Advanced Techniques of Stained Glass Conservation

HOA00044M

Conservation Report for the Conservation Project on panel: 883040681.4, Head panel St. George

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This report is submitted in partial fulfilment of the course requirements of an MA in Stained Glass Conservation and Heritage Management

Date: 23rd April 2014

Contents

Preliminary Conservation Report

Object details and technical description

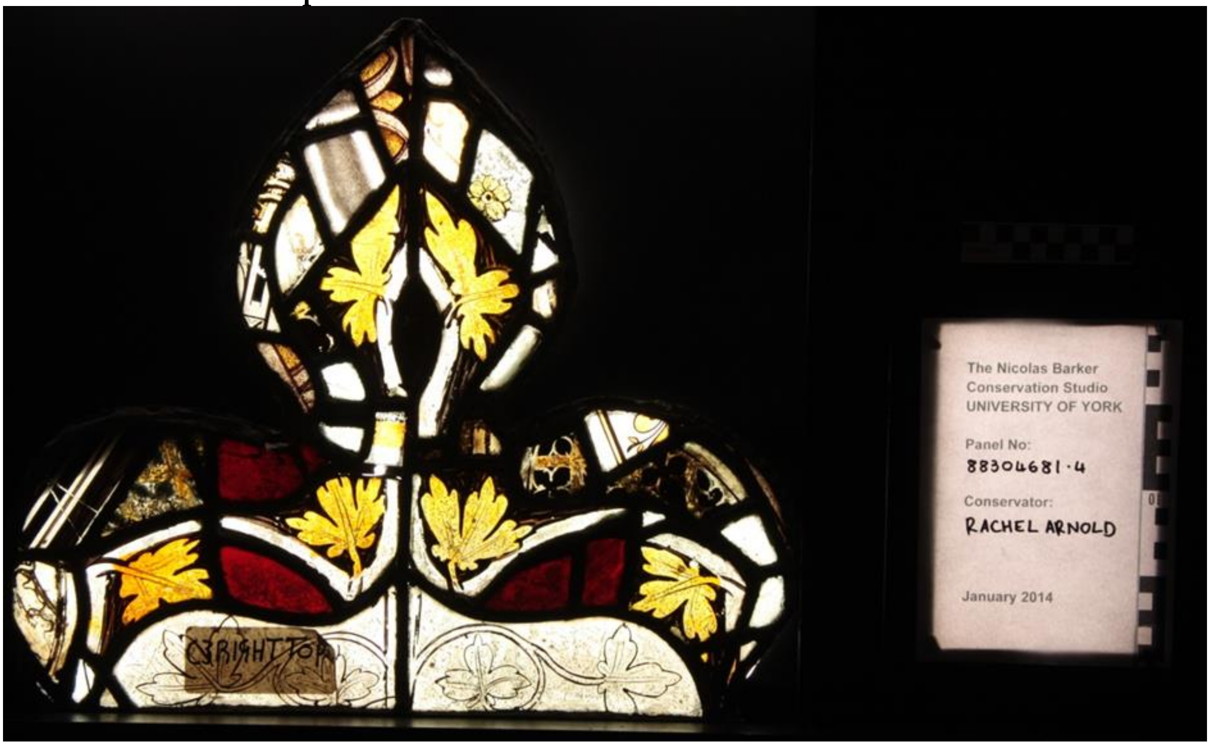
Panel Number: 88304681.4
Title: Head panel for St. George from light C, window E1.
Date of Practical Conservation: March – April 2014

Media: Glass, lead, glass paint.	**Owned by:** English Heritage **Date:** 1334-1340

Overall Dimensions: (mm) Height - 426 Width - 488 Depth – 11	**Location:** From the chancel of the, now redundant, church of St. Peter, Barton-on-Humber, Lincolnshire. Now in storage in Fulford, York.

Examination Conditions: Examined on a light box with a microscope, in the Nicholas Barker Studio, King's Manor, at the University of York, by the author. **Date of Examination:** February 2014. **Date of Conservation:** March – April 2014.

Brief Technical Description:



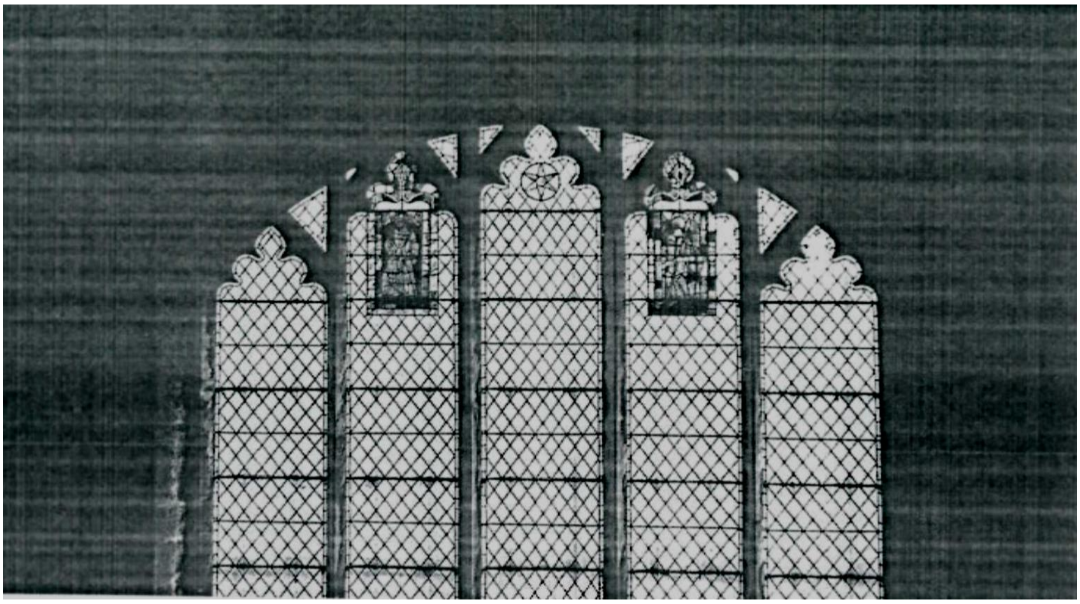
Glass: All the glass is either clear or ruby, flashed glass. The central area dates from between 1334 and 1340. Medieval fragments of a similar date, some of which may be from the same series, were inserted around the original glass, to enlarge it. There are also a few nineteenth century glass infills.

Paint layers: The painted decoration is grisaille paint and yellow stain. The grisaille paint is mostly applied thickly and in trace lines, except some of the nineteenth century pieces, which have washed paint layers. Some stipple effects have been used in the nineteenth century pieces, perhaps to make them look older.

Lead: The lead is not original to the panel and it may have been re-leaded in 1877, when the associated figure panels were re-leaded, by Knowles of York. The lead is in good condition with only a few minor breaks.

History of the panel
This panel originates from the same window as the figurative panels of St. James and St. George, and the matching head panel, no. 88304681.2. This group was situated in the east window in the chancel until 1985, when they were removed for conservation and put into storage. The east window consisted of these panels alongside plain quarries, but it is clear that they were made for a different window, with shorter and narrower lights, due to the size of the panels (see image below), yet it is not certain they did not originate in the old chancel, as it was later rebuilt. The rearrangements of the panels and their movement in the church is undocumented, until the nineteenth century when illustrations appear of the figurative and head panels in the east window surrounded by diamond quarries.
Antiquarian sources suggest that the saints, and therefore the head panels, were given by Henry Lord Beaumont (Edward II's second cousin), c.1340.[1]

The incorporation of a number of fourteenth century and nineteenth century infills, to replace missing areas of glass is typical of pre-Victorian restoration, which often does not attempt to make, or find an appropriate piece, which fits the design.
It is apparent that, due to their vulnerability, Knowles re-leaded the figurative panels in 1877, and it is likely that the head panels were re-leaded at the same time. Presumably at this time the nineteenth century infills were introduced and perhaps some of the earlier pieces were too. It is impossible to tell whether all of these fragments originated in the church, or whether glaziers brought them from elsewhere.[2]



Above: Upper part of EI showing stained glass in situ, in the chancel of St. Peter's church in 1979. (Source W. Rodwell, *St. Peter's, Barton-upon-Humber, Lincolnshire: A Parish Church and its Community. Vol. 1 (2),* Oxford: Oxford and Oakville, 1983: 598).

Statement of significance
The considerable amount of medieval glass is historically valuable. The various sources of later infills and the history evident in their installation, outlines the common practise of restoration processes, before the Victorian period. We can therefore derive a history of the panel itself, as well as aspects of historic restoration practises. Furthermore, the interventions performed by a well-known glazier of the nineteenth century: Knowles, gives the panel historic significance by association with a famous figure.
All aspects of this panel are of a high level of importance and significance, and are wholly worth keeping.

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[1] P. Hebgin-Barnes, *The Medieval Stained Glass of the County of Lincolnshire* (Oxford: Oxford University Press, 1996), 24-25.
[2] W. Rodwell *St. Peter's, Barton-upon-Humber, Lincolnshire: A Parish Church and its Community. Vol. 1 (2)* (Oxford: Oxford and Oakville, 1983), 580-581.

Pre-Conservation Photographs

All were photographed by the author on the 1st February, 2014 in the Nicholas Barker Conservation studio, University of York. The images are of the full panel in colour.
Interior with reflected light

Interior with transmitted light

Exterior with reflected light

Condition

General condition

The condition assessment is to be read with reference to the condition mappings on subsequent pages.
The panel is not in a stable condition, and requires a great deal of care and professional experience to move it. This is due to broken leads and failing putty.
There are some cracks, chips and paint loss, and there is a high level of corrosion in the form of pitting and corrosion crusts across the whole of the panel.
There is a light surface soiling across the front of the panel, and significant amounts of putty close to the leads.

Condition of individual components

Lead: The lead net itself is strong and in good condition although there are six breaks occurring at or near solder joints along the centre of the panel, which are weak points in the network. Throughout the panel there is failing putty/cement which makes the panel fragile. It is visible beneath the lead, in a dry and crumbling state. Vertically through the centre of the panel there are a number of breaks and the putty has failed completely, which means the panel is liable to separate down the middle (see condition mapping on page 11).

There are some white deposits on the lead in areas, which may be caused by oxidisation but this is not clear, without further laboratory testing. There is no major corrosion.
Some damage has occurred on the leads, such as small cuts which have folded back on themselves. These cuts do not carry all the way through. On one occasion the lead has been damaged by something scraping across it and gouging a chunk out. This damage could have occurred during the de-installation, because the exposed lead looks shiny and silver which indicates it has not been exposed to the atmosphere for a long time, and is likely to be a relatively fresh incident.

There are sporadic putty smears across the lead-net which will have been caused by careless re-puttying in situ, or elsewhere.

The flat leads are 7mm and the rounded leads are 6mm. The outer lead is 12mm. The outer lead is open on all surfaces except for the bottom. It can be assumed that this lead was closed so it could stand in the open, exterior lead of the panel below. Generally the flanges all around the exterior of the lead are damaged, and have remnants of mortar and putty attached. It can be concluded that the panel was held in its place in the east window with the use of mortar and the damage incurred to the exterior lead occurred during the de-installation.

Glass: The provenance of the infills has been discussed earlier and can be seen with ease on the mapping for the origin of the glass on page 9. One of the pieces is inverted.

Across the panel we find general soiling which has accumulated from years of settling dust, and condensation. Around the edges of most of the pieces of glass, there is dried putty, most likely caused by seepage. There are eight small mortar splashes. Toward the left of the panel in two places residue from adhesive tape can be found; which give the glass a light, shiny appearance. Across the bottom left of the panel is a sizeable label detailing the location of the panel, when it occupied the east window. This label is a generic adhesive labelling sticker, the mapping for surface accretions can be found on page 10.

There are around twenty-one breaks across the whole of the panel; one piece in particular has numerous breaks. This piece is on the edge, and the cracks are close together, some of them do not continue through the whole of the piece. This damage is most likely caused by pressure, with it being a piece at the edge, and unlikely to be due to impact or vandalism.

The damage may even have occurred during de-installation, due to the fact that the cracks, which only reach part way across the piece of glass, are very clean. None of the breaks appear to have been mended with anything, i.e. resins or animal glues. There is a lot of chipped glass, which mostly occurs where there are breaks, or at corners. Due to the re-leading and the excessive use of infills not originally destined for this panel, there is evidence of the glass pieces not fitting properly in the lead-net. In some cases attempts have been made to groze the edges, but where the putty has failed, gaps are clearly visible (see page 11).
There is some mechanical damage, in the form of scratches on both sides of the glass and this may have been caused by harsh cleaning from an earlier date.

There is a severe amount of pitting covering the majority of the panel; however more occurs on the outside than the inside. The nineteenth century glass does not show signs of pitting, whereas most of the fourteenth century glass does. In some cases it is evident that the pitting has erupted along the scratches caused by earlier mechanical damage. The paint seems to prevent the pitting. On the reverse however, pitting often occurs on the yellow-stained areas, sometimes avoiding the areas which have not been stained. In all cases the pits are filled with dirt and are white. There are some corrosion crusts which are all in a developed stage. There is also evidence of missing layers of glass, which are likely to have been corrosion crusts which have flaked off. There is a couple of instances where the flash layer has detached, and two instances where the surface of the glass is uneven, and has a chipped texture, but this does not affect the painted areas or instigate corrosion and is likely to be a production default rather than damage occurring later (see pages 15 and 16).

The inverted piece has a significant amount of corrosion compared to the other pieces, yet it is unclear whether the paint has disappeared or not, due to the amount of dark corrosion crusts which are in place. Pitting also occurs on this piece.

Paint layers: The paint has suffered partial loss in several places across the panel, almost always in the fourteenth century pieces. There is major loss in two medieval infills, where only ghost lines are visible. These pieces are likely to be from an entirely different source due to the fact that the majority of the other paint remains and seems to be in a stable condition. Some paint loss is difficult to detect due to the appearance of a corrosion crust across the surface, but in general the paint prevents against pitting, so is not lost in this way.
Some of the yellow stain on the reverse of the panel has been damaged, due to pitting which appears in it. There are pits distributed across the surface of the yellow stain causing the colour to break up in appearance (see pages 13 and 14).

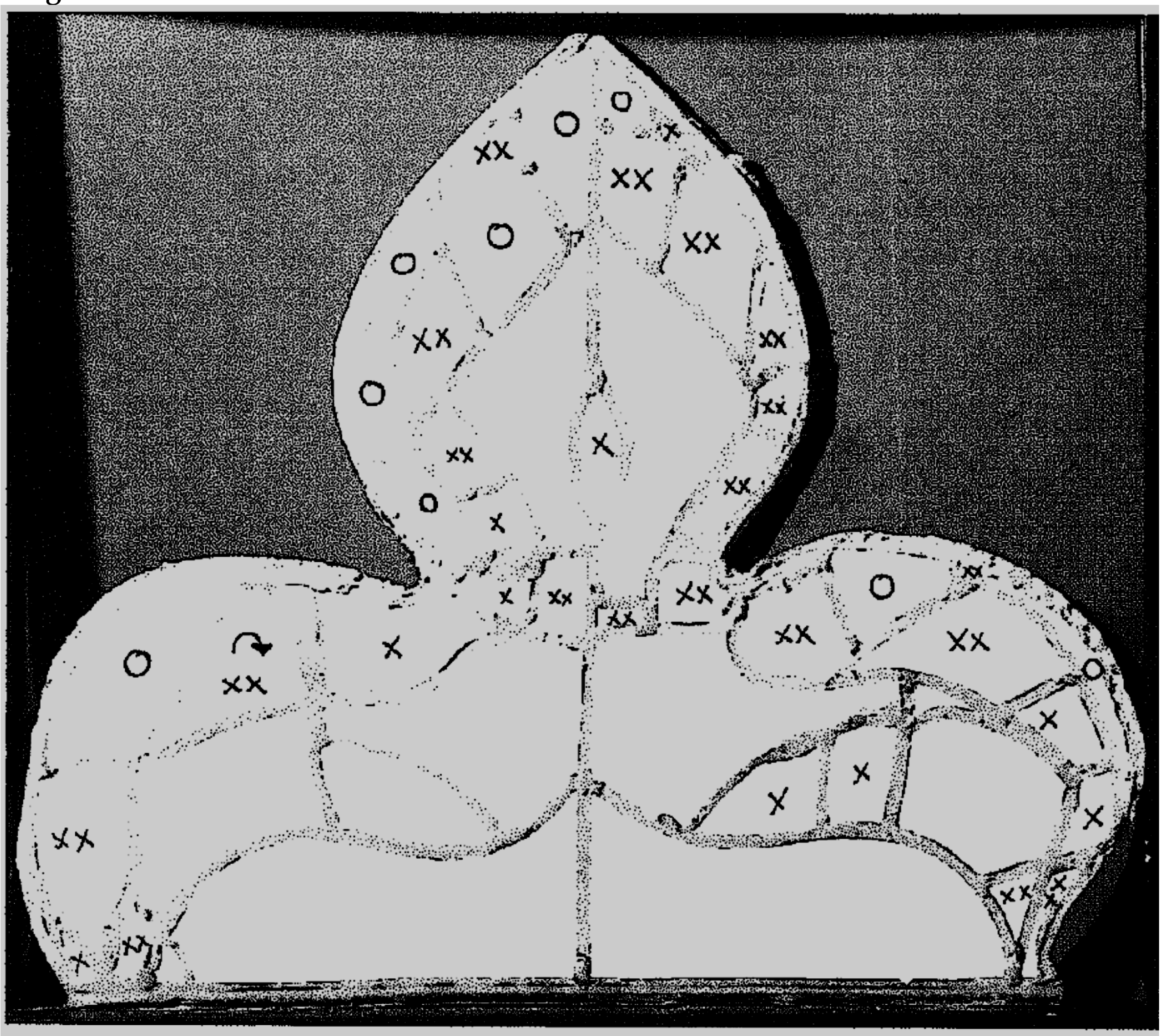
Current environment: The windows of St Peter’s are currently in a temporary storage unit, which has some benefits of keeping the stained glass away from dangers that could emerge from their contact with weather and other environmental factors associated with being installed in a building. However the storage unit is not without its disadvantages. There is a distinct lack of ventilation within the shelving which may encourage damp, microorganisms etc. Furthermore, dust is able to settle on the surface of the glass and lead because of their horizontal position.
No thorough assessment has been made into the climatic environment of the place where the windows are being stored.

Previous conservation/restoration **(e.g. repairs, additions)**
The panel has been re-leaded in the nineteenth century and additional pieces have been added as time has progressed. There is a mending lead on the back of the panel which looks to be of the same date as the nineteenth century restoration but may have been later. The exterior lead also dates form this time. No later alterations have been made, aside from the removal of the panels from their place in St. Peter’s church in 1985.

