S T A T I O N S O F T H E C R O S S

Our Lady of Montserrat Church, Parish of Tortuga, Trinidad

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RESTORATION REPORT

Our Lady of Montserrat Catholic Church, Tortuga

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Introduction

In the first half of 2001, I was contacted by Simone Taylor from Trinidad. The Catholic Church there (Our Lady of Montserrat in the parish of Tortuga) had obtained funding to allow for a restoration project concerning their Stations of the Cross- a series of 14 pictures depicting scenes from the Passion of the Christ. There being no locally available artist with the requisite skills, I was approached to do the work.After an exchange of faxes and photographs, I agreed to accept one panel to restore and use as a guide to the overall extent of work required. Subsequently, I was commissioned to restore the entire series of panels and offer guidance as to their future preservation.

The church itself is a wooden structure built in 1878 by L'Abbé Dupoix, and is somewhat open to the elements. A good deal of natural sunlight illuminates the interior, with may openings unglazed. The paintings appear very roughly contemporaneous with the building. The artist remains unknown, although there stylistic similarities to artists of the period. Indeed, the paintings themselves may be copies of previous works, but there is little evidence to determine the original source, apart from the aforementioned stylistic similarities.

The climate in Trinidad was to provide some unexpected challenges, but these were finally addressed when I eventually visited in November of 2006

Initial condition of panels

Overall condition

Although the panels are uniformly rectangular, they are framed in arched mounts.
These are obviously not the original or intended frames as they often obscure details, for example most of the legend nailed to the top of the cross and much of the hands of Christ(see Fig 1, below).

Fig 1 The darkened area at the top of the picture clearly shows the extent of the arched frame

The area under the frame has also suffered due to the ingress of dust and moisture.

Much of the corrosion present is at the corners or edges of the panels, with little evident elsewhere.

The back of the panels has been treated with what appears to be red lead - a common corrosion-resistant coating in artifacts of this age.

There is no visible evidence of cracking in the steel, although hard X-rays may reveal such damage. Neither is there any significant bending or other warping of the panels. The primary damage sites due to corrosion are at the edges and corners where bare metal is easily exposed and moisture has equally easy ingress. Other areas affected by rust presented as pitting where the applied paint and varnish layers had not sufficiently wetted the underlying metal surface.

Some panels exhibit severe degradation of the varnish layer, with discolouration and a loss of transparency in evidence, and in some cases this has impacted on the underlying paint layers. It is likely that the elevated temperatures, high humidity, and levels of UV have all contributed significantly to the polymerisation of the varnish layer, which has become discoloured and tending towards opaque.

It also appears that a layer of varnish has been applied whilst the panels were still within their frames. The evidence for this is a thickening of the varnish around the margins of the panels following the general outline of the frames.

Those with corrosion have suffered paint loss where the corrosion is apparent on the front of the panel.
Since iron and steel expand significantly when they rust due to the formation of ferroso-ferric oxides, the paint has literally been pushed off of the surface.

On darker and some shaded areas of paint, there is crazing of the surface. This is due to the use of bituminous pigments which are commonly used to produce deep browns and brownish-blacks. The bitumen does not cross-link with the oil medium causing the paint to dry very slowly.

The crazing is not extensive enough to warrant in-filling, and becomes invisible following application of the final protective varnish layer.

Where the top of the painted surface depicts a sky, the areas which have been covered by the arched frame make it obvious that some fading of the blue pigment had occurred. This is probably due to the use of Prussian Blue[1] as a pigment.

Materials used

The paintings have been executed in oils on steel panels. The use of steel is mildly surprising, given the moisture-rich environment (see below), but is not entirely uncommon.

The rear of the panels has been painted with red lead - a method of corrosion proofing only recently discontinued due to the risk of lead poisoning. This is not a significant risk with these panels, however, since they will rarely, if ever, be handled once they are re-instated.

Any risk incurred during dis- and re-assembly, may be mitigated by the correct use of an appropriate mask.

Environmental considerations

The climate of Trinidad, whilst varied over the whole island, is predominantly tropical, with high noon temperatures and extremely high humidity the norm. Although they have been housed in a wooden building which is, to some extent open to the elements, the panels have survived remarkably well. The steel in particular shows less damage than may perhaps have been anticipated. On intial examination, there does not appear to be evidence of disolouration due to insects or fungal growth.

The effects of transporting the panels

Since the panels were transported to the UK via normal passenger aircraft, and were carried in the hold of the 'plane, they inevitably underwent a thermal cycle, with its attendant contraction and expansion. Whilst this may have been expected to trigger some paint loss or flaking, this does not appear to happened. Upon delivery to Trinidad, however, it was discovered that the waxy varnish used to finish and protect the paint surface has suffered some slight adhesion to the Mylar protective film. This was rectified by polishing the surface with a silk cloth. This adhesion may have been exacerbated by the cooling and reheating experienced during transport, or the sudden exposure to elevated temperatures with a surface still containing traces of solvent.

[1] Prussian blue (German Preußischblau or Berliner Blau, in English Berlin blue) is a dark blue pigment used in paints and formerly in blueprints.Prussian blue was discovered by accident by painter Heinrich Diesbach and Johann Konrad Dippel in Berlin in 1704–05, which is why it is also known as Berlin blue. (Diesbach was attempting to create a paint with a red hue.) It has several different chemical names, these being iron(III) ferrocyanide ferric ferrocyanide, iron(III) hexacyanoferrateII), and ferric hexacyanoferrate. Commonly and conveniently it is simply called "PB."

Overview of processes

Cleaning

Cleaning is the first stage of the restoration process and is a valuable guide to the condition of both any varnish layer present and also the paint surface. Paint or varnish surfaces are frequently covered in what can only be described as grime - a combination of dust, insect faeces, and tarry or oily deposits. This may often be easily removed by gentle rubbing or rolling with a moist cotton bud. In some cases, a dilute aqueous solution of ammonia is more effective, sometimes with the addition of a mild surfactant or detergent.

Where a discoloured varnish surface has to be removed, preliminary solubility tests are performed on a hidden or unobtrusive area of the surface to determine the correct or most suitable solvent or solvents.

Very occasionally, some debridement will be required where there are adhesions of foreign matter to the surface, or the paint surface has degraded to the extent that there is severe flaking and detachment of the paint from the underlying substrate.

Happily, this was very seldom the case with the Tortuga panels.

Cleaning steel substrate

The rear surface of the panels had been painted with what appears to be red lead, a common means of steel and iron protection. Whilst this is effective when the protective layer is contiguous, it can accelerate corrosion if a break is made through to the substrate. The effect is similar to that produced by tin-plating, where once the underlying material is exposed, corrosion will proceed more rapidly due to cathodic effects.

It was considered important to remove all traces of rust, since it can act as an accelerant to further corrosion when present on iron or steel. Consequently, the panels were scrubbed on the rear with a stiff wire brush to remove all traces of rust.

Surface cleaning

Surface cleaning was effected primarily with a dilute ammonia solution using cotton swabs prior to application of dichloromethane gel. This latter was employed to remove the overlying varnish, which had proved resistant to solvents such as acetone, propanol/toluene in a 1:1 ration, **cellosolve**[2], methoxy propanol, and **Vulpex**[3].

