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Tree-Ring Analysis of Timbers from the Church of St Mary the Virgin, Strethall, Essex

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Summary

The nave and chancel roofs were assessed for their dendrochronological potential. No datable timbers were found in the chancel roof as they had too few rings. The nave roof was thought to be of early-fifteenth century date and to possibly incorporate earlier timbers. No evidence was found of the presence of earlier re-used timbers in the nave, and the rafters and tie beam were found to have been made from trees most likely felled in the period AD 1520-41, making this an early-sixteenth century roof.

Keywords

Dendrochronology
Standing Building

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Introduction

The Church of St Mary the Virgin, Strethall (NGR TL 485398; Fig 1) is a grade I listed building of flint rubble with a very small nave of Saxon origin. The church is thought to have been re-roofed in the early fifteenth century, at which time the chancel was added. This stylistic dating is based on the use of cambered tie beams with arch braces of early Perpendicular curvature (Figure 2). It is thought possible that the nave roof incorporates earlier timbers.

Tree-ring dating of the nave and chancel roofs was commissioned by English Heritage in order to provide precise dates for their construction and also to determine whether there were any earlier timbers present, to inform a programme of grant-aided repairs.

Methodology

The site was visited in March AD 2004. Oak timbers with more than 50 rings, traces of sapwood, and accessibility were the main considerations in the initial assessment. Those 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.

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. The software used in measuring and subsequent analysis was written by Ian Tyers (1999a).

Ring sequences were plotted to allow visual comparisons to be made between sequences on a light table. This activity also acts as a measure of quality control in identifying any errors in the measurements when the samples crossmatch. Statistical comparisons were made using Student's *t*-test (Baillie and Pilcher 1973; Munro 1984). The *t*-values quoted below were derived from the original CROS program (Baillie and Pilcher 1973). Those *t*-values in excess of 3.5 are taken to be indicative of acceptable matching positions provided that they are supported by satisfactory visual matches, and give consistent matching positions.

When crossmatching between samples is found, their ring-width sequences are meaned 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, which 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 rings available on each sample. Interpretation of these dates then has to be undertaken to relate these findings to the construction date of the phase under investigation. An important aspect of this interpretation is the estimate of the number of sapwood rings missing. In this instance, the sapwood estimates are based on those proposed for this area by Miles (1997), in

