Fig. 1: Benvenuto Tisi, called Garofalo, *Resurrection of Christ*. 1520. Oil on poplar, 315 × 181.5 cm. Vienna, Kunsthistorisches Museum, Picture Gallery, inv. no. 9551. After conservation treatment.

Garofalo's *Resurrection of Christ* Altarpiece (1520)

Provenance – Painting Technique – Technical Observations – Conservation

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1. INTRODUCTION

The *Resurrection of Christ* by Benvenuto Tisi, called Garofalo (1481–1559), *(fig. 1)*[1] is one of the last major works acquired by the Kunsthistorisches Museum; this was realized in 1962 thanks to collaboration between the Federal Monuments Office (*Bundesdenkmalamt*) and the Picture Gallery. Even at the moment of its acquisition, however, the condition of the monumental panel was problematic. Despite two conservation initiatives in the Paintings Conservation Department of the Picture Gallery during the 1960s and 1970s, in 1976 installation of the painting in the primary gallery was considered impossible and it was finally put into storage. The move of the storage facility in 2011 offered an opportunity to return the panel to Paintings Conservation for investigation. Following detailed study of the condition and scientific investigations, the Picture Galley management and the conservators advocated an intervention. This proved to be a challenging, labour intensive, and extensive treatment occupying a period of two and a half years. To ensure the stability of the panel as well as an aesthetically appropriate presentation of the painting, a new frame was also designed and constructed in the Paintings Conservation carpentry workshop, in a close collaboration between art historians, conservators, and carpenters. In autumn 2015, the altarpiece could again, for the first time in more than forty years, be exhibited in Gallery III of the Picture Gallery.

[1] The first mention of the work is by Giorgio Vasari: see *Le vite de' più eccellenti pittori, scultori ed architettori* [Florence 1568], ed. Gaetano Milanesi, Florence 1881, vol. 6, 457–469, esp. 466. See also Klaus Demus, *Kunsthistorisches Museum Wien. Verzeichnis der Gemälde*, Vienna 1973; Anna Maria Fioravanti Baraldi, *Benvenuto Tisi da Garofalo: aggiunte al catalogo delle opere*, in: Musei Ferraresi 9–10 (1979–1980), 129–139; Id., *Il Garofalo. Benvenuto Tisi Pittore (1476–1779). Catalogo generale*, Rimini 1993. Alessandra Pattanaro has devoted numerous important essays to Garofalo, listed in her article *Tisi Benvenuto, detto Garofalo*, in: *Dizionario Biografico degli Italiani*, vol. 95 (2019), 727–732. See also Laura Malagutti, *La Resurrezione di Garofalo a Vienna per la chiesa arcipretale di Bondeno*, Thesis, Scuola di specializzazione in beni storico-artistici, Università degli Studi di Firenze 2013/14. The library of the Picture Gallery of the Kunsthistorisches Museum holds a copy of this work.

2. PATRON AND PROVENANCE

Signed and dated 1520 *(fig. 2)*, this monumental altarpiece is one of the most representative works by the Ferrarese painter Benvenuto Tisi, called Garofalo. It was commissioned by Girolamo Sacrati for the archprelatic church in Bondeno, near Ferrara.

Sacrati was a member of one of the most important Ferrarese families, one closely connected with the house of Este. Little is known of his career at the court of Pope Julius II in Rome. We know, however, that he occupied the office of protonotary apostolic. According to Vasari, it was Sacrati who, as a lover and patron of the arts, brought Garofalo to Rome. The painter travelled to the Eternal City in 1512, where he quickly joined the circle of Raphael. Vasari reports that Garofalo befriended the painter, who supported and promoted him. The intensive activity as a draftsman and the study of works by Michelangelo and Raphael in Rome influenced and shaped his style.[2] As recent research has suggested, Garofalo was perhaps in Rome again around 1517–1519. The stylistic features of the works created in these years, in any case, show that he was artistically up to date: he was familiar with the development of Raphael's frescoes in the Stanze, and the Farnesina and Vatican loggias. He was also able to see one of Raphael's cartoons for the Stanza of the Fire in the Borgo at Alfonso's court in Ferrara.[3]

In September 1520, Sacrati was named archpriest of Bondeno. He engaged his protégé Garofalo in the redecoration of the church. It can be assumed, however, that the commission for the *Resurrection of Christ* had already been given by the beginning of the year, as it is unlikely that such a large panel was completed in only four months.

The painting shares its fate with that of the *Saint Sebastian with Saint Roch and Saint Demetrius* by Giovanni Battista Benvenuti, called L'Ortolano, now in the National Gallery in London.[4] The two pictures adorned the altars on either side of the main altar:[5] Garafolo's *Resurrection of Christ* on the right, in the Chapel of the Holy Sacrament, the panel by L'Ortolano on the left.[6] There they remained until, around the middle of the nineteenth century, they were sold to private individuals to finance the church's urgently needed renovation – on the condition that they remain in the city of Ferrara (a requirement that was not fulfilled).[7] The originals were replaced by copies by Alfonso Alessandro Candi.[8]

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2 Vasari 1881 (cit. n. 1), 457–469.

3 Alessandra Pattanaro, *La maturità del Garofalo. Annotazioni ad un libro recente*, in: Prospettiva 79, 1995, 39–53; *Id., Garofalo: il terzo decennio e la difficile cronologia di un nuovo disegno*, in: *De Lapidibus sententiae. Scritti di Storia dell'arte per Giovanni Lorenzoni*, Padua 2002, 295–305, here: 296; Pattanaro 2019 (cit. n. 1), 729.

4 Inv. no. NG 669, wood transferred to canvas, 230.4 × 154.9 cm.

5 Luigi Napoleone Cittadella, *Bondeno e la sua chiesa arcipretale. Cenno storico e descrittivo*, Ferrara 1856, 33 f.

6 See the graphic reconstruction in Malagutti 2013/14 (cit. n. 1), figs. 3–7.

7 See Cittadella 1856 (cit. n. 5), 33 f.; Cammillo Laderchi, *La pittura ferrarese*, in: Antonio Frizzi, *Memorie per la storia di Ferrara*, vol. 5, Ferrara 1848, Appendix: *Ferrara; Id., La pittura ferrarese. Memorie del Conte Cammillo Laderchi*, Ferrara 1856. Both altarpieces were still in the city around 1856. The date of sale can only be reconstructed through mentions of the painting's location in the literature.

8 Cittadella 1856 (cit. n. 5), 34. Candi's copy, signed and dated 1852, is located in the Archbishop's Palace in Ferrara. See Malagutti 2013/14 (cit. n. 1), 2, n. 10.

Fig. 2: Signature and date: 'BENVENVTO · GAROFALLO · F / ·M·D·XX'.

Around 1848, both paintings were owned by the antiques dealer Ubaldo Ghersi.[9] Ortolano's picture left the city a few years later.[10]
The further history of our painting is unclear.[11] At an unknown point, it entered the collection of the Bourbon-Parma family. In 1962, its then owner, Alice Bourbon-Parma, decided to sell the panel, and an export license was sought from the Federal Monuments Office in Vienna. There, the outstanding quality and exceptional significance of the picture for Austria were determined and its provenance recognized. After a negative verdict was issued on 17 October 1962, purchase by the Republic was recommended and completed within a few weeks by the director of the Kunsthistorisches Museum's Picture Gallery, Vinzenz Oberhammer, with the approval of the Financial Procurator's Office.[12] With the acquisition of this important panel, a prominent addition was made to the Italian High Renaissance holdings of the Picture Gallery for the Central Italian School and a rare altarpiece from this period, preserved in original condition, secured.

9 Laderchi 1848 and 1856 (both cit. n. 7).

10 Around 1858, Ortolano's painting was owned by the collector Alexander Barker in London, who presented it in an exhibition: see George Scharf, *Artistic and Descriptive Notes on the most Remarkable Pictures in the British Institution*, London 1858, 51–53, no. 19 (https://archive.org/stream/gri_33125008298016/gri_33125008298016_djvu.txt [last accessed: 20 October 2020]). It was purchased in 1861 for the National Gallery in London.

11 According to Luigi Napoleone Cittadella, *Benvenuto Tisi da Garofalo. Pittore ferrarese del Secolo XVI*, Ferrara 1872, 38, the *Resurrection* was still owned by Ubaldo Sgherbi at the moment of publication ('[…] Risurrezione di G. C., che vedevasi nella Chiesa Arcipretale di Bondeno, ora di proprietà del negoziante Ubaldo Sgherbi').

12 The documentation of the purchase can be studied in the archive of the Picture Gallery of the Kunsthistorisches Museum, Zl. 9/Gal./1962/XIV. The confirmation of payment is dated 30 November 1962.

3. THE PAINTING

The scene takes place at sunrise in a populated landscape with rolling hills. In the background at left, a town lies at the foot of a pointed mountain; on the right, houses with a tower on a promontory can be seen, before which the three Marys are depicted on the way to Christ's grave.

Before this landscape backdrop, the miracle of the resurrection occurs. The scene with Christ hovering above the grave follows the traditional iconography of the resurrection and emphasizes the unattainability of the Son of God for humanity. Although the unopened grave is uncommon in the iconography of the early Italian Renaissance, it was, interestingly, depicted relatively often from the fifteenth century in combination with the levitating Christ.[13] Following a medieval tradition[14], the closed sarcophagus symbolizes the virginal womb of Mary, the Mother of God. The subject of rebirth, or the beginning of new life expressed in the resurrection, is thus explicitly emphasized.[15]

A white robe with loose folds wraps the lower body of the Resurrected and is thrown over his left shoulder from behind. The upper body is bared so that, as signs of his suffering, the side wound is visible along with the wounds on his hands and feet. He holds in his left hand the staff of the Resurrection flag, which waves above his head like a baldachin, a symbol of Christ's victory over death, while his right hand is raised in a gesture of blessing.

The sarcophagus stands in the middle of the scene, arranged frontally below the figure of Christ. This is reproduced in Renaissance forms, generally based on 'classical' antiquity. The corners of the lid terminate in acroteria. The front is vertically divided into three sections; in the middle is a niche in which a statue, probably of Moses, is depicted in grisaille. His gaze is directed upward toward the Resurrected, at his feet are the tablets of the law.[16] Viewed theologically, Moses prefigures Christ and the tablets of the law form the basis for the New Testament. The depiction of the prophet in the lower part of the sarcophagus emphasizes that the New Testament is based on the Old.

A number of guards are grouped to the left and right of the grave, some with windblown hair, depicted in different postures expressing fear and astonishment. They are overwhelmed by the miracle and cover their eyes before the light of God. The reactions evoked in the individuals by the event express great agitation, but this is mitigated by the overall effect of the picture. The painter sought a balanced, harmonious scene, which he achieved through a symmetry of colour and composition within the two groups of figures.

The staging of Garofalo's *Resurrection of Christ* recalls that of Madonnas classically enthroned atop marble bases with saints before a landscape, in a Giorgionesque or Venetian manner, and is found in the painter's many altarpieces created between 1515 and 1520.[17] The focus of the composition is now not the Madonna but the resurrected Christ. The colouring, too, recalls Giorgione and Titian. In many figures, on the other hand, the influence of Raphael is

[13] Pia Wilhelm, *Auferstehung Christi*, in: *Lexikon der christlichen Ikonographie*, vol. 1 (1968), 202–218, here: 217.

[14] Theologians such as Ephrem the Syrian, Augustine, and Bede proposed this comparison. See Louis Réau, *Iconographie de l'art chrétien*, vol. II: *Iconographie de la bible. Nouveau Testament*, Paris 1957, 544; Wilhelm 1968 (cit. n. 13), esp. 216 f.

[15] Réau 1957 (cit. n. 14), 544.

[16] According to the traditional iconography, Moses is recognizable by horns or rays visible on his head after he received the tablets on Sinai, a sign of his encounter with God. These are not depicted in Garofalo's painting, however the tablets of the law serve as clear evidence for an identification as Moses. Without shifting the interpretation, however, the figure could also be interpreted as a personification of the Old Testament. The connection between the Old and New Testaments would be equally expressed in this iconographic variant. Thanks to Mino Gabriele for support in the analysis of the painting's iconography.

[17] See Fioravanti Baraldi 1993 (cit. n. 1), cat. nos. 42, 43, 52, 53, 65.

evident. Perhaps Raphael's *Transfiguration*,[18] his final painting left unfinished due to his sudden death, served as a model for Garofalo's *Resurrection*. The Ferrarese painter could have had the opportunity to see preparatory drawings for the painting in Raphael's workshop during his second stay in Rome, around 1517–1519. Perhaps he was inspired by the division of the composition into two levels and the figure of Christ hovering in the air. Raphael's countless pictorial inventions, which Garofalo could admire in Rome, formed an inexhaustible source of inspiration – not only for the luminous figure of Christ but also for the tomb guard seated in the right foreground. The latter appears to be a citation from the *Expulsion of Heliodorus from the Temple* in the Vatican Stanze – a figure recorded by Raphael on a sheet now in the Ashmolean Museum in Oxford.[19] A study for an unrealized *Resurrection* by Raphael, depicting the grave, angels, and guards in the lower register, appears to be another significant model.[20] Garofalo's altarpiece is closely related to this sheet compositionally. The latterly inserted figure of the soldier also appears derived from the parallel figure on the right side of this sketch.

3.1 ART HISTORICAL INTERPRETATION OF THE TECHNICAL DATA

On the basis of the infrared reflectogram *(see fig. 3)* and x-radiograph *(see fig. 7)* made during the current conservation treatment, the development of the composition reveals a methodical approach. The insights gained from the images allow the following reconstruction of the picture's creation.[21]
Garofalo prepared the composition carefully. Vasari reports that he employed jointed models made of clay and wood to study the positions of figures and record them on paper, thereby emphasizing the importance of observation from nature.[22] Although his drawn oeuvre is relatively small and no sheets related to the *Resurrection* are known, it can be assumed that Garofalo made both preparatory drawings and compositional sketches. The infrared reflectogram shows an underdrawing executed in a dry medium. Lines drawn using a ruler divide the scene *(see fig. 9)*, while the figures are generally sketched with free lines *(see fig. 12b)*.
The x-radiograph reveals that the relatively few pentimenti are largely confined to the figure of Christ and the sarcophagus. Garofalo corrected the foreshortening of the blessing arm during the painting process, moving it slightly upward; he narrowed the fold of the robe below the arm and shifted the position of the foot to the right *(see fig. 14b)*. With minimal changes, Garofalo corrected the figure of Christ to determine his proper position in relation to the sarcophagus. The changes to the sarcophagus likewise relate especially to its spatial relationship with the resurrected Christ. The lid originally had a high, narrow, gabled roof that – like that executed – terminated in acroteria. In the first version, Jesus's foot rested directly on the lid. To visualize the movement of the Resurrected into heaven, Garofalo changed the shape of the lid, making it wider and lower. The change to the Moses statue followed that of the sarcophagus. This was originally larger and stood on a round base *(see fig. 17a)*. The painter

[18] Rome, Pinacoteca Vaticana, inv. no. 40333.
[19] Malagutti 2013/14 (cit. n. 1), 19, fig. 9.
[20] Oxford, Ashmolean Museum, inv. no. PII558; ex. cat. Achim Gnann (ed.), *Raffael*, Vienna (Albertina) 2017, 278 f., cat. no. 87; Malagutti 2013/14 (cit. n. 1), 21 f.
[21] For a detailed description of the picture's creation from a technical perspective, see section 4.
[22] Vasari 1881 (cit. n. 1), 464. See also Alessandra Pattanaro, *Per Garofalo disegnatore: uno studio per la pala di Modena e qualche riflessione sull'uso dei modelli di terra e di legname*, in: Prospettiva 119–120, 2005, 105–111.

reduced the figure of the prophet and placed it in a niche, flanked on either side by simple rectangular panels. The initially suggested egg and dart decoration of the cornice was discarded *(see fig. 17a)*. The first version of the division of the façade is recognizable in the vertical lines visible in the infrared reflectogram *(see fig. 9b)*. The redesign of the sarcophagus lid, particularly the earlier version of the pointed gable, is clearly recognizable in the underpainting visible in the x-radiograph *(see fig. 9a)*.

As a consequence of the changes to the sarcophagus, Garofalo appears to have felt it necessary to add to the composition in the foreground. He hence inserted the figure of the seated, bare-chested soldier on the right. Unlike his pendant on the left, which was planned from the beginning and thus held in reserve *(see fig. 10a)*, this figure is clearly painted over the final version of the sarcophagus. The infrared reflectogram shows that the painter first sketched the soldier over the sarcophagus in a free underdrawing before completing him in paint. The figure's naked upper body echoes that of Christ. With his gaze directed to the left, the soldier leads the viewer's eye from the right foreground to the seated man in armour on the left who in turn looks upward, thereby creating a visual connection to the resurrected Christ. Through successive changes and improvements in the course of the painting process, Garofalo created a monumental and balanced composition developed from a combination of 'controlled' dynamism and lively colouring.

The *Resurrection of Christ* represents Garofalo's stylistic highpoint following his second Roman sojourn. As noted above, his most important source of inspiration for this painting was the art of Raphael, particularly his frescoes in the Stanze and the *Transfiguration*. Garofalo transcribed these impulses in this imposing work, both in relation to the compositional structure and in the many citations from the great master's creations. Around 1520, in this particularly fruitful phase of Garofalo's output, the Raphaelesque aspects meet an important component: the naturalism of Venetian painting, which was prominently represented and extremely influential through the works of Giovanni Bellini, and particularly due to the presence of Titian and Dosso Dossi at the court of Alfonso I d'Este in Ferrara. In the *Resurrection of Christ*, Garofalo achieves a successful synthesis of these ground-breaking artistic currents, which coalesce in a charming and balanced 'classical' style. It is a style that rightly distinguishes Garofalo as the most important representatives of Raphaelism in Emilia.

4. PAINTING TECHNIQUE – PICTORIAL DEVELOPMENT – TECHNICAL OBSERVATIONS

4.1 METHODOLOGY

Scientific study occupied an important place in the current conservation efforts. Technical investigations – particularly photography under visible and ultraviolet light, infrared reflectography, and x-radiography – as well as scientific analyses of pigments and binding media together with the clarification of the paint stratigraphy, were indispensable prerequisites for the subsequent, comprehensive conservation treatment. The application of these methods also offered information on the development of the picture, painting process, and conservation history. Although the results of these analyses are best understood in the following sections, a selection are presented separately here.

Through infrared reflectography *(fig. 3)*, information on the creation of paintings, sketches or ideas, and the composition can be gained.[23] For Garofalo, for instance, it can be seen whether he prepared the motifs of his painting in great detail or only as loose sketches.

In the *Resurrection of Christ*, it is notable that the underdrawing of the landscape, figures, and textile passages appears largely executed freehand, hence presumably not following a model, and that the thickness and intensity of the (black chalk) lines vary slightly. These were not strictly followed in the later, painterly execution. There are nonetheless a number of exceptions, particularly in the group of figures at left, where detailed indications of drapery folds and shadows with hatching are visible, exactly matching the final painting *(fig. 4)*.

Based on its size, it can be assumed that the altarpiece was painted vertically with the aid of a ladder. As the contours of the figures show similarities with depictions in other works by Garofalo, and because of the size and complexity of the groups of figures, it is conceivable that Garofalo also employed cartoon models for the basic composition. Corresponding traces, such as pouncing points from the transfer of a design to the prepared panel, are not present, however. The pouncing points were probably connected to lines or wiped away.

The changes to the composition between the underdrawing and the painting as executed, discovered using infrared reflectography and x-radiography, are also largely visible in the relief of the paint surface. Examples include Jesus's weight leg and right arm *(fig. 5)*. Some heads in the figure groups were also reworked by the artist during the first phase of establishing the composition, with strikingly broad and vigorous dark lines *(fig. 6)*.

[23] Through infrared reflectography, lines of underdrawing can be made visible when black, carbon-containing media were employed.