Condition Mappings

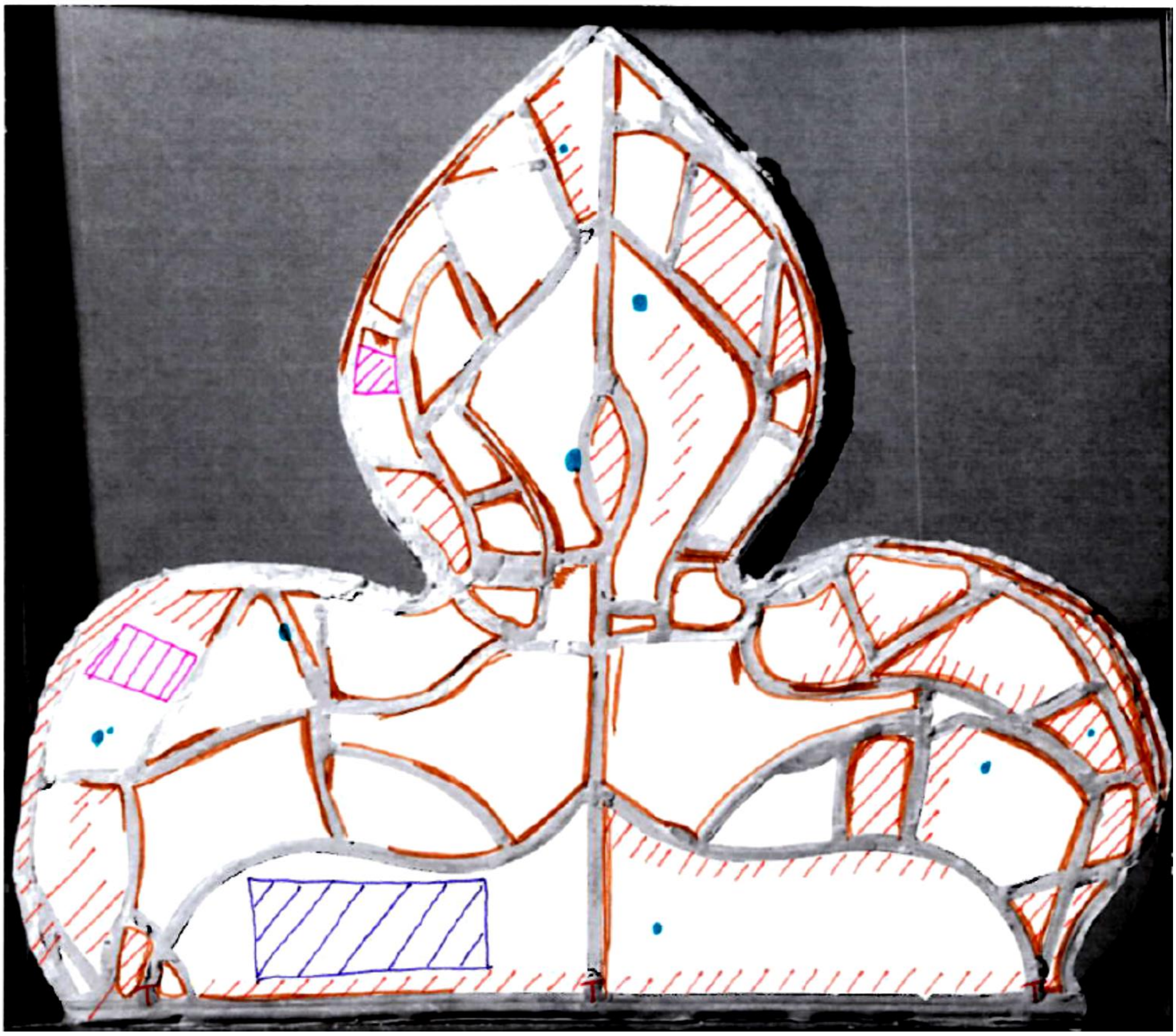
The following pages contain hand-drawn condition mappings using a template of the lead-net of the window. They were drawn on the 12th February, 2014 by the author.

Origin of Glass



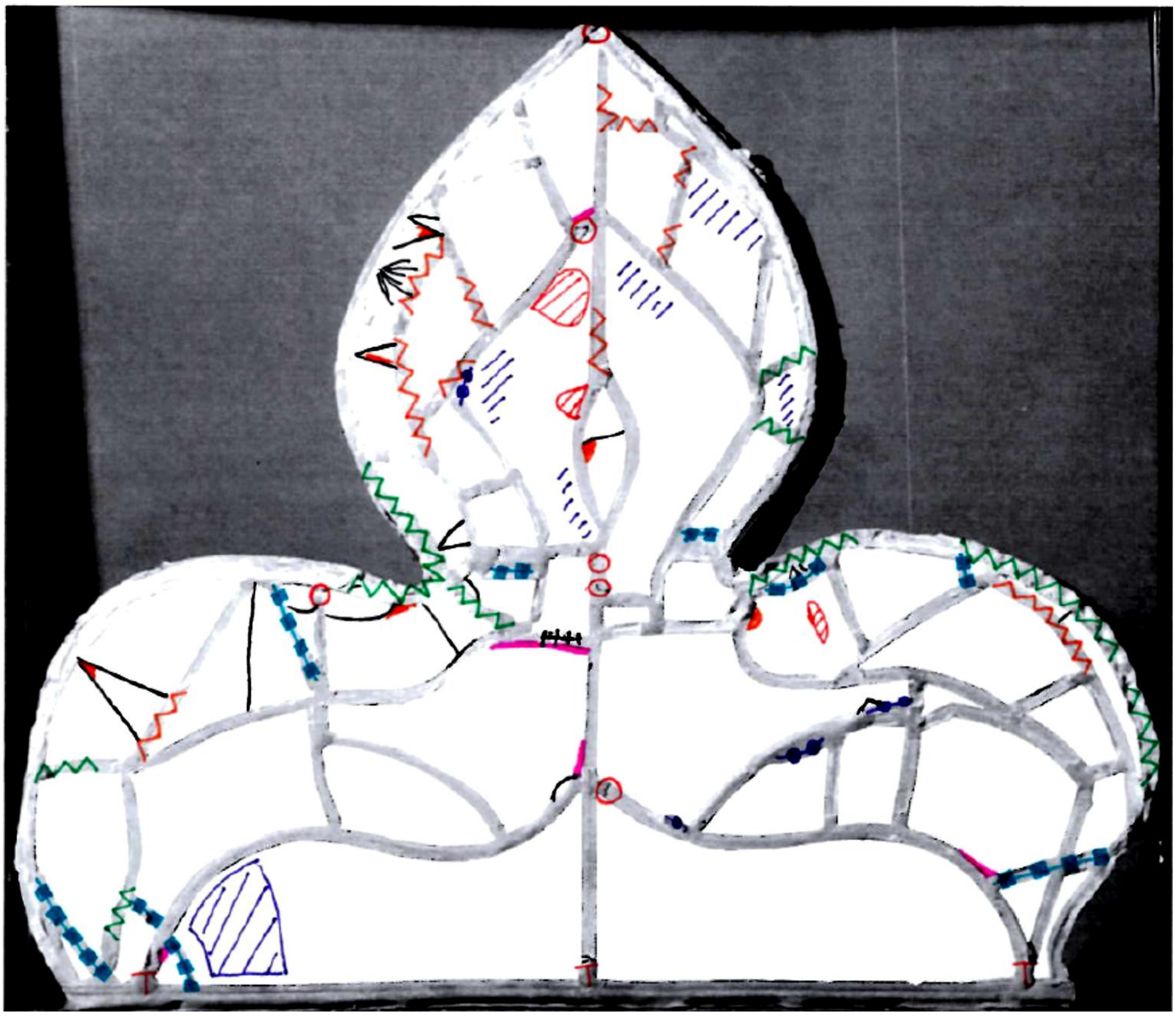
Type of glass	Symbol
Infill with painted medieval glass	X X
Infill with unpainted medieval glass	X
Infill with painted nineteenth century glass	O
Inverted piece	↷

Surface accretions on the glass and lead (interior)



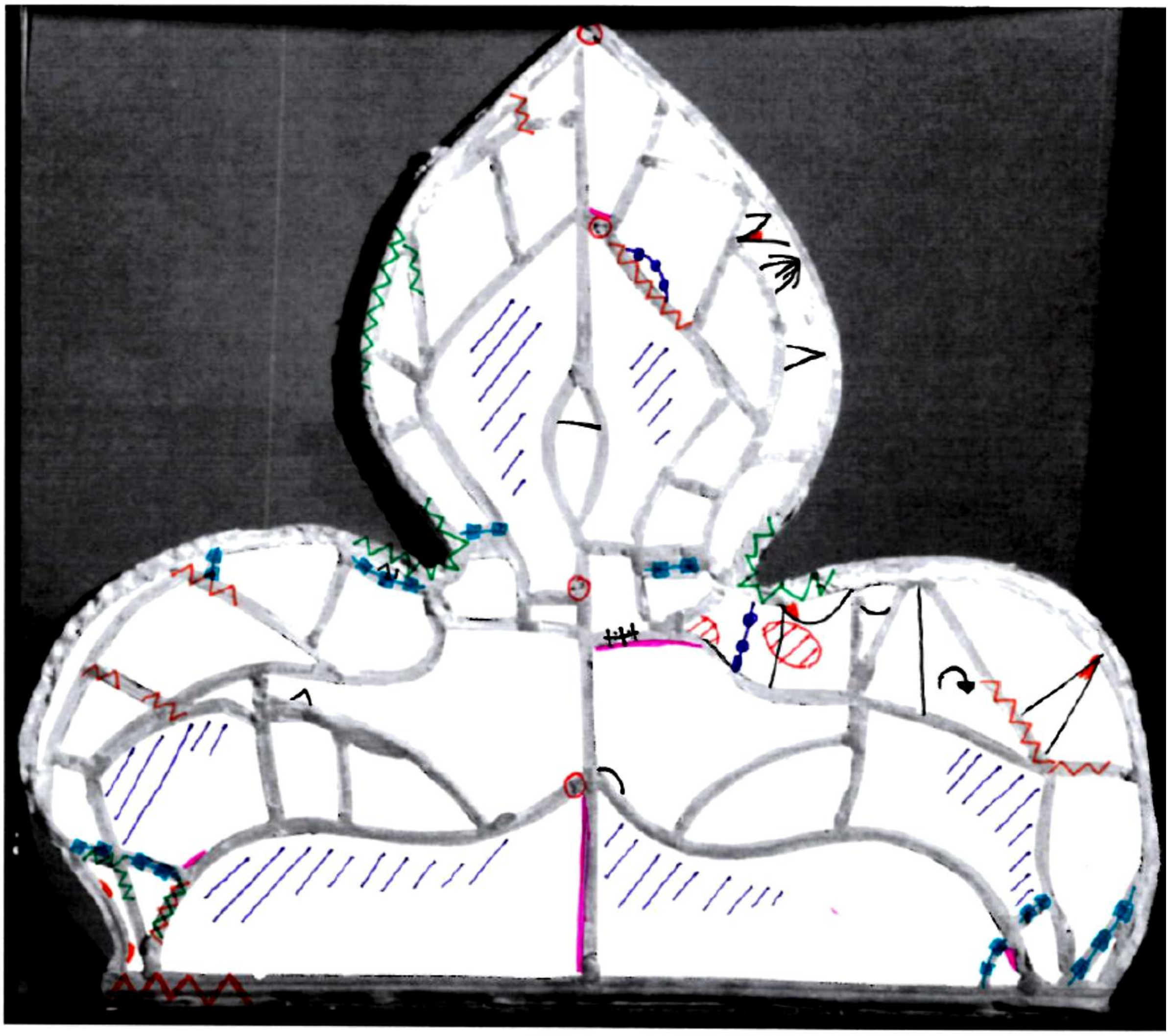
Type of surface accretion or dirt	Symbol
Heavy soiling/dust - General	
Putty smears or putty seepage	
Mortar splashes	
Adhesive tape or labels	
Residue from adhesive tape or labels	
Copper tie	T

Damage/condition of the glass and lead (interior)



Condition or damage	Symbol
Copper tie	T
Broken lead or solder joint	O
Damaged lead	green zigzag
Corroded lead	red zigzag
Missing lead	├┼┼┼┤
Mending lead	blue dashed line
Strap lead on interior	blue dotted line
Chipped glass	red mark
Original missing glass/glass cut too small	pink line
Crack	black line
Mechanical damage e.g. from previous cleaning	blue hatching
Other – i.e. flaking glass and flash layers	red hatched box

Damage/condition of the glass and lead (exterior)



Condition or damage	Symbol
Broken lead or solder joint	○
Damaged lead	
Corroded lead	
Missing lead	
Mending lead	
Strap lead on exterior	
Chipped glass	
Original missing glass/glass cut too small	
Crack	
Mechanical damage e.g. from previous cleaning	
Other – i.e. flaking glass and flash layers	
Inverted piece	

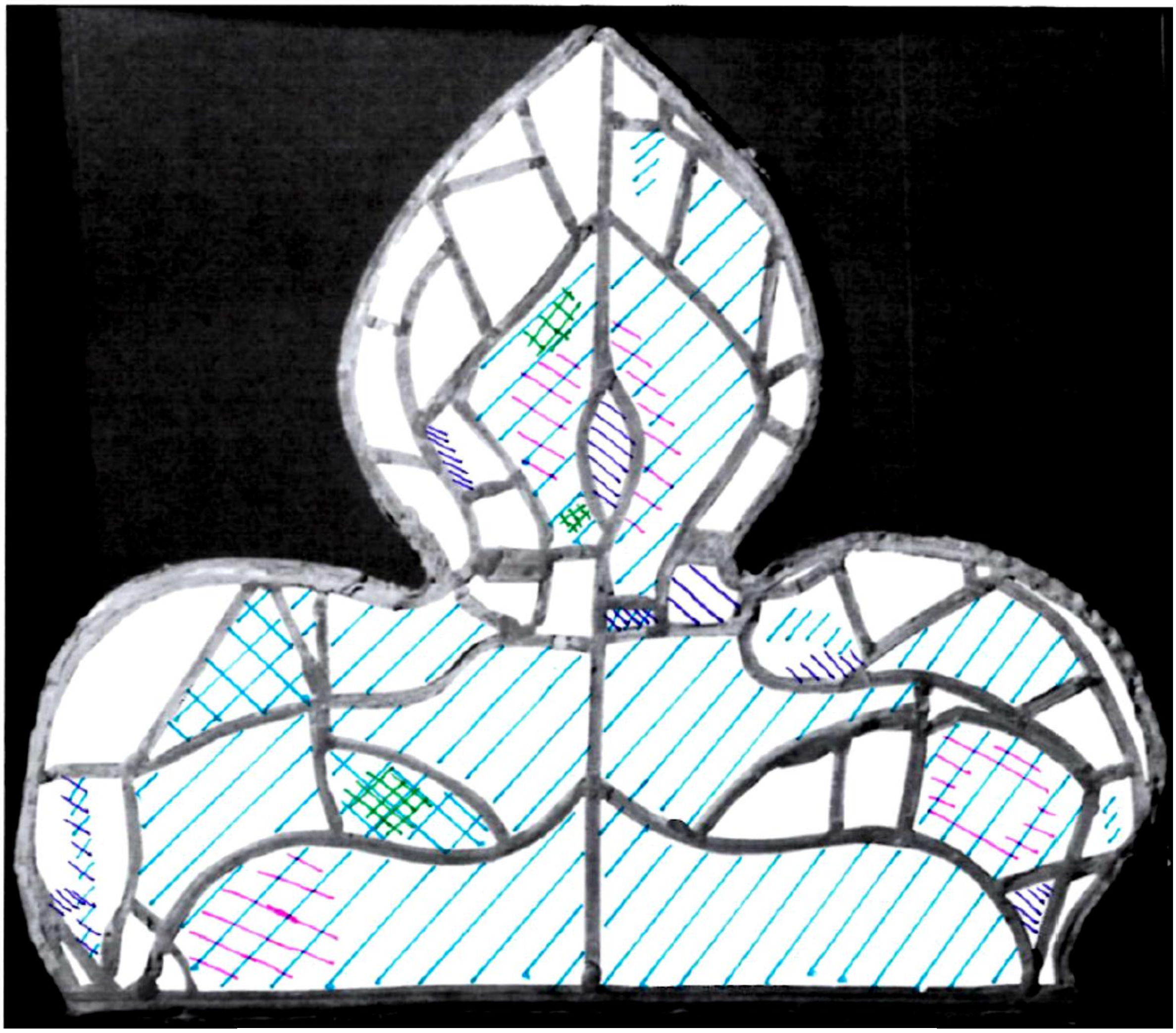
Condition and damage of paint layers (interior)

Type of paint/damage	Symbol
Trace lines lost	(solid magenta line)
Trace lines partially lost	(dashed magenta line)
Yellow stain	YS
Damaged yellow stain	(dashed red line)
Flash layer flaking off	(solid red line)
Flash layer damaged	////

Condition and damage of paint layers (exterior)

