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ALL SAINTS' CHURCH, KINGTON MAGNA, DORSET
TREE-RING ANALYSIS OF TIMBERS FROM THE BELFRY FLOOR

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Dr Martin Bridge

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NGR ST 768 231

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SUMMARY

A total of eight samples was taken from timbers in the belfry floor. Four timbers dated, including the two major east-west foundation beams. Both these timbers, which may be reused in their current positions, dated to the late-fifteenth, or early sixteenth century. Only two subsidiary beams dated, and these may have come from a single parent tree felled in the mid- to late-fifteenth century. It is suggested that the present floor comprises old timbers reset into their current positions at some time after the late-fifteenth century.

CONTRIBUTORS

Dr Martin Bridge

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Dorset DT1 1XJ

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INTRODUCTION

This grade II*-listed parish church (NGR ST 768 231; Fig 1) has a late fifteenth-century tower, with much of the rest of the church being extensively rebuilt in the nineteenth century. Dating of the belfry floor was requested by the English Heritage Historic Buildings Inspector, Isla MacNeal, to inform ongoing repair work in the tower. The significance of the floor was a matter of some interest, as its removal was discussed. It is not clear whether the floor is all of one build, nor what its date of construction might be.

METHODOLOGY

The site was visited in February 2008. In the initial assessment, accessible oak timbers with more than 50 rings and where possible 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.

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 0.01mm, 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 (2004). Cross-matching 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.

Figure 1: Map showing the location of All Saints' Church, Kington Magna, Dorset

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 (1997), in which 95% of oaks contain 9–41 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).

RESULTS AND DISCUSSION

Details of the samples taken, which were all oak (*Quercus* spp.), are given in Table 1, with their positions being indicated on Figure 2. Many of the timbers were assessed as having too few rings for dendrochronological study, including the south wall plate and the beam numbered 4 in Figure 2.

*Table 1: Details of oak (*Quercus *spp.) timbers sampled from the belfry floor, All Saints' Church, Kington Magna, Dorset*

Sample number	Timber and position	No of rings	Mean width (mm)	Mean sens (mm)	Spanning dates AD	H/S bdry AD	Sapwood complement	Likely felling date ranges (AD)
ask01	Main east-west beam on south side	77	2.00	0.20	1396–1472	-	-	after 1481
ask02	Main east-west beam on north side	61	2.20	0.28	1418–78	1478?	?h/s	1487–1519
ask03	Diagonal beam	66	2.22	0.14	undated	-	?h/s	unknown
ask04	Beam 6	53	1.56	0.26	undated	-	?h/s	unknown
ask05	Beam 7 east	<45	nm	nm	undated	-	h/s	unknown
ask06	Beam 8 west	77	1.38	0.28	1367–1443	1443	h/s	1452–84
ask07	Beam 8 east	46	1.31	0.26	undated	-	h/s	unknown
ask08	Beam 9	71	1.75	0.24	1379–1449	1449	h/s	1458–90

Key: h/s = heartwood/sapwood boundary; ?h/s = suspected heartwood/sapwood boundary; nm = not measured

Beams 3 and 5 (Fig 2) were identified as being of elm (*Ulmus* spp). The southern main east-west beam (ask01), coloured green in Fig 2, rested on a relatively new stone corbel and had sockets for joists spaced approximately 300mm apart. The northern main east-west beam (ask02) has a chamfer-stop at the east end, but not at the west end. These factors suggest that these two major beams could be reused in their current position.

Cross-matching was found between some of the timbers (Table 2), with the possibility that samples ask06 and ask08 may have come from the same parent tree. As some of these matches were relatively weak, and the overlaps were all relatively short, the four timbers shown in Table 2 were each dated independently against reference material as a way of confirming the internal matches found.

Although it is possible that samples 06 and 08 came from the same parent tree, they displayed heartwood/sapwood boundaries some six years apart, and there was no other evidence to link them. They were therefore kept as two separate trees when combined along with sample 01, with which they matched, to form a 106-year site chronology, KNGTNMAG. This chronology was dated to the period AD 1367–1472 by comparison with dated reference material, the best results being shown in Table 3a. Sample ask02 did not match well with the other timbers (Table 2), but did date individually, the best results being shown in Table 3b. The data for the site chronology and sample ask02 are given in Table 4. With only heartwood/ sapwood boundaries remaining on the timbers, no precise felling dates can be given for any of the timbers.

