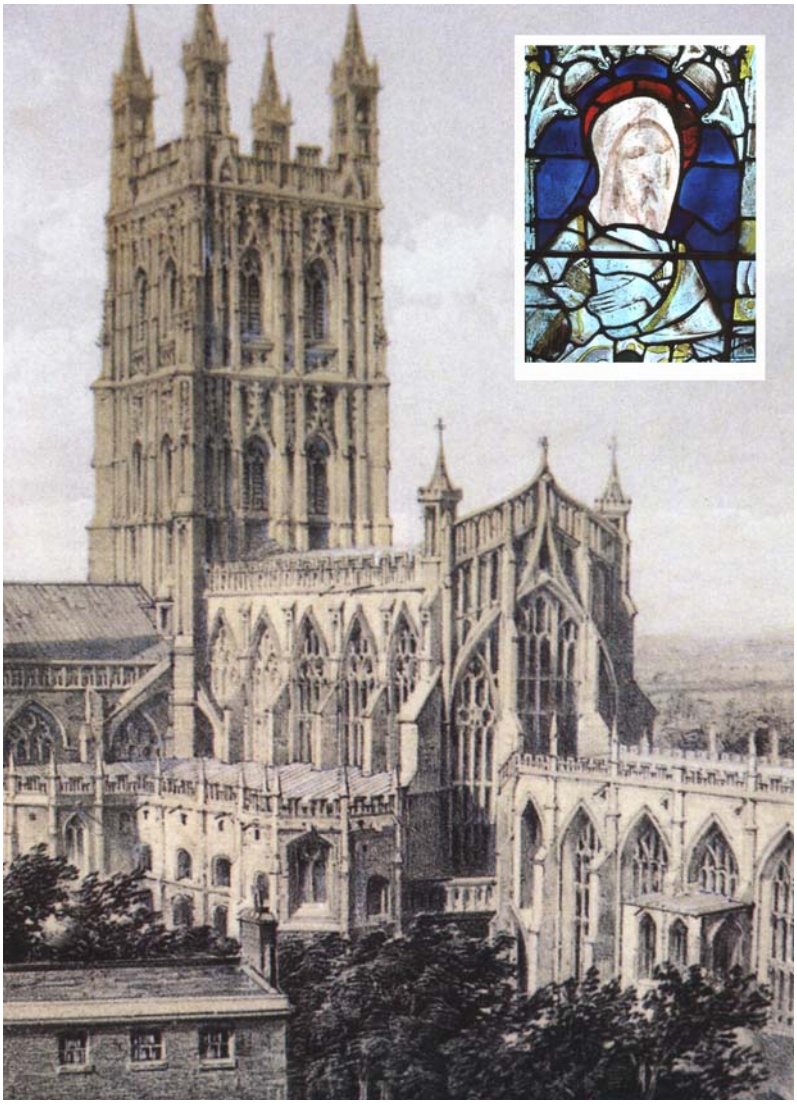
# A History of Repairs to the Stained Glass in the Great East Window of Gloucester Cathedral

**Léonie Seliger**



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**For Lilo**

# Abstract

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***A History of Repairs to the Great East Window of Gloucester Cathedral***

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The Great East Window of Gloucester Cathedral is the second largest medieval window in Britain. The thesis investigates its history of repairs and both quantifies and qualifies these.

A landmark restoration campaign in 1861-62 under the guidance of the eminent art historian Charles Winston was important in its implications for the development of modern conservation philosophy. The thesis shows that, contrary to general assumption, this campaign has not been obliterated by later interventions.

The validity of some repairs (seven replacement heads) is discussed and proposals are made for their future.

Recommendations are also given for future conservation measures to ensure the long-term survival of the glass.

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# Acknowledgements

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# Introduction

In 1999 the Great East Window of Gloucester Cathedral was cleaned in situ by a team of conservators from Canterbury Cathedral's stained glass conservation studios, the Cathedral Studios, with myself as conservator in charge.

A question by Gloucester Cathedral's architect, Mr. Ian Stainburn, as to the likely provenance of seven replacement heads in the window, and as to the possibility of replacing them again, sent me to research into the repair history of this important window.

I was looking for a subject for a thesis for my MA course at the Institute for Advance Architectural Studies at the time, and the Great East Window of Gloucester Cathedral turned out to be the perfect choice.

It has been the subject of several articles dealing with the art historical aspects of the window.

In terms of its repair history and condition, however, no in-depth study has ever been attempted. While very little is known about the early history of the window, the interventions of the nineteenth and twentieth centuries are, compared to today's recording practices, only poorly documented.

This has resulted in misconceptions being formed about the amount and the condition of original glass in the window. In some cases, even the identification of certain figures has been erroneous, due to undocumented later interventions muddying the waters.

With this thesis I will try to set the record straight. One nineteenth century writer claimed that *fully two-thirds of the window are false* (Welander 1985, 133), a statement that has never been contradicted until now.

In addition to the text I have produced two plans of the window, charting - where possible - the age and provenance of each piece of glass (see appendix H). It is hoped that these plans will be a useful tool for art historians in the future.

Part I of this thesis starts with a short overview of the art historical aspect and the type and condition of the stained glass and the stonework.

It then details the repair history of the stained glass and looks at the motivations for the choices made by restorers as to their interventions.

It closes with recommendations for the future preservation of the stained glass.

Part II tries to answer the architect's question. It starts with an assessment of the cultural significance of the seven replacement heads, giving a date and provenance, and evaluates their validity as repairs.

It then sets out the aims of the proposed intervention and tests several alternatives against the requirements of international charters on conservation policy.

Part II closes with specific recommendations for replacement.

As I am sending the reader on a whistle stop tour through the second largest medieval stained glass window in the country, I have included two foldouts at the back of the appendices. The first is a total view of the Great East Window; the second is a plan which gives the numbering of tiers and lights. I suggest keeping these open while reading the text.

Capital letters denote the horizontal tier, and figures identify the individual lights in each tier. Each main light is divided into three panels (four in tier F), which are again numbered starting at the bottom of the light. Thus, E11, 2 is the second panel from the bottom of the eleventh light from the north in the fifth tier from the bottom*.

The technical terminology specific to stained glass is explained in appendix A. Appendix B gives an introduction into the manufacturing techniques of stained glass in the Middle Ages, and appendix C explains the processes involved in the deterioration of stained glass windows.

*This numbering system was adopted by us from the existing system used by Gloucester Cathedral's masons in order to facilitate communication between masons and stained glass conservators. The internationally agreed numbering system for stained glass windows, devised by the Corpus Vitrearum Medii Aevi, works along different lines.

## Part I: The Restoration/Conservation History of the Great East Window of Gloucester Cathedral

The Great East Window of Gloucester Cathedral is the second largest surviving stained glass window in Britain, with a height of 72 feet, and a width of 38 feet. Only the east window of York Minster, which is some forty or fifty years younger, has a slightly greater expanse of glass (Kerr 1985, 116).

The lower portion of the window is always in the shadow of the Lady Chapel. The Early English Lady Chapel, replaced by today's building in the second half of the fifteenth century, was apparently large enough to produce the same effect (Welander, 1985, 11).

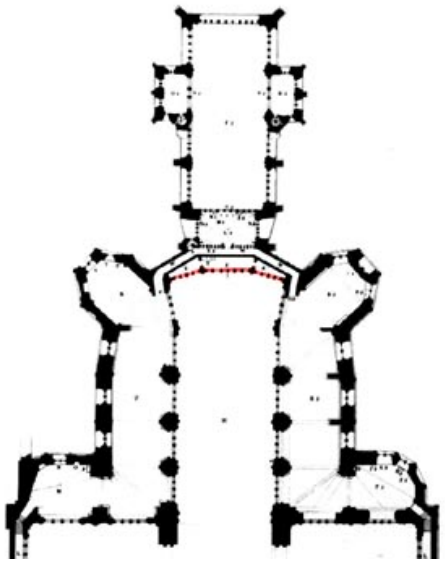


**fig. 1** Plan of the east end of Gloucester Cathedral. The Great East Window is highlighted in red.

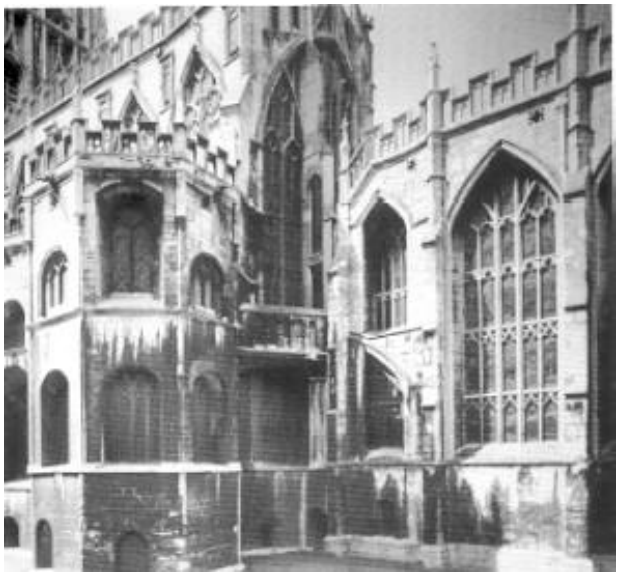


**fig. 2** View of the exterior of Great East Window and Lady Chapel from the south-east.

## I. 1. Art Historical Evaluation

### I. 1. 1. Date

Unfortunately, most of the records of Gloucester Cathedral for the Middle Ages have been lost (Welander 1991, 364), so there is no documentary proof for the age of the Great East Window.

Some art historians have tried to date the glass by interpreting the evidence from a row of heraldic shields, which stretches across the bottom of the window. Ten of originally fourteen shields still exist, the other eight are not part of the original glazing (Grimké-Drayton 1915, 78-87).

Since *"all but two of those whose shields survive were at Crecy, and these two were certainly present at the siege of Calais"* the Great East Window has *"long been accepted as a vertical war memorial to those who served at the battle of Crecy"* (Welander 1991, 125). The battle of Crecy took place in 1346, the siege of Calais in 1347.

In her 1985 article Jill Kerr shows convincingly that this method of dating does not hold up to close scrutiny. Using stylistic comparisons with the Tewkesbury Abbey glazing of the 1340s and other glass in Bristol and Wells, together with comparison of the armour worn by one of the figures in the Gloucester glass with contemporary armour, Kerr gives a date of between 1350 and 1360 for the Great East Window (ibid., 127).

The row of coats of arms may only represent a sort of General Roll of the leading nobles of the period (Marks 1993, 87).

### I, 1, 2. Style

While the stonework of the choir and east end of Gloucester Cathedral is an early example of perpendicular architecture, the glass itself was described by Charles Winston as "*a pure Decorated example, late in the style however*" (Winston 1867, 86).

It was probably made by the same local workshop that made the glass in the choir clerestory of Tewkesbury Abbey (Brown 1991, 80).

It is avant-garde in its restrained use of colour, limiting itself to white, blue and red as its main colours.

The whole may be seen as a gigantic extension to the altar retable. With its division into three main vertical sections it resembles a medieval triptych filled with tier upon tier of figures.

The three bottom tiers (A, B and C) were originally all filled with white quarries painted with a starburst design and surrounded by a coloured border showing grapevines. In addition to that tier C carries the row of heraldry. The same quarries fill the tracery panels, but here no coloured border is present.

The main lights above tier C are filled with near life-size figures surrounded by architectural canopies. This glass architecture takes no account of the real stonework, but rather works as a separate visual support for the figures.

**fig. 3** F2
Painted decoration on the head of an apostle.
Left: interior in transmitted light.
Right: exterior in reflected light.

The figures themselves are painted nearly exclusively on white glass. The painting style is monumental and done for impact at a distance: dense trace lines and bold smear shading on the interior surface are reinforced by extensive backpainting. Silver stain is used on some hair and throughout to embellish the border designs of the draperies.

An interesting feature of the Great East Window is the use of repeat cartoons (see figs. 11, 54-56). This technique was not uncommon in the middle ages (Marks, 1993, 34). The same design was used to produce two or more identical figures. Depending on the amount of detail given in the original cartoon, the individual figures could vary in their painted line work and shading, as well as in the colouring of the glass.

Several different main glasspainters were at work in the production of the window.

One has a rather sparse dry style, with faces of a somewhat pinched expression. They are rather tight-lipped and sharp-eyed. The hair of his figures falls in brittle tight waves, and the shading is minimal.

Another painter exhibits a much more lyrical style, with sweeping confident trace lines and more dramatic and loosely falling waves in the hair.

Yet another painter may be distinguished by his use of shading below the eyes, giving the faces a slightly owlish look.

The window is divided into vertical strips of alternating blue and red, with a double row of red backgrounds in the centre. Each figure is placed in front of either a blue or a red background. This treatment reinforces the three-dimensional quality of the figures, which seem to be standing in architectural niches.

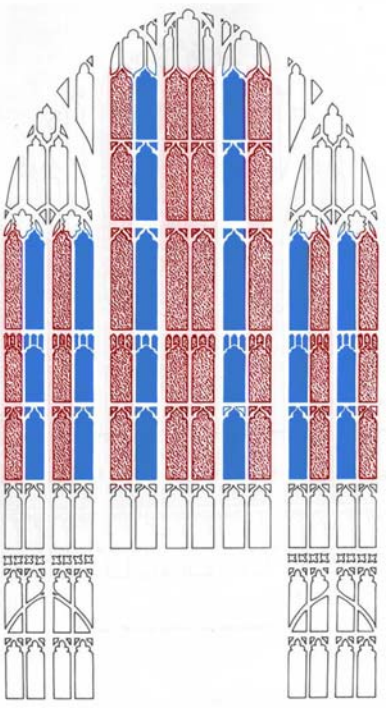


**fig. 7** Background colours in the Great East Window

One unusual feature of the stonework is the use of 'false' tracery. Maybe in order to simplify the manufacture and installation of the glass, much of the intricate stone 'lace' in tiers A-E only exists as a superimposed layer on the inside. The stained glass panels are set against this internal stonework from the outside.

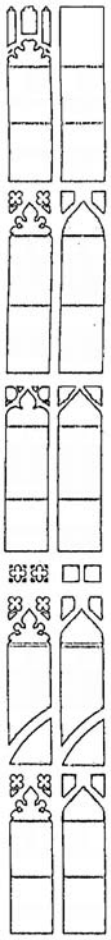


**fig. 8** Diagram showing the use of 'false' tracery. Left: the apparent shapes of the stained glass panels; right: their actual shapes.

This phenomenon has only been seen in two other places: the west window of Gloucester Cathedral, and the east window of Exeter Cathedral (Kerr 1985, 116).

**fig. 9** View of 'false' tracery in tier C, seen from the outside with the glass removed.

### I. 1. 3. Subject

The subject of the Great East Window has until recently been supposed to be the Coronation of the Virgin (e.g. Rushforth 1922, 296). Again, Kerr questions this attribution and puts forth a different interpretation. In her opinion the Great East Window "*depicts a specific, formalised hierarchy – the derivation of authority from heaven to earth*" (Kerr 1985, 121-122).

Given that the figures of Christ and the Virgin, apart from both originally being seated, are in no way enhanced over the other figures in the window, and that the Virgin is already crowned, this interpretation seems entirely plausible to me.

Another hierarchic aspect of the glass could be seen in the representation of the individual figures. A steady progression from sober realism to inspired drama and eventually to non-figurative abstraction may be observed:

The figures in tier D, particularly those of the abbots and bishops, appear stolid and earthbound in their postures. The faces have none of the spiritual fire and beauty so evident in the higher tiers.

Tier E, the tier of saints, represents an intermediate state: the figures are more animated and some are quite beautiful.

The figures in tier F, the tier of apostles and Christ and the Virgin, are more elongated than those of the lower tiers. Some have the slightly manic expression of prophets.

Tier G originally contained only angels. Whereas the other figures in the window are credible as corporeal beings, the angels' draperies do not entirely convince as hiding real bodies. They seem to be designed to represent spiritual beings.

The topmost level of the window originally probably contained three great wavy stars (see fig. 14), two of which still survive (Welander 1985, 16). This could be read as a totally abstract representation of the Trinity, the final consequence of an artistic journey from earthbound existence to pure spirituality.

### I. 1. 4. The Fabric

#### Stonework

The original stone of the Great East Window is an oolithic limestone from Painswick, a type of stone found around Gloucester. The surviving medieval stone is of exceptional quality (Mychalysin 1998, 2-3).

The Painswick quarries did not have very deep beds, but because of the high quality freestone they yielded, the medieval masons were able to produce long uninterrupted mullions which were face bedded.

The Victorian replacements use two different types of stone: Painswick and a Bath type limestone. A third stone type was used probably in 1939, when repairs to the stonework became necessary again. This is thought to be Leckhampton stone, another limestone (ibid., 4).

#### Stained glass

Like the stone, the glass of the Great East Window is of exceptional quality. The thickness of the individual pieces varies from ca. 3 to 5mm. The glass itself was probably made in France, since no coloured glass was made in England in the Middle Ages, and English white glass was usually of inferior quality to continental glass (Marks 1993, 30-31). It would have travelled by boat across the Channel and up the Severn to Gloucester.

The large amount of ruby and blue glass shows that no expense was spared in the making of the window. Ruby and blue were the most expensive glass colours in the Middle Ages (Kerr 1985, 118). The white glass is also of superior

quality, with very little green tint, which indicates the use of very pure raw materials.

Most of the original glass has lasted remarkably well.

The Great East Window is full of later insertions, both of glass contemporary with the window, and of fifteenth century glass probably from elsewhere in the cathedral.
There is also a certain quantity of glass which dates from the 1863 repair campaign, and a few pieces which were inserted in 1945-46 or 1960 and in 1975-76. During cleaning in 1999 another seven pieces were inserted to replace glass too badly shattered or too corroded to be repaired.

## I. 2. Repair history

### I. 2. 1. Repairs to the Stonework

While there is evidence of stone repairs pre-dating the nineteenth century, the type of stone used and the working methods employed are identical to the original work. It is likely that some repairs to the stone were done during the seventeenth century (see below), but the unbroken tradition of workmanship makes it impossible to date individual stones with any certainty.

This is not, however, the case with Victorian repairs. Victorian masons used different tools than medieval masons, resulting in neater joints and different surface treatments.[1]

In 1855 Henry Fulljames, the cathedral architect, drew attention to the *"decayed condition of the (…) stone mullions* (which) *rendered the fabric exceedingly insecure"* (Welander 1985, 132-133).

Given the size of the window one might expect that it had suffered from structural problems throughout its history. We do not know whether the decay Fulljames talked about was caused by structural problems, or whether some of the face bedded mullions had laminated under the weight of the window.

Whatever the case, the stone repairs to the window, which coincided with repairs to the glass in 1861-62, seem to have been quite drastic. The stonework was reported to have been *"rebuilt"* (Winston 1963, 327). In the opinion of the current master mason of Gloucester Cathedral, Pascal Mychalysin, only the two main piers may have been left in situ, while the rest of the stonework was taken down. His survey of the window shows that a large amount of replacement took place on the outside, while the inside retained a good proportion of original stone. What happened in many cases was that the medieval stones were sliced in two, with the internal part being reused, while the external half was replaced and fixed to the inside with iron cramps (see appendix F).

These iron cramps, together with the iron bars which hold the glass panels in place, would become a major problem later on.

