Dendrochronologically Dated Doors in Great Britain

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The wooden doors of castles, churches and grand houses have fulfilled several simultaneous roles. They have often had to withstand violent attack, and at the same time, convey the status of the building by their sturdiness and decoration. Their construction was therefore a demanding task for Saxon and medieval carpenters, and today we can see examples of many different design solutions to the same basic requirement, each representing a different level of technological development and understanding. In one respect, they are more akin to furniture than structural carpentry, and because they tend to use better quality oak, they actually have better dendrochronological potential than most structural elements from timber framed buildings. Often, the oak will be of the finest imported boards from the Baltic region, and almost invariably this material will be quarter sawn or riven, again giving the most optimal ring sequences. Tracy reminds us that there must sometimes have been a productive collaboration between door-maker and mason, especially with regard to decoration. Occasionally other wood is used, Rackham noting the use of imported pine boards for a tower door in the church at Lakenheath, Suffolk, believed to date to the thirteenth century.

Too often the historical significance of doors has been overlooked, as at Chepstow Castle where the doors in the gatehouse were removed in the 1960s and stored, only to be threatened with disposal in the early 1990s. Happily, they were kept and dendrochronological dating confirms they were made from trees felled in the 12th century. This gave new evidence for the use of sawing in Britain in the post-Roman period, and for the apparent importation of jointing styles from the Mediterranean. Little on the evolution of door types has been written, although Hewett produced some useful guidelines with a suggested chronological framework, often making the assumption that the extant doors are original to the buildings which are stylistically dated, without any certain knowledge of this. He suggested that the skills employed in shipbuilding were shown in early doors; for example, the use of boards fitted to round stiles by iron lozenge-shaped roves and rivets, such as those at Hadstock (Figure 1) and Buttsbury (both in Essex), perhaps setting their makers apart from those more usually found constructing the rest of the timber-framed or stone buildings with which they are associated. A fuller appreciation of this subject can only really take place when the doors themselves are independently dated and a valid timeframe for each door is therefore available. Some progress towards this came with the publication of Geddes’s book which provided a great deal of information concerning the evolution of the ironwork.

1 Hewett and Gibson (1993).
2 Tracy (2008).
5 Hewett (1982), pp. 78–94.
of doors, and which gave a testable chronology for many door types.\textsuperscript{6} The problem here, of course, is that the ironwork can be re-used on later woodwork, as has proved to be the case at Rainham (Essex), where the undoubted twelfth-century ironwork is applied to a door, the outer boards of which have been dated to the late fourteenth- or early fifteenth-century.\textsuperscript{7}

This paper brings together as many dendrochronologically dated doors in Britain as could be identified from the literature and from asking our tree-ring dating colleagues for their input. Some of the examples are referred to as gates, but this distinction seems to be somewhat arbitrary, and is not discussed further here. There are of course other doors studied abroad, which help put these studies in a wider context, for instance the 1974 study of Romanesque doors in the Auvergne (none of which have been dendrochronologically dated as far as is known), and the Swedish ‘picture door’, a pine church door with elaborate ironwork, tree-ring dated to 1275.\textsuperscript{8} Many other doors are effectively dated by virtue of being thought original to their current position, where

\textsuperscript{6} Geddes (1999).
\textsuperscript{7} Bridge and Miles (2009).
\textsuperscript{8} Cahn (1974); Nordanskog (2006).
that context is firmly dated, and whilst these are invaluable in any discussion of the evolution and understanding of doors, these have not been included here as they have not had their dating independently verified.

As with the recent review of dendrochronologically-dated English chests, published in this Journal in 2011, the individual dating projects are often either only available through unpublished laboratory reports, or specialist report series, such as those produced by English Heritage, and not in widely distributed publications.

The main problem in conducting dendrochronological research on doors is to obtain samples from which the tree-ring sequences can be read. The various methodologies employed in gaining the raw ring-width data are broadly the same as were discussed by Bridge and Miles in 2011 — with the use of a hand-held graticule, photography, impressions taken using modelling clay, and more recently the use of a specialist micro-borer. This latter device is particularly suitable for doors constructed of a series of boards or planks in that one small hole in the side of the door can obtain successive cores from many boards with minimum intervention. The main problem is that centuries of fixings, repairs, holes, and splits makes finding a clear path through not just one but many boards challenging. V-edged boards are also problematic in that the outer 20 or 30 years may not be possible to be cored due to the orientation of the V-edges near the face of the door. In addition, the nature of the objects under study often means that the lower boards become rotten in use, and it is common to find that repairs have to be made. When the old boards are cut back to solid wood, this may allow the opportunity to take an additional thin cross-section which can be sanded to reveal the ring sequence. This was recently used at Christ Church, Oxford, with great success, but it relied entirely on good co-ordination between the College and the laboratory well in advance of the proposed repairs. It is frustrating to be called into a building to date a door only to discover that it had already been dismantled and major repairs carried out, with the off-cuts being disposed of.