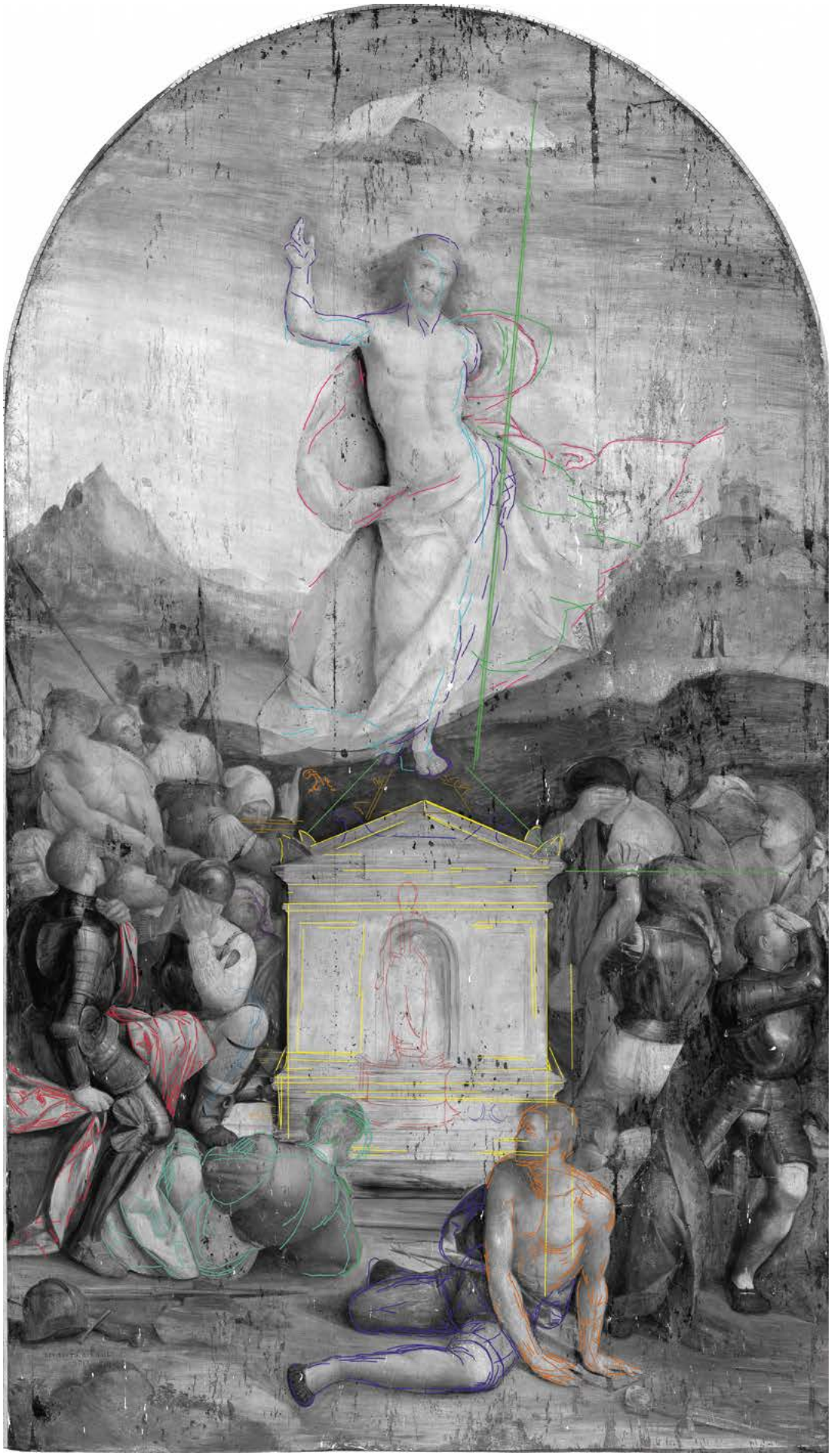

Fig. 3: Infrared reflectogram, with diagram of compositional changes around the sarcophagus.

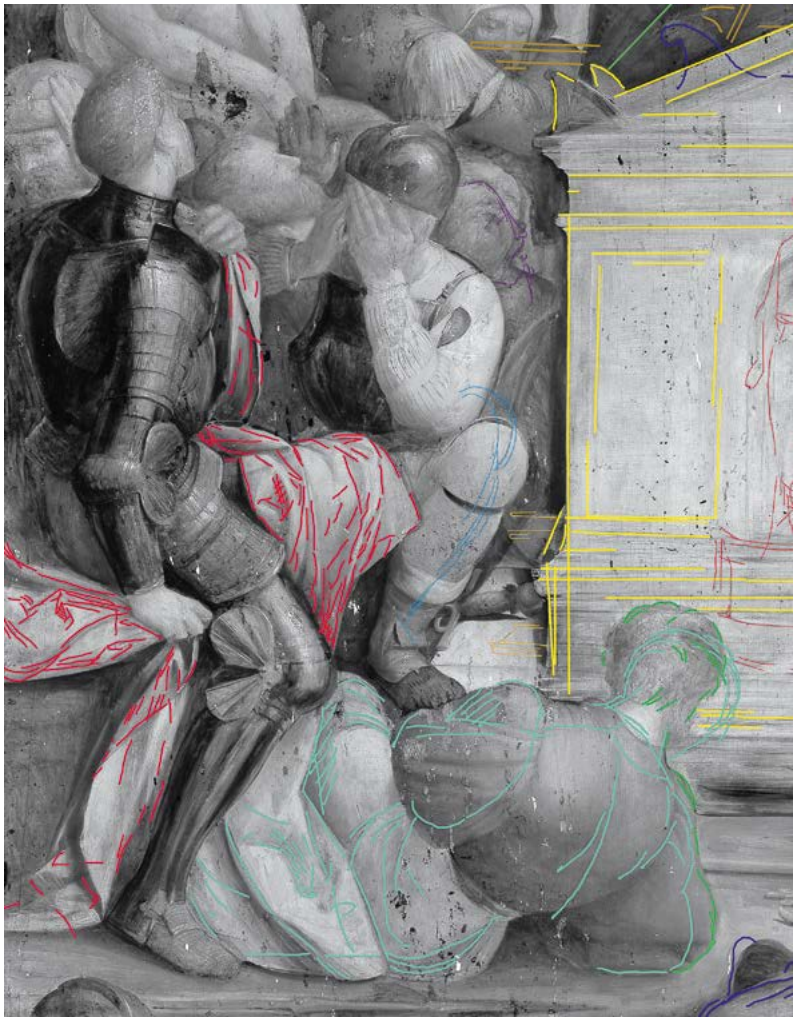

Fig. 4: Infrared reflectogram, detail of the standing soldier in full armour (red) and the reclining soldier in the green garment (turquoise) from the figure group at left.

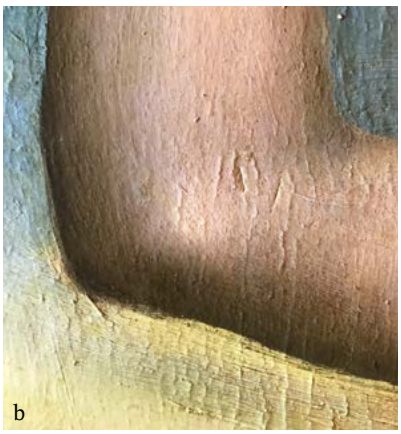

Fig. 5: a. X-radiograph, detail of Christ's right arm.
b. Detail of Christ's right arm.
c. Detail of Christ's right hand, which was held in reserve; the flesh paint partially overlaps the impastoed paint of the sky at the edges.
d. Detail of Christ's weight leg and right foot.

Fig. 6: Detail of the head of the standing soldier from the group of figures at front right.
a. Infrared reflectogram.
b. Visible light.

X-radiography *(fig. 7)* documents both the construction and the condition of the wood panel. Thus, for instance, the original carpentry of the panel as well as later interventions are revealed.[24] Information on Garofalo's painting technique can also be gained. Broad white strokes reveal the application of the lead white–containing imprimitura using a broad brush *(fig. 8)*. A number of pentimenti are likewise recognizable in the x-radiograph, e.g. in Jesus's right arm and feet. Here the painter's first composition was reworked with paint containing lead white, and these areas thus appear light. Comparison of the x-radiograph with the painting as executed confirms that the pentimenti largely occurred during the painting process *(see fig. 5)*.
The sarcophagus and the surrounding groups of figures to the left and right deserve particular attention. The execution of the first design was already well advanced when Garofalo made modifications in the area of the sarcophagus. The accumulation of the lead white–containing brushstrokes testifies to compositional changes made after paint was already applied *(fig. 9)*. Only the comparison of the infrared reflectogram with the x-radiograph allows the complex sequence of pentimenti in this area to be reconstructed to some degree. For the development of the final composition of the sarcophagus described in the following section, however, the question of whether the pentimenti reflected the artist's own conception or occurred at the behest of the patron must remain unanswered.

[24] See section 5.2.1 Support.

Fig. 7: X-radiograph.

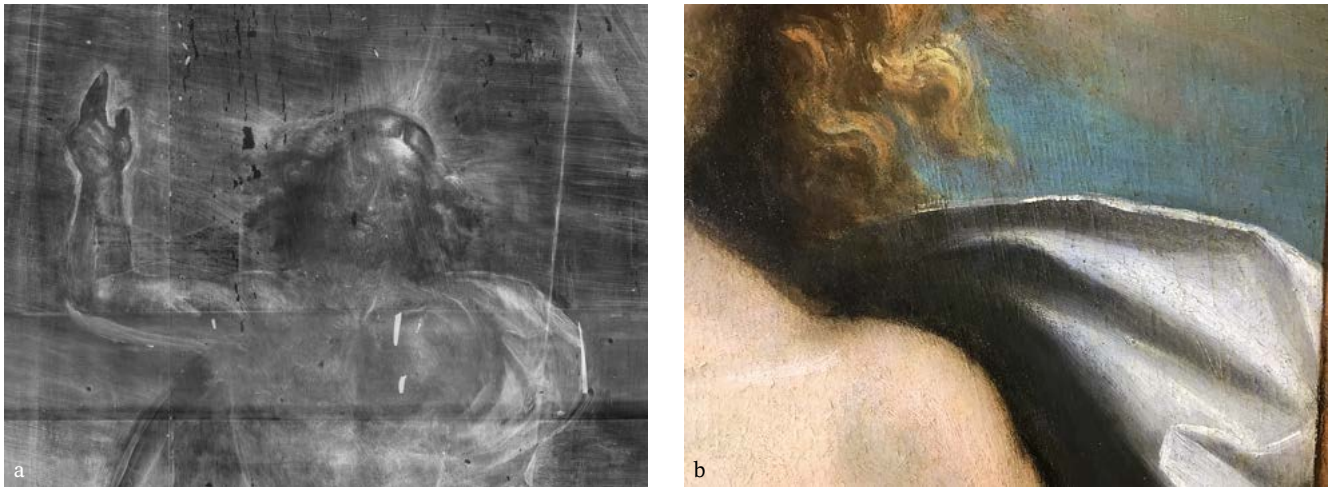

Fig. 8: a. X-radiograph, detail of Christ's head: The application of the imprimitura with quick, broad brushstrokes is visible.
b. Detail of Christ's left shoulder: Here the application of the imprimitura is also evident in visible light.

4.2 PAINTING TECHNIQUE - PICTORIAL DEVELOPMENT

The altarpiece was constructed from multiple planks glued together (see section 5.2.1 Support) and the surface coated with glue before the application of the ground layer. There followed multiple layers of a glue-bound gypsum ground; the final layer, the imprimitura,[25] contains lead white and a small amount of lead-tin yellow (see Section 4.3.1 Painting Media and Paint Stratigraphy).[26]
After the preparation of the smooth ground and the application of the imprimitura as a thin intermediate layer, the underdrawing was executed. The imprimitura thus preceded the establishment of the composition. The underdrawing appears to employ a dry rather than a liquid medium, presumably black chalk. Garofalo also used a dry medium in the underdrawing of the pentimenti. The fine surface texture of the imprimitura, applied with a broad brush, allows the better transfer of the chalk.[27] Clearly interrupted (dotted) lines can sometimes be observed, where the chalk only transferred to the high points of the brushwork. In some areas, the underdrawing of pentimenti occurred after the application of the first layers of underpainting, directly onto the paint surface.
It seems likely that Garofalo used cartoons to aid in the complex composition of the monumental altarpiece. Guidelines were also used. Particularly in the area of the sarcophagus, vertical lines were drawn to define the proper position.
A vertical line, corresponding to the left edge of the sarcophagus, ends at the reclining soldier wearing the green garment in the picture's left foreground. This could suggest that the figure was always planned there. Another indication is that, in the x-radiograph, an area of reserve held during the painting process for a first indication of the head is recognizable. The angle

[25] The imprimitura not only modulates the absorption of the ground, it also increases the reflection of light and gives an initial tone for the subsequent painting, which is influenced by it.
[26] The results are described in greater detail in section 4.3 Technical Investigation.
[27] David Bomford (ed.), *Underdrawings in Renaissance Paintings*, London 2002, 61–73; Andreas Siejek – Kathrin Kirsch, *Die Unterzeichnung auf dem Malgrund. Graphische Mittel und Übertragungsverfahren im 15.–17. Jahrhundert* (Kölner Beiträge zur Restaurierung und Konservierung von Kunst- und Kulturgut, vol. 11), Munich 2004, 182–201.

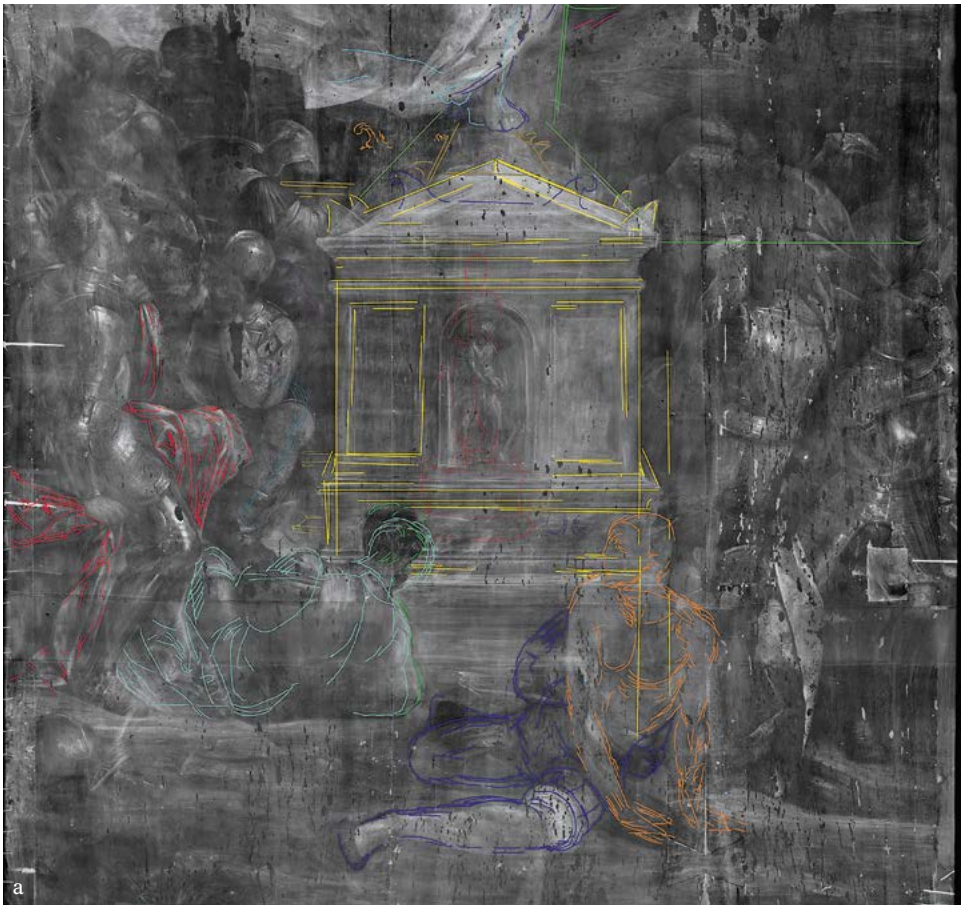

Fig. 9: Detail of the sarcophagus.
a. X-radiograph.
b. Infrared reflectogram with diagram: first placement of the sarcophagus (orange), statue in front of the sarcophagus (red); second placement of the sarcophagus (yellow), perspective and horizon lines (green).

Fig. 10: Detail of the head of the reclining soldier in the left foreground.
a. X-radiograph: In the sarcophagus, the head was kept in reserve during the painting process.
b. Infrared reflectogram: The lines of underdrawing in the head are sketchily executed.
c. Detail of the locks of hair, which overlap the paint of the sarcophagus.

of the head was later slightly changed such that, through a shift to the upper left, the curls lie atop the already executed paint of the sarcophagus *(fig. 10)*. In contrast, the right border of the sarcophagus continues below the figure of the soldier with the nude upper body *(see fig. 9)*. This could suggest that this figure was added to the composition later. The x-radiograph reveals that the soldier's head was only executed after the final, detailed rendering of the sarcophagus, above this paint layer. This indicates that the figure was not planned originally *(fig. 11)*.

A further interesting detail is that for the partially clothed soldier seated in the foreground – in contrast to his otherwise more sketchy and minimal underdrawing – Garofalo rendered the final form of the muscular upper body with numerous parallel lines, working with great precision. Christ's naked upper body is underdrawn in a similar manner *(fig. 12)*. These two together represent the main figures in the composition.

Because of the alteration to the size and position of the sarcophagus and resulting compositional change, individual heads and postures of figures were later adjusted and corrected during the painting process with bold chalk lines. In the infrared reflectogram, the profile of the soldier at the front right of the group of figures at right shows powerful, swiftly executed lines *(see fig. 6a)*. The head of the figure to the left of the grave was changed from profile to frontal view with reinforced lines. For the final execution of the head – the type appears conspicuously often in Garofalo's work – there is no underdrawing *(fig. 13)*.

The change to the vertical position of Christ's head presumably occurred at the same time as the shift of his weight leg due to the alteration to the sarcophagus. In the final painterly execution, Jesus's head is tilted to the right, without additional underdrawing. The body is thereby given a flowing, serpentine movement *(fig. 14)*.

Furthermore, the garments of the figures were generally schematically indicated with only a few summary notations for painting. It is striking that the group of figures on the left side on the picture shows much more detailed underdrawing than that on the right. Garofalo presumably began to develop the composition here. The standing soldier in the splendid full-body

Fig. 11: Detail of the head of the seated, bare-chested soldier.
a. X-radiograph.
b. Visible light.
c. Raking light. The horizontal brushwork of the paint of the sarcophagus is visible. The contour of the profile was corrected in the final step.

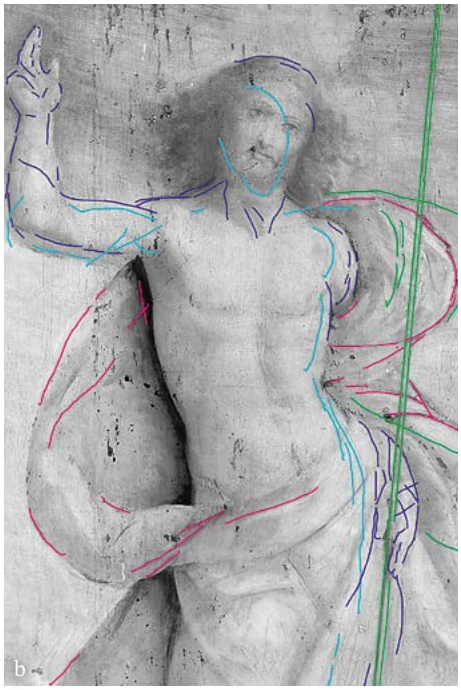

Fig. 12: a. Infrared reflectogram, detail of the seated, bare-chested soldier: body (orange), garments (violet).
b. Infrared reflectogram, detail of Christ's bare upper body: First placement (light blue), second placement (violet); drapery, first placement (green), second placement (red).

Fig. 13: Detail of the head of a figure in the middle of the picture, to the left of the sarcophagus.
a. Infrared reflectogram.
b. Visible light.

armour at the left edge and the reclining soldier in the green garment in the foreground show detailed indications of folds and shadow passages marked with parallel hatching. These differ from the garments (e.g. for Christ) and contours of figures in which lines appear freely drawn and less dependent on a model. They are also less closely followed in the painterly execution. The final depiction of Jesus's body and white robe appear to have only been worked out during the painting process *(see figs. 5 and 20)*.

It can certainly also be stated that the overall compositions of the figure groups on both sides were planned in this form from the start, even if, due to the change in the sarcophagus, a number of pentimenti were made, especially to the heads.

Another interesting detail is found in the area of the roof-shaped lid of the sarcophagus: lines pressed into the still-wet paint of the acroteria during the painting process *(fig. 15)*.[28] These perspective lines, which are also visible in the infrared reflectogram, converge at Christ's weight leg *(see fig. 9)*.

In the x-radiograph, it is also evident that the sarcophagus was smaller and narrower, was positioned higher, and was decorated with volutes. A drawing on the reverse of the support, on the outer right plank – in nearly the same position as on the painted side – is very similar to the volutes in the infrared reflectogram.

[28] The benefit of incisions over drawn lines is that they are better visible further along in the painting process.

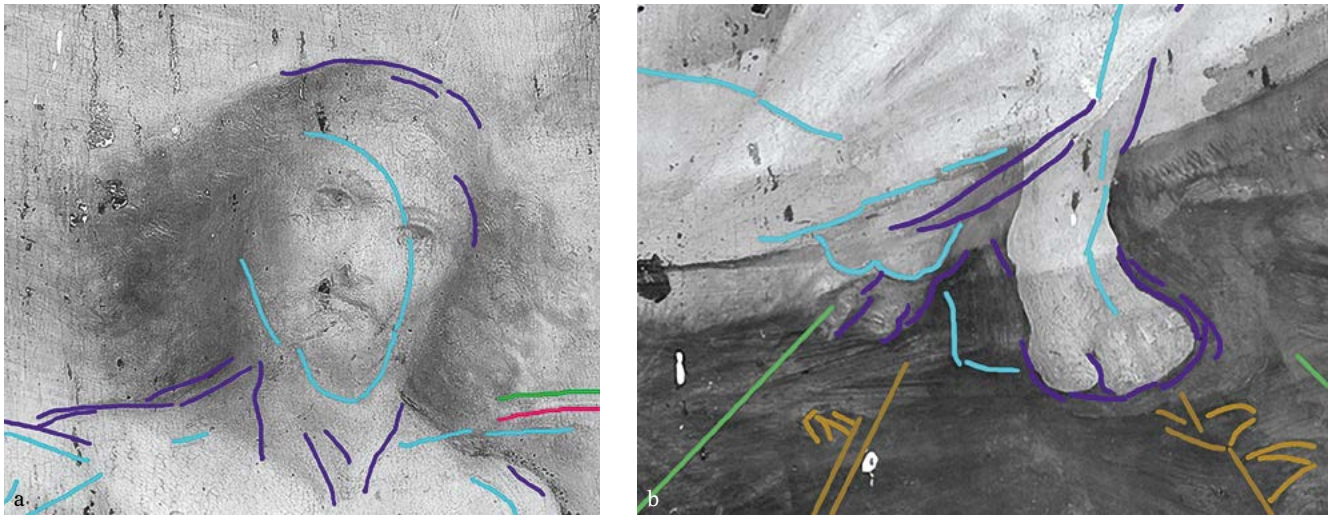

Fig. 14: a. Infrared reflectogram, detail of Christ's head angled to the right: First placement (light blue), second placement (violet). b. Infrared reflectogram, detail of the shifted weight leg due to the change to the sarcophagus: First placement (light blue), second placement (violet).

