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Plate 6
Claude, *Seaport: The Embarkation of the Queen of Sheba* (No.14). After cleaning and restoration.

Plate 9a Jacopo Tintoretto, *The Redeemer Adored by Doge Alvise Mocenigo,* Metropolitan Museum, New York. Detail of seated lute player showing redrawing in white on top of the paint layer.

Plate 9b Jacopo Tintoretto, *The Redeemer Adored by Doge Alvise Mocenigo,* Metropolitan Museum, New York. Detail of unfinished figures in the sky.

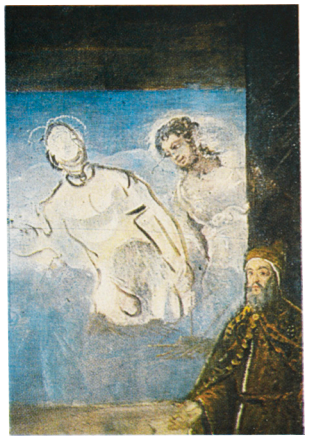

Plate 7 *(Top right)* Claude, *Seaport: The Embarkation of the Queen of Sheba* (No.14). Detail during cleaning in 1979. Note the pentimento in the flag in the lower right corner, much discussed by the Select Committee of 1853.

Plate 8 *(Bottom right)* Claude, *A Seaport* (No.5). Detail of the foreground before cleaning, showing the blanched paint of the left-hand figure's trousers, and some blanching in the landscape.

Some Observations on Blanching
(with Special Reference to the Paintings of Claude)

Martin Wyld, John Mills and Joyce Plesters

Three National Gallery Claudes
Martin Wyld

Introduction

The National Gallery collection has, from its earliest years, included pictures by Claude. Five were bought, with John Julius Angerstein's Collection, at the foundation of the Gallery in 1824. Sir George Beaumont gave three Claudes before his death in 1828, and another, the so-called 'Chigi Claude' was bequeathed by the Rev. W. Holwell Carr in 1831.

Three of the Claudes purchased with the Angerstein Collection have been re-lined, cleaned and restored during the last few years. All three had been cleaned in 1948, and all of them at least once before in the nineteenth century. The first part of this article will give a brief account of the recent treatment, the reasons for it, and what is known of the history of the three pictures since their importation into England in the early years of the last century. The second part of the article will be concerned with a technical problem, not unique to Claude's pictures but perhaps more commonly found in his work than in that of any other artist. This phenomenom is generally known as 'blanching', i.e. when a paint layer (as distinct from a varnish layer) becomes lighter and 'chalkier' in appearance. The causes of blanching, which has affected many Claudes much more seriously than any of the three discussed here, are not clear.

Numerous explanations for blanching, mostly of a rather simplistic nature, have been proposed; their number is matched by the various traditional remedies. Explanations of blanching (which in Claude's pictures usually affects the foliage and figures most badly; see, for example, Plate 8, p.48) include: that the pictures were sized before they were varnished, and that the size has become opaque; that the medium has decomposed or been leached out during cleaning; that minute drops of water are trapped in the paint layer; that aqueous lining adhesives have blanched the paint; that the paint is porous and has absorbed varnish which has caused the blanched appearance; that pigments have changed; that the effect of ultra-violet light is responsible; that alkaline liquids used as cleaning agents have attacked the pigments, and so on. Some of the likely factors involving paint medium and pigment are discussed below in the two sections which follow on pp.60-61.

Traditional remedies include: rubbing with egg or oil to replace a supposedly lost or decomposed medium; treatment with solvents such a diacetone alcohol; scraping off the top layer of paint; 'Pettenkoffering'; the use of heat, and so on. These remedies are more to do with folklore than with science, though some of them may sometimes be near the mark. At least one successful treatment has been recorded [1].

Nineteenth century restorations

The three pictures with which this article is concerned are No.5, *A Seaport;* No.12, *Landscape: The Marriage of Isaac and Rebekah* ('The Mill'), and its pendant, No.14, *Seaport: The Embarkation of the Queen of Sheba* (Figs.1, 2 and 3; Plates 6 – 8, p.48). By the time it was imported into England in 1803, the year in which it was bought by Angerstein, the small *Seaport* (No.5, Fig.1) had had at least seven owners, and had been twice auctioned in Paris in the previous forty years. No.12 and No.14 (Figs.2 and 3) were also imported in 1803 and immediately bought by Angerstein [2]. Buchanan's *Memoirs* of April 1803 [3] refers to the two larger Claudes (Nos.12 and 14) as '. . . the famous picture of the Seaport by Claude, known by the name of the Bouillon Claude, which may be considered the *chef d'oeuvre* of that particular class of pictures, not only by Claude, but of every other master in that line. He [Mr Sebastian Erard] transmitted this picture, with its companion, to England, and they were purchased by the late Mr. Angerstein. [Buchanan was writing in 1824.] The companion is but an inferior performance, and the same subject as that in the Doria Pamfili of Rome, which is a capital picture — doubts therefore exist as to its originality. . . .'

In a footnote, Buchanan adds 'In the purchase of a collection it frequently happens that the good and the bad must be taken together. It does not, however, follow that such should afterwards be kept together. Weeds will creep into every garden, and the sooner they are rooted out the more delightful will the genuine flowers appear. . . The National Gallery of Great Britain, with the powerful means which England as a country possesses, should be rendered a model of excellence, and never allowed to become, under any circumstances, "a wild where weeds and flowers promiscuous shoot" .' Buchanan's advice on acquisitions has, on the whole, been followed. The originality of No.12, the companion he mentions, has been questioned at various times since; at the time of the Select Committee of 1853 there was still a general assumption that it was a studio picture although it is now accepted as entirely original. Buchanan remarks that *The Embarkation* (No.14, Fig.3) was in exceptionally fine condition. Sir George Beaumont remarked, apparently in disparagement, that the sea was blue, and Lord Carysfoot thought the picture