It is important that samples are taken without visually defacing the door; this should be left to experienced woodworkers or dendrochronologists. So long as the door is not visually damaged, Listed Building Consent is not normally required. However, Scheduled Monument Consent is required for any intervention in certain National Monuments, and it is best to check with a dendrochronologist or English Heritage in the first instance.

Once samples can be obtained and ring sequences derived, the cross-matching and dating of the material is routine. However, like the chests summarised last year, interpretation of these results can be problematic. Rarely does any sapwood survive, certainly not bark edge (although amazingly complete sapwood was found on one of the Whittington Castle gates), and even the heartwood/sapwood boundaries are lacking on many doors. Thus it is imperative that as many boards are sampled as possible to see how consistent the last heartwood rings’ dates are. Generally the last measured ring dates fall within a cluster of a couple of decades, allowing for a simple interpretation that only the sapwood and a minimum number of heartwood rings were removed when converting the tree, allowing for a reasonably close estimate of rings lost to the bark edge. Baltic boards are also better suited for this as they have about half the

9 Bridge and Miles (2011).
maximum number of sapwood rings as home-grown oak, generally between 8 and 24 years.\(^{10}\) A textbook example of this can be found at Westminster Abbey, where a series of boards produced last measured ring dates of between 1263 and 1275, which accords well with the historically attributed date shortly after a documented burglary in 1303. However, this is not always the case. This can be best illustrated by the example from Christ Church, Oxford, where a single board was initially dated with no heartwood/sapwood transition, giving a last measured ring date of 1356, producing a *terminus post quem* of 1364, and suggesting a construction date in the late fourteenth century. The rest of the board offcuts were then analysed and all six boards dated, giving last measured ring dates of 1233, 1356, 1370, 1385, 1420, and 1433. This latest date had a clear heartwood/sapwood boundary, producing a felling date range of 1441–57, changing significantly the interpretation. Had only the earliest board with a last measured ring date of 1233 been dated, then the interpretation could well be two centuries out.

**CATALOGUE OF DENDROCHRONOLOGICALLY DATED DOORS IN BRITAIN IN CHRONOLOGICAL ORDER**


   This remarkable survival (Figure 2) was excavated recently in the City of London. It has been dendrochronologically dated to the period 53–89 AD, but the context suggests it probably dates to around 70 AD. It consists of three boards with a narrow stile down one side, and four ledges nailed across it.


   This door (Figure 3) is constructed of five oak boards of varying widths. Close inspection reveals that they were all converted tangentially by sawing through and through, and not ‘cut on the quarter’ as had been suggested by Hewett, who recognised this as

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\(^{10}\) Tyers (2000).
one of the earliest doors still in use. The seasoned boards were rebated and edge-pegged, being held together by three flush inset ledges, one each at the top and bottom of the back, and one in the centre on the front, maintaining a smooth surface on both sides. The door has been altered and reduced in width by at least four inches (100 mm). The average heartwood/sapwood boundary date for two boards was 1023, giving a likely felling date range of 1032–64, and it is thought likely to date from around 1050 when Edward the Confessor was carrying out work in the Abbey. This is the earliest example of post-Roman square-rebated boards and sawn boards, which had previously thought to have been introduced by the Normans about a century later.

3. North door, St Botolph’s Church, Hadstock, Essex (Bridge and Miles 2003; Miles et al. 2004)

This door was recognised by Hewett as of probable Anglo-Saxon origin and was described by both him and Geddes. The splayed-edge joints and details of the D-section ledges and their attachment using nails and roves in the shipbuilding tradition are illustrated in figure 1. All four boards were found to have come from the same tree, which itself was over 400 years old when felled. With no sapwood on any of the boards it is not possible to give a felling date range for the tree used for the door. The latest sequence had an estimated date of 1025 for the last heartwood ring. This is derived by

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12 Damian Goodburn, personal communication.
taking the date of 977 from the last actual ring obtained on the core and adding to it a detached section of 12 rings which was not measured, as well as the likely number of missing rings, based on measurements of the board and the core. The board was cored to within 40mm of its outer edge, this being the equivalent of 36 rings given the average ring-width in the outer section. Adding the minimum likely number of sapwood rings (9) gives a terminus post quem or earliest possible felling date of after 1034. It is thought to date to the period 1050–75 in accordance with the arch in which it hangs.\textsuperscript{14}