Fig. 15: Detail of the lid of the sarcophagus: incision of a perspectival line leading to Christ's weight leg.

This, interestingly, reveals another volute on the right, beside the figure, who points to Christ with his index finger and simultaneously holds an object, a stone or a coin. In contrast to the other volutes, largely recognizable in the x-radiograph through the lead white–containing paint *(see fig. 9)*, this volute is only indicated in the underdrawing and is reversed compared with the drawing on the back of the panel *(fig. 16)*. Paint for this version of the volute is neither visible in the infrared reflectogram nor in the x-radiograph. The underdrawing was thus part of the first placement of the sarcophagus, in front of which a larger statue on a circular pedestal was originally planned *(fig. 17a)*.[29] Beside the pedestal, geometric (egg-and-dart) shapes for the decoration of the sarcophagus as later laid in are recognizable, which were not executed in paint.

[29] See section 3. Painting.

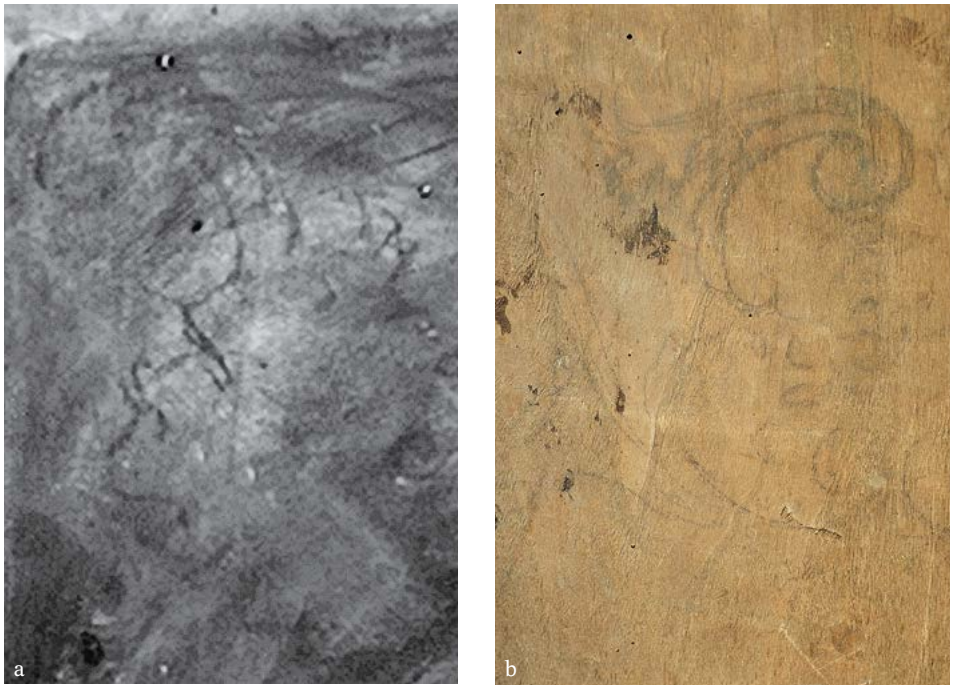

Fig. 16: a. Infrared reflectogram, detail of the volute to the left of the sarcophagus.
b. Detail of the volute drawn on the back of the panel in visible light.

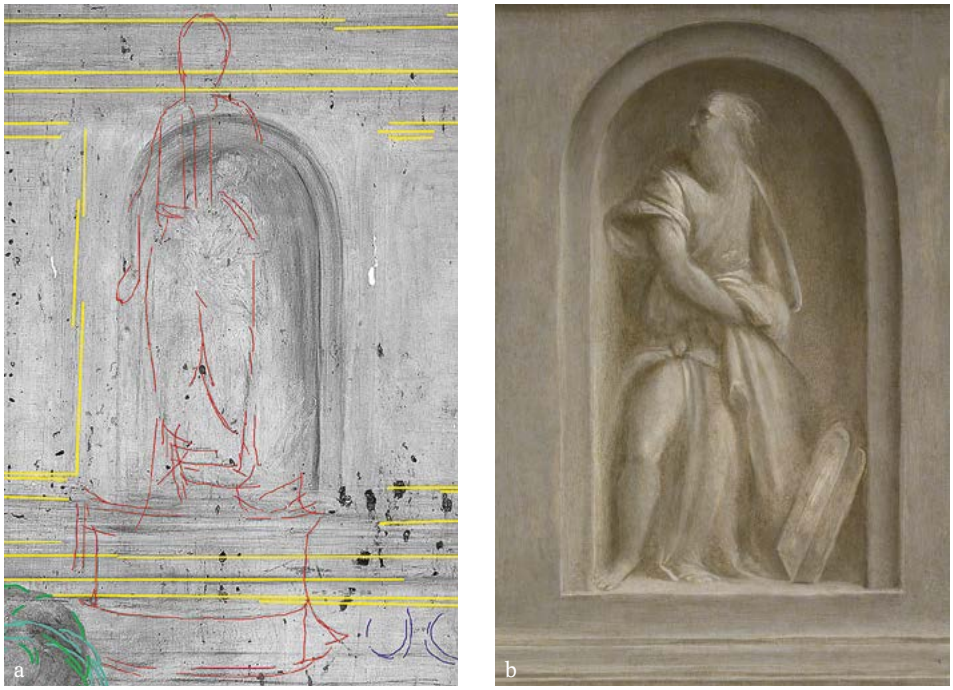

Fig. 17: a. Infrared reflectogram, detail of the statue in front of the sarcophagus in its first form (red).
b. Detail of the 'Moses' statue in visible light.

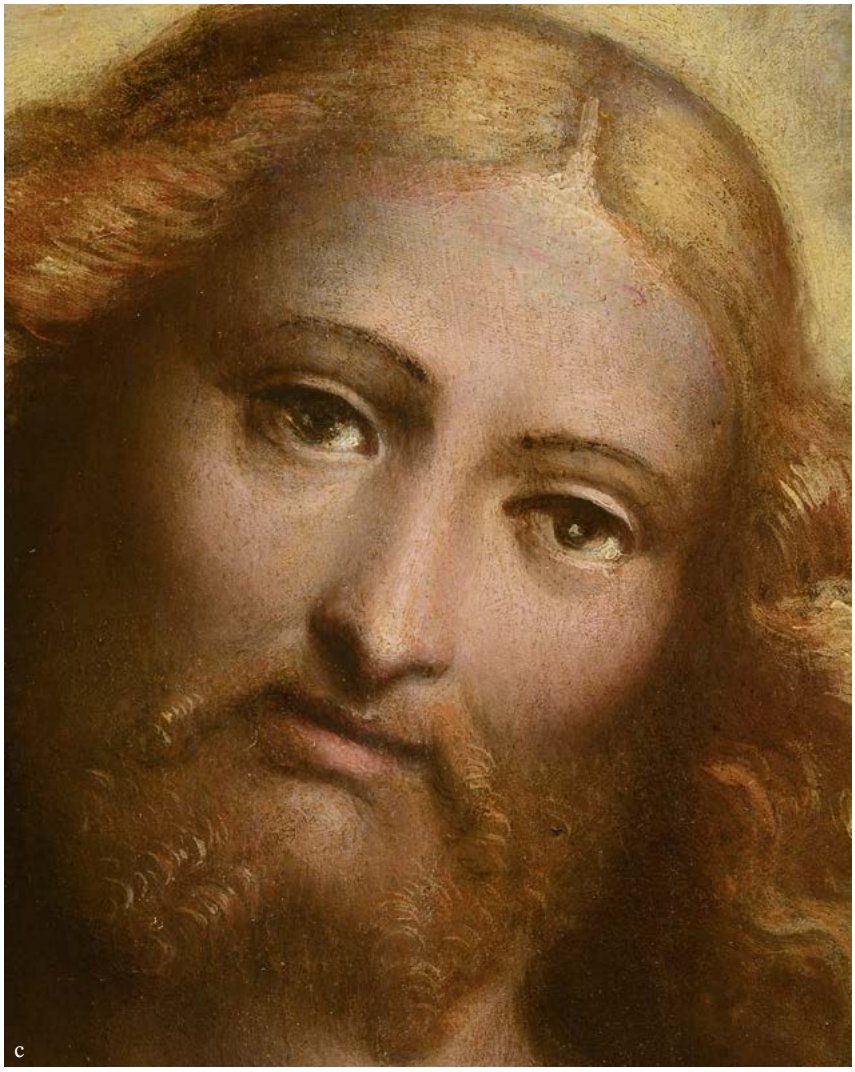

Fig. 18: a. Detail of the head of the soldier standing at right rear, from the group of figures at right.
b. Detail of Christ's left eye.
c. Detail of Christ's head.

4.2.1 FLESH

The flesh areas of the individual figures were largely held in reserve. The handling is smoother and less impastoed than the multi-layered paint application of the landscape and garments. The main areas were modelled over a lead white–containing layer with light-dark transitions through grey-brown shadow passages and lead white highlights. There is no detailed internal drawing. Details of the faces and reflections in the eyes and mouths are executed with finer brushstrokes. The black brushstrokes of the eyebrows appear to have pearled up from the light flesh colour, cannily employed design elements exploiting the principle of 'fat over lean' *(fig. 18)*.[30]

[30] Iris Schäfer, *Gewebeabdrücke in farbigen Lasuren spätmittelalterlicher Tafelmalerei*, in: Zeitschrift für Kunsttechnologie und Konservierung 13/1, 1999, 40–49, here: 42: 'the rule "fat over lean" was sometimes not respected, and in fine linear details even consciously ignored, as characteristic pearling up of the paint attests.'

Fig. 19: a. Detail of the flag.
b. Detail of the juncture between the sky and the flag.

Fig. 20: a. Detail of the white robe in the upper right half of the picture, at the border with the sky.
b. Detail of the background landscape at centre right, at the transition to Christ's white robe.

4.2.2 PAINT APPLICATION

The colour of the sky displays a lively facture and 'relatively' open manner of painting. The blue tone was applied with rapid, broad brushstrokes (ca. 1–1.5 cm) of liquid paint. The light and dark areas lack clear boundaries. The imprimitura is sometimes visible in the depths and in transitions to other colour passages and is exploited to create the effect *(fig. 19)*.
The lively colourism of the textile passages was achieved through the application of multiple layers of paint. In the areas held in reserve, the lower layers of the garments were executed on the desired surfaces in a smooth paint with little impasto. Thus e.g. the white colour of Christ's robe was first applied to the reserved areas. Next, corrections were made at the borders of the robe to achieve the final form. There are thus areas that lie above the paint of the sky and others in which the paint of the background landscape covers parts of the white robe.
The painting of the background landscape varies from liquid, wet-in-wet areas to impastoed passages with visible brushstrokes *(fig. 20)*.
The flag was likewise held in reserve in the sky. The white flag with the red cross, the symbol of Christ's resurrection, is smoother and thinner than the paint application in the sky. Brushstrokes that limit the area of the flag and slightly correct its contours are evident. The cross was painted last.
Jesus's left hand holding the staff was laid above the already executed paint of the white garment. Through lines drawn with a ruler, the staff of the flag

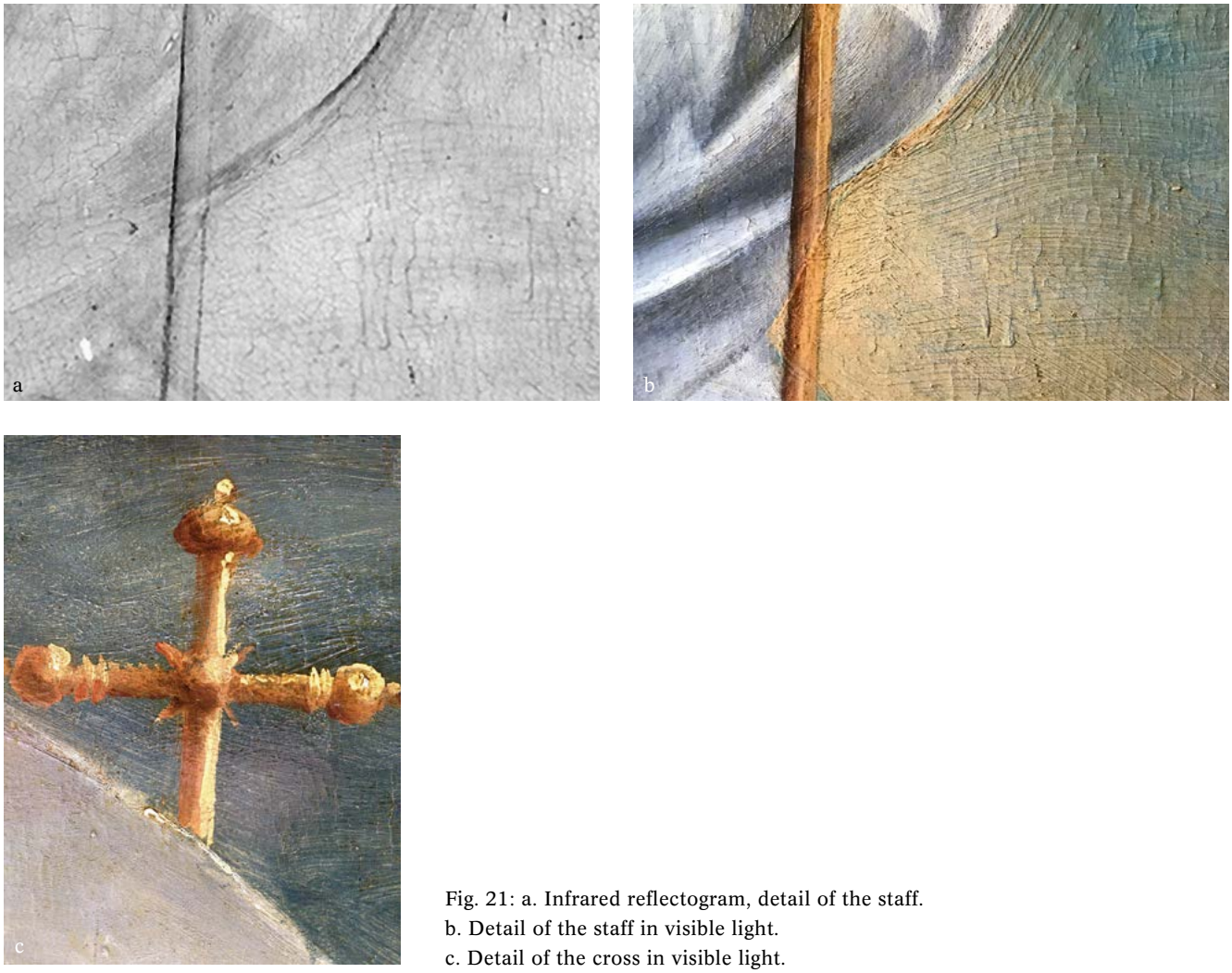

Fig. 21: a. Infrared reflectogram, detail of the staff.
b. Detail of the staff in visible light.
c. Detail of the cross in visible light.

was also underdrawn and painted in the final step. The fine, straight, broken strokes are visible in the infrared reflectogram, drawn over the paint of the sky and the white robe. The carbon medium transferred only to the high points of the brushwork. This confirms that the underdrawing of the staff with the cross was one of the final steps in the painting process, which is also recognizable in visible light *(fig. 21)*.

Christ's right hand was also kept in reserve from the paint of the background. The definitive form of the arm was achieved using the blue background colour of the sky to work out the final contour. The reason for the reduction of the arm could also be a heightening of the perspective foreshortening in the monumental work. The x-radiograph shows these painterly changes clearly, due to the lead white–containing paint *(see fig. 5)*.

The infrared reflectogram reveals that the outcropping in the middleground of the picture is laid in with loose, fluid brushstrokes. Because of the change to the composition of the sarcophagus and Jesus's posture, his weight leg was extended further into the already indicated rocks. The dark zone creates the impression that Christ hovers, emphasizing the character of the apparition. Through the shift of the weight leg to the right and the right leg downward, the fall of folds in Jesus's white robe also changed. The position of the feet is more standing than floating, however, as Christ presumably originally stood on the sarcophagus when the grave was positioned higher *(see figs. 5 and 14)*.

Fig. 22: Detail of the sun.

Fig. 23: Detail of the three weeping Marys on the way to Christ's grave.

4.2.3 PAINTERLY ACCENTS

A number of features that illustrate the richness of artistic detail and the artist's painterly capabilities reveal themselves to the attentive viewer in many particulars, briefly outlined here.

Garofalo depicted a morning atmosphere, with the sun rising over a city on the horizon at left, in a luminous yellow tone. The sun is rendered through an impastoed arc of paint as one of the final accents on the orange paint of the sky *(fig. 22)*.

On the horizon at the right background and thus not in the centre of the action, 'the three Marys' are shown, rendered in detail and richly coloured despite the distance *(fig. 23)*.

The radiant figure of Christ in his fluttering robe dominates the scene. The soldiers and other witnesses react to the resurrection differently, which is further emphasized through the vivid colours of their garments.

Particularly painterly accents are found in the standing soldier in full armour on the left side of the picture: the armour mirrors his red garment, emphasizing the metallic character and smooth reflective surface *(fig. 24a)*. The blue accent in the grey hose of the seated, bare-chested soldier is also an interesting detail. The fabric reflects the blue undergarment of the hose, thereby assuming the character of a smooth, even surface such as satin *(fig. 24b)*.

Fig. 24: a. Detail of the armour of the standing soldier in the left foreground.
b. Detail of the grey hose of the bare-chested soldier in the foreground.

Fig. 25: Detail of the figure raising his hand.

This blue tone is repeated in the mountainous landscape and the sky. The white of his left stocking reappears in Jesus's light robe.
The raised hand of the figure that was changed from an originally profile view to a frontal one (in the group of background figures to the left of the sarcophagus; *see fig. 13*) was particularly emphasized with bluish contours and bright accents of light *(fig. 25)*.
The white, feathered plume of the figure's headgear in the left background represents another artful detail. With fine brushstrokes, the artist creates the light, airy character of a feather blown by the wind *(fig. 26)*.
The bow and arrow in the foreground in front of the sarcophagus are also executed with detailed brushstrokes. The triple white fletching, the spiral-grooved cylindrical shaft, and the nock to receive the bow string are clearly recognizable on the arrow *(fig. 27)*. The weapons appear as though randomly scattered on the ground, but achieve a spatial delineation of the foreground, middleground, and background with their foreshortening and overlapping. Their arrangement emphasizes the depth, leading the viewer into the events taking place at an undefinable distance.

Fig. 26: Detail of the feathered headgear.

Fig. 27: Detail of the bow and arrow in the foreground, in front of the sarcophagus.

4.3 TECHNICAL INVESTIGATION

The Conservation Science Department analysed 32 samples from the front and reverse of the painting using light microscopy (LM)[31], scanning electron microscopy with energy-dispersive x-ray detection (SEM/EDX)[32], and gas chromatography-mass spectrometry (GC-MS).[33] In order to study the paint stratigraphy and the pigments and binding media used, 21 samples were prepared as paint cross-sections. The inorganic components were determined using SEM/EDX and the organic binding media classes for the individual cross-section layers indicated through (histo-)chemical staining. Further investigation and identification of particular binding media or mixtures was generally undertaken using GC-MS analysis, on samples suitably prepared or removed directly for that purpose. The methods employed also sought to reveal or clarify changes in the substance of the object caused by damage or past restoration measures.

The comparison of the investigation results from the current painting with those from already analysed works by the same master from the museum's holdings as well as published studies from other collections made it possible to gather information on the continuity of Garofalo's painting technique.

[31] Axioplan2, Zeiss, Germany.

[32] FEI Quanta 200F with EDX system (energy dispersive x-ray detection).

[33] 6890N gas chromatograph coupled with a quadrupole mass spectrometer, model 5973N, both Agilent Technologies, USA.

4.3.1 PAINTING MEDIA AND PAINT STRATIGRAPHY

Following Italian tradition of 'gesso', the panel has a light (off-white coloured) ground made from gypsum (calcium sulphate). To determine the binding medium used, on two samples the ground was mechanically separated from the remaining paint layers with the aid of a stereomicroscope and subsequently analysed with GC-MS. The detection of amino acids suggests that an animal glue was used to bind the gypsum, although due to the small sample size a more precise classification of the proteinaceous binding medium was not possible.

To prepare a surface that was as flat as possible for the application of paint, this underlayer was sanded (in alternating directions) in multiple working steps. To prevent the absorption of the precious paint, but also to achieve a high light reflection and thereby great luminosity for the paint layers, an overall layer of lead white, the so-called imprimitura, was laid over the highly absorbent ground. Using SEM/EDX, in many of the cross-sections some tin could also be determined along with the main lead signal in the imprimitura: hence, a small amount of lead-tin yellow was added to the lead white.

Through detailed study of the painting (especially in raking light), both the initial consistency of the imprimitura layer and its method of application can be evaluated. The imprimitura was distributed over the ground with a broad brush; the striated texture of the thick paint is clearly recognizable in the x-radiograph due to the high lead content and occasionally also in visible light *(see fig. 8)*.

The paint structure above is characterized by the overlapping of many thin layers. An opaque layer usually follows the imprimitura, thin enough to not wholly mask its luminosity. Further modelling occurred through the application of multiple glazes, with coordination of the colouration of the opaque underpaint and the translucent layers above. Hence, for example, an opaque red underpaint of lead white with vermilion was followed by medium-rich layers of red lake *(fig. 28)*; above an opaque layer of lead white, lead-tin yellow, and carbon black, copper green glazes were applied, likewise with a high proportion of binding medium *(fig. 29)*.

