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Plate 1 *The Virgin and Child before a Firescreen* (NG 2609). Panel, whole, including later additions (see text), 63.3 × 48.8 cm. After cleaning and restoration.

The Virgin and Child before a Firescreen: History, Examination and Treatment

LORNE CAMPBELL, DAVID BOMFORD, ASHOK ROY AND RAYMOND WHITE

History

LORNE CAMPBELL

The Virgin and Child before a Firescreen (NG 2609) (Plate 1) came to the National Gallery as part of the bequest of George Salting (1836–1909).¹ It had previously belonged to Léon Somzée (1837–1901), a Belgian collector, who bought it in Venice in 1875.² Some time before then it had been on the Florentine art market; it had come from the collection of the ‘Conte de Bardi’,³ Enrico di Borbone, Conte di Bardi (1851–1905), brother of Roberto, the last reigning Duke of Parma.⁴ The only indication of its earlier history is an inscription on the reverse, written in an eighteenth- or nineteenth-century hand: *conte balbiano* (Fig. 1).⁵ A Balbiano family had divided into three titled branches, the marchesi di Colcavagno, the conti di Viale and the conti di Aramengo.⁶ The Balbiano were from the small town of Chieri, near Turin. From Chieri had come many, perhaps most, of the ‘Lombard’ money-lenders active in the Low Countries during the fifteenth century.⁷ Prominent among them were the Villa di Villastellone, who commissioned several important Netherlandish works of art.⁸ The Balbiano intermarried with descendants of the Villa⁹ and it is just possible that the *Virgin before a Firescreen* had been acquired by, or even commissioned for, a money-lender from Chieri, perhaps a member of the Villa family, and that it had passed by descent to the Balbiano.

Evidently before being sold to Somzée in 1875, the picture was restored.¹⁰ The unknown restorer, presumably an Italian, was responsible for the strips added at the top and right side of the panel. The strip at the top is pure invention, for it makes nonsense of the structure of the fireplace; the strip on the right may have been based on the restorer’s fantasy, or else on some knowledge of what he was replacing.

A version of the *Virgin*, lent in 1911 to an exhibition at Charleroi by a Madame Reboux from Roubaix, was published in 1926 but cannot now be found and is known only from the rather inadequate reproductions made in 1926 (Fig. 2).¹¹ It was a smaller, slightly simplified but generally faithful version and was thought to have been painted towards the end of the

fifteenth century. Here the window is closed and the ‘heraldic medallions’ on the glass, which would have identified its first owner, are nowhere described and cannot be deciphered in the reproductions. A simple, undecorated cupboard with a half-open door and a brass bowl take the places of the elaborately carved cupboard and complex chalice added in the last century to the *Virgin before a Firescreen*. The missing section probably showed a cupboard and bowl similar to those in the Reboux version.

It was Wilhelm von Bode who, in 1887, first associated the *Virgin before a Firescreen* with the *Merode Triptych* (now in New York, Metropolitan Museum of Art, The Cloisters).¹² Hugo von Tschudi in 1898 attributed to his ‘Master of Flémalle’ the paintings grouped by Bode with the *Merode Triptych*; the *Virgin before a Firescreen* has been almost unanimously given to the Master of Flémalle, identified by many art historians as Robert Campin.¹³

Even if a nineteenth-century restorer has enhanced the splendour of the Virgin’s surroundings, it is surely a mistake to call her room a ‘humble, everyday setting’.¹⁴ The floor is inlaid with valuable coloured stone; the bench and fireplace are of types thought suitable by an illuminator of about 1450 for a French royal palace;¹⁵ the Virgin’s robes are decorated with gold and edged with jewels; her book has a jewelled clasp; and her firescreen is only slightly smaller than that behind the Duc de Berry in the January miniature of the *Très Riches Heures*.

Certain incongruities seem to demand explanation. The Virgin is not sitting on the bench or on its footrest but is at some intermediate level. It appears impossible to make sense of the structure of her skirts and mantle. Her right arm is in a cramped and awkward position and she would feed the Child more gracefully and more naturally if she put her right hand to her left breast. The Child ignores her exposed breast; the gesture of his left arm is puzzling, without obvious meaning. The book floats precariously between the Virgin and the cushion.

The painting is close in style and technique to the *Merode Triptych*. If it is accepted that the centre panel of the *Triptych*, the *Annunciation*, is by a pasticheur follower of Campin, it may prove possible



Fig. 1 *The Virgin and Child before a Firescreen*. Inscription on the reverse of the panel.



Fig. 2 Version of *The Virgin and Child before a Firescreen*. Panel, 46 × 38 cm. Formerly in the collection of Madame Reboux.

to explain some of the anomalies of the *Virgin before a Firescreen* by postulating that it, too, is based on several Campinesque compositions.¹⁶

A resemblance has been noted between the *Virgin before a Firescreen* and Rogier van der Weyden's *Saint Luke drawing the Virgin* in Boston (Fig. 3).¹⁷ In the Rogier, however, the Virgin is securely supported by cushions placed on the footrest of her bench; her garments have a logical structure; and she feeds the Child in a natural way by taking her right breast in her left hand. She is seated before a red and gold cloth of honour. The upper part of the background in the London picture is underpainted in vermilion and the painter's original intention may have been to include a similar cloth. Campin appears to have been responsible for a *Saint Luke painting the Virgin*, known from a version of about 1500 signed by the Brussels artist Colijn de Coter (Vieure near Moulins, parish church).¹⁸ There the Virgin's bench is against a fireplace and the Child plays with a string of beads, which explains the gesture of his right hand. The painter of the London picture, reversing the figure, has omitted the beads and the gesture has lost its meaning. In a Campinesque *Holy Family* (Le Puy, cathedral), the Child is similarly posed and the Virgin and Saint Joseph sit on a bench in front of a closed fireplace. An angel holds a large open book towards which the Virgin looks.¹⁹ In drawings after a Campinesque *Virgin and Child with Saints and Donors* (Paris, Louvre, Cabinet des Dessins, and Paris, Ecole des Beaux-Arts), the Virgin is enthroned on a bench draped with cloth and beside her is a cushion remarkably similar to the cushion in the *Virgin before a Firescreen*.²⁰ The painter of the London picture would seem to have taken his Virgin from Rogier and his Child from Campin's lost *Saint Luke*. Both figures are reversed and placed in uneasy relation to each other and to their setting, an interior similar to rooms depicted in several Campinesque paintings.²¹ In assembling the elements of his composition, the painter has not given much attention to logic of space, structure or emotional interaction, but, whereas the *Merode Triptych* is incoherent in design, the *Virgin before a Firescreen* is skilfully composed around one diagonal axis.

In the landscape seen through the window, the tiny figures are dressed in the fashions of about 1440. The men's clothes, with waists at waist level and skirts above the knees, are decidedly later in style than the clothes of the bystanders in Rogier's *Saint Luke*, where waists and skirts are lower.²²

It would therefore seem that the *Virgin before a Firescreen* was painted in about 1440 and that it is a creative amalgam of Campinesque and Rogierian ideas by an artist of considerable skill.

Treatment and examination

DAVID BOMFORD

Structure and condition before cleaning

Apart from minor repairs, *The Virgin and Child before a Firescreen* had not been treated since acquisition by the Gallery in 1910 (Fig. 4). Since then it had become progressively obscured by dirt, darkening varnish and discoloured retouchings. Although cleaning had been desirable for many years, the decision to proceed was postponed because of the problem of the nineteenth-century additions which formed nearly a quarter of the entire painting.

