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Summary

Tree-ring samples were taken from seven carved stub-ties to the nave roof of the church of St Swithun, Compton Bassett, Wiltshire (SU 031 716). All seven timbers showed such a high degree of similarity that were considered to have all originated from the same parent tree. These were all combined to form a site master of 109 ring and dated, spanning the years AD 1346-1454. The average last heartwood ring date of AD 1452 produced an estimated felling date range of AD 1461-93. None of the other structural timbers from the roof were considered suitable for dendrochronology.

Keywords

Dendrochronology
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THE TREE-RING DATING OF THE NAVE ROOF OF ST SWITHUN'S CHURCH, COMPTON BASSETT, CALNE, WILTSHIRE

1. INTRODUCTION AND OBJECTIVES

The church of St Swithun lies in the parish of Compton Bassett, near Calne, Wiltshire (SU 031 716; Fig 1), and is a multi-phased building with Norman origins (Fig 2). It is aligned 17 degrees north of east from a precise east-west alignment and consists of a fifteenth-century western tower, nave with fifteenth-century clerestorey and aisles, and a north porch, chancel, and lean-to side aisles dating from AD 1866. The lower part of the nave dates primarily from three periods: some of the first-phase Norman work survives at the lower level of the east and west ends, whilst the north arcade was inserted in the late-twelfth century, and the south arcade slightly later, sometime during the mid-thirteenth century. It is not until the fifteenth century that the nave takes its present form with the insertion of the high clerestorey, and the present nave roof is thought to date from this phase (Reynolds 1993).

The nave roof is comprised of seven moulded arch-braced principal trusses forming six bays with curved rafters. The foot of each principal rafter is founded on an outer wall-plate and on an inner stub-tie notched on an inner plate with an interrupted moulded upper plate notched in between. The inner ends of these stub-ties are all elaborately carved with stylised figurative carved heads (Fig 3). Further support is given to every other stub-tie by a moulded timber wall-post supported on corbels some distance down the nave clerestorey wall.

As a consequence of the present repair work to the roof, the principal and common rafters alike have been numbered 1-35 from the west, although the principal trusses were originally numbered 1-7 in large Roman scribed assembly marks counting from the east, the common rafters being similarly numbered independently. A semi-circle compass mark was used on the south-side principal-truss assembly marks to differentiate them from those on the north (Fig 4).

The objective of the tree-ring dating was to inform the programme of grant-aided repairs if the date of the nave roof could be established, confirming whether it belonged to the raising of the clerestorey, and if so, to allow a firm date to be ascribed to this phase. The dating was commissioned by the Ancient Monuments Laboratory of English Heritage following a request from Mr Arnold Root, Historic Buildings Architect for the South West Regional Team.

2. METHODOLOGY

The roof was assessed for tree-ring dating, and all the structural timbers were considered unsuitable due to low ring counts of less than 50 rings. The only exception were the carved stub-ties, the backs of which were accessible from the outside of the roof. Therefore, only those with long ring sequences or some indication of a heartwood/sapwood boundary were sampled. All timbers sampled were taken from what appeared to be primary first-use oak (*Quercus* spp.). Sampling was carried out with a 16mm hollow coring bit.

The dry samples were sanded on a linisher using 60 to 1200 grit abrasive paper, and were cleaned with compressed air, to allow the ring boundaries to be clearly distinguished. They were then measured under a x10/x30 microscope using a travelling stage electronically displaying displacement to a precision of 0.001mm, rounded to the nearest 0.01mm.

After measurement, the ring-width series for each sample was plotted as a graph of width against year on log-linear graph paper. The graphs of each of the samples in the phase under study are then compared visually at the positions indicated by the computer matching and, if found satisfactory and consistent, are averaged to form a mean curve for the site or phase. This mean curve and any unmatched individual sequences are compared against dated reference chronologies to obtain an absolute calendar date for each sequence.

Here this was accomplished by using a combination of both visual matching and a process of qualified statistical comparison by computer. The tree-ring curves were first matched visually, and then independently matched by computer. The ring-width series were compared on an IBM compatible 486SX computer for statistical cross-matching using a variant of the Belfast CROS program (Baillie and Pilcher 1973). A version of this and other programmes were written in BASIC by D Haddon-Reece, and latterly re-written in Microsoft Visual Basic by M R Allwright and P A Parker.