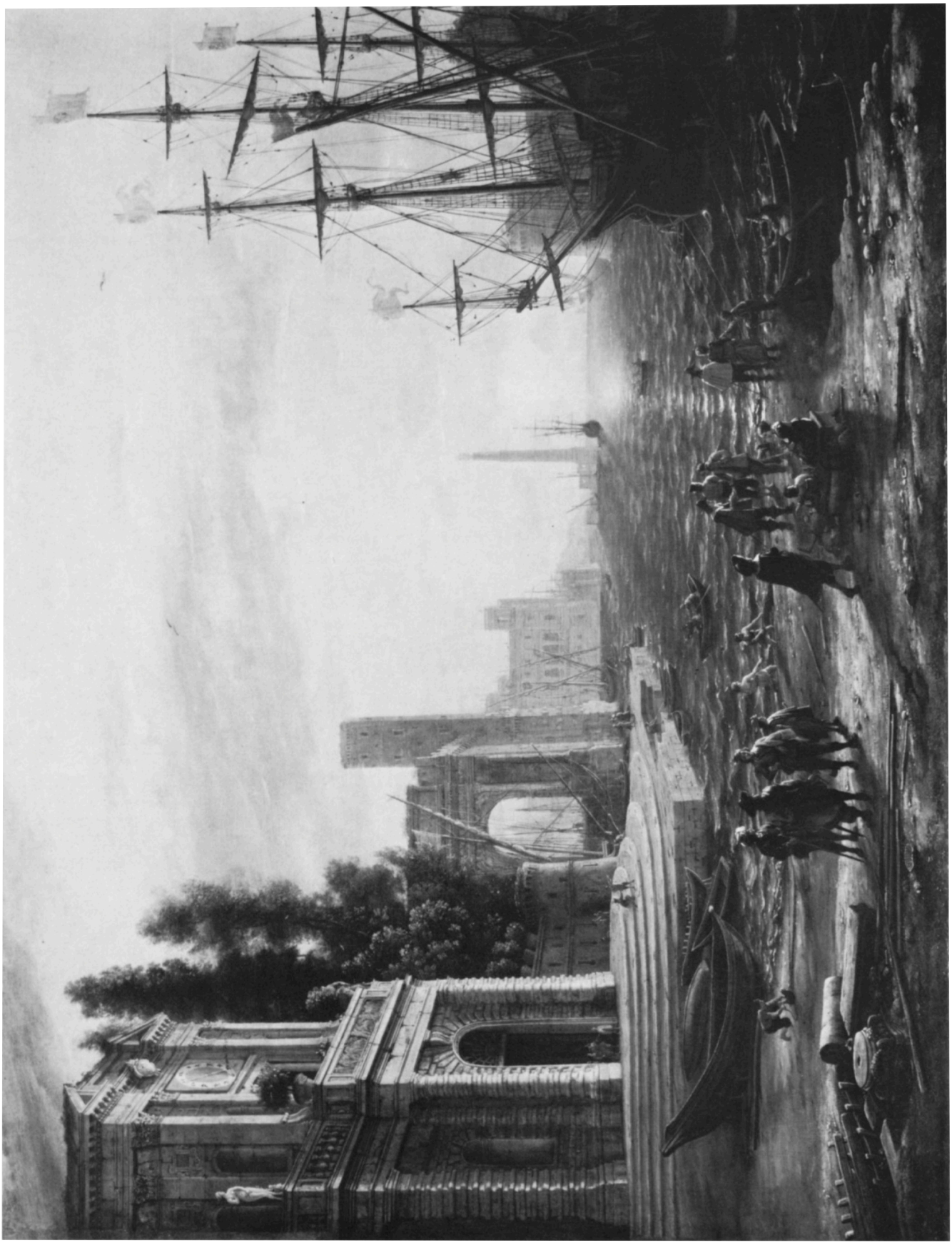

Figure 1
Claude,
A Seaport
(No.5)
after cleaning,
lining and
restoration.
39 × 51
(0.991 × 1.295).

Figure 2
Claude,
Landscape: The Marriage of Isaac and Rebekah
(No.12),
after cleaning,
lining and
restoration.
58¾ × 77½
(1.492 × 1.969).

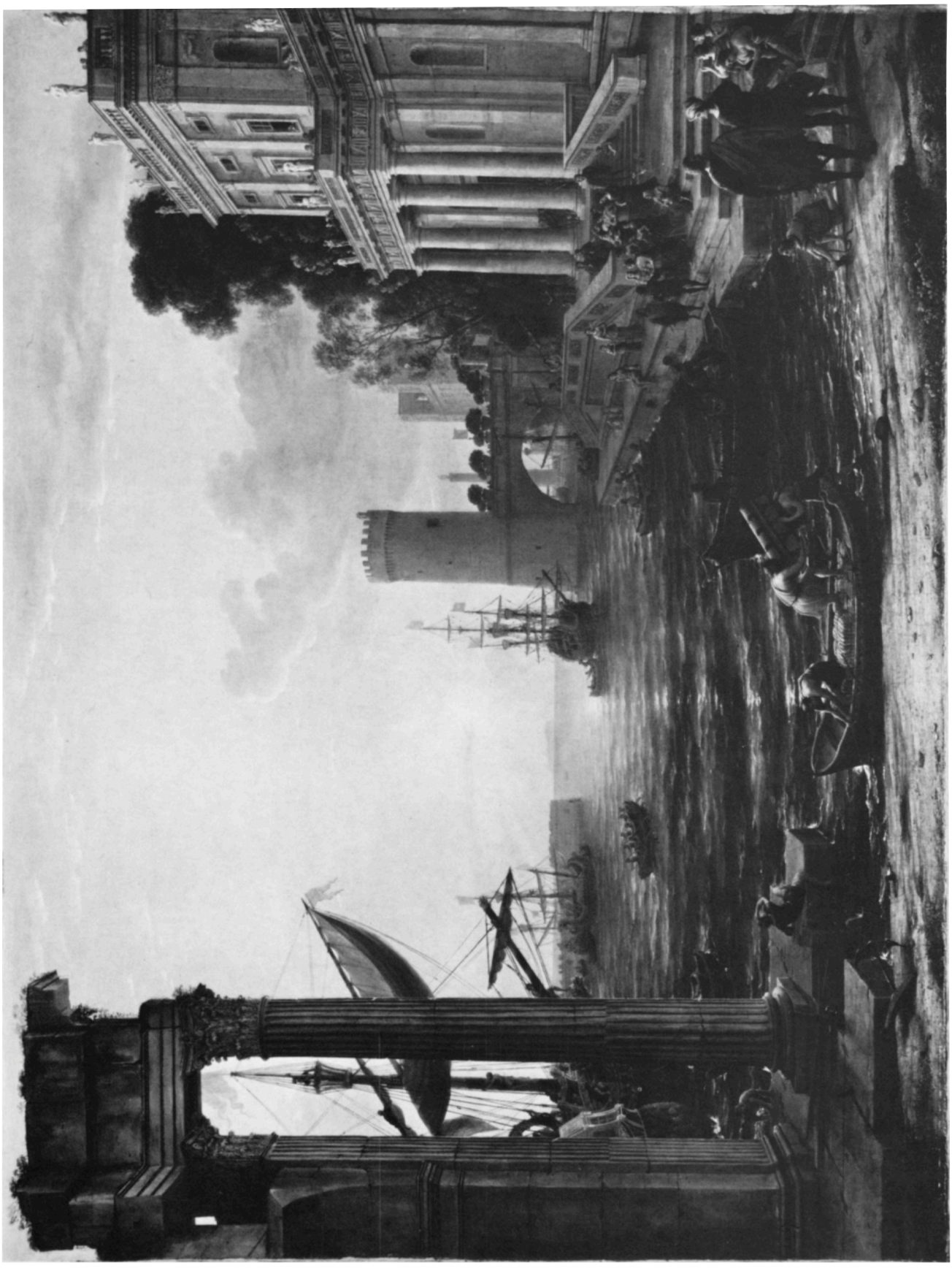

Figure 3
Claude,
Seaport: The Embarkation of the Queen of Sheba (No.14),
after cleaning and restoration.
58½ × 76¼
(1.486 × 1.937).

needed a coloured varnish. No.14 was probably lined just before its voyage from France. A figure on the right-hand side was damaged and repaired by an Italian in 1815 (Fig.4). Apart from this minor incident, no details have survived of what may have been done to the three pictures while they were owned by Angerstein.