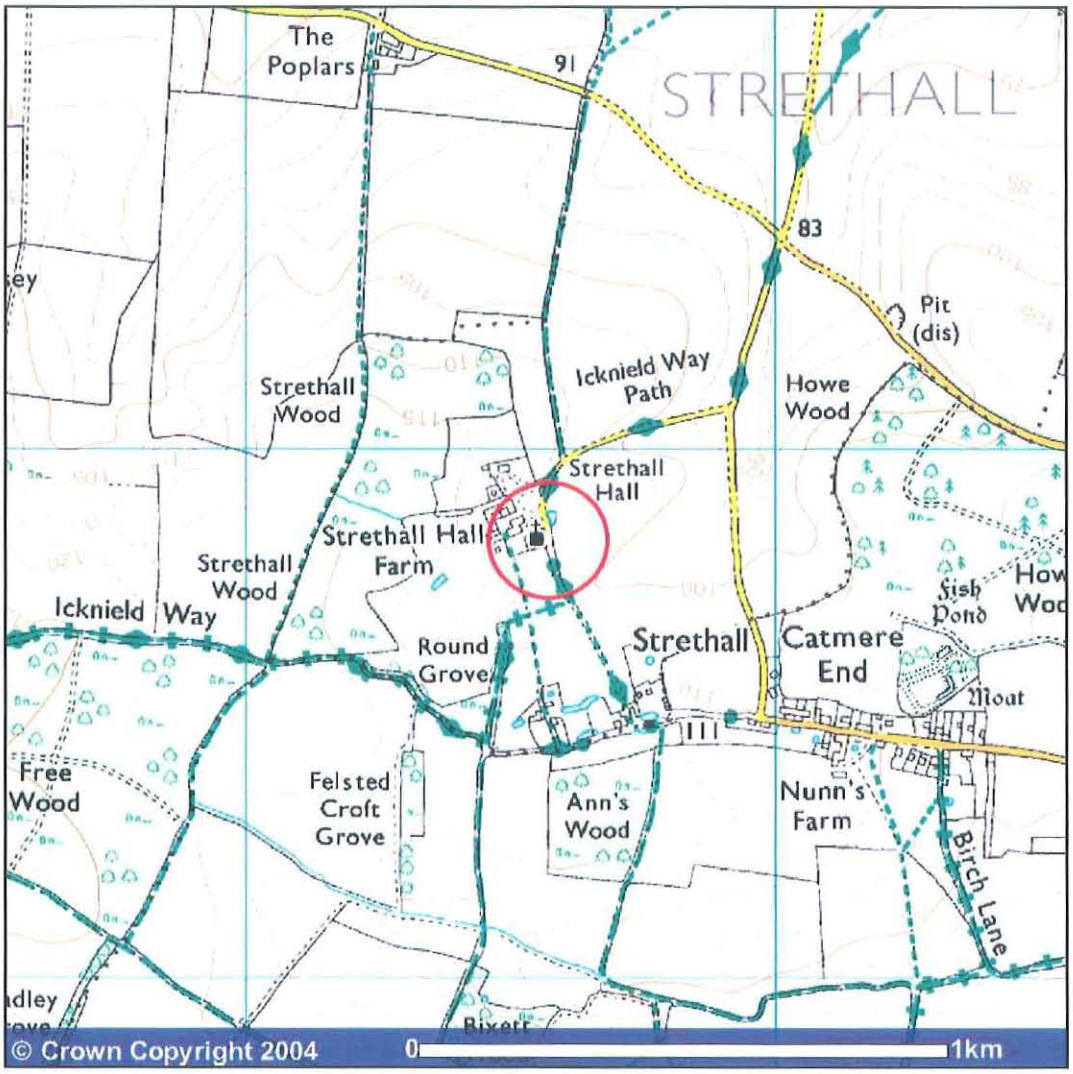

Figure 1: Map showing the location of the Church of St Mary the Virgin, Strethall

which 95% of samples are likely to have from 9 to 41 sapwood rings. Where bark is present on the sample the exact date of felling of the tree used 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 re-use of timbers, construction in most historical periods took place within a very few years after felling (Salzman 1952; Hollstein 1965).

Results

All the timbers investigated were of oak (*Quercus* spp.). Details of those timbers sampled are given in Table 1, with the locations of those from the nave roof timbers being illustrated in Figure 3, and two of the chancel roof timbers in Figure 4. Access was limited in both roofs, with a scaffold tower allowing access to the tie and one section of the nave roof, and scaffolding at the east end of the chancel allowing limited access to timbers of the east end only.

Very few timbers in the chancel roof appeared to have sufficient rings for dendrochronological analysis. The most favourable timbers were sampled and all found to contain less than 40 rings (Table 1). Of the limited number of timbers accessible from the scaffold tower in the nave, all had sufficient rings to justify further analysis.

Two samples were taken from the central tie to maximise the number of rings available, and the sapwood information. The samples *mvs01a* and *mvs01b* crossmatched (t = 9.9 with 80 years of overlap) and were combined to form a single series, *mvs01m*, with 156 rings.

Crossmatching between the nave roof samples revealed very strong matching between samples *mvs03* and *mvs07* (t = 11.2 with 116 years overlap) and comparison of the plots of these two series made it clear that there was a very strong possibility that the two timbers had been derived from the same parent tree. These two series were also combined to form *mvs37m*, and this was regarded as a single sequence in subsequent analysis. The crossdating between the samples is shown in Table 2.

The series were combined into a 165-year site chronology, ***STRETHAL***, which was dated by comparison with a range of regional and individual site chronologies, the best matches being shown in Table 3. Figure 5 illustrates the relative positions of overlap of the dated timbers, and the data for the site chronology are given in Table 4.