The extent of the additions is shown in Fig. 5. That at the right, which runs the whole height of the panel, is 9 cm wide and includes the entire cupboard and chalice, the Virgin's elbow and the right-hand parts of the firescreen and fireplace. The top addition, 3 cm deep, runs from the left side of the panel to meet the right-hand addition above the Virgin's shoulder: it includes the upper part of the window with the horizontal window bar, the top of the shutter and part of the left side of the fireplace. The line where the top addition meets the top edge of the original panel slopes upwards slightly from left to right: this suggests that it is not an original edge and that at least some wood has been trimmed from the original at the top.

Where the original part meets the right-hand addition may well have been an original join and the panel may have simply lost its right-hand member: this is discussed further below. In any case, there can be no certainty that the size of the additions makes up the size of the original panel, or that what is painted on them reflects what was there in the beginning: indeed, the reconstruction on the top addition was shown to be erroneous during cleaning. The bottom edge of the panel appears to have been trimmed a little. The left edge is the only remaining original one.

The additions are attached by a heavy wooden framework on the back of the panel; these are of a different wood from the original oak (probably walnut) and are seen to be heavily worm-channelled in the X-radiograph (Fig. 10).

The panel has an original join 17 cm from the left edge (see Fig. 5) which has been broken in the past and repaired very unevenly. There is also a repaired vertical split running through the faces of the Virgin and the Child. Both the join and the split have been reinforced with mahogany buttons attached to the back of the panel. There is paint loss along both the split and the join and also in the region of some short but complex splitting in the lower left corner. Before cleaning, all these losses were extensively covered with discoloured retouching. The whole painting – original part and additions – was covered with layers of dirt and discoloured, opaque varnish which were concealing much of the detail and quality of the work.



Fig. 3 Rogier van der Weyden, *Saint Luke drawing the Virgin*. Panel, painted surface 135.3 × 108.8 cm. Boston, Museum of Fine Arts. Gift of Mr and Mrs Henry Lee Higginson.



Fig. 4 *The Virgin and Child before a Firescreen*. Before cleaning.



Fig. 5 *The Virgin and Child before a Firescreen* showing later additions (right and top), original join (broken line) and major splits (solid lines).



Fig. 6 *The Virgin and Child before a Firescreen*. After cleaning, before restoration.

Cleaning

When cleaning commenced it was judged it would be desirable to retain and continue to display the additions, so it was important that the nineteenth-century paint should be left intact. Therein lay a problem, because this paint was based on a varnish medium which was readily soluble in organic cleaning solvents. In order to clean it safely, a water-based soap²³ was used (on the nineteenth-century paint only) to thin the discoloured varnish gradually.

The original paint on the main part of the panel was cleaned straightforwardly with normal cleaning solvents.²⁴ The extensive discoloured paint along the join and splits was slowly removed by scalpel. Original paint was recovered at the edges of the panel, where it had been covered by encroaching nineteenth-century paint from the additions – and this resulted in two unexpected gains.

First, some horizontal folds appeared next to the fur cuff of the Virgin's left sleeve (Fig. 8). These not only gave important clues about the intended structure of the sleeve, but were also more purple in colour than the rest of the Virgin's mantle: this was the first indication that a significant colour change had occurred in the drapery (see p. 33).

Secondly, important structural elements of the fireplace were uncovered above the Virgin's head (Fig. 7). A double metal ring can now be seen just above the centre strut of the firescreen: this may be the support of the firescreen itself, or of a chain to a water pot hanging behind. Moreover, the ring is clearly above the centre strut of the fireplace, a thin slice of which is now visible at the top edge of the original part of the panel: this wedge-shaped fragment survived only by virtue of the upward slope of the cut edge here. Its presence confirms that the reconstruction of the fireplace on the top addition without a lintel was incorrect. The ring and lintel fragment had been visible in the X-ray photograph before cleaning, but their significance was not clear until cleaning uncovered them.

Cleaning also revealed many details in the main part of the picture which had been either painted out or rendered indistinct by the darkened varnish. One significant detail that had been suppressed by a previous restorer was the area of Christ's genitals (see Figs. 4 and 8). We may assume that this was intended as a particular focus of the painting since, as infra-red examination makes clear (see below), the composition was deliberately modified in order to give prominence to this part of Christ's body. Consequently, painting it out was an intentional alteration of an important part of the picture's iconographic programme.

An octagonal floor-tile, overlapped by a corner of the Virgin's mantle at the lower left, had also been overpainted. When cleaned it became apparent that it

was intended to be recessed, light catching its vertical edges at the right (see Fig. 4 and Plate 1). It is a curious detail of which the significance (if any) is unclear; a recessed tile seems domestically hazardous and no comparable examples have yet been noted in paintings elsewhere.

Subtle effects of light were revealed by the removal of the darkened varnish. Yellow points of the fire are now visible through the woven firescreen, and a previously invisible flame dances at its lower left edge. The near edge of the window shutter now has a prominent highlight, reflecting the light of the fire: with precise observation, the painter has stopped the highlight at just the point where the projecting buttress of the fireplace blocks the firelight. Perhaps the cleverest – if slightly fanciful – light effect is that on the leg of the stool at the left. The highlights on its right side are of two distinct colours – pink above the cross-bar and white below, presumably representing reflected firelight and daylight respectively.

Everywhere, the exceptional quality of the original paint was made evident by cleaning. From the minutely detailed landscape beyond the window, to the individual drops of milk flowing from the Virgin's breast, this painting is now seen to be a work of jewel-like precision.

Retouching and presentation

The condition of the cleaned picture is shown in Fig. 6. There is a clear disparity between the original part and the additions. The paint on the additions is darker and muddier in tone than the adjacent original, presumably because it was matched to colours already covered by opaque, discoloured varnish. Flake losses and filled damages also make the junctions between original and additions seem prominent and the overall impression is of a large, unbalanced fragment visually separated from its extensions.

The decision was made to keep the additions and to retain the familiar form of the composition. This was a famous image and a famous nineteenth-century restoration. It seemed in many ways desirable that the entire image should be preserved, provided that the original and later parts could be distinguished in some way.

This, then, was the aim of the restoration. All damages within the original part were filled and retouched first, including the join, splits and scattered small losses. Damages adjacent to the additions were retouched up to the limit of the original paint. The paint on the additions was then retouched by means of thin glazes and scumbles: the purpose was not to match the adjacent original exactly, but to aim for a colour that was fractionally darker. In this way, the viewer could take in the whole composition without too sharp a discontinuity, but could distinguish



Fig. 7 *The Virgin and Child before a Firescreen*. Detail after cleaning, before restoration. Above the Virgin's head, a metal ring and a narrow strip of the fireplace lintel have been revealed at the top edge of the original panel.