In 1914-15 repairs to the stonework were necessary again, but this seems to have been a relatively minor operation (Clerk of Works Time Account Books 1914-15).

By 1934 the damage done by iron tie-bars and saddle-bars had become obvious in the choir clerestory windows, and new delta metal bars were installed (ibid. 1934).

[1] I am grateful to Gloucester Cathedral's master mason, Pascal Mychalysin, for the information on medieval and Victorian working methods.

This was not entirely repeated at the Great East Window when the glass was returned from wartime storage. Maybe due to the shortage of materials after the war only the main tie bars across the window were replaced with delta metal.

In 1997 a large chunk of stone fell from the Great East Window at the feet of one of the Cathedral's volunteers. A survey through binoculars showed that the internal stonework was fractured in many places due to the expansion of corroding metal bars and cramps. One central mullion was split down its full height.

Urgent repair of the stone and replacement of the iron components with phosphor bronze was needed. Three mullions had to be replaced entirely, as there was an immediate risk of more stonework falling. Smaller stone replacements, piecing and mortar repairs were necessary all over the window.

These repairs were done by the cathedral's own masons between 1998 and 1999.

**fig. 10** Damage to mullion by expanding ferrous saddle bar.

The scaffolding remained in place for cleaning of the glass and eventually of the stonework. The stone was cleaned by Carthy Conservation in 2001, using the 'arte mundit' latex cleaning technique. This treatment involves application of latex bound chemicals (EDTA and others) which combine with surface dirt. After c. 24 hours the latex can be carefully peeled off, and any residue is removed from the stone with slightly damp sponges. The advantage of this method is that it uses very little water that could carry the chemicals into the stone, where they might interact with metals oxides. Virtually

no salt florescence occurred during cleaning, and the natural patina of the stone appears to be untouched.[2]

### I. 2. 2. Repairs to the Stained Glass

Maintenance of stained glass was a normal activity in medieval churches and cathedrals. Numerous medieval accounts mention odd jobs such as washing, repairing and replacing missing pieces in windows. Replacement of missing pieces could be done by insertion of new glass painted in a contemporary style. But there are also cases where the glaziers copied the original style of the window they were repairing (Lowe 1962, 507-508).

With the reformation most of this careful and sustained maintenance work ceased. Stained glass windows survived iconoclast destruction more frequently than e.g. wallpaintings because windows fulfil a practical function as weather shields and are expensive to replace. In some cases only the most offending images, such as representations of the Trinity or of Christ, were destroyed. What survived was allowed to slowly decay and was only patched either with fragments of other windows, or with plain unpainted glass (Marks 1993, 232).

The nineteenth century introduced the concept of restoration into the realm of stained glass. No longer were the medieval windows seen as an inconvenient hindrance to the ingress of clear light. As with gothic architecture, stained glass appealed to the romantic mood of the moment.

This does not mean, however, that the old fabric was treated with respect for original material.

[2] Personal communication, Deborah Carthy, July 2001.

The rediscovery of the nearly lost art of glassmaking in the medieval tradition meant that glaziers felt free to replace broken original glass with copies, a practice which occasionally resulted in the complete loss of whole windows. A good example of this can be found in Canterbury Cathedral, where the two remaining panels of the thirteenth century Jesse Tree in the Corona Chapel were 'restored' by George Austin in 1853. In reality Austin produced an entire window in new glass (Caviness 1981, 173). The Dean and Chapter of Canterbury do not appear to have minded.

The remaining panels were sold by Austin's successors in 1908, and only returned to the cathedral forty-five years later (ibid.).

Not only were medieval windows threatened by 'restoration', they were also in danger of destruction to be replaced by modern glass. The Great East Window of Gloucester Cathedral narrowly escaped just this fate (see below). Sadly, this kind of destruction still goes on, as the example of the Pugin window in Sherbourne Abbey illustrates: After a lengthy court battle this important nineteenth century window was replaced with modern glass in 1996 (Hayward 1997, 92).

The twentieth century, informed by the battles fought by the nineteenth century preservationists such as John Ruskin, William Morris and the Society for the Protection of Ancient Buildings (SPAB), and Charles Winston, placed a firmer emphasis on conservation.

**Medieval repairs**

Since the accounts of Gloucester Cathedral for the Middle Ages have been lost we do not know what kind of maintenance was carried out during the window's early life.

The fact that the starburst pattern on the quarries varies in execution, but not in design, may be as much down to later repairs as to different painters working on the original glass.

There is, however, one clear example of medieval repair still in existence: the head of the angel in G6 dates stylistically from the late fourteenth or early fifteenth century[3]. The outline of this head is identical to that of another angel (G4), which is a repeat of G6.

G4, 2 G6, 2

**fig. 11** Medieval replacement head in contemporary style. An example for the use of repeat cartoons.

The later head fits the outline perfectly, but interprets the angle of the head slightly differently. It was clearly painted for this place, and is not a re-used fragment from another window.

Stylistically it is very closely related to the Madonna in G5 and two other faces used as stopgaps in the window, and may be by the same hand.

It is quite possible that the damage and repair to G6 occurred just at the time when Gloucester Cathedral had a major glazing campaign for another window going on, which is now lost.

The Madonna and the two face fragments, which were probably inserted into the Great East Window in the seventeenth century, may be the only survivors of a lost late fourteenth or early fifteenth century window.

[3] I am grateful to Professor Richard Marks for suggesting this date for the face.

G5 D13 G6 F13

**fig. 12** Late fourteenth or early fifteenth century faces in the Great East Window

## Seventeenth century repairs

The earliest documentary evidence for repairs to the Great East Window dates from 1660.

Gloucester Cathedral seems to have suffered relatively little wilful damage through Puritan iconoclasm or Cromwell's soldiers (Welander 1985, 60).

Nevertheless, the fabric of the cathedral, including its windows, was in a "*very ruinous"* (ibid.) state by 1660. While wilful damage may not have played a great part in the decay, neglect and the inevitable acceleration of damage through the elements and through casual vandalism eventually led to a state of affairs which prompted the Dean and Chapter of Gloucester to ask Charles II for financial assistance. This was duly granted. *"The king 'being desirous to contribute what may be towards a work of so great piety' agreed to divert funds due to the Crown to the restoration work"* (ibid.).

The glaziers' accounts for 1660-62 are still in the Cathedral Archives. For 3 May 1661 they contain the following entry: *"In the great window on the East end of the Quire old glass new leaded – Sixty and 2 paines in measure – 345½ feet. And in quarrells – 17 duzon"* (Gloucester Cathedral Library, MS60).

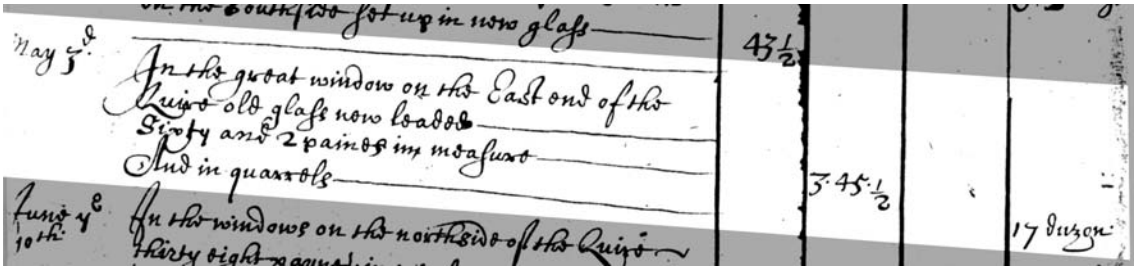



**fig. 13** Seventeenth century glaziers' account

Since the glass of the Great East Window measures some 2000 square feet, it is clear that not the whole of the window was releaded. What the account seems to refer to is rather those panels which were made up from fragments of other windows ('old glass'), or repaired with a substantial amount of such fragments. Other panels may have been transferred from the clerestory whole (Marks 1993, 88), while still other repairs with fragments may have just been stopped in without releading.

**fig. 14** J3
Quarries replaced with unpainted glass

The seventeen dozen quarries may very well be accounted for by some of the numerous insertions of unpainted cylinder glass quarries which occur in many lights.

How many - if any – repairs were done by insertion of unpainted white glass in the figurative portion of the window is unclear. A few such repairs survive in the Great East Window (e.g. the 'Golfer's' head in C11), but they may have been part of an earlier or later repair campaign.

That such repairs were present in the west window of the choir is documented in Prebendary Fowler's account of 1681: *"It was the old Popish Picture of the Trinity* (…) *which was patcht with a piece or two (as I remember) of plain glass"* (Fowler 1681).

**Nineteenth century repairs**

The next restoration of the window, for which there is documentary evidence, took place between 1861-62. There is, however, evidence in the window itself that points towards an intermediate restoration campaign.

The central lights of tier C have been altered substantially by insertion of several coats of arms not original to the window (Grimké-Drayton 1915, 82-87). The lights containing these shields do not retain any original quarries. Instead, the glass used is very flat slightly tinted cylinder glass. It is painted with an even matt. The same glass appears in several other quarry windows in the tracery. In addition to that, tier A does not now contain any coloured borders, although it originally probably did. The eyelets of this tier still retain the original vine-leaf border. The number of quarries means that they cannot be part of the seventeenth century repairs, and the type of glass is typical of the first half of the nineteenth century.

At the top of the window are two names scratched with diamonds into original quarries: one is 'Joe Conwy' (in J2), the other inscription reads: 'W H L Lacey painter and glazier from London' (in J3a), both in nineteenth century copperplate.

Several pieces in the coloured portion of the window may also be part of this undocumented restoration campaign.

During the whole of the second half of the nineteenth century Gloucester Cathedral underwent a major restoration programme. In 1856 the American author Nathaniel Hawthorne visited Gloucester and described the scene he encountered in the cathedral: *"There was a great dust in the nave, arising from the operations of the workmen. They had been laying a new pavement, I believe, and scraping away the plaister* (sic) *which had heretofore been laid over the pillars and walls. The pillars come out from this process as good as new"* (Hawthorne 1856, 368).

An important part of the restoration programme was the reglazing of the windows. This work began in 1853 and continued until the early years of the twentieth century (Welander 1985, 73). Amongst the eight firms employed in the manufacture of new glass for the cathedral was William Wailes of Newcastle, who filled the west window of the nave with stained glass in 1858-59 (ibid., 74).

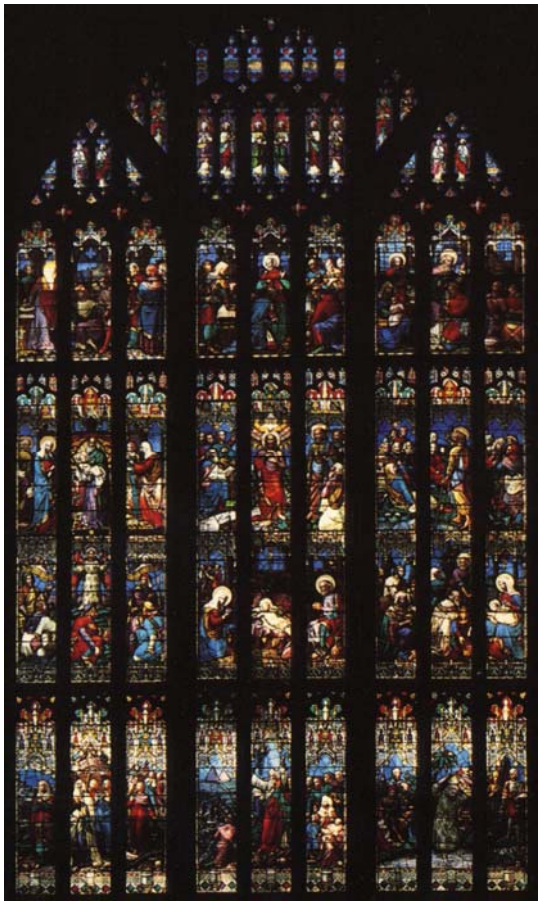


**fig. 15** William Wailes' west window in Gloucester Cathedral

The enthusiasm with which the restoration programme was pushed forward put the Great East Window at risk. It had weathered the age of iconoclasm, the Civil War, and the ravages of five hundred years of storms, vandalism, neglect and haphazard repair, when in 1855 the architect to Gloucester Cathedral, Henry Fulljames drew attention to the *"serious condition of the glass which was in danger of complete collapse"* (Welander 1985, 132). The glass was dirty and the leadwork decayed.

The Dean and Chapter of Gloucester approached the firms of Hardman of Birmingham and Wailes of Newcastle for estimates and designs, and Joseph Bell of Bristol offered some advice. The suggestions by these firms ranged from removal of all 'alien' fragments and restoration to a hypothetical original state, to partial or complete replacement of the old glass with a modern window (Winston 1863, 327). Wailes actually produced a design for a new window, for which the Dean and Chapter paid him the sum of £50[4].

It was at this point that Charles Winston entered the picture.

## Charles Winston

The importance of Charles Winston for the understanding and preservation of medieval stained glass in England can hardly be overestimated.

**fig. 16** Charles Winston

Born in 1814, he was called to the bar in 1845, but his real passion was stained glass. In 1847 he published *An Inquiry into the Difference of Style observable in Ancient Glass Paintings, especially in England, by an Amateur*, the first in-depth study of the subject published in Britain. He was, as Sarah Brown put it *"undoubtedly the first man to apply what might be termed an 'art-historical' eye to stained glass"* (Brown 1997, 108). He was also one of the founder members of the Archaeological Institute.

[4]16 January 1861 "*Paid Mr Wailes for drawing of proposed restoration of the East Window £50"* (Gloucestershire County Records Office D936 A/1/12). Sadly, I have not been able to track down the design, which, considering the rather large sum paid for it, must have been a very detailed version.

He acted as *"art-historical consultant"* (ibid.) in several major restoration projects, amongst them Bristol, Lincoln Cathedral, North Moreton and eventually Gloucester.

Dissatisfied with the quality of coloured glass available in the first half of the nineteenth century, he collaborated with J. Powell & Sons of Whitefriars in the analysis and production of glass that would emulate medieval glass in brilliance and richness of colour (Sewter 1961, 85).

While Winston's personal taste favoured the style of glasspainting of the early sixteenth century (Winston 1867, 337), Winston the archaeologist recognised the importance of stained glass of all periods.

To him, the type of restoration which was current in the first half of the nineteenth century was nothing less than destruction of archaeological evidence: *"The ravages of time, the obliteration and confusion consequent on repeated repairs* (…) *are really trifling evils compared with that careful and elaborate eradication of trustworthy features, which is always more absolute and complete as we are assured that a 'restoration' has been 'skilful', costly', or 'thorough'.* (…) *Where the so-called 'Restorer' comes, he rarely fails to make an utter devastation, leaving the puzzled inquirer no means of forming an opinion* (…) *as to what may have been the original import or appearance of the work"* (Winston 1863, 327).

<u>The restoration campaign of 1861-62. Charles Winston and Ward & Hughes</u>

In 1860 the Archaeological Institute held a congress at Gloucester, during which the fate of the Great East Window was discussed (Winston 1863, 327-328). Winston's recommendation to merely relead the glass and *"to attempt nothing in the way of restoration, beyond supplying such insignificant parts of the coloured grounds as were wanting, with modern glass of corresponding hue"* (ibid., 328)

was adopted. The London firm of Ward & Hughes was contracted to do the work under Winston's supervision.

*North Moreton*

In 1858 Winston had been involved in another major restoration, that of the east window of the Chapel of St. Nicholas (now known as Stapleton's Chantry), at All Saints Church, North Moreton (Oxon.). The window dates from ca.1300 (Whyte 1993, 105).

**fig. 17** The east window of the chapel of St. Nicholas, All Saints' Church, North Moreton

Here, as later in Gloucester, he advised Ward & Hughes on the restoration policy (ibid., 106). In both cases 'restoration' in the mid-nineteenth century sense of returning the glass to an as near as possible 'original' state was rejected by Winston.

The window was releaded and, *"where a piece of the original white or coloured glass had been lost, a corresponding piece of white or coloured glass has been inserted, simply dulled over for the purpose of toning it down somewhat into harmony with the ancient material"* (Morgan 1861, 153).

Neither here nor in his description of the Gloucester glass does Winston specify what exactly he means by 'lost'.

Compared to Gloucester the North Moreton window contains a large percentage – maybe more than fifty

**fig. 18** North Moreton, panel 2c.

percent in some panels - of this ‘dulled over’ replacement glass. So much, in fact, that it begs the question what was there before, if not holes? On the other hand there is hardly anything in the way of repair with medieval stopgaps or untreated clear white glass, traditional techniques very much in evidence in Gloucester.

Whyte remarks that *“window sVIII in the vestry is a composite of fragments, several of which may have originated in the east window”* (Whyte 1993, 106).

It seems at least possible that the North Moreton campaign represents a cruder precursor to the work on the Great East Window of Gloucester Cathedral. What seems to have happened in North Moreton is a large-scale removal of old repairs, leaving in situ only glass which belonged to the window originally.

*Gloucester*

In the case of the Great East Window of Gloucester Cathedral Winston insisted that *“things were left as they were found. The archaeological inquirer has, therefore, precisely the same means of investigation now as he would have had before the recent repairs, if we except such guidance as the ancient leadwork supplied”* (Winston 1863, 328).

The loss of the ancient leadwork is certainly deplorable but may have indeed been unavoidable.

No photographs appear to have been made of the window prior to Ward & Hughes’ releading, and neither do we have detailed restoration records dating from that time. Winston published a relatively detailed account of the Great East Window in 1863, in which he states that *“having had occasion to compare these notes, written for the most part before the glazing was moved, with the window since its repair, I could detect no other difference in its appearance than would naturally result from the glass having been unavoidably freed from a good deal of*

*the whitewash and mortar which in the course of years have encumbered its surface"* (ibid.).

Overall he gives the impression that very little was done to the window in terms of introduction of new glass. Since there is, in fact, a good deal of post-medieval glass in the window, the assumption was that reglazing after the Second World War had obliterated the important minimalist restoration campaign by Ward & Hughes (Kerr 1985, 122).

If such reglazing had taken place, the majority of the lead in the Great East Window would have to date from 1945-46.

## Dating the lead

Documentary, anecdotal and archaeological evidence concerning the age of the lead in the Great East Window is conflicting.

### *Documentary evidence*

According to Winston, the until then still surviving original lead[5] (Winston 1863, 245) was *"so decayed as to render its complete repair imperative"* (ibid., 327) (for 'repair' one has to read replacement).

The window remained essentially untouched until it was removed in 1940 to protect it against air raids during the Second World War (CWTAB 1940). It was not, however, completely removed.

The tracery panels above the main lancets (essentially the painted quarries at the top of the window) remained in situ (Ashwell 1975, 2). The same is probably true for the majority of small eyelets throughout the window.

[5] It would certainly have been a patchwork of original and seventeenth century lead. If my assumption about an undocumented early nineteenth century restoration is correct, lead dating from that period would also have been present.

The Clerk of Works Time Account Books for the years immediately after the war show that before reinstallation the glass was repaired by Mr Wallace Beck of Cheltenham.

These repairs took less than a year, from 28 September 1945 until 16 August 1946 (Clerk of Works Time Account Books 1945/46).

In October 1946 the cathedral architect, Mr. Waller, reported that *"the leadwork was examined and repaired* <u>*where necessary*</u> (my underscoring) *by Mr. Beck,* (and) *the glass cleaned"* (Waller 1946, 8).

