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THE CHURCH OF ST MARY THE VIRGIN, CLEOBURY MORTIMER, SHROPSHIRE
TREE-RING ANALYSIS OF TIMBERS FROM THE SOUTH PORCH ROOF

SCIENTIFIC DATING REPORT

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Tree-Ring Analysis of Timbers from the South Porch Roof of The Church of St Mary the Virgin, Cleobury Mortimer, Shropshire

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Summary

A total of seven timbers, representing six trees, from various elements of the south porch roof were cross-matched and dated. All retained the heartwood/sapwood boundary and one also had two sapwood rings. The likely felling date range for the combined series was found to be AD 1212–42, making this one of the earliest dated roofs extant in the county.

Keywords

Dendrochronology
Standing Building

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Introduction

The south porch of the church of St Mary, Cleobury Mortimer (NGR SO 67396 75786; Fig 1) is part of a Grade-1-listed church receiving grant-aided repairs. The church mostly dates from the thirteenth century, and the projecting stone gabled porch with a plastered, vaulted ceiling is stylistically dated to this century. Cranage (1901) stated that the porch was the same age as the south aisle and notes that a silver penny from the reign of Edward I (AD 1272–1307) was found in a square-headed recess in the south wall of the south aisle.

The roof consists of a series of seven rafter-couples of unusual form. This consists of a sole-piece with cogged joint over a central T-sectioned wall-plate, with halved joints at each end to the rafter and ashlar respectively. The apexes of the rafters are similarly halved, and the high-set collar has notch-lapped dovetail joints to the rafters with both side and face pegs. The curved ashlars and soulaces form a pointed arch which is still plastered from below (Fig 2). The joints of the ashlars and soulaces to the rafters and collars are unusual; generally they are butt-jointed at the rafter (Figs 2 and 3), although some have a vertical scarf above the junction of the rafter (Fig 4). The joints to the rafters are lap halvings with refined entries, whilst those to the collar are notch-lap joints, again with refined entries. The joints of the ashlars and soulaces to the rafters are not side-pegged, but face-pegged with four pegs, two per timber (Fig 3), whilst the halving joints with the soulaces to the collars and soul pieces are side-pegged (Fig 4).

Dendrochronological dating of the timbers of the porch roof was requested by John Tiernan, Historic Buildings Architect, English Heritage, and commissioned by John Meadows.

Figure 1: Map showing the location of the Church of St Mary the Virgin, Cleobury Mortimer.

Methodology

The site was visited in June and July 2006. In the initial assessment, accessible oak timbers with more than 50 rings and traces of sapwood were sought, although slightly shorter sequences are sometimes sampled if little other material is available. Those building timbers judged to be potentially useful were cored using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis. On the second visit to the site, a number of *ex-situ* roof timbers, removed during the course of the repairs, were extracted from a skip and were sectioned for further analysis.

The cores were prepared for measuring by sanding, using an electric belt-sander with progressively finer grit papers down to 400 grit. Any further preparation necessary, eg where bands of narrow rings occurred, was done manually. Suitable samples had their tree-ring sequences measured to an accuracy of 0.01 mm, using a specially constructed system utilising a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC, which recorded the ring widths into a dataset. The software used in measuring and subsequent analysis was written by Ian Tyers (1999a). Cross-matching and dating was accomplished by a combination of visual matching and a process of qualified statistical comparison by computer. The ring-width series were compared for statistical cross-matching, using a variant of the Belfast CROS program (Baillie and Pilcher 1973). Ring sequences were plotted to allow visual comparisons to be made between sequences on a light table. This method provides a measure of quality control in identifying any errors in the measurements when the samples cross-match.

In comparing one sequence or site sequence against another, *t*-values over 3.5 are considered significant, although in reality it is common to find *t*-values of 4 and 5 which are demonstrably spurious because more than one matching position is indicated. For this reason, it is necessary to obtain some *t*-values of 5, 6, and higher, and for these to be well replicated from different, independent chronologies and with local and regional chronologies well represented, unless the timber is imported. Where two individual sequences match with a *t*-value of 10 or above, and visually exhibit exceptionally similar ring patterns, they most likely came from the same parent tree.

When cross-matching between samples is found, their ring-width sequences are averaged to form an internal 'working' site mean sequence. Other samples may then be incorporated after comparison with this 'working' master until a final site sequence is established. This is then compared with a number of reference chronologies (multi-site chronologies from a region) and dated individual site masters in an attempt to date it. Individual long series which are not included in the site mean(s) are also compared with the database to see if they can be dated.