4. \textit{Gundulf Door, Rochester Cathedral} (Miles \textit{2002a}; Miles and Worthington \textit{2002})

A four-board door made for a narrow flat-topped doorway, it has since been extended and reversed, with the addition of nine horizontal boards. The boards are rebated. There are two rows of 7/16” (11 mm) dowels, spaced 20” (590 mm) apart, through the rebates, connecting the boards, which were originally nailed through the overlapping part of the rebate. The rebates themselves had an undercut bevel of approximately 19°, but only on the outside face. The boards had not been seasoned, as evidenced by the shrinkage after being made into the door. The ironwork on the door is discussed in detail by Geddes.\textsuperscript{15} The likely felling date range for the tree which was the source of three of the boards is 1075–1108, with the fourth board coming from a tree at least 300 years old when felled. Gundulf was Bishop of Rochester from 1077–1108.

5. \textit{St Peter’s Church, Old Woking} (Moir \textit{2008})

A door of four unequal width counter-rebated boards with no wooden frame. The door is held together by iron bands on the front and rear, the ironwork suggesting a date of 1100–25.\textsuperscript{16} The tree-ring date is given as 1106–38.

6. \textit{South and North Nave Doors, Durham Cathedral} (Caple et al. \textit{1999})

The leaves of the doors are composed of a series of substantial oak planks, around 2\frac{1}{2} ins (60 mm) thick and nearly 18 ft (6 m) long, each with a groove cut in the sides holding free tongues, or tenons, running the length of the door. All eight planks used in both doors are likely to have been derived from the same tree. Three thin tapering horizontal ledges on the rear hold the vertical planks together. These are of near semi-circular cross-section, attached by sliding them into shallow dovetailed grooves cut across the full width of the planks. Small raised vertical mouldings have been added on the north door to cover the long vertical joins between the planks, but their mainly decorative function is shown by the fact that the spacing is kept constant even where the boards vary in width. The north door has had a smaller wicket cut into the east leaf, whilst the west leaf of the south door has been cut horizontally to produce a smaller more convenient door for entry into the cloister. There was some thought that the doors may have been replaced following disturbances in the cathedral during the Civil War, but tree-ring dating established a likely felling date range for the tree of 1109–44, with a likely date range being derived from the known history of the building of the nave making their construction most likely to fall in the range 1128–33.

\textsuperscript{14} Fernie \textit{(1983)}.

\textsuperscript{15} Geddes \textit{(1999)}, pp. 362–63; Geddes \textit{(2006)}.

\textsuperscript{16} Geddes \textit{(1999)}, p. 357.
7. **West Door, St Mary’s Church, Kempley, Gloucestershire (Miles et al. 1999)**

The door comprises three vertical oak boards, originally fastened together with four slip-tenons per joint (although Hewett only illustrated three), and four bands of iron on the outside face (Figure 4).\(^{17}\) Three boards were tapered to reflect the thickening of the tree towards the butt end, the southern and middle board aligned with the butt end at the base of the door, with the north board being the other way up. The rear has been recently reinforced with horizontal boards screwed to the original boards. A likely felling date range of 1114–44 is given. Although not sampled, the south door is of similar construction and must be coeval.

8. **North Nave Door, St Mary’s Church, Buttsbury, Essex (Bridge and Miles 2010)**

Hewett wrote that this door (Figure 5) must be from the beginning of the eleventh century.\(^{18}\) The rounded ledges to which the outside boards are attached using nails and roves are similar in construction to the north door at Hadstock, and Geddes suggests the ironwork is mid-twelfth century.\(^{19}\) There are similarities with the hinges at Rainham (Essex), where the south chancel door has the same unusual arrangement of the ends

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\(^{17}\) Hewett (1980), Fig. 41, p. 46.

\(^{18}\) Hewett (1982), p. 79.

5 The north nave door, Buttsbury Church, Essex. The authors
of the hinges, where they fit around the pintles, they are horizontally aligned, rather than forged around the pintle (Figure 6). Buttsbury church itself has records going back to the 1190s. A *terminus post quem* of 1156 was derived, which accords well with the likely date of the ironwork at Rainham, dating from the 1170s.