### *Anecdotal evidence*

In her 1985 article Jill Kerr quotes Edward Payne, the then cathedral glazier, in whose opinion the entire window had been releaded (Kerr 1985, 122).

In June 2001 the same information was given to me by Wallace Beck's son, the Rev. John Beck, who stated that his father 'single-handedly' releaded the entire window after the war.

In 1975, however, one of the stone masons who had assisted in removing the panels from their wartime storage stated that *"due to the skilled removal only the ½" lead borders to the glazing had been damaged. These were repaired by Mr. Constance* (sic) *of Cheltenham. None of the 'crystal' glass was broken either during removal or re-fixing"* (Ashwell 1975, 3).

### *Archaeological evidence*

In 1913 Sidney Pitcher took a series of photographs of the Great East Window.

During the cleaning of the Great East Window in 1999, these photos were used to illustrate the individual conservation records made for each light. They were at the time still the best available photos of nearly all the figurative lights.

While working on the glass with the photos at hand, only very minor differences were noted, such as additional strap leads both on the interior and the exterior, and three major areas where releading had occurred: G5, 1 and G5, 2 (the fifteenth century Madonna) had been releaded in their entirety; D7, 1 was partly releaded, and also a large portion of H9, 1.

G5 and D7 use flat lead ranging from ¼" to ½" in width and are part of the 1976 repairs by Payne and the York Glaziers Trust. H9, 1 shows a different flat lead of 3/8" and this repair is not on the chart Payne produced to illustrate his repairs in 1976.

This same lead occurs in several other areas along the daylight borders and in corners of panels. In E11, 1 it was also used around the main outline of the figure, suggesting that this panel was partly dismantled.

**fig. 19** Flat lead in G5

The vast majority of the lead in the Great East Window is of very consistent appearance and condition. It is very typical of nineteenth century lead, both in section and milling marks. It is round and ranges in width between 3/16" and ¼". The main outlines of the figures are enhanced by the use of double leads, that is two ¼" leads stacked into each other.

While its condition is not alarming, the lead still shows the corrosion skin which one would expect lead to acquire over a period of a hundred and forty years, and fine cracks have developed, which also point to an age higher than fifty-odd years. There is no perceivable difference between the lead of those panels which remained in situ during the war, and those which were removed.

### *Conclusions*

The archaeological evidence points towards a sensitive and restrained repair in 1946, consistent with what one would expect to be necessary after hasty removal of glass in eighty-year-old lead.

Certainly each individual panel would have required attention, such as cleaning and repairs to the edges and occasional repairs to broken pieces throughout the panels. This may have given rise to the misconception that the whole window was releaded.

But only an act of overt vandalism would have made complete releading necessary. The fact that the glass was returned within less than a year makes it quite impossible for one person to have releaded all of the removed panels 'single-handedly'.[6]

It seems therefore that the Great East Window is still essentially in its 1860s lead. Small areas are identifiable as having been releaded, but the vast majority of the glass still represents the state Ward & Hughes left it in. It is therefore fair to assume that the majority of post-medieval glass in the window stems from the Ward & Hughes restoration.

## Assessing the 1861-62 restoration

Having established the fact that we are indeed looking at the famous 1861-62 restoration, it may be asked how well the evidence lives up to Winston's policy.

[6] I have asked several of my colleagues to estimate the time needed to take rubbings, dismantle, clean, repair, relead and cement all panels removed from the window in WWII. Their estimates and my own vary between 380 and 550 working days.

There is a significant amount of blue and red background glass which has been painted with stippled or streaky matts. A very small number of ruby pieces have been etched to resemble the original streaky ruby, a technique which Winston described in a letter to Joseph Bell in 1847 (Brown 1997, 111).

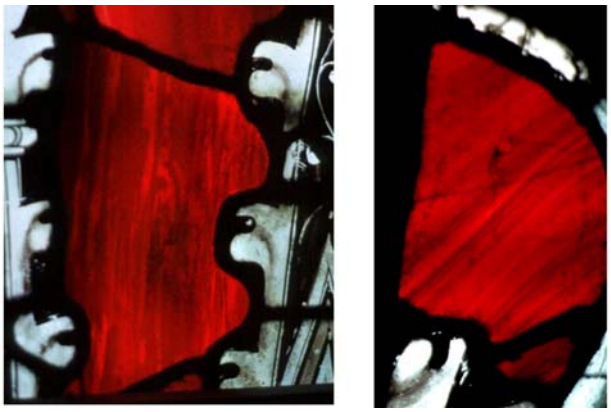


**fig. 20** Etched (left) and real (right) streaky ruby glass

Overall, the treatment of many pieces in the Great East Window does comply with Winston's recommendations for replacement of missing pieces, by inserting a new piece of glass of corresponding colour simply dulled over to make it harmonise with the ancient glass.

The amount of replacements, however, not only in the backgrounds but also in draperies, exceeds what one might assume from reading Winston's account.

One type of insertion in particular has been questioned as being part of the 1861-62 restoration campaign: seven missing heads have been replaced with matted pink glass, which in some cases show the faint representation of a face. I will talk about these in Part II.

## Twentieth century repairs

### 1914-15

The stone repairs in 1914-15 were accompanied by an attempt to re-cement the glass in situ (CWTAB 1914-15). It is unclear whether scaffolding was erected on both sides of the window, but it was certainly there on the inside. The re-cementing was probably a very basic operation, most likely done by a scrubbing brush dipped into soft glazing cement and then rubbed over the surface of the

stained glass panels. It would almost certainly have resulted in the loss of any paint that was not firmly attached.

**1939-1945 Wallace Beck**

The majority of the glass of the Great East Window was removed in 1939 and 1940. The individual panels were marked with paper labels, packed into wooden crates and put into storage in two different places: one part went into the crypt of Gloucester Cathedral, a notoriously damp place, while another part was taken to the cellar at Miserden Park (CWTAB 1939-40)– presumably not an entirely dry place either.

When the crates were opened upon their return to Gloucester in 1945 the majority of the paper labels had fallen off. *"The only record of the window layout at hand was a coloured picture postcard purchased from Percy's Shop in College Court. The glazing was laid out on the Choir/Presbytery floor and sorted to conform with the colour pattern and as far as possible with the original layout"* (Ashwell 1975, 3).

It was probably then that the panels were marked with numbers painted onto the glass. The paint used has adhered so well that it is still in situ. In a few places an attempt was made to remove it, but this has resulted only in scratching the glass paint.

**fig. 21** Scratch marks in glass paint

The individual panels were taken to Cheltenham to be repaired by Wallace Beck (see above). Apart from replacing a number of daylight border pieces Beck seems to have worked in the best tradition of Charles Winston – to merely relead and otherwise leave things as he found them. There are a lot of strap leads covering cracks in the glass. Those on the outside of the window are screwed into the heart of the Victorian lead, and some of them support plating glass. This

operation almost certainly requires the panels to be flat on a bench, and is therefore probably Beck's work.

Unfortunately, Mr Beck did not leave any restoration records.

### 1960 Wallace Beck

Beck returned to the window in 1960 for repair in three places (Welander 1985, 135). There is no record of what these repairs entailed. There are, however, several pieces of glass which were inserted in situ, and which are not on Edward Payne's 1976 chart of his repairs (see below). These may date from either 1945-46 or 1960.

### 1976 Edward Payne

By 1976 the window was perceived to be leaking again[7], and scaffolding went up on the outside. Edward Payne, the cathedral glazier, carried out the work between June and October 1976.

Five lights in tier F and all lights in tiers A to E were washed down *"as the lower portions of the window were dirtier than the top portions & required more scrubbing to get off dirt"* (Payne 1977). As in 1914-15 the glass was re-cemented in situ by the traditional method of rubbing liquid glazing cement under the leads with a scrubbing brush. Not only did this method scratch the patina on the exterior surface of the glass, the cement was also not cleaned off properly. This means that a surplus of cement was left either side of the lead, making the lead-lines of the glazing look up to twice as wide than they really are.

A number of pieces were plated with clear glass, and ca. 15 new pieces inserted to replace broken glass.

[7] The high levels of condensation on the window make me wonder whether this may not have been mistaken for leaking.

In all three panels were removed for further treatment. This work was done with the assistance of Peter Gibson of the York Glaziers Trust.

In May 2001 I asked Mr Gibson how they managed to remove the panels without having access to the inside of the window. It apparently involved chiselling out the pointing from the glazing groove and then passing a bent metal strip through the resulting gap and cutting away the copper wires which attach the lead cames to the internal glazing bars – without being able to see what they were doing.

This procedure could result in the partial disintegration of the leadwork and fracture of glass. This method of removing medieval stained glass is highly dangerous to the fabric of a window, not only to the stained glass, but also to the stonework. On no account should fragile glass be removed without access to both sides. There is also a possible danger to the public and to artefacts underneath the window: large chunks of internal stonework might suddenly fall, as could loose saddle-bars.

Payne produced a large drawing of the window in which he detailed the work done. This is the first instant of a restoration record in existence for the Great East Window. While he does not give any indications of the condition of the window or explain the reasons for replacements and releading, he does at least specify some methods and materials used.

The three panels removed were the lower half of E7, St Catherine (?) and the two main panels of G5, the fifteenth century Madonna.

Pitcher's photo of 1913 shows that E7, 1 was very fragmented and seemed to contain a lot of corroded original glass and some alien fragments in the

**fig. 22** E7, 1; 1913

**fig. 23** Payne's restoration

drapery and in the architectural border. Payne's treatment was to discard all of those pieces and replace them with new pieces painted in a robust abstract style. On one of them he introduced a different fall of the drapery, a misinterpretation of the original lines which leads me to think that the original pieces were either already lost, or may have been badly damaged in the removal of the panel.

Curiously, given the fact that the original design of the draperies in this window used quite large pieces, he painted the nineteenth century repair leads onto his larger new pieces, repeating the impression of badly fragmented glass. The panel was releaded using flat lead of mainly 3/8", much wider than the Victorian lead it replaced.

The Madonna in G5, a late fourteenth or early fifteenth century creation which was probably introduced into the Great East Window in the seventeenth century, contained large areas of badly corroded glass.

While the white crown glass of the face and drapery were very well preserved, all remaining coloured glass original to the two panels had developed thick opaque corrosion crusts. These crusts had been there for a long time. A photo of the exterior of the window, dating from ca. 1870, shows the coloured areas of G5, 1&2 covered in a uniformly white corrosion layer, and Pitcher's 1913 photo of the interior shows that those areas had become totally opaque.

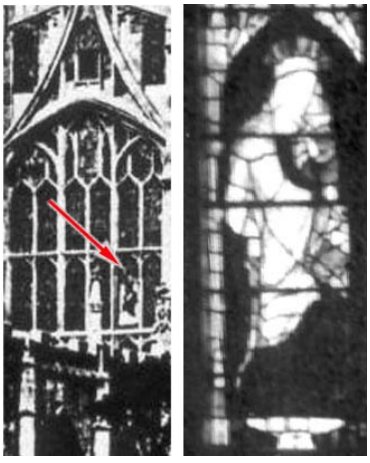


**fig. 24** Exterior and interior views of G5 before 1976

The panels were taken to York and the corrosion crusts removed with airbrasive. This technique uses abrasive powders, which are applied to the

glass surface by compressed air, very much like an airbrush[8].

Some of the cleaned glass was worn extremely thin. There may have been several pieces, particularly in the pink drapery and in the serpent at the foot of the figure, which crumbled on dismantling of the panels.

Payne replaced these with new glass, again painted in his robust style. The serpent now only contains three pieces of original glass, the rest of it is probably largely an invention, particularly in terms of the colour scheme.
Although the paint on the corroded pieces had disappeared, it had protected the glass from corrosion for a time. This meant that the surface was attacked more deeply in the unpainted areas, and in slanting light many of the original trace lines could still be made out.

Payne plated the corroded pieces with thin bits of clear glass both internally and externally. The internal plate was painted with what he could reconstruct of the original decoration. In other places he even used coloured plates.

The two panels were then releaded, again using very wide flat leads with in places extremely high hearts. This high heart was necessary to accommodate the thick sandwiches of original and plating glass.

Edward Payne was a stained glass artist in his own right. He was born into an Arts&Crafts background – his father, Henry Payne, was the leading stained glass

[8] In the 1970s this technique was still in its infancy, and the powders used were aluminium oxide or glass beads.

The use of such harsh abrasive materials put the technique into disrepute, but recent studies by the German Federal Institute for Material Research and Testing, using samples provided by the Cathedral Studies, Canterbury, have shown that airbrasive can be a most effective and gentle tool if used by an experienced operative (Adam et al, 1996).

Airbrasive should only be used on unpainted exterior surfaces which are heavily corroded. Rather than harsh abrasive powders, sodium bicarbonate and ground nutshells should be used, and the air pressure adjusted to a minimum.

craftsman of the Birmingham Group, and had trained under Christopher Whall (Moss 1995, 3).

Edward Payne was heavily influenced by Whall's book *Stained Glass Work*, which he treated as his *"Bible"*, he even knew whole passages by heart (ibid.).

Edward Payne in his studio.

**fig. 25** Payne in his studio

Whall had produced windows for the Lady Chapel and the Chapter House in Gloucester from 1898 until 1921, and it is very possible that Payne, who was born in 1906 and lived in Gloucestershire, was present at the installation of the later windows. Later, as cathedral glazier, he would have been surrounded by some of Whall's finest work.

This influence is clearly visible in Payne's approach to restoration. The use of thick sandwiches of coloured glass held together with wide flat lead is one of Whall's trademarks. *"Respect your bars and lead-lines, and let them be strong and many"* (Whall 1905, 176).

Whall's diatribe against 'modern' restoration compared with the makeshift patchwork of what he called *"delightful 'builders-glazing'"* (ibid., 180) of the post-reformation period is worth quoting: *"A modern restorer would have delighted* (…) *to complete the mutilated canopies by careful matching, making the window entirely correct and uninteresting and lifeless and accomplished and forbidding. The very blue-bottles would be afraid to buzz against it; whereas here, in the old church, with the flavour of sincerity and simplicity around them,* (…) *they glitter with fresh feeling, and hang there, new and old together, breaking sunlight; irresponsible, absurd, and delightful"* (ibid., 181).

This sense of fun and the abhorrence of ‘correctness’ are very evident in Payne’s approach to restoration. While this works well in many cases and is certainly honest about what it is, in the case of the changed drapery in E7 it goes beyond what we would feel to be acceptable today.

In the case of the Madonna his robust interpretation of the background pattern together with the use of wide leads altered the elegant appearance of the fifteenth century glass considerably. Payne’s very reddish paint on the plates also moved the colour of the blue glass into the purple spectrum.

The weight of the plates and of the wide thick lead also caused the panels to buckle (a problem often associated with Whall’s stained glass), and consequently put the thin original glass under pressure.

**fig. 26** Payne’s serpent

His serpent, however, is a delightful and original new addition to the window.

## Cleaning and Repair in 1999

In 1997 scaffolding was erected on the Great East Window both externally and internally for stone repairs. This gave access to the interior of the window for the first time since 1946.

In September 1997 Dr. Sebastian Strobl of the Cathedral Studios, Canterbury, was invited to prepare a report on the condition of the stained glass. This report was submitted in March 1998.

The recommendations given by Dr. Strobl, based on the premise that the glass was not to be removed, included:

- *The careful in situ cleaning of all panels internally, using de-ionised water on cotton wool swabs, soft bristle brushes and glass fibre brushes.*
- *The removal of surplus glazing cement and of dust on the external surface with scalpels and brushes.*
- *The recording of specialist observations with regards to technical peculiarities and to other findings of historical importance for each individual panel* (Strobl 1998, 7).

Several stones were damaged so badly that replacement was necessary. Eight lights were removed by Graham Dowding of Stroud to enable the repair to the stonework: G4-G7, and H2-H5.

These lights were taken to the Cathedral Studios in Canterbury for cleaning, repair where necessary, and safe storage.

In 1999 the removal of two more panels (B7, 1&2) became necessary to enable more repairs to the stonework. Since both panels were badly buckled, they were releaded by Graham Dowding.

**Cleaning and conservation at the Cathedral Studios, Canterbury.**

Each of the seven lights is divided into three panels, two main rectangular ones, and one ‘head’, which follows the shape of the top of the light.

## G5

### Condition

It immediately became obvious that panel G5, 1 and G5, 2 (the fifteenth century Madonna) differed significantly from the others. They had been releaded and plated by Edward Payne only twenty-two years earlier, but already they were bulging badly.

Slight bulging can often be rectified by simply laying a panel flat on the bench. After a period of time the leadwork may relax and flatten itself. If the causes for the bulging can be rectified by e.g. deepening the glazing groove or adding additional bars, releading may be quite unnecessary.

A very positive sign was the complete absence of reoccurrence of the white corrosion product.

### Treatment

Comparison of G5 with the other seven lights showed that G5 was the only one suffering from pronounced bulging. The weight of the panels was therefore the likely reason for the state they were in. After consultation with the architect, the decision was taken to dismantle both panels completely and relead with lead of the same section and width as that of the other panels.

Many pieces had been plated both internally and externally with 2mm to 3mm thick glass. As weight was an issue, the efficacy of each individual plate was investigated.

It was decided to respect Payne's additions in terms of painted plates and new painted glass where glass had been lost, but to remove any plates that were unnecessary (all unpainted internal plating). All necessary unpainted external plating was replaced with new 1mm thin glass which was heat-moulded to follow the surface contours of the original pieces, thus reducing the risk of pressure points between plate and original glass.

There were exceptions to this rule: the large external plate on the Madonna's face (which is quite unnecessary, but is diamond inscribed with Edward Payne's name) and the painted plates on the blue background. The inscribed plate was heat-moulded to conform to the slightly warped surface of the crown glass. It was then diamond inscribed along the edge to document its treatment and re-use.

Payne's interpretation of the background decoration was idiosyncratic, but not very accurate. Having taken rubbings of the individual blue pieces, I discovered that it was possible to reconstruct the original pattern with a much higher degree of accuracy. This harmonised much better with the elegance of the surviving fifteenth century surface decoration.

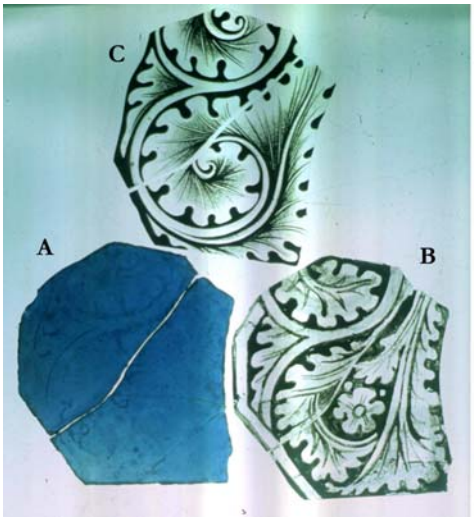




**fig. 27** old and new plating

**A**: original C15 blue background glass.
**B**: Payne's internal plating with his reconstruction of the floral pattern.
**C**: New external plating with more accurate reconstruction of floral pattern.
**D**: C15 glass and new external plating combined.