A gel was used to inhibit a “soak” effect that would have increased the risk of damage to the paint layer. Traces of remaining varnish were then removed using either butanol or cellosolve. It was found that these remaining areas could be rendered to a gel by application of a 1:1:1 mix of water, acetone, and IMS, which then rendered removal a simple task of gentle scraping.

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[2] Glycol ethers are a group of solvents based on alkyl ethers of ethylene glycol, also sometimes called Cellosolve. These solvents typically have higher boiling point, together with the favorable solvent properties of lower molecular weight ethers and alcohols. The original glycol ether is ethyl cellosolve.

Ethylene-glycol-monobutyl-ether(2-butoxyethanol, $CH_3CH_2CH_2CH_2OCH_2CH_2OH$), a widely used solvent in paintings and surface coatings, cleaning products and inks

[3] Potassium methyl cyclohexyl oleate.

A non corrosive, non-foaming, non hazardous, germicidal, non-acidic insecticidal formulation used throughout the museum world as a versatile 'wet' or 'dry' (spirit) cleaner for practically any material from paper to stone.

It is likely that these remaining varnish deposits were removable in this way, in contrast to the majority of the varnish layer, because they had polymerised to a lesser degree.

Once a clean paint surface had been reached, no further cleaning was required apart from very localised abrasion where rust spots or pits were found.

Consolidation

With paintings on canvas, flaked or cupped surfaces are frequently re-adhered with a heated wax which solidifies on cooling. This was not considered appropriate in this case, however, due to the impermeable nature of the substrate under the paint layer.

In fact, very little of the paint surface had detached, apart from areas of obvious damage caused primarily by the effects of corrosion (See Fig 2, below). Iron oxides formed in a moist environment (rust) swell on creation, distorting the surface of the material and causing any surface coating to detach.

Fig 2 Showing rusting and subsequent paint loss.

Where this had occurred, the paint surface sadly proved unrecoverable. On the positive side, most of these areas were confined to edges or corners with little detail apparent. Their repair, then, was easier than hoped.

In some small areas, the edges of the paint surface around areas of loss were loose. These were consolidated with **BEVA**, heat sealed, then swabbed with dilute dichloromethane cleared with IMS to remove traces of excess.

Proofing against corrosion (rust)

Consultation with several British museums showed that the preferred method of proofing against corrosion on iron or steel artifacts was best effected by the application of, and where possible integration with barrier films. Often iron and steel surfaces become somewhat porous over time due to previous corrosion. This allows for the use of molten wax and resin composites for the purpose. It is generally accepted that the application of coatings containing lead or zinc is not advisable due their cathodic effect should the protective film be breached. There may also occur irreversible chemical changes in the underlying substrate when such materials are employed.

The rear of the panels was treated with a mixture of **piccolyte**[4] and **bareco** - a microcrysalline wax - to prevent ingress of moisture, and so prevent further corrosion.

Preparation of paint surface

The nature of the paint surface, and to some extent that of the substrate, meant there was little flaking of the surface. What was in evidence in a number of panels, however, was pitting where the paint surface had been lost.

These losses were filled using a specially formulated mix of **BEVA**[5], calcium sulphate and pigments. This mixture was applied as a paste in combination with xylene, and subjected to pressure and heat to cure.

The mixture is essentially inert in this environment, and will present no threat to the integrity of the paint layer to which it is applied, and will prove easily removable should this be required at a future date.

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[4] Piccolyte® C115 polyterpene resin is a pale, neutral, low molecular weight, highly stable, thermoplastic resin. Produced from *d*-limonene, a natural terpene of citrus origin, it is characterized by its light color, resistance to aging, high thermal stability, and excellent balance of tack and of adhesive and cohesive properties. This resin is a highly effective tackifier for both elastomeric- and thermoplastic-based adhesivesystems, particularly pressure sensitive and hot melt types. It is also excellent as a higher softening point.

[5] A heat seal adhesive developed by Gustav A. Berger of New York which is widely used for the lining of oil paintings, heat seal facings and the making of laminates with fibreglass etc. BEVA 371 is non-aqueous and is dissolved in non-polar petroleum fractions known to be harmless to most paint films. It is applied cold. It causes no contractions, expansion or softening of the materials to which it is applied making its application possible on even the most delicate surfaces. Shrinking and distortion is minimal. Heat sealing can be done days or weeks after application. Since BEVA 371 is completly dry at room temperature, it is easy to reassemble fragments and secure them in the right position with a tacking iron. BEVA 371 was specially formulated to have an activation temperature of 65-70° which was considered best for the themoplastic treatment of old, distorted paint films and cellulose tissues. At this temperature, old paint films usually become quite soft and can be bent to be brought back into intimate contact with the supporting fabric. At 65°C BEVA 371 becomes as tacky as a contact adhesive at room temperature. A firm bond can be achieved almost instantly and with minimal pressure so that even the most delicate textures do not suffer. BEVA 371 does not have to be adhered and is viscous at activation temperature, the smallest fragments can be put together at leisure without danger of soiling them. BEVA 371 is reversible and errors can be easily corrected even after heat sealing. It is easy to remove and can be remelted whenever needed. BEVA 371 has only limited solubility at room temperature though it absorbs solvents and forms gels which no longer adhere to the bonded materials. These gels permit removal without staining. A large proportion of low molecular substances with high melting points have been incorporated in the formulation, they make it fairly rigid and free from cold flow at room temperature. These qualities enable BEVA 371 to keep the painting straight after lining and to provide a film bond for facings. The large proportion of low molecular substances in the formulation enables it to maintain low viscosity when used hot or dissolved in harmless petroleum fractions. This makes impregnation and consolidation of paint layers and canvas possible at every stage of the lining process and afterwards if needed. BEVA 371 can be applied by brush, paint roller or spray without impregnation of solvents. It is possible to lower the heat sealing temperature by using BEVA 371 films half dry or moistened with sprayed on petroleum fractions.

Restoration

Steel substrate

Once cleaned and wax treated, the rear surface required no further treatment.

Paint surface

An isolating layer of **B72**[6], compatible with consolidant **BEVA** and the **AYAB** medium, was applied to provide a transparent barrier to moisture. This compound has demonstrated stability under exposure to UV, as well as moisture and heat resistance.

Once the isolation layer had dried, losses were filled with the compound outline in **Consolidation**, above. These were then rubbed down flat.

A further coat of **B72** was then applied. Paint losses were repaired. Where required, some features were reconstructed, e.g.

After cleaning, showing paint losses

After restoration, showing reconstruction

Varnishing

Once the paint layer had dried, the whole of the paint surface was coated with Ketone resin N[7]. This is a stable, non-yellowing varnish, suitable for high UV environments.

Solvents/Media

Poly(vinyl acetate) **AYAB** was used as the primary medium because of its excellent adhesive properties. This medium is used extensively within conservation because if its resistance to degradation over time. It is also removable after extended periods, in keeping with conservation and restoration methodology.