The dates thus obtained represent the time of formation of the measured rings in each sample. These dates require interpretation for the construction date of the phase under investigation to be determined. An important aspect of this interpretation is the estimate of the number of sapwood rings missing. The sapwood estimates used here are based on those proposed for this area by Miles (1997a), in which 95% of oaks contain 11–41 rings. Where complete sapwood or bark is present, the exact date of tree felling may be determined.

The dates derived for the felling of the trees used in construction do not necessarily relate directly to the date of construction of the building. However, evidence suggests that, except in the reuse of timbers, construction in most historical periods took place within a very few years after felling (Salzman 1952; Hollstein 1965; Miles 2005).

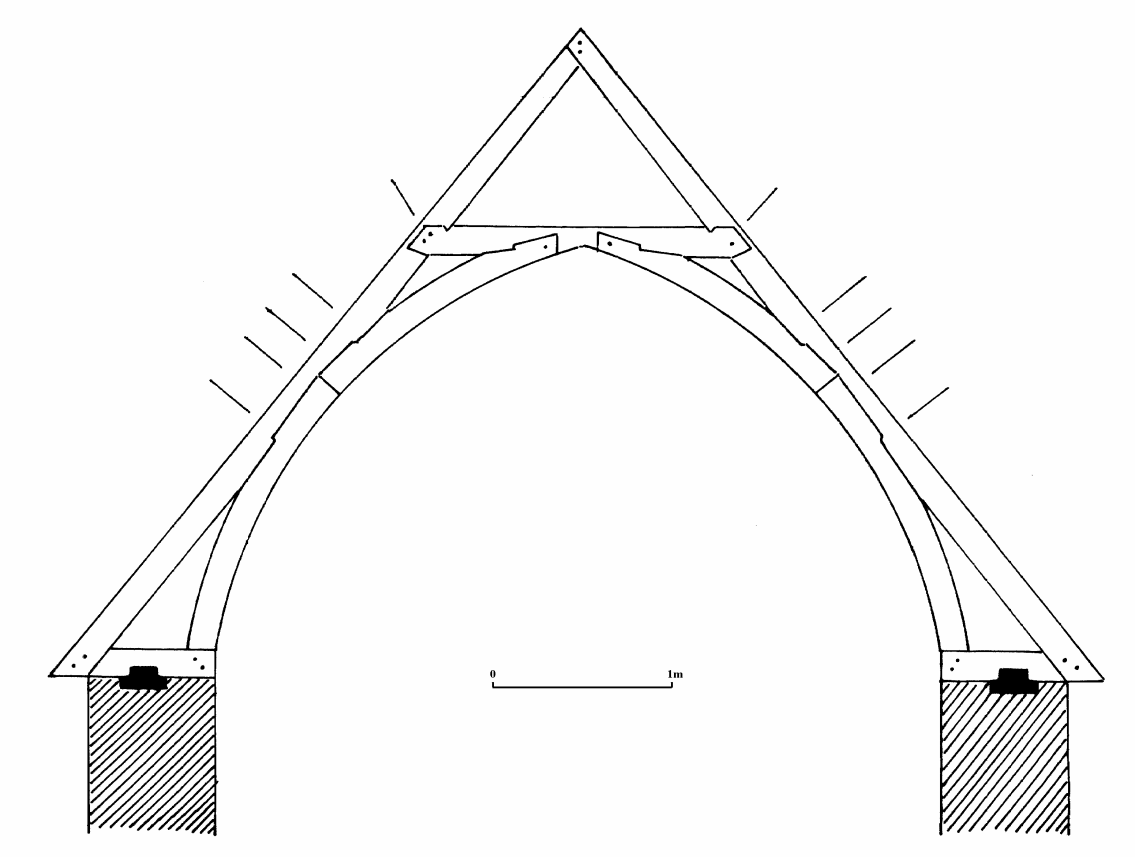

Figure 2: Section drawing of a typical porch rafter-couple with butt-joined soulace/ashlar pieces, based on an original drawing by Henry Hand