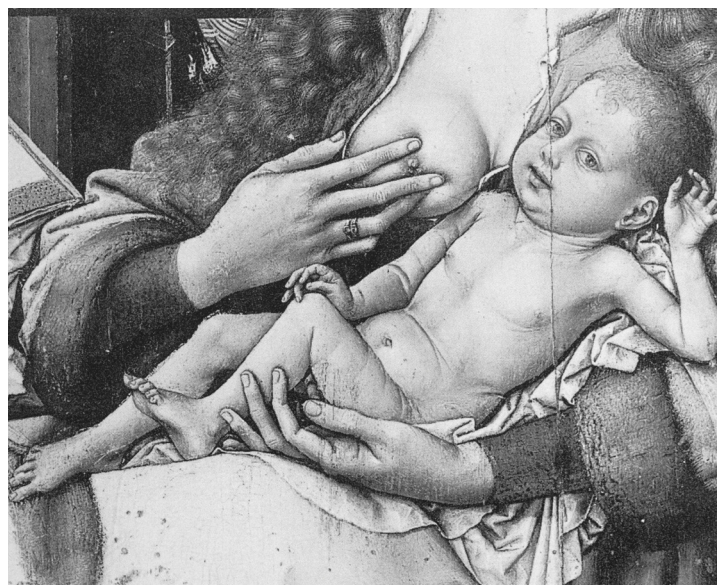


Fig. 8 *The Virgin and Child before a Firescreen*. Detail after cleaning, before restoration. At the underside of the Virgin's sleeve, horizontal folds are now visible that had been concealed beneath paint encroaching from the adjacent addition (see Fig. 4). The Child's genitals, overpainted by an earlier restorer, have been uncovered.

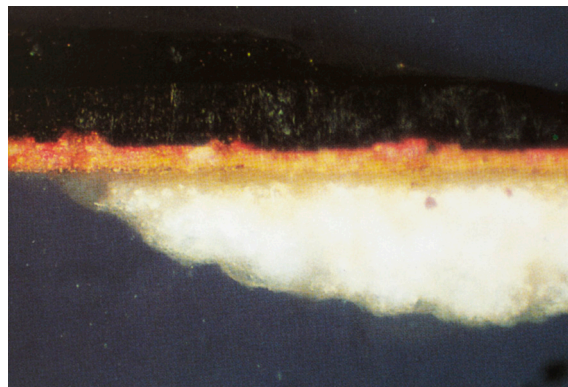


Plate 2 Cross-section from dark background above firescreen, before cleaning. The early lay-in containing vermilion over the chalk ground is clearly visible. Over this is the original black background, some varnish and overpaint. Photographed in reflected light under the microscope at 275x; actual magnification on the printed page 240x.



Fig. 9 *The Virgin and Child before a Firescreen*. Detail after cleaning and restoration. Small damages and splits have been filled and retouched.



Fig. 10 *The Virgin and Child before a Firescreen*. Composite X-ray photograph.

between original and later paint on closer examination (see Plate 1 and Fig. 9).

The essential form of the nineteenth-century restoration was preserved. The Gothic cupboard, the chalice and the wrongly coloured last jewel on the hem of the Virgin's mantle (it should have been blue) were all left as they were. Less justifiably perhaps, the missing lintel across the fireplace was not reconstructed, despite the fact that this left the newly discovered original fragment floating in space above the Virgin's head. If this is later considered too strange, a reconstruction on the top addition could be made.

For the present, the panel is exhibited unframed in acknowledgement of its fragmentary state and hangs opposite the unframed fragmentary *Magdalen Reading* by Rogier van der Weyden.

Surface examination

Two observations made during microscopic examination threw light on a major change of composition during the evolution of the painting and a possible explanation for the fragmentary nature of the picture.

First, it was observed in all damages in the background of the upper half of the picture that a red layer is present below the visible paint; this was confirmed in the X-radiograph and by cross-sections (see, for example, Plate 2). This red underlayer, identified principally as vermilion, seems to extend across the entire painting down to the level of the bench seat, but not under the figure of the Virgin. A possible explanation for it is that the painter at first intended the Virgin to be seated before a cloth of honour, for which this red was to be the basic colour. The idea seems not to have been pursued beyond the preliminary lay-in, and the interior scene was painted over it.

The second observation was of a small area of blistered, pitted paint at the right edge of the original part, just below the Virgin's fur cuff. This had the appearance of a burn mark and may be a clue to the cutting-down of the picture: if it had been in a fire and the right side of the panel was damaged, a restorer may well have replaced wood up to an original join. At the same time, the top of the panel may also have been singed, trimmed off with a cut that was not (as we have seen) quite level, and a thin strip of new wood added. This explanation still gives us no firm evidence as to the original dimensions of the panel, but it is probable that the restorer knew how much he was replacing and might not have changed the size significantly.

X-ray examination

The X-ray image (Fig. 10) is dominated by the framework that holds the original and the additions together and also by the denser, worm-channelled wood of the additions themselves.

Fig. 11 *The Virgin and Child before a Firescreen*. X-ray detail. The Child's eyes originally looked upwards (see Fig. 9). The Virgin's left hand (or some drapery) was originally placed higher up across the Child's thigh.



The join in the original panel running vertically through the book is clearly visible. Along the bottom, left and top edges of the original part, irregularly spaced dowel holes can be seen. A possible explanation of these is that the panel was once pegged to a surrounding frame;²⁵ their irregular positioning may have been deliberate – to avoid creating lines of weakness along the grain of the panel or the frame.

The X-ray photograph reveals a number of pentimenti and corrections of outline. The most striking example is that of the Child's eyes which now look out at the viewer but – in the X-ray image – look upwards towards the window (Figs. 9 and 11). The reserve left for the Virgin's head within the firescreen was smaller than the present head: the hair has been extended somewhat over the woven screen. The Virgin's face, too, is a slightly different shape in the radiograph – a little broader in the forehead: in its final state, the forehead has been narrowed by bringing in the hair-line fractionally.

Other changes are evident in the Virgin's sleeves. Her right sleeve was narrower and simpler in outline, without the exaggerated folds now seen next to the book. Her outer cuffs may not originally have been made of fur: in the X-ray, they seem to be of the same crisp material as the rest of the mantle. The inner blue cuffs, now tight around her wrists, seem to have been looser and to have hung down a little.

The position of the Virgin's left hand appears to have been altered: a shadowy thumb lies just above its present position and covers the Child's genitals. This is discussed further in the section below on infra-red examination. The Child's right leg was initially

broader, overlapping the Virgin's wrist. There are also changes in the position of his feet which show more clearly under infra-red reflectography.

These numerous, but largely minor, alterations have been cited by Frinta²⁶ to support his suggestion that *The Virgin and Child before a Firescreen* evolved through distinct states over an extended period of time. In our view there is no evidence for this: such changes as these are no more than the normal revisions many painters make in determining the final shape of their work.

Close inspection of the X-ray image shows brushstrokes of the vermilion red layer that underlies the upper half of the picture. They can be seen most clearly as diagonal streaks between the book and the firescreen.

Infra-red examination

Infra-red reflectography reveals a certain amount of underdrawing and some pentimenti. Van Asperen de Boer has published a fairly comprehensive set of reflectograms²⁷ and our findings are similar, even if the inferences we draw are not precisely the same.²⁸

Underdrawing is only visible in the Virgin's draperies. There appears to be no underdrawing in the floor (except for shadows of the Virgin's robe), the background or distant landscape. None is detectable in the faces or hands by infra-red reflectography, but, as noted below, there are underlayers present which would block infra-red radiation. In fact, cross-sections indicate that there is a substantial amount of drawing beneath the faces and hands (see also Table 1).