From the layer sequences of the two cross-sections illustrated here, it is also evident that Garofalo usually worked from darker to lighter tones. When necessary, local highlights of reflected light are placed on the glazed layers in thick, opaque paint (impasto).

Of the colourants used it can be determined that Garofalo's palette in this painting is characterized by the brilliant, highly luminous colours typical of the artist. Through the skilled combination of pigments and dyes he achieved a variety of tones and thus nuanced colour effects.

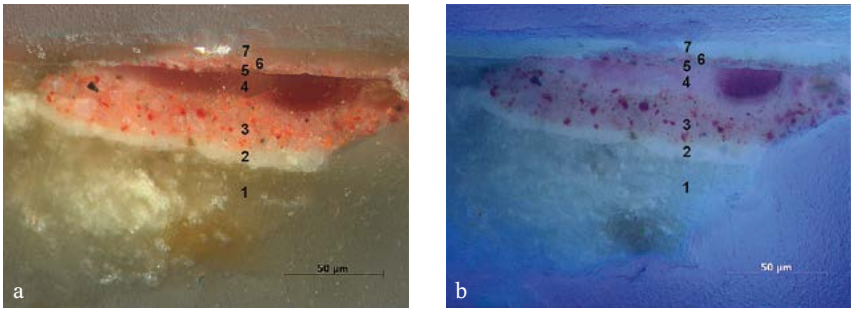

Fig. 28: Cross-section (a. VIS and b. UV, both 500x) of a sample from the red robe (soldier in the foreground, group of figures at left):
1. Ground: gypsum; 2. White imprimitura: lead white, occasional lead-tin yellow; 3. First red layer: lead white, vermilion, red lake; 4. Second red layer (glaze, high organic content): red lake, slight lead signal (some lead white or a drier); 5. Thin organic intermediate layer; 6. Third red layer (retouching): barium sulphate and zinc white (or lithopone), cadmium selenide and/or sulphide; 7. Varnish.

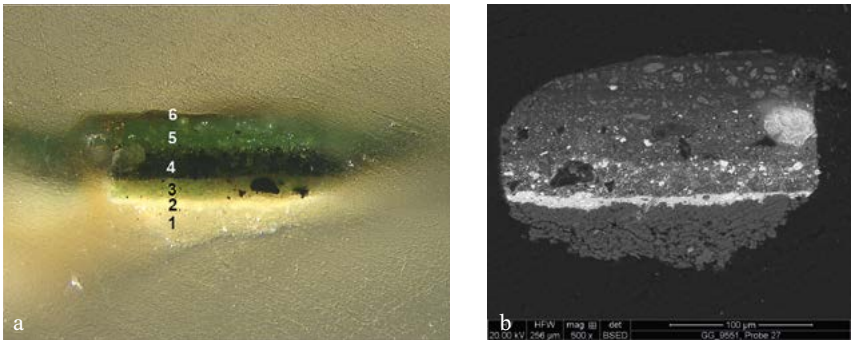

Fig. 29: Cross-section (a. VIS, 200x and b. SEM/BSE, 500x) of a sample from the green garment of the reclining soldier turning his head, left foreground:
1. Ground: gypsum; 2. White imprimitura: lead white, occasional lead-tin yellow; 3. Light green layer: lead white, lead-tin yellow, copper green, carbon black; 4. Dark green layer: high organic content, copper green, lead-tin yellow, little ochre and chalk; 5. Light green layer: highly organic, copper green; 6. Browned glaze: highly organic, copper green.

4.3.2 EXCURSUS ON THE GLAZING TECHNIQUE

Largely mineral pigments were available to artists of the Renaissance. To create new possibilities in their palette and expand the variety of tones, a new technique emerged with oil painting: glaze painting.[34] This is a layered technique with sequences of multiple, in part translucent colour layers. Dependent on the transparency of the individual paint layers, the overall effect is achieved by the combined contributions of all the layers. The reflection of light through one or two transparent layers (executed in low-pigmented, medium-rich mixtures) is usually constrained by an opaque, light underpaint. Through different toning and layering, not only can many

[34] Laurence de Viguerie – Guylaine Ducouret – Marine Cotte – François Lequeux – Philippe Walter, *New insights on the glaze technique through reconstruction of old glaze medium formulations*, in: Colloids and Surfaces A: Physicochemical and Engineering Aspects 33, 2008, 119–125; Helena Melo – Jana Sanyova – António João Cruz, *An unusual glazing technique on a Portuguese panel painting from the second half of the 16th century: materials, technique and reconstructions*, Preprints of ICOM-CC's 16th Triennial Conference in Lisbon, 2011.

colour nuances be achieved, the painting method also allows for colours with great depth effects and increased saturation and luminosity. The drawback of this technique lies in the considerable time required, as quick working by the artist is not possible due the drying necessary between the applications of the individual layers.

Among the reds, the opaque pigment vermilion has dominated since antiquity. It is valued for its high covering power, but the luminous red also has the detriment of an orange undertone. Its incompatibility with copper pigments and instability (blackening)[35] were also known, particularly manifest in aqueous techniques. The artists of the Renaissance overcame these faults by employing vermilion in different mixtures as underpaint, glazed with various coloured lakes (for example madder or carmine).[36]

As an intense green, verdigris, a copper acetate of variable chemical composition and thus varying tonality ranging from dark blue-green to luminous turquoise, was principally available from the Middle Ages. This had the most intense colour of the available green pigments but displayed a lower covering power than malachite. Verdigris was notorious for its instability, and numerous historic manuscripts warn of its use (Cennino Cennini, Strassburg Manuscript); de Mayerne even refers to the pigment as the 'enemy of all colours'.[37]

The literature reports highly varied recipes for processing verdigris into a transparent green paint, so-called copper resinate. Chemically, this consists largely of copper salts of abietic acid ($C_{19}H_{29}COOH$) and is a product of boiling copper salts with natural resins (usually colophony, larch turpentine, or mastic) in a drying oil. A dark green, thick resin paste was formed that had to be thinned before application as a glaze. Like verdigris, copper resinate glazes can turn brown on aging.

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35 Chemically, vermilion or cinnabar is mercury sulphide, which appears in three forms: the red cinnabarite (trigonal crystal system), the black metacinnabarite (cubic crystal system), and the black-violet hypercinnabarite (hexagonal crystal system); all three forms appear as minerals in nature (hypercinnabarite very rarely), but can also be synthetically produced. Cinnabar was already used as a pigment in antiquity and its instability was also known early on (*Des Marcus Vitruvius Pollio Baukunst*, translated by August Rode, vol. 2, Leipzig 1796; https://digi.ub.uni-heidelberg.de/diglit/vitruvius1796b/0134 [last accessed: 27 October 2020]). In the literature, the UV-induced transformation of the crystal modification (cinnabarite to metacinnabarite) is primarily given as the explanation for the blackening, however the accompanying elements of cinnabar, such as chlorine, also appear to play a role in the colour change (Rutherford J. Gettens – Robert L. Feller – W. T. Chase, *Vermilion and Cinnabar*, in: Ashok Roy [ed.], *Artists' Pigments. A Handbook of Their History and Characteristics*, vol. 2, Washington – Oxford 1993, 159–182, here: 167; Marine Cotte – Jean Susini – Nicole Metrich – Alessandra Moscato – Corrado Gratziu – Antonella Bertagnini – Mario Pagano, *Blackening of Pompeian cinnabar paintings: X-ray microspectroscopy analysis*, in: Analytical Chemistry 78/21, Nov. 2006, 7484–7492, https://doi.org/10.1021/ac0612224).

36 Coloured lakes are organic dyes, largely obtained from plants though in some cases also from animals such as scale insects, fixed on inorganic supports such as chalk or aluminium sulphate.

37 Renate Woudhuysen-Keller, *Aspects of Painting Technique in the Use of Verdigris and Copper Resinate*, in: Arie Wallert – Erma Hermens – Marja Peek (eds.), *Historical Painting Techniques, Materials, and Studio Practice: Preprints of a Symposium, University of Leiden, the Netherlands, 26–29 June 1995*, Los Angeles 1995, 65–69, here: 65.

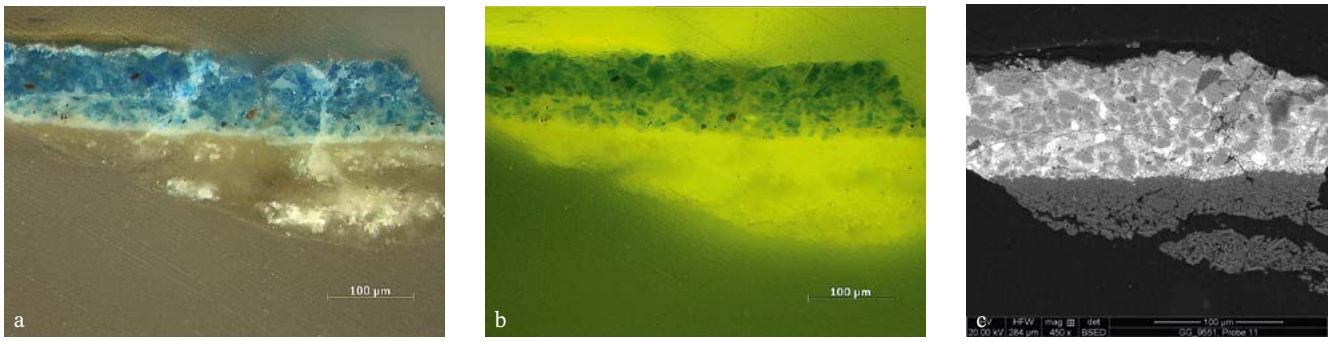

Fig. 30: Cross-section (a. VIS and b. UV, both 200x; c. SEM/BSE, 450x) from the blue hose of the seated soldier: build-up of the blue paint in multiple layers using increasingly coarse particles of azurite.

Pre-treated drying oils were used as the binding medium for the thin, smooth glazes. Thickened by warming, pre-polymerized oils are distinguished by quicker drying and improved film formation. The brushstrokes dissipate more easily and become invisible, resulting in extremely smooth surfaces. Some paintings also show signs that the glazes were dabbed with textiles after their application to remove excess paint and achieve the thinnest possible glaze layer.[38]

4.3.3 COLOURANTS

As the common white pigment, lead white was employed in light areas and in mixtures for darker passages. As a yellow pigment, lead-tin yellow is found in the imprimitura, in yellow areas, and also in other mixtures, e.g. in greens. Earth pigments in many different hues are found, i.e. from various ochre and brown tones to dark brown umber, either alone or in admixture with other pigments and lakes; the same is true of carbon black, as e.g. plant black, bone black, and/or lamp black.

In blue areas of the painting, for instance parts of the sky and in different garments, azurite was determined as the only blue pigment. The use of azurite is normally characterized by a multi-layer build-up: an underlayer using fine-grained azurite mixed with lead white was applied first; coarsely ground, more intensely coloured azurite, with only slight additions of lead white, was applied above *(fig. 30)*.[39]

Green elements in the painting are composed of a combination of blue or green and yellow pigments. An initial opaque layer of azurite (or sometimes also copper green) with additions of lead white and lead-tin yellow is usually present, above which Garofalo laid one or more glazes of copper green with slight additions of lead-tin yellow or ochre, with increasing amounts of organic binding medium. Depending on the desired lightness of the green tone, these glazes were sometimes muted with carbon black *(see fig. 29)*. Today many copper glazes unfortunately appear browned due to the age-induced changes described above.

[38] Jill Dunkerton – Nicholas Penny – Marika Spring, *The Technique of Garofalo's Paintings at the National Gallery*, in: National Gallery Technical Bulletin 23, 2002, 20–41, here: 31.

[39] Roy 1993 (cit. n. 35), 23–35.

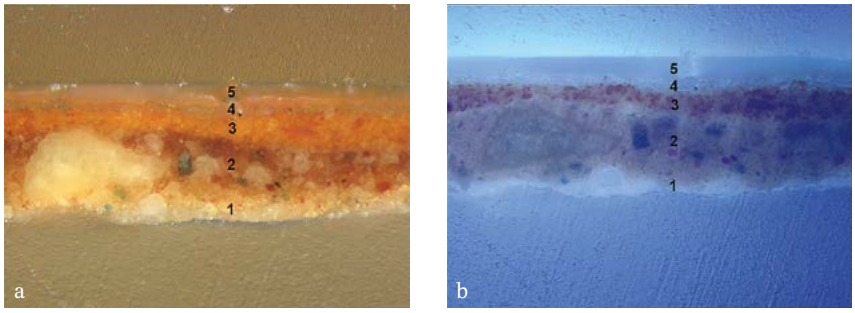

Fig. 31: Cross-section (a. VIS and b. UV, both 500x) of the orange hose of the reclining soldier turning his head, left foreground:
1. Trace of the imprimitura: lead white; 2. Dark red layer: lead white, lead-tin yellow, arsenic sulphide (orpiment or realgar), ochre, red lake, copper pigment; 3. Orange layer with yellow highlight: realgar with siliceous impurity, areas of lead-tin yellow on the surface as a highlight; 4. Glaze: highly organic, chalk; 5. Varnish.

Red details in the painting show a similar build-up of paint layers: over an opaque layer consisting of lead white, vermilion, and a little red lake, glaze layers of red lakes follow, sometimes with lead-containing additions (lead white or driers, sometimes also glass – see below), with increasing amounts of organic binder. The flesh passages likewise consist of lead white, vermilion, and red lake, with some ochre and carbon black as well.
The analysis of the orange areas is particularly worthy of note (*fig. 31*). Here it is clear that Garofalo was certainly familiar with the Venetian painting technique, or rather the *Venetian palette* (the latter term, while not wholly unambiguous, seeks to describe the typical palette of Venetian Renaissance painters such as Giovanni Bellini, Titian, etc.).[40] He, too, employed the arsenic sulphides realgar (As_4S_4) and orpiment (As_2S_3), yellow to light-red pigments considered typical of Venice in this period and often used there by artists beginning around 1490. Through the proximity of Garofalo's workplace, Ferrara, to Venice and the new profession of *vendecolori* (merchants specializing in the trade and sale of painting materials)[41] developing there at the end of the fifteenth century, these then novel pigments were also available to Garofalo.

[40] Barbara H. Berrie – Louisa C. Matthew, *Material Innovation and Artistic Invention: New Materials and New Colors in Renaissance Venetian Paintings*, in: Scientific Examination of Art. Modern Techniques in Conservation and Analysis (Arthur M. Sackler Colloquium, National Academy of Sciences, Washington, D.C., March 19–21, 2003), Washington, D.C. 2005, 12–26, https://doi.org/10.17226/11413 [last accessed: 29 October 2020].

[41] https://www.nga.gov/conservation/science/16th-century-pigments.html [last accessed: 29 October 2020].

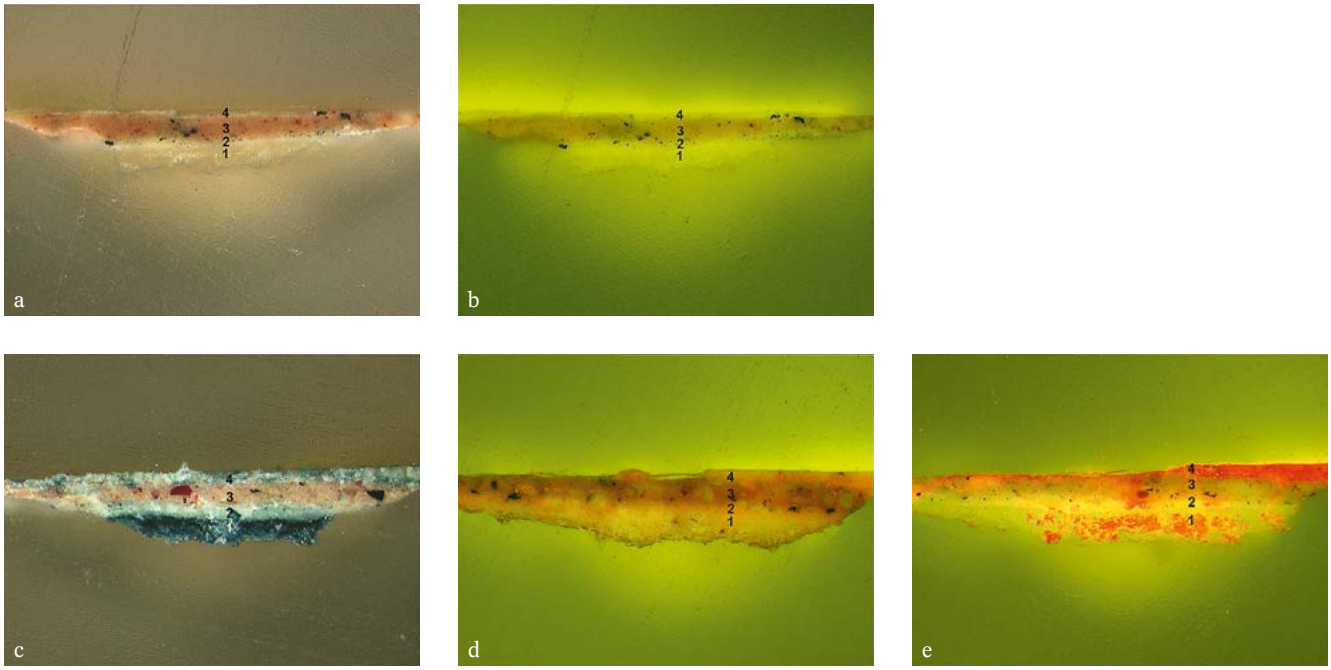

Fig. 32: Photomicrograph for (histo-)chemical staining of binding media, cross-section from the flesh of the seated soldier, foreground: 1. Ground: gypsum; 2. Lead white with some chalk; 3. Red layer with lead white, vermilion, carbon black; lead-tin yellow, ochre; 4. Varnish.
a. Image for comparison before staining, VIS, 200x.
b. Image for comparison before staining, UV, 200x.
c. Protein staining, VIS, 200x.
d. Resin staining, UV, 200x.
e. Oil staining, UV, 200x.

4.3.4 BINDING MEDIA

The precise identification of the organic binding media is of great theoretical interest, but poses a significant practical challenge due to the complexity of the mixtures used, the age-related changes in their composition and the small sample sizes available for analysis.

As a binding medium for paints, oil offers the advantages of high luminosity and brilliance, as it does not become matte on drying but rather maintains its gloss. Oil painting also convinces because of its translucency – that is, the colour reflection of the individual paint layers – and through its great colour depth and intensity. To augment this effect, ground glass was sometimes added.[42] Typical sixteenth-century glass had a high concentration of lead.[43] As lead has a siccative effect, the addition of glass also increased the drying behaviour. These advantages of the oil binding medium enabled artists completely new working methods.

To differentiate and localize the binding media in the individual paint layers, the cross-sections were (histo-)chemically stained *(fig. 32)*: determinations on the use of proteins, natural resins, and drying oils[44] in the individual paint layers could thus be made. The positive staining for protein of the ground (colour change to dark blue) supported the assumption that a typical gesso was used. The imprimitura did not show a clear medium indication with any of the stainings. This is because the lead pigments in it require little binding medium on grinding, and the sensitivity of the staining

[42] Berrie – Matthew 2005 (cit. n. 40), 17.

[43] Ulrich Birkmaier – Arie Wallert – Andrea Rothe, *Technical Examinations of Titian's Venus and Adonis: A Note on Early Italian Oil Painting Technique*, in: Arie Wallert – Erma Hermens – Marja Peek (eds.), *Historical Painting Techniques, Materials, and Studio Practice: Preprints of a Symposium, University of Leiden, the Netherlands, 26–29 June 1995,* Los Angeles 1995, 117–126, here: 123.

[44] Protein staining with amido black dye AB2; staining for natural resins with fluorescent alkanna dye; staining for oils with fluorescent dye rhodamine B.

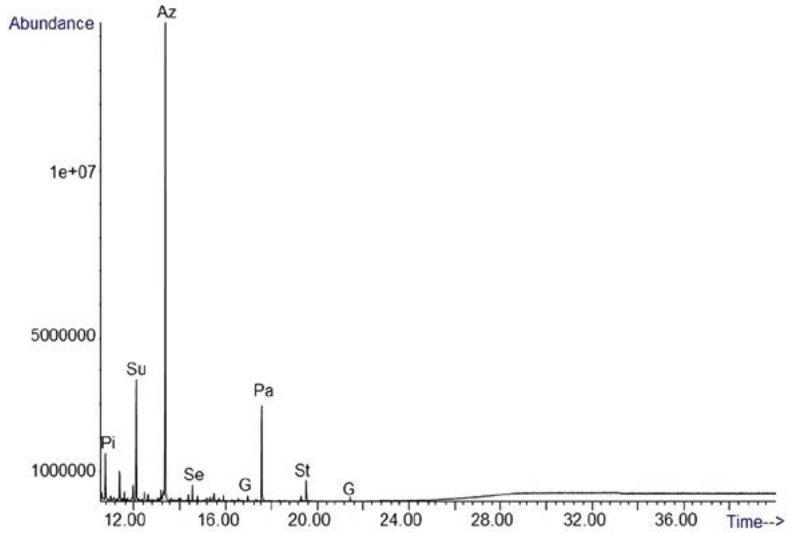

Fig. 33: TIC-chromatogram of the paint film from a sample from the blue-green garment of the standing soldier at right: indication of typical fat components glycerol (G), pimelic acid (Pi), suberic acid (Su), azelaic acid (Az), sebacic acid (Se), palmitic acid (Pa), stearic acid (St).

method for these slight concentrations is too low. The red paint shows a positive staining result for both resin and oil (orange-red fluorescence); these two binding media are also present in the varnish. The blue staining on the uppermost surface of the paint layers is a clear indication for the already described consolidation measures with proteinaceous media.

