A Carpenter's Study of the Chapter House Vestibule Door, Westminster Abbey

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INTRODUCTION

The Westminster Abbey Chapter House vestibule door is a rare example of mid-eleventh century carpentry in Great Britain. In studying it, we have established both how the timbers were produced and how the door was manufactured. We have also determined the many types of tools used by the highly skilled carpenters who made it. This study has also given an insight into Anglo-Saxon timber sawing and the management and the use of timber storage yards for prepared timber. The door is situated in the passage vestibule to the Chapter House of Westminster Abbey from the cloisters on the right-hand side and is still used as access to the vestibule cupboard. It has been identified as having originated from Edward the Confessor's abbey and has been dated by dendrochronology to between 1032 and 1064, making it possibly the oldest Saxon door in Great Britain.[1] Cecil Hewett studied it in the late 1970s, Jane Geddes later described the construction and ledges in her book about decorative ironwork, and it was mentioned recently by Campbell and Tutton in their general survey of the history and conservation of doors.[2] Angela Thomas carried out a detailed survey in 2005, producing front and rear elevation drawings (Figures 1 and 2). The door has been made narrower by about 100mm and its original size and location are not known. However, the Pyx Chamber, the room next to the Chapter House vestibule, is of Saxon masonry with a stone vaulted ceiling, built in the early eleventh century as part of the earlier abbey. It is very likely the door was made for Edward the Confessor's Abbey under the supervision of Teinfrith, the master carpenter (churchwright) to Edward the Confessor at the time of the building of the Abbey between 1050 and 1066.[3] The door was salvaged and reused in its present position during the thirteenth century.

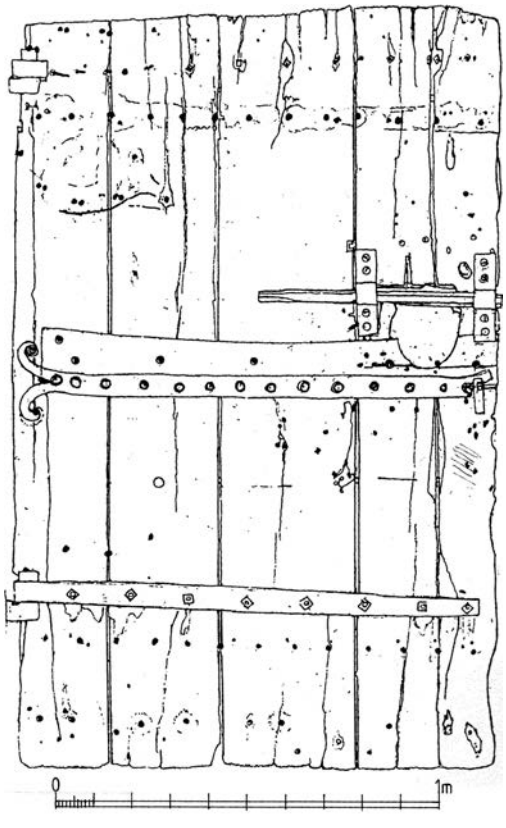
DESCRIPTION OF THE DOOR

The door consists of five vertical parallel oak boards varying in width from 225 mm to 390 mm. The existing overall width of the door is approximately 1270 mm and its height is 1980 mm. There is a surviving original central iron strap on the door; the original decorative hinge straps no longer survive, but the ghosting of the nail holes can be clearly seen (Figure 1). The door is believed originally to have been about 1350 mm wide and possibly 2490 mm high, with a semi-circular top (Figure 3). The

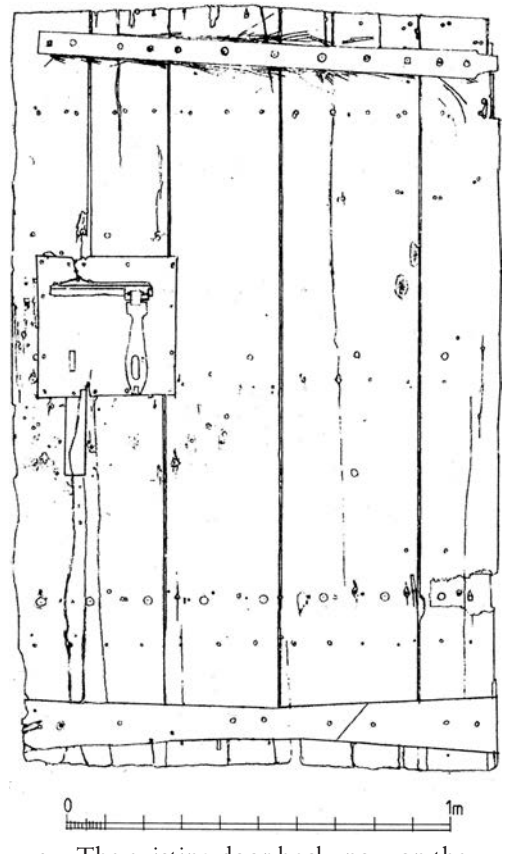
[1] Rodwell, Miles, Hamilton and Bridge (2006), pp. 25–7; Rodwell (2012), pp. 44–6, giving a detailed description of the door.

[2] Hewett (1978), pp. 214–16; Hewett (1980), pp. 25–6; Hewett (1982), pp. 343–44, giving a detailed description of the construction of the door; Geddes (1999), pp. 22–3; Campbell and Tutton (2020), p. 38.

[3] Harvey (1987), pp. 294–95.



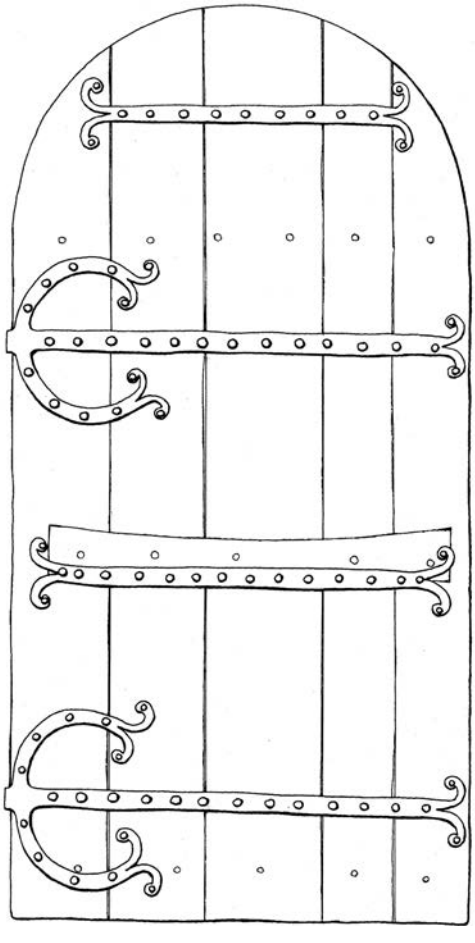
1 The existing door front, now on the inside of the cupboard. *Drawn by Angela Thomas*