The types of underdrawing have been accurately

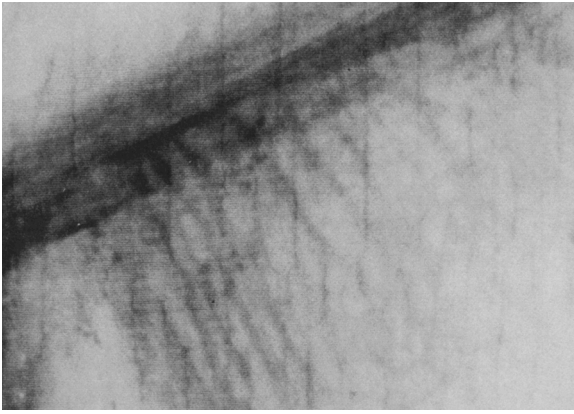


Fig. 12 *The Virgin and Child before a Firescreen*. Infra-red reflectogram detail of fold and shadow in the Virgin's robe.

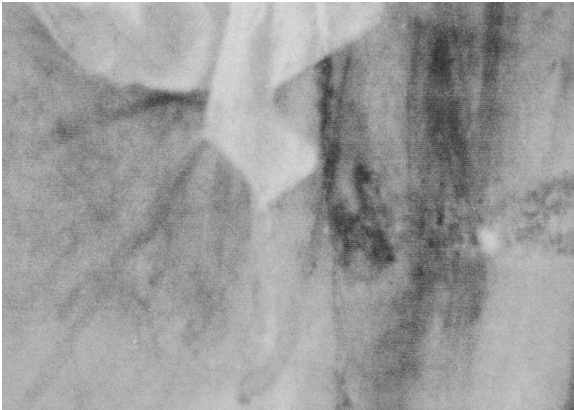


Fig. 13 *The Virgin and Child before a Firescreen*. Infra-red reflectogram detail of the Virgin's robe below the white cloth.



Fig. 14 *The Virgin and Child before a Firescreen*. Infra-red reflectogram detail of a deep fold in the Virgin's robe.



Fig. 15 *The Virgin and Child before a Firescreen*. Infra-red reflectogram detail of the Virgin's robe.

summarised by van Asperen de Boer and are confirmed and expanded here. The main folds of the Virgin's gown are indicated by thick lines, sometimes curved at the ends and, in two places making extended S-shapes. The shadows in the folds are indicated by short irregular strokes perpendicular or angled to the principal fold lines (Fig. 12). Just below the Child's white cloth, several folds are indicated quite simply with single broad fluid strokes and no shadow hatching (Fig. 13). Deep, sharply angled folds are drawn with clusters of parallel curves, also probably in a fluid medium (Fig. 14). Shallow modelling elsewhere is indicated by general formations of lightly curved strokes. Finally, there is one passage of looped drawing – a succession of curved Ws – seen in one of the lower folds of the gown but not apparently repeated elsewhere (Fig. 15).

Van Asperen de Boer²⁹ sees the underdrawing described here as closely resembling that seen in the Frankfurt *Virgin and Child*, one of the key works in the Master of Flémalle oeuvre. In our view, there are similarities of a general kind – broad, fluid fold lines, irregularly hatched shadows and clusters of curved parallels for sharper folds – but these might also be described as fairly common conventions. Indeed, the main fold lines on the Frankfurt panel seem considerably bolder than those on the *Virgin before a Firescreen*, and the hatched shadows more expansive. We are, therefore, reluctant to make any direct connection between the underdrawing on the Frankfurt and London panels. Interestingly, the underdrawing of the Merode *Annunciation* (New York, Metropolitan Museum of Art, The Cloisters), published by van Asperen de Boer,³⁰ also has a superficial resemblance in places to that of the London panel, but the shadows are extravagantly cross-hatched in a way quite unlike either the London or Frankfurt panels.

Infra-red reflectography also illuminates the nature of the pentimenti on and around the Child, some of which have already been seen in the X-ray image. As mentioned above, there is a strong indication that the Virgin's hand and/or some drapery has been moved down to reveal the area of the Child's genitals, clearly intended to be a focus of the composition. In the infra-red reflectogram assembly (Fig. 16) the higher first position of the hand or drapery is seen as a dark band across the Child's thigh.

The Child's feet, as far as we can tell, have also been altered at the painting stage. The left foot was initially turned slightly towards the viewer and the original positions of the toes to the right of their present position can be seen both in the reflectogram and on the picture itself. The right foot seems either to have had drapery across it, or to have been painted over the underlying folds: this can be seen both in the X-ray and in the infra-red reflectogram.



Fig. 16 *The Virgin and Child before a Firescreen*. Infra-red reflectogram mosaic showing detail of the Child and the Virgin's left hand.

Technical analysis

ASHOK ROY AND RAYMOND WHITE

Technical examination of the *Virgin and Child before a Firescreen* was undertaken with two principal aims in mind: first, to provide a material analysis of the picture in support of its recent cleaning and restoration, the results of which are described above by David Bomford; secondly, to investigate the general characteristics of layer structure and technique as part of a programme of study by Lorne Campbell of Early Netherlandish paintings at the National Gallery.³¹

There are insufficient specific data on the painting methods and materials of the Master of Flémalle or Campin group for the results noted here to form a reliable basis for attribution or dating of the *Virgin before a Firescreen*. In fact there are problems in defining Campin's oeuvre in the first place.³² Some general comparisons with techniques, sometimes classified as pre-Eyckian may be made, however, and the method of painting of the *Virgin before a Firescreen* can be correlated with some other technical results for fifteenth-century Netherlandish painting recorded in the literature.³³ In this study, particular attention has been paid to the analysis and differentiation of paint media within the layer structure of the picture, for example in examining the complex method of flesh painting (see below; Plate 3 and Fig. 17), and to interpreting the role of the design and underpainting stages in the final image. The hypoth-

esis that the initial design may have involved a vermilion backdrop perhaps in the form of a cloth of honour draped behind the Virgin is dealt with above. The cross-sections and radiographic evidence that reveal the extent of this substantial pentimento are not discussed here, since the dense red underlayer present in the upper half of the painting is a feature peculiar to this panel and not, of course, a general characteristic of the type of technique.

In certain respects, *The Virgin and Child before a Firescreen* is typical and standard for a Netherlandish painting: the support is an oak panel³⁴ with a preparation of natural chalk³⁵ bound in animal glue.³⁶ Examination of the underdrawing has been made by infra-red reflectography (see pp. 27–8) and by layer structure investigations. It is interesting that an earlier infra-red survey noted that, 'reflectograms do not reveal any underdrawing at all in the Virgin's face'; interpretation was confined to noting some minor changes in design between the drawing stage and the painted image.³⁷ A series of cross-sections taken for the present study explains the relative lack of clarity in the infra-red reflectogram mosaics. There were phases of execution that tend to block the penetration of infra-red radiation to the drawing layer: underpaints containing carbon-based dark pigments are present on top of the drawing. In the case of the flesh paints, two layers of this kind were applied, effectively reducing infra-red access to the lowermost drawn image (see Plate 3). Sombre-toned or mono-

Table 1 The layer structure of 'The Virgin and Child before a Firescreen'