In addition to linseed oil, walnut oil was preferentially used in Italian paintings, especially with white and blue pigments: it is lighter in tone and tends to yellow less.[45] Due to its greater tendency to turn brown, linseed oil was more often used for darker colours.

As using the (histo-)chemical staining only allows a classification into the binding media classes protein, oil, and natural resin, but no precise identification within these, individual additional samples were also analysed with GC-MS. The use of proteinaceous binding media in the ground has already been described (see section 4.3.1 Painting Media and Paint Stratigraphy). For four additional samples the paint layers were separated from the rest of the section and investigated via GC-MS for the presence of oils, waxes, and natural resins. The use of a drying oil could be confirmed in all of the samples. The analyses were characterized by high concentrations of azelaic acid (1,7-heptane-dicarboxylic acid, a saturated fatty acid) *(fig. 33)*, a natural oxidation product of drying oils. As a consequence of oxidation, the reduced amounts of palmitic and stearic acid, which serve as markers for a specific oil classification, made a precise determination of the type of oil difficult. That and the presence of binding media mixtures prevented an unambiguous characterization of the oil used as linseed, poppy, or walnut.

[45] Sabine Stanek – Václav Pitthard – Katharina Uhlir – Martina Griesser – Elke Oberthaler, *Survey of the Bruegel Paintings of the Kunsthistorisches Museum from a Technological Point of View,* in: *Brueghel. The Hand of the Master. The 450th Anniversary Edition. Essays in Context*, Vienna 2020, 248–261, here: 258.

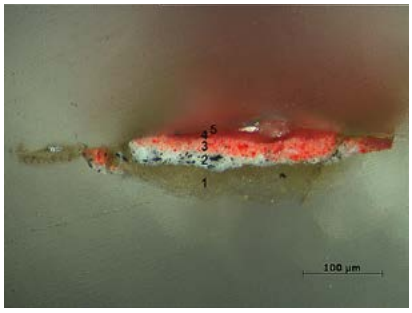

Fig. 34: Cross-section (VIS, 200x) of a sample from Garofalo's *St Roch* (Kunsthistorisches Museum, Picture Gallery, inv. no. 295), red robe: 1. Ground: gypsum; 2. Grey imprimitura: lead white, some carbon black; 3. First red layer: vermilion, lead white (or red lead), some red lake; 4. Second red layer: higher organic content than layer 3, red lake, slight lead content; 5. Remains of varnish.

4.4 COMPARISON OF FINDINGS WITH OTHER WORKS BY GAROFALO

In a number of samples from Garofalo's *Resurrection of Christ*, with the main component lead white a slight admixture of lead-tin yellow was detected in the imprimitura *(see figs. 28 and 29)* – as in four paintings by Garofalo in the National Gallery, London. Similarly composed imprimiture appear to have been popular during the first half of the sixteenth century and have been observed in numerous paintings by contemporaries including Ortolano, Raphael, and Lorenzo Lotto.[46]

An imprimitura tinted slightly grey using carbon black, typical of Garofalo's rival Dosso Dossi, was also determined in a number of works by Garofalo in the National Gallery, London, and in his *Triumphal Procession of Bacchus* in the Dresden Gemäldegalerie Alte Meister.[47] Such preparatory layers, often dark grey however, were common between 1530 and 1540, especially in Northern Italy.[48] This is interesting for the dating of two other works by Garofalo in the Picture Gallery of the Kunsthistorisches Museum, the small panel *Noli me tangere* (poplar, inv. no. 6757) and the *St Roch* (canvas, inv. no. 295), both previously dated 1525/30. These two paintings show a grey layer (composed of lead white and carbon black, *fig. 34*) above a gypsum ground; binding medium analyses detected walnut oil in the paint layers.

The small differences in the colouring of the imprimitura aside, Garofalo's paintings (the three works from the Kunsthistorisches Museum, eight from the National Gallery, London, and one from Dresden) appear very similar in both their materials and painting techniques: over the gypsum ground is a thin isolation, primarily of lead white; the paint layers above employ a glazing technique in drying oil, executed using pigments common during the Renaissance (lead white, lead-tin yellow, orpiment/realgar, vermilion, red lake, azurite, copper green (verdigris), ochre or umber, and carbon black).

4.5 CHANGES TO THE PAINT LAYERS

Major changes were apparent in a number of the cross-sections, particularly blanching in the uppermost layers. These could be localized to the areas with pronounced white, turbid spots on the paint surface that were visible after the removal of the Japanese paper facings (see section 5.2, Condition, and *fig. 45*). The cross sections revealed that these changes largely affected the varnish *(fig. 35)*.

In a number of cross-sections, however, it could be observed that, along with the varnish, the uppermost paint layer was also somewhat affected. The damage, probably caused by a combination of consolidation medium and moisture, unfortunately extended to the paint layers. *Fig. 36* contrasts a relatively well-preserved area (left) with a damaged one (right). In the latter, materials from earlier restoration appear to have penetrated more deeply (the varnish in this sample is also considerably thinner than in the comparative one). The backscattered electron image (BSE) from the scanning electron microscope shows that the phenomenon spreads from the sample surface to the first blue layer; individual pigment particles in this paint layer appear to have separated from the paint matrix.

46 Dunkerton – Penny – Spring 2002 (cit. n. 38), 26; Jill Dunkerton – Susan Foister – Nicholas Penny, *Dürer to Veronese. Sixteenth-Century Paintings in the National Gallery* (National Gallery Publications), London 1999, 219.

47 Christoph Schölzel, *Die Restaurierung des 'Triumphzuges des Bacchus' von Garofalo*, in: Beiträge zur Erhaltung von Kunst- und Kulturgut 1, 2004, 36–53, here: 45.

48 Dunkerton – Penny – Spring 2002 (cit. n. 38), 26.

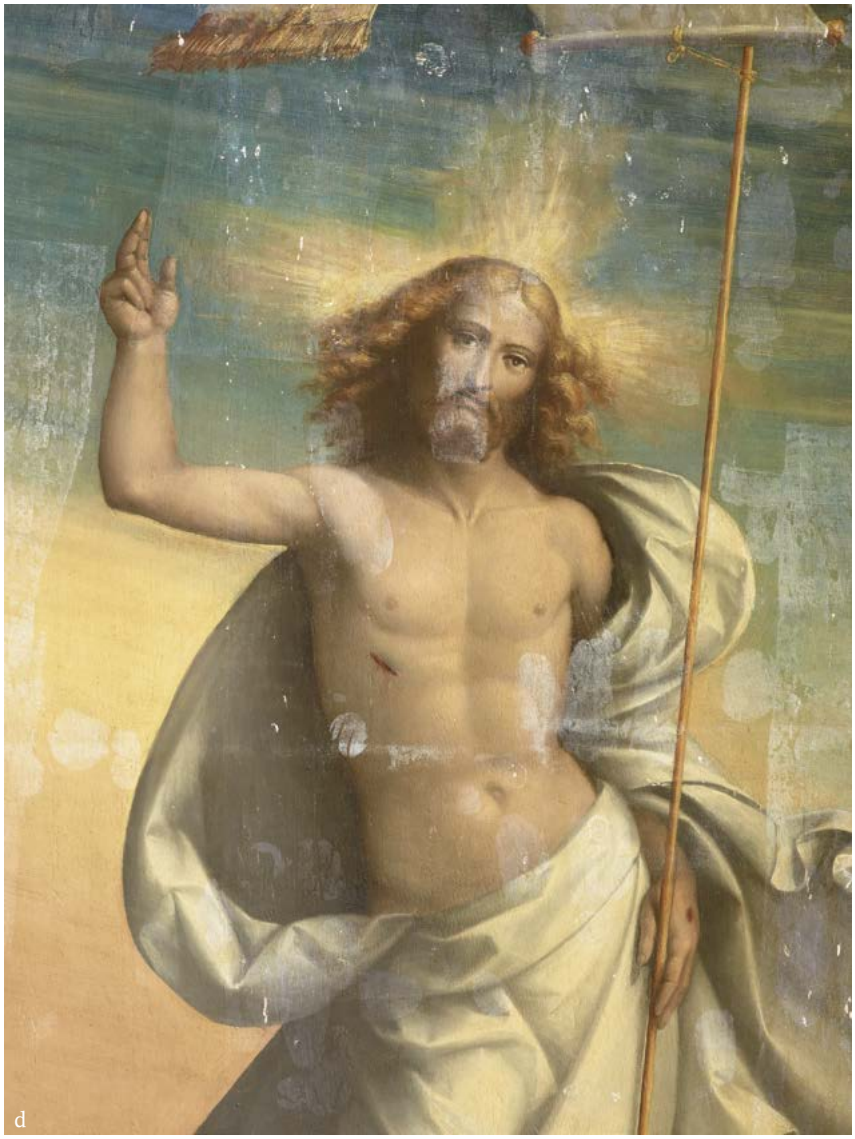

Fig. 35: a. Detail of blanched varnish: the spots are largely round.
b. Macro photograph of a damaged area.
c. Cross-section (VIS, 200x) of the background (sunrise) next to Christ's left elbow.
d. Detail of the figure of Christ after removal of the Japanese paper facing: numerous white, opaque spots interrupt the depiction.

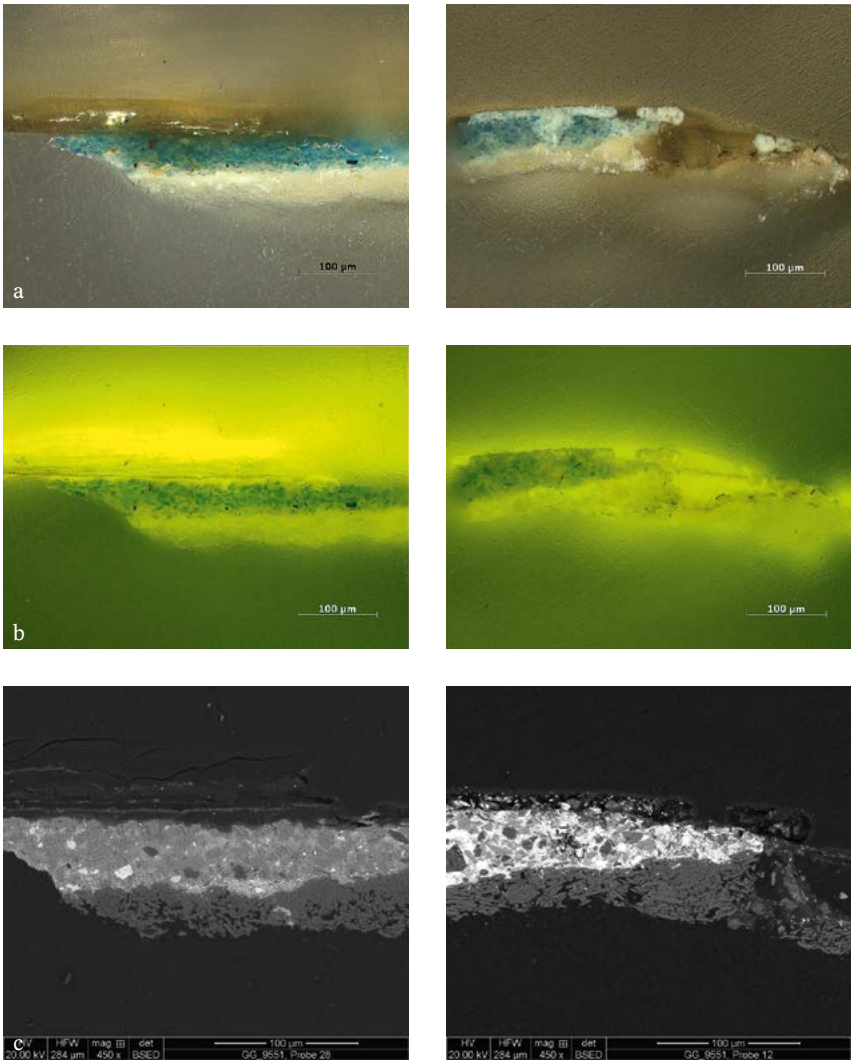

Fig. 36: Comparison of cross-sections (a. VIS and b. UV, both 200x; c. SEM/BSE, each 450x) of a relatively intact (left) and a blanched (right) area of blue.

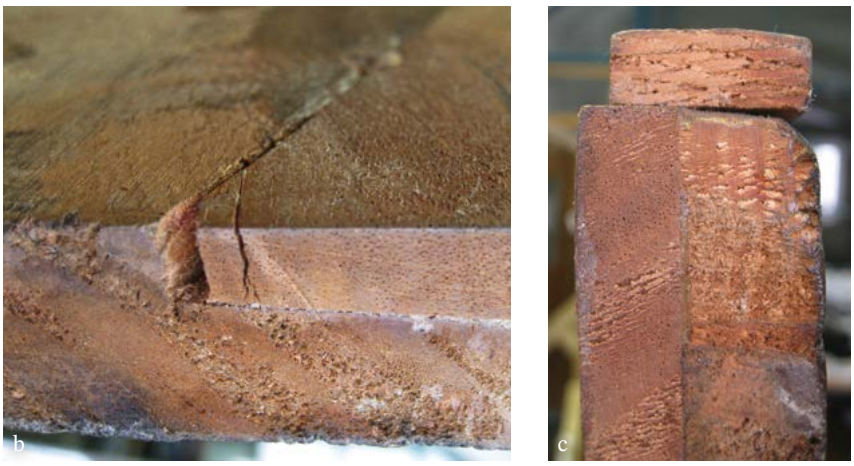

Fig. 37: a. Detail of the lower left corner of the reverse (area of the signature on the painted side): The okoume wood insert and the lower, original crossbar are visible.
b. Detail of the bottom edge in the area of the insert.
c. Detail of the original support with wood insert (2.8 cm) and with added edge strip (bottom edge, right corner).

5. CONSERVATION OF THE PAINTING

As mentioned above, following its acquisition in 1962, the painting could no longer be presented in the Picture Gallery of the Kunsthistorisches Museum from 1976 due to severe damage. The poor condition of the monumental altarpiece (acute lifting of the paint layer, yellowed varnish, earlier water damage, etc.) made a comprehensive conservation treatment necessary, which was guided by an interdisciplinary team of curators, conservators, and scientists.

5.1 CONSERVATION HISTORY

Conservation reports from shortly after the purchase of the altarpiece in 1962 already detail its poor state of preservation.[49] Damages listed include severe woodworm activity with numerous visible worm channels and a loss of adhesion in the paint layer. As a result, initial consolidation measures were undertaken and a comprehensive conservation treatment begun.[50] The following interventions to the support were presumably also begun during this first phase of conservation: the insert on the reverse of the panel at the lower-right corner, in the area of the signature (executed in okoume wood[51]), and the affixing of 10 mm wide strips to stabilize the open-pored, worm-damaged edges of the poplar panel at the left and right edges and the semi-circular top *(fig. 37)*.[52]
Another entry,[53] already from the next year, documents the unsatisfactory results of these first conservation measures. It was thus again attempted to secure the loose areas of the paint layer. The conservation documentation unfortunately gives no information on the methods employed or the consolidation materials. That the second treatment likewise failed to stabilize the painting in the long term is indicated by another entry, from 1976:[54] after only ten years, acute lifting and blister formation were again observed.

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49 Purchase documents (Zl. 9/Gal/1962, Acquisitions: Section XIV, Garofalo, *Resurrection of Christ* Altarpiece) indicate that there was no right of return after the purchase, as the painting was bought for half of its actual value. This observation can also be seen as an indication of the painting's extremely poor condition.

50 Conservation treatment from spring 1963 to 1965 (Franz Sochor, Valerie Raschka, Josef Kimmel): 'Condition of the picture: Very blistered. Worm-eaten. Overpainted. Yellow varnish. Measures undertaken: Covering, setting down numerous blisters [Zustand des Bildes: sehr blasenkrank. Vom Wurm zerfressen. Übermalt. Gelber Firnis. Vorgenommene Arbeit am Bild: Abdeckung, Niederlegen von zahllosen Blasen].'

51 Dendrochronological investigation by Peter Klein, Universität Hamburg, Institute of Wood Biology, report from 10 June 2012: 'The later 20th century additions are made of the tropical wood "okoume". Okoume comes from Africa and was certainly not used in Europe before the 19th century, availability only in the 20th century is even more likely.'

52 The large insert in this area was probably undertaken because of the severe insect damage. Both interventions occurred after 1963 and were probably carried out in the Kunsthistorisches Museum. Unfortunately, there are no detailed notes on the structural work on the support in the museum's documentation, however the choice of materials and execution are similar to conservation practices in the museum at the time.

53 Conservation treatment in November 1965 until autumn 1966 (Franz Sochor, Valerie Raschka): 'Condition of the picture: The entire panel is sewn with blisters. Numerous losses (through lost blisters). Shrinkage along the grain direction. Measures undertaken: Setting down blisters, closing of losses [Zustand des Bildes: Die ganze Tafel von Blasen übersät. Zahlreiche Fehlstellen (durch bereits abgefallene Blasen). Schrumpfungen längs der Holzfaserrichtung. Vorgenommene Arbeit am Bild: Niederlegen der Blasen, Schließung der Fehlstellen].'

54 1976 (Josef Kimmel): 'Condition of the picture: Recent severe blistering. Measures undertaken: Comprehensive setting down [Zustand des Bildes: neuerlich starker Blasenbefall. Vorgenommene Arbeit am Bild: durchgehende Niederlegung].'

Fig. 38: a. The painting overall with Japanese paper facing.
b. Overall of the reverse of the poplar panel before conservation treatment.

Among the causes are certainly to be found the poor environmental conditions in the gallery at the time.[55] A comprehensive setting down of the endangered areas was undertaken.

Repeated conservation measures required in panel paintings by Garofalo due to adhesion problems with the paint layers have also been documented in other museums. For these institutions, the procedure of transferring the paintings from wood to canvas seemed a possible solution.[56]

Similar considerations were also posed in the course of another conservation campaign at the Kunsthistorisches Museum, in 1981. The staff conservator Josef Kimmel[57] was charged with developing the structural treatment, and Hubert Dietrich[58] was to head the restoration. Because of the altarpiece's troubled prehistory, however, the difficulty of the task at hand was evident and

[55] Elke Oberthaler, *Zur Geschichte der Restaurierwerkstätte der 'k. k. Gemälde-Galerie'*, in: ex. cat. *Restaurierte Gemälde. Die Restaurierwerkstätte der Gemäldegalerie des Kunsthistorischen Museums 1986–1996*, Vienna (Kunsthistorisches Museum) 1996/97, 26–33.

[56] Christoph Schölzel, *Gemälde aus Dresden. Bewahrung und Restaurierung der Kunstwerke von den Anfängen der Galerie bis 1876*, Dresden 2012.

[57] Picture Gallery curatorial files, nos. 292-VK/81 and 26/Gal/81.

[58] Hubert Dietrich was active both as professor at the University of Applied Arts, Vienna, Faculty of Conservation and Restoration, and as conservator for the Picture Gallery of the Kunsthistorisches Museum.

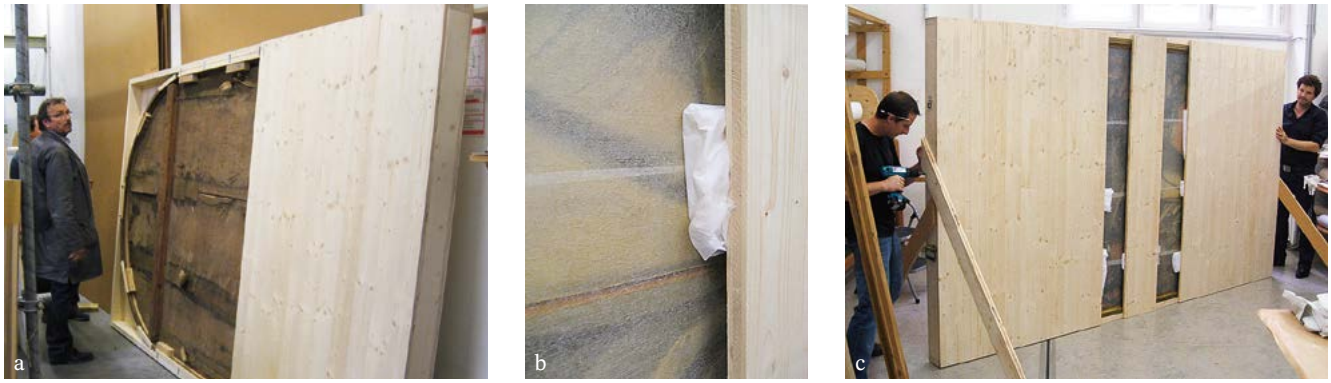

Fig. 39: a. Transport of the painting in a custom-built auxiliary frame, in paintings storage.
b. Detail of the construction with supporting layers of foam.
c. Set-up in Paintings Conservation at the Kunsthistorisches Museum.

expertise from external institutions was already sought in advance of the planning.[59] The conservation was never undertaken, however. Instead, to prevent further paint losses, the face of the painting was secured with Japanese paper[60] and in 1990 the altarpiece was removed to storage, then in Inzersdorf (Vienna) *(fig. 38)*.

5.2 CONDITION

After 21 years, the altarpiece had to be moved again because of the closure of the Inzersdorf storage facility in 2011. Nitrogen treatment was undertaken beforehand, to securely eradicate any woodworm activity. After the construction of a special auxiliary frame[61] for the transport, the painting was moved to Paintings Conservation at the Kunsthistorisches Museum in September 2011 *(fig. 39)*.
There, as a first step, detailed documentation of the condition was undertaken. Both the material composition of the painting itself and the extent and current state of the numerous past interventions were to be precisely recorded.