2 The existing door back, now on the outside of the cupboard. *Drawn by Angela Thomas*

dendrochronology report by Daniel Miles and Martin Bridge confirms that the timber used was from oak trees grown locally near London.[4] The door boards are 40 mm thick with oak ledges housed, or let-in, so that they are flush with the surface of the door. There is a central recessed ledge on the front, partly under the original iron strapwork. At the top of the reverse side of the door are the remains of the housing for a second recessed ledge with a third, almost complete, close to the bottom on the same side (Figures 1, 14, and 33). Most of the top ledge was cut away when the door was reduced in both height and width to fit its present opening, during Henry III's rebuilding of the Abbey in the mid-thirteenth century. The flush ledges are slightly bowed along their length, 140 mm wide at the edges diminishing to 90 mm in the centre. There is no evidence that the ledges were added after the door was made: the original iron strap still surviving partly covers the central ledge (Figures 6 and 7). The ledges are the main element that prevents the door from sagging. The closing edge of the door

4 Miles and Bridge Report 38/2005, p. 8.



3 Conjectural reconstruction of the door. *Drawn by Warwick Rodwell*

is very uneven where it has been reduced by approximately 100mm to fit the present opening. This was done very crudely, most likely with an axe, and was not neatly finished off, exposing one end of the central ledge. The remaining vertical boards are very straight and parallel, as was confirmed by checking them with a stretched string line. During examination of the door we found no evidence that any timbers had been reused or recycled from another door or from structural timbers. There is clear evidence that the door was covered with hide or leather on both sides. This is probably why the ledges were recessed, so that the door had a smooth and flush finish to receive the leather covering before the iron strapwork was fixed.[5] This hide or leather covering on both sides suggests that it was a high-status door and highly decorated. As further evidence that it was fully covered with leather, one can see knife score marks on the boards on either side of the top hinge strap where the face leather has been removed, the remaining leather surviving behind the iron straps (Figure 1).

5 Rodwell (2012), p. 145.

INTRODUCTION TO ANGLO-SAXON WOODWORKING

For half a century archaeology has expanded our knowledge of Anglo-Saxon and Viking building structures and the development of early woodworking and building technology, through many new discoveries of complex Anglo-Saxon centres such as those at Cheddar in Somerset, Yeavering in Northumberland, Cowdery's Down in Hampshire, Bishopstone in East Sussex and Lyminge in Kent, as well as the Viking settlements in Dublin and York.[6] These sites are good examples of advanced Anglo-Saxon and Viking building technology still not fully understood. However, they are also high-status royal or monastic centres, where there is evidence of highly skilled sophisticated woodwork and setting out. But throughout England hundreds of lower status Saxon sites have been excavated or identified; waterfront revetments, modest dwellings and store buildings from villages or farmsteads.

Archaeologists Damian Goodburn, an expert in Anglo-Saxon woodworking, and the late Richard Darrah both did experimental woodworking, replicating tool marks on waterlogged timbers found on sites where Saxon and Viking timbers have been preserved for study through water saturation. Many timbers from London riverfront sites have been freeze-dried and are on display in the Museum of London. Similar timbers from other sites can be seen at the Jorvik Viking Centre in York and in the National Museum of Ireland in Dublin. Stemming from Goodburn and Darrah's work in experimental woodworking there are now many reconstructed Anglo-Saxon buildings in England open to the public, for example, Jarrow Hall, South Tyneside, West Stow in Suffolk, Charlton (Butser Farm) in Hampshire, the Weald and Downland Museum, West Sussex, and more recently, The House of Wessex in Oxfordshire. All these open-air museums are based on actual archaeological sites where ancient domestic buildings once stood, and all the reconstructions use split and hewn timbers. All the sites have used earth-fast structural timber members for the walls and internal supports.[7] Some of these reconstruction sites have been built, following the advice of Goodburn and Darrah, using three basic tools: a broad axe, a narrow axe and an auger, the evidence for these being the toolmarks studied on waterlogged Saxon or Viking timbers, mainly of the ninth to the eleventh centuries. Other Saxon and Viking tools — broad and narrow adzes, chisels, planes and saws — which are displayed in museums all over England, have been ignored. This wider range of tools is very likely to have been used on royal palaces and monastic sites where the King and the Church could afford to employ and attract the most skilled craftsmen with a wide range of tools at their disposal. However, simple domestic buildings did not warrant high-skilled input, as Goodburn has demonstrated. The builders of earth-fast Saxon and Viking structures did not have a knowledge of bracing and hence relied on fixing timbers in the ground to prevent a building from falling over.

A problem for the carpenters making doors was to prevent the boards from sagging. Green planks, whether split or sawn, would warp and shrink. Fixing elaborate ironwork to the door planks prevented the board timbers from warping but did not

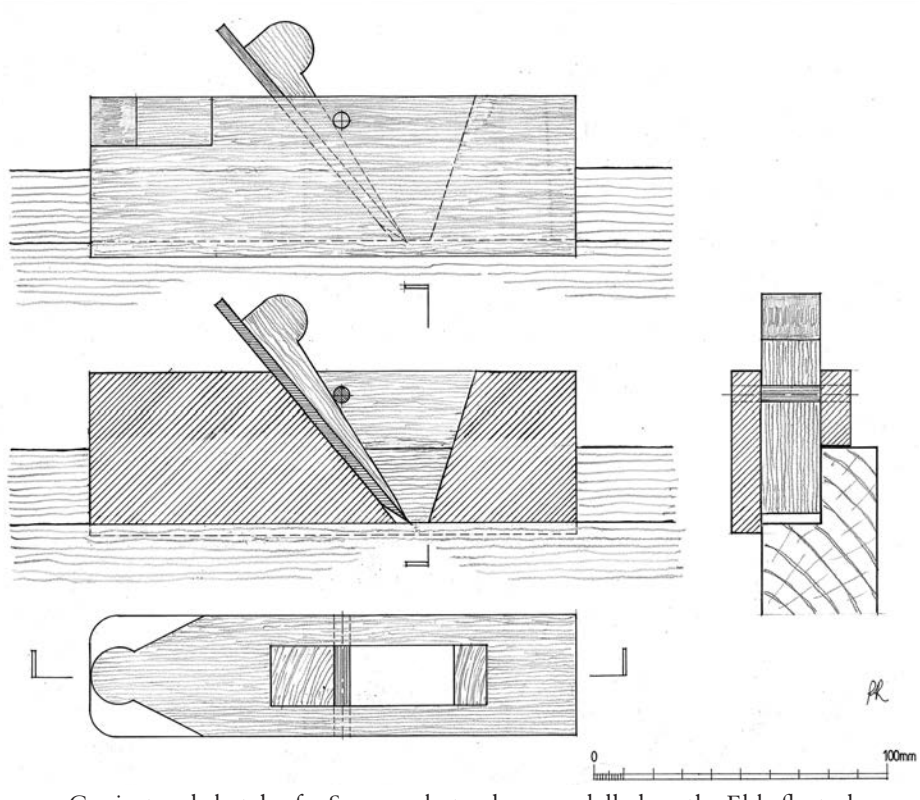
[6] Cheddar: Rahtz (1962); Yeavering: Hope-Taylor (1977); Cowdery's Down: Millet and James (1983); Bishopstone: Thomas (2004); Lyminge: Thomas (2013); Dublin: Murray (1983); York: Hall (2014).
[7] Goodburn (2007), pp. 46–89; reconstruction in the Museum of London.

