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FRONT COVER

Vincenzo Foppa, *The Adoration of the Kings*
(NG 729) (detail of Plate 1, p. 19)

TITLE PAGE

Attributed to Pedro Campaña, *The Conversion of the Magdalen*
(NG 1241) (detail of Plate 1, p. 55)

Uccello's *Battle of San Romano*

ASHOK ROY AND DILLIAN GORDON

THE FULL TITLE of Uccello's National Gallery panel is *Niccolò Mauruzi da Tolentino at the Battle of San Romano* (NG 583; PLATE 1). The Battle of San Romano took place in the valley of the Arno on 1 June 1432 when the Florentines decisively beat the combined forces of Lucca and her allies, Genoa, Milan and Siena, in a dispute over access to the port of Pisa.¹ Uccello depicted the battle on three separate panels, now in the National Gallery, London, the Uffizi, Florence (PLATE 2) and the Louvre, Paris (PLATE 3) (although see below). The three paintings are recorded in the Camera di Lorenzo, that is, the room belonging to Lorenzo de' Medici, in an inventory of the Palazzo Medici, in Florence, taken at the death of Lorenzo in 1492.² By 1598 the three paintings had been moved to a vestibule approaching the chapel in the Palazzo Medici.³

Due to the constant Medici provenance, it had hitherto been assumed that they were commissioned by a member of the Medici family, probably Cosimo

de' Medici. However, Francesco Caglioti has recently discovered a document showing that the three paintings belonged originally to the Bartolini Salimbeni family.⁴ On 30 July 1495 Damiano Bartolini Salimbeni claimed that he and his brother had jointly owned three panels showing the Battle of San Romano. His brother had been persuaded by Lorenzo de' Medici to make over to Lorenzo his share of the paintings but Damiano had refused and they had been forcibly removed from his house by the woodworker Francione who had been sent by Lorenzo to obtain them against the will of Damiano. This probably took place between 1479 and 1486.⁵

The date of execution for the paintings remains uncertain. They have been dated anywhere between 1435 and 1460, and often (and wrongly as it now transpires) linked to the building of the Palazzo Medici which was begun in 1444/6.⁶ In 1970 Lionello Boccia showed that the armour is accurately depicted and dates from around 1435.⁷ It is now generally



PLATE 1 Uccello, *Niccolò Mauruzi da Tolentino at the Battle of San Romano* (NG 583), c.1440. Poplar, 182 × 320 cm.



PLATE 2 Uccello, *The Battle of San Romano*, c.1440. Poplar, 182 × 323 cm. Florence, Galleria degli Uffizi.



PLATE 3 Uccello, *Michelotto da Cotignola in Battle*. Poplar, 180 × 316 cm. Paris, Musée du Louvre.

considered that the paintings date from the early 1440s, although Pietro Roccasacca has plausibly argued that the paintings in the National Gallery and Uffizi were painted earlier than the Paris painting. He proposed that the latter dates from after 1441 and depicts the Battle of Anghiari.⁸

Uccello's *Battle of San Romano* (NG 583) has been the subject of wide-ranging technical examination and analysis over a number of years: first at the National Gallery during preliminary investigation and conservation treatment in 1959–65, and subsequently in the 1990s in support of investigations



FIG. 1 Uccello, *Niccolò Mauruzi da Tolentino at the Battle of San Romano* (NG 583). Diagram showing the structure of the spandrel additions, probably applied at some time in the fifteenth century.

undertaken for a new catalogue of Italian fifteenth-century paintings to be published shortly.⁹ This revised catalogue will present new research on the history and location of NG 583 and particularly its relation to the two associated battle scenes now in Florence and Paris. Certain of the arguments pursued there rely on technical evidence gathered from the London picture and from the collation of similar evidence supplied by colleagues in Florence and Paris. However, since it is not possible within the space allowed in the forthcoming catalogue to present and illustrate in detail a full technical description of the Uccello, we have taken the opportunity to compile this material here as a supplementary account to the catalogue entry, and as a means of placing Uccello's work in a context of contemporary Florentine panel-painting practice. We also hope that the publication of this account will stimulate further investigation of the two other panels of Uccello's series.

This article is divided into two sections. The first deals with the methods of construction and painting of the *Battle of San Romano*. The second part, which relies on information derived from the first, considers the status and date of the corner spandrel additions to the panel of the London picture (see FIG. 1) and which are present also on the paintings in Florence and Paris. The date and origin of these additions have been the subject of considerable discussion and speculation since they are crucial to understanding the locations of the paintings when they were in the possession of the Medici. This was an aspect of the London picture first studied by paint analysis in the late 1950s, and re-examined more recently in the light of increased knowledge of Florentine techniques of the mid-fifteenth century. The additions appear to have been made immediately after the cutting down of the panels from arch-

topped formats to their present rectangular profiles in the move from one location to another.

The construction and materials of *The Battle of San Romano*

The National Gallery panel consists of about eight horizontal planks of poplar,¹⁰ butt-joined along the edges, but not doweled, with broad strips of irregularly shaped reinforcing canvas laid vertically over the joins on the front face of the panel. There are large gaps between these pieces of fabric. The support has been altered in a number of ways. Originally it was larger and shaped to fit an architectural setting with carved stone corbels, which were evidently in contact with the upper part of the panel.¹¹ It also appears to have had an arched top, possibly a Gothic arch, which was cut away, probably in connection with a move in location. The spandrel-shaped remains of the arching corners were made up with new pieces of gessoed poplar, so that all three panels of the series are now rectangular in format (see below). The evidence is that these alterations were made in the fifteenth century (see below). The back of the London picture had been planed down before acquisition by the National Gallery from the Lombardi-Baldi collection in 1857, and the Uffizi panel has also been thinned. That in Paris has a reinforcing thin oak panel supporting the original.¹² Poplar panels from this period in Italy for large pictures were generally rather thick, and the backs left fairly roughly finished. Some idea of the general appearance can be gained from Uccello's *Hunt in the Forest*, of about 1460, now in Oxford (Ashmolean Museum), which retains its original thickness and unaltered reverse surface. A photograph of the back has been published.¹³