Once a tree-ring sequence has been firmly dated in time, a felling date, or date range, is ascribed where possible. With samples which have sapwood complete to the underside of, or including bark, this process is relatively straight forward. Depending on the completeness of the final ring, ie if it has only the spring vessels or early wood formed, or the latewood or summer growth, a *precise felling date and season* can be given. If the sapwood is partially missing, or if only a heartwood/sapwood transition boundary survives, then an *estimated felling date range* can be given for each sample. The number of sapwood rings can be estimated by using a statistically derived sapwood estimate with a given confidence limit. An accepted sapwood estimate for British and Irish oaks is given as between 10 and 55 rings with a 95% confidence range (Hillam *et al* 1987). A recent review of the geographical distribution of dated sapwood data from historic building timbers has shown that a 95% range of 9-41 rings is more appropriate for the southern part of England (Miles 1997a), and this sapwood estimate will be used throughout this report. If no sapwood or heartwood/sapwood boundary survives, then the minimum number of sapwood rings from the appropriate sapwood estimate is added to the last measured ring to give a *terminus post quem* or *felled after* date.

3. RESULTS

Seven samples were taken from the backs of the stub-ties as they were the only timbers in the roof with sufficient rings for analysis (Table 1; Fig 5). None of the samples retained any sapwood, but a number still exhibited a clear heartwood/sapwood boundary (Fig 6). These appeared to have been cut from trees of between 100 to 125 years of age.

All seven of these were found to match each other with extremely high *t*-values suggesting that they all originated from a single tree probably in the order of 125-150 years old (Table 2). Given that the stub-ties are no longer than 16 inches (0.4m) long, and are converted from a quartered log, it is not surprising that they all could have originated from a single log some five feet (1.5m) long and 2 feet (0.6m) in diameter. As the seven samples matched together satisfactorily, they were all combined to form the site master ***SSWITHUN*** of 109 rings. This was compared with the reference chronologies and found to date, spanning the years AD 1346-1454 (Tables 3 and 4).

Six of the dated samples retained heartwood/sapwood boundaries. As it had been already shown that the individual samples were coeval by virtue of the fact that they originated from the same tree, a felling date range was determined from an average taken of the heartwood/sapwood boundary dates. Thus an average heartwood/sapwood boundary date of AD 1452 produced a felling date range of AD 1461-93 (Fig 7).

4. CONCLUSIONS

The wagon roof of the nave as found to be constructed predominately of fast-grown timber from trees less than fifty years old. However the sole exception to this are the carved stub-ties which were from slower-grown oak. Of the fourteen stub-ties, seven samples distributed throughout the roof were found to have originated from a single tree. Given the similarity of the growth rings in the remaining seven stub-ties, it is likely that they too originated from the same tree. It is quite possible that this tree was chosen particularily for its finer rings more suitable for fine carving.

All seven samples dated, and six retained heartwood/sapwood transition. These ranged from AD 1449 to 1454, with an average heartwood/sapwood boundary of AD 1452. From this a felling date range of AD 1461-93 was determined. Evidence of subsequent shrinkage shows that these were cut and fashioned whilst still green, so this date range should reflect the date of the rest of the roof structure (Fig 6). This felling date range is also consistent with the stylistic dating of the roof to the fifteenth century.

5. ACKNOWLEDGEMENTS

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Table 1: Summary of tree-ring dating

Sample Number & Type		Timber and position	Dates AD spanning	H/S bdry	Sapwood	No of rings	Mean width mm	Std devn mm	Mean sens mm	Felling seasons and dates/date ranges
CHURCH OF ST SWITHUN, COMPTON BASSETT, WILTS										
* ***sscb1***	c	Carved stub-tie T6 north	1360-1440			81	1.70	0.44	0.236	
* ***sscb2***	c	Carved stub-tie T16 north	1349-1453	1453	H/S	105	1.80	0.51	0.240	
* ***sscb3***	c	Carved stub-tie T16 south	1356-1454	1454	H/S	99	2.00	0.64	0.201	
* ***sscb4***	c	Carved stub-tie T21 north	1363-1451	1451	H/S	89	1.80	0.63	0.247	
* ***sscb5***	c	Carved stub-tie T21 south	1370-1451	1451	H/S	82	1.77	0.55	0.235	
* ***sscb6***	c	Carved stub-tie T26 north	1346-1454	1454	H/S	109	1.75	0.94	0.266	
* ***sscb7***	c	Carved stub-tie T26 south	1351-1449	1449	H/S	99	1.92	0.94	0.238	
* = ***SSWITHUN*** **Site Master**			**1346-1454**	**1452**	**H/S**	**109**	**1.92**	**0.67**	**0.216**	**1461-1493**