prevent the timbers from shrinking away from the straps, causing the door to sag through the dead weight of the timbers and the planted-on ironwork. To overcome the problem of doors sag, the door makers also used timber ledges to hold the planks tight together and thereby prevent both door sag and wind.[8] The vestibule door is an excellent example of this: the ledges were let into the face of the rebated boards, which were all fitted tightly together and had been seasoned to reduce shrinkage. Another door described by Geddes and Hewett, the Durham Cathedral door of *c.* 1128, had square rebated planks like the vestibule door but let-in tapered ledges. These were slid into a dovetail-tapered recess from the side of the door, and after two years, when the boards had shrunk, the tapered ledges could be tapped further into the tapered recess to tighten up the shrunken boards. It was a clever design, except the door couldn't be hung in a recess until the wedged ledges had been driven home, two years after it had been made, and the surplus remains of the wedge removed, so that the door could function on its hinges and close in the opening. Other doors had different types of ledges, for example, the Hadstock door, of *c.* 1050–75, where there are D section ledges, fixed with nail and rove.[9] The Hadstock door also had bevelled, continuous rebated jointed planks. On some early doors, to prevent sagging, the joint planks had counter-rebates, which must have been very time-consuming to make using a chisel and plane.[10] However, the counter-rebate was very effective in preventing sagging. It wasn't until *c.* 1200 that additional diagonal lattice bracing was added, which made the door very rigid.[11] Ledged and braced doors are still made today.

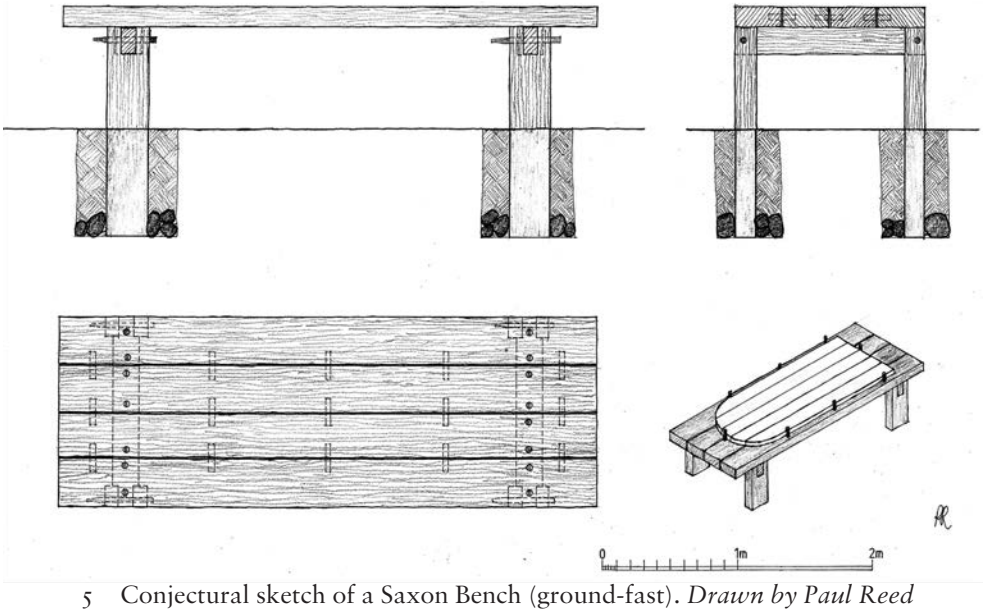
HOW WAS THE DOOR MADE?

The boards of the door have been converted from the log by sawing through and through. The orthodox view, held by Goodburn, claims that Saxon woodworkers didn't use saws as no Anglo-Saxon timbers found to date have shown saw marks.[12] Goodburn also rightly states that all Saxon woodworking was produced from round logs squared up with broad axes, a process known as box-heart conversion. Wet timbers studied by Goodburn didn't have saw marks, only axe marks.[13] Other timbers studied by archaeologists were produced by splitting a log radially or tangentially and finishing it with a broad axe or adze. For the Saxon woodworker it was necessary for the log to be straight-grained and knot-free to enable conversion, by splitting or hewing, to be carried out with ease.[14] However, the boards on this door have many knots, which would have been difficult to hew and near impossible to split; hence it would make sense to saw the logs to make the planks. This could be an indication that knot-free trees for splitting were becoming scarce, necessitating the use of a saw. Although Goodburn and others have not found saw marks on the Saxon timbers they have studied, the evidence of the vestibule door suggests that Anglo-Saxon and Viking

[8] Geddes (1999), pp 19–29, pp. 50–7; Hewett (1982), pp. 78–94; (1985), pp. 155–87.
[9] Hewett (1982), p. 78. Geddes (1999), p. 20; Table 2.1 lists doors with rounded ledges.
[10] Geddes (1999), p. 29, fig. 2.16 illustrates counter-rebate. Hewett (1985), p. 162, fig. 156.
[11] Geddes (1999), p. 24, table 2.4 lists doors with lattice bracing; Hewett (1985), p. 161, fig. 155.
[12] Goodburn (2007), pp. 302–15; Hill and Woodger (1999), pp. 47–51.
[13] Milne (1992), pp. 106–14.Hall (2014), p. 775 (Hall quoting Goodburn).
[14] Darrah (1982), pp. 219–23.



4 Conjectural sketch of a Saxon rebate plane modelled on the Ebbsfleet plane. *Drawn by Paul Reed*



5 Conjectural sketch of a Saxon Bench (ground-fast). *Drawn by Paul Reed*

6 and 7 Details of the door, showing how neatly the ledge is let into the boards of the door. *Photo Paul Reed*

carpenters did at times use saws. Martin Bridge and Daniel Miles were the first to note the saw marks on this door.[15] Hugh Harrison has observed saw marks on the door at All Saints Church, Staplehurst in Kent, dated by Geddes to *c.* 1100.[16] This door was made approximately forty years after the vestibule door, and also has rebated jointed boards, as well as D-section ledges like the Hadstock door. The authors have inspected the door at Staplehurst and there are saw marks visible at the bottom on the right-hand side.