In keeping with a thick and heavy panel support and the extensive use of metal leaf in the composition, the gesso preparation layers are also substantial. Measurement on cross-sections indicates a total thickness of over 700 microns, comparable to the thickness of the plaster *intonaco* of some contemporary frescoes.¹⁴ The gesso was applied to Uccello's panel in at least three layers: two of *gesso grosso*, and a final fine layer of *gesso sottile*. X-ray diffraction analysis (XRD) indicates the *gesso grosso* to be largely anhydrous calcium sulphate (anhydrite), which has superior mechanical properties with a glue binding medium, whereas the final *sottile* layer is pure gypsum, which may be applied as a smoother, finer-grained upper layer, very well suited to take bole, and then gold and silver leaf, and the thin flat

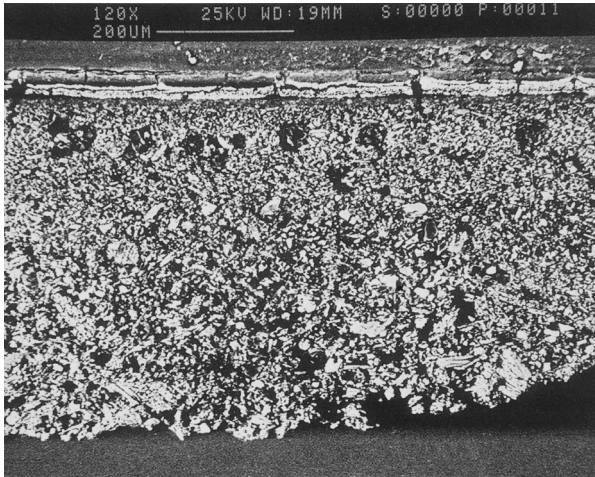


FIG. 2 Cross-section of paint and gesso ground as a back-scattered electron image in the scanning electron microscope, showing coarse gesso and finer gesso at the surface beneath the paint layers. Original magnification 120 \times ; actual magnification 88 \times .

paint layers of egg tempera paint. The distinction between the gesso layers is revealed clearly in SEM micrographs of cross-sections (FIG. 2), an observation made first by Elisabeth Martin at the Laboratoire of the Louvre.¹⁵ In contrast to the total thickness of gesso on the panel, the layers of bole for gold and silver leaf are exceptionally thin, rarely exceeding five microns (see PLATE 12).

For such an elaborate composition requiring many complex interlocking forms, the detailed construction of perspective and recession, and a highly wrought decorative surface, considerable advance planning and design were clearly necessary; elements of the design were worked up in a certain amount of preliminary drawing in thin fluid dark paint or ink on the gesso surface and using incised lines inscribed freehand, with a straight edge and with compasses. Traces of drawing can be seen through the paint outlining the bodies and limbs of the horses, in the lances, in Niccolò da Tolentino's banner, and for elements of the horses' saddlery and harnesses, as well as in smaller details such as the outlines of the red boots of the figure hidden behind the black charger on the left (PLATE 4).

In general, when the passage to be painted adjoins an area of intended gold or silver leaf, the drawing seems to be reinforced with an incised line which continues the outline, although this procedure was not followed slavishly everywhere in the preliminary design. An example can be seen clearly, however, in the outline of Niccolò's head, where incised lines mark the border of his forehead and gold hat, and where his neck and chin meet the silver armour



PLATE 4 Detail of the boots of the partially hidden figure, centre left, showing underdrawn outline on the gesso ground beneath the paint.

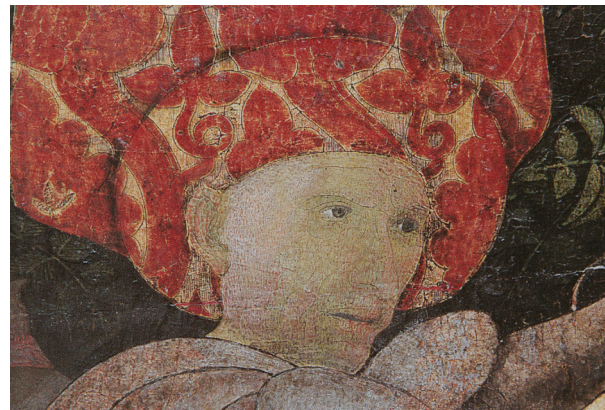


PLATE 5 Detail of Niccolò's head with incised lines at the junction of paint with gold and silver leaf. The lines around the brows, cheeks, nose and lips are painted, not incised.

(PLATE 5). A similar use of drawing continued or reinforced by incision is used for the outline for the page's head. Freehand inscribed lines include many of the outlines defining the structure of the knights' silver armour, the gilded ellipses of decorative medallions on the horses' harnesses, and some of the smaller circular decorations such as the gilded balls attached to the white charger's bit. Freehand straight lines are also inscribed in the gold bands and decorations of the harnesses. There are also incised hatched lines made freehand in the gold leaf of Niccolò's hat, and S-shaped curves in some of the silver plumes of the surrounding knights, but these are decorative rather than part of the preliminary design.

Many other elements, such as the broken lances, were drawn along a straight edge, and ruled straight lines can be seen in the upright lances, the scabbard of the knight at the right and the outstretched silver blade of the sword of the knight challenging him. The tubes of the trumpets at the left are drawn simi-



PLATE 6 Compass points in decorative medallions on the harness of the black charger to the left.



PLATE 8 Detail of the trumpeters, left, showing thin dense lines of paint around their eyes, cheeks and fingers.



PLATE 7 Detail showing Uccello's use of the compass in the hilt of a broken lance, centre foreground.



FIG. 3 X-ray detail of the trumpeters to the left showing thin lines of radio-absorbent paint in the eyes, cheeks and hands of the figures.

larly and are continued with freehand curving lines for the bells. Many indentations produced by the points of a compass remain visible through the gold leaf in the circular decorative medallions on the horses' harnesses and a few features which are painted rather than gilded were also defined with the compass, for example the hilts of the broken lances in the foreground (PLATES 6 and 7). Some of the intersecting incised arcs which define the armour were constructed using compasses; others are freehand.