Key: * = sample included in site-master; c = core; H/S bdry = heartwood/sapwood boundary (last heartwood ring date); std devn = standard deviation; mean sens = mean sensitivity

Table 2: *t*-values and overlaps for components of ***SSWITHUN***

Sample:	***sscb2***	***sscb3***	***sscb4***	***sscb5***	***sscb6***	***sscb7***
dated at:	1453	1454	1451	1451	1454	1449
sscb1	11.5	11.80	12.14	10.43	11.51	11.59
	81	81	78	71	81	81
	sscb2	10.66	16.32	14.44	11.97	14.60
		98	89	82	105	99
		sscb3	9.42	9.53	10.22	9.33
			89	82	99	94
			sscb4	20.35	11.00	22.39
				82	89	87
				sscb5	9.61	16.64
					82	80
					sscb6	11.35
						99

Table 3: Dating of ***SSWITHUN*** against reference chronologies at AD 1454

Reference chronology	**Spanning (AD)**	**Overlap**	**t-value**
LATTON *(Miles and Worthington 1997)*	1350-1464	105	7.18
SENG98 *(Bridge 1998)*	944-1790	109	7.58
HANTS97 *(Miles 1997b)*	1041-1972	109	7.63
ACTON *(Haddon-Reece and Miles 1994)*	1328-1575	109	7.83
LINCNOX1 *(Miles and Worthington forthcoming)*	1333-1436	91	7.94
OXON93 *(Haddon-Reece et al 1993)*	632-1987	109	8.26
LONDON *(Tyers pers comm)*	413-1728	109	8.28
* ALTON *(Hillam 1983)*	1348-1504	107	8.76
GEORGIN2 *(Miles and Worthington 1998)*	1290-1509	109	9.16
GEORGIN1 *(Miles and Worthington 1998)*	1258-1457	109	9.29
MASTERAL *(Haddon-Reece and Miles 1993)*	404-1987	109	9.39
BDLEIAN2 *(Miles and Worthington forthcoming)*	1346-1485	109	9.41

* Component of MASTERAL

Table 4: Ring-width data for site master curve

SSWITHUN AD 1346-1454 Church of St Swithun, Compton Bassett, Wiltshire - mean of samples ***sscb1 - sscb7***

109 rings, starting date AD 1346

ring widths (0.01mm)										number of samples in master									
327	248	268	256	362	529	251	346	357	257	1	1	1	2	2	3	3	3	3	3
276	234	187	293	257	249	278	347	302	210	4	4	4	4	5	5	5	6	6	6
176	213	226	255	251	161	193	171	232	214	6	6	6	6	7	7	7	7	7	7
243	212	205	231	208	192	166	222	126	198	7	7	7	7	7	7	7	7	7	7
229	197	169	173	165	157	145	216	106	109	7	7	7	7	7	7	7	7	7	7
180	164	180	161	187	176	126	179	155	103	7	7	7	7	7	7	7	7	7	7
195	128	151	160	134	126	134	129	152	175	7	7	7	7	7	7	7	7	7	7
126	141	126	88	150	142	119	149	129	103	7	7	7	7	7	7	7	7	7	7
73	109	286	168	150	158	233	156	140	190	7	7	7	7	7	7	7	7	7	7
229	203	144	184	171	234	151	214	166	168	7	7	7	7	7	6	6	6	6	6
148	160	165	178	190	204	146	113	142		6	6	6	6	5	5	3	3	2	