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[6] Acryloid B-72 (Paraloid B-72)

Chemically an ethyl methacrylate co-polymer, Paraloid B-72 is a durable and non-yellowing acrylic polymer used for consolidating wall paintings (1-5%), fragile wood (5-20%), etc. It may be used as a fixative when diluted with a solvent to secure markings on artifacts and as an adhesive (50%+) for a variety of substrates. Paraloid B-72 is soluble in acetone, toluene, xylene and isopranol.

[7] Ketone Resin (N) (Larapol K80)

A cyclohexanone condensate which is soluble in white spirits and produces a glossy, relatively non-yellowing film. It is used in a 40-60% concentration, for surface coating easel paintings and as a lining medium in conjunction with beeswax.. It is pale in color, light-stable and non-hydrolysable. K-80 is soluble in most organic solvents - Stoddard Solvent, VM&P naphtha, ketone (except acetone), toluene, turpentine and methylene chloride. It is not soluble in methanol, it is only partially soluble in ethanol, but better in the higher alcohols. K-80 softens at 75-85°C and is neutral in its pH

Pigments

Where appropriate, mineral pigments were employed throughout. These exhibit good stability over time, and closely match the original materials used.

Panel Conditions

N.B. These photos have been colour-enhanced to show damage and do not represent accurate colour reproduction, nor are intended to do so.

Station No:I - Jesus is condemned to death

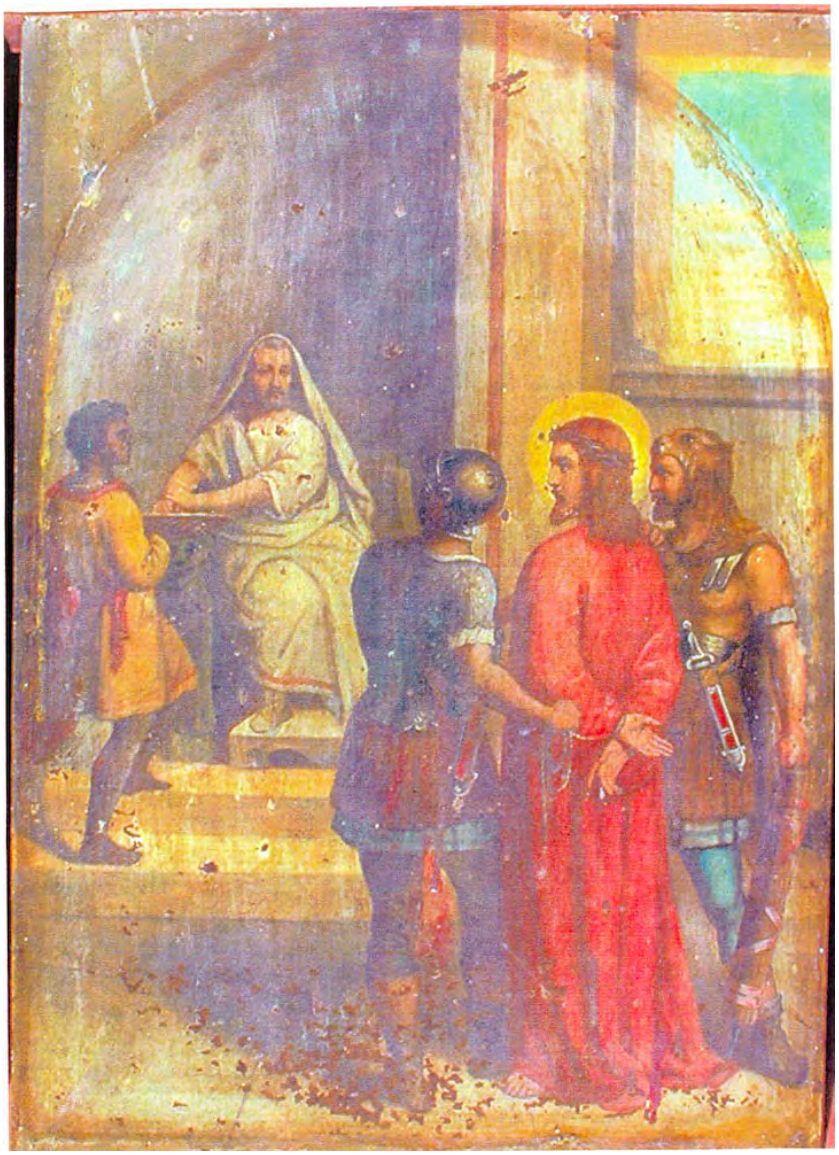
Initial condition

Steel substrate

Badly rusted

Paint surface

Varnish discolouration, with significant paint loss at the bottom centre. Further paint loss due to pitting over much of the rest of the surface. Several chips in paint surface. Edges sound - no significant flaking, bubbling or .chipping.



