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CONSERVATION ASSESSMENT
NOVEMBER 2017



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Reading Central Club Mural

Condition Survey and Conservation Assessment

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Date: 20 November 2017

Reading Central Club Mural

Condition Survey and Conservation Report

1.0 Background

The Reading Central Club (London Street, Reading, Berkshire, RG1 4QA) was a well-known centre for cultural events used mainly by the African Caribbean community, between 1999 and its closure in 2005. The building is well known for its colourful mural depicting local and global aspects of Black History commissioned in 1988 by Reading Borough Council.

The following report was commissioned by Reading Borough Council and aims to address questions regarding the current condition of the mural and its long-term conservation. A detailed survey of the mural was carried out between the 9th and the 20th of October 2017.

2.0 Description

The mural spans the length of the former Central Club building, along the north façade facing Reading's Inner Distribution Road (IDR). It is located approx. 2m from street level and measures approx. 35m in length and approx. 4.5m in height, covering a total area of some 157.5m². It is painted on approx. 2-3cm thick cement render within a metal frame inset into the brick façade.

The artist Alan Howard and his team painted the mural with images of the people of Reading who were involved in founding Central Club together with positive historical Black role-models. The painting is presented as a montage of iconic figures depicting significant people and moments in black history going back to ancient Egypt. The mural starts on the left with a series of hieroglyphs above and below a bust of Nefertiti, which translate as something like: 'Rage is what God loves to hearken to: and you should live up to yourself in his name'¹. Nefertiti was the wife of the 18th Dynasty Egyptian pharaoh Akhenaten (reigned 1351-1334 or 1353-1336 BC) whose huge head stands against the backdrop of the Pyramids of Giza and below him a cartouche bearing his name in hieroglyphs. The mural contains other important black religious and political leaders such as Toussaint l'Ouverture, Emperor Haile Selassie, Malcolm X, Martin Luther King, Bob Marley, Harriet Tubman and others. The last panel of the mural and the various symbols presented look to the future and depicts a variety of tools that people might use to shape that future.

¹ Montserrat, D. - 'Akhenaten: History, Fantasy and Ancient Egypt' Publ. Routledge 2002 p166-117



A brass plaque on the wall beneath the mural bears a livication (*Rastafari dedication*) to those killed in the Soweto Uprising and record the names of the people involved in the production of the mural as follows:

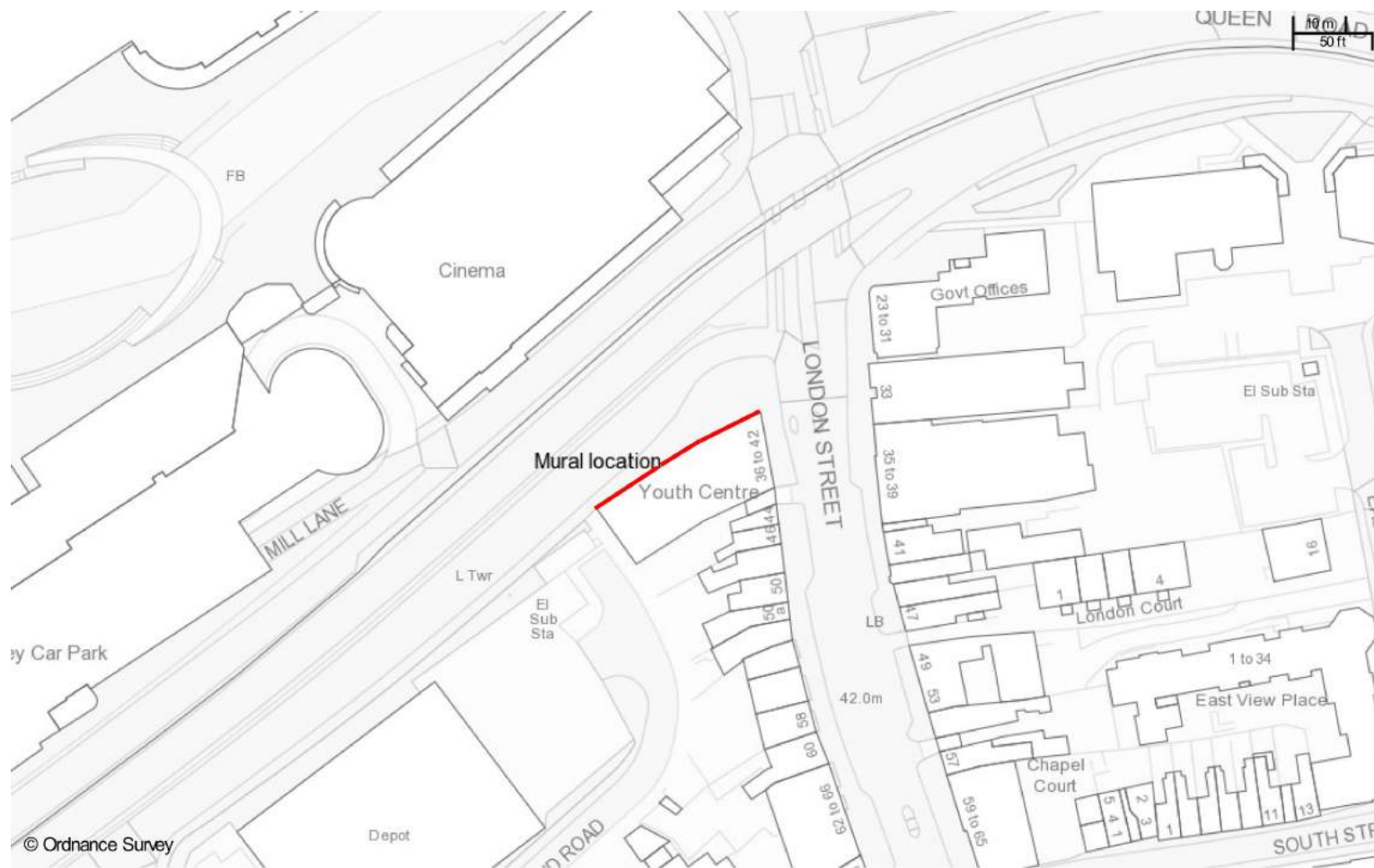
“Central Reading Youth Provision Black history mural
Livicated on 16th June 1990 to the memory of C. L. R. James 1901-1989
and the peaceful anti-apartheid demonstrators who were massacred in
Soweto by the South African regime during the uprising which began on this day in 1976.
Painted by the Central Club Mural Team:
Patrick Dawkins, Wayne Edwards, Alan Howard, Kevin Taylor
with assistance from: Jeff Allamby, Andrea, Allison Hewitt, Izasha, Martyn James, Conrad John, Cleo Lee, Dennis Small
Commissioned by: Reading Borough Council
Supported by: Reading Borough Council, Central Reading Youth Provision,
Earley Charities, C.F. Rawling and Son, OSS Scaffolding, Covell Matthews, Wheatley Architects Ltd, B & B Foods Ltd, LINCS, 21 South St,
Central Publications Group, Carlos Holder, Patrick Israel, Larry Sweeney,
Iyakka Talliman, Timmy Toussaint, Alan Warren.
Project Director: Alan Howard”

3.0 Location

Site address:

Reading Central Club
London Street
Reading
Berkshire
RG1 4QA

The mural is located
on the external north
-facing wall of the
former Reading
Central Club building



© Ordnance Survey
Black History Mural Location

Scale: 1:1000

Printed on: 6/7/2017 at 12:49 PM



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4.0 Summary of Requirements

The brief for the condition assessment and survey was as follows:

- 4.1 A light conservation cleaning of the mural to facilitate a detailed photograph survey and assessment. Cleaning was not carried out due to the powdery condition of the paint layer.
- 4.2 A detailed inspection and condition assessment including percussion tests across the entire face of the mural to assess the mural's structural stability.
- 4.3 A detailed high-resolution photographic record and mapping with notation of the mural's deterioration to aid its future restoration.

5.0 Survey Methodology

A detailed survey of the mural and the building envelope was carried out using a mobile elevating work platform (MEWP) provided and operated by Reading Council. The MEWP allowed close examination of all areas of the painted surface and facilitated a detailed condition assessment and photographic survey. In addition to the condition survey and guided by the nature of the deterioration phenomena encountered a limited, but targeted range of conservation trials were carried out in order to help determine an appropriate approach to the conservation and restoration of the mural.

The following report describes and records the condition of the support, ground, paint layers and overlying layers. The report defines all condition categories and any treatment proposals, methods and materials as might be required. The text and accompanying graphic condition survey illustrate types of condition and deterioration phenomena, and any information of historic, artistic or technological importance. The report provides a detailed description of the current condition of the mural, an interpretation of the results of both the treatment trials and subsequent material analysis and recommendations on the use of compatible conservation materials and treatments to aid its future preservation and repair, including budgets for these. Methods of examination included the following:

- Visual examination was carried out using normal and raking light. The presence of a surface coating on part of the mural was confirmed using an ultra violet light (the Tank 007 UV-AA02 365nm ultra-violet torch can highlight areas of retouching, later surface coatings, etc.).
- Digital Photography - a range of overall and detailed photographs were taken using normal and raking light (to show lifting paint and plaster deformation, for example), including photomicrography of paint samples.
- Chemical tests (representative, but small and discreet) were carried out in order to assess the removal of surface coatings and other accretions. In this case the cleaning trials were limited to aqueous tests to remove ingrained surface dirt. Close visual inspection and examination under UV light indicated the presence of a surface coating (e.g. a varnish). Because this layer is deteriorated and might need to be removed solvent tests were also carried out to determine its solubility parameters.
- Percussion Tests (Echography) were employed across the surface of the render in all areas to determine the extent of detachment from the support

- Indirect measure of humidity and temperature (thermohygrometer, protimeter, capacitance meter, etc.). These tests were not required. If weather conditions allow, such tests can help to assess possible areas of damp - e.g. capacitance meter tests may be useful in identifying specific areas where damp presents a problem. However, there were no obvious areas of deterioration, which might be associated with a specific damp problem other than the fact that the mural is on an external wall and is adversely affected by the elements.
- Samples were taken for analysis in order to answer some questions raised by the initial examination. A number of paint samples have been analysed in order to determine the nature of the original paint, which displays some unusual deterioration phenomena.

6.0 Condition

The mural was painted between 1988 and 1990 on the north wall of the Reading Central Club. The building is currently unoccupied and the mural is subject to daily fluctuations in environmental conditions and exposure to the elements, as it has been for the last 27 years. Its condition is described stratigraphically below, starting with the wall support, proceeding up through the layers to the surface.

6.1 Support

The mural was executed on an existing wall, of brick construction, onto which a new support was prepared for the purpose. Whilst much of the support is hidden behind the mural itself there are areas of localised damage which allow the structure to be examined. Two areas of detachment have occurred either side of the window revealing that the painting is executed over a hard cementitious render applied to an expanded metal lath (EML) support, affixed to the brick wall behind using screws and washers. The EML appears to be made of stainless steel and where exposed there were no signs of corrosion. However, in the areas examined the washers used in conjunction with the screw fixings were not made of stainless steel and had rusted, the corrosion resulting in expansion of the metal and causing the covering render to become detached. No signs of similar expansion damage were noted elsewhere so either the remainder of the washers used in its construction were stainless steel or they have remained protected from the adverse effects of damp to a greater degree.