Figure 1: Site location plan *(Reynolds 1993)*

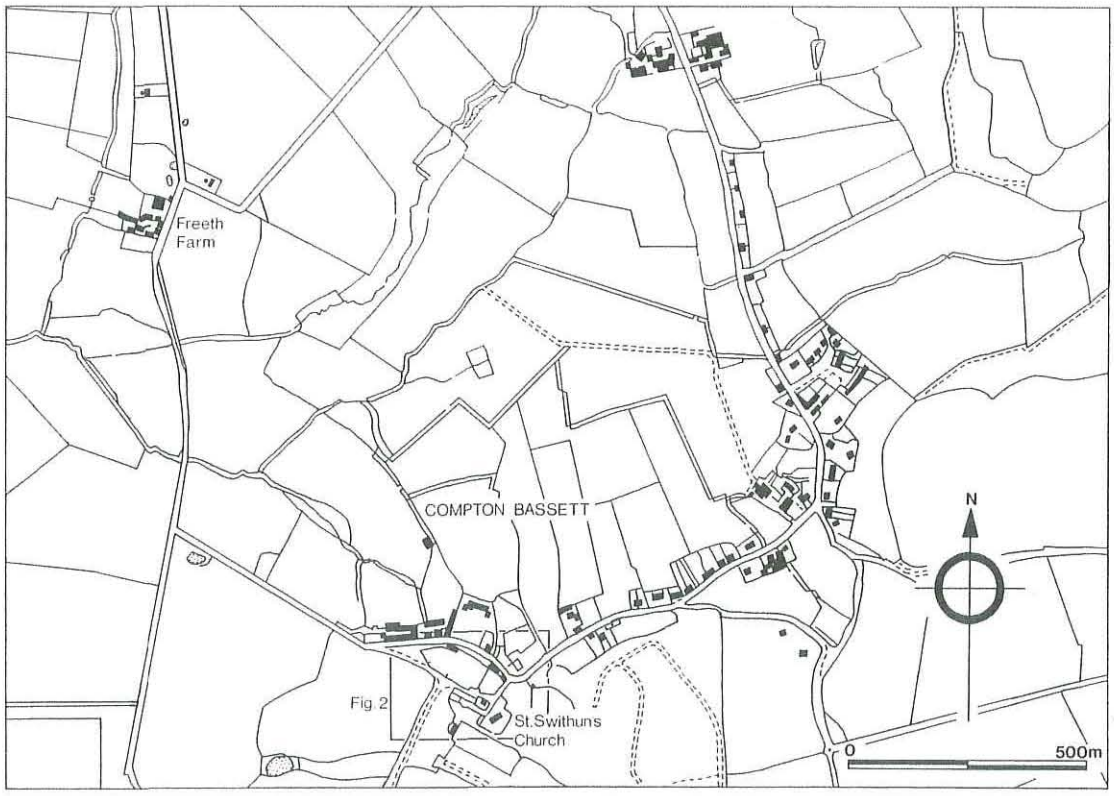

Figure 2: Phasing plan of St Swithun's Church *(Reynolds 1993)*

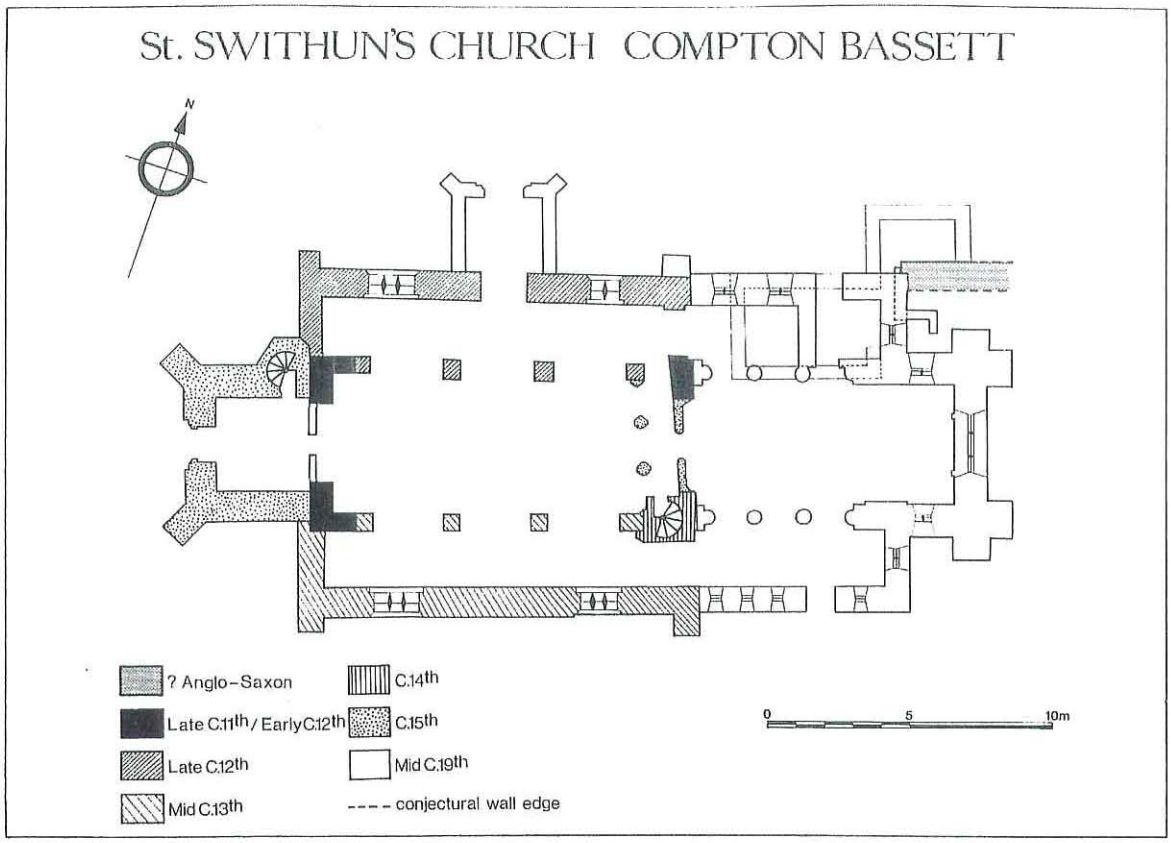

Figure 3: Photograph of stub-tie at T16, north side *(Philip Scorer)*

Figure 4: Roof plan of Nave showing sample locations *(After Slade, Smith, and Winrow 1999)*

