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CHURCH OF ST MARY MAGDALEN, WIGGENHALL ST MARY MAGDALEN, NORFOLK

TREE-RING DATING

SCIENTIFIC DATING REPORT

Dr Martin Bridge

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NGR TF 598 114

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SUMMARY

Timbers from the south porch were rejected, whilst eight samples were taken from the south aisle roof. Two series, both from common rafters, were found to match each other well, possibly having been derived from the same tree. The resulting series dated to the period AD 1278–1394 and retained the heartwood-sapwood boundary, producing a likely felling date range of AD 1403–35. This agrees well with a known campaign of building work in the church of *c.* AD 1420–35, when it is thought the windows were inserted in the south aisle wall.

ACKNOWLEDGEMENTS

This work was commissioned by Dr John Meadows of the Scientific Dating Service, English Heritage. Access arrangements were made by Ruth Blackman who also arranged for the contractors to have a 'cherry-picker' available on the day. I was assisted in the field by Dr Carol West. I thank Cathy Tyers (Sheffield University) and Jane Sidell (English Heritage) for useful comments on an earlier draft of this report.

DATE OF FIELDWORK

September 2007

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INTRODUCTION

The grade I listed parish church of Wiggenhall St Mary Magdalen (NGR TF 598 114; Fig 1) lies about 10km south of King's Lynn, and dates back to the thirteenth century. It is predominantly of brick with some rubblestone. The nave aisles have flat stepped buttresses, with angle buttresses to the east. Each bay has a three-light Perpendicular window dating to a building campaign *c.* AD 1420-1435 (listing description on www.imagesofengland.org.uk). The nave roof has tie beams on arched braces with solid carved spandrels on grotesque corbels. It has moulded queen posts to butt purlins and principals, also both moulded. The two storey south porch is of brick with ashlar dressings and diagonal buttresses and is dated stylistically to the early fifteenth century. Dating of the porch and south aisle roof was requested by Ian Harper, Historic Buildings Architect, to inform the on-going grant-aided repair programme.

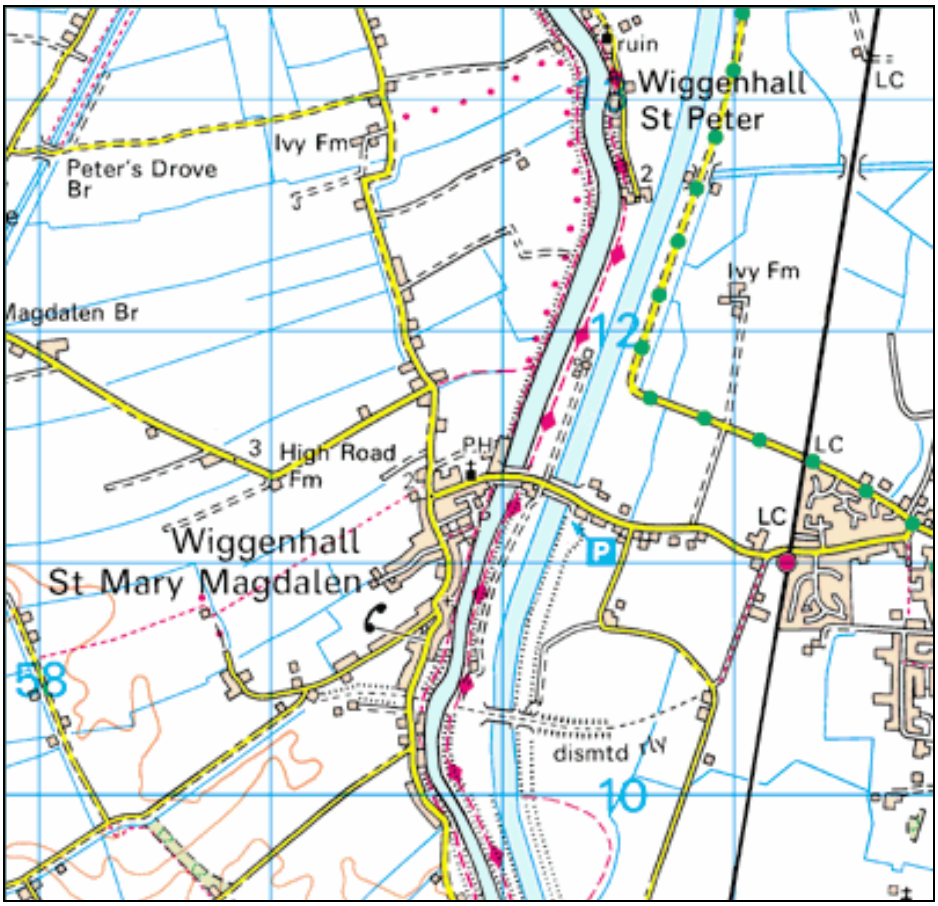

Figure 1: Map showing the location of the church of St Mary Magdalen, Wiggenhall St Mary Magdalen, Norfolk.