The two areas of loss associated with the corrosion of the washers have occurred along the vertical juncture between two adjacent EML panels, each of which is in line with the sides of the window opening. Close examination indicates that the EML has been placed against the edges of the window reveal, forming a straight vertical edge against which the render has been applied, thus also creating a corner to the reveal. Above the window opening the edge of the EML continues vertically to the parapet of the roof – i.e. the area over the window is a separate rectangular panel of EML. The effect of this is that there is an exposed, vertical metal edge within the mural above both corners of the window, each side corresponding with the areas where the washers have become corroded. It is possible that localised structural movement along this edge has allowed water to penetrate to a greater degree and this location and resulted in corrosion here but not yet elsewhere.



Edge of EML and corroded washers

The window area presents the only break in what is an otherwise continuous expanse of brickwork and has been subject to localised structural movement, which is evident at the corners of the reveals. There are three areas where the render has blown due to relatively small structural movements that have resulted in compression at these corners. This is evident on the upper left, lower left and lower right corners of the double window where compression have resulted in cracking and lifting of the render away from the wall plane. (See Page *i* - Plates 1-5)

With the exception of the areas around the window opening there is little evidence of adverse effects on the support render which might be attributed to significant structural movement to the building itself and whilst the brickwork behind the render cannot be examined the exposed brickwork of the wall below the mural appears to be stable.

In general the overall condition of the render can be described as good. The surface is cohesive and the cementitious render remains materially sound. The mix used in the render has not been subject to scientific analysis, but is clearly a dense, hard mix of sand and cement. At this stage it is felt that there is no reason to carry out further analysis of the render as this element of the support does not present problems per se.

Percussion tests carried out across the entire surface indicate that there are areas where the render is partially detached from the support. However, there is no evidence of planar distortion, bulging or movement in the render so whilst some areas sound hollow they retain structural integrity, in part no doubt to the fact that it is executed on a secure expanded metal lath support which remains securely fixed to the brick wall.

There is a pattern of cracking across the entire surface of the painting, which is likely to be associated with movement between the render and the brick support. The causes of this are not immediately obvious, but might include a combination of factors including the following:

- shrinkage caused by the of drying of the render when first applied
- differences in thermal behaviour between the brick support and the overlying render – i.e. differential rates of expansion and contraction on heating and cooling of the different materials
- vibration from heavy traffic using the IDR
- the subsequent effects of freeze-thaw cycles on hairline cracks caused by the above

In general, the majority of the cracks are considered to be hairline (<0.1mm) although in the few places where some movement has occurred they can be up to 1mm in size. These larger cracks are primarily around the window and where there are corners e.g. at the east end and where the brick wall is stepped backwards away from the road by a foot. The pattern of cracking is primarily seen in horizontal and vertical lines, consistent with the joints in the courses of brickwork below.

Assessment of the size of individual cracks reveals that whilst some may initially appear to be of concern, close examination reveals that their apparent size is affected by other factors such as staining (which has occurred as a result of calcareous material being deposited along the crack) or losses of the upper paint layers at the edges of what are, in fact, much smaller hairline cracks. The visually widening effect is probably the result of erosion to the paint layer along the hairline crack in the render caused by water ingress, localised salt damage and freeze-thaw cycles, amongst other weathering phenomena.

6.2 Ground

The even compact surface of the cementitious sandy render is covered with a white ground. This was thickly brushed directly onto the surface of the render and pigment analysis shows that it is a zinc white (zinc oxide) with the addition of chalk as an extender and silicate particles to produce a matt finish. Zinc oxide was used in commercial house paints in the first half of the 20th century, in place of traditional lead white, but poor weathering issues became evident over time and its use was discontinued in domestic house paints by circa 1950. Since then it has only been used for artist's paints. Its extensive use in the mural would therefore appear to indicate that the preparatory ground used was an artist's paint and not commercially available exterior house paint.

The paint ground remains cohesive and well adhered to the render in almost all areas. Although some loss and erosion of the ground has occurred at the edges of larger cracks, most significantly where there has been minor structural movement around the windows and at the corners as mentioned above, in general the preparatory layer remains sound.

6.3 Paint Layer

Overall the condition of the mural appears to be good when initially viewed at a distance and although it is exposed to the elements there are few immediately obvious signs of water-damage, erosion and loss. However, close examination reveals adverse long-term effects caused by water and weathering in almost all areas. There are unsightly drip marks on the surface of the painting in places and the inspection revealed that a degraded surface coating covers the west side of the mural and that its careless application left numerous drips, which have now become more evident as the material has degraded.

The paint surface is not as dirty as one might expect, given its location next to a busy road and exposure to airborne debris, bird droppings and other atmospheric pollutants. This is almost certainly due to its exposure to rainwater, which continually washes loose material from the surface over time.

Paint analysis shows that the colours are made of pure pigments (red ochre, French ultramarine, chrome yellow, iron oxide yellow, Prussian blue, carbon black, iron oxide browns, titanium white and zinc white, etc.) which all indicate the use of artist's colours rather than house paints. The paints are heavy bodied and unusually thickly applied in places. Analysis of the medium by Brian Singer (Analysis for Conservation – University of Northumbria – see *Appendix 2 attached*) shows that the binder is alkyd oil. Alkyd paints were first developed by DuPont in 1931 and are now in common use. Winsor & Newton describe their Griffin alkyd products as follows: *"The speed of drying and hard paint film make Griffin Alkyd Colour ideal for outdoor signs and oil colour murals"*.

The most serious issue threatening the long-term stability of the mural, in its present form, is the deterioration of the binder for the paint layer itself. Whilst the thickly applied paint appears in most areas to be cohesive and well adhered there is a very serious issue of instability at the upper surface of the paint layers. This problem affects all colours in all areas and results in a powdery surface. The situation is just the same in the area, which is now covered by the later surface coating. The coating itself is badly degraded and can be flaked away revealing powdery, underbound pigment beneath.

Whilst the main body of the paint layer appears to be well bound and well adhered to the underlying zinc oxide ground, the binder has leached away at the surface with the result that touching any area of the mural results in pick-up of the pigment in that area. To some degree the problem is colour-specific – i.e. some colours are more badly affected than others. This can occur because of the different properties of various pigments, including their morphology or particle size and the way that a binder interacts with them. This in turn can affect the extent to which one particular binder might break down within a particular colour, a process that can be influenced by a complex combination of factors, chemical interactions, etc. which are neither predictable nor necessarily clearly understood. In this case, for example, there are areas where the red colour has been particularly badly affected, its breakdown resulting in pigment being washed down the surface of the mural and deposited on areas below.

6.4 Surface Coating

There is a semi-opaque surface coating on approximately three fifths of the mural, on the right (west) side. The layer appears to have been deliberately applied, but it is unclear why it only appears to exist on half of the painting. The layer is probably a varnish or protective surface coating which has itself now deteriorated, probably through a combination of UV oxidation and the effects of humidity. Paint analysis shows that the layer is thin and discontinuous and examination of the boundary between the coated and un-coated sides of the mural show that it was probably applied as a spray rather than a brush. There are numerous spots and spatters of the material fading out to none as one moves from the varnished west side of the mural to the other unvarnished east side. The juncture between the two areas is distinctly visible on one figure in particular. Here the sprayed finish, a degraded semi-opaque surface coating, fades out on the black area of hair, the coated right and uncoated left sides clearly evident (see photo right – the spray varnish finishing at the vertical blue line).

The surface coating provides an element of water resistance to the surface of the painting as is clearly evident when it rains and water falling on the uncoated side is absorbed whilst that landing on the coated side is easily visible as water droplets. This does not, however, mean that the potentially adverse effects of the rainwater are totally mitigated as the surface coating is degraded and fine cracking in the surface mean that the water will still penetrate the paint layers.



With varnish layers degradation can occur through a complex combination of factors, but in situations such as this where the surface coating is exposed to the elements it is likely that UV will be a major factor. The primary degradation process in resin varnishes has been shown to be auto-oxidation under the influence of light (*de la Rie*²). Photo-degradation results as UV energy is absorbed into the film causing a loss of gloss, cracking and yellowing and subsequent photo-oxidation means that many of the original components found in the fresh resin are altered to a wide range of oxidation products. These may then undergo further alteration such that in aged varnishes the original components of the resin may no longer be detectable by analytical chemical methods.

In addition to the effects of UV, migration of water through a varnish may contribute to the physical disruption of the varnish with the presence of water causing the layer to 'blanch' or become whitish and increasingly opaque as is seen here in all areas where the paint layer has been coated. Another adverse effect, clearly seen on the figure of Martin Luther King (*image right*), is the numerous disfiguring drip marks, which have been left as a result of the uneven application of the coating. In areas that received an excessive amount of spray the varnish has run down the surface and whilst this may not have been evident when first applied, the deterioration of the coating and heavy blanching has resulted in clearly visible whitish deposits.



6.5 Graffiti

The mural is remarkably unaffected by later graffiti and other surface accretions, and although a few crudely scratched right-wing insignia have been scrawled into the mural at lower level, these have been over-painted with brown paint and are not immediately evident. However, the incisions appear to be made relatively deeply into the paint layers and are therefore only partially obscured by the later re-paint. A more successful repair would require filling of the incisions with a more accurate retouching of the colours and design.



² E. René de la Rie, "Photochemical and Thermal Degradation of Films of Dammar Resin," *Studies in Conservation* 33 (1988) 53-70.

6.6 Later Accretions

There are numerous traces of later material on the surface, but in general their effect is minimal possibly as a result of the regular uncontrolled 'washing' of the surface that occurs when there is rainfall. The main exception to this is areas of black mould on the upper part of the mural in the area protected from the elements by the parapet capping. Here the protection from the rain means that organic material, dirt, cobwebs, etc, can accumulate and provides conditions suitable for the growth of the mould (*photo far right*). The mould is mostly found at the top on the left, unvarnished side of the mural although there are traces elsewhere.

In addition to airborne contaminants there are also localised areas of calcareous material in places. This is mostly found at the top of the wall on the left side where rainwater has apparently found its way down between the joints of the parapet capping, seeped into vertical cracks in the render and leached out part of the calcium content of the cement (*photo left: white deposits along cracks*). The most obvious areas are above the windows where whitish calcium deposits are evident around the cracks. The effect of this has also been to cause some patchy staining and darkening of the colours in these areas.