Once the planks for the vestibule door had been sawn, they would have been stacked in the woodyard on a level area to be seasoned. Planks of this thickness would need to be in stick for at least two years before being used. Saxon woodworkers must have known about seasoning timber, as examination of the door shows that the ledges still fit tight in the boards with no shrinkage (Figures 6 and 7). However, later doors were still being made from green oak and were prone to shrinkage and sagging. Artefacts recovered through archaeology prove that Saxon carpenters had knowledge of handsaws, for example, the Thetford saw (Figure 20). The evidence of the vestibule door, where the boards have clearly been sawn from the log, implies that some used the frame saw for ripping along the grain (Figure 17).[17] This is also proof that the Saxon blacksmith could produce steel to make into saw blades – over a metre long for a frame saw –with teeth that can be set to allow clearance of the blade, especially when cutting through a depth over 400mm, as was the case with one of the boards in this door (Figures 1 and 2).

[15] Bridge and Miles (2012), p. 77.
[16] Harrison (2007), p. 53; and personal communication. Geddes (1999), p. 21, table 2.1.
[17] Goodburn (2007), p. 302, and in private correspondence with the authors.

8 Ebbsfleet plane. *Maidstone Borough Council: photo Robert J. Williams*

PRODUCING THE REBATES TO JOIN THE BOARDS TOGETHER

After the planks had been seasoned, they would have needed straight, parallel edges produced by flicking a chalk or a charcoal dust base line. Parallel lines could be achieved by using a lath or a gauge. The edges of the boards would be removed by sawing or by using a broad axe and truing up the edges of the planks using a plane. Straight edges would be required to produce precise rebates like those found on the door. The boards would have been secured on a sturdy bench or trestles and were probably held in place with large removable pegs and wedges (Figure 5). No Saxon rebate plane has been found to date but the evidence of the door implies that its maker used such a plane. There are Saxon planes made from bone and horn and one found at Sarre in Kent can be seen in Maidstone Museum.[18] One of the authors, Peter Massey, recently made a replica of this plane (Figures 9 and 10). Other bone planes have been found in Friesland, Netherlands, while a wooden plane was found during excavations at Ebbsfleet in Kent in 2002 (Figure 8).[19] This plane has been conserved and is in the care of Kent County Council. We here propose a reconstruction of a supposed Saxon rebate plane modelled on the Ebbsfleet plane (Figure 4).[20]

In terms of the construction of the vestibule door, when the rebates were cut out on all the boards, holes were augered, equally spaced, four to a board, through the rebates to receive location pegs (Figures 23 and 24). These held the rebates inline and together when the boards were assembled on the bench or trestles. With this done, the next step was to clean up both faces by removing the saw marks with a curved shave (Figures 18 and 19) or a plane with a curved blade. Such a blade would be similar in profile to the Viking chisel, excavated at Skerne, near Driffield, in 1982 and now in the

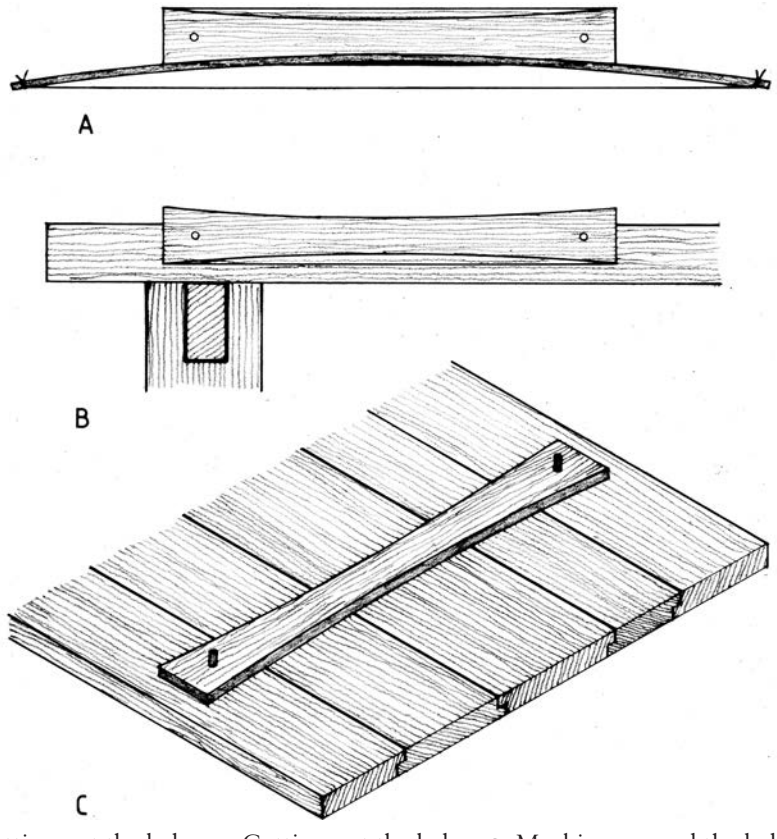
[18] Goodman (1959).
[19] Goodman (1978), p. 55. Williams (2011), pp. 41–3.
[20] Williams (2011), pp. 41–3.

9 and 10 Replica of the Anglo-Saxon plane from Sarre, made by Peter Massey. *Photo Peter Massey*

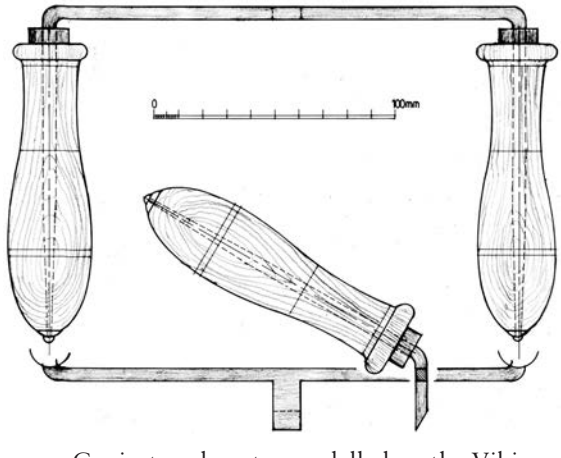
Hull and East Riding Museum collection (Figure 15). This process is visible where the distinctive, slightly concave toolmarks pass over both boards, and is seen on both sides of the door (Figure 16). These tool marks have only survived through being protected by the hide or leather covering for hundreds of years.

