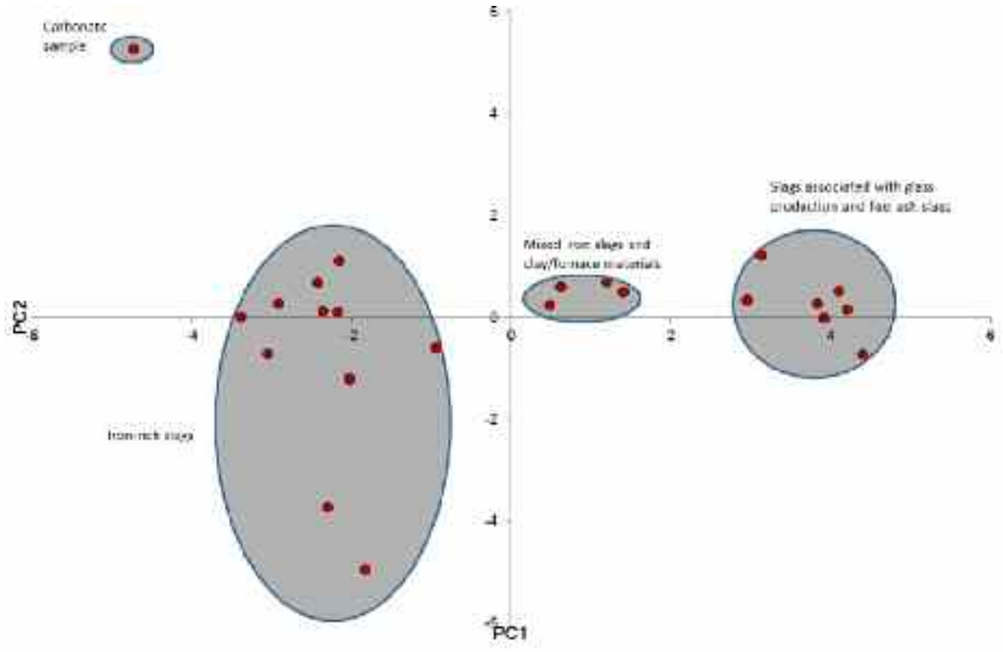

Fig 8.55 Principal Component Analysis (PCA) of the slag samples from Glastonbury (diagram: S Black)

8.11 Stained and painted window glass

C Pamela Graves, with contributions from Chris Caple and R Barnett

Introduction

The assemblage of window glass from antiquarian excavations at Glastonbury Abbey comprises 2,085 fragments (not including items on display); this represents over 15,952cm^2 in area. The condition of the glass varies: the post-medieval glass is generally well preserved and translucent, with the fragment sizes often remarkably consistent; most of the thirteenth- to fourteenth-century material is opaque and friable, and of varying fragment size; the material identified as 'durable blue', probably dating to the twelfth century, is either well preserved and translucent, or has been subject to heat distortion. Interim excavation reports noted that window glass was found but gave no detailed account of find spot, description or quantity of glass recovered.[313] The major work on the excavated glass is by A R Lewis (1991), an art-historical survey of all the painted glass from the Saxon period to the sixteenth century.[314] Relatively little of the glass was recovered from contexts for which there is good archaeological information. Much of the material had already been sorted by colour and some by stylistic identification of painted pattern, but there has been no previous effort at quantification.

This report re-examines the excavated material in order to identify the various painted patterns present and their date. The material is analysed according to stylistic motifs and date range, characteristics of production method, grozed shape, colour and colouring technique; the material was quantified by area (in preference to number of fragments). In conjunction with such spatial and stratigraphic data as there is, suggestions are made about glazing schemes, locations, and any transformative processes that the material may have undergone. In order to confirm the identifications of motif, and to establish as far as possible any difference of stylistic 'school' or origin within the excavated assemblage, the material has been compared with glass of known and suggested connection to Glastonbury. Glass related to post-Dissolution activity on the site is also of interest due to the large quantities of clear or white glass.

Of major significance is the recognition for the first time of considerable quantities of durable blue early medieval window glass, confirmed by compositional analysis to have a mixed soda potash composition. The durable blue glass is likely to date to the twelfth century and presents stylistic affinities to northern French glass-painting. The assemblage of durable blue glass confirms that early glazing schemes at Glastonbury were of the highest quality – for example, comparable to York, Winchester, Chartres and St-Denis. It is suggested that this early glass may have been reused in the rebuilding of the church that followed the fire of 1184, a practice that would be consistent with the abbey's deliberate use of archaic style for ideological purposes.[315] The assemblage has comparatively low representations of thirteenth-century grisaille and later figural glass, perhaps the result of selection and retention policies.

An extended report, methods statement and full catalogue are published online, together with an assessment of glass connected with Glastonbury Abbey and now located elsewhere in the precinct or beyond (at St Patrick's Chapel and the abbot's kitchen within the precinct; St John's Church and the Tribunal Chapel, Glastonbury; Taunton Museum and Taunton Castle; and the Somerset churches of Butleigh, Chilton Polden and High Ham). Separate online reports provide detailed analysis of the lead cames from Glastonbury Abbey and the compositional analysis of durable blue window glass.

The excavated material

Romanesque

Palmette and acanthus scrolls and leaves

Eleven fragments of acanthus scrolls and leaves were recorded (1–11), in addition to ten fragments of palmette borders (12–21), principally in translucent mid-blue pot-metal but also including opaque (1, 13) and translucent light green pot-metal (9). Palmettes and acanthus leaves are amongst the most frequently occurring of Romanesque and early thirteenth-century vegetal motifs in all media, having their origins in classical art, and transmitted through late antique and Byzantine decoration. They occur both as individually drawn leaves and as composites in borders in major windows in England and France. The semi-circular grozed shapes, and at least one portion of a broken or recut semi-circle probably formed the central point of an arrangement. It is accepted that the design principles of reliquaries and windows are similar and, on this basis, we may compare the Glastonbury palmette borders with the small-scale palmette frieze on the reused Byzantine cloisonné cross panel of the Mosan Stavelot Triptych of *c* 1150–6/8, thought to originate at the imperial abbey of that name in Belgium.[316] Palmette and acanthus borders, finely detailed in outline and in internal articulation, are also used throughout the Winchester Bible.[317]

Foliate scroll and trefoil foliage meander borders

Five fragments were recorded in translucent mid-blue pot-metal (22–26). The tendril-like stickwork pattern is very similar to border patterns excavated in Winchester and dated to the fourteenth century.[318] The length and basic form of the side-alternating units is the same as that of the palmette borders, but whereas the palmettes have at least two widths of stickwork detail, this pattern generally eschews fine detail. Side-alternating trails on a ground picked with extensive stickwork detail occur on both the base and body of the cross of the Crucifixion panel in the *Arche d'Alliance* window of the mid-twelfth century at St-Denis, in the Moses window and in the Annunciation scene in a choir window, both of 1140–4, in the same church.[319] It is also a pattern that is found directly paralleled in metalwork of the second or third quarter of the twelfth century, including the detail of small protrusions where the tendrils split.[320] Given that visually the glass is of the same blue pot-metal as the Romanesque glass, and of the same width and grozing as the early glass, it seems likely that these patterns are also of the twelfth century in this case.

Drapery

Six fragments of drapery were recorded in translucent mid-blue pot-metal (27–32). The paintwork identified as drapery mostly consists of deeply recessed or nested V-folds or a number of V-folds set at ninety degrees.[321] The variety of V-folds and slightly curved V-folds (especially the nested, overlapping V-folds of no. 29) are all consistent with mid- to late twelfth-century drapery forms.[322] Catalogue no. 10, if not a foliate detail, may be the kind of internally swirled highlight of drapery visible over the hips and thighs in figures in manuscript illumination such as the Bury Bible, *c* 1135, and the Winchester Psalter, *c* 1150.[323] Little more can be reconstructed from these pieces with regard to scale or the nature of the iconography.

