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Giovanni di Paolo's 'SS. Fabian and Sebastian'

David Bomford and Jo Kirby

Cleaning and restoration

David Bomford

The National Gallery has five pictures attributed to Giovanni di Paolo: four small predella panels of scenes from the life of S. John the Baptist and the larger votive panel *SS. Fabian and Sebastian* (No. 3402).

Whereas there appears never to have been any dissent in ascribing the predella panels, attribution of *SS. Fabian and Sebastian* has not always found art historians in total agreement. It was first published as Giovanni di Paolo by Borenus in 1915 (1); he wrote with considerable enthusiasm (while conceding that Giovanni 'is assuredly not a great artist') of the 'delicate drawing and exquisite silhouetting' of the figure of S. Sebastian which 'has scarcely its superior in the whole of Giovanni di Paolo's work'. Pope-Hennessy in his monograph of 1937 (2) agreed in principle, accepting it as a late work, but was less generous in describing it as 'a poor little panel [...] in the National Gallery'.

Other critics did not incline to Giovanni di Paolo at all; but suggestions of an unnamed Pisan follower or of one Giacomo del Pisano found little support. The present unequivocal attribution is Martin Davies's in the *National Gallery Catalogues* (3). He concludes, 'although the picture is inferior to the works of Giovanni di Paolo's best time, it seems reasonable to accept Pope-Hennessy's view'.

The unfavourable (but undeniable) contrast with Giovanni di Paolo's best work may have stemmed from a number of factors. The picture's apparent coarseness may be merely a matter of scale: merely that the almost miniaturist tempera technique of the figures in the small predella panels did not survive translation to a larger size. Or, more simply, that Giovanni's style was more attractive and successful in his small delicate landscape scenes than in his larger figure studies. Then it may have been a matter of chronology, as Martin Davies implied—an unevenness of quality becoming apparent in the later works, or simply that the late works differed in style from the earlier ones.

Then again, it may have been a matter of condition. It is not without significance that in the *National Gallery Catalogues* each entry gives a summary of the apparent physical state of a picture before going on to discuss its attribution: it is essential that the art historian should first know precisely what he is looking at. Even so, for pictures obscured by layers of repaint and discoloured varnish it is often difficult or impossible to arrive at a satisfactory assessment. The cleaning of paintings is obviously of importance in assigning

them, therefore: attributions are changed occasionally, confirmed usually, but the situation is always made clearer.

Cleaning *SS. Fabian and Sebastian* is unlikely to result in a change of attribution, but it demonstrated, rather entertainingly, the dangers of taking an uncleaned picture at its face value. Whether or not the inferiority claimed for it was due to one or all of the factors considered above, it did become apparent as the picture was cleaned that much of the original had not been satisfactorily visible before; and indeed (as will be seen) that some of the paint thought to be original was not by Giovanni di Paolo at all.

History and condition before cleaning

Nothing is known of the history of *SS. Fabian and Sebastian* before it appeared in the Charles Butler sale in May 1911 catalogued as *SS. Gregory and Sebastian* by Giovanni del Poggio (a correct but little used alternative name derived from Poggio Malavolti near Siena where Giovanni lived). It was subsequently presented to the National Gallery in 1919 in memory of its late owner.

The condition of the picture then was identical with its condition immediately before the present cleaning began in 1976 (Fig.1). No treatment other than a routine fixing of small paint blisters had been carried out in its time at the National Gallery.

The overall size of the panel is 90.5 × 60.5cm. It is probably of poplar (although this has not been confirmed) and consists of three vertical boards joined edge to edge: a wide central piece encompassing virtually all of the composition and a narrow strip down either side. There is thus an original joint about 6cm in from each vertical edge.

An integral gilded frame, largely original, is attached to the front of the panel; therefore the picture size is smaller than the overall panel size and measures 84.5 × 54.5cm. The thickness of the panel is approximately 3cm (although it was once thicker), that of the frame almost 2cm and, in addition, there is a heavy mahogany cradle 2cm thick at the back.

The condition of this complex and rather heavy support was, on the whole, good except that at some point in its history the whole bottom edge had been substantially damaged, cut away and replaced by newer wood. The bottom 3cm of the panel, 6cm of the framing on each side and the entire frame along the lower edge were not original (Fig.2). At the base of the picture surface also an irregular strip of original paint varying in width from 2 to 12cm was completely missing (although it had been filled and retouched). These losses are consistent with the panel having once

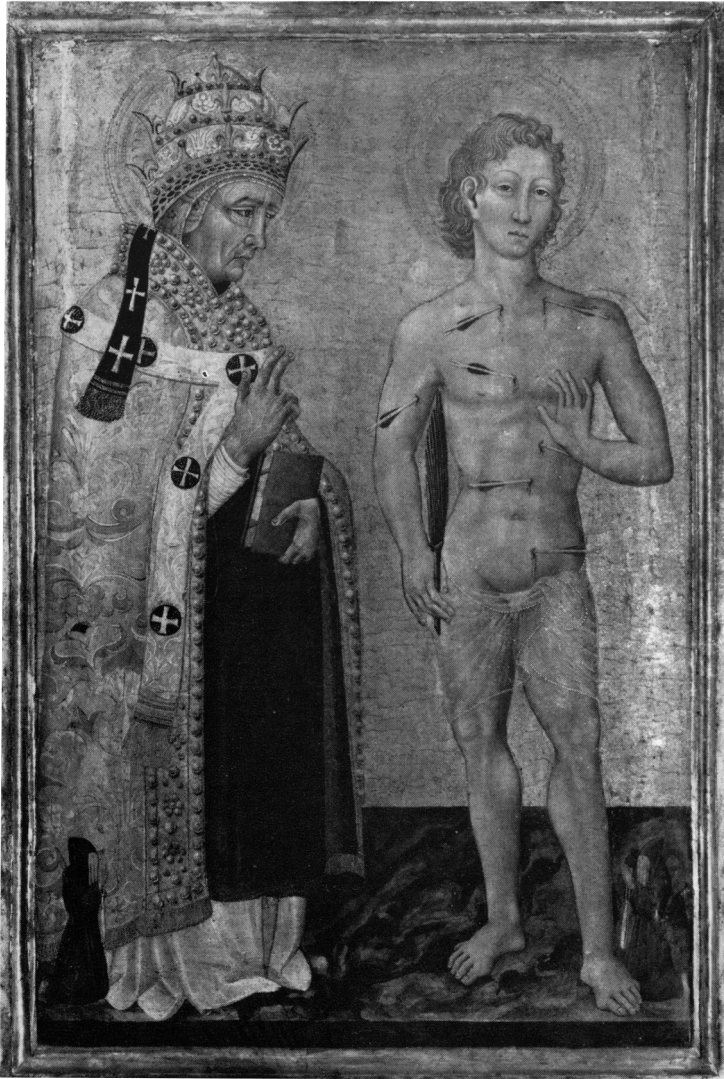


Figure 1
SS. Fabian and Sebastian before cleaning.

Figure 2
Side of Panel, bottom left, showing (left to right) the mahogany cradle, the panel with the bottom 3cm new wood and the frame with the bottom 6cm new.



stood for some time, if not actually in water, at least on a very damp floor.