LETTING IN THE LEDGES

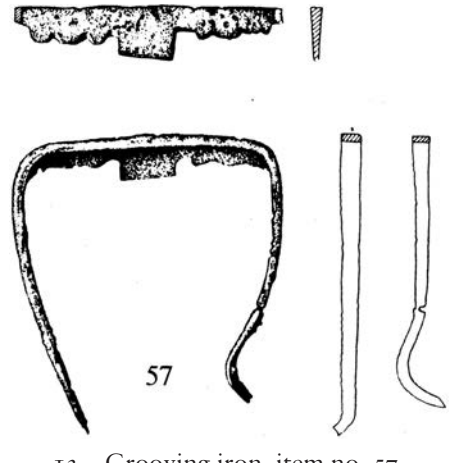
The flush ledges are slightly bowed along their length, 140 mm wide at the edges diminishing to 90 mm in the centre. The next stage would have been to let in the ledges. The surviving ledges are quarter-sawn or riven, and the medullary rays are present on the face. The ledges are very precisely made from well-seasoned oak, free from knots



11 A: Setting out the ledge. B: Cutting out the ledge. C: Marking around the ledge on the assembled door planks. *Drawn by Paul Reed*



12 Conjectured router modelled on the Viking grooving iron no. 57, Mästermyr Find. *Drawn by Paul Reed*



13 Grooving iron, item no. 57, Mästermyr Find. *Nordiska Museet*

14 (left) Chisel marks on the top of the vestibule door. *Photo Paul Reed*

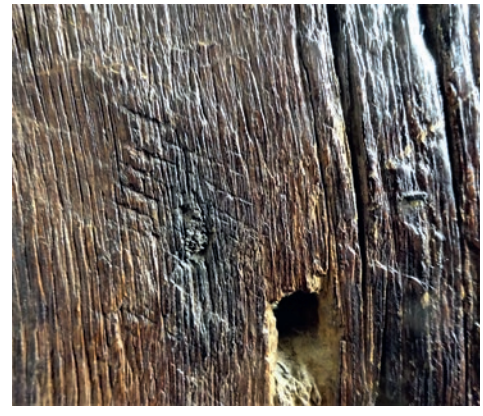
15 (above) Viking split-socketed iron chisel, excavated at Cleaves Farm, Skerne, 1982. *Hull & East Riding Museum, KINCM: 1984.58.3.*

(Figures 1, 11 and 31). The ledges are made from a flat board 15 mm thick, 140 mm wide, and 1100 mm long, that is, about 150 mm shorter than the width of the original door. The long sides of the surviving centre ledge are concave, creating dovetail ends that are square and neatly finished, possibly by a handsaw (Figure 20). The centre ledge, being curved along its length, was probably set out with a straight-grained lath made into a bow, secured with a cord, and marked out along the edge of the lath with a sharp knife to produce a clear curved line on the face of the ledge (Figures 11A and 27). With the ledge board securely fixed on edge on the side of the bench or trestle using the peg holes in the ledge itself (Figure 11B), the marked-out curved score lines were cut out, using a small hand sideaxe, or a mallet and chisel, or a saw to remove the waste (Figures 28 and 29), and then finished with a drawknife to leave a square edge (Figures 11B and 30). The housed, or let-in, ledge on the bottom of the door has straight sides which could indicate that this ledge has been replaced and is not original. This ledge also has a recent repair (Figure 2).

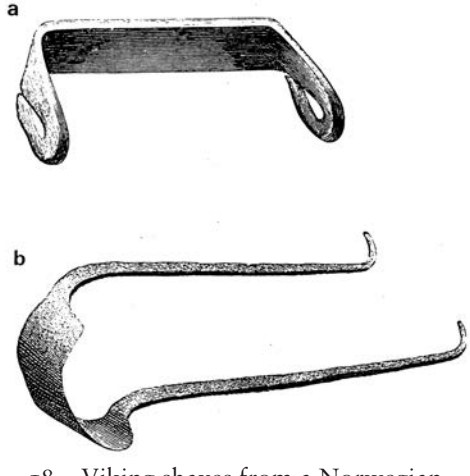
The ledges would then have been used as templates, their outlines scored using a knife, and the trenches to receive them made using a chisel (Figure 11C). The original recess at the top of the door, exposed when it was shortened in the thirteenth century, provides clear evidence of marks made by a chisel with rounded corners and a very sharp cutting blade, 40 mm wide (Figure 14). Such chisels from archaeological contexts include the Skerne example and others now at the Maidstone Museum, the Jorvik Viking Centre and the National Archaeological Museum, Dublin. Hewett mentions that 'the housing was cut out with some kind of cutting gauge to cut the radii of the socket recess edges to the correct depth', assuming the carpenter making the door had the room and provision to make a large-radius cutting tool.[21] Hewett obviously had not seen the chisel marks at the top of the door.

[21] Hewett (1980), p. 26; McGrail (1982), p. 343; Hewett (1978), p. 214.

16 Tool marks seen going across the boards to remove the saw marks. *Photo Paul Reed*



17 Saw marks missed by the finishing tool. *Photo Paul Reed*



18 Viking shaves from a Norwegian grave. *Drawn by Arne Christensen*

19 Shave made for the production of the replica door. *Photo Peter Massey*

The recessed edges of the housing have been formed using a chisel and a router (Figures 12 and 34). There is no evidence of a Saxon router, but the Vikings did use a grooving/moulding iron, similar in shape to a drawknife, to make the depth of the housing floor base consistent and flat (Figure 13).[22] This flat surface is seen at the top of the door where the ledge has been removed (Figure 14 and 33). The carpenter has fitted the ledges very precisely; even today there is no gap between the ledge and the boards of the door (Figures 6 and 7). Once the ledge was let into the door, the remaining pegs were inserted into the ledges and boards. The door was then turned over on the bench and the two remaining ledges were fixed as described above. We could find no end-wedging to the pegs securing the ledges, as shown in Cecil Hewett's

[22] Arwidsson and Berg (1982), item 57, plate 13.

drawing.[23] In the case of the bottom ledge, the pegs securing it go right through the door, which indicating a repair; the pegs securing the central ledge do not go right through, which must mean this ledge is original. These pegs could have been fox-wedged (Figure 35) or it may be that some kind of adhesive was used.[24] Glue may have been used to adhere leather to the faces of doors and in the making of shields.[25]