Incised lines, however, were not confined to the earliest stage of design. Certain lines were drawn with a stylus into the early paint layers, particularly the pink paint of the foreground, and incised lines are also used as finishing touches to the design in the paint layers, and are clearly meant to be a visible part of the composition. This technique is familiar for the decoration of gold leaf, but less usual as a device to break the surface of tempera paint. Early incised lines can be distinguished from those applied after a paint layer, or layers, was present by close examination of the paint surface with a hand lens, but they are also sometimes distinguished in the X-ray images

of the painting, the incisions directly on to gesso often appearing light in the X-ray, whereas those that cut through the paint register as dark.¹⁶ The *Hunt in the Forest* (Ashmolean, Oxford) provides a similar case, in which it has been noted that inscribed lines were applied to the finished paint layers as well as to the gesso as the first stage of composition and of the construction of a vanishing point.¹⁷ Similar finishing touches produced by inscribed lines in the still soft paint can be detected in the six scenes on a single panel making up Uccello's *Profanation of the Host* now in Urbino, where the scale of painting is closer to the Oxford picture than to the *Battle of San Romano*.¹⁸

There are finely painted lines with a pronounced graphic quality at or near the surface, clearly intended to reinforce the design and, in the case of those drawn onto the paint of Niccolò's face – around his brow, nose, lips and cheeks – to render more striking

his tense, determined facial expression (see PLATE 5). These lines are in thin, fluid mid-brown paint, and can be seen also in the faces and hands of the two trumpeters at the left (PLATE 8), and in the curls and ringlets of the white charger's forelock. Unusually, these linear elements register as fine, very clear white features on the X-ray, that is, they are X-ray absorbent (FIG. 3), although they do not appear obviously to follow earlier incisions in the gesso or lower paint layers.¹⁹ A drawn lance-point on the pink foreground between the legs of the large black horse, never completed in paint or silver leaf, also registers in just this way in the X-ray photograph.

It is usual in large panels in which metal leaf plays a prominent role, for the gilding, and silvering, to be carried out at an early stage, usually before any paint is applied. The incised lines marking out these areas are the first stage, followed by the application of a thin layer of bole mixed with an aqueous binder. In places the bole layer can be seen to infill incised lines, where there is a slight overlap in the application of bole. Examination of cross-sectional samples from areas of metal leaf reveals that the colour of the bole layer for the gold leaf differs slightly from that used beneath silver: the former is lighter and more orange-red, while the bole for silver is cooler, browner and contains a small proportion of black pigment. A variation in bole colour, where both gold and silver leaf are used together on a picture, has been noted elsewhere, for example in the panels of Sassetta's Sansepolcro altarpiece of 1437–44 in the National Gallery (NG 4757–63). In the *Battle of San Romano*, the bole layers for both gold and silver, although thin, are sufficiently strongly toned to conceal the whiteness of the gesso below and to influence the colour of the thin metal leaf on top.

Two possible reasons for the variation in bole colour suggest themselves: either a cooler, darker tone was specifically sought for the silver leaf of the knights' armour, or a more practical explanation is involved: that in order to distinguish areas designed to be gilded from those where silver leaf was intended, the difference in bole colour was introduced as a guide to be followed by the workshop. It is likely that all the areas of metal leaf were applied before painting began, but, since the paint has been applied so carefully to pre-planned outlines, there are few clearly detectable areas of paint overlapping metal leaf. An exception is at the periphery of Niccolò's hat, in which the dark green surrounding paint can be seen just to encroach onto the gold leaf. After the metal leaf was burnished, further decoration of gilded and silvered areas – by punching, inscribing and the

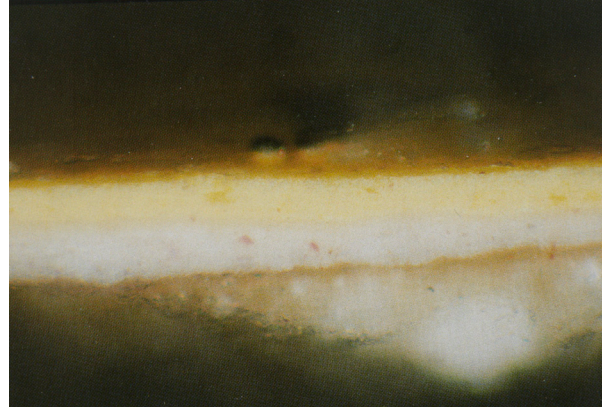


PLATE 9 Cross-section of yellow lance, foreground left, painted in lead-tin yellow 'type I' with a surface glaze of yellow lake and golden ochre. The pink paint of the foreground and the gesso ground are visible beneath. Original magnification 275×; actual magnification 235×.

application of glazes – would have followed the painting of the main parts of the composition. This order of execution would have been standard for a panel with significant areas of gilding or silver leaf.

The principal binding medium for the paint layer on the main part of the composition has been shown by analysis to be egg tempera, with the limited use of egg tempera combined with a little drying oil (*tempera grassa*),²⁰ in this case walnut oil, in certain of the foliage greens.²¹ Where drying oil is incorporated with egg as a medium, the paint is a little slower drying and the resulting film glossier and more saturated than one bound in egg alone, although the quantity of egg medium also influences the optical properties of the dried paint. Other factors also play an important part in the optics of the dried paint, particularly the proportion of lead white with which it is combined. It is common to find the use of egg and oil in areas where greater saturation and translucency is required, as in glazes of all kinds, and in the darker colours of foliage greens and landscape. A binder of *tempera grassa* occurs also in the spandrel additions (see below).

Following the application of bole and metal leaf to selected areas, as described, the main broader elements of the painted composition – the pink foreground, the horses' bodies, the black background to the hedge of roses and the distant terraced hilly landscape – were first laid in thin flat unmodulated applications of pure tempera paint. Each is essentially a single layer, with the smaller-scale details worked directly on top, for example the broken lances in the foreground (PLATE 9), the foliage and flowers of the rose hedge, the figures and landscape details in the distance, and the oranges and orange blossom to the



PLATE 10 Detail of the silver-leaf armour of a knight to the left, showing fingerprints in the brownish-black surface glaze.

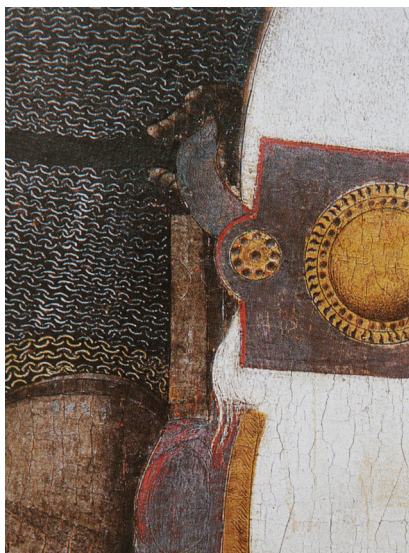


PLATE 11 Detail of darkened vermillion in the white charger's harness.

right. The final stages would have been the highly elaborate detailing of metal leaf, using further incised lines, the application of glazes of various colours and the punching and tooling of the gold and silver leaf to produce both decorative effect and three-dimensional structure. The dark, almost black, translucent glaze-like modelling over silver leaf to create the forms of the armour, identified as a soft-wood pitch combined with walnut oil, was clearly applied, or worked with the fingers: many areas preserve the clear impression of finger and thumb prints to spread and blot the paint and to create the modelling (PLATE 10).²² So far, no fingerprints have been detected in the red glazes on gold, for example on Niccolò's brocaded hat and cape, nor in the green glazes on the page's surcoat, but these glazed areas are more decorative in function and involve less modelling to represent three-dimensional form.