In other respects the condition of the support was not abnormal. The original frame at the top edge was beginning to detach from the panel but this would be reattached quite simply during treatment. The two vertical joins had loosened in the past and caused associated lines of flaking paint on the picture surface, but they were now secure. Although the mahogany cradle on the back was unnecessary it could safely be left alone. The practice of cradling is now considered ill-advised, but where there is no actual harm being done an existing cradle is not removed; in this case the cross-members were still just movable. Paradoxically, if an old cradle still functions properly it is a fair indication that it was not required in the first place.

The condition of the gilded and painted picture surface was investigated with the aid of a composite mosaic of X-ray photographs (Fig.3), although the information was somewhat confused by the grid pattern of the cradle. The joins at each side of the panel were clearly visible, together with long metal spikes driven in from the edges to secure them and the lines of paint losses running along them.

The missing lower edge could also be seen, the dense paint ending in a ragged line, approximately horizontal but rising sharply in the centre and again at the right side. The limit of the damage here ran up the middle of S. Sebastian's left foot and lower leg and then horizontally through the waist of the kneeling figure. The fact that this part of the picture was missing could not easily be detected by direct inspection since it had been filled and repainted with some skill by a past restorer.

Smaller damages to the paint could be seen elsewhere. Losses showed on the X-ray mosaic as dark holes in the lighter paint structure in, for example, the green robe hanging from S. Fabian's left arm. Another damage by S. Fabian's chin actually appeared in the X-ray lighter than the surrounding paint since it was filled with denser material. Other losses, especially in S. Fabian's crimson undercloak, were noted.

Examination of S. Sebastian revealed an oddity. In the picture there were just seven arrows piercing him, but in the X-ray there appeared to be rather more, with a few fragmentary ones besides (eventually, twenty were discovered). It had already been noticed that the body of S. Sebastian was much retouched and it had been assumed then that damage such as scratches were being concealed. But another explanation now suggested itself: that the retouching deliberately covered the original paint of the arrows in order to alter the design.

It became clear as the picture was cleaned that the figure of S. Sebastian had been altered in many other ways. With hindsight it is possible to see some of these changes in the X-ray taken before cleaning, but most were not detected until the cleaning revealed them—even the most radical one of all. That was to the upraised hand and arm and that, by a curious chance, was where the first cleaning test was made.

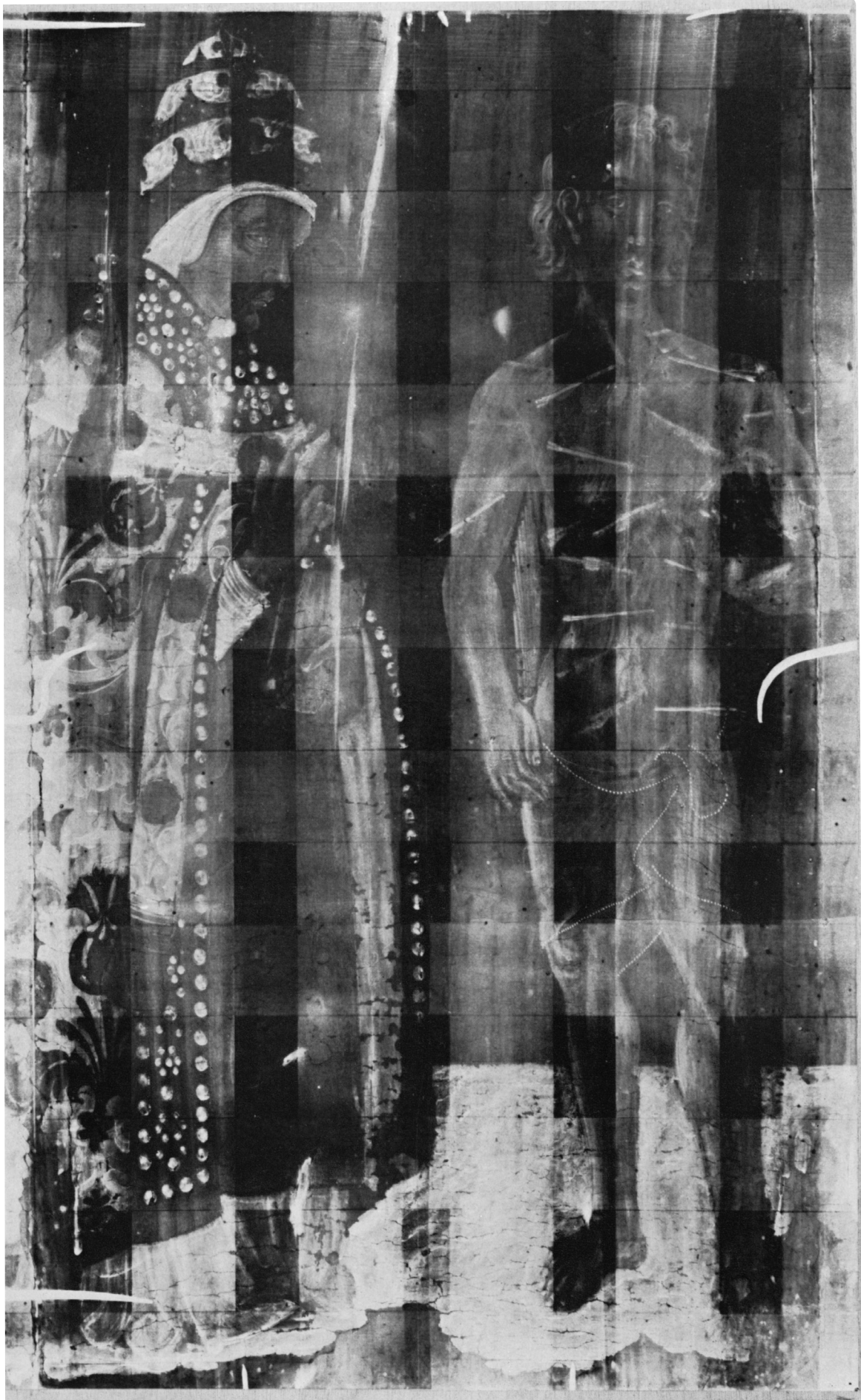


Figure 3
X-ray mosaic of
picture
(excluding
frame) before
cleaning.
(42kV, 20mA,
45 sec.)



Figure 4 (top) Cleaning test on S. Sebastian's left arm and hand.

Figure 5 (above) S. Sebastian's left arm and hand fully cleaned.

The cleaning

The appearance of *SS. Fabian and Sebastian* before cleaning was further distorted by a heavy layer of darkened varnish. It was likely that the picture had not been cleaned for a century or more and the discolouration was entirely consistent with a varnish film of such an age.

Cleaning was carried out with organic solvents on small cotton wool swabs. A particular precaution that has to be observed for pictures of this kind is in the treatment of the gilded areas. Although gold itself is almost totally inert, being attacked only slowly by the strongest of acid mixtures (aqua regia), the underlying layer of red bole is always vulnerable to water. Bole, a fine clay traditionally from Armenia, is prepared as an underlayer for water-gilding by suspension in a gelatin or skin glue which remains permanently water-soluble. The gold in pictures of this age is usually so thin and cracked that it is easily eroded by aqueous solvents penetrating and softening the bole layer beneath.

