
the south clerestory of the nave of Gloucester cathedral:
archaeological recording in 2001

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Gloucester Cathedral Archaeological Report

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Introduction

During the summer of 2001 a programme of archaeological recording on the eastern bays of the south clerestory of the nave was undertaken while this part of the building was under scaffolding (Fig.1). This report has been prepared following the specifications for recording work included in the archaeological assessment of the south clerestory by Carolyn Heighway, archaeological consultant to the cathedral (Heighway 2001).

The numbering system for the bays follows that used in the building repair specifications provided by Stainburn Taylor, architects, that is from one to nine moving from west to east. The area of masonry under consideration is the western part of bay 5 and bays 6 to 9 (Fig.1)

The interior faces of the upper clerestory walls were subjected to a preliminary archaeological survey, focusing on the south wall. A measured drawing of the south wall was made at a scale of 1:50, illustrating the consecutive phases of building. The wall was lit with floodlights, photographed and a rapid survey was made of both north and south walls, in order to identify the type and location of the reused decorative elements visible in the fabric. A number of the worked stones were drawn and photographed. Small samples of mortar from archaeological contexts were taken, examined and retained.

A list of drawings and their associated computer files deposited in the cathedral archive are included in Appendix 1.

Previous research

The nave clerestory has received little attention from archaeological and architectural writers when compared with other, better known, parts of the cathedral. Any serious consideration of its architecture has been confined to a discussion on the form of the Romanesque clerestory and whether it carried a stone vault or a timber roof. Whilst it has been assumed that the Romanesque nave had a timber roof (the arguments are rehearsed in Welander 1991:63) more recent writers have proposed a quadripartite vault over the nave with a stepped tripartite arrangement for the Romanesque clerestory (Thurlby 1985:47-8; Wilson 1985:73).

The later medieval remodelling of the clerestory has not been considered in any detail. Massé (1908:32) and Thompson (1977:157) state that the interior of the clerestory was altered to its present form in the mid 13th century with the installation of the vault. Dean Gee, working from Bilson's notes, suggests that the nave clerestory could be the work of Abbot Morwent, in an episode of remodelling that included the rebuilding of the western bays of the nave (Gee 1921:429). A 15th century date has been suggested for the windows (Ashwell 1985:3/12; Freeman 1884:137; Verey 1970:203), while a number of writers have mentioned, in passing, these 13th and 15th century dates for the interior and exterior elevations of the clerestory (eg. Hoey 1989:85; Wilson 1985:71).

Welander gives the most coherent attempt at an explanation of how the interior and exterior elevations of the clerestory achieved their present form. He writes that the windows belong to the 15th century phase of rebuilding of the west end of the nave, but concedes that the design of the tracery could be earlier (1991:245). By stating that the window splays were opened up as part of the installation of the windows he implies that the interior elevation also belongs, at least in part, to the 15th century.

The small amount of comment that the south clerestory has attracted has been influenced by the post-*Historia* narrative for the building provided by Leland, written after his visit to Gloucester in 1541. The account is based upon a conversation with an 'auld man' who had recently been made a monk and who related that Abbot Morwent renewed the west front, one arch either side of the nave and the south porch. Morwent was said to have intended to rebuild the nave in its entirety but was prevented from doing so by his death (Chandler 1993:175). Whilst the Leland narrative clearly has some basis in fact it cannot be used uncritically for the interpretation of the cathedral church; Carolyn Heighway, for example, has pointed out that the narrative does not accord with the structure of the west end of the nave which contains at least two phases of Perpendicular rebuilding (Heighway 1999:33).

An account of 19th and 20th century repairs is given in the preliminary archaeological assessment (Heighway 2001).

Description and interpretation of the fabric

Please refer to Figures 2 and 3 when consulting this section, as well as the other figures cited in the text.

Period I (1089-1100)

The Period I fabric is represented by a strip of masonry at the extreme east of the clerestory, in the angle formed by the south wall of the nave and west wall of the south transept. It is an undecorated buttress rising from the south aisle roof line and terminated at the top by a short length of Period IV string course. Where the buttress rises from the south aisle roof it projects from the wall face by 0.21m. At 0.75m above this point it is chamfered back; above the chamfer it projects 0.13m from the face of the clerestory wall. On the interior face the Period I work extends to the top of the wall forming the wall plate.

The masonry and mortar of period I are essentially the same as those of Period II (see below) but the building sequence can be determined by the evidence on the interior face where the Period II stonework abuts that of Period I. The Period I work probably belongs to a phase of construction that included the Romanesque crossing and lower parts of the tower.

A similar observation has been made at the equivalent point of the north clerestory wall; the bottom three or four courses of the easternmost buttress are undecorated, those above have the clasping chevron decoration. Wilson (1985:73) has argued that these undecorated stones represent the western limit of the initial building campaign that saw the completion of the east arm of the church.

The Period I work contains three mason's marks in contrast with the Period II masonry where none were recorded (Fig. 4; 6,7,8). However the marks are very faint and their appearance exclusively on the earlier masonry is due to its protected position by the angle with the south transept. The three marks are the same reverse 'Z' form that is found on work of differing periods at the cathedral, however the size and roughness of execution accord with an 11th or 12th century date.

Period II (early 12th century)

On the exterior the Period II masonry is preserved between the Period IV windows and the stringcourse that runs between them. It consists of an ashlar wall face with pilaster buttresses marking the divisions between the bays. The buttresses are decorated with angle rolls clasped by a stepped curved moulding that resembles chevron. The pilaster buttresses are 0.8-0.9m wide and project 140-150mm from the face of the wall.

The length of the ashlars range from 200-500mm most being between 300-400mm; the course heights all fall between 170 and 210mm, except for a single course of large stones 260mm in height immediately beneath the Period IV string course. The width of the joints

range from 3-20mm, with 80% falling between 8-10mm.

No mason's marks are recorded on the Period II masonry. The absence of mason's marks is the result of the masonry being subjected to a greater degree of weathering than stonework, of an equivalent date, in other parts of the building, due to its height and southern aspect. The tooling marks have also, for the most part, weathered off; on a small number of stones they are preserved as faint diagonal axe marks.

The Period II mortar is pink to purple brown in colour with inclusions of various colours visible to the naked eye. The mortar has a fine fraction of clear, orange and pink, rounded to sub-rounded, fine to medium, grains of quartz sand with a smaller amount of similarly sized rock fragments. The coarse fraction is composed of rounded and sub-rounded stones up to 20mm in size with angular fragments of Inferior Oolite (Lower Freestone and Pea Grit) up to 10mm across. The mortar sample also contained numerous individual ooids. The ooids and angular fragments of oolitic limestone would have been derived from crushed rock. The most likely origin of the sand and remainder of the gravel are the Severn Terrace gravels, or the equivalent Fan gravels, available in central Gloucester.

Mortar samples taken from the exterior joints (2), the core (1) and from the interior face were found to be identical in composition. Mortar with a similar composition and appearance was found in the masonry of the Romanesque (Period I) east end of the cathedral (Bagshaw 2000:3), however this Period I mortar also contained crushed ceramic material, brick or tile, and charcoal, ingredients absent from the Period II mortars from the nave clerestory.

The Period II mortar was identified in the masonry immediately below the mid-wall string course except in the eastern part of Bay 8, before the string course steps down to Bay 9. In Bays 5 and 6 where the profile of the wall face is corrected, forming a slight batter, the stonework is also set in Period II mortar, suggesting that the correction was made during the initial construction of the clerestory.

The 12th century masonry on the interior face of the clerestory, as seen from the roof space, is composed of roughly coursed rubble. The courses rise and fall in an apparently erratic manner, in places the coursing breaks down and the stones are laid in a random fashion with an excess of mortar. Enough mortar survives on the inner face of the wall to suggest that it was finished with a render of mortar during the building process.

The Period II masonry extends up to within 0.9-1.10m of the wall plate in Bays 6 to 9 on the interior face. It reaches its greatest height in Bays 8 and 9 standing to approximately 35.7m AOD. This is the height at which the Romanesque masonry survives on both the exterior and interior faces at the eastern end of the north clerestory; 35.7m AOD is also the maximum height reached by the 13th century vault which, in turn, shows that it was not necessary to raise the clerestory walls in order to build the vault. The coincidence of the top of the 12th century clerestory wall with the top of the 13th century vault suggests that the height of the vault may have been determined by the height of the pre-existing Romanesque clerestory.

Period III (1240-2)

The masonry assigned to Period III includes the vault and a small amount of stonework on the interior face of the upper clerestory wall. No Period III work was identified on the exterior face of the wall.

The Period III masonry shown on Fig 3. consists of short lengths of roughly coursed rubble that project from the Period II (12th century) wall where it meets the ends of the vault. These small areas of masonry are reinforcing walls, tying the vault into the Period II wall and translating the thrust more evenly into that wall. They are more extensive and project further on to the vault in Bays 7, 8 and 9; projecting from the face of the wall by 400mm in Bay 9. They occur in every bay with the 13th century vault, except Bay 3.

The stonework is composed of small, unworked pieces of Inferior Oolite with some Blue Lias Limestone laid in rough courses. The mortar is a pale grey-brown colour with a fine, well sorted texture. It is visually distinct from the Period I, II and IV mortars but very similar to the mortar used in the construction of the vault (described below).

These supporting walls were constructed after Period II but before Period IV, as they were cut away with the Period II stonework prior to the raising of the wall, by around 0.9m, in Period IV. Equivalent areas of 13th century stonework have been identified in the interior wall of the clerestory, below the vault, at the junction of vault with wall (Thurlby 1985:48) and the more extensive rebuilding of the clerestory walls, at this junction, in Bays 7, 8 and 9, below the vault (Welanders 1991:117), correspond with the greater amounts of Period III stonework in the same bays above the vault.

The vault was not systematically recorded. Bays 3-9, that is the 13th century vault, are constructed from cut blocks of tufa, most blocks being 300-600mm by 200-400mm in size. A number of these blocks are larger, particularly those forming the ridge of the central vault; some exceed two metres in length. Other materials identified in the vault included a fragment of brick, 45mm thick, on vault 5 (N); a fragment of angle roll moulding of 12th century date on vault 4 (S) and three fragments of roll moulding, 125mm in diameter, were found on vault 7(S).

The junction of the 13th century vault (Period III) with the two bays of 15th century vaulting (Period V) at the west end can be seen as a straight joint running north-south across the vault between Bays 2 and 3.

Period IV (14th century)

The exterior masonry assigned to Period IV consists of the windows along, the string course that runs between them and around their arches as a hoodmoulding, the ashlar wall

face from string course to cornice and the triangular wall shafts that punctuate the bays.

On the interior face the upper 1-1.5m of the wall in Bays 3-9 belong to Period IV, excluding the 1950s concrete wall plate. 125 pieces of 12th and 13th century decorated stone were identified in the interior Period IV work, these are analysed and discussed below.

Windows

The windows have acute four centred arches with ogee reticulated tracery (Fig.6). The tracery is composed of three lights with cinquefoils in their heads topped by two reticulations framing quatrefoils. There is a triple stepped chamfer arrangement on the jambs, reduced to a double chamfer around the arch heads. The hoodmoulding is a continuation of, and carries the same moulding as, the string course that runs between the windows. It also follows the projecting profile of the Period II buttresses that mark the divisions between the bays. Above the string course the buttresses are chamfered back to a triangular profile. The profile of the string / hoodmoulding is: a small angular moulding, a hollow and chamfer.

The windows are composed of irregularly coursed Lower Freestone; tooling marks made with a flat-toothed claw are visible in places. The moulded stone immediately east of the apex of the arch in Bay 8 has traces of three chevrons on its face. These chevrons have been incompletely cut back and would have been flat, or 'face', chevron, that is, cut on the vertical plane, as opposed to projecting from the face at 90 degrees (Fig.7).