Close examination of the surface reveals just how varied and detailed the designs are, with the use of at least seven different punches on the metal leaf, used singly and in combined patterns, as well as a great deal of freehand inscription. Perhaps the best way of appreciating this diversity and the intricacy of Uccello's technique in the three associated battle-pieces is to consult the beautifully printed colour details in Pietro Roccasacca's recent book on the battle scenes.²³

Uccello's palette for the National Gallery *Battle of San Romano* is fairly standard for the period. The results of identification of the materials of the picture from paint samples and cross-sections are collected in the Table, with notes on their manner of use. Overall, the palette employed is rich and powerful in colour, and this is strikingly the case when these strongly coloured materials are seen set against the reflective qualities of burnished gold and silver. Final glazes are also present on the preliminary paint layers: for the shadowed areas of yellow lances in the foreground, the roses, the blue trappings of the horses and the darker foliage of the rose bushes and orange trees, for example. While the condition of the picture could be described as reasonably good given its scale, original function and date, sadly there has been widespread, drastic and distorting colour change in many of the pigments, and, unfortunately of course, considerable tarnishing of the silver leaf of the knights' armour. There is also paint loss, loss of metal leaf, abrasion and damage from repeated cleanings and clumsy retouching and reconstruction, some of which has been allowed to remain on the picture.²⁴

Perhaps the most damaging change in pigments, apart from the general diminishment of some of the reflective quality of the silver leaf, is the very extensive darkening of vermillion in the picture, which almost everywhere has developed a purplish-grey metallic-looking cast (PLATE 11).²⁵ It is particularly serious in the red of the banners seen between the group of knights at the left and in the shafts of the lances behind, in the horses' harnesses and saddlery, including that of Niccolò's white charger, and in the broken lances in the foreground at the right. There is also some darkening of the green glazes containing copper, in the foliage of the rose hedge, and in details in the foreground and more distant landscape. There is fading of red lake pigment in the pink foreground, and in the glazes on the rose blossoms, although it survives well in the thicker, pure glaze-like paint over gold on Niccolò's hat and cape, and on some of the areas of silvered armour. The dark brownish-black

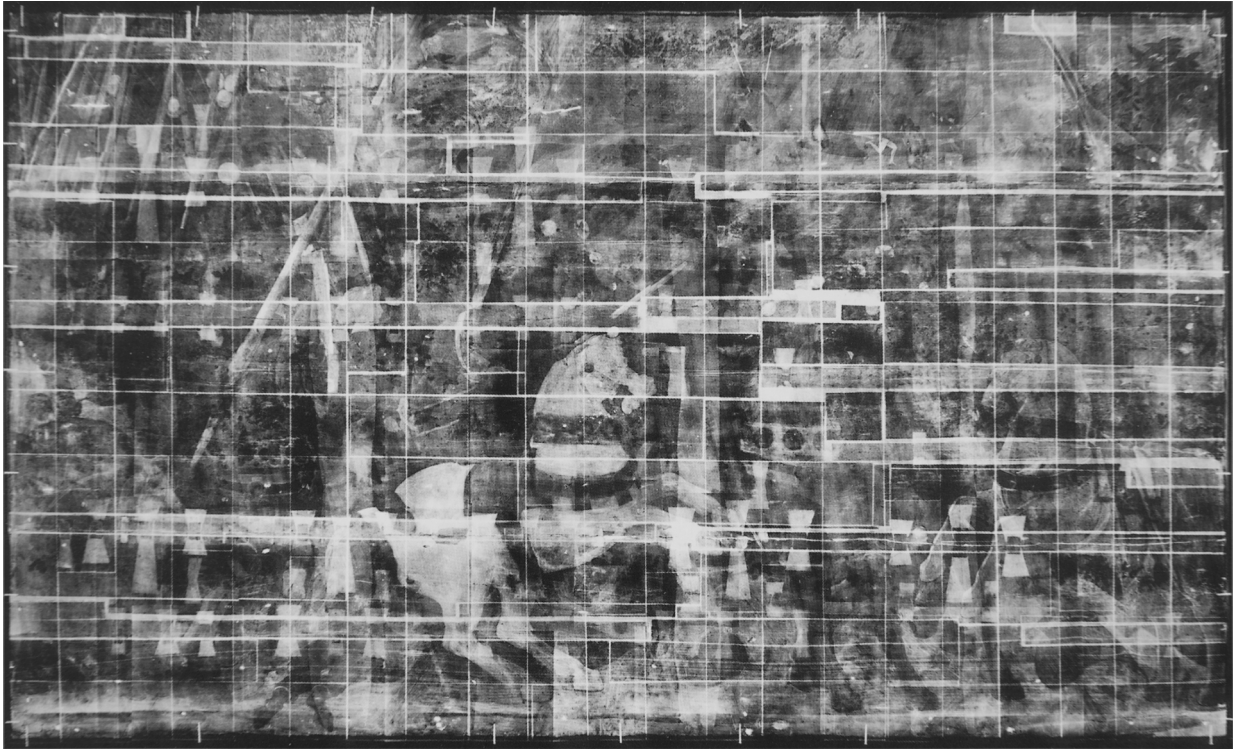


FIG. 4 Uccello, *Niccolò Mauruzi da Tolentino at the Battle of San Romano* (NG 583). X-ray of the whole. Note that the grid of white lines arises from the balsa wood build-up on the back of the thinned original poplar panel.

glazes on the original parts of the silver armour are fairly well preserved, even if rubbed and reinforced in places. The ultramarine blues seem not to have changed much, although surface glazes of pure ultramarine painted over pale blue underlayers of ultramarine mixed with white are abraded. The red lead paint of the oranges has changed and lightened to some degree, particularly at the outer edges of each fruit.²⁶ It can be presumed that the whites, greys, dull browns and blacks have altered quite little since stable pigments only are present in these paint layers.

