RESEARCH REPORT SERIES no. 10-2012

CHURCH OF ST MARY, WEST SOMERTON, NEAR GREAT YARMOUTH, NORFOLK
TREE-RING ANALYSIS OF TIMBERS

SCIENTIFIC DATING REPORT

Martin Bridge

INTERVENTION
AND ANALYSIS

ENGLISH HERITAGE

This report has been prepared for use on the internet and the images within it have been down-sampled to optimise downloading and printing speeds.

Please note that as a result of this down-sampling the images are not of the highest quality and some of the fine detail may be lost. Any person wishing to obtain a high resolution copy of this report should refer to the ordering information on the following page.

Research Report Series 10-2012

CHURCH OF ST MARY, WEST SOMERTON, NEAR GREAT YARMOUTH, NORFOLK

TREE-RING ANALYSIS OF TIMBERS

Dr M C Bridge

NGR: TG 4755 1955

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)

The Research Report Series incorporates reports by the expert teams within the Investigation & Analysis Division of the Heritage Protection Department of English Heritage, alongside contributions from other parts of the organisation. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, the Architectural Investigation Report Series, and the Research Department Report Series.

Many of the Research Reports are of an interim nature and serve to make available the results of specialist investigations in advance of full publication. They are not usually subject to external refereeing, and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation. Where no final project report is available, readers must consult the author before citing these reports in any publication. Opinions expressed in Research Reports are those of the author(s) and are not necessarily those of English Heritage.

Requests for further hard copies, after the initial print run, can be made by emailing:
Res.reports@english-heritage.org.uk
or by writing to:
English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD
Please note that a charge will be made to cover printing and postage.

SUMMARY
The main structural timbers of the medieval nave roof were assessed and considered to contain too few rings for dendrochronological analysis. Several thatching spars were however noted as having sufficient rings and were sampled. When sampled though, they were found to be almost destroyed by insect attack, with only three proving suitable for measuring. None of these could be dated. An *ex situ* sill beam also had a cross-sectional slice removed for analysis, but this could not be dated either.

CONTRIBUTORS
Dr M C Bridge

ACKNOWLEDGEMENTS
This work was commissioned by Isabelle Parsons (English Heritage Scientific Dating Team). I would like to thank Stewart Barnes, the foreman of the contractors on-site for his assistance during the fieldwork. Cathy Tyers (Sheffield University Dendrochronology Laboratory) made useful comments on earlier drafts of this report.

ARCHIVE LOCATION
Norfolk Historic Environment Record
Norfolk Landscape Archaeology
Union House
Gressenhall
Dereham
Norfolk NR20 4DR

DATE OF INVESTIGATION
2009-11

CONTACT DETAILS
Dr M C Bridge
UCL Institute of Archaeology
31–34 Gordon Square
London WC1H 0PY
E-mail: martin.bridge@ucl.ac.uk

CONTENTS

INTRODUCTION

This grade II* parish church is in a remote location, on the eastern side of the hamlet of West Somerton, and around two kilometres west of the coast at Winterton-on-Sea (Figures 1 and 2). The church was restored in AD 1867, but is unusual in that it retains a thatched roof, and is one of the round towered churches of Norfolk. Its Norman nave is thought to date to around AD 1200, and was extended westwards to meet the new round tower, built in the thirteenth century, but which has a fourteenth-century tower arch. The slated chancel dates to the fifteenth century.

Grant-aided repairs to the nave roof were to be undertaken in 2009, and ahead of this, the roof timbers were assessed for their potential for dendrochronological dating in November 2008. At that time it was noted that the main structural elements of the roof all contained too few rings to make them viable as dendrochronological samples, but that a number of the thatching spars on the outside of the roof, immediately under the thatch appeared to have sufficient rings, but no apparent sapwood. When the thatch was subsequently removed as part of the repair process, Ian Harper, English Heritage, requested that these thatching spars be sampled in order to try to determine their date and inform the grant-aided repairs.

METHODOLOGY

A number of thatching spars considered likely to contain sufficient numbers of rings for analysis had cross-sectional slices sawn from the ends where they overlapped the principal rafters. In addition, an *ex-situ* structural timber, thought to be potentially associated with the original nave roof, also had a thin section removed from one end.

