

Raphael's Paintings in French Museums: Some New Results from Recent Technical Investigations

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The musées de France own six paintings dating from before Raphael's move to Rome in 1508. In the Louvre is the *Angel with Scroll* (Fig. 1), a fragment of the altarpiece of the Coronation of Saint Nicholas of Tolentino ordered from Raphael and Evangelista da Pian di Meleto for a church in Città di Castello and delivered in September 1501. It also has a *Saint George* (Fig. 3) and a *Saint Michael* (Fig. 2), two small panels which form a pair and which date from around 1503–4, as well as the *Virgin and Child with the Infant Saint John*, known as *La Belle Jardinière*, which bears the date of 1508.¹ The Musée Condé in Chantilly



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owns the tiny *Three Graces* (Fig. 4) dated circa 1504–5, which forms a companion piece to the London *Allegory* also known as *The Vision of a Knight*. It also holds the *Orleans Madonna* (Fig. 5), another small painting which dates from 1505–7. From a later period is the Chantilly *Loreto Madonna*, which dates from Raphael's stay in Rome and which will be mentioned as a comparison to the other earlier works.²

All of these works have already been examined from a scientific point of view, notably by Lola Faillant-Dumas, Jean-Paul Rioux, Sylvie Béguin, Charles de Couessin and Elisabeth Martin.³ However, most of these studies are at least twenty years old and need to be re-evaluated through new technical investigations for the following reasons. Firstly, the C2RMF now owns new scientific equipment such as the infrared reflectographic camera, which has allowed complete reflectograms of four of these paintings to be made, as well as a scanning electron microscope, with which the old samples were re-examined, notably from the *Angel with Scroll* and the *Loreto Madonna*. Secondly, the more recent studies on Raphael's beginnings and on painting techniques around 1500, notably at the workshop on the painting technique of Perugino in April 2003 organised by Labs TECH (now Eu-ARTECH)⁴, would be enriched by a careful analysis of the *Angel with Scroll*, a part of the earliest panel securely attributed to the artist. Finally, it seemed worthwhile to reconsider some unresolved questions, such as the relationship between the Chantilly *Three Graces* and the London *Allegory*.

The panels and their grounds

The six works are painted on poplar. The wood from the *Angel with Scroll* has been identified by microscopic examination of a sample, and that from the other works visually or by examination of the x-radiographs. Four of the panels apparently retain their original thickness, which is around 6 mm for the *Orleans Madonna*, 13 mm for the *Saint Michael* and the *Saint George*, and 33 mm for the *Belle Jardinière*. Both the *Angel with Scroll* and the *Three Graces* have been thinned.

The four smaller works are painted on a single board. The *Belle Jardinière*, like the *Loreto Madonna*, is painted on three boards which are butt joined and have a narrow strip

Fig. 1 - Raphael, *The Angel with Scroll*, Paris, Louvre.



Fig. 2 - Raphael, Saint Michael, Paris, Louvre.



Fig. 3 - Raphael, Saint George, Paris, Louvre.

Fig. 4 - Raphael, The Three Graces, Chantilly, Musée Condé.

of cloth embedded in gesso covering the joins. The same was observed on the *Angel with Scroll* (Fig. 6), a fragment which consists of two planks. On *Saint Michael* and *Saint George* the gesso and paint does not extend to the very edge of the panel (the exposed wood is now overpainted), which proves that the paintings had integral frames when they were made. The same is probably true for the *Three Graces*, as we shall see later. In contrast, we know that the *Orleans Madonna* was painted unframed because the ground extends to the edges of the panel and the limit of the paint film is defined by an incision line drawn about 13 mm from the edge (Fig. 7). A similar border of unpainted ground can be observed in the *Loreto Madonna*, but not in the *Belle Jardinière*, which is painted up to the edges.

Analysis of samples showed that the gesso on the *Angel with Scroll* consists only of *gesso sottile*, without a first layer of *gesso grosso* (Figs. 8 and 9). The use of a single kind of gesso was frequent in Umbria or in the Marches, but was rare in Florence, although Raphael continued to use only *gesso sottile* even when he was in Florence.⁵ This gesso was probably not covered with a layer of glue, and this seems to have limited the delamination often observed in Raphael's paintings between the gesso and the paint film. It is covered by a rather thick white *imprimitura* (20–50 microns). This *imprimitura* is thicker than that used by Perugino during the same period, and that used later by Raphael, for example in *La Belle Jardinière*, where it is only 5 microns thick and was missed in previous technical examinations. Some strong

oblique streaks on the X-radiograph of the *Orleans Madonna* indicate the presence of an *imprimitura*; these streaks are less evident in the X-radiographs of the other works by Raphael that were studied.