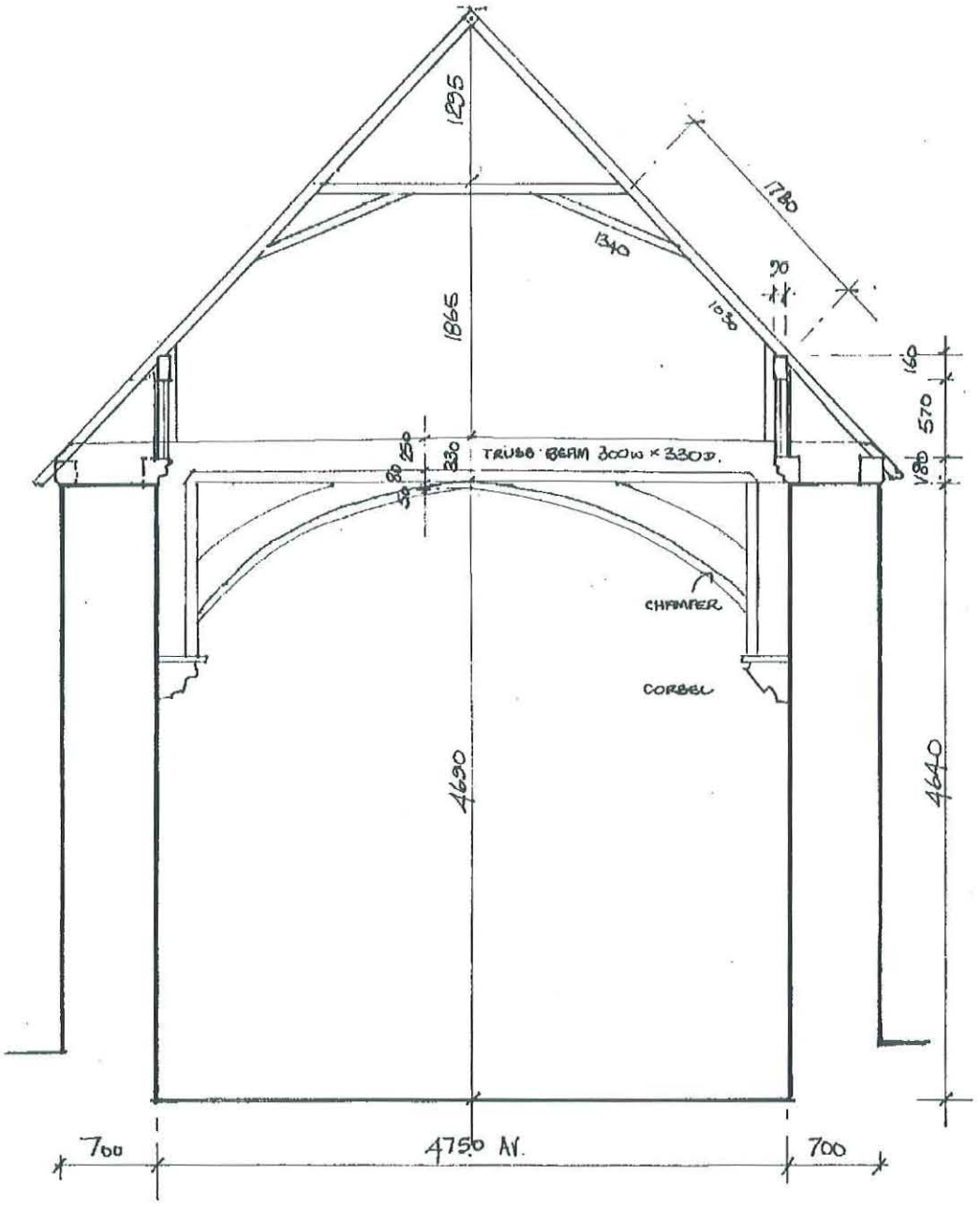

Figure 2: Cross-section of the nave roof showing the form of the central truss, adapted from an original drawing by Kay Pilsbury

