

ST MARY'S CHURCH, CRATFIELD, SUFFOLK TREE-RING ANALYSIS OF TIMBERS FROM THE BELLFRAME AND WINDLASS

SCIENTIFIC DATING REPORT

Martin Bridge



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TREE-RING ANALYSIS OF TIMBERS FROM THE BELLFRAME AND WINDLASS

Dr Martin Bridge

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SUMMARY

A windlass and its supporting structure were investigated. Only two timbers were found to be suitable for sampling from the windlass and none from either the associated floor or ladder. Although these two timbers cross-matched to form an 89-year site chronology, this could not be dated. Seven timbers from the bellframe were sampled. Two were found to have come from the same tree, and six series were combined into a 137-year site chronology that dated to the period AD 1503–1639. Four timbers retained complete sapwood and were found to have been felled in the period summer AD 1639 to summer AD 1640. Subsequently, churchwardens' records revealed extensive 'worke about the frame and the bells' in AD 1640–1, paid for in October AD 1640.

CONTRIBUTORS

Dr Martin Bridge

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Suffolk Historic Environment Record
Suffolk County Council Archaeology Service
Shire Hall
Honey Hill
Bury St Edmunds
Suffolk IP33 2AR

DATE OF INVESTIGATION

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CONTACT DETAILS

Martin Bridge
UCL Institute of Archaeology
31–34 Gordon Square
London WC1H 0PY
Tel: 020 7679 1540
E-mail: martin.bridge@ucl.ac.uk

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INTRODUCTION

This Grade I-listed parish church (NGR TM 313 748; Fig 1) was much restored in the late Victorian period, but the nave and tower are thought to date to the mid-fifteenth century. Dendrochronological investigation of a windlass structure, a rustic ladder and former floor, and the bellframe were requested by Graham Pledger, as part of ongoing casework at the church. The bellframe has an unusual form with sloping interlocking sills. Although thought to date from around AD 1600, there was a question as to whether it might in fact be older than this.

METHODOLOGY

The site was visited in March 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.

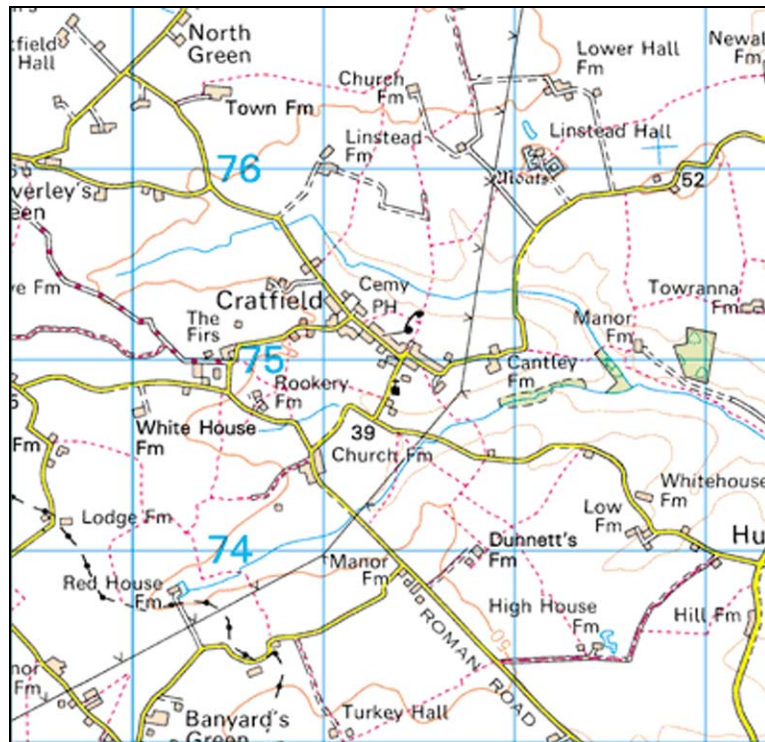


Figure 1: Map showing the location of the St Mary's Church, Cratfield, Suffolk

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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, 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.

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.

RESULTS

On close inspection, the rustic ladder in the chamber below the bell chamber and the former floor above the windlass were found to contain too few rings to be considered suitable for dendrochronological dating. The windlass structure (Fig 2) had only limited potential for dating, although it was considered worthwhile sampling the two timbers supporting the structure to see if these matched the bellframe above. Details of the samples taken, which were all oak (*Quercus* spp.), are given in Table 1, with their positions being indicated on Figures 2 and 3.