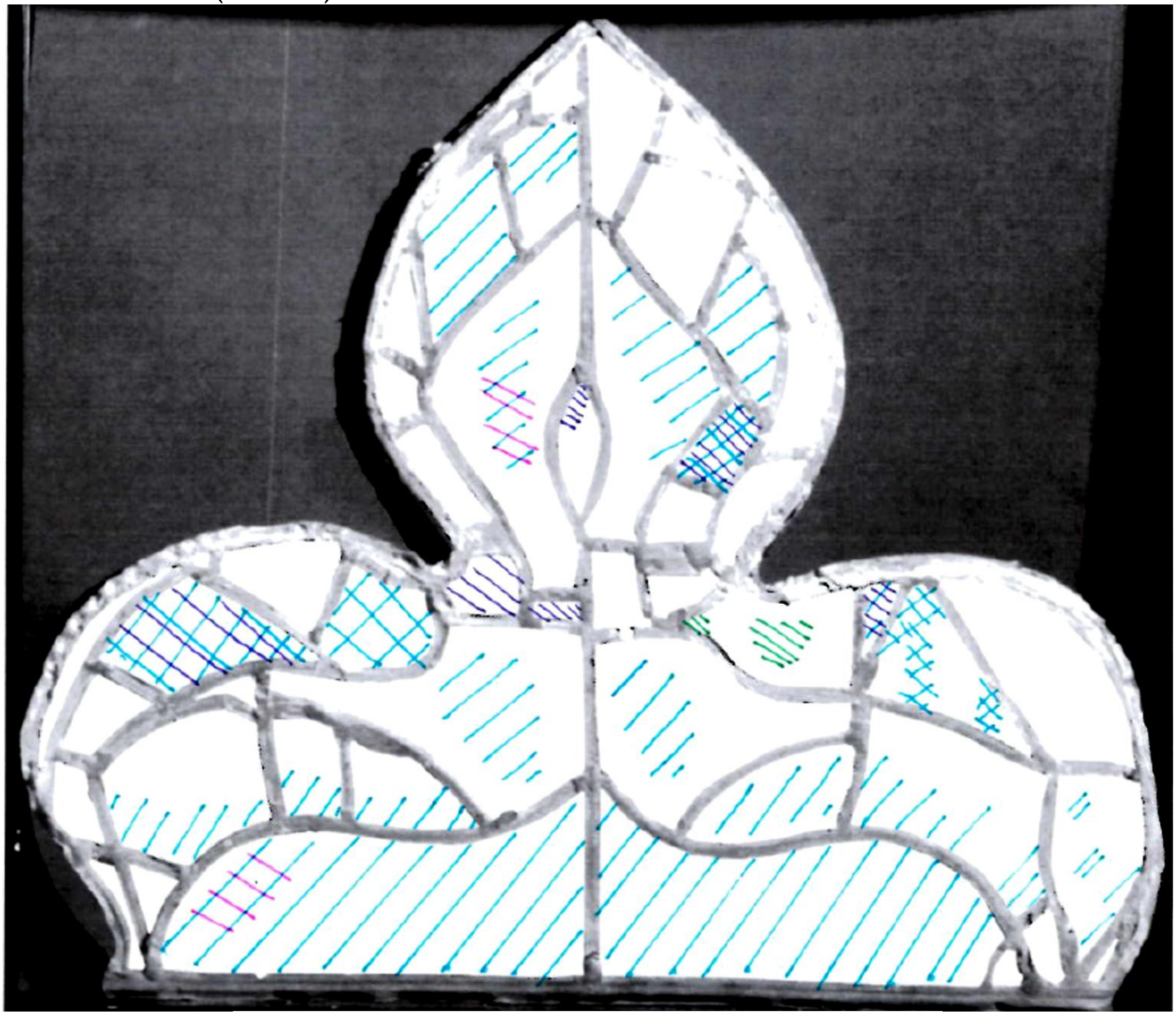
Type of paint/damage	Symbol
Trace lines lost	
Trace lines partially lost	
Yellow stain	YS
Damaged yellow stain	
Flash layer flaking off	
Flash layer damaged	

Glass corrosion (interior)



Type of corrosion	Symbol
Pitting	
Severe pitting	
Corrosion crusts	
Corrosion developing from harsh cleaning/scratches	
Other damage	

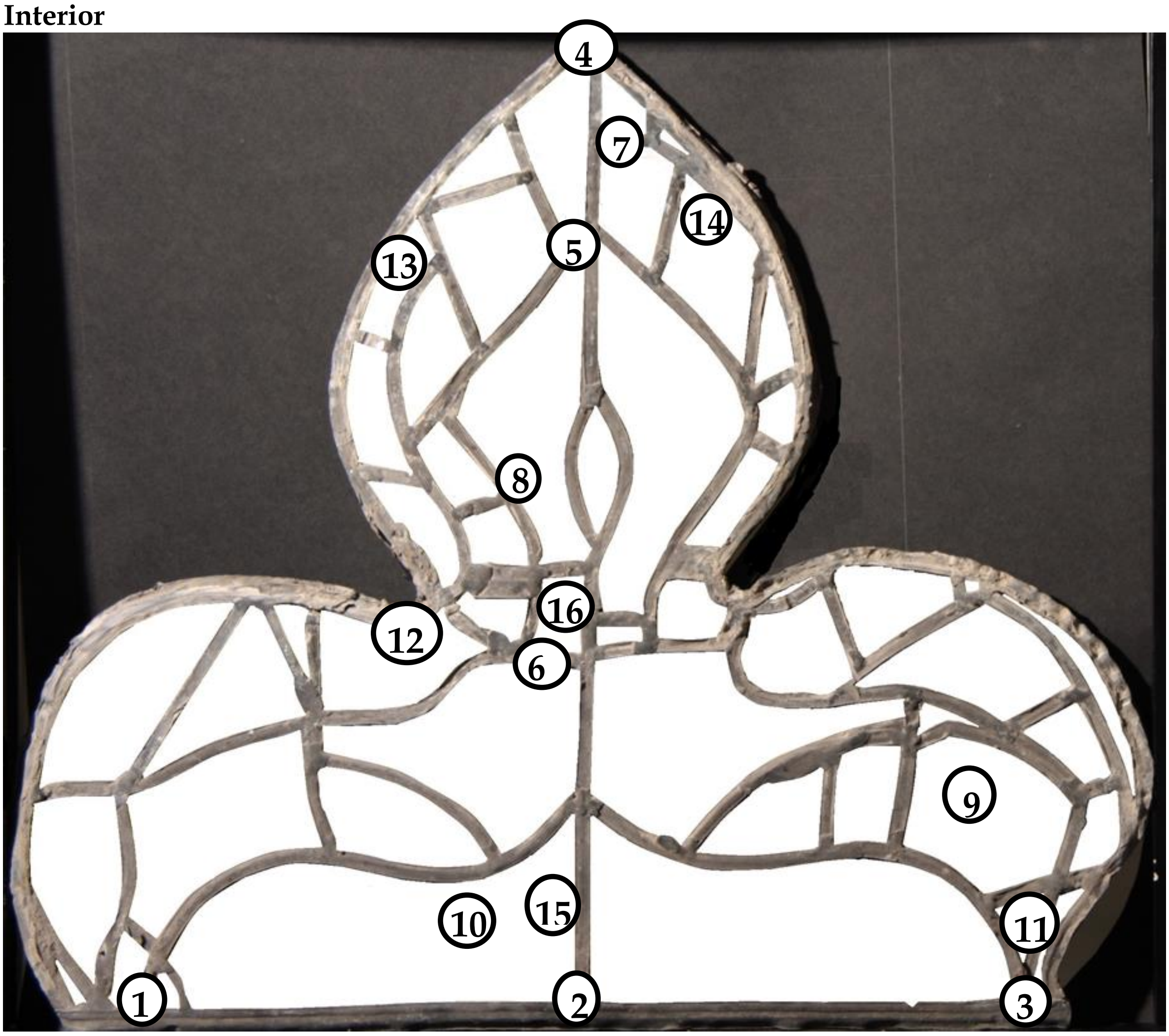
Glass corrosion (exterior)



Type of corrosion	Symbol
Pitting	[cyan single hatching]
Severe pitting	[cyan cross hatching]
Corrosion crusts	[dark blue hatching]
Corrosion developing from harsh cleaning/scratches	[magenta hatching]
Other damage	[green hatching]

Pre-Conservation Detailed Photographs

All the detailed photographs were taken by the author on 5th-6th February 2014. They highlight the most significant areas of damage, corrosion or dirt, which have been outlined on the condition mapping diagrams. Below is an image of the interior of the panel with numbers; the numbers indicate the location of the detailed images. The images for the interior are on pages 18-19. Following these are the detailed images for the exterior of the panels on pages 20-21.
Interior



1-3	Copper ties	4	Torn lead at the apex of the panel
5	Torn lead near the centre of the panel	6	Missing lead
7	Lead oxidation	8	Surface soiling – putty
9	Surface soiling – mortar splashes	10	Surface soiling – sticky label
11	Heavy surface soiling and flaking corrosion crusts	12	Deep pitting, cracks, chipped glass and damaged lead
13	Heavily fractured piece of glass, with a small missing area	14	Mechanical damage (scratches), where pitting has developed
15	Paint loss	16	Severe paint loss

Interior

1 – Copper tie on the right side

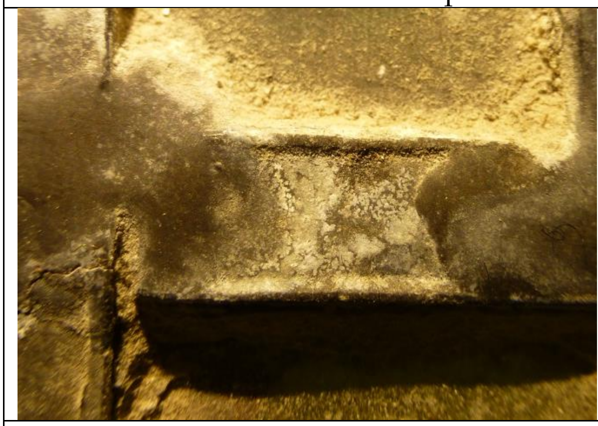
2 – Copper tie in the centre

3 – Copper tie on the left side

4 – Topmost broken lead at the apex

5 – Torn lead in the centre of the panel

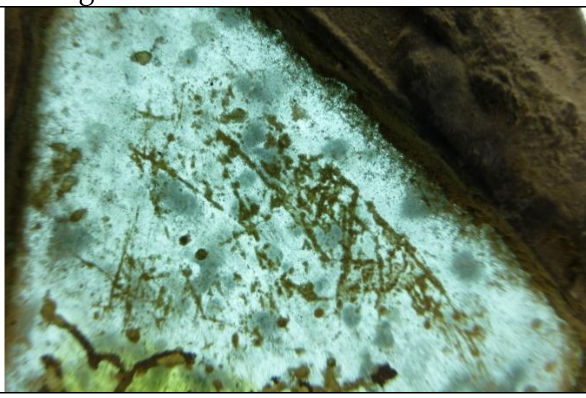
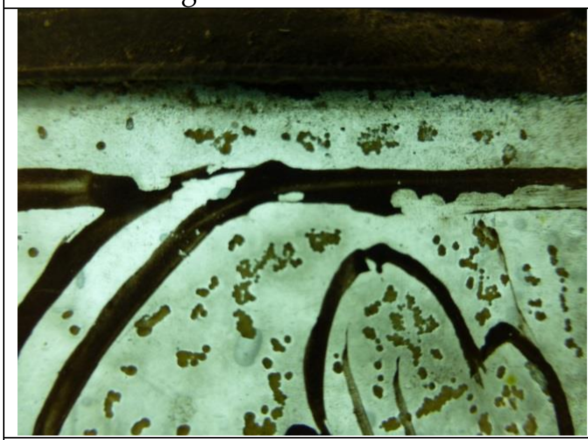
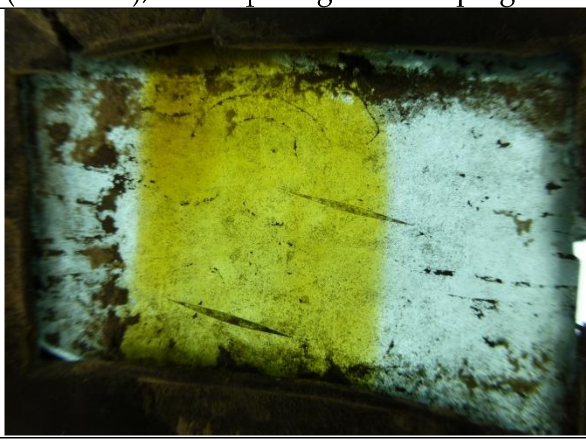
6 – Small area of missing lead



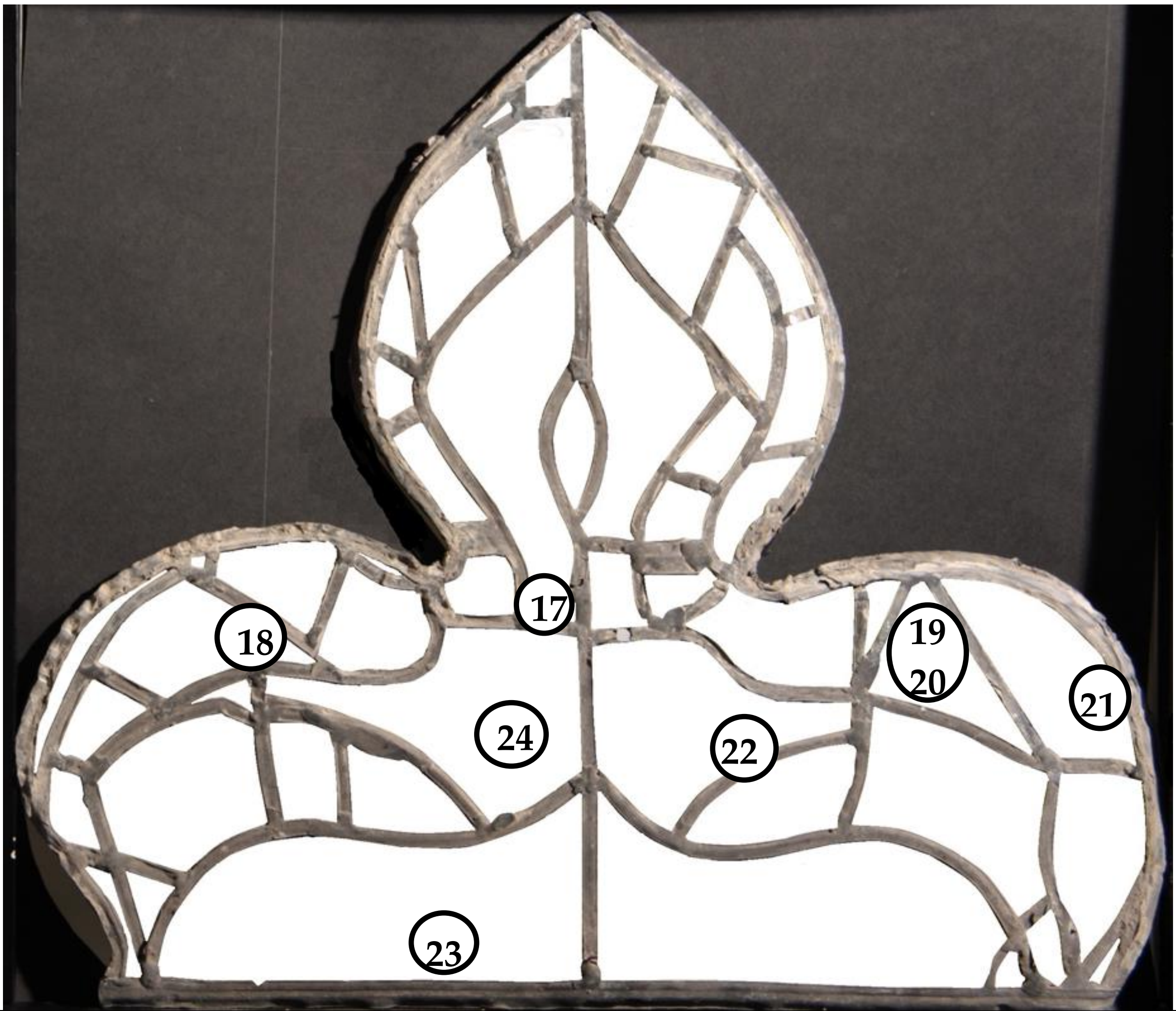
7 – Lead oxidation

8 – Surface soiling – putty

Interior continued

	
9 – Surface soiling – mortar splashes	**10 –** Surface soiling – sticky label
	
11 – Heavy surface soiling and flaking corrosion crusts	**12 –** Deep pitting, cracks, chipped glass and damaged lead
	
13 – Heavily fractured piece of glass, with a small missing area.	**14 –** Mechanical damage on the glass (scratches), where pitting is developing
	
15 – Paint loss	**16 –** Severe paint loss

Exterior



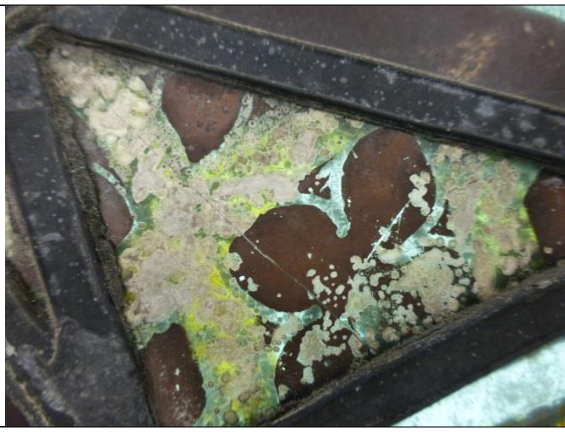
17	Strap lead	18	Severe corrosion
19	Inverted piece, heavily corroded	20	Inverted piece with transmitted light
21	Cracked and chipped glass	22	Failing putty
23	Deep pitting	24	Pitting and mechanical damage (scratches) on yellow stain