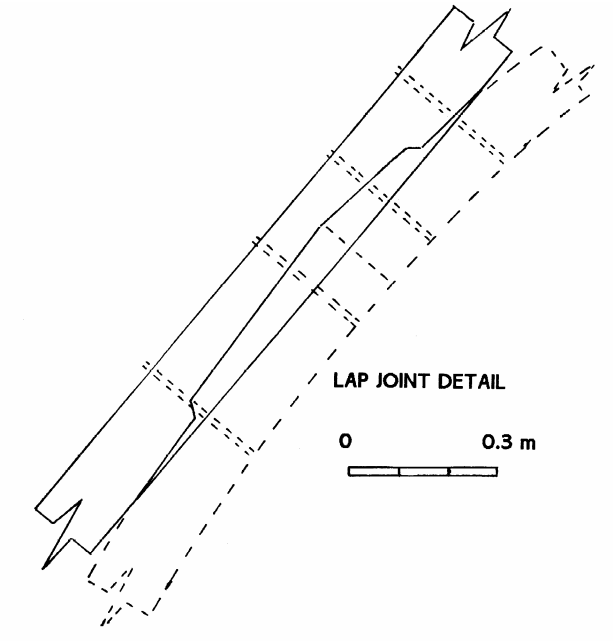

Figure 3: Detail of the unusual lap joint with refined entry between the soulace/ashlar piece and the rafter, drawn by Henry Hand

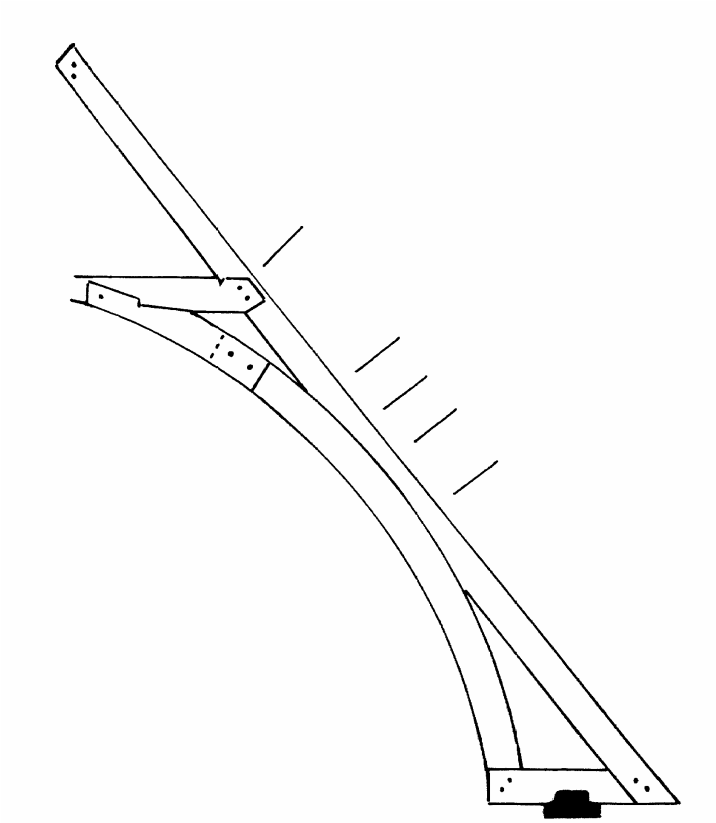

Figure 4: Part section of a scarfed soulace/ashlar-piece rafter-couple in the porch, drawn by Henry Hand

Results and Interpretation

All timbers sampled were of oak (*Quercus* spp.). Details of the samples are given in Table 1. A number of the original cores taken turned out to have fewer rings than was expected, and these were not analysed further. All the measured series subsequently dated.

Cross-matching between the individual samples showed that two of the unidentified *ex-situ* samples were almost certainly off-cuts from the same timber (**cmp09** *vs* **cmp12**, $t = 14.0$ with 50 years overlap), and these were combined into a single 68-year sequence **cmp912m**. This combined sequence and a further five samples cross-matched (Table 2). These six ring sequences were combined to form a site master **CLEOBMT**, which was subsequently dated to the period AD 1125–1208, the best results being shown in Table 3, with the relative positions of overlap of the dated samples being illustrated in Figure 5. The mean heartwood-sapwood boundary date of AD 1201, using the combined heartwood-sapwood boundary date for series **cmp912m**, gives a most likely felling date range for the timbers used in this roof of AD 1212–42. The data for the site master are given in Table 4.

Discussion

Although the porch was thought to be of thirteenth-century date, this range is somewhat earlier in that century than was expected, and this represents one of the earliest dated extant roofs in the county, after the north transept of Wistanstow Church, dated to AD 1200–22 (Miles 1997c).

There are three main features which make the porch roof of Cleobury Mortimer of exceptional importance nationally. First is the use of a T-shaped central wallplate, second is the early use of compass, or curved, timbers, and third is the use of side-lap joints for the ashlars and soulaces.