9. Main gates to the Outer Bailey, Chepstow Castle, Monmouthshire (Miles and Worthington 1998)

The doors together measure approximately 9 ft (2.7 m) wide and 11 ft 11 ins (3.6 m) high (Figure 7). Each leaf is composed of an L-shaped substantial hanging style 12 ins (30 cm) wide and 5¼ ins (13 cm) thick. The boarding is of random widths between 6 ins (15 cm) and 12 ins (30 cm), with bevelled, rather than square edge jointing. There is no meeting stile, the boarding is simply square edged where it meets at the centre. At the back, the 5 ins (12.5 cm) hanging stiles are continued around the top of the semi-circular head in a top rail. The horizontal rails are jointed into the hanging stiles with well-executed bare-faced and haunched mortise and tenon joints, secured with octagonal ¾ in (1.8 cm) draw-bored pegs. These are the earliest examples of such important constructional joints in post-Roman British carpentry. Between the horizontal rails and the hanging stiles, diagonal lattice-braced ledges are fixed at approximately 6½ ins (16.3 cm) centres. The angle of the bracing is slightly higher above the locking rails than below them. The diagonal braces are halved over each other, the outer ones being
those running from the bottom centre, upwards and outwards. The outer boarding, hanging stiles and some of the diagonal ledges have been made from one or two large fast-grown oak trees, converted by sawing, with some planks having been cut tangentially. The majority of the lattice bracing, the locking rails and the arched heads were derived from several straight slow-grown oaks. The dating (1159–89) is significant in that it heralds the period of transition when new carpentry techniques are being introduced, possibly from southern France, which progressed rapidly such that by the mid-thirteenth century the simple lap joint had been largely replaced by the mortise and tenon.\textsuperscript{20}

\textsuperscript{20} Damian Goodburn, personal communication.
10. North Choir Aisle Door, Canterbury Cathedral (Fletcher 1981)
Last measured ring date of 1150, suggested date after 1175, following a fire at the cathedral in 1174.

11. Salisbury Cathedral, West Doors (Miles 2002b)
The west doors (Figure 8) are 12 ft 4 ins (3.7 m) high and 6 ft 5 ins (1.9 m) wide and have between six and seven boards with outer rings ranging from 1169 to 1208. The felling date range, given the absence of sapwood, is estimated to be between 1225 and 1275. The boards are wide, square-edged 1 in (25 mm) quarter-sawn oak boards mounted on a frame of fifteen diagonal ledges in each direction. The doors are hung by three large strap hinges sandwiched between the cross ledges. Nails are riveted on the back of the ledges with diamond-shaped roves. The oak is of Irish origin, and matched with other Irish material from earlier phases at the Cathedral with an unprecedented t-value of 31. As these doors have roves, it was thought that stylistically they dated to before 1250.

12. Stokesay Castle, Shropshire, Solar Undercroft Doors (Miles and Worthington 1997)
The door of the solar undercroft (Figure 9a and 9b) produced two felling date ranges from the doorposts: 1261–64 from the south inner post, and 1251–81 from the north inner door post. A photograph from a board to the door gave a last measured ring date of 1192 (205 rings) resulting in a terminus post quem of 1203. These are slightly earlier than the 1289 date for the solar roof above, and possibly from a slightly earlier phase.

13. Stokesay Castle, Shropshire, North Tower Undercroft Door (Miles and Worthington 1997)
These much repaired doors are shown in figure 10a and 10b. A photograph from the face of a single door plank had a last measured ring date of 1241, giving a terminus post quem date of 1252.
9a and 9b The front and rear of the door to the solar undercroft, Stokesay Castle, Shropshire. © English Heritage

10a and 10b The front and rear of the door to the north tower, Stokesay Castle, Shropshire. © English Heritage
Four boards were sampled from this door, which had lattice bracing on the back. Three of the boards were of English origin, two of which have felling dates of 1219–51 and 1229–61. Another English board gave a terminus post quem of 1219, and one Irish board gave a terminus post quem of 1182.

Nine timbers from this door (Figure 11) were sampled, including planks, stiles, rails, and noggins. Two groups of timbers were found, both English, and five of the samples had heartwood/sapwood boundaries, giving felling date ranges of 1223–55 and 1240–72. As this part of the cathedral was not completed until 1252, the construction date for this door would have been in the latter part of both ranges.
16. Westminster Abbey, North-East Vice Door, North Transept (Miles and Bridge 2005)

A door of four vertical feather-edged boards (Figure 12), two with in excess of 200 rings. The boards have a *terminus post quem* date of 1227, consistent with the likely construction date of *c.* 1250 for the surrounding masonry. The wood originates from Germany or the Netherlands.