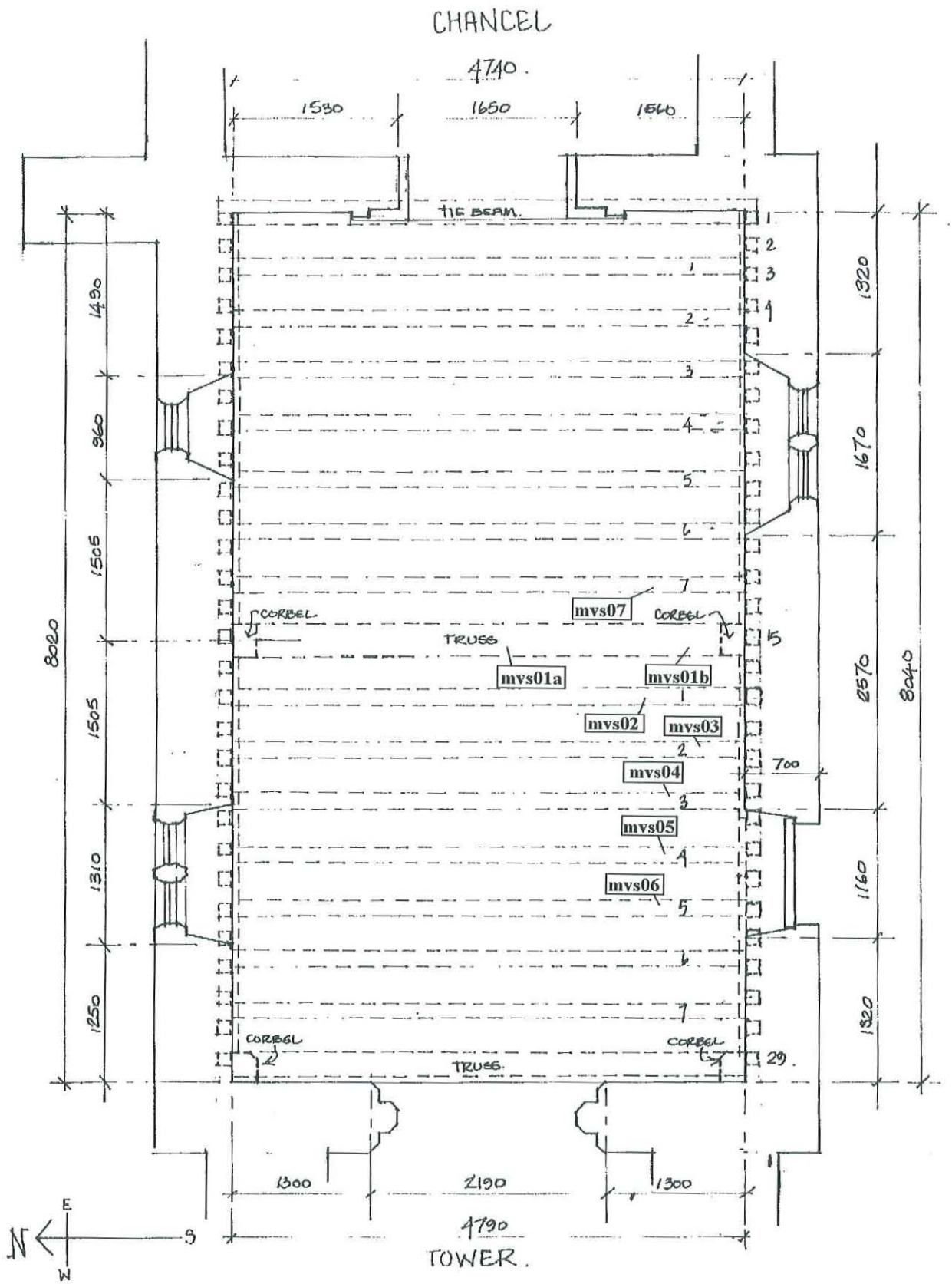

Figure 3: Plan of the Nave, showing the approximate locations of the samples taken for dendrochronology from this part of the church, adapted from an original drawing by Kay Pilsbury