Station No:II - Jesus receives the cross

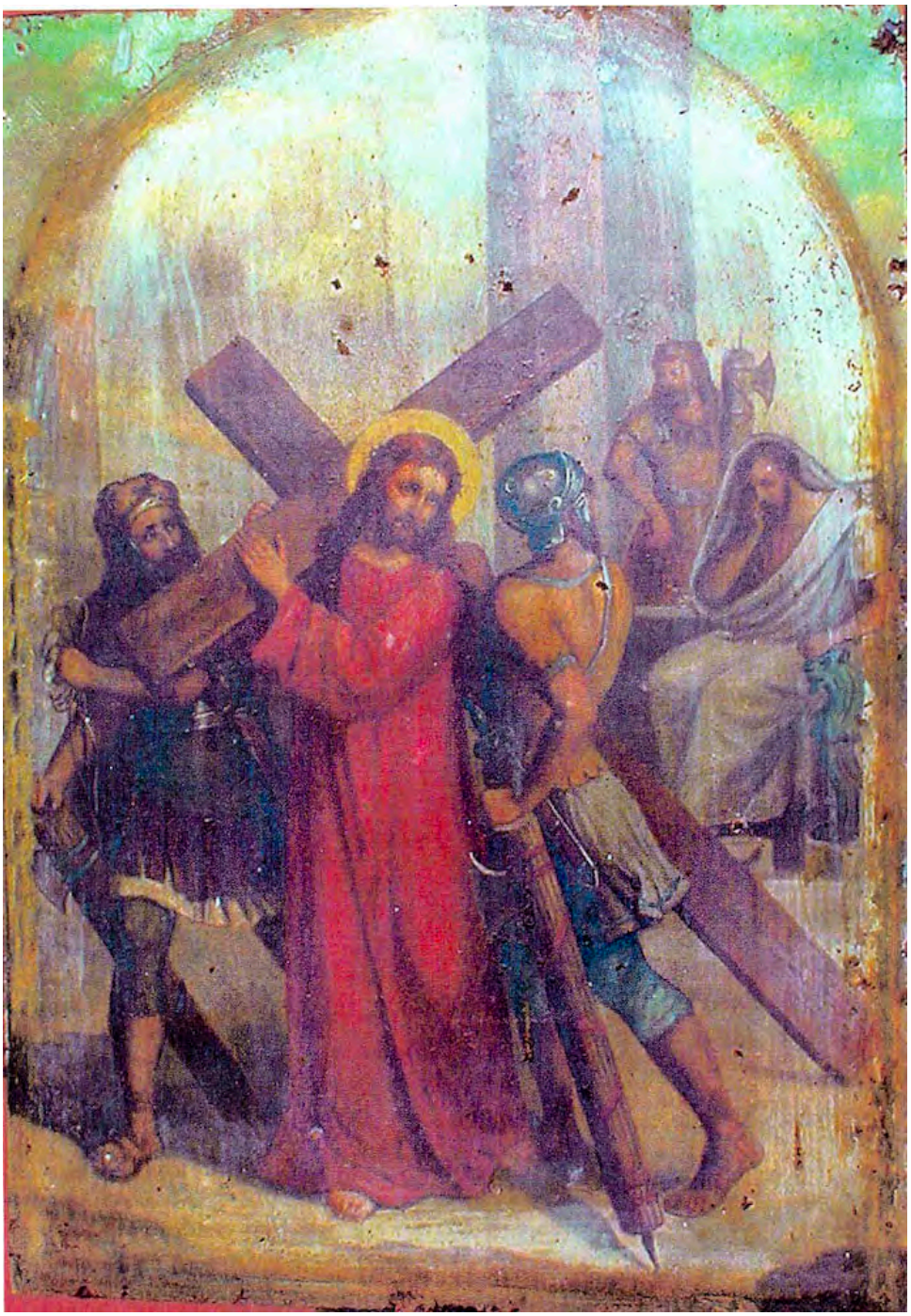
Initial condition

Steel substrate

Corrosion of edges and some evident on front surface.

Paint surface

Discolouration of varnish. Paint loss on right hand edge with a significant loss at the top right corner. Large pits and paint loss, mostly towards the top of the picture.



Station No:III - Jesus falls the first time

Initial condition

Steel substrate

Overall good condition, with some minor edge damage.

Paint surface

Varnish discoloured and becoming opaque. Significant paint loss in centre, bottom left corner, with pitting near the top edge. Right edge chipped and corroded.

Station No:IV - Jesus meets His Mother

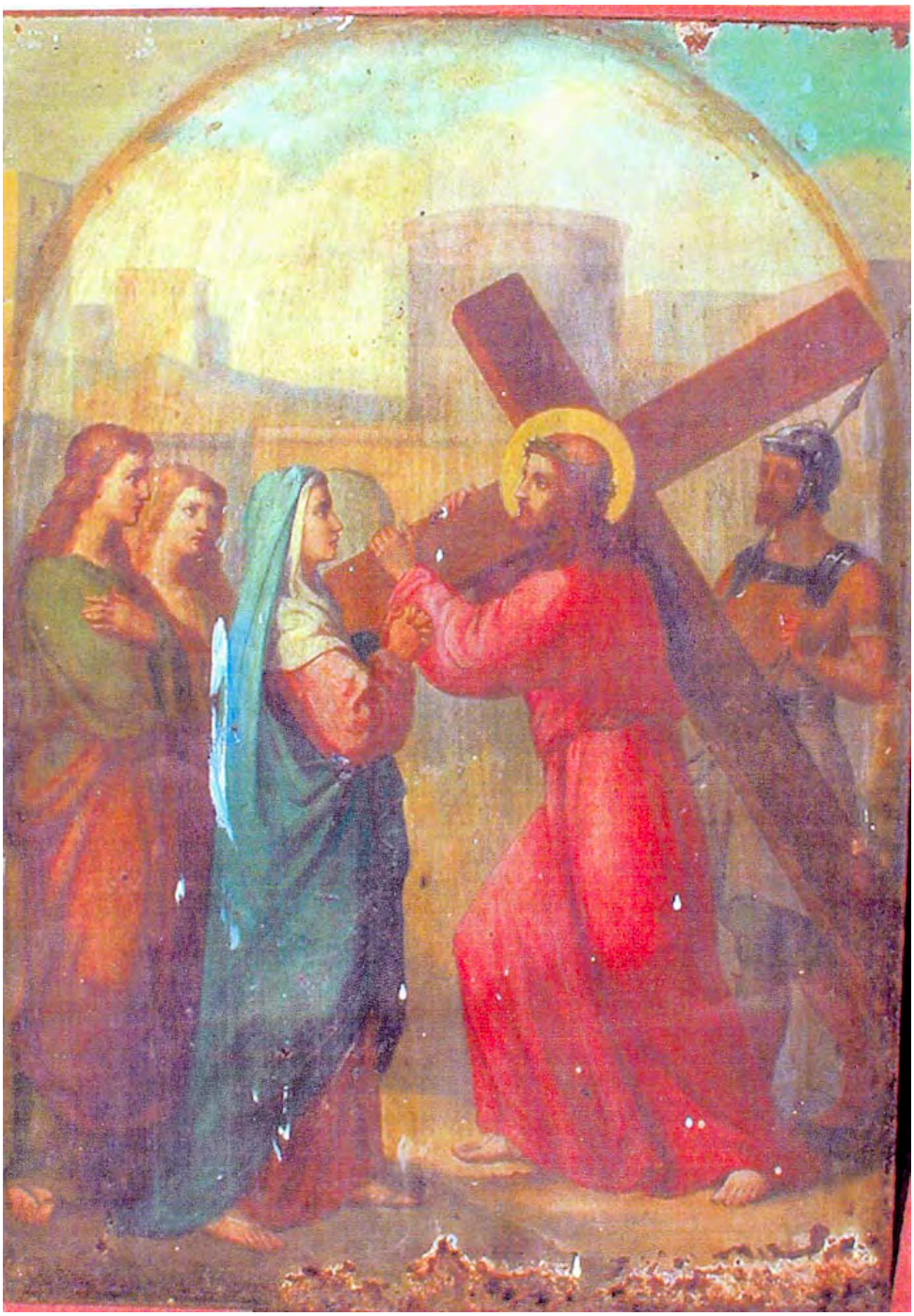
Initial condition

Steel substrate

Bottom edge severely corroded, with smaller areas of corrosion visible on top right hand corner.

Paint surface

Varnish discoloured and streaked. Varnish also becoming opaque. Major paint loss along bottom edge with some additional surface damage. Chips in top edge towards right. Paint faded in centre top.