Exterior

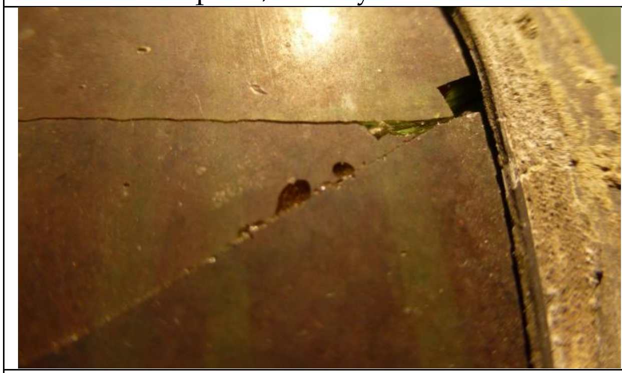
17 – Strap lead

18 – Severe corrosion

19 – Inverted piece, heavily corroded

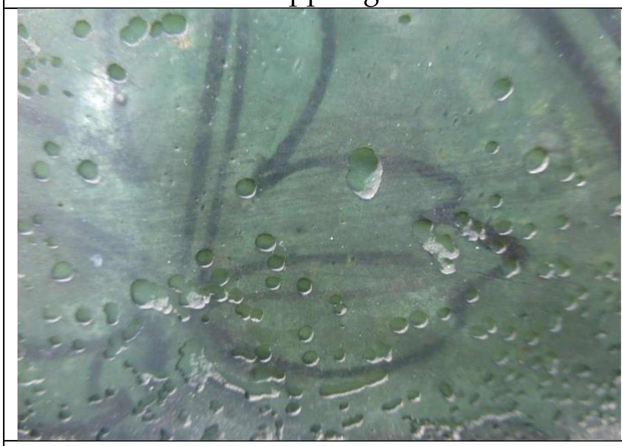


20 – Inverted piece with transmitted light

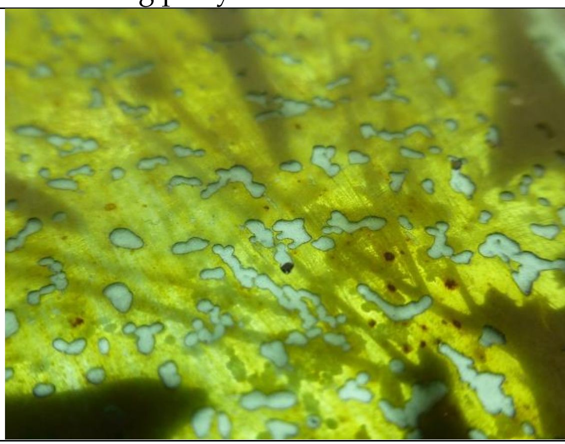


21 – Cracked and chipped glass

22 – Failing putty



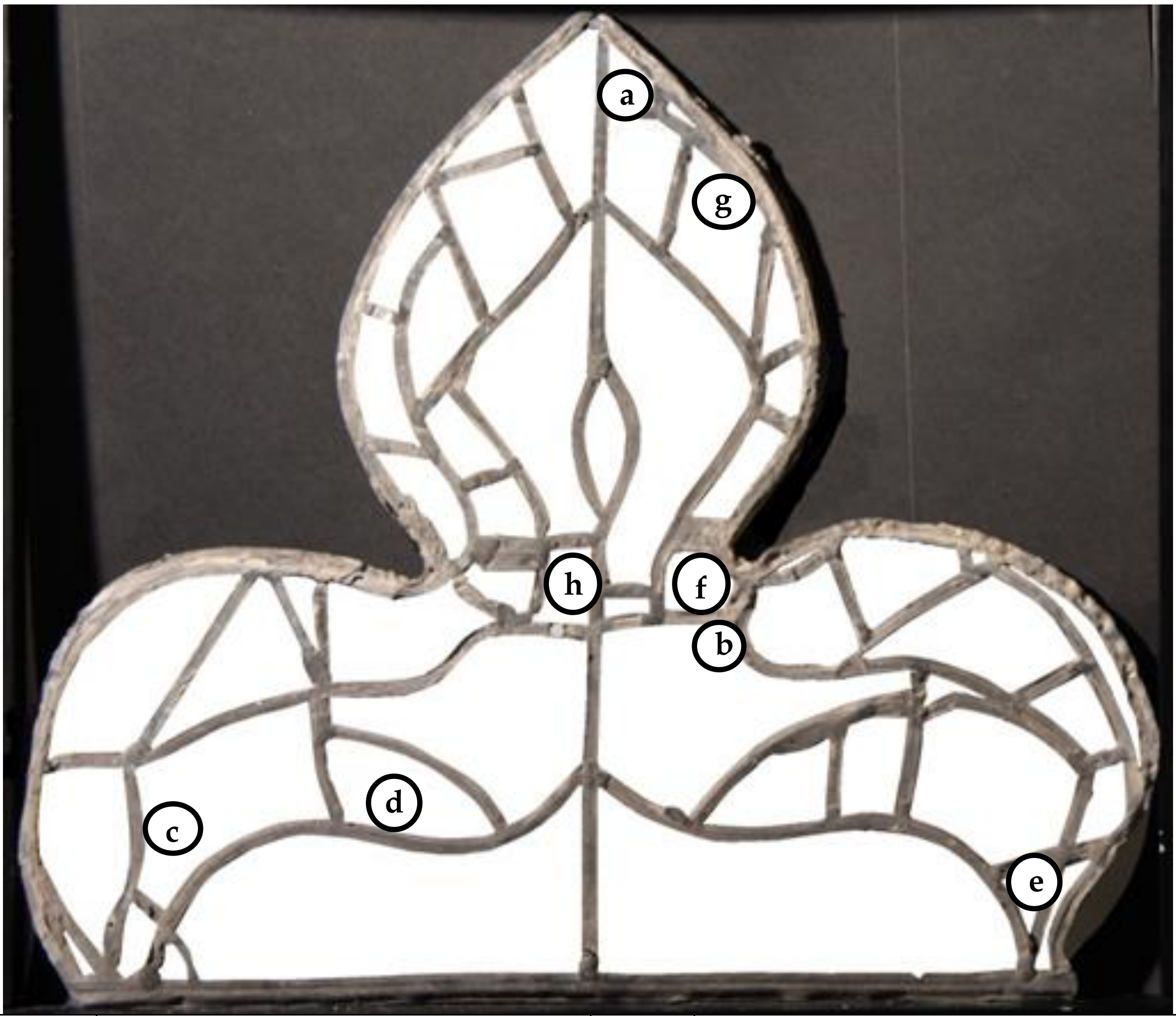
23 – Deep pitting



24 – Pitting and mechanical damage (scratches) on yellow stain

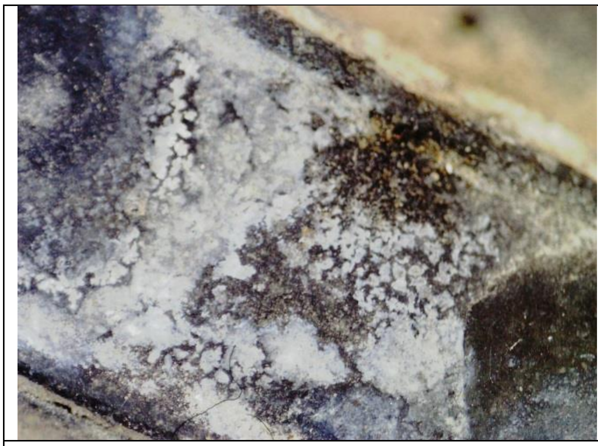
Pre-Conservation Microscopic Photographs

All the microscopic photographs were taken using a by the author on the 5th-6th February 2014, in the Nicholas Barker Studio, King's Manor, University of York. A digital microscope was used which has a magnification of between x1-x4. Below is an image of the panel; the numbers indicate where the microscopic photographs were taken. The images are on the following pages; interior: 23, exterior: 25.
Interior

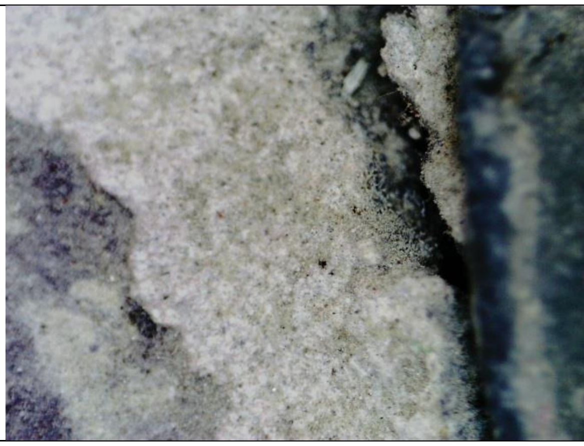


a	Lead oxidisation x1	b	Surface soiling – putty x1
c	Light pitting x3	d	Heavy pitting x3
e	Corrosion crusts x1	f	Corrosion crusts x4
g	Mechanical damage x1	h	Paint loss x1

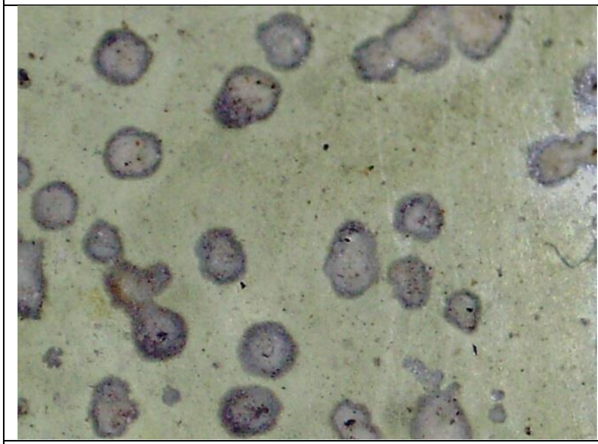
Interior



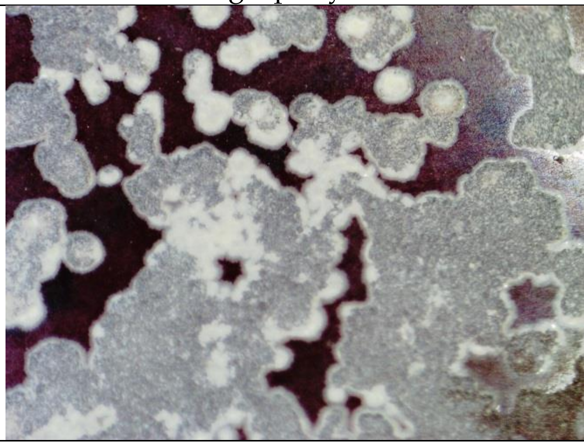
a – Lead oxidisation x1



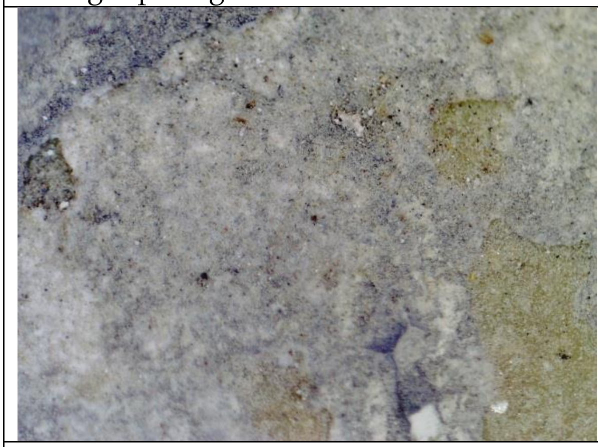
b – Surface soiling – putty x1



c – Light pitting x3



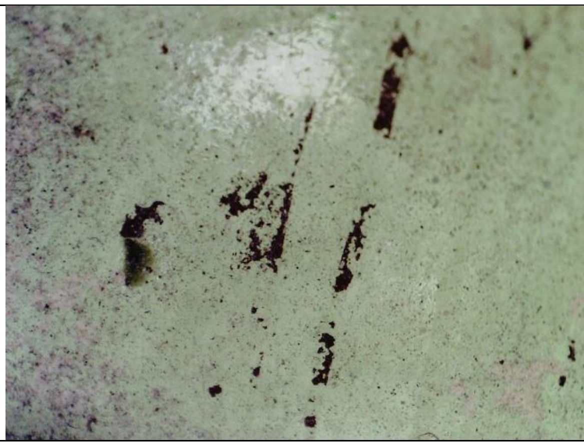
d – Heavy pitting x3



e – Corrosion crusts x1

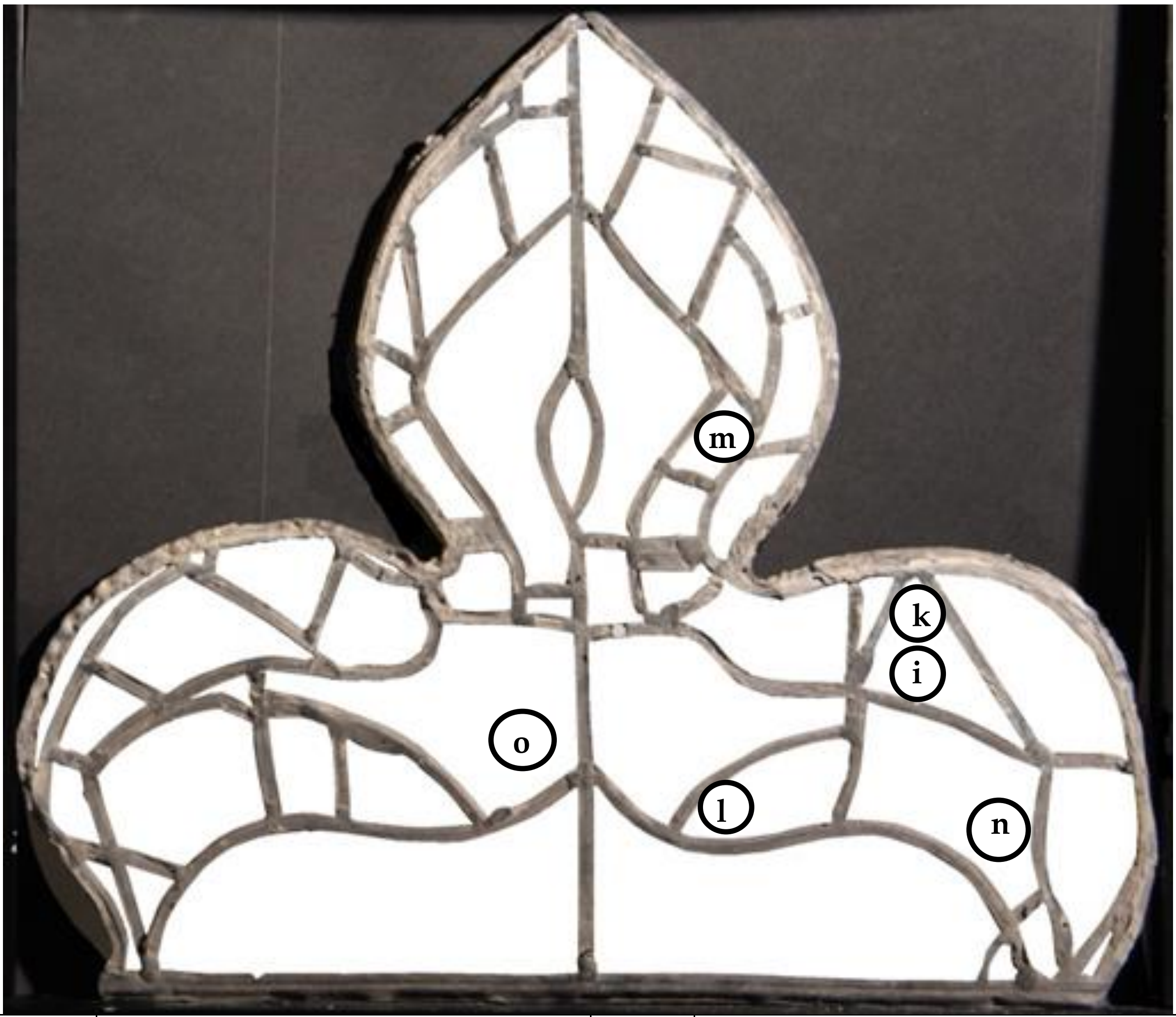
f – Corrosion crusts x4

g – Mechanical Damage x1



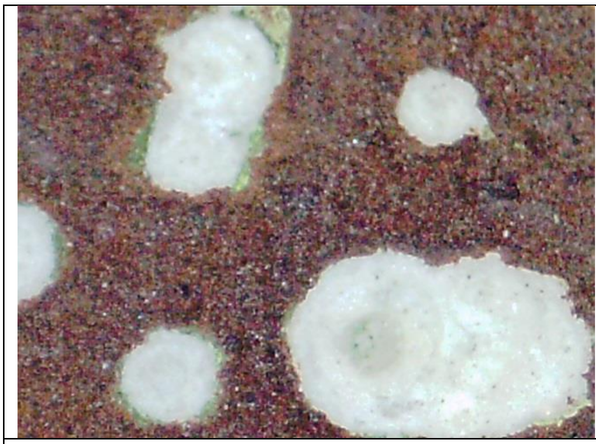
h – Paint loss x1

Exterior



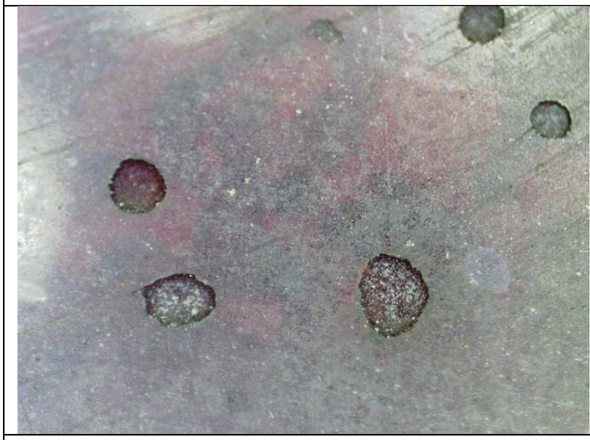
i	Inverted piece with paint	k	Inverted piece without paint
l	Mild pitting	m	Heavy pitting
n	Mechanical damage	o	Yellow stain with pitting

Exterior

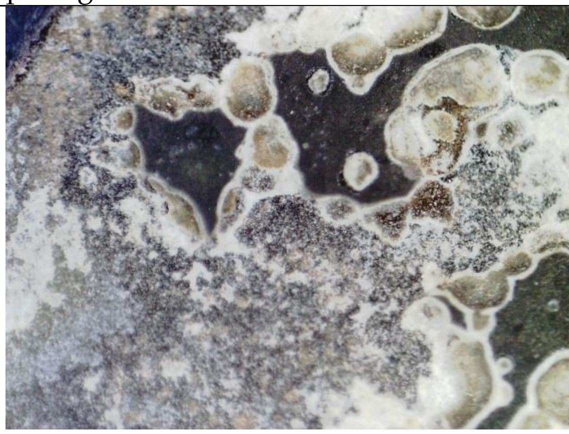


i – Inverted piece with paint and pitting x3

k – Inverted piece without paint, with pitting x1

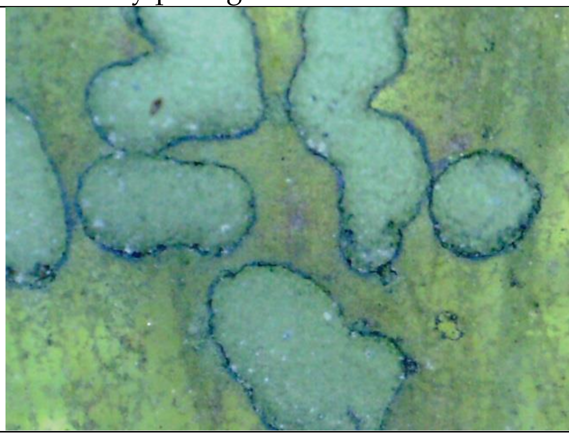


l – Mild pitting x1



m – Heavy pitting x1

n – Mechanical damage (scratches) x1



o – Yellow stain with deep pitting x3

Initial Conservation Proposals
(These proposals were presented to the client on 19th February 2014, for consideration.)

Removal of copper ties: This is done by first cleaning the surface of the solder joint over the copper tie, to aid the heat transfer when de-soldering. They are then de-soldered.

Cleaning Trials: The trials are carried out on painted and unpainted glass from different centuries on the panel, to ensure that the proposed methods of cleaning are safe to use. Mechanical cleaning with brushes and smoke sponges, and chemical cleaning with deionised water, ethanol and acetone will be carried out under a microscope.
If the glass or paint appears to be unstable, the trials will be halted and paint consolidation will be performed (Paraloid B72).

Removal of loose dirt with brushes: This is done to make the panel easier and cleaner to work with. Using soft brushes, brush the surface of the glass and the lead to remove excess dirt. Have the extractor on to get rid of the excess.

Re-soldering broken joints: The old solder joints will first be cleaned, in order to make the heat transfer quicker. This will minimise the risk to surrounding glass and lead which may be exposed to the heat. Solder will then be applied to seal the break.