In the interior of the clerestory, Bays 7 and 8, blocks with 90 degree chevron can be seen reused in the apex of the splays. This chevron is of the same size and type as that used in the remains of the Romanesque clerestory, and reused in the existing interior reveals as well as the interior face above the vault (see below-Reused architectural decoration from Period IV).

Four mason's marks were recorded on the exterior of the windows, a further fourteen were recorded on the interior tracery, mouldings and splays (Fig. 4, 9-12; Fig.5). The marks are smaller and more precisely cut than the Romanesque marks. Some of them are commonly used in all periods and thus no use for dating. The '[' mark is unusual, it, and related forms, have been recorded on 14th century decoration on the exterior of the south ambulatory and on the interior moulded surrounds of the north and south tribune gallery windows. The swastika and reverse swastika (Fig. 5, 3i, 3ii) are also unusual, this mark has been recorded on the tracery and splay of a 14th century window in the south ambulatory (Bagshaw 2000:20).

Reticulated tracery was a development of the Decorated style but the clerestory windows have certain adaptations to the basic reticulated form that are found in early Perpendicular windows. Along with the four-centred profile of the arch the quatrefoils are slightly elongated, along the vertical axis, and the tracery that rises from heads of the two outer lights, dividing oculi from mouchettes, intersects vertically with the frame of the arch. This last feature is seen, in an exaggerated form, in the two light windows, with a single reticulation, that occur in the tribune gallery and radiating chapels, at the east end of the cathedral in the mid 14th century.

Reticulated tracery is found in other of the greater churches in the region. For example at Bristol Cathedral the standard form of reticulations are used in the Lady Chapel windows, dated 1298-c.1330 (Pevsner 1958:378). At Tewkesbury Abbey the chapels to the east and north-east of the north transept contain four light ogee reticulated windows. Here the tracery dividing oculi and mouchettes intersects vertically with the arch and the windows have stepped chamfer mouldings; these windows have been provisionally dated to c.1320-1330 (Morris 1985:93). More widely, ogee reticulated tracery appears in early Perpendicular contexts, notably in the chapter house of Old St Pauls (Harvey 1961:plXIII). Such curvilinear forms continued to appear in the more conservative Perpendicular designs until the 1370s (Harvey 1978:44).

The stepped chamfer moulding becomes common in the Severn Valley from the 1320s and remained in use into the 15th century (Morris 1979:8). At Gloucester Cathedral it is, for example, used in the proto-Perpendicular windows in the east and west walls of the south transept, as well as in 15th century windows, such as those in the Lady Chapel and the South Porch.

The profile of the string course / hoodmoulding is one of the most commonly occurring Perpendicular forms (Paley 1891:96). Related forms occur in both 14th and 15th century work at the cathedral, however the moulding with the most similar profile is the hoodmoulding of the south window, south transept, c.1335-7. Where the string course meets the 15th century string course at the west end of the clerestory, in Bays 1 and 2, the two do not match, the 15th century moulding is smaller with a different profile (Fig. 6). This can also be seen in Bays 1 and 2 on the north side of the clerestory.

Dr. R. K. Morris, after being supplied with photographs and moulding profiles, has suggested a date of c.1325-1360 for the window tracery and moulded surround (correspondence 19.VI.2002).

The relationship of the windows with the ashlar wall face, above the mid-wall string course, is not immediately obvious. Whilst the received view is that the windows were inserted in to this masonry (see above-Previous research) little evidence was found to support this interpretation. The usual signs of such an insertion, that is, disturbance to the masonry around the arch head, are absent. However, this absence of disturbance around the arch heads is not conclusive evidence of a single build, as in the north wall of the clerestory, where in places, the windows were inserted in to Romanesque masonry there is also little disturbance around the arches.

Examination of the mortar suggests that both wall and windows may belong to the same campaign of construction. The same pale brown speckled black mortar (Period IV) could be traced from the surviving medieval hoodmoulding into the surrounding ashlar masonry in several bays. This was the case even on the west side of Bay 6 where two of the surviving medieval courses, between the window and the wallshaft, do not match up across the wall. This mis-match of courses is exaggerated on the elevation drawing and confused by the 19th century repairs; it could indicate a break in construction during Period IV or, more probably, represents an attempt to reconcile the megalithic blocks

used for the triangular wallshafts (see below) with the smaller ashlar used for the wall face.

Triangular wallshafts

The triangular wall shafts mark the divisions between the bays, above the mid-wall string course. They rise from large blocks of Lower Freestone chamfered back in such a way that the rectangular profile of the Period II buttresses are transformed into more narrow projections with a triangular profile. The wall shafts are 0.5m wide except for the two either side of Bay 9 which are 0.31m in width. This same arrangement of narrower triangular wall shafts occurs at the equivalent position in the north wall of the clerestory, possibly indicating that the Period IV work was begun at the east end.

The wall shafts were originally built with blocks of Lower Freestone, most were replaced in the mid-19th century with pieces of Bath stone. Where this Bath stone has been removed it showed that the Period IV wall shafts were constructed with reused Period II stone. In the wall shafts below pinnacle 7 and 8 it was possible to see that the decoration on the Period II (12th century) pilaster buttresses has been re-cut and turned in for use in the wall shafts (Fig. 8). Blocks with this pilaster decoration have been identified on the interior face also in Period IV (see below).

The removal of the 19th century Bath stone repairs revealed that the original (Period IV) chamfered blocks, at the base of the wall shafts, are larger than is shown on the elevation drawings, extending deep into the wall face either side of the shafts; the block in this position between Bays 5 and 6 is, for example, 0.85m wide (Fig. 9). The shafts are in course with the surrounding ashlar. There is no discernible change in the mortar, in both joints and core, between the shafts and the wall face. These observations suggest that the shafts belong to the same episode of building as the wall in which they are set.

It has not been possible to date the introduction of such features in the greater churches of the West Country with any degree of precision. However it is possible to say that the wall shafts are not consistent with date in the mid-13th century, the date of the vault over the nave. Such triangular projecting shafts are, for example, not found in the 13th century work at Bristol or Wells Cathedral, but are introduced into both of these buildings during the first half of the 14th century. Triangular wall shafts are found nowhere else at Gloucester Cathedral but related, perhaps slightly more evolved, forms are present in the mid-14th century work around the exterior of the ambulatory and choir, as well as in the 15th century Lady Chapel.

Ashlar Face and Core

The exterior wall face belonging to Period IV wall was built using recycled Period II (12th century) ashlar. The ashlar is laid in level regular courses and, as with the work of preceding periods, is peppered with mid-19th century repairs in Bath stone (Fig. 10). Although the western bays are beyond the present survey area it would appear that the exterior Period IV masonry

extends intact to Bay 4. Bay 3 marks the junction of the Period IV masonry with work of a later period. The sketch of the interior face supports this interpretation (Fig.3).

The Period IV core was exposed in several places where stone had been removed by the masons. It consists of irregularly shaped pieces of Lower Freestone and Blue Lias Limestone set in the pale brown speckled black mortar that is also seen in the Period IV joints. Where the string course had been removed in Bay 7 it was possible to identify, after wetting, three layers of Period IV mortar, of different hues, that had been poured up against the Period II core. Evidently the Period II core had been left intact to a greater height behind the buttresses in order to stabilize the wall whilst the Period IV work was in process (Fig.11).

Interior Face

The Period IV masonry on the upper interior face of the clerestory, above the vault, extends from the Period I (1089-1100) work, in the east, to the boundary with the larger ashlar belonging to Period V (15th century) in Bays 2 and 3. The masonry is built on Period II stonework, as well as Period III work around a number of the vaults. On the west side of Bay 9 the masonry of the tower buttress (Period VI) dissects the Period IV stonework, extending down in to the Period II wall. The top of the Period IV masonry forms the wallplate in Bay 9 and the eastern part of Bay 8; west of Bay 8 the top two courses of the Period IV wall has been removed and replaced by a concrete wall plate during Period VIII (1953).

The base of the Period IV masonry is level with the top of vault 9, moving westwards it extends down to around 1.8m below the level of the wall plate. The masonry is composed of reused Period II ashlar, some bearing Romanesque mason's marks, together with 12th and 13th century decoration.

Summary of Period IV

The masonry belonging to this period pre-dates the rebuilding at the west end (Period V) but post-dates Periods I, II and III. It corresponds with the rebuilding of the top of the wall and the windows on the exterior. Period IV therefore consists of the raising and rebuilding of the upper clerestory wall, the windows, string course and hoodmouldings, the interior splays, reveals and reused 12th and 13th angle shafts. A date in the second or third quarter of the 14th century is suggested.

A similar sequence of construction can be seen in the north clerestory where more of the Period II masonry, buttresses and mid-wall string course, were left intact and the hoodmouldings not continued between the windows.

Period V

Period V represents the rebuilding of the west end of the clerestory. It probably includes work of at least two campaigns of building as the vault and clerestory differ in Bays 1 and 2, however the chronology of the west end of the nave is beyond the scope of the present report.

The cornice and parapets have been included but it is possible that they belong to Period IV. Most of the medieval cornice and a smaller amount of the medieval parapet survived the 19th century restoration (Fig.10). The cornice has a hollow moulding with a chamfered top, similar mouldings can be seen in both 14th and 15th century contexts in other parts of the cathedral, and is cut from blocks of shelly Pea Grit (see below-Building Stone). The use of oyster shells and Stonesfield Slate tilestone in the joints between the cornice and remaining medieval parts of the parapet confirm that the cornice is medieval and was not replaced in the 19th century.

The use of oyster shells for packing joints was not uncommon in the later medieval Period. Shells in the equivalent position have been recorded in the parapet of the south ambulatory and radiating chapels at the cathedral; they can also be seen in other late medieval structures, for example the 15th century Oriel window in the Abbey Wall facing Pitt St. 15th century building accounts from several Oxford colleges document the purchase of oyster shells where they were used as packing and to provide a damp course (Gee 1952:57).

The parapet is a solid piece of crenellated masonry decorated with units of three panels with trefoils in the heads. The line of the wall shafts is carried up through the parapet and terminated with a pinnacle, none of the medieval pinnacles survive. Unlike most other parapets in the cathedral it is not pierced.

Period VI

The base of the tower buttresses can be seen intruding in to both north and south walls. They are composed of masonry, of the same composition as Period IV, laid in courses at an angle of around 45 degrees. It is, again, possible that the buttresses could belong to Period IV, if the lower part of the tower and buttresses date from c. 1350, as has been suggested (Welander 1991:252).

Period VII

This refers to a length of wall between vaults 2 and 3. It projects from the 12th and 15th century masonry by 200-300mm and consists of small pieces of unworked stone laid in rough courses. It may have been built to reinforce the 15th century vault its junction with the 13th century vault.

Period VIII

The concrete wall plate running from Bay 8 to the west end of the clerestory was laid in 1953. In the process a number of blocks were taken from the top of the wall (Welander 1991:514) (Period IV) among these is the worked stone/sculpture referred to as 'Worked stone No. 222'.

Summary of Periods I - VIII

A narrow strip of masonry at the east end of the clerestory belongs to the first phase of Romanesque building at the cathedral (Period I – 1089-1100). The masonry between the windows, below the mid-wall string course, including the decorated Romanesque pilaster buttresses belongs to Period II (early 12th century). The outward lean of the wall was, in Bays 5 and 6, corrected as the Period II construction progressed. In places, on the interior face, the top of the Period II masonry is level with the top of the vault, giving the impression that the vault was simply built on top of the pre-existing Romanesque clerestory.