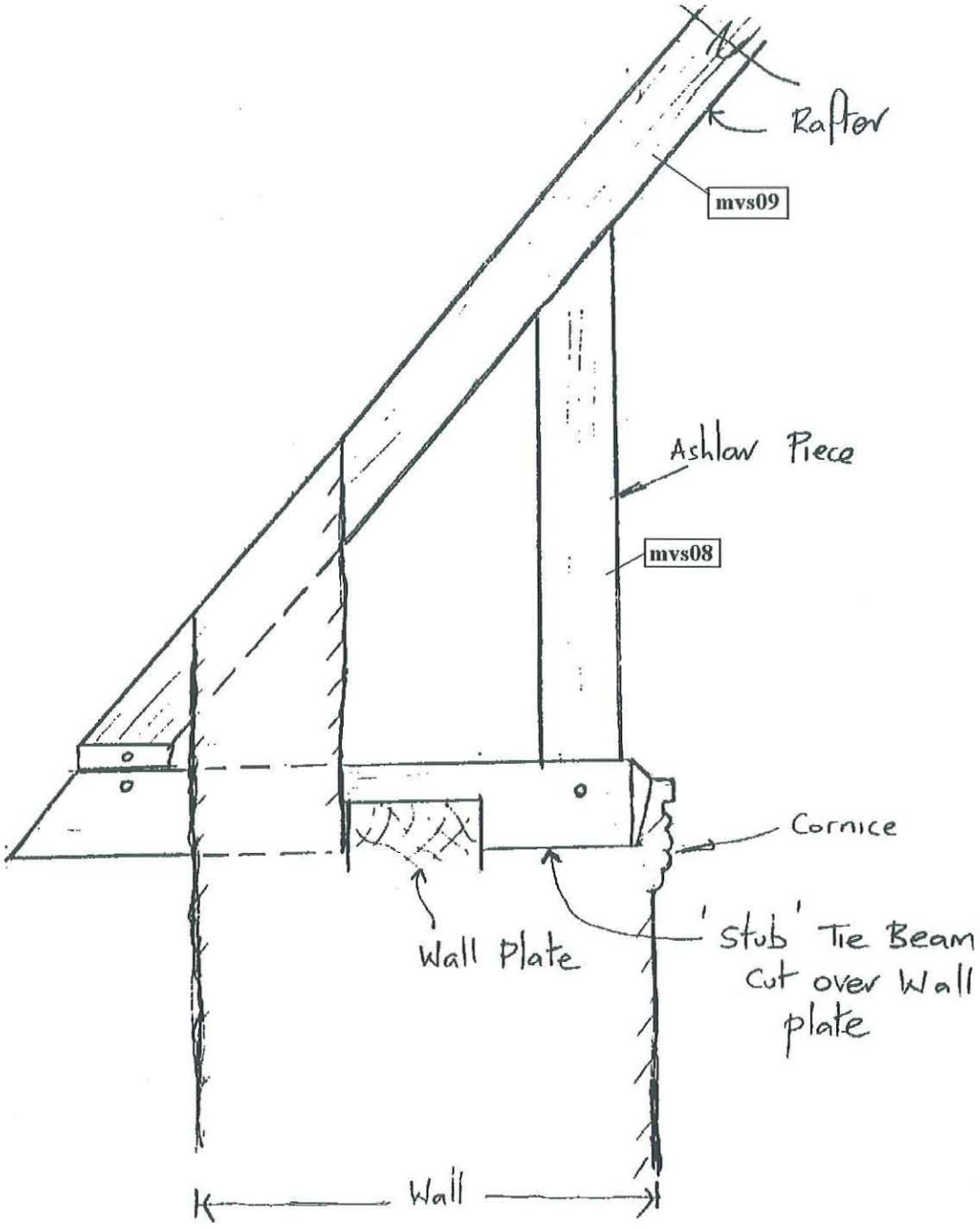

Figure 4: Drawing of the general form of the lower section of the chancel roof showing the approximate locations of two of the samples taken for dendrochronology, mvs 10 and 11 from the north side are not illustrated, adapted from an original drawing by Kay Pilsbury

Table 1: Dated oak (*Quercus* spp.) timbers sampled from the roofs of the church of St Mary the Virgin, Strethall, Essex

Sample number	Timber and position	Dates AD spanning	H/S bdry	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens mm	Felling seasons and dates/date ranges (AD)
NAVE									
mvs01a	Central tie beam	1347-1478	-	none	132	1.01	0.44	0.183	-
mvs01b	Central tie beam	1399-1502	1502	h/s	104	0.99	0.26	0.170	-
mvs01m	(mvs01a + mvs01b)	*1347-1502*	*1502*	*h/s*	*156*	*1.03*	*0.40*	*0.179*	*1511 - 1543*
mvs02	Rafter 1W, south	undated	-	h/s	48	1.51	0.74	0.190	unknown
mvs03	Rafter 2W, south	1382-1500	1500	h/s	119	1.03	0.37	0.226	1509 - 1541
mvs04	Rafter 3W, south	1373-1502	1502	h/s	130	1.17	0.48	0.171	1511 - 1543
mvs05	Rafter 4W, south	1444-1511	1502	9 (+9NM)	68	1.61	0.37	0.175	1520 - 1543
mvs06	Rafter 5W, south	1416-1477	-	-	62	1.84	0.97	0.306	after 1486
mvs07	Rafter 1E, south	1385-1500	1500	h/s	116	1.28	0.65	0.210	1509 - 1541
mvs37m	(mvs03 + mvs07)	*1382-1500*	*1500*	*h/s*	*119*	*1.15*	*0.48*	*0.208*	*1509 - 1541*
CHANCEL									
mvs08	Ashlar piece, south	undated	-	h/s	NM				unknown
mvs09	Rafter 4, south	undated			37 (NM)				unknown
mvs10	Rafter 2, north	undated			NM				unknown
mvs11	Wallplate tie 3, north	undated			NM				unknown
STRETHAL	**(01m + 37m + 04 + 05 + 06)**	**1347-1511**			**165**	**1.28**	**0.42**	**0.182**	**1520 - 1541**