Those sections that did not disintegrate on sampling 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 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 attempted 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 on the computer monitor to allow visual comparisons to be made between sequences. 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 showing the location of St Mary's Church, West Somerton. © Crown Copyright. All rights reserved. English Heritage 100019088. 2012

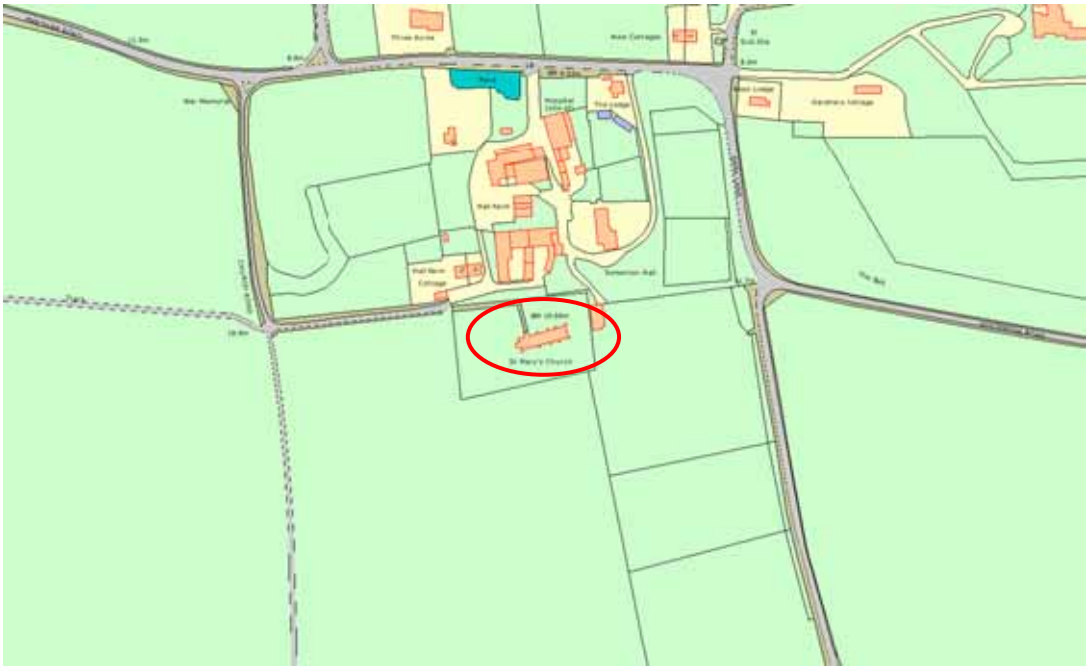

Figure 2. Map showing the location of St Mary's Church, West Somerton, within its immediate environs. © Crown Copyright. All rights reserved. English Heritage 100019088. 2012

RESULTS AND DISCUSSION

The thatching spars looked sound from the outside (Fig 3). However, most were found on sampling to have suffered severe insect attack (Fig 4) and the samples disintegrated. Sampling was therefore much less extensive than had been initially envisaged. Only three spars provided sufficiently robust samples worthy of retention for measurement of their ring sequences. A fourth sample was taken from the *ex-situ* timber (Figs 5 and 6), thought to be associated with the original nave roof, that had been found in the void between the internal and external nave walls. Details of the four samples are shown in Table 1, whilst the raw ring-width data is given in the Appendix.

No cross-matching was found between any of the sequences measured from the samples obtained, and neither could any of these sequences be dated against the available reference material. Thus it has unfortunately not been possible to provide any dating evidence relating to the nave roof.

