# ST NICHOLAS' CHURCH, FUNDENHALL, NORFOLK TREE-RING ANALYSIS OF TIMBERS FROM THE BELFRY STAGE, DOOR AND DOORFRAME

SCIENTIFIC DATING REPORT

Martin Bridge





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## ST NICHOLAS' CHURCH, FUNDENHALL, NORFOLK

## TREE-RING ANALYSIS OF TIMBERS FROM THE BELFRY STAGE, DOOR AND DOOR FRAME

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#### SUMMARY

Of the few available timbers from the belfry stage three, representing two trees, were dated from components of the belfry stage. One joist was most likely felled in the late sixteenth or early seventeenth century, whilst the other two main beams were felled in the early- to mid- seventeenth century. The timbers from the potentially original Norman door and its frame contained too few rings to be dated dendrochronologically.

#### CONTRIBUTOR

Dr M C Bridge

#### ACKNOWLEDGEMENTS

The sampling and analysis of these timbers was funded by English Heritage (EH), and requested by Colin Jeffries (EH Historic Buildings Architect). The work was commissioned by Isabelle Parsons (EH Scientific Dating Team). I am grateful to the contractor, Mr Stephen Capper, for arranging access. Cathy Tyers (Sheffield University) and John Meadows (EH) are thanked for their comments on an earlier draft of this report.

#### **ARCHIVE LOCATION**

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## INTRODUCTION

This church is located in the village of Fundenhall, some 15km to the south-west of Norwich (Figs 1 and 2) and is characterised by a Norman crossing tower with small, original, north and south windows. There is a chancel and aisle-less nave. The church was closed in 2004 after stones fell from the tower, but should re-open following repairs grant-aided by English Heritage. At the head of the stair is a door set in a wooden frame which may be part of the original build, and above this is a belfry stage thought to have been added in the fifteenth century. Many of the ends of the floor beams have decayed and further decay around the central trap has led to the decision to remove most of the floor structure, but its dating would help increase the understanding of phasing within the development of the tower. For this reason, dendrochronological assessment and sampling of the door, doorframe, and belfry stage were requested by Colin Jeffries, Head Buildings Architect/Surveyor at the Cambridge office of English Heritage.

The belfry stage (Fig 3) is supported by two large north-south beams, and consisted of a large east-west beam at either end of the floor and nine smaller east-west joists, one of which is interrupted by a central opening with north-south trimmers. The door frame and door opening onto the lower stage (Fig 4) are illustrated in Figure 5. The frame has two planks forming an arch at the head, a very old style. The door consists of three large planks some 58mm  $(2\frac{1}{4}")$  thick.

## METHODOLOGY

The timbers were originally assessed and sampling carried out in November 2008. The timing of this visit was such that the majority of the belfry stage timbers had already been removed from the site. It was initially anticipated that some of these *ex-situ timbers* might be located and hence incorporated into the investigation, but unfortunately, having delayed production of the report, this subsequently proved not to be the case. Sampling was therefore far more limited than had been initially expected. Slices were obtained from two of the timbers being removed from the belfry stage, and cores were taken from *in-situ* timbers from the belfry stage and door using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis.

The cores and the slices were polished on a belt sander using 80 to 400 grit abrasive paper to allow the ring boundaries to be clearly distinguished. The samples had their treering 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 lan 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 potential errors in the measurements when the samples cross-match.

In comparing one sample or site master against other samples or chronologies, *t*-values over 3.5 are considered significant, although in reality it is common to find demonstrably spurious *t*-values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some *t*-value ranges of 5, 6, and higher, and for these to be well replicated from different, independent chronologies with both local and regional chronologies well represented, except where imported timbers are identified. Where two individual samples match together with a *t*-value of 10 or above, and visually exhibit exceptionally similar ring patterns, they may have originated from the same parent tree. Same-tree matches can also be identified through the external characteristics of the timber itself, such as knots and shake patterns. Lower *t*-values however do not preclude same tree derivation.

#### Ascribing felling dates and date ranges

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 straightforward. 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 an empirically derived sapwood estimate with a given confidence limit. 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 (tpq)* or felled-after date.