t - values						
Sample No	**mvs03**	**mvs04**	**mvs05**	**mvs06**	**mvs07**	**mvs37m**
mvs01m	4.3	5.5	3.8	3.5	3.5	5.6
mvs03		4.6	5.5	5.3	11.2	*
mvs04			3.0	-	3.5	4.6
mvs05				-	6.0	6.2
mvs06					4.8	5.3

Table 2: Crossmatching between the dated individual sample series and the same-tree series, mvs37m, from the nave roof, St Mary the Virgin, Strethall, Essex. A (-) represents a *t*-value below 3.0, and (*) is used to show that no calculation was made as mvs03 is a constituent of mvs37m.

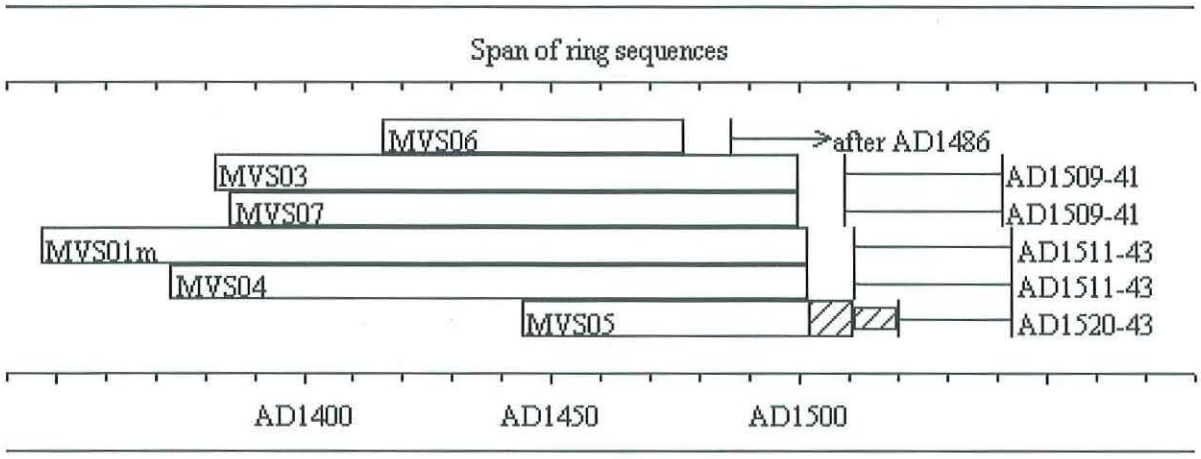

Figure 5: Bar diagram showing the relative positions of overlap of the dated samples from the nave roof of the Church of St Mary the Virgin, Strethall, along with their interpreted likely felling dates. Shaded parts of the bar represent sapwood rings, and narrow sections of bar represent additional unmeasured rings

Table 3: Dating of the oak site chronology ***STRETHAL***, the upper section contains multi-site regional chronologies, the lower section contains individual site chronologies