7.0 Conservation Trials

A limited number of conservation trials were undertaken during the survey. These focused on the two main issues affecting the paint layers – the presence of the degraded surface coating and the powdery condition of the underbound paint. Localised cleaning tests were undertaken using aqueous solutions to remove superficial surface dust and dirt. An initial cleaning trial was carried out using deionised water applied and cleared using small cotton wool swabs but it was felt that the result was uneven and required prolonged contact with the surface which risked damage to the underbound pigment. An increase in strength was considered, as it was felt that adding different reagents might obtain a better result, speeding up the cleaning process and reducing contact time with the paint layer. Slightly stronger mixes were trialed with the addition of ammonium bicarbonate and tri-ammonium citrate to create solutions in deionised water. A 5% solution of tri-ammonium citrate proved to be the most effective in lifting superficial dirt from the surface. The cleaning was carried out through acid-free L2 tissue since this minimises initial contact with the cotton wool swab and allows greater control. Cleaning also removed the white surface 'bloom' found on some areas (*photo right*).

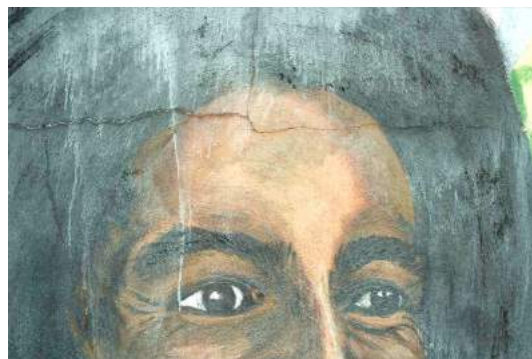


Preliminary cleaning tests proved effective in removing superficial dust and dirt from the surface of the paint. However, the underbound nature of the paint means that the work must be done carefully to avoid unacceptable loss of the original. Removal of the grey dirt layer exposes strong, bright colour beneath. Localised losses within the surface are also revealed (see *photo right*).

The areas that are coated with degraded varnish were also tested and here trials focussed on determining possible methods for the removal of the coating without risking damage to the underlying original polychromy. Close examination of the area around Bob Marley's head revealed the surface coating to be thickly but unevenly applied, resulting in the formation of numerous drip marks (*photo below left*). The increased opacity of the layer where it is thickest is most evident where there are drips and in areas where it has pooled within the troughs of the brushwork. The degraded layer is flaking away in places (*photo centre below*) revealing the original colour and demonstrating the degree to which the colour has become transformed and hidden by the increasingly opaque layer that now covers it.



Cleaning trials were carried out using a range of solvents applied and cleared using cotton wool swabs. Preliminary tests indicated that the surface coating could be successfully cleared from the underlying paint using a range of organic solvents including isopropanol and acetone. Minimal contact was maintained through the application of a tissue layer and care required to ensure that risk to the underlying paint was minimised. For a larger area to be cleaned one would need to determine an optimum method of application and removal and it will be necessary to look at options for stabilising areas of weak and powdery paint in conjunction with cleaning.



Discrete stabilisation tests were carried out on the mural to determine a suitable material for the consolidation and strengthening of the original paint layers. Whilst the main body of the paint layer appear to remain sound the upper part of the pigment layer is de-cohesive and powdery in all areas of the mural most likely due to degradation and leaching out of the original binder. Consolidation of the friable material should be carried out to reduce the rate of future loss. The application of a dilute conservation-grade acrylic binder should ensure the long-term stability of the painting. Lascaux™ Acrylic Glaze³ an organic solution of an acrylic resin based on n-butyl methacrylate and methyl methacrylate has many of the properties required. Lascaux™ Acrylic Glaze is a thermoplastic acrylic resin with high transparency, good light-fastness, age- and weather-resistance, which is available in gloss and matte finishes so that the level of gloss can be modified. Depending on the nature of application the acrylic can be diluted to perform a range of tasks, including consolidation and, if necessary, as a protective finish.

Percussion tests across the surface of the render revealed that whilst the majority of the render appeared sound there are localised areas that sounded hollow indicating detachment of the render from the brick support. With the exception of the small areas of lifting and detachment caused by minor structural movement around the windows and in the upper east corner, the majority of the render appears to be stable. Should work be carried out to the mural, however, it would provide an opportunity to ensure the stability of the render by injecting a compatible grout into the hollows between the wall and the mural.

Grouting tests were not carried out during the treatment trials as this was considered unnecessary at this stage. The choice of grout will be determined to some degree by the nature of any future restoration and the conditions affecting the mural at that time. The use of Ledan TC 1 Plus would appear to be an appropriate choice of grout for the hollow areas in this case. Ledan TC1 Plus is a chemically stable hydraulic grout with high sulphate (salt) resistance specifically designed for the conservation of murals where cementitious material is found. Comprising hydraulic binding agent components (Portland cement), non-hydraulic lime and very fine Terra Pozzuoli, Ledan TC1 contains an additive mixture to improve the fluidity during injection. The mixture is very finely ground and when in liquid state can be injected without pre-wetting the wall, which ensures that a minimum of water is added.

Repairs to the areas of damaged render should be carried out using a cementitious render of similar mix to that used originally. This will require some testing to determine the ratio of cement to aggregate and the type of sand used. Filling of numerous cracks within the render would probably be best done using a material such as Flügger™⁴, a compatible lime-based filler that is fine enough to be able to fill hairline cracks to sufficient depth to ensure a good bond. On drying the filler becomes water resistant and provides a good base for subsequent retouching.

³ The manufacturer describes the material as follows: "Lascaux™ Acrylic Glaze is used for colourless, lightfast, weather-and age-resistant non-saponifying protective coatings on virtually any surface such as stone, sandstone, plaster, concrete, wood, aluminium, copper, brass, chrome, etc. It is used for sealing murals, panel paintings, sculptures, etc., as a final varnish on acrylic, tempera, mineral paints, frescoes, etc. and as a fixative for delicate charcoal, pastel and pencil drawings. The acrylic is also suitable for use as a deep sealer to consolidate old paint layers, for restoration and conservation work, for gluing and as a binder for benzene-resistant retouching work."

⁴ Flügger™ - a reversible acrylic filler with low shrinkage consisting of a calcium carbonate aggregate with a butyl methacrylate binder

7.0 Conservation Proposals

The long-term preservation of the murals is integrally linked with the building and therefore both deserve the highest levels of care. The focus of the treatment should be to stabilise and conserve areas of damage and subsequently restore the murals to the highest standards. The aim should be to leave a legacy artwork, restored to a condition as close as possible to the piece as it was when originally executed by the artists. Active engagement with the community should be built into the conservation processes, with conservators discussing the work on site as it progresses and through the additional use of illustrative display boards showing photographs of work in progress and describing the technical processes.

7.1 Materials & Methodology

The conservation of the paintings will be carried out using standard conservation techniques and materials as follows, in no particular order:

- | | |
|------------------------|---|
| 7.1.1 Assessment | Prior to the treatment of the paintings the conservators should take the opportunity to carry out a more detailed assessment of the nature, extent and causes of deterioration. This should be combined with a photographic and graphic condition survey of the work of art, which will provide baseline information on the condition of the painting prior to full conservation treatment. Preliminary photographic documentation will include overall views of the paintings and details to illustrate types of condition and deterioration. The condition survey will provide both an accurate method of assessment of the problems and will form part of the final treatment report that will form the archival record. (See Documentation and Written Report below). |
| 7.1.2 Surface cleaning | Superficial cleaning of the painted surfaces to be carried out in order to remove accumulated dust and dirt using soft brushes and vacuum extraction followed by cleaning using Wishab™ ⁵ sponges. Localised aqueous cleaning may also be carried out using deionised water applied and cleared using cotton wool swabs or gently cleaning using a soft Slurpex ⁶ sponge. Where dirt deposits are ingrained and difficult to clear it maybe necessary to consider the use of dilute ammonium bicarbonate or tri-ammonium citrate solutions in de-ionised water. |
| 7.1.3 Varnish removal | Small discrete cleaning tests will need to be carried to determine a methodology for varnish removal that does not adversely affect the original paint layers. If possible the varnish will need to be completely removed, so far as this is possible, as this should provide considerable visual improvement. It is likely that the best result will be obtained using organic solvents such as acetone, propan-2-ol, |

⁵ Wishab™ sponges consist of pH-neutral soft vulcanised latex rubbers designed to crumble in use removing dust and dirt in the process - produced by Aka-Chemie, Germany.

⁶ These sponges consist of a super absorbent PVA chamois material with a very fine soft texture and are able to absorb large quantities of water and dirt

white spirit, etc. and/or solvent mixtures. For some degraded vanishes it may be necessary to consider the use of solvent gels (often called 'Wolber's gels'), but these would need to be tested further in due course once the project is underway in order to determine the optimum materials and methodology. The varnish is very degraded and it may also be possible to remove it mechanically – effectively lifting the poorly adhered material from the underbound paint surface beneath.

- 7.1.4 Temporary facing Under normal circumstances it is preferable to work with a paint layer exposed and visible so that it can be monitored for signs of damage during treatment. However, on occasion it is necessary to use a protective facing to ensure that the stability of the paint layer is maintained during work. This entails the application of a layer of acid-free L2 tissue⁷ paper, applied with a reversible adhesive such as Tylose MH300⁸. The adhesive layer remains flexible and is readily reversible and cleared using deionised water.
- 7.1.5 Flaking paint Where found, any areas of weak or flaking paint should be carefully re-adhered and laid back in their original plane using Plextol B500⁹ (5-10% in deionised water) applied by brush or syringe as necessary.
- 7.1.6 Paint Consolidation Apply Lascaux™ Acrylic Glaze an organic solution of an acrylic resin based on n-butyl methacrylate and methyl methacrylate has many of the properties required. Lascaux™ Acrylic Glaze is a thermoplastic acrylic resin with high transparency, good light-fastness, age- and weather-resistance, which is available in gloss and matte finishes so that the level of gloss can be modified. Depending on the nature of application the acrylic can be diluted to perform a range of tasks, including consolidation and, if necessary, as a protective finish.
- 7.1.7 Grouting Inject Ledan TC1¹⁰ into the voids between the render and the brick support to ensure that the render is fully stabilised in all areas.

⁷ Acid-free L2 lens tissue (formerly Eltoline tissue) available from Conservation Resources, UK

⁸ Tylose is a cellulose-based water-soluble adhesive Methyl hydroxyl ethyl cellulose chemically neutral and reversible with very good resistance to biological and chemical decomposition - available from Kremer, Germany

⁹ Plextol B500® - An acrylic copolymer emulsion % weight average 50 methyl & ethyl methacrylate - manufactured by Rhöm. A conservation Grade A synthetic organic polymer suitable for paint stabilisation due to its compatibility with the original organic materials. It has excellent working properties and performance characteristics and is renowned for its ease of application, controllability and effectiveness. Diluted in water it has acceptable health and safety parameters.

¹⁰ Ledan TC1 Plus is a chemically stable hydraulic grout with high sulphate (salt) resistance specifically designed for the conservation of murals where cementitious material is found. Comprising hydraulic binding agent components (Portland cement), non-hydraulic lime and very fine Terra Pozzuoli, Ledan TC1 contains an additive mixture to improve the fluidity during injection. The mixture is very finely ground and when in liquid state can be injected without pre-wetting the wall, which ensures that a minimum of water is added.