The year after the foundation of the National Gallery *The Embarkation* (No.14) was found to be flaking. William Seguier, an agent and restorer who had been Angerstein's adviser, had been appointed first Keeper of the National Gallery, and he delegated to his brother John Seguier, also a restorer, the task of laying the blisters and repairing the places where paint was missing. William Seguier was succeeded as Keeper in 1844 by Charles Eastlake R.A. Eastlake had spent many years on the Continent studying, amongst other subjects, the techniques of the old masters; he was to publish the first part of his *Materials for a History of Oil Painting* in 1847. His ideas on cleaning differed from those of the Seguiers, who had done little more than apply the now notorious 'Gallery Varnish', a mixture of mastic and drying oil which presumably remained tacky for a long time and so attracted a thick layer of dirt from the filthy London air. The combination of the surface dirt and the natural yellowing of the varnish led to pictures becoming obscured in a very few years.

Eastlake instructed John Seguier (who had survived his brother William) in picture cleaning. It is probable that Seguier's experience had not been confined solely to applying surface coatings, laying blisters and making minor repairs; he was employed in the art trade and by private collectors as well as by the National Gallery, and must at times have cleaned or partly cleaned pictures. In those days the National Gallery closed for six weeks every year, and Eastlake took this opportunity of having some pictures cleaned. When the Gallery reopened after the holiday in 1846 to reveal five newly cleaned pictures (most notably Rubens' *Peace and War* and Velazquez' *Boar Hunt*) a controversy immediately started. Eastlake was overwhelmed by abuse and criticism of the way in which the pictures had been cleaned, and although the Trustees eventually passed a resolution supporting him, he resigned the following year [4].

Thomas Uwins R.A. was appointed Keeper in succession to Eastlake, and he continued the policy of having pictures cleaned in the annual holiday. The controversy over cleaning came to a head in 1852, when nine pictures were cleaned. Among them were the two large Claudes, No.12 and No.14. Because of the gravity of the accusations made against the National Gallery (on other matters as well as cleaning) a Select Committee of the House of Commons was appointed in 1853 to inquire into the administration of the Gallery. One of the four main heads of inquiry was 'The management of the Gallery, as specially connected with Picture Cleaning'. The Select Committee sat from 18 April until 29 July and its report, including the minutes of evidence given before it and various appendices, was nearly one-thousand pages long.

It seems that almost anyone who had criticized the cleaned pictures was summoned to give evidence before the Committee. The most vociferous critic had been J. Morris Moore, an unsuccessful artist who had turned to dealing. He had written many letters to *The Times* under the pseudonym 'Verax' between 1846 and 1847, and his hostility towards the Gallery's cleaning policy had not weakened by the time he appeared before the Committee in 1853.

Evidence given to the Select Committee

The Marriage of Isaac and Rebekah (No.12) was not discussed by the Committee as much as *The Embarkation of the Queen of Sheba* (No.14), but some interesting points were made. Mr Retra Bolton, a dealer and cleaner, said of No.12: 'If I had cleaned that picture myself, though I had found no glazing upon it, I should have put a coat of warmth over it; I would have tinted a coat of mastic varnish as it has such a very crude appearance . . . I do not know whether the master glazed that picture or not, but there is no glazing on it now . . . .' J. Morris Moore went further: 'This picture has been reduced to a most lamentable state; the upper glazing has been almost entirely removed from it by the late cleaning; the aerial perspective is completely gone. The picture is now hard and flat like a tea board; the objects in the distance being as near the spectator as those in the background; the sky has been excessively tormented, even in the body colour; there is a washy, tame look about the whole picture, extremely offensive.' He was asked whether the distant water appeared to him to recede or to come forward: '. . . it comes more forward than that which is near, so utterly has the aerial perspective been destroyed.' Uwins defended himself strongly: 'If the glazing has been removed, as he states it has, I can only say that it is very much for the benefit of the picture; but I do not believe that any glazing was ever passed over the sky, or the upper part of the picture, or that glazing was ever any part of Claude's ultimate process'. He went on to deny that the 'aerial perspective' was gone, saying that '. . . it is quite as perfect as ever it was . . .', and scathingly remarked of Moore's assertion that the objects in the distance were as near as those in the background: '. . . that any man possessing any knowledge of art could state such a thing as that, with the picture before him, does appear to me to be most extraordinary.'

No.14 was discussed in great detail by many witnesses. John Seguier gave evidence about the cleaning: 'I discovered that it had a varnish next the picture, and it appeared to have had some oil, not oil varnish, but merely oil over the varnish; and there was a vast accumulation of dirt which rendered it very obscure, arising from the bad atmosphere and from the effluvia of such a number of people coming into the place. It was very loose dirt, which was removed without any difficulty.' Seguier was asked what parts of the picture he had repaired, and what damages existed. He referred to the blister-laying he had done in 1825, saying that a great many small pieces of paint were gone, due to the then recent lining, and that he

Figure 4 Ultra-violet photograph, detail of the figure in No.14 which was damaged and repaired in 1815. The retouchings were done by John Seguier in 1852. (Photograph taken in 1948.)

had repaired the lower part. After removing the loose dirt and oil (in 1852) he found a mastic varnish, which had chilled, and which he therefore partly removed by friction so that the picture would 'bear out properly' when he re-varnished it. He denied that he had removed all the varnish; had he done so, he claimed, he would inevitably have discovered and removed his own repairs of 1825, and this he had not done. He was also questioned about a pentimento of a flag at the top of one of the masts (see Plate 7, p.48); but claimed not to have seen it; when asked whether his eyesight was fresh and good he replied: 'It is not so good as it was formerly, but with glasses I can see very well.' There was some discussion of cleaning methods, chiefly about whether it was safe to use a sponge with soap and water to remove the 'loose black dirt' which had settled on the pictures, and whether any pictures might be damaged by being cleaned with spirits of wine. It is probable that the latter cleaning agent, almost pure alcohol, was used undiluted. Seguier admitted that the practice of adding oil on its own to the surfaces of pictures (which he blamed on his brother) had greatly contributed to their becoming obscured by dirt.

Mr Retra Bolton thought that no harm had been done to *The Embarkation* in the recent cleaning, and that there was both some old varnish and some toning left on it. J. Morris Moore however reserved his most serious criticism for this picture. According to him, glazes (which he had been able to detect under all the dirt) had been removed from the whole surface; so had the shadows of the boats, the rigging and the inscription. Moore was then asked rather sharply whether, since he had studied the picture so closely before it was cleaned, he had observed the pentimento in the flag (see Plate 7, p.48). He said he had not, which surprised the questioners and led to some comments hostile to him. Then Moore produced a surprise witness, Mr Arney, who claimed never to have possessed a catalogue of the Gallery, nor to have read any account of the inscription on the Claude, but to have been able to read the inscription clearly before the cleaning: 'I cannot read it now, though probably I might trace it if I were to apply a magnifying glass; I could read it with tolerable facility before last year's cleaning' [5].

Another dealer and cleaner to be called before the Committee, Henry Farrer [6], used the occasion for some self-advertisement, while protecting his professional secrets. He had said that he had a different method of restoring from other people in his profession, and was asked if that meant that he used water-colours. Farrer replied: 'I do not know whether I am obliged to expose my mode of restoration; I would rather not do it; I do not use oil. I can say that I dislike oil too much ever to use it.' He was of the opinion that glazes and original toning had been cleaned away, though he admitted that the rigging was intact. He was asked whether in foreign galleries cleaning was given over to a single cleaner: 'Yes, I have an instance of it; I wrote a letter some time ago to The Atheneum, in connection with the cleaning of the two Rubens, at Antwerp; they were cleaned by M. Ettienne le Roy [7], and I never saw anything done better in my life.' He was then asked if there were special restraints in the foreign galleries upon the operations of the cleaners which did not exist in the National Gallery: 'I know that no person could even get to see the pictures. Those to whom they were entrusted had the key of the room they were in while they were cleaning, and no person could enter the place unless they took them in. They would not be interfered with in any way.'