More importantly, however, the now visible continuance of the floral vines proves that most of the background glass original to the Madonna is still in situ. The paint used for the new backing plates was very close in colour to the original fifteenth century paint. This eliminated the purple tint Payne's paint had given to the blue glass. The old painted plating glass had been located on the inside of the original glass, with unpainted plating glass giving protection to the external surface. The new painted plates were applied to the external surface only, with no internal plating. This was done to reduce the weight of the panel. Improvements to the internal environment of the window will hopefully prevent corrosion from reoccurring on the inside (see below).

The two panels were finally hand-puttied on the outside with butyl mastic, which was injected using an EFD injection system.

Photographic records were made, including before and after conservation photos of the individual panels and during conservation photos of certain aspects of the conservation process.

A written conservation record was also produced, using the Cathedral Studios' standard format. This includes condition of lead, glass and paint before conservation, previous restoration treatments, and current conservation treatments, methods and materials, as well as a series of illustrative drawings.

**fig. 28** G5, 1& 2
Before restoration.

**fig. 29** G5, 1& 2
After restoration.

## G4, G6, G7, and H2-H5

**fig. 30** Hairline fracture in lead next to solder joint

Assessments of the remaining twenty-four panels revealed that much of the leadwork, though generally stable, had developed hairline cracks, particularly near solder joints. Such fractures would not be cause for great alarm in panels that are in situ, are firm and well cemented and show little signs of bulging. While the state of such lead should be monitored, action is not necessarily needed.

In the case of the removed panels, however, repeated handling meant that there was a danger of the cracks deepening, which might result in partial disintegration of the leadwork. It was decided to solder over these cracks. This stabilised the lead enough for the panels to be handled safely, but is not a 'cure' of the problem. Hairline cracks often develop next to solder joints. This may be a result of metal fatigue due to the sudden change between the harder area of the soldered lead and the softer unsoldered lead. Fatigue crystallisation may be *"hastened by the 'heat treatment' of soldering"* in very pure lead (Newton and Davison 1989, 248). New cracks are likely to develop over time next to the new solder joints.

Usually cleaning and conservation of stained glass panels is done with the panels flat on the lightbox or the bench. In this case, however, we decided to replicate the situation we were going to be working in with the window in situ. This gave us the opportunity to try working methods in the studio, and enabled us to plan for supplies. It also gave us a reasonable idea of the time scale involved.

The panels were therefore fitted into a vertical easel lit by natural light. Since the condition of these panels and their treatment followed along the lines for the rest of the Great East Window I will deal with these items below.

## Cleaning and conservation in situ

In July 1999 the in situ cleaning and conservation of the Great East Window commenced.

The team of three conservators from the Cathedral Studios included David Griffiths, Alison McCaffrey, and myself.

Each conservator spent two weeks in Gloucester and one week in Canterbury, thus allowing for a work schedule that ensured the presence of two conservators on site at any one time. It also enabled each individual to take a break from the relative monotony of rolling cotton buds by the tens of thousands, and continue with other work in Canterbury.

## Condition

### Condensation

The Great East Window suffers from a high rate of condensation. This condensation occurs throughout most of the year, but is obviously worst during the winter months. The cathedral has been heated since the nineteenth century. Currently, two large heaters are situated directly below the north and south bays of the window, blasting hot air up the internal surface of the glass.

**fig. 31** G4
Condensation on the internal surface of the Great East Window

This warm air quickly reaches its dew point on contact with the colder glass. On a sunny morning the upper and south-facing regions of the Great East Window tend to dry off relatively quickly, but in the lower regions in the shadow of the Lady Chapel and in the northern bay condensation can be a permanent condition.

The lack of ventilation in the choir of Gloucester Cathedral adds to the high air humidity levels. Although there are casement windows in the north and south clerestory windows, their opening mechanisms are only accessible from the outside. Opening and closing those casements therefore requires a trip onto the roofs of the choir ambulatory. While this seems to have been a regular task for the cathedral's vergers in the past[9], today the casements are not even fitted with ropes and are therefore impossible to open without access by ladders.

**fig. 32** Casement in south choir clerestory of Gloucester Cathedral

Lead

As with the seven removed lights, hairline cracks have occurred in many places. Since the panels are generally stable and remained in situ no action was taken.

Glass

**Dirt**

The interior surface of the glass was covered in a layer of accumulated dust and dirt, which over time had formed a grey film. The density of this layer varied, and the smell of the cotton buds used to

**fig. 33** Test square left uncleaned on ruby glass.

[9] According to Alan Norton, Clerk of Works.

clean the glass resembled that of a damp basement. It is likely that much of this grimy layer contained bacterial moulds or fungi. Interestingly, the ruby glass tended to be worst affected. Red glass eliminates ultra-violet light, and is therefore an ideal habitat for some microbial growths.

The exterior surface of the window was covered in some areas with stone dust from the recent repairs.

The scaffolding, particularly in the lower regions between Lady Chapel and Great East Window, offered perfect habitat for a large colony of pigeons. This resulted in severe soiling of the stained glass with bird guano. The situation was eventually improved by the installation of netting around the scaffolding.

**fig. 34** Pigeon guano on the exterior.

**Fractures**

For a window the size and age of the Great East Window astonishingly few cracks in the glass had developed since its last releading (see appendix E).

Many pieces had only single fractures, but some pieces showed multiple cracks, and a few were badly shattered, most of those probably due to airgun pellets.

**fig. 35** H3, 1
Corrosion line due to water run-off

**Corrosion**

Corrosion had occurred both on the internal and the external faces of the glass. On the interior, very shallow and small scale pitting was observable,

with areas of even surface corrosion where water accumulated underneath horizontal leads and in areas of water run-off.

The exterior again shows pitting, which is largely confined to surfaces with back-painting. This phenomenon can often be observed in medieval glass, and may be due to several factors: the paint may have a high alkali content and may therefore be more prone to corrosion.

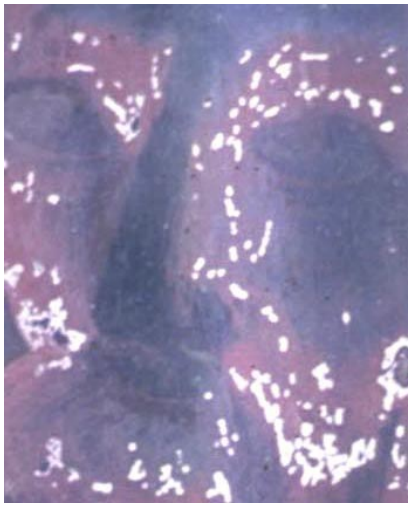


**fig. 36** F3
Pitting on areas with back-painting

Also, dirt adheres more easily to painted surfaces, trapping moisture and thus promoting corrosion.

In contrast, the silver-stained areas in the window are practically unaffected by corrosion. Newton puts forth the hypothesis that the protective effect of some silver stain may be explained by an exchange of sodium ions with silver ions in the surface during firing (Newton 1989, 145)[10].

**Microbial growths**

While bacteria and some forms of fungi may be invisible to the naked eye, the presence of algae and/or Cyanophyta on the Great East Window is plainly obvious in some areas. This may not be a recent phenomenon, but comparison of the condition of affected areas now with photographs from 1913 shows that corrosion seems to have spread.

Storage in damp conditions during World War II combined with possible re-cementing after the war with linseed oil based cement may well have given a nutritional boost to micro-organisms already infecting the glass.

[10] Silver-stain can, however, also sometimes be seen to weaken the resistance to corrosion.

*Paint*

Much of the painted decoration is in stable condition, although some paint loss has occurred in the past. These paint losses affect both trace lines and smear shading. The thicker paint of the trace lines has in places flaked off completely, leaving only a faint ghosting on the glass surface. In some places loose flakes of paint have become completely dislocated, and are adhering to the glass surface by virtue of the grimy dirt which covers much of the glass. Many of the fifteenth century stopgaps are particularly badly affected.

**fig. 37** Dislocated paint flakes.

The thin layer of smear shading shows areas of patchy thinning and loss.

The condition of the internal painted decoration deteriorates towards the lower regions of the window. It is also generally worse in eyelets and close to overlapping false tracery. These areas suffer from higher condensation rates and low ventilation.

The back-paint, however, although under attack by corrosion of the glass underneath, is perfectly stable.

Although the silver stain varies in intensity throughout the window, no loss has occurred. The variation in tone is due to the initial silver content of the stain, the temperature it was fired at, and the composition of the white glass.

**Treatment**

Our tool kit for the different conservation procedures included:

cleaning

- cotton wool and bamboo skewers
- deionised water
- soft squirrel hair brushes to dust off loose dust from glass
- soft hog bristle brushes to dust off surrounding stonework and saddle-bars

paint consolidation

- Paraloid B72
- small sable brushes

removal of unnecessary strap leads

- lead knife
- scalpel

consolidation of broken glass

- copper wire
- soldering iron, flux and solder

puttying

- butyl mastic glazing compound
- injection gun
- quills for cleaning off surplus

documentation

- camera
- record sheets

health and safety

- surgical gloves
- dust masks

Work started in July 1999 at the top of the window, and progressed downwards over a period of five months.

**Cleaning**

The glass surface was cleaned both internally and externally with deionised water on cotton wool buds, which were rolled over the surface. Rolling the buds picks up dirt without the danger of scratching the glass with any abrasive particles that might have adhered to the cotton wool while cleaning.

Areas with very unstable paint were left uncleaned.

This cleaning method works very well on glass with a generally intact surface. Since the conservator can make cotton buds of any size, it is possible to clean very selectively and to avoid unstable areas.

On heavily corroded glass cleaning with cotton wool is not advisable, as the rough surface of the glass will pick up strands of cotton which could provide nutritional resources for microbial organisms in the future (Drewello 1997, 342).

The few pieces of heavily corroded glass (none of which were original to the Great East Window) were only gently brushed with soft brushes to remove loose corrosion products.

Cleaning of the bird guano covering portions of the exterior was very unpleasant and for health and safety reasons was done wearing gloves. Bird guano can contain infectious material and is particularly hazardous when inhaled as dust. Since we were using a damp cleaning method, inhalation of dust was not an issue.

**Consolidation of loose paint**

Paint consolidation was only attempted in cases where whole flakes of tracing paint had become detached from the surface and were in immediate danger of falling off.

In cases were paint flakes had become dislocated they were consolidated as found. Returning them to their proper position might have been feasible in studio conditions, but is practically impossible when working on a vertical panel.

A very small amount of Paraloid B72, an acrylic resin, was applied to the flake in a 5% acetone solution with a small sable brush.

**Removal of unnecessary strap leads**

In several cases strap leads had been applied to pieces with only single cracks. Since this was a purely cosmetic intervention with the intention of making the window look 'intact', but resulted in confusion of the original design, it was decided to remove those where possible.

**Consolidation and replacement of broken glass**

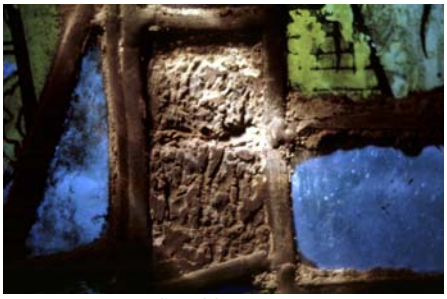


**fig. 38** E13
Sugared glass

In all seven new pieces of glass were inserted into the Great East Window. Of those only four replaced medieval glass, two original pieces, which were severely shattered and missing fragments, and two stop-gaps, which showed a type of corrosion known as 'sugaring' and were about to disintegrate completely. The new insertions were exact copies of the original pieces[11], and were signed and dated.

[11] Or in the case of the two stop-gaps blue unpainted glass of the same colour as the original blue background.

All other pieces were shattered cathedral glass quarries probably by Ward & Hughes.

Wherever possible the removal of glass was avoided. In a situation without protective glazing, consolidation with resin alone is not a long-term solution. We therefore used a technique we had observed in glass from Canterbury Cathedral, where it had been used successfully in the nineteenth century.

There, thin copper wires had been attached to the lead surrounding broken pieces on the inside, while thin plating glass held the fragments in place on the outside.

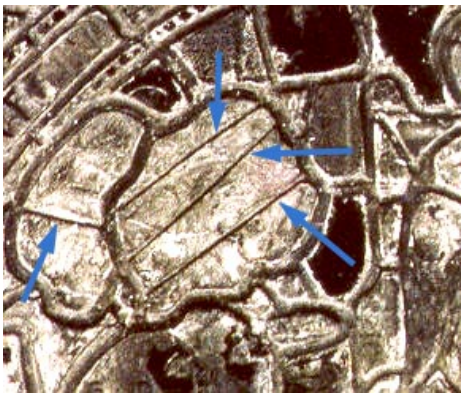


**fig. 39** Canterbury Cathedral, nXV, 29 Consolidation of broken glass with copper wires

Since plating was not an option for in situ work, we decided to attach the wires to both sides of the panel, and where possible hide them behind trace lines. This technique is very inconspicuous, but holds the fragments firmly in place. There may be a slight possibility of verdigris developing on the copper, which could lead to localised staining of the glass surface. In the Canterbury examples, however, this has not happened.

**fig. 40** The same technique used in Gloucester.

**Puttying**

Inevitably, in a window with exposure to high winds and large fluctuations of temperature, some loss of cementing material will occur over time. Only minimal loss had occurred since the window's last in situ re-cementing in 1976, but those

areas where cement had fallen out were puttied with a butyl glazing compound. In contrast to traditional linseed oil cement, which sets solid, butyl putty remains flexible and should accommodate the movement of the stained glass panels.

The putty was injected with a small hand-held gun, and any excess was removed with goose quills. These do not scratch the glass surface and give a smooth surface to the putty.

No attempt was made to remove the surplus 1976 glazing cement. The cement had set very hard, and without the aid of a microscope removal of hard old cement will very likely result in scratching the glass surface.

**Documentation**

For each light a conservation record was produced, giving a description of the condition of lead, glass and paint, as well as a description of its treatment and the materials used The photos used to illustrate the documentation sheets were copies of Sidney Pitcher's 1913 series.

With the scaffolding in the way, photographs of individual lights in their entirety were impossible. Any alteration to the fabric, however, was documented with before and after photos.

Our conservation policy called for minimum intervention. In most cases, this was adhered to, but in the case of G5, 1&2, the needs of the glass dictated a complete releading and re-assessment of the amount of plating glass.

Since the 1976 plating glass was very thick and in many cases did not follow the shapes of the original pieces exactly, their re-use was impractical. We therefore had a choice of either copying Payne's inaccurate reconstruction of the floral background pattern onto new thinner plates, or try to reconstruct it more

accurately. After consultation with English Heritage and the architect, the latter option was adopted.

## I. 3. Recommendations for the future

The main points of concern for the future of the Great East Window of Gloucester Cathedral are the deteriorating condition of the painted decoration on the internal surface of the glass, and the acceleration of glass corrosion due to biological growths.

Paint loss is not a new phenomenon to the glass. Pitcher's 1913 photos show areas of loss even then, but comparison between his pre-war photos with those taken in 1946 shortly before reinstallation reveals the extent of loss that has taken place in the meantime.

It is impossible to tell how much of that is due to damp storage during the Second World War – although that would certainly have had an impact on the condition of the paint –, and how much was due to internal in situ re-cementing in 1914-15 and cleaning and re-cementing in 1945-46.

What is clear is that since 1946 the paint has continued to deteriorate. Particularly in the lower regions of the window much of it is flaking.

Biological growth, on the other hand, seems to have increased considerably after the war. The re-cementing of the window with linseed oil cement is the likely culprit here, giving a nutritional resource to the micro-organisms.

What the 1999 cleaning of the window achieved was only a temporary respite. The removal of dirt and of those micro-organisms that live on the surface of the glass has deprived the biological growths of some of their food.

It will also allow the glass to dry more quickly, since much of the hygroscopic layers are now gone.

But as long as the window suffers from high levels of condensation, the problems will reoccur and worsen. Micro-organisms are notoriously difficult to remove, as some of them live inside the corroded layers of the glass and cannot be reached by conventional cleaning.

### I. 3. 1. Biocides

We did consider the use of biocides, but decided against it. Biological growths can recover very quickly after treatment, and the new biofilm may even acquire resistance. Industrial warranties for biocidal products therefore usually do not exceed three years (Drewello and Weissmann 1997, 339).

The long-term conservation of the Great East Window will have to address its environmental conditions to reduce the levels of condensation.

Ideally, condensation should not occur. This, however, can only be achieved if both surfaces of the glass are kept at a temperature above the dew point of the surrounding air.
Since the air temperatures and relative humidity of the internal and external atmosphere of a building vary significantly during the year, the glass has to be isolated from either one or the other environment.

### I. 3. 2. Protective glazing

Protective glazing is at the moment the only way of achieving this. Protective glazing means the addition of a second layer of glazing to the outside of the historic glass.

In order to prevent condensation from forming between the two layers, the interspace has to be ventilated and be of sufficient width to allow a steady airflow to take place (the so-called ‘chimney-effect).

Ventilation of the interspace takes place through hidden gaps at the top and bottom of either the historic glazing (internal ventilation) or the protective glazing (external ventilation). Internally ventilated protective glazing systems have been shown to afford the highest protection to the historic glass (Oidtmann et al 2000, 206).

From the point of view of the preservation of the historic glass, the best system currently available is the 'isothermal' system. It requires the removal of the historic glass from its original glazing groove. The protective glazing takes its place.

The historic glass is surrounded by custom-made bronze frames, which are then installed on the inside of the protective glazing. Hidden gaps at the top and bottom of the frame allow for a steady airflow.

This system not only isolates the historic glass from the external environment, but also to a large extent from the effects of the colder stonework. The glass is effectively kept in museum-like conditions, while still in more or less its original position.

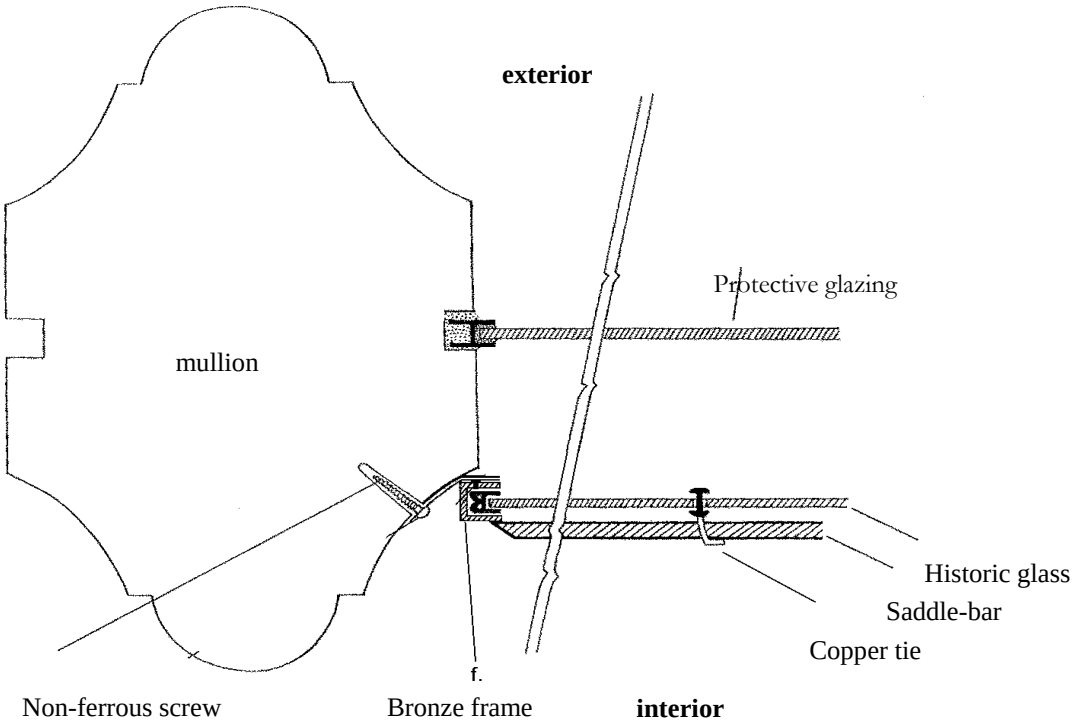



**fig. 41** Isothermal glazing

The external layer can take many shapes, depending on the aesthetic and practical requirements of the place. Laminated glass sheets, for instance, while unsightly, give protection against impact damage.