17. Westminster Abbey, Chapter House Undercroft Door (Miles and Bridge 2005)

This door (Figure 13) is not in its original position, but has been cut-down to fit its current location. It consists of five vertical feather-edged boards with cross-braced ledges on the rear. It has an added hanging stile and a truncated top. Projection of the lines of the cross-braces reconstructs a door of approximately 4 ft (1.2 m) wide and just over 8 ft (2.4 m) high — with only one doorway within the Abbey fitting this, the side door to the west of the main north transept doors, and documentation later confirmed this. The original door dates to *c.* 1250 and uses oak of local origin.
This door was clearly made for its current location (Figure 14). It is constructed of vertical boarding attached to a portcullis frame with clenched nails and roves. The boards are edge-pegged with iron dowels. An interesting feature is the horizontal tongued end joint of the boards towards the top of the door where the boards were not long enough. The exterior face is heavily ornamented with ironwork, the scrolls and stamped decoration being characteristic of the mid-thirteenth century. The design and detailing of the undercroft suggests construction in the later 1250s or ’60s. The terminus post quem date of 1265 for one of the boards and earlier dates for the other three boards suggest the door was constructed very soon after 1265 from local timber.
These doors are very similar in construction (Figure 15), diagonal braces are used on the inside of the outer door, whereas the ledges are horizontal on the other faces. The fast-grown durns and muntins appear to be of local origin, whereas the boards are imported from the eastern Baltic. The outer rings of the boards cluster between 1266 and 1275 for the outer door, and 1263 and 1274 for the inner door, suggesting minimal loss of heartwood and a felling period of around 1300. This accords well with a documented burglary in 1303, and it seems likely these doors were put in place after that robbery. The later middle lock box added to the inner door was of English oak felled in the period 1595–1627.
The door consists of eight vertical feather-edged boards, the outer two on each side having curved tops to fit the doorway. These are nailed to a rear frame with six horizontal ledges with horizontal boards between to give a flush surface (Figure 16a and 16b). One front board was dated to after 1336, and the door is almost certainly original to the 1360s construction of the tower. The oak is of Baltic origin.

22. Westminster Abbey, Upper Passage Door to Chapter House Undercroft (Miles and Bridge 2005)

Viewed from the main body of the Abbey (Figure 17), the door has a series of seven vertical square-edged boards, clench-nailed in a square pattern to twelve horizontal boards on the back. It has a two-centred head. The boards are between 6 ins (15 cm) and 7 ins (17.5 cm) in width and are ¾ ins (20 mm) thick. The two layers of boards are nailed together by clenched nails in a 3 ins (7.5 cm) grid, some of which accidentally align with the joints in the boards. The oak is of eastern Baltic origin dated to after 1338.
Upper passage door to the Chapter House undercroft, Westminster Abbey. *The authors*
23. *Tower of London, Sub-Crypt Door* (Miles 2007)
This door (Figure 18) is constructed of three layers of Baltic boards (after 1346).

This door consists of five vertical boards about 1¼ to 1⅛ ins (3.0 to 3.5 cm) wide, except the board nearest the hinges, which is narrower. They are shaped at the top to match the Gothic arched doorway. The rear boards are horizontal, of the same thickness and about 10 ins (25 cm) wide. The door was thought to date to c. 1280, but the dating showed it to be after 1356, a mix of Baltic planks on the front and local timber on the rear.
25. Peterborough Cathedral, Precinct Door (Tyers and Parsons 2010)
The Great Gateway in which this two-leafed door sits is on the western edge of the cathedral precincts. The southern leaf has a wicket gate. The front boards are of riven oak, probably minimally trimmed. They are 11 to 11½ ins (28–29 cm) wide and of Baltic origin dated to after 1356. The inner boards could not be dated, but are thought to be later, and their faster-grown sequences suggest a more local origin. There are diagonal ledges notch-lapped into the frame.

26. St Peter’s Church, Barton on Humber, Lincolnshire, North Door (Tyers 2001)
This consists of two layers of boards, one horizontal and one vertical, riveted together with diamond-headed rivets. At some later stage an ogee-headed wicket gate has been cut through the door. Four series were measured, and no matching was found between them, but two series dated against eastern Baltic material, giving a felling date of after 1385, making this either a late fourteenth-century, or early fifteenth-century door.

27. Panelled door re-used as sheathing in Thames revetments (Goodburn 2009)
Little detail is given other than that several doors were found re-used as sheathing in revetments on the south bank of the River Thames near Fastolf Place and that one, described as a ‘large almost complete oak panelled door’ had a last heartwood ring date of 1386, giving a likely felling date after 1394, almost certainly dated by Ian Tyers. The timber came from the south-east Baltic region.

