

JANE DAVIES CONSERVATION

Architectural Paint Research

PETERBOROUGH CATHEDRAL, NAVE CEILING ROOF SPACE

INVESTIGATION OF PAINT MATERIALS AND TECHNIQUES



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SUMMARY

The nave ceiling at Peterborough is a rare survival of a thirteenth century timber ceiling *in situ* in England. It retains original thirteenth century paint although heavily restored in the 1740s and again in 1836. The ceiling is currently being conserved and recorded by the Perry Lithgow Partnership. As part of the conservation programme a thorough technical examination of the painting materials and techniques has been commissioned. A major research programme investigating the materials and techniques of the painted ceiling was undertaken by the Conservation of Wall Paintings Department, Courtauld Institute of Art between September 1997 and December 1999. As an aid to ongoing conservation programmes, further research has been carried out by Jane Davies and reported on in August 2001 and May 2002. This additional report examines four samples from the east side, easternmost joist of the roof space above the Nave, where some polychrome geometric decoration was observed. Paint survives on the joist for a c. 2 meter length across the centre of the timber, showing red and black circles and triangles on a white ground.

The samples show evidence of a single decorative scheme, with an off-white ground and simple application of red or black paint to form the decorative patterns. There is some evidence of contamination of the paint with materials from the conservation treatment with hessian and adhesive.

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1 BACKGROUND AND BRIEF

1.1 INTRODUCTION

The nave ceiling at Peterborough is a rare survival of a thirteenth century timber ceiling in situ in England. It retains original thirteenth century paint although heavily restored in the 1740s and again in 1836. The ceiling is currently being conserved and recorded by the Perry Lithgow Partnership. As part of the conservation programme a thorough technical examination of the painting materials and techniques has been undertaken. Research was undertaken by the Conservation of Wall Paintings Department, Courtauld Institute of Art. They have documented their findings in three reports dated September 1997, September 1998 and December 1999.¹ Jane Davies was commissioned by Julian Limentani (of Marshall Sisson), to undertake technical examination to support phases 3 and 4 of conservation work. This report is an addendum to phase 4 research and describes four paint samples taken from the nave ceiling roof space, where painted decoration was identified along a two meter length of the east side of the easternmost joist of the Nave ceiling.

The aims of this research phase have been to identify and characterise paint found on the painted joist. The joist is decorated with an off-white background upon which are circles and triangles in red and black.

¹Howard, H. 'Peterborough Cathedral, Nave ceiling: Scientific examination of the original decoration', unpublished report, Conservation of Wall Painting Department, Courtauld Institute of Art, September 1997. Howard, H. 'Peterborough Cathedral, Nave ceiling: Scientific examination of the original decoration of bays 36-39', unpublished report, Conservation of Wall Painting Department, Courtauld Institute of Art, September 1998. Kakoulli, J. 'Peterborough Cathedral, Nave Ceiling Paintings: Scientific Examination Phase 2', unpublished report, Conservation of Wall Painting Department, Courtauld Institute of Art, December 1999.

2 PAINT ANALYSIS

2.1 METHODOLOGY

Paint samples were examined under low power magnification (2.5x-10x) and representative fragments mounted in acrylic modified polyester resin and polished in cross-section using a Metaserve 2000 grinding/polishing machine and a range of graded abrasives. Prepared cross-sections were examined under dark-field reflected light at magnifications 50x-500x using a Leica DMLM research grade microscope. Microchemical tests were carried out to identify some metallic ions and functional groups. Histochemical tests were undertaken to indicate the presence of proteins (glue) and oils.² Samples were also mounted as dispersions (in Meltmount, which has a refractive index of 1.662) and polarised light microscopy (PLM) carried out. Representative samples were photographed for reproduction within this report.

Scanning electron microscopy with energy dispersive X-ray (SEM.EDX) analysis has been undertaken by Dr Andrew Beard, Department of Geology, University College London.

