of Saint Joseph (San Giuseppe) in Ferrara.[13]

Technique and the role of the ground in Troppa's paintings

All the examined Troppa paintings have a dark brown ground. By the start of the 17th century, commercial primers sold pre-primed canvases. The cost of primed canvas and stretchers in Rome in the 17th century was minimal, although naturally it depended on size and quality.[14] The ground was often a single layer but double layers are also seen at this time.[15] In many instances, the use of a double ground can be a pragmatic and economical solution to modify a pre-prepared canvas to the artist's wishes; this is supported by a recipe from De Mayerne, who suggested the use of a thicker layer of ochre for the lower layer to create a smooth surface upon which a thinner top layer of the desired and more expensive pigments could be applied in order to reduce the cost.[16] Studies of both contemporary sources and examination of contemporary paintings reveal that brown and red grounds were commonplace in Rome in the 17th century.[17] Although it suited the *chiaroscuro* style, it also provided a reason for art critics' contemporary debates of *colore vs designo*. It is speculated that the predominant use of this type of ground was founded on economy because the artist, having mastered the technique, could accomplish a dramatic effect with seemingly little effort.[18] The *alla prima* technique is well suited to large-scale production, and Troppa in fact boasted of his speedy painting technique on the back

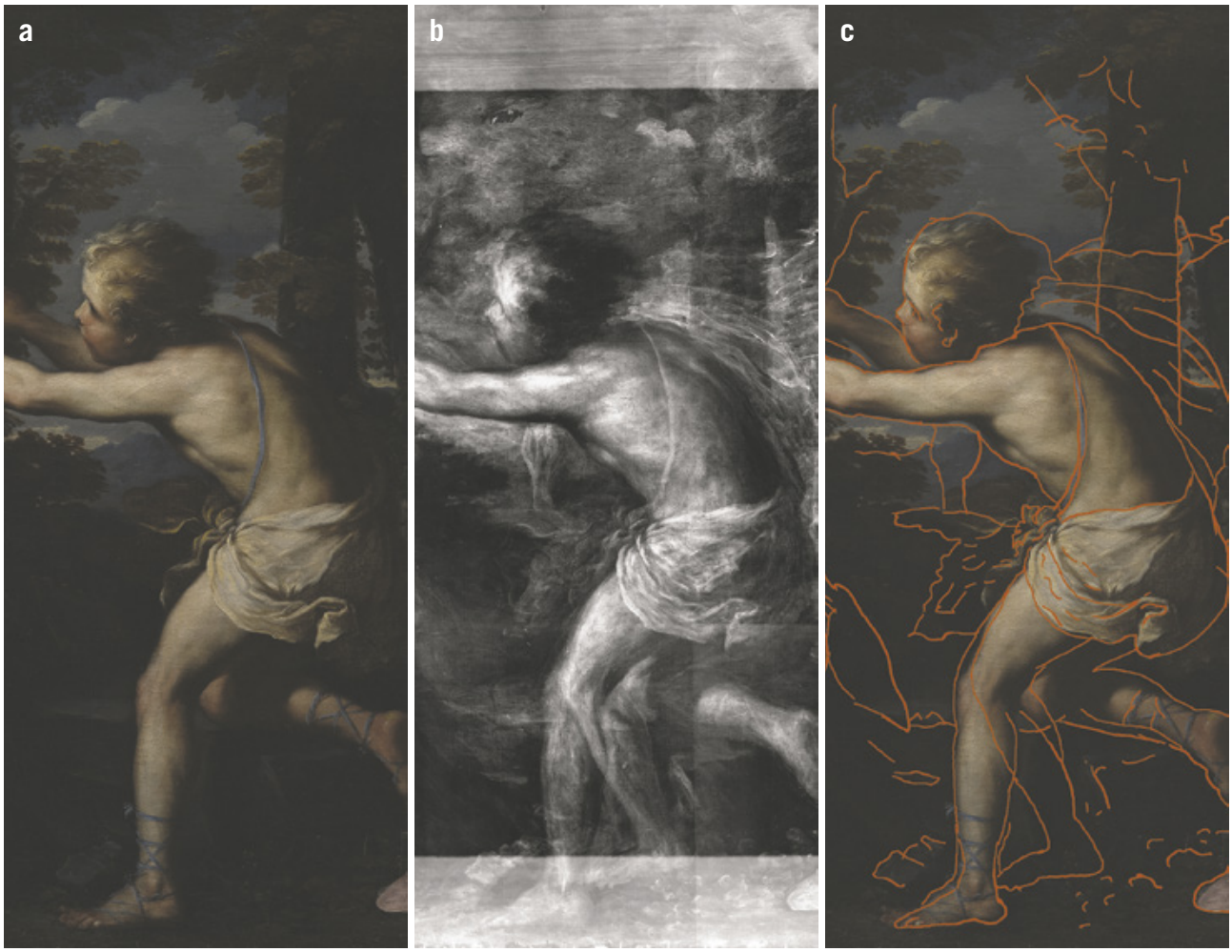

Fig. 5 Detail of Girolamo Troppa, *Apollo Flaying Marsyas* (Fig. 3b), (a) visible light, (b) X-radiograph showing the altered positions for Apollo's foot and a piece of fabric draped over his back and shoulder, and (c) tracing of the X-radiograph overlaid on (a). (Photos: Jakob Skou-Hansen; Troels Filtenborg and Jakob Skou-Hansen; Loa Ludvigsen/SMK.)

of the painting *Saint Jerome in the Wilderness*, by writing 'OPERA D.UN GIORNO DEL CAVALIER TROPPA (made in one day by the gentleman Troppa)'.[19]

Troppa's *Philosopher* series (Fig. 1) consists of four half-length paintings of emotionally agitated men, stirred by the forces of creative imagination or religious fervour. In his portrayal of the two poets, Troppa appears to have observed a commonplace iconography for the depictions of poet-philosophers, whose written basis may be Horace's statements concerning the appearance of genius. All four paintings are nocturnal scenes, the sky dramatically painted in dark blue, contrasting with the frontally illuminated figures in voluminous colourful robes. The palette is harmonious, created from a limited range of pigments used to build up corresponding saturation and tonal intensity by defining space with *chiaroscuro*. The ground plays a key optical role in Troppa's painting technique for these four paintings, slightly shining through the dark blue sky and setting their tone. The cooler tones on top of the dark ground also enhance the sensation of an optical blue in the sky.[20] The hair and beards are painted vividly with a broad stiff brush over the partly exposed ground, using it as the middle tone. Flesh tones are executed with clearly visible rapid brushstrokes with only slight impasto in the highlights. The execution of the paintings of the four 'philosophers' bear all the marks of a skilful *alla prima* technique. The paintings show no signs of *pentimenti*: X-radiographs reveal minimal application of paint to create these intense and expressive paintings. They were completed swiftly as if the artist had painted the compositions many times before.[21]

The half-length figure painting of *The Penitent St Mary Magdalene* bears a great likeness to Guido Reni's popular depictions of the same subject from the 1620–30s. On an almost monochrome background, a haloed repentant saint is looking upwards while holding her right hand to her chest, which is covered by her long blonde hair.[22] The figure stands out from the background by virtue of a light grey contour around the head, eliminating the tone of the ground otherwise shining through the thinly applied green-grey colour. In contrast to the technique used in the *Philosopher* series, Troppa blended the brushstrokes in the fair skin of the Magdalene, creating form with subtle *chiaroscuro*: only the highlights, the tears and the hair evidence Troppa's rapid working touches applied with a stiff brush. The ground also plays its part as a middle tone in the hair and cloak. Her left shoulder is placed in the shadow, covered only by light touches of hair. Unlike the *Philosophers* series, in which no changes of positions for