John Nieuwenhuys, a native of Brussels who had moved to London and who practised dealing and, in an amateur way, cleaning, was called before the Committee. He believed that the best way of ensuring that no damage was done was to have a commission of well-known men, some of them artists, to advise on the necessity for cleaning. One question put to him was: 'Do you admit that the principle is good, that a thin coat of varnish should always, where it is practicable, be left upon the surface of the picture to protect it?' He replied: 'I do not understand that way of explaining it; I say you cannot keep the first surface. If you want to clean a picture you must do it evenly; if you use spirits of wine it dissolves it in spots. I defy them to do it, as they pretend to do it, by leaving a last coat of varnish on it; it is only by friction that you can obtain, to a certain extent, the keeping a part of the varnish on the picture, but you cannot do it with any spirit; it is impossible.' Parts of the proceedings of the Select Committee are extraordinarily like debates which continue today.

Nieuwenhuys was asked: '. . . if, when an experienced picture-cleaner's sight began to fail considerably, he was more likely to do injury to a picture than an inexperienced man would, because he would have more confidence in his own judgement . . .?' This question is probably a snide reference to Seguier's admission that his eyesight was failing. Nieuwenhuys replied that if the cleaner was a man of prudence, he was not more likely to do such injury. Perhaps his most interesting answer came when he was asked about defects in *The Embarkation:* '. . . I can very well judge, by seeing the surface of the picture, that it wants new lining; that lining may well have been done 60 or 70 years ago; it is a French lining, and they never lined well, because the glue or paste they used does not stick well; in general it all detaches from the old canvas.' Seguier had also thought that the picture had been lined in France, rather than England, in or before 1803. Giving evidence about the repairs he had made in 1825, he said: '. . . the injury was possibly owing to some damp having got behind the picture; the picture had been lined, I presume, in France; there they line them very close, and sometimes, if they are in a warm room, the colour will rise from the cloth.'

John Bentley, who was also a picture cleaner, complained that old re-paint had been removed from *The Embarkation,* and that the re-paint had harmonized with the picture and should have been left on it. He also explained the necessity for repair in 1815: '. . . There was a fire close to Mr. Angerstein's, and they ran away with the picture, and knocked out nearly the whole of one figure on the right-hand side, which was

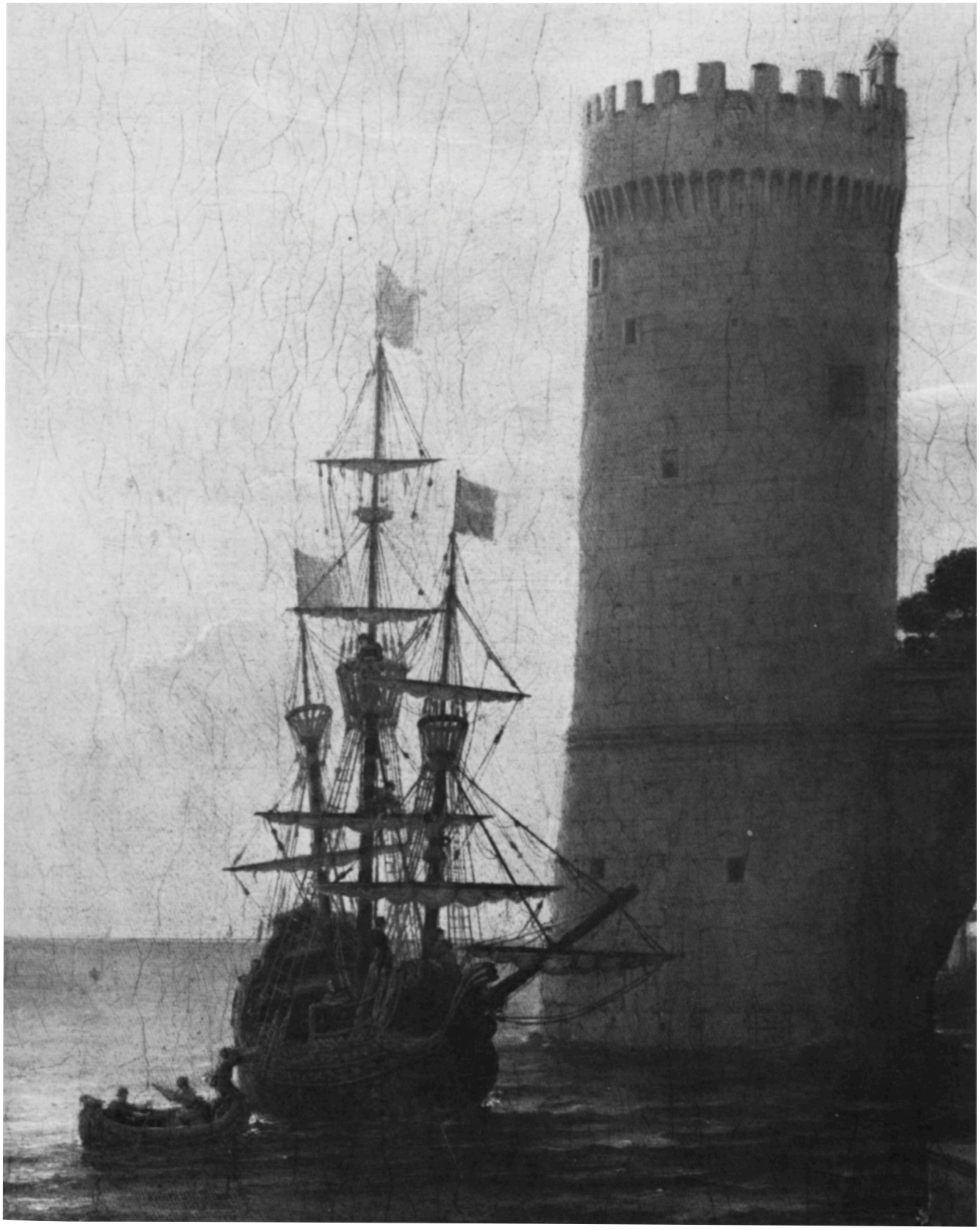

Figure 5 Detail of No.14, showing accumulations of dirt and varnish in the cracks. (Photograph taken in 1939.)