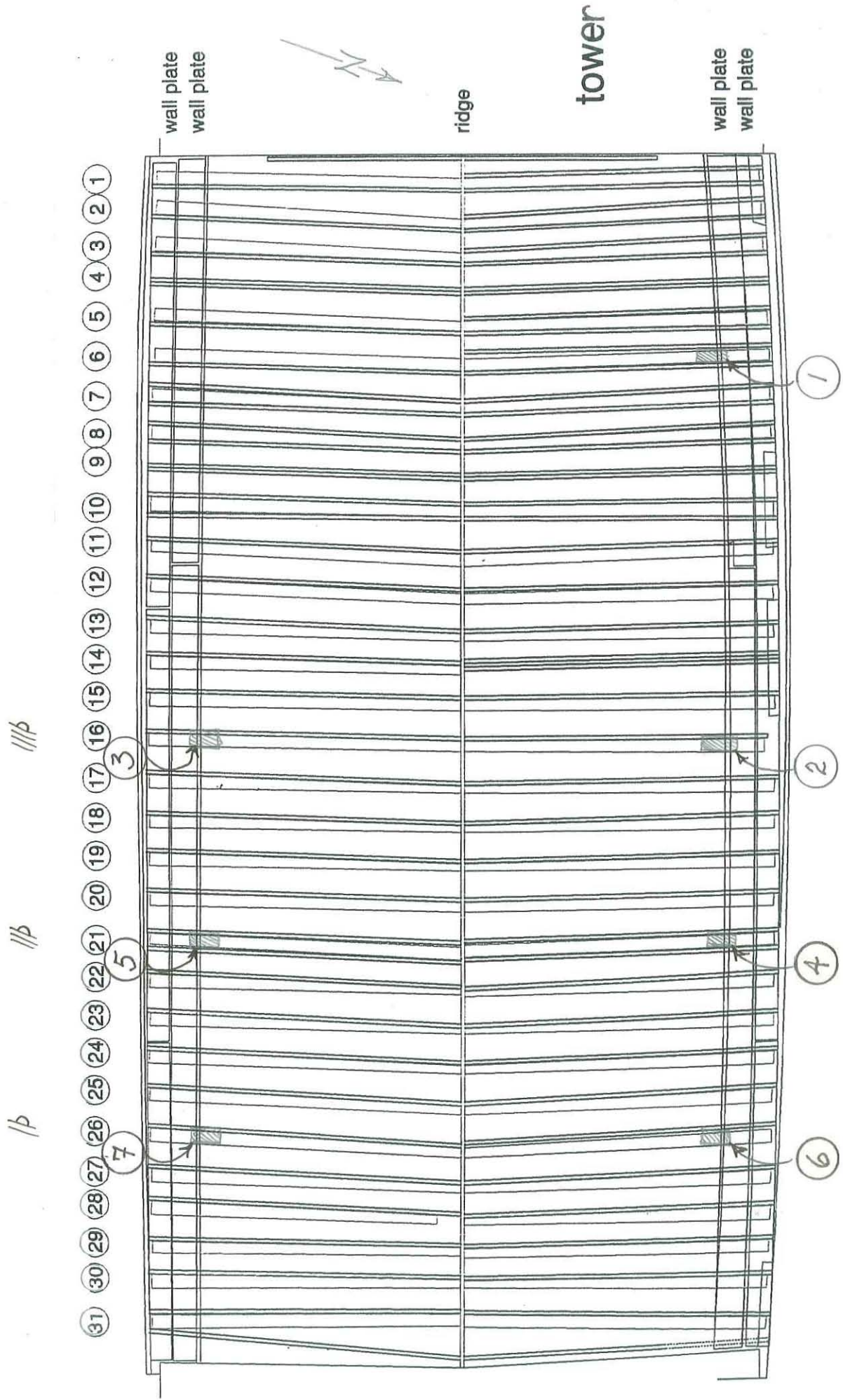

Figure 5: Section of eaves showing stub-ties *(Scale 1:12)*

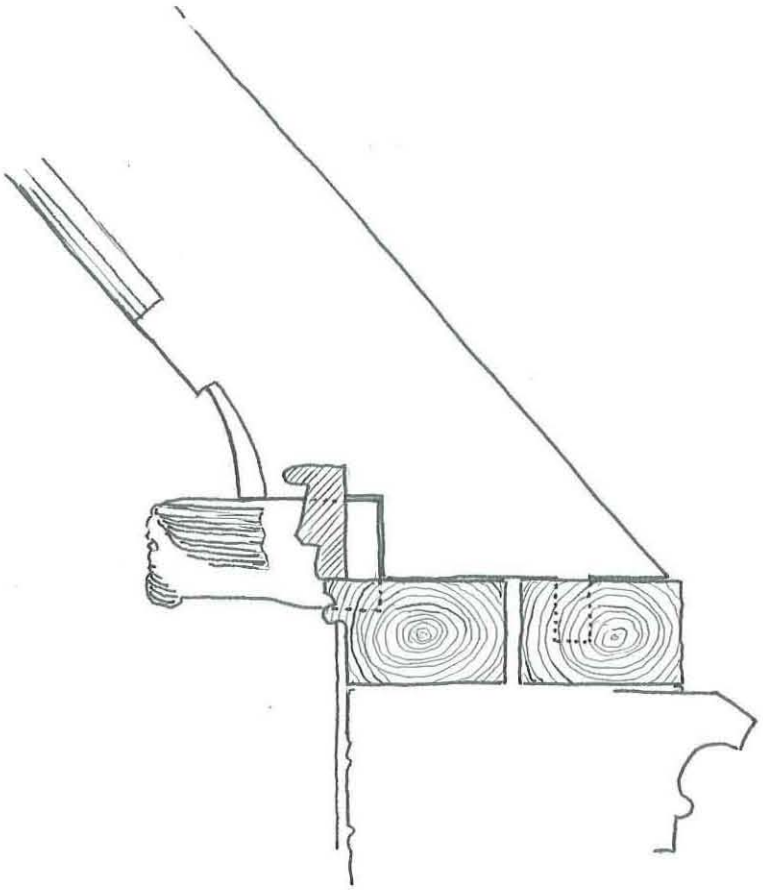