² The microchemical tests included: hydrochloric acid and potassium chromate, which produce a yellow stain for lead and hydrochloric acid, which results in the evolution of carbon dioxide to identify carbonates. Preliminary staining for oils used Sudan Black B which stains oils a blue black colour. Preliminary staining for proteins used Coomassie blue (R250) which stains proteins (glue) a mid-blue colour.

2.2 Sample 32 (3101, P4a:1)

Sample 32 (3101, P4a:1) was taken from the east side of the easternmost joist of the Nave ceiling, from an area of black paint.

Sample location photograph (*below*):

Image shows general location of samples only



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Description

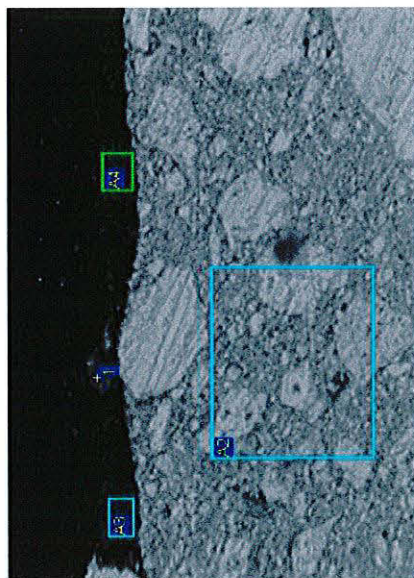
The sample shows a simple layer structure, with an off white ground and a relatively thin upper dark paint layer. The white ground is composed largely of lead white, with a few iron oxide articles and some carbon black. The black layer contains a carbon black pigment together with some iron oxide — an orange iron oxide particle is visible on the cross-section photomicrograph. Calcium is also

present in the black paint. No phosphorous was detected by SEM.EDX therefore the possibility of the black being Bone black pigment has been ruled out. The calcium presumably originates from an inert calcium based filler — occasional transparent white particles are visible.



Sample 32 (3101, P4a:1) photographed in cross-section under reflected light at 200 x magnification. (Printed magnification not calculated).

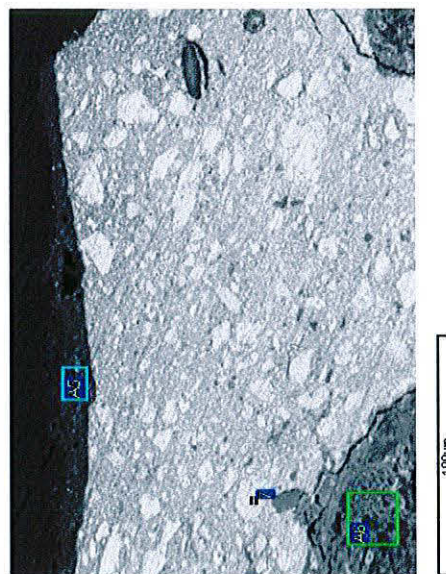
SEM.EDX backscattered images of sample 32 (3101, P4a:1) showing the location of SEM.EDX spectra.



Spectra 1 (orange particle) showed major peaks for iron (Fe). This suggests the orange coloured particles in the black layer are an iron oxide pigment.

Spectra A3 and A4 (black paint) show peaks for carbon (C), calcium (Ca), iron and lead (Pb). The lead probably arises from the white ground below. The iron from the iron oxide pigment present in the layer. No phosphorous was detected, ruling out the presence of Bone black pigment. The calcium presumably originates from an inert filler, such as calcium carbonate.

Spectra A2 shows peaks for lead, confirming its identity as lead white.



Spectra A5 (black paint) again shows major peaks for carbon, calcium and lead.

Spectra A6 (timber substrate) shows peaks for lead and traces of iron and carbon. These probably arise from the adjacent off-white ground layer.

Spectra 7 (white particle) shows peaks for lead. The particle is lead white.

Sample 33 (3102, P4a:2)

Sample 33 (3102, P4a:2) was taken from the east side of the easternmost joist of the Nave ceiling, from an area of white paint.