This door (Figure 19) has a documented date of 1397 which is supported by dendro dates of 1347, 1357, 1357 and 1360 for the outer rings of four boards dated. The timber is from the eastern Baltic. The building accounts are remarkably detailed, stating that 22 Waynscot, costing 3½d a board, were used in the construction of the two leaves, 300 ‘white’ nails used at 3s per hundred, and that 6s 8d was paid to the carpenter William Wys for fabricating the door. Other incidentals included glue for the door at 22d, a ‘great iron bar’ weighing 15 lbs at 2d per pound, and a lock costing 20d, adding up to a total of £1. 3s. 9d for the construction of both leaves. In studying the door, the quantities were found to correlate almost exactly for the boards and nails. The boards measured 1⅛ inches (29 mm) thick and between 10–12 ins (250–275 mm) wide and are square edged.

29. Church of St Helen and St Giles, Rainham, Essex, South Chancel Door (Bridge and Miles 2009)
The door has clearly been altered in the past, probably losing its lowest section at some stage. In its present form (Figure 20) it is approximately 28 ins (71 cm) wide by 8½ ins (206 cm) high. The outer (front) three boards are between 7 and 8¼ ins (18 and 21 cm) wide, and about 1¼ ins (30 mm) thick at one end, gently tapering to around ¾ ins (15 mm), before tapering more sharply in about the last inch (25 mm) to a near-point. The thicker ends contain similarly shaped grooves to receive the pointed end of the neighbouring board. The innermost board, closest to the hinge, hardly tapers at all. Seven rectangular ledges remain in place, and although difficult to see, these appear to be original. The rear of the door has much thinner boards, which also taper and fit
19 New College, Oxford, Bell-Tower door. The authors
into grooves on the adjacent board, and these have again been covered in much thicker boards. The outer boards have been heavily weathered, and the position of now moved or missing ironwork can be seen as ridges of less weathered material. The door is noted for its ironwork which dates to around 1170, and is unusual in that the ends of the hinges, where they fit onto the pintles, are horizontally aligned rather than forged around the pintle (as seen at Buttsbury), but the boards were found to be Baltic in origin and date to after 1385.

30. Muchelney Abbey, Somerset, Door to the cloisters (Bridge 2002)
The two leaves of this Gothic arched door were originally a single door. It bears applied tracery, which appears to have come from the same timber source as the boards. The last measured ring was formed in 1401 and is of local origin, giving a likely felling date after 1410.
31. York Minster, Zouche Chapel Door (Fletcher and Morgan 1981)
The pair of high arched doors which provide access to the Zouche Chapel from the south choir aisle have eleven horizontal boards on the chapel side which were dated, and five vertical boards on the choir side. The horizontal boards are all likely to have come from the same tree, the last measured ring being 1381, with a suggested likely felling date after 1405. Although not recognised at the time, the timber was of Baltic origin, and the felling date may therefore have been a few years earlier.

32. Christ Church, Oxford, King Charles’ Gate (Miles and Bridge unpublished)
Repairs to this gate by the College workshops allowed access to cross-sections of all six vertical boards which vary in width. These had unusual blunt V-edge profiles (Figure 21) and were dowelled together. Three horizontal ledges remained and a bottom board (with 285 rings) of eighteenth-century date was found (after 1700) which were of German origin. The original boards were of Baltic origin and one retained the heartwood/sapwood boundary, allowing a felling date range of 1441–57 to be derived.

33. Tower of London, Bottom Door to the North East Vice (Miles 2007)
Baltic timber felled after 1458. The outer layer of vertical oak boards, and inner layer of horizontal elm boards appear to be coeval.

34. Wells Cathedral, Outer Door to the Chapter House Undercroft (McDermott and Miles 2003)
This door is heavier than the inner door (Figure 14) and is constructed of vertical boarding on the outer side and horizontal boarding on the inner, held together with numerous clenched nails and roves. A *terminus post quem* date of 1456 is likely to be close to the actual date as extensive works were carried out by Bishop Thomas Bekynton (1443–65), and the timber is of local origin.

35. Prudhoe Castle, Northumberland (Arnold et al. 2002)
These gates had been assigned to the mid-fourteenth century on the basis of their style and carpentry, and in the early twentieth century it was suggested they belonged to the second quarter of the twelfth century, probably based on the round-headed gateway in which they sit. Tree-ring dating found a felling date for a ledge of 1459–84. Sir Walter Scott wrote in 1814 of the lattice on the open gate remaining, implying that the boards had been removed.\textsuperscript{21} The gates are portcullis-braced with the ledges dovetailed into

\textsuperscript{21} Discussed in Dower et al. (2004).
the hanging and opening stiles, which themselves are thicker than the ledges and uprights, so that the boards fit flush with the front of the stiles. The boards are butt-edged, the joints being covered by moulded ribs. Rectangular roves survive, and the left gate has had a wicket cut into it. The gates are illustrated in Dower et al (2004).