Figure 6: Sections of timbers sampled *(scale 1:8)*

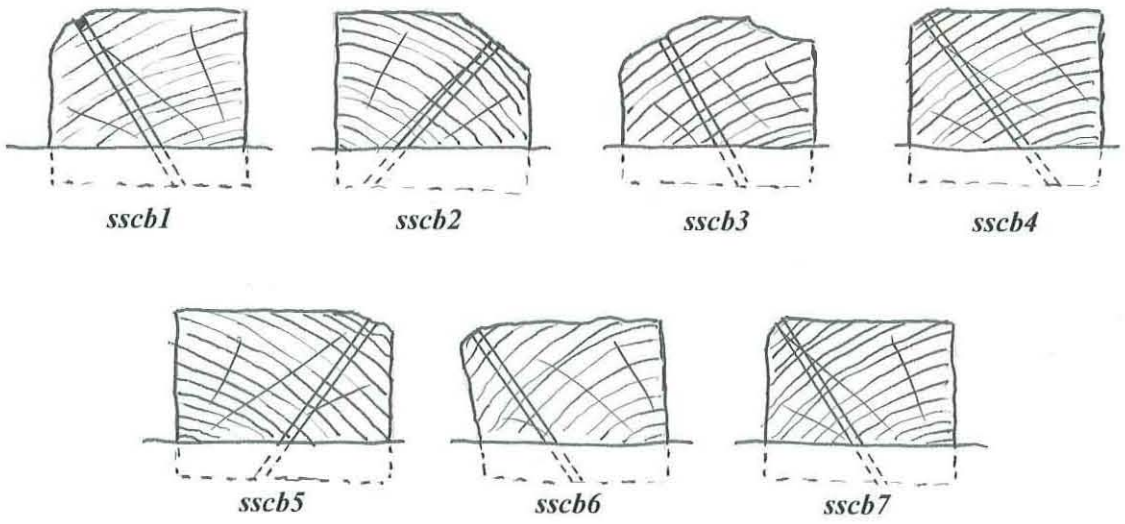