Sample location photograph (below):

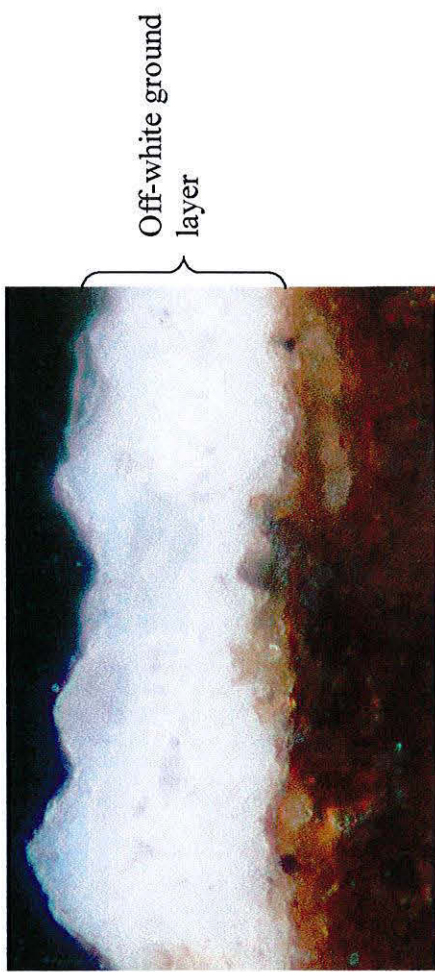
Image shows general location of samples only



© Perry Lithgow Partnership 2002

Description

This sample shows the off-white ground layer. No surface paint layer is present on the sample. No SEM.EDX was undertaken on this sample.



Sample 33 (3102, P4a:2) photographed in cross-section under reflected light at 200 x magnification. (Printed magnification not calculated).

Sample 34 (3103, P4a:3)

Sample 34 (3103, P4a:3) was taken from the east side of the easternmost joist of the Nave ceiling, from an area of white paint, where red ground appeared to be present below when sampling.

Sample location photograph (below):

Image shows general location of samples only



© Perry Lithgow Partnership 2002

Description

The sample shows the timber substrate, white ground and upper red paint layer. The off-white lead white ground contains a few transparent white calcium containing particles as well as a very few black and brown pigment particles. The red paint layer also contains transparent particles, also calcium based. The red layer has a microscopic appearance consistent with an iron oxide red pigment. The red layer produces SEM.EDX spectra with

peaks for lead, iron and calcium. The lead present is attributed to the underlying white lead ground.

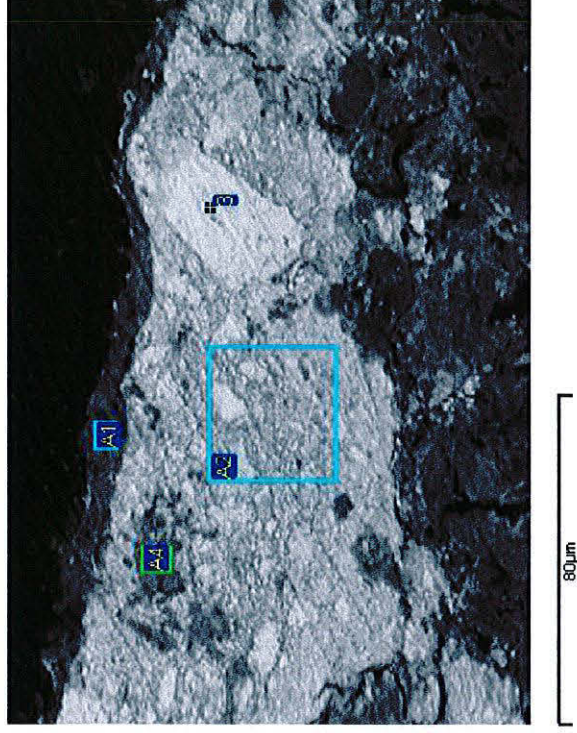


Sample 34 (3103, P4a:3) photographed in cross-section under reflected light at 200 x magnification. (Printed magnification not calculated).