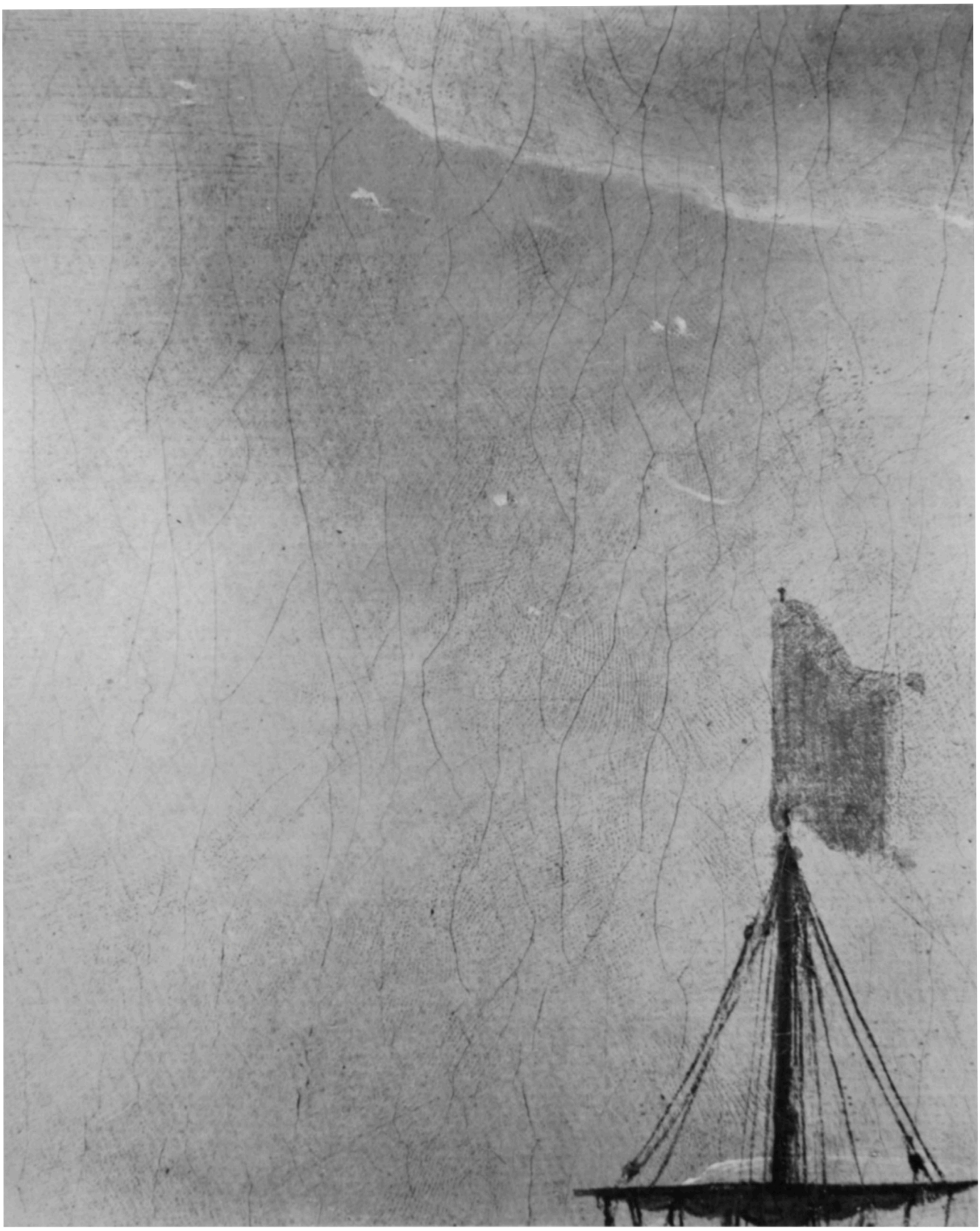

Figure 6 Detail of No.14, during cleaning in 1979. Claude's palm prints can be seen.

put in by an Italian, a clever man, about 40 years ago, or nearly so.' The Italian would certainly have been clever if he had put in the whole of the figure on the right; in fact, the damage was a V-shaped tear about three inches long (Fig.4).

The majority of the evidence given to the Committee claimed that the picture had been injured in the recent cleaning. Glazes, shadows, ropes and rigging, the inscription, the peculiar qualities of Claude's touch, the over-glaze, the harmony, the gradations of tint, the delicate touches, the warm rich glow were all said to have been removed. The contrast of light and shade was gone, the sky was now bluer than Claude intended, and had a 'flat and metallic appearance'. Richard Ford, one of the 'amateurs' who gave evidence, made perhaps the most risible statement of all: 'I think if it *(The Embarkation)* were sent back to Rome, and left there for two or three months during the summer, you would find that there are restorers there who are capable of doing almost anything.'

Ultimately, the main result of the Select Committee was that Sir Charles Eastlake was appointed first Director of the Gallery in 1855. One of the Committee's recommendations was that 'no picture be hereafter cleaned, lined or otherwise repaired, without a previous written report from the Director to the Trustees' [8, 9].

Even Eastlake thought that *The Embarkation* had been tastelessly cleaned, and recommended that another cleaned picture '. . . should be left without its glass for a twelvemonth, so that it might have the benefit of dirt'. It is therefore surprising to find a note in the National Gallery's Manuscript Catalogue in 1855, possibly by Eastlake, which says of No.5, the small *Seaport* which had not been cleaned: 'The general tone inclines rather too powerfully to red, an appearance increased by the partially darkened varnish. The upper edge has become brown, apparently from the same cause.' This is not the place for a discussion about whether this picture, and indeed No.14, represent sunset or sunrise, or whether the clock in the former, which stands at 4.55, is meant to be taken literally. What is clear after the cleaning of all three Claudes since 1976 is that the colour and light of each of them is particular and individual, and that none of them has suffered any serious damage.

The small *Seaport* (No.5) was cleaned and varnished in 1881, without attracting comment. *The Embarkation* (No.14), was re-lined, repaired and varnished in 1899, but needed strip-lining in 1931.

Twentieth century restoration

Any restorer who works in a museum which keeps proper photographic and written records of work done is acutely aware of the inadequacy of traditional restorer's materials. All three of the pictures discussed here were cleaned, restored and re-varnished in 1948. Within twenty years the mastic varnish and oil retouchings applied then had noticeably discoloured (Plate 7, p.48). The discolouration became progressively worse, and considerably changed the effect of the pictures which depend greatly on atmospheric or 'aerial' perspective. The London air is much cleaner than it was in the nineteenth century, but even so, in the non-air-conditioned part of the National Gallery surface dirt still settles heavily on the pictures. Dusting does not remove all the dirt, some of which remains in the cracks and wrinkles of the paint surface. The two larger Claudes, No.12 and No.14, have the appearance of having begun to shrink during lining, and the cracks with raised edges caused by this become very prominent as surface dirt accumulates (Fig.5).

The old linings, particularly that on No.14, *The Embarkation,* had very thick and hygroscopic layers of glue, which led to the pictures becoming buckled. It may be that all three of the linings removed recently were done in France in or shortly before 1803. No.14, which, according to the conservation record was lined at the National Gallery in 1899, was then simply reinforced with a second lining canvas.

During the removal of the mastic varnish applied to all the pictures in 1948 (this was not a difficult task, one part of propan-2-ol in three parts of white spirit dissolved the varnish) the areas of blanching tended to revive, presumably due to the action of the solvent. When the solvent evaporated the blanching returned, but disappeared again when a thin coat of varnish (MS2A or Ketone N) was brushed on. The blanching which affected parts of the figures in No.5, and of the foliage and figures in No.12 and No.14, were less of a problem than had been anticipated. Lining, using an aqueous adhesive (which has been suggested as a cause of blanching) also seemed to help revive the blanched paint in some places. No scientific claim can be made for either of these forms of treatment; in the present state of knowledge the revival of blanched areas is an uncertain procedure. One other change, of a more permanent and irreversible kind, has occurred in the blue drapery of a figure in No.12. The blue appears to have become deeper and more intense. This phenomonom, like blanching, is common in Claude's pictures and is found in the work of many other painters as well (see pp.61 – 3).