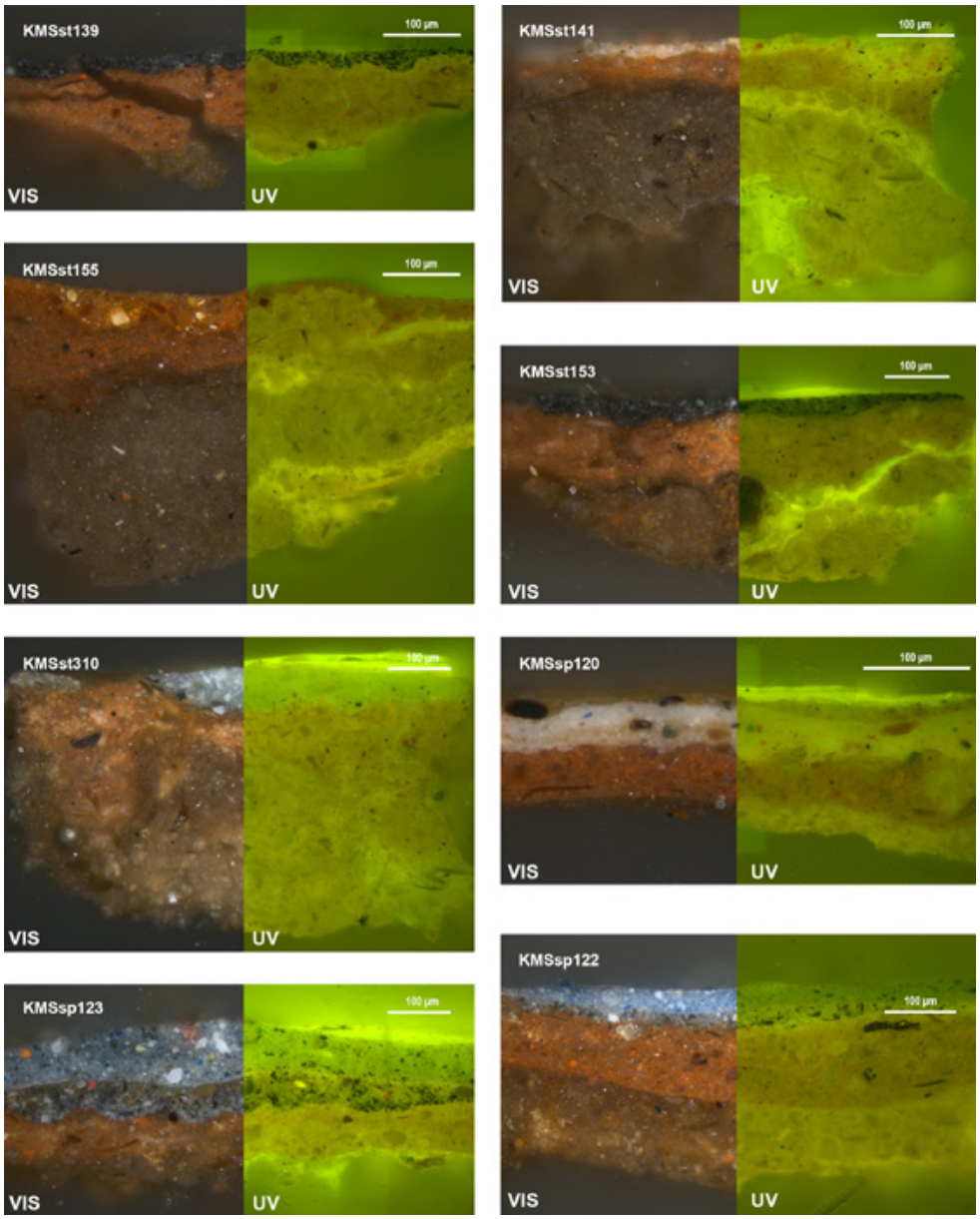

Fig. 6 Cross-sections including the ground layers for all eight paintings, labelled by the SMK inventory number as given in Figs 1–3, in visible (VIS) and ultraviolet (UV) light.

the figures can be seen, the Magdalene's gaze has shifted somewhat according to the X-radiograph. Troppa was probably less familiar with this motif than with the poses for the *Philosophers*, and had to develop it more.

The literary sources for the two mythological paintings, *Mercury Killing Argus* and *Apollo Flaying Marsyas* (Fig. 3), are Ovid's *Metamorphoses*. Both tales concern not only the jealousy of the gods and hubris, but also music as an art form and music's power to affect an audience. The *Apollo/Mercury* pendants are painted in a more elaborate manner than the *Philosopher* series, in accordance with the high style expected for history painting. The creative process included preparatory drawings.[23] Schleier drew attention to four preparatory studies now in the Kupferstichkabinett, Berlin, two of which are for the *Apollo/Mercury* pendants at SMK.[24] According to Schleier, the style of drawing is from Troppa's early years when Mola's influence was still perceptible. Both paintings exhibit *pentimenti* and reworking, especially in the figures, which can be observed in the X-radiograph (Fig. 5).

The transition of the composition from the drawings to the paintings also introduced several compositional changes. Although the overall design is similar, the *Apollo* figure shows significant changes while the composition in *Mercury Killing Argus* is partly inverted: Mercury's left leg is bent, but most importantly, he is seen from behind in the finished painting as opposed to from the side in the sketch. The X-radiograph shows that the current positioning of Mercury is unaltered, so we must assume that there were intermediate preparatory steps between the drawing and the finished painting.[25] The same applies to *Apollo Flaying Marsyas*: the most prominent discrepancy between the Berlin drawing and the finished painting is the placement of the figures. Marsyas is turned away from Apollo, his hands tied in the upper left corner of the painting, but he is turned to the right in the drawing.