In the *Angel with Scroll*, as in the other works studied, analyses have allowed us to detect a very small amount of lead-tin yellow, also called *giallorino*, in the *imprimitura* (mixed with lead white); an *imprimitura* of similar composition was used by Perugino⁶ and also by some other contemporary painters.⁷ In his treatise, Leonardo da Vinci mentions an "imprimatura di biacca e giallorino" which he recommends for application on paper⁸, but he doesn't seem to have used it himself.

The *imprimitura* also contains some powdered glass, of a now well-known composition which includes some manganese.⁹ This can be seen in samples in the scanning electron microscope (Fig. 9), due to its darker grey appearance in the back-scattered image relative to the lighter grey matrix of lead white. It is present in much greater quantity than the lead-tin yellow (*giallorino*). There is no powdered glass in the *imprimitura* on the *Loreto Madonna*, where instead an equivalent amount of red lead was found, a material which tints the layer and which has a proven siccativ effect. Perugino seems not to have used powdered glass in the *imprimitura* on his works before 1500, and even after then seems to use it very rarely, since manganese was not detected across the whole painting in the many works that have been studied by X-ray microfluorescence.¹⁰ Samples from the panels from Certosa di Pavia, painted before the *Angel with Scroll*, have been examined in the scanning electron microscope, and no powdered glass was found in the *imprimitura*.¹¹



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The paint film

The presence of an *imprimitura* seems to be directly linked to the use of an oil medium for the paint film. The use of an *imprimitura* on the early *Angel with Scroll* suggests that the young Raphael used oil from the beginning of his career, as confirmed by recent analyses.¹² The use of an oil medium was strongly encouraged in Urbino by Federico da Montefeltre, who invited Justus of Ghent and Pedro Berruguete to paint his studiolo in the Ducal Palace around 1475.¹³ But what was left in Urbino of this oil painting practice, especially in the workshop of Giovanni Santi, Raphael's father, who worked partly in oil and partly in *tempera grassa*?¹⁴ He died in 1494 but his workshop most likely continued to function after his death, possibly under the direction of Evangelista da Pian di Meleto,

the painter who worked on the Blessed Nicola da Tolentino altarpiece with Raphael.

The X-radiographs of the *Angel with Scroll* (Fig. 6) show a rather thick and pasty paint film, with characteristic long brush strokes. This technique is rather different and heterogeneous compared to what was found in the X-radiographs of the other surviving parts of the altar: the brushstrokes are softer in the *Angel's head* from Brescia, more blended in the *Virgin*, more rapid in the *God the Father* and more simple in the cherubs from the Naples' Pinacoteca di Capodimonte.¹⁵ However, in each fragment a similar and rather X-ray opaque paint film rich in lead white can be seen, and a similar way of depicting flesh with a pasty material which forms



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Fig. 5 – Raphael, *The Orleans Madonna*, Chantilly, Musée Condé.

Fig. 6 – Raphael, *The Angel with Scroll*, X-radiograph.

Fig. 7 – Raphael, *The Orleans Madonna*, X-radiograph.

a common ground among the different hands who worked on this altarpiece. This shows a different approach to that of the thin layers of paint used by Perugino, for example in his depiction of *Tobias* in the London panel from the Certosa di Pavia, where the similarities with the *Angel with Scroll* appear to be more in composition than in technique. Raphael also worked with thin layers for his flesh tones, but only in later years, as can be seen in *La Belle Jardinière* (Fig. 10).

In the *Angel with Scroll* extensive use of powdered glass was observed; it was found in the mordant gilding for the silver leaf of the collar, in the blue areas, in the grey-brown of the architecture and mixed with vermilion (Fig. 9). This use of powdered glass is quite unlike Perugino's who, at the end of the fifteenth century, restricted its use to a siccativ for his red lake glazes; Raphael does not seem to have used it in this way and for this purpose at this period. Powdered glass was not detected in the three samples from the *Belle Jardinière*, taken from two areas of blue and one of green, but it was found in samples from the *Loreto Madonna* in association with the red lake for the Virgin's dress and in small amounts in the child's flesh and the green hangings.

