National Gallery Technical Bulletin

Volume 7, 1983

Published by Order of the Trustees,
Publications Department, National Gallery,
London

National Gallery
Technical Bulletin

Garry Thomson, Scientific Adviser
Martin Wyld, Chief Restorer

Ashok Roy: Editor

ISBN 0 901791 88 1
ISSN 0140 – 7430

Designed by James Shurmer

Printed by Henry Stone & Son
(Printers) Ltd, Banbury, Oxon.

'Samson and Delilah': Rubens and the Art and Craft of Painting on Panel

Joyce Plesters

Introduction

Rubens' *Samson and Delilah* (No.6461, Fig.1) was acquired by the National Gallery in 1980. Its condition and subsequent treatment is described in a note by David Bomford below. After cleaning and restoration the picture was the subject of an exhibition in the series 'Acquisition in Focus'. The exhibition included a short summary of technical information about the picture, but some aspects at least seemed sufficiently interesting to merit the more detailed account given below.

The history, iconography, and the development of the pictorial composition from preliminary drawing on paper to finished painting is outlined by Christopher Brown in a booklet published on the occasion of the exhibition mentioned above [1]. The picture was painted in *c.*1609, shortly after Rubens' return to Antwerp after several years in Italy. It was commissioned by Nicolaas Rockox, a notable figure in Antwerp society who was several times a burgomaster and held other public offices. He was not only Rubens' patron but personal friend and the *Samson and Delilah* was a private, not a public commission. As Christopher Brown explains, the large panel was specifically intended to hang above the seven foot high mantelshelf in the 'great salon' of Rockox's house. The modelling and foreshortening of the figures and the general perspective are appreciated to full effect only when the picture is viewed from below at this height (the height at which it was hung in the exhibition).

Rubens' technique of painting has always excited attention and admiration. The magnitude of his output, in number, scale and quality of pictures demanded a combination of bravura, speed and skill (not to mention the participation of numerous studio assistants). Yet his technique was such that his works have come down to us for the most part with the paint surface and colours wonderfully preserved. Now the discoloured varnish has been removed from the *Samson and Delilah* some passages, for instance the impasto of the candle flame (Fig.2 and Plate5g, p.49) and the locks of Samson's hair (Fig.3) seem to have retained the gloss and freshness of newly-applied oil paint.

A documentary source for Rubens' painting materials and technique

A useful documentary source for Rubens' materials and techniques, as well as for those of seventeenth century Flemish and Dutch painters in general, is the De Mayerne manuscript in the British Museum [2]. The author, Sir Theodore Turquet de Mayerne, became Royal Physician to James I, Charles I and Charles II in succession and at the English court had the opportunity to meet Rubens, Van Dyck and many other painters, and Rubens painted his portrait. As well as being deeply interested in painting and painters, he applied his scientific training to technical aspects of the subject and made experiments with artists' materials. The more important parts of the manuscript, from the point of view of painting technique, have been published more than once in the present century. The edition cited below is that by J.A. van de Graaf [3]. It has to be remembered that the manuscript was originally a private notebook of random jottings made over a period of twenty-five years (*c.*1620 – 46), and as a result some parts are difficult to interpret today. The compiler, van de Graaf, has conveniently rearranged the items under subject headings. More recently M. Kirby Talley has provided an interesting commentary [4].

A comparable work by the artist

Few paintings by Rubens have been subjected to detailed technical examination by modern methods, but it so happens that of the very few that have, the most important, the great altarpiece of *The Descent from the Cross* in Antwerp cathedral is of particular relevance to the National Gallery's *Samson and Delilah.* Not only were the pictures painted at almost exactly the same time, but *The Descent from the Cross* was commissioned by the Guild of Arquebusiers of Antwerp of which a leading official was Nicolaas Rockox who commissioned the *Samson and Delilah.* Indeed Rockox's portrait, in the guise of a biblical figure, appears in a wing of the altarpiece. The altarpiece underwent cleaning and restoration, combined with extensive examination, in 1961 – 62 at the Institut Royal du Patrimoine Artistique, Brussels, and a full report was published in the 'Bulletin' of that Institute [5], from which comparisons with the *Samson and Delilah* will be drawn. Since then, H. Von

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Rubens' 'Samson and Delilah': a Note on the Condition and Treatment

David Bomford

The large panel on which *Samson and Delilah* is painted must originally have been substantially thicker than it is now. At some time, probably during the present century, the panel was planed-down to a thickness of less than 3 mm and subsequently glued onto a sheet of blockboard.

The reason for this major treatment was undoubtedly that some or all of the joins between the five planks had become loose and a number of splits had developed along the horizontal wood grain near the left and right edges. The most severe split runs the width of the panel, very near the

Figure 1
Rubens,
Samson and Delilah
(No.6461),
oak panel,
185 × 205 cm;
after cleaning and
restoration.

top edge, and it is possible that the entire strip may have splintered away from the rest of the panel. In order to re-attach it and to strengthen the other splits and disjoins, the whole assembly was mounted on the secondary support of blockboard, having first been reduced to a fraction of its original thickness.

The practice of thinning panels before applying secondary supports or cradles was widespread until recent years. If wetted as well, the wood became soft and flexible and deformations could be pressed out; but, in many cases, even worse deformations resulted as the wood dried out and the restrictive influence of the secondary support or cradle became dominant.

Although the nature of the treatment would not find favour today, *Samson and Delilah,* fortunately, had been treated skilfully. The joins and splits are still secure, the panel is firmly attached to the blockboard in all areas and the overall warp (which one might expect to be considerable in a picture of this size) is minimal. Because of the extreme thinness of the original support it remains an inherently fragile structure, but its condition is stable and no further support treatment is necessary.

The condition of the paint and ground is very good. Apart from small flake losses associated with joins and splits, there are no lacunae of any appreciable size. However, it was noted during examination before the picture was cleaned in 1982 that incipient blistering was present in many areas, especially Delilah's red dress: although no paint had yet been lost, it was beginning to curl and detach from the ground. Extensive blister treatment using a gelatine adhesive was carried out during and after cleaning. Routine conservation work of this kind often goes unnoticed alongside the more spectacular results of cleaning, but it is actually of far greater importance in the preservation of a painting.

Two other features of the paint layer were noted in the preliminary examination. Firstly, shrinkage cracks in some dark areas had revealed the light colour of the ground; the most prominent of them were reduced slightly during inpainting. Secondly, the status of the dress of the old woman was unclear. Before cleaning it had appeared to be covered by retouching; afterwards it was evident that an original glaze had discoloured.

The principal reason for cleaning *Samson and Delilah* was the presence of a thick, considerably yellowed varnish which distorted both the brilliance of the colours and the subtlety of their juxtaposition. For example, concealed by the varnish, there seemed practically no difference in colour between Delilah's pink hand and Samson's swarthy back; after cleaning, it is seen to be a crucial contrast, perhaps the key to the whole composition.

In addition to its colour, the varnish had an opacity which destroyed any illusion of recession within the picture, and a thickness which filled and clogged the impasto and paint texture which can now be seen everywhere on the picture surface.

Cleaning was entirely straightforward: there was little surface dirt and normal cleaning solvents were used. Inpainting was carried out using pigments ground in the acrylic resin Paraloid B72, and preliminary and final varnishes were the polycyclohexanone resin, Ketone – N.

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Sonnenburg has published a useful overall survey of Rubens' technique but one which could not accommodate detailed analytical results from specific paintings [6]. By contrast a very detailed account of a canvas painting by Rubens, the group portrait of the Gerbier family (National Gallery of Art, Washington) contains contributions by several authors and also incorporates some otherwise unpublished analyses on Rubens paintings by H. Kühn [7].

Stages in the making of the painting

Two preliminary studies for the *Samson and Delilah* survive, a drawing on paper (Fig.4) and an oil sketch on wood panel (Fig.5).

The preliminary drawing on paper

Rubens, like most artists before and since, made an enormous number of drawings on paper, ranging from the briefest of sketch-notes to highly-finished complete pictorial compositions. Their principal purpose was to provide working material for the production of oil paintings.

The preliminary drawing for *Samson and Delilah* (Fig.4) is in ink and wash as are many of Rubens' drawings. Sometimes in such drawings traces of an initial stage are discernible, a first rough sketch in black chalk or charcoal, often partially obliterated either by accident or design. Rubens frequently makes alterations in the drawings, trying out different positions of limbs or drapery.

A good deal of use is made of hatching, particularly in his earlier drawings. In the drawing for *Samson and Delilah* diagonal hatching is used for the half-shadows, the deepest shadows being in wash. The direction and angle of the parallel lines serve to model the form of the muscles of Samson's back and the folds of Delilah's draperies. The degree of closeness of the hatched lines hints at the colour values in the final painting, the dark of Delilah's red dress against the bright gold of her cloak, while the black armour of the soldiers in the doorway is indicated with thick vertical black strokes. Rapidly executed cross-hatching forms the shadowed area around the doorway, throwing into relief the dark outline of the back of the man cutting Samson's hair. The extensive and varied application of hatching techniques may reflect the art and industry of making engraving plates, much practised in painters' studios in the seventeenth century, and particularly in Rubens' own. In the process of engraving copper plates those areas to appear dark on the print were closely covered with parallel or criss-cross lines.

The oil sketch on panel

The oil sketch on panel is in the Cincinnati Museum (Fig.5). In addition to preliminary drawing on paper, Rubens before embarking on a large-scale work frequently made a small preparatory oil sketch or *modello* on wood panel. Other painters have used this device, but Rubens seems to have exploited it more than most, and several hundred such sketches survive, six of which are in the National Gallery's own collection.