Strap lead over the missing lead: A strap lead will be applied to the front and back of the missing area of lead, using as close to the same size and profile of lead. It will be soldered in place.

Removing excess putty and other dirt: Mortar, putty etc. will be removed from the surface of the glass using a brushes and a scalpel, under a microscope. Where any bonds between the dirt and the glass are too great ethanol and water will be used to loosen them. Acetone will be used if the ethanol solution does not work.

Removal of the adhesive label: A fume chamber will be made by placing a piece of cotton wool soaked in acetone in a resistant container, and placed next to the adhesive label. A box or air tight container e.g. upside down Tupperware, will be placed over the top of the label and the cotton wool. The fumes will be trapped inside the space and after some time the adhesive bonds should loosen. The fumes will be left to develop for 30minutes, then their effect on the adhesion of the label will be analysed every fifteen minutes.

Securing cracks: I will clean the cracks with acetone, cotton swabs and un-waxed dental floss. Then use Araldite to bond the edges of the break together.

Re-puttying: I intend to re-putty on the back so that the putty does not get into the corrosion or paint layers.

Special Requirements for future use and handling
I would like to recommend that this panel be put on display and used as a teaching tool. Useful information about conservation practises, infills and painting techniques from different periods can be learned. Furthermore the panel can be examined as a sort of warning to show people up close, under a microscope, the appearance and problems of corrosion. People who are not experts in glass science and conservation may not know this but may own stained glass. They should learn how to look after it properly and some people will learn better by seeing, touching and investigating.

After the conservation, the panel will be stable enough to be handled by individuals employed in a museum, to enable this sort of use to be carried out.

Time Schedule

Task	Date	Hours
Condition Report and Mapping		
Pre-conservation Photography	1st Feb 2014	3
Microscopic observation	5th Feb – 6th Feb 2014	4
Observation and condition mapping	6th – 7th and 11th Feb 2014	8
Writing conservation report and proposal	17th – 18th Feb 2014	8
Preparation and meeting clients	19th Feb 2014	4
Further research into methods and trip to church	24th and 26th March 2014	6
Tests and trials	25th March 2014	6
Write up of trials and updated proposal	25th March 2014	3
Performing Conservation treatment		
Removal of surface accretions	7th April 2014	6
Removal of excess putty	7th – 8th April 2014	8
Removal of adhesive label	8th April 2014	3
Re-soldering broken lead joints	10th April 2014	3
Strap lead over missing area of lead	10th April 2014	1
Securing cracks	8th – 10th April 2014	15
Re-puttying	11th April 2014	2
Documentation		
Post-conservation photography	18th April 2014	3
Mapping interventions	14th April 2014	4
Write up report	14th – 15th April 2014	8
Creation of a maintenance plan	15th April 2014	3
Total		**98**

Cleaning Trials – 25th March 2014

Aims

The aim of performing cleaning trials is to determine the safest methods of removing potentially harmful surface accretions from the panel, and discover the success of the methods used. A number of methods have been put forward to the client in the conservation proposal; these will be tested and are as follows:

- Mechanical cleaning with brushes (four types)
- Mechanical cleaning with smoke sponges
- Chemical cleaning with deionised water
- Chemical cleaning with deionised water and ethanol (50:50)
- Chemical cleaning with acetone

Methods

A variety of glass types will be tested: painted and unpainted, corroded and non-corroded, and glass from different dates. This is to ensure all phenomena have been accounted for, because different pieces of glass may not react identically to treatment.

General soiling, putty smears and mortar splashes will be cleaned.

Lead will not be tested in the cleaning trials because it has been determined the dirt is not significant enough to cause further damage.

A microscope will be used at all times during the cleaning trials to ensure the maximum degree of control over the results.

Preliminary examination under a microscope shows that the paint layers are stable.

If the paint appears to be fragile and flaking after cleaning, the trials will be stopped. Paint consolidation, using Paraloid B72 will be performed on flaking paint.

Brushes	Gentle brushing with soft brushes working up to slightly rougher. Only the side off the brushes are to be used, rather than the point and strokes only in the same direction, to minimise risk of damage. Four types of brushes were used. A small very soft one, a large very soft one, a rougher flat one and a rougher round brush.
Smoke sponges	The smoke sponge is rolled over the dirty area, without applying pressure and without wiping. The sponge will attract the dirt in its substrate, and remove it safely.
Chemicals and cotton swabs	A cotton swab is dipped, but not soaked in the solution. It is then rolled across the surface of the glass to loosen the bonds and absorb the dirt. The swab is not wiped across the glass surface.

Conclusions from the cleaning trials

All methods tested did not damage the original fabric of the panel and care was taken to ensure that nothing was removed from the panel which would not cause harm or further damage. Acetone was not tested in the end because it was felt that all surface phenomena could be treated effectively with the methods outlined above, based on their results.

Soft brushes will be used for the majority of the cleaning of general soiling in conjunction with smoke sponges, which will pick up the excess of loose dirt. Where dirt is still adhered to the surface, steps will be taken using deionised water, and deionised water and ethanol (50:50) to remove it, however this treatment will not be carried out on heavily corroded glass. The same method will be applied for the removal of putty smears and mortar splashes. Corrosion pits will only be brushed using a soft brush because more vigorous action is not necessary.

At all times a mask will be worn and the extractor fan switched on. This is done as a health precaution, due to the discovery that a lot of dust was distributed into the air during the cleaning. Furthermore red lead was found inside the putty. This is an extremely dangerous product which should not be inhaled.

As mentioned above the microscope will remain in use throughout the cleaning, as well as a lamp, which offers a greater degree of control and observation.

Revised Conservation Proposals

The following are a revised set of conservation proposals based on meetings and correspondence between the conservator and the client (see appendix A), and the results of the cleaning trials (which can be seen in detail in appendix B).
The majority of items stay the same; however the treatment of the copper ties, the use of chemicals and the extent of re-puttying has changed.

Straightening and flattening copper ties

Removal of general soiling, excess putty and mortar splashes

Removal of adhesive label and sticky residue

Re-soldering broken joints

Strap lead over the missing lead

Securing cracks

Re-puttying where necessary

Methodology and Reasons

Flattening and straightening of copper ties
The copper ties will not be removed from the panel, as originally suggested, because they embody an element of the objects history, and according to the CVMA guidelines are integral to the panel as part of a whole.[3]
The ties will be straightened and flattened as best as possible against the lead. This will ensure that no damage will occur on the surrounding glass. Extra care will be taken during the conservation of the panel to ensure no adverse effects will be caused due to their retention, especially when the panel is lying on its front.
Advise will be recommended for the future handling of the panel and how best to work around the ties.

Removal of general soiling, putty smears and mortar splashes
Dust and other surface dirt must be removed because of the potential damage that can occur on the surface of the glass. Humidity can become trapped and the dirt is potential food for microorganisms. This will increase the likelihood of further corrosion and degradation.[4] However, if the putty or mortar is too difficult to remove, it should be left rather than forced, such force could damage the glass further.
Soft brushes will be used to clear the dust from the panel and rougher brushes will be used where the soft brushes have not succeeded. The brushes must be brushed against the glass and dirt in one direction, for the safety of the glass and paint. Smoke sponges will also be rolled gently across the glass to remove excess loose dirt.
If remnants of putty and mortar remain, deionised water or ethanol and deionised water (50:50) will be applied with a cotton swab. This should be sufficient to remove all the dirt on the panel, which has been shown in the trials. The swab will be rolled across the surface of the dirt and not wiped, for the safety of the glass and paint. The dirt will be absorbed.

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[3] CVMA, *Guidelines for the Conservation and Restoration of Stained Glass,* (Nuremburg, 2004), 4.5.
[4] J. Ashley-Smith, *Science for Conservators, Vol. 2: Cleaning,* 2nd edition (London: Museums and Galleries Commission, Conservation Unit, 1992), 14.

If a stronger solvent is considered to be necessary later in the conservation, more trials will be carried out to ensure it is safe.
Wet cleaning will not be carried out on the pieces of glass which have corrosion on them including pitting or corrosion crusts. This is because water and chemicals can accumulate in these areas, increasing the possibility of future chemical reactions, between the cleaning solution and the glass, causing the deterioration of the glass to accelerate.[5]
All cleaning will be carried out under a microscope, with a lamp and the conservator will wear a mask and have the extractor fan on.

Removal of the adhesive label
It can be considered that the adhesive label offers important information on the history of the panel; however the negative effects are significantly strong enough for its removal. Adhesive labels on glass can be damaging for the same reasons which were mentioned with reference to surface dirt, putty and mortar; but the removal of adhesive labels is more dangerous. For this reason a particular method will be used for the removal, which is safer. A fume chamber will be made by placing a piece of cotton wool soaked in acetone in a resistant container, and placed next to the adhesive label. A box or air tight container e.g. upside down Tupperware, will be placed over the top of the label and the cotton wool. The fumes will be trapped inside the space and after some time the adhesive bonds should loosen. The fumes will be left to develop for 30minutes, then their effect on the adhesion of the label will be analysed every fifteen minutes.

Re-soldering broken joints
Broken leads and solder joints will need to be soldered in order to give the panel stability and make it safer to handle. Currently the panel is very fragile and falling apart.
The old solder joints will first be cleaned, in order to make the heat transfer quicker. This will minimise the risk to surrounding glass and lead which may be exposed to the heat. Solder will then be applied to seal the break.

Strap lead over the missing lead
The small area of missing lead will be covered and soldered using a strap lead of the same size and profile as the original lead. This will increase the stability of the panel and support the surrounding areas of glass and lead.

Securing cracks
The cracks will be cleaned with acetone, cotton swabs and a scalpel. Araldite will then be used to bond the edges of the break together. This will ensure that the broken glass is protected from potential loss and again, adds stability to the whole of the panel. Araldite was chosen for the edge bonding because it is strong and adheres well to the bulk. Although it is not weatherproof, the panels will not be put in situ.[6] Furthermore the type of araldite used (see table of materials) only showed slight browning in published research whilst others browned significantly, and it did not show signs of brittling or flaking.[7]

[5] R. Pender and S. Godfraind, (eds.) *Practical Building Conservation: Glass and Glazing,* (Farnham: Ashgate, 2011), 207.
[6] E. Jägers, H. Römich and C. Müller-Weinitsche, 'Conservation: Materials and Methods', in A. Wolff (ed.), *Restaurierung und Konservierung historischer Glasmalereien,* (Mainz: Verlag Phillip von Zabern, 2004: 129-166), 2.6.
[7] Jägers, Römich and Müller-Weinitsche 'Conservation: Materials and Methods', 2.4.

Re-puttying
Certain areas on the reverse of the panel will be re-puttied. There are some areas in the central section where the putty has come away completely and the panel is unstable.
Old putty will not be removed from the entire panel, only a small amount from the sections where the re-puttying will take place, to ensure its strength. These areas are mapped on the interventions mapping diagram.
Only the reverse of the panel is to be re-puttied because, this ensures the new putty is less likely to come in contact with original paint layers, or in corrosion crusts, or pits.
A sample will be kept of the old putty, and all areas where the new putty is placed, will be recorded.

Materials

New Material	Composition	Manufacturer
Araldite 20:20 (XW396) (XW397)	Bisphenol A (epichlorhydrin), epoxy resin: isophorone diamine, butanedroldiglycidyl.	Huntsman LLC, Advanced Materials, Europe.
6mm Flat profile lead	Lead alloy	Stilleman's lead, sourced from York Glazier's Trust.
Glazier's putty	Linseed oil, whiting, lampblack	Unknown, Nicholas Barker Studio, University of York.

Discoveries

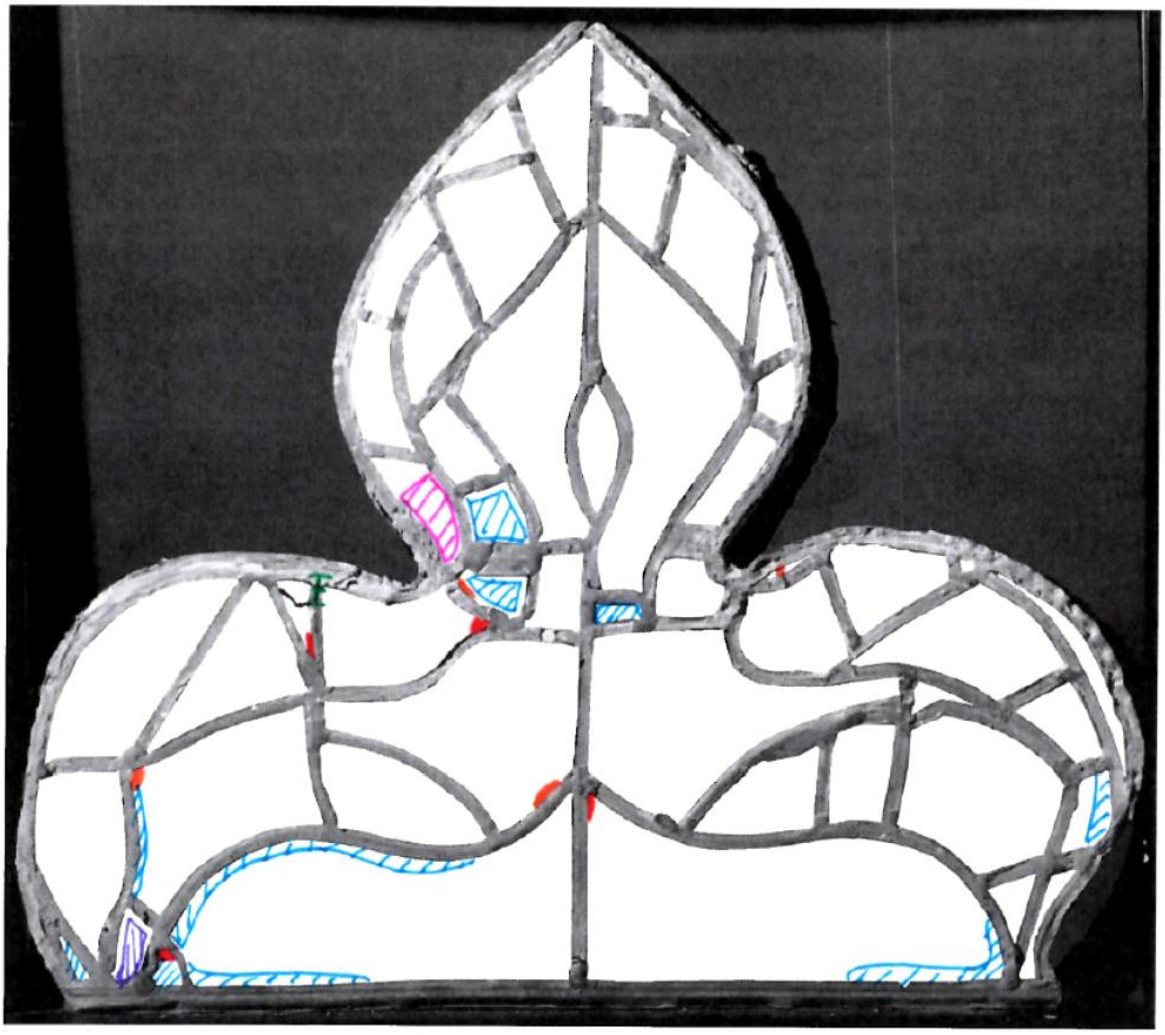
The conservation work was completed as specified above in the methodology between the 7th and the 11th April 2014, a detailed and illustrated diagnostic of which can be found in appendix C.
During the cleaning work a number of interesting factors came to light. The first of which was the appearance of two more areas of sticky residue underneath the dirt. There was also chipped glass, glass that was cut too small and one crack in a piece of glass, underneath copious amounts of dried putty. One broken gap in the lead beside a soldering joint was also revealed underneath an amount of dry putty. More scratched glass was discovered under the dirt in one small area.
These factors must be considered and acted upon in the remainder of the practical conservation. A further mapping diagram has been made for these discoveries, and is on the following page. The broken lead must be re-soldered, the sticky residues will be removed along with the already mapped ones and some of the chips and missing areas of glass will be puttied. The discovered crack does not require edge bonding because it is in a small piece and seems to be secure.

All interventions are mapped in the intervention mapping diagrams on pages 38 and 39.

Most interestingly paint was discovered around the edges of the two large pieces at the bottom of the panel. Around the lead there was a thick layer of putty and underneath this there appears to be a wash of paint. This is an unusual discovery and could point toward the suggestion that there was a wash across these pieces, and the paint has been lost. Although this type of paint loss seems unlikely more investigation could be carried out. Two other areas were uncovered which show signs of remnants of paint. These are identified on the following diagram.

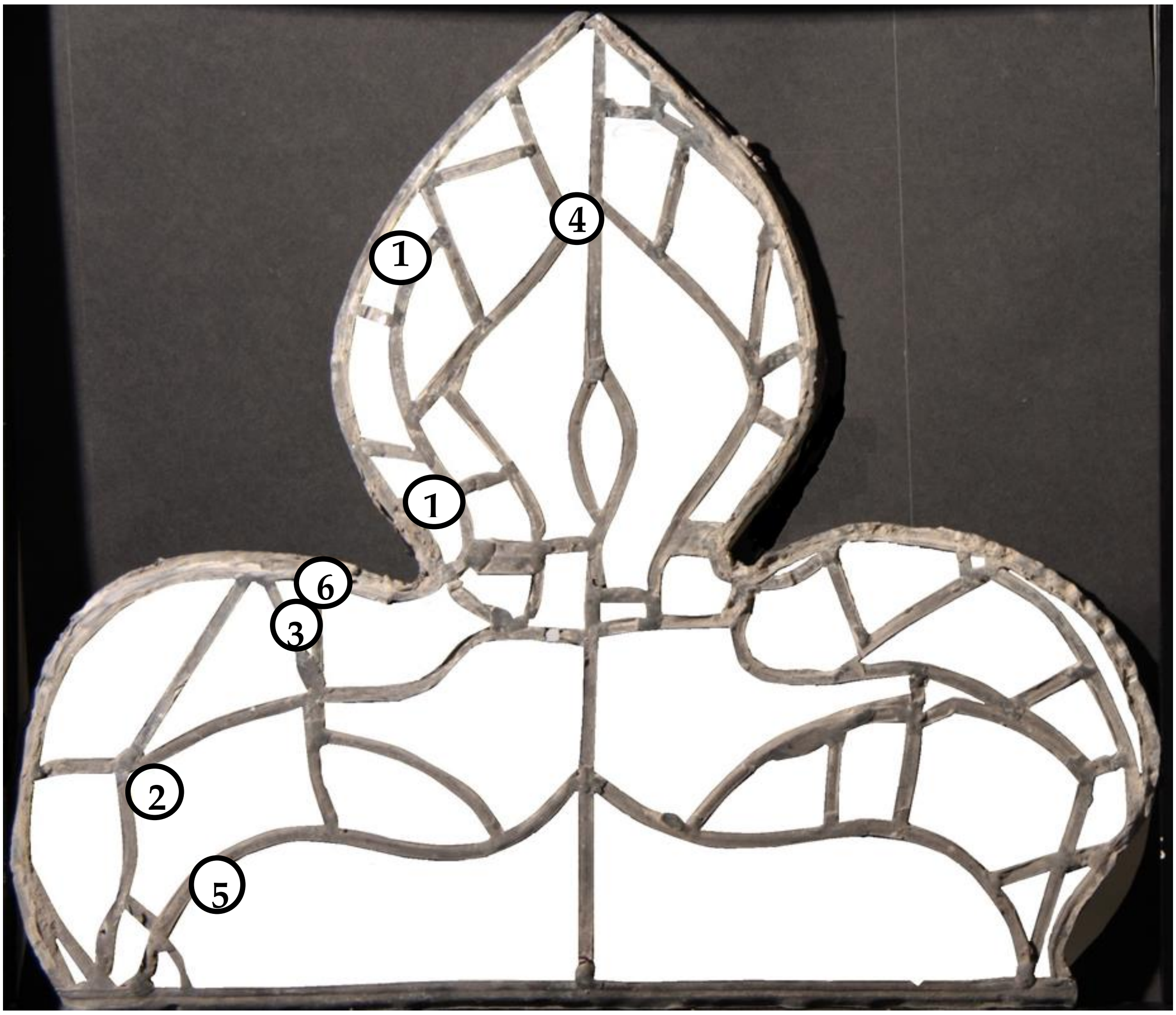
Mapping of Discoveries

The following mapping was hand drawn by the author on Friday 11th April 2014, using a template of the lead net of the panel. It shows the location of the discoveries described above which came to light in the conservation work, on the interior.