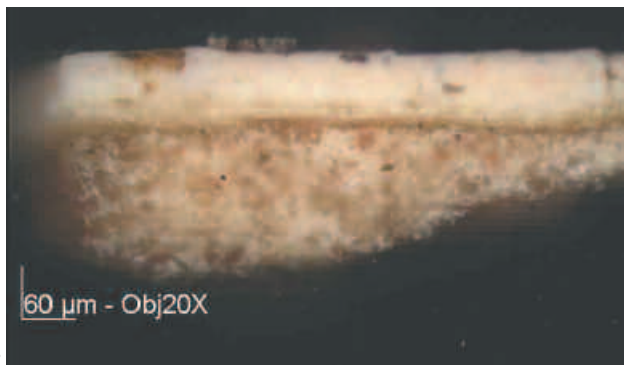
In the brownish layer of the background of the *Angel with Scroll* a black pigment, sometimes large in particle size, was found in which sulphur and carbon were detected by energy dispersive X-ray analysis in the scanning electron micro-

scope. In comparison with the National Gallery's recent research, this material can be identified as a 'black coal.'¹⁶ We have not found this material in other paintings, perhaps because of the lack of samples coming from brown layers based on earth pigments. Perugino used this pigment in his paintings from around 1500.

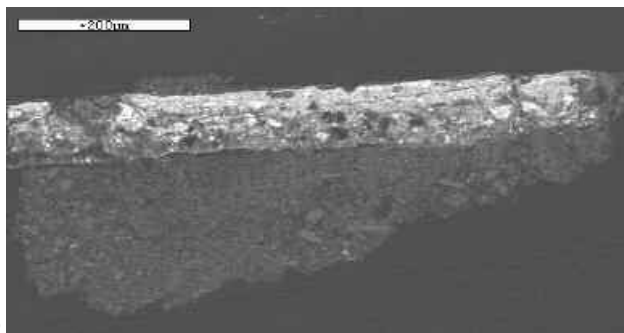
We prefer not to speculate on the respective influence of the painters from Urbino and from Perugia on the young Raphael, since Perugino himself was influenced by Giovanni Santi, Raphael's father.¹⁷ However, we would like to emphasise the importance of powdered glass in Raphael's paintings and to point out that the first known example in Italian easel painting of the use of smalt, which is powdered glass coloured with cobalt, is found in Urbino in the second phase of the decoration of Federico da Montefeltre's studio, from around 1475.

The underdrawing

Infrared photography shows that the underdrawing of the *Angel with Scroll* is very faint and limited to a few lines used for positioning the mouth and the nose. However, in some cross-sections of paint samples a very thin layer of black particles, which is probably underdrawing, was seen directly on the gesso (Fig. 8). The underdrawing may therefore



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Fig. 8 – Raphael, The Angel with Scroll. Cross section of a sample from near the angel's ear. From the bottom upwards; gesso, black pigment possibly associated with the underdrawing, imprimatura, paint film.

Fig. 9 – Raphael, The Angel with Scroll. Back-scattered image of the cross section in Fig. 8 showing glass particles in the imprimatura.

Fig. 10 – Raphael, The Belle Jardinière, X-radiograph of the head.

Fig. 11 – Raphael, Saint George, infrared reflectogram.

Fig. 12 – Raphael, Saint George, cartoon for the Louvre Painting (Firenze, Gabinetto disegni e stampe degli Uffizi).



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possibly lie under the lead white-based *imprimitura* and therefore be difficult to detect by infrared. These black particles are very scattered and seem to be embedded in a slightly proteinaceous medium. The use of incised lines is limited to the architecture.

The underdrawing is easier to discern in the other paintings. The underdrawing on *Saint George* (Fig. 11) can be compared to a preliminary drawing now in the Uffizi in Florence (Fig. 12)¹⁸, which is pricked for transfer and is the same size as the painting, but whose direct link to this work is sometimes questioned because of the numerous differences between them.