36. Muchelney Abbey, Somerset, Door to the Steward’s Room (Bridge 2002)
This door has a two-centred top with well finished exterior, the internal face being composed of six wide, diagonal boards of local origin. One of these boards matched with timbers of the doorhead, the last measured ring being formed in 1466. It seems likely this door is contemporaneous with the ceiling and roof over the room, which are of early sixteenth-century date.

37. Bede House, Lyddington, Rutland (Howard, in preparation)
Five internal doors have been dated in this English Heritage property, all dating to after 1484, and possibly of early sixteenth-century date.

The main gates into the property were thought to have thirteenth- or fourteenth-century work in them, perhaps because of the use of lap-jointed canted ledges, which are close parallels to those found in the Founder’s Tower of Magdalen College, Oxford. The gate leaves consist of a top, bottom, and moulded mid-rail into which muntins are jointed which have a deep hollow chamfer on the outside face (Figure 22). Each leaf has ten panels of fine-grained oak, five above and five below the mid-rail. The panels are flat on the back, but have a raised, slightly concave, bevel on the outer face, typical of the later Tudor period. The meeting stiles have a large half-round projecting tongue on the north meeting stile which fits into a corresponding hollow on the south leaf when closed together, creating an effective weather-seal. The design and execution of the gates are extremely sophisticated, and clearly reflected the high status of the bishopric of London. They were found to have frames made from local material, and vertical boards of Baltic origin dating to after 1495. The gateway itself was dated to the late 1490s.

39. Framlingham Castle, Suffolk, Main Gates (Bridge 2008)
The southern main entrance gates are of two leaves, the west leaf having a wicket gate within it (Figure 23). The boards are quite thick, probably just under 2” (50 mm). Dated 1496–1528, the oak used was of local origin.

40. Chepstow Castle, Monmouthshire, Upper Bailey Gate (Miles and Worthington 1998)
These gates consist of two layers of butt-edged 2¼ ins (57 mm) thick planks, the front being vertical and the rear horizontal, secured with large clenched spikes in a diamond pattern. There are three vertical planks per leaf, averaging 18 ins (45 cm) wide, which are butt-jointed with four sets of free-tenons between, and pegged with slightly over ½ in (14 mm) diameter pegs. The backing boards have been cut in an alternating overlapping fashion resulting in every other board protruding 2 ins (50 mm) beyond the outer edge of the door centre, with the intervening boards similarly recessed to
accommodate those from the opposite door leaf. The boards for both faces had come from large diameter trees, sawn through and through. Several different trees were used to provide the horizontal boards, and their often distorted growth patterns suggested the use of local hedgerow trees. Triangular loopholes, two per leaf, appear to have been cut through at a later date. These gates are dated to the first quarter of the sixteenth-century.

41. *Stokesay Castle, Shropshire, South Tower Door* (Miles and Worthington 1997)

Six panels from a panelled door from the South Tower (repaired in 1640/41) dated. These panels were found to originate from two trees of local origin giving *terminus post quern* dates of 1535 and 1541. Other panelling in the solar gave last measured ring dates of 1612–1628, suggesting that this door relates to an earlier phase of work.

42–44. *Stirling Castle, Stirling* (Crone 2008)

Three double-skinned doors with vertical boards on one face, and horizontal on the other. PD03 between the King’s Guard Hall and the Presence Chamber has six vertical boards, PE07 at the north end of the west gallery has nine vertical boards, and PD09 between the Queen’s Presence Chamber and the Queen’s Bedchamber has six vertical boards. All three are probably associated with the major building works of 1539, and the timber for all most likely came from south and east Poland.
45. Penrhos, Monmouthshire, Waun Farm (Bridge unpublished)

A rather humble door to an outbuilding (Figure 24) consisting of three wide and one narrow vertical boards, each gently tapering in thickness, and with splayed rebated joints. A \(4 \times 4\) grid of sixteen holes was drilled through one board, presumably to provide ventilation. The ends of the boards were photographed and the ring sequences matched structural timbers from the building. The timbers dated to after 1545.

46. Whittington Castle, Shropshire, Main Gates, North Leaf (Miles et al. 2004)

This gate is constructed of a lattice framework of 3 in thick rails and muntins tenoned into substantial stiles with 1\(\frac{3}{4}\) in thick boards; the southern leaf has a pedestrian doorway included. Remarkably, a middle rail gave a felling date of winter 1485/6 (must have been reused), and a muntin with complete sapwood gave a precise felling date of winter 1579/80, which was consistent with the other dated timbers from the gates. It is possible that the gates have been rebuilt, reusing some earlier material, but it had hitherto been thought to date from the early eighteenth century. This is the only door or gate which retained complete sapwood, and certainly the only one in Britain to give two precise felling dates of different periods.
47. *Stokesay Castle, Shropshire, Main Gate* (Miles and Worthington 1997)

Two main gate boards were measured with a graticule, one of which dated, with a last measured ring date of 1472. Adding to this an additional 137 rings which could not be accurately measured, a *terminus post quem* date of 1620 has been produced. This almost certainly relates to the construction of the gatehouse in 1640/41.