Miscellaneous narrative designs

Two fragments in translucent mid-blue pot-metal may represent the body of an animal (33) and a decorated sword scabbard or knife (fig 8.56: 34). The deep slope of the animal's chest suggests that the animal is kneeling on its front legs, the front paw of which divides into three very distinct claws. This appears to be a very small-scale

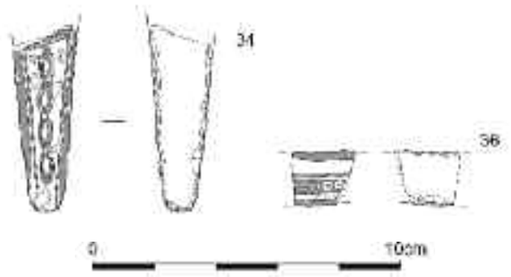

Fig 8.56 Romanesque stained glass 34 and 36

lion or possibly griffin, cf the elongated claws of the St-Denis griffins, dating to 1141–4.[324] The possible sword scabbard suggests a narrative theme with soldiers or knights. Throughout the Romanesque period, in stained glass and in manuscript illumination, much armour and weaponry was portrayed in the colour blue, presumably as an approximation to the colour of steel.[325] At least one scabbard in the Winchester Bible is depicted as decorated with a central meander pattern highlighted from the main colour in a way analogous to stickwork in glass, although the main scabbard colour here is pink, against a general background of blue.[326]

Border and diaper patterns

Five fragments of stickwork beading were recorded in translucent mid-blue pot-metal of four different types of design (35–39; fig 8.56: 36). Six fragments of stickwork lozenge and bead pattern were recorded in translucent mid-blue pot-metal of five different types of design (40–45). One characteristic of these repeated patterns or diapers (a description usually applied to later medieval work) is their extremely small-scale and fine execution. There are at least two variations on the circles and squares or lozenges theme (G14 (40); G22 (42); G24 (41)). Lozenge and bead patterns (or 'crosshatch with pinpoints of light in the centers') were used in ornament now located in the retro-choir tribune of the abbey church of St-Remi, Reims, dated to *c* 1170–80.[327]

In manuscript illustration, lozenge-based or cross-hatched patterns were used to represent textiles, for example the bed on which King Henry is sleeping when he has his vision of peasants in the *Chronicle of Florence and John of Worcester*, *c* 1130–40, Worcester Cathedral Priory.[328] Variations on the lozenge and bead design occur repeatedly throughout the Winchester Bible as floor or roof tile patterns.[329] Cross-hatching was a technique used widely in metalwork – where chased surfaces bordered or formed the background for other metalwork techniques on champlevé enamels of the Romanesque period, particularly reliquaries, triptychs and ornaments of Mosan and Rhenish origin – and might be one of the patterns most easily evoked in glass painting. The larger lozenge / cross pattern represented by number 43 may be the glass equivalent of patterns found in architectural sculpture of the mid–late twelfth century; for example fragments of 1140–5 from Lincoln Cathedral, and the door to the late twelfth-century hall of Durham Castle.

The appearance of the glass, the metal itself and the consistent corrosion patterns strongly suggest that this comprises one category and period of glazing. Consequently, patterns have been identified within the early glass that were not detected by Lewis.[330]

Bead-and-reel design

Six fragments were identified in dark blue and translucent mid-blue pot-metal (46–51). This pattern is not a conventional bead-and-reel, given that there are normally paired (or more) upright elements in classical bead-and-reel; here there are circles. The format is more like the medieval convention for a jewelled border or hem, used from the eleventh century and throughout the Middle Ages. In such jewelled borders, the elongated bead or ellipse often has at least one line of emphasis on one side. Here, however, the distinguishing element is the number of emphasising lines on either side of the elongated bead or ellipse. Three fragments of durable blue early medieval window glass of the Winchester Group 3 were painted with drapery folds and a 'jewelled' border, dated by Kerr to the twelfth century.[331] Even so, the 'jewels' of these three fragments are very much simpler than the Glastonbury patterns.

The bead-and-reel passed into the Romanesque repertoire from classical and late antique art and appeared in many media and in many variations, not only as a border pattern, but as representative of lathe-turned stonework and woodwork balusters. A bead-and-reel pattern constructed mosaic-like from separate pieces of glass for each bead-and-reel was used to emulate lathe-turned wood on the uprights of an emperor's throne at Strasbourg in the late twelfth century; it occurs as an elaborate linear stickwork design in the glass borders preserved *c* 1170–80 in York Minster.[332]

Unidentified or miscellaneous designs

Ten fragments exhibited miscellaneous designs on translucent or semi-translucent mid-blue pot-metal (52–61), including Lombardic script (52) and overlapping scale pattern (61).

Discussion

In total, more than 1,347cm^2 of the Glastonbury assemblage is identified as early (Romanesque) glass, principally early blue with smaller quantities of opaque glass with side-curling acanthus or palmette (4cm^2) and light green glass painted with a variation on the fleur-de-lys or lily (8cm^2). At least 28cm^2 of reamy or streaky blue were identified.

These identifications were not based on painted decoration alone: instead, the colour and nature of the glass were considered, how it has weathered (a distinctive iridescent weathering, often quite white / white opal but ranging through to a deep multi-coloured, or black opal, iridescence in some instances), the close-set, often very precise, nature of the grozing and the occasional heat-distortion of the material. In addition to this, it was evident that the paintwork survived in different ways and to different extents. On very few pieces was the original dark paint still discernible. In most cases it was traceable as a faint fawn to white colouring; in many more instances the paint was hardly detectable to normal inspection at all. As a consequence, all the blue fragments were subjected to scrutiny under a variety of lighting conditions.

There are some extremely fine, carefully grozed shapes amongst this material;[333] there are numerous curved or tapering round-ended shapes (G14, G22; *c* 16.25mm wide × *c* 53.68mm long). The bow or bracket shape is similar to shapes used frequently to depict waves: for example St Peter walking on the water from the axial chapel window of Sens Cathedral, possibly of the 1150s.[334]

The bead-and-reel, linear beaded patterns and linear palmette borders may all have been used in ornamental strips and knotwork, which bounded some border designs; for example the two pieces of border from the *Infancy of Christ* window of St-Denis in the Victoria and Albert Museum, dating to *c* 1140–4.[335] Given that the Glastonbury fragments tend to be grozed to particular repeated modules of length, width and shape (straight and curved), it seems likely that they originated in the borders, if not of these direct designs, then something in this vein. However, another source is possible, suggested by a combination of other shapes and designs. The repeated vesica shapes – one of which certainly had a grozed concave curve at the bottom – along with the partial roundel with a concave curve at the bottom suggest repeated geometric shapes leaded around a central roundel. Geometric shapes like quatrefoils and sexfoils, centered on roundels and squares, and bounded by strapwork, made up the principal design elements of windows such as those from the retro-choir tribune of St-Remi.[336] Since two of the St-Remi designs employed variations on the crosshatch / lozenge-and-bead ornament, the Glastonbury assemblage includes several elements or design motifs that could be said to be part of the vocabulary of contemporary northern French glass-painting.

Some of the motifs are directly paralleled in metalwork and manuscript illumination in both France and England of the second to third quarter of the twelfth century: Mosan and Rhenish *vernis brun* metalwork, in particular, share manufacturing characteristics involving the scraping away of darkened oil to reveal an area of trefoil foliage meander, cross pattern or diaper pattern.[337] Many of the beaded and stickwork borders and patterns can be paralleled in metalwork and enamel work of this period. It is noticeable, however, that all these shapes – and indeed the majority of this collection – consists of very small pieces. This, and the attention to minuscule detail in the paintwork, suggests something about the level of investment in this medium, both artistically and in terms of the patronage. It may also suggest something about the scale and visibility of the windows.

A number of sites have produced twelfth-century glasses that have proved highly resistant to corrosion when compared to other contemporary and later glass. The light blues of the St-Denis and Chartres west windows have survived in this way, albeit that some of the St-Denis glass has not been exposed to weathering or industrial pollutants since the eighteenth century.[338] Excavated glass from York Minster and Winchester has similar properties, which is extraordinary given that they have lain in the soil for such a long time. SEM analysis of three samples of the Glastonbury blue confirms that they have a mixed soda potash composition, with the presence of copper in all three and cobalt in two of the three samples giving the distinctive blue colouration. These analyses correspond well with Cox and Gillies Group 1 glasses and Biddle and Hunter Group 3 glasses, a durable soda lime blue glass, primarily coloured by cobalt, or cobalt and copper.[339] Normally derived from tenth- to twelfth-century contexts, it is frequently reused and present in later stained glass windows.

A high proportion of the early blue has been subject to heat damage. It was noticeable that in many cases the heat distortion was greater on the outer, unpainted sides than on the painted surfaces. In the case of the worst-affected of the border strips, the glass had almost folded around the unpainted surface, leaving the painted surface as an external skin. This begs the question whether the

paint inhibited the rate of melt in the glass, protecting these surfaces; or whether the fire started on the exterior of the building, or at least exterior in relation to the position in which this glass was installed?

Post-Romanesque glass

Thirteenth-century grisaille

Eight fragments of opaque glass were recorded (62–69), representing at least 89cm^2 of this type of grisaille (with a further 7cm^2 of possibly related stickwork beading). Compared with most excavated assemblages of window glass from monastic sites in Britain, there is surprisingly little identifiable thirteenth-century grisaille. The scale and crudity of number 65 implies that this may have been located in a position in a window far from the eye, whereas the scale and fineness of the cross-hatching from number 67 is more akin to most grisaille of this period. There is insufficient representation of this type of pattern to be able to make specific statements about comparison with Salisbury grisaille, the most famous representation *in situ* in the region. According to Marks, there is no evidence for this type of grisaille before the beginning of the thirteenth century.[340] There are stylistic distinctions between, for example, French and English grisailles, but these tend to relate to how either interlacing or 'layering' of geometric planes is represented in the treatment of the lead work and painted straps or bands. Without a substantial representation of grisaille motifs and the relationship between the leading and the glass designs, it is difficult to make any more interpretative comment. However, the five-lobed design and the relationship of the curling stem to the painted strap may be a characteristic feature. There are no identifiable pieces of twelfth-century grisaille.