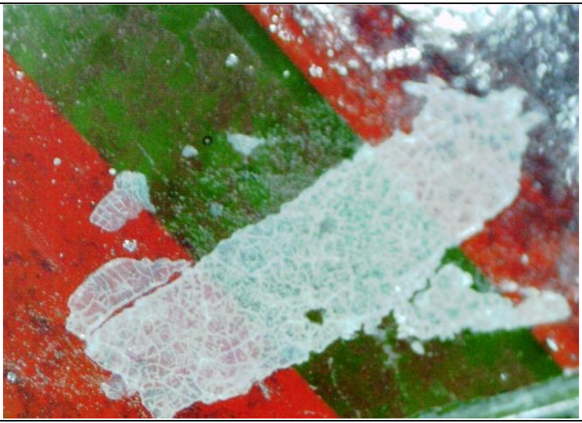
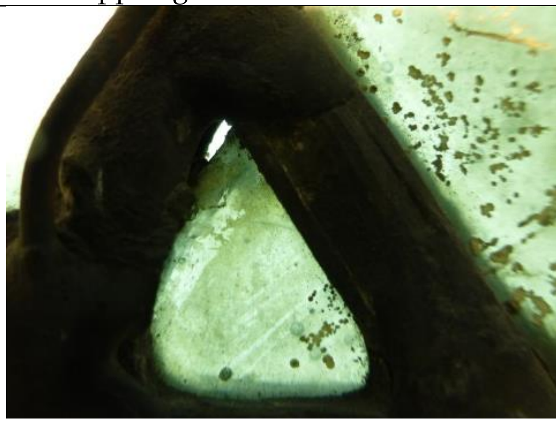
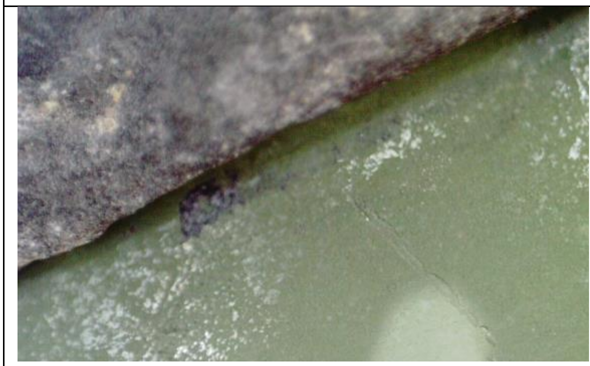
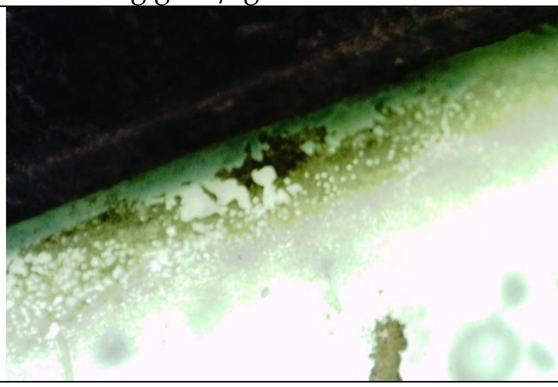
Damage or other found during the cleaning	Symbol
Sticky residue	
Chipped glass	
Crack	
Scratched glass	
Missing glass/glass cut too small	
Broken/missing lead	
Paint	

Detailed/ microscopic photographs of discoveries

All the detailed photographs were taken by the author on 8th-10th April 2014. They highlight significant discoveries which came about during the practical conservation, which have been outlined on the mapping diagrams for discoveries. Below is an image of the interior of the panel with numbers; the numbers indicate the location of the detailed images.
Interior 

1	Sticky residue	2	Chipped glass
3	Crack	4	Missing glass/glass cut too small
5	Paint	6	Broken/missing lead

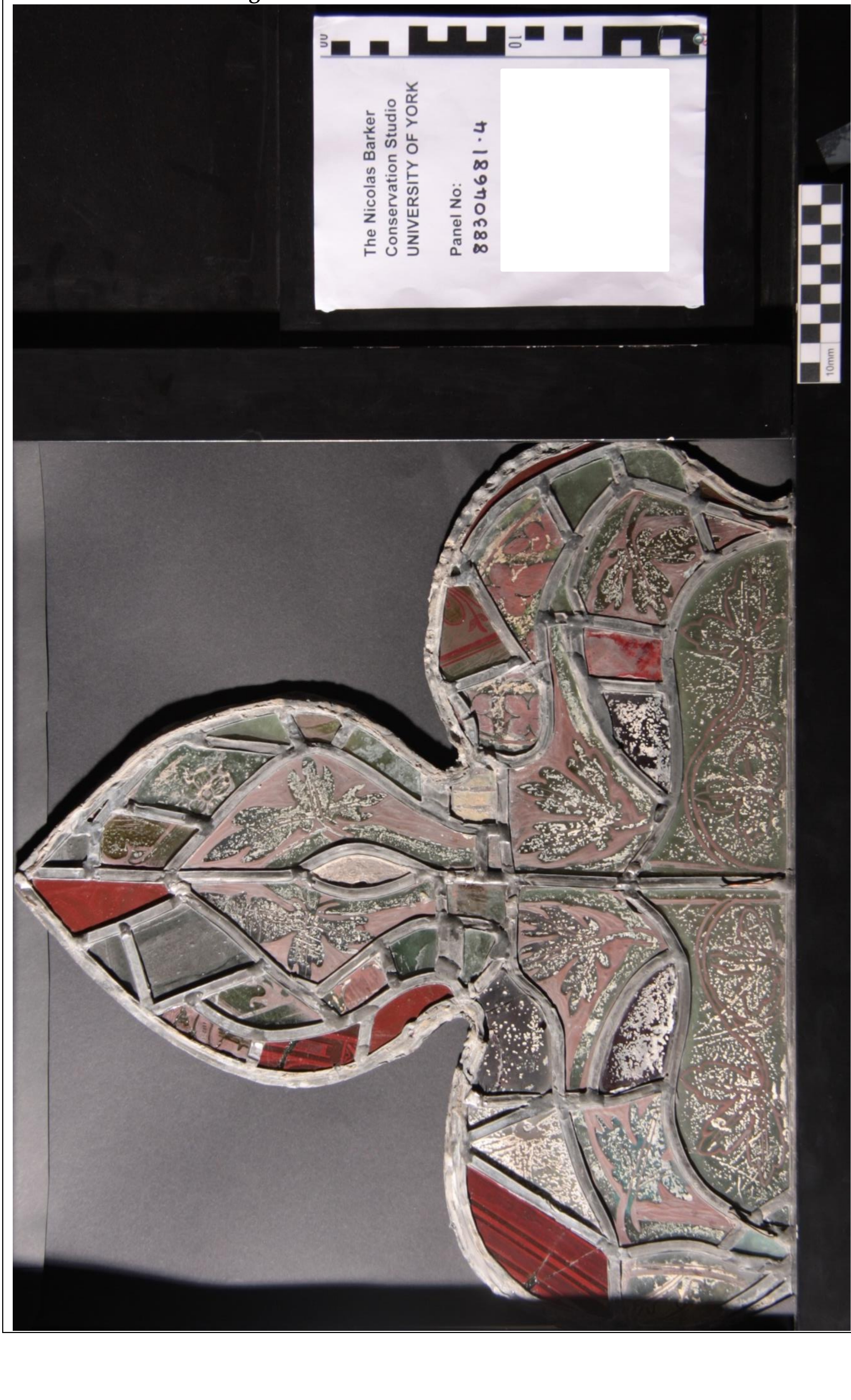
Interior

	
1 – Sticky residue (x1 zoom)	**2 –** Chipped glass
	
3 – Crack	**4 –**Missing glass/ glass cut too small
	
5 – Paint	**7 –** Paint (x1 zoom)
	
6 – Broken/ missing lead	

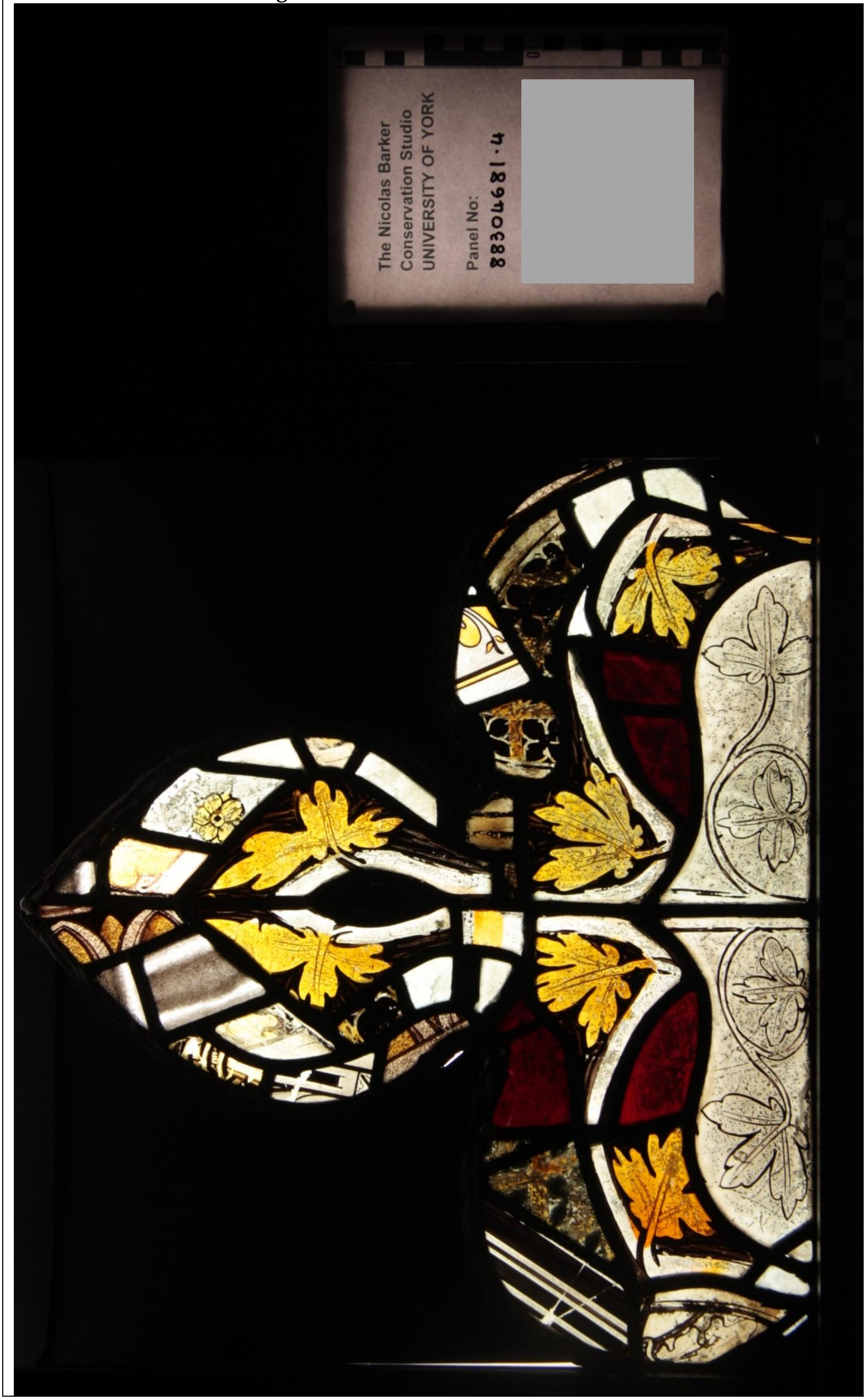
Post-Conservation Photographs

All photographs were taken by the author on Friday 18th April 2014, in the Nicholas Barker Studio, University of York. The images are of the full panel in colour.