7.1.8 Fill losses	Hairline cracks and small losses within the paint layer will be made up Flügger™. The missing areas of colour can then be built up and reconstructed to match the original. Larger losses and repairs to the cementitious render should be made up using new render to match that existing.
7.1.9 Retouching	Retouch localised areas of loss to match the existing decoration. Retouching could be carried out using high quality Golden™ Artist's Acrylics ¹¹ . These can be gloss modified to ensure that the finish matches that of the original.
7.1.10 Mould treatment	If found clean with industrial methylated spirit (IMS ¹²) or apply a water-based microemulsion fungicide of low toxicity containing propiconazole and 3-Iodo-2-Propyl-n-Butyl Carbamate.
7.1.11 Rust treatment	If required apply Hammerite Kurust ¹³ rust treatment, which contains tannin and converts iron oxide to stable iron tannate. Treated areas to be given protective surface coating consisting of Paraloid B72 varnish (15% in acetone). Rusted washers and other ferrous fixings should be replaced with stainless steel versions.
7.2 Documentation & Written Report	A written report detailing the conservation processes and discoveries made during work will be produced as part of the conservation programme. Documentation of the work will include a detailed photographic record showing conditions before, during and after treatment. One digital copy will be supplied unless otherwise agreed.
7.3 Access	A fully boarded tubular scaffold, protected against the elements, will be required to all areas to allow the cleaning and conservation of the mural in all weathers.
7.4 Weather	Due to the nature of the materials used in the conservation processes it would be best to avoid very cold or freeing weather and to carry out the work during dry weather in the spring, summer or autumn months.

¹¹ Golden™ Acrylics are high quality artist's paints made using powdered earth and mineral pigments in a pure acrylic binder.

¹² IMS - industrial methylated spirits GPR 98/99% - typical analysis ethanol >90% methanol >5%.

¹³ Kurust styrene-acrylate copolymer produced by ICI. Contains tannin, which reacts with the iron oxide, converting it to iron tannate, a stable blue/black corrosion product.

Reading Central Club Mural Budget for Conservation Works

1.0 Conservation Treatment

1.1 Preliminaries and Initial Assessment	£	2,500.00
1.2 Surface Cleaning to remove superficial dust, etc.	£	1,500.00
1.3 Varnish removal	£	25,000.00
1.4 Stabilisation of flaking paint	£	2,000.00
1.5 Stabilisation of powdering paint	£	16,000.00
1.6 Fill small losses & hairline cracks	£	3,000.00
1.7 Grouting	£	3,500.00
1.8 Render Repair	£	700.00
1.9 Retouching paint losses	£	10,000.00
Total labour	£	64,200.00
Travel	£	3,500.00
Accommodation	£	8,500.00
Materials	£	2,500.00
Documentation & Photographic Record	£	1,300.00
<u>Treatment Total (excl. VAT)</u>	£	<u>80,000.00</u>

Timescale – Estimated time required is 12 weeks plus 4 weeks contingency

Excludes cost of scaffold to be provided by the client to the conservator's specification



Plates 1-5 - Condition of Support & Render (clockwise from lower left)

Overall view of the windows showing generally good condition of the render with the exception of the details show above

Area of delamination in upper left corner of left window associated with minor structural movement

Loss of render caused by corrosion of ferrous washers and cracking along juncture of expanded metal lath panels above upper left corner

Delamination and bulging of the upper surface of the render in lower left corner of left window caused by compression below the sill

Area of cracking and bulging in upper left corner of right window associated with movement the juncture of the lintel and the central pier



Plates 6-10 - Condition of Support & Render (clockwise from lower left)

Overall view of left half of the mural showing the parapet roof construction. There appears to be no difference in condition between the upper area exposed to the elements on both sides and the lower parts backed by the interior of the building.

The rendering edge of the EML is visible in places above the windows

Areas of delaminating render and evidence of the underbound paint layer where red pigment has run down the wall

An area of loss reveals the white ground layer to be well attached

Cracking and delamination in the upper corner

READING CENTRAL CLUB

Black History Mural

Appendix 1 – Paint Analysis

READING CENTRAL CLUB

1980s mural depicting Black History

Eight paint samples were taken from the mural by Tom Organ of Arte Conservation.

Samples 1, 2, 3 and 4 came from areas with a varnish over the top

- 1 Black from area 4 - partially varnished figure area
- 2 Black from flag to right of figure in hat by ship
- 3 Green from red black green stripped flag
- 4 Red from flag
- 5 Area 3 Blue under window
- 6 Area 2 yellow from top of wall above turban figure
- 7 Green from trees above zone 4
- 8 Black hair from figure of Bob Marley - taken after cleaning test to remove degraded surface coating

Examination The samples were examined under low magnification and then the fragments were mounted as cross-sections in cold-setting polyester resin. The sections were viewed at high magnification and the layers compared. Material from the different layers was dispersed on glass slides, and the pigments were identified using a polarising light microscope. EDX analysis was carried out on material from the white ground and from the yellow of sample 6.

RESULTS

The white pigment found in the ground layer and in some of the paint layers suggest that the paints were not ones that would normally be used for exterior paintwork.

White ground

In all the samples, apart from Sample 8, which may have become detached, the coloured paint layers rest on a pure white ground which was brushed directly onto the render surface.

The main pigment in this ground is zinc white [zinc oxide]. It is mixed with chalk as an extender and contains silicate particles, to give it a matt finish. Some zinc white was also mixed into the yellow and the green.

There was a period in the first half of the twentieth century when zinc oxide was quite widely used for house paint, in place of traditional lead white, but it tended to weather badly, to the extent of sometimes turning black, and it had ceased to be used for domestic paints by circa 1950. Since then it has only been used for artists' paints. Zinc white has a low refractive index, so is not as opaque as titanium dioxide white, and it still has an important use in water colours.

The use this pigment may have contributed to the deterioration of the paint layers.

Coloured layers

Some of the brown paint layers contain barium sulphate as an extender, but the more brightly coloured layers do not.

The browns are all iron oxides.

The black is carbon black.

The bright blue is French ultramarine mixed with a small amount of an unidentified synthetic organic blue.

The red is red ochre

The green is a Prussian blue/chrome yellow mixture and contains a small amount of zinc oxide.

The yellow contains a small amount of iron oxide yellow, but also a synthetic organic yellow dye. The white in this yellow is titanium dioxide white extended with chalk. EDX analysis [see p.7] also detected a small amount of zinc, probably from zinc white added by the painters.

Varnish

Samples were taken from the varnished part of the painting, as well as from the unvarnished part.

The layer varies in thickness. In most samples it is so thin that that it is almost invisible, and it follows the contours of the paint surface. In Sample 3 it is present much more thickly and the cross-sections show it to have a cloudy appearance [see p.4]. It is only semi-translucent when the cross-section is lit from behind.

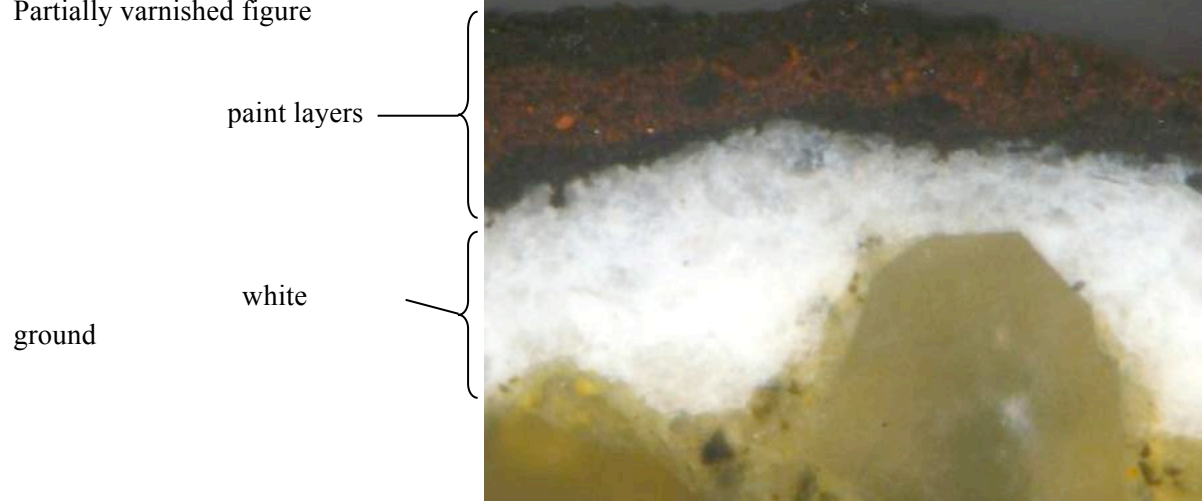
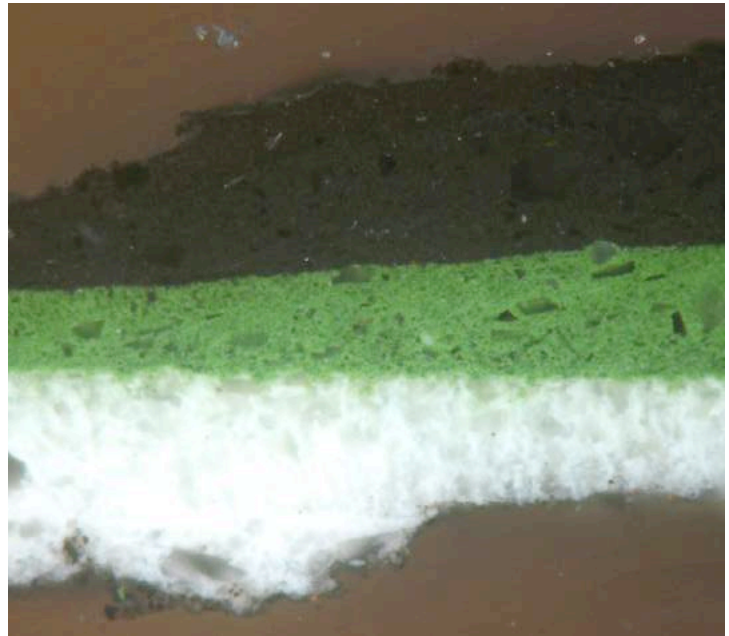
Without carrying out instrumental organic analysis one can only guess at the material, but the layer does not have the bright fluorescence in UV which indicates the presence of a natural resins.

The fact that the layer does not have an even thickness and a smooth surface, may mean that it was quick drying, and perhaps not applied with a brush.