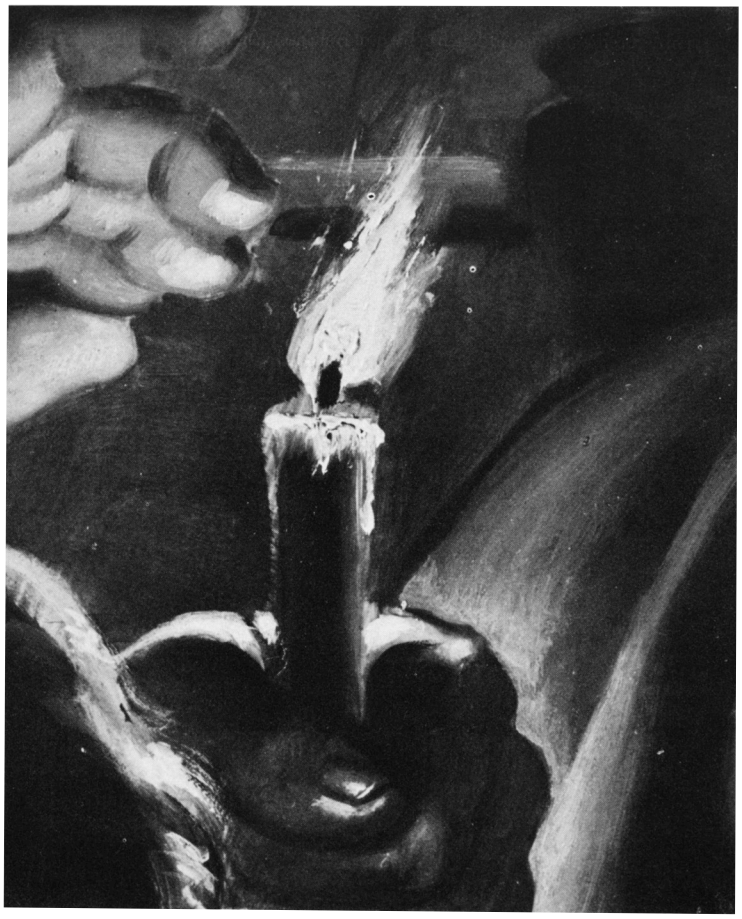

Figure 2 Rubens, *Samson and Delilah* (No.6461), detail of impasto of the flame of the candle held by the old woman. After cleaning and restoration.

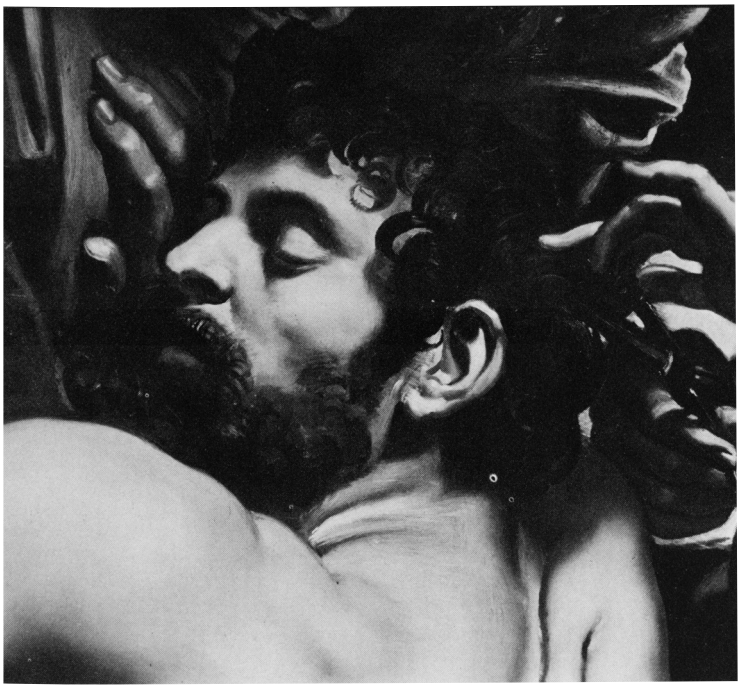

Figure 3 Rubens, *Samson and Delilah* (No.6461), detail of Samson's head. After cleaning and restoration.

Figure 4
Rubens,
Samson and Delilah,
pen and wash on
paper,
16.4 x 16.2 cm.
Collection of Mrs.
A. Van Regleren
Altena-Van
Royen,
Amsterdam.
Preliminary
drawing for
National Gallery
No.6461.

Figure 5
Rubens,
Samson and
Delilah,
wood panel,
51.8 x 50.6 cm.
Art Museum,
Cincinnati.
Preparatory oil
sketch for
National Gallery
No.6461.

The oil sketches had a dual purpose: to show the patron how the finished work would look and gain his approval before proceeding to the full-scale paintings, and as a guide to composition, design and sometimes even, as here, colouring, in the production of the full-size, often large-scale, works in the studio. Rubens had special need for such sketches since the routine preparation and painting of the full-size version of the composition was often handed over to his many assistants and pupils [8], Rubens returning to carry out final touches. In any case his diplomatic missions and numerous other commitments must often have taken him away from the Antwerp studio.

The degree of finish of the oil sketches, like that of the drawings, varies greatly from summary monochrome outlines covering little of the whitish ground to what could pass for finished oil paintings. The oil sketch for *Samson and Delilah* lies somewhere between the two extremes. The main figure group is more or less fully painted but the background only roughly sketched.

Practically all the oil sketches are on wood panel and follow the Early Netherlandish tradition of the wood being oak. Strangely enough, the only recorded exception is the panel of the *Samson and Delilah* sketch which is reported to be a softwood, that is a conifer wood [9]. It has been noted that all but the smallest of the sketches are on composite panels of two or more planks glued together and the Cincinnati panel has vertical joins.

The oak panels of the sketches, again in the Early Netherlandish manner, were given a preparatory coating or ground of chalk [10] bound with animal glue. A thin wash of grey or brown was passed over the white ground of Rubens' sketches before painting was begun, what might be termed an *imprimatura* or priming. That in itself was not uncommon in the seventeenth century. The practice is described by De Mayerne [11] and occurs, for example on the panel paintings of Rembrandt. A distinctive characteristic of Rubens' sketches is, however, that the grey or brown *imprimatura* is generally not uniform but thinly striped or streaked. J. Held, in his comprehensive survey on Rubens' oil sketches goes so far as to remark that, 'The streaky layer of priming is such a constant element in Rubens' sketches that its absence alone must be considered as a warning signal in making attributions' [12]. In certain of the sketches where the chalk ground is thin and the grain of the oak apparent, it looks as if the striated effect might have been produced accidentally from the grey or brown wash collecting in the hollows of the wood grain. Whether or not it was a fortuitous effect, it must have pleased Rubens, for in other sketches the areas of chalk ground left unpainted may have vertically, horizontally, or even diagonally striped *imprimatura* irrespective of the direction of the grain of the wood of the panel. Rubens' sketch of *A Lion Hunt* (No.853P) shows vertical and horizontal striations overlapping to give a criss-cross pattern rather like the cross-hatching in the backgrounds of some of the drawings (Figs.6 and 7). To obtain these effects, Rubens or his studio assistants may have used coarse-bristled large brushes or even some comb-like implement. The purpose, presumably, was to tone down the white of the exposed chalk ground a little to prevent it from distracting the eye from the design, but the stripey textures do add a certain liveliness and suggest some sort of painted background. The oil sketch for *Samson and Delilah* is more fully-painted than many of the sketches, but some striped *imprimatura* is visible, for example between the folds of Delilah's sleeve.

In the sketches, as in the preliminary drawings, traces of the earliest stage, a rough charcoal or black chalk drawing have sometimes survived. The composition is then redrawn and modelled usually in a warm translucent red-brown with the brush, here and there emphasized with black and with carefully modulated highlights in lead white. The sketch is often left in this 'grisaille' state or may be coloured as

Figure 6 Rubens, *A Lion Hunt* (No.853P), wood panel, 73.6 x 105.4/105.7 cm. 'Grisaille' sketch in brown and black washes, heightened with white and touches of red. One of a series of sketches by Rubens for lion hunt compositions.

Figure 7 Rubens, *A Lion Hunt* (No.853P), detail of striped *imprimatura* with horizontal and vertical striations overlapping.

Figure 8
Rubens,
The 'Coup de Lance'
(No.1865),
oak panel,
64.8 × 49.9 cm.
'Grisaille' sketch in brown and black, heightened with white and with a few touches of colour.
Preparatory oil sketch for the high altarpiece of the church of the Recollets, Antwerp.

Figure 9 Rubens, *The 'Coup de Lance'* (No.1865), composite X-radiograph. The sparse but telling touches of lead white for the highlights give a clear image of the modelling and composition. The vertical grain of the oak panel is visible.

required. The small *modello* in the National Gallery (No.1865) for another large altarpiece of the *Crucifixion* (a commission which also happens to be associated with Nicolaas Rockox) is in this warm brown 'grisaille', apart from a few touches of red and blue-grey to indicate the colour of drapery, sky, and so on (Fig.8). The subtly-modelled lead white highlights show up on the X-radiograph to give an even clearer idea of the composition than the sketch itself, since in the latter they have been partly worked over with brown glazes (Fig.9). Obviously there was scope to make changes to the composition between the stage represented by the drawing or drawings on paper and that of the oil sketch and this was done in the case of *Samson and Delilah.* C. Brown has enumerated the changes [1] which are ones of detail, but tending to give a tighter composition, particularly to the main figure group.

Obviously it would have been wasteful to use expensive pigments in these preparatory oil sketches, or to take the work to a further stage of completion than was required in any particular case. In the Cincinnati sketch, for *Samson and Delilah,* although the folds of Delilah's dress have been quite carefully modelled, it is painted in a dull reddish brown which looks more like a cheap red ochre pigment than the expensive crimson-coloured lake and vermilion of the dress in the final painting. The same dull red, this time only partly covering the brown underpaint, does duty for the opulent purple of the swags of drapery which are such a striking feature of the final picture. The old woman's dress appears to be yellow ochre without the final greenish glaze seen in the full-size work. The carpet, a bold splash of pattern and bright colour in the National Gallery picture, is in the sketch just laid in with brown with token patches of red. The background of the sketch is roughly brushed in with a warm translucent brown paint.