A review of the geographical distribution of dated sapwood data from historic timbers has shown that a sapwood estimate relevant to the region of origin should be used in interpretation, which in this area is 9–41 rings (Miles 1997). It must be emphasised that dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure or object under study.



Figure 1. Map to show the location of Fundenhall

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Figure 2. Map showing the location of the church within its immediate environs

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## RESULTS

As indicated above, fewer timbers than expected could be sampled, as the majority of belfry timbers had already been removed from the site, and of those left, few contained sufficient numbers of rings to be considered likely to date. The timbers sampled, other than fdn04 which was a supplementary trimmer in the belfry floor not shown on the drawing, are shown in Figures 3 and 4, with the door and its frame being shown in Figure 5. The door frame contained fewer than 40 rings and was not sampled.

Basic information about the samples taken is presented in Table 1. Samples fdn04 and fdn06 both contained fewer than 40 rings and were not measured as further analysis could not be justified on these short sequences. Cross-matching between the measured samples is shown in Table 2. Samples fdn02 and fdn03, the two north-south support beams to the belfry stage, matched each other very well and they are thought to have come from the same tree because of their high *t*-value match, the similarity in the plots of their rings, and the visual similarity of physical characteristics of the timbers. The ring series from these two samples were therefore averaged and the resulting series, fdn23m, was used in subsequent analysis. Sample fdn05, from the original joist at the south side, matched fdn23m (t = 4.4), and the two series were also dated independently (Tables 3a and 3b). These two series were combined to form the site chronology FUNDNHL1. This was subsequently dated to the period AD 1503–1614, the dating evidence being presented in Table 3c. The data for the two dated series is given in the Appendix.

Sample fdn01 had only 48 rings and did not match the other series, nor did it date independently, and it therefore remains undated.

,					
Sample	Description	Description Rings Sapwood Date of measured sequence (AD)		Interpreted felling date (AD)	
fdn01	Northern east-west beam	48	h/s	undated	unknown
fdn02	Eastern north-south beam	81	h/s	1534–1614	1623-55
fdn03	Western north-south beam	63	h/s	1552–1614	1623-55
fdn04	Supplementary trimmer	<40	-	undated	unknown
fdn05	South-most joist	86	h/s	1503–88	1597-1629
fdn06	Inner (hinge) leaf of door	<40	-	undated	unknown

Table 1. Details of the samples taken for dendrochronology (h/s = heartwoodsapwood boundary)

Table 2. Cross-matching between dated individual samples, and the same-tree mean fdn23m

<i>t</i> -value							
Sample	fdn03	fdn05					
fdn02	9.2	3.6					
fdn03		3.9					
fdn23m		4.4					

#### Table 3a. Dating evidence for the site sequence fnd23m, AD 1534–1614

Reference chronology	Overlap (yrs)	<i>t</i> -value
WRD-B, Wardington Manor, Oxfordshire (Miles et al 2006)	68	5.8
ALFASQ01, Manor House, Alford, Lincolnshire (Howard et al 2003)	81	5.7
BLSBSQ01, Bolsover Castle, Derbyshire (Arnold <i>et al</i> 2003)	81	5.6
APMASQ01, Appleby Magna, Leicestershire (Arnold et al 2008a)	81	5.4
EASTMID, East Midlands Master (Laxton and Litton 1998)	81	4.9
ANGLIA03, East Anglian Master (Bridge 2003 unpubl)	81	4.7
BRTASQ03, Bretby Hall, Derbyshire (Howard et al 1999)	80	4.7
MODELFM, Model Farm, Linstead Magna, Suffolk (Bridge 2002)	81	4.6

Reference chronology		<i>t</i> -value	
	(yrs)	e valae	
NETTLE I, Nettlestead Chace, Suffolk (Miles <i>et al</i> 2007)	60	6.8	
CHENIES I, Chenies Manor, Buckinghamshire (Miles et al 2004)	49	6.5	
OTLEY_EN, Otley Hall, Suffolk (Tyers 2000)	53	5.9	
KNGHSQ01, Kingsbury Hall, Warwickshire (Arnold <i>et al</i> 2006)	62	5.9	
MTTNGHM2, Mettingham, Suffolk (Bridge 2009)	61	5.8	
DEBNHM2, Gracechurch Street, Debenham, Suffolk (Miles <i>et al</i> 2009)	86	5.6	
MODELFM, Model Farm, Linstead Magna, Suffolk (Bridge 2002)	86	5.5	
ANGLIA03, East Anglian Master (Bridge 2003 unpubl)	86	5.4	