[59] The then director of the Kunsthistorisches Museum, Friederike Klauner, placed a request for special vacation for Mr Josef Kimmel to the Federal Ministry for Science and Research on 20 May 1981: 'for this purpose it is absolutely necessary to study comparable material and cultivate exchange of experience with Italian conservators at the Soprintendenze of Florence and Siena.' Picture Gallery curatorial files, nos. 292-VK/81 and 26/Gal/81.

[60] At the moment of the transport around 1990 to the storage facility in Inzersdorf/Vienna (Traviatagasse), the face of the painting was already completely secured with Japanese paper to prevent further losses to the paint film. According to information from Karl Schütz, this measure was undertaken at the end of the 1970s by Ehrhard Stöbe or Ms Köb. The paint film was not consolidated after the transport.

[61] An auxiliary frame was built around the existing frame of the altarpiece to allow sheets of wood to be attached on both sides – both to prevent diagonal twisting and to allow the surface to be supported on the front and reverse with foam blocks.

5.2.1 SUPPORT

The monumental altarpiece with a semi-circular top, with the dimensions 315 × 181.5 cm and a weight of 110 kg, still keeps its original support, as the potentially fatal intervention of transferring the paint film (from wood to canvas or to another wooden support) was, as mentioned above, luckily never undertaken.

The panel is composed of three wide poplar planks[62] with vertically oriented grain and a thickness of 2.5–3.5 cm. The two widest[63] come from a single, thick board that was split along its length. One of the planks was flipped before gluing the two together to prevent deformation of the support.[64] A third, somewhat narrower plank (44.5 cm wide) was attached on the right; this shows the most severe woodworm damage and is the worst preserved in comparison with the other planks.[65]

At either side of this assemblage of three main planks, another narrow plank, almost a strip, was added. This was presumably done to achieve the ideal width for the semi-circular top.[66] The glue joints of the planks were secured on the reverse with dovetails.[67] The right plank shows two larger wood inserts[68] on the paint film side: as the x-radiograph clearly reveals different applications of the ground, these were probably not executed at the same time. The insert that appears lighter in the radiograph may have been made after the ground was applied.

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62 Dendrochronological investigation by Peter Klein, Universität Hamburg, Institute of Wood Biology, report from 10 June 2012 (see n. 51): The original panel is made of poplar (*Populus sp.*). The upper and lower crossbars are made of spruce (*Picea sp.*). The 87 annual rings of the lower crossbar could be assigned to the years 1517–1431 using the comparative chronology for the Alpine region: 'The youngest annual ring dates to the year 1517. As usually only the bark was removed in the production of planks from spruce, a felling date of 1517 for the tree can be assumed and, with a minimal wood storage time of two years, an earliest working to a plank is conceivable from 1519. The dovetails are likewise poplar (*Populus sp.*)'.

63 The arrangement of the planks to form a large panel was probably consciously chosen such that none of the joints would disturb the depiction (the danger of wood movement at these interfaces was well known). In comparison, Garofalo's *Ascension of Christ* in Rome, Galleria Nazionale d'Arte Antica, Palazzo Barberini, is assembled from multiple horizontal planks, the curvature of which disrupts the depiction. The Florentine panel painting tradition likewise considered the tendency of wood to move. Thus, narrow lateral planks were commonly attached to one wider middle plank, as e.g. in the support construction of Bronzino's portraits.

64 Seen from the panel reverse, the wood grain of the upper middle plank is found in the lower area of the right plank.

65 This is probably a plank containing sapwood, which would explain the severe woodworm infestation. The wood grain is very uneven and contains knots.

66 The width of the individual planks, seen from the panel reverse, from left to right: 5.5 cm – 44.5 cm – 57.5 cm – 67 cm – 5 cm.

67 The technique of dovetail inserts along glue joints is found in numerous works from Garofalo's oeuvre, as e.g. the altarpiece of *The Virgin and Child Enthroned with Saints William of Aquitaine, Clare (?), Anthony of Padua, and Francis* (London, National Gallery, inv. no. NG 671). See Dunkerton – Penny – Spring 2002 (cit. n. 38), 22 f.

68 Both the wood inserts, which were presumably executed because of faults in the panel (perhaps disturbing knots) and the massive woodworm infestation confirm the suspicion that this piece must be a tangential plank from the outer part of the trunk, with sapwood.

An additional dovetail, somewhat larger than those on the panel reverse, is visible at the glue joint in the lower area. This was inserted from the front of the panel, presumably to secure an insufficient gluing of the two planks. Only after this measure was the ground applied *(fig. 40)*.[69]

The x-radiograph also shows dowels along the joints, located in the middle between the dovetail inserts. Additional dowels along the narrow planks at the sides are somewhat smaller *(see figs. 7 and 40d)*.[70]

Numerous nails of different size and length are evident at the edges in the x-radiograph.[71] The large number of nails again illustrates the persistent poor condition of the panel, as all are later additions. The longer, handmade nails sought to lend additional stability to the narrow original lateral strips, probably to additionally secure the glue joints already weakened by woodworm activity.[72]

The smaller nails secure the narrow, 10 mm wide strips added at the edges (see section 5.1, Conservation History), which were added in the Kunsthistorisches Museum to protect the open-pored poplar.

The support is additionally braced on the reverse through the insertion of two opposing, trapezoidal crossbars. Both are made of spruce. The crossbar at the lower edge of the painting is original. Dendrochronological studies suggest a felling date of 1517.[73] That at the upper edge is a later addition *(fig. 41)*.[74] At an unknown moment, the original crossbar was reduced to 3.9–4.7 cm. This was presumably done to give some allowance for the strong tendency of the planks to warp and to reduce the resulting tension in the support, especially in the area of the signature.[75]

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69 The wood in the area of the glue joints damaged and weakened by woodworm infestation was strengthened and reglued with a wedge-shaped wood insert during conservation measures at the Kunsthistorisches Museum (presumably simultaneous with other wood repairs on the reverse).

70 The dowels connecting the main planks are ca. 12–14.5 cm long, those at the edges ca. 8–10 cm. Both dowel types are ca. 1 cm in diameter.

71 Particular thanks are due to Ina Slama, who solved the difficult problem of obtaining an x-radiograph of the altarpiece in the vertical position (film: Agfa Structurix D4 30 × 40 cm; Isovolt Seifert & Co x-ray tube, working distance 110 cm). The individual digital films were mosaiced by Michael Eder, Department of Visual Media.

72 This intervention presumably occurred when the painting was still in the parish church of Bondeno or before the sale around 1855.

73 See n. 62.

74 Water damage could have been the reason for removing the upper original crossbar; tidelines visible in the wood lead to this supposition. The water damage likely occurred during the original installation of the painting in the parish church of Bondeno. The intervention was perhaps undertaken around 1855, when the altarpiece was sold to a private person, as water damage would have had to be treated before the sale and transport.

75 The original crossbar is 10.5–12.5 cm wide. It narrows to the left, as it was inserted from right to left into a dovetailed channel. Including the dovetail, it is 3.9–4.7 cm thick. The upper, replaced crossbar has the opposite orientation and narrows to the right, from 12 cm to 10.2 cm. The trapezoidal form was achieved by nailing on a thin strip, which narrows from 2.7 cm to 0.7 cm. The replaced crossbar was not thinned.

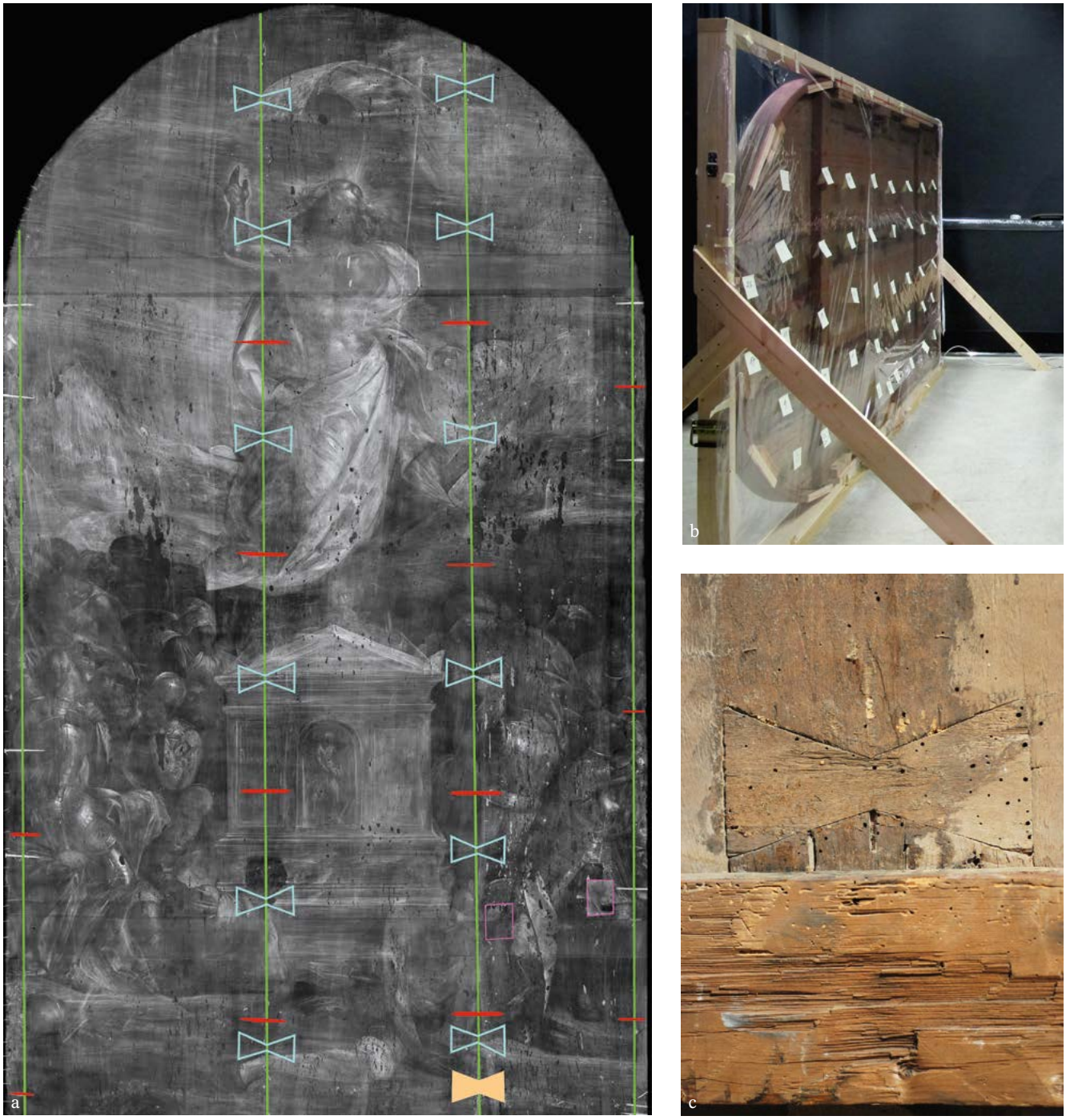

Fig. 40: a. Overall x-radiograph with diagram of the support indicating panel construction: glue joints (green), dovetails (front yellow, reverse blue), dowels (red), inserts (front magenta).
b. X-radiography was done with the fragile panel vertical to avoid introducing stress. The x-ray film was attached to the surface, which was faced with Japanese tissue, using special tape.
c. Detail of the support in the area of the joint with poplar dovetail insert in the area of the lower, original crossbar.

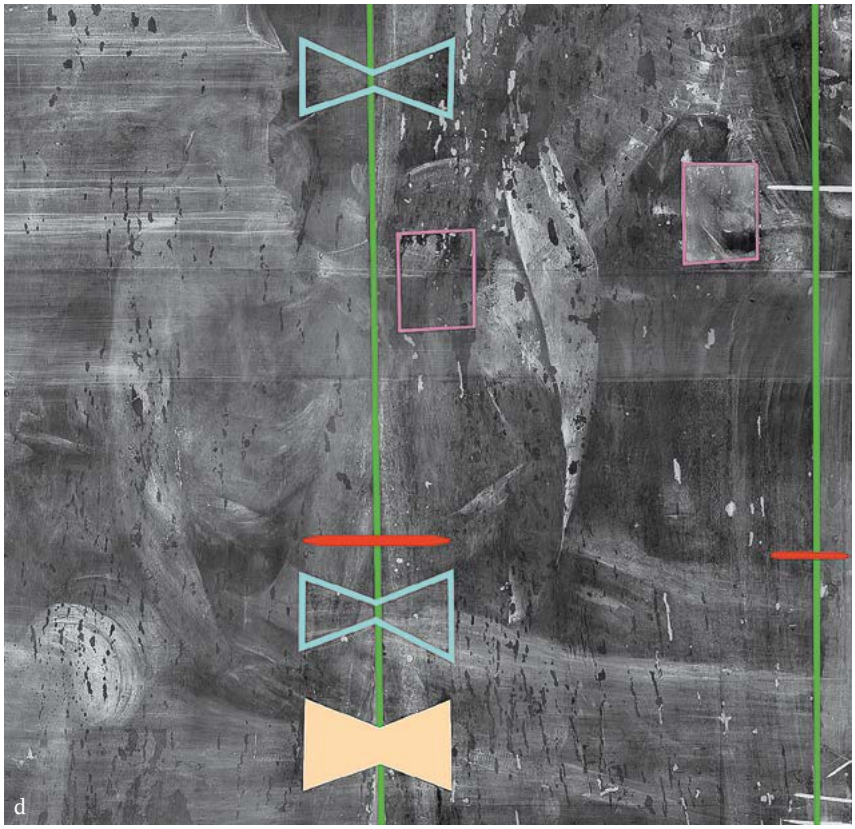

Fig. 40: d. Detail of the x-radiograph with wood inserts visible (front magenta) and the dovetail inserted from the front (yellow) that additionally stabilize the joint at the lower edge.

Fig. 41: a. Detail of the upper, replaced crossbar.
b. The upper crossbar, right edge (the annual rings are horizontal).
c. The lower, original crossbar, right edge (the annual rings are vertical).

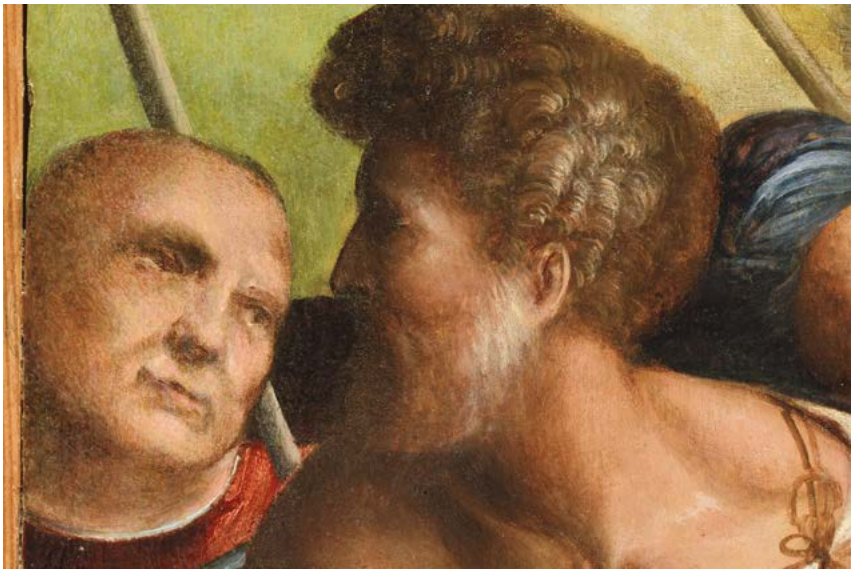

Fig. 42: Trimming at the left edge of the panel, which cut through the head of a figure.

Observing the sides of the panel, it is clear that the original borders of the paint and ground are not present, an indication of slight trimming. Somewhat more material was presumably removed from the left edge, where the head of a figure is somewhat cut *(fig. 42)*.[76] Sawmarks are also visible at the lower edge, suggesting another reduction to the panel. The panel now does not rest on the middle of the lower edge, rather the outer sides bear the weight; the cutting also tilted the depiction slightly to the right.

To secure the weakened glue joints, presumably during a later intervention, numerous strips of canvas were affixed to the panel reverse. Pieces of canvas in different lengths were attached both along and across the joints using animal glue.[77] Below the canvas strips is a dark coating, in which linseed oil, some beeswax, pine resin, and benzoin[78] were identified. The latter addition sought both to increase the adhesive strength of the glue and serve a protective function (presumably against further woodworm infestation). This measure was unfortunately unsuccessful as the glue joints were further damaged by insects, evidenced by the hollow worm channels found during the condition assessment. The adhesion of the canvas strips is very uneven.[79] The canvas itself has a simple, irregular weave and has become very hard and brittle through its saturation with animal glue and the oil coating. The strips are heavily soiled and also show tidelines. The animal glue and the oily coating have darkened and differ greatly in colour from the wood. Numerous dark splatters suggest the means by which the medium was added: with the painting positioned face down, presumably on sawhorses, the glue was generously applied with a brush.

76 The differing widths of the narrow, added strips of 5 cm on the left and 5.5 cm on the right (seen from the front) are also evidence of slight, differing trimming of the left and right edges.

77 All analyses of binding media were performed by Václav Pitthard using GC-MS: report of 25 June 2012, samples 1–3.

78 Benzoin occurs naturally in a number of plants. The aromatic resin is formed in different types of trees in the genus styrax (*Styracaceae* family). It was used for its sticky but elastic consistency, but also possesses antibacterial qualities. See John S. Mills – Raymond White, *The Organic Chemistry of Museum Objects*, Oxford – Boston 1994, 95.

79 For successful application the glue, with additives, must fill any spaces, and there can be no new insect channels.

Fig. 43: a. Detail of the reverse showing the strip of wood at the upper left edge: The panel is weakened by earlier woodworm activity.
b. Detail of the paint layer at the upper right edge: The paint layer has suffered numerous losses.

Overall it can be observed that, despite numerous past conservation measures, the panel is now in a greatly weakened state *(fig. 43)*.

5.2.2 PAINT LAYERS

To assess the face of the painting, in a first step the Japanese paper applied to the entire surface to secure the fragile paint film had to be removed. Prior analyses confirmed that the paper was attached with a mixture of glue and starch.[80] It could thus be taken off with slight moisture (distilled water) *(fig. 44)*.

After the complete removal of the facings, the painting surface showed conspicuous alterations: in addition to the yellowing caused by the aging of the natural resin varnish,[81] numerous spots disturbed the appearance. These cloudy, white areas, usually round or rectilinear in shape, could be explained by the painting's turbulent conservation history *(fig. 45)*.

The attempts of earlier conservation treatments to secure the endangered paint layer led over time to a varied mixture of consolidation materials on the surface. The result was a blend of different amounts and combinations of wax, glue, and varnish, as well as fibres from the facing paper. As a consequence, the paint film had become hard and brittle in the affected areas, and fine hairline cracks had developed in the varnish layer that dominated the appearance.

The exposed disturbing, cloudy, whitish areas are a result of earlier measures involving locally applied, aqueous consolidants. For these, a small piece of Japanese paper was laid on the afflicted area and the consolidant (a mixture of glue and starch – i.e. paste – or only cellulose) was applied with circular movements of the brush, through the paper and into the paint film. If the entire rectangular surface of the Japanese paper was not fully brushed with consolidant, the moisture was limited to the round areas, which were visible after the removal of the paper. In total, the sequence of individual, uncoordinated interventions led to the blanching of the varnish and the

[80] GC-MS analysis Václav Pitthard, report of 25 June 2012, sample 4.

[81] The painting was stored in a dark room for 35 years. The interplay of darkness and the oily components in the extremely thick varnish may have influenced the discolouration process.