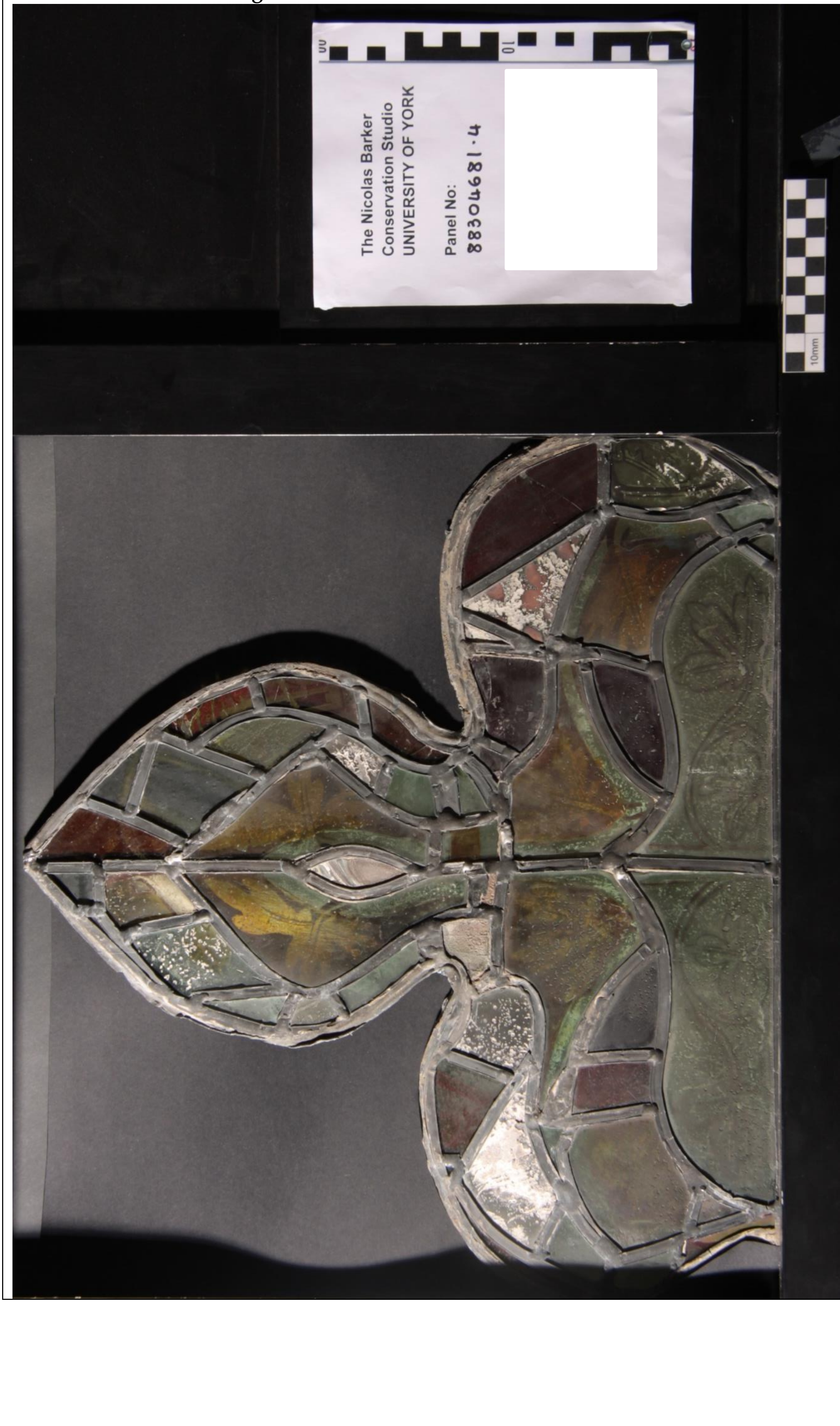
Interior with reflected light



Interior with transmitted light



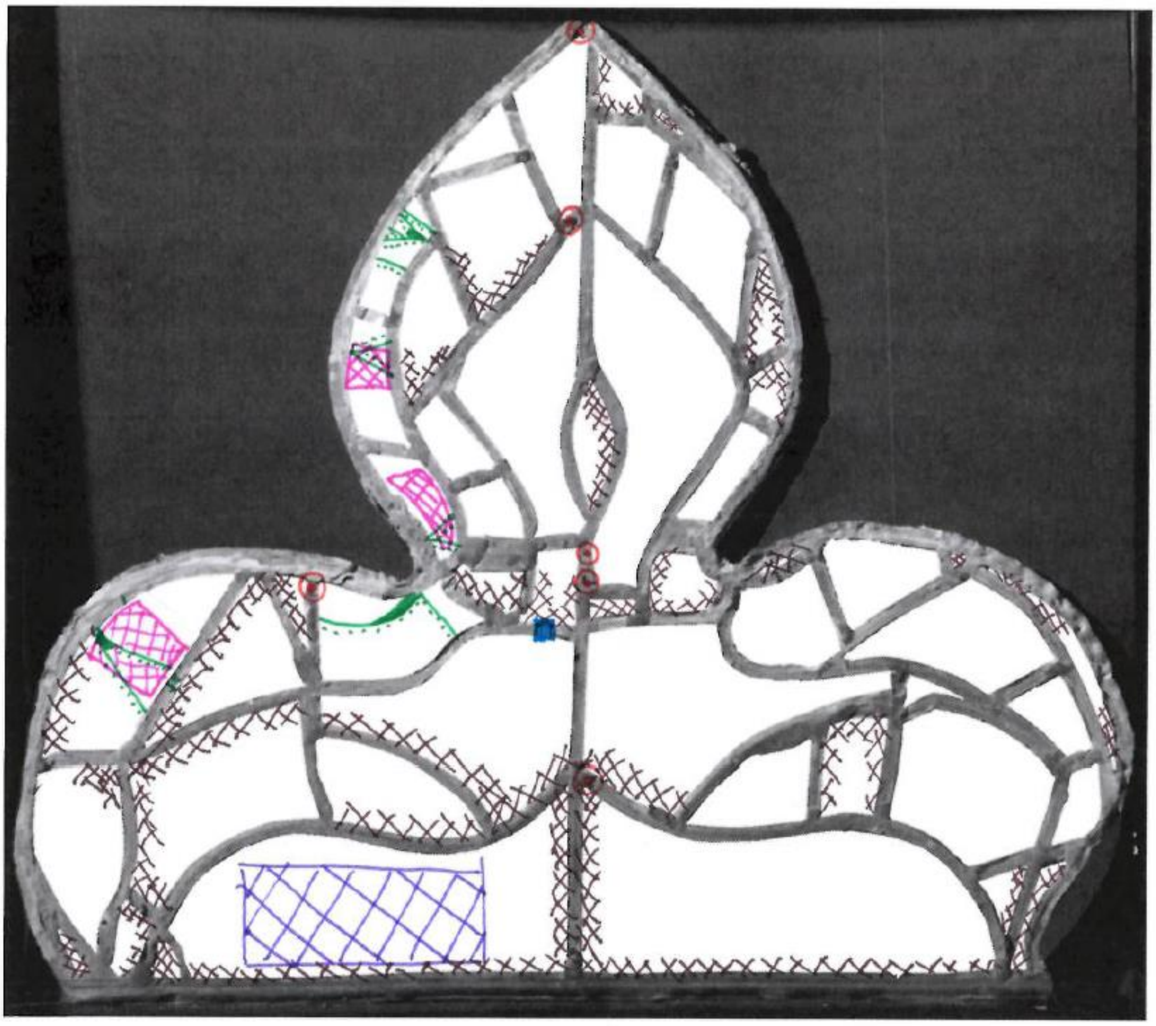
Exterior with reflective light

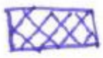


Intervention Mappings

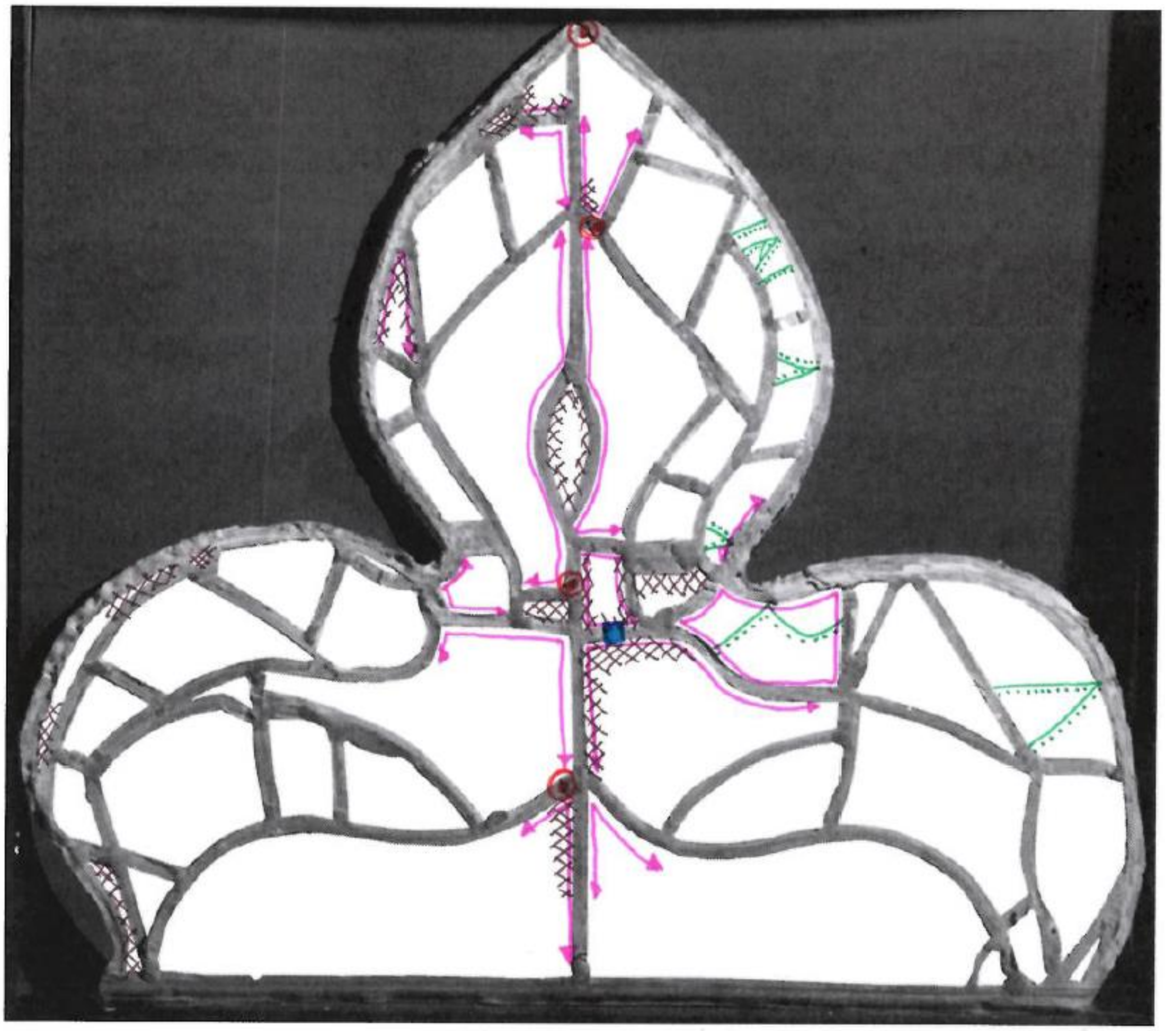
The following pages contain hand-drawn condition mappings using a template of the lead-net of the window. They were drawn on the 11th April 2014, by the author, after the completion of the conservation work.

Interior



Damage or other found during the cleaning	Symbol
Cleaning of label	
Cleaning of sticky residue	
Cleaning of excess putty	
Edge bonded cracks	
Araldite infill	
Resoldered joints	
Strap lead	

Exterior

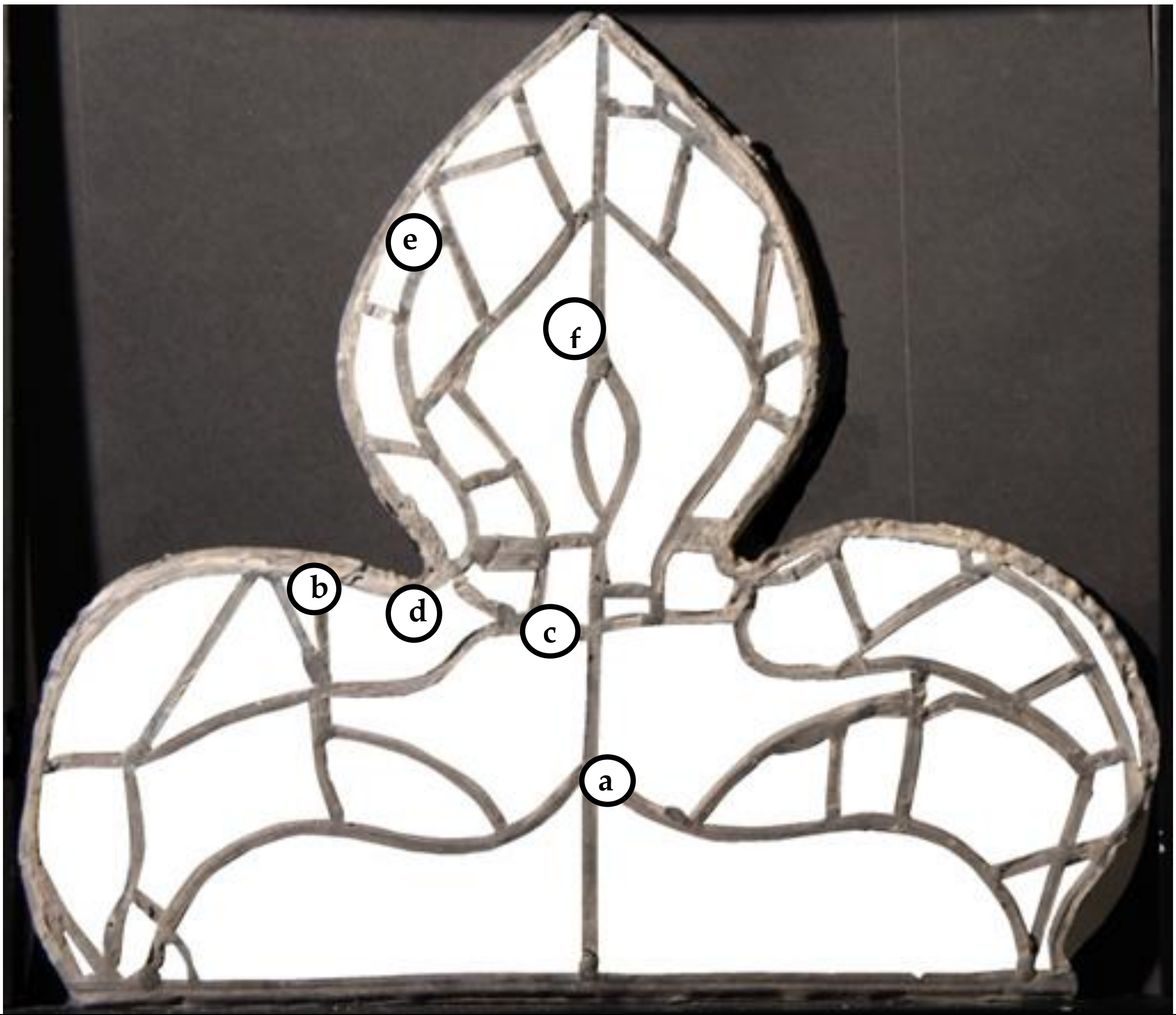


Damage or other found during the cleaning	Symbol
Cleaning of excess putty	(cross-hatched box)
Edge bonded cracks	(green line with dots)
Resoldered joints	(red circled dot)
Strap lead	(blue square)
Area of reputtying	(pink line)

Post-Conservation Detailed Photographs of interventions

All the detailed photographs of interventions were taken by the author on the 9th-11th April 2014, in the Nicholas Barker Studio, King's Manor, University of York.
Below is an image of the panel; the numbers indicate where the photographs are taken.

Interior



a	Solder joint	b	Solder joint
c	Strap lead	d	Araldite infill
e	Araldite infill	f	Re-puttying (on exterior)

a – Solder joint

b – Solder joint

c – Strap lead

d – Araldite infill

e – Araldite infill

f – Re-puttying (on exterior)

Conclusions

Cleaning
The cleaning was carried out according to the proposed methods discussed in the detailed conservation proposals. The cleaning was successful although it took slightly longer than was expected. This was due to the careful removal of thick putty which took longer in some places than it had in the trials. Furthermore one area of mortar which was on the lead was removed; this was not trialled and needed the application of a poultice for its removal.
The adhesive residue was removed with ease using the fume chamber method, however the removal of the label took several exposures to the fumes, and each time a little more of the label was loose. All the label and adhesive residue was successfully removed.
Although the surface soiling, putty, mortar and adhesive residues and label were removed successfully using the methods outlined in the proposals, the end result still looks dirty due to the large levels of corrosion on the surface of the glass. These areas could not be thoroughly cleaned because it would be more damaging to the glass, and for this reason pits in the glass remain white, and some still contain putty.

Re-soldering
The re-soldering proved to be quite difficult due to the dirt on the surface of the lead. Most of this was removed but the new solder did not adhere easily to the old lead. The final result was, however a success, with no damage to the existing lead and neat solder joints.

Strap lead
A strap lead of the correct size was found and cut to fit the area. Aside from the aforementioned issues with the solder and the existing lead, no problems arose with its attachment.

Edge bonding and araldite infills
The preparation of the cracks for edge bonding was quite difficult because it was difficult to clean thoroughly inside the cracks, with moving the glass. In order to move the glass to help clean the cracks more thoroughly, putty would have to be removed and that was not acceptable. The cleaning seems to have been sufficient as the araldite bonds are strong. There were no problems with the edge bonding and cleaning after the edge bonding.
Two very small araldite infills were made and these have held nicely in place and ensure the survival of the surrounding glass.

Re-puttying
A lot of dry putty fell out from beneath the lead during the cleaning of the panel. Although the panel seems stable at the moment, there is a chance this has made the panel weaker. The re-soldering of the joints made the panel much stronger, but re-puttying was still considered necessary for the central areas of the panel which were the weakest. The re-puttying was carried out on the reverse and left to dry. The lead was not moved to put the putty in and in some areas a scalpel had to be used to push the putty into the small space, but this was achieved to an acceptable level.

General
The panel is now in a much more stable condition and safe to handle, without the danger of losing pieces of glass or damaging the glass or lead further. The panel is much cleaner and this is beneficial from an aesthetic point of view, but also helps prevent against things such as condensation and corrosion.

Samples from the panel

Samples of putty were taken from the panel and saved for the client. The areas from where the putty was sampled are shown in appendix D.
One small piece of lead that came off the panel during cleaning was also saved, this piece was dry and damaged and there was no way to reattach it. It is not even clear where it came from, because the area of lead where it was found seems to be entirely complete. This is also pointed out in appendix D.
One tiny piece of glass was found in the dirt which accumulated alongside the bottom lead. It is not clear where this piece came from but it could have fallen and rested there with the other dirt, when the panel was upright, or during its de-installation.
Two other miniscule shards of glass flaked off an area which has a crack in it. These shards were saved because they have some remnants of paint intact, but even with the use of araldite they could not have been re-placed in the correct area.

Recommendations for Future Handling and Maintenance

Environmental conditions

It is essential that the environmental conditions are controlled because it has a major effect on the corrosion of the glass.[8] The suggested humidity and temperature levels are as follows:
Relative humidity: 45-65% RH with a maximum fluctuation of 10% per 24 hours.
Temperature: 16-24˚C with a maximum fluctuation of 4˚C per 24 hours.

Storage

The panel will be in storage for some time with the possibility of its use on display in the future. The storage unit should be stainless steel because it will not react with the lead or panel. However this is an expensive measure and the alternative would be a cheaper material, such as MDF for the shelving unit with the panel resting on acid-free paper which provides a safe barrier between the panel and the shelf. The acid-free paper should also be placed on the top of the panel, as this will protect it from dust.
The panel should not be stored upright unless a suitable display case has been produced for its storage on display. If this is considered in the future, a professional conservator should be consulted on the specifications for the display case.

Handling

The panel should be handled as little as possible. Once put into storage handling should be avoided unless it is moved for relocation or display. The panel can be moved by individuals who are not conservators providing they have been trained. It is small and stable enough to do so, while taking care not to damage it.
The panel should only be carried vertically, with one hand supporting it underneath and the other at the top. The glass should not be held during the handling, only the lead, at strong points such as joints. When lifting the panel should be moved to the edge of the table or shelf and slid carefully off so that the bottom half is no longer on the shelf. The panel can then be pivoted on the edge of the table/shelf into the hand of the carrier which is at the bottom of the panel. This action should be reversed when putting the panel down again.

[8] S. Fearn, 'Investigation of the room temperature corrosion of replica museum glass', *V&A Conservation Journal* 50, (2005), 3.

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Appendix A – Client / Conservator correspondence

This appendix contains details copied from emailed correspondence between the conservator and the client. Details are quoted word for word, but names, contact details and attachments have been left out.

Email from the client to the conservator on 21st March 2014. A response to the condition report and conservation proposals presented in the meeting of 19th February 2014.

Dear [redacted],

It was good to meet you on 19th February to discuss the conservation treatment on the panel from St. Peter's Church, Barton-upon-Humber.

Caroline and I have discussed the proposed treatment and read your report in more detail and have the following comments:

We thought your report was very clear, professionally presented and it was good to see the brief history/description and especially the statement of significance included.

Please go ahead with the proposed treatments taking note of the following:

Removal of copper ties: please only remove if they do pose a risk to the object which cannot be mitigated any other way.

Re-puttying: Please only re-putty where necessary for stability..

Please feel free to contact me if you want to discuss anything further.

Best wishes,
[redacted]

Email from the conservator to the client on 27th March 2014. A response to the email from the client and cleaning trials containing revised conservation proposals.

Dear [redacted],
It was great to meet you and Caroline last month, and thank you so much for the comments on my report.

I have considered your comments, performed some cleaning trials and come up with a revised conservation plan based on both of these things. Please find this attached. A lot of it remains the same, but there are changes to the treatment of copper ties, cleaning and re-puttying.