In fact, the underdrawing on *Saint George* appears to be the missing link between the drawing and the painting. Some details of the drawing, such as the skull and the

bones, disappear in the underdrawing while other details are present in both the drawing and the underdrawing but disappear in the painting, such as the horse's tail and the first position of the sword's hilt. Finally, others seem to have been directly sketched with a brush during painting, as is the case with the princess and the countryside. This shows the great variety of methods used by the artist, and the constant evolution of his compositions.

We were not able to examine the pricking of the Florence cartoon but it is presumably limited to the main lines of the drawing, allowing the master to considerably rework the organisation of the forms and the placing of the shadows, and to draw details such as the harness of the horse. A fragment of the spear which pierces the dragon's throat is left unchanged between the drawing and painting. This is not



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Fig. 13 – Raphael, *Saint George*, detail of the fragments of the spear showing incised lines.

the case for the pieces of spear lying in the foreground; absent from the drawing, they are engraved with a pointed tool whose lines can be seen in raking light and in the X-radiograph and seem to be situated near the surface (Figs. 13 and 14). These incisions appear to be an intermediate stage between the underdrawing and the painting, as with the sword where the incised lines differ from the underdrawing but correspond to the painting.

No preparatory drawing is known for the *Saint Michael*, but the mechanical aspect of the underdrawing and the focus on the outlines lead us to assume that a cartoon was used (Fig. 15). As already noted, the left part of the countryside was considerably reworked. The X-radiographs show that the fortress was different initially and that everything around it was repainted on a layer containing a large amount of lead white (Fig. 16). This layer was applied at a later stage and altered the outline of *Saint Michael's* right cheek, which eventually had to be reworked with some reddish dots. The initial composition of the countryside possibly corresponded

to the pinkish sky we can see under the wings of the angel, which now has no clear link to the rest of the painting.

The *Procession of Hypocrites* is painted over the lead white layer with a very subtle and refined mix of gold leaf and shell gold, which is slightly enhanced with a dark paint for the shadows of the clothes. The *Saint Michael* is one of the most elaborate of Raphael's paintings in its use of gold, sumptuously enhancing the angel's wings or imperceptibly adorning the horns of the little monster placed under the shield. It can only be compared to the Sao Paolo *Resurrection of Christ*, convincingly ascribed to Raphael in the London exhibition.¹⁹ This use of gold is reminiscent of the methods of the Quattrocento.

The use of gold aside, we must point out the many similarities that link *Saint George* and *Saint Michael*. They have an identical panel thickness, their painted surface is the same size, they show the same use of incised lines for the sword and the same red colour placed over a grey undercoat, topped by some bluish-grey strokes which seem to corre-



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spond to darkened vermilion. These numerous similarities have led us to propose a closer date of production between the two paintings than is usually suggested.

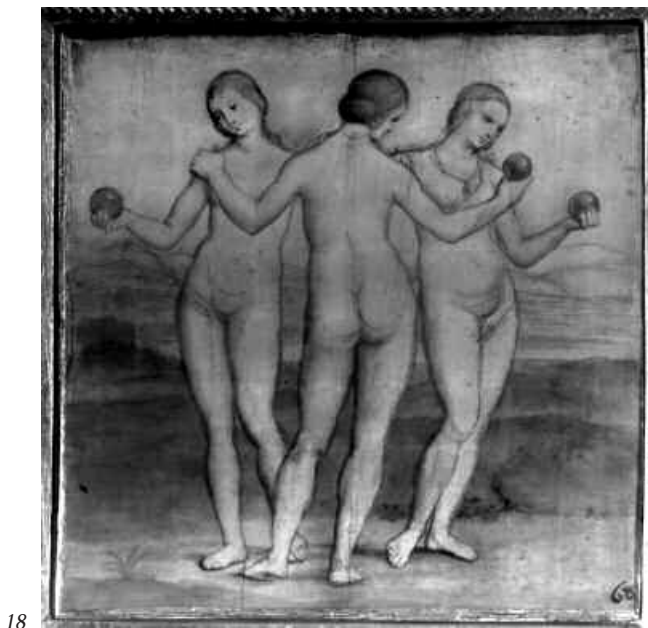
We shall mention briefly the underdrawing on the *Orleans Madonna*, which has been studied by Charles de Couessin (Fig. 17).²⁰ It is noteworthy for the extensive *spolvero* dots, which can be observed in the Virgin and the Child, and for the free-hand drawing used for the definition of the forms and the background.