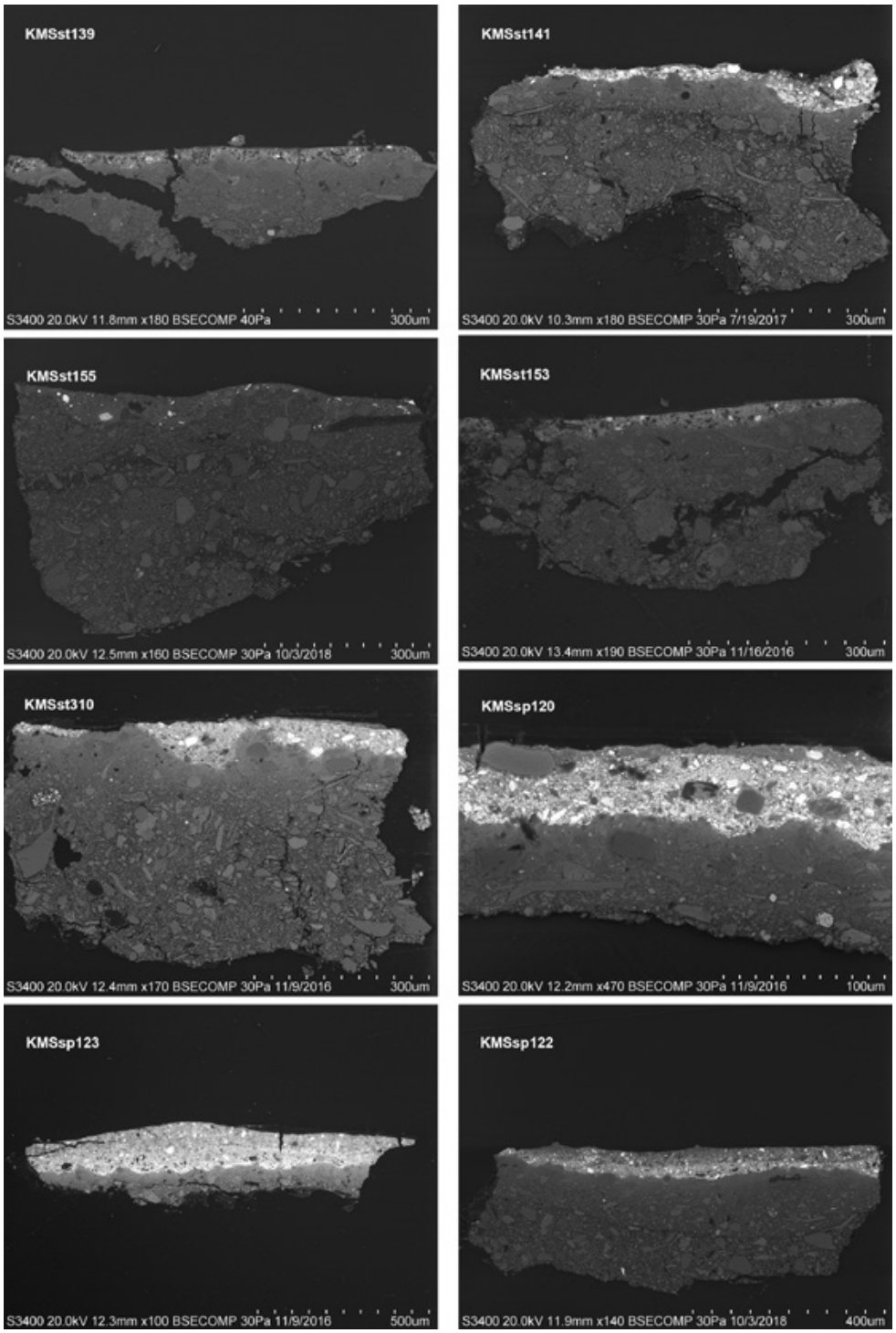

Fig. 7 SEM-BSE images of the cross-sections shown in Fig. 6.

The X-radiograph shows no changes in the Marsyas figure, whereas Apollo's left leg has altered, which occurred late in the painting process. X-radiography also reveals garments over the shoulders of both figures, replicating the drawing but eliminated in the painting. Crude brushstrokes, seen in the X-radiograph, indicate the cloth falling over the right shoulders of both figures. The clothing on Apollo's upper body is billowing in the wind. To the naked eye, traces of bright red colour are still visible around the figure of Apollo. The garments around the hips originally had more fabric, as drawn in the sketch, but this was painted out. Most notable is the use of a brown colour for the modelling of shade on the body of the sleeping Argus. Uncharacteristically, it was applied on the fully painted chest and around the right elbow, adding additional shadow from the attacking Mercury, perhaps revealing that the design was less carefully thought out and not previously replicated. Overall, the paintings evidence distinctive use of the visible ground colour for the *chiaroscuro*. The faces, hair and beard were painted as described above with a stiff bristle brush over partly exposed ground. Flesh tones reveal clearly visible brushstrokes. The foreground rocks and vegetation were painted swiftly, with a minimum blending of

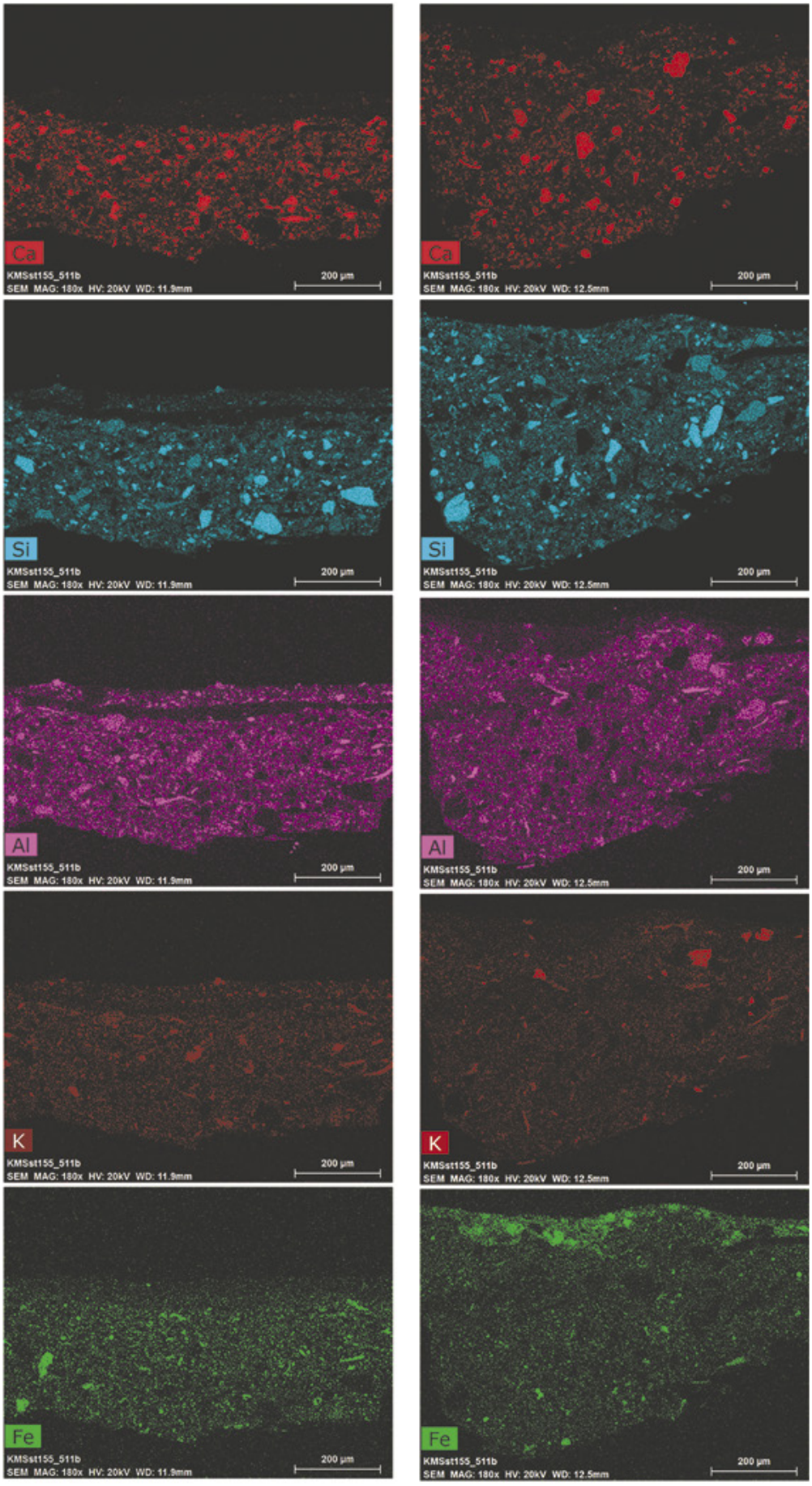

Fig. 8 EDX maps of the elemental distribution of calcium (Ca, red), silicon (Si, cyan), aluminium (Al, magenta), potassium (K, brown), and iron (Fe, green) in two cross-sections representative of the grounds for *Mercury Killing Argus* and *St Peter Penitent*. All the elements and hence the pigment particles are distributed homogeneously.

colours. The form was built up by accurate, rapidly applied colours worked from the darks to the highlights, which were added with a stiff, dry brush. The details of plants are more roughly executed compared to works by other artists such as Mola, who blended his brushstrokes and added more detail to flowers and shrubbery. The same applies to the treatment of flesh tones: Troppa used hatching and distinct brushwork as opposed to the blending seen in Mola's paintings.

The literary source for Troppa's sketchily painted *Dream of Jacob* is biblical (Genesis 28:10–22). Troppa's composition interprets the story by utilising powerful visual imagery and an arresting use of colour, light and darkness with the intention of making the story clear and easily understandable for the viewer. Jacob's vision of angels ascending and descending is painted in bright, saturated colours including white, blue and black opposed with yellow, orange-red and green. In contrast to this luminous vision, the earthly lower part of the composition depicts the sleeping Jacob almost hidden in the night's sombre darkness. *The Dream of Jacob* has a very different style compared to the other seven paintings. The colour of the ground plays a central role for the many angels in the middle ground, which are suggested only by a few light brushstrokes. The carefully planned design enabled the figures to be painted in reserves.