The execution of the final version of the 'Samson and Delilah'

The components of the picture

The wood panel support

As with other of Rubens' panel paintings and sketches of which the wood has been positively identified, the panel of the National Gallery's *Samson and Delilah* is of oak, in the tradition of Early Netherlandish painting. The panel is made up of six horizontal planks glued together. It is likely to have been supplied by a professional panel maker. The panel makers of Antwerp who also made frames, formed a separate section of the painters' guild, the Guild of S. Luke. Rubens' panels sometimes bear the branded or carved mark of the panel maker [13,14], an example in the National Gallery being the Portrait of *Susanna Lunden (?) (Le Chapeau de Paille)* (No.852). Unfortunately, as David Bomford has described, the back of the panel of the *Samson and Delilah* had been planed-down to a thickness of only about 3 mm and then the whole set into blockboard before the picture was acquired by the

National Gallery, so any such marks would have been eradicated. The same treatment by rendering the edges of the panel inaccessible would effectively prevent dendrochronological (tree-ring dating) measurements being made, as has been done in the case of some other of Rubens' oak panels [15], but since the date and provenance of the painting are not in doubt, dendrochronology would in this case have served little practical purpose. The construction of the panel is quite straightforward compared with others by Rubens. For example, the landscapes in the National Gallery have successive strips of wood added to all four edges of the panel apparently to enable the artist to enlarge the pictorial composition in several stages [16,17]. For the *Samson and Delilah* the form of the composition was already established first in the preliminary drawing and then the oil sketch, so no such modifications to the size or shape would have been required.

Canvas might have been a wiser choice for a work as large as the *Samson and Delilah,* and indeed some of Rubens' largest works, such as the *Marie de Medici* series in the Louvre, are on canvas. He seems, however, to have had a special liking for the smooth flat surface of wood panels prepared with a white ground. Although in a letter describing a picture he is despatching to a client, he remarks, 'It is done on panel because small things are more successful on wood' [18], when he chose to use wood, the problems of cost, weight, construction, transportation (and conservation!) associated with very large composite panels did not deter him, and *Samson and Delilah* is by no means his largest composition on wood panel. No precise count seems to have been made, but the present author would estimate roughly half of Rubens' output of oil paintings to be on wood panel, these including the oil sketches.

The chalk ground

The full-size painting of *Samson and Delilah* has the same sort of white ground as other of Rubens' panel paintings and sketches so far examined. Chemical microscopy and X-ray diffraction powder analysis of a sample identified it as natural chalk (calcium carbonate) with a binding medium of animal glue, hence in the tradition of Early Netherlandish painting. De Mayerne describes [11] how the paste of chalk and glue (the Northern European version of the Italian *gesso* ground) is applied to the panel and scraped smooth with a special curved knife. Like Early Netherlandish painters, Rubens often exploits the lightness of the chalk ground only slightly modified by the wash of grey or brown *imprimatura,* to give luminosity to thinly-glazed areas of the picture and to the flesh paint. It is rash to generalize, but Rubens' paintings on panel often seem to have, and to have retained, a freshness and brightness of tone sometimes lacking in his canvas paintings. This is partly accounted for by the fact that when painting on canvas he tended to follow the current seventeenth century practice of using dark-coloured (red-brown or grey, or sometimes a greyish *imprimatura* over orange-red) oil grounds on canvas, and their dark tone may have become more obtrusive with increasing transparency of oil paint layers with age and with any wearing of the paint surface.

The striped imprimatura

It is interesting to find that in the full-scale version of *Samson and Delilah* the striped *imprimatura,* so characteristic of the preparatory oil sketches on panel, has been used. In this case it is light yellow-brown in colour and runs for the most part diagonally from top right to bottom left. It is clearly visible where the boundaries of individual painted areas do not quite juxtapose, for example, where the carpet is painted round the contours of Samson's foot, and could, of course, in this case be the accidental result of speed and boldness in painting. Elsewhere, though, Rubens appears deliberately to have left parts of the striped *imprimatura* showing to serve as the lighter warm shadows, as in the folds of Delilah's white sleeve (Fig.10 and Plate5a, p.49), and as the mid-tone on which the black curls of Samson's hair are painted (Fig.3). The striations are to be seen *through* the paint layer in some of the lighter-coloured and more thinly-painted parts. Where light flesh tones are drawn thinly over it a cool, pearly, translucent appearance results, what has sometimes been called the 'turbid-medium effect' [19]. The striped *imprimatura,* which, from inspection of the picture surface beneath the travelling binocular microscope, and from examination of paint cross-sections, was deduced to go over the whole surface of the chalk ground beneath the paint layers proper, consisted of a yellow-brown earth pigment, similar in appearance to raw umber, with a sparse scattering of comparatively large grains of lead white. Insufficient sample was obtainable for medium analysis by gas-chromatography (the average thickness was $10-15\,\mu$, though some of the grains of lead white were so large as to project up into the paint layer; see Plate 5d, p.49). However, staining tests for media carried out on paint cross-sections gave staining with Sudan Black indicating that the medium is drying oil, not protein. This would be in accordance with instructions in the De Mayerne MS. [11]. It is reported that the grey *imprimatura* on the chalk ground of the Rubens altarpiece, *The Descent from the Cross,* is in an 'aqueous medium' [20], but no particulars are given of the methods of testing. Von Sonnenburg also considers that generally speaking the medium of the *imprimatura* is aqueous [6]. Pigments identified in the layer on *The Descent from the Cross* were lead white, chalk and 'noir animal' (ivory or bone black). This grey *imprimatura* is not described as having a streaky appearance, but the latter seems much rarer in the finished pictures than in the oil sketches. It is not evident, for example, in either of the National Gallery's versions of *The Judgment of Paris* (Nos. 194 and 6379), both on wood panel with white grounds, but is just discernible with the unaided eye beneath the flesh paint of *Susanna Lunden (?) (Le Chapeau de Paille)* (No.852) and clearly visible in the infra-red photograph (Figs.12 and 13), suggesting in this case the inclusion of a small amount of black pigment. The presence, visibility and conscious use of the striped

Figure 10 Rubens, *Samson and Delilah* (No.6461). Detail showing the striped yellow-brown *imprimatura* left uncovered to serve as the warm middle tone of the shadows between the folds of Delilah's sleeve. See also Plate 5a, p.49.

Figure 11 Rubens, *Samson and Delilah* (No.6461), detail of Delilah's head. After cleaning and restoration.

Figure 12 Rubens, *Susanna Lunden (?) ('Le Chapeau de Paille')* (No.852), oak panel, 79.0 × 54.0/54.6 cm.

imprimatura in the final version of *Samson and Delilah* seems to bring it closer to the sketch stage and to Rubens' creative process (see, for example, Fig.14).

Preliminary drawing on the primed chalk ground

Since the design of the composition had been determined by the drawing on paper, and the oil sketch, a detailed drawing on the chalk ground of the actual picture would probably have been unnecessary. Any such drawing, provided it were done in black, would be rendered visible by infra-red photography or reflectography, given the comparative thinness of the paint layers in most areas, but in fact an infra-red photograph showed only one or two bold strokes of black, notably round the curve of Samson's wrist and the shadowed side of his biceps, also in the folds of Delilah's sleeve and white drapery. This might have been enough just to indicate the disposition of the forms prior to painting, but in any case it would seem from the De Mayerne MS. [21] that it was customary to erase, or nearly so, the initial rough drawing in black chalk before or during the painting process.

The pigments used in the painting

One of the lists of pigments given in the De Mayerne MS. is prefaced by the remark that 'few colours [pigments] are necessary for a painter to paint in oil and mixtures of these few make and compass all the others' [22]. The truth of that remark is by no means universal, but although *Samson and Delilah,* particularly since its recent cleaning, impresses by its richness of colour, the artist has nevertheless employed both a limited range of colours and a fairly restricted palette of pigments to achieve his effects. Although, in view of the happily excellent condition of the picture, the number of samples was comparatively small they were representative of the main colour areas of the picture.

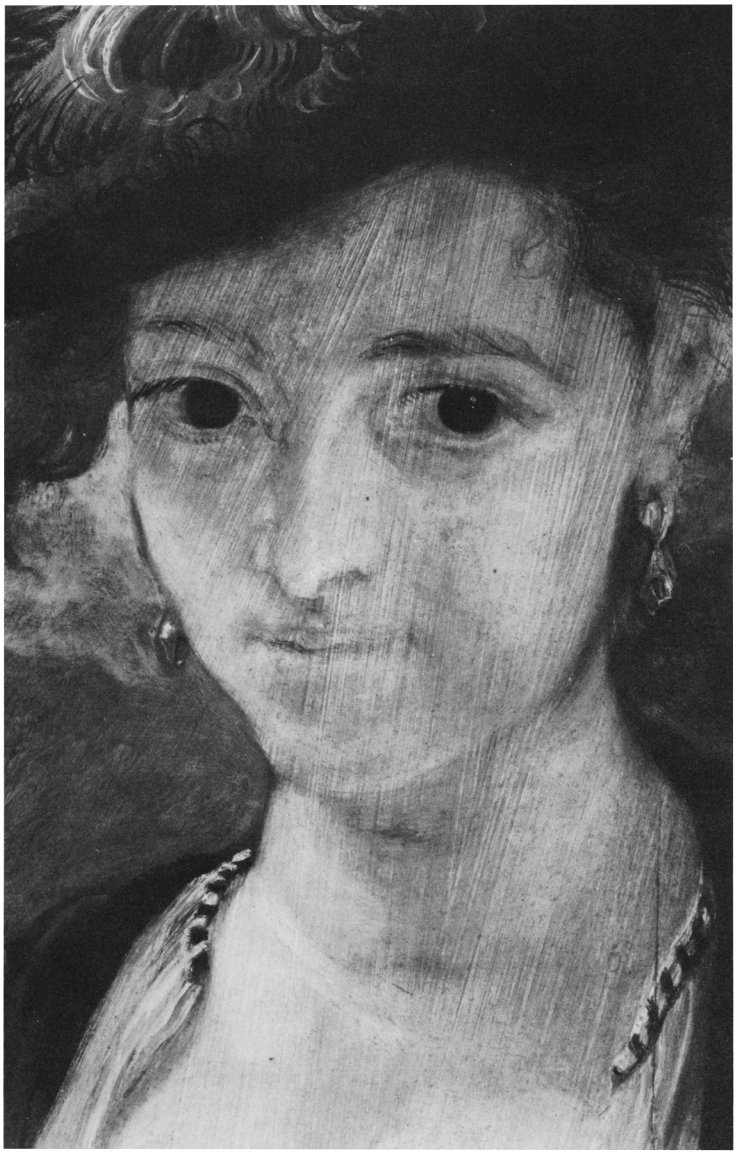

Figure 13 Rubens, *Susanna Lunden (?) ('Le Chapeau de Paille')* (No.852), infra-red photograph, detail of face showing diagonally-striped *imprimatura*.