Station No:V - Simon of Cyrene carries the cross

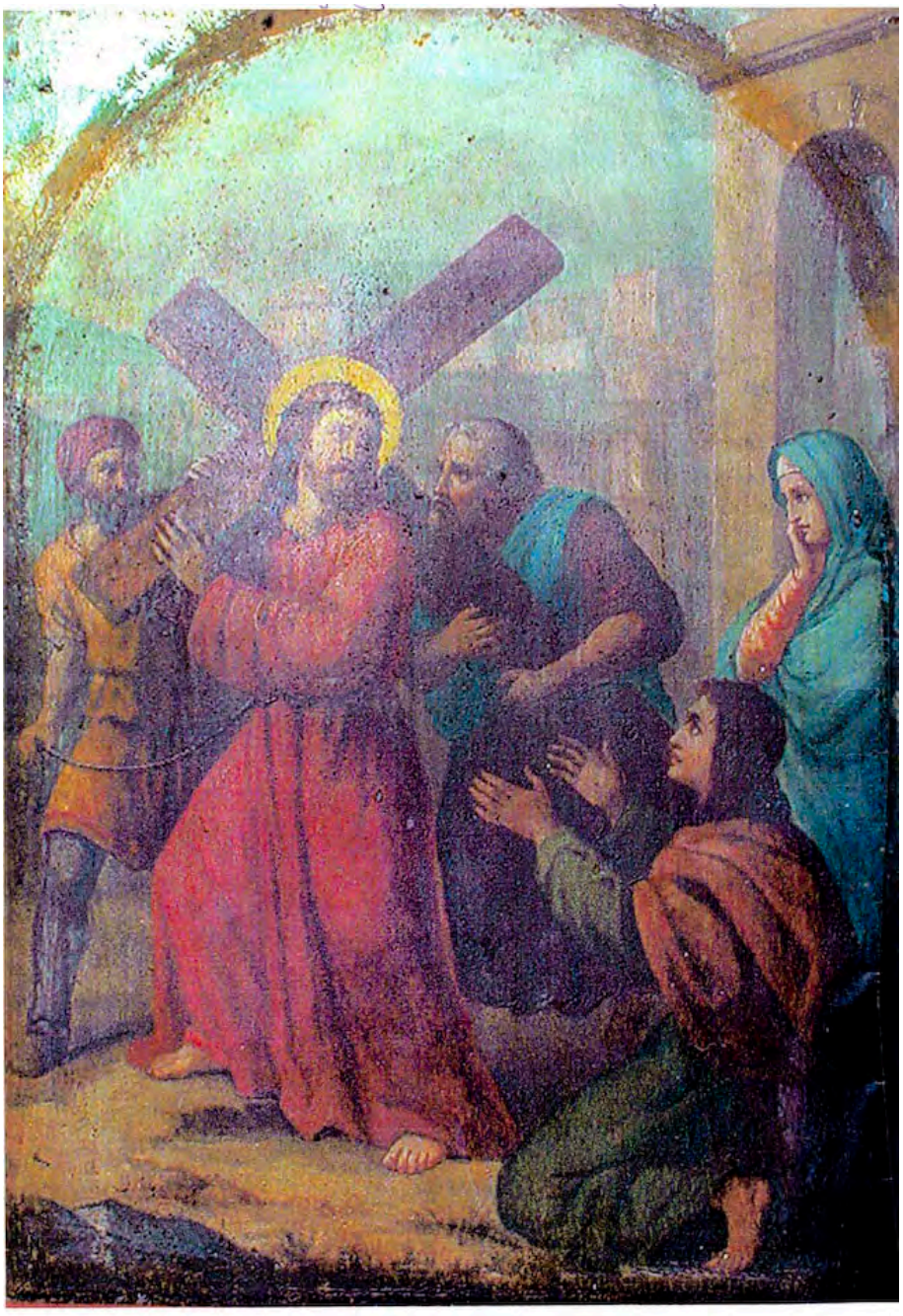
Initial condition

Steel substrate

Good general condition, but with minor damage to right and left edges.

Paint surface

Varnish becoming opaque. General pitting of surface, with “orange peel” effect over the face of Jesus and the top of the cross. Crazing of surface in centre. Paint losses at top left corner.



Station No:VI Veronica wipes the face of Jesus

Initial condition

Steel substrate

Generally in good condition, but with six or seven major pits, and erosion of bottom edge.

Paint surface

Badly discoloured varnish layer with some paint loss, particularly on bottom right corner and in the centre towards the left hand edge. Severe discolouration towards top left corner. Right edge chipped.

Station No:VII - Jesus falls the second time

Initial condition

Steel substrate

Both top corners show severe rusting on front surface. Rear reasonably intact.

Paint surface

Varnish badly discoloured, streaked, and opaque. Major paint losses at both top corners. Areas of pitting evident elsewhere, with some degradation of paint surface in darker areas.

Station No:VIII - Jesus meets the women

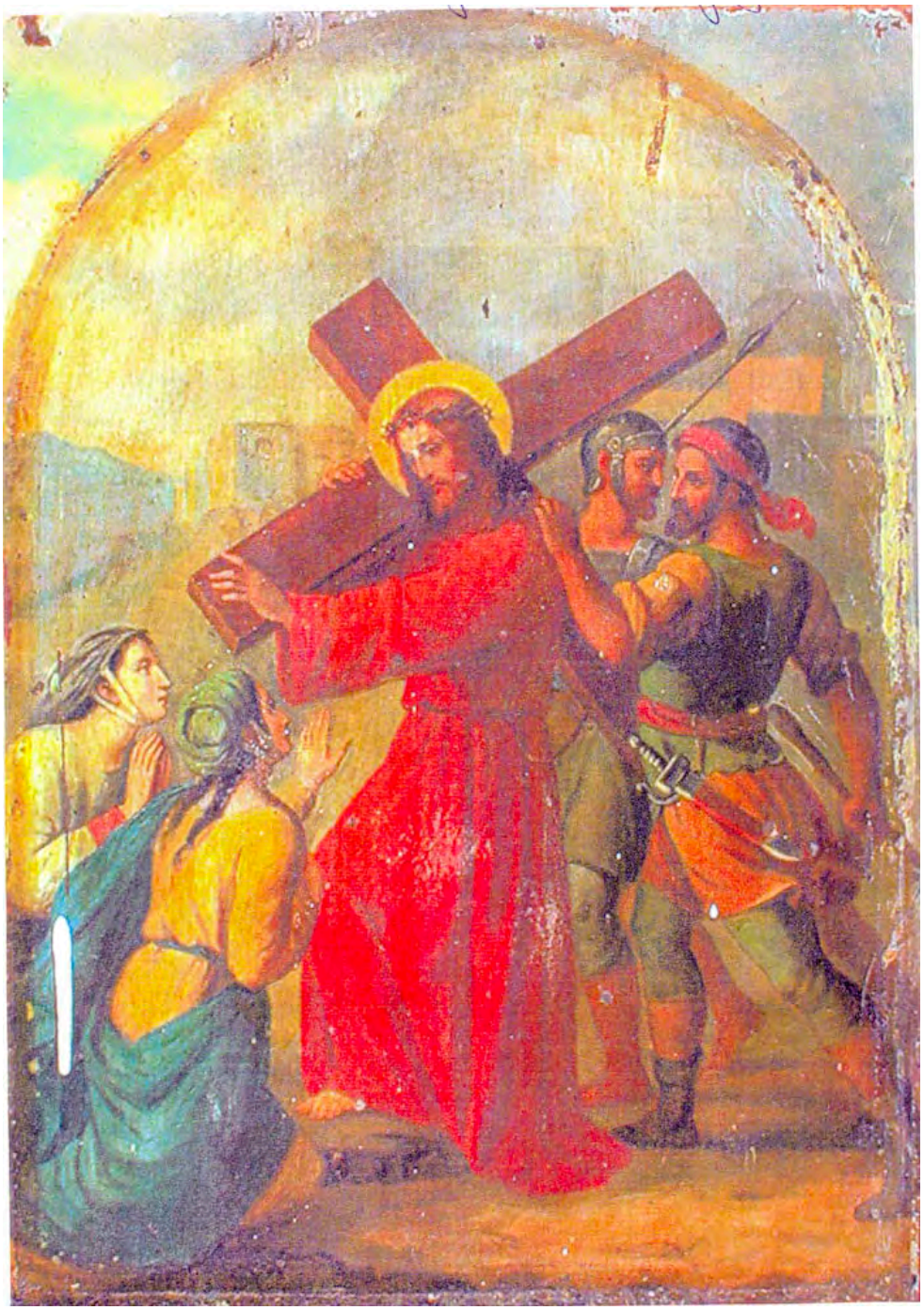
Initial condition

Steel substrate

Reasonably good condition, with damage confined primarily to top edge.