	<i>Underdrawing</i> ¹	<i>Underpaint(s)</i> ²	<i>Upper paint layer(s)</i> ³
<i>Background</i>			
Black background	+	Red ⁴	Carbon black
Grey-brown column, near shutter, left	+	Red ⁴	Carbon black, lead white, yellow ochre
Green hillside seen through window	++	i. Pinkish red ⁴ ii. Cool mid-grey	White, lead-tin yellow(?) [azurite]
Highlight on firescreen	+++	i. Cool grey ii. Pinkish red ⁴ iii. Warm grey	1. White, black, lead-tin yellow 2. White, black, lead-tin yellow 3. White [lead-tin yellow]
Green cloth on bench	+	i. Red ⁴ ii. Cool grey	1. Verdigris, lead-tin yellow 2. Verdigris [lead-tin yellow] 3. Thin copper green glaze
Pink of cushion	?	Red ⁴	1. White, red lake 2. Red lake, vermilion, white [black] 3. Thin red lake glaze
Yellow-green edge of Virgin's book	+	i. Red ⁴ ii. Pink body colour of cushion	White, lead-tin yellow
<i>Foreground</i>			
Cream-coloured tile, left-hand side	+	Warm brownish grey	Mainly lead white [trace tinting pigments]
Grey-green tile, left-hand side		Warm brownish grey	Mainly lead white [trace tinting pigments]
<i>Virgin's drapery</i>			
Deepest purple-toned shadow	+++	Thick translucent dark brown shadow	Ultramarine, red lake
Mid-tone, greyish blue	+++	Cool grey	Ultramarine, white, red lake
Highlight	+	Cool grey	White, ultramarine [red lake]
Greyish-green lining	+	i. Cool grey ii. Greenish azurite with white	Azurite, white [black]
<i>Flesh</i>			
Highlight on Virgin's brow	?	i. Cool grey ii. Warm grey-brown	1. White, vermilion [earths, black] 2. White, vermilion [earths, black]
Shadow on Virgin's chin	+	i. Cool grey ii. Warm mid-brown	1. Vermilion, red lake, earths [black] 2. Earths, black [white]
Child's thigh, mid-tone	+	i. Cool grey ii. Warm grey-brown	White, vermilion [earths, black]: two layers
Highlight on Child's chin	+	i. Cool grey ii. Warm pinkish grey	White, vermilion [earths, black]: two layers
<i>Right-hand addition</i>			
Gold thread on Virgin's hem			Naples yellow (lead antimonate) ⁵
Virgin's sleeve			White, Prussian blue

Notes

1. The density of the underdrawing layer detected in cross-sections is indicated by the number of crosses.
2. The order of paint layers in the understructure is given, the lowest layer listed first.
3. The uppermost paint layer is listed last. Minor component pigments are noted in brackets.
4. The underlayer of vermilion present in the upper part of the picture (see text).
5. Identified by XRD; agreement with JCPDS file No. 18-687 (synthetic bindheimite; lead antimony oxide).

chrome paint underlayers are present beneath the design in general, for example in the Virgin's robe (Plate 4), the tiled foreground, and parts of the background, including the firescreen and the view through the open window. However, it appears only to be for the flesh paint that a second brownish modelling underlayer was used over grey (Plate 3). The layer structures for the underdrawing and underpainting stages are collected in Table 1.

Cross-sections show that the white chalk ground was given first a very thin warm brown toning (*imprimatura*), containing red and yellow earth pigments combined with a little black and white, presumably to reduce the stark whiteness of the ground. The medium of this *imprimatura* cannot be determined by analysis – its thickness is no more than 2μ – although staining tests suggest a proteinaceous content.³⁸ The main elements of the composition were drawn on to the *imprimatura* using a fluid material containing carbon black pigment. The drawing layer is most clearly seen in cross-sections taken from the flesh of the Virgin and the Child (Plate 3), and from the Virgin's robe (Plate 4), but it appears also in background details and must have been a fairly detailed stage in the design of the painting. The difficulty in revealing the extent of this design by infra-red reflectography has already been noted. Some further shading in dark translucent paint was then carried out over the drawing, particularly in the deepest shadows of the folds of the Virgin's robe (see also below), while other parts of the design, planned to be lighter in tonality, including the passages of flesh, were blocked in with a thin grey underpaint (Table 1). The figures of the Virgin and Child were then modelled again in a second thin but dense underpaint of a warmer and browner tone (Plate 3). The final painting of the flesh was carried out in two further layers in which a variety of pigments was mixed with the white (see Fig. 17). The constitution of these upper layers was dictated by the final

tonality, whether highlight or semi-translucent shadow (see Table 1). The flesh paints at the surface, in addition to lead white, contain small quantities of vermilion, red lake pigment, earths and black.³⁹

This complex method of painting, particularly for the representation of flesh, poses the question of the distribution of painting media within the many superimposed layers. The problem has been tackled by a combination of techniques: analysis by gas-chromatography linked to mass-spectrometry (GC-MS) and study of individual layers by Fourier-transform infra-red microspectrophotometry (FTIR), accompanied by staining tests for protein on cross-sections. The results reveal a mixed technique of egg tempera and oil medium, and also that the different media are localised within particular parts of the layer structure. As a broad description, the upper paint layers are bound in linseed oil, not heat-bodied, while egg tempera occurs in the underlayers for the flesh paint and, by inference, in the equivalent grey underpaint structure of the Virgin's robe. These results are summarised in Table 2 and may be compared with some further media analyses and media identification in Early Netherlandish paintings carried out at the National Gallery⁴⁰ and elsewhere.⁴¹ In addition to the use of egg tempera under paint layers bound in a drying oil in the early fifteenth century, the selection also of specific media for certain pigments has been suggested, particularly for paints containing the mineral blues, ultramarine or azurite.⁴² Some reported results imply the use of mixed oil and proteinaceous media within individual paint layers.⁴³ These features were not found in the present painting.

The constitutions of upper paint layers are collected in Table 1. The method of painting, although employing final pure glazes to a limited extent – the pink of the cushion (Plate 5) and the green of the cloth over the bench are examples – is more generally reliant on modelling of paint containing lead white in

Table 2 'The Virgin and Child before a Firescreen': results of media analyses

Chalk ground		Glue ¹
Highlight on Virgin's dress	Upper layers	Linseed oil
Flesh of Virgin's neck (pink)	Upper layers	Linseed oil
Flesh of Virgin's neck (grey)	Underpaint	Egg tempera ¹
Green tile, foreground	Upper layer	Linseed oil
Green tile, foreground	Cream underpaint	Oil ²
Red lake glaze on cushion	Upper layer	Linseed oil
Distant hills, window view		Linseed oil

Notes

1. Confirmed by staining (amido black 10B) on cross-sections.
2. FTIR examination only.

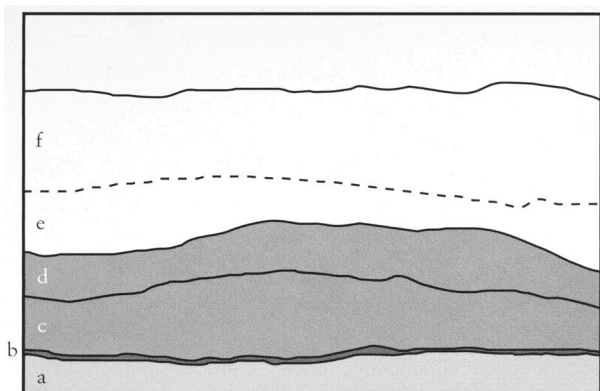


Fig. 17 Schematic diagram for clarity of the paint layer structure for a highlight of the Child's flesh (adapted from Plate 3, below). (a) chalk ground (b) thin brown *imprimatura* and drawing layer (c) cool grey underpaint [egg medium] (d) warm grey-brown underpaint [oil medium] (e, f) pinkish highlight in two layers, *c.* 50 μ , wet in wet [oil medium].