The use of cogged solepieces or tiebeams over a T-shaped central wallplate is unusual, and certainly an indicator of early carpentry practices, of which very few examples survive. Only one other similar configuration is known, and is geographically nearby at Kempley, Gloucestershire, which dates from the first half of the twelfth century (Miles *et al* 1999). Generally, cogged joints make use of a square-sectioned plate, which has notches cut just where the solepiece or tiebeam overlap, as at the early thirteenth-century north transept roof at Wistanstow (Miles 1997c). This feature was also noted by Henri Deneux (Hewett 1969) as being used in Northern France from 1149 to the beginning of the thirteenth century. An example of an arcade plate with an upstand, surviving only under the tiebeam, was noted at Sycamore Farm, Long Crendon, Buckinghamshire, dating to AD 1205 (Alcock *et al* 1992; Walker 1999, 44–5).

In his study of Essex churches, Hewett suggests that rafter-couples with compassed, or curved, ashlars and soulaces rafter-couples were introduced in the latter part of the thirteenth century, and became more common in the fourteenth century. The north aisle roof of Danbury, stylistically dated to the late thirteenth century (Hewett 1982), as well as the eastern part of the nave roof at Greyfriars, Lincoln, thought to have been completed by 1260 (Hewett 1985), are the only surviving examples from before the end of the thirteenth century. Placing the Cleobury Mortimer porch in a more regional context, it is useful to compare it to the corpus of early roofs recorded in nearby Herefordshire and Worcestershire (Currie 1990). Here 13 archaic roofs were identified, dating from the twelfth to the end of the thirteenth centuries, yet none of these employed compass timbers. Thus the use of compass timbers at Cleobury Mortimer is one of the earliest recorded in the country, and can be compared to some of the earliest examples in Europe, such as the hall of the castle of Blois, about 1200 (CRMH nd, D-6981), and a roof at Mittelzell Abbey, Reichenau, in Southern Germany, dating from *c* AD 1235 (Binding 1991, 42–3).

The final exceptional feature is the use of side-lapped joints with refined entries for the joints of the ashlars and soulaces to the rafters, and the notch-lapped joints of the soulaces to the collars. Only one other similar example is known in Britain from the thirteenth century, which is at Greyfriars, Lincoln (Hewett 1985, 28). Here, a generation later than the Cleobury Mortimer porch, the joints into both the rafters as well as the collar employ similar lap-dovetails which are face as well as side pegged. This feature is so unusual that even Hewett states that it 'tends to evade definition'. At Blois Castle, these joints are similar but more elaborate (CRMH nd). Earlier aisled buildings sometimes used halved joints for the intersection of the curved arcade braces to the plates themselves, as at the Bishop's Palace, Hereford (AD 1179), and Burmington Manor, Warwickshire (after AD 1159) (Bridge 1993; Walker 1999).

The dendrochronology here has shown the porch roof at Cleobury Mortimer to be an important transitional timber roof dating to AD 1212–42. Whilst retaining features of Norman carpentry tradition, it is a prototype of the fourteenth-century compass timber roofs in an Early English idiom.

Table 1: Details of oak (*Quercus* spp.) timbers sampled from the porch, Church of St Mary the Virgin, Cleobury Mortimer, Shropshire. Trusses are numbered from north to south

Sample Number	Timber and position	No of rings	Mean width (mm)	Mean sens (mm)	Dates AD Spanning	H/S bdry AD	Sapwood complement	Likely felling date ranges (AD)
Cores								
cmp01	Rafter-couple 6, west sole piece	53	1.23	0.16	1147–99	1199	H/S	1210–40
cmp02	Rafter-couple 7, east lower arch-brace	68	1.53	0.23	1125–92	1192	H/S	1203–33
cmp03	Rafter-couple 7, east sole piece	57	1.75	0.20	1150–1206	1206	H/S	1217–47
cmp04	Rafter-couple 3, west rafter	<45	NM	-	undated	-	-	unknown
cmp05	Rafter-couple 2, west rafter	<45	NM	-	undated	-	-	unknown
cmp06	Rafter-couple 2, east sole piece	<45	NM	-	undated	-	-	unknown
cmp07	Rafter-couple 3, east sole piece	<45	NM	-	undated	-	-	unknown
cmp08	Rafter-couple 2, east lower arch-brace	<45	NM	-	undated	-	-	unknown
***ex situ* slices**								
cmp09	unidentified	50	1.64	0.23	1159–1208	1206	2	1217–47
cmp10	unidentified	66	2.58	0.21	1134–99	-	-	after 1210
cmp11	Sole piece	57	1.70	0.15	1140–96	-	-	after 1207
cmp12	unidentified	68	2.00	0.19	1141–1208	1208	H/S	1219–49
cmp912m	**cmp09 + cmp12**	68	1.97	0.20	1141–1208	1207	1	1218–48
CLEOBMT	**Site Master**	84			1125–1208	1201		1212–42