Fig. 14 – Saint George, X-radiograph.

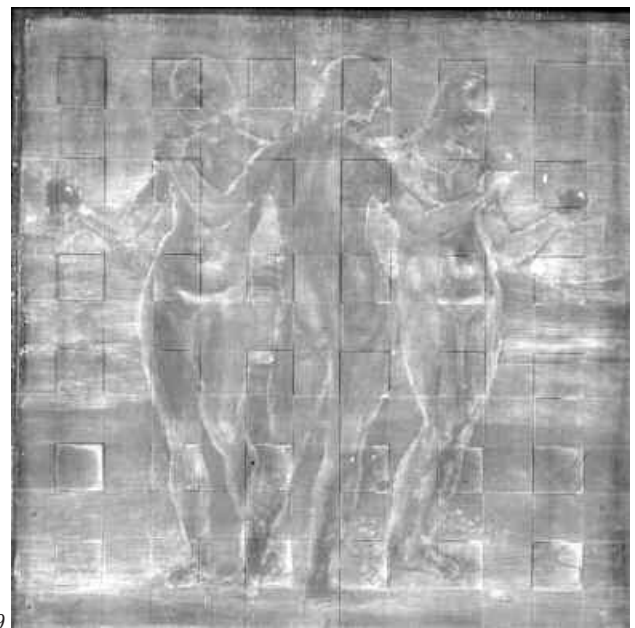
Fig. 15 – Raphael, Saint Michael, infrared reflectogram.

Fig. 16 – Raphael, Saint Michel, X-radiograph.

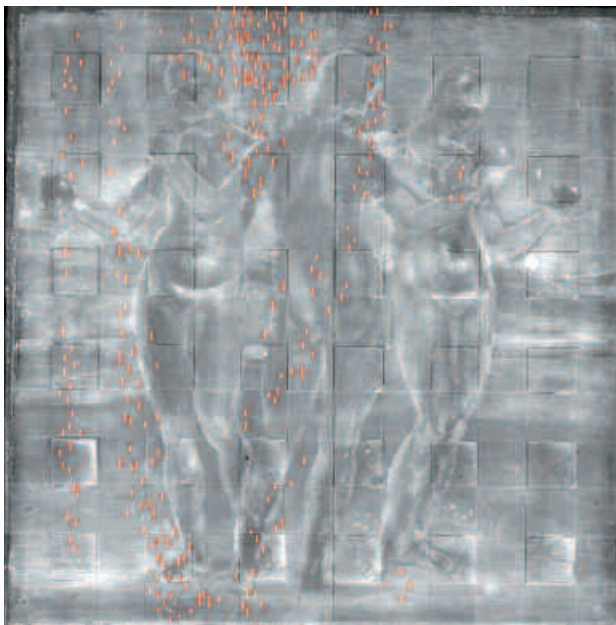
Fig. 17 – Raphael, The Orleans Madonna, infrared reflectogram.



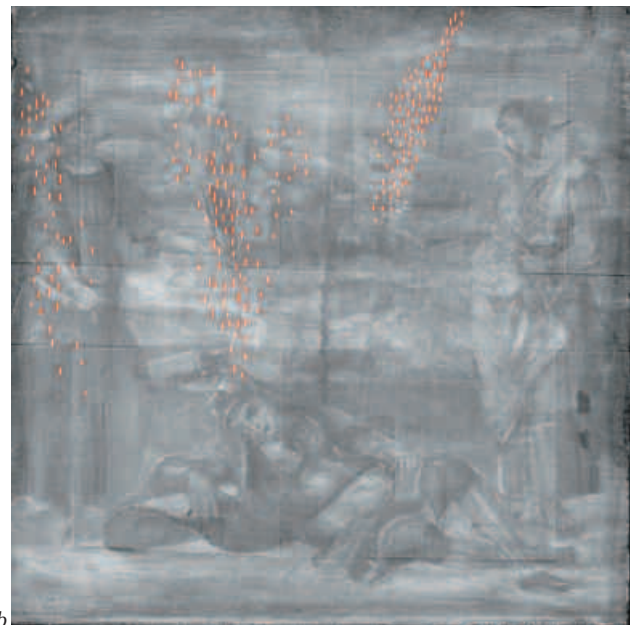
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20b

The Three Graces

We shall end with the *Three Graces* (Fig. 4). The painting is associated with the London *Allegory* known as *The Dream of the Knight* in that they each belonged to the Borghese collection in the 17th century. They share a miniature aspect and an identical size.