Table 1: Details of oak (Quercus spp.) timbers sampled from the tower of St Mary's Church, Cratfield, Suffolk

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)
ctf01	East beam into which east windlass post fits	89	1.63	0.28	undated	-	h/s?	unknown
ctf02	West beam into which west windlass post fits	53	1.73	0.24	undated	-	-	unknown
ctf03	South sloping base of inner frame	107	1.80	0.20	1533–1639	1609	30+½C	Summer 1640
ctf04a	East sloping base of inner frame	122	1.82	0.21	1503–1624	1606	18	
ctf04b	<i>ditto</i>	83	1.12	0.20	1556–1638	1606	32+½C	
ctf04	Mean of 04a and 04b	136	1.68	0.21	1503–1638	1606	32+½C	Summer 1639
ctf05a	South-east corner post of inner frame	74	1.57	0.20	1557–1630	1613	17	
ctf05b	<i>ditto</i>	53	1.40	0.18	1587–1639	1614	25C	
ctf05	Mean of 05a and 05b	83	1.52	0.20	1557–1639	1614	25C	Winter 1639/40
ctf06	North sloping base of inner frame	91	2.31	0.19	1511–1601	1601	h/s	1610–42
ctf07a1	North east corner post of inner frame	49	2.02	0.26	1529–77	-	-	
ctf07a2	<i>ditto</i>	60	0.89	0.22	1576–1635	1617	18	
ctf07	Mean of 07a1 and 07a2	107	1.40	0.24	1529–1635	1617	18	Summer 1639
ctf08a1	East post to north side frame	80	1.60	0.23	1524–1603	-	-	
ctf08a2	<i>ditto</i>	25	2.18	0.25	1599–1623	1614	9	
ctf08	Mean of 08a1 and 08a2	100	1.75	0.24	1524–1623	1614	9	1623–55
ctf09	East sill beam	76	1.66	0.20	1564–1639	1611	18+½C	Summer 1640

Key: h/s = heartwood/sapwood boundary; C = complete sapwood, winter felled; +½C = complete sapwood, felled the following summer

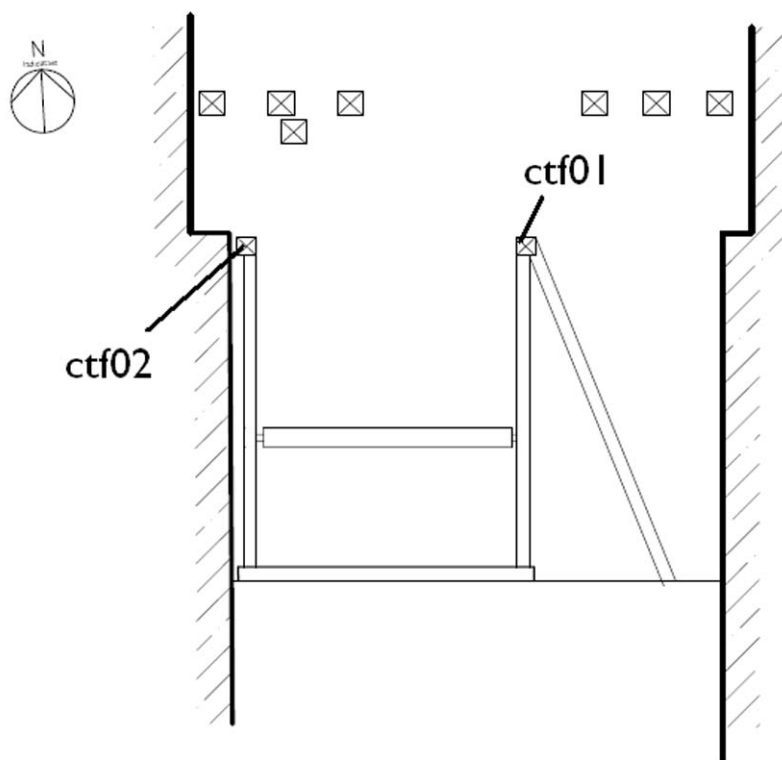


Figure 2: Drawing of a section through the tower, showing the position of the windlass and its supporting structure, with the timbers sampled indicated

Adapted from an original drawing supplied by English Heritage

Cross-matching between the cores revealed that samples ctf01 and ctf02 matched each other ($t = 5.8$ with 53 years overlap). These two samples from the windlass structure were combined to make an 89-year site chronology CRATFLD1. This was compared with a large database of regional and site chronologies, but no consistent matches were found, and the series remains undated.