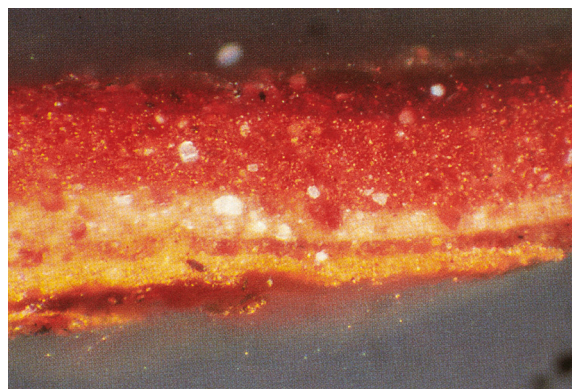


Plate 5 The multilayered paint structure for the pink cushion on the bench. The body colour is of red lake and white and red lake and vermilion. At the surface is a thin layer of virtually pure red lake glaze. The lowest orange-red paint layer is the vermilion underlayer representing the abandoned cloth of honour backdrop (see text and Plate 2, p. 25). Cross-section photographed in reflected light under the microscope at 275 \times ; actual magnification on the printed page 215 \times .



Plate 3 Cross-section from pinkish highlight on the Child's thigh. A very thin *imprimatura* over the chalk ground is just discernible, with some drawing. Over this are two blocking-in paint layers: the first of grey and the second of a warmer grey-brown. The flesh highlight comprises two further layers of lead white tinted with a little vermilion. Photographed in reflected light under the microscope at 510 \times ; actual magnification on the printed page 415 \times .

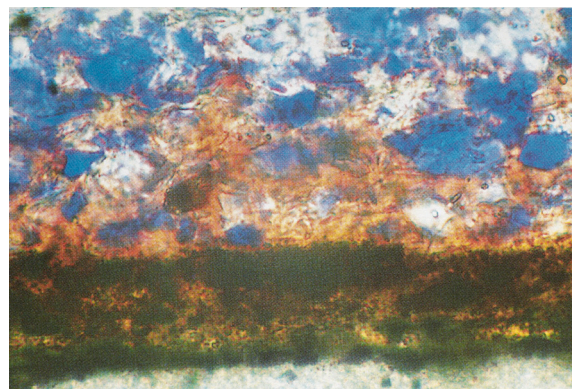


Plate 6 Deepest purple-toned shadow of the Virgin's drapery of natural ultramarine and (madder?) lake. Fading of the red lake component is evident in the upper fraction of the paint layer. Beneath the glaze are several layers of drawing and shadow modelling in dark-coloured paint. Thin cross-section photographed in transmitted light under the microscope at 750 \times ; actual magnification on the printed page 515 \times .

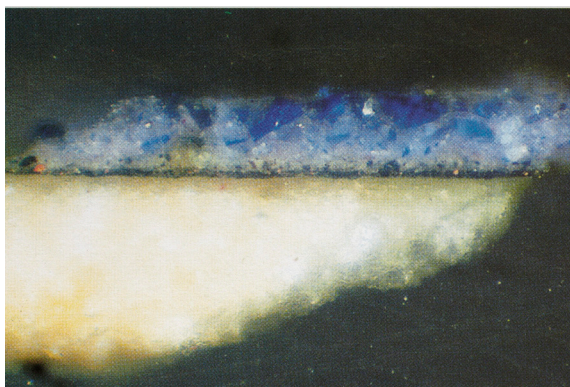


Plate 4 Mid-tone of the Virgin's robe comprising natural ultramarine, white and some red lake pigment (faded). There is an underlayer of cool grey and a thin layer of drawing/modelling of shadow directly over the ground. Cross-section photographed in reflected light under the microscope at 275 \times ; actual magnification on the printed page 260 \times .

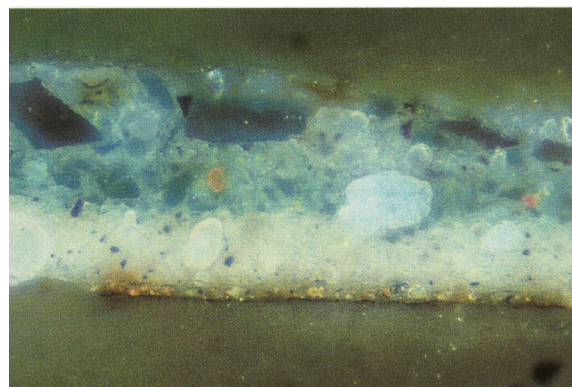


Plate 7 The grey-green turned back lining of the Virgin's robe of natural azurite and white over a cool grey underpaint. The thin brownish *imprimatura* beneath the layer of grey paint is evident. Cross-section photographed in reflected light under the microscope at 660 \times ; actual magnification on the printed page 540 \times .

oil, blended while wet to produce graduations of tone. The larger part of the Virgin's drapery is painted in this manner, and the method of modelling draperies, from dark to light, has been noted⁴⁴ also in Robert Campin's triptych of *The Entombment* (London, Courtauld Institute Galleries) and in the red turban of the Campin *Portrait of a Man* (NG 653.1).

The mauvish blue of the Virgin's drapery revealed by cleaning owes its subtlety of colour to a combination of high-quality ultramarine mixed with a red lake (Plate 6). The lake is probably based on madder.⁴⁵ The technique, however, is quite different to that found for the deep purple dress of the National Gallery *Portrait of a Woman* (NG 653.2) by Robert Campin, in which azurite and red lake are combined, then glazed with a thin layer of natural ultramarine. In the deepest most purple-toned shadows of the Virgin's drapery in the present picture, no white pigment is involved, but the mid-tone and highlight areas contain progressively more lead white to lighten the colour. Examination of thin cross-sections from the shadow values in transmitted light (Plate 6) and ultraviolet light under the microscope demonstrates fading in the red lake component of the mixture,⁴⁶ this effect presumably being more significant in terms of colour change in the mid-tones (Plate 4) and lights where the quantity of red lake pigment in the paint mixture is

lower and white pigment constitutes a substantial proportion. It seems probable, therefore, that two effects of change in the Virgin's robe have taken place: first, an overall diminution in the purplish tone of the drapery, as a result of fading of the red lake component; and, secondly, an increase in the contrast of light and shade in the range of tonal values, brought about by greater loss of colour in the red lake in the lighter parts of the drapery. An attempt using the image-processing capabilities of the VASARI digital imaging system has been made to reconstruct an image of the painting before the colour changes of the drapery took place.⁴⁷

Variation of colour in the Virgin's drapery was clearly one of the painter's interests, since a different blue – natural azurite – was used for the turned-back lining, lending this passage a quite distinctive greenish tonality influenced by the greyish tinge of the underpaint (Plate 7). Another contrast of cool tone is made by the use of pure ultramarine for the cuffs of the Virgin's sleeves.

Note

Dr Lorne Campbell of the Courtauld Institute, University of London, is currently engaged in writing the new National Gallery Catalogue of the Early Netherlandish School.