The white pigment used throughout is *lead white,* which also forms the basis of the lightest flesh tones. In a sample from the white of the old woman's head-dress it was found from X-ray diffraction powder analysis that there was present in addition to the usual basic lead carbonate ($2PbCO_3.Pb(OH)_2$) some neutral carbonate ($PbCO_3$), although the significance of its presence cannot yet be explained. The intact condition of Delilah's white drapery did not permit a sample for similar analysis, so it is not known if this mixture is typical of the lead white in the picture as a whole. A trace of the neutral carbonate was detected, however, also by X-ray diffraction, in four samples of lead white from the *Gerbier Family* portrait [7].

Carbon black of two different types could be distinguished microscopically, the first being coarse wood-charcoal particles (as found in the dark crimson glaze of the deepest shadow of the purple drapery) and

Figure 14
Rubens, *Samson and Delilah* (No.6461), detail showing the striped *imprimatura* showing through thinly-painted drapery below Samson's left hand.

a type with smaller, more regular and rounded particles similar in appearance to bone or ivory black and occurring for example in the black pattern of the carpet. The X-ray diffraction pattern of a sample of the second type failed, however, to show up the presence of calcium phosphate, an essential constituent of ivory or bone black which it is usually possible to detect by this method of analysis.

Ochre pigments in the usual range of red, brown and yellow shades occur in numerous parts of the picture, but, apart from yellow ochre as the pigment of the mid-tone of Delilah's dress, were present mainly in mixtures with other pigments. Manganese was detected (by laser microspectral analysis) in a sample from a brownish underlayer beneath the dark shadow of the purple drapery and also in a sample from part of the brownish glaze on the old woman's dress, its presence indicative of *umber pigments* which contain manganese oxide in addition to the iron oxides which constitute ochres. Umbers were used not only for their colouring properties but also as drying agents to hasten the drying of oils, a use recorded by De Mayerne [23].

Of the more colourful pigments, the most conspicuous is the crimson-coloured *lake pigment* of Delilah's red dress, where it occurs by itself in the glaze and mixed with vermilion in the opaque layer beneath. A dark crimson-coloured lake pigment was found, mixed with charcoal black, in the deepest shadows of the swags of purple drapery near the top of the picture. Sufficient samples were possible from the red glaze of the dress and that on the purple drapery to run thin-layer chromatograms of the dyestuffs alongside those of standard samples of red lake pigments prepared in the laboratory from known plant and insect raw materials [24]. The method leaves a little to be desired in the way of absolute identification of dyestuffs, but it was possible to say that the sample from the glaze of Delilah's red dress derived from some type of scale insect and most probably kermes, while that from the dark glaze on the purple drapery derived from a plant dyestuff, the chromatogram resembling most closely that of the standard sample of madder lake. Results from a previous analysis by the same method of a sample of red glaze from drapery in Rubens' *The Rape of the Sabine Women* (No.38) had also indicated the probability of a madder lake. On the other hand cochineal lake was identified by both a spectrophotometric method and thin-layer chromatography in samples from both bright red and brownish purple drapery in Van Dyck's double portrait, *Lady Elizabeth Thimbleby and Dorothy, Viscountess Andover* (No.6437) of the 1630s. Cochineal, deriving from a scale insect found on a Mexican variety of cactus, was not imported into Europe until the discovery of the New World, and would not be expected to be used until the early sixteenth century, although there is some confusion arising from the fact that some related European scale insects are sources of the same colouring matter (carminic acid) [24]. The presence of Al in some samples of red glazes from the *Samson and Delilah* points to the substrate of the lake pigments being aluminium hydroxide. As well as in the red and purple drapery, red lakes occur in other parts of the picture as a minor constituent in pigment mixtures, particularly in the translucent reddish brown of the background architecture.

Vermilion (red mercuric sulphide, HgS) is most readily recognizable as the scarlet motifs of the carpet, although even here it is mixed to some extent with red lake pigment. Additionally it occurs as the opaque red underpaint of parts of Delilah's dress (Plates5c and 5d, p.49), in flesh paint and as a minor constituent in pigment mixtures.

Lead-tin yellow is evident in the highlights of Delilah's golden-coloured cloak, mixed with lead white in the candle flame (Plate 5g, p.49), and in the greenish yellow underpaint of the old woman's dress where it is mixed with black. X-ray diffraction powder analysis of two samples gave the typical pattern for 'type I' of the two types described by H. Kühn [25], that is, Pb_2SnO_4, the more common type which has frequently been identified in seventeenth century Flemish and Dutch pictures among many others. In common with most other documentary sources, the De Mayerne MS. neither gives instructions for the preparation of lead-tin yellow nor names

it as such, but it is generally conceded that where in early documentary sources 'massicot' or 'masticot' is mentioned, as often in the De Mayerne MS., lead-tin is to be understood [26], and not yellow lead monoxide. Kühn quotes the two recipes, relating to glass-making, from the fifteenth century Bolognese MS., which are the principal source of information concerning the manufacture of the pigment. Oddly enough, it seems not to have been previously pointed out that a sixteenth century manuscript in the Musée Plantin-Moretus in Antwerp, published in part by E. Vandamme in 1974, contains a recipe for *massicot* which consists essentially of calcining tin and lead together, the product of which would be a double oxide, namely lead-tin yellow [27]. This brings production nearer in time and place to seventeenth century Flemish painting. It also serves to explain, perhaps, why some late sixteenth century Italian authors, when referring to different types of 'giallolino' or 'giallarino' (the Italian terms now equated with lead-tin yellow) as coming from Flanders. Lomazzo even specifies its origin as 'the furnaces of Flanders' [28]. On some parts of Delilah's yellow cloak and red dress a yellow glaze was present but insufficient sample was available even to establish whether it was a lake pigment (such as that called *Schitgeel* by De Mayerne and by Dutch and Flemish writers, usually implying a yellow lake from buckthorn berries), or some organic pigment.

Blue pigments as such play almost no part in the picture. In fact, as will be explained below, the only sizeable area of what might be described as blue, the coat of the man cutting Samson's hair, contains no actual blue pigment at all, and a few bluish touches elsewhere, as in the carpet pattern, proved on microscopical examination to be mixtures of charcoal black and white. A few particles of blue copper carbonate, for the most part exhibiting the small, regular rounded particles associated with the early synthetic form, *blue verditer,* rather than mineral azurite, were found scattered sparsely in mixtures with other pigments in, for example, the cool shadows of Samson's flesh (Plate 5b, p.49).

Green is also a colour conspicuous by its absence from the picture, but this may not originally have been the case, for in some parts at least of the brownish glaze on the old woman's dress no recognizable brown pigment was detected but a high concentration of copper present suggested that the glaze would have been green 'copper resinate', now browned. The grey-green border of the carpet does, however, contain some mixed blue and green particles which look like *azurite,* and the associated copper carbonate mineral *malachite* respectively.

By comparison, pigment analyses of samples from the altarpiece of *The Descent from the Cross* in Antwerp Cathedral gave the following results [29]: Lead white was detected microchemically as carbonate, but since at the time no X-ray diffraction powder analysis seems to have been carried out there is no means of telling whether the neutral carbonate was present in any of the samples in addition to the more usual basic carbonate. Only one type of black, described as 'animal black', that is bone or ivory black, was noted. Red lake pigment was identified, but although the word 'garance' (madder) is used it is probably only as a term for red lakes in general, since before recent methods of identification were evolved it was commonly supposed – and now it would seem, wrongly so – that madder lake was the variety most often employed by painters in the past. Vermilion was noted, and, as in the *Samson and Delilah,* often glazed with and mixed with red lake pigment. The yellows seem to have been mainly yellow ochre. Lead-tin yellow was not reported. The use of umber pigments in the yellow and brown areas was suggested, but the presence of manganese apparently not confirmed. No yellow glazes corresponding in appearance to either yellow lake or organic pigments were noted. In contrast to *Samson and Delilah* four blue pigments were detected: lapis lazuli ultramarine, azurite, smalt and indigo, but the varied subject matter and iconography of the altarpiece and its wings probably required a different and more varied palette than did *Samson and Delilah.* 'Copper resinate' type greens also seem to have been absent; the only green pigment identified being malachite, the green basic copper carbonate mineral.