Analysis of Troppa's ground layers

Paint samples were taken from all the paintings and prepared as cross-sections[26] to study the stratigraphy and analyse the layers using scanning electron microscopy with energy dispersive X-ray (SEM-EDX) analysis,[27] Fourier transform infrared (FTIR) spectroscopy,[28] and Raman spectroscopy.[29] The eight paintings have a similar stratigraphy with a double-layered ground structure (Fig. 6). Despite a slight variation in hue among the samples, the cross-sections show that the lower layer (labelled *ground I*) always looks more brownish in colour with a semi-transparent appearance, while the upper layer (labelled *ground II*) has a more orange-reddish and opaque appearance. A difference can be seen in the ultraviolet (UV) images: *ground I* has a yellowish fluorescence compared to *ground II*, which has a more pinkish fluorescence (Fig. 6). Furthermore, in UV light a consistent difference in morphology between the two ground layers is also visible: the bottom layer is more coarsely grained with some larger particles, while the upper layer contains finer particles.[30] Both grounds are likely oil-based (*vide infra*) and the different appearance in UV might also indicate the use of different oils, differences in oil preparation, ageing of the oil before it was used, the quantity of added driers in the two layers or a different pigment/binder ratio. The grounds are fairly thinly applied, albeit applied more thickly than the paint layers, and the most that can be said about the relative thickness of the two ground layers is that they are comparable.

Apollo Flaying Marsyas, which has a single ground layer (Fig. 6), seems to be the only exception to the double-layered ground structure. But compared to the other paintings, where

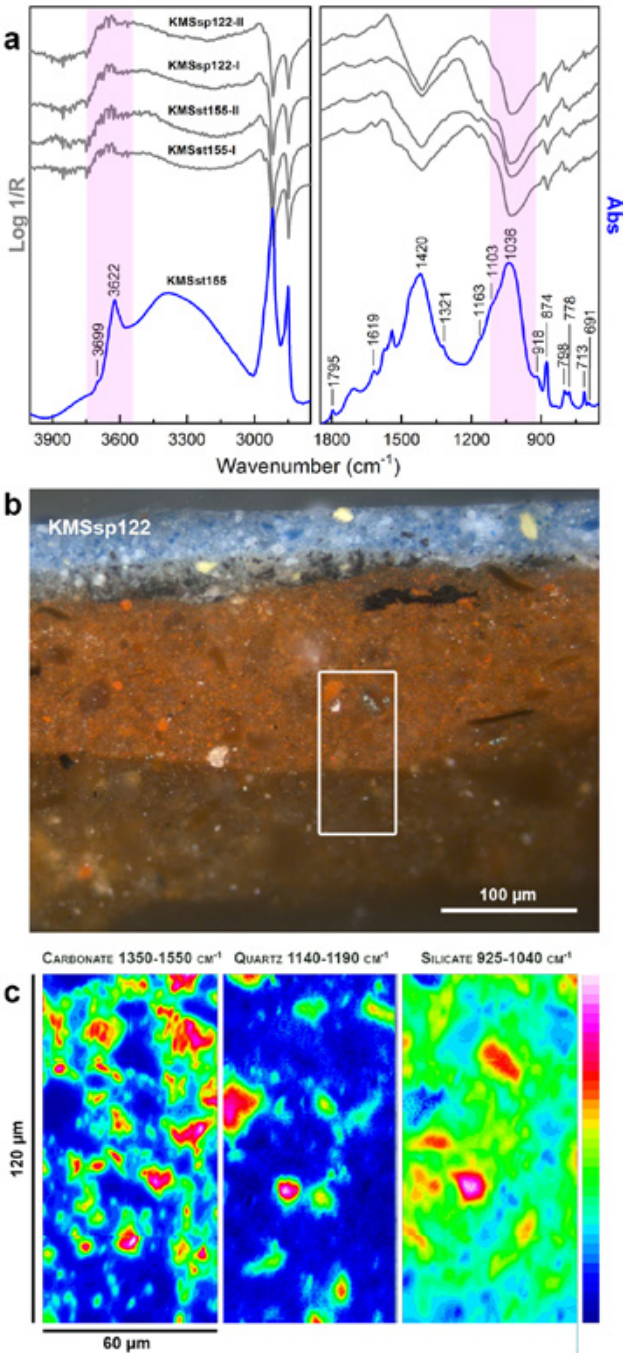

Fig. 9 (a) Reflection FTIR spectra from cross-sections representative of the ground structures in *Mercury Killing Argus* and *St Peter Penitent*, compared with the transmission spectrum of a paint fragment from the latter, showing measurements carried out on *ground I* and *II*. The pink rectangles indicate the features possibly ascribable to illite. (b) Detail of a cross-section showing the ground structure in VIS for *Mercury Killing Argus*. The white rectangle indicates the area mapped by ATR. (c) ATR maps for calcium carbonate, silicates (possibly illite) and quartz in the ground structure, indicating that the three compounds are distributed homogeneously.

the availability of several samples confirms the overall double-layer structure, only one sample was collected and it is plausible, taking into account the otherwise consistent structure of Troppa's grounds, that the sampling in this specific case did not include the bottom layer.

Compared to the visible light and UV images, the SEM backscattered electron (BSE) images (Fig. 7) do not illustrate

the presence of two ground layers so distinctly. Regarding particle size and morphology, the dissimilarity between *ground I* and *II*, as described for the UV images, is even more pronounced in almost all the BSE images of the cross-sections. In *Mercury Killing Argus* in particular, the lower layer clearly has a higher proportion of coarse grains compared with the upper layer, which seems more compact, containing finer-grained pigments. However, it should be stated that this distinction is very clear in cross-sections from *Mercury Killing Argus*, *St John the Baptist* and *The Dream of Jacob* but less so in samples from the other paintings.

Regarding the elemental composition of the ground structure (Fig. 8), silicon, aluminium and calcium are present in high amounts, together with relatively low amounts of potassium, iron, magnesium, lead, sulphur, titanium and sodium across the complete stratigraphy of the grounds in all the cross-sections. Trace amounts of titanium are often found associated with iron-based minerals in natural earth pigments.[31] The EDX results imply that the elemental composition of *ground I* and *II* is largely similar and, even more significant, it is identical in all the eight paintings apart from small differences in the relative amount of some of the minor elements. The elemental mapping gives a better idea of the homogeneity of the composition of the ground layers. Fig. 9 shows EDX maps of Ca, Si, Al, K and Fe for *Mercury Killing Argus* and *St Peter Penitent*. All the elements are equally distributed in the two ground layers without an evident separation.

Reflection FTIR identified calcium carbonate, silicates and quartz, indistinguishable between *ground I* and *II* in all the samples (Fig. 9a, upper spectra in grey). Calcium oxalates occasionally detected in *ground I* and *II* are possibly due to degradation phenomena of the organic binder. The band for Si-O stretching, indicating the presence of silicates, is not structured and therefore does not assist in the identification of a specific compound. Furthermore, quartz also absorbs in the same spectral region, making identification of a silicate even more difficult. Finally, considering that Si and Al are the major elements present in the grounds, sometimes correlated with other elements such as Na or K, it is reasonable to expect the occurrence of more than one type of aluminosilicate or the presence of other compounds such as feldspar and/or mica. The shape of the O-H stretching bands at higher wavenumbers seems more 'structured' and therefore more useful for the molecular identification. It is worth noting that in this region, the FTIR reflection profiles of the spectra collected on *ground I* and *II* are similar, indicative of the possible presence of the same compounds (Fig. 9a). This similarity occurs in all the paintings by Troppa in this study. During conservation treatment the opportunity to collect a sample of the ground that had penetrated through the canvas weave to the reverse of *St Peter Penitent* enabled identification of the main silicate compound responsible for the FTIR profile in the O-H stretching region. The FTIR spectrum[32] (Fig. 9a, blue line) is characterised by the signals for quartz (691, 778, 798, 1103 (sharp) and 1163 (sharp) cm^{-1}),[33] calcium carbonate (713, 874, 1420 and 1795 cm^{-1})[34] and calcium oxalates (1321 and 1619 cm^{-1}).[35] The silicates' spectral features at 918, 1036, 3622 and 3699 cm^{-1} (indicated by the pink highlights in Fig. 9a) can be attributed to the clay mineral illite.[36]

ATR-FTIR maps (Fig. 9b and c) confirm what was already observed using EDX. The map of the antisymmetric stretching band of $CO_3^=$ of calcium carbonate at *c.*1500 cm^{-1}, of the Si-O stretching band of illite at *c.*1000 cm^{-1} (integrated excluding the contribution of quartz) and of the Si-O stretching band of quartz at 1160 cm^{-1} can be seen in Fig. 9c. The three mapped compounds are not distinctly different in the two ground layers. With respect to the organic component, the presence in both ground layers of the carbonyl band at *c.*1730 cm^{-1} together with the CH signals at *c.*2855 and 2925 cm^{-1} could indicate the use of a lipid-containing binding medium such as oil. However, as the paintings have been subjected to conservation treatments in the past, such as lining, information on the organic components now present may not relate only to the original binding media.