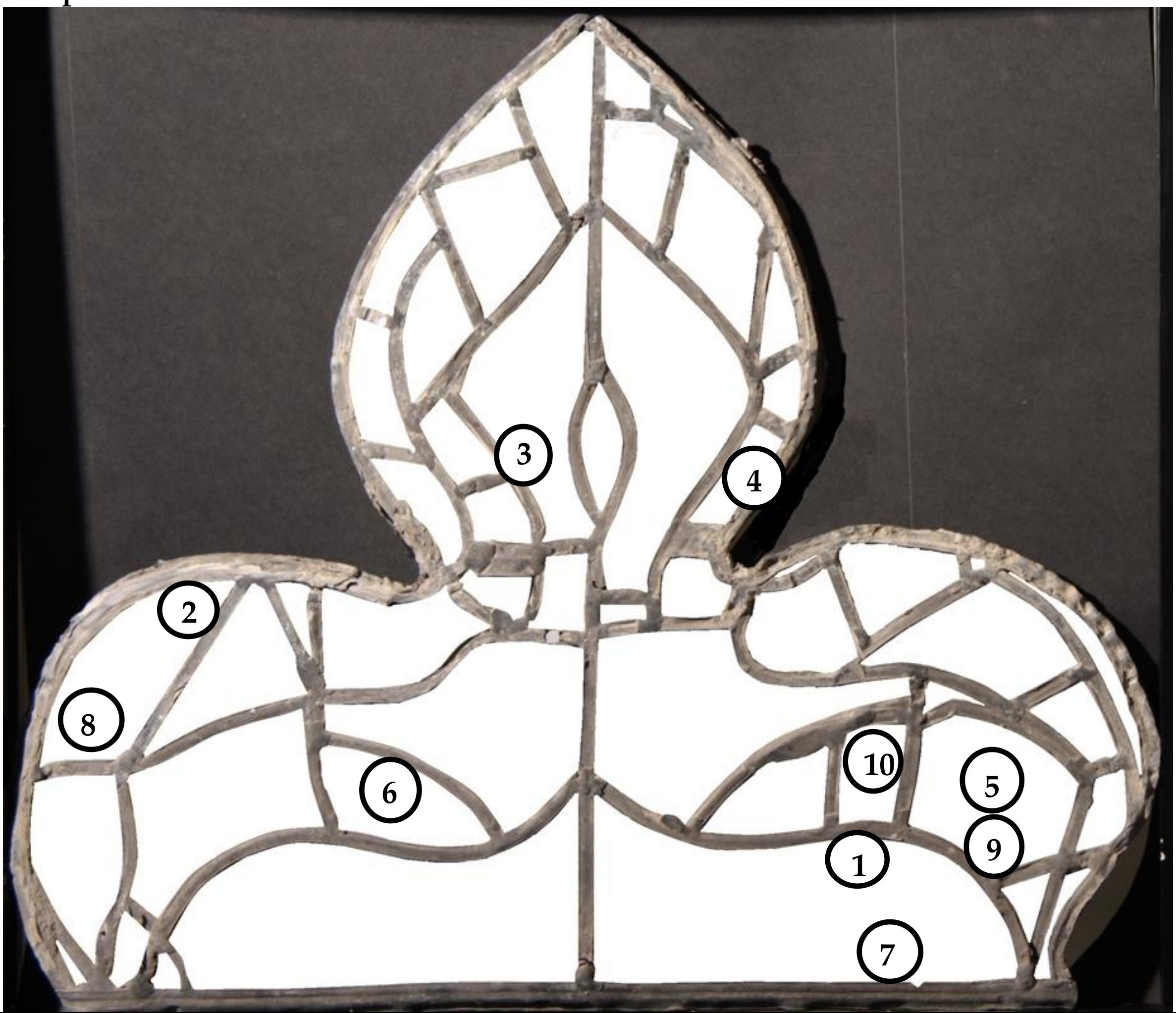
I have also included a table of the results of the cleaning trials and a plan of my time schedule for the project if you would like to look at them.

With regards to the copper ties, I have had a chat with Lauren, Hanna and Monika. Lauren and I feel that leaving the ties attached is certainly something we could work with for our head panels. The ties are attached to the front of the panel only, are not very long and can be straightened against the nearby lead quite easily.
With this in mind the panel must be handled more carefully and this will be worked into the handling and maintenance instructions in the final report.
For the time being we are not considering coming up with an alternative method of covering them, because this would only serve to make the ties themselves more

bulky. However if you feel strongly about having something in place do let me know. I will keep you posted if any other problems arise. All the best [redacted]
Email from the client to the conservator on 1st April 2014, confirming the agreement of the conservation plans. Dear [redacted], Thank you for this further information, very useful and comprehensive. I'm pleased you have been able to find a way to retain the original copper ties. Please go ahead with the revised treatment plan. Best wishes, [redacted]

Appendix B – Detailed results of cleaning trials

The following is a detailed log of the results of the cleaning trials performed on the 25th March 2014. A variety of areas were chosen for testing and these are identified below. They were tested to ensure their stability and the safety and success of the cleaning methods. The conclusions are presented in the main report and outline the reasons for choosing methods in the final conservation proposals.
Samples



Testing mechanical methods Cleaning general soiling	1	14th century, painted
	2	19th century, painted
Testing mechanical methods Cleaning putty	3	14th century, painted
	4	19th century, unpainted
Testing mechanical methods Cleaning mortar splashes	5	14th century, painted
Testing mechanical methods Cleaning pits	6	14th century, unpainted
Testing deionised water Cleaning general soiling	7	14th century, painted
Testing deionised water and ethanol (50:50) Cleaning general soiling	8	19th century, painted
Testing deionised water alone and water ethanol (50:50) Cleaning putty	9	14th century, painted
Testing deionised water Cleaning mortar	10	14th century, unpainted

Results

(The numbers correspond with the areas tested and marked on the preceding diagram)

<table>
<tr><th>Action</th><th>Type of dirt</th><th>Type of glass</th><th>Pictures</th></tr>
<tr><td rowspan="2">Mechanical cleaning with brushes</td><td rowspan="2">General soiling</td><td>14th Century Painted (1)</td><td rowspan="4">(1) Before, during and after cleaning
</td></tr>
<tr><td>19th Century Painted (2)</td></tr>
<tr><td colspan="3">Results</td></tr>
<tr><td colspan="3">All brushes could be used on the surface of the glass without negative effects.
The larger soft brush however was ill fitted to remove dirt from smaller crevices and pieces of glass, such as (2) and the areas close to the lead in (1).
The flat ended soft brush (pictured to the right) was the most effective in this situation because it was easiest to control and handle.
Although the dirt was dislodged by the brushes, quite a significant amount remained on the surface.
The nineteenth century glass resulted in a smoother surface after cleaning with a brush; this is likely due to its lack of corrosion.
It has been concluded that although they did not damage the glass, it is not necessary to use the rougher brushes for general soiling.</td></tr>
<tr><th>Action</th><th>Type of dirt</th><th>Type of glass</th><th>Pictures</th></tr>
<tr><td rowspan="2">Mechanical cleaning with a smoke sponge</td><td rowspan="2">General soiling</td><td>14th Century Painted (1)</td><td rowspan="4">
(2) Before cleaning and during cleaning with a smoke sponge

The result of the use of the sponge can be seen in the shiny appearance of the glass.</td></tr>
<tr><td>19th Century Painted (2)</td></tr>
<tr><td colspan="3">Results</td></tr>
<tr><td colspan="3">The smoke sponge was not found to be harmful to the glass or the paint.
The smoke sponge was effective at picking up loose dirt, and dirt which was lightly adhered to the glass. It also proved successful in conjunction with the brushes, in order to pick up dirt which had been dislodged by their use.
The smoke sponge seemed to turn darker after a very short time of use, making it clear to see that dirt was being picked up and removed from the surface of the glass.
However this method is very time consuming. It is therefore concluded that the sponge should be used alongside the brushes, in delicate areas, but should not be used as a treatment on its own.</td></tr>
</table>

Action	Type of dirt	Type of glass
Mechanical cleaning with brushes	Putty	14th Century Painted **(3)**
		19th Century Unpainted **(4)**

Results

The glass and paint was not damaged by any of the brushes.
The putty was removed much more easily than expected from both the fourteenth and the nineteenth century glass.
A significant amount of the putty tested was removed with the soft brushes, however large remnants remain. The rougher brushes remove most of these.
It is therefore concluded that rough brushes should be used to remove the putty smears.
For the small amounts of remaining putty further tests will be carried out. This will be useful to test because areas of putty may be harder to remove in different places.

Pictures

(3) Putty smears before, during and during cleaning with brushes

The difference is already visible even with a soft brush

Action	Type of dirt	Type of glass
Mechanical cleaning with a smoke sponge	Putty	14th Century Painted **(3)**
		19th Century Unpainted **(4)**

Results

The use of the smoke sponge to remove putty was not affective because the putty was too thick and well adhered. The smoke sponge is useful only for loose dirt.
The sponge was used on the area which had been tested with brushes **(3)** but achieved no effect on the remaining putty.
The sponge should be used to safely remove excess, loosened putty, but not to attempt to remove well adhered putty.

Pictures

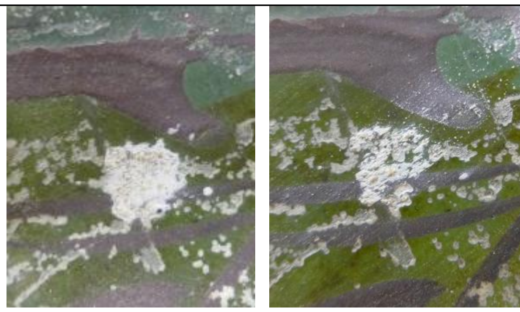
(3) After cleaning with both brushes and smoke ponged. A few small remnants of putty are still visible.

Action	Type of dirt	Type of glass
Mechanical cleaning with brushes	Mortar splashes	14th Century Painted **(5)**

Results

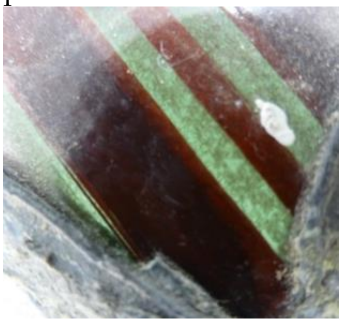
The mortar splashes were difficult to remove with soft brushes. Some of the mortar came off with a rougher brush but not a significant amount.
More trials will be carried out on them.

Pictures



(5) Mortar splash before and after cleaning with brushes. Some, but not all layers of the dirt have been removed.

Action	Type of dirt	Type of glass	Pictures
Mechanical cleaning with brushes	Corrosion pits	14th Century Unpainted **(6)**	 **(6)** Testing the safety of a rough brush on the corroded areas of glass. No damage is done.
Results			
All brushes could be used on the corrosion pits without adverse effect. The topmost layer of dust was removed successfully using only the soft brushes. It has been concluded therefore to only use these brushes, as the removal of more than just dust from the corrosion pits, could be harmful to the glass. This will mean that some white deposits will remain in the pits.			

Action	Type of dirt	Type of glass	Pictures
Chemical cleaning with deionised water	General soiling	14th Century Painted **(7)** 19th Century Painted **(8)**	 **(7)** Dirt being removed from a medieval piece with a cotton swab.  **(8)** Nineteenth century piece with surface soiling removed and paint unaffected.
Results			
The deionised water, applied with cotton swabs did not have a negative effect on the glass or the paint layers. Removing general soiling with the deionised water was very effective, as can be seen in the two images on the right. However the dirt was so excessive the cotton swab became dirty very quickly. This would make the process more laborious and costly. With this in mind it would be advisable to remove the loose layers of dirt with a brush first and where necessary, use deionised water.			

Action	Type of dirt	Type of glass	Pictures
Chemical cleaning with ethanol and water (50:50)	General soiling	14th Century Painted **(9)** 19th Century Painted **(8)**	 **(9)** Effective use of ethanol and water on a painted surface.
Results			
The use of ethanol and water did not have any detrimental effects to the glass surface or paint. The surface dirt was removed successfully. This chemical will only be used where necessary, and where deionised water or brushing alone is not sufficient.			

Action	Type of dirt	Type of glass	Pictures
Chemical cleaning with deionised water	Putty	14th Century Unpainted **(10)**	 **(10)** Use of a cotton swab on putty smears.
Results			
As can be seen from the image on the right, the cotton swab has an effect on the putty, loosening the bonds and absorbing it. The putty can then be removed. This is very useful because in some cases it may not be possible to remove all of the putty using mechanical methods.			

Action	Type of dirt	Type of glass	Pictures
Chemical cleaning with ethanol and water (50:50)	Putty	14th Century Unpainted **(10)**	 **(10)** Putty softened with ethanol and water but not completely removed.
Results			
Ethanol and water also works to effectively remove the putty. The results were even quicker than with just deionised water alone, but shall only be considered where necessary.			

Action	Type of dirt	Type of glass	Pictures
Chemical cleaning with deionised water	Mortar splashes	14th Century Painted **(5)**	 **(5)** The mortar splash completely removed. 
Results			
Mortar splashes were completely removed with deionised water. This is a safe option where the mortar cannot be removed through mechanical methods. Ethanol was not needed.			

Appendix C – Log of conservation work

Log of the progress on the conservation work between the 7th and the 11th April 2014, complete with images.

Monday 7th April 2014

Cleaning commenced successfully although it took slightly longer than expected, due to the large amount of loose dirt and putty that accumulated on the surface of the glass. A conservation vacuum cleaner had to be used several times. Chemical cleaning was reserved only for areas of glass which did not have any corrosion. Ethanol and water (50:50) was used.

Tuesday 8th April 2014

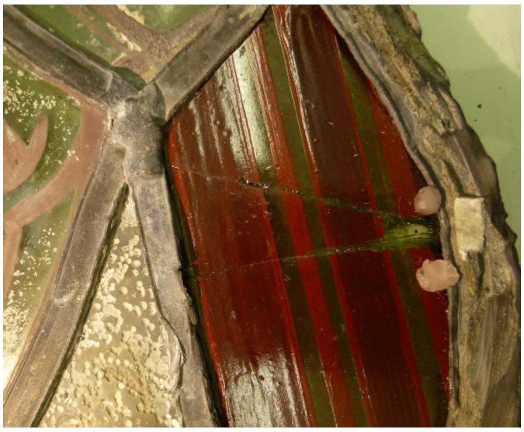
The cleaning continued and the front of the panel was completed, aside from the adhesive label and the residue from adhesive labels.

Wednesday 9th April 2014

The reverse of the panel was cleaned today which took a considerably shorter time than the front. This was due to the fact there is no paint on the back.

The adhesive residue and adhesive label were cleaned in the afternoon. Fume chambers were created using cotton wool soaked in acetone and placed in tea light holders, under an airtight container (see images). The fume chamber was left over the areas for half an hour and this proved sufficient for the removal of the adhesive residue. The removal of the label was much more difficult and took several applications, due to its size. Each time the label was removed a little more.

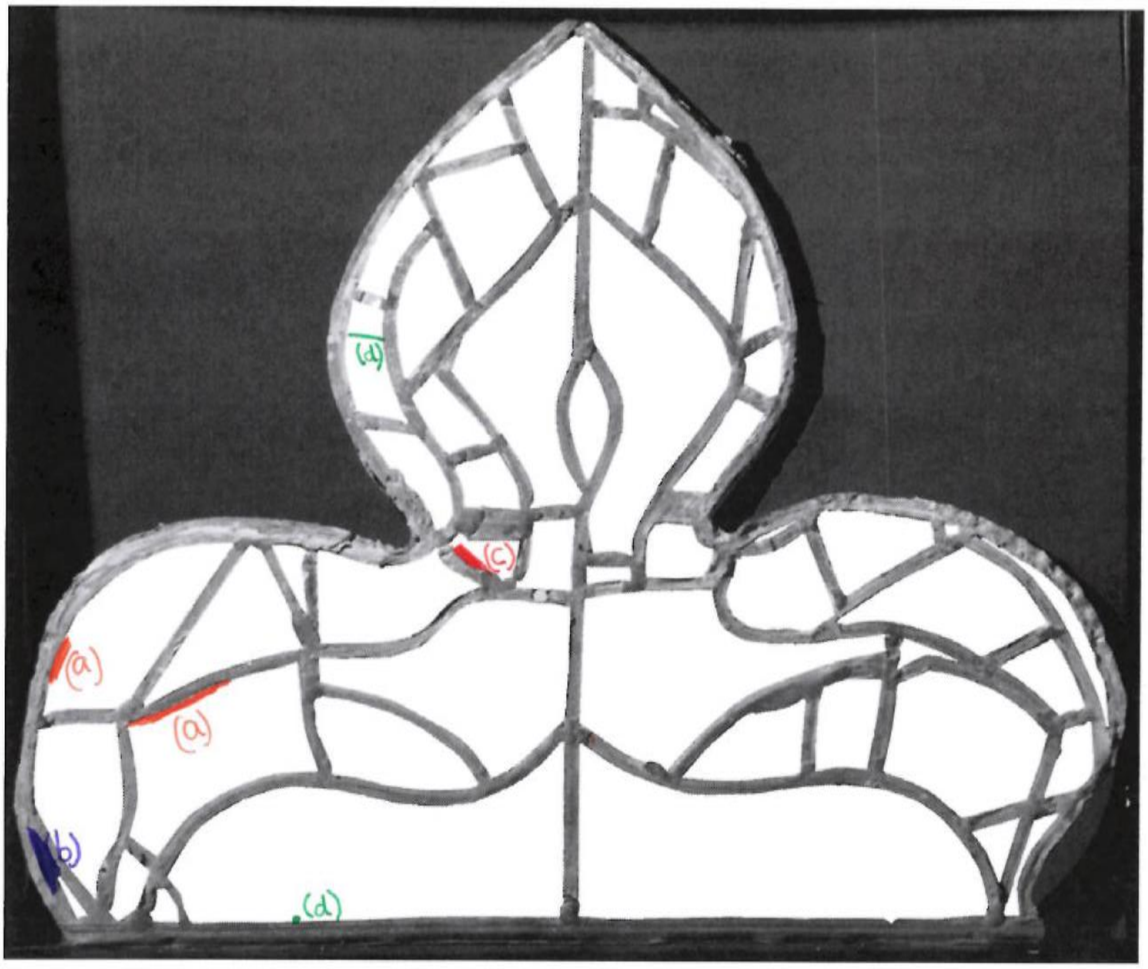
Thursday 10th April 2014
Re-soldering broken joints and attaching a strap lead to the missing area was done in the morning. This was a simple procedure although the solder had some trouble adhering to the old lead which was quite dirty. The areas to be soldered had to be cleaned quite thoroughly. Small pieces of paper were placed underneath the lead in places which ensured the solder did not come in contact with the glass and minimised the heat transfer (see images).
Cleaning and preparation for edge bonding took place in the afternoon. This was done using ethanol and a scalpel in most places. On two occasions the un-waxed dental floss was used but it was impossible to clean the others due to the fact that the breaks were very tight, and the floss could not fit between the glasses. This proved to be sufficient.
The preparation of the areas for araldite infills was difficult because complete airtightness had to be ensured. Dental wax and tape was used for this.
Araldite was used for the edge bonding as well as the infills.

Friday 11th April 2014
The panel was re-puttied on the back in the areas labelled on the intervention mapping diagrams. Only the central areas of the panel were re-puttied where the existing putty had failed and fallen out. The putty used was soft glazier's putty.
The application of the putty was quite difficult because the lead was rough and oxidised. Furthermore extra care must be taken when applying putty to areas where the glass has corrosion on. One area had to be left because the corrosion crusts were so severe.


Appendix D – Sample taking

Samples of putty and mortar, which were removed from the panel during cleaning, were saved for future reference, and will be given to the client upon completion of the project for them to file and keep as they feel necessary. A small piece of dry, damaged lead and some small glass shards, which had paint on them, and separated from a crack in the glass during cleaning, were also saved. A further piece of glass was also found in the bottom lead but it is unclear where this has come from because there is no evidence of missing glass nearby. These have all been saved and the locations of which are detailed below.



Sample type from the panel	Symbol
Putty	—— (a)
Mortar	—— (b)
Lead	—— (c)
Glass shards	—— (d)