The corner additions

The origin and date of the additions to the panel that make up the spandrel corners to produce the present rectangular format are critical to understanding the early history of the painting and, by extension, that of the associated battlepieces in Florence and Paris. Evidence can be gained from the physical construction of the additions, where these are accessible, the X-ray images of the junctions of the main panel with their additions (FIGS. 4 and 5), and the layer structure and materials of the paint on the additions. From sampling and analysis of the National Gallery painting, it is evident that the spandrel additions are very old, and, on the basis of their materials and technique of painting, they can be dated most probably

to the later part of the fifteenth century.²⁷ It is debatable, however, whether they were applied by Uccello himself, since documentary evidence seems now to point to a date for the additions after the painter's death in 1475.

There is a correspondence in technique between the structure on the additions and the main panel, but there are four important differences. First, the layer of reinforcing canvas covers the whole of each addition rather than just the joins in the wooden members, as on the main panel. Second, the gesso ground layer on the additions is composed solely of gypsum, rather than a sequence of layers utilising anhydrite and gypsum. Third, the paint medium on the additions is *tempera grassa*, but the oil content combined with egg is linseed oil rather than the walnut oil medium mixed with egg for the green paints on the main panel. Fourth, while the foliage greens in the principal composition are based on layers of verdigris, with and without a content of lead-tin yellow, painted over a layer of solid black to give depth of colour to the greens (see PLATES 13 and 14), those on the additions consist of layers of artificial malachite painted over solid black (see PLATE 15). Nowhere on the main panel has artificial malachite been found, and nowhere on the additions was verdigris used in the foliage greens.

The use of the artificial form of malachite, par-



FIG. 5 X-ray detail of the junction between the left-hand spandrel addition and the main panel. Note that one of the original iron fixings used to hang the panel is visible as a white streak to the right of the image.

ticularly for foliage paint, is a fairly common technique in Florentine panel painting of the fifteenth century and occurs also in works from Siena, Ferrara and Venice.²⁸ It is fairly standard also to find the artificial form of malachite painted over a black underlayer for dark foliage and landscape greens, and, in fact, this is the method used in the main part of the composition in the Paris battlepiece²⁹ as well as in large passages of the landscape in Uccello's *Hunt in the Forest*.³⁰ Similar techniques, for example, are used in the landscape of Pesellino's altarpiece *The Trinity with Saints* now in the National Gallery, begun in 1455 and finished by Filippo Lippi and his workshop³¹ after 1457, and artificial malachite for landscape, foliage and draperies has been found in a number of works throughout the fifteenth century, including Botticelli's canvas painting, *The Virgin*

adoring the Sleeping Christ Child, probably of the 1480s, acquired recently by the National Gallery of Scotland, where it occurs over a black underlayer in foliage paint.³² However, this pigment appears to have been abandoned towards the end of the fifteenth century or just at the beginning of the sixteenth century, probably because its use is suited to the optical properties of egg tempera and *tempera grassa*, rather than to oil. The use of artificial malachite on the spandrel additions of the *Battle of San Romano* is consistent with a date in the later part of the fifteenth century, and suggests that the additions were not applied as late as the sixteenth century, when the techniques for depicting foliage had changed with the development in Italy of media involving drying oils as the main binder.

Overall, the painter of the additions, while not

duplicating precisely those of the main panel, employed methods which are generally comparable. The oranges on the main panel are painted in red lead (lead tetroxide) and so are those on the additions. Moreover, in each case a single layer of orange paint is applied over a layer of black, thereby rendering the tonality of the main composition and the addition very similar. At the far right side of the panel, there are also passages of foliage paint of a coarser texture, dull brownish green in colour and painted in a style that differs from the surrounding dark green foliage. This paint is also present on the right-hand addition and since it passes over greens containing artificial malachite on the addition, appears to be a later modification to the right-hand side of the composition, perhaps to correct a disunity that had developed in the continuity of the composition as it traverses the joins in the panel from Uccello's original to the slightly later spandrel.

The fact that the corner additions are fifteenth century almost certainly suggests that they were made when the paintings were moved from the Bartolini Salimbeni town house, now destroyed but originally between Via Porta Rossa and Corso degli Strozzi (now Via Monalda), to the Palazzo Medici in Via Largha, probably between 1479 and 1486.³³ The paintings would not have fitted between the vaults of the Camera di Lorenzo for which they had not been designed, and so were reduced in height as far as was possible without impinging too much on the composition, but probably the hill-tops of the landscape and the sky were lost. In the inventory of 1492 the paintings are stated to be $3\frac{1}{2}$ braccia high, including, by implication, their frames.³⁴ Each currently measures about 180 cm high, that is approximately 3 braccia, thus allowing for about 15 cm for frames top and bottom. The unsightly gaps, originally designed to fit around corbels, were probably filled by the woodworker who removed the paintings, Francione, as suggested by Caglioti,³⁵ since pure gypsum, as a ground, as described above was presumably more commonly used by carpenters and framemakers.

The three paintings almost certainly hung in a row along the east wall, that being the only uninterrupted wall long enough to accommodate them, as well as the best lit.³⁶ There Lorenzo the Magnificent could glory in the heroic actions of past Florentines, and admire the magnificent decorative effects of gold and silver leaf and the intricacies of armour so accurately depicted in the tapestry-like paintings he had so unscrupulously commandeered.

Acknowledgements

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Notes and references

- 1 NG 583 is included in the revision of the catalogue of Italian Paintings in the National Gallery, 1400–1460, to be published in autumn 2001. For the painting see S. and F. Borsi, *Paolo Uccello*, Paris 1992, pp. 126–8, and 308–12, with bibliography, and P. Roccasacca, *Paolo Uccello. Le Battaglie*, Milan 1997. For discussion of the historical sources, the Battle of San Romano and the issues involved see G. Griffiths, 'The Political Significance of Uccello's Battle of San Romano', *Journal of the Warburg and Courtauld Institutes*, 1978, pp. 313–16; Randolph Starn and Loren Partridge, 'Representing War in the Renaissance: The Shield of Paolo Uccello', *Representations*, Vol. 5, 1984, p. 59, note 6; S. and F. Borsi, *op.cit.*, p. 309; W. J. Wegener, '“That the practice of arms is most excellent declare the statues of valiant men”: the Luccan War and Florentine political ideology in paintings by Uccello and Castagno', *Renaissance Studies*, Vol. 7, no. 2, June, 1993, pp. 131ff.; and Roccasacca, *op.cit.*, pp. 10ff. An extremely thorough discussion of the sources with lengthy quotations is to be found in Volker Gebhardt, *Paolo Uccello's 'Schlachten von San Romano'*, *Bochumer Schriften zur Kunstgeschichte*, 1989, Frankfurt am Main 1989, pp. 53–9 and 189–207.
- 2 Ed. M. Spallanzi and G.G. Bertelà, *Libro d'Inventario dei Beni di Lorenzo il Magnifico*, Florence 1992, p. 11. The copy of the inventory was made in 1512. Earlier sources simply call them a joust. See *Il Codice Magliabecchiano* (ed. C. Frey), Berlin 1892, p. 100: 'Dipinse (Uccello) e quadri delle giostre del palazzo de medici nella via Largha.'
- 3 Document transcribed by H.P. Horne, 'The Battle-Piece by Paolo Uccello in the National Gallery', *The Monthly Review*, 1901, p. 138.
- 4 F. Caglioti, *Donatello e i Medici. Storia del David e della Giuditta*, Florence 2000, pp. 265–81. I am extremely grateful to Professor Caglioti for allowing me to read his chapter on the Battle of San Romano when the book was still in proof.
- 5 Caglioti, *op.cit.*, p. 274
- 6 For a summary of views on dating see S. and F. Borsi, cited in note 1, pp. 331–2.