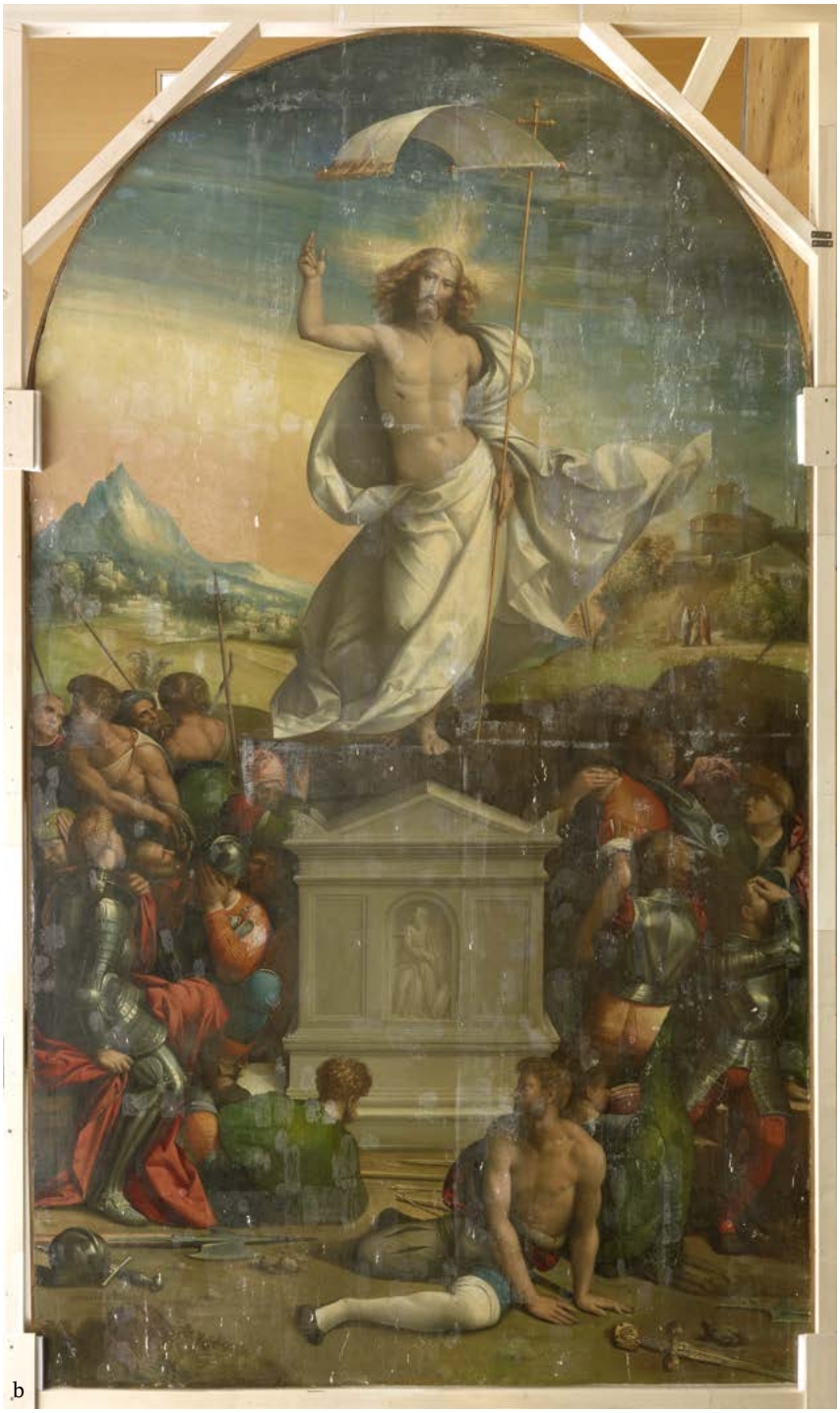

Fig. 44: a. Overall photograph in UV light.
b. The panel before conservation treatment, after complete removal of the Japanese paper facing.

paint film. Finally, renewed moisture penetration during the overall facing with Japanese paper caused additional, substantial stress to the blanched varnish and partly also to the paint layers, already damaged by various consolidation media *(fig. 46)*.

Aside from the spotty appearance, the aforementioned earlier loss of adhesion was evident in the form of lifting paint: the paint layer suffered from the shrinkage of the wooden support caused by inappropriate environmental conditions, and developed flaking and blisters as a reaction to this movement along the wood grain direction *(fig. 47)*.

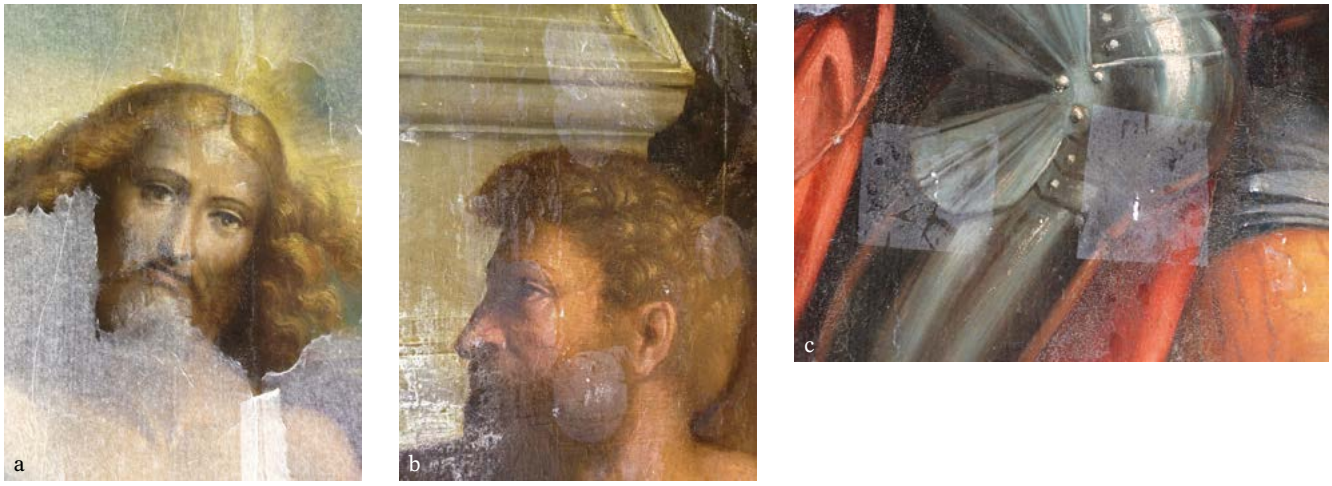

Fig. 45: a. Detail of the head of Christ during removal of the Japanese paper facing and starch adhesive with distilled water.
b. Detail of the soldier's head in the foreground after removal of the facing.
c. Detail of the knee of the standing soldier at the left edge after removal of the facing: square areas of consolidation are visible.

Fig. 46: a. Detail at Christ's feet: Blanching of the paint and remains of old material damaged the paint layer.
b. Detail of the figure to the right of the sarcophagus: Blanching of the varnish and paint film from different consolidation campaigns is visible.

Traces of multiple past restorations could be identified in the form of darkened retouching, overpaint, and old fills; untreated wormholes were also present on the paint film side.
In the x-radiograph,[82] numerous areas with different x-ray absorption provide information on later additions and improvements, and thus indications of the true scope of the paint loss.[83] It is also obvious that the paint layer is in poorer condition on the right side than on the left.

[82] In the x-radiograph, chalk-glue fills appear dark and fills with lead white impurities are light.

[83] Because of the exposure conditions, the degree of woodworm damage cannot be directly assessed from the x-radiographs. Due to the panel thickness of 24–32 mm, higher excitation parameters were required (39 kV, 4 mA, 2 min). Under these measurement conditions, the fine woodworm channels could not be captured on film.

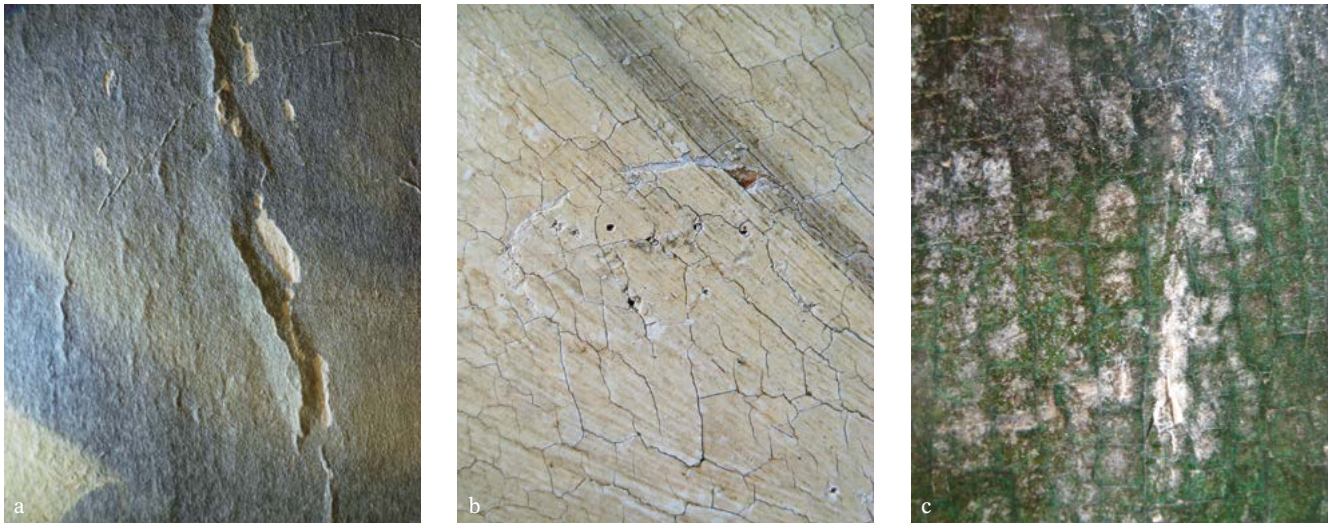

Fig. 47: a. Detail of the sky: Small blisters were secured with Japanese paper to prevent further paint loss.
b. Detail of Christ's white robe: Small holes are evidence of earlier consolidation attempts.
c. Detail of the green garment of the reclining soldier in the left foreground: Different layers of adhesive, yellow varnish, and paper fibres – embedded in the varnish – disturbed the paint film.

In summary, it can be observed that the current condition of the altarpiece reflects its chequered fate in private ownership. Many of the measures undertaken were accompanied by irreversible consequences. The conservation treatment of the altarpiece thus not only faced the challenge of preserving the painting's original substance, but also that of reckoning with past conservation measures.
The following damages were to be addressed in the comprehensive conservation treatment, and future degradation forestalled through preventive measures:

- Damages to the poplar panel:
  - Earlier woodworm infestation
  - Cracks, holes, thinned and cracked sections of wood
  - Old water damage
  - Later wood additions causing tension
- Damages to the paint layer:
  - Extensive lifting along the wood grain, and blister formation
  - Remains of various earlier consolidation media, paper fibres, and old chalk fills on the original paint
  - Blanching of the paint film and varnish
  - Extensive overpainting and darkened retouching
  - Yellowed, opaque varnish
- Framing:
  - Lack of mechanical stability

5.3 CONSERVATION AND RESTORATION

After the nitrogen treatment and the already mentioned transport of the painting in a specially constructed auxiliary frame, all working steps were carried out with the painting vertical in order to minimize movement-induced stress to the support. Due to its size, the altarpiece had to rest on its right side *(fig. 48)*.
The conservation of the support and the paint layer stood at the centre of the following measures. The preservation of the original substance of the

Fig. 48: Set-up with newly constructed auxiliary frame (unframed) in the conservation studio.

painting, with minimal invasive measures, was the primary goal. It was also sought to extend future cycles of restoration as much as possible, to minimize subsequent interventions to the painting. In securing the paint layer, the consolidation of the paint and the structural measures on the wooden support were mutually dependent: in the past, the treatment of the paint layer had been prioritized regrettably often over that of the panel. This was reflected in the documentation preserved, which primarily recorded work on the panel front. The current conservation hence sought to encompass both work on the painted side and on the reverse.
Both sides of the painting were first carefully cleaned – by dry means[84] and in part with slight moisture and solvents.

5.3.1 TREATMENT OF THE SUPPORT

The consolidation of the woodworm-damaged areas was carried out with Paraloid® B67 and B72.[85] After drying, the losses were filled with old conifer wood and wood putty.[86] Next, all cracks in the support *(fig. 49)* and the slightly open glue joints on the middle of the panel reverse could be secured (see also section 5.2.1 Support).[87]

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84 Dry cleaning of the support was done using brushes, a vacuum, microfibre dusting cloths, and fine-pored PU sponges. Remains of synthetic adhesives (Ponal) from attaching the lateral protective strips were softened with acetone compresses and removed mechanically.

85 15–25% Paraloid® B67 dissolved in petroleum spirits (b.p. 100–140°C, petroleum naphtha, index-No. 649-32-00-1) and 15–25% Paraloid® B72 dissolved in toluene (both Merck).

86 Fill material made from club moss spores (*Lycopodium sp.*) and Plexisol® P 550 TB 40% (Plexisol®, a LASCAUX product, butyl methacrylate, is a thermoplastic synthetic resin [T_g 40–50°C] with a high viscosity, soluble in nonpolar solvents).

87 Christina Young – Paul Ackroyd – Roger Hibberd – Stephen Gritt, *The Mechanical Behaviour of Adhesives and Gap Fillers for re-joining Panel Paintings*, in: National Gallery Technical Bulletin 23, 2002, 83–96.

Fig. 49: a. and b. Gluing of cracks at the lower edge.
c. and d. Gluing the crack at the dovetail to the left of the joint, before and after treatment.

The 10 mm wide wooden strips at the edges attached with wood glue (Ponal)[88] and in parts additionally with nails were kept. These had been added in the past to protect the damaged, open-pored edges of the poplar panel.[89] To reduce tensions in the strip nailed to the arched top, this was weakened with additional, 5 mm deep cuts to the exterior edge. The canvas strips over the joints were largely retained, except where there was greater woodworm damage to the support or the joint had opened.
During the treatment, the environmental conditions and the tendency of the painting to move were monitored using a potentiometer[90] to observe changes in the support before and after the weakening of the massive upper, later crossbar[91] (5.4–6 cm in thickness) through cross-grain cuts, 1–1.2 cm deep and ca. 6–7 cm apart *(fig. 50)*.[92]

88 Ponal is a formaldehyde-free dispersion based on polyvinyl acetate (PVAc), also known as white glue.
89 See n. 84.
90 Rissfox® Mini data logger for analysis of crack movements and changes in length as well as ambient humidity and temperature, Scanntronik Mugrauer GmbH, available at: http://www.scanntronik.de/Produkt_Rissfox_Mini_deu.php [last accessed: 30 October 2020].
91 See section 5.2.1 Support.
92 Because of its size and the spatial logistics, a surface scan of the entire panel with a laser before and after the weakening of the upper crossbar was not possible. The point measurement with the potentiometer (Rissfox®) at the left edge in the area of the crossbar showed a movement of ca. 5 mm. There were further slight movements over the entire panel surface after the separation of all connections with the auxiliary frame. One can speak of a slight convex movement spread over the entire picture surface.

Fig. 50: Detail of the upper crossbar: Cuts were made with a Japanese saw.

Fig. 51: a. to c. Movement measurements with the potentiometer (Rissfox®).

Likewise during the conservation phase, the movement tendency at the lower edge was also measured over a longer period with the potentiometer *(fig. 51)*.

The lower, original crossbar had already been thinned during an earlier structural intervention to a thickness of 3.9–4.7 cm (see section 5.2.1 Support). The resulting splintering was secured with fish glue.[93]

[93] High tack fish glue (56K6000), Norland Products Inc., 2540 Route 130, Suite 100, Cranbury, NJ 08512 USA, available at: sales@norlandproducts.com [last accessed: 30 October 2020].

Fig. 52: Detail of the orange garment of left figure in the middleground.
a. Blanching after removal of the facing paper.
b. Paper remains at areas of loss and abrasion impaired the paint layer.
c. After cleaning and retouching.

5.3.2 TREATMENT OF THE PAINT LAYER

The round and rectilinear blanching of the varnish and paint layer apparent after the removal of the Japanese paper facings *(see fig. 44b)* and the various remains of old restoration material could be reduced sometimes with water, sometimes with organic solvents, aided by mechanical action with sharp knives *(fig. 52)*. As a next step the consolidation of the paint layer was essential, as this showed extensive lifting over the entire surface. For this, sturgeon glue was used as the consolidant.[94] The introduction of the consolidant was initially verified under the microscope and later under 3x magnification with a loupe.
Woodworm exit holes on the paint film side were consolidated with Paraloid® B72 and filled with wood putty using small spatulas and dental probes *(fig. 53)*. More than 480 differently sized holes were treated in this way.
The extremely yellowed varnish and numerous darkened retouches disturbed the picture's appearance. These were reduced with solvents in different mixtures,[95] with specially prepared solvent gels,[96] or mechanically with a scalpel *(fig. 54)*. This exposed areas that had been deliberately broadly overfilled and overpainted to mask abrasion or local losses as well as areas of apparently undamaged original paint. The blanching of the paint and varnish layers could be almost completely reduced through the cleaning. In some dark areas, unfortunately only a reduction of the blanching was possible.

[94] 7% sturgeon glue with slight addition of Dowanol™ (Dipropylene glycol n-butyl ether).
[95] Isooctane and ethanol in 1:4, 1:2, and 1:1 mixtures.
[96] Red, green, and lead white–containing ochre coloured overpaints were removed using thick applications of a solvent gel containing acetone (3.75 ml), H_2O (12 ml), benzyl alcohol (10 ml), 0.5 g Carbopol, 1.25 g Ethomeen C25 (pH 7, 60 s application time) or thin applications of a solvent gel containing ethanol (70 ml), isooctane (40 ml), 0.5 g Carbopol, 1.25 g Ethomeen C25 (pH 7, 30 s application time).

Fig. 53: a. The wormholes were consolidated and filled with wood putty.
b. Detail of lifting paint caused by woodworm damage.

Fig. 54: a. Detail of Christ's white garment during cleaning with solvents.
b. Detail of the remains of the yellowed varnish.

Fig. 55: Detail of the group of figures on the right half of the picture after filling of losses.
a. In the area of the rocky outcropping.
b. To the right of the sarcophagus.

Fig. 55: c. Lower right corner beside the seated soldier in the foreground.

After the cleaning, all losses were filled with a putty of chalk and glue *(figs. 55 and 56)*.[97] The texture of the surrounding paint was imitated with white gouache to improve the integration of the large losses *(fig. 57)*. Before retouching, a varnish of mastic dissolved in turpentine (ca. 11%) was applied with a broad, flat brush to isolate the gouache[98] and saturate the colours for further retouching. Losses and abrasion were integrated with watercolours and finally with thin glazes of resin-oil colours *(fig. 58)*.[99]

[97] Small losses were filled with gouache colours and a liquid chalk–glue putty (6% rabbit skin glue, 1:2 Champagne : Bologna chalks) in multiple layers.

[98] Horadam® gouache colours.

[99] Mussini® watercolours, Mussini® resin-oil colours.

Fig. 56: a. 10 mm wide strip of wood at the edge and filling of woodworm damaged areas with old spruce fibres and wood putty.
b. Detail after filling of the loss.

Fig. 57: Detail of the white robe during retouching. The paint texture was imitated with white gouache.

Two sprayed applications of varnish followed *(fig. 59)*.[100] To avoid possible threats to the substance of the painting in the future[101] such as wood movement and lifting of the paint layer, particular attention was placed on the microclimatic environmental conditions at its exhibition location. Temperature and humidity sensors were hence installed.[102]

[100] A sprayed natural resin varnish (6–8% mastic (Chios1A) in double rectified turpentine) unified the gloss of the paint surface.

[101] Inspection of the paint film, October 2019: condition unchanged, no new acute lifting observed since 2014. The surface gloss of the varnish appears even (see condition report by Ingrid Hopfner, Paintings Conservation, Kunsthistorisches Museum).

[102] Wireless data logger MSR 145 WD (Bluetooth): measurement/save rate: 1/s, acceleration: ±15 g, data capacity: 1,000,000 measurement values, available at: https://www.msr.ch/de/produkt/funk-datenlogger-msr145wd/ [last accessed: 30 October 2020]; Testo 184 H1, available at: https://www.testo.com/de-AT/testo-184-h1/p/0572-1845 [last accessed: 30 October 2020].

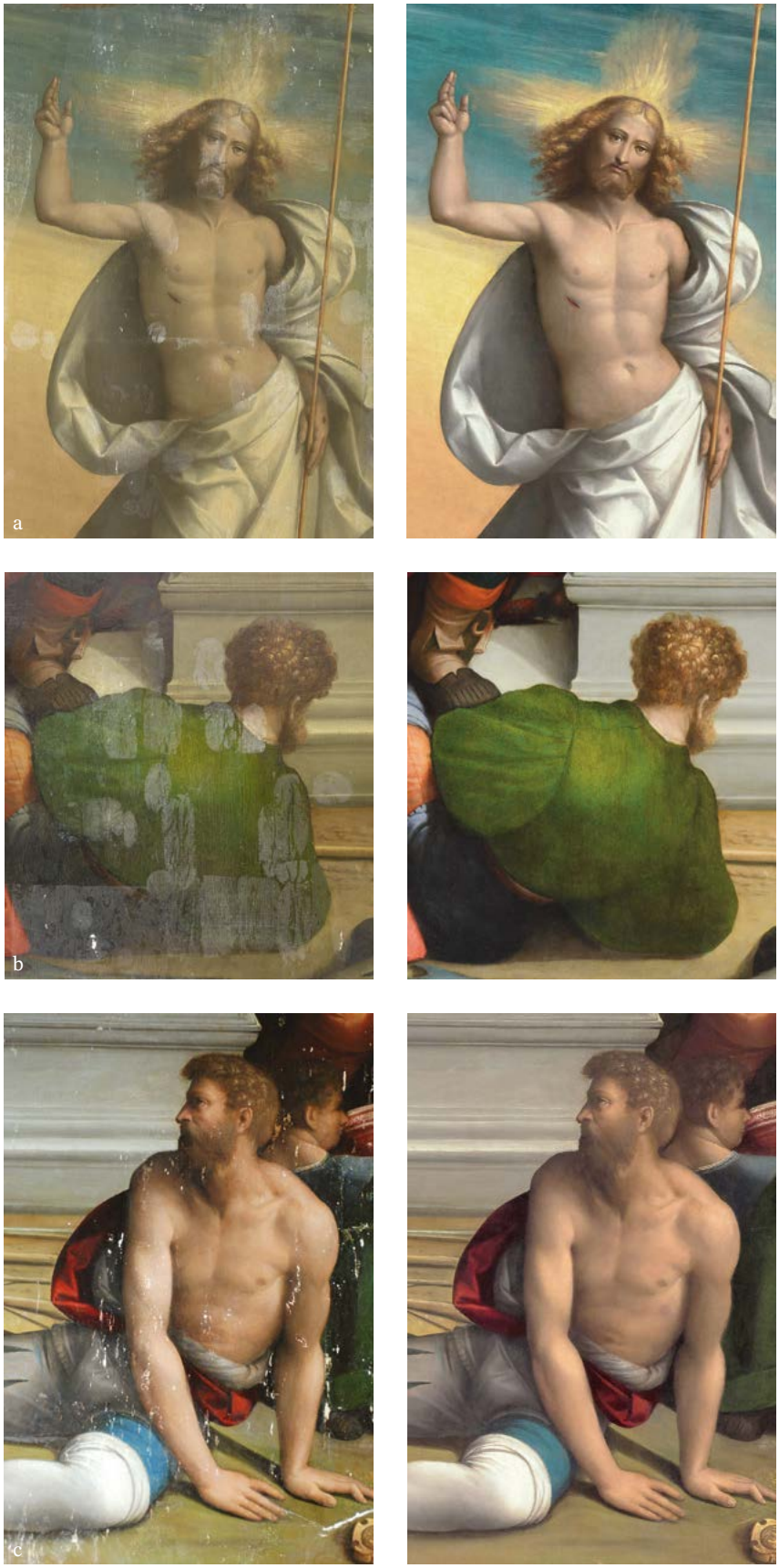

Fig. 58: a. Detail of the figure of Christ after removal of the facing paper (left) and after restoration (right).
b. Detail of the reclining soldier with the green garment after removal of the facing paper (left) and after restoration (right).
c. Detail of the seated, bare-chested soldier in the foreground after cleaning and filling of losses (left) and after restoration (right).