Figure 7: Dated samples in chronological position

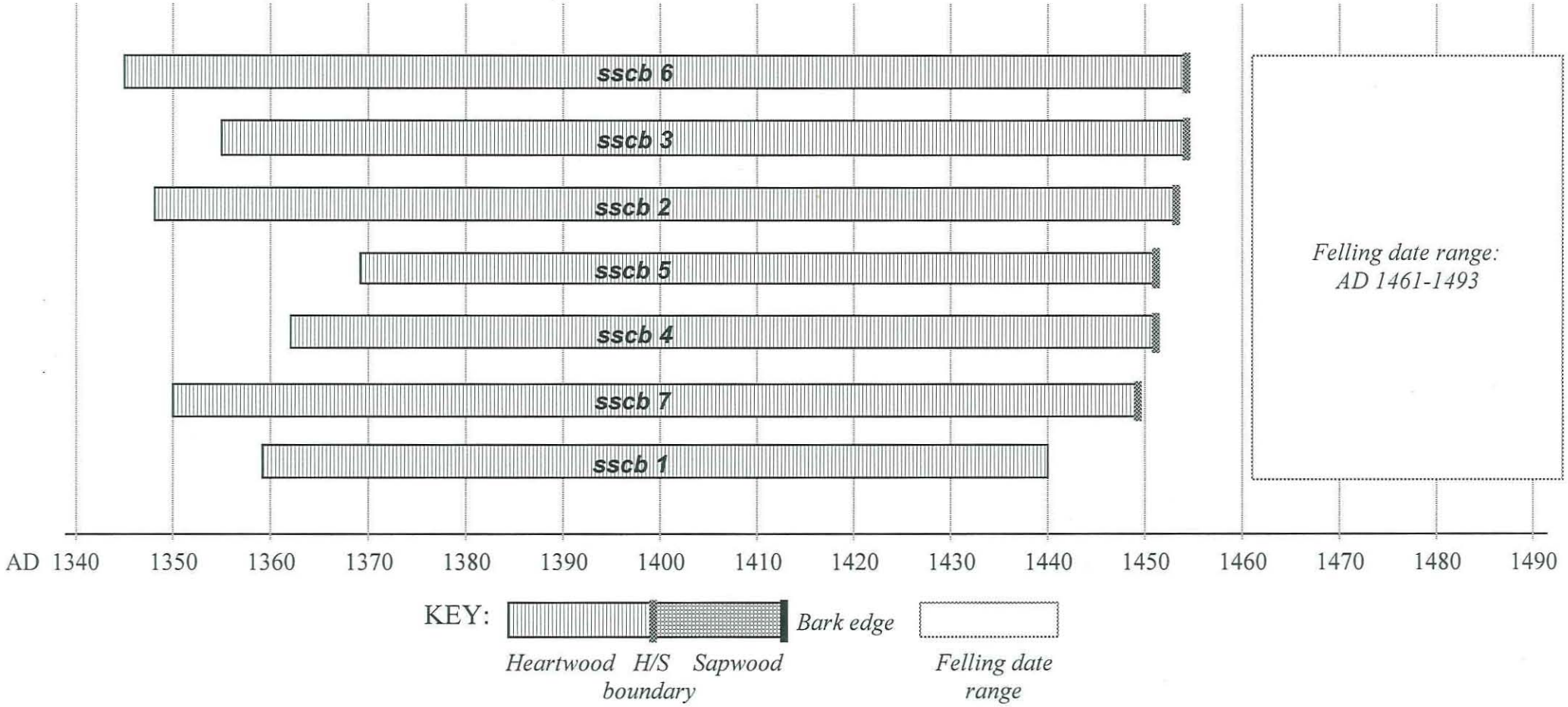

Figure 2: Phasing plan of St Swithun's Church *(Reynolds 1993)*