As Brommelle [8] has pointed out, it is a characteristic of picture cleaning controversies that the criticism expressed is transmitted almost unchanged from one controversy to another, as if some hereditary factor was at work, and that it is always the most recent cleaning which is blamed for any supposed damage. The general opinion in 1803 was that *The Embarkation,* though in good condition, was too blue and needed a coloured varnish. Perhaps it had been cleaned in France shortly before. How dirty it had become by 1852 due to the Seguier's habit of rubbing oil over the pictures, and of varnishing them thickly with the 'Gallery Varnish', will never be known. Eastlake's recommendation that another cleaned picture should be left without glass for a year so that it might have the 'benefit of dirt' implies that even one year's accumulation of dirt (helped by yellowing varnish) would make a substantial difference. After nearly fifty years in London, the last fourteen of which were at Trafalgar Square [10], *The Embarkation* must have been very dirty indeed. It is likely that Seguier

left some old varnish on it; he was a busy man and his cleaning had been under attack for the previous six years.

There was then, as there are now, those who thought that all painters covered their pictures with toned resinous glazes. The real glazes, of pure pigment in an oil medium applied over a lighter underpaint, went unnoticed, obscured as they were by re-paint, dirt and varnish. Claude's palm and finger prints can be seen in many places in the sky of *The Embarkation* (Fig.6). This was not mentioned by any of those who gave evidence in 1853, the year after it had been cleaned. Perhaps enough varnish had been left on the picture then to hide the palm prints; perhaps nobody had looked at the texture of the paint closely enough to see such a detail of Claude's technique.

Painters from the fifteenth century onwards (Giovanni Bellini and Leonardo are obvious examples) have used their fingers, thumbs or the palms of their hands to modify the paint while it is still wet. With rare exceptions, it has been the top layer of paint which has been treated in this way, usually in order to achieve smooth transitions of modelling which would be more difficult, or need thicker paint, if done with a brush. The clarity and sharpness of Claude's prints demonstrate that his paint has survived well.

Notes and references

1. LANK, H. and PEMBERTON-PIGOTT, V., 'The Use of Dimethylformamide Vapour in Reforming Blanched Oil Paintings', in N. Brommelle and P. Smith (eds.), *Conservation and Restoration of Pictorial Art,* Butterworths (London 1976), pp.103 – 109.
2. For a full account of the history and provenance, see DAVIES, M., *National Gallery Catalogues: French School,* 2nd ed. (London 1957), p.31ff. A version of No.12 is still in the Doria Palace in Rome.
3. BUCHANAN, W., *Memoirs,* Vol.II (London 1824), p.188.
4. See ROBERTSON, D., *Sir Charles Eastlake and the Victorian Art World,* Princeton University Press (Princeton 1978).
5. Arney was later Chief Justice of New Zealand. His evidence may be explained by the inscription having been reinforced by a restorer, and some of the reinforcement having been removed in 1852. Arney claimed to have been able to read the word 'trouver' quite clearly; in fact, the inscription is abbreviated at that point, and reads 'TROV'. Ralph Wornum, and others, insisted that the inscription had not changed at all.
6. Farrer had sold Velazquez' 'Boar Hunt' to the National Gallery in 1846, encouraging the purchase by pretending that the picture was about to be shipped to the King of Holland.
7. Ettienne [or Etienne] le Roy was 'the eminent commissaire-expert of the royal museums of Belgium'; he had cleaned Gerard David's altarpiece, later No.1432 of the National Gallery Collection, before its sale in 1877. See *National Gallery Technical Bulletin,* **3** (1979), p.51.
8. See *The Museums Journal,* **56,** 11 (February 1957) for Norman Brommelle's account of the 1846 cleaning controversy and the events leading up to the Select Committee of 1853. This article is reprinted in RUHEMANN, H., *The Cleaning of Pictures,* Appendix D, Faber and Faber (London 1968), p.327ff.
9. All the quotations are from *The Report from the Select Committee on the National Gallery,* together with the 'Minutes of Evidence', The House of Commons, 4 August 1853.
10. Until Wilkins' building in Trafalgar Square was completed in 1838, the National Gallery pictures were hung in Angerstein's old house (the lease of which had been purchased with his pictures) at 100 Pall Mall, and from 1834 onwards at 105 Pall Mall after Angerstein's house became too decrepit to house them.

Blanching of the paint film involving possible changes in the medium

John Mills

A paint film will display to maximum intensity the colour of the pigments in it when two conditions are satisfied: that the pigment particles are embedded in a medium which has the minimum of discontinuities, other than those provided by the pigment itself, to cause diffusion of the light and reduce the colour saturation within the film; secondly that diffuse reflection from the surface is minimized by ensuring that it is smooth and transparent, for example by varnishing. A paint film in glue medium (gouache) is matt and of low colour saturation because there is insufficient medium to fill the spaces between the pigment particles, and an initially clear paint film in some other medium can become gouache-like if, for any reason, the medium develops micro-voids, or part of it separates out as a different phase. This could happen in various ways. Firstly it is conceivable that solvent action could swell the medium and leach out soluble components such as unpolymerized or depolymerized fractions. When the residual swollen medium shrank once again the relative rigidity of a pigmented film (especially one rather lean in medium in which the pigment particles are in contact with one another) might ensure that disruptive stresses tore the medium apart and away from the pigment. Secondly water, either liquid or as vapour, could produce turbidity in two ways. It could open up micro-fissures which did not seal again when the water evaporated or it could precipitate a solid phase from the glassy medium which might well not redissolve subsequently.

In seeking an explanation for the blanching in Claude's paintings we have to find an answer to the question: what makes them especially susceptible to this phenomenon? The mechanisms adumbrated above might seem applicable to all oil paintings. In practice the majority of these show no such reactions except, perhaps, in extreme circumstances such as prolonged contact with water. Generally the blanching in Claudes is not reversed, or not reversed fully, by the process of cleaning and revarnishing alone and so it cannot be simply a surface phenomenon. We have to seek therefore for some peculiarity of medium, of interaction between pigment and medium, or of build-up of layers, which renders them especially liable to matting within the paint film under conditions which do not have this effect on most oil or tempera paintings.

It is too early to say whether there was anything special about Claude's medium *per se* or whether he might have used different media in separate layers of his often multilayered paint structure. This latter feature has made it difficult to secure homogeneous samples for gas-chromatography while studies using differential staining techniques have not so far been undertaken. Results obtained up till now (see p.67) indicate that in *A Seaport: Embarkation of the Queen of Sheba,* No.14 (which showed minimal blanching) the medium was oil alone. In *A Seaport,* No.5 (which showed rather more blanching) there was some indication that egg tempera might be present also. In *The Marriage of Isaac and Rebekah,* No.12, an unblanched area was in oil alone.