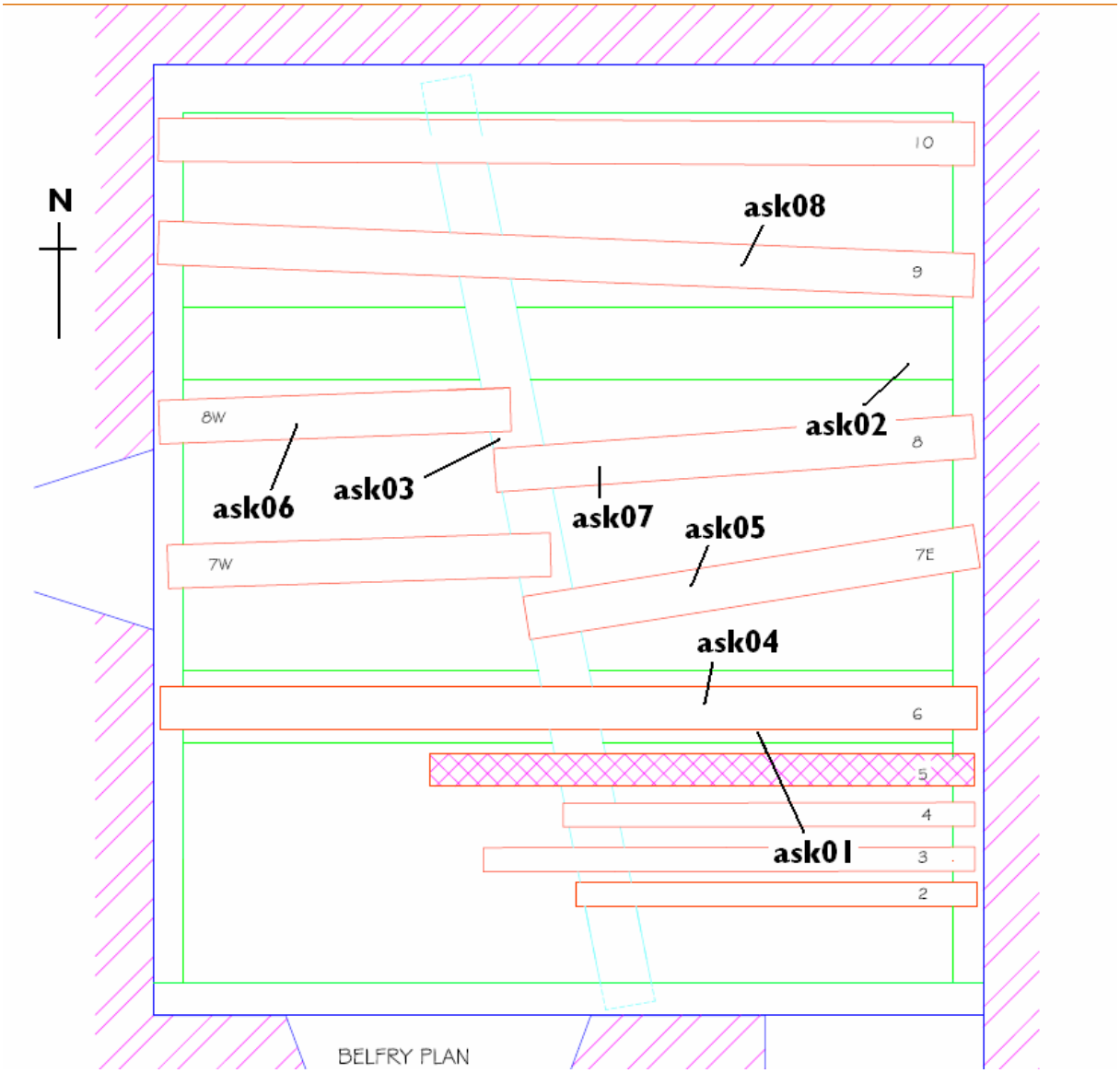

Figure 2: Plan of the belfry floor, showing the timbers sampled.

Adapted from an original drawing supplied by English Heritage

Other timbers showed potential cross-matches with the site chronology and with the reference material, but none of these were accepted because of the shortness of the overlaps and the relative weakness of the matches.

Table 2: Cross-matching between the dated elements from the belfry floor

Values over 3.5 are significant

	t-values		
Sample No	ask02	ask06	ask08
ask01	2.8	4.5	4.7
ask02		4.2	3.3
ask06			10.1

Dendrochronology has been successful in showing that a number of the timbers in the belfry floor are of fifteenth- (or early sixteenth-) century origin. It would appear that the floor contains timbers representing at least two different felling phases. Evidence has already been presented that suggests that the two major east-west foundation beams may be reused in their current positions. Interestingly, the tree-ring series from these two major beams did not give significant cross-matches with each other. These were found to be of a later date than the only other two timbers dated, although the possibility remains that these came from a single tree. These two minor beams were most likely felled in the second half of the fifteenth century.

The mix of species used, the strange angles and spacing of the beams relative to each other, and the lack of reliable cross-matching between the beams all suggest that the current floor is an amalgam of late fifteenth-century or possible early sixteenth-century timbers and possibly some from other periods too.