Late thirteenth- to early fourteenth-century grisaille

Thirteen fragments of translucent white to opaque glass were recorded (70–82; fig 8.57). Number 70 is painted with a wide bow or cup in reserve from a solid ground, with a central stem, highlighted in yellow stain, and an acorn to the right-hand side; ivy and oak leafs were also represented. The finer quality painting represents 149cm^2.

Quarry edges and strapwork

Three fragments showed a distinctively painted quarry edge (83–85; 15.5cm^2; fig 8.57). Naturalistic foliage featuring vine leaves, oak leaves, ivy and maple leaves were illustrated in English manuscript illumination by *c* 1270; and featured in architectural sculpture in the late thirteenth to early fourteenth centuries. The use of naturalistic foliage in English stained glass seems to have occurred slightly later, but the windows of the Chapter House vestibule at Wells Cathedral featuring ivy leaves may have been amongst the earliest manifestations, dating to *c* 1286.[341] It is possible that some grisaille at Exeter dates to the 1280s, but amongst the most cited examples are the windows of the Chapter House at York Minster, *c* 1285–90, and Merton College Chapel, Oxford, *c* 1294.[342] The Glastonbury examples are rather fragmented, and it is not really possible to establish an affiliation to 'schools' of artistic production at this time, but the glass is certainly of this date bracket. There are also examples of oak leaves and probable oak leaves; all this material has painted strapwork or bands.

The grisaille is unlikely to have been used on its own but to have featured in so-called band windows, in which the glazing formed alternating horizontal bands of grisaille and figured glass. This form of glazing was probably introduced from France, appearing at Tours Cathedral in the 1260s.[343] Naturalistic grisaille was certainly used in England, in conjunction with figured panels – usually under micro-architectural canopies – in York Minster and Merton College Chapel; this type of window became widespread in the early fourteenth century. The implication is that the grisaille was part of a suite of contemporary painted designs that would have been used in any single glazing programme of the time. The Glastonbury assemblage has therefore been searched for indications of micro-architecture, background patterns, figural and animal detail and border patterns that may have complemented the grisaille settings.

Pieces from the edges of grisaille of this period are not necessarily diagnostic in themselves, as without accompanying floral or foliate designs they cannot be identified and dated with certainty. The glass tends to be of a consistent thickness and reacts within the soil to produce the opaque, corroded products typical of much thirteenth- to fourteenth-century glass. However, it is clear that the edges, painted with straps or bands, are more highly represented than the central foliate elements of the designs. This perhaps tells us more about the processes by which glass was extracted from the cames for reclamation of the lead. In other words, the lead was valued, not the glass, and in recycling the lead no great care was taken to preserve the integrity of the panes.

Quarries

There was one quarry fragment of mostly transparent white glass (fig 8.57: 86), a Somerset / Wells quarry design of the fifteenth century. Woodforde recognised that there are variations on quarry designs specific to, or

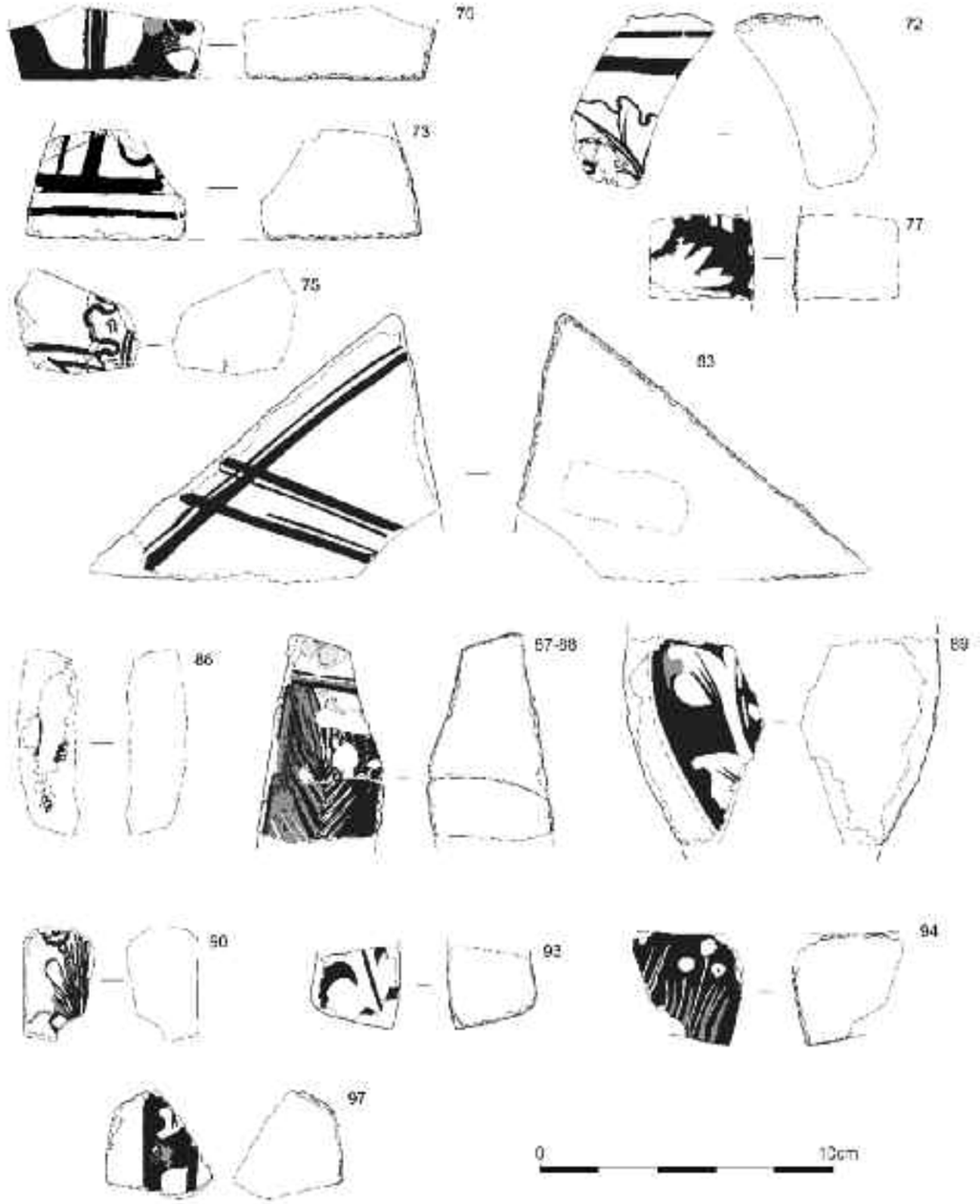

Fig 8.57 Post-Romanesque stained glass 70, 72, 73, 75, 77, 83, 86, 87, 88, 89, 90, 93, 94 and 97

at least indicative of, Somerset glass. Some of these patterns appear within the Wells Cathedral windows, with an extended typological range identified by Ayers.[344] The tendril trail is the most recognisable motif and can be compared with those excavated from Winchester Castle and St Mary's Abbey, Winchester.[345]

Floral and foliate patterns

Fourteen fragments were recorded of translucent to opaque white and transparent to opaque blue pot-metal (87–100; fig 8.57). Foliage designs were used from the late eleventh century onwards in English glass. Certain

conventions of design are characteristic of different periods, however, as has been seen with the Romanesque glass and the stylised foliage of the thirteenth century. In the early fourteenth century, in particular, certain foliage patterns were used as backgrounds against which figures were placed, usually under architectural canopies (see below). Some details, which may be part of diaper patterns, are so isolated that they have been classed here, however. These include number 96 as well as 97 (fig 8.57), the example from G31, which resembles a rinceau commonly used in the 1320s–40s in Yorkshire. The Glastonbury fragment, however, has been reserved from a far thicker area of matt paint than is usual for rinceaux.