Period III represents the construction of the vault (1240-2). No Period III masonry was identified on the exterior elevation. In the roof space the Period III work consists of the vault and short reinforcing walls between the vault and Period II face. The windows, string course and ashlar face, above the string course, belong to Period IV. A date in the mid 14th century is suggested by the architectural detail.

The cornice and parapet have been provisionally assigned to Period V (early 15th century). The Period VI work consists of the base of the tower buttress, identified on the interior face of Bay 9. A short wall connecting vault 2 and 3, on the interior face, is attributed to Period VII; this wall could have been built in, or after, the 15th century. The concrete beam forming the wall plate belongs to Period VIII (1953).

Reused architectural decoration from Period IV

120 stones cut with architectural or decorative forms were identified in the inner faces of the clerestory walls, above the vault. A further five were built into the top of the vault. Of these 120 stones 83 could be identified as bearing Romanesque decoration, 28 had 13th century decoration and the remaining 9 could not be dated. On the evidence of block size and tooling marks the majority of the unidentified stones also belong to the 12th century.

The stones were grouped according to their decorative types and frequency the their locations were plotted on simple bar charts (Fig.12). The horizontal axis represent the north and south walls of the clerestory, with the bays numbered 1 to 9; the bars show the frequency and location of the decoration. The most frequently occurring types of decoration are described and discussed below.

Chevron

The chevron is the type that projects from the plane of the wall at an angle of 90 degrees, also termed ‘saw tooth chevron’ (Borg 1967:136). Where the full chevron is visible the profile is formed by a fillet followed by the roll then two quirks, with a width/height of 15cm (Fig.13a). It occurs elsewhere in the building, for example, on the nave arcade, in the triforia and extensively in the transepts, in both Romanesque and reused, contexts and in the strengthening of the crypt. This type of chevron was also used on the interior of the clerestory. It can be seen running continuously around the remains of 12th century arches that are partially preserved in the present ashlar face of the inner wall. It is also found reused on a number of the clerestory reveals.

The chevron decoration was evidently released from the 12th century wall during the remodelling of the clerestory and any pieces not used to decorate the clerestory reveals were used for the inner face of the wall.

Roll mouldings

Roll mouldings and roll stops have been plotted together as they are related. The mouldings in this group all possess a roll with a diameter of 90-100mm. On the stops the roll is terminated without a base (Fig.13b). The ashlar faces have striated diagonal tooling marks and a Romanesque mason's mark is preserved on a single example.

The roll mouldings are distributed from bay 3 to 9 in both north and south walls (Fig.12) and although they are probably reused from the 12th century clerestory their place in the Romanesque design is not immediately obvious. It is possible that these roll mouldings formed the reveals to the central clerestory openings or, alternatively, they could have formed the moulded surrounds for the Romanesque windows.

Pilaster buttress

This refers to blocks bearing a vertical roll at one of the angles, diameter 90-100mm, with a chevron-like clasping motif. This decoration appears on the exterior elevation at the angles of the pilasters that are preserved below the string course on the south side of the clerestory, and which extend above the string course on the north.

The distribution of stones bearing this decoration is of interest as 19 of the total 21 blocks recorded are in the south wall (Fig.12) This is the result of the complete dismantling and reconstruction of the 12th century (Period II) south clerestory wall above the string course, whereas the 12th century north clerestory wall was left largely intact, apart from the insertion of new windows. This shows, as does the example of the chevron, that much of the material found reused in the upper clerestory walls was derived from the 12th century clerestory and the concentration in the south wall indicates that the stone did not travel far, not even across the vault, between its removal from, and reuse in, the Period IV clerestory walls.

Two stones bearing this decoration were turned in and reused in the Period IV triangular wall shafts on the exterior of the south clerestory.

Circles

An unusual form of geometrical decoration, consisting of semi-circles recessed in to the faces of blocks, was identified on 13 blocks in the inner clerestory walls (Figs.15, 16). Where complete the blocks are 255mm in height and between 365 and 370mm long. The semi-circles have radii of 70-75mm and are recessed to a depth of 38-40mm into the block faces. When examined under x10 magnification no traces of paint were visible on the flat faces neither of the blocks

nor in the recessed decoration. The faces have fine diagonal axe marks typical of much of the later Romanesque work in the cathedral.

A Romanesque mason's mark is visible on one example (Figs. 15, 16). This mark was also recorded on a block with the clasped roll decoration, found at the angles of the pilaster buttresses on the exterior of the clerestory, but later reused in the Period IV raising of the interior clerestory wall (B3-4S). The mark has also been identified on the top stage of the turret at the south west angle of the south transept.

The blocks have been cut with the geological bedding running parallel to the long edges, in other words they were cut to lie on their sides as opposed to their ends.

Of the 13 examples recorded four types with distinct designs can be identified (Fig.15) and occur with the following frequencies:

- Type 1-5
- Type 2-2
- Type 3-2
- Type 4-1
- Unidentified fragments-3

The three unidentified blocks have traces of the motif that are insufficiently complete to enable them to be assigned to a particular type. The original design cannot be reconstructed from these 13 fragments with any degree of certainty as there may be further 'types' not identified in the survey. Also the number of blocks used in the original design and the proportions in which they occur, are not known. It is, however, possible to arrange the block types in a number of combinations to produce a variety of patterns.

The distribution of stones with this decoration shows a concentration in bays 5 and 6 of the northern wall. No other examples of the decoration are preserved *in situ* or are recorded as being reused in any part of the cathedral so there is no obvious parallel or source for the stones.

Most, if not all, of the reused decoration found in the interior faces of the upper clerestory walls can be shown to have been derived from the earlier 12th or 13th century clerestory. The source of the recessed circle decoration is not so obvious. If, for example, it were derived from the exterior of the clerestory then one might expect it to be concentrated in the south wall, where the exterior rebuilding was most extensive, as with the pilaster decoration. If it were derived from the interior of the clerestory then one might expect it to be distributed more evenly across the bays in both north and south walls, as with the chevron.

One possible source might be the former Romanesque structures at the west end of the nave, either the west front or the turrets. Richard Bryant has arranged the decorative elements to form a triangular design that, at 1.8 wide by 2.5m high could, for example, have fitted on the west face of such a turret (Fig.15). Recessed half circles form part of the decoration on the turrets of the south transept. Alternatively, the circles could have been derived from the former Romanesque tower, dismantled possibly as early as c.1350 (Welander 1991:252).

Although not common there are examples of such recessed circles used as decoration in the French Romanesque. At Gassicourt church (Seine-et-Oise) a double order of recessed circles run around the arch of the 12th century west doorway (Baum. 1928:138). The Old Choral School of Lyon cathedral has a band of recessed circles running beneath the eaves of the 12th century wall as a cornice. Here recessed circles are also used to form cross motifs in plain ashlar masonry as well as appearing in the spandrels and capitals of a 12th century blind arcade (*ibid*:179) (Fig.15).

Other examples of circles arranged in repeating patterns include the gable of the west end of St Mary's church at Poitiers and the, now demolished, exterior of the south side of the Abbey of Saint Germain, Auxerre (Sapin 2000:85); both 12th century.

An Italian example shows plain recessed circles, albeit on a smaller scale, used to decorate the tomb of Christ in relief on a capital from Modena (Male. 1978:139) (Fig.15). Research has yet to provide a similar example from England.

Double quirk

Three fragments of this moulding were identified in bays 5 and 6 in the south wall and bay 7 in the north. The moulding consists of two quirks, 2cm in depth, running side by side across a flat face (Fig.13c). The form of the moulding and the tooling marks suggest an 11th or 12th century date. The partial nature of the recorded mouldings together with their simple form make it difficult to be precise about the place of these mouldings in the Romanesque scheme of decoration.

Quarter-roll

Two examples from bays 5 north and 6 south. The roll has a radius of approximately 19cm with a 7mm lip at the transition to the flat face of the block. The slight curve visible on one edge of the block from bay 5 north suggests that it is a voussoir. Mouldings with this size and form are used as nook shafts in the aisle responds and as a continuous mouldings framing the openings into the radiating chapels from the ambulatory.

Wall shaft

Two blocks with a semi-circular profile were recorded in bay 7-8 in both north and south walls. The mouldings have a diameter of 38cm. As with the quarter-roll the engaged half-shaft is a key element in the Romanesque scheme of decoration in the interior of the nave. It is used on the north aisle responds acting as the springing points for transverse arches, flanked by two nook-shafts for the diagonal ribs and two for the wall openings.

It has been suggested that this five part form of wall-shafts acted as the springing point for a Romanesque vault over the nave (Thurlby. 1985:48); the identification of these components reused in the upper inner clerestory walls could support such a hypothesis.

Bead-hollow-roll

This is a 13th century moulding identified in Bays 5 to 9, concentrated in the south wall. In the majority of the recorded examples the upper roll has been cut away leaving only a partial profile (Fig.13c), however an example from Bay 5 – 6 S illustrates the complete profile (Fig.14a). The moulding is applied to elongated blocks with a slight curve on the lower and upper edges; it is therefore possible that the mouldings formed a surround to large two centred openings, or were cut as ribs.

Other 13th century decoration include a fragment of capital with stiff leaf, a base with a water holding moulding and pieces of a shaft with roll and fillet, all in Bay 3 (N). The capital is one of a pair; the other can be seen at the top of an ill-fitting 12th century shaft in Bay 3 on the south side of the clerestory. The combination of 12th and 13th century elements is also found in the clerestory opening of Bay 7, where a 13th century filleted shaft is fitted to a larger 12th century base.

Carved Head (Worked stone No. 222)

The stone was removed from the top courses of the upper interior clerestory walls in 1953 when the stone wall plate was replaced by a concrete beam, as part of the new roof. Several of the stones removed with it had 12th and 13th century decoration and it is described as being a 13th century sculpted head that had been damaged and abandoned during the process of carving (Welander 1991: 514). A description of the stone is included here as it originated from the Period IV masonry described above. In the following description the face of the block with the sculpted head is taken as the front (Figs.17, 18).

The block is 360x175mm and 220mm in height; the stone is Lower Freestone, from the white beds (referred to as 'Painswick'). It bears the traces of several episodes of cutting and reuse. The face opposite the sculpted head, or the back, has part of a Romanesque roll moulding and ashlar face (Fig.17). Most of the moulding was removed during subsequent re-cutting. It would have had a diameter of approximately 150mm and has vertical striated tool marks running parallel with the moulding; the tool marks are diagonally striated on the flat ashlar face.

The top of the block also has these diagonal striated tooling marks over much of its area. There are also setting out marks for the carved head consisting of a cross with two concentric circles, 58 and 76mm in diameter, radiating from its centre point (Fig.17). The outer circles appear to have been used as a guide in forming the overall shape of the carved head. Three more linear marks are inscribed, front to back, on the top of the block. One of these lines has been used to form the edge of a roll and fillet moulding that has been started but not finished. This 13th century moulding has, with the exception of the fillet, an identical profile to the 'bead-hollow-roll' moulding identified in the Period IV interior wall (see above).

The stone, then, had a roll moulding and was probably a part of the 12th century clerestory, possibly as a wall shaft or arch moulding. It may have been removed from the wall when the vault was built (1240-2). Part of the roll moulding was cut away, the setting out marks were made and the head was carved. Damage to the left side of the face occurred at the later stages of the carving, or after the sculpture was finished. Finally the setting out lines for the roll and fillet moulding were made and the carving started. This moulding was abandoned almost immediately. It is not clear if, or how, the stone was used in the 13th century structure before it ended up in the mid 14th century (Period IV) clerestory wall.