The paint medium

Although it might seem reasonable to assume that Rubens painted in oil, the nature of the painting medium which he used with such success has been the subject of speculation and even controversy. Max Doerner claimed that Rubens used 'resinous and balsam-like painting media, such as Venice turpentine combined with thickened oil [30], probably on the basis that plausible copies of Rubens' paintings could be made using such a medium. (The validity of this argument is disproved every day in picture conservation departments where original paint of old pictures is successfully matched often using entirely modern synthetic pigments and media.) Maroger's hypothesis in the 1940s of the use of a 'black jelly' oleo-resinous medium by Rubens [31] appears to have originated from a misreading of the De Mayerne MS. [32]. More recently, however, Julius Held, in an otherwise admirable note on the 'Physical Aspect of the Sketches' which forms part of the introduction to his comprehensive published work on Rubens' oil sketches, seems to have taken too literally a passage in the De Mayerne MS. Held remarks: 'We are on fairly firm ground in regard to the medium Rubens employed for binding the pigments, since we have the testimony of a man who had received the pertinent information from the artist himself – Dr. Theodore Turquet de Mayerne (1573–1655). Of all the available binding media, Rubens by far preferred the oil of turpentine, distilled from pine resin "che é megliore e non tanta fiera come l'oglio di spica" (see Van de Graaf, p.191, no.122; Rubens apparently used the Italian term "acqua di ragia"). The description of this medium found on fol. 150 of the Mayerne Manuscript begins with a direct reference to "Il Signor Cavaliero Rubens" who told him that all colours ought to be bound in this manner.' [33]. Now, 'acqua di ragia'

was, and still is, the Italian term for distilled 'spirits of turpentine', the thin mobile liquid traditionally used by painters as a thinner for oil paint. From the context of the passage in the De Mayerne manuscript, in which Rubens expresses a preference for turpentine distilled from pine resin rather than for oil of spike, which is distilled from lavender, and from other references in the manuscript, it is clear that Rubens' use of turpentine distillate would have been as a thinner for oil paint in the usual way. When turpentine distillate is exposed to air in a thin film it evaporates leaving only a scarcely-perceptible trace of non-volatile residue which of itself would not be sufficient to bind the pigment particles together to form a cohesive film. But used as a thinner for paint already prepared by grinding the pigment in a drying oil like linseed oil, it would confer the triple advantage of increasing the brushability of the paint, shortening the drying time, and reducing any yellowed appearance of the oil medium during the drying process (since the higher the proportion the thinner in the mixture, the lower the proportion of oil to pigment). These attributes would have been useful to Rubens who had to cover large areas and work rapidly. He was also anxious that his pictures should not yellow.

Confirmation of Rubens' use of oil medium is the often-quoted letter of his of 1624 [34], in which he expresses anxiety lest a self-portrait left in a packing case in Antwerp should take on a yellow tone, as oil paint is prone to do if left to dry in the dark or even in low light levels. It is a fact that this particular type of yellowing associated with early stages of drying of 'fixed' or 'drying' oils like linseed, walnut and poppy oils, can be reversed by exposing the oil or paint film to strong light over a period. The yellowing seems to be a surface phenomenon not necessarily associated with the long-term yellowing which may occur with age and oxidative degradation. Rubens was obviously aware of the phenomenon, for he instructs that the picture be exposed to the sun 'whose rays will dry out the surplus oil which caused the change', even if his explanation of its mechanism is faulty.

The first analysis of the medium of a Rubens painting by gas-chromatography in the Scientific Department of the National Gallery was of *Minerva Protects Pax from Mars* (No.46), a canvas painting of *c.*1629 – 30, and the medium of two samples of white proved to be linseed oil [35]. More recently four samples from different-coloured areas of *The Watering Place* (No.4815) were analysed and while the ratios of the fatty acids indicated linseed oil for three of the samples, the fourth, a sample of white paint from a cloud was closer to walnut oil [36].

Gas-chromatographic analysis was carried out by John Mills and Raymond White on five samples from different parts of the *Samson and Delilah,* and the result in every case indicated linseed oil as the principal component of the medium. In addition, however, the gas-chromatograms gave an extremely small peak for a resinous component. The presence of the resinous component was confirmed by mass-spectrometry, although even by this sensitive means of detection the proportion of resin was estimated to be just a trace, nevertheless it could be identified as being of pine resin. Details of the analytical results and a discussion of their possible significance are given by John Mills and Raymond White in their account of recent analyses of paint media on p.66 of this *Bulletin.* The interpretation of the analytical results is not, as is pointed out by them, as straightforward as it might seem. Because so little is known about the long-term oxidative degradation of natural resins, the rate of which is probably dependent to some extent on the physical conditions to which a paint or varnish film has been exposed during its lifetime, and the further complication, as in this case, of being mixed with drying oil, it is impossible to guess what proportion of resin might have been present in the paint originally. It also has to be borne in mind that resinous substances, in the form of surface coatings, adhesives and consolidants have frequently been applied to paintings in the past. It seems unlikely, but by no means certain, that Rubens' use of turpentine distillate as a thinner could have left sufficient resinous solid residue still to be detectable by present analytical methods.

Painting procedure and the paint layer structure

The interpretation of the X-radiographs

The X-radiographs give a composite image of the absorption of X-rays by all layers comprising the total thickness of the picture. The chalk ground is comparatively transparent to X-rays and it is only those areas of the paint which contain pigments consisting of compounds of heavy metals, particularly lead white, but also lead-tin yellow and vermilion, which will show strongly white on the X-radiograph. The background on the right of the picture appears on the X-radiograph (Fig.15) as dark and almost featureless because, apart from the strong highlights on the faces and armour of the soldiers, it is painted almost entirely, as will be described below, in brown paint which contains very little of the type of pigments which strongly absorb X-rays. The striking feature of the composite X-radiograph is how comparatively sparingly and how subtly Rubens has used lead white, reserving the strongest touches for the brightest highlights and tapering the thickness of the white highlight to almost nothing. This system of painting which uses the light-coloured ground showing through thin translucent paint layers for the middle tones, particularly of flesh, is similar to that used by Early Netherlandish painters who also used a chalk ground on oak panel (Figs.16 and 17). It is also similar to the system Rubens used on his oil sketches on panel (Figs.8 and 9). When working on canvas on dark-coloured grounds Rubens tended, not surprisingly, to paint the flesh and lights rather more heavily and solidly, so that X-radiographs of his canvas paintings are not always comparable with those of the panel paintings.

X-radiography is frequently used to show up changes made by artists during the painting process. Such changes do occur in some of Rubens' pictures (a

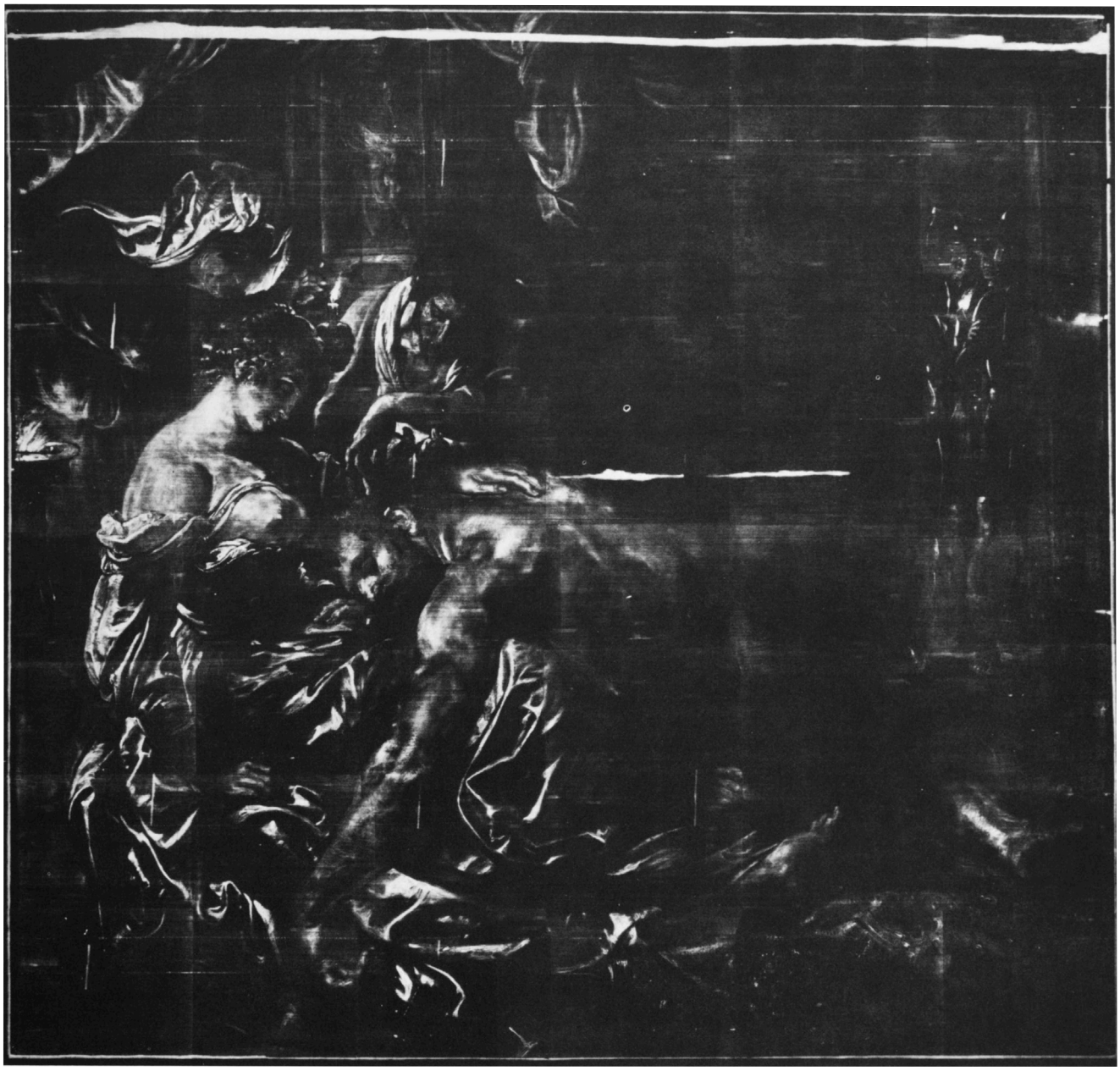

Figure 15
Rubens, *Samson and Delilah* (No.6461), composite X-radiograph. The radiograph shows the sparing use of lead white even in the flesh tones, except for the highlights.

notable example is *The Judgment of Paris* (No.194), in which some radical changes have been made by the artist, including the painting out of the entire figure of a *putto*). The X-radiograph of *Samson and Delilah* shows no such alterations. Modifications to the composition had already been made in the drawing, between the drawing and oil sketch stage and between the latter and the painting of the full-scale version. The general lay-out and most of the detail having been pretty well established, the artist could go on to paint the full-size composition with a swiftness and sureness of touch and without making any corrections. The X-radiographs serve to confirm, incidentally, the remarkably good condition of the paintings.