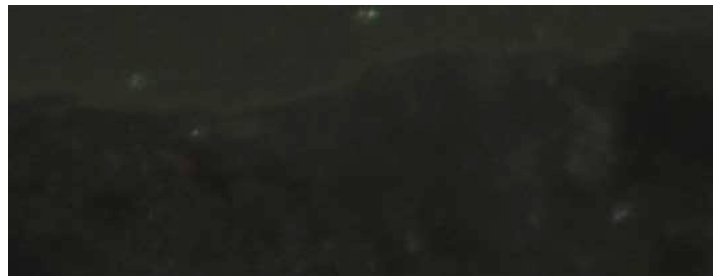
SAMPLE 1

Black from area 4

Partially varnished figure

**SAMPLE 2**Black from flag to right of figure
in hat by ship

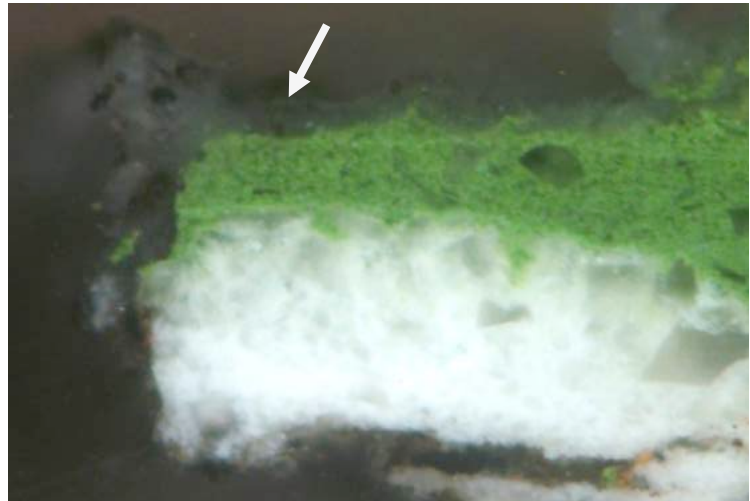
Detail of the surface of the black

Lit from behind to show the thin
layer of varnish

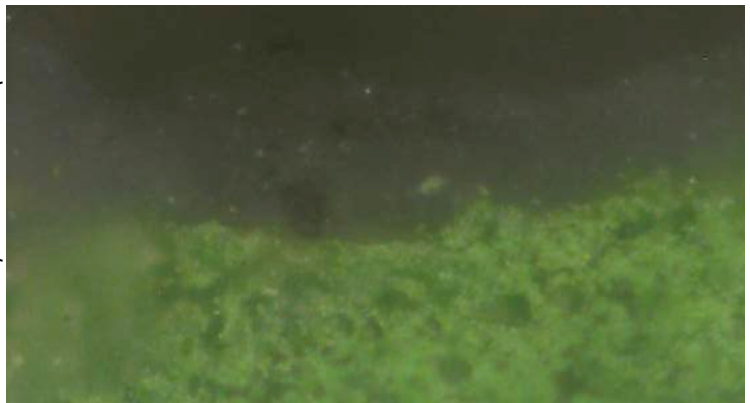
SAMPLE 3

Green from red black
green
stripped flag

In this sample there is a
thick
area of the 'varnish'
coating



Detail of the coating
which
cloudy appears



Lit from behind to show that
the coating is semi-
translucent

**SAMPLE 4**

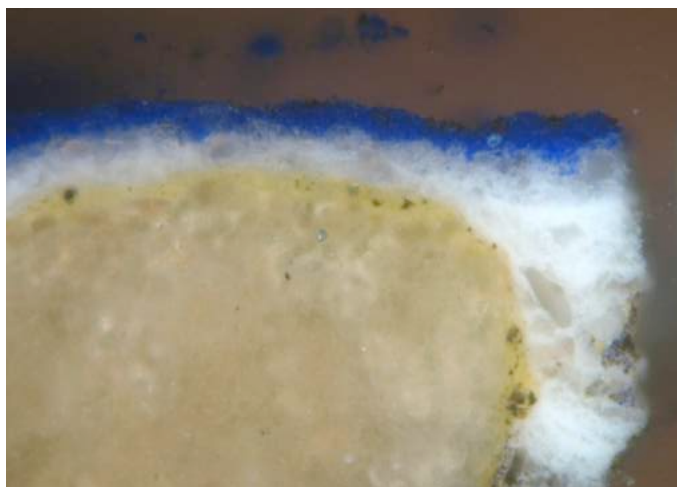
Red from flag

In this sample the varnish is
so thin that it is almost invisible

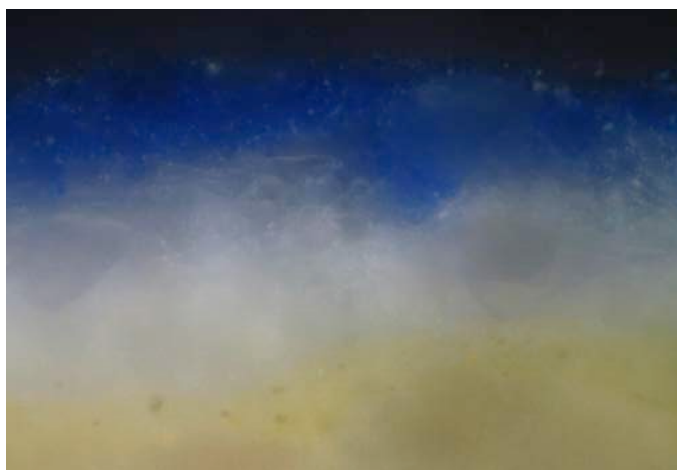


SAMPLE 5

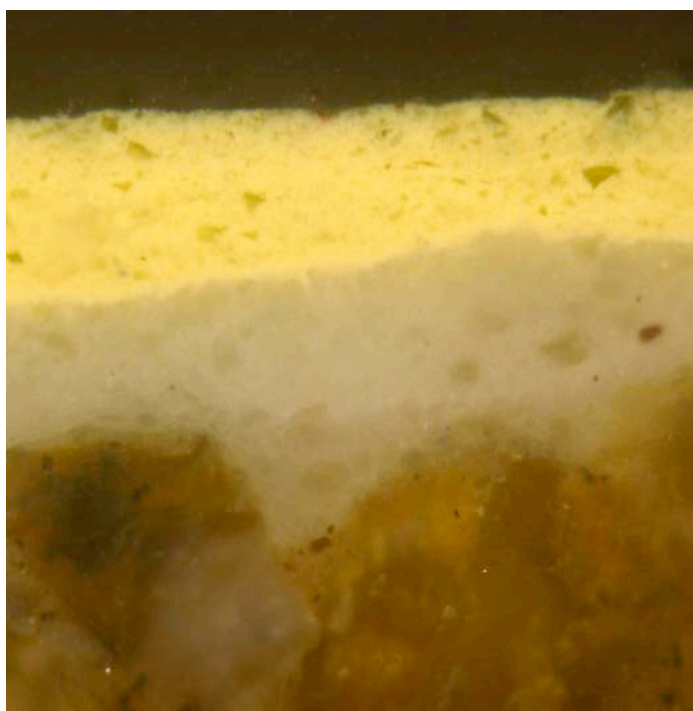
Area 3 - Blue under window
with no varnish

**Detail of the blue**

French ultramarine mixed with
a small amount of organic
blue

**SAMPLE 6**

Area 2 yellow from top of wall above
turban figure.



SAMPLE 7

Green from trees above zone 4

**SAMPLE 8**

Black hair from figure of Bob Marley – taken after cleaning test to remove degraded surface coating

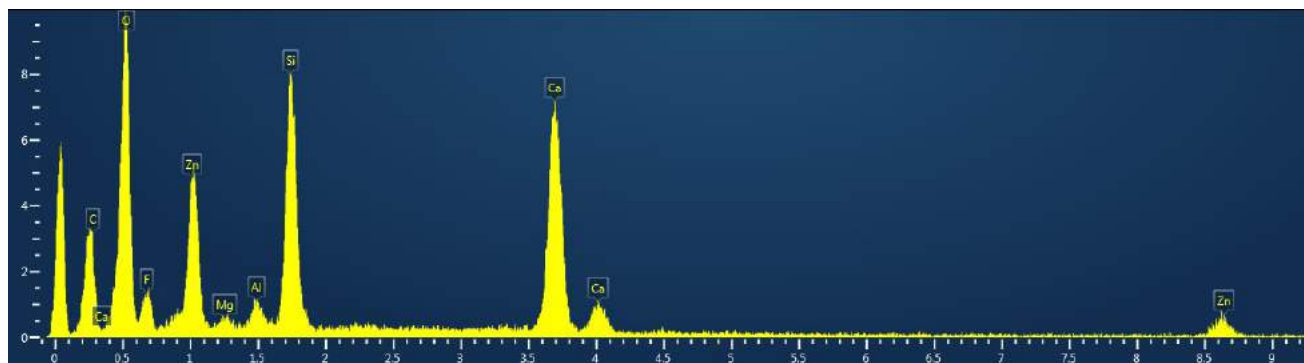
There is no ground layer and it must have been lost when the fragment was taken.

The section is confusing because of the many layers of brown. This particular figure must have been gone over several times, when the mural was being created



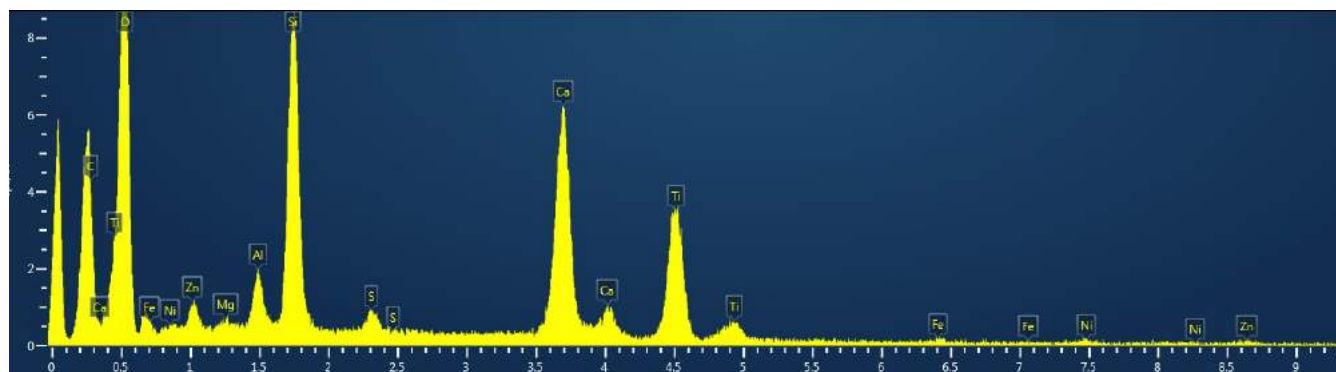
EDX analysis of the white ground

Showing features for calcium [Ca] from chalk, zinc [Zn] from zinc oxide and silicon [Si] from silicates



EDX analysis of the yellow in Sample 6

Showing features for calcium [Ca] from chalk, titanium [Ti] for titanium dioxide, and silicon [Si] from silicates, and small features for zinc [Zn] from zinc oxide, and iron [Fe] from iron oxide.



READING CENTRAL CLUB

Black History Mural

Appendix 2 – Medium Analysis

**Investigation of a Yellow paint sample
From Reading Central Club
For
Arte Conservation**

Distribution

Thomas Organ
Arte Conservation Ltd
69 South Road
Faversham
Kent ME13 7LX

thomasorgan@me.com

Signed

A handwritten signature in blue ink, reading "BW Singer".