Possible causes of blanching involving changes in pigments or interaction of pigment and medium

Joyce Plesters

Blanching of the type which occurs in pictures by Claude has in the past more often been attributed to some change or defect in the paint medium rather than the pigment. An exception has been the patchy greyness which sometimes occurs in areas of deep blue paint, notably that of blue drapery of foreground figures, which has often been described as 'ultramarine sickness'. It has gradually become evident over the last twenty years of examination of samples from a number of pictures of different schools and periods that some other pigments might contribute to bringing about changes in the paint film which could lead to a 'blanched' appearance. Unfortunately, this slight gain in knowledge seems merely to have brought the greater realization of the complexity of the problem. Also it would seem that the particular palette and technique employed in some seventeenth century paintings predisposes them to paint defects of this kind, as will be seen below. The following are some possible causes of blanching which are related to pigments:

1. *In green areas which have become bluish a final glaze, either yellow or green, may have been lost,* either by action of cleaning agents and/or abrasion or flaking. At the same time the surface of the blue or bluish opaque underpaint may have been revealed as roughish and matt, or become so as a result of cleaning. Blue leaves are sometimes conspicuous in seventeenth century Dutch landscapes and flowerpieces otherwise remarkable for botanical accuracy of form and colour. The blue colour of such foliage is usually explained as the fading of a light-fugitive component of the paint, such as a yellow lake pigment. Such may indeed sometimes be the case (see 2. below), but painters of flowers and landscapes in order to achieve an adequate range of shades of green with the limited number of pigments at their disposal had to resort to many different techniques, and one of these was the, by that time well-established, art of glazing. There is, for example, in the Metropolitan Museum of Art, New York, a flowerpiece by Margareta Haverman (a pupil of Jan van Huysum) in which the majority of the foliage is completely blue with only here and there a patch of rich deep green. In the green areas, there survives a green glaze, which was identified from samples as being of copper 'resinate' type [1]. It is cracked and crazed almost like shattered glass in the few places where it has not fallen away to expose the matt, opaque blue underpaint. Loss of a yellow glaze over blue or green-blue underpaint would produce a similar effect.

2. *In the affected greenish areas fading of a yellow lake pigment or of a yellow organic pigment may have occurred,* present either in a final glaze or as a component of a mixture of pigments in a single paint layer. Such fading has been detected in some seventeenth century Dutch landscapes. A notable example occurs in the foliage of a *Landscape with Cattle* by Adriaen van de Velde, signed and dated 1664, in the Fitzwilliam Museum, Cambridge, which presented much the same appearance, both on the picture surface and in paint samples under the microscope as foliage in badly blanched Claudes [2]. The top surface of the paint layer of some samples of foliage from the van de Velde was seen under the microscope as a matrix of lead white with scattered blue verditer (basic copper carbonate) particles, but aluminium was detected chemically in the layer suggesting the presence of aluminium hydroxide which could be accounted for as the substrate of a yellow lake pigment now faded to the point of disappearance. Elsewhere in the picture there were one or two examples of unchanged yellow lakes, mixed with blue pigment to give green, sometimes surviving unchanged in underlayers. It is conceivable that if the dyestuff of a yellow lake pigment faded with complete loss of colour, the residual substrate plus medium might have a degree of turbidity which could give the visual effect of blanching. More extensive use seems to have been made of yellow lake pigments in the seventeenth century than at earlier periods. Lakes were made from dyestuffs extracted from a number of the many different plants which give a yellow colouring matter and there are recipes not only for lakes on the usual substrates of aluminium hydroxide and chalk, but also for yellow pigments in which the dyestuff was adsorbed onto lead white. Yellow lakes seem early on to have gained notoriety for their tendency to fade; a Dutch term for them is *Schietgeel,* an abbreviation for *Verschietgeel,* i.e. 'disappearing yellow', and indeed such samples as have been prepared or painted out in the laboratory seem to deserve this reputation, fading rapidly in a matter of months when exposed to strong light. It is not proposed here to deal in any detail with this class of pigments for it is expected that at some future date they will be the subject of research. Another possibility which cannot be excluded is the use of yellow organic pigments (as distinct from lakes) particularly saffron, used as a pigment from medieval times at least, and gamboge which was probably introduced into Europe from the Far East at the close of the sixteenth century. Even less seems to be known about these materials or their permanency, whether as colorants or as film-forming substances and, like the yellow lake pigments, they are very difficult to identify in small paint samples even when not faded. In the sixteenth century the most frequently-occurring green pigment was verdigris [3], used by itself, in combination with other pigments, particularly with lead white or lead-tin yellow, or dissolved in a medium to form a copper 'resinate' type material. In the seventeenth century, particularly in the Netherlands, but also elsewhere, there seems to have been a tendency to make greens from a combination of blues and yellows, either by physical mixture of blue and yellow pigments or by means of an optical mixture produced by a yellow glaze over a blue underpaint or a blue glaze over yellow. Some of the green areas in the pictures by Claude reveal under the

microscope both complex pigment mixtures and multilayer structures not always easy to interpret (see Plates 2a and 2b, p.21).

3. *Use of artificial blue and green copper carbonate pigments:* The very small size and regular rounded shape of copper carbonate pigments in many areas and paint layers of Claude's pictures indicate that they may be manufactured rather than the natural minerals azurite and malachite, although the artificial and mineral forms seem indistinguishable on the basis of their X-ray diffraction powder patterns. Although the artificial forms were known and produced from late medieval times their more extensive use, particularly in combination with yellow lake and organic pigments to form greens, seems to be associated with seventeenth century painting and has frequently been observed in samples from Dutch and Flemish pictures of the period. The very fine particle size results in poor colouring strength (whether the copper carbonate is of artificial production or the finely-ground mineral) and this means that the blue or green colour of the paint will be worse affected by any change in colour or optical properties of the medium. In addition, the fine particles, because of higher ratio of surface area to volume, are likely to be more vulnerable to chemical attack from action of chemical reagents like acids or alkalis, or to effect of moisture. Also it has only recently been realized that not only verdigris but copper carbonate pigments have a tendency to react chemically with the organic materials of which paint media are composed [3], and this tendency is likely to increase with decreasing particle size. For the blue pigments, at least, there survive a large number of recipes, not all chemically sound, and early manufacturers may not have been too scrupulous about washing out excess reagents such as alkalis from the precipitated pigment, thereby introducing factors which could lead to instability of the resulting paint.

4. *Effect of alkaline cleaning reagents:* In the past alkaline materials, of which the most common is ley (an aqueous solution of potash) have been used in picture cleaning and may well have been found necessary for the removal of some early varnishes of the boiled hard resin type or even of later copal/oil varnishes. As well as being disruptive to the medium of the paint film caustic alkali would be capable of attacking copper carbonate pigments dissolving them, or partially dissolving them and re-precipitating the copper as whitish copper hydroxide. If the copper carbonate is totally converted to hydroxide, the latter may on exposure or dehydration become blackish or brownish copper oxide, but slight attack might just result in a turbidity or greying of the paint film. Again pigment of a small particle size would be most vulnerable to change. Ultramarine, unlike the blue and green copper pigments, is unaffected by alkali. Caustic alkali could alter the colour of yellow lake pigments.