Foliate designs were used particularly from the early fourteenth century to fill the backgrounds of architectural canopies and figural glass. Number 89 is this form of foliage, though its use was fairly widespread in England. The long tear drop / loop leaf of number 90 resembles shapes frequently used in the 'Somerset' type of quarry, and resembles a small-scale version of flower heads and long tear drop / loop of quarries in the Old Deanery porch at Wells Cathedral (sI 1a), dated to *c* 1472–98.[346]

Beaded and other border patterns

Ten fragments were recorded (101–110; fig 8.58) and a further 4.5cm² from group G31. A range of beaded and

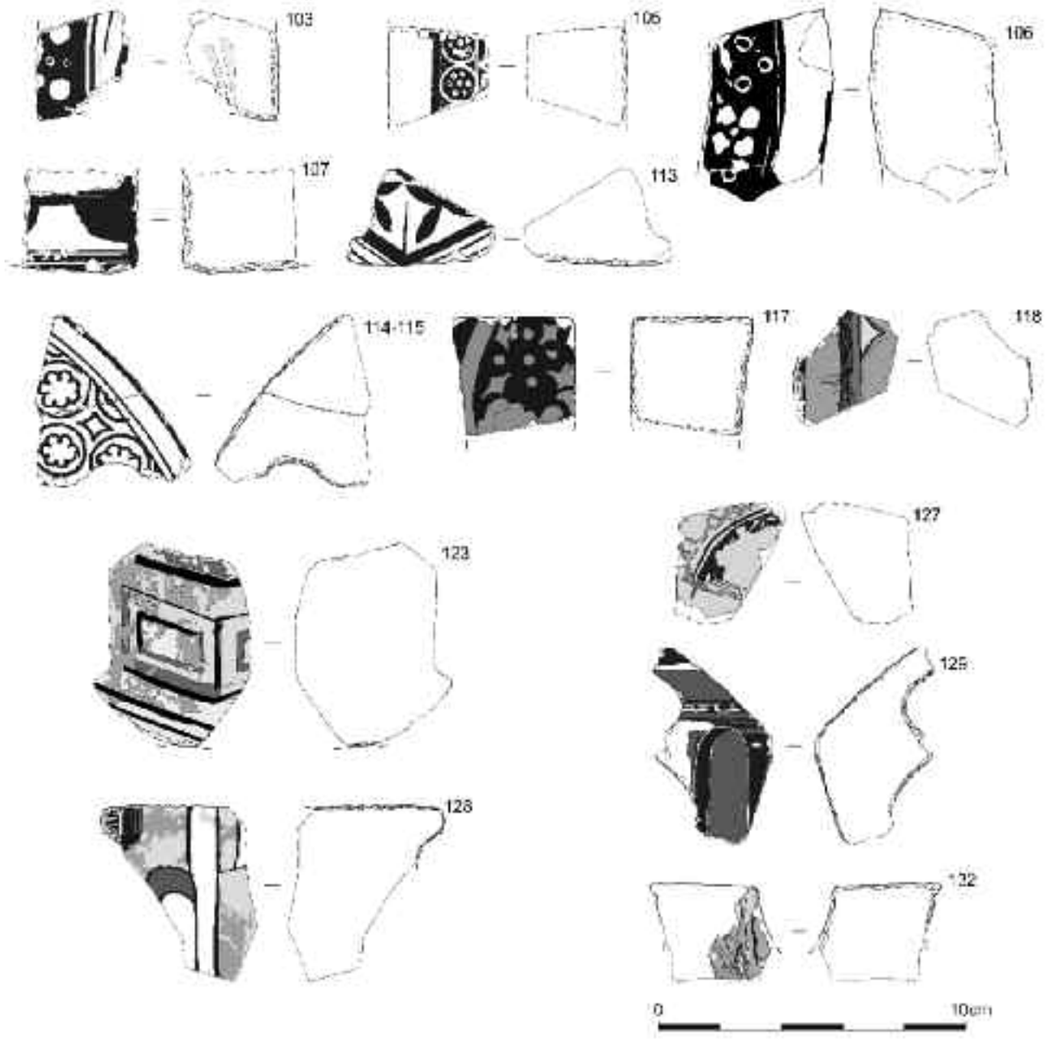

Fig 8.58 Post-Romanesque stained glass 103, 105, 106, 107, 113, 114, 115, 117, 118, 123, 127, 128, 129 and 132

stickwork border patterns are represented, some of which were used throughout the Middle Ages and were not particular to any one period. Nonetheless, the examples described here can be compared with patterns in extant windows. The most extensive sample from Glastonbury has been preserved in the framed glass, namely the running lozenge-and-circle pattern. This combination could have formed a decorative border of alternating roundels and strips. It may even have been used within a grisaille design of the thirteenth century. It is noticeable that many of these stickwork patterns are relatively crude in execution, whereas stickwork could be immensely detailed and fine (contrast, for example, the stickwork patterns on blue pot-metal identified as Romanesque in this assemblage).

Rinceaux and diaper patterns

Seven fragments (111–117; fig 8.58) were found, including one of opaque flashed ruby glass (111). Whilst some of the diaper patterns here were most probably used as grounds for figural glass and for architectural canopies in particular, one might have expected a greater range of types of diaper and rinceaux, particularly the more common forms used in the West Country. The hawthorn-type leaf (77) may in fact be a fragment of background leaf diaper, similar to that seen amongst fragments from the Chapter House at Wells Cathedral.[347] The pattern in numbers 114–115 resembles one used as a background in the early fifteenth century, for example a form of wall-painting or tapestry in an architectural setting (in 1g) of the Great East Window of York Minster.[348]

Micro-architecture

Twelve fragments were identified representing crockets, cusps, column bases, arches and buttresses (118–129); a further six shaded fragments are probably architectural (130–136; figs 8.57 and 8.58); a final fragment may be either anthropomorphic or architectural (137).

A number of these pieces are painted with parts of design, too fragmentary in themselves to be accurately diagnostic, but they are forms recognisable in surviving window glass. The representation of canopies in window glass was at first very two-dimensional. Three-dimensional depiction was used in the choir clerestory glass of Wells Cathedral in the early 1340s.[349] More sophisticated renderings of depth, recession and perspective were conveyed by use of shading, highlighting and angle of line. Different periods used different forms of crocket decoration for canopy gables, pinnacles, cusped openings and arches, and offsets and niches on the side-shafts or buttresses supporting the canopies.

Furthermore, different 'schools' developed distinct traits in depicting these elements. By far the largest category of micro-architectural depiction represented at Glastonbury is the side-shaft. From the 1340s onwards, architectural canopies and their side-shaft supports in Wells Cathedral, and more generally in Somerset, as elsewhere in England, were depicted on white glass with yellow stain highlights. Particularly in the late fourteenth and fifteenth centuries, when depth and three-dimensional depiction is prominent, fragments of these design elements are only recognisable as having angled lines and graded shading, with an increased use of scratchwork highlighting. The cylindrical column and base (122) is perhaps typical of the early fifteenth century, as seen in, for example, the Great East Window of York Minster.

The use of shading and highlighting to depict recession is represented in catalogue numbers 123, 126 and 136 (figs 8.58 and 8.59). These could be portions of the bases of the supports of architectural canopies, or they could be solid balustrades with recessed rectangular panels or mouldings.

It is also interesting to note what appears to be missing or under-represented at Glastonbury compared with many other excavated assemblages. This includes castellated features, such as the merlons, towers, cusping and offsets of the early to mid-fourteenth century or later, especially as castellated features occur in the superstructure of canopies of the choir clerestory windows in Wells Cathedral;[350] tiled floors (although there may be at least one example); cross-hatched window recesses of the late fourteenth to fifteenth centuries; pinnacles and pinnacle neck-rings; and the characteristic 'scumbled' shading of the undersides of canopy vaults of the fifteenth and early sixteenth centuries.

Architecture is the single biggest category that allows an indirect inference of the presence of figural representation to be made. In conjunction with drapery fragments, the picture overall is of a (proportionately) large presence of late fourteenth- to fifteenth-century windows.

Heraldry

Only one fragment (fig 8.59: 138) was identified: probably a lion, *passant gardant*, in reserve from plain ground and now completely opaque. Heraldic borders began to feature in English stained glass windows towards the end of the thirteenth century at Merton College Chapel, Oxford, and in York Minster Chapter House in the first half of the fourteenth century.[351] Lions or leopards *passant gardant* were extremely popular as border motifs, and the scale of the Glastonbury fragment is consonant with a border location. Wells Cathedral, in particular,