Microscopical examination of paint samples and their cross-sections

A study of the layer structure of the various samples by means of their cross-sections combined with analytical results and examination of the surface of the painting itself with a travelling stereo-binocular microscope, provides some insight into the method of painting.

1. *The architectural background and the areas of deeper shadow*

From analogy with the oil sketches it might be supposed that in the full-scale work Rubens might follow through the same system of monochrome undermodelling in translucent red-brown with lead white highlights, but this does not seem to be quite the case here, and indeed it would be unnecessary and timewasting to repeat this stage in the final version. No layer corresponding to a monochrome undermodelling could be found in cross-sections of the paint samples, with the exception of one or two where dark drapery in the top left-hand corner either has a brown underpaint or is more probably painted over part of the brown architectural background. For the main figure group the paint layers representing local areas of

Figure 16
Memlinc,
Portrait of a Young Man
(No.2594),
oak panel,
38.7 × 25.4 cm.

Figure 17 Memlinc, *Portrait of a Young Man* (No.2594), X-radiograph, detail of head. The panel has a chalk ground which like that of Rubens' *Samson and Delilah* (No.6461) is comparatively transparent to X-rays. The same sparing use is made of lead white in the flesh paint as in Rubens' panel paintings and oil sketches. The vertical grain of the wood is visible.

colour are applied directly on the thin striped brownish yellow *imprimatura* over the chalk ground. From the point of view of technique, as well as degree of 'finish', there is a distinction between the main figure group on the left and the background depicting the interior of the room and the open door with the group of soldiers. The greatest care and skill is expended on the main figure group, particularly on the heads of Samson and Delilah, on Delilah's naked flesh and on her crimson and gold draperies. The elaborate but consummately skilful drapery painting also extends to the purple curtain above. The background, by comparison, has not developed much farther than the Cincinnati sketch stage (Fig.5), as for example the rough outlining of the panelling of the open door (Fig.18). The architectural background is carried out almost entirely in a translucent reddish brown which proved from microscopical examination to consist not simply of a red-brown earth pigment of the 'burnt siena' type, but of a complex mixture of pigments in a translucent yellowish brown matrix. (The matrix leaves little residue of itself when a sample is treated with sodium hydroxide, merely a yellow-brown solution, and may be one of the varieties of translucent bituminous pigment such as those labelled by artists' colour merchants of later generations as 'Van Dyck' brown.) The paint is used quite thinly and has dried without developing the disfiguring drying cracks often associated with brown pigments containing a proportion of organic matter. Scattered throughout this matrix is an assortment of different coloured pigment particles, some carbon black, particles of earth colours, in some areas quite a high proportion of red lake pigment, and here and there isolated particles of vermilion, and even of blue and green pigment looking like verditer. The proportions seem to vary in different samples. This basic mixture contains a very low proportion of pigment particles opaque to X-rays, so is virtually blank on the radiographs except for the modelling in lead white or lead-tin yellow of the statues of Venus and Cupid in the niche and a few highlights on the glass vessels. The group of soldiers is boldly and swiftly sketched in, leaving the red-brown paint of the architectural background uncovered in some middle tones (Fig.18). The technique recalls that of some of Tintoretto's later works in the Scuola di San Rocco, but he is employing the brown ground on his canvas for the same purpose.

It looks as if at least some of the brown background might have been sketched in early on, leaving the area for the main figure group in reserve, for the edges of the latter sometimes go over the brown background paint. From examination of paint samples it was interesting to find that brown or red-brown areas of warm shadow elsewhere in the picture, of the flesh, Delilah's yellow cloak, the yellow-brown sleeve of one of the soldiers, are painted in the same type of paint containing a scattering of a variety of different coloured pigments. It is tempting to speculate that Rubens made up a quantity of a warm brown, rather translucent paint, employing it largely for the background but modifying its colour and tone slightly with whatever pigments came to hand on the palette and using it

to lay in the warm brown shadows elsewhere, including the flesh. This would be a very time-saving device, roughly equivalent to the translucent warm brown modelling seen in the oil sketches. It is worth noting that in *The Descent from the Cross* also, areas of brown, yellowish and grey paint, including the darker flesh tones, were found to contain a similar variety of multi-coloured particles, even a few of ultramarine. It is rare to find in pictures of before the eighteenth century at any rate, paint of what might be called 'neutral' tones, namely browns and greys, in which multi-coloured pigments occur in the same paint layer. (Some exceptions have been noted in certain paintings of Rembrandt and Tintoretto.) It is rare, in fact, to find in earlier pictures mixtures of more than two different *coloured* pigments (as distinct from mixing with white to produce a lighter shade, which is a universal practice). The painter usually preferred to use the pure colour from the palette and modify it not by the physical mixing of grinding different coloured pigments together, but by optical mixing, applying one layer over another. Rubens himself has done this to an advanced degree in the glazing techniques used in painting the draperies of the *Samson and Delilah.* Generally, if a painter wanted a brown colour one or more of the range of earth colours would be used, which were also cheap, and if grey were required, carbon black and white mixtures served. Complex ready-made mixtures were sometimes marketed in the late eighteenth and nineteenth centuries and may even be found in colour boxes labelled 'neutral tone'.

The main areas of the pictures are on the whole comparatively thinly painted, thick impasto being reserved for dramatic highlights, like the candle flame (Fig.2 and Plate 5g, p.49), the bright yellow highlights on Delilah's golden cloak (Plate 5e and 5f, p.49) and the reflections on the soldier's armour. Nor is the layer structure complex in many areas, in which a single layer of paint often occurs on top of the striped *imprimatura* and chalk ground. Multi-layer systems and the use of glazing techniques are more or less confined to the drapery painting.

2. *The flesh painting*

The flesh of Delilah was in such perfect condition (Fig.11) that no small damage could be found from which to take a sample, but viewed under the stereoscopic binocular microscope at low magnification the pale parts of the flesh appear to consist of lead white tinted with a little vermilion, a mixture which results in a clear rosy pink. The transition between the white, pinkish and more creamy tones (probably lead white with a little yellow earth colour) are smoothly brushed out apparently in a single paint layer. Apart from the strongest highlights the flesh paint is quite thin, so much so that in parts the striped pattern of the yellowish *imprimatura* below is visible lending a pearly translucent effect which Rubens may have calculated. Lighter warm shadows outlining the limbs and the junction of the white drapery and the flesh, and in the folds of the white sleeve itself (Fig.10 and Plate 5a, p.49) are left as the uncovered yellowish-striped *imprimatura,* but deeper warmer shadows, as under the breasts and round the upper arm, are laid in with the same types of reddish brown glazes and scumbles as are used for the background architecture. A very sudden transition occurs between the carefully modelled highlight on the back of Delilah's right hand and the comparatively roughly laid in red-brown shadow above and below her wrist. The same contrast occurs between the light on Samson's right calf and heel, and the roughly scumbled red-brown shadow above the knee. It was possible to take samples from the edges of tiny paint losses on Samson's right foot and in the shadows were found variations of the multi-coloured pigment mixtures described in the painting of the architecture, with a higher proportion of red lake in the pink of the toes and a scattering of blue-green particles (probably verditer) in the paint of the cool greenish shadow on the sole of the foot (Plate 5b, p.49). Outlining of limbs and features, for example of Samson's toes, or the shadows between the barber's fingers is often done in red or deep pink, a feature often seen in Tintoretto's flesh painting. A dark purplish red lake in flowing brushstrokes outlines the facial features of the man cutting Samson's hair and it may be noted that the proper left side of his face seems to be laid in fairly roughly with the translucent reddish brown 'warm shadow' mixture.

Figure 18
Rubens, *Samson and Delilah* (No.6461), detail of figures of soldiers in the doorway. After cleaning and restoration.

3. *Delilah's crimson satin dress*

This is an extremely skilful, complex, and in some respects original, piece of drapery painting (Plates 5c and 5d, p.49). The principal pigment is a crimson-coloured lake pigment, the red dyestuff of which was identified as that from the kermes insect. The lake pigment is used here in various ways. The middle tone of the drapery consists of an opaque layer which is a mixture of vermilion and red lake (Plate 5d, p.49) (similarly found in red drapery in the altarpiece of *The Descent from the Cross*), modified with minor additions of lead white and black, then in the shadows a glaze of red lake alone (Plates 5c and 5d, p.49). The strongest highlights are applied in lead white then glazed with red lake, but a different effect is achieved in the half lights by applying the lake glaze directly on the primed chalk ground. Similar techniques are used by Titian for crimson drapery in *The Vendramin Family* (No.4452). Rubens elaborates even further, for in the warm yellow reflections of the candlelight on the red satin over Delilah's lap he incorporates a transparent orange-yellow pigment, which may be a yellow lake, not only as a final glaze, but as a component of the layer beneath. The final crimson glaze on the skirt which give such richness and depth of colour to the dress must have been added in the latest stage of painting the picture, for it has run onto the adjacent edges of the carpet (Plate 5c, p.49) and Samson's fur wrap.

4. *Delilah's golden-yellow cloak*

The mid-tone is yellow ochre with thick highlights in lead-tin yellow ('type I') (Plates 5e and 5f, p.49). De Mayerne describes painting yellow drapery in yellow ochre with highlights in 'masticot', and this method can be seen in the yellow dress of Van Dyck's double portrait, *Lady Elizabeth Thimbleby and Dorothy, Viscountess Andover* (No. 6437). Again, Rubens elaborates on the system by incorporating a little vermilion, crimson-coloured lake and a translucent yellow glazing pigment into the main paint layer in the warmer-toned parts, and in some places as a final glaze (Plate 5f, p.49). This corresponds exactly with De Mayerne's description for painting not just yellow drapery but yellow satin ('satin jaune') [37]. The darkest, browner shadows are, however, done with the 'warm-shadow' mixture described in the painting of the background.