		STRETHAL AD 1347 – 1511	
Dated reference or site master chronology	**Dates spanned (AD)**	***t*-value**	**Overlap (yrs)**
London1175 (Tyers pers comm)	413 - 1728	7.3	165
Hants02 (Miles pers comm)	443 -1972	6.4	165
KENT88 (Laxton and Litton 1989)	1158 - 1540	5.1	165
Sutton House, London (Tyers and Hibberd 1993)	1319 - 1534	7.7	165
Mary Rose Refit (Bridge and Dobbs 1996)	1372 - 1535	6.6	140
Otley Hall panels, Suffolk (Tyers 2000)	1380 - 1555	6.5	132
Lawns Farm, Essex (Bridge unpubl)	1377 - 1536	6.4	135
Victoria Wharf, London (Tyers pers comm)	1410 - 1585	6.4	102
Widdington, Essex (Tyers 2001)	1361 - 1578	6.3	151
Forty Hall, London (Bridge 1997)	1364 - 1475	6.3	112
Palace Gate Farm, Odiham, Hampshire (Miles and Haddon-Reece 1996)	1271 - 1531	6.3	165
Marriotts, Norfolk (Tyers 1999b)	1310 - 1583	6.3	165
QEHL, London (Tyers 1993)	1398 - 1541	6.1	114
Mottisfont Abbey, Hampshire (Miles 1996)	1338 - 1538	6.0	124
Upton Hall, Northamptonshire (Pilcher and Meirion-Jones, pers comm)	1388 - 1485	6.0	98
Bruce3, London (Bridge 1998)	1434 - 1542	6.0	78
Charlwood, Surrey (Miles and Worthington 2001)	1424 - 1515	5.9	88
Warfield, Berkshire (Miles and Worthington 2002)	1338 - 1567	5.7	165
Barton Stacey, Hampshire (Miles and Worthington 2002)	1381 - 1539	5.6	131
Badge Court, Worcestershire (Bridge 2002)	1418 - 1578	5.6	94

Interpretation and Discussion

An inspection of the timbers of the nave roof, carried out with Richard Bond, suggests that no use was made of earlier, possibly Saxon timbers in the present roof and none were identified through dendrochronological analysis. Although access was only available to a limited area of the roof, the tie and rafters sampled suggest a most likely felling period of AD 1520-41 for the timbers of the nave roof, rather later than the date previously suggested on stylistic grounds. The crossdating suggests that the timbers used were most likely of relatively local origin.

Unfortunately, no suitable samples for dating were found in the chancel roof.

Acknowledgements

This work was commissioned by English Heritage, and I would like to thank Derek Hamilton for his assistance in arranging this work. Kay Pilsbury, the church architect, met me on site and was most helpful in supplying the drawings adapted for use in this report. Richard Bond (English Heritage) also visited during my fieldwork on-site, and discussed the building with me. The contractors, Lodges of Dunmow, were most helpful in allowing access, erecting, moving, and dismantling the scaffold tower.

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Table 4: Ring width data for the site chronology, ***STRETHAL,*** dated AD 1347 - 1511

ring widths (0.01mm)										no of trees									
324	87	66	100	297	218	241	126	58	70	1	1	1	1	1	1	1	1	1	1
77	81	90	63	83	122	129	138	158	134	1	1	1	1	1	1	1	1	1	1
177	241	173	143	182	136	141	111	153	201	1	1	1	1	1	1	2	2	2	2
139	167	159	174	178	169	155	111	164	168	2	2	2	2	2	3	3	3	3	3
187	189	144	130	138	111	101	101	129	147	3	3	3	3	3	3	3	3	3	3
135	169	189	145	120	156	178	170	167	164	3	3	3	3	3	3	3	3	3	3
122	113	113	79	70	59	64	71	87	74	3	3	3	3	3	3	3	3	3	4
69	93	82	93	108	95	125	122	84	75	4	4	4	4	4	4	4	4	4	4
109	127	118	116	127	187	112	88	110	140	4	4	4	4	4	4	4	4	4	4
144	130	96	100	98	128	196	142	131	123	4	4	4	4	4	4	4	5	5	5
129	113	121	149	164	145	119	135	142	158	5	5	5	5	5	5	5	5	5	5
164	113	95	100	139	110	139	117	137	160	5	5	5	5	5	5	5	5	5	5
166	213	182	176	135	145	130	143	163	117	5	5	5	5	5	5	5	5	5	5
95	91	97	104	132	94	90	90	82	116	5	4	4	4	4	4	4	4	4	4
120	105	125	111	83	90	95	111	98	129	4	4	4	4	4	4	4	4	4	4
98	74	78	86	91	96	112	147	147	153	4	4	4	4	3	3	1	1	1	1
108	98	114	133	156						1	1	1	1	1					