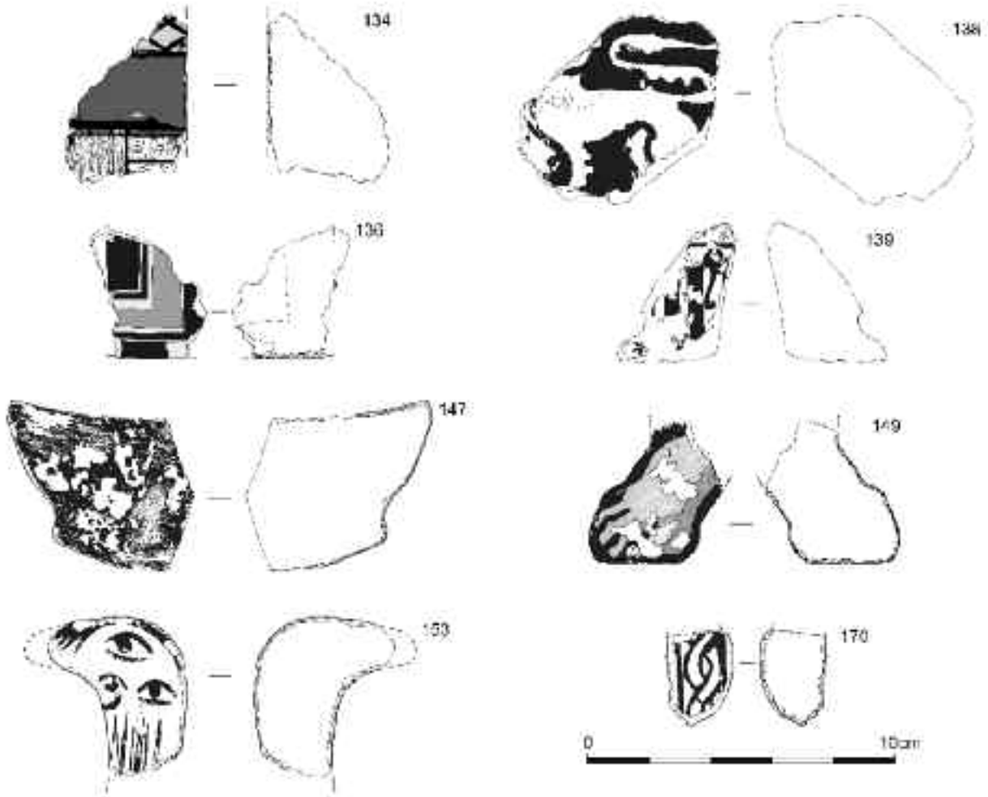

Fig 8.59 Post-Romanesque stained glass 134, 136, 138, 139, 147, 149, 153 and 170

used the lion *passant gardant* border motif in alternation with crowns, and both could be seen as indications of loyalty to the reigning house. Examples can be found in Wells windows EI 6–7d and SIII 2–3a.[352] The Wells type of lion has noticeably projecting ears and whiskers, and the Glastonbury example has one scratched whisker, but has been broken off before the ear.

Ayers notes that lions have a hierarchical significance at Wells, and possibly an iconographical one as well.[353] In borders, they may play an equivalent part to beasts in the marginalia of manuscripts, but in windows they may also evoke royalty, both as a specific allusion to the heraldry of the kings of England and because bestiaries refer to the lion as the king of beasts. He argues that the lions in the Lady Chapel glass of the early to mid-fourteenth century at Wells evoke the royalty of Christ and the lions of the Throne of Solomon. The latter imagery informed the iconography of the thrones and the seals of Henry III and Edward I. At Glastonbury Abbey, Leland reported that lions supported the monument to King Arthur, who had been interred in 1278 in the presence of Edward I, and thus the use of lions in windows here may have had an additional resonance.

Inscription

One fragment (fig 8.59: 139) and at least seven conjoining fragments (140) were found of letters in solid paint against a plain ground in Gothic Black Letter script (*textualis quadrata*) with elaborate serifs and decorative terminals, in at least two registers. In later medieval stained glass, Black Letter text accompanied the depictions of saints and recorded the names of donors; they also referenced parts of the liturgy and evoked particular feasts and fasts. In certain contexts, contemporary poems were written out as sub-text to figural or narrative glass. The ornate serifs, decorative terminals and stops or word spacers here suggest a date in the mid- to late fifteenth century.[354]

Shaped fragments

Grozed shapes (as seen in the seven fragments, 141–147; fig 8.59) can often indicate something of the sort of space which they filled; for example, tightly curved glass fitting into the multi-cusped (usually cinque-foliated) heads of late fourteenth- to fifteenth-century lights. This may explain number 141: a fragment of translucent pot-metal green with a grozed and curved outer edge. The grisaille of the early to mid-thirteenth century often used geometrically shaped panes to complement the painted designs and this may explain the origin of the tear-shaped piece, number 145. At least two examples had been carefully grozed to have a protruding hump or hook (142–143), and these may have echoed or accommodated some aspect of architecture, for example the shapes surrounding the neck-ring at the base of a micro-architectural finial.

As an excavated assemblage the Glastonbury material is notable for its relative under-representation of what are often called glaziers' side strips, frequently recurring rectangular or rhomboidal strips of unpainted white glass that were used as a frame of white glass between the main panels and the stone or wooden embrasure into which the panels were sunk or affixed. Curved pieces of the same width and equivalent length would continue this plain frame around the curves and cusps of the heads of windows. Whilst the exact width of such strips might vary between periods or campaigns, they tended to be very consistent, at least in terms of width, within each window. In many assemblages from monastic contexts there is a fair representation of this type of glass, suggesting that the margins of windows have been left to enter the archaeological record, whereas the pictorial centres of the windows were either broken up and removed, or separated from their surroundings for sale or reuse elsewhere. This point is illustrated at Clarendon Palace, Wiltshire, where one season's assemblage of window glass amounted to only four pieces, but of these one was a plain, rectangular side strip.[355] The relative paucity of side strips at Glastonbury may indicate a very thorough stripping of the windows at the Dissolution.

Figural details

Two fragments of white glass showed figural painting. One (148) has a combination of fine stipple and smear shading: a human eye and brow are discernible as a combination of outline and scratched highlights, as is part of the ear; the hair is largely shaded, highlighted and coloured in yellow stain on the outer face, indicating a fifteenth- to early sixteenth-century date. The other (fig 8.59: 149) is late fourteenth to fifteenth century, painted with either a human foot or an animal claw in reserve and moulded with shading.

Drapery and other figural attributes

Two fragments of drapery (150–151) and one possible drapery (152) were identified. Other attributes include part of a wing (fig 8.59: 153), possible parts of armour (154–155) and two fragments of partially translucent flashed ruby showing rays, such as those of a halo (156–157).

Of these, the most significant is number 153 (fig 8.59), in semi-opaque white glass, grozed all round. It is painted with tapering lines at the top left-hand side and three eyes – one at the top, two beneath – and tapering lines beneath, with part of a wing. This piece was tentatively identified by Lewis as the wing of a seraph or the Beast of the Apocalypse.[356] There are references in the Bible and the Apocalypse of the Virgin to many-eyed cherubim and six-winged seraphim, and in many places the attributes of many eyes are given to the seraphim as well. Seraphim are depicted with eyes scattered across their wings in the vault mosaic of Cefalù Cathedral, Sicily, dated *c* 1150, and both seraphim and the Beasts of the Apocalypse / Evangelists have eyes on their wings in the Bury Bible (*c* 1135) and the illuminated initial of the vision of the Prophet Ezekiel in the Winchester Bible.[357] In a scene from the Winchester Psalter of *c* 1050, Christ is shown being tempted by the Devil who has a wing with exactly three eyes on the upper part, and long tapering wing feathers below.[358] Lucifer was, of course, a fallen angel. The wing must have been depicted with longer lower wing feathers originally, either in a separate piece of glass, or on this piece when it was a longer shape. Since this lower edge has grozing it may reflect a breakage and releading at some point. Presumably, there would have been six wings in the original design from which this fragment came, unless it was a more or less faithful copy of the Winchester Psalter Devil, who only has one many-eyed wing.

Since the piece came from group G22, Lewis felt that it was a piece of mid-twelfth-century glazing, along with the early blue material. This fragment is definitely white, and is of the thickness and weathering condition akin to potash glass from the late twelfth through to the early fourteenth centuries, so that the condition of the glass does not help in dating it. There are fragments of a range of dates in this context. However, the iconographical currency of the many-eyed seraphim / cherubim is persuasive of a date from the mid-eleventh to mid-twelfth centuries.

There is at least one portion of a book in the assemblage, represented by G220, encased in the separately leaded glazed frame held in the museum store.

This depicts a book in three dimensions, with the leaves conveyed by scratchwork through a wash of paint. The cover is depicted in a thicker wash, and part of a cover decoration has been picked out in stickwork and highlighted in yellow stain. Books representing sacred texts are a common attribute of saints, clerics and scholars.

Discussion

Figural glass, other than drapery, tends to be under-represented in excavated medieval window glass assemblages relative to its former dominance of the glazing schemes of most periods and institutions. The reasons for this may be to do with iconoclasm, but the pattern is so widespread that there may be other factors (considered below). A possible foot or claw is formed in reserve from a matt ground, on thick glass, which is largely opaque from the progress of corrosion (fig 8.59: 149). It has not proved possible to specify whether this is a human or animal foot as neither toenails nor claws are depicted. This is a much earlier depiction than is represented by the head. Again, this is a relatively small scale of depiction.