Of course, the gesso ground under the entire picture surface is equally vulnerable since it is bound by a skin glue, but in general, painted areas, unless especially cracked, are fairly impervious to water. The greater danger (demonstrated by the lost inches at the bottom) is when moisture penetrates the edge or the back of the panel.

Cleaning was started at the right edge in the region of S. Sebastian's left arm and hand. Usually, cleaning tests are made in uncontroversial parts of a picture on passages of light-coloured paint, in order simply to gauge the solubility and discolouration of the varnish. Under normal circumstances, the area chosen on *SS. Fabian and Sebastian* would have been quite suitable for such a test, but it soon became clear that more than simple varnish removal was involved here (Fig.4).

The existing hand and arm cleaned away easily with the varnish to reveal another, slightly displaced hand and arm underneath. At the same time, the test was extended to reveal fragments of two of the painted-out arrows.

Disconcerting though it is to have parts of a painting disappear during cleaning, it is at least rewarding to regain the original composition thereby. For that is what had happened. The hand and arm visible before cleaning were the invention of a past restorer; the newly revealed hand, arm and arrows were the original work of Giovanni di Paolo. The anonymous restorer undoubtedly thought he could improve on Giovanni's knowledge of anatomy and design (and undoubtedly he could) but it is certainly no part of a restorer's responsibilities to correct the inaccuracies or naivete of a painter.

The false hand had been painted over the original, higher and slightly to the left. The false arm appeared to be thicker than the slender original it concealed, but this was misleading: as cleaning progressed, another rather disturbing alteration became apparent.

It had already been noticed that the original hand had lost most of the little finger and a triangular

area of paint near the wrist. When the whole arm was cleaned (Fig.5) the reason for these and other losses became clear. Instead of merely painting over the original, the restorer had scraped it away where it did not coincide with his new version. Thus the triangular damage at the base of the hand was where the angle of the wrist had been raised, and the missing little finger was where the hand and chest had been shifted to the left.

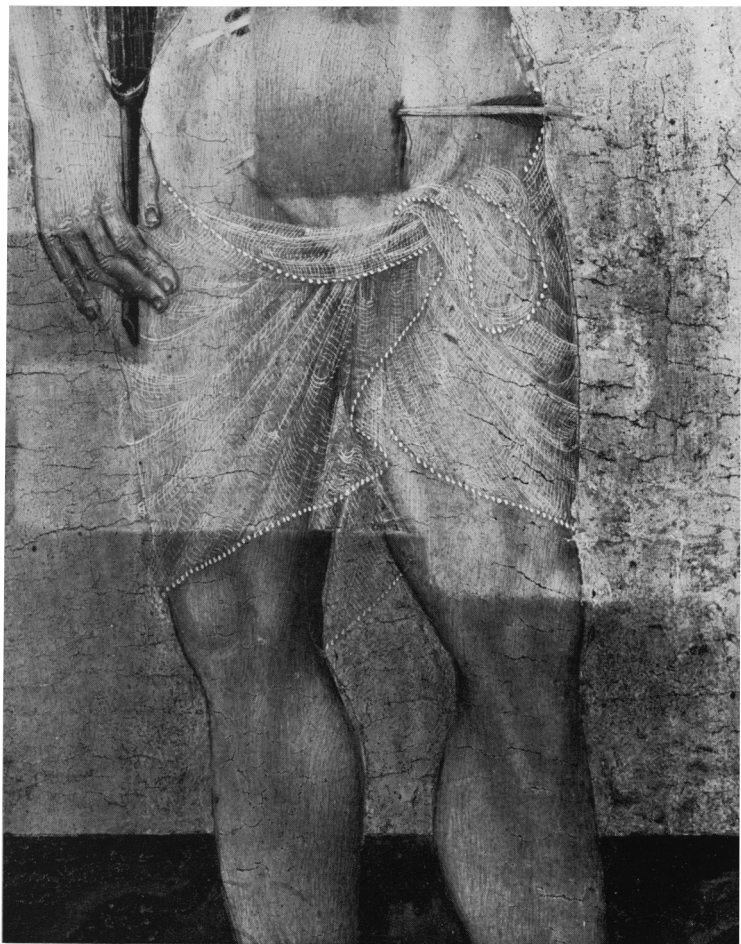
In addition, the whole configuration of the upper arm and body had been changed. The torso was made narrower by scraping out a new armpit to the left of the original one (the line was continued down through and below the hand) and by moving the entire upper arm to the left. But, so that the arm did not become too broad, the outer edge was scraped away. During cleaning, one fragment of the true outer edge was found (level with the armpit) which was the only indication of how wide the arm had originally been (see Fig.5).

Other alterations appeared as S. Sebastian was cleaned further. Paint had also been removed from the tops of both shoulders as far as the neck, from the inside edge of his right arm at the elbow, from the outside edge of his right lower leg and from the unwanted arrows where they ran over the gold background. Paint had also been added in places apart from the major reworking of the left arm and hand: the right arm and both legs had been made wider by painting in new outlines (Fig.7).

These seemingly random additions and deletions were probably fairly carefully calculated, since the new outlines were first marked out with inscribed lines. There are many incised lines in the gold, and apart from the elaborate decoration of the haloes (Fig.6) and S. Fabian's cloak they appear to be of four types: (i) original lines closely following the correct outlines; (ii) original lines which diverge from the correct outlines—these may be classed as *pentimenti* and the most striking example is over S. Sebastian's left shoulder (see Fig.6); (iii) lines which follow the restorer's alterations described above; (iv) random lines with no apparent purpose—probably more correctly described as scratches—such as a row of crosses discovered over S. Fabian's right shoulder.

Once the restorer had decided how he wanted the picture to look, the scraping away of various painted areas became inevitable. For although it is a simple matter to paint over original paint and gold, it is not possible to gild over existing paint. It must be abraded back to the gesso and a new bole layer applied. It can be seen, therefore, that the rather wanton damage had behind it a certain ruthless logic.

The cleaning of the rest of the picture was relatively uneventful. Damages noted in the preliminary examination were uncovered as the varnish and retouching were removed. At the lower edge, the limits of the missing area were established but the paint of the reconstruction was not removed. Since it had been well done, it was considered that it might usefully form the basis of any reconstruction attempted in the present restoration. If, on the other hand, it was later decided that the area should be left blank, it could