Notes and references

1. Martin Davies, *Les Primitifs flamands, I. Corpus . . . 3, The National Gallery, London*, 2 vols, Antwerp 1953–4, I, pp. 65–9; idem, *Early Netherlandish School*, National Gallery Catalogues, 3rd edn., London 1968, pp. 25–7; idem, *Rogier van der Weyden, An Essay, with a Critical Catalogue of Paintings assigned to him and to Robert Campin*, London 1972, p. 253.
2. Alfred von Wurzbach, *Niederländisches Künstler-Lexikon*, III, *Nachträge*, Vienna and Leipzig 1911, p. 73.
3. Wilhelm von Bode, *Mein Leben*, 2 vols, Berlin 1930, I, p. 138.
4. Enrico, who had been educated in Italy, Austria, France and England and who had fought in Spain in the Carlist wars, married in November 1873 and may have sold the *Virgin* to raise money for his future wife's establishment. He was later to form an important collection of Japanese works of art. See Francesco Borri, 'Enrico di Borbone Conte di Bardi', *Archivio storico per le province parmensi*, 4^a ser. XIII, 1961, pp. 213–17. He could have inherited the *Virgin before a Firescreen*, for two of his grandparents were noted collectors: his paternal grandfather, the Duke of Lucca (1799–1883), had owned Jan van Eyck's *Lucca Virgin*, now in Frankfurt; while his maternal grandmother, the Duchesse de Berry (1798–1870), had owned Petrus Christus's *Virgin and Child in an Interior*, now in Kansas City.
5. Davies read 'conte balviano (?)' but 'balbiano' seems correct. No Balviano family of comital rank has been traced.
6. Antonio Manno, *Il patriziato subalpino*, II, Florence 1906, pp. 143–8. Giulio Cesare Balbiano di Aramengo and Andrea Balbiano di Colcavagno have been kind enough to inform me that they can find no reference to the picture among their family papers. The Balbiano di Viale family died out in 1871.
7. Georges Bigwood, *Le régime juridique et économique du commerce de l'argent dans la Belgique du Moyen Age (Académie royale de Belgique, Classe des lettres et des sciences morales et politiques, Mémoires, collection in-8°, 2^e sér. XIV)*, Brussels 1921–2, I, p. 235.
8. Riccardo Passoni, 'Opere fiamminghe a Chieri' in *Arte del Quattrocento a Chieri, Per i restauri nel Battistero*, eds. Michela di Macco and Giovanni Romano (*Archivi di arte e cultura piemontesi*), Turin 1988, pp. 67–97 and references.
9. Netherlandish works of art passed from the Villa to the Broglia and the Costa di Trinità. The Balbiano intermarried frequently with the Broglia, and Vittorio Balbiano, last conte di Viale (1794–1871), was the son of Marianna Luisa Costa di Trinità (Manno, op. cit., p. 145).
10. Bode, who knew the picture before it was purchased by Somzée (see note 3 above), made no references to changes in its appearance.
11. *Les arts anciens du Hainaut*, exhibition catalogue, Palais des Beaux-Arts, Charleroi 1911, pp. 58–9; Joseph Destrée, 'Altered in the Nineteenth Century? A Problem at the National Gallery, London', *Connois-*

- seur, LXXIV, No. 296, April 1926, pp. 209–10; the same article appeared in French, 'Un primitif flamand de la National Gallery modifié au cours du XIXe siècle', *Revue d'art*, XXVII, 1926, pp. 22–3, and in Dutch, 'Een Vlaamsch primitief schilderij van de National Gallery, gewijzigd in den loop der XIXe eeuw', *Onze kunst*, XLIV, July–December, 1926, pp. 35–7. A second version, made after the nineteenth-century restoration, may be noted: this was a tapestry in which the composition was reversed and which was in the Drugman sale at Ixelles, 23–24 March 1926 (lot 454, reproduced: a cutting from the sale catalogue is in the Master of Flémalle boxes in the Witt Library).
12. Wilhelm von Bode, 'La Renaissance au musée de Berlin, III. L'ancienne école flamande', *Gazette des Beaux-Arts*, 2e pér. XXIX, 1887, pp. 209–20, 423–34, esp. p. 218.
 13. Hugo von Tschudi, 'Der Meister von Flémalle', *Jahrbuch der königlich preussischen Kunstsammlungen*, XIX (1898), pp. 8–34, 89–116, esp. pp. 89–90; Max J. Friedländer, *Early Netherlandish Painting*, 14 vols, trs. Heinz Norden, Leyden and Brussels 1967–76, II, pp. 40, 71; Erwin Panofsky, *Early Netherlandish Painting, Its Origins and Character*, Cambridge (Mass.) 1953, pp. 163–4; Davies 1972, op. cit., p. 253; J.R.J. van Asperen de Boer, J. Dijkstra and R. van Schoute, *Underdrawing in Paintings of the Rogier van der Weyden and Master of Flémalle Groups (Nederlands Kunsthistorisch Jaarboek, XLI, Zwolle 1992)*, pp. 71–5; Jochen Sander, *Niederländische Gemälde im Städel 1400–1500* (Kataloge der Gemälde im Städelischen Kunstinstitut Frankfurt am Main, II), Mainz am Rhein 1993, p. 122.
 14. Barbara G. Lane, *The Altar and the Altarpiece, Sacramental Themes in Early Netherlandish Painting*, New York 1984, p. 2.
 15. Roman de Girart de Roussillon, Österreichische Nationalbibliothek, Vienna, cod. 2549, f. 80: Dagmar Thoss, *Das Epos des Burgunderreiches*, Graz 1989, plate 24.
 16. The argument that the Merode *Annunciation* is a pastiche is set out by Lorne Campbell, 'Robert Campin, the Master of Flémalle and the Master of Mérode', *The Burlington Magazine*, CXVI, No. 860, November 1974, pp. 634–46. It has received support from the findings of van Asperen de Boer, Dijkstra and van Schoute 1992, pp. 97–116.
 17. See, for example, Dirk De Vos, 'De Madonna-en-Kindtypologie bij Rogier van der Weyden en enkele minder gekende Flemalleske voorlopers', *Jahrbuch der Berliner Museen*, XIII, 1971, pp. 60–161, esp. p. 114.
 18. Friedländer 1967–76, IV, plate 92; Catheline Périer-D'Ieteren, *Colyn de Coter et la technique picturale des peintres flamands du XVe siècle*, Brussels 1985, Fig. 127.
 19. Friedländer 1967–76, II, plate 143 (Add. 153); Nicole Reynaud, 'Barthélemy d'Eyck avant 1450', *Revue de l'Art*, LXXXIV, 1989, pp. 22–43.
 20. Friedländer 1967–76, II, plate 100 (72a); Micheline Comblen-Sonkes in *Rogier van der Weyden*, exhibition catalogue, Musée Communal, Brussels 1979, pp. 161–2.
 21. Lorne Campbell will argue elsewhere that the Campinesque *Virgin by the Fireplace* (St Petersburg, Hermitage: Friedländer 1967–76, II, plate 93) and the *Virgin and Child in an Interior* (NG 6514), perhaps by Jacques Daret, derive from a lost original by Campin. That lost original would have been another source used by the painter of the *Virgin before a Firescreen*.
 22. For the fashionable dress of the period, see Margaret Scott, *The History of Dress Series: Late Gothic Europe, 1400–1500*, London 1980; for a detail of the background of Rogier's *Saint Luke*, see Colin T. Eisler, *Les Primitifs flamands, I. Corpus . . . 4, New England Museums*, Brussels 1961, plate CIV.
 23. A 0.1M solution of 9-fluorenone-4-carboxylic acid soap was prepared by adding 0.1M of the corresponding acid to 100 ml of deionised water, using a magnetic stirrer. The mixture was stirred for two hours and then triethanolamine was added dropwise, with 15-minute stirring intervals between each drop. The pH of the mixture was monitored until 7.8 was obtained. Following a further period of one hour stirring, 1 g hydroxypropylmethylcellulose (HPMC) was added with continuous stirring. The pH was checked and adjusted to 7.8 again after standing for one hour. This cleaning formulation was designed and prepared by Raymond White.
 24. Propan-2-ol and white spirit, 1:3.
 25. Roger van Schoute and Hélène Verougstraete-Marcq, personal communication; see also their book, *Cadres et supports dans la peinture flamande aux 15e et 16e siècles*, Heure-le-Romain 1989.
 26. Mojmir S. Frinta, *The Genius of Robert Campin*, The Hague 1966, pp. 39–45.
 27. J.R.J. van Asperen de Boer et al. 1992, op. cit., pp. 71–5.
 28. Reflectograms were recorded at the National Gallery by Rachel Billinge, Leverhulme Research Fellow. The method of assembly is given in Rachel Billinge, John Cupitt, Nicolaos Dessipris and David Saunders, 'A note on an improved procedure for the rapid assembly of infrared reflectogram mosaics', *Studies in Conservation*, 38, No. 2, 1993, pp. 92–8.
 29. J.R.J. van Asperen de Boer et al. 1992, op. cit., p. 75.
 30. *Ibid.*, pp. 103–16.
 31. The results of a comprehensive technical survey of the early Netherlandish paintings in the Collection using infra-red reflectography, pigment, layer structure and paint media studies conducted by members of the Conservation and Scientific Departments at the National Gallery will be included in the new systematic catalogue.
 32. For recent comment on the question, see J. Sander, op. cit., pp. 98–105 (note 13).
 33. An overview is given by C. Périer-D'Ieteren, 'La technique picturale de la peinture flamande du XVe siècle', *La pittura nel XIV e XV secolo: il contributo dell'analisi tecnica alla storia dell'arte*, edited by H.W. van Os and J.R.J. van Asperen de Boer, Bologna 1983, pp. 7–71. Some specific data for Early Netherlandish technique are recorded in P.W.F. Brinkman, L. Kockaert, L. Maes, L. Masschelein-Kleiner, F. Robasynski and E. Thielen, 'Het Lam Godsretabel van Van Eyck: Een heronderzoek naar de materialen en schildermethoden. 1. De plamuur, de isolatielaag, de tekening en de grondtonen', *Bulletin de l'Institut Royal du Patrimoine Artistique*, XX, 1984/85, pp. 137–66, and in part two of this article, P.W.F. Brinkman, L. Kockaert, L. Maes, E. Thielen and J. Wouters, '2. De hoofdkleuren blauw,