The largest category of anthropomorphic representation is undoubtedly drapery / textile. Whereas details of different kinds of drapery fold can be seen in numbers 150–151, and these have come from very small-scale figures, the greatest proportion of drapery fragments must come from figures of a larger scale. By the later Middle Ages a great deal of drapery was conveyed by combinations of shading and highlighting to depict the three-dimensional moulding of the fabrics around figures and as they fell towards the ground. In a large-scale figure, this means that large expanses of fabric have no other details than just this shading and moulding. When this has been broken up, the fragments may not look very convincing in isolation. Certain repeated painted patterns, such as simple roses or flowers, were used to convey fabrics, especially highlighted in yellow stain, but it has not been possible to identify any of this amongst the excavated fragments.

Miscellaneous colour (painted and unpainted)

A detailed discussion of colour and shades can be consulted in the online report. In summary, the assemblage can be characterised as follows:

- 672cm^2 blue pot-metal in total (not including the 'early' blues)
- 7.5 cm^2 turquoise pot-metal
- 212cm^2 green pot-metal
- 406cm^2 flashed ruby
- 342cm^2 murrey
- 55.5cm^2 yellow pot-metal
- >450cm^2 total yellow stain

Whilst some deep blues can be attributed to the later Middle Ages, thanks to their painted detail, a particular shade of grey-blue was also popular. The turquoise pot-metal is extremely similar in colour and metal to the Anglo-Saxon turquoise examples from Glastonbury. However, one example (178) clearly has applied yellow stain, indicating a date after *c* 1320.

Recent research has demonstrated that flashed ruby glass was produced by a complex technology in which multi-layered glasses were formed by the incomplete mixing of an oxidised high-Cu and a reduced low-Cu glass. The red colour forms due to the diffusion of oxidised copper into the reduced glass and the nucleation and growth of metallic copper during heat-treatment.[359] A great deal of the Glastonbury ruby glass has a fine layer visible through the chipping of the edges. Glass that appears to be 'red streaky' occurs at least three times in the Glastonbury assemblage (G18, G28 and one unknown context in the separately leaded glass frame held in the museum store (fig 8.60)). On close inspection, however, the Glastonbury streaky appears to be flashed ruby that has had the ruby layer abraded to produce a variety of reds, pinks, and white glass. The differential thickness of the surfaces can be felt with the human hand on the loose fragments. Consequently, it is likely that the red streaky glass encased in the glazed frame is also a product of controlled abrasion techniques. However, there is at least one fragment that does appear to be genuinely streaky or reamy red, from G18 (214). Glass described as 'red streaky' occurs at Wells, for example, in the eyelet sII A4b, beside the St Wulfstan trefoil, dated to *c* 1325–30, and elsewhere.[360]

The murrey glass in the Glastonbury assemblage occurs in variations from pink, to light and mid-lilac, to a deep dark purple. The pale murreys (pink and lilac-pink) are often badly corroded, and this may be due to the deterioration of the specific colourants within the metal in conjunction with the soil conditions. The condition may, however, also be indicative of relative age. Some of the deepest purple occurs in large fragments of fairly consistent thickness, and can be judged to be late medieval. Broad pieces of deep murrey were used for garments in much late medieval glass composition, and this seems to have been the case with some of the Glastonbury examples.

Fig 8.60 Selected stained glass in the Glastonbury Abbey Museum (photos: Cheryl Green)

Pot-metal yellow occurs, but is not a significant proportion of the overall colour representation. In particular, a deep amber or tobacco yellow is noticeable (43.5cm^2 in total). Where pot-metal yellow might be expected, for example, as the base glass for the heraldic lion, the glass is so corroded that it is no longer possible to tell if this was so.

A relatively high proportion of yellow stain was present in the overall assemblage, most of it occurring on relatively thin glass, and in combination with smear shading and stipple shading. As yellow stain is known to have been deployed in English glass from at least 1307–12 when it appears in the Heraldic Window of York Minster nave (nXXIII), this probably means that all the yellow-stained fragments post-date this point in time.[361] In reality, most of the yellow-stained fragments can be dated by their painting and shading to the later Middle Ages. Much of the staining seems to have been used to highlight architectural detail.

The relative quantities of pot-metal, coloured glasses are noteworthy. It might be expected that yellow staining would have the highest representation, but blue is by far the best represented colour.

Glass manufacture and technology

There are examples of both crown and cylinder glass manufacture (240–243). Study of the lead cames provides additional insights into the technology deployed (see online report). There are two small roundels of came that give no indication that another lead came was soldered onto them (L16 and L19). This integrity and implied isolation suggests that they may have been used as discrete inserts, sometimes referred to as 'jewels', meaning that a hole would have been drilled in the piece of host glass into which the jewel was set without the need for a supporting lead network. This technique took a great deal of skill, both in drilling the host glass without breaking it, and in fixing the insert securely.[362] Consequently, this technique is usually an indication of virtuosity in

artisanship and expensive, high-status commissions.

Where medieval potash glass has corroded to the point of being completely opaque, it can be almost impossible to determine the original colour of the glass from visual inspection alone. Materials analysis can be used to determine the presence and relative quantities of metal oxides and trace elements. In the course of visual examination of the Glastonbury material, it was noticed that a distinctive verdigris corrosion occurred on glass of two distinct colours. It is visible in two conjoining fragments from G20, in which the broken section revealed a substantial layer of ruby flashing. The verdigris corrosion had taken place in both the white and the ruby layers. In another sample, verdigris corrosion was observed on green pot-metal glass. Copper oxide was commonly the colourant used to produce red, and iron oxide was commonly used to produce greens. A sample from G20 (area: 6.5cm^2; thickness: 3.76–3.25mm) also displays verdigris corrosion on what is still plainly visible as green-tinted white glass. Verdigris corrosion may result from the presence of iron in the constituent elements of the white glass. Observing verdigris-coloured corrosion, therefore, is no failsafe means of identifying original colour by eye.

The unpainted white glass assemblages

Very little of the medieval white glass was unpainted relative to the painted and pot-metal material (5,801cm^2). Whilst medieval potash glass may display a number of weathering traits (eg pitting, opacity, friability, scaling or lamination), medieval glass-working techniques are also indicative of date (eg grozed edges). It was obvious, however, that a great deal of the white unpainted glass did not have any of these traits and fitted the profile of post-medieval glass with a greater soda content, and modern glass. Much of this glass was consistently thin, and there was a preponderance of fire-rounded edges, indicative of broad and crown glass manufacture.

There were four distinct assemblages of white glass among the post-medieval / early modern material: 1) one that has a consistent blue tint, and tends to be transparent; 2) one that is extremely colourless and transparent; 3) one that is relatively colourless and thin, but has a consistent iridescent corrosion product, often with lead ghosting; 4) one that is olive-green in tint, and tends to be less transparent due to a fairly consistent orange-coloured corrosion product, generating pits that coalesce (ie more like potash glass pitting), and which also has signs of lead ghosting. Only the last of these assemblages has any signs of grozing (48cm^2), the rest all having cut or broken edges. The iridescent white (3) and the olive-green-with-orange-corrosion (4) were both used to form diamond-shaped quarries that were glazed into a leaded trellis of diamond or lozenge panes, suggesting late medieval to early modern use. The olive-green type (4) bears more resemblance to late-medieval metals in its characteristic corrosion, and it may be that this material bridges the late-medieval and early-modern traditions. The picture is further complicated by the fact that some of the better-preserved late-medieval painted glass is very colourless and free of inclusions. Some of the metals (1–4) have a great many inclusions (seeds or air bubbles, usually characteristic of hand-blown window glass manufacture). Furthermore, there are large quantities of fire-rounded edges in all four metals, characteristic of the hand-blown cylinder manufacture of flat glass. Quantities of fire-rounded edges in concentration are not unknown but they are relatively uncommon and tend to indicate an episode of glass installation (ie these tend to be off-cuts from the glazing process).[363]

There is a very limited amount of information to be deduced from visual inspection of early modern and later glass alone. Recent studies have demonstrated the value of chemical analysis applied to window glass in the post-medieval period.[364] Without chemical analysis, little more can be done to characterise the Glastonbury colourless and post-medieval window glass, but it is worth considering the evidence of the lead window cames in respect of this glass. At least 441.24g of lead came (maximim 605.01g) were deemed to have been produced in an untoothed mill, dating them according to Knight's 1986 typology (Type D) to the mid- to late sixteenth century.[365] This category includes at least 290.79g with secondary cames soldered to create a triangle, perhaps from the edges of diamond-quarry lead lattices [L19].