.....
Brian W Singer BA BSc MEd PhD
November 2017

Investigation of a yellow paint sample from Reading Central Club for Arte Conservation

Samples Investigated in this report: The sample has been sent by Catherine Hassall and is analysed using FTIR and GC-MS and/or Py-GC-MS.

Sample number	Description of sample	Methods used
Sample 1	Yellow Paint flake	FTIR and py-GC/MS

Table 1 List of samples

Purpose of the investigation.

The purpose of the investigation is to discover the binding medium in the paint layer

Experimental

Fourier Transform Infra-red (FTIR) Analysis

A sample of paint was placed onto the diamond window of a Bruker Opus Fourier transform Infra-red spectrometer. The sample was pressed directly on the diamond window, using enough material to cover the central area (if possible), ie. the centre 0.5 mm portion of a line of approximately 0.2 mm width. The spectrum was recorded in the range from 4000 to 380 cm^{-1} , using 24 scans at 4 cm^{-1} resolution. The background scan was automatically subtracted and the scans averaged to produce a spectrum.

Thermal methylation / Pyrolysis GC-MS analysis for resins, waxes and paint

Each sample was placed on a the platinum ribbon of a Pyrolla 2000 pyrolyser and treated with tetramethyl ammonium hydroxide (25%) reagent (1 μl) and pyrolysed at 600°C for 2 seconds. This procedure yields the methyl esters of any fatty acids present as free acids or as part of a lipid ester, and any resin acids present and also decomposes any polymers present in the resins or paints. The pyrolysis products were then analysed by GC-MS. The GC-MS instrument used was a Thermo Focus GC fitted with a DSQ II mass detector. The column used was a Thermo TR-5 30m column and the temperature of the column was raised from 40°C to 290°C at a rate of 10°C per minute within the run and then held at 290°C for 16 minutes. Detection was started after 2.8 minutes to allow for the trimethylamine produced in this process to clear from the column first. Mass spectra obtained could be compared with a NIST library of mass spectra of compounds.

Pyrolysis GC-MS analysis

The sample was placed on a the platinum ribbon of a Pyrolla 2000 pyrolyser and pyrolysed at 600°C for 2 seconds. This procedure decomposes polymers present in the resins. These components were then analysed by GC-MS. The GC-MS instrument used was a Thermo Focus GC fitted with a DSQ II mass detector. The column used was a Thermo TR-5 30m column and the temperature of the column was raised from 40°C to 290°C at a rate of 8°C per minute within the run. Detection was started after 0.1 minutes. Mass spectra of the compounds found were compared with the NIST library of mass spectra of compounds.

Results and Discussion

The sample was investigated by FTIR in order to establish the general type of binder. This method also gives some information on some pigments and extenders present. The sample was then investigated by an appropriate GC-MS method: in this case, a direct Py GC-MS method for acrylics, vinyls and other modern resins was the chosen method initially and on line derivatisation with TMAH coupled with Pyrolysis gas chromatography-mass spectrometry and was then chosen for further investigation.

Investigation of sample 1 pale yellow paint

FTIR Analysis

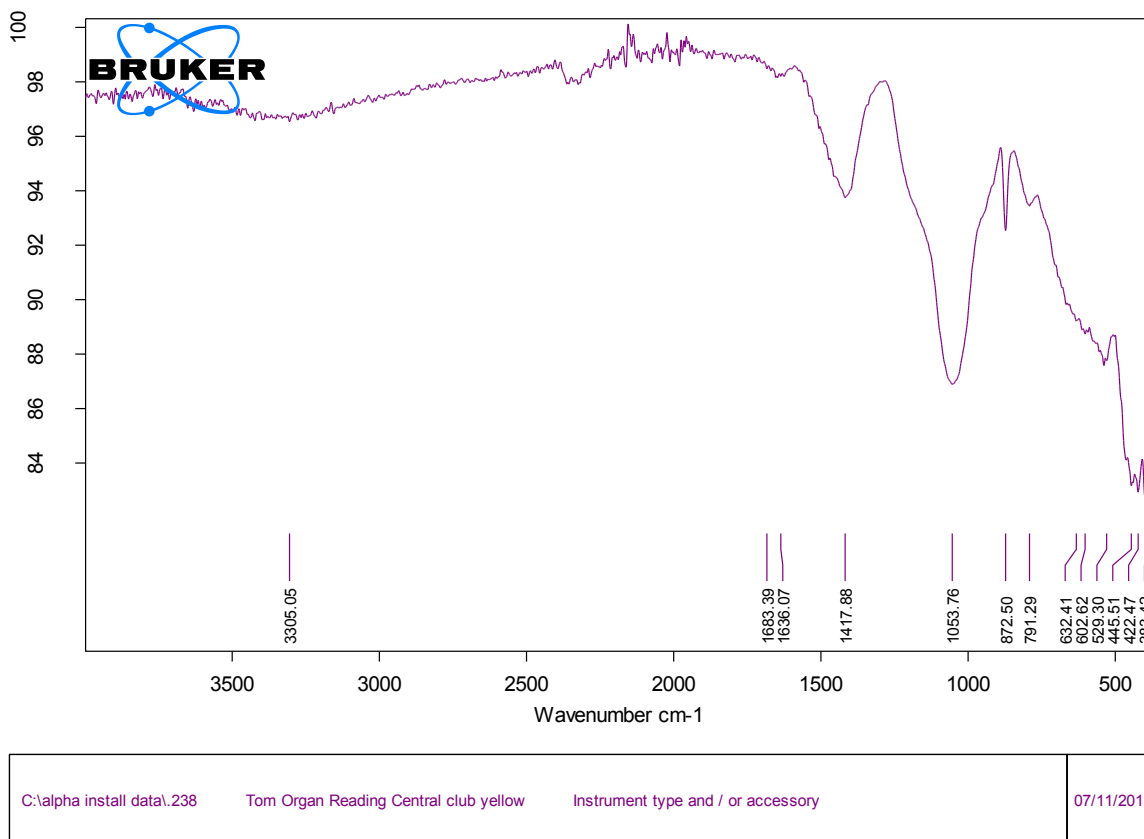


Figure 1 FTIR Spectrum of sample 1 yellow paint

A Sample of the yellow paint was analysed by FTIR spectroscopy.

The spectrum (figure 1) indicates the presence of:

- Some anatase (broad peak at 422 cm^{-1}) (cf. Figure 2).
- Some calcite (chalk) (peaks at 1418, 872 and 712 cm^{-1} (shoulder)) (cf. Figure 3).
- Some sulphate (peak at 1052 cm^{-1} .)
- No obvious peaks were seen for binders

Report written by Brian Singer, Analysis for Conservation, for Arte Conservation / Northumbria University, November 2017, BS contract no.182

Hence the yellow paint, sample 1, from the FTIR alone, seems to contain: titanium dioxide (anatase) calcite and a sulphate, possibly lead sulphate. Calcite is the main component of chalk. Anatase is a modern pigment dating from around the 1920's onwards but is less common than rutile, the other form of titanium dioxide. There were little clues as to the binder which must be present in very small proportions relative to the pigments and extenders.