THE DOORHEAD RADIUS

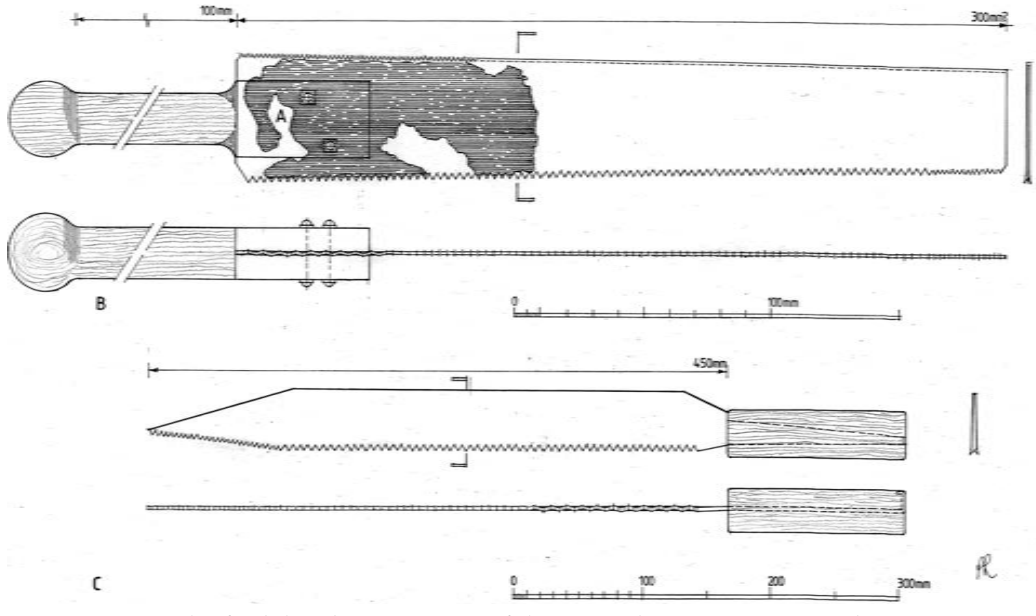
The most likely method used to set out the original radius head of the door involved two nails and a piece of lath or string. One nail was tacked into the centre of the door and the other was attached to the lath or string so that a radius could be scored into the door planks. The surplus timber could have been removed with a narrow-bladed handsaw similar to that found at Mästermyr, Gotland, Sweden (Figure 29).[26] Alternatively, the waste timber could have been removed using a very sharp side axe, or a chisel with a mallet. The final finishing of the radius to the doorhead would have been completed with a drawknife.

FINISHING THE DOOR

Finally, with the ledges fixed in place on both front and rear sides, the original ironwork was fixed after it was covered in leather. There is clear evidence that the surface of the tooled finish of the boards was rubbed over across the grain with a piece of coarse sandstone acting as an abrasive to remove any highpoints (the same treatment a carpenter would apply today to smooth the surface of the timber with glass paper). Once the carpenter had made a very neat finish on the door and all the timber components were fitted very precisely. Could his intention have been for the door to be decorated without the need for it to be covered with leather?

The Saxo-Norman north door at the Church of St Botolph at Hadstock, Essex, is similar to the Abbey door.[27] It has continued splayed rebated planks, is flush on one side, was covered with hide or leather, and could have been painted like the vestibule door. The door at All Saints Church at Staplehurst in Kent (*c.* 1100) also has rebated boards. The pattern of the medullary rays indicates that these boards were radially sawn.[28] The authors have inspected this door and found some evidence of possible saw marks surviving on the interior bottom right hand side plank. This door, like the one at Hadstock, has 'D' ledges fixed with clenched roves. Once again, a plane and a rebate plane must have been used. Another early door of *c.* 1140 at Kempley church in Gloucestershire, has counter-rebated boards suggesting that a plane, a rebate plane and a chisel must have been used. Hewett drew the door with parallel boards each with three slip or loose tenons, whereas the door actually has tapered boards with four

[23] Hewett (1978), pp. 214–16; (1980), p. 25 showing pegs end wedged; (1982), p. 344, same drawing pegs not wedged?
[24] Fern (2019), p. &. Jewels were secured to items in the Staffordshire Hoard with animal glue containing beeswax.
[25] Rodwell (2012), p. 45. Underwood (1998), p.79.
[26] Arwidsson and Berg (1982), p. &. Saw no. 42. Goodman (1964), p. 123.
[27] Bridge and Miles (2012), pp. 73-4; Hewett (1980), pp. 21–3.
[28] Geddes (1999), p. 27. Harrison (2007), p. 53.

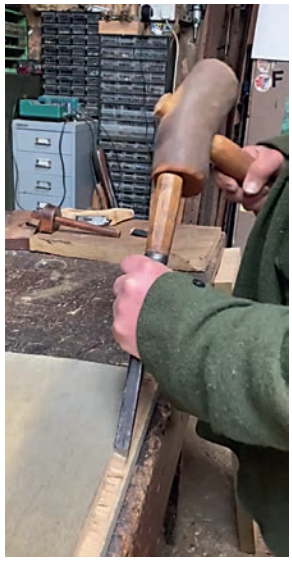


20 A: Saxon 'Thetford' handsaw: remains of the original saw; B: Conjectural reconstruction; C: the Viking handsaw, Mästermyr Find, Sweden. *Drawn by Paul Reed*

slip tenons as identified by Bridge and Miles.[29] Also, the Hadstock church has three Saxon timber windows with tenons secured with pegs on chamfered stiles set into a morticed arched head and a sill member.[30] This is another good example of Anglo-Saxon carpentry/joinery where a bench must have been used.

It is the belief of the authors, that the Anglo-Saxon carpenter not only had a full kit of tools but was capable of making high-quality buildings, doors, windows and furniture. These tools, except for two types of axes and an auger, are not mentioned in archaeological reports because there is no recognised archaeological evidence that such tools were used.[31] However, the Abbey vestibule door is surviving proof that other tools were skilfully employed by Anglo-Saxon carpenters. A certain number of excavated Anglo-Saxon woodworking tools do exist: axes and adzes, claw hammers, augers and drawknives etc. The British Museum in London, the East Riding Museum in Hull, and the Jorvik Viking Centre in York have many examples of Saxon and Viking woodworking tools.[32] In Norwich Castle Museum there is the handsaw from Thetford (Figure 20A).[33] In the Oslo Museum there are Viking handsaws with set teeth (Figure 20C).[34] It is also pertinent to note Hewett's observation that Cuthbert's coffin,

[29] Hewett (1980), p. 46, fig.41, and p. 57. Miles, Worthington and Grove dendrochronology Report 36/99 5.
[30] Hewett (1980), p. 211 and p. 213; Rodwell (2012), p. 22; Rodwell (2012), *Archaeology of Churches*, p. 147.
[31] Goodburn (2007), p. 302.Darrah (2009), p. 98, has included three other tools: chisel, adze and twybil.
[32] Hull Museum Cat. Ref. KINCM:1984.58.3 (Split-socket iron chisel excavated at Cleaves Farm, Skerne, North Yorkshire, 1982); Morris (&&&&), p. 2109.
[33] Rogerson and Dallas (1984), p. 78. NWHCM:1950.12.887.
[34] Arwidsson and Berg (1982), saw no.41.