In Canterbury Cathedral, protective glazing has been installed since the 1970s. In the virtually vandalism-free environment of the precincts of the cathedral we are able to install protective glazing made from leaded lights.

These follow the main lead lines of the historic glazing, and the individual clear white pieces are kiln distorted to create a lively reflection similar to that of uncorroded medieval glass. The aesthetic impact of the protective glazing on the exterior of the building is thus minimised.

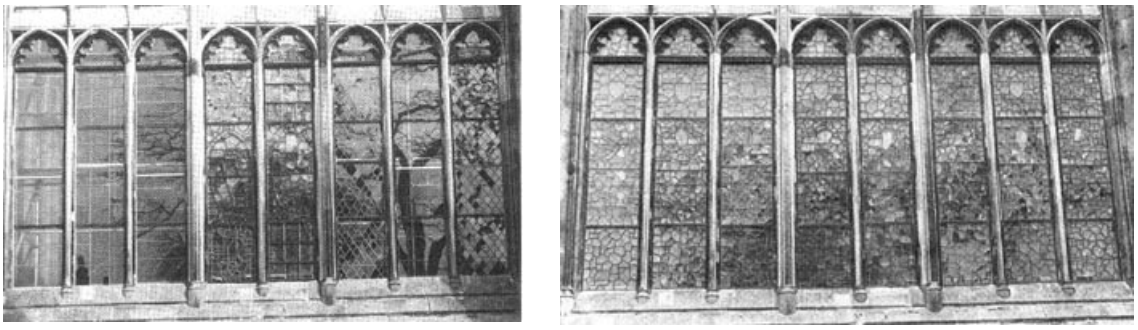


**fig. 42** Protective glazing trials in Canterbury Cathedral.
Left: several different options. Right: the adopted design.

In the case of the Great East Window, however, isothermal glazing is not an option, as the internal 'false' tracery (see I.1.2.) prevents the movement of the historic glass to the interior of the stonework.

Internally ventilated protective glazing, with the stained glass remaining in its glazing groove and the protective layer attached to the outside might still be possible.

This would, however, have an impact on the visible depth of the external stonework, an effect that is usually not so obvious on the inside. In addition to

that, the added weight of the protective glazing could prove too much for the delicate balance of the Great East Window.

Since protective glazing, at least for the moment, is not an option, other methods will have to be adopted to reduce condensation.

### I. 3. 3. Heating

The architect of Gloucester Cathedral, Mr. Ian Stainburn, is currently assessing the viability of new heating systems to replace the two large heaters, which are now placed underneath the window. Particularly short wave radiant heaters could provide an answer to both the requirements of the congregation and those of the stained glass[12].

Short wave radiant heaters do not heat up the air itself, but the radiation can penetrate clothing and contribute to a feeling of well being in the public. Since this type of heating would result in a generally lower air temperature, and cold air can hold only much lower quantities of water vapour than warm air (Bemrose 1994, 24), the amount of condensation on the window would very likely be reduced.

### I. 3. 4. Ventilation

Another factor contributing to the high air humidity in the choir of Gloucester Cathedral is the lack of ventilation.

Casements

The situation could certainly be improved by putting the casement windows in the choir clerestory back into operation. To facilitate their use, an automatic opening and closing device could be installed.

[12] Personal communication, Ian Stainburn 2001.

Ventilation quarries

There are medieval examples of a very simple ventilation system, dating from the fourteenth century (Woodforde 1946, plate LI): instead of glass, decorative lead lattice quarries were inserted into quarry windows, ensuring a steady exchange of air. The pierced openings in the lead lattice would, of course, allow some ingress of driving rain, but this could be reduced by a slatted design of the quarries. It may be worth considering removing a few of the nineteenth century quarries in the clerestory windows and replacing them with such lattices.

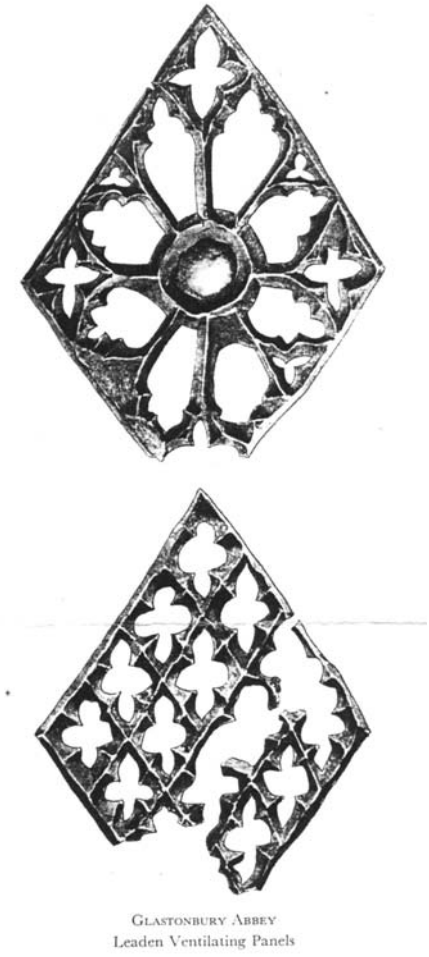



**fig. 43** Lead ventilation quarries from Glastonbury

**I. 3. 5. Documentation**

Unfortunately, the scaffolding on the Great East Window made photographic recording of the very long individual lights all but impossible. Not only are tubes and boards in the way, the scaffolding is also too close to the window.

Sidney Pitcher took his excellent 1913 series of photos from scaffolding erected in the second bay of the presbytery, giving him a distance of ca 5-7m from the glass. The Dean and Chapter of Gloucester are planning to have the whole window recorded once the scaffolding is removed. The ideal position for this would probably be from a temporary tower placed in the centre and at the sides of the choir.

One of my disappointments in the research into Ward & Hughes' work on the Great East Window was that I was unable to find a photograph of the interior of the window predating 1861. A lot of questions would have been answered immediately.

## Part II: The Seven Pink Replacement Heads

In July 1999 I was asked by the architect to Gloucester Cathedral, Mr Ian Stainburn, to submit proposals for alterations to the seven pink replacement heads which would render them less obtrusive. This went clearly far beyond the scope of the agreed work on the window, and would require separate faculty.

The initial motivation for looking for alternatives can be divided into two separate issues:

Aesthetic

The objection by the Dean of Gloucester, the Very Reverend N.A.S. Bury, and by the cathedral architect, was that they were attracting attention by their colour, which is pink rather than the pure white of the medieval faces in the window, and by the hazy painting style which on some of them approaches a sketchy representation of a face.

Religious/Ethical

The Dean in particular perceived them to be an insult to the spirit in which the House of God should be built, filled with ornament, and maintained. Only the very best materials and artistic effort should be employed, neither of which seemed evident in those heads.

While the points above are certainly valid, they cannot be enough to justify the alteration of the historic fabric of the window.

### The Charters

Fortunately we have internationally agreed guidelines which are designed to help those involved in formulating and executing conservation policies and practices to come to valid decisions on the treatment of historic monuments.

The International Council on Monuments and Sites (ICOMOC) has published several charters, two of which, the International Charter for the Conservation and Restoration of Monuments and Sites (Venice Charter) (ICOMOS 1964), and the Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (Burra Charter) (ICOMOS 1979) I consulted in this case.

Both charters stress the importance of respecting the fabric as whole, including alterations and later additions.

The Venice Charter in Article 11 states that “The valid contributions of all periods to the building of a monument must be respected, since unity of style is not the aim of a restoration”.

And the Burra Charter in Article 10 states that “The removal of contents which form part of the cultural significance of the place is unacceptable unless it is the sole means of ensuring their security and preservation”.

The question is therefore, whether these seven heads are a valid contribution to the window, and whether they form part of the cultural significance of the window.

Part II.1. of this chapter will try to find answers to these questions. They will influence any decisions taken as to the retention, modification or replacement of the seven heads.

Part II.2. will show several alternative treatments, and close with specific recommendations.

## II. 1. Assessment of Cultural Significance

### II. 1. 1. Dating the Seven Pink Heads

In order to establish the place of the seven pink heads in the cultural significance of the Great East Window their date and authorship had to be investigated. Only then could their validity as later additions and their success as repairs be assessed.

The assumption at the time was that they had either been introduced by Wallace Beck during his complete releading of the window in 1945 – 46, or had been inserted after the 1861 – 62 conservation of the window.

A set of photographs by Sidney Pitcher from the Cathedral Archives, published in 1915[13], shows all seven heads in situ.

They were therefore clearly not insertions by Beck.

The earliest photograph of the interior of the Great East Window I was able to find dates from c. 1862 and shows the choir before the remodelling by George Gilbert Scott. It is very small and a large portion of the glass is overexposed. Even with the help of a magnifying glass it is difficult to see any detail.

Since the photographic record does not give a conclusive age for the seven heads, archaeological and documentary evidence have to be consulted.

[13] They were in fact taken between 1913 and 1914, when scaffolding was erected in the second bay of the presbytery from the east, and subsequently on the Great East Window itself (CWTAB 1913-14).

Archaeological evidence: The lead

Lead can be a useful tool in dating a piece of glass in a window. A piece of glass can be inserted without taking the leadwork apart, by carefully lifting up the flanges of the lead came, inserting the glass, and then pushing the flanges back down to prevent the piece from falling out. Since the new piece has to be slightly smaller than the piece it replaces, putty is pushed into the gap between lead and glass to secure it further. This operation inevitably leaves the lead slightly warped, and the putty is usually of a different colour and texture than the original cement.

All such repairs to the window must necessarily be younger than the lead.

A careful inspection of the lead surrounding all seven pink replacement heads both internally and externally showed that three of them (D1, D6 and D10) could not have been inserted later. The remaining four are surrounded by wider flat lead inconsistent with the majority of the lead in the window. This lead probably dates from 1945-46, and may be due to partial releading of the panels. These four heads are, however, identical in glass and painted treatment with the first three.

In chapter I. 2. 2. I have shown that the Great East Window is still essentially in its Victorian lead. Since there is no sign of three of the heads having been inserted after the window was releaded, and all seven are of identical make, it is certain that they date at least from 1862.

The next question was whether they were introduced into the window during Ward & Hughes' restoration, or whether they were even older than that.

Again, two different sources of information are available: Charles Winston's account of the window in 1863, a letter by Winston to Gambier Parry, and comparative evidence from All Saints Church, North Moreton (Oxon.).

Documentary evidence: Charles Winston's accounts

The first detailed survey of the Great East Window was in fact done by Charles Winston. It was published in 1863, but was very likely written just before and during the Ward & Hughes restoration, when Winston would have had access to the glass either on the scaffolding or in Ward & Hughes' workshops.

Between November 1861 and April 1862 he produced a series of exquisite watercolours of glass from the Great East Window of Gloucester Cathedral. They are extremely accurate and of the original size of the glass, but unfortunately only of some of the best preserved panels. None of them show any of the panels in question.

In his 1863 account of the glass Winston does, however, go into great detail for each of the figurative panels. His assessment of the seven figures in question contains the following statements as to their heads:

"The face is lost." (E5)

"The head of this figure is gone." (E9)

"The head is lost." (E10)

"Apparently a male figure. The head is lost." (E11)

"A male figure in mass vestments, tonsured." (D1)[14]


**fig. 44** E5


**fig. 45** E9


**fig. 46** E10


**fig. 47** E11


**fig. 48** D1

[14] The fact that he describes D1 as tonsured but not as lost may be an oversight on his part. He also describes D6 as tonsured, but explains that statement with the shape of the "*indent*" (Winston 1 1863, 253). Another possibility would be, of course, that there was a head, which subsequently disappeared and was replaced with a pink replacement.

"The head is lost." (D6)

"The face is lost." (D10)

(Winston 1863a, 251-253)

**fig. 49** D6

**fig. 50** D10

Given the relatively clear indication of a face painted onto some of the pink replacement heads which are now in those places, e.g. E9 and E11, it seems unlikely that Winston should have elected not to mention them.

In a letter to Thomas Gambier Parry, dated 16 November 1863[15], Winston alludes to "some abominable modern heads which had been substituted for old ones" (Winston 1863b) (see appendix G). The letter is in answer to a question by Gambier Parry as to the identity of some "few terribly bad bits which you (Gambier Parry) could hardly believe to be part of the original glazing" (ibid.).

Winston expresses his regret that they had not been removed, he even professes himself to having been "angry at seeing them" (ibid.).

But is he talking about the seven pink replacement heads?

The evidence from the lead suggests that they were in situ at the time Gambier Parry inquired as to the identity of some of the glass. So, are there other heads in the window which Winston would have described as modern?

An overview of the figures in the Great East Window and the condition of their heads may be helpful to settle this question.

[15] I am grateful to Mr Tom Fenton for bringing this letter to my attention

**Classification of heads and faces in the Great East Window**

| Class | Location | Number |
|---|---|---|
| I<br>Original figures probably in situ with intact head. | G4, G7, G9,<br>F1, F2, F3, F4, F5, F6, F7, F8,<br>E1, E2, E6, E7, E8, E12, E14,<br>D3, D4, D7, D11, D12 | 22 |
| II<br>Original figures probably in situ with partially surviving head | F10,<br>E3, E4,<br>D2, D4 | 5 |
| III<br>Original figure probably displaced within the window with intact head: | E13 | 1 |
| IV<br>C15 replacement head purposely painted for this panel: | G6 | 1 |
| **V**<br>Figures presumably from other parts of the cathedral (e.g. choir clerestory or Lady Chapel) with intact head: | J2,<br>G5,<br>F11, F12, F14,<br>D8, D9 | 7 |
| VI<br>Heads made up using C14 and C15 faces or fragments thereof: | G8,<br>F9,F13,<br>D5, D13, D14 | 6 |
| VII<br>Head replaced with clear unpainted glass: | C11 (the 'golfer) | 1 |
| VIII<br>Pink replacement heads: | E5, E9, E10, E11,<br>D1, D6, D10 | 7 |
| | total | 50 |

Only the figures in classes IV, VI, VII and VIII do not have heads which originally belong to them. The heads in class VIII are identified by Winston as either 'lost' or 'gone' (with the exception of D1, see footnote above), while those in classes IV and VI are correctly identified as medieval glass. C11, the 'golfer' is not mentioned by Winston at all.

**fig. 51** All Saints Church, North Moreton, east window of St. Nicholas' Chapel, panel 2d.

What Winston is talking about in his letter must therefore be the seven pink replacement heads.

**Comparative evidence: North Moreton**

In part I.2.2. I have mentioned Winston's collaboration with Ward & Hughes on the glass of the east window in Stapleton's Chantry in North Moreton.

A significant difference between the North Moreton glass and that in Gloucester is the quality and colour of medieval glass.

While the Gloucester window uses only three colours (white, blue and red) to the virtual exclusion of all others, the earlier glass in North Moreton is typical of its period in the greater palette and in the variety of hues it uses for flesh tones.

The Ward & Hughes repairs reflect this variety of flesh tones. The glass used is a flat even pot metal. There are four or five different pink tints

**fig. 52** Comparison between pink heads; left: North Moreton, right: Gloucester

used to replace missing heads, arms and legs. All of them are dulled over with a rather reddish paint,

and in many cases the paint gives a slight indication of a face.

In short, they are in glass, colour (of one of the North Moreton tints), paint and style identical to the pink faces in the Great East Window of Gloucester Cathedral.

Another feature which is identical is the treatment of draperies.

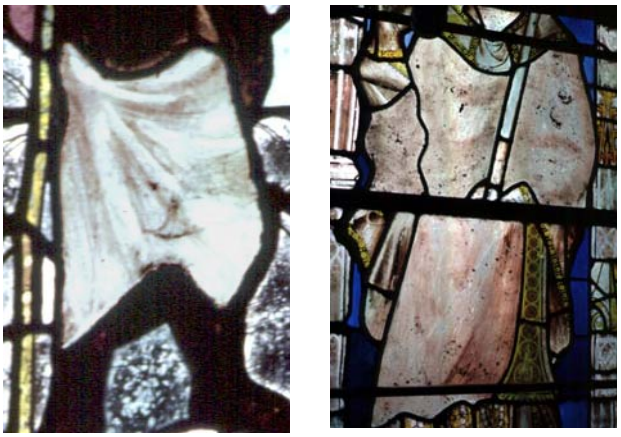


**fig. 53** Draperies painted on 'Cathedral glass';
left: North Moreton,
right: Gloucester

## Conclusions

There is no doubt that the seven pink heads in Gloucester are by the same hand as those in North Moreton. We know who was responsible for the insertions in the latter case, so it follows that Ward & Hughes must also be the authors of the seven Gloucester heads.

I suspect that Winston, who did have a profession to attend to, was not constantly available to give advice on the repairs to the Great East Window.

On the other hand, Ward & Hughes may not always have felt the need to consult Winston for every decision. They had, after all, just finished a long restoration project under his guidance. They may have felt justified in applying some principles from North Moreton onto the Great East Window.

And they may very likely have had some pink glass left over from their earlier project.

Winston's reaction to the pink heads in Gloucester shows that he considered them to be a mistake. His brief for Gloucester had been to "attempt nothing in the way of restoration, beyond supplying such insignificant parts of the coloured grounds as were wanting, with modern glass of corresponding hue" (Winston 1863a, 328).

Winston is clearly downplaying the amount of replacements Ward & Hughes introduced into the window. But while most of them do comply with the brief of 'modern glass of corresponding hue', the pink faces do not. In his letter to Gambier Parry he states that "a piece of white glass, dirtied over, might have been substituted for each of these modern heads" (Winston 1863b).

It sounds to me like Winston may have realised who put those heads there, but with the repair of the Great East Window having been such a high profile exercise, and the damage done, he may not have wanted to blacken his friend Henry Hughes' name.

### II. 1. 2. The Validity of the Seven Pink Heads as Later Additions and their Success as Repairs

Winston's objection to the faces was purely an aesthetic one.

There is another aspect to be considered: The Venice Charter in Article 12 states that "replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence" (ICOMOS 1964).

How then do the seven faces measure up to these requirements?

Gambier Parry, Winston, the current cathedral architect, the current Dean of Gloucester Cathedral and almost everybody I have shown these faces to immediately picked them out as later additions. They seem to comply with the requirement of being 'distinguishable from the original', while they certainly are not generally perceived to 'integrate harmoniously with the whole'.