- groen, geel en rood', *Bulletin de l'Institut Royal du Patrimoine Artistique*, XXII, 1988/89, pp. 26–49. L. Kockaert has recently reported new analyses of the Dieric Bouts altarpiece at Louvain, see L. Kockaert, 'The Altarpiece of the Holy Sacrament by Dieric Bouts in Louvain: A Re-examination of the Paint Samples', *Bulletin de l'Institut Royal du Patrimoine Artistique*, XXIII, 1990/91, pp. 201–9.
34. The identification as oak was made by examination of the wood grain in the X-radiograph (see Fig. 10 above) and of the panel itself. No sample could be taken for microscopical confirmation.
 35. A natural chalk ground was confirmed microscopically and by EDX analysis.
 36. The presence of gelatin in the ground was confirmed by strong positive staining results with acid fuchsin and two reagents containing amido black (AB2 and AB3). See E. Martin, 'Some Improvements in Techniques of Analysis of Paint Media', *Studies in Conservation*, 22, 1977, pp. 63–7.
 37. J.R.J. van Asperen de Boer et al., op. cit., pp. 71–4 (note 13).
 38. Based on a positive staining result with amido black (AB2) in a cross-section. See E. Martin, op. cit. (note 36).
 39. Examination under the stereomicroscope of the flesh paint in the small panel, *A Monk* (NG 6377), attributed to Robert Campin, showed the addition of natural azurite to the surface paint layer (Rachel Billinge, personal communication); the flesh tones in his *Entombment* ('*The Seilern Triptych*') (London, Courtauld Institute Galleries) are reported to contain lead-tin yellow in all areas examined, as well as natural azurite, which occurs in many parts of the painting (Caroline Villers, Courtauld Institute, personal communication).
 40. See J. Mills and R. White, 'Analyses of Paint Media', *National Gallery Technical Bulletin*, 1, 1977, p. 59 (for the Master of Saint Giles); J. Mills and R. White, 'Analyses of Paint Media', *National Gallery Technical Bulletin*, 9, 1985, pp. 70–1 (for D. Bouts); J. Mills and R. White, *National Gallery Technical Bulletin*, 11, 1987, pp. 94–5 (for the *Portrait of a Man* (NG 653.1) and the *Portrait of a Woman* (NG 653.2), both attributed to Robert Campin).
 41. See for example L. Kockaert, 'Note sur les émulsions des primitifs flamands', *Bulletin de l'Institut Royal du Patrimoine Artistique*, XIV, 1973/74, pp. 133–9 and L. Kockaert and M. Verrier, 'Application des colorations à l'identification des liants de Van Eyck', *Bulletin de l'Institut Royal du Patrimoine Artistique*, XVII, 1978/79, pp. 122–7. See also Brinkman et al. 1988/89, op. cit. (note 33).
 42. Kockaert and Verrier, op. cit.; L. Kockaert, 'A Note on the Painting Technique of Melchior Broederlam', *Preprints of the 7th Triennial Meeting, ICOM Committee for Conservation*, Copenhagen, 1984, Vol. II, 84.19.7/10; Brinkman et al. 1988/89, op. cit.; Kockaert 1990/91, op. cit. (note 33).
 43. See note 41 and Kockaert 1990/91, op. cit. (note 33).
 44. We are very grateful to Caroline Villers of the Courtauld Institute for communicating her interpretation of the drapery painting technique in the *The Entombment*.
 45. The red lake dyestuffs in samples from these mixed purple paints are thought to derive from madder on the basis of a strong pinkish-mauve fluorescence observed under the microscope in ultra-violet light. The samples were too small for direct analyses of the red dyestuffs to be carried out.
 46. Loss of colour in visible (transmitted) light and reduction of ultra-violet fluorescence (reflected light) in the upper fraction of the paint layer were noted in samples.
 47. Work on the colour recording and image-processing was by David Saunders. The digital data were first transformed into CIELAB colour space coordinates. The colour of the cushion to the left of the Virgin was used to provide some indication of the coloration of the red lake pigment that might have faded in the robe. To simulate possible appearances of the robe before fading, the blue-redness of the cushion was combined (in CIELAB vector space) with the colour of the robe in different proportions. Experiments were conducted in which the amount of red 'added' was varied according to the lightness of the region of the robe. Finally, the CIELAB data were transformed to gun voltage data in order to display the result on a computer monitor. See D. Saunders and J. Cupitt, 'Image Processing at the National Gallery: The VASARI Project', *National Gallery Technical Bulletin*, 14, 1993, pp. 72–85.