21 (far left) Setting out the rebates. *Photo E. Massey*

22 (left) Cutting out the rebates using a chisel. *Photo E. Massey*

made in 698 and today displayed in Durham Cathedral, was made using a handsaw which left visible kerf marks, and that possibly a chisel, a router and a rebate plane were also used.[35]

MAKING A SAMPLE REPLICA OF THE DOOR

Peter Massey, one of the authors, has made a sample replica of the vestibule door as a demonstration example of how this door was made, using a combination of modern and replica tools. A gauge is used to set out the rebate on the edge and the side of the door board using the centre of the board as a measurement. The gauge is a very simple tool which could have an adjustable fence, as here (Figure 21), or a fixed fence with a sharp nail used as a marker. The gauge would also be used to measure the width of the boards to ensure they are parallel. When the rebates have been set out, the board is laid on the bench and held in place using pegs with wedges to prevent the board from moving about while the rebates are cut out with a chisel (Figures 5 and 22). A rebate plane could do the same job, and the authors are convinced the Saxon plane makers could have made a rebate plane (Figure 4). We assume that bench vices were not in use during this period.

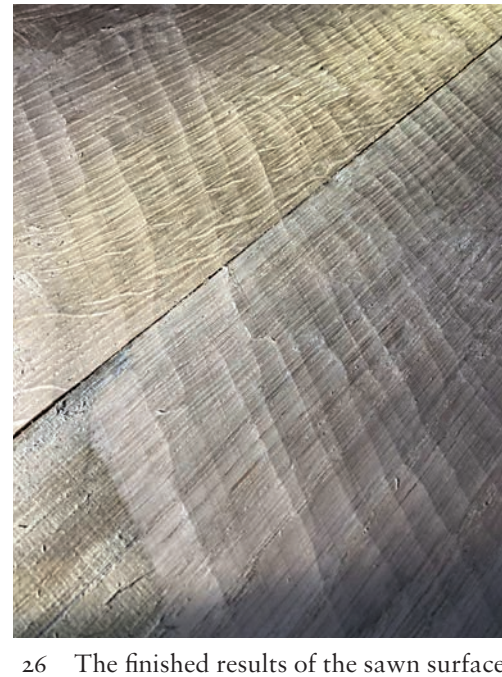
The next stage is marking out the peg holes on the boards to be joined and inserting the location pegs (Figures 23 and 24). If set out accurately, the boards will fit perfectly, as seen on the original door. It was decided to cut the rebates first and then set out and sink the holes for the location pegs after the rebates were produced, as was done on the original door. However, it would be possible to sink the peg hole first before running out the rebates. Once the boards have been assembled and secured on the

[35] Hewett (1982), pp 339–41. However, in a report written in 1978, Hewett did not mention saw kerf marks. Cronyn and Horie (1985), Appendix 7 (1978), pp. 65–7.

23 Setting out the location pegs. *Photo E. Massey*

24 The peg hole is made with a shell auger to receive the location peg. *Photo by E. Massey*

25 Shave in use. *Photo E. Massey*



26 The finished results of the sawn surface of the door boards. *Photo E. Massey*

bench, they are cleaned up using a shave to remove the saw marks on the surface of the planks (Figures 25 and 26). For this task Peter made a replica shave, adapting a modern shave by re-forging the modern blade into a shape that would replicate the historic tool marks on the original door (Figure 19).

A suitable board is then selected for the ledge, free from knots, quarter-sawn and planed up to the right thickness throughout. The board is laid out flat on the bench, and the concave radii set out (Figure 11A). This is a simple process using just a piece

27 The radius is made with a bow and scored with a knife. *Photo E. Massey*

28 Waste is removed with a side axe. *Photo E. Massey*

of string and a lath to make a bow. A large radius, described by Hewett, is not necessary.[36] The ledge board is cut to length with square ends using a handsaw. The bow is lined up on both ends of the ledge board and the radius is scored on the boards with a sharp knife (Figure 27). When both sides of the ledge board have been radius-scored, the waste is removed using a hand side axe (Figure 28). It could equally be removed using a saw (Figure 29). The edges are finished with a draw knife (Figure 30). Two holes are augered towards the ends of the ledge so that it can be securely held in place with temporary pegs and the boards of the door are scored with a sharp knife around the edges of the ledge to mark the area where it is to be let in. This has to be done very accurately so the ledge will fit tightly. On the original door, one can see where the carpenter has over-scored with his knife (Figure 6).

The ledge is removed (Figure 31) and the edge of the housing is carefully cut following the scored line, and the remaining waste is removed with the chisel (Figure 32). When all the waste has been removed, a router is used to cut out the bottom of the housing to the required depth. Peter used a granny-tooth router with a narrow blade (Figure 34). A sample of the ledge, a small piece of the same thickness, is used to check the depth of the housing. The marks of the router can be clearly seen on the original door (Figure 33). Finally, letting in the ledge, it has to fit perfectly as it would be impossible to remove for the purposes of adjustment without damaging the edges of the housing; fit once – precision carpentry.

On the original door the centre ledge was affixed to each of the outer boards with two pegs and to each of the three interior boards with a single peg. The pegs are blind,

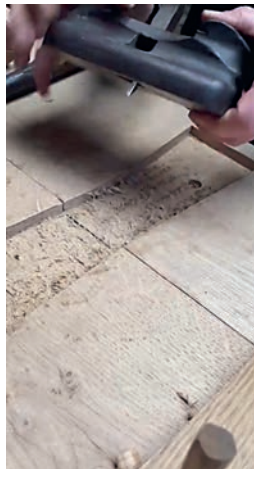
[36] Hewett (1978), p. 214: (1980), p.26; (1982), p.343, in Sean McGrail.

29 Cutting out the waste using a saw.
Photo E. Massey

30 Truing up the edges with a draw knife.
Photo E. Massey

31 Showing the scored outline of the ledge.
Photo E. Massey

32 Cutting out the housing with a chisel.
Photo E. Massey


33 (left) Marks of router on the original door. *Photo Paul Reed*
34 (middle) Routering out the housing. *Photo E. Massey*
35 (right) Fox wedging. *Photo E. Massey*

meaning they do not go right through the board. The pegs remain tight in their holes, continuing to secure the ledge in its housing. The Saxon carpenter may have used some kind of glue to secure the pegs but the other likely explanation is that the pegs were fox-wedged. This is where the end of the peg has a fine cut in the end and a wedge inserted, so that when the peg is driven into the hole, the wedge forces the end of the peg to open out and bite into the wall of the peg hole, preventing it from coming out (Figure 35). To secure the ledge the peg would also have to be slightly tapered so that the ledge could not come away from the peg. Again, understanding, experience and accuracy would be required to achieve this mechanical fixing.