Finally, Raman spectroscopy indicated the sporadic presence of a carbon-based black pigment as one of the components of Troppa's grounds (with no distinction between the upper and lower layers) together with the presence of hematite (Fe_2O_3), always occurring only in *ground II* (bands of carbon-based black pigment at *c.*1325 and 1590 cm^{-1}, hematite bands at *c.*253, 232 and 343 cm^{-1}; data not shown).[37] This finding is of paramount relevance since hematite, a component shared by *ground II* in all Troppa's paintings, is so far the only marker distinguishing the two ground layers from one another. It is worth mentioning that the presence of hematite in the top ground layer – probably used to give a deeper orange-reddish hue to *ground II*, the layer closest to the paint layers – does not affect the overall average distribution of Fe in the EDX maps. As already pointed out, there is no distinction between *ground I* and *ground II* from the elemental point of view.

The analytical results collected so far lead us to hypothesise that the same compound (a brown earth pigment containing calcium carbonate, quartz, iron oxides, illite and other silicates) was used for both ground layers, but with the further addition of red hematite to give the desired orange-reddish colour only to the top ground layer. Furthermore, the results indicate that the earth pigments could have undergone different grinding processes before their application in two different layers. This is very similar to the description by the English diarist Richard Symonds recorded in his notebook from Rome in 1650; apart from providing information on prices and dimensions of the pre-primed canvases, he also wrote about materials. He described the use of two ground layers, the lower being less finely ground.[38]

Comparative studies of paintings by or attributed to Troppa

The visual characteristics and composition of the SMK paintings are in accordance with the results reported in the only published study of the ground composition of another painting by Troppa.[39] This painting, signed on the reverse, is a large altarpiece of *St Thomas of Villanova* produced for the Church of Santa Maria Novella in Bracciano outside Rome,[40] dated

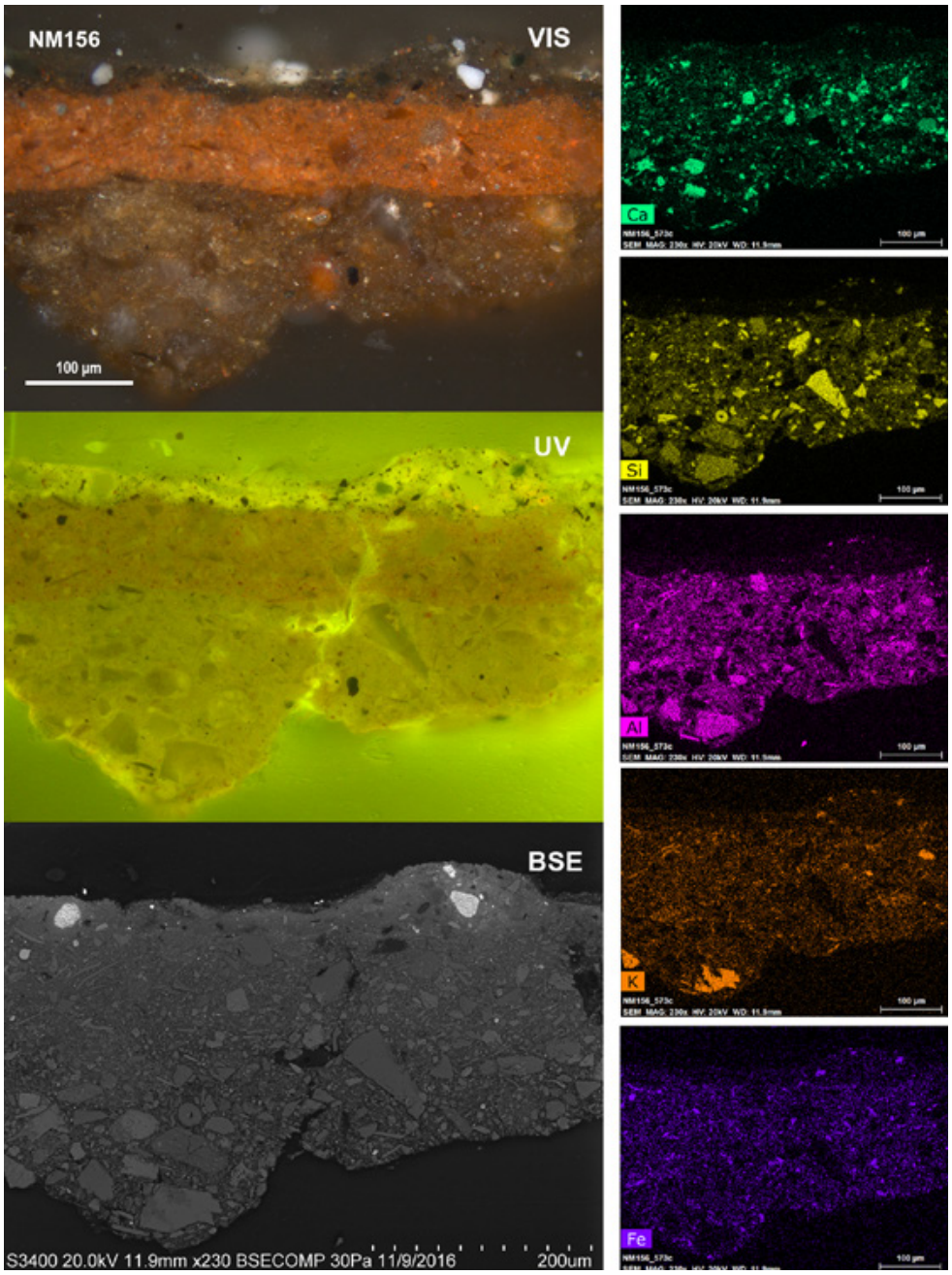

Fig. 10 Cross-section of Girolamo Troppa (attributed to), *Shepherd Playing the Pipe*, Nationalmuseum, Stockholm, inv. no. NM156. Left column: VIS, UV and SEM-BSE. Right column: elemental maps for Ca, Si, Al, K and Fe.

1658–68.[41] The image and description of the cross-section in the aforementioned publication clearly show a double ground structure as seen in the SMK paintings, while the optical microscopy and EDX results indicate that the lower brownish layer contains calcium carbonate, aluminosilicates, quartz and iron-based compounds, the latter reported in that publication as '*caput mortuum* and earth pigments'.[42] The reddish upper layer had a similar composition, with analysis indicating a higher amount of red iron-based particles, plausibly hematite, although not specifically identified as such by these authors. Therefore, the ground layer's build-up and appearance fit perfectly with those of the SMK paintings, and the chemical composition is very similar.