- 7 L. Boccia, 'Le armature di Paolo Uccello', *L'Arte*, 3, 1970, pp. 58–91, for the armour in the battle scenes, esp. p. 68.
- 8 Roccasacca, cited in note 1. He dates the NG and Uffizi paintings around 1436 and the Paris painting around 1456–8.
- 9 Catalogue of Italian Paintings in the National Gallery, 1400–1460, cited in note 1.
- 10 There is no clear record of the original panel structure for NG 583 in the Conservation Dossier, but examination of photographs taken in 1954 of the reverse and an assessment of the positions of reinforcing wooden butterflies set into the back of the panel suggest that it is made up of eight horizontal planks of poplar. The Uffizi panel has the same number of members, whereas that in the Louvre is made up of just five horizontal planks. The reverse of the National Gallery panel was built up with balsa wood in 1960.
- 11 The structures and original shapes of the panels of Uccello's series are discussed in detail by U. Baldini, 'Restauro di dipinti fiorentini', *Bollettino d'Arte*, XXXIX, 1954, pp. 226–40.
- 12 We are grateful to Patrick Le Chanu for this information.
- 13 A. Massing and N. Christie, 'The Hunt in the Forest by Paolo Uccello', *The Hamilton Kerr Institute Bulletin*, Vol. 1, 1988, figs. 2 and 3, p. 31.
- 14 Similar measurements were found for the plaster *intonaco* layer in Domenico Veneziano's transferred fresco in the National Gallery (NG 766, 767 and 1215).
- 15 A number of SEM micrographs as back-scattered electron images showing the structure of gesso layers and their thicknesses have been published by Elisabeth Martin et al. See E. Martin, N. Sanoda and A.R. Duval, 'Contribution à l'Etude des Preparations Blanches des Tableaux Italiens sur Bois', *Studies in Conservation*, 37, 2, 1992, pp. 82–92.
- 16 The usual explanation for incised lines appearing as light in X-radiographs of paintings is that they have been made directly on the gesso ground and are subsequently infilled by X-ray absorbent wet paint applied on top; where the incised line is made through dried paint it should appear dark in the X-ray. This interpretation is not always correct and some of the incised lines which are present in the gesso of NG 583 are in fact dark in the X-ray image, and certain continuous lines are dark in places and light in others. This must be a function of the drying properties and fluidity of the tempera paint applied on top.
- 17 Massing and Christie, cited in note 13, pp. 35–6, and plates 25 and 26, p. 42.
- 18 Uccello's *Profanation of the Host* is illustrated in Borsi, cited in note 2, pp. 260–5.
- 19 Close examination of the paint surface reveals that these lines drawn in paint are fairly thickly applied, although narrow in profile. The material used must be highly X-ray absorbent.
- 20 The origin and use of *tempera grassa* in fifteenth-century Italian painting is discussed by Jill Dunkerton in 'Modifications to traditional egg tempera techniques in fifteenth-century Italy', *Early Italian Paintings: Techniques and Analysis*, Symposium, Maastricht, 1996, ed. T. Bakkenist, R. Hoppenbrouwers and H. Dubois, Limburg Conservation Institute, Maastricht 1996, pp. 29–34.
- 21 The analysis of the organic components of the paint film, and particularly the binding media used, was carried out by Raymond White using GC–MS and FTIR.
- 22 The constitution of this glaze containing oil and charred resinous material would have rendered it sticky and difficult to apply with a brush. It would have been natural for the painter to apply and model the glaze with the fingers. The application of glazes in this way, and putting them on with the palm of the hand, is described by Armenini in 1586, see G. B. Armenini, *Deveri precetti della pittura*, ed. Marina Gorreri, Turin 1988, Book II, Ch. 9, pp. 144–5.
- 23 Roccasacca, cited in note 1.
- 24 Horne, cited in note 3, p. 135, noted already in 1901 that the paintings had been overcleaned.
- 25 The darkening of vermilion is a common phenomenon in egg tempera medium, and is thought to be induced either by light or by rubbing and abrasion of the paint surface containing this pigment. Impurities in vermilion may catalyse the process. See R.J. Gettens, R.L. Feller and W.T. Chase, 'Vermilion and Cinnabar', *Artists' Pigments: A Handbook of Their History and Characteristics*, Vol. 2, ed. A. Roy, Washington 1993, pp. 167–9. More recent research has been carried out by R. Grout at the Courtauld Institute, Department of Technology and Conservation, and her unpublished dissertation on the darkening of vermilion is lodged there.
- 26 The lightening of red lead was first observed in English medieval wall paintings by Helen Howard. See S. Cather and H. Howard, 'St. Gabriel's Chapel, Canterbury Cathedral: its technique, condition and environment reassessed', in *Forschungsprojekt Wandmalerei-Schäden, Arbeitshefte zur Denkmalpflege in Niedersachsen*, 11, Hanover 1994, pp. 141–56. Current research by David Saunders and Marika Spring in the Scientific Department of the National Gallery has demonstrated the role of light and humidity in bringing about the transformation of red lead to lead carbonate and lead hydroxycarbonate in test samples painted out in a variety of media.
- 27 Alessandro Conti in E.H. Gombrich, O. Jurz, S. Rees Jones, J. Plesters, *Sul Restauro*, ed. A. Conti, Turin 1988, p. 78. Conti suggested the corner additions to the Uffizi painting were fifteenth century.
- 28 See J. Dunkerton and A. Roy, 'The Materials of a Group of Late Fifteenth-Century Panel Paintings', *National Gallery Technical Bulletin*, 17, 1996, pp. 21–31.
- 29 Artificial malachite with a spherulitic particle form has been noted in cross-sections taken from the original foreground landscape in the Paris Battlepiece. We are very grateful to Elisabeth Martin for sharing these unpublished results with us.
- 30 Massing and Christie, cited in note 13, pp. 36, 45 and plates 29 and 30, p. 42.
- 31 Two distinctive types of green landscape and foliage are present on Pesellino's altarpiece, *The Trinity with Saints*: thin translucent copper-containing glazes in the middle distance landscape, now extensively browned, and thicker, crustier deep green paint for the more substantial