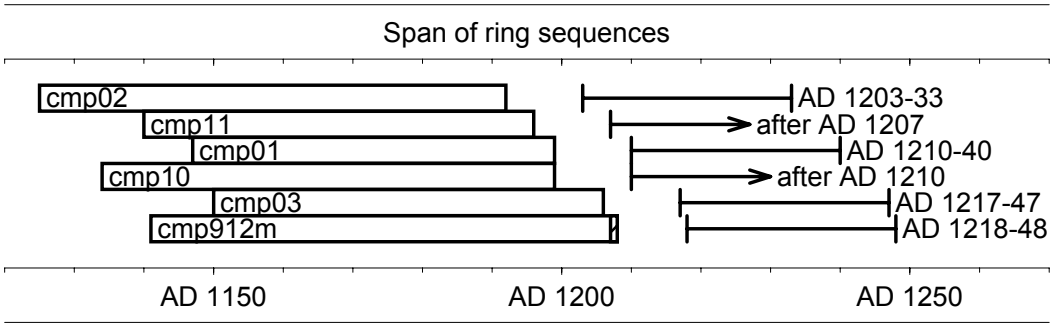

Figure 5: Bar diagram showing the relative positions of overlap of the dated timbers, along with their interpreted felling dates. Hatched sections of the bars represent sapwood

Table 2: Cross-matching between samples from the south porch roof

	t-values				
Sample	cmp02	cmp03	cmp912m	cmp10	cmp11
cmp01	4.8	3.7	3.7	-	3.1
cmp02		6.4	5.9	4.5	4.1
cmp03			5.0	4.4	-
cmp912m				7.8	-
cmp10					-

- = *t*-value less than 3.0

Table 3: Dating evidence for the site chronology **CLEOBMT,** AD 1125–1208 (regional multi-site chronologies have the file name in **bold**)

County/ region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning: (yrs AD)*	*Overlap (yrs)*	*t-value*
Shropshire	Wistanstow Church	(Miles 1998)	WSTNSTOW	1069–1199	75	8.9
Shropshire §	Stokesay Castle	(Miles and Worthington 1997)	STOKE2	1046–1289	84	8.8
Gloucestershire	Gloucester Blackfriars	(Hillam and Groves 1993)	GLOUCBLF	1076-1219	84	8.5
Wales	Welsh Master Chronology	(Miles 1997b)	**WALES97**	404-1981	84	8.5
Worcestershire	Mamble	(Tyers 1996)	MAMBLE_A	1109-1204	80	7.8
Bristol Area	Bristol Master Chronology	(Hillam 1994)	BRISTOL	770-1320	84	7.4
Herefordshire	Dore Abbey	(Tyers and Boswijk 1998)	DORE1	1073-1195	71	7.3
Shropshire	Shropshire Master Chronology	(Miles 1995)	**SALOP95**	881-1745	84	7.1
Shropshire §	Great Oxonbold	(Miles and Haddon-Reece 1993)	GTOXNBLD	1081-1246	84	7.1
Cambridgeshire	Peterborough Cathedral	(Tyers 1999b)	PETERC	887-1225	84	7.1

§ = component of SALOP95 regional chronology

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Table 4: Ring width data for the site chronology **CLEOBMT**, AD 1125–1208

Ring widths (0.01mm)										no of trees									
405	228	317	345	188	253	149	117	139	213	1	1	1	1	1	1	1	1	1	2
254	283	200	271	244	258	359	263	200	263	2	2	2	2	2	3	4	4	4	4
248	233	220	244	299	197	207	196	241	190	4	4	5	5	5	6	6	6	6	6
187	184	205	197	195	242	172	210	156	196	6	6	6	6	6	6	6	6	6	6
205	164	163	172	158	149	194	176	169	137	6	6	6	6	6	6	6	6	6	6
123	163	133	166	200	145	156	165	160	108	6	6	6	6	6	6	6	6	6	6
141	167	179	109	140	167	147	124	147	159	6	6	6	6	6	6	6	6	5	5
158	154	150	153	159	125	131	113	123	118	5	5	4	4	4	2	2	2	2	2
110	149	72	109							2	2	1	1						