*Table 1. Details of oak (*Quercus *spp.) samples from St Mary's Church, West Somerton, Norfolk*

Sample	Timber and position	No of rings	Mean HW width (mm)	Mean sens (mm)	Sapwood
wsc01	Thatching spar from nave roof	80	1.32	0.21	-
wsc02	Thatching spar from nave roof	44	1.38	0.22	-
wsc03	Thatching spar from nave roof	73 +6NM	1.00	0.21	-
wsc04	*Ex-situ* timber, possible sill or wallplate	115	0.86	0.17	?h/s

HW = heartwood; NM = not measured; ?h/s = possible heartwood-sapwood boundary present

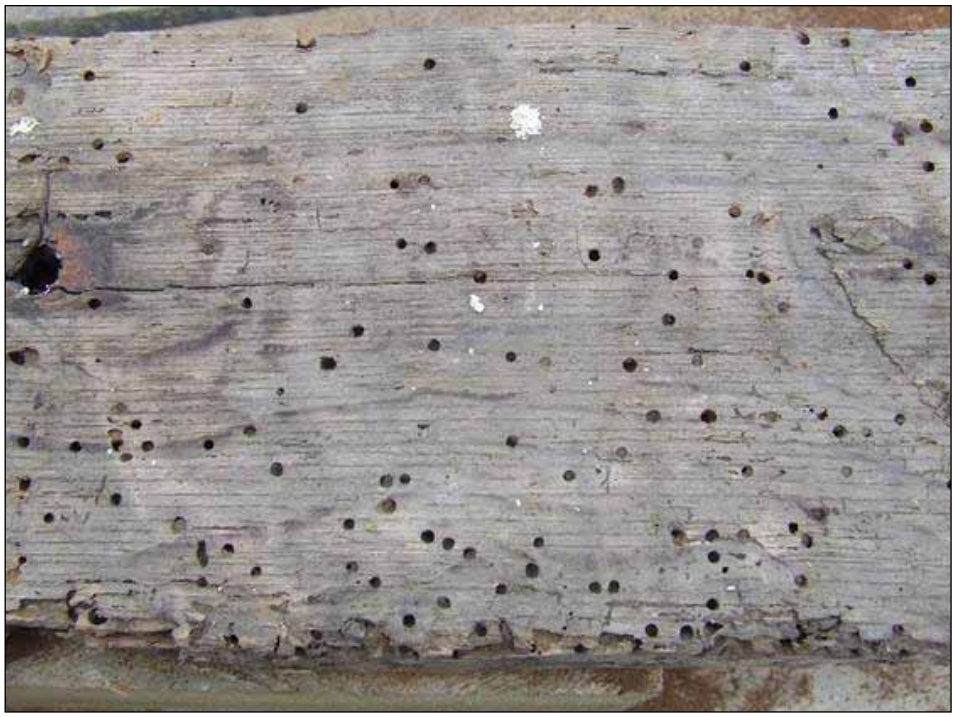

Figure 3: External view of a typical thatching spar, the grain showing a large number of rings, but also evidence of insect attack

Figure 4: View of a section of a typical thatching spar showing the severe internal decay