Fig. 59: a. The painting before treatment.
b. After cleaning and filling.
c. After treatment.

6. FRAME AND PREPARATION FOR FRAMING

Another necessity for the future preservation of this singular work was the construction of a new, stable frame,[103] to allow the tension-free mounting of the panel and thus an appropriate stability and presentation.[104] The old, non-original frame was far too narrow in width and slight in construction for the 110 kg painting.

To find the ideal sight size for the frame, the dimensions of the painting were traced on a transparent film and transferred to cardboard *(fig. 60)*. A CAD drawing[105] created a 1:1 model for the new frame, the basic elements of which were prepared with a CAD/CAM milling machine. The spruce frame was next glued together from multiple pieces of wood. The creation of the arched top proved to be a particular technical challenge. Following this, the profile ornament was carved with a chisel *(fig. 61)*.

Before the application of the ground, the wood frame was coated with bone glue. A chalk–glue ground (a 4:1 mixture of Bolognese and Champagne chalks) and, depending on the type of gilding, yellow or in parts red bole formed the preparation for the gilding, which was partly polished and partly matte.[106] Out of stylistic considerations related to the altarpiece, a floral motif[107] was punched on the flat surfaces. After polishing the gold, the sheen was partially reduced with ground pumice[108] to give the frame a slightly aged appearance. The application of an overall shellac layer offered protection for the further working of the delicate gold. Following the application of a varnish toned with oil paints, the patina could be built up in multiple steps using watercolour glazes *(fig. 62)*.

A strip of balsa wood matching the curvature of the panel was inserted in the frame rebate to achieve the best possible surface for mounting the painting. A backing[109] was also prepared from two layers of fabric *(fig. 63)*.

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[103] Claus Grimm, *Alte Bilderrahmen. Epochen – Typen – Material*, 3rd ed. Munich 1986.

[104] Construction of the frame by Rudolf Hlava, and Markus Geyer; gilding: Barbara Steiner, Markus Geyer, Rudolf Hlava and Michael Odlozil; digital editing of the model: Michael Eder.

[105] Wagner and Taschler, available at: https://www.schoenemoebel.at/ [last accessed: 30 October 2020].

[106] Areas with red bole received polished gilding; areas with yellow bole receive matte gilding executed with skin glue.

[107] The motif ultimately executed was determined after numerous experiments. To present the painting in a visually appealing way, both the choice of punchwork design and the frame shape represented major challenges. The frame of the painting *Sacrificial Death of Marcus Curtius* by Paolo Veronese (Kunsthistorisches Museum, Picture Gallery, inv. no. 6744) served as a model for the final profile.

[108] The porous, glassy volcanic rock (silicate) is used as a fine powder for intermediate polishing (e.g. in shellac polishes) or to fill pores.

[109] Cut and sewing: Michaela Kratochwil and Eva-Maria Jerabek, Textile Conservators, Kunsthistorisches Museum.

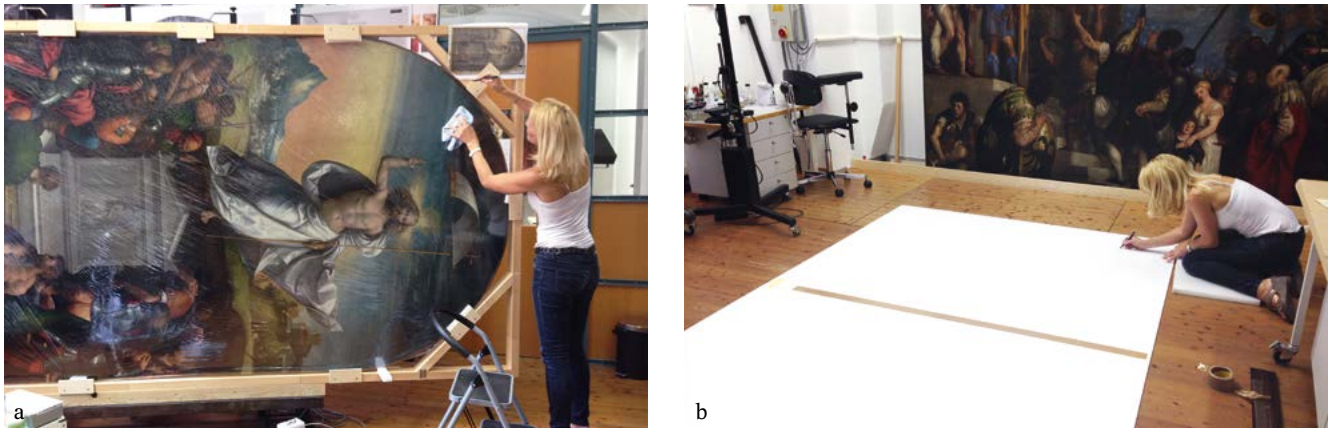

Fig. 60: a. and b. The shape of the painting was traced on plastic film and transferred to cardboard in order to determine the ideal sight size for the frame.

Fig. 61: a. The reverse of the frame during gluing.
b. Construction of the face of the frame.
c. Joining the individual pieces of wood for the arch.
d. Carving ornament with a chisel.

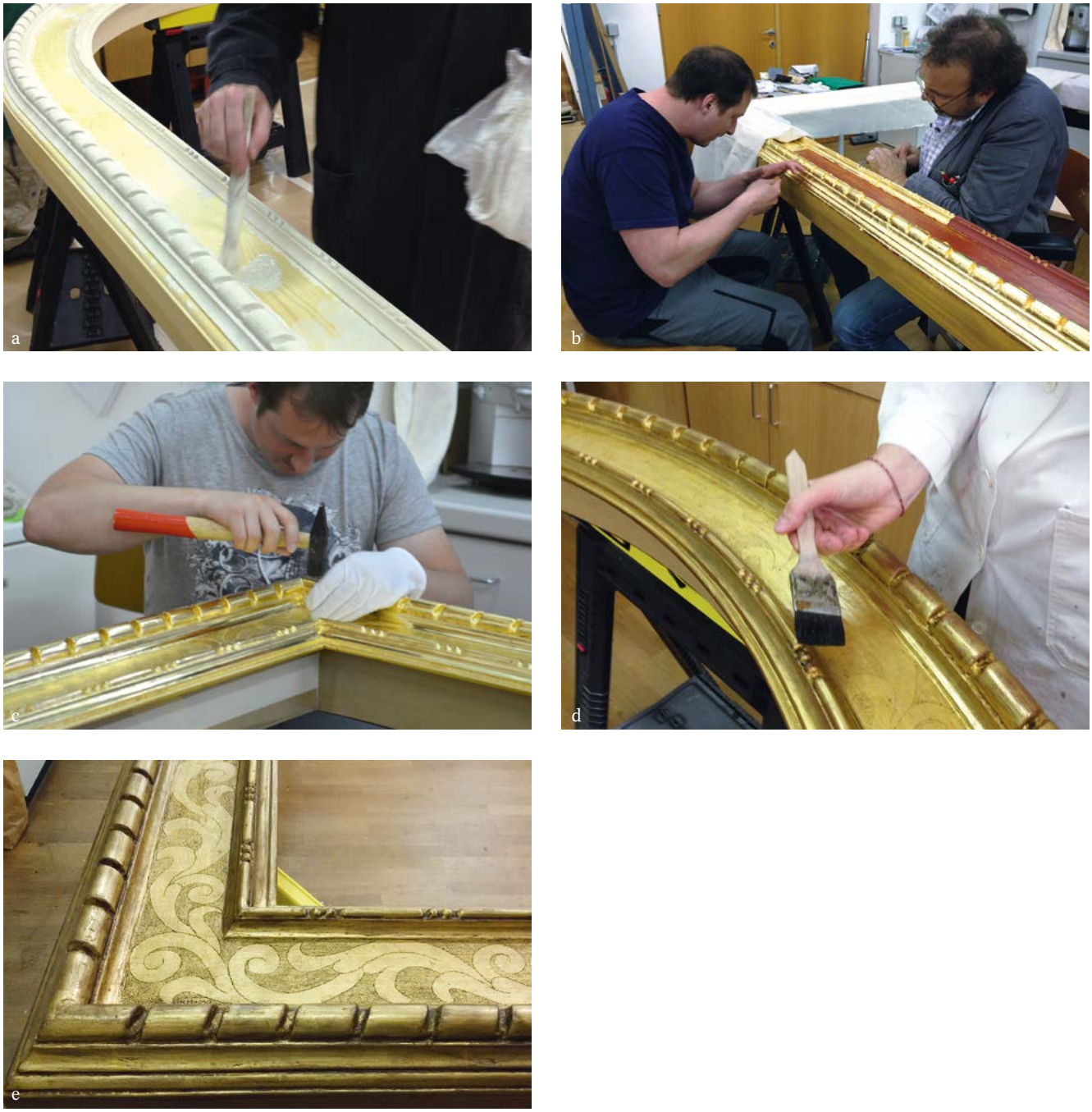

Fig. 62: a. Applying the ground to the frame.
b. Gilding the frame.
c. Punching the floral motif.
d. Patinating the gilding.
e. Detail of the finished frame.

Fig. 63: a. and b. Attaching strips of balsa to the frame rebate.
c. Trimming and attaching the backing.

7. TRANSPORT AND INSTALLATION IN THE PICTURE GALLERY

Because of its large format, great weight, and fragility, a wooden transport frame was used to transport the restored painting into the Picture Gallery[110] – to minimize tensions during movement of the painting and lend additional stabilization. Multiple wooden planks were secured to the front and reverse of the transport frame to prevent distortion of the support due to its considerable weight. This measure was especially done to prevent diagonal distortion when handling the panel. The space between the perpendicular planks and the panel was further cushioned (on both the front and reverse) with foam blocks covered in tissue paper to achieve optimal support over the entire picture surface. Because of its size, the painting had to be brought horizontally (on its right side) to the main entrance of a museum in a truck. Six people then carried it up the main staircase into the Gallery.

Aided by the transport frame and the uniform stabilization of the entire picture surface, the painting could again be laid flat on the floor and uprighted for mounting in the frame. The entire transport was monitored with a vibration logger.[111]

The frame, custom built by the carpenters, was separately transported in the same way. In the Gallery, the frame was placed upright and held vertical by lateral wooden supports. The altarpiece could then be mounted in the frame. To secure it, two blocks of wood with foam cushioning facing the panel[112] were screwed to the frame at both the upper and lower edges, along the centre axis. At the sides, flexible plates with Teflon strips[113] were attached to hold the painting but allow some movement on slight changes to the panel (e.g. on changes in room humidity). To achieve the best possible and complete contact of the uneven lower edge, small blocks of wood were fitted, which also corrected the slightly askew vertical position before treatment. To allow the heavy panel to slide on its lower edge, a 2 mm thick strip of polycarbonate[114] was screwed to the bottom of the frame rebate. Its smooth surface should allow the movement of the wood blocks, which are additionally treated with soap. After the mounting in the frame, the painting was hung on cables.

After this enormous effort of conservation and framing, precautions were likewise taken to preserve and protect the artwork. It was important to shield the reverse of the painting from dust and, as much as possible, from short-term changes in room humidity. This is to be achieved through two layers of a very smooth, densely woven, acid-free and dirt-repellent fabric,[115] which was attached to the back of the frame with Velcro *(figs. 64 and 65)*.[116]

One additional preventive measure, the protection of the front of the painting by glazing, could not be considered because of the size and already great weight of the object.[117]

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110 This frame was also used in modified form as an auxiliary frame during the entire conservation process.

111 *Testo 184 G1*, available at: https://www.testo.com/de-AT/testo-184-g1/p/0572-1846 [last accessed: 16 November 2020].

112 Foam: black cellular rubber, Nuschei Spezialdichtungen GmbH, Vienna.

113 Spring plates: Temart® spring plate, available at: https://deffner-johann.de/de/temart-federblech-large-chromatisiert.html [last accessed: 14 December 2020] with strips from PTFE® (Polytetrafluorethylene) sheets, available at: https://www.s-polytec.de/kunststoffplatten/ptfe-platten/ptfe-platten-teflon-im-zuschnitt.html [last accessed: 14 December 2020].

114 192 × 9 cm, Wettlinger Kunststoffe Handelsg.m.b.H., Vienna.

115 Unisono III fabric, 100% cotton; black (100)/Création Baumann; Oddy tested for permanent use, KHM data sheet no. 23/10.

116 Belousek Leopoldine & Co GmbH, Vienna.

117 Altarpiece (110 kg) and frame (120 kg).


a

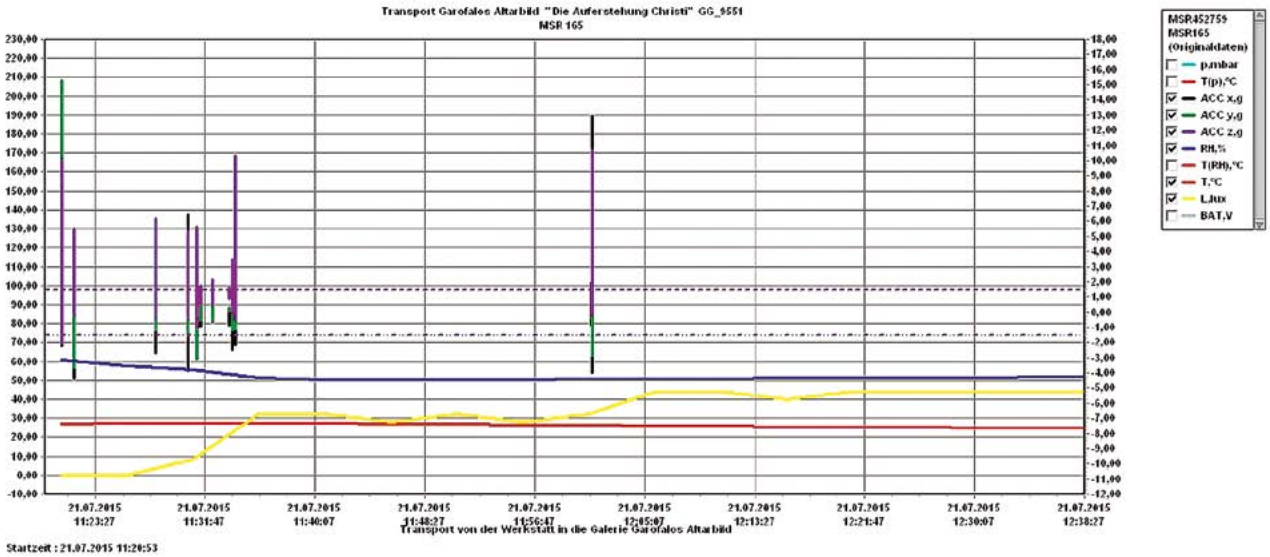

b


c


d


e


f


Transport Garofalos Altarbild "Die Auferstehung Christi" GG_9551
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Transport von der Werkstatt in die Galerie Garofalos Altarbild
Startzeit : 21.07.2015 11:20:53
g

Fig. 64: a. Transport frame with cushioning on the front and reverse for the horizontal transport of the painting.
b. Transport with a truck.
c. Transport up the main staircase of the museum.
d. Vertical positioning of the painting to mount it in the frame.
e. Transport of the frame up the main staircase.
f. Set-up for framing.
g. Shock logger and its readings: a slight number of impacts, minimum values of 2 g and two maximum values of 12 g and 15 g (m/s^2).
h. Securing the sides using flexible plates with Teflon strips.
i. The reverse after mounting in the frame.
j. Overall after attaching the protective backing.
k. Securing the panel along the middle axis at the upper and lower edges with two wooden blocks attached to the frame with screws.
l. Hanging the altarpiece from doubled cables using a jack.

Fig. 65: Final position after adjustment of the altarpiece.

8. THANKS

We sincerely thank the numerous colleagues, who helped in the realization of this difficult and comprehensive conservation project,[118] particularly Silvia Ferino-Pagden, former Director of the Picture Gallery, and her successor Stefan Weppelmann. Special thanks are also due to Elke Oberthaler, Head of Paintings Conservation of the Picture Gallery, for professional exchange and support, and to the Department of Visual Media (Stefan Zeisler, Andreas Uldrich, and Michael Eder).

[118] We would especially like to thank Anne Campman, Markus Geyer, Eva Götz, Rudolf Hlava, Sonja Kocian, Michael Odlozil, Ina Slama, Monika Strolz, and Elisabeth Wolfik for their support of the conservation treatment.

SUMMARY

Following its acquisition in 1962, Garofalo's 1520 *Resurrection of Christ* altarpiece, still on its original support, could no longer be presented in the Picture Gallery of the Kunsthistorisches Museum from 1976, despite two rounds of conservation measures, due to severe damage. The poor condition of the monumental work (acute flaking, yellowed varnish, earlier water damage, etc.) made a comprehensive conservation treatment necessary, which was supported by an interdisciplinary research team comprised of curators, conservators, and scientists.
In preparation and parallel to the conservation measures, the scientific study of the painting technique played an important role, aided by investigations including infrared reflectography, x-radiography, microscopy, and binding medium analysis.
The artist's use of a limited selection of painting materials could be confirmed: drying oil as the binding medium for the paint layers, gypsum as the ground, an *imprimitura* containing lead white, and pigments including lead white, azurite, vermilion, lead-tin yellow, ochre, carbon black, and copper green are common for the artist's period and region. The brilliant colourism of his palette, achieved through the use of a glazed painting technique, is impressive for this work and could be confirmed as typical for Garofalo's oeuvre through comparison with his other paintings.
The treatment of the altarpiece sought both the stabilization of the endangered substance (consolidation of woodworm-damaged areas, securing of lifting paint, regluing of cracks in the support) and the unified appearance of the picture through aesthetic measures (removal of overpainting, retouching, and yellowed varnish; compensation/integration of abrasion and losses) to allow the quality of the painting's brilliant colourism to again be appreciated. A new frame was also made and additional preventive measures undertaken to ensure that this masterpiece of Ferrarese Renaissance painting remains publicly accessible in the long term.

ZUSAMMENFASSUNG

Nach seiner Erwerbung 1962 konnte Garofalos Altarbild *Die Auferstehung Christi* aus dem Jahre 1520, mit noch originalem Bildträger, aufgrund massiver Schäden trotz zweier Restaurierungsmaßnahmen ab 1976 nicht mehr in der Gemäldegalerie des Kunsthistorischen Museums präsentiert werden. Der schlechte Erhaltungszustand des monumentalen Werks (akute Malschichtabhebungen, vergilbter Firnis, frühere Wasserschäden usw.) machte eine umfassende Restaurierung notwendig, die von einem interdisziplinären Forschungsteam, bestehend aus Kuratoren, Restauratoren und Naturwissenschaftlern, begleitet wurde.
Im Vorfeld und parallel zu den Restaurierungsmaßnahmen wurde der wissenschaftlichen Aufarbeitung der Maltechnik und Bildgenese des Gemäldes mithilfe von technologischen Untersuchungen wie Infrarotreflektografie, Röntgenaufnahmen, Mikroskopie und Bindemittelanalysen ein bedeutender Stellenwert beigemessen. Als Ergebnis konnte die Verwendung einer limitierten Auswahl von Materialien durch den Künstler bestätigt werden: Trocknendes Öl als Bindemittel der Malschichten, Gips als Malgrund, eine bleiweißhaltige Imprimitur und Pigmente wie Bleiweiß, Azurit, Zinnober, Bleizinngelb, Ocker, Kohlenstoffschwarz und Kupfergrün zählen zu den gängigen Malmitteln seiner Zeit und Region. Die durch Anwendung der Lasur-Maltechnik brillante Farbigkeit seiner Palette zeigte sich beeindruckend für dieses Werk und konnte durch Vergleich mit anderen Gemälden als typisch für Garofalos Œuvre verifiziert werden.
Die Restaurierung des Altarbildes erzielte sowohl eine Stabilisierung der gefährdeten Gemäldesubstanz (Festigung holzwurmgeschädigter Bereiche, Konsolidierung von Malschichtabhebungen, Verleimung von Rissen im Bildträger) als auch ein geschlossenes Erscheinungsbild durch konservatorische und ästhetische Maßnahmen (Abnahme von Übermalungen, Retuschen, vergilbtem Firnis; Schließung/Integration von Bereibungen und Fehlstellen), um die Qualität der brillanten Farbigkeit der Malerei wieder voll zur Geltung zu bringen. Außerdem wurde für das Gemälde ein neuer Zierrahmen angefertigt und weitere präventive Maßnahmen gesetzt, um dieses Hauptwerk ferraresischer Renaissancemalerei langfristig der Öffentlichkeit zugänglich machen zu können.