Image above: Box shows approximate location of SEM Backscattered image on sample cross-section.

Image above right: SEM.EDX backscattered image of the sample showing points at which EDX spectra were made.



Spectra A1 shows peaks for lead, iron and calcium.

Spectra A2 shows peaks for lead.

Spectra point 3 shows peaks for lead.

Spectra A4 shows peaks for lead and a trace of calcium.

Sample 35 (3104, P4a:4)

Sample 35 (3104, P4a:4) was taken from the east side of the easternmost joist of the Nave ceiling, from an area of white paint.

Sample location photograph (below):

Image shows general location of samples only



© Perry Lithgow Partnership 2002

Description

The sample shows a single layer of lead white, with a few coloured iron oxide, carbon black and white transparent particles. Noticeable on the sample is the translucent brownish layer on its surface. As similar material is also present at the substrate/paint interface. The presence of silica and aluminium, suggestive of a clay rich material, in this substance was confirmed by SEM.EDX. Previous research (Howard 1997) identified calcium sulphate and a

clay-rich material at the wood/paint interface which was attributed to previous conservation treatment of the ceiling. Given the proximity of the sample location to areas of hessian and glue applied during previous conservation it appears likely that the clay-rich material may not be original to the painting, but a later introduction.



Sample 35 (3104, P4a:4) photographed in cross-section under reflected light at 200 x magnification. (Printed magnification not calculated).

interface and on the surface of the sample. Previous research (Howard 1997) identified calcium sulphate and a clay-rich material at the wood/paint interface which was attributed to previous conservation treatment of the ceiling. Given the proximity of the sample location to areas of hessian and glue applied during previous conservation it appears likely that the clay-rich material may not be original to the painting, but a later introduction.

Spectra A2 and Spectra point 4 both show peaks for lead, carbon and oxygen.

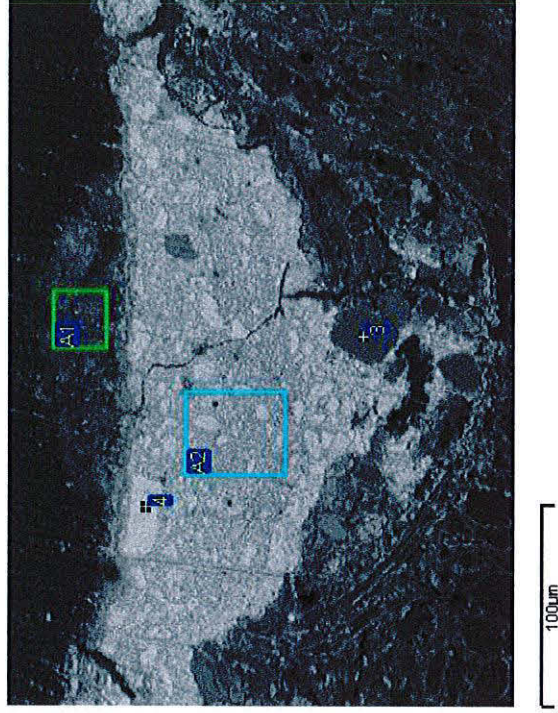


Image above: Box shows approximate location of SEM Backscattered image on sample cross-section.

Image right: SEM.EDX backscattered image of the sample showing points at which EDX spectra were made.

Spectra A1 (brown layer) shows peaks for lead, silica (Si), sulphur (S) and calcium. Aluminium (Al), iron, oxygen, carbon and phosphorous. The lead reading probably originates from the white lead ground. The spectra from point 3 also shows peaks for silica and aluminium, together with potassium (K), oxygen and a trace of sodium (Na). The presence of silica and aluminium is suggestive of a clay rich material, present at the substrate paint

3 DISCUSSION OF FINDINGS

The samples show evidence of a single decorative scheme, with an off-white ground and simple application of red or black paint to form the decorative patterns. There is some evidence of contamination of the paint with materials from the conservation treatment with hessian and adhesive.