Figure 5: Ex-situ timber found between the internal and external nave walls

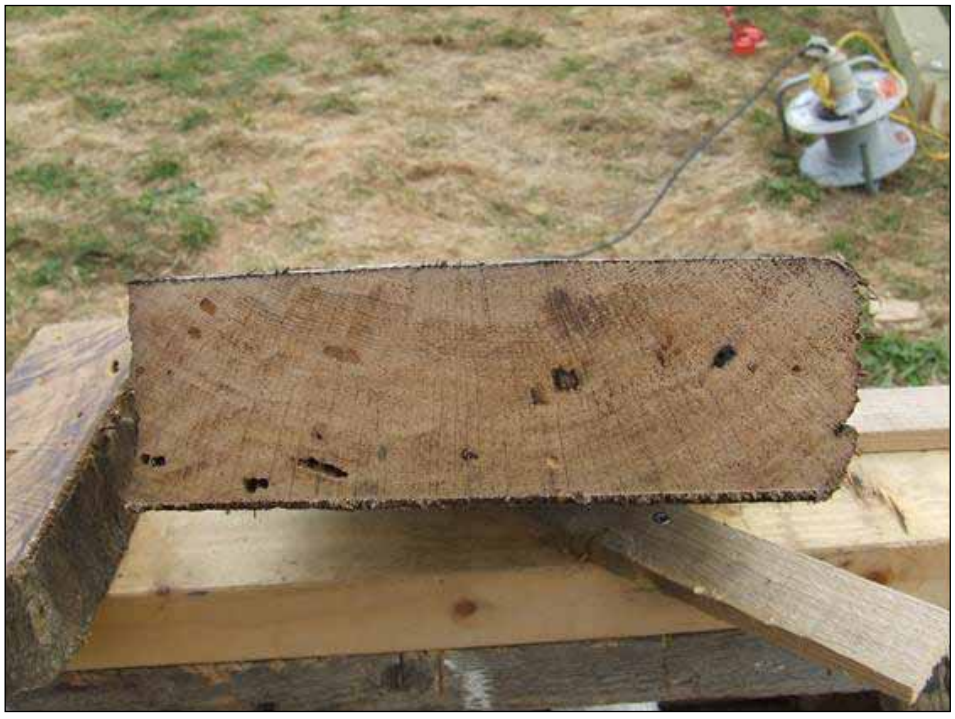

Figure 6: Cross-section of the ex-situ timber after the removal of a sample from one end

BIBLIOGRAPHY

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

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

Tyers, I, 2004 *Dendro for Windows Program Guide* 3rd edn, ARCUS Report, **500b**

APPENDIX

Ring width values (0.01mm) for the measured samples from St Mary's Church, West Somerton

wsc01

69	83	115	148	122	106	80	180	112	154
183	123	95	131	166	129	180	95	123	179
162	223	137	125	134	210	193	166	151	159
147	69	115	95	128	129	175	155	172	139
114	110	114	110	123	173	166	204	129	114
160	163	169	180	160	158	116	162	121	140
113	89	95	126	142	108	105	174	124	124
109	77	78	76	88	86	108	91	92	78

wsc02

142	128	113	163	123	151	149	225	198	142
122	108	223	268	219	188	211	167	101	71
133	168	185	144	169	106	93	84	112	87
99	126	99	123	92	96	82	101	118	137
155	126	98	124						

wsc03

176	69	75	82	94	125	129	117	107	170
196	146	131	114	157	162	86	91	166	110
125	88	82	94	84	89	101	89	64	67
75	72	123	113	48	83	75	53	73	89
99	100	82	61	68	62	83	80	78	82
63	99	104	113	102	103	104	87	74	74
79	55	64	73	90	95	93	147	177	104
184	120	105							

wsc04

110	123	55	67	72	55	57	65	103	149
110	138	118	133	112	141	129	115	128	146
129	154	136	139	117	111	75	89	99	75
99	110	88	87	52	87	93	78	50	38
64	44	49	57	47	55	51	48	59	82
89	111	84	50	62	76	90	103	92	104
108	112	137	113	86	100	123	103	77	68
64	66	84	81	76	77	72	78	63	74
78	88	96	88	97	82	75	70	59	59
45	47	61	66	69	87	79	66	78	95
57	63	62	62	75	90	76	88	82	74
93	102	95	86	84					

ENGLISH HERITAGE RESEARCH AND THE HISTORIC ENVIRONMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for the protection and sustainable management of the resource, and to promote the widest access, appreciation and enjoyment of our heritage. Much of this work is conceived and implemented in the context of the National Heritage Protection Plan. For more information on the NHPP please go to http://www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/.

The Heritage Protection Department provides English Heritage with this capacity in the fields of building history, archaeology, archaeological science, imaging and visualisation, landscape history, and remote sensing. It brings together four teams with complementary investigative, analytical and technical skills to provide integrated applied research expertise across the range of the historic environment. These are:

* Intervention and Analysis (including Archaeology Projects, Archives, Environmental Studies, Archaeological Conservation and Technology, and Scientific Dating)
* Assessment (including Archaeological and Architectural Investigation, the Blue Plaques Team and the Survey of London)
* Imaging and Visualisation (including Technical Survey, Graphics and Photography)
* Remote Sensing (including Mapping, Photogrammetry and Geophysics)

The Heritage Protection Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support community engagement and build this in to our projects and programmes wherever possible.

We make the results of our work available through the Research Report Series, and through journal publications and monographs. Our newsletter *Research News*, which appears twice a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities.

A full list of Research Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

For further information visit www.english-heritage.org.uk

ENGLISH HERITAGE

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)