Paint surface

Varnish discoloured and streaked. General pitting of surface, with significant losses towards top right and along the right hand edge where the painting has rested on the frame. Some chipping of paint surface along top edge.



Station No:IX - Jesus falls the third time

Initial condition

Steel substrate

Severe general pitting over much of rear, with attendant loss of protective coating..

Paint surface

Varnish very discoloured and streaked. Significant damage over much of the surface, with severe pitting, particularly on the face of Christ. Significant paint losses left of centre and further damage towards right hand edge.

Photo unavailable.

Station No:X - Jesus is stripped of His garments

Initial condition

Steel substrate

Overall good condition, but with damage to top edge.

Paint surface

Very discoloured varnish. Streaked and becoming opaque, Significant pitting and paint losses on robe of Christ and over the face of the man on His right. Chipping along top edge. Paint loss along bottom edge.

Station No:XI - Jesus is nailed to the cross

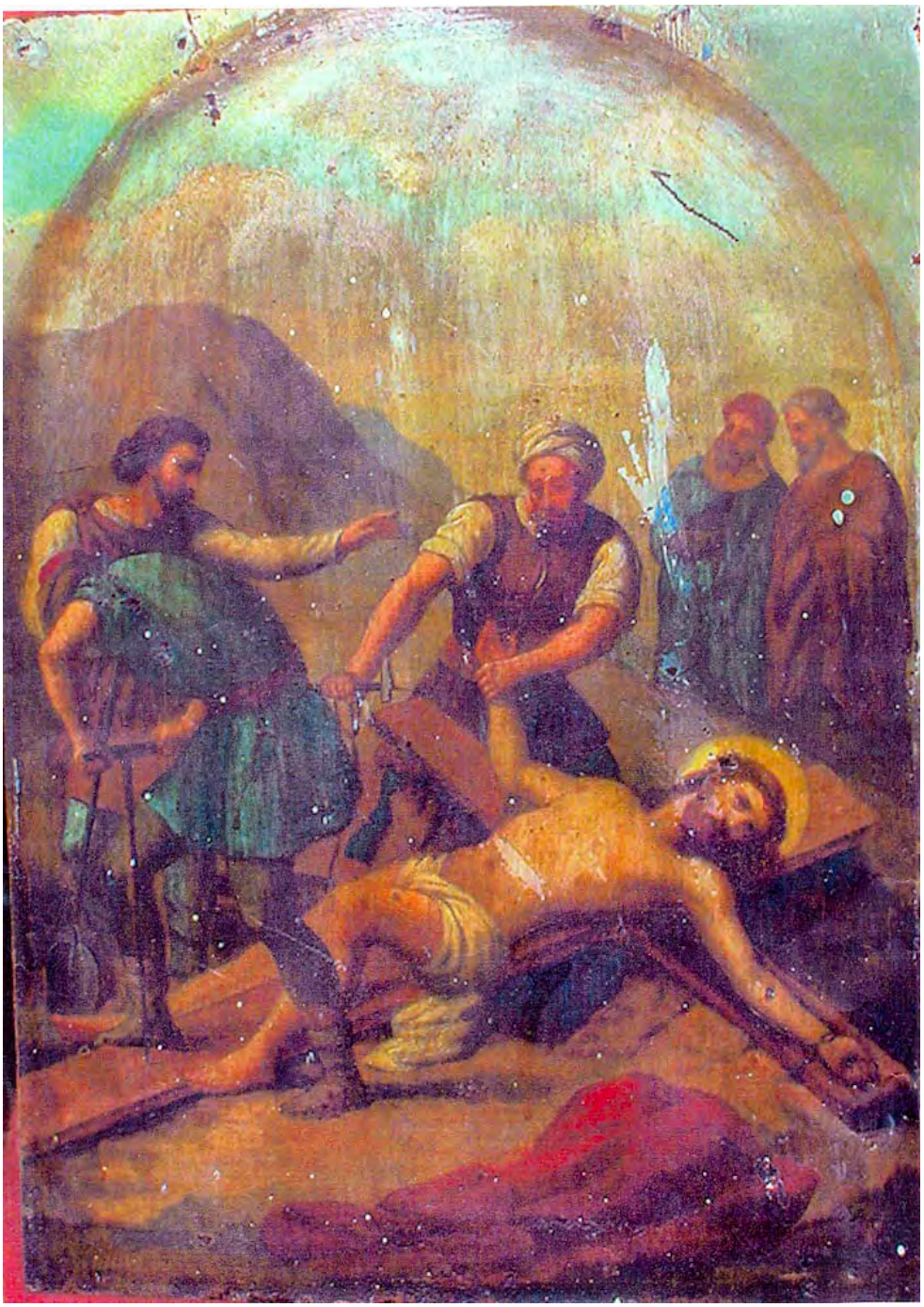
Initial condition

Steel substrate

Overall good condition with little evident corrosion apart from bottom edge.

Paint surface

Discoloured and streaked varnish. Significant paint losses over the face of Christ, and what appears to be a large scratch some 3 cm long almost through to the steel.