METHODOLOGY

The site was assessed in September 2007. 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, labeled, 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 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 date of felling of each timber and subsequent 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

The south porch was assessed and found to contain a number of quite small timbers with insufficient rings to allow for dendrochronological dating. No sampling was undertaken in this area. Prior to visiting the site, the original brief was extended to include the north aisle roof if this was accessible and potentially useful with respect to getting decent samples that might aid the dating of the south aisle roof. Unfortunately it was not accessible at the time of sampling.

The south aisle roof was accessed from a 'cherry-picker' that was sited in the aisle (the pews having been removed) and had limited manoeuvrability along the length of the aisle. The narrowness of the aisle meant that not all timbers could be readily accessed, and some timbers were not therefore assessed. Nevertheless, a total of eight potentially useful timbers, including a principal rafter, five common rafters, and two cornices were sampled. All timbers sampled were of oak (*Quercus* spp.). Details of the samples are given in Table 1, and the positions of the samples are illustrated in Figure 2. The principal rafters were numbered 1-11 from east to west, and the common rafters were labeled in the same direction on a bay-by-bay basis.

The sample **wig07** was found to have too few rings to warrant further analysis. Cross-matching between the remaining samples revealed sample **wig06** matched sample **wig08** (t = 10.0 with 86 years of overlap). These were two common rafters in different bays, but may well have come from the same parent tree. The two series were combined to make a 117-year site master, **WIGGNHLL**. No other samples matched each other. Comparisons of the site master and the remaining individual series dated the site master to the period AD 1278–1394, some of the best matches being shown in Table 2, but failed to date any of the remaining individual series.

The relative positions of overlap of the two dated series are shown in Figure 3, and the data for the site master are given in Table 3.

INTERPRETATION AND DISCUSSION

It was disappointing that so few timbers were accessible at the time of sampling, but nevertheless two common rafters, possibly representing a single parent tree, did date. One of these retained the heartwood-sapwood boundary, allowing a most likely felling date range to be calculated as AD 1403–35. This accords well with a known phase of work in the church when it is thought that the south aisle windows were added, in *c.* AD 1420–35).

Whilst this appears to support the other dating evidence for of the south aisle roof, it may be possible to narrow the date of construction further, should the aisle be scaffolded providing better access during future works. The north aisle, thought to be of the same age, may itself yield further suitable samples if it too becomes accessible in the future.

The best matches for the site series derived from this study were with Norfolk chronologies, strongly suggesting that the timber used was of local origin.