The stone had been on display in an exhibition in the north tribune gallery during the 1990s before being stolen in the summer of 2002.

Building Stone

The identification of the building stone on the exterior was carried out by Pascal Mychalysin, Head Mason (Fig.19).

12th Century (Periods I and II)

The Romanesque exterior face is, with the exception of a single block, composed entirely of stone from the Lower Freestone formation of the Lower Inferior Oolite, often termed 'Painswick' stone. The stone is composed of ooids 375-750µm in size in a porous matrix with a high micrite content. It is white to cream in colour, contains few finely comminuted fossil fragments with many blocks showing pronounced current bedding. The ooids and matrix have weathered at roughly the same rate. The nearest source of this variety of Lower Freestone would be from the Cotswold escarpment where it could have been quarried from Crickeley Hill / Birdlip in the north to Selsley in the south. Within this range the stretch of the scarp between Birdlip and Edge represents the most probable source.

The single 12th century block not from the Lower Freestone is a block of Pea Grit beside the west jamb of the window, immediately below the inserted string course. Despite its location by masonry from the later medieval Period it is judged, from the evidence of the Period II mortar along two of its edges, to belong to the 12th century. It has a different lithology to the Pea Grit that was used for the string course / cornice at the base of the parapet (see below) but is similar to the varieties found in the 11th century work in the south ambulatory and radiating chapels (Bagshaw 2000:12).

On the interior face of the Period I and II wall approximately 80% of the stone is Lower Freestone. Blue Lias Limestone comprises around 15% with tufa making up the bulk of the remaining 5%. Additionally three blocks from the Brownstones formation of Old Red Sandstone were recorded in the 12th century masonry of bays 6-7 N and 7-8 S. The Lias Limestone could have been dug from pits in the Severn Vale in, and around, Gloucester (Donovan and Kellaway. 1984:16) and the Old Red Sandstone from the eastern perimeter of the Forest of Dean, or possibly south Gloucestershire (Green 1992:25). The nearest sources of tufa are Edgeworth and Chalford, 13 km south, Leonard Stanley, 15km south west, where it was being quarried

before the late 11th century (Bagshaw 1998:11) with a large deposit at Dursley, 22km south west (Goudie and Parker 1992:62).

The presence of tufa in the 12th century walls is of interest as in other parts of the Romanesque building tufa has so far been recorded only in the splays / soffits of window heads or in vaults (Price 1999:50). Its occurrence in the inner face of the clerestory wall at this level suggests that it was being used for vaulting around the time of the construction of the Period II wall. The most likely explanation is that the clerestory walls formerly carried a Romanesque vault of tufa. A similar conclusion was reached at Tewkesbury after tufa was found reused at the top of the 14th century clerestory in the nave (Morris and Kendrick 1999:19).

A single fragment of brick was identified in the Period I and II masonry, in bay 7-8N on the interior face. The comparatively small quantities of certain categories of reused Roman building materials in the Romanesque work was noted. Brick, ceramic and stone tiles are used to pack the joints throughout the eastern arm of the church and the eastern bays of the nave, they are largely absent from the western Romanesque bays of the nave, the clerestory, the cloister and chapter house.

13th century (Period III)

The building stone referred to is the vault over the nave and the small supporting walls that span the angle formed by the meeting of the vault and the clerestory wall.

The vault, spanning all but the two westernmost bays of the nave, was completed in 1242 (Hart 1863:29) and is constructed from cut blocks of tufa. Fragments of 12th and 13th century decoration, Stonesfield Slate roof tiles and brick, 45-50mm thick, were also identified in the fabric of the 13th century vault. It is possible that the 13th century vault was constructed using materials derived from an earlier 12th century tufa vault over the nave.

The small supporting walls running across the angle formed by the intersection of the north–south walls of the vaults with the east–west walls of the clerestory are constructed of small, unworked stones laid in rough courses. The stone is predominantly Lower Inferior Oolite with a small quantity of Blue Lias Limestone.

14th century (Period IV)

The exterior face of the Period IV wall has been built with blocks reused from the Period II wall and so the stone type is the same Lower Freestone. It is of interest that Lower Freestone was used for the string course / hoodmoulding where a more resilient weatherstone would be expected.

The interior faces of the Period IV walls, as noted above, contain much reused 12th and a lesser quantity of 13th century decoration, all the examples that were examined were of a Lower Freestone lithology. The remainder of the stonework consists of ashlar blocks, again reused from Period II with a similar Lower Freestone lithology.

In addition, 11 blocks of green Carboniferous Coal Measure Sandstone were identified in both north and south interior walls. Blocks of this stone type have recently (2002) been discovered, hidden behind the 19th century repairs, running in bands between the

upper stages of the turret at the south-west angle of the south transept. The 11 green sandstone blocks, as with the remainder of the Period IV interior, are reused Period II material. A similar provenance, such as the former Romanesque turrets at the west end of the nave, or the tower, would be expected.

15th century (Period V)

The string course/cornice at the base of the parapet is built using stone from the shelly beds of Pea Grit. The stone is oolitic, ooids 375-750µm in size, with much finely comminuted fossil debris consisting primarily of fragments of shell and echinoid spines set in a spar cement. The weathered surface appears white with the sparry matrix prominent, however a freshly broken surface shows the stone to be slightly ferruginous with a yellow tinge. The rock would be classified geologically as a bio-oosparite.

The parapet proper is composed of large blocks of massively bedded Lower Freestone, slightly more ferruginous than the Lower Freestone used in earlier Periods, possibly suggesting a source north east of Birdlip.

The Period V ashlar blocks on the interior face of the clerestory wall, that is bay 1 and 2, are composed of blocks of Lower Freestone. The course heights range from 350-500mm, the block lengths fall between 400 and 950mm; the blocks have an average size of approximately 600x400mm. Around 70% of the blocks have sockets, 35mm square and 30-35mm deep, cut into their faces, occasionally the sockets occur in pairs. These sockets may have been cut to receive a bar attached to some form of lifting device necessary because of the large block size.

The two 15th century western vaults are, unlike the remainder of the vault, constructed from slabs of Lower Freestone.

14th/15th century (Period VI)

The stonework of the tower buttress is composed of the same material as the Period IV work, which in turn consists of recycled Period II stone, with the exception of a small number of large blocks where the stonework approaches the wall plate. The stone is from the Lower Freestone formation with the addition of four blocks of green Carboniferous Coal Measure Sandstone with the same lithology as the sandstone recorded in the Period IV stonework.

15th–19th century (Period VII)

The Period VII masonry is represented by a short stretch of walling running between the lower parts of vault 2 and 3. It is built with small pieces of random rubble with four blocks of Inferior Oolite. The petrology of the rubble was not investigated.

1953 (Period VIII)

The wall plate between bay 1 and 8 is formed by a layer of modern concrete and brick.

Acknowledgements

The stone identifications on the exterior were made by Pascal Mychalsin, along with two reports on the structure; these are deposited in the cathedral archive. Richard Gem and J. P. McAleer commented on the circle decoration. Richard Bryant commented on the circle decoration and suggested a possible design. Richard K Morris commented on the tracery and mouldings. Carolyn Heighway advised, commented and edited throughout.

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Appendix 1

Location of reused decoration in Period IV masonry

Bay type / quantity

- 1-2S chevron x2, roll moulding in vault 2.
- 2-3N chevron, roll, 13th century base with water holding moulding, fragment of stiff leaf, mutilated stiff leaf capital, filleted roll moulding x2.
- 2-3S chevron.
- 3-4N face chevron.
- 3-4S pilaster x4, roll, roll stop, roll in vault 4.
- 4-5N round headed window head, pilaster, roll moulding x3, roll stop x2, large quarter roll voussoir, circle decoration.
- 4-5S pilaster x6, roll x3, roll moulding (diameter approx. 6cm) ?13th century, double quirk moulding.
- 5-6N roll, pilaster, plain voussoir, circle decoration x4.
- 5-6S chevron x4, roll stop, pilaster x2, large quarter roll, double quirk moulding, 13th century filleted roll voussoir x2, 13th century roll x2, roll moulding (diameter 6cm), circle decoration.
- 6-7N chevron, plain voussoir, roll, roll stop x3, circle decoration x6.
- 6-7S chevron, pilaster x3, circle decoration, roll moulding x2, curved moulding x5, on vault 7: roll mouldings (12.5cm diameter x3).
- 7-8N curved moulding x6, half shaft (diameter 380mm), double quirk moulding, plain voussoir x4.
- 7-8S pilaster x4, roll moulding x4, roll stop, curved moulding x4, 13th century moulded voussoir, half shaft (diameter 37.5cm).
- 8-9N chevron, roll moulding (diameter 12.5cm), roll stop (diameter 12.5cm), plain voussoir x2.
- 8-9S plain voussoir, curved moulding, [in buttress: roll stop, plain voussoir].
- 9N chevron.

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- Fig.8. 12th century decorated pilaster reused in the 14th century (fig.8.psd)
- Fig.9. Base of triangular wallshaft, Bay 5-6 (fig.9.psd)
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Text file : gcar2001f.doc

Drawings

Corrected paper copies of the AutoCAD elevation drawings of individual bays at a scale of 1:20.

- Bay 9 - 2001/f/1
- Bay 8 – 2001/f/2
- Bay 7 – 2001/f/3
- Bay 6 – 2001/f/4
- Bay 5 – 2001/f/5