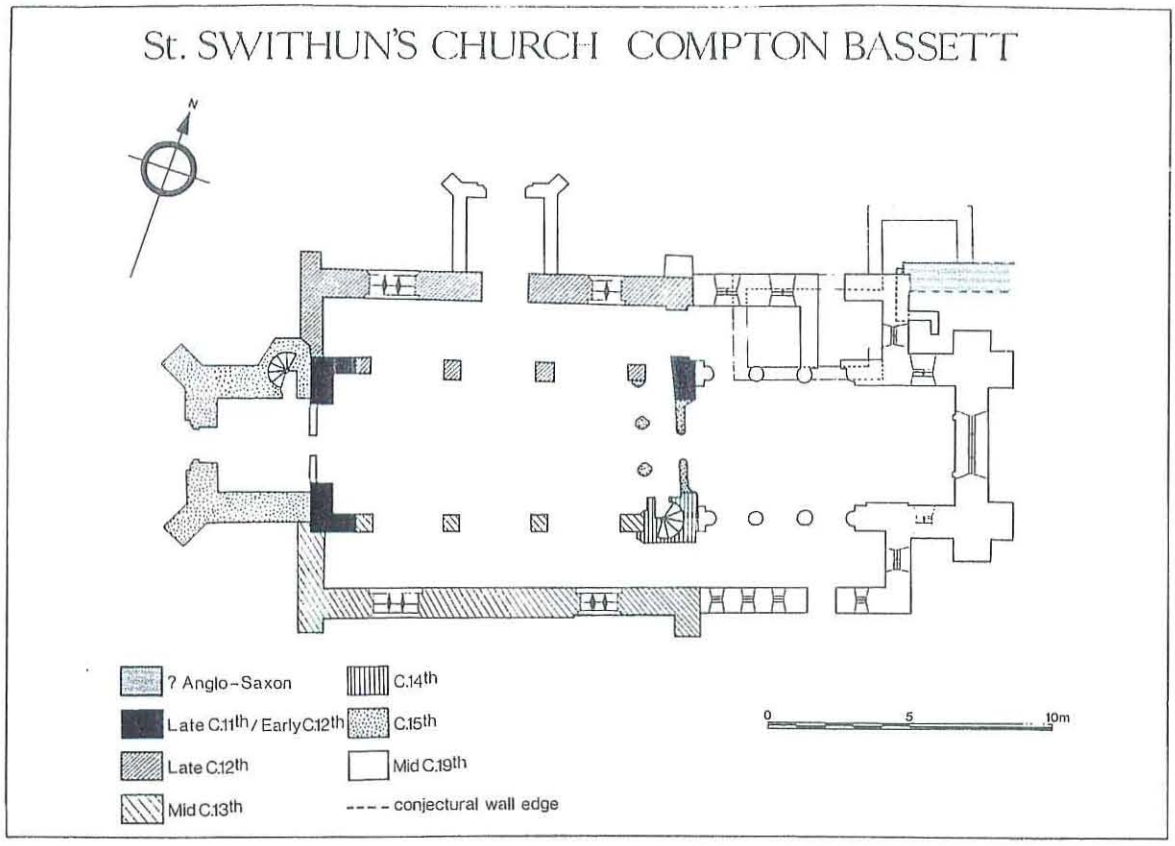

Figure 3: Photograph of stub-tie at T16, north side *(Philip Scorer)*