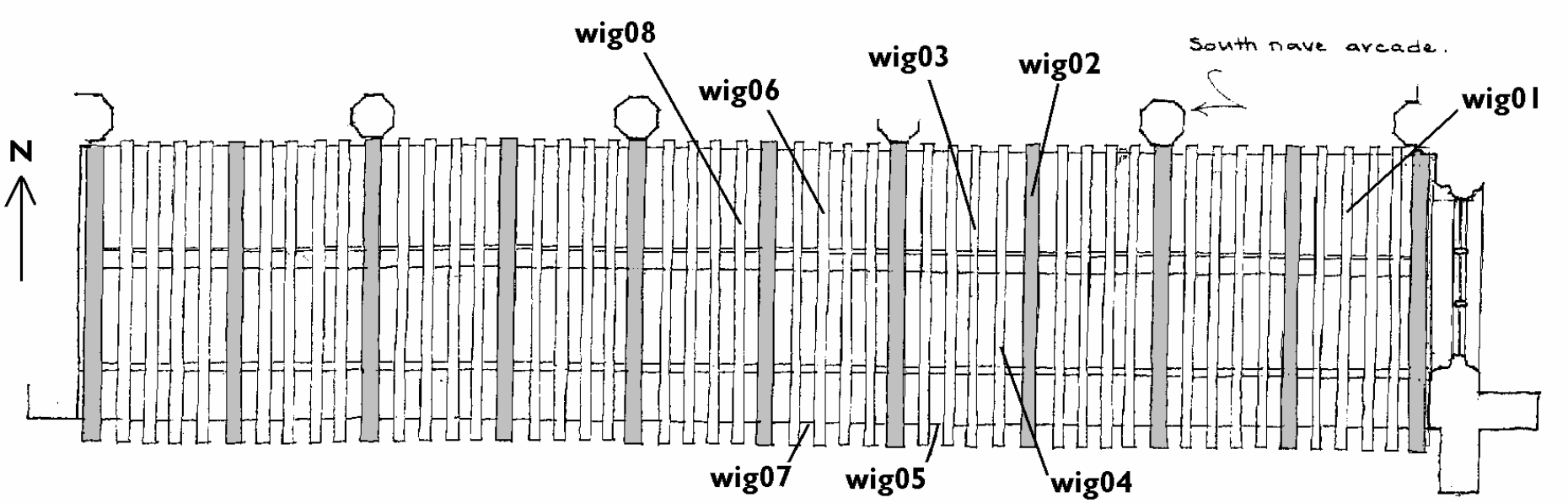

Figure 2: Plan of the south aisle roof, showing the timbers sampled for dendrochronology, based on an original drawing by Ruth Blackman. The principal rafters have been shaded to assist in distinguishing the bays

*Table 1: Details of oak (*Quercus *spp.) timbers sampled from the South Aisle Roof, Church of St Mary Magdalen, Wiggenhall St Mary Magdalen, Norfolk. Bays, principal rafters, and rafters are numbered from the east end*

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)
wig01	Bay 1, rafter 3	97	1.18	0.19	undated	-	-	unknown
wig02	Principal rafter 4	89	1.37	0.25	undated	-	h/s	unknown
wig03	Bay 4, rafter 2	57	1.33	0.24	undated	-	-	unknown
wig04	Bay 4, rafter 1	60	2.14	0.23	undated	-	h/s	unknown
wig05	Bay 4, cornice	48	1.05	0.24	undated	-	h/s	unknown
wig06	Bay 5, rafter 3	108	1.48	0.18	1278–1385	-	-	after 1394
wig07	Bay 5, cornice	<40	NM	-	undated	-	-	unknown
wig08	Bay 6, rafter 1	95	1.40	0.16	1300–94	1394	h/s	1403–35

Key: NM = not measured; h/s = heartwood/sapwood boundary

Table 2: Dating evidence for the series ***WIGGNHLL****, AD 1278–1394*

County/ region	Chronology	Reference	File name	Spanning (yrs AD)	Overlap (yrs)	t-value
Norfolk	Castle Acre Priory	Tyers 2000	CAP-LOW	1237–1356	79	7.9
Norfolk	Norwich Great Hospital	Bridge 2003	NORWICH	1249–1435	117	5.8
Norfolk	Lodge Farm, Denton	Groves and Hillam 1993	DENTON	1215–1335	58	5.6
Norfolk	Abbey Farm, Thetford	Howard *et al* 2000	THTASQ02	1237–1428	117	5.5
Essex	Mill Street, St Osyth	Miles *et al* 2005	OYMFOUR	1282–1418	113	5.3
Oxfordshire	Godfrey's Farm, East Hendred	Miles and Worthington 2002	EAHC10	1301–1419	94	5.1
Essex	Cann Hall	Tyers 1998	CANNHALL	1301–1511	94	4.9
London	Gentleman's Row, Enfield	Bridge 1997	GENTSROW	1291–1464	104	4.8
Suffolk	Debenham Church	Bridge 2001	DEBENHAM	1256–1388	111	4.7
Hampshire	Place House Cottage	Miles and Worthington 1999	PLACEHS	1311–1447	84	4.5