## Table 3b. Dating evidence for the site sequence fnd05 AD 1503-88

## Table 3c. Dating evidence for the site master FUNDNHLI, AD 1503-1614

Reference chronology	Overlap	<i>t</i> -value
5	(yrs)	
ALFASQ01, Manor House, Alford, Lincolnshire (Howard <i>et al</i> 2003)	112	7.3
OKMASQ02, Flore's House, Oakham, Rutland (Arnold et al 2008b)	89	7.1
EASTMID, East Midlands Master (Laxton and Litton 1998)	112	6.9
OWSTON2, St Andrew's Church, Owston, Leicestershire (Howard et al 1998)	109	6.7
NETTLEI, Nettlestead Chace, Suffolk (Miles <i>et al</i> 2007)	60	6.5
ANGLIA03, East Anglian Master (Bridge 2003 unpubl)	112	6.3
BLSBSQ01, Bolsover Castle, Derbyshire (Arnold <i>et al</i> 2003)	83	6.3
MODELFM, Model Farm, Linstead Magna, Suffolk (Bridge 2002)	112	6.2
CRATFLD I, Cratfield bellframe, Suffolk (Bridge 2008)	112	6.1
BOARSTL2, Boarstall Tower, Buckinghamshire (Miles and Worthington 1999)	112	6.1
CATESBY, Priory Meadow, Lower Catesby, Northamptonshire (Bridge 2000)	77	6.1
BEDFLD2, Bedfield Hall, Suffolk (Miles <i>et al</i> 2007)	112	6.1



Figure 3. Plan of the belfry stage showing the timbers samples, adapted from an original drawing by Ruth Blackman



Figure 4. Cross-section of the tower, looking south, showing the positions of two timbers sampled and the doorway, adapted from an original drawing by Ruth Blackman



Figure 5. Photograph of the door and doorframe.



Figure 6. Bar chart showing the relative positions of overlap of the three dated timbers along with their likely interpreted felling date ranges

## INTERPRETATION AND DISCUSSION

There is a 26-year range in the heartwood-sapwood boundary dates between the three dated components of the belfry stage (Table I, Fig 6). This relatively large difference, yet nevertheless overlapping felling date ranges mean it is not possible to distinguish whether these elements represent a single felling phase or two felling phases separated by several years, or the dated timbers represent stockpiled elements or subsequent modifications or repairs. It is possible, however, to say that the belfry stage incorporates a single joist felled either at the very end of the sixteenth century or early seventeenth century, and two supporting north-south beams were derived from a tree felled in the early to mid-seventeenth century, thus providing some information on the development of the tower itself.

A single sample was taken from a door leaf to confirm the assessment of the planks as having too few rings for dating, as the rings were not easy to distinguish on this grimeladen door. The trees used in the construction of the door and its frame were fastgrown, and not suitable for dating.

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## APPENDIX

Ring width values (0.01mm) for the sequences measured

fnd23m AD 1534-1614

248	267	247	259	371	430	339	243	196	233
238	234	290	242	307	295	312	271	305	303
252	350	291	176	255	358	318	334	361	299
203	243	230	222	321	244	330	208	217	231
246	277	333	356	310	331	406	307	321	300
283	265	333	168	208	208	175	145	262	297
273	289	255	251	244	216	256	181	192	285
244	195	241	267	201	168	244	243	244	249
198									

fnd05 AD 1503-88

299	396	433	560	394	238	275	215	210	214
266	197	190	198	166	325	157	121	126	158
112	162	119	166	189	198	207	149	252	171
131	109	168	127	185	183	235	203	196	131
146	125	158	139	120	194	252	214	193	184
191	119	92	70	66	83	158	129	162	155
138	101	105	119	95	143	114	169	82	104
78	4	128	147	109	156	154	160	112	71
104	81	91	128	144	103				