The *Three Graces* is painted on poplar. The wood has been thinned to about 2 mm, like the *Allegory*, and strengthened by a glued cradle. The ground is white and is probably covered with an *imprimatura*. The underdrawing has already been studied by Charles de Couessin and Sylvie Béguin.²¹ As demonstrated by Sylvie Béguin, the three Graces were initially represented with Beauty on the left, holding an apple, with Love in the centre, and with Modesty on the right, her hand hiding her pubis (Fig. 18). The lack of equilib-

rium of this first drawing appears clearly. Next, Raphael seems to have sketched a perfectly symmetrical movement of the arms, placing an apple in the hand of the Grace on the right at the same level as the Grace on the left. Finally, having placed an apple in the hand of the central Grace, he lowered slightly the hand of the Grace on the right and decided to completely break the symmetry by moving the left hand of the Grace on the left.

Other compositional changes can be seen, notably in the

Fig. 18 – Raphael, *The Three Graces*, infrared reflectogram.

Fig. 19 – Raphael, *The Three Graces*, X-radiograph.

Fig. 20a and b – Raphael, *The Three Graces* (Chantilly, Musée Condé), Raphael, *The Allegory* (London, National Gallery), X-radiographs with red dots indicating the main networks of the pores in the wood panel.

countryside, where the mountains were initially higher and closer to the foreground, and in the source of light, which came initially from the left, as indicated by the hatchings placed on the right side of the bodies.

Examining the borders of the painting, along the lower edge a bulge of paint and a barbe can be seen which testify that the painting was made after the panel was framed, at least at the bottom. However, no bare wood remains on the external edge of this border, which has been trimmed and bevelled. The left and top edges have no bulge of paint but were also bevelled. Since the bevelling has left traces of abrasion on the paint film, we can conclude that this was done after the completion of the work.

A gold line runs along three edges; it covers the bevelling and runs over the external edge of the barbe at the bottom; it was applied after the integral frame was removed. The fourth edge, which was changed afterwards, has no gold and is cut neatly. With the help of Marika Spring from the National Gallery London, we were able to compare the borders of the Chantilly and London paintings. The *Allegory* has the same barbe on the lower edge; this shows that the London painting was also painted in an integral frame. None of the edges are bevelled but they have the same golden border on the four sides. As in the Chantilly painting, the gold runs over the external barbe of the lower edge. In London, the gold covers some orange-red paint and dark greenish blue, which stop where the original paint ends and which could be linked to the original frame. Both paintings have therefore been similarly modified after their completion; the integral frame has been removed, the bare wood has been cut, they have been thinned to about 2 mm, the borders have been covered with a golden line.

This is important because nothing is really known about the origins of these paintings. Many hypotheses have been proposed but none totally proven. Did the paintings form a pair? Were they intended as book covers, or as two wings of

a diptych? Was the *Allegory* the cover of the *Three Graces*, or vice-versa, or were they the front and the reverse sides of one panel which was later divided?

Thanks to the National Gallery London we are able to compare the X-radiographs of the paintings.²² In both cases the gesso-soaked surface allows us to see the signature of the wood. On the *Three Graces* (Fig. 19 and Fig. 20a) a typical array of rings centred around a knot located at the top edge can be seen. A very similar array on the *Allegory* (Fig. 20b) allows us to conclude that the two panels probably came from the same part of the same tree. However, we cannot go further with this conclusion, because the boards are tangentially sawn and come from the central part of a tree. Moreover, we did not notice any major loss or crack that would have indicated a common history between the two works.

Our present conclusion, slightly modified since our talk at the London meeting, is that the two paintings were probably made at the same time, with wood coming from the same tree, but without any indication that they once composed the two sides of a single work. This conclusion seems to be reinforced by an inventory of the Borghese collection, dated around 1615–30 and recently published, where the two paintings are described separately:²³

–251: Un quadro delle tre Gratie cornice d'ebano, alto 2/3, alto 2/3, Rafael in tavola

–252: Un quadro delle tre Virtù cornice d'ebano, alto e largo 2/3, Rafael in tavola.