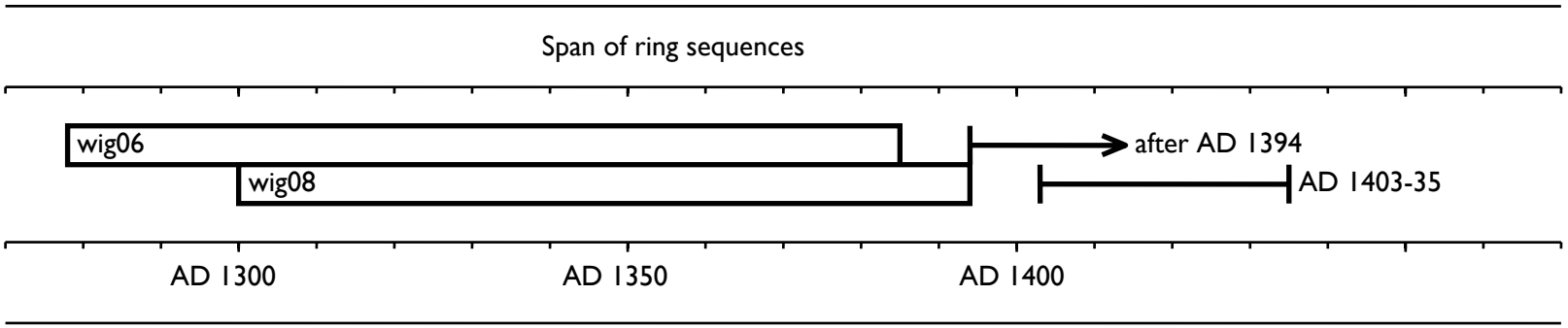

Figure 3: Bar diagram showing the relative positions of overlap of the two dated timbers, along with their interpreted likely felling dates

REFERENCES

Baillie, M G L, and Pilcher, J R, 1973 A simple cross-dating program for tree-ring research, *Tree Ring Bulletin,* **33**, 7–14

Bridge, M C, 1997 *Tree-ring analysis of timbers from 17 Gentleman's Row, Enfield, London*, Anc Mon Lab Rep, **97/97**

Bridge, M C, 2001 *Tree-ring analysis of timbers from the Church of St Mary Magdalene, Debenham, Suffolk*, Centre for Archaeol Rep, **43/2001**

Bridge, M C, 2003 *Tree-ring analysis of timbers from the Great Hospital, Bishopgate, Norwich, Norfolk*, Centre for Archaeol Rep, **10/2003**

Groves, C and Hillam, J, 1993 *Tree-ring dating of oak timbers from Lodge Farm, Denton, Norfolk*, Anc Mon Lab Rep, **85/93**

Hollstein, E, 1965 Jahrringchronologische von Eichenholzern ohne Walkande, *Bonner Jahrbuecher,* **165,** 12–27

Howard, R E, Laxton, R R, and Litton, C D, 2000 *Tree-ring analysis of timbers from the barn and cottage, Abbey Farm, Thetford, Norfolk*, Anc Mon Lab Rep, **48/2000**

Miles, D H, 1997 The interpretation, presentation, and use of tree-ring dates, *Vernacular Architect,* **28,** 40–56

Miles, D H, and Worthington, M J, 1999 Tree-ring dates, *Vernacular Architect*, **30**, 98–113

Miles, D H, and Worthington, M J, 2002 Tree-ring dates, *Vernacular Architect*, **33**, 81–102

Miles, D H, Worthington, M J, and Bridge, M C, 2005 Tree-ring dates, *Vernacular Architect*, **36**, 87–101

Salzman, L F, 1952 *Building in England down to 1540,* Oxford

Tyers, I, 1998 *Tree-ring analysis of Cann Hall, Clacton, Essex*, Anc Mon Lab Rep, **25/98**

Tyers, I, 2000 Tree-ring analysis of oak timbers from the Prior's House, Castle Acre, Norfolk, Anc Mon Lab Rep, **46/2000**

Tyers, I, 2004 *Dendro for Windows program guide 3rd edn*, ARCUS Rep, **500b**

Table 3: Ring width data for the site chronology ***WIGGNHLL****, AD 1278–1394*

Ring widths (0.01mm)										no. of trees									
252	122	179	318	402	257	263	277	202	179	1	1	1	1	1	1	1	1	1	1
226	340	331	299	364	252	228	268	342	276	1	1	1	1	1	1	1	1	1	1
227	124	128	165	216	168	177	112	109	169	1	1	2	2	2	2	2	2	2	2
164	226	195	133	135	138	145	169	158	156	2	2	2	2	2	2	2	2	2	2
180	145	141	159	152	164	138	115	89	117	2	2	2	2	2	2	2	2	2	2
122	153	113	89	94	68	114	110	113	105	2	2	2	2	2	2	2	2	2	2
120	166	122	129	107	97	134	135	114	123	2	2	2	2	2	2	2	2	2	2
107	89	111	158	164	169	118	132	142	149	2	2	2	2	2	2	2	2	2	2
104	122	115	124	98	120	143	117	125	112	2	2	2	2	2	2	2	2	2	2
98	97	112	108	115	103	129	130	112	105	2	2	2	2	2	2	2	2	2	2
103	85	106	144	129	135	111	116	151	144	2	2	2	2	2	2	2	2	1	1
138	141	138	141	101	120	130				1	1	1	1	1	1	1			