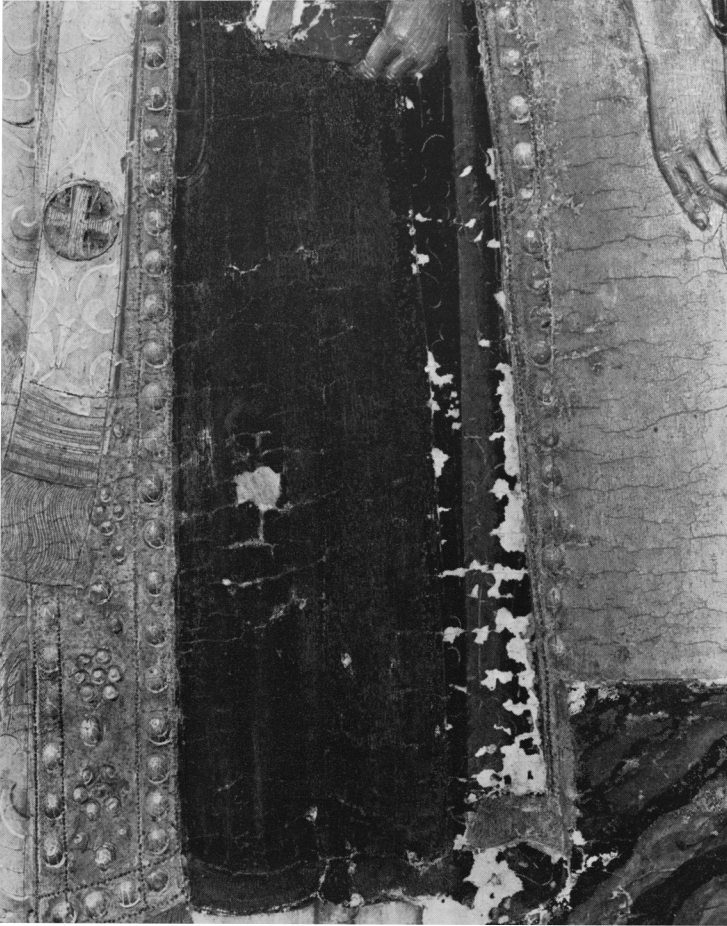


Figure 6 (top left) S. Sebastian's head, after cleaning before restoration.

Figure 7 (left) S. Sebastian's legs during cleaning.

Figure 8 (top) S. Fabian's crimson undercloak, after cleaning before restoration.

Figure 9 (above) Detail of marble floor, after cleaning before restoration.



easily be cleaned away or painted over with a so-called 'neutral' colour. The paint here could not be left entirely without adjustment since it was appreciably darker than the cleaned original: this was due partly to the inevitable darkening of any retouching, but more because it was painted to match a picture covered with an already discoloured varnish.

Apart from total paint losses which penetrated right to the ground, there were some areas which had suffered from different degrees of flaking. A particularly interesting passage was the crimson undercloak of S. Fabian (Fig.8) which had looked distinctly unpromising before cleaning. That it was damaged was indeed confirmed, but it was damage of a very revealing kind. The fairly complex striated paint layers (including one of silver leaf) had flaked away from each other in such a way that it was possible to read off the whole sequence of construction. There is an added significance in the fact that identical passages in almost identical condition were found on panels of Sassetta's Sansepolcro altarpiece, recently cleaned (4). This parallel is pursued further and a description of the materials and technique is given in the report by Jo Kirby on p.64.

Another part where the upper paint layers had separated and flaked away from the lower ones was in the marble floor (Fig.9). The dark veins of the marble appeared to be painted with very little binding medium; there was hardly more than a dry crust of pigment in places, and the top layers had simply crumbled and fallen away.

Some features of S. Fabian's elaborate apparel had been repainted or strengthened, especially where they were painted over gold. The jewels of his mitre, some pearls on the cope, parts of the black roundels with gold crosses and many of the outlines were new. Probably they replaced paint that had been there originally but there was little trace of it: paint will not stick well to gold and it is not unusual in a picture of this age for such passages to be lost.

The gold background and frame were cleaned and the more obtrusive repairs along the joins removed. But the new parts of the frame matched quite well and were retained. It is a point of some debate but, in general, gold backgrounds were not and should not be varnished. Discoloured varnish films are especially disfiguring over gold, therefore, and are removed and not replaced. Of course, the possibility of an original toning layer must never be totally discounted but, even so, the likelihood of one surviving five hundred years and several cleanings is very small.

By degrees, then, the whole picture was cleaned. Its condition after cleaning is shown in Fig.10. Before retouching, a thin coat of an acrylic resin varnish, Paraloid B67, was applied to the painted parts.

Restoration

In the decision whether or how to retouch a picture, it is unwise—and, with the current emphasis on easy reversibility, unnecessary—to be too dogmatic. (The word *retouch* is possibly unfortunate, in implying

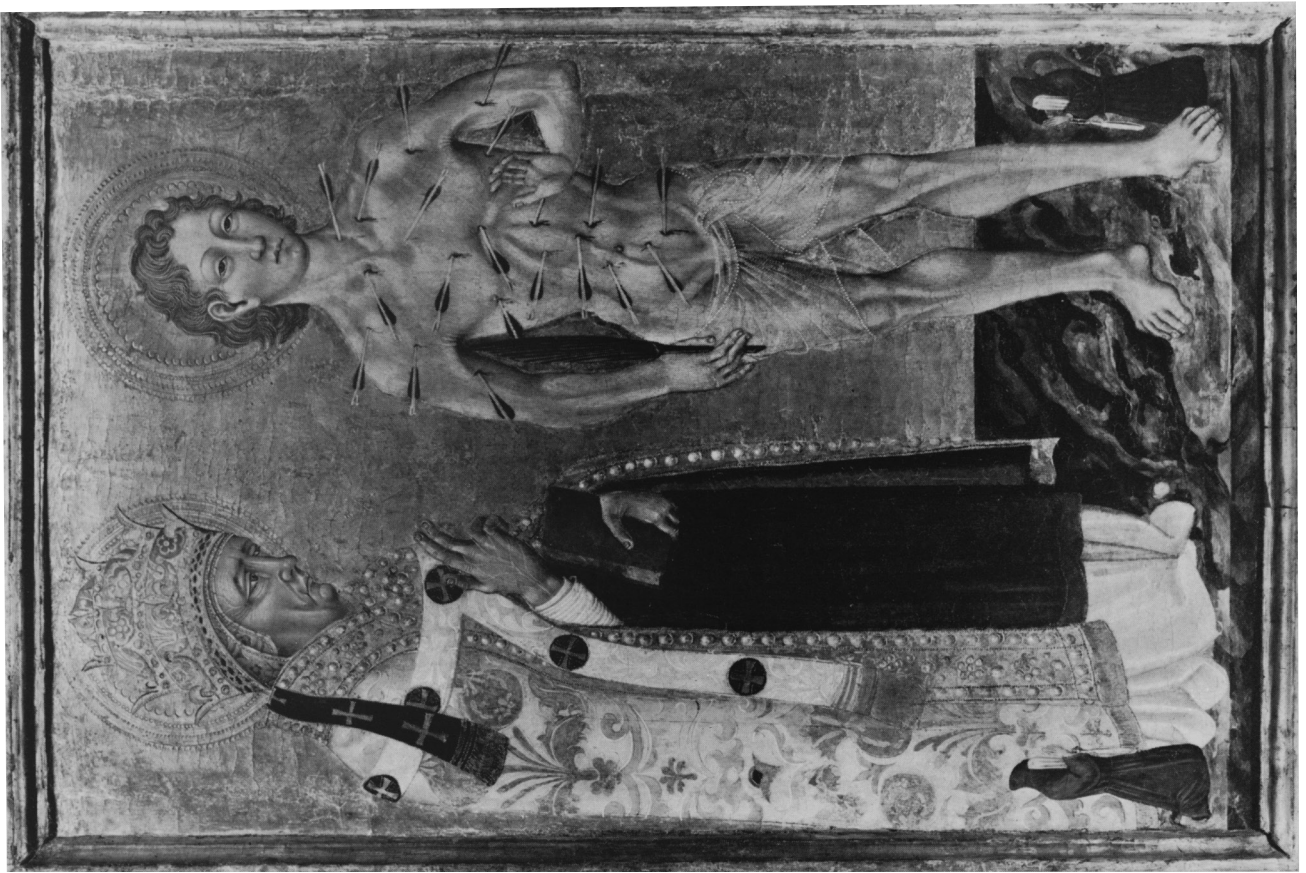


Figure 10
SS. Fabian and Sebastian
after cleaning,
before
restoration.