5. *In the blue areas, true 'ultramarine sickness',* i.e. the discolouration of ultramarine to a yellowish grey or white by action of acids [4]. The sulphur in the ultramarine molecule is displaced with evolution of hydrogen sulphide gas and simultaneous loss of the blue colour of the material, leaving only a yellowish grey or whitish silicaceous mass. Mineral acids in dilute solution have an almost instantaneous effect, but weak organic acids such as maleic acid will gradually produce the same result and even the fatty acids in oil media have been suspected of being capable of causing the disorder, as is sulphur dioxide or other acid fumes present in polluted atmospheres. Fortunately true ultramarine sickness seems a rather rare phenomenon in easel paintings compared with the number of cases of discolouration which seem to be associated with another blue pigment, smalt (see 6. below). It is not, however, unknown in the National Gallery; an instance is reported on p.27 of this issue of the *Technical Bulletin* and an extreme case can be seen in Sassoferrato's *The Virgin in Prayer* (No.200) in which the Virgin's blue cloak has a very blanched and greyish appearance. Ultramarine, which in the seventeenth century was still the genuine lapis lazuli variety, was used quite extensively by Claude, both in skies, where it is mixed with a high proportion of lead white, and in the drapery of figures, where it is often used alone or mixed with only a very little lead white to give an intense deep blue. Lead white, chemically a basic material, may serve to protect ultramarine particles with which it is mixed from effect of acids. Blanching is certainly prominent on *some* of the deep blue ultramarine drapery of foreground figures in Claude's paintings, for example the blue jacket and hose of the man in the bottom left corner of No.30, *Seaport: The Embarkation of S. Ursula.* (See also Plate 8, p.48.) In others the deep blues seem in perfect condition. Samples of paint from pictures by Claude so far examined reveal that ultramarine present, like the copper carbonate pigments, tends to be of rather small particle size which, again, would render it more vulnerable to chemical attack.

6. *Interaction of the blue pigment smalt with oil medium:* The blue cobalt-glass pigment smalt has been observed to produce discolouration in paint films probably resulting from excess alkali in the glass of which it is made interacting with oil medium [5]. Discolouration may vary from a dull greenish grey to brownish yellow and depending on whether and to what extent lead white is also present. The low refractive index of the pigment (*c.*1.46 – 1.55 [6]) is close to that of a dried oil film, and with the rise in refractive index of the oil film which usually takes place with ageing, the blue colour of the pigment, initially weak, may be all but suppressed by the discolouration of the medium. Although one of the effects is of increased translucency of the film, coupled with loss of blue colour and brownish discolouration of the medium, another type of deterioration can sometimes occur. An electron microscope study of a discoloured smalt paint revealed that the surface of the blue glassy pigment particles had in this instance become roughened and pitted from interaction with the medium [7]. When this happens, the blue paint film is likely to become whitish and more opaque, i.e. blanched. Smalt is rarely found in easel paintings before the latter half of the sixteenth

century, but becomes quite common in the seventeenth century all over Europe, though particularly in those countries farthest from Italy, like Spain and the Netherlands. That is not surprising for it was generally used as a substitute for ultramarine which, as the dry powder pigment, it closely resembles in hue, and lapis lazuli ultramarine would be likely to get scarcer and more expensive the greater the distance from Venice, its port of entry from the East. It has been noted that Claude, who for the most part worked in Italy, used a good deal of ultramarine in his pictures, particularly in skies and blue drapery, but recent examination of the National Gallery Claudes has revealed the presence of smalt in a number of samples, particularly from greens of foliage (and in one instance in the sky, of No.5, *A Seaport*). If used in combination with yellow pigments to make greens smalt may induce brown discolouration not dissimilar in appearance, and sometimes confused with, that which occurs in copper 'resinate' greens. Smalt can also have been introduced into ultramarine, either to act as a drier, since ultramarine itself dries slowly in oil when unmixed with lead white, or as an adulterant. It may be of interest here to mention that in samples of paint from Claude's pictures there were often seen in various layers and mixtures not only the recognizably blue glassy particles of smalt, but some apparently colourless glass particles. When interaction of smalt with oil medium occurs some cobalt combines with the fatty acids of the oil to form cobalt salts which act as drying agents. It follows therefore that some cobalt must be leached out of the pigment particles and as the concentration of cobalt in them is quite low (about 2 – 18% of cobalt oxide by weight) such loss might result in a serious reduction, or even disappearance of the blue colour which is due to the presence of cobalt. (An alternative explanation is that the colourless glassy particles are ground white glass, presumably lead glass, added as a drying agent as is sometimes recommended.) The conclusion to be drawn is that in any of the circumstances mentioned above smalt might provoke some discolouration and/or blanching of the paint film.

It can easily be appreciated that in one and the same picture, and even in the same area within that picture more than one combination of the causes and effects described above, involving either medium or pigment or both, might be operating [8]. A full investigation is likely to be both difficult and time-consuming. In addition to the facilities already available in the Department for examination and analysis it has been proposed that a study of the topography of the surfaces of the blanched areas of Claude's paintings might provide some interesting and useful information since some relevant features may be beyond the resolving power of the optical microscope.

Notes and references

1. The author acknowledges a debt of gratitude to the late Theodore Rousseau, former Vice-Chairman and Curator of Paintings at the Metropolitan Museum of Art, New York, for permission to examine and sample the flowerpiece by Margareta Haverman.
2. *The Fitzwilliam Museum Cambridge, Catalogue of the Paintings,* Vol.I (1960), p.131. No.88, Adriaen van de Velde, 'Landscape with Cattle and Figures'. The catalogue entry describes the appearance of the picture before its most recent cleaning in 1969 which was the occasion on which the samples were taken in order to investigate the blanched and bluish appearance of the foliage evident even beneath the old discoloured varnish.
3. Examples from fifteenth century Italian paintings of interaction between what seems to be an early synthetic form of green copper carbonate pigment and the paint medium are described in previous volumes of the *National Gallery Technical Bulletin:* **1** (1977), p.13; **2** (1978), pp.23 and 65.
4. PLESTERS, J., 'Ultramarine Blue, Natural and Artificial', *Studies in Conservation,* **11,** 2 (1966), pp.68 – 9 discusses ultramarine sickness and other disorders to which the pigment may be subject.
5. PLESTERS, J., 'A Preliminary Note on the Incidence of the Discolouration of Smalt in Oil Media', *Studies in Conservation,* **14,** 2 (1969), pp.62 – 73.
6. MÜHLETHALER, B. and THISSEN, J., 'Smalt', *Studies in Conservation,* **14,** 2 (1969), pp.53 – 7 provides a list of occurrences of smalt in easel paintings in chronological order within each school of painting.
7. GIOVANOLI, R. and MÜHLETHALER, B., 'Investigation of Discoloured Smalt', *Studies in Conservation,* **15,** 1 (1970), pp.37 – 44.
8. The phenomenon of 'blanching' in pictures by Claude is not, of course, in any way confined to those in the National Gallery's collection, as was testified by a number of the paintings in the exhibition, 'The Art of Claude Lorrain', which took place at the Hayward Gallery in 1969. Of these the most striking case was the large 'Landscape with Ascanius Shooting the Stag of Silvia', lent by the Ashmolean Museum, Oxford, which stood out by reason of its all-over pale bluish tonality. Close to, the surface had somewhat the effect of a pastel seen beneath a sheet of glass (though the picture was not, nor is it at present, exhibited under glass), and it was quite clearly seen that the 'blanching' of the paint surface is below and independent of the protective coating of varnish. Apart from the all-over blanched effect there also occurred in the deep blue drapery of foreground figures on the left the local greyish patches associated with 'ultramarine sickness'.