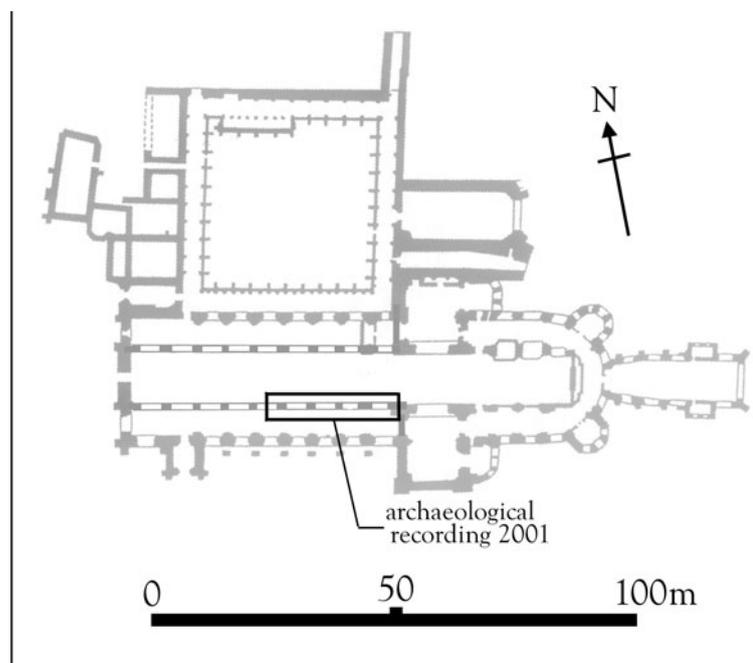


Fig.2 Gloucester Cathedral, Eastern Bays of South Clerestory - Interpretation

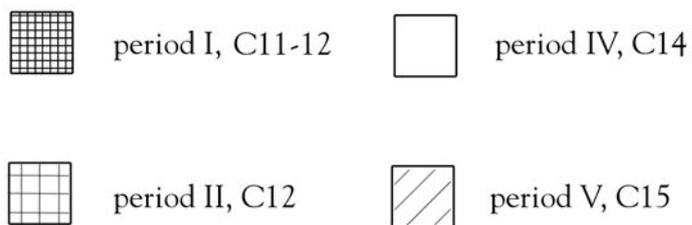
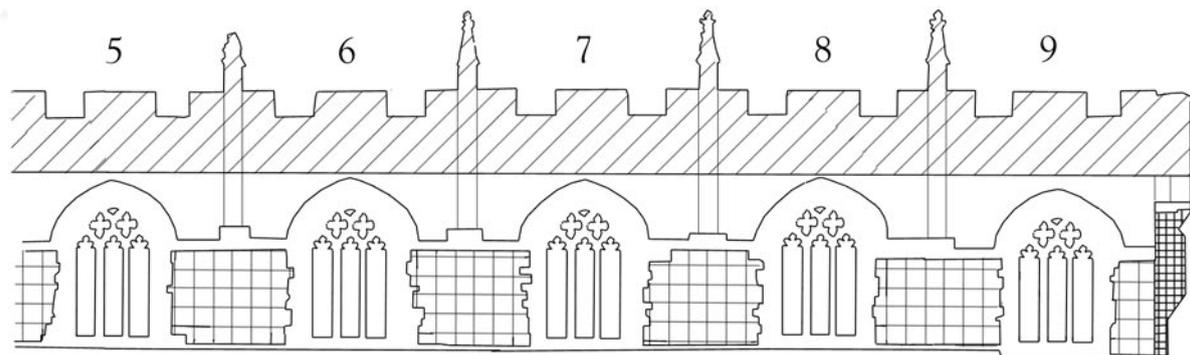
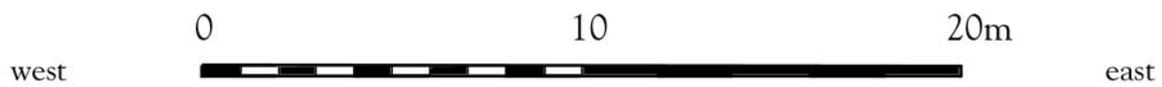
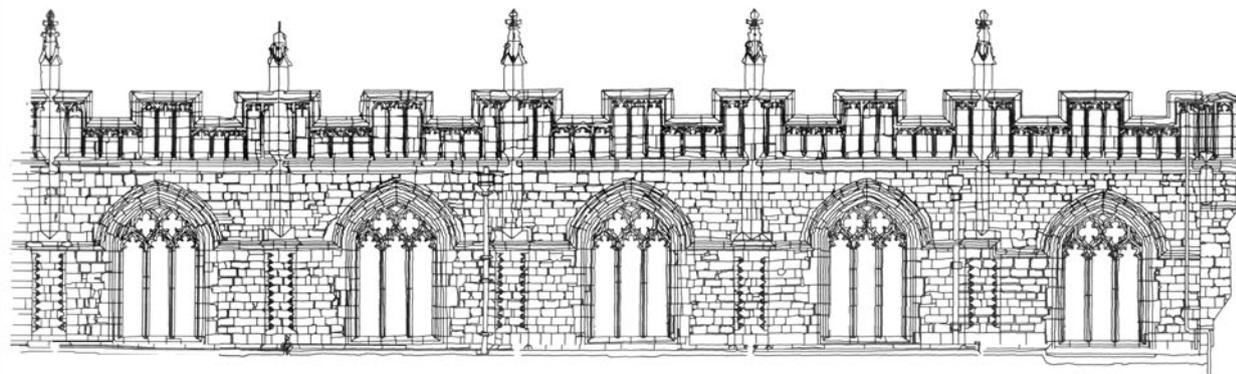


Fig.3 Gloucester Cathedral, Upper South Clerestory, Interior

Scale 1:100

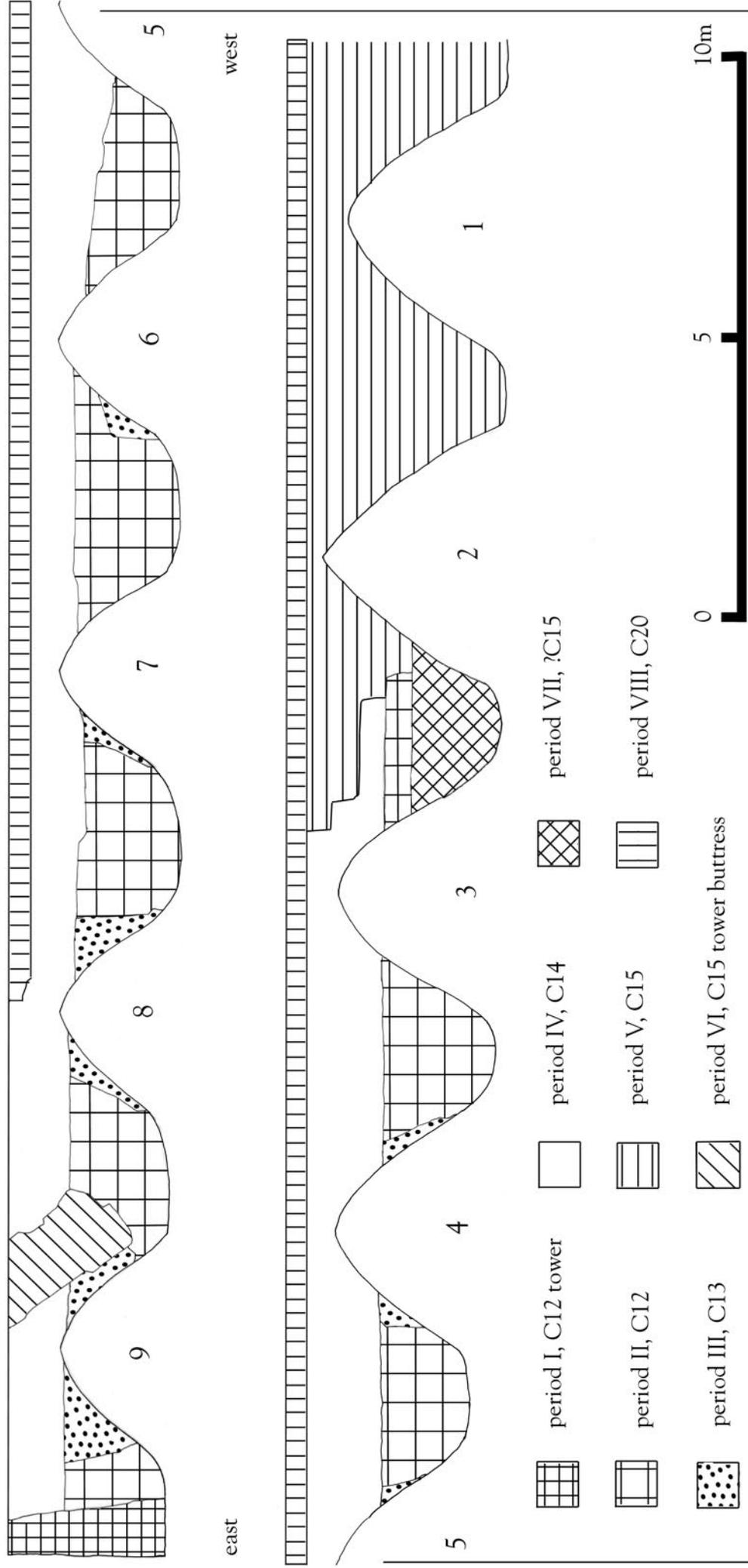


Fig.4 Mason's Marks
Scale 1:2

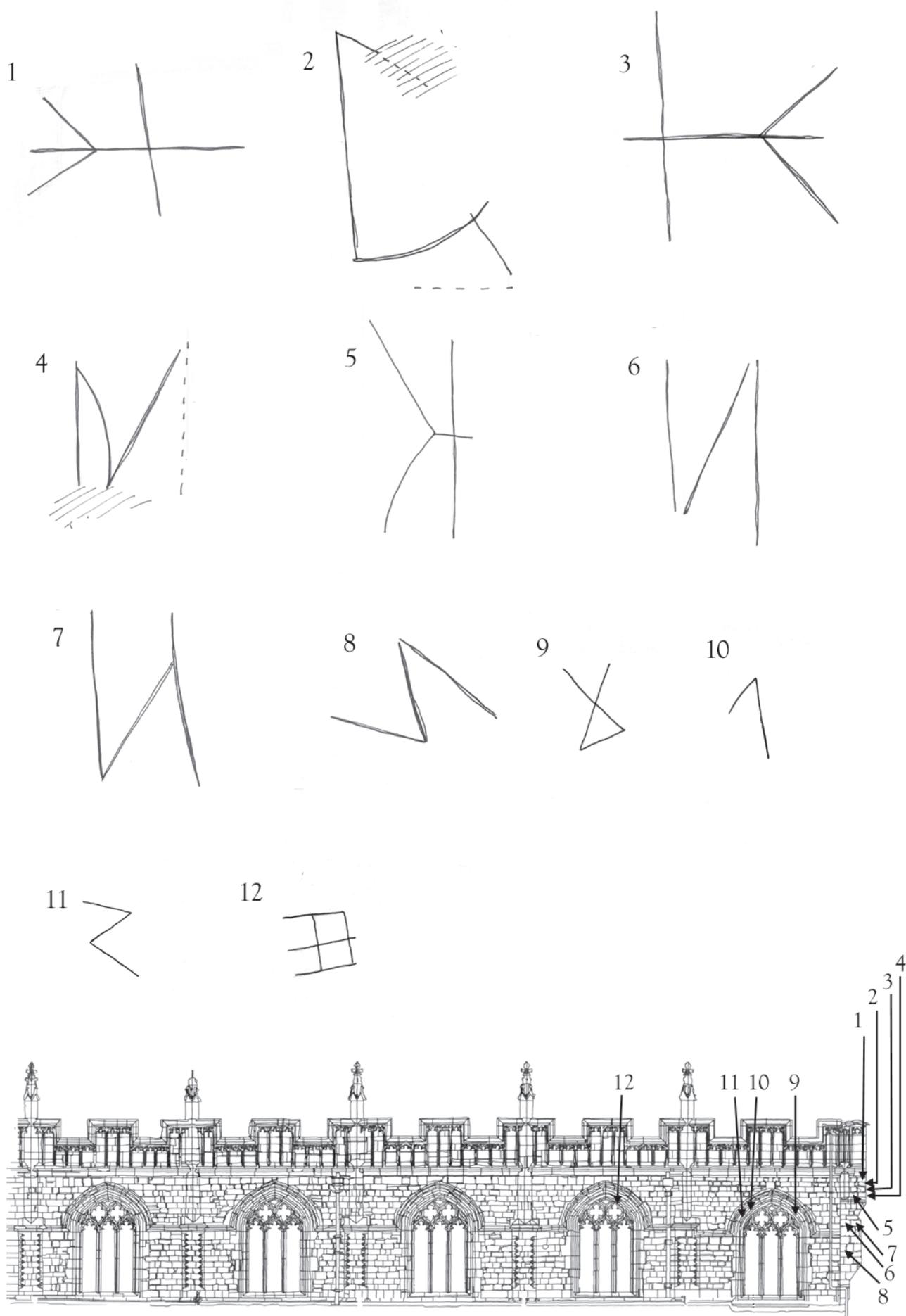
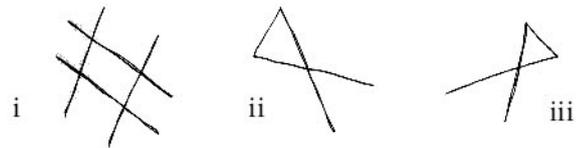