In this inventory, more than anywhere else, the two paintings appear as a pair, if the identification of the London *Allegory* as The Three Virtues can be confirmed. And we shall keep in mind, thanks to Jürg Meyer zur Capellen²⁴, that the Hesperides are the wardens of the golden apples given by the goddess Gaia to Zeus and Hera as a wedding present; were these paintings intended for a marriage?²⁵

Notes and references

1. *Angel with a Scroll*, Paris, Musée du Louvre, RF 1981-55, poplar (analysed), 55 x 36 cm.

Saint George fighting the dragon, Paris, Musée du Louvre, Inv. 609, poplar (Marette n°538), 30.5 x 26.6 (painted surface: 29.5 x 25.6; thickness 1.3 cm). *Saint Michael*, Paris, Musée du Louvre, Inv. 608, poplar (Marette n°537), 30.9 x 26.5 (painted surface 29.5 x 25.4; thickness c.1.4 cm). *La Belle Jardinière*, Paris, Musée du Louvre, Inv. 602, poplar (Marette n°540), 122 x 80 cm.

2. *The Three Graces*, Chantilly, Musée Condé, Inv. 38, poplar, 17.5 x 17.4 (painted surface 17.1 x 17.2; thickness 0.2 cm). *The Orleans Madonna*, Chantilly, Musée Condé, Inv. 39, poplar, 31.7 x 23.3 (painted surface 29.2 x 20.6; thickness 0.6/0.7 cm). *The Loreto Madonna*, Chantilly, Musée Condé, Inv. 40, poplar, 120 x 90.5 (painted surface 117.5 x 87.5; thickness ca 2.6 cm).

3. For preceding technical studies of these paintings, see Faillant-Dumas L. and Rioux J.-P., 'Raphaël étudié au Laboratoire', *Hommage à Raphaël: Raphaël dans les collections françaises*, exh. cat., Paris, Grand-Palais, 1983, pp. 411–428; Lautreite A., 'Etude au Service de la restauration des peintures des musées nationaux', *Hommage à Raphaël: Raphaël dans les collections françaises*, exh. cat., Paris, Grand-Palais, 1983, pp. 429–443; Faillant-Dumas L., 'Etude de la technique picturale et du dessin sous-jacent de quelques tableaux de Raphael', *ICOM-CC, 7th triennial meeting, Copenhagen 1984*, pp. 84.1.10–84.1.13; Béguin S., 'The Saint Nicholas of Tolentino Altarpiece', *Raphael before Rome, Studies in the History of Art (Symposium series V)*, 1986, Vol. 17, pp. 15–28; Béguin S., 'Contribution des techniques de laboratoire à l'étude du retable de saint Nicolas de Tolentino', *Raffaello, recenti indagini scientifiche*, ICOM Comitato nazionale italiano, Milano, June 1986, s.d., pp. 31–33; de Couessin C., 'Le dessin sous-jacent de quelques tableaux de Raphaël des