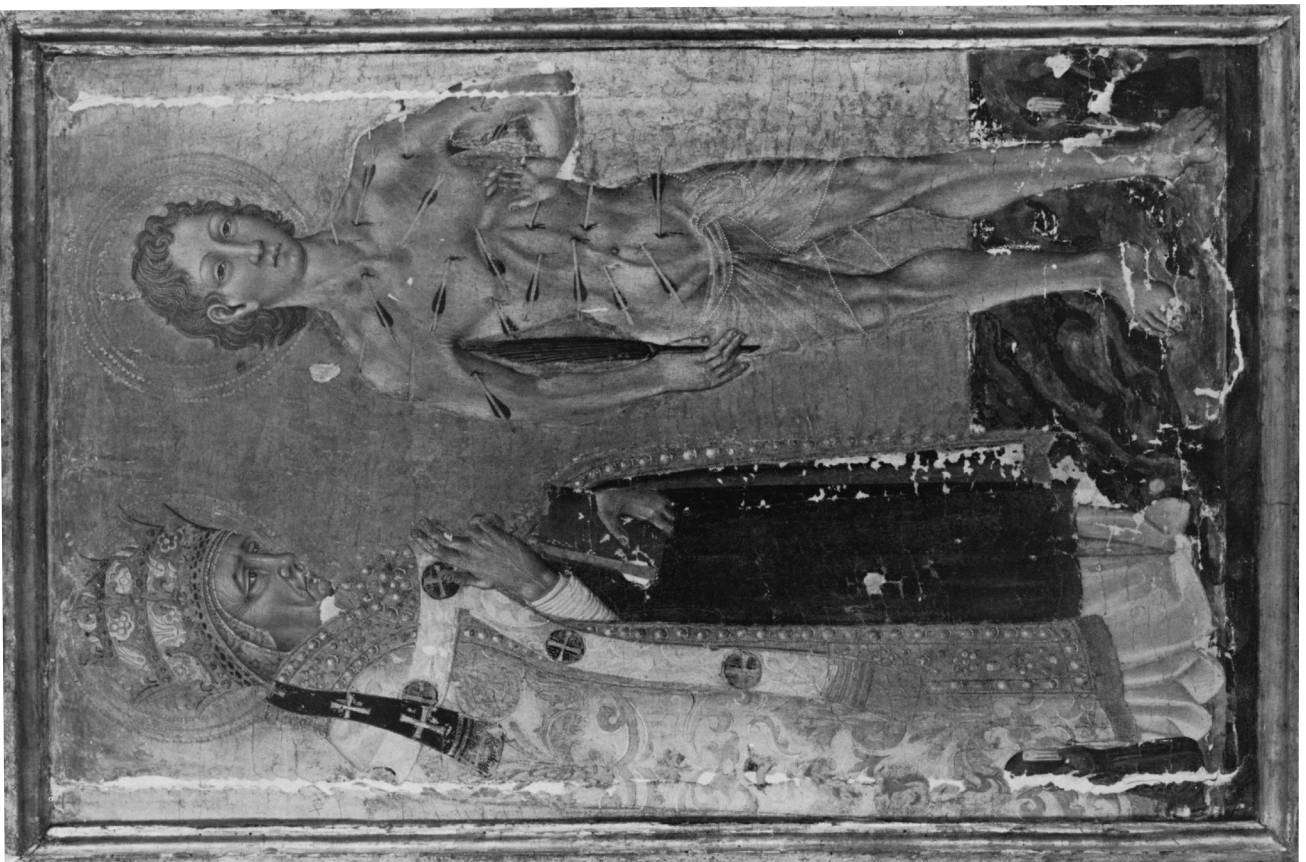


Figure 11
SS. Fabian and Sebastian
after cleaning
and restoration.

repainting: the unattractive but now commonly used term *in-painting* perhaps better describes the careful touching-in of damaged or missing areas.)

The first principle in restoration is that what remains of the original work must be shown entirely and to its best advantage. No original paint should be concealed if it can be shown. The picture cannot be repainted wholesale to alter it or hide its condition.

At the other extreme, to make a virtue of a picture's poor condition by displaying every damage is equally unfair. The casual viewer wishes to see a painting but his eye is distracted and misled by discontinuities in the composition. At the same time, the scholar and art-historian needs to be able to distinguish between original and later work.

What these conflicting considerations mean in practical terms is, of course, variously interpreted. Retouching or in-painting can be a contentious subject. Solutions to the problem range from leaving actual holes in the fabric of the painting, through use of so-called 'neutral' colours, to striped retouching (*rigattino*) and finally completely matched in-painting. There is no ideal solution.

There is one important preliminary, however, whatever the preference for retouching. An accurate, detailed photographic record should first be made of the picture in its cleaned but unrestored state. To this permanent record the art historian can refer. The subsequent retouching, difficult to do perhaps, time-consuming certainly, must only be regarded as an impermanent and reversible process. Reversibility is in fact the most important criterion of any method, and it actually makes the stylistic details of the method less important. A retouching of any type assumes less significance in the history of a painting if it can be wiped away easily in seconds.

Nevertheless, restoration of *SS. Fabian and Sebastian* did involve decisions of principle. Parts of the picture were missing, although there was no doubt as to their content, and reconstruction would not be difficult. It was decided that lost areas of *SS. Fabian and Sebastian*—that is, the outlines of S. Sebastian's body and the arrowheads—would be put back. The form of these parts was known absolutely from evidence on the picture—from incised outlines, fragments of paint, comparison with other areas and so on.

The missing strip at the bottom of the picture would also be reconstructed (using the previous restorer's paint, which had been left) but here the situation was slightly different. The content was known—a marble step, part of S. Sebastian's foot, the lower half of the kneeling monk—but exact details, such as the pattern of the marbling, were not. In such a case there was a compromise which had before been considered satisfactory. The missing part would be reconstructed as completely as possible using the internal evidence of the composition, but the actual colours would be made fractionally different in tone and transparency to the adjoining paint (5).

S. Fabian's crimson robe would be retouched only minimally—much as similar areas on the panels of Sassetta's Sansepulcro altarpiece were treated. Actual holes would be retouched but the partial flaking

would be left visible. The vertical striations (briefly mentioned above and described in the technical examination following) would also show. The partial flaking of the marble floor would be reduced, but not touched out entirely.

Retouching was carried out using pure pigments ground in the acrylic resin Paraloid B72. As far as possible the layers were built up in the same way as in the original. Therefore areas of flesh paint were first underpainted with a green earth colour (although not actually a green earth pigment) and finished with hatched layers of pink, brown and white, imitating the tempera technique of the original.

Damages in the gold background, principally along the joins near the left and right edges, were prepared with a bole layer adjusted to the colour of the original bole by addition of cadmium red and cadmium orange. Gilding was carried out by traditional water-gilding techniques, using gold leaf and powder. The new gold was abraded to match the original as closely as possible.