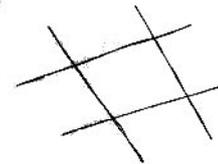
Fig.5 Mason's Marks - Interior

Scale 1-2

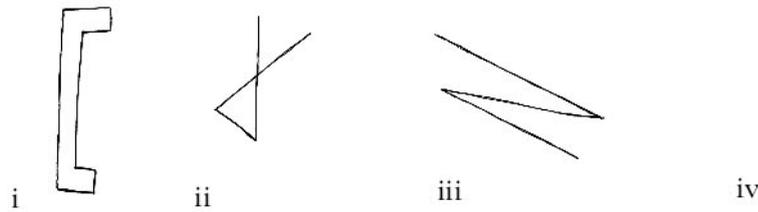
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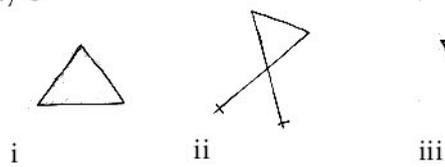
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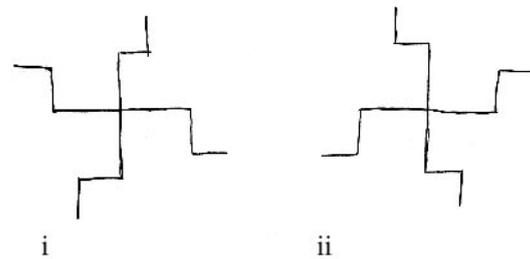
Bay 7



Bay 6



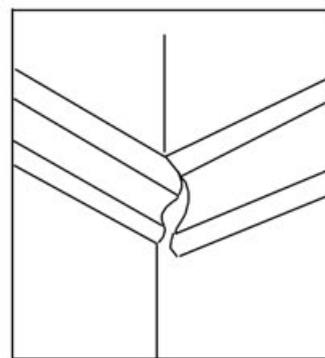
Bay 3



Bay 2



Fig.6 South Clerestory, Nave - Bay 2



Detail of string courses

Window Mouldings 1:10

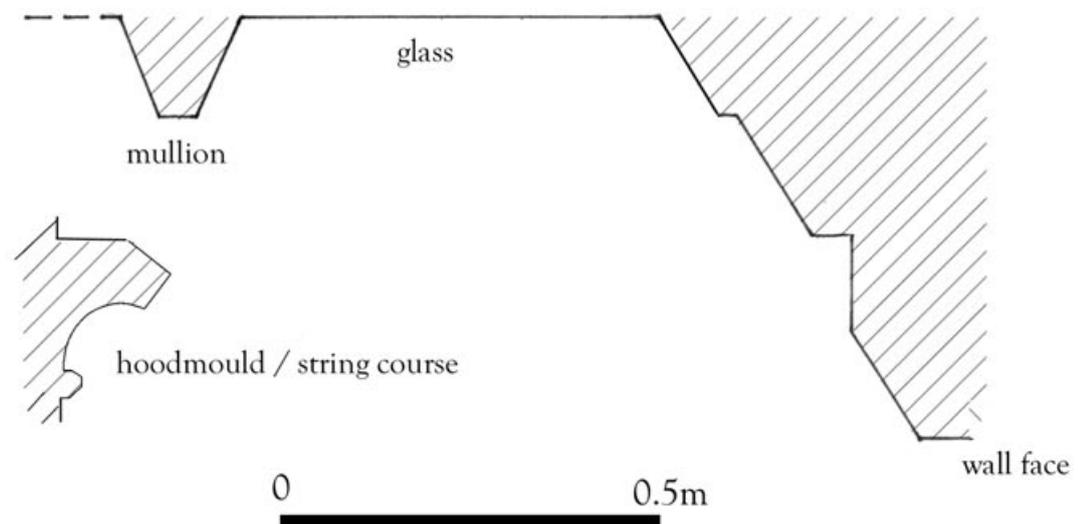


Fig.7 Reused chevron in Period IV window - Bay 8



Scale = cm

Fig.8. 12th century decorated pilaster re-used in the 14th century



scale = cm

Fig.9. Base of triangular wall shaft, Bay 5 - 6



Scale = cm

Fig.10. Gloucester Cathedral, East Bays of South Clerestory
19th and 20th Century Repairs