Station No:XII - Jesus dies

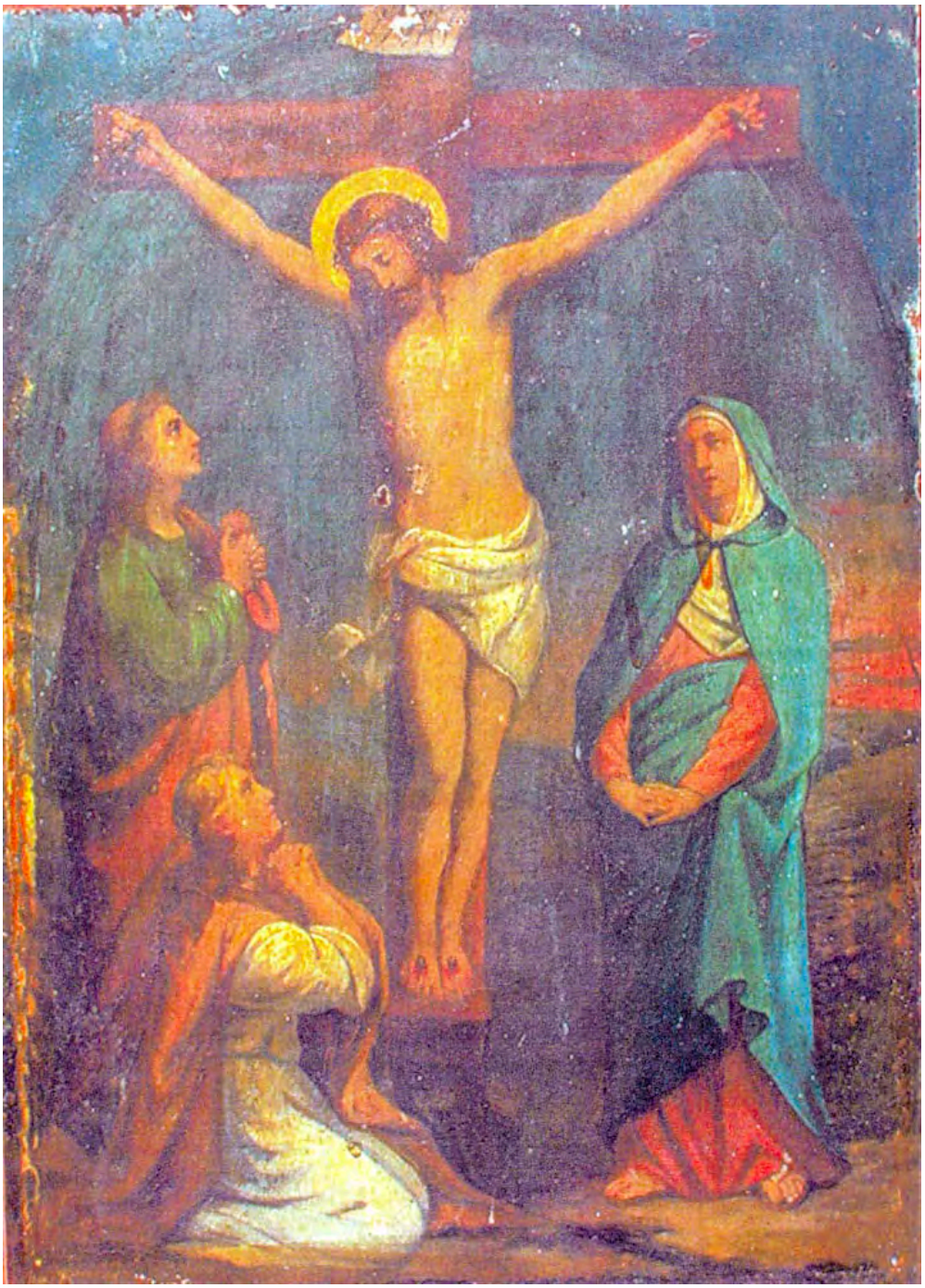
Initial condition

Steel substrate

Corrosion damage to all edges.

Paint surface

Badly streaked and discoloured varnish. Large chip near centre. Significant damage along left hand edge and along top edge to the left.



Station No:XIII - Jesus is taken down from the cross

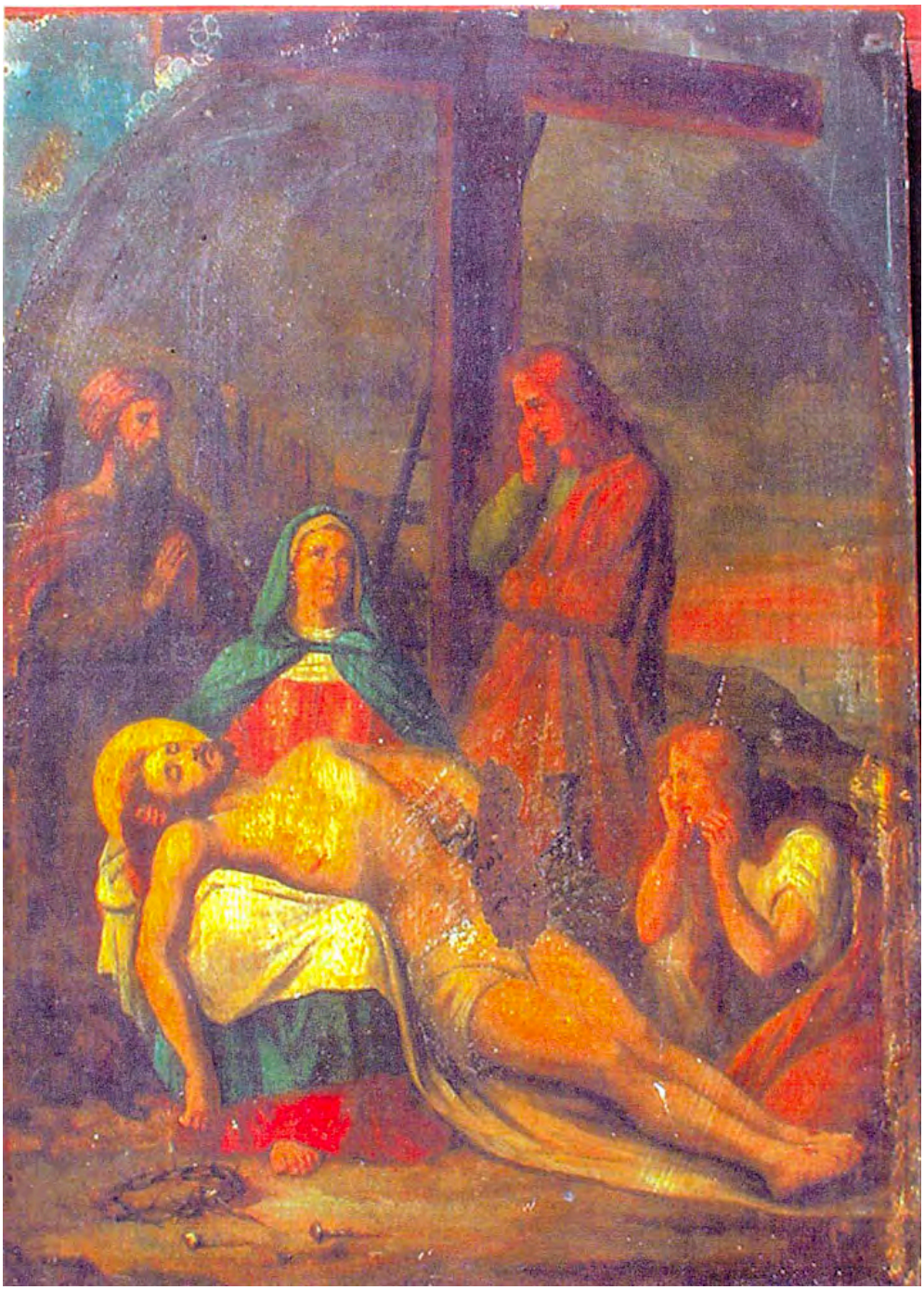
Initial condition

Steel substrate

General good condition, with minor corrosion damage confined to the edges.

Paint surface

Very discoloured varnish. Major paint loss near centre with what appear to be marks of abrasion. Further damage and bubbling of paint surface at top left. Pitting over the rest of the surface.