Retouching was completed along the lines of the proposals described above. The painted areas were given a final varnish of Paraloid B67.

Conclusion

Giovanni di Paolo's *SS. Fabian and Sebastian* is now, in appearance, as close to its original state as it can be. (Fig. 11). The cleaning and restoration were longer and more complex than had been anticipated, but as a result the picture can be examined without ambiguity.

There seems no reason to question the attribution: indeed now that it is properly visible, the style can be seen to have marked similarities with that in Giovanni's undisputed predella panels—especially if the discrepancies of scale are taken into account. Comparison with the paintings of Sassetta is even more striking. That the picture should be placed firmly in the main stream of fifteenth century Siennese painting is confirmed by the findings of the technical examination below.

Notes and references

1. BORENIUS, T., 'SS. Fabian and Sebastian by Giovanni di Paolo', *The Burlington Magazine*, **XXVIII** (1915), p.3.
2. POPE-HENNESSY, J., *Giovanni di Paolo*, Chatto & Windus (London 1937).
3. DAVIES, M., *National Gallery Catalogues: The Earlier Italian Schools*, 2nd ed. revised (London 1961).
4. WYLD, M. and PLESTERS, J., 'Some Panels from Sassetta's Sansepulcro Altarpiece', *National Gallery Technical Bulletin*, **1** (1977), pp.3–17.
5. This solution had been adopted in the restoration of Cima's *S. Sebastian* (No.4946); here, too, the bottom of the picture had been damaged.

An examination of the materials and techniques used

Jo Kirby

Of all the Italian paintings examined during restoration by the Scientific Department, very few have been of the Sieneese School. It was particularly gratifying, therefore, to examine a work by the fifteenth century Sieneese painter Giovanni di Paolo during its restoration, and to be able to take a number of samples from the areas of damaged paint revealed during cleaning. The technical examination of several panels from the Sansepolcro altarpiece, by Giovanni di Paolo's rather more distinguished Sieneese contemporary Sassetta, has recently been described by Joyce Plesters (1); an interesting comparison may thus be made of some of the materials and techniques used by the two artists.

Giovanni di Paolo's career was rather longer than that of Sassetta (1392(?)–1450): Giovanni was active in 1420 and died as late as 1482 (2). *SS. Fabian and Sebastian* is thought by Pope-Hennessy to be a late work, dating, that is, from between 1463 and 1482 (3), a view accepted by Martin Davies in the *Early Italian Schools Catalogue* (2). The painting is, apparently, a complete votive picture, perhaps, at first sight, a little archaic in appearance for its proposed date, with its plain gold background, but, taking the purpose of the work into account, its traditional appearance becomes less surprising. In fact many of the techniques used by both Giovanni di Paolo and Sassetta would have been entirely standard practice for many years: the treatment of metal leaf by the two artists is a good example. The fact that Giovanni di Paolo is still using some of the older techniques in the second half of the fifteenth century is interesting but not unexpected in a work such as this.

The support for the painting is a wood panel, complete with what appears to be its original frame except for the restored bottom edge. It would be necessary to obtain a transverse section of a sample of the wood for positive identification of the species: this, unfortunately, was not possible. The gilding of the frame is in good condition and suitable samples could not be taken from the edge of either the frame or the panel itself. Although the back of the panel is accessible between the cross-members of the cradle, a suitable sample was not obtainable from this area.

In common with other Italian School panel paintings examined, including the Sassetta panels, the white preparatory layer or ground was found to consist of gesso (calcium sulphate) in an animal-skin glue medium. By examination of a number of thin paint cross-sections (6–10 µm thick, cut on a glass-knife microtome) under the polarizing microscope, it was possible to identify strongly birefringent, rectangular and rather fibrous particles of anhydrite (CaSO₄), although the material appeared to have been quite finely ground. It is probable that a proportion of gypsum (CaSO₄·2H₂O) is also present; X-ray diffraction analysis would be necessary to confirm this and to give a rough estimate of the proportion of each in the mixture.

The artist drew on the gesso ground, using a black pigment, probably charcoal, to indicate the main elements of his design, before gilding the panel. Traces of the drawing may be seen in several of the samples taken from the picture, and particularly clearly in the cross-section prepared from a sample taken from the shadowed outer edge of the green lining of S. Fabian's cope (Plate 8, p.47), where it may be seen as a thick black line between the lowest white ground layer and the thin orange layer (bole). The thickness of the black layer suggests heavy undermodelling rather than simple drawing, perhaps to indicate the area of shadow. The main outlines of the design, however, have been incised in the gesso after gilding and not, as had been the case in the Sassetta panels, before. A number of *pentimenti* may be seen in, for example, the outline around S. Sebastian.

The application of metal leaf to the panel takes place before any other painting is carried out. In *SS. Fabian and Sebastian* a large part of the panel surface is gilded, the gilding of panel and frame having apparently been carried out in one operation. As in the Sassetta panels, water-gilding was the method used: bole (a clay, given its red colour by the ferric iron it contains) was applied over the ground in those areas where gilding was intended. The animal-skin glue medium of the bole itself acted as an adhesive for the metal leaf. The bright orange-red colour of Giovanni's bole (seen in Plate 8, p.47) is remarkably similar in colour to that seen in the Sassetta panels. Occasionally, bole is found to have overlapped areas not intended to be gilded (hence its appearance in Plate 8). The gold leaf itself has also extended very slightly outside its intended limits in some areas, for example, around the figure of S. Sebastian; in such areas as this it has subsequently been covered by paint, which has tended to adhere badly.

The large area of gold in the picture might have appeared monotonous, had the various areas of gold—the background, the haloes, S. Fabian's crown and cope—not been treated differently to give interest to the picture surface. The haloes have been tooled quite elaborately so that they stand out from the plain burnished gold background, using concentric incised circles and a variety of punches: a tiny 'Gothic arch' shape, a five-pointed star, a small circle and an arc of a circle (e.g. Fig.6). Further punches, including two larger circles and what might be described as a coarse and fine stipple, have been used on S. Fabian's crown and cope. The hatching on the white and gold brocade cope and the rather carelessly incised crosses and fringes on the Saint's other garments appear crude on close examination, but from a fairly short distance, as the picture would originally have been viewed, the clumsiness is less apparent; considerable variation of texture and surface richness have been achieved very simply.