- collections publiques françaises', *Raffaello, recenti indagini scientifiche*, ICOM Comitato nazionale italiano, Milano, June 1986, s.d., pp. 65–96; Béguin S., 'Nouvelles recherches sur le 'Saint Michel' et le 'Saint Georges' du Musée du Louvre', in Sambucco M. and Stocchi M.L. eds., *Studi su Raffaello*, Atti del Congresso Internazionale di Studi, Urbino meeting 1984, Urbino-Florence 1987, pp. 455–464; Béguin S., 'Nouvelles analyses résultantes de l'étude et de la restauration des Raphaël du Louvre', *The Princeton Raphael Symposium: Science in the Service of Art History*, Princeton 1990, Shearman J. and Hall M.B. eds., pp. 39–47; Martin E. and Bret J., 'Enquête technique sur quelques chefs-d'œuvre italiens', *Les peintures italiennes du musée Condé à Chantilly*, s.l., Editoriale Generali, 2003, pp. 198–219.
4. Brunetti B.G., C. Seccaroni and A. Sgamellotti eds., *The Painting Technique of Pietro Vannucci, called Il Perugino*, *Proceedings of the LabS Tech Workshop, Quaderni di Kermes*, Florence 2004.
 5. Martin E., Sonoda N. and Duval A.R., 'Contribution à l'étude des préparations blanches des tableaux italiens sur bois', *Studies in Conservation*, 37, 1998, pp. 82–92.
 6. Landau A., Martellotti G., Moiola P., Scafè R., Seccaroni C. and Traversa E., 'Identification d'une terre riche en zinc dans les œuvres tardives du Pérugin', *Art et Chimie, la Couleur, Actes du Congrès Paris 1998*, 2000, p. 199. Found in Perugino's *Madonna della Consolata* (Perugia, Galleria Nazionale dell'Umbria), dated around 1496–98.
 7. Dunkerton J. and Spring M., 'The development of painting on coloured surfaces in sixteenth century Italy', *Painting Techniques: History, Materials and Studio Practice*, Preprints of the IIC Congress, Dublin 1998, Roy A. and Smith P. eds., pp. 120–135.
 8. Raphael Trichet du Fresne, *Trattato della Pittura di Lionardo da Vinci*, 1651, chap. 352.
 9. Martin E. and Rioux J.-P., 'Comments on the techniques and the materials used by Perugino, through the study of a few paintings, in French collections', *The Painting Technique of Pietro Vannucci, called Il Perugino*, *Proceedings of the LabS Tech Workshop, Quaderni di Kermes*, Brunetti B.G., Seccaroni C. and Sgamellotti A. eds., Florence 2004, pp. 43–56.
 10. Landau A. et al., cited in note 6, but manganese can remain unnoticed by XRF if it is in a deep layer.
 11. Roy A., 'Perugino's Certosa di Pavia Altarpiece: new technical perspectives' in *The Painting Technique of Pietro Vannucci, called Il Perugino*, *Proceedings of the LabS Tech Workshop, Quaderni di Kermes*, Brunetti B.G., Seccaroni C. and Sgamellotti A. eds., 2004, p. 13–20.
 12. Roy A., Spring M. and Plazzotta C., 'Raphael's Early Work in the National Gallery: Paintings before Rome', *National Gallery Technical Bulletin*, 25, 2004, pp. 4–35.
 13. Bret J. and Martin E., 'Les portraits d'hommes illustres du Studiolo d'Urbino au Louvre par Juste de Gand et Pedro Berruguete, annexe: restauration et étude technique', *La Revue du Louvre et des Musées de France*, 1–1991, pp. 114–16.
 14. Roy A., Spring M. and Plazzotta C., cited in note 12, p. 8.
 15. Thanks to the Pinacoteca di Capodimonte we were allowed to study these pictures in 1982.
 16. Spring M., Grout R. and White R., 'Black Earths': A Study of Unusual Black and Dark Grey Pigments used by Artists in the Sixteenth Century', *National Gallery Technical Bulletin*, 24, 2003, pp. 96–114.
 17. Hiller von Gaertringen R., *Raffaels Lernerfahrungen in der Werkstatt Peruginos*, Munich and Berlin 1999, pp. 212–213.
 18. Florence, Gabinetto disegni e stampe degli Uffizi, n°530E, 266 x 267 mm.
 19. *The Resurrection of Christ*, oil on wood, 52 x 44, about 1501–2, Museu de Arte de Sao Paulo Assis Chateaubriand, Sao Paulo, 17.1958, in Chapman H., Henry T. and Plazzotta C., *Raphael, from Urbino to Rome*, exh. cat., London, National Gallery, 2004, n°21, p. 108.
 20. de Couessin C., cited in note 3.
 21. de Couessin C., cited in note 3; Béguin S., cited in note 3.
 22. Thanks to Ashok Roy and Marika Spring who allowed this examination, and to Jo Padfield who reduced the effect of the cradles in the X-radiographs of the two paintings.
 23. Corradini S., 'Un antico inventario della quadreria del Cardinale Borghese', *Bernini scultore, la nascita del barocco in casa Borghese*, exh. cat., Rome 1998, pp. 449–456. The identification of the London *Allegory as Three Virtues* doesn't seem to have been previously proposed. We thank Dottoressa Kristina Hermann Fiore for the reference to this inventory hitherto only partially published.
 24. Meyer zur Capellen J., *Raphael. The Paintings. Volume I. The beginning in Umbria and Florence ca. 1500–1508*, Landshut 2001.
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