greens of the foreground and trees, which are painted using artificial malachite over a layer of solid black pigment. Stylistic analysis of the altarpiece suggests that the paint containing artificial malachite had been applied by Pesellino, whereas the glaze-like passages were the responsibility of the Filippo Lippi workshop.

- 32 Cross-sections from the Edinburgh *Virgin adoring the Sleeping Christ Child* by Botticelli were supplied by Michael Gallagher, Keeper of Conservation at Edinburgh, and examined by Marika Spring at the National Gallery. Artificial malachite is used for the darker foliage of the rose hedge surrounding the Virgin, as a single layer over solid black pigment. Interestingly, the deep green lining of the Virgin's cloak makes use of natural malachite.
- 33 One of the alternatives raised by Caglioti (cited in note 4, p. 268), namely that they could have been adapted when they were moved from the Bartolini Salimbeni's country house in Santa Maria a Quinto (northwest of Florence) to their town house, is less likely. It cannot entirely be discounted that the paintings were not commissioned by the Bartolini Salimbeni family but acquired by them. Caglioti (p. 271, note 192) raises and then dismisses the possibility that they could have been commissioned for the Palazzo Vecchio.
- 34 See note 3 above.
- 35 Caglioti, cited in note 4, p. 268.
- 36 W. Bulst, 'Usò e trasformazione del palazzo mediceo fino ai Riccardi', in eds. G. Cherubini and G. Fanelli, *Il Palazzo Medici Riccardi di Firenze*, Florence 1990, p. 110; P. Joannides, 'Paolo Uccello's *Rout of San Romano*: a new observation', *Burlington Magazine*, 131, 1989, pp. 214–15 and V. Gebhardt, 'Some problems in the reconstruction of Uccello's *Rout of San Romano* cycle', *Burlington Magazine*, 133, 1991, pp. 179–85. Both the latter authors were exploring the possibility first raised by Boccia, cited in note 7, p. 133, and by Conti, cited in note 27, p. 78, that the series had not been designed for the Camera di Lorenzo, and thus not for the Palazzo Medici. Boccia, Conti and Gebhardt suggested they had been intended for the previous Medici home, the Casa Vecchia, nearby, and also in the Via Largha. For the most detailed analysis of the Camera di Lorenzo and its furnishings see A.M. Amonaci and A. Baldinotti in the exhibition catalogue, eds. G. Morolli, C. Acidini Luchinat, L. Marchetti, *L'architettura di Lorenzo il Magnifico*, Florence 1992, pp. 126–8.

See pp. 16–17 for Table.

Table. The Structure and Materials of Uccello's *Battle of San Romano* (NG 583)

THE MAIN COMPOSITION

Support, Ground, Drawing and Paint Medium

Support: Horizontal poplar¹ planks, 182 × 320 cm. Thinned before 1857 and supported by balsa wood build-up applied in 1960.

Ground: Several layers of coarse *gesso grosso* (gypsum + anhydrite), with a thin surface layer of *gesso sottile* (gypsum);² animal-skin glue binder.

Drawing: Thin paint or ink containing very fine black pigment, probably lampblack, applied directly to the gesso ground; medium unknown. Much of the composition is marked out by incised lines in the gesso.

Medium: Analysis of the paint binding medium³ from a number of samples showed the straightforward use of egg tempera paint in much of the picture, the pink foreground, for example, and the oranges in the middle distance to the left. Certain of the red glazes were shown to be rich in egg medium, while the green foliage paints contained egg tempera mixed with walnut oil (*tempera grassa*). Walnut oil was also found in the dark translucent glazes on the silver armour (see below).

Metal Leaf

Gold: Water gilding; gold leaf over thin orange-red bole with an aqueous adhesive. Certain areas are decorated with glazes, for example Niccolò's gold and red hat and cape (red lake glaze, probably lac), and the page's gold and green sleeve (verdigris and oil glaze).

Silver: Silver leaf⁴ over thin orange-brown bole with an aqueous adhesive (PLATE 12). The knights' armour is modelled with a brownish-black glaze identified as containing a softwood pitch combined with walnut oil.⁵ Red glazes over silver are present elsewhere, as in the page's drum, the fallen shields in the centre foreground and right, and the knights' plumes (identified in a sample as lac lake).⁶ A green glaze based on verdigris over silver leaf occurs in the saddle of the knight on the black horse to the right, and ultramarine is used as a glaze over silver for parts of the knights' armour, particularly the central lancer on the dark grey charger. The knights' silver chain mail is worked as a *sgraffito* design in black over a solid layer of silver leaf.

Paint Structure and Materials⁷

Foreground: The pink foreground consists of red lake mixed with white; two layers are present in places. The broken yellow lances are painted directly over the pink foreground using lead-tin yellow ('type I'),⁸ and their edges shaded with a semi-translucent glaze of yellow earth mixed with yellow lake. The dark blue-greens of the lance in the foreground and the fallen shield to the right are painted with mineral azurite

Flesh paint: The flesh paints consist of single layers of lead white combined with small quantities of vermilion, and red

and brown earths, painted over a layer of *verdaccio* comprising white, green earth, golden ochre and a trace of red earth.

The horses and their trappings: The body of the black charger to the left is painted in a mixture of charcoal black with a little lead white, over a very thin layer of red-brown earth; that of the white charger is largely lead white with small quantities of black pigment and yellow earth in the greyish halftones. The blue saddlery and harnesses consist of natural ultramarine with white; the darker modelling is applied on top as glazes of purer ultramarine. The reds are finely ground vermilion; many sections are heavily discoloured at the surface resulting in a greyish-purple sheen.