Some timbers had cores with breaks or more than one core representing the timber, and these were first resolved into single series either by cross-matching the individual cores or by matching the parts to other series and then combining them. The matching between the remaining samples is shown in Table 2. The strong match between samples ctf04 and ctf07 ($t = 11.2$ with 107 years overlap) strongly suggests that these two samples came from the same tree, and the two series were combined to give a new series, ctf47m, which was used in all subsequent analysis. Other pairs of ring width series gave high t -values, perhaps suggesting a common source woodland. The six series were combined to make a second site master, CRATFLD2, 137 years long. This was compared with the database of reference chronologies, when its sequence was dated to the period AD 1503–1639, the best results being shown in Table 3. The data for this series are given in Table 4, and illustrated in Figure 4.

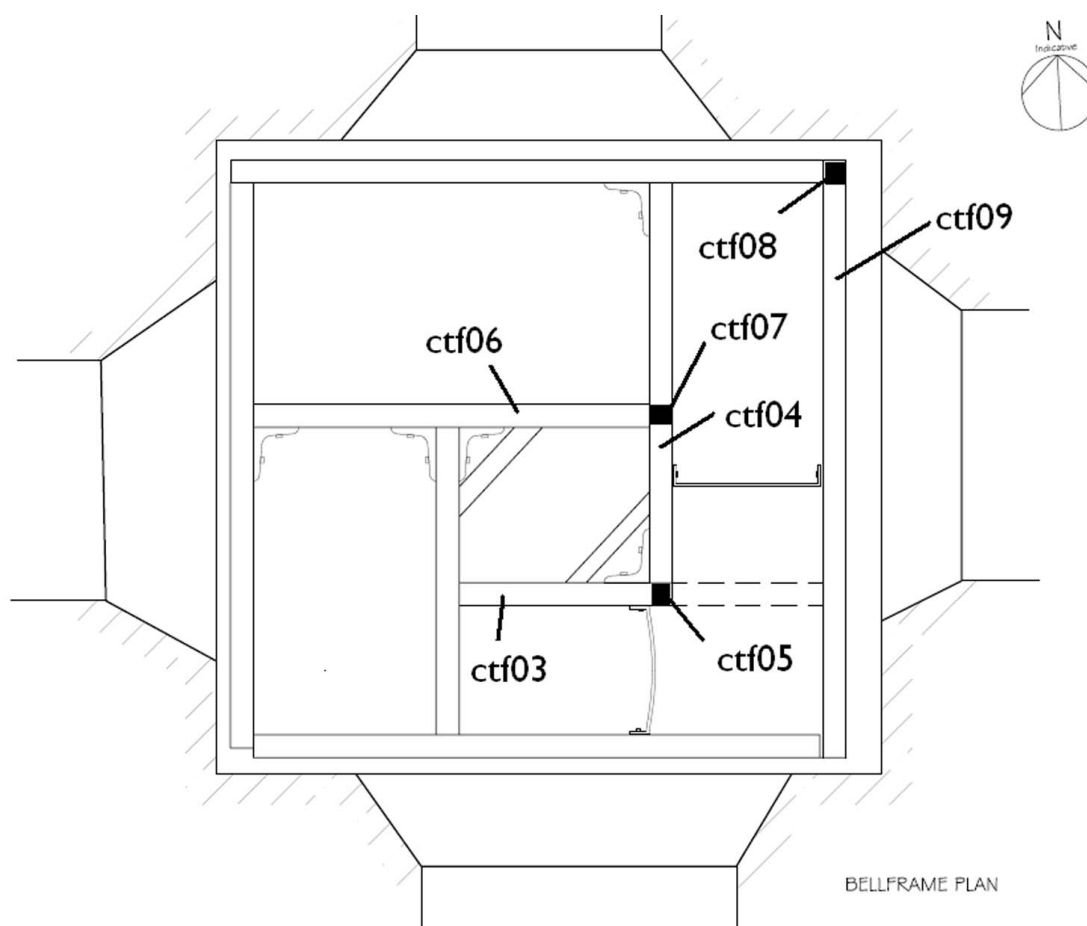


Figure 3: Plan of the bellframe, showing the timbers sampled

Adapted from an original drawing supplied by English Heritage

Table 2: Cross-matching between the dated samples from the bellframe at St Mary's Church, Cratfield, Suffolk

t – values

Sample	ctf04	ctf05	ctf06	ctf07	ctf08	ctf09
ctf03	5.1	8.0	4.6	5.1	5.5	9.3
ctf04		2.2	3.6	11.2	9.0	1.7
ctf05			4.8	3.5	1.6	6.2
ctf06				4.1	4.5	1.3
ctf07					6.8	1.6
ctf08						1.5

Table 