5. *The purple hanging drapery*

It is unusual to see such a large area of this particular hue in a picture, certainly before the Pre-Raphaelite painters. A pigment of a true purple colour and of reasonable permanence for use on easel paintings was lacking from the artist's palette until the invention of cobalt violets in the nineteenth century. Earlier than that painters made purples from the obvious combination of red and blue, either with physical mixtures of red and blue pigments, or more often by superimposing a red glaze over a blue underpaint and vice versa. The De Mayerne MS. contains instructions for making purple for drapery by mixing red lake with the blue pigment smalt [38]. It might be expected that the purple of the drapery (Plate 5i, p.49) in *Samson and Delilah* would turn out to be some combination of red and blue pigments, but, surprisingly enough, it is painted throughout without the use of a blue pigment, by a combination of crimson-coloured lake pigment, lead white and coarse charcoal black. Charcoal black mixed with white does actually result in a distinctly bluish colour. (With greater back-scattering from the white pigment towards the blue end of the spectrum, compared with the red, as a consequence of higher refractive index, there is a comparatively greater tendency for the latter wavelength to be absorbed by the black pigment.) The system of painting the purple drapery in the *Samson and Delilah* is a fairly elaborate one. Cross-sections were made of paint samples from the mid-purple tone, the bluish mauve highlights and the dark purplish red shadow. The middle tone had an opaque underlayer consisting of a mixture of lead white, red lake and a little charcoal black and was then lightly glazed with red lake (Plate 5j, p.49). The sample from the bluish highlight had an underlayer consisting of a lead white matrix lightly tinted pink with lake, and containing large undispersed granules of lake and scattered small charcoal particles, with a paler upper layer rather similar, but the larger red particles omitted and no final red glaze. The dark purple-red shadow is achieved by means of a thick red lake glaze in which are suspended coarse charcoal black fragments. Thin-layer chromatography of a sample of this glaze had tentatively identified the red lake as deriving from the madder plant. The introduction of black (lamp black, not charcoal black) in the deepest shadow of purple drapery is mentioned by De Mayerne, but in connection with red and blue mixtures. The making of a convincing purple colour by a combination of red, white and black to the exclusion of any blue pigment seems to be quite rare, but a previous occurrence was the purple of the child's dress in Van Dyck's *Woman and Child* (No.3011) (Fig.19 and Plates 5k and 5l, p.49), the artist being Rubens' most famous pupil. So far the only reference found in the literature to this method of making a purple colour is in a handbook by the early nineteenth century author, Tingry [39]. It has been pointed out that Rubens had a particular interest in the colour theories current in the early seventeenth century [40].

6. *The grey-blue coat of the man cutting Samson's hair*

Appearing convincingly blue (Plate 5g, p.49), this paint again contains no actual blue pigment, but is the same mixture as before in the purple hanging, namely lead white, red lake and charcoal black. As in the bluish highlights of the purple hanging, the red lake component, though much reduced is present but the other two components predominate (Plate 5h, p.49).

7. *The old woman's greenish brown dress*

On the picture the dress appears as a more or less khaki colour, not too different from the yellow-ochre looking colour it has in the oil sketch. It could be seen from cross-sections that the light opaque body colour contains no actual green pigment, but is a mixture of

lead-tin yellow ('type I') with carbon black, producing a greenish tone. The brown glaze was found to contain no known brown pigment in all but the deepest shadows but analysis revealed a high proportion of copper, indicating that it had once been a green 'copper resinate' type glaze. It has discoloured with age and exposure and the green colour is only slightly perceptible beneath the browned surface where the glaze is thickest. Unlike the glazes elsewhere in the picture it had been damaged and partly removed and replaced at some time in the past and is as a result rather patchy in appearance. 'Copper resinate' glazes are not nearly so frequently found in seventeenth century Flemish and Dutch paintings as in fifteenth century Netherlandish ones (where the colour is often well-preserved), or fifteenth and sixteenth century Italian ones (where often it has become brown). This is despite the fact that the De Mayerne MS. contains what is virtually the only recipe known for 'copper resinate' green [41]. In practice in seventeenth century Dutch and Flemish painting green colours are more often made from mixtures or superimposed layers of blue and yellow pigments, often featuring the fugitive yellow lake pigment called by De Mayerne 'Schitgeel', meaning 'disappearing' or fading yellow. Greens of this sort have been identified in Rubens' landscapes. A green 'copper resinate' glaze does, however, feature in the dark green curtain in the Van Dyck double portrait (No.6437) referred to above. 'Copper resinate' glazes were not reported in *The Descent from the Cross,* nor in the *Gerbier Family* portrait. The decision to add the glaze, presumed green, to the old woman's dress must have been taken late on in the painting of the picture, since it goes over the edge of the brazier. Also a cross-section of a sample from where the edge of the purple drapery goes over the shadow on the shoulder of the old woman's dress does not include the glaze beneath the purple.

8. *The carpet pattern*

Although the carpet itself was included in the oil sketch, its colourful pattern was evolved only in the final version. Compared with the meticulous painting of the draperies, the carpet pattern is executed with a boldness and freedom of brushwork more usually associated with twentieth century painters like Matisse. The brightest note is vermilion, but here also mixed with lake. The 'blue' border is nothing but a mixture of lead white and black, although the greenish border and motifs contain a mixture of pigments which include some green particles with the characteristics of malachite. Malachite was identified in the deep greens in *The Descent from the Cross.*

A note on Rubens, varnish and varnishing

The discoloured varnish recently removed from the picture is certain to have been a comparatively modern one, for the picture is likely to have been cleaned and revarnished more than once in its past history.

Newly-painted pictures in oil medium usually need no varnish, and indeed the act of varnishing would be likely to damage them. It is during the slow drying process, which may take as long as twenty years or more for the polymerization of the oil to take place, that the surface of oil paintings become gradually matt, and often patchily so, since different pigments absorb different amounts of oil during grinding and also cause the oil to dry at different rates.

As can be seen from his letters and from contracts, pictures often left Rubens' studio as soon as the paint was dry enough for them to be safely packed, so that it seems unlikely that they were as a rule varnished before they left the studio. In fact, though in his letters Rubens mentions the time taken for pictures to dry in connection with despatching them to clients, he never once mentions varnish or varnishing. This does not of course exclude the possibility, or even likelihood of their being varnished at a later date. It is noteworthy that when pictures by Rubens are cleaned, the surface after removal of old varnish often still retains a perceptible gloss, so that they could almost be rehung without revarnishing. By contrast most 'old master' paintings look matt and patchy in the unvarnished state. The *Samson and Delilah* emerged from beneath the discoloured varnish looking almost like fresh oil paint. In the present state of knowledge it is not possible to say whether this special quality of Rubens' paint is due to the addition of some resin to the oil medium or to the mode of preparation of the oil itself. There is a rather enigmatic reference in the De Mayerne MS. to Rubens and varnishing. The paragraph in question, beside which in the margin is noted the name of 'M. Rubens', reads: 'Turpentine with time dries, turpentine oil or petroleum disappear and cannot endure water. The best varnish, resisting (air, water?) is made with drying oil, very much thickened in the sun over litharge without boiling it at all.' [42]. This has generally been interpreted quite literally as Rubens having applied a coat of drying oil to the finished picture [43], but there is no evidence from examination of the pictures themselves for this having been done, and it seems likely that such a coating might well have formed a yellow film during drying, especially if a picture were in a packing case for some time after its application. Rubens was, as we have seen, anxious to avoid yellowing. The recipe given in the passage quoted is the standard method for preparing a pale-coloured drying oil, the drying time hastened by the formation of soluble lead compounds. Heating or boiling was to be avoided because it produces darkening of colour. Could it be that this is Rubens' way of saying that pictures painted in this type of drying oil medium require no varnishing?

Notes and references

1. BROWN, C., *Rubens' Samson and Delilah,* National Gallery (London 1983).
2. BM MS. Sloane 2052 is the better-known of the two manuscripts in the British Museum and the one which is principally concerned with materials and techniques of painting.
3. VAN DE GRAAF, J.A., *Het de Mayerne Manuscript als bron voor de schildertechniek von de barok* (Utrecht 1958).
4. TALLEY, M.K., *Portrait Painting in England: Studies*

in the Technical Literature before 1700, published privately by The Paul Mellon Centre for Studies in British Art (London 1981), pp.72 – 149.

5. *Bulletin, Institut Royal du Patrimoine Artistique* (Brussels), **5** (1962), pp.4 – 172; **6** (1963), pp.7 – 68. Contributions by various authors.

6. VON SONNENBURG, H., 'Rubens Bildaufbau und Technik: I Bildtraegen, Grundierung und Vorskizzierung', *Maltechnik-Restauro,* **85,** 2 (1979) pp.77 – 100; II 'Farbe und Auftragungstechnik', **85,** 3 (1979) pp.181 – 203.

7. *1973 Studies in the History of Art,* National Gallery of Art (Washington DC 1974). The issue is devoted to studies by various authors of Rubens' 'Deborah Kip, Wife of Balthasar Gerbier, and her Children', the so-called 'Gerbier Family'.

8. VLIEGHE, H., 'Erasmus Quellinus and Rubens's Studio Practice', *The Burlington Magazine,* September 1977, pp.636 – 43.

9. HELD, J., *The Oil Sketches of Peter Paul Rubens,* Vol.1 (Princeton 1980), p.430.

10. Not *gesso* grounds as described by HELD (*ibid.,* p.10) but usually chalk (that is, calcium carbonate, not sulphate). The present author, however, identified by microchemical tests only, a small proportion of calcium sulphate in the chalk grounds of a few of Rubens' panel paintings, but not necessarily ones associated with Rubens' Italian sojourn. In the case of chalk grounds it is possible under high magnification, preferably with the scanning electron microscope, to identify the microfossils of which natural chalk is composed and ascertain the geographical origin of the chalk deposit. This was done in the case of the chalk ground from one sketch by Rubens in the National Gallery, *S. Bavo Assuming the Monastic Habit at Ghent* (No.57) and produced the unremarkable but satisfactory result that the chalk derived from deposits one or other side of the English Channel (see WINTER, J., 'Note on the Preparation and Mounting of Samples of Chalk/Glue Ground from Paintings for Scanning Electron Microscopy', *Studies in Conservation,* **20,**3 (1975), p.169.)