To reinforce the hypothesis of a pattern in the preparation and composition of Troppa's ground layers, an additional painting attributed to him, *Shepherd Playing the Pipe* in the Nationalmuseum in Stockholm, was examined at the CATS laboratories.[43] The Nationalmuseum describes the painting as 'executed in the manner of Salvator Rosa'[44] but Petrucci listed the painting among the artworks by Troppa in 2012.[45] This painting, although it is neither signed nor dated, exhibits the same ground structure of the SMK paintings by Troppa. Furthermore, the similarities in the elemental composition and distribution are significant. The sample has a ground structure similar to the SMK examples, both from the visual and materials point of view. Furthermore, in the BSE image a difference in the grain size between *ground I* and *II* can be clearly seen, similar to the SMK paintings (Fig. 10). These findings strengthen Petrucci's attribution to Troppa. Additionally, four investigated paintings by Salvator Rosa from the SMK

collection, dated from 1630 to 1661, show ground layers of different structure and different compositions, without any consistency even in the number of layers.[46] Differences in grounds have been observed in many instances for artists moving geographically and hence adapting to local practices, for example Van Dyck[47] and Velázquez.[48] Newly published research on Caravaggio's Roman paintings also reveals a lack of consistency.[49]

In addition, three paintings under investigation at the CATS laboratories – one by a follower of Mola and two by Carlo Maratti (1625–1713), dated to the second half of the 17th century – provided the opportunity to compare Troppa's ground layers with those used by two contemporary Roman artists. A study of the cross-sections revealed that all three paintings have a single ground layer (images not shown). In addition to the difference in structure, the colours are also divergent: light orange in one case and bright red in the other two. Finally, SEM-EDX analysis indicates that the composition of these single ground layers is also very different from Troppa's grounds: the two red grounds contain mainly red iron oxide, whereas the light orange ground consists largely of lead white, calcium carbonate and a little red iron oxide.

To confirm the pattern of Troppa's grounds emerging from this study, research needs to be expanded, increasing the number of paintings for comparison. But the study of three paintings by the circle of Maratti and Mola, both artists working in Rome at the same time as Troppa and influential to his career, further suggests that the consistent use of a double ground of a very well-defined composition could be a feature specific to Troppa.

Troppa and the art market in Rome

Rome was a thriving art market in the 17th century, serving high-profile collectors as well as common citizens. Paintings were sold directly from the painters and from second-hand shops, but also from barbershops and by other shop owners. As early as 1636 the Accademia di San Luca listed sellers of paintings for the purposes of regulation. Between 1650 and 1655 there was an increase from 19 to 46 registered *pittori bottegari* (painters as art dealers), but the actual number of dealers in paintings was likely to be substantially higher.[50] It is known from contracts between patrons and artists that the cost of stretchers, canvases, primers and ultramarine was often covered by the patron, in addition to the price agreed with the artist for commissioned works.[51] At least six of the eight SMK paintings were probably not commissioned hence the cost of materials was included in the price of the paintings. However, the Bracciano altarpiece was most likely a commission. Since the paintings all exhibit the same type of ground, it might be assumed that Troppa primed his canvases in his workshop, possibly using assistants, or purchased his pre-primed canvases from the same source for all the examined paintings, perhaps adding the hematite-containing layer himself. The census of 1656 of Campo Marzio lists a colour grinder (*Macinatore de colori*) living in Troppa's 'poor' household, which implies that Troppa could have used assistants for the preparation of materials for his production as early as that date.[52]

The choice of materials might well have its roots in Troppa's financial situation and status as a painter. A letter from 1672 named him among the second-rate artists,[53] although according to Dobos, he was represented in collections of renowned cultural personalities of his time.[54] The prices paid by Van Haven in 1669, noted earlier, rank among the more modest on the list of the king's acquisitions.[55] It should be noted, however, that Van Haven bought four landscapes of unknown size by Salvator Rosa, by then a well-known artist, for only 22 *scudi* apiece. We do not know how, where or from whom Van Haven purchased his paintings. However, Troppa is known to have sold paintings through art dealers. For instance, in 1656 he worked for at least two months for the painter/art dealer Mario Nuzzi de' Fiori.[56] It was quite common for young artists in Rome to work on exclusive contracts with dealers for a year or so, in order to establish themselves and become independent.[57] But it appears that after working for Nuzzi de 'Fiori, Troppa worked for the Genoese art merchant Pellegrini Peri,[58] and was obliged by contract to produce paintings for Peri on a monthly basis.[59] The inventory of Peri's possessions in 1699 lists 88 paintings of sacred and profane subjects by Troppa. *Mercury Killing Argus* and *Apollo Flaying Marsyas*[60] are also listed in the inventory and were appraised at 12 *scudi* each: these could be the paintings that ended up in Amsterdam and bought by Morell in 1763: 'He [Peri] employed artists to work for him to keep up his stock, he sold their products at the low end of the market but also supplied major collectors.'[61] Peri had painters on exclusive contracts working in his upstairs studio. In his shop downstairs, the most talented artists sold their paintings, which they could have painted in their own studios. Peri had upscale clients such as Cardinal Benadetto Pamphili, and it is plausible that Van Haven could have bought from Peri as well.[62] Troppa also painted frescos and received large commissions from churches and convents, as well as from wealthy patrons. His relative success, and membership of the Accademia, seem to indicate that he was not bound to Peri by an exclusive contract that forced him to work in the workshop upstairs, copying and painting all day long.

Conclusions

Troppa signed many of his paintings, including four of the eight in the SMK collection, indicating that his signature was of value. The question remains: why he would sell his works through an art dealer? Perhaps he was satisfied with a steady income as a supplement to fighting for commissions.[63] It is possible that he had his own workshop: if Troppa did have a large workshop production, this could explain why the composition of his grounds was so homogeneous in all the paintings studied for this paper, even though they range from secular easel paintings to altarpieces. The investigations strongly suggest that Troppa did in fact have

a preferred workshop practice: using a double ground of thicker and more coarsely ground earth pigments under a thinner layer of similar materials, but more finely ground and with the addition of hematite to achieve the desired colour. This practice might have been used to keep costs down.

Another reason for Troppa's consistent use of double grounds could be that most of the paintings examined in this study were acquired at the same time in Rome (1669) and were therefore probably produced around the same time using the same type of canvases, grounds and pigments connected to the place of production (i.e. in fashion in Rome) rather than reflecting personal choice. The *Apollo/Mercury* pendants do not have the same provenance and so far we have found no date on either. However, art historians agree in placing the execution of all eight paintings in the SMK collection to the late 1660s, a period in which Troppa was influenced by Pier Francesco Mola (d.1666).[64] The two paintings not belonging to the SMK collection might also have been produced in Rome; *St Thomas of Villanova* may have been painted in Bracciano outside Rome.

The consistency of the materials used in the grounds of the eight paintings could be coincidental, but may also indicate a very consistent working practice. The large number of paintings listed in Peri's inventory does imply a considerable workshop production alongside the many commissions Troppa is known to have executed. As further research into ground materials becomes available, we might detect more patterns in the suppliers of canvases with a ground already applied and artists' use of specific ground structures. As of now, our knowledge of Troppa and his workshop, including his supply of materials and working practice, is still incomplete. However, we can establish that the grounds of the eight early paintings from SMK were produced with an identical overall structure, technique and using the same materials. As a limited but significant reference to this group, the same materials and technique were utilised in the grounds of the Bracciano altarpiece and the painting now in the Nationalmuseum, Stockholm.

Future studies will confirm if this pattern of a double ground – a coarse lower and a smoother upper layer with slight additions of hematite – can be used as a marker for Troppa's specific workshop. In addition, further research may reveal whether it was a Roman workshop practice or if it can also be found in Troppa's paintings executed in other regions of Italy.