48. *Hay Castle, Breconshire, West Gate, North Leaf* (Miles et al. 2008)

The undated leaf is of different construction, bearing some similarities to the Chepstow Castle main gates. The dated north leaf (1610–40) with wicket gate is of simpler construction with a layer of vertical boards to the front and horizontal boards to the rear. Figure 25 shows both gates. The south leaf was assessed for dendrochronological potential at the same time, but it was of significantly faster-grown oak with insufficient rings for dating, which was a pity because it was clearly the original leaf of the pair.
Our work on dated chests showed how woodworkers had found a progression of different sources for the oak used through time. The timing and origins of the oak found in this collection of dated doors is almost identical, with a change in the mid-thirteenth century away from the use of boards sourced from local timber to those imported from the near Continent (probably the Netherlands or Germany), the first dated example being the north east vice door in Westminster Abbey. The one difference here is the earlier importation of wood from Ireland at the very beginning of the thirteenth-century for the Salisbury Cathedral main west doors, although unusually structural timbers were being brought in from Ireland at the same time for use in the cathedral, so this may be a unique situation. Very rapidly it seems that all the fine doors dated over the next two hundred and fifty years have timber of Baltic origin, mostly from further east, in modern Poland. Some have frameworks of apparently local timber, but the boards are imports. Then, as in the chests, there is again a sudden change around 1500 to a return to locally sourced timber. However, it is worth noting that most of the later examples are from the west of England, which Bowett has suggested did not have such ready access to imported timber. This hypothesis is supported by the example of Wells Cathedral, where the fine door to the Chapter House Undercroft with its excellent decorative ironwork (after 1265) was found to be of local origin rather than imported. At Wells there are a good many doors employing V-edged boarding, and many of these are tangentially-sawn, including wall panelling in the Vicar’s Hall which is almost exclusively from boards sawn through and through, and undoubtedly local in origin. Other doors in cupboards at Wells were found to have been of fast-grown tangentially-sawn timber again most likely to be from a local source. In Scotland, which was a separate nation in the sixteenth century, Baltic timber was used in the mid-sixteenth century for the doors in Stirling Castle.

Sometimes we find doors made of timbers from different sources. At Salisbury, the lower door to the Parvis Chamber was found to be constructed from a mixture of English and Irish boards. At New College in Oxford the great door to the cloister was found to be of Baltic origin, whereas other doors higher up in the bell tower were noted to have been of fast-grown timber most likely of local origin.

Another interesting observation is that at least one of the doors has re-used early ironwork on a later replacement door in an early doorway, e.g. Rainham. Whilst Geddes has produced a sound framework for dating the ironwork on many doors, the woodwork that ironwork now finds itself on may of course be much younger in origin.

Although several works have attempted to produce a dating framework for the evolution of door construction, some of these have got details of the construction incorrect. This was only noticed during the careful examination carried out on dendrochronological dating, and because of circular stylistic arguments without the benefit

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22 Bridge and Miles (2011).
of independently derived dates, there are several problems. Take for example the case of Prudhoe Castle gates, thought to be a century older than they turned out to be. Prudhoe also reminds us that the framework and boards may be independently dated, the gates seemingly having new boards fixed to the old frame.\textsuperscript{26}

As has been noted through the study of the above examples, doors have exceptional dating potential, the majority of them having been constructed of slow-grown, clean oak with long ring sequences. Paradoxically, doors might be the only dateable timber element in an important historical building, although early shutters (thirteenth-century) have also been found in Stokesay Castle.\textsuperscript{27} Ironically, they have tended to survive better than many of the larger structural timbers inside the buildings. This is probably because they have generally remained well ventilated, and any dampness through wind-driven rain would dry out fairly quickly, due to their exposed situation. Conversely, doors which have such excellent potential for dendrochronological analysis pose considerable problems in obtaining the samples with minimum intervention, and the lack of sapwood gives added problems in the interpretation of the dating results. Given this, it is vital that dendrochronological analysis should be considered very early on in any work which might range from simply lifting the doors from their pintles to major repair and reconstruction. In this way these important features of our historic and vernacular buildings may be coaxed to give up their secrets, not only of their date, but of the origin of the timber.

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\textsuperscript{26} Dower et al. (2004).

\textsuperscript{27} Miles and Worthington (1997).
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