The rose hedge, pomegranates and orange grove, middle distance: The underlayer for all areas of the foliage paint consists of a solid paint of pure charcoal black, with the details of the deep green foliage painted on top (PLATE 13). The green paint comprises a mixture of verdigris and lead-tin yellow, with a larger proportion of lead-tin yellow in the lighter and greener areas. Earth pigments and black are present in varying quantities. The pink roses consist of red lake glazes (abraded) over a layer of white paint; the ruby flesh of the pomegranates is painted in the same way. The oranges are virtually pure red lead pigment (lead tetroxide)⁹ (PLATE 14).

Landscape background: The greys and greyish-mauve tones of the distant landscape consist of variable quantities of white, charcoal black and red lake pigment, with a greater proportion of red lake in the mauve tones.

THE SPANDREL ADDITIONS

Support, Ground, Drawing and Paint Medium

Support: Poplar.¹⁰

Ground: Single layer of gypsum.¹¹

Drawing: None detected.

Paint medium: Analysis of the medium¹² of foliage paint and of one of the oranges indicated the use of a mixed medium of egg tempera and oil (*tempera grassa*), in this case linseed oil.

Paint Structure and Materials

Foliage and oranges: The dark greens of foliage consist of a layer of artificial malachite¹³ over a layer of solid charcoal black paint. This dark layer is present also beneath the oranges (PLATE 15), which, as on the main panel, consists just of red lead pigment (lead tetroxide).¹⁴

Notes

- 1 Microscopical identification.
- 2 X-ray diffraction analysis (XRD).
- 3 Paint media examined by gas-chromatography linked to mass-spectrometry (GC-MS) and by Fourier-transform infra-red microspectrophotometry (FTIR). Some earlier

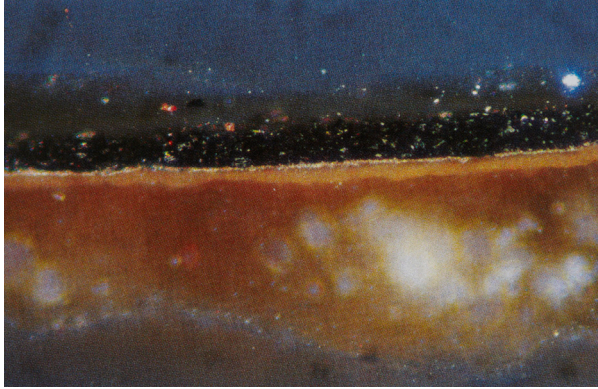


PLATE 12 Cross-section showing a very thin layer of silver leaf for armour, with orange-brown bole beneath. A brownish-black glaze is present at the surface. Original magnification 400 \times , actual magnification 345 \times .

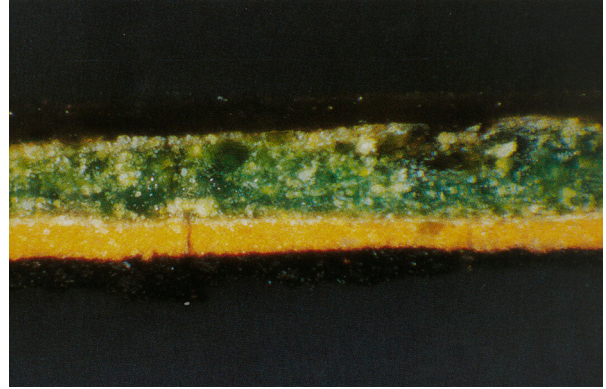


PLATE 14 Cross-section of one of the oranges, left, painted in red lead (lead tetroxide) over green foliage. No gesso is present in the sample. Original magnification 275 \times ; actual magnification 235 \times .

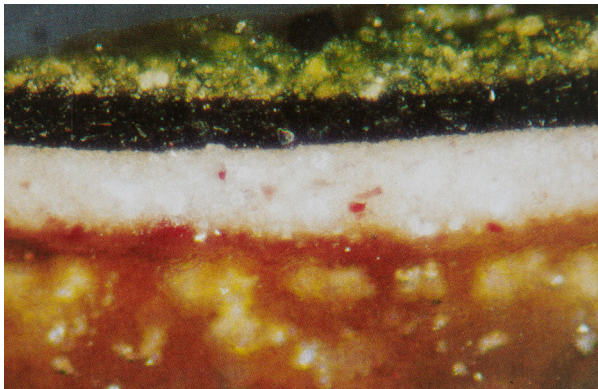


PLATE 13 Cross-section of dark green tuft of grass, foreground right, comprising verdigris and lead-tin yellow over a layer of solid charcoal black. The pink paint of the foreground lies beneath. Original magnification 400 \times ; actual magnification 345 \times .

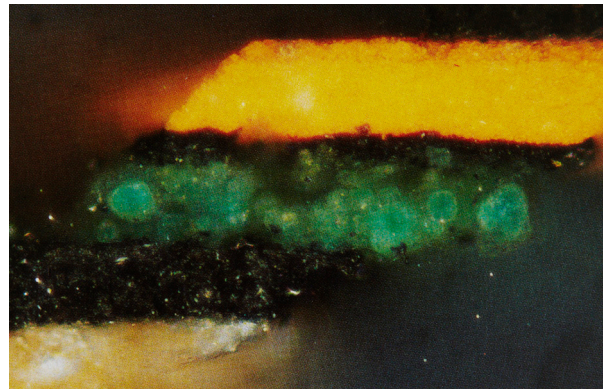


PLATE 15 Cross-section from one of the oranges on the spandrel addition, right-hand side, painted in red lead over a layer of charcoal black. Beneath this the foliage paint consists of artificial (synthetic) malachite, also over a layer of charcoal black. Original magnification 350 \times ; actual magnification 300 \times .

results were obtained using heating and solubility tests and by staining reactions.

- 4 Electron micro-beam probe analysis and energy dispersive X-ray microanalysis (EDX).
- 5 GC-MS; FTIR.
- 6 Identified by high performance liquid chromatography (HPLC).
- 7 Paint samples were examined using standard microscopical methods as paint cross-sections, thin sections and dispersed samples. Analyses were carried out microchemically, by XRD and using EDX.
- 8 XRD.
- 9 XRD.
- 10 Microscopical identification.
- 11 XRD.
- 12 GC-MS and FTIR.
- 13 The green pigment present on the spandrel additions was identified as malachite microscopically and by XRD. The spherulitic particle form of the pigment is characteristic of a manufactured origin.
- 14 XRD.