Station No:XIV Jesus is laid in the tomb

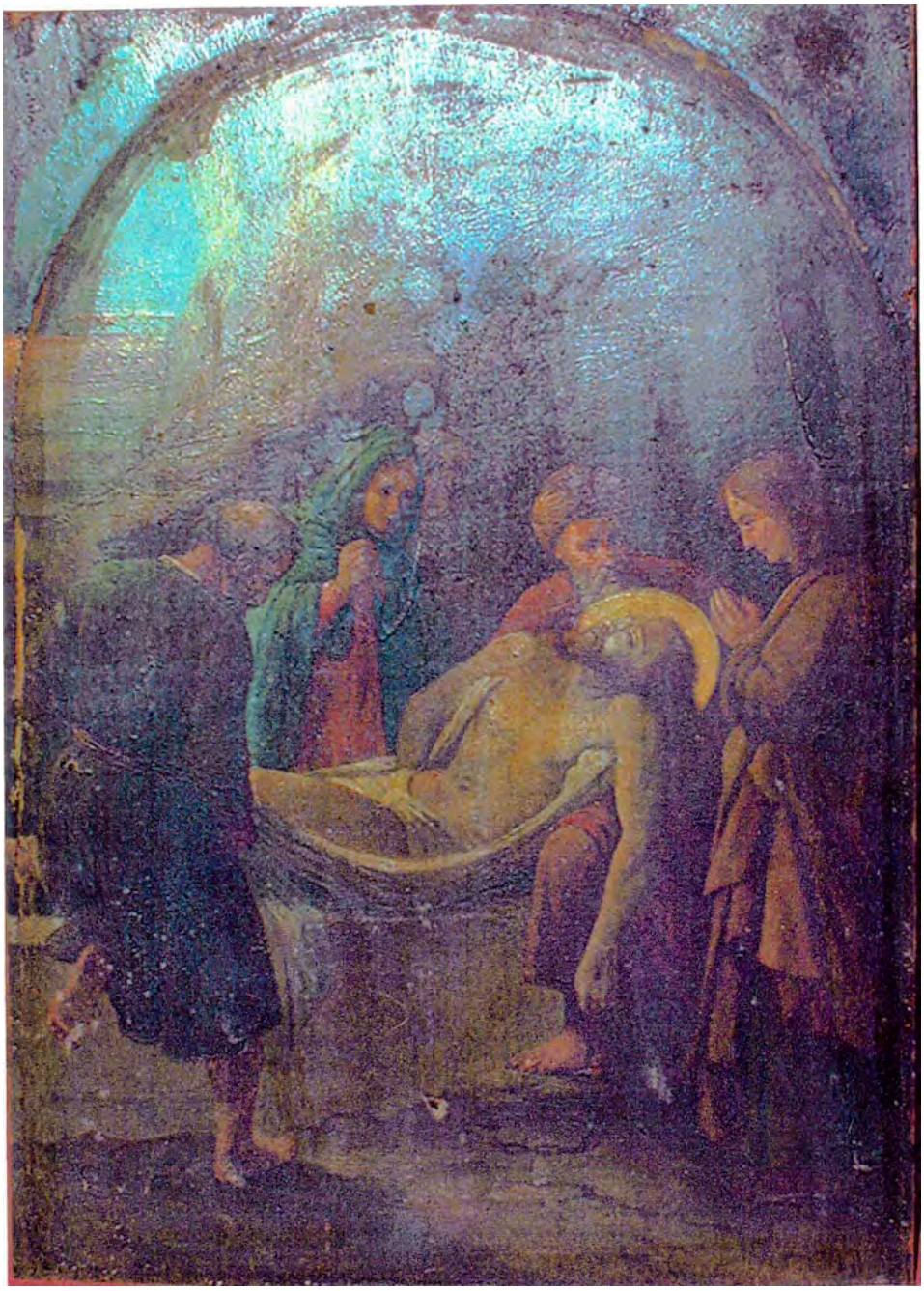
Initial condition

Steel substrate

Pitting over much of the rear surface.

Paint surface

Varnish very discoloured. Cracks and chipping evident on surface with substantial paint loss at the top left corner. General pitting of surface.



Recommendations for the future

Protection from the environment

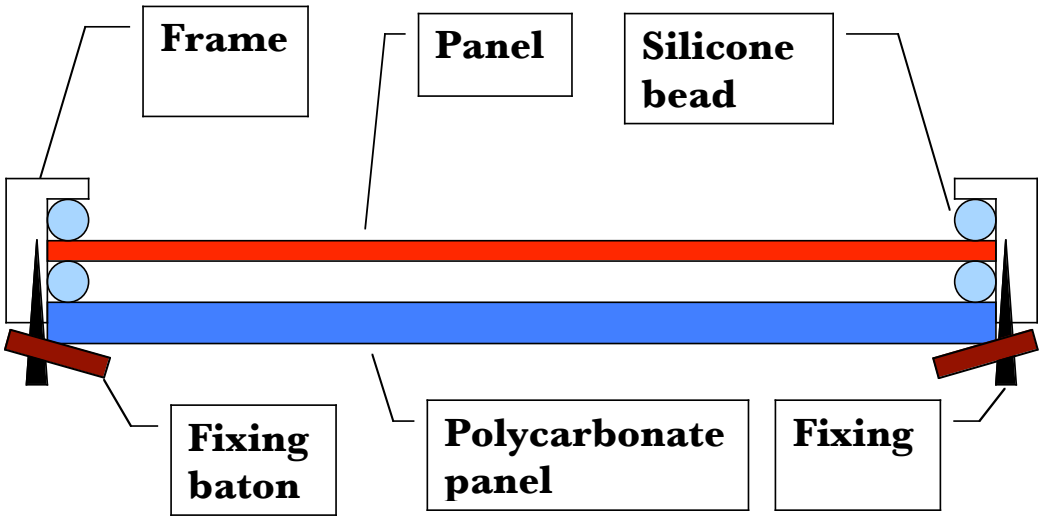
The primary issue surrounding these historic panels must be the environment to which they are subjected, and the main feature of this is the high moisture content of the air.

Consequently, it may be advisable to protect against the atmosphere. Although the panels have been treated on the rear with hot wax, and the front, paint surface coated with a moisture resistant varnish, minute fissures may open up and allow ingress of moisture. Once this occurs, corrosion may proceed at an alarming rate.

It has been suggested that a cheap but effective means of protection may be achieved in the following way:

1. Obtain a sheet of double-walled polycarbonate, similar to that used for roofing and glazing.
2. Cut this to the size of each panel
3. Along the perimeter, on one surface apply a continuous bead of clear silicone mastic. This may be obtained from builders merchants or plumbing suppliers.
4. Allow this bead to completely cure. **N.B.** It is essential that curing is allowed to fully complete - this normally takes 24 to 48 hours - as ethanoic acid vapour is released during the curing process. This itself is highly corrosive and must be allowed to dissipate before assembly of the painting and frame.
5. Apply a similar continuous bead along the face of the rebate in the frame. Again, allow to fully cure.
6. Place panel in frame so that its edges rest on the silicone bead.
7. Place the cut polycarbonate panel on the rear with the silicone bead towards the rear of the panel.
8. Fix in place by means of overlapping batons, so as to apply slight pressure to the panel.

Refer to diagram, below.



For a more complete solution, the paintings could be glazed. In spite of the not inconsiderable cost of UV-resistant and anti-reflective glass, this would provide excellent protection against fading and moisture.