At least one recent writer, however, mistook some of them for original glass with severe paint loss. In her 1985 article Jill Kerr identifies the heads in D1 and E11, as well as the drapery in D2, as originals. This shows that they are apparently not as clearly distinguishable as would be desirable.

What is even more worrying is the fact that in some cases the pink replacement heads do indeed 'falsify the artistic or historic evidence'. A look at lights E9, E10 and E11 will show this:

## E11, E9 and E10: three cases of mistaken identity

### *E11*

Winston already remarked on the fact that some figures in the Great East Window were made from *"one common model"* (Winston 1863a, 249), meaning that the glaziers used identical cutlines for two or more figures.

The clearest example for this practice in the Great East Window can be found in the tier of angels (tier G). For the originally six angels only two different cutlines (cartoons) were used, one for the south facing and one for the north facing angels.

**fig. 54** Repeat cartoons in tier G. Panels not original to this tier are masked off.

D1 – D6 may be similarly based upon only two different cartoons (Kerr 1985, 124), but the fragmented state of many of them makes it difficult to be sure.

Another example is D10, 1 (the upper half of the figure has not survived), which is a repeat of D12, 1.

D12, 1 D10, 1

**fig. 55** Repeat cartoons

A more subtle use of a repeat cartoon in this window has escaped notice up to now: panel E11, 2 (the upper half of the figure) is, though very fragmentary, still recognisably a variation of E1, 2, a female saint.

E1, 2 E11, 2

**fig. 56** Repeat cartoons

The choice of a male head for this panel may have its origin in Winston's attribution of a male sex to this figure whose head he described as 'lost'. But with the bearded head now in place, no writer has since questioned the male identity of this figure.

**fig. 57** E9, 2

***E9***

A similar example of gender confusion can be found in E9, where the pink replacement shows a clear indication of a veiled female head. In this case fragments of at least two different original figures, together with unrelated medieval fragments, were used to make up the figure. At least one of the original figures was that of a bishop or abbot, as indicated by the surviving embroidered gloves.

***E10***

While the upper half of this figure is made up entirely from medieval fragments not related to the Great East Window, about two-thirds of the lower half of the figure are intact and may be in situ. They are remarkably similar to (though not a repeat cartoon of) E7.

E7, a female saint holding a sword, has been tentatively identified as St. Catherine by several writers. Apart from Catherine, there are other female martyr saints which could be represented with a sword, e.g. Agnes, Justina, Euphemia, and Lucia (Hall 1974, 295). It is therefore not impossible that the Great East Window contained more than one female saint with a sword.

The pink replacement head in E10, however, though with only a very faint suggestion of a face, favours a male aspect. It has a vague similarity with the original head in E2, that of the helmeted St. George.

**fig. 58** E10 E2

**Conclusions**

The aim of part 1 of this chapter was to establish the place of the seven replacement heads in the cultural significance of the Great East Window, and to assess their validity as restorations.

I have shown that they were part of the landmark restoration campaign of the 1860s, but were seen by the instigator of this campaign, Charles Winston, as a

regrettable mistake. They can therefore not be seen as an important part of the history of the window.

As to their validity as restorations, they have been shown to fail in every respect. Their colour does not harmonise with the original glass, but they have still been mistaken for originals. And most importantly, their content is misleading and has led to falsification of the historic evidence.

## II. 2. Proposals for alternatives

In part II. 2. I will set out the aims of the proposed intervention, show a variety of options for treatment, and consider their practicability. I will then describe an experiment which used a combination of two of those options.

Finally, I will give specific recommendations for the future treatment of the seven pink heads.

### II. 2. 1. Aims

Part 1 of this chapter has shown that there is a case to be made for looking for alternatives to the seven pink heads.

Any new intervention will have to make sure that the mistakes, which have made these heads so unwelcome, are not repeated.

This already sets certain parameters:

- The example of E11 shows that the information gained from a face colours our perception of the rest of the figure. It is therefore imperative that the proposed replacements do not prejudice the historic or artistic evaluation of the figure they may be attached to.

- Since the first and most generally agreed objection to the seven heads is their colour, their removal and replacement with more appropriately coloured (in this case clear white) glass may be necessary.

- In my conversations about these heads I have found that people tend to refer to them as ‘blobs’ (I have been guilty of using this term myself). Since there is very little paint on most of them, which would visually break up their shape, they tend to read larger and less defined than the other heads in the window. It may therefore be necessary to introduce paint lines of some kind into the proposed replacements.

The Venice Charter in Article 12 states that “replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence.”

In Article 9 the aim of restoration is defined as follows: “(…) to preserve and reveal the aesthetic and historic value of the monument (…). It must stop where conjecture begins, and in this case moreover any extra work which is indispensable must (…) bear a contemporary stamp” (ICOMOS 1964).

Interestingly, the Great East Window is full of repairs of quite divers dates that fulfil the requirements of the Venice Charter to a large extent, and in some cases to perfection:

- The repairs of the seventeenth century used fragments of old glass jumbled together in an attempt to fill missing areas with the semblance of figures.

  While this technique was misleading in one or two cases (e.g. the crown in

D10), the majority of these repairs make no claim to being anything else than what they are – collections of fragments.

They succeed in blending harmoniously with the original glass because of their colour and painted detail, and the size of the individual pieces

- The head of the 'golfer' in C11 has been replaced with a piece of unpainted clear white glass. While it is not possible to date this intervention other than to pre-1863[16], it still qualifies as an honest repair that does not prejudice the evaluation of the figure.

- The head of the angel in G6 dates from the late fourteenth or early fifteenth century. It is clearly painted for this place, not a fragment used as a stopgap.

  It again blends harmoniously with the surrounding original glass, but is easily dateable by its contemporary painting style.

- The dragon at the feet of the Madonna in G5 (itself a late fourteenth/early fifteenth century intruder) dates from 1976. It is by Edward Payne, who restored the two main panels of this light together with the York Glaziers Trust.

  Not only is it painted in Payne's inimitable style, he also indicated this intervention on his chart of the window. Last but not least the plating glass on the exterior of the Madonna's face is diamond inscribed with Payne's name and the date, a nice - if not easily accessible - example of in situ documentation.

[16] This kind of repair is documented for the west window of the choir, which was destroyed in 1681 (Fowler 1681) (see appendix D).

It seems entirely appropriate to let the Great East Window itself educate us through its history of repair. The challenge to the conservator is to apply these lessons in a sensitive and responsible manner.

The examples of the figures in E9 – E11 (see above) give an indication of the complexity of the task. It cannot be a simple matter of showing a range of options, which could be applied as a blanket solution to all seven heads. Each figure has to be assessed individually, and proposals have to be formulated accordingly.

### II. 2. 2. Alternatives for Treatment

With the requirements for restoration as set out by the Venice Charter in mind, I will now test the validity of six alternative treatments. Most of these alternatives are informed by examples from the window itself.

**fig. 59** 'Golfer' roundel in C11. What looks like remnants of painted decoration on the head is in fact glazing cement dating from 1976

***Option 1***

Replacement with clear white unpainted glass.

This alternative has only one precedent in the Great East Window: C11.

Unfortunately Winston in his 1863 account of the glass does not tell us what was in the place of the seven 'lost' faces[17]. There are several heads in the window which survive only partially. The missing portions in those heads are sometimes filled with unpainted white glass, sometimes with

**fig. 60** D4 Repair with unpainted glass

[17] In his 1863 account of the Great East Window Winston does not mention the 'golfer' r in his numbering system) (Winston 1 1863, 321). He did, however, produce a watercolou which shows the head in the condition it is in today.

fragments of unrelated faces. Other completely missing heads were also replaced with unrelated faces, sometimes a whole head, sometimes with a collection of fragments.

Given that these repairs are still in place, it seems logical to assume that the seven heads in question were different. I believe that they may have been filled with single pieces of clear white unpainted glass. Because of their size they would have looked too glaringly like holes to be acceptable, and may therefore have been replaced with the pink heads in an attempt to lessen their impact.

C11 escaped this treatment because the head is much smaller than those of the main figures.

For these reasons I do not believe that replacement with unpainted white glass is an option which would satisfy today any more than it satisfied in the nineteenth century.

**fig. 61** F9
Repair with unrelated fragments

***Option 2***

Replacement with white glass 'dirtied over'

In his letter to Gambier Parry Winston states that "a piece of white glass, dirtied over, might have been substituted for each of these modern heads" (Winston 2 1863).

One problem with the pink heads, which I have not touched upon before, is their opaque quality. This opacity comes from the thin layer of paint that covers them both internally and externally.

**fig. 62** Great East Window, tiers D and E, lights 5-10.
Effect of indirect lighting on the pink heads compared with original glass (D6, D10, E5, E8 and E9 marked with arrows).

As a result the pink heads catch indirect light (which is the sort of light situation during most of the day in the shadow of the Lady Chapel) in a different way from the other heads in the window. They appear to be lit up by their own personal spotlights.

While this sort of treatment works well together with evenly corroded medieval glass, it does not blend harmoniously with the extremely well preserved glass of the Great East Window.

***Option 3***

Replacement with fragments

Using unrelated medieval or other fragments of stained glass to fill gaps in a window is a technique which was widely used until quite recently.

The seventeenth century repairs to the Great East Window work well aesthetically, and they reflect a time in history when large amounts of stained glass fragments were available as a result of iconoclasm. At the same time the supply of good quality new coloured glass had all but dried up.

The same does not apply today. We are fortunate enough to have at our disposal high quality new glass that can blend well with medieval glass.

Using fragments of historic glass to patch up a window without the necessity to do so is therefore ethically unacceptable. It would also prejudice any possibility of returning those fragments to their original setting in the future.

This does not mean, however, that we cannot use the aesthetic qualities of fragments (see below).

***Option 4***

Replacement with abstract patterns

One of the aims of the proposed intervention is to facilitate the historic and artistic evaluation of the window. Any replacement should therefore reflect the contents of the panel it is inserted into.

Four of the seven heads are in a context of collections of fragments (see below). I have mentioned before that we tend to evaluate a figure based upon the information we gain from its face.

A valid alternative may be to treat some of the heads with an abstract rendition of patterns taken from the fragments the panels themselves are made of. This would reinforce the reading of those panels as collections of fragments.

One might even consider the introduction of patterns that are typical of our time, such as printed circuit boards or the double helix, to name but two. Painted in an abstract way they could integrate very well with the fourteenth and fifteenth century patterns in the window, while reflecting their own age.

***Option 5***

Insertion of modern heads in a contemporary style

The angel's head in G6 illustrates the potential successfulness of this alternative. Clearly it is not appropriate for all cases, and has to be done very carefully to avoid misinterpretation and self-importance.

The new head would have to be based upon good evidence as to the sex of the figure and the direction it is turned.

As with all other options, it would have to harmonise with the original glass, but would also have to bear a contemporary stamp in the rendition of the face.

***Option 6***

Addition of a superimposed layer

This alternative would leave the seven pink heads in situ. A piece of glass the size and shape of the pink head would be surrounded with a lead came and then attached to the lead surrounding the pink head.

This alternative could be used in combination with several of the above options.

The advantages of this alternative are:

- It is easy to execute and fully reversible.
- It would leave the pink heads in situ. (Although that may also be a disadvantage.)

The disadvantages are:

- It does not address the issue of colour and opacity.
- The suggestion of a face on some of the pink heads is strong enough to read through the superimposed glass.

**Practicability**

Option 6 is the least interventionist of the list. However, dirt might accumulate in the interspace between the two layers.

This could be avoided by sealing the edges completely. In my experience it is quite difficult to ensure a long-term seal between layers. The most reliable material for this task is silicone. However, because of its initially low viscosity it

would be nearly impossible to apply the amount needed to seal the edges in a controlled and clean manner when working in situ on an upright panel.

The other five options would require the removal of the pink heads and their replacement with new glass.
The new glass could be cut and painted in advance (the necessary templates for each head already exist), and only once this is finished would the pink heads have to be removed.

A piece of glass is removed in situ by first lifting up the flanges of the lead. The cement is then scraped away carefully, and the old piece loosened until it comes free. The replacement can then be inserted in its place.
With access to both the exterior and the interior of the window, and with a second person assisting, the chances are very good that the old piece can be removed whole, but an element of danger to the piece always remains. Glass can break.

The height of the seven heads above ground level would make some form of scaffolding necessary.

### II. 2. 3. E5: An Experiment

While working on the Great East Window in 1999, I decided to try an experiment. I wanted to see how a superimposed face would affect the aesthetic quality of the pink heads.

My approach was that as described under option 6, a new head inspired by surviving original examples, but bearing a contemporary stamp.

The pink head I chose for this experiment was that in E5. This figure is comparatively well preserved, and there is no doubt as to her identity. The

shape of the head is probably original, and there are three surviving female saints' heads to serve as examples.

The paint on the pink head is very indistinct, just a few darker areas in an otherwise even matt.

This head has a crack which was repaired with a strap lead. Before the new head was soldered in place, the strap lead was removed and the crack glued with Paraloid B72.

I started by making precise drawings of the three surviving female heads in this tier (E1, E3, and E7). A comparison of the shapes of these heads proved that the head in E5 is turned towards North. This was unexpected, as all the other surviving females in the window (E1, E3, E7, E11 and F7) face South. The shape of the surviving hair on her shoulders nevertheless supports the northern orientation of E5.

**fig. 63** Drawings of female saints' heads.
From left to right: St. Catherine; St. Cecilia; unidentified saint;

In order to blend the modern head with the originals I chose a painting technique similar to that of the fourteenth century: dense trace lines with a lively variety of widths applied with a squirrel hair brush, and smear shading applied with a soft long bristle brush. No highlights were taken out. Silver stain was applied to the hair. The glass used was white mouthblown cylinder glass, and the paint colour is a sepia brown like that of the originals.

**fig. 64** Design for a new head for E5

The new head is distinguished from the original heads by a different cheek and jaw line, as well as by a less formalised treatment of the hair. I also added a fringe, which is certainly not a medieval hairstyle for women. The shading of her mouth is more naturalistic. The main difference, however, is the fact that her eyes are cast down. No other figure in the window does this.

Finally, the new head was signed and dated.

It was then surrounded with a lead came, and attached to the lead around the pink head with four small dots of solder.

**fig. 65** E5, 2
Before introduction of a new face

**fig. 66** E5, 2
With superimposed new face

**fig. 67** Close-up, showing the interference of paint on the pink face with the new design

**Evaluation**

This experiment served to illustrate several aspects:
Positive aspects:

- The addition of a face visually closes the panel. The attention is not drawn away from the surviving original glass to the opaque pink head.
- The division of the head into a silver stained and an unstained part returns it to its proper scale.

Negative aspects:

- The dark areas in the matt on the pink head interfere with the new painted detail on the superimposed head. Instead of expressing mild melancholy, the face now seems to be filled with grumpy disgust.
- While I still think that the thought processes that went into the design of the new head are valid, I now think that I should have been more courageous in the choice of style. In retrospect I wonder whether the new head does not blend in a little too well.
- The signature and date are too small to be read from any distance.
- The interspace between the two layers is prone to trap moisture and dirt.

Before giving specific recommendations for the future treatment of the seven pink heads, an overview over the individual settings of each of the seven pink heads is necessary. It will help to decide which of the above options might be appropriate in each case.

## II. 2. 4. The Setting of the Seven Pink Heads

**fig. 68** D1

**D1**

Subject:

An abbot.

Condition:

The figure is similar in stance to D3, but not a repeat cartoon. The figure's right arm down to the wrist and the left hand are missing and were replaced with unrelated medieval fragments. Apart from a few other minor stop gaps the drapery is intact.

The ruby background glass surrounding the pink head contains very few replacements. The shape of the head is probably original.


**fig. 69** D6

**D6**

Subject:

An abbot.

Condition:

The figure is a conglomerate of fragments, some from the Great East Window or maybe from the clerestory glazing, others from other glass of a later date.

The blue background glass, which in this lancet should be painted with a pattern of swirling leaves, consists mainly of unpainted medieval glass. Only four painted pieces survive.

The shape of the pink head, though consistent with the shape of the other surviving abbots' heads, may not be original.

**fig. 70** D10

**D10**

Subject:

An abbot.

Condition:

The lower half of the figure is a repeat cartoon of D12.

The upper half of the figure, including the background glass, consists entirely of fragments of later glass. Only the hand in this panel may originate from the Great East Window. The iconography of this panel, a crowned figure holding a spear, is a complete invention. The shape of the pink head bears no resemblance to any other head in the window.

**E5**

**fig. 71** E5

Subject:

St. Margaret of Antioch

Condition:

The drapery of the figure has a few stopgaps, but is largely original. There are remnants of the saint's hair on her shoulders.

The background surrounding the top half of the figure consists largely of flashed ruby glass painted with a streaky matt, and is therefore very likely by Ward & Hughes. The ruby glass immediately around the head, however, is largely original.

The shape of the pink head is consistent with that of other female saints in this tier and is probably original.

**E9**

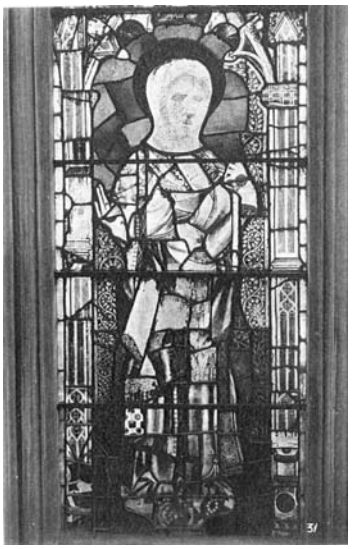


**fig. 72** E9

Subject:

Conglomerate of glass fragments probably originally from the Great East Window or from the clerestory glazing, and of later glass. Some fragments clearly come from the figure of a bishop or abbot.

Condition:

The blue background glass surrounding the head is painted with a stippled matt and is therefore very likely by Ward & Hughes.

The shape of the pink head is unlike that of any other figure in this window (except that of E10, also a pink head, and E2, a helmeted knight) and is unlikely to be original. It is painted with hazy suggestion of a veiled female head.

**E10**

**fig. 73** E10

Subject:

A saint holding a sword

Condition:

Ca. 60% original glass survive in the lower half of the figure.

The upper half is entirely made up from fragments of later glass. The ruby background glass consists largely of flashed ruby painted with a streaky matt and is very likely by Ward & Hughes. Only a small portion of original ruby survives at the top of the figure. The halo is also not original.

The shape of the pink replacement head is unlikely to be original.

**E11**

**fig. 74** E11

Subject:

The top half is that of a female saint and uses the same cartoon as E1. It is probably in situ.

The lower half shows a person holding a club. The club is the attribute of two apostles, James the Less and Jude (Hall 1974, 72). It is therefore probably displaced from the tier above.

Condition:

The lower half of the figure contains much original glass, with only ca. 10% stopgaps. The drapery of the upper half contains ca. 30% stopgaps, but these are mostly confined to the bottom edge of the panel. The background glass around this half of the figure consists entirely of original glass.

The shape of the pink head is consistent with the shape of other female saints' heads in this tier. It is also entirely surrounded by original glass. The shape of the head is therefore very likely original. It is painted with the hazy suggestion of a hooded and bearded face.

**Assessment**

It becomes obvious that there are two distinct groups of heads:

- Heads that are likely to have retained their original shape and setting (D1, E5 and E11), and

- heads whose shape is dubious and that are attached to composite figures made up from fragments from the Great East Window and/or other glass (D6, D10, E9 and E10).