Silver leaf has only been used beneath S. Fabian's crimson robe, providing an exact parallel with a phenomenon described in connection with the Sassetta panels. Before restoration, it was observed that the crimson glaze of S. Fabian's garment had

deteriorated in several areas; also, there appeared to be a black material beneath the glaze. Examination of paint fragments taken from the damaged areas showed that the black material was blackened silver leaf, exactly as found in, for example, S. Francis's red garment in No.4757, *The Whim of the Young S. Francis to Become a Soldier*, by Sassetta (1). As in the case of the Sassetta, the binding medium of the paint above the silver was found to be egg, probably egg-yolk. It seems likely that interaction between sulphur compounds in the glaze medium and the silver has caused both tarnishing of the silver and deterioration of the glaze. It is interesting to note that areas of highlight on the robe have survived relatively well; the cross-section prepared from a sample taken from such an area is illustrated in Plate 8a. Between the silvery leaf and the crimson glaze, both in good condition, is a relatively thick layer of lead white, giving the highlight; no tarnishing of the silver has occurred although analysis indicates that the white layer also contains egg-yolk. (Presumably the interaction between lead white and egg-yolk is such that no free sulphur compounds are available to attack the silver.) Tarnishing of the silver and deterioration of the glaze have only occurred in those areas where the lead white layer is very thin or absent. In his treatment of the silver leaf, Giovanni di Paolo has also used another technique used by Sassetta: the silver leaf has been incised with short vertical lines before glazing, presumably to represent velvet, exactly as Sassetta is described as having done for the angel's robe in No.4757, *The Whim of the Young S. Francis to Become a Soldier*. The crimson lake pigment used for the glaze is very similar in colour to that used by Sassetta, when examined both by reflected and by transmitted light; the colour is, perhaps, a little more intense. In this case, it was possible to identify the natural organic dyestuff present in the lake pigment, using thin-layer chromatography, as that produced by the lac insect (*Kerria lacca* or a related species). The inorganic substrate of the lake contained aluminium hydroxide.

Of the pigments identified in *SS. Fabian and Sebastian*, one of the most interesting was the green pigment used for the lining of S. Fabian's cope. Chemically identified as copper carbonate and tentatively identified as malachite (the basic copper carbonate $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$), physically it was in the form of rounded particles exactly like those found in samples of green paint from the Sassetta panels, wherein the presence of malachite was confirmed by X-ray diffraction analysis. It seems likely, therefore, that the pigment is also malachite in this case (it is hoped to have the pigment analysed by X-ray diffraction to confirm this). A similar form of malachite has also been identified in No. 1233, *The Blood of the Redeemer*, by Giovanni Bellini, discussed on p.22. The fact that malachite in the form of spherulites has now been identified in several works does support the suggestion made in the description of the Sassetta panels that this is, perhaps, a particular variety of artificial malachite (1,4). Plate 8b shows the rounded green particles clearly in both layers of green paint. It is possible that a certain amount of dissolution of the

malachite may have taken place in the upper green layer, chemical reactions between pigment and paint medium being partly responsible for the ultimate browning of the paint medium, as it appears today. Originally, this and, for example, the browned marbling of the floor, would probably have been a brighter green in colour. In the lower green layer, the malachite is mixed with lead-tin yellow (fused lead and tin oxides), a pigment also used for the light streaks in S. Sebastian's hair. Malachite was not the pigment used for the green underpainting of the shadows of the flesh, another long-established technique used by Giovanni; he used the traditional pigment, green earth (a complex silicate, in which the green colour is due to the presence of a trace of ferrous iron) which Sassetta did not. Other pigments identified include lead white (basic lead carbonate), the red lake pigment already discussed, vermilion (red mercuric sulphide), the blue pigment azurite (a basic copper carbonate), yellow ochre (iron oxide) and black (probably charcoal).

As can be seen from Plates 8a and 8b, the paint has been applied in thin, straight layers; most of the samples examined were very much simpler in structure than those illustrated, consisting of only one or two layers of paint. A sample of flesh paint from S. Sebastian's chest, for example, consisted only of a layer of green earth mixed with lead white, immediately over the ground, for the shadow of the flesh, and a layer of lead white and vermilion above this for the flesh colour itself.

The presence of egg tempera as the binding medium in S. Fabian's red garment has already been mentioned. Samples of this red and of the flesh of S. Sebastian's arm were taken for analysis of the paint medium by gas-chromatography, the results indicating the presence of egg tempera in both cases. These results were confirmed by staining thin cross-sections (6–10 μm thick) prepared from similar samples, with stains for proteins (Light Green and Amido Black 10B) and lipids (Sudan Black B). By this method, animal-skin glue was identified in the ground and bole layers, egg-yolk in the upper layers of paint. The use of egg tempera is perhaps as traditional a feature of the picture as all the others described.

References

1. PLESTERS, J., 'A Technical Examination of Some Panels from Sassetta's Sansepolcro Altarpiece', *National Gallery Technical Bulletin*, 1 (1977), pp.10–17. Reference is made to this paper throughout the text.
2. DAVIES, M., *National Gallery Catalogues: The Earlier Italian Schools*, 2nd ed. revised (London 1961), pp.242 and 502.
3. POPE-HENNESSY, J., *Giovanni di Paolo*, Chatto & Windus (London 1937), pp.126 and 143.
4. GETTENS, R.J., and FITZHUGH, E.W., 'Malachite and Green Verditer', *Studies in Conservation*, 19, 1 (1974), pp.16–17.

Plate 6 Titian, *Bacchus and Ariadne* (No.35).

Photomicrographs of paint cross-sections, photographed by reflected light at a magnification of 250×, magnification on the printed page quoted beneath photomicrograph.

(a) Scarlet of Ariadne's scarf, left shoulder.

1. Gesso ground (trace).
2. Azurite + lead white; presumed to be blue paint of sea.
3. Lead white + crimson-coloured lake pigment, presumed pale flesh tone.
4. Deeper pink layer of similar composition.
5. Paler pink with addition of a few blue pigment particles, possibly cool highlight on flesh.
6. Finely-ground, close-packed vermilion.
7. Final thin layer of large, deep red vermilion particles.

The scarf at this point seems to have been painted over fully-modelled flesh, which is painted on top of the blue of the sea.

(b) Crimson from edge of Bacchus's cloak.

(Gesso ground missing from sample)

1. Lead white underpaint of cloak.
2. Very thick translucent glaze of crimson-coloured lake pigment.
3. Lead white layer, possibly underpaint for layer 4.
4. Azurite + lead white, corresponding to blue of distant landscape.

In this sample the blue paint of the sky goes just over the edge of Bacchus's crimson cloak, indicating that the latter was laid at an early stage before the sky was painted (cf. (a) above).

(c) Dark blue drapery of Bacchante with cymbals.

1. Gesso ground (trace).
2. Yellow ochre underpaint or undermodelling.
3. One or two grains of carbon black (intermediate drawing?).
4. Crimson-coloured lake pigment in large granules.
5. Lead white + scattered small ultramarine particles.
6. Thin layer of dark blue, high-quality natural ultramarine.
7. Brighter blue; ultramarine + lead white.
8. Final glaze of ultramarine.

It appears from this section and from inspection of the area on the picture, that the drapery was initially deep pink and the artist then repainted it in blue.

(d) Mauve drapery of Bacchante with tambourine.

(Gesso ground missing from sample.)

1. Yellow ochre (trace) underpaint or undermodelling.
2. Lead white underpaint.
3. Very pale pink; lead white + crimson-coloured lake pigment.
4. Lead white with scattered particles of crimson-coloured lake pigment and ultramarine.

(e) Bright green foliage just above and to left of Bacchus's left leg.

1. Gesso ground, yellow-brown from excess glue.
2. Double layer of yellow ochre + lead white, which seems to be a *pentimento* of part of Bacchus's chariot.
3. Green earth + lead white; underpainting for foliage or landscape.
4. Azurite + lead white, presumably blue of distant landscape.
5. Malachite + lead white.
6. Slightly-browned 'copper resinate' type final green glaze.