Table 3a: Dating evidence for the site series KNGTNMAG, AD 1367–1472

County/ region	Chronology name	Short publication reference	File name	Spanning (yrs AD)	Overlap (yrs)	*t*-value
Shropshire	Milk Street, Shrewsbury	(Miles 1996a)	MILKST2	1392–1565	81	6.2
Somerset	George Inn, Norton St Philip	(Miles and Worthington 1998)	GEORGIN2	1290–1509	106	6.2
Devon	Prowse Barn	(Groves 2005)	PROWSEBN	1380–1473	93	5.8
Gloucestershire	St Andrew's Chapel, Frocester	(Fletcher *et al* 1985)	FROC247	1385–1476	88	5.7
Hampshire	Mottisfont Abbey	(Miles 1996b)	MOTISFNT	1388–1538	85	5.6
England	Ref3 Master Chronology	(Fletcher 1977)	REF3	1399–1687	74	5.5
Berkshire	Shaw House, Newbury	(Miles *et al* 2004)	SHAW1	1391–1579	82	5.4
Worcestershire	Mere Hall, Hanbury	(Miles *et al* 2005)	MEREHALL	1408–1610	65	5.4
Worcestershire	The Commandery, Worcester	(Arnold *et al* 2006)	WORDSQ01	1284–1473	106	5.4

Table 3b: Dating evidence for the site series ask02, AD 1418–1478

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
Herefordshire	Booth Hall, Hereford	(Boswijk and Tyers 1997)	HIGHTOWN	1302–1487	61	7.7
Herefordshire	Cradley Village Hall	(Miles *et al* 2004)	CRADLEY	1347–1530	61	7.6
Southern England	Southern England Master	(Bridge 1998a)	**SENG98**	944–1790	61	7.6
Worcestershire	Church House, Areley Kings	(Miles *et al* 2003)	ARELEY	1365–1535	61	7.5
Surrey	East barn, Newdigate	(Bridge 1998b)	EASTBARN	1312–1483	61	7.3
Worcestershire	St Andrew's Church, Pixley	(Bridge 2006)	PIXPORCH	1388–1467	50	7.3
East Midlands	East Midlands Master	(Laxton and Litton 1988)	**EASTMID**	882–1981	61	7.1
Warwickshire	Gorcott Hall	(Nayling 2006)	GORC_T17	1385–1531	61	7.0
Warwickshire	Saltisford	(Howard *et al* 1996)	SALTIS	1412–99	61	7.0
London	Fulham Palace	(Bridge and Miles 2004)	FULHAM1	1356–1494	61	6.9

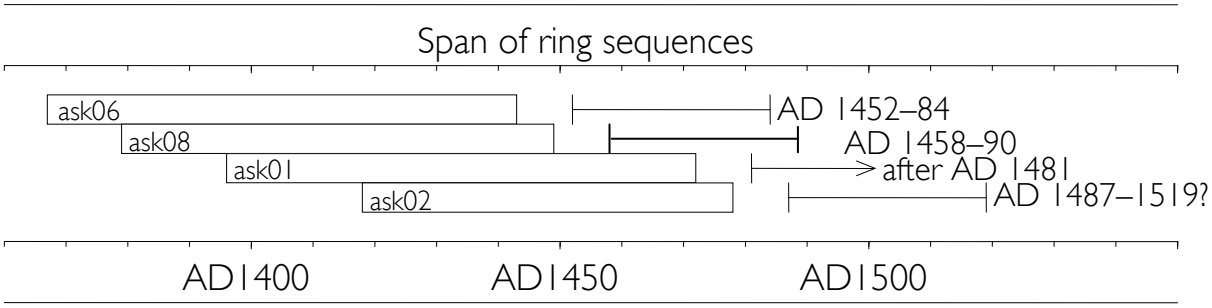

Figure 3: Bar chart showing the relative positions of overlap of the dated timbers along with their derived felling date ranges

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Table 4: Ring width data for the site chronology KNGTNMAG AD 1367–1472, and ask02 AD 1418–78

Ring widths (0.01mm)										no of trees									
KNGTNMAG																			
136	170	284	314	190	160	128	217	319	185	1	1	1	1	1	1	1	1	1	1
228	115	63	46	53	81	103	95	67	123	1	1	2	2	2	2	2	2	2	2
145	135	158	174	188	115	109	103	124	306	2	2	2	2	2	2	2	2	2	3
259	292	315	308	297	139	140	130	172	317	3	3	3	3	3	3	3	3	3	3
233	224	258	180	161	203	188	145	177	152	3	3	3	3	3	3	3	3	3	3
163	199	135	166	180	173	293	241	238	159	3	3	3	3	3	3	3	3	3	3
131	194	150	103	139	189	174	116	200	162	3	3	3	3	3	3	3	3	3	3
194	182	131	126	155	156	135	167	161	156	3	3	3	3	3	3	3	2	2	2
161	116	120	94	96	129	108	115	129	136	2	2	2	1	1	1	1	1	1	1
116	118	153	146	102	96	115	99	125	132	1	1	1	1	1	1	1	1	1	1
131	155	129	163	132	142					1	1	1	1	1	1				
ask02																			
358	202	347	341	263	379	364	305	217	246										
370	165	182	201	463	208	240	361	266	278										
211	144	144	241	150	287	229	141	150	219										
245	144	186	283	214	196	215	186	293	271										
203	115	155	130	157	166	131	255	246	211										
311	210	227	128	93	93	108	175	131	129										
125																			