## II. 2. 5. Recommendations

Options 1, 2, 3 and 6 are in my mind not applicable for the reasons stated above.

This leaves options 4 and 5: replacement with abstract patterns, and insertion of modern heads in a contemporary style.

In the cases of D10, E9 and E10 I believe it would be a mistake to insert anything even resembling a face.
The shapes of the heads are awkward and certainly not original. A decision as to the sex of the face would have to be made, which would colour the perception of the two surviving original lower halves of D10 and E10.

The heads in D10, E9 and E10 should therefore be replaced with a piece of clear white glass painted and possibly also partly silver stained with an appropriate pattern. This would reinforce their status as collections of fragments.

The heads in E1, E5 and E11 should also be removed and each be replaced with clear white glass painted with a face in a contemporary style.

These faces should be recognisable as modern additions, but could be loosely based on surviving faces of similar figures in the window. This would aid in their harmonious integration into the window.

D6 is a more difficult case. The shape of the head may or may not be original, but the figure is comprised of fourteenth and fifteenth century fragments. From a

distance it reads rather well as the figure of an abbot, which is what was probably there originally.

I find it difficult to decide whether a face or an abstract pattern would be the best solution here.

On the other hand, it might be a good idea to leave at least one of the pink heads in situ, as a physical document of a (albeit somewhat regrettable) past repair to the window.  D6 would be the perfect candidate for this role.

Any removed heads should be catalogued and deposited in the cathedral's archives, together with pre- and post-restoration photographs and written documentation.

Any new addition to the window must be signed and dated on the glass in a way that is unobtrusive but easily legible through binoculars.

## Conclusion

The Great East Window is not only a magnificent example of late Decorated stained glass; because of its later insertions it is equally valuable as a record of Gloucester Cathedral's other lost medieval windows. Six kings from the choir clerestory have found refuge here[*], as have the remains of one or more later windows which may originate from the cathedral[**]. A survey of the contents of the far more fragmented east window of the Lady Chapel could help to shed more light on the subject.

My research into the repair history of the Great East Window confirmed the need for detailed documentation of interventions.

The absence of such records can compromise the value of the historic evidence provided by a monument to art historians and the public alike. The result may be the misinterpretation of the historic fabric as well as of the policies and motivations of the restorers.

For me as a conservator, the lessons gained from the historic repairs to the Great East Window were extremely useful in formulating policies for our own interventions.

An interesting discovery was how relatively little help the ICOMOS charters offer when dealing with obtrusive repairs. I have tried to show how I used what help there is in formulating a policy for the seven replacement heads, but that did require some creative thinking.

[*] Another king, a repeat cartoon of F11, 2 can be found in the east window of the Lady Chapel.
[**] Also in the Lady Chapel east window are more faces by the same school as the Madonna in G5 of the Great East Window, although they do not seem to be part of the original glazing of the Lady Chapel window, either.

This may, in fact, be the most important lesson learned: charters can only give so much help, but interpreting this help in a responsible and creative manner tailored to the needs of the individual monument is the task of the operatives and the professionals involved in the particular case. And, as the Burra Charter states in article 1.4 of its guidelines both on cultural significance and conservation policy, it cannot be assumed that any one practitioner will have the full range of skills required to assess cultural significance / develop a conservation policy (ICOMOS 1979).

In the case of the Great East Window, the architect and English Heritage were involved at all stages of the 1999 conservation/restoration.

My research into the seven replacement heads will equally only be part of the discussion when the Dean and Chapter of Gloucester raise the question of the seven heads with the Fabric Advisory Committee later this year. If the FAC decide that this is an item of national importance, the Cathedral Fabric Committee for England (CFCE) will have to be called in to consider the matter further.

Being able to contribute to ensuring the continued survival of the stained glass has been a pleasure and a privilege.

The Great East Window of Gloucester Cathedral is, above all, a thing of great beauty.

# *Appendix A*

# Glossary

***Cartoon***

The black and white full-size drawing of the stained glass panel or light, containing the lead lines and details of painted decoration. Today, cartoons are usually quite elaborate drawings, while the leadlines are often repeated on separate drawings, called 'cutlines'. The latter are used to cut the glass on and eventually the panel will be leaded up on them. The cartoon is used as a model for the painted decoration only. In the Middle Ages cartoons were drawn on white-washed wooden benches and contained only the bare minimum of the painted decoration, relying very much on the experience of the painters and on workshop tradition (see appendix B).

***Cathedral glass***

'Cathedral glass' is one of many types of cast glass. Cast glass is produced by pouring molten glass onto a metal bench, where it is then flattened by a metal roller. The result is a thick glass with a rough surface. Cast glass was first produced in France in the seventeenth century, but the type known as Cathedral glass, a relatively thin glass, only came into production in the nineteenth century (Kamphausen 1983).

***Daylight border***

These are narrow strips of glass leaded along the edges of the panels. They usually are of a very light colour. Their role is to serve as a sacrificial border between stonework and stained glass when a window is removed by chiselling it from its glazing groove. They also have an aesthetic function in visually separating the stained glass from the stonework.

### *Etched glass*

Glass has a high resistance to acid attack. Hydrofluoric acid, however, will attack glass readily. This means that the coloured surface layer in flashed glass can be etched away to reveal the clear glass underneath. Done in stages, an ever lighter hue of the colour of the flash can be achieved.

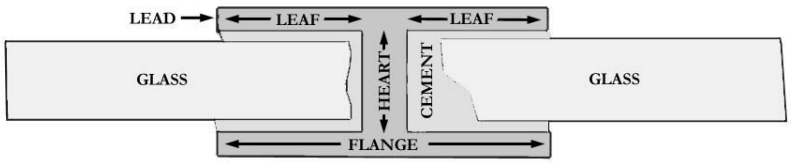
### *Eyelet*

Small triangular shaped lights usually either side of an arched head of a main light.

### *Flashed glass*

Glass consisting of a thick layer of usually clear white and a thinner layer of coloured glass (see appendix B).

**fig. 75**
SECTION THROUGH POST-MEDIEVAL LEAD AND GLASS




### *Lead:*

- ***Flat lead***
- Lead with a flat surface to the flange.
- ***Lead came***

Length of H-profile lead.

- ***Milling marks***

These are left on the heart of the lead in the milling process by teeth on the wheels of the mill. Milling marks can be very typical of the age of lead, as the distance between the teeth on the wheel changed over time. Medieval

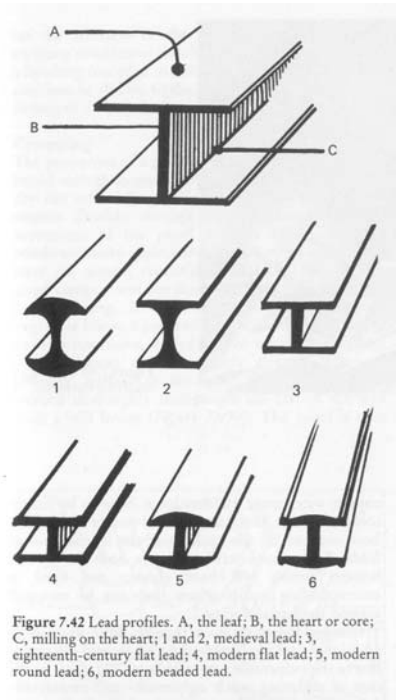



**fig. 76**
Figure 7.42 Lead profiles. A, the leaf; B, the heart or core; C, milling on the heart; 1 and 2, medieval lead; 3, eighteenth-century flat lead; 4, modern flat lead; 5, modern round lead; 6, modern beaded lead.

lead, being cast, not milled, does not have any marks in the heart.

- ***Round lead***

Lead with a convex surface to the flange.

***Light***

Any expanse of glass uninterrupted by stonework in a window with mullions, transoms or tracery.

***Matt***

A thin layer of paint spread evenly over the surface of the glass. Matts may be even, stippled or streaky, depending on the application and brushwork.

***Panel***

The individual sections that make up a light (see appendix B).

***Plating glass***

Plating is used as a means of supporting badly broken historic glass pieces, which even after edge-bonding would be too fragile to survive for long.
Thin pieces of glass, usually clear white, are cut to the same shape as an original piece and attached to this by sealing the edges with silicone. Sealing the edges is important, to prevent moisture from ingress into the interspace. Ideally, an imprint of the surface of the original glass is made on a bed of dry loose plaster of Paris, and the plate placed onto the imprint. It is then heat-moulded to the exact surface undulations of the original glass, reducing any risk of pressure points developing between original and plating glass.

***Pointing***

The mortar used to fill the gap between glazing groove and stained glass panel.

***Pot metal glass***

Glass coloured throughout its mass (as opposed to flashed or streaky).

***Saddle-bars***

Metal bars whose ends are inserted into the stonework either side of the stained glass. The stained glass panels are attached to these with lead strips or copper wire for support.

***Smear shading***

Technique of applying thin layers of paint with a soft bristle or cow hair brush in areas that require shading. The paint is laid down in broad strokes, and is usually not scratched out or thinned down afterwards. Typical treatment until the end of the fourteenth century.

***Stipple shading***

This technique of paint application appeared at the end of the fourteenth century and replaced the use of smear shading. The paint is picked up with the ends of a bristle brush and stippled onto the glass. Repeated applications allow very delicate shading. Detailed highlights are sometimes scratched out of the dry paint before firing.

***Quarry***

The word quarry describes an individual piece of glass in leaded windows with a repeating pattern of rectangular or diamond-shaped pieces.

# *Appendix B*

## Manufacture of Stained Glass in the Middle Ages

Our knowledge of how stained glass was made in the Middle Ages is based upon numerous literary sources, the most important of which is the schedula “De diversibus artibus” by Theophilus Presbyter, dating from the early twelfth century (Strobl 1990, 31-36).

### Glass Production

The main component of glass is sand (silica). Medieval glass also contains large quantities of potash and lime. Adding these enabled the medieval glassmakers to lower the very high melting temperature of pure silica.

Metal oxides added to the sand/lime/potash mix before melting dyed the glass in different colours. Iron oxide could produce shades of green, copper oxide would produce red, manganese oxide purple, cobalt blue etc. The final mixture was molten in pots inside large kilns.

The most common method of sheet glass production in the Middle Ages was the following:

<u>Cylinder glass production</u>

The glassblower picked up a certain amount of molten glass with the end of his glassmaker’s pipe and blew into the pipe to produce a large bubble of soft glass.

**fig.77** The different stages of cylinder glass production

The bubble was elongated until it formed a cylindrical shape. The cylinder was then opened up at both ends and allowed to cool. When cold, a cut was made along the length of the cylinder and the glass reheated to soften it slightly. Eventually it opened up along the cut and was folded out and flattened to produce a flat sheet of glass.

Crown glass production

Another method produced large roundels. The central 'bullion' where the pipe had been attached was usually recycled or sold off for low-status glazing.

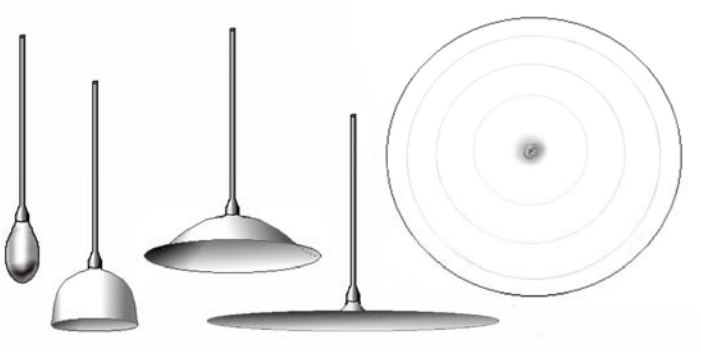


**fig. 78** The different stages of crown glass production

While most coloured glass was made as 'pot metal glass' (coloured throughout by metal oxides in the melting pot), red, or 'ruby' glass as it is commonly known, was usually not.

The colour of ruby glass is extremely intense, and pot metal ruby tends to be quite opaque. Medieval glassmakers overcame this problem by dipping their pipes first into clear white glass, and then adding a thin layer of molten ruby glass over the top. This resulted in a layered glass known as 'flashed' glass.

Another method produced 'streaky' glass. This may have been achieved by repeatedly dipping the pipe into white and ruby pots, or by combining molten ruby and white glass in a single pot without stirring the mixture much.

The result was a multi-layered glass with uneven swirls. The original ruby background glass of the Great East Window of Gloucester Cathedral consists entirely of this type of glass.

## Design

Since medieval windows were made from pot metal glass, each colour change required a different piece of glass to be cut. The lines along which the glass was to be cut form the main design lines of the window. These are drawn out in a 'cartoon', which also usually contained the main lines of the painted decoration. In the Middle Ages cartoons were normally drawn onto whitewashed wooden benches. These benches were reused for successive cartoons, which is why only very few medieval cartoons have survived to this day.

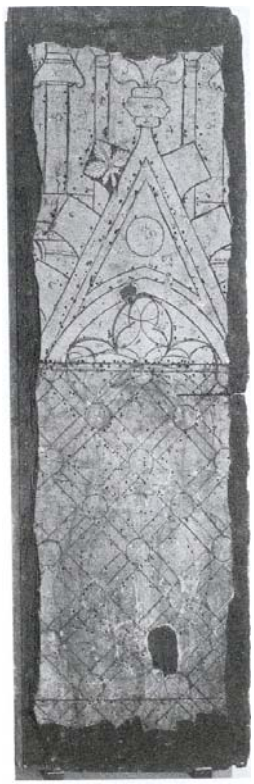


**fig. 79** Medieval cartoon on a wooden bench

## Cutting

The individual pieces of glass were cut by touching the edge of the glass sheet with a hot iron. This produced the start of a crack, which would then be guided around the rough shape of the desired piece with the iron on top of the sheet.

Small fragments were then nibbled from the edges with a 'grozing' iron, until the piece was precisely the right shape, leaving space between the individual pieces to allow for the heart of the lead.

## Painting

Glass paint is essentially very finely ground glass with an admixture of different metal oxide pigments (e.g. iron), which render the paint dark and opaque. The addition of lead oxide also lowers the melting temperature of the powdered glass.

**fig. 80** Painting on glass over the cartoon

The powder is mixed with a painting medium[18] to produce a liquid paste, which is then painted onto the individual glass pieces. Depending on the thickness of the paint layer, dense trace lines and semi-transparent shading can be applied.
The painted glass pieces are then transferred to a kiln where they are fired at a temperature sufficient to fuse the molten paint with the softened glass.
The only material available to the medieval glasspainter, which allowed the addition of a transparent colour to the glass after its production was silver stain. This was first used on stained glass around 1300.
Silver chloride or silver sulphate are suspended in ochre and applied to the outward-facing surface of the glass. During firing the silver ions transfer into the glass matrix and stain the glass yellow. The ochre is then washed away.

**Leading**

Once the individual glass pieces are finished they are 'leaded up'. Stained glass windows are usually divided into individual 'panels'. The panels are leaded up separately and subsequently assembled on site by stacking the panels on top of each other. This technique allows for safe handling and transport.

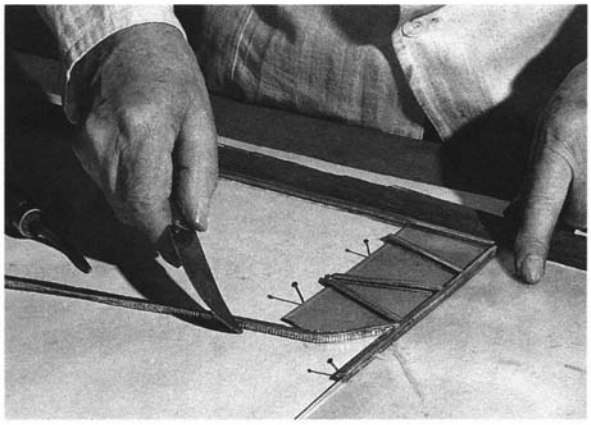


**fig. 81** Leading up

Starting in one corner, the panel is assembled on a wooden bench piece by piece, each piece held in place and divided from its neighbour by a length of H-section lead came. Once the whole panel has been assembled the points were the individual leads meet are soldered, thus forming an intricate and stable framework for the glass.

[18] Various oils, water and gum, and vinegar are used today. In the Middle Ages urine was used frequently.

Medieval lead was cast into forms and then trimmed to the required width with knives. Post-medieval lead was passed through lead mills after casting, resulting in longer cames of different custom widths. This additional processing rendered the lead less durable than the medieval technique.

**Support Structure**

The finished panels are then inserted into their architectural setting. They may be inserted straight into grooves in the stonework, or into wooden or metal frames.

To strengthen the resistance of the stained glass to wind pressure, and to prevent the panels from sagging, saddle-bars are fitted into the stonework or frame. These bars cross the stained glass panels and are attached to the leadwork with 'ties' made from strips of lead or from copper wire.

# *Appendix C*

## Deterioration of Stained Glass

Stained glass windows are conglomerates of different materials. They form a thin membrane between the external and internal environment of a building. Mechanical and chemical stresses affect all components, and the failure of one material influences the performance of others.

### Glass

### Corrosion

#### *Corrosion through water*

The large percentage of potash and lime used in the production of medieval glass make it more susceptible to corrosion than Roman or modern glass, both of which contain soda as their alkali component rather than potash.

Water is the primary agent for glass corrosion. Water attacks glass by an ion exchange process:
The alkali ions in the glass matrix are replaced with hydrogen ions (protons) from the water. The alkali ions migrate to the glass surface in the company of hydroxyl ions. These hydroxides combine with carbon dioxide in the atmosphere into carbonates. The carbonates subsequently react with sulphur dioxide to form sulphates.

water + glass → hydroxides → carbonates → sulphates.

The exchange of the large alkali ions with the much smaller protons means that the glass surface shrinks, leading to micro-fractures in the surface. These permit the ingress of more water and the continuation of the ion exchange. The fact that potassium ions are far larger than sodium ions explains why Roman and modern

soda glasses are more durable than medieval potash glass. Ion exchange in soda glass will not result in pronounced surface shrinkage.

Medieval type glass develops an alkali-deficient surface layer (gel layer) within a relatively short period of time after exposure to the elements. The gel layer reduces the progress rate of corrosion, because the protons have to travel deeper into the glass before reaching their alkali ion targets.

**fig. 82** Weathering crust on the interior of a window from Erfurt. The well-preserved dark paint layer is beginning to fail along the edges.

What happens on the surface of the glass, however, determines whether the condition of the glass remains stable or deteriorates.

If the surface of the glass is continuously damp, the accumulation of alkali ions in the water will eventually raise the pH of the water to a point where the silica and other components of the glass network can be leached out. The result is total destruction of the glass surface.

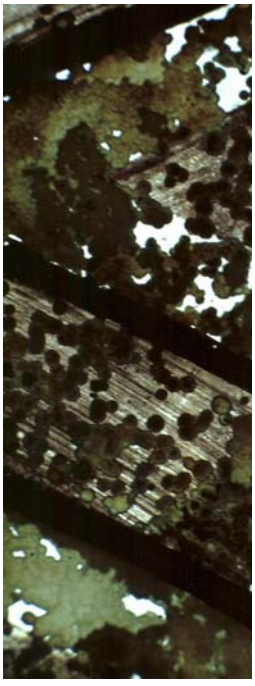


**fig. 83** Corrosion of glass aggravated by acidic secretions from micro-organisms. Gloucester Cathedral , Great East Window, panel F1, 2.