Although the green glaze has browned with age and exposure, the area has maintained its intense green colour because of the malachite underpaint (cf. (f) below).

(f) Dark brown feathery foliage of trees right.

(Gesso ground missing from sample.)

1. Lead white underpaint, faintly pink-tinged with crimson-coloured lake pigment.
2. Ultramarine + lead white.
3. Green glaze of 'copper resinate' type.
4. Lead white layer, presumably to obliterate layers 2 and 3.
5. Ultramarine + lead white, similar to layer 2 above, but a higher proportion of blue pigment.
6. Very dark brown 'copper resinate' type glaze in which a few unchanged green particles of verdigris are still visible under the microscope.

Layers 5 and 6 are virtually a repeat of layers 2 and 3, so that it looks as if the artist was dissatisfied with his first attempt at painting sky and foliage, covered it over and began afresh. Layer 3, protected from light and atmosphere, has retained its green colour, whereas layer 6 is now almost completely brown.

(g) Orange drapery of Bacchante with cymbals, lightest area.

Crushed sample showing crystalline particles of orpiment and realgar pigments; photographed dry at 250× magnification.

(h) Sandy shore beneath Ariadne's feet; sample taken before cleaning.

1. Gesso ground (trace).
2. Lead white underpaint.
3. Granular grey layer; lead white + scattered small blue and black pigment particles.
4. Thick discoloured varnish.

Before the picture was cleaned the area looked yellow-brown instead of grey.

Plate 7 Giovanni Bellini, *The Blood of the Redeemer* (No.1233).

(a) Less-brown green of landscape, left of Christ's right arm; sample taken after cleaning.

Top surface of sample photographed by reflected light at 110× magnification, showing 'globular' green copper carbonate pigment particles in a brown matrix of medium.

(b) Partly-browned green of landscape to right of crucifix.

Cross-section photographed by reflected light at 110× magnification.

1. Gesso ground.
2. Line of brown glue priming on the gesso.
3. Lead white underpainting.
4. Brown matrix containing green globules of copper carbonate pigment.

Plate 8 Giovanni di Paolo, *SS. Fabian and Sebastian* (No.3402).

Photomicrographs of paint cross-sections, photographed by reflected light at 110× magnification.

(a) S. Fabian's red robe, area of highlight where glaze is in good condition.

1. Gesso ground.
2. Orange-red bole.
3. Silver leaf.
4. Lead white (to give highlights), in egg tempera medium.
5. Red glaze (lac lake in egg tempera medium).

(b) Green lining of S. Fabian's cope, shadowed outer edge.

1. Gesso ground.
2. Thick black undermodelling (charcoal).
3. Thin layer of orange-red bole.
4. Thick light green layer: lead-tin yellow mixed with spherulites of malachite.
5. Darker green layer: malachite spherulites in browned medium.
6. Old discoloured varnish.

Plate 6
 Titian,
Bacchus and Ariadne,
 No. 35.
 Full caption on facing
 page.

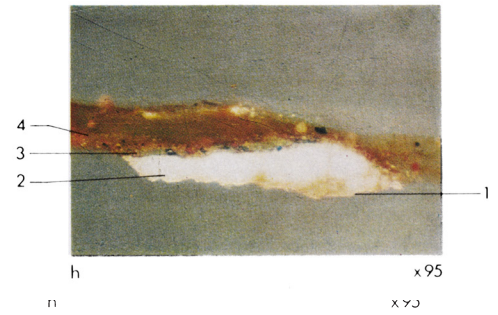
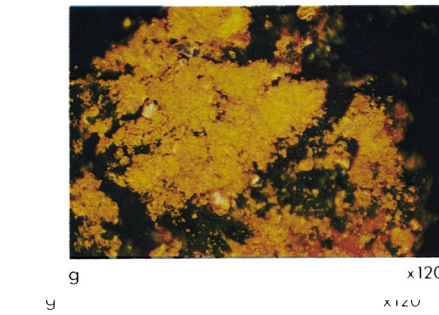
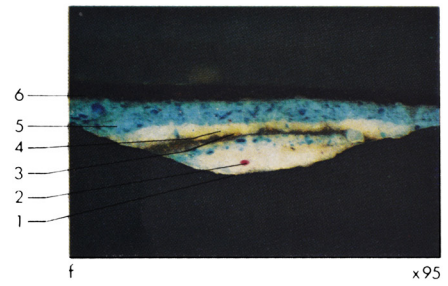
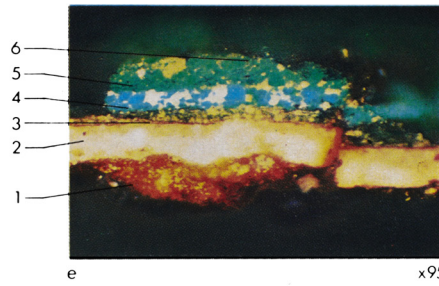
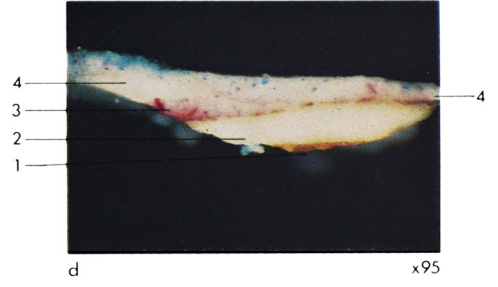
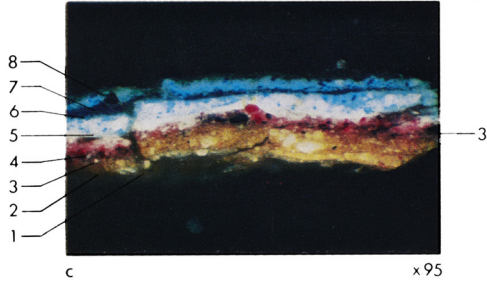
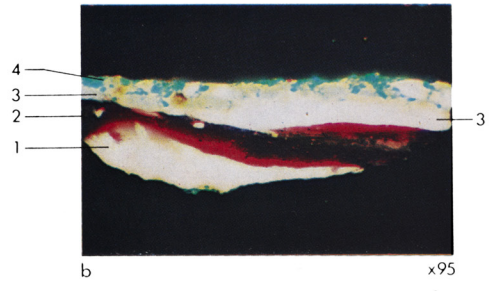
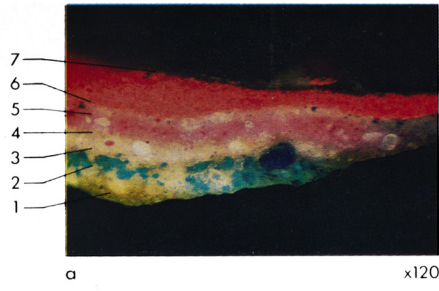


Plate 7
 Giovanni Bellini,
The Blood of the Redeemer,
 No. 1233.
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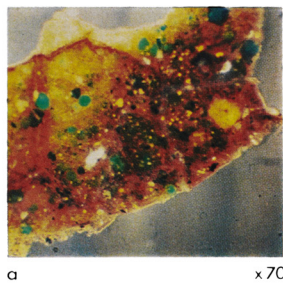


Plate 8
 Giovanni di Paolo,
SS. Fabian and Sebastian,
 No. 3402.
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