General discussion

There are several significant groups amongst the excavated window glass from Glastonbury Abbey. Undoubtedly the most important is the assemblage of largely still-translucent blue pot-metal, painted mostly with leaf designs, running beading, fragments of drapery and some swirling patterns, which may be decorative grounds, comparable to those used in twelfth-century manuscripts (fig 8.61). Lewis identified this as mid-twelfth century, and a twelfth-century date seems sustainable. Moreover, the fairly consistent condition of the blue (as opposed to the heavily pitted and opaque thirteenth- and fourteenth-century material of potash composition) suggests that some of it is of the 'durable'

Fig 8.61 Durable blue glass in the Glastonbury Abbey Museum (photos: Cheryl Green)

soda-lime composition identified by scientific analysis.[366] At Winchester the date for this type of glass ranged from the late Anglo-Saxon to late twelfth century and beyond. Similar material has been excavated from York Minster, Old Sarum and Dover Castle.[367] As it seems highly unlikely that blue was the only colour used, the entire assemblage was scrutinised for any other candidates for twelfth-century design, but this has proved extremely limited. The major collections of twelfth-century glass remaining in England are at Canterbury and York Minster, although there are examples in a few other churches and a little is known from excavation. The stylistic affinities in this period may also relate to French glass painting, in particular. Chemical analysis has demonstrated that blue glass from Chartres Cathedral and the abbey church of St-Denis also share this durable soda-lime composition. The results of Scanning Electron Microscope (SEM) analysis on three Glastonbury examples confirm that the glass composition falls within the range of recognised durable blues, of mixed soda and

potash composition, with both cobalt and possibly high levels of copper causing the distinctive blue colouring (see below).

The predominance of blue in the surviving ambulatory chapel windows and relocated panels from St-Denis has been attributed to a deliberate evocation of 'divine darkness' and the 'inaccessible light in which God is said to dwell' that were referred to by Pseudo-Dionysius the Areopagite.[368] A patron such as Abbot Suger may have drawn on a number of theological sources for his choice of glass painting, and his schemes are thought to have been variously narrative and anagogical in theme. Beyond the theological, however, iconographic and stylistic sources need not coincide; in other words a *composition* for a specific biblical or hagiographical episode could be borrowed from an iconographic source, like a manuscript or a reliquary, but the *style* in which that scene was conveyed might come from entirely different sources, only to be further subject to creative adaptation and invention.[369]

Much of the 'early' blue from Glastonbury has been subject to heat distortion, which has rounded the edges, produced bevelling and often created a dull, frosted appearance. Most of this category of glass exhibits an iridescent weathering product. Lewis assigned fragments from group G22 to the period of Henry of Blois from art-historical comparison of the painted designs, from Bond's description of the 'azure-blue' glass he found in the area of Edgar's Chapel and on the rationale that the burning was probably the result of the great fire of 1184.[370] There seems to me to be a logical inconsistency here, for if the glass had been burnt in the 1184 fire, why was it located where it was, with both burnt and unburnt fragments? Did the pre-fire church extend this far eastward? It seems more likely that the burning was connected with the destruction at the Dissolution, the glass having been used in the Edgar Chapel until that point. The relevant group [G22] is not exclusively 'early' glass, but contains later medieval glazing, albeit a small relative quantity – less than twelve per cent of the contents of this context. If the glass was deliberately reused in the later Middle Ages, this would be particularly interesting in the light of Glastonbury's demonstrated deliberate evocation of the past in architectural and other matters.[371] It would not be the only major church to reuse old glass in later glazing schemes for ideological purposes. At St-Denis fragments of glass dated *c* 1150 were included in a thirteenth century scheme after having been damaged by fire in 1184.[372] Glass from Troyes dated to before 1188 was also repaired in the thirteenth century. The twelfth-century glass at York Minster was used in glazing of the fourteenth century to emphasise the depth of history and the equally deep claims to primacy of the See of York in comparison with its rival Canterbury. It is conceivable, then, that portions of the Romanesque glass at Glastonbury were deliberately redisplayed to emphasise the depth of history at the site, with one eye to its historic rivals as well. Furthermore, if some of the stickwork rinceau / trefoil foliate meander borders (22–26) are in fact fourteenth-century approximations of twelfth-century designs, the Romanesque glass may have been reglazed along with later medieval glass deliberately intended to emulate or blend in with the older revered material.

Many, if not most, monastic sites produce some grisaille of the thirteenth century (eg Bayham Abbey, Sussex),[373] and some sites produce a great deal of this type of glazing (eg Rievaulx Abbey, N Yorks). By contrast, thirteenth-century grisaille is relatively under-represented at Glastonbury. One must be cautious in making judgments based on the overall paucity of window glass from the site (all the glass, of all periods put together, would not fill one large window). The choice of thirteenth-century grisaille at many sites may coincide with the major building campaigns and respect either aesthetic or ideological preferences on the part of the institution or the patron. Grisaille was, for example, used by some Cistercian houses perhaps as a deliberate ideological and doctrinal choice to avoid coloured narrative or historiated windows. Other monasteries chose this method of glazing because it would have admitted more light than narrative windows typical of the mid- to late twelfth century, and thus perhaps have enhanced the elaborate contemporary architectural mouldings. This type of glazing could be much cheaper than coloured glass, which was probably imported through most of the thirteenth century.

The small representation of grisaille at Glastonbury may be worth considering a little further, however. Salisbury Cathedral, in particular, had set the example of grisaille glazing in the south west of England, but here historiated glass was 'confined to the east end and to windows above altars'.[374] Thus, the juxtaposition of grisaille and narrative glass could be used to articulate the relative liturgical importance and sanctity of the space within the building. Ayers suggests that the same was probably true of Wells Cathedral in the early to mid-fourteenth-century work.[375] Draper emphasises the points of difference architecturally between Wells and Glastonbury in the late twelfth and early thirteenth centuries in respect of window decoration, that at Wells being very simple, with simple hoods, and plain chamfered surrounds, 'whereas at Glastonbury the heads of the very similar form of windows are enriched with chevron ornament'.[376] The argument goes that Glastonbury and Wells were great rivals at this time over their relative antiquity and their rights to the 'seven churches' and to the See, and that this was consequently borne out in their respective architectural and artistic directions. Glastonbury chose to emphasise depth of history and continuity, combining the latest developments with conscious artistic quotations of the past. Overall then, two hypotheses may be suggested with reference to the paucity of grisaille at Glastonbury. The first is that areas that might have used grisaille extensively have not been excavated (or the locations in which this glass was dumped have not been excavated). The second is that widespread use of thirteenth-century grisaille may have been eschewed as part of a more integrated architectural and ideological programme.

There were few indications of figural glass of this period. In a house of the size and wealth of Glastonbury, figural or narrative glass would have been expected. The paucity may well be the result of the retention policy of earlier excavations or, as with the patterning of the grisaille, the result of the selection of areas excavated. It is also possible that figural glass was excavated but is now missing from the collection.

A small quantity of early to mid-fourteenth-century grisaille was identified, as was some contemporary diaper or decorated ground, possibly architecture and drapery, but this is not extensive. Moreover, where comparisons can be made stylistically, there are no definite associations with the major glazing programmes in Wells Cathedral. The evidence for later medieval glass, particularly of the late fourteenth to late fifteenth and possibly even early sixteenth centuries is far more extensive. This includes some pieces of Gothic Black Letter inscription, as well as a great deal of three-dimensional architectural, drapery and figural detail, including the finely delineated head fragment. Some of this material suggests a late fifteenth-century glazing programme. Even some of the colour ranges – for example the quantity and range of murreys, plums and purples, and the grey-blues – suggest later medieval glazing programmes. All this is congruent with the building activities of the later abbots. Indeed, as the evidence from St John's Glastonbury, Butleigh, Chilton Polden and elsewhere demonstrates, the later abbots introduced glazing bearing their own arms, or those of the abbey, in many churches throughout the region over which they had any influence (see online report). Although the use of heraldry in connection with patrons, benefactors and donors was widespread in this period, there may be a deliberate policy of imprinting a recognisable institutional connection far and wide as a sort of religious *imperium*.

Since this period witnessed a *floreat* of production in Somerset and Devon, and in such cities as Bristol and Gloucester, many workshops were available to the abbot and convent throughout the Middle Ages, a point emphasised by both Woodforde and Ayers.[377] Consequently, one of the aims of this report was to try to identify stylistic detail by which an attribution to a regional 'school' of glass-painters might be made. Archaeological assemblages, being so fragmentary, are notoriously difficult to link to recognised workshops. Nothing, for example, may be attributed definitely to 'Thomas Glasier' or 'Thomas of Oxford', whose work is recorded at Winchester College and New College, Oxford, in the late fourteenth to early fifteenth centuries under the patronage of William of Wykeham, and whose work may also be represented amongst fragments excavated in Winchester.[378] The three-dimensional character and exceptional quality of some of the architecture depicted amongst the Glastonbury assemblage is possibly of this date, but too fragmentary to be attributable.

There is no evidence for a particular affinity with the Wells glass, with the exception of the characteristic heraldic lion. It may be that successive patrons of Glastonbury chose to avoid obvious similarities with its great rival, Wells. On the other hand, glass supposedly initiated by abbots of Glastonbury in parish churches (such as High Ham) appears to have been of Woodforde's 'Somerset School', and one or two fragments of identifiable Somerset-type quarries remain in the abbot's kitchen at Glastonbury and St John's Church in the town. Woodforde also identified work of his 'Devonshire School' amongst the figures in St John's and related work in St Patrick's Chapel.[379] It is thus probable that the patrons of Glastonbury used different sources for their glass painting at different times, and probably for varying reasons of cost, workmanship, precedent and distinctiveness.