To achieve this level of pH water has to remain on the surface for long periods of time. If it is replaced (e.g. by rain), or if the glass dries rapidly, the necessary pH level cannot be reached.

In the past, sulphur dioxide in the shape of air pollution has been accused of corroding glass. In fact, sulphur dioxide does not in itself attack glass, but takes part in the formation of weathering crusts on the corroded glass surface. These crusts contain carbonates and sulphates (gypsum, syngenite, calcite) and are often hygroscopic.

Their rough surface also attracts dirt, which can hold moisture on the glass surface. By supplying the corrosion process with a stable water supply, weathering crusts accelerate the deterioration of glass.

The installation of heaters in many churches since the nineteenth century means that internal condensation will occur on the glass. Not only does this accelerate corrosion on the glass, it also provides a habitat for micro-organisms.

(Newton and Davison 1989, 136-153)

***Microbially influenced corrosion***

Microbial organisms need certain environmental conditions to survive:

- Water

  Although many organisms can survive dry conditions for long periods, they need water to grow.
- Light

  Photosynthetic micro-organisms need some level of daylight. Some, however, cannot survive high levels of ultraviolet light (Cameron et al. 1997, 31).
- Nutrition

  Micro-organisms can derive nutrition from glass itself as well as from air-borne nutrients. The acidic secretions of microbes can release mineral components from the glass, and in the process create evenly corroded surfaces ideal for further colonisation (Drewello and Weissmann 1997, 341).

Most biological growths occur as colonies of different organisms. Bacteria, fungi, lichens, mosses and algae can all be found on medieval glass (ibid.).

**Fracture**

Medieval glass varies considerably in its resilience to mechanical stress. Depending on its original chemical makeup, glass can be more or less brittle. On the whole, however, glass can withstand surprisingly high bending stresses, provided its surface is intact. As soon as the surface is damaged through scratches or corrosion, its tensile strength is greatly reduced.

Apart from wilful damage through vandalism or iconoclasm, fractures can occur due to hail and high winds.

Another reason for breakage may be the distortion of the lead matrix (bulging). This can put the glass under considerable stress. Bulging can have several different reasons:

- The panel has been leaded up too tightly originally.
- The panel is cemented into the glazing groove too tightly.
- Insufficient support by glazing bars.
- High temperatures causing lead to expand (particularly common in south-facing windows with dark glass)
- Several layers of glass and wide leads causing the panels to be very heavy.

**Paint**

The loss of the painted decoration on stained glass can have various reasons.

Insufficient firing means that the glass powder did not fuse perfectly with the substrate. Some particles of the paint may not have fused together properly, leaving a porous structure whose non-vitreous components may corrode or be washed away. This type of paint can also promote corrosion of the

**fig. 84** Paint loss between the spokes of a cart wheel on a window from Erfurt.

substrate directly beneath, because the paint retains water.

Some additives to the paint mixture may be detrimental to its durability. Generally additives which lower the melting temperature of the paint could produce a poor result, as the substrate might not have become sufficiently softened to achieve a reliable fusion with the paint. This type of mistake might not be immediately obvious, as the paint will look properly fired.

A high alkali content in the paint will also make it more vulnerable to corrosion (Newton and Davison, 1989, 144).

The corrosion of the glass underneath the paint often leads to the loss of perfectly sound paint.

Harsh cleaning methods are another culprit. Hydrofluoric acid, ultra-sonic baths, long immersion in warm water, all sorts of solvents, abrasive powders and brushes, and good old-fashioned elbow grease have all been used to clean glass with unstable painted decoration.

**Lead**

Lead as a heavy metal forms an oxidised surface layer, but does not corrode any further in normal atmospheric conditions. Very thin leafed lead may, however, eventually oxidise throughout and become very brittle. The impurities and additives in the lead used in stained glass (silver, tin, antimony, copper etc.) vary considerably. They influence the mechanical properties of the material, as does the production method of the lead cames. Passing lead castings through a mill alters the molecular structure of the metal. Medieval cast lead cames are more durable than post-medieval milled lead.

Lead will, however, react with organic acid vapours. The white corrosion product (lead carbonate) is highly toxic, as are all lead compounds (Newey 1994, 129).

A study by English Heritage is currently underway to try and determine the factors that influence the durability of different types of lead.

## Support Structure

### Corrosion of saddle bars

Ferrous saddle bars can have disastrous effects on the stonework, as the case of the Great East Window of Gloucester Cathedral clearly shows. Rusting and expanding bars can fracture stones, leading to the loss of support to the stained glass panels. Stone fragments trapped between bar and glass can lead to fracture of glass. Water run-off from rusty bars can stain the glass and lead.

### Failure of ties and pointing

The loss of adhesion between the stained glass panels and the saddle bars through broken ties can lead to sagging of the stained glass. The weight of the panels will eventually become too much for the pointing material in the glazing groove to hold, and the whole window will start to slide downwards. The lower panels will then buckle under the increased weight, and fractures will develop both in glass and lead.

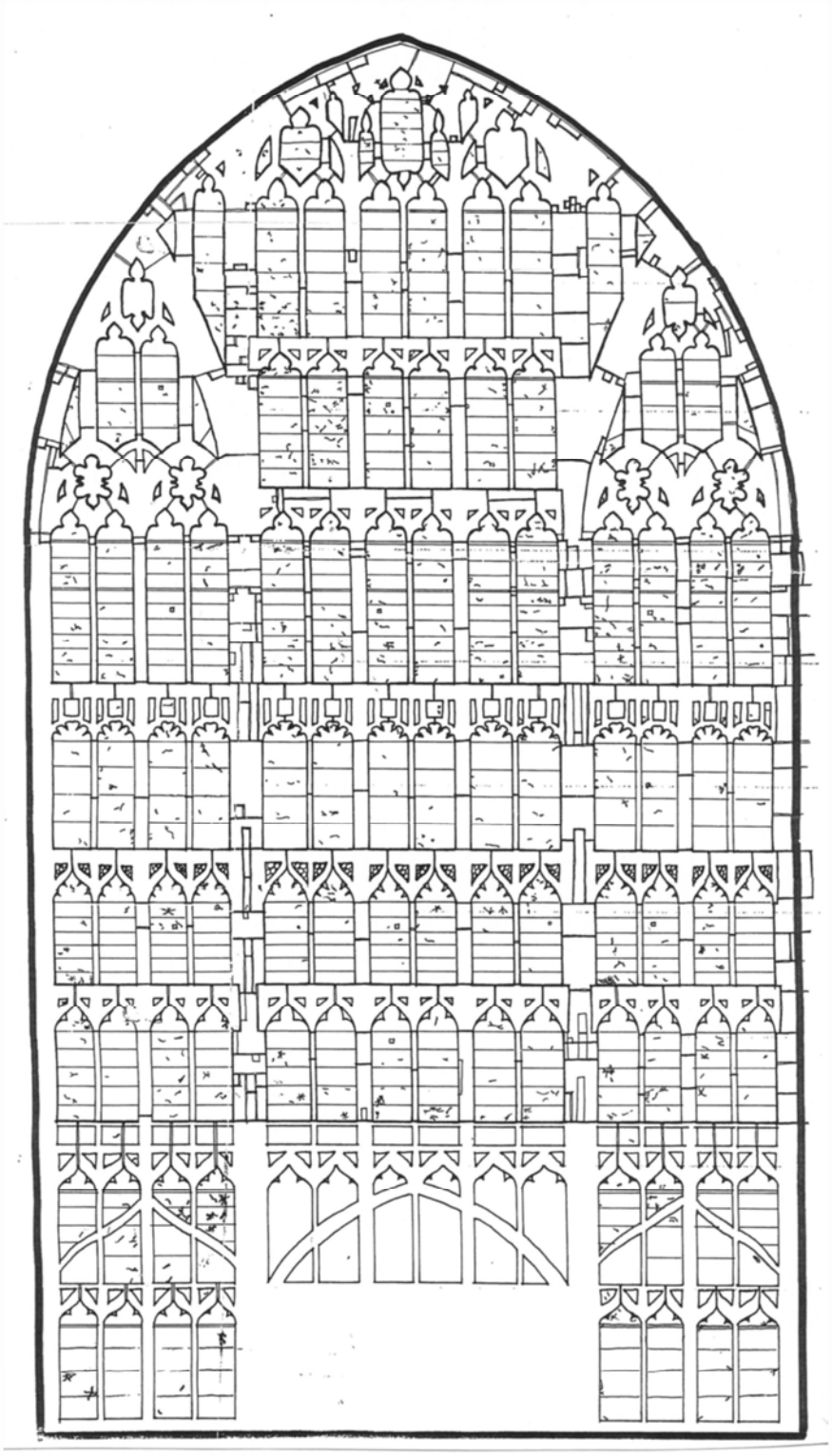
## *Appendix D*

A Sermon Preached before the Judges, &c. In the time of the Assizes in the Cathedral Church at Gloucester, On Sunday Aug. 7. 1681.
Published to put a stop to Fake and Injurious Representations.
By Edward Fowler, D.D.

*"There lately stood in the West-window of the Quire of Gloucester Cathedral, a most scandalous Picture, viz. Of the Blessed Trinity: Which, had it been much observed, could never have outstood the first year of the Reformation; and much less continued till about two years since.*
*(…) through oversight it had been omitted thus long: it being not long after the discovery of the Plot, and many Factious people then at work in vilifying the Church of England as advancing apace towards Popery. (…)*
*I moved, as I said, that it should be taken down, that is, by a Glasier (sic); but for a great reason (…) it was as readily consented to, that it should be immediately broken, as 'twas before, that it should be taken down, and new glass set up in the room of it. Whereupon the greater number of the Chapter went together to the place to countenance the action, and it was done by my hand.*
*(…) But when it came to be known abroad, there was a hideous noise and clamour made by some few people; who are, I dare say, the first Protestants that ever so concern'd themselves about a vile Relique af Popish Superstition.*
*(…) they have given it out (…)that it was only a Picture of a Saint or Angle, or at worst of our Saviour, when the contrary was visible to us all (…).*
*It was the old Popish Picture of the Trinity (…) which was patcht with a piece or two (as I remember) of plain glass."*

# *Appendix E*

Schedule of fractures in the Great East Window
D. Carthy, Carthy Conservation, 2001.

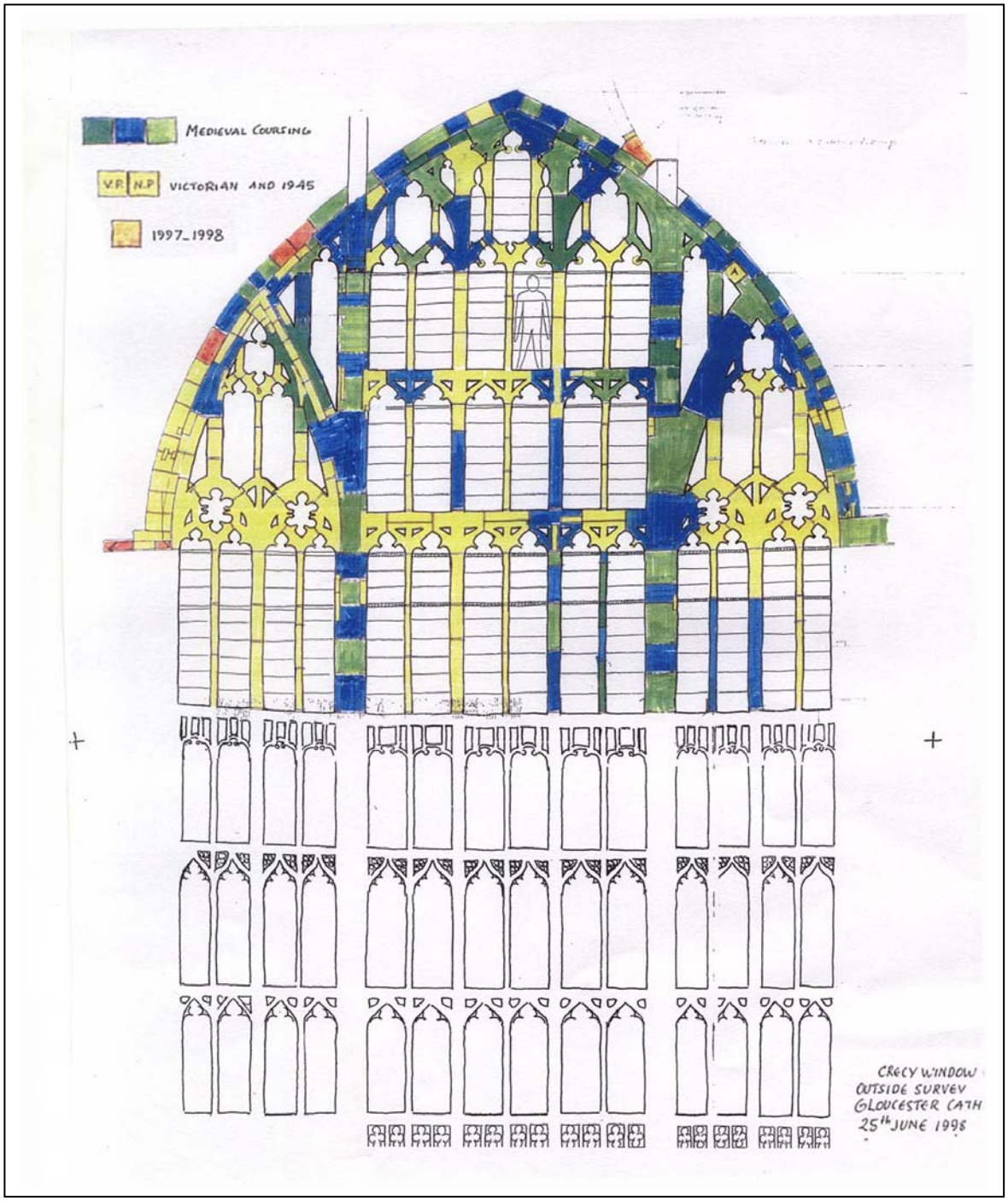


# *Appendix F*

Survey of the stonework of the Great East Window

P. Mychalysin, 1998


interior




Exterior
(unfinished)

## *Appendix G*

**Letter dated 16 November 1863, to T. Gambier Parry of Highnam Court, from Charles Winston Esq., to accompany a copy of his article, 'An Account of the Painted Glass in the East Window of Gloucester Cathedral', 1863. Transcript by T. J. Fenton.**

*My Dear Sir*
*With reference to what you say about some few terribly bad bits which you could hardly believe to be part of the original glazing, unless I had so stated them to be –*

*I think it is not impossible that when you compare my printed notes with the window, you will find that these bits are not part of the original glazing. I cannot say that this is so,- but from what I recollect of the window, & of the blots in it, I think it highly probable that these particular bits will turn out to be either later glass, or clear glass of the same date as the original, but brought from some other window. It was the mixture of glass that made the investigation of the window so tedious & difficult.*

*Of course it would be desirable if possible that these blots should be got rid of. One or two blots I remarked myself & was angry at seeing them because it never was intended that such eye sores should be left. I allude to some abominable modern heads which had been substituted for old ones. A piece of white glass, dirtied over, might have been substituted for each of these modern heads.*

*But the difficulty those anxious to avoid a "restoration" were placed in, was, how to prescribe any limits to variation. And we were so weak a party numerically, & the "Restorers" had canvassed so actively, that we found our only chance was to stick to a releading pure & simple. And this programme has been carried out to the very letter.*

*I am sorry that in order to frustrate what promised to be a sad job we were obliged to impose such strict limits upon Hughes. But under the circumstances it was an absolute massif.*

*I am my dear sir, yours truly*

*C. Winston.*

……. (presumably the place of writing, possibly Quimper) *16 Nov. 1863*

# *Appendix H*

Notes to the plans of the Great East Window of Gloucester Cathedral, showing the different types of glass.

In trying to understand the complexity of the window's make-up, I created a list of criteria to assess the age and, were possible, the provenance of individual pieces. I drew in this upon literary sources (Winston, Grimké-Drayton, and Kerr), Pitcher's photographic records and Payne's drawing, as well as upon. my own experience from working with English stained glass dating from the twelfth to the twentieth century

**Type of glass**

Cathedral glass clearly dates the piece to the nineteenth century (see glossary).

Other types of glass, such as good quality cylinder glass and crown glass were produced both in the Middle Ages and afterwards.

**Condition**

The condition both of the glass itself as well as of the painted decoration was also helpful in deciding the age of the piece. Pitted or deeply corroded glass points towards medieval glass, although there are examples (not, as far as I could see, in this window) of Victorian glass corroding. Painted matts with a high gloss finish are unlikely to be medieval.

**Paint**

The style and colour of the glass paint often dates glass to a specific time. Smear shading is the typical treatment up to the fourteenth century, while stipple

shading replaced it in the fifteenth century. The medieval glasspainters at work on the Great East Window as well as on the later medieval glass were highly trained craftsmen with a strong workshop tradition and an unwavering hand. Bad draughtsmanship and uncertainty in the brushwork are sadly often the work of the twentieth century.

After looking at the window over a period of months I began to recognise the hands of different glasspainters. While the painters of the Great East Window are clearly all working in the same workshop tradition, the clerestory figures are distinctly different in their linework.

**Condition of lead**

Where a piece had been inserted after the last releading, it clearly dated to post-1862.

In some cases, it was simply impossible to tell the age of a piece just by looking at it. It is not unusual for high quality medieval glass to be perfectly preserved, and in cases without paint the jury is still out.

**Recording**

I then drew up a list of nineteen categories of glass, such as:

- Original glass probably in situ;
- C14 glass probably from clerestory, displaced with context;
- the same, used as a stop-gap;
- Medieval stop-gap unrelated to this glazing campaign;
- ruby or blue replacement, unpainted cylinder glass;
- ruby acid etched glass;
- In situ repair, etc.

Pitcher's photos served as templates for creating a drawing of the lead lines for each light. On these drawings I marked each piece with the appropriate number from my list.

The first half of the survey was done in 1999 while the scaffolding boards were still in place, the second half was completed in 2001 with the aid of a very high-powered telescope from the organ loft.

The result was a folder full of drawings looking like painting-by-numbers, very accurate but unfortunately not very helpful in gaining an overview of the quantities and the dispersal of the different glass types in the window.

In order to pull the information together into a usable form, I grouped my initially nineteen categories into eleven larger ones, six for medieval glass, and five for post-medieval glass (see plans).

Colour-coded they could then be plotted on enlargements of a postcard from the Cathedral Shop (working in the tradition of 1945, when a postcard from Percy's shop in College Green was used as a guide to reassemble the window - see page 25).

What surprised even me was the amount of original glass which seems to be in situ. William Wailes' assumption that *fully two-thirds of the glass are false* (Welander 1985, 133) was clearly wrong. The opposite seems to be the case.

Two large areas of significant damage are now also visible: the southern bay of the window and the lowest two tiers of the central bay. The latter are relatively easily accessible to vandalism from the Lady Chapel roof, while the south bay is the part of the window most exposed to extreme temperature changes and high winds.

These plans are, of course, open to discussion. I am not an art-historian, and an even more detailed survey might well reveal a clearer understanding of the provenance particularly of those medieval stop-gaps not related to the choir glazing of the fourteenth century.

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