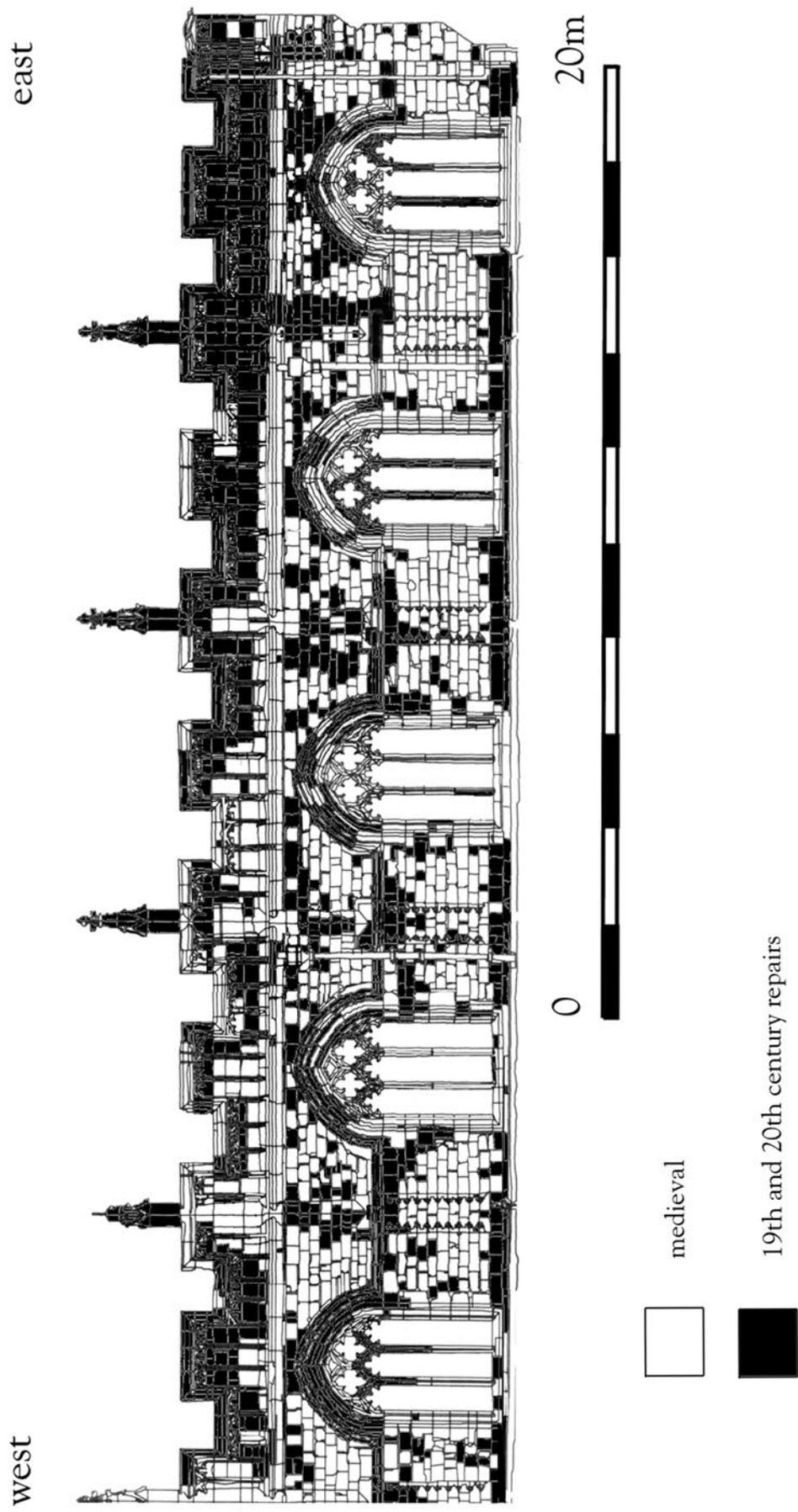


Fig.11. Bay 7 - Core

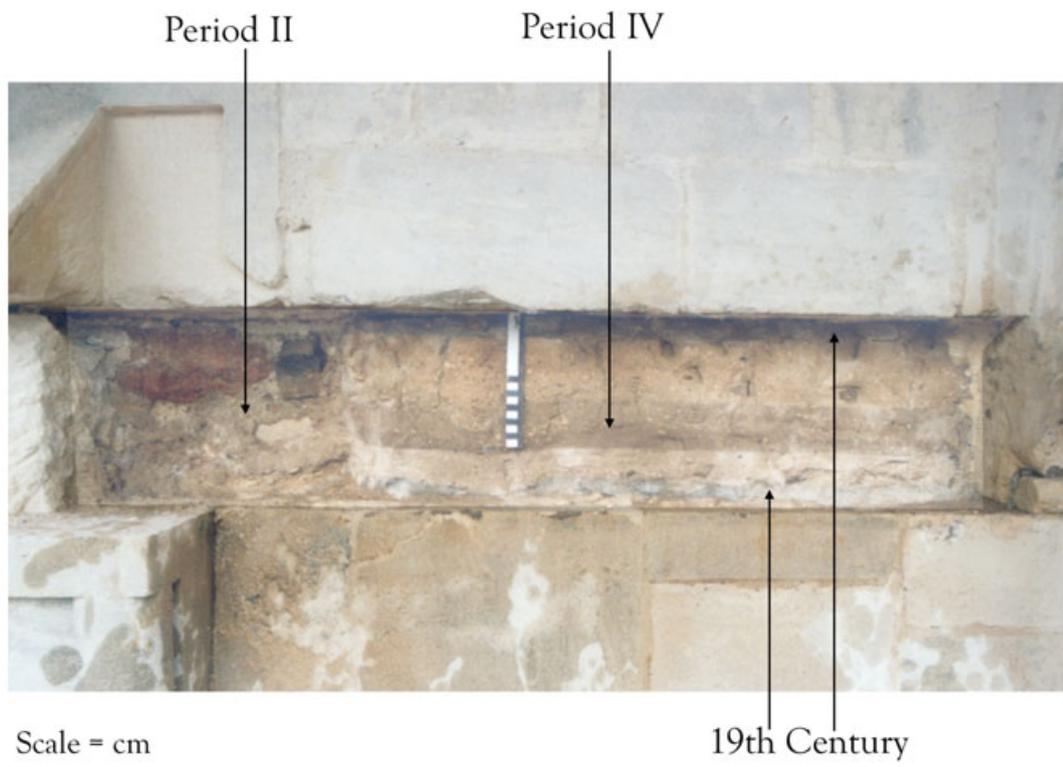


Fig.12. Reused decoration in the interior faces

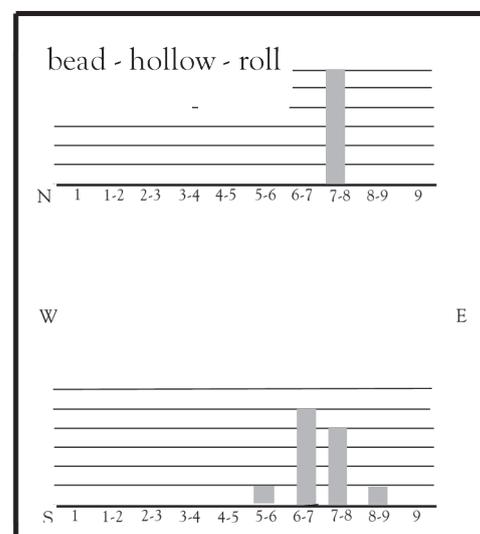
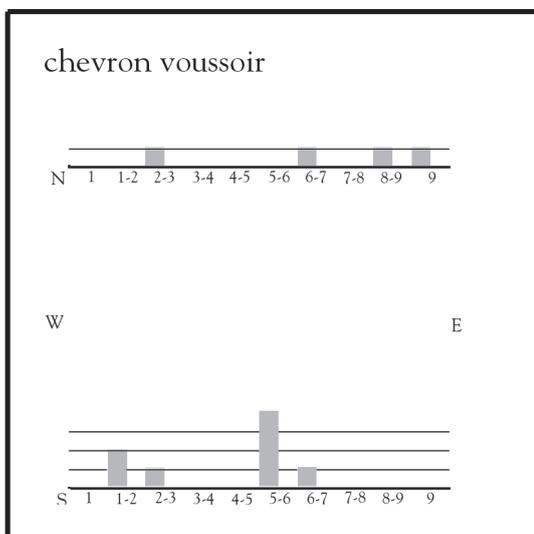
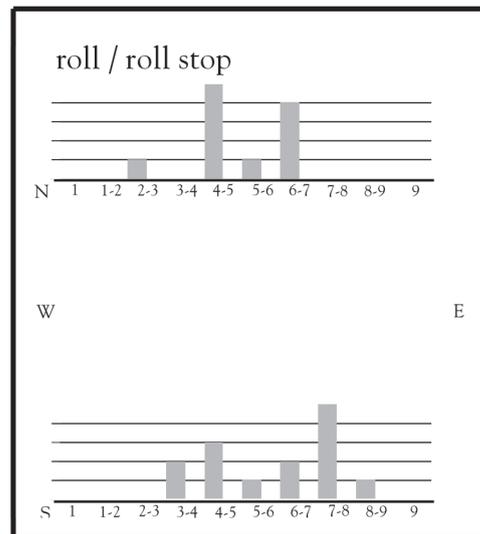
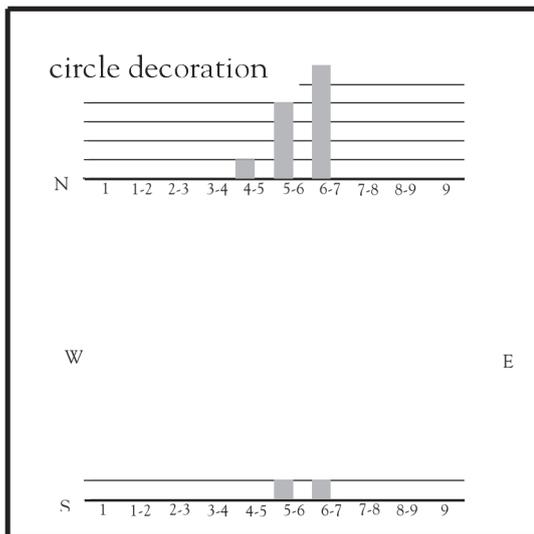
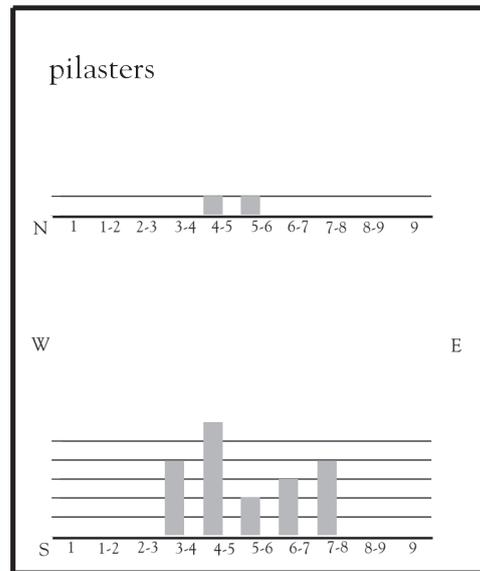
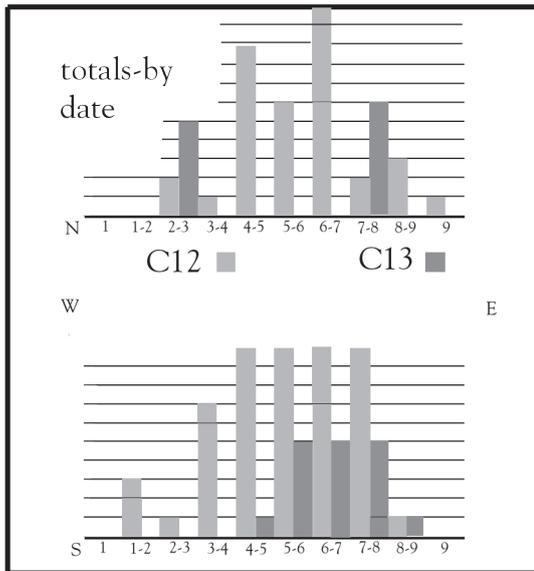


Fig.13. Moulding Profiles

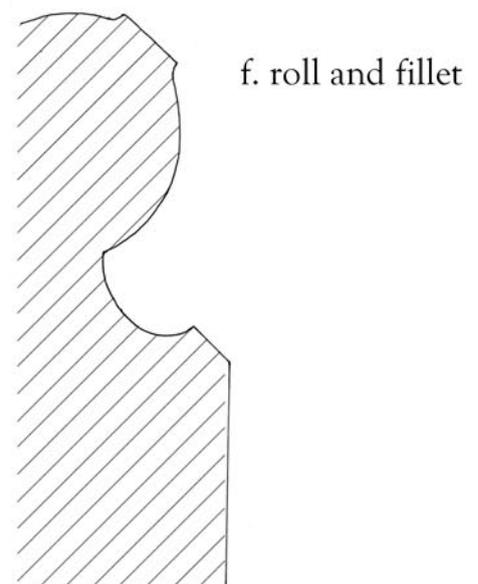
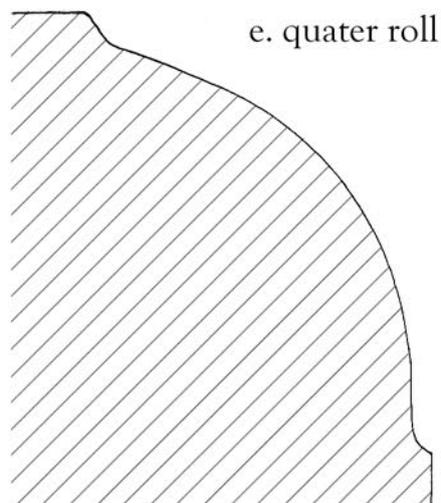
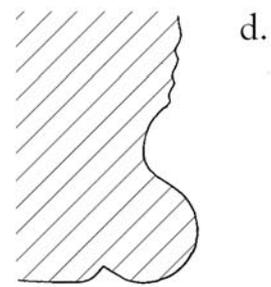
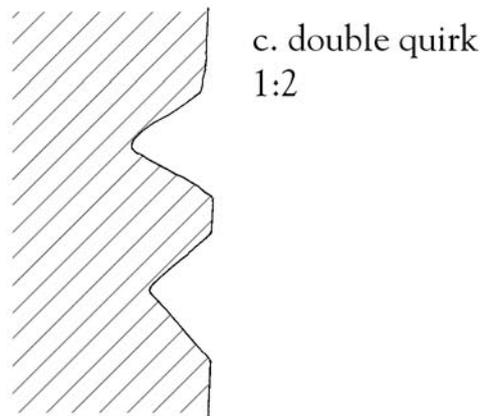
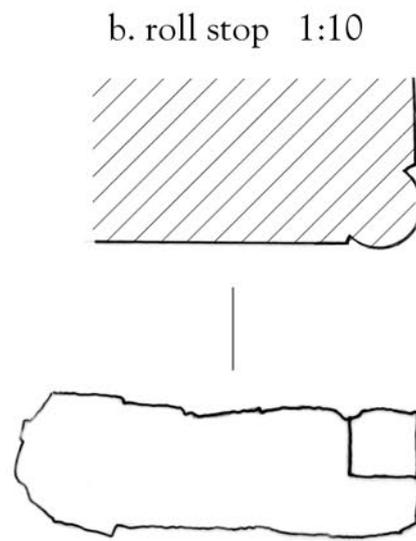
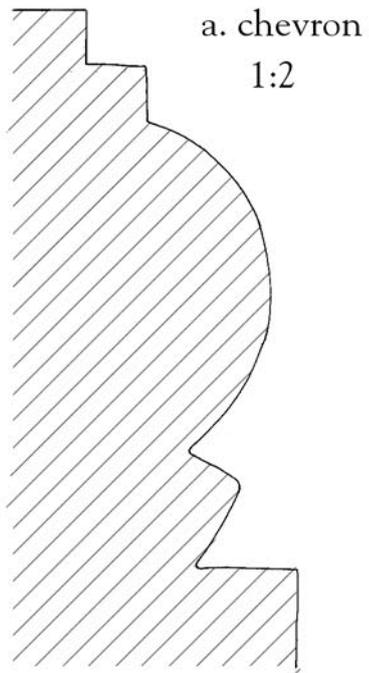
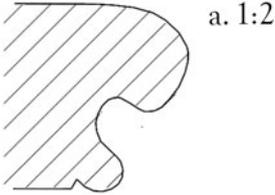


Fig. 14. Mouldings



Reused in Period IV masonry
Scale 1:5

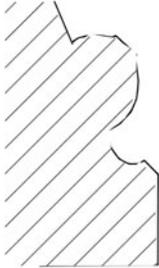
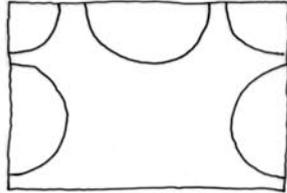