Reuse of glass within the Middle Ages

Quite apart from the possible reuse of early glass in later buildings for political and ideological reasons, one of the aims of this report was to recognise any post-installation alterations or damage and post-depositional processes. Examination of the relationship between grozed edges and the integrity of the painted design suggests that many fragments were regrozed, and therefore presumably releaded within the course of the Middle Ages. Lead

deteriorates and tends to be replaced every 100 to 150 years. However, it is also demonstrable that some leadwork survives from the Middle Ages. The regrozing at Glastonbury may indicate releading of a window for occasional 'maintenance' purposes when, by and large, the integrity of the original glazing scheme was maintained. In some instances, however, a window may have been dismantled and replaced by a newer composition. In this instance fragments from older designs may have been redistributed to be used as space-savers or repairs in other designs to which they were not original. In some instances this may have been due to deliberate retention: perhaps the earlier glass was invested with significance in asserting the antiquity of the abbey and to distinguish it from its rivals, most notably Wells Cathedral. In some instances, older glass may have been used more haphazardly to fill in spaces in later releadings.

Regrozings were detected, for example, in group G23 (foliage, or a possible architectural canopy crocket 94), G24 (159), G25 (112), G29 (123), G30 (a stylised floral design 113), G36 (a quarry edge 76) and several times in G31 (ivy leaf grisaille 74; indented leaf 96). Whilst some of this material dates to the late thirteenth or fourteenth centuries, and may, therefore have been subject to reuse, it is perhaps more surprising that late medieval fragments have been regrozed.

Spatial patterning

Apart from the possible relationship between the durable blue and the area of Edgar's Chapel (see above), the spatial patterning seems to relate mostly to Dissolution-period activities, to post-Dissolution / early modern probably domestic fenestration debris, and to possible clearance during the early excavations. Late thirteenth- to early fourteenth-century grisaille (G36) was recovered in the area of the abbot's hall, outside a wall beside a burnt floor. The abbot's hall would contain painted glass of equal quality to anywhere in the church or chapter house. If the fragments releaded into the abbot's kitchen relate to the abbot's hall in origin, their high quality can be confirmed.

The Dissolution process

The Glastonbury stained glass assemblage is quite distinctive in terms of the archaeological pattern it represents with respect to the process of Dissolution. Many monastic assemblages produce quantities of thirteenth-century grisaille, fourteenth- and fifteenth-century background diaper and rinceaux, micro-architectural fragments, border motifs and glaziers' side strips: in other words characteristically peripheral motifs or older glass. This could be the result of the best glass having been reclaimed for sale or even the results of iconoclasm that targeted the figural representations. At Glastonbury, this pattern is less clear-cut and, indeed, there is a noticeable absence of the most peripheral glass, in the form of border motifs and plain side strips. Study of the lead cames provides additional insight to the process: almost every single fragment of came has been twisted, torn or pushed together in some way (see online report).

The much-cited Rievaulx Inventory states that the glass from the church was 'to be layd up under lok and key and out of danger of wastyng and stelyng'. It was 'to be sortyd into iij partes. One the fayrest to be sortyd. The second sort to be sold. The iij sort to be taken out of the lede and the lede molten'.[380] The lead, a valuable commodity, was to be kept for the king in order that the value might be realised for the Crown. The fairest and much of the second sort may account for the glass which was sold and reused in houses and churches. However, much of the selection of the second category to be sold may have required discrete panels, such as armorials, to be removed from a background of other glazing. The debris from such selection and stripping may have contributed to the archaeological deposits recovered. The treatment of the poorest glass implies thorough stripping of the lead cames, with little or no consideration for the glass at all. What constituted 'the iij sort' of glass in the context of a house as wealthy and glorious as Glastonbury from the perspective of someone in the 1530s–40s? Given that the glass of the late fifteenth and early sixteenth centuries could be exquisite in both colour and drawing, as demonstrated by the extant examples of this date found in St Patrick's Chapel, St John's Glastonbury and elsewhere, it may be that a lot of the older grisaille, for example, constituted 'pore glasse'.[381] This, if it existed in quantity, may have been discarded altogether. The best glass may have been resold or appropriated, and even the second-best glass at Glastonbury may have been worthy of retention for domestic purposes by those with the money and influence to acquire it.

Compositional analysis of durable blue medieval window glass

Chris Caple and R Barnett

Three fragments of blue medieval window glass and one of clear glass were selected for compositional analysis. A full method statement and discussion is available online. Table 14 sets out the results, confirming that the blue glass fragments (samples G14, G24P, G24E) are all durable soda-lime glasses, of similar composition to that identified as coming from eleventh- and twelfth-century contexts in York Minster, Dover Castle, Old Sarum, Chartres, St-Denis and Winchester.[382] The trace levels of cobalt and low concentration of copper were responsible for the blue colouration. The clear glass (sample G25) is similar in composition to other examples of the potash and lime-rich 'forest glass' which is used for most medieval window glass during the twelfth to sixteenth centuries.

Cox and Gillies suggest an impure cobalt oxide 'zaffre', also known as 'Damascus pigment', as the colouring agent. Henderson, however, suggests the cobalt copper mineral 'trianite' ($2Co_2O.CuO.6H_20$) as one of a number of possible colouring minerals for cobalt-blue coloured glasses produced in ancient Egypt and by other ancient civilisations.[383] The use of such a mineral would explain the presence of both copper and cobalt in the samples. These fragments from Glastonbury extend the known distribution of the durable blue glass into the West Country.

Table 14 Compositional analysis of Glastonbury blue glass fragments

Element Oxide wt %	G14 Blue Glass	G24 - P Blue Glass	G24 - E Blue Glass	G25 Clear Glass
Silicon	65.48	58.90	55.08	61.25
Sodium	6.97	10.83	14.13	2.95
Calcium	6.92	9.03	11.20	15.03
Potassium	5.55	7.00	6.60	7.13
Aluminium	4.90	2.53	1.83	3.98
Chlorine	2.43	2.57	1.98	2.15
Copper	4.12	4.17	4.10	2.73
Iron	1.63	1.50	1.48	1.13
Magnesium	0.62	1.10	1.35	0.93
Sulphur	0.58	0.60	0.35	0.28
Phosphorous	0.32	1.03	1.08	1.60
Manganese	0.36	0.63	0.85	0.33
Cobalt	0.09	0.04	0.00	0.00
Titanium	0	0	0	0.40

8.12 *Ex-situ* painted wall-plaster

Chris Caple, with a contribution from C Pamela Graves

Introduction

The collection comprises some 474 fragments of painted wall-plaster (30.3kg), in addition to six larger fragments of painted wall-plaster that are displayed in the museum at Glastonbury Abbey. This represents a relatively large assemblage in comparison with many monastic sites and indicates extensive internal décor. However, the quality of the decoration and the pigments represented among the excavated fragments are more characteristic of the basic schemes that were executed at parish churches. In almost all cases, the decoration is in the form of red line on white plaster, possibly representing foliage, scrollwork or drapery. There is nothing in the *ex-situ* painted wall-plaster that compares with the extant polychromy in the Lady Chapel at Glastonbury – for example, the expensive ultramarine dated *c* 1187, which is comparable with the use of the same pigment in the Holy Sepulchre Chapel, Winchester Cathedral, *c* 1175.[384]

It can be suggested that medieval wall-paintings fulfilled three primary roles: to support religious ideals through reproducing scenes from the Bible or allegorical tales; to create visual interest through the enjoyment of colours and shapes and the ideas and emotions that they generated; and to serve as a sign of wealth and sophistication. The fact that only medieval churches, monasteries and lordly private apartments were decorated in this manner clearly marked them out as places of importance, where the affluence of their owner was displayed. Wall-paintings in twelfth- to sixteenth-century Britain were normally executed in *fresco secco*, in which the dry plaster was painted with pigments that were dissolved in lime water, possibly with an additional skimmed milk binder (*secco*), rather than the true (*buon*) fresco that is more common in southern Europe,[385] a technique that holds the pigments in a partially lime-cemented layer on the surface. Occasionally, pigments were applied in other media, such as egg or oil (*tempera*); for example, the wall-paintings of the Byward Tower, Tower of London and the feretory of St Albans Cathedral.[386] *Tempera* media were often used to apply valuable pigments, such as ultramarine (lapis lazuli), or unstable pigments, including lakes (inorganic materials, such as dyed powdered chalk), which could discolour in direct contact with the alkaline environment of the plaster. Wall-paintings were normally executed either by journeyman painters, who travelled from one building project to another applying paint to the walls of recently constructed and plastered buildings, or by members of the monastic community.[387]

This report summarises the results of the analysis of a 5 per cent sample of the painted wall-plaster using