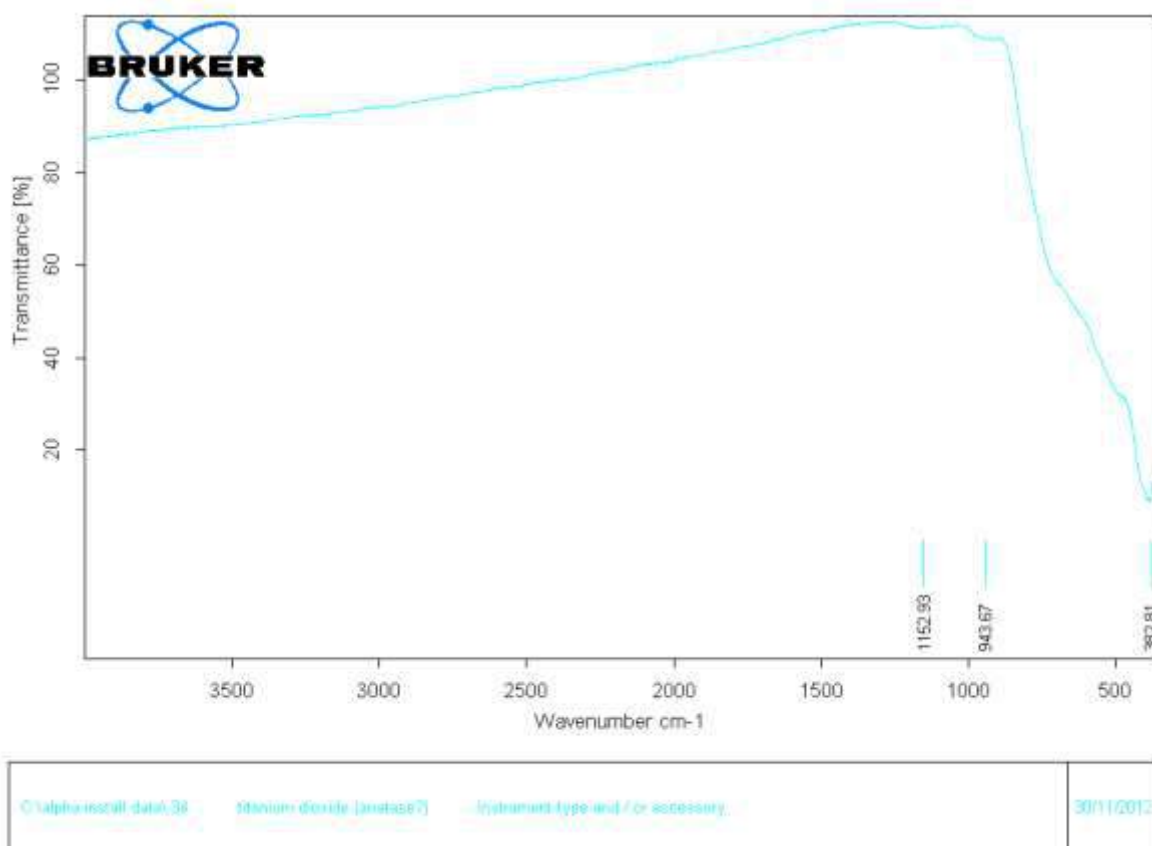


Figure 2 FTIR Spectrum of Anatase

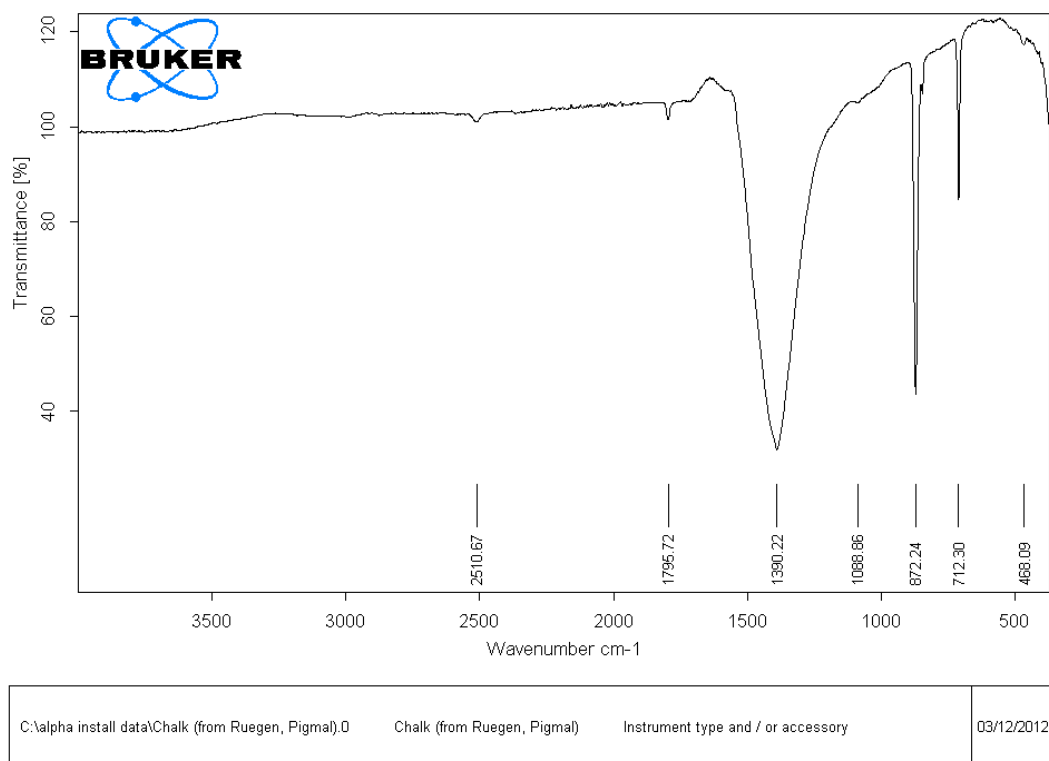


Figure 3 FTIR Spectrum of Chalk

Py-GC-MS Analysis

Initially this method was chosen to look for modern binders such as acrylic, vinyl or other modern resins. However the chromatogram (Figure 4) yielded only carbon dioxide presumably from decomposition of the calcium carbonate (chalk) present.

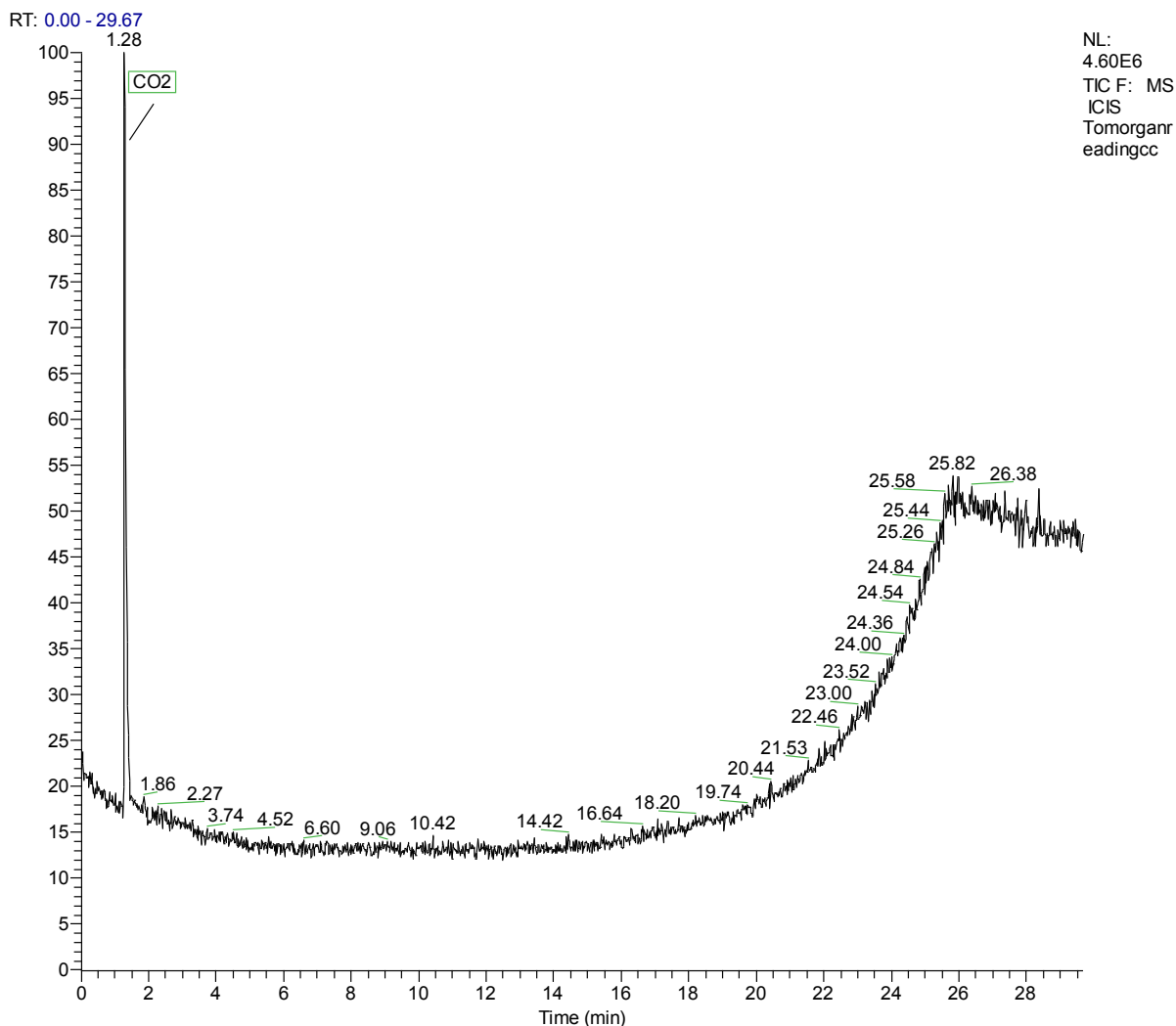


Figure 4 Pyrogram of sample 1, yellow paint

On line methylation, TMAH- Py-GC-MS Analysis

Sample 1

This on line methylation method was chosen as oil or alkyds were now suspected here. A portion of the sample 1 gave a pyrogram (Figure 5) in which the derivatised components were recognised by mass spectroscopy as various fatty acids including : azelic acid, lauric acid, myristic acid, palmitic acid, oleic acid and stearic acid as their methyl esters. This is the typical output of a lipid such as a fat or drying oil but there is also a very large peak for dimethyl phthalate indicating an ortho-phthalate alkyd, one formed from an oil and phthalic anhydride. The ratios of one acid to another were measured (Figure 6, Table 2). The azelate to palmitate ratio is 0.1 which indicates that very little drying oil is present and that the sample may contain some fats. The palmitate to stearate ratio is 3.2 (cf. Table 3). The

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Analysis for Conservation

presence of lauric acid and Myristic acid may indicate the presence of a little coconut oil in the mixture of oils which has been used to make the alkyd paint. Coconut oil has been used for the production of alkyds.

The azelate to suberate and azelate to sebacate ratios⁸ could not be measured.

In order to characterise the oil further the chromatogram was view in a 74 ion count (Figure 6). The low molecular mass carboxylic acid, methyl esters peak at the C8/9 acids (table 4), which is typical of linseed oil which peaks at C8^{5,9} and animal fats which peak at C9⁵ perhaps mixed with a little Coconut oil which peaks at C10, within this range.

Ratio of acids, as methyl esters	Value of ratio
Az/P	0.1
P/S	3.2

Table 2: ratio of acids in sample Sample 1 by peak area of methyl esters (*sub* = dimethyl suberate, *Az* = dimethyl azelate, *seb* = dimethyl sebacate *P*= methyl palmitate, *S* = methyl Stearate)

oil	P/S ratio	P/S ratio	P/S ratio	P/S ratio for artificially aged oil films
linseed oil	1.1 - 2.3 ¹	1.5 ²	1.1 - 2.1 ³	TFTMTH off line 1.01 ±0.1 ⁴ TMAH-PY-GC-MS 1.15±0.07 ⁴
walnut oil	2.2 - 3.6 ¹	2.5 ²	2.5 - 4.2 ³	TFTMTH off line 1.86 ±0.09 ⁴ TMAH-PY-GC-MS 1.86±0.11 ⁴
poppy oil	2.9 - 3.7 ¹	5.0 ²	2.9 - 6.5 ³	TFTMTH off line 4.58 ±0.30 ⁴ TMAH-PY-GC-MS 4.50±0.23 ⁴
egg	-	3.0 ²	1.7 ³	-
Sunflower oil	0.8-1.5 ⁵	2.0 ⁶		
Safflower oil	1.4-2.2 ⁵	3.0 ⁶		TMAH-PY-GC-MS 2.70 ±0.04 ⁷
Soya oil	2.5-4.1 ⁵	3.0 ⁶		

Table 3: Palmitate to Stearate ratios for oil binders and egg from different literature sources

Acid , as methyl ester	%Area
C4	15.4
C5	4.5
C6	9.6
C7	6.4
C8	24.1
C9	30.7
C10	9.4

Table 4 low molecular mass acids in sample 1 by peak area of methyl esters

(C4=methyl butanoate, C5 =methyl pentanoate, C6 = methyl hexanoate, C7 = methyl heptanoate, C8 = Methyl octanoate, C9 = methyl nonanoate, C10 = methyl decanoate)