Fig.15. Circle decoration

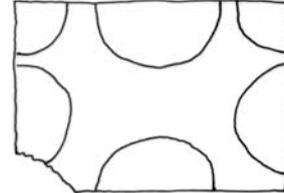


Block types

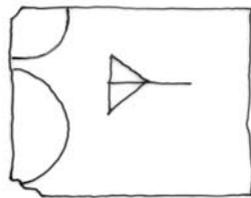
type 1



type 2



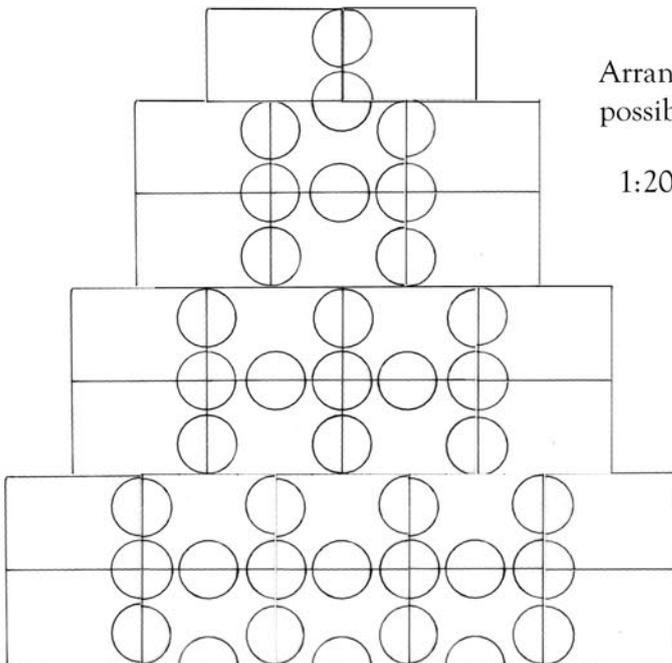
type 3



type 4



scale 1:10

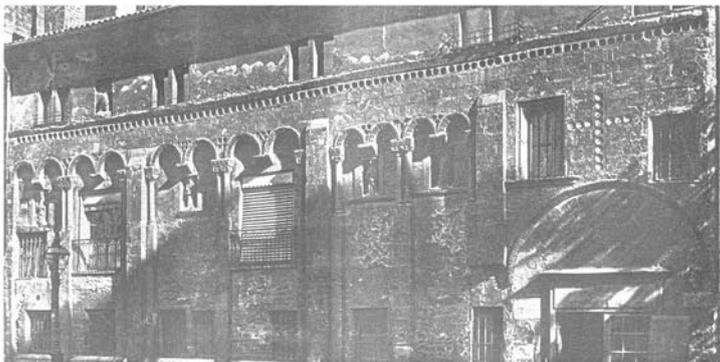


Arrangement of circles to form possible decorative scheme

1:20

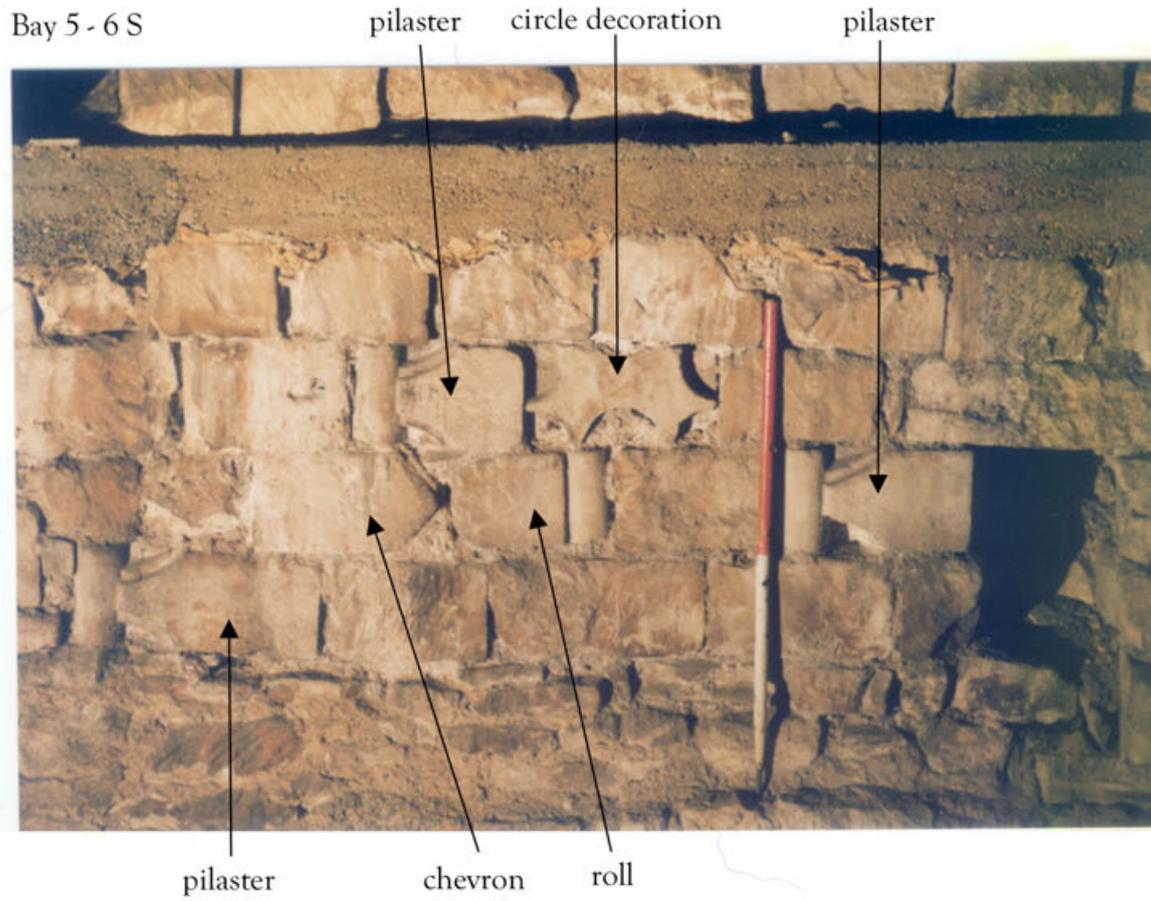


Romanesque capital from Modena
Male 1978:139



Lyon Cathedral
Baum 1928:179

Fig.16. Reused decoration in Period IV interior masonry



Bay 6 - 7 N

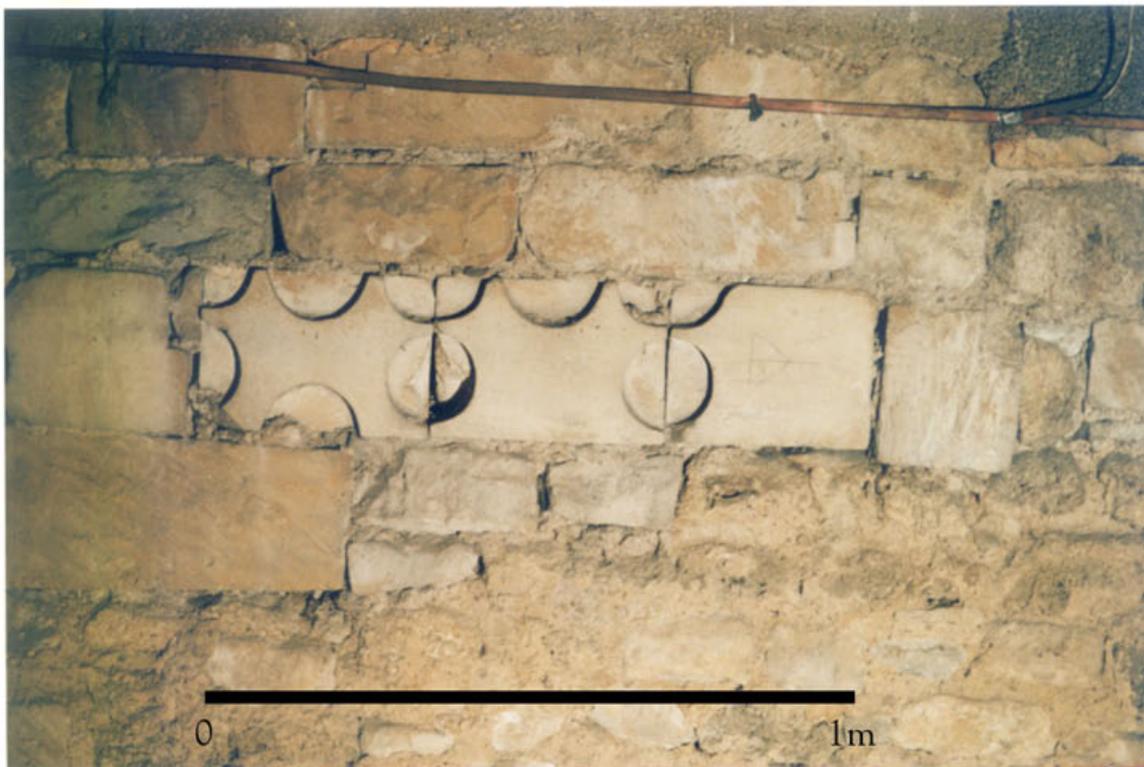
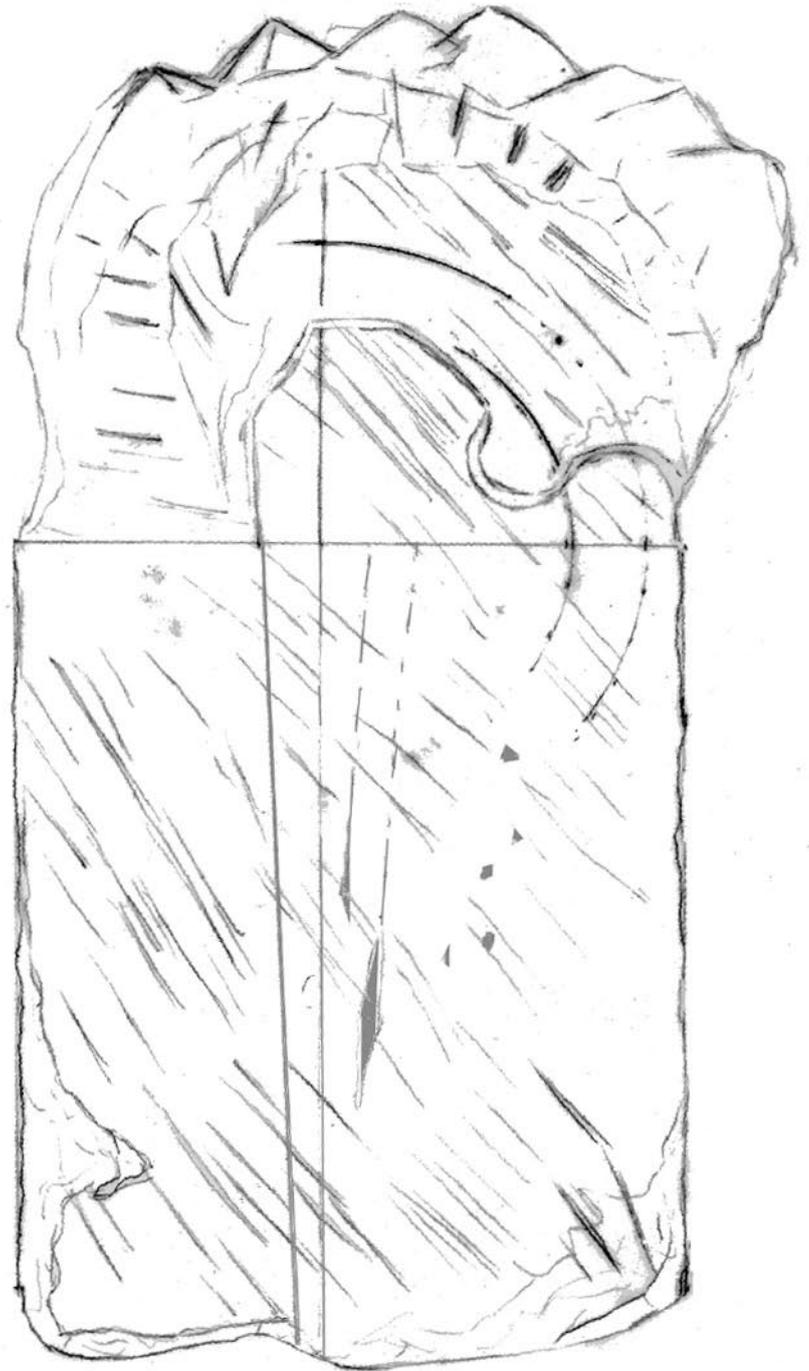


Fig.17. Carved Head (worked stone No. 222)

Scale 1:2

i. top of block



ii. moulding on back of block

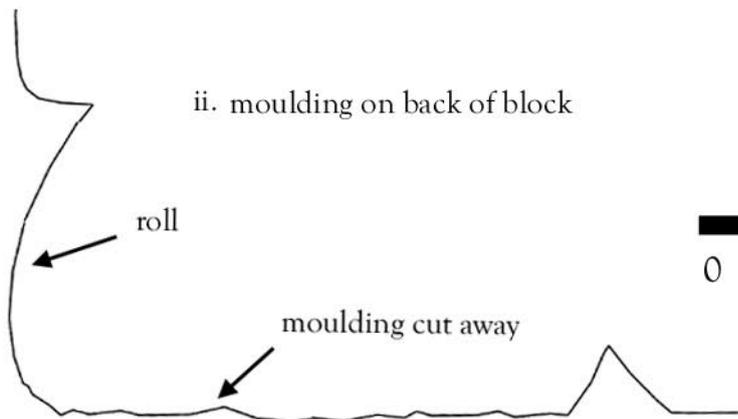


Fig.18. Carved Head