SUMMARY

This Abbey vestibule door is a very rare surviving sample of Anglo-Saxon carpentry/joinery showing very high-quality woodwork that is nearly 1000 years old. The construction is uniquely different from other medieval doors found in the British Isles in that the ledges are flush on both sides. As the door was covered in leather and decorated, it is very likely to have been high status. Our study strongly suggests that its makers had access to a much wider range of tools than merely axes and augers. The Old English word 'sage' meant 'saw'.[37] This alone suggests that Saxon carpenters were familiar with saws. The vestibule door has been dated by dendrochronology to *c.* 1032–64, making it possibly the oldest remaining Anglo-Saxon door, with the Saxo-Norman Hadstock door, *c.* 1050–75, being the second oldest.[38] (Additionally, the fragmentary remains of a ninth or tenth century door were excavated at Pudding Lane

[37] Recent correspondence with Christine Rauer, Reader in Medieval English, University of St Andrews, Scotland.
[38] Miles and Bridge (2012), pp. 77–8; Rodwell (2012), pp 43–4.

36 Completed replica sample of the vestibule door by Peter Massey. *Photo E. Massey*

in the City of London in 1979–82, in building PDN5.[39] This door consisted of four vertical boards secured on the internal face by eleven or more diagonal ledges, the structure largely evident from the nail-work that remained from the time that it had been abandoned in a horizontal position.) It is quite clear that the vestibule door did not belong to the apparently Norman school of door makers which used rove fixed ledges, wedged ledges or counter-rebated planks. The only possible link could be the continuous rebated planks, but the method of fixing the ledges is completely different. The vestibule door is in a school of its own, to be recognised as Anglo-Saxon and unrelated to Norman influences.

Anglo-Saxon timber buildings, doors, windows and furniture were built by carpenters having knowledge of setting out using a line and plumb bob, making mortice and tenon joints, lap-halving (possibly notched lap/dovetail) joints, tongue-and-groove joints and housing joints (as used on Cuthbert's coffin), and matched rebates using timber location pegs to hold timbers together as found on the vestibule door). They were able to split or saw logs to make planks and had the knowledge to season timber, square up logs with hewing broad-axes, and make roof shingles. The following tools were employed on the vestibule door: plane (Figures 8–10), rebate plane (Figure 4), an auger, mallet and chisel (Figure 15), a router (Figure 12), possibly a handsaw to trim the ends of the boards and the ledges (Figure 19), a shave or plane

[39] Horsman, Milne and Milne (1988), pp. 88–91. This door was 2.3 m high, 80 cm wide and 50 mm thick, with boards 35 mm thick.

to remove the saw marks from the face of the door (Figure 20), a drawknife (Figure 30), an adze, a hand side-axe (Figure 28), very likely a square for setting out boards and ledges, a flick line, an auger to make the peg holes and finally the use of a bench (Figure 5) or trestles in a workshop. For timber conversion the woodman would have needed a felling axe, a lopping axe and a frame saw that was used to saw the planks from the log, probably on trestles or over a saw-pit or by adopting the see-saw method following the flick line as a guide. The rake of the saw marks on the door boards is about 55°, as found on see-sawn timbers.[40] For lifting heavy logs or timbers, pulleys and ropes would have been required. Taken together this represents a very good toolkit indeed for a carpenter. We believe our study provides compelling evidence that Anglo-Saxon carpenters were highly skilled craftsmen, who were more than capable of precision setting out and assembly, and making and adapting tools to do specific jobs, as demonstrated by Peter Massey in making the replica sample of the vestibule door.

However, there were very likely three roles for the carpenter/woodworker in Anglo-Saxon times. There were woodworkers who constructed domestic buildings and waterfront structures using the tools described by Goodburn and Darrah. Then there were carpenters who constructed high-status buildings for wealthy nobility — for example, Yeavering and Cowdery's Down — for the monarchy and the Church; these craftsmen very likely had the use of high-quality tools such as saws and planes.[41] Finally, there were carpenters who could also make high-status doors, windows and furniture, and who understood timber seasoning and used saws and planes — craftsmen we would call joiners and cabinet makers today. Goodburn has stated that 'the earliest example of timber framing or 'carpentry' in London occurs in the late 12th century (1180) and at the London Guildhall site there is no archaeological evidence for its use until the 13th century.'[42] It is our view that this cannot be the case, and that the English school of carpentry was well established before the Normans arrived in 1066. It is also plausible that Anglo-Saxon carpenters with a full range of tools and skill at their disposal could have progressed from earth-fast structures to braced, box-frame structures fixed above ground on sole plates supported on masonry using well-jointed posts, tie-beams and framed roofs.[43] Such framing technology could in fact have been developed prior to the currently accepted date of introduction, from the continent, *c.* 1180–1200.

ACKNOWLEDGEMENTS

We would like to thank the Dean and Chapter of Westminster Abbey, the Abbey Archaeologist, Dr Warwick Rodwell, and the Surveyor of the Fabric, Ptolemy Dean, for granting access to conduct this study, and the Abbey conservation department for providing lighting and equipment so that we could carry out our study effectively. We

[40] James (2012), p. 7.
[41] Yeavering: Hope-Taylor (1977), p. 38, close plank walling; p. 121, theatre; p. 126, building A2. Cowdery's Down: Millett and James (1983), p. 231 and p. 234, examples of wall type.
[42] Bowsher and Dyson, et.al (2007), p. 308.
[43] Darrah (2009), pp. 96–108, showing the use of sole plates with let-in bracing and housing joints, as used in later medieval roof and frame construction; Armstrong (1991), showing continued construction at Beverley from 930–1600 AD, from earth-fast structures adapted to isle posts on padstones to timber-frame structures on soleplates.

are grateful to Angela Thomas and Warwick Rodwell for providing copies of the drawings of the door to aid us with our study. We would also like to thank Dr Dan Miles and Dr Martin Bridge for discussions about the door and Dr Damian Goodburn in correspondence regarding his theory on early medieval woodworking. Dr Christine Rauer, Reader in Medieval English at the University of St Andrews, kindly confirmed not only the Saxon name for 'saw' but the apparent absence of an Anglo-Saxon equivalent for 'woodworker/carpenter'. Katie Meheux, University College London, Department of Archaeology Library, kindly sourced references during the Covid 19 pandemic. We must thank Hull and East Riding Museum for permission to use the image of the Viking chisel and Robert Williams kindly shared his photo of the Ebbsfleet plane. Thanks to Roger Bunney for his support and advice. We also thank Julian Beecroft and Stephen Jackson for editing this article.

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