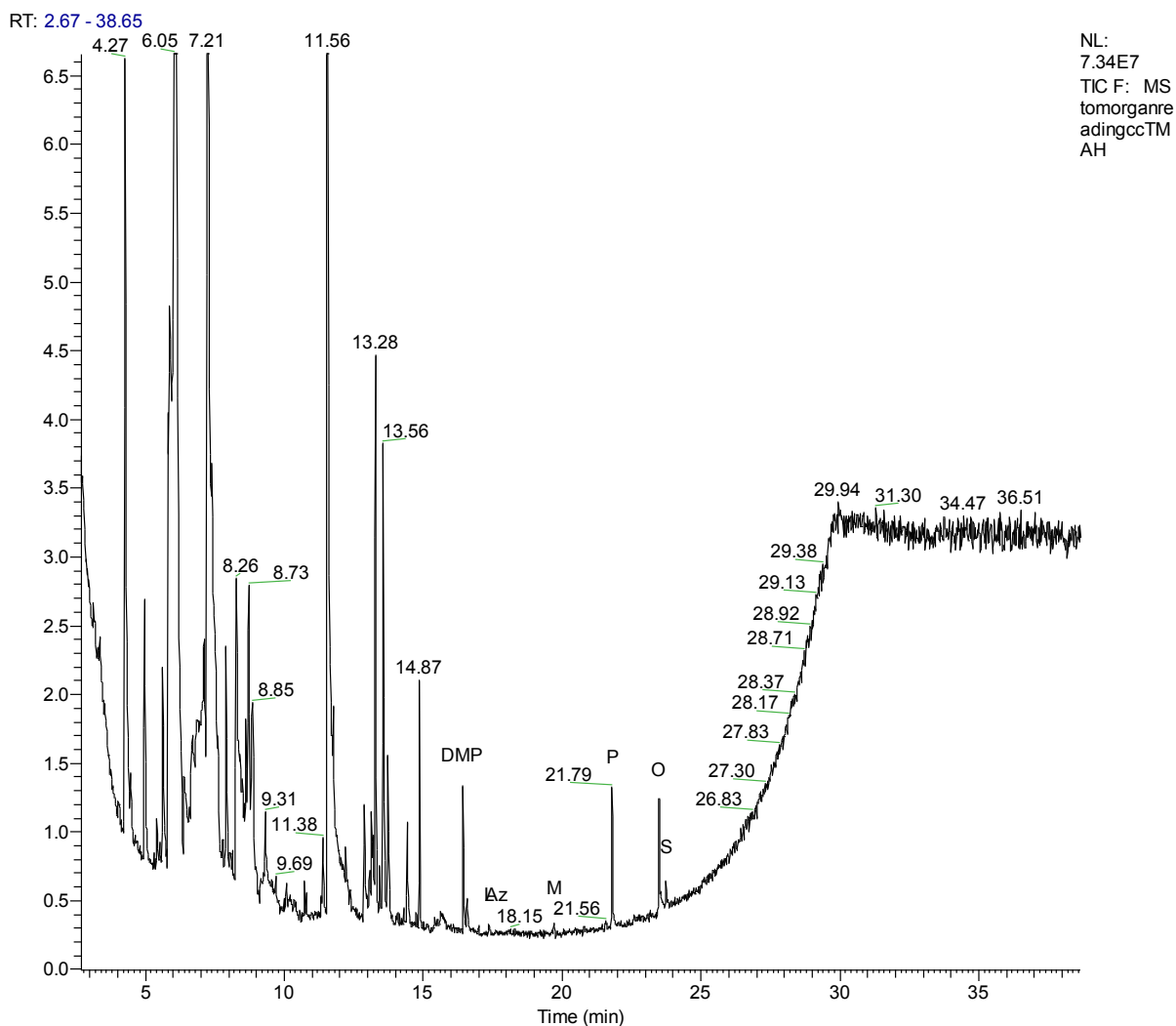


Figure 5 Py-GC-MS pyrogram of sample 1, detail 2-38 mins. (DMP = dimethyl *o*-phthlate, L = methyl laurate; Az = dimethyl azelate, M = methyl myristate P= methyl palmitate, O = methyl oleate, S= methyl Stearate).

RT: 15.63 - 24.16

NL:
9.79E5
TIC F: MS
tomorganre
adingccTM
AH

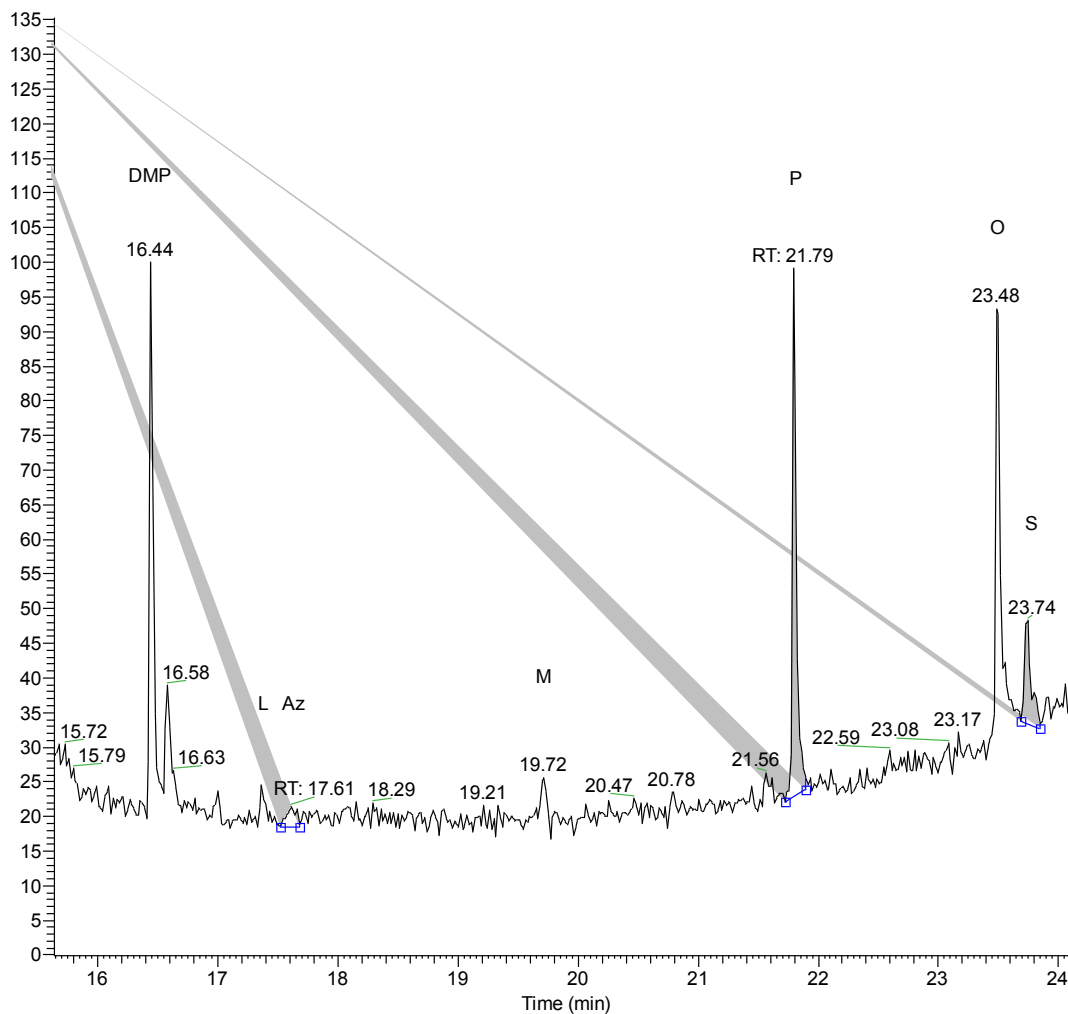


Figure 6 Py-GC-MS pyrogram of sample 1, detail 15-25 mins., showing measurement of peak areas (DMP = dimethyl o-phthlate, L = methyl laurate; Az = dimethyl azelate, M = methyl myristate P= methyl palmitate, O = methyl oleate, S= methyl Stearate).

RT: 2.45 - 15.38

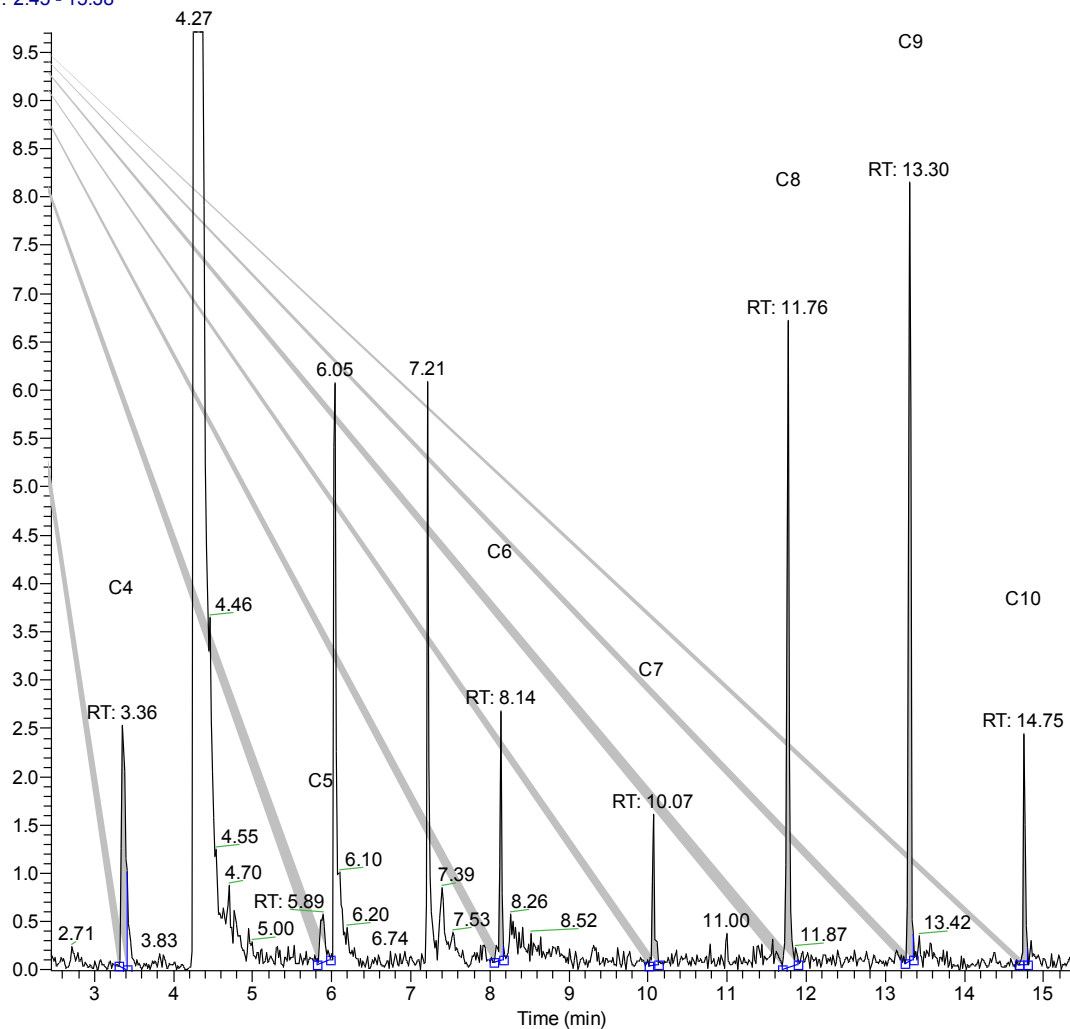


Figure 7 Py-GC-MS pyrogram of sample 1, detail 2-15 mins.,74 ion count (C4=methyl butanoate, C5 =methyl pentanoate, C6 = methyl hexanoate, C7 = methyl heptanoate, C8 = Methyl octanoate, C9 = methyl nonanoate, C10 = methyl decanoate)

Conclusions

The yellow paint sample 1 contains an alkyd paint based on an oil mixture which may contain coconut oil, linseed oil and other oils. The paint may also possibly contain a little fat or the surface has been contaminated with fat. There is very little binder in the paint.

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3. Michael R Schilling and Herant P. Khanjian, "Gas Chromatographic determination of the Fatty acid and Glycerol Content of drying Oils part 1.", *ICOM Committee for Conservation, 11th triennial meeting, Edinburgh, 1996, Pre-prints, Volume 1*, James and James, London, 1996, p222.
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8. John S. Mills and Raymond White, "Organic Mass spectrometry of art materials: work in progress", *The National Gallery Technical Bulletin*, **Volume 6** (1982). 3-18.
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