11. VAN DE GRAAF, J.A., *op. cit.,* p.135.

12. HELD, J., *op. cit.,* Vol.1, p.10.

13. GEPTS, G., 'Tafereel Michiel Vriendt, leverancier van Rubens', *Jaarboek Koninklijk Museum voor Schone Kunsten* (Antwerp), 1954 – 60, pp.83 – 7.

14. MONTBALLIEU, A., 'P.P. Rubens en het Nachtmael voor St. Winoksbergen (1611), een niet uitgeroerd schilderij van de Meester', *Jaarboek Koninklijk Museum voor Schone Kunsten* (Antwerp), 1965, pp.183 – 205. Publication of documents in connection with a panel and frame ordered by Rubens from the Antwerp panel maker Hans van Haecht who seems to have been a regular supplier to the artist.

15. BAUCH, J., ECKSTEIN, D. and BRAUNER, G., 'Dendrochronologische Untersuchungen an Eichenholztafeln von Rubens Gemälden', *Jahrbuch der Berliner Museen,* **20** (1978), pp.209 – 21.

16. MARTIN, G., *National Gallery Catalogues: The Flemish School* (London 1970), Appendix I: 'The Supports of Pictures by or Associated with Rubens', by Joyce Plesters.

17. BROWN, C., REEVE, A. and WYLD, M., 'Rubens' ''The Watering Place'' ' *National Gallery Technical Bulletin,* **6** (1982), pp.27 – 39. Recent treatment of the panel enabled the method of construction to be seen more clearly requiring slight amendments to the diagram of construction previously published which had been based mainly on the study of the radiographs.

18. *The Letters of Peter Paul Rubens* translated and edited by R.S. Magurn (Cambridge, Mass. 1971), p.31. Letter to Sir Dudley Carleton, Antwerp, 26 May, 1618.

19. RUHEMANN, H. and KEMP, E.M., *The Artist at Work* (London 1951), p.42.

20. COREMANS, P. and THISSEN, J., 'Composition et Structure des Couches Originales', *Bulletin, Institut Royal du Patrimoine Artistique,* Brussels, **5** (1962), p.119.

21. VAN DE GRAAF, J.A., *op. cit.,* p.147.

22. VAN DE GRAAF, J.A., *ibid.,* p.142.

23. VAN DE GRAAF, J.A., *ibid.,* p.190.

24. KIRBY, J., 'A Spectrophotometric Method for the Identification of Lake Pigment Dyestuffs', *National Gallery Technical Bulletin,* **1** (1977), p.43.

25. KÜHN, H., 'Lead-tin Yellow', *Studies in Conservation,* **13,** 1 (1968), p.8. Lead-tin yellow was identified in thirteen paintings by Rubens in the Bavarian State Collections. Of samples from seven of these which were subjected to X-ray diffraction powder analysis the lead-tin yellow was identified as Kühn's 'type I', the more common of the two forms.

26. HARLEY, R., *Artists' Pigments c.1600 – 1835, A Study in English Documentary Sources,* 2nd ed., Butterworths (London 1982), pp.96 – 8. A mention of tin as a constituent of massicot is noted in a seventeenth century English documentary source, though the latter does not give an actual recipe for making lead-tin yellow.

27. VANDAMME, E., 'Een 16e-eeuws Zuidnederlands recepten boek', *Jaarboek, Koninklijk Museum voor Schone Kunsten* (Antwerp 1974), pp.101 – 107. Recipe 8, p.106: *Om massicot:* Nempt 3lb loots ende 2lb tins calcineret gelyemen de menie doet tot dry resen toe, soedt in laetste. Doeter in 2lb menie ende roeret oock 12 huren lanc als de menie. The author is grateful to Dr M. Kirby Talley for the following translation: [*On massicot:* Take 3lb lead and 2lb tin. Burn like one does the *menie* three times, salt in the last. Add in 2lb *menie* and stir twelve hours long as the menie.] N.B. *menie* = minium, by which is usually understood red lead (lead tetroxide). Both recipes include salt as an ingredient, but its purpose and function in the preparation is not stated; it might be as a flux.

28. BORGHINI, R., *Il Riposo* (Florence 1584), p.166; LOMAZZO, G.P., *Trattato dell'arte della pittura, scultura et architettura libri VII* (Milan 1584), p.191. Lomazzo's *Trattato* was 'Englished' by R.M. Haydocke in 1598 and he translates 'giallarino' as 'massicot'.

29. COREMANS, P. and THISSEN, J., *op. cit.,* pp.119 – 27.

30. DOERNER, M., *The Materials of the Artist,* translated by E. Neuhaus (London 1935). The quotation given is from this, the first English translation,

the first German edition being published in 1922. The account of Rubens' medium and technique continued to appear more or less unchanged in revised editions in both languages up to the present day.

31. MAROGER, J., *The Secret Formulas and Techniques of the Masters,* translated from the French by E. Beckham (New York 1948), pp.93 – 120 and pp.165 – 7.
32. WERNER, A.E.A., 'The Vicissitudes of the Maroger Medium', *Studies in Conservation,* **3,** 2 (1957), pp.80 – 2.
33. HELD, J., *op. cit.,* Vol. 1, p.11.
34. *The Letters of Peter Paul Rubens* translated and edited by R.S. Magurn (Cambridge, Mass. 1971), pp.8 – 9. Letter to Annibale Chieppio, 24 May, 1603.
35. MILLS, J.S. and WHITE, R., 'The Gas-Chromatographic Examination of Paint Media. Some Examples of Medium Identification in Paintings by Fatty Acid Analysis', in *Conservation and Restoration of Pictorial Art,* N. Brommelle and P. Smith (eds.), Butterworths (London 1976), pp.72 – 7.
36. MILLS, J.S. and WHITE, R., 'Analysis of Paint Media', *National Gallery Technical Bulletin,* **5** (1981), pp.66 – 7.
37. VAN DE GRAAF, J.A., *op. cit.,* p.150 for 'yellow drapery', and p.154 for 'satin jaune'.
38. VAN DE GRAAF, J.A., *ibid.,* p.155 – 6 and p.157.
39. TINGRY, P.F., *The Painter and Varnisher's Guide,* trans. of 2nd ed. (London 1816), p.290.
40. PARKHURST, C., 'Aguilonius' Optics and Rubens' Color', *Het Nederlands Kunsthistorisch Jaarboek,* **12,** 1961, pp.35 – 49.
41. VAN DE GRAAF, J.A., *op. cit.,* p.174.
42. *ibid.,* p.203.
43. *ibid.,* p.87.

Figure 19 Van Dyck, *Portrait of a Woman and Child* (No.3011), canvas, 131.5 × 106.2 cm. Probably painted in Antwerp in 1620 or 1621. See also Plate 5k, p.49.

Plate 5 Rubens, *Samson and Delilah* (No.6461).

Details from the picture and photomicrographs of paint cross-sections and surfaces *(a) – (j).* The magnification at which each photomicrograph was taken is given within the relevant caption below; the actual magnification on the printed page is shown opposite.

A detail and a paint sample from Van Dyck's *Portait of a Woman and Child* (No.3011) are included for comparison with the purple drapery of the Rubens, *(k)* and *(l).*

(a) Detail of Delilah's sleeve showing the yellow-brown *imprimatura* left uncovered to serve as the warm middle tone of the shadows of drapery and flesh.

(b) Samson's flesh, greenish shadow on sole of foot. Photomicrograph of the top surface of a paint sample, 120 × . As elsewhere in shadow areas of the picture, the paint contains in addition to ochre pigments scattered particles of other colours; in this sample those of red lake, vermilion, and blue and green copper carbonate can be discerned.

(c) Detail of Delilah's red dress showing the crimson glaze running onto the edge of the carpet.

(d) Delilah's red dress, mid-tone. Photomicrograph of cross-section of sample, 220 × .

1. White chalk ground.
2. Yellow-brown *imprimatura:* yellow-brown umber pigment with scattered granules of lead white, one exceptionally large aggregate particle penetrating the red paint layer above.
3. Principal red paint layer: vermilion and red lake mixed, with traces of lead white and black.
4. Thin red glaze: lake pigment the dyestuff of which was identified as from the *kermes* insect.

(e) Detail of Delilah's golden-yellow cloak and red dress.

(f) Delilah's golden-yellow cloak, highlight. Photomicrograph of cross-section of paint sample, 220 × .

1. White chalk ground as layer 1 in *(d).*
2. Yellow-brown *imprimatura* as layer 2 in *(d).* A large granule of lead white can be seen.
3. Principal yellow paint layer: yellow ochre with a little lead white, occasional flecks of red lake, and translucent deep yellow inclusions which might be yellow lake.
4. Pale yellow highlight: lead-tin yellow ('type I').
5. Thin yellow glaze: unidentified (yellow lake?).

(g) Detail showing part of 'blue' coat of the man cutting Samson's hair.

(h) 'Blue' coat of man cutting Samson's hair. Photomacrograph of surface of picture, 10 × .
No actual blue pigment is present, the effect of blue has been obtained by a mixture of lead white and charcoal black with a trace of red lake pigment.

(i) Detail of purple hanging drapery, near top of picture.

(j) Purple hanging drapery, mid-tone. Photomicrograph of the top surface of a paint sample, 120 × .
No blue pigment is present in the mixture which consists of red lake, lead white and charcoal black.

(k) Van Dyck, *Portrait of a Woman and Child* (No.3011).
Detail of child's purple dress (see Fig.19, opposite for complete picture).

(l) Van Dyck, *Portrait of a Woman and Child* (No.3011). Purple drapery of child's dress. Photomicrograph of top surface of a paint sample, 120 × .
A mixture of red lake, lead white and charcoal black has been used and is closely similar to that found in the purple hanging drapery in Rubens' *Samson and Delilah* (see *(j)* above).

Plate 5
Rubens,
Samson and Delilah
(No.6461)
Details from the picture and photomicrographs of paint cross-sections.
Full caption on facing page.