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Notes

1. The information regarding Van Haven's journey and acquisitions can be found in Danske Kancelli, Rentekammerafdelingen, arkivserie: Afregninger, løbenummer 216-220, under 'VI Hoffunktionærer', which is arranged alphabetically. See also H.C. Bering Liisberg, *Kunstkammeret, dets Stiftelse og ældste Historie*, Kbh: Det Nordiske Forlag, 1897, p. 137; H. Olsen, *Italian Paintings and Sculpture in Denmark*, Copenhagen, Munksgaard, 1961, pp. 97–98.
2. In the Danish National Archives (cited in note 1).
3. For a discussion on the identification of the four men, see E. Pedersen. 'Girolamo Troppa's "Four Portraits of Ancient Philosophers"', *Perspective*, 2017, http://perspective.smk.dk/en/girolamo-troppas-four-portraits-ancient-philosophers.
4. The Roman art market was expanding through the 17th century. In only five years from 1650 to 1655 the number of officially registered *pittori battegari* increased from 19 to 46, but it is suspected that the number of unregistered/unlicensed sellers was much larger. Artists, art dealers, second-hand dealers and various other shopkeepers such as barbers sold paintings. See L. Lorizzo, 'People and practices in the paintings trade of seventeenth-century Rome', in N. de Marchi and J. van Miegroet (eds), *Mapping Markets for Paintings in Europe 1450–1750. Studies in European Urban History 6 (1100–1800)*, Turnhout, Brepols, 2006, pp. 343–362; R.E. Spear and P. Sohm (eds), *Painting for Profit: The Economic Lives of Seventeenth-Century Italian Painters*, New Haven, Yale University Press, 2010.
5. See *Fortegnelse over Wahls & Morells Køb*, p. 126, nos. 36 and 37, handwritten acquisition inventory, Statens Museum for Kunst, Archive.
6. At Herman van Swoll's auction in Amsterdam 1699 and 1707: G. Hoet, *Catalogus of Naamlyst van Schilderyen Met Derzelver Pryzen Zedert Een Langen Reeks van Jaaren Zoo in Holland Als Op Anderen Plaatzen in Het Openbaar Verkogt, Benevens Een Verzameling van Lysten van Verscheyden Nog in Wesen Zynde Cabinetten*, 's-Gravenhage, Pieter Gerard van Baalen, 1752. On *Apollo Flaying Marsyas* see p. 50, no. 65 and p. 97, no. 10; on *Mercury and Argus* see p. 50, no. 64 and p. 97, no. 9.
7. See E. Schleier, 'Bemerkungen zu Wiederentdeckung Girolamo Troppa', in T. Ketelsen (ed.), *Girolamo Troppa: Der Zeichner. Ein Phantom*', Cologne, Wallraf Richartz Museum, 2016, pp. 8–17.
8. See G. Sestieri, 'Repertorio della pittura romana della fine del Seicento e del Settecento', *Archivi di arte antica*, Turin, Allemandi, 1, 1994, pp. 177–179.
9. See E. Schleier, 'Adiciones a Girolamo Troppa, "pintor y dibujante"', *In sapientia libertas* 26, 2007, pp. 526–534; E. Schleier, 'Nuove proposte per Girolamo Troppa pittore', *Arte Cristiana* 70, 2012, pp. 245–256; E. Schleier, 'Integrazioni e nuove proposte per Girolamo Troppa disegnatore e qualche aggiunta a Troppa pittore', *Arte Cristiana* 75, 2013, pp. 83–98; Schleier 2016 (cited in note 7); Z. Dobos, 'New additions to the art and research of Girolamo Troppa', *Bulletin du Musée Hongrois des Beaux-Arts* 106–107, 2007, pp. 115–130; F. Petrucci, 'Considerazioni su Girolamo Troppa: un *tenebrista* del tardo Seicento romano', *Prospettiva: rivista di storia dell'arte antica e moderna* 146, 2012, pp. 88–102; Spear and Sohm 2010 (cited in note 4).
10. Spear and Sohm 2010 (cited in note 4), p. 43.
11. Schleier 2016 (cited in note 7); Dobos 2007 (cited in note 9), p. 115.
12. Dobos 2007 (cited in note 9), p. 124.
13. See A. Tantillo Mignosi, 'La Galleria e l'alcova del cardinale Chigi: G. Troppa e C. Fancelli nel Palazzo ai Santi Apostoli',

in M.G. Bernardini, S. Danesi Squarzina and C. Strinati (eds), *Studi di storia dell'arte in onore di Denis Mahon*, Electa, Milan, 2000, pp. 305–312. Troppa's ceiling mural is reproduced in fig. 3, p. 308, and regarding San Giusepe, p. 309.

14. See Spear and Sohm 2010 (cited in note 4), p. 67; J. Kirby, 'The painter's trade in the seventeenth century: theory and practice', *National Gallery Technical Bulletin* 20, 1999, p. 28; M. Stols-Witlox, *A Perfect Ground: Preparatory Layers for Oil Paintings 1550–1900*, London, Archetype Publications, 2017, pp. 141–152.
15. Kirby 1999 (cited in note 14), p. 28; A. Roy, 'The National Gallery Van Dycks: technique and development', *National Gallery Technical Bulletin* 20, 1999, p. 59.
16. M. Stols-Witlox, 'Grounds 1400–1900', in J.H. Stoner and R. Rushfield (eds), *Conservation of Easel Paintings*, 2012, Oxford, Routledge, p. 175; Kirby 1999 (cited in note 14), p. 28.
17. Stols-Witlox 2017 (cited in note 14); M. Stols-Witlox, '"By no means a trivial matter": the influence of the colour of ground layers on artists' working methods and on the appearance of oil paintings, according to historical recipes from North West Europe, *c.*1550–1900', *Oud Holland* 128(4), 2015, pp. 171–186.
18. Spear and Sohm 2010 (cited in note 4), p. 65.
19. *Saint Jerome in the Wilderness* is in the Kunsthistorishes Museum, Vienna. It is large, measuring 235 × 166 cm. See Dobos 2007 (cited in note 9), pp. 115, 128 n. 6.
20. It was exceedingly difficult to identify any blue pigments in the sky of the four 'Philosophers': the optical blue confers a very convincing blue colour. This effect is described by Stols-Witlox 2015 (cited in note 17), p. 173.
21. See Pedersen 2017 (cited in note 3). Mass production of standardised works was not uncommon due to the growing demand for art: see Spear and Sohm 2010 (cited in note 4), p. 20. The Peri inventory lists numerous paintings of saints: '*Originali di Palmi 4 e 3, Santi e Sante per dritto mezze figure*' to mention a few, '*Giovanni Battista Originale di Troppa, S. Pietro Originale di Troppa*' and although not ascribed to Troppa a '*Filosofo con penna e libro Originale del…*'. See L. Lorizzo, 'Documenti inediti sul mercato dell'arte: i testamenti e l'inventario della bottega del Genovese Pellegrino Peri'rivenditore di quadri' a Roma nella seconda metà del Seicento', in F. Cappelletti (ed.), *Decorazione e collezionismo a roma nel Seicento: vicende di artisti, committenti, mercanti*, Rome, Gangemi, 2003, p. 167.
22. Guido Reni, *Saint Mary Magdalene*, 1634–35, oil on canvas, 79 × 68.5 cm, National Gallery, London, NG177.
23. In 2016–2017 an exhibition on Troppa as a draughtsman was held at the Wallraf-Richartz-Museum and the Fondation Corboud in Cologne, Germany. For Troppa's drawings see T. Ketelsen (ed.), *Girolamo Troppa: Der Zeichner. Ein Phantom*, Cologne, Wallraf Richartz Museum, 2016.
24. KdZ16124. See Schleier 2016 (cited in note 7), pp. 8–12, nos. 18–20.
25. C. Fischer and J. Svenningsen, 'Determining the composition', in *Art in the Making*, Copenhagen, National Gallery of Denmark, 2018, pp. 41–51; L. Keith, '*Giulio Romano* and *The Birth of Jupiter*: studio practice and reputation', *National Gallery Technical Bulletin* 24, 2003, pp. 38–49.
26. The cross-sections were made by embedding the samples with Technovit 2000 LC in an EasySection (http://easysections.com/). The first part of the polishing was carried out wet and the last part dry using MicroMesh with grit size up to 12,000.
27. Elemental analysis and mapping were carried out with a Hitachi S-3400N SEM equipped with a Bruker Quantax 200 detection system with two Peltier-cooled XFlash silicon drift detectors with an active area of 20 mm^2 each. Measurements were performed in variable pressure mode (30 Pa) on non-coated polished sections using 20 kV voltage, 50 µA probe current and 10 mm working distance. The acquisition times for spot analyses and maps were respectively 60 and 600 seconds.
28. The samples were analysed in reflection, transmission and attenuated total reflection (ATR) mode with a Bruker Tensor 2 spectrometer coupled to a Hyperion 3000 microscope equipped with cryogenic MCT and FPA detectors. For reflection mode, the samples were analysed using the MCT detector, ×15 objective, 64 scans and 4 cm^{-1} spectral resolution in the 4000–600 cm^{-1} spectral range. The same settings were used for the transmission analysis, where the sample was placed in a diamond anvil cell. ATR was performed with the FPA detector using a ×20 objective and a Ge crystal with a refractive index of 4.01, which has an anvil design with an 80 µm tip. FPA maps were acquired in the 4000–900 cm^{-1} spectral range with 8 cm^{-1} spectral resolution and 128 scans.
29. Raman spectroscopy was carried out with a Bruker Senterra system with a thermoelectrically cooled CCD detector. Raman spectra were recorded by focusing a 785 nm laser beam using a ×50 or ×100 Olympus objective lens; c.9–18 µm lateral resolution with a 400 lines/mm grating, and 3–5 µm lateral resolution with a 1200 lines/mm grating were used. The laser power at the sample was 1–25 mW with an acquisition time between 7 and 120 seconds for each spot, and 1 or 2 accumulations.
30. We have not pursued the identification of the binding media since the result would include contamination from various conservation treatments, especially the glue paste lining. The canvases are so open weave that the ground layer is either protruding or just visible through the canvas. An emulsion ground or pure glue ground would be expected to react with/soak up glue from a lining and a possible prior glue impregnation.
31. C. Seccaroni and P. Moioli, *Fluorescenza X: prontuario per l'analisi XRF portatile applicata a superfici policrome*, Florence, Nardini Editore, 2002.
32. The sample was analysed in transmission mode thus avoiding the spectral distortions inherent to ATR and reflection FTIR. Due to the minute size of the unembedded samples obtained for transmission measurements, separation of *ground I* and *II* was not possible. However, as the aim of the analysis was the identification of the compound(s) causing the same spectral reflection FTIR profile in the two layers, this was not a drawback.
33. See L. Monico, F. Rosi, C. Miliani, A. Daveri and B.G. Brunetti, 'Non-invasive identification of metal-oxalate complexes on polychrome artwork surfaces by reflection mid-infrared spectroscopy', *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 116, 2013, pp. 270–280.
34. See V.C. Farmer, *Infrared Spectra of Minerals*, London, Mineralogical Society, 1974; M. Sitarz, M. Handke and W. Mozgawa, 'Identification of silico-oxygen rings in SiO_2 based on IR spectra', *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 56(9), 2000, pp. 1819–1823.
35. Farmer 1974 (cited in note 34).
36. Monico *et al*. 2013 (cited in note 33).
37. Farmer 1974 (cited in note 34); J.L. Post and L. Borer, 'Physical properties of selected illites, beidellites and mixed-layer illite–beidellites from southwestern Idaho, and their infrared spectra', *Applied Clay Science* 22(3), 2002, pp. 77–91; E. Srasra, F. Bergaya and J. Fripiat, 'Infrared spectroscopy study of tetrahedral and octahedral substitutions in an interstratified illite-smectite clay', *Clays and Clay Minerals* 42(3), 1994, pp. 237–241.
38. Spear and Sohm 2010 (cited in note 4), p. 67; Kirby 1999 (cited in note 14), p. 28.
39. See I.M. Bell, R.J.H. Clark and P.J. Gibbs, 'Raman spectroscopic library of natural and synthetic pigments (pre- ≈ 1850 AD)', *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 53(12), 1997, pp. 2159–2179.

40. Bracciano is roughly 42 km from Rome.
41. C. Sodano, 'L'elemosina di San Tommaso da Villanova del cavalier Gerolamo Troppa: la storia, il restauro', in C. Sodano (ed.), *Restauro dell'elemosina di San Tommaso da Villanova del cavalier Gerolamo Troppa*, quaderni del Museo Civico, vol. 1, pp. 25–32, Rome, Edizioni Effigi, 2009; M. Cardinali and M.B. De Ruggieri, 'Materiali constitutivi e tecnica di esecuzione ne *l''Elemosina di San Tommaso da Villanova:* l'approccio diagnostico alla questione delle copie', in Sodano 2009, *op. cit.*, pp. 33–40. The altarpiece measures 190 × 125 cm.
42. In the literature, *caput mortuum* is considered to be an iron oxide-based pigment even though the type of iron oxide is uncertain: see G. Mastrotheodoros, K. Beltios and N. Zacharias, 'Assessment of the production of antiquity pigments through experimental treatment of ochres and other iron based precursors', *Mediterranean Archaeology and Archaeometry* 10(1), 2012, pp. 37–59; Sodano 2009 (cited in note 41).
43. Three samples were collected, embedded in resin to produce cross-sections and analysed by optical microscopy and SEM-EDX.
44. Attribution based on Schleier (several publications cited in note 9), according to the online collection information for the Nationalmuseum, Stockholm.
45. See Petrucci 2012 (cited in note 9), pp. 90 (fig. 5) 91 and 101, and n. 171.
46. CATS internal reports, data not yet published.
47. See Kirby 1999 (cited in note 14), p. 28; Stols-Witlox 2017 (cited in note 14), p. 142.
48. M. Jover de Celis and Maria Dolores Gayo, 'Velázquez and his choice of preparatory layers: different place, different colour?', in this volume, pp. 44–54.
49. See R. Vodret, *Caravaggio. Works in Rome: Technique and Style*, Milan, Silvana Editoriale, 2016, pp. 279 and 301.
50. See Lorizzo 2006 (cited in note 4), pp. 343–345; Spear and Sohm 2010 (cited in note 4), p. 42.
51. Spear and Sohm 2010 (cited in note 4), p. 68.
52. Ibid., p. 308, n. 148.
53. A letter from Padre Resta to the Spada family, advising on painters for the decoration of the family chapel in Chiesa Nouva: see Spear and Sohm 2010 (cited in note 4), p. 90.
54. See Dobos 2007 (cited in note 9), p. 126.
55. Van Haven spent roughly 4,100 *scudi* in Rome and Venice: see Bering Liisberg 1897 (cited in note 1), pp. 136–138.
56. In 1655 Fiori was licenced by the Accademia di San Luca to keep a shop for the sale of pictures and paintings; see Lorizzo 2006 (cited in note 4), p. 355; Y. Primarosa, 'Nuove proposte per Mario dei Fiori e Karel van Vogelaer con Luigi Garzi, Giovan Battista Gaulli, Anthoni Schoonjans e Girolamo Troppa', in A. Bacchi, F. Mambelli and E. Sambo (eds), *La matura morta di Ferico Zeri*, Ferrara, Fondazione Federico Zeri, 2015, pp. 195–216.
57. Primarosa 2015 (cited in note 56); Lorizzo 2006 (cited in note 4).
58. Peri also sold artist' materials, such as pigments and canvas, see L. Lorizzo, *Pellegrino Peri. Il mercato dell'arte nella Roma barocca*, Rome, De Luca Editori d'Arte, 2010, pp. 40–43.
59. Ibid., p. 47.
60. '*N. 18 Martia, et Apollo Originale di Troppa 12[scudi] & N.19 Mercurio, et Argo Originale di Troppa 12 [scudi]*' see Lorizzo 2003 (cited in note 21), p. 165.
61. Spear and Sohm 2010 (cited in note 4), p. 290.
62. Although a preliminary comparison between the list of artists from Peri's inventory and the acquisitions by Van Haven does not show any matches to artists other than Troppa, see Lorizzo 2003 (cited in note 21), pp. 165–174; Bering Liisberg 1897 (cited in note 1), p. 137.
63. See Primarosa 2015 (cited in note 56).
64. See Schleier 2016 (cited in note 7), p. 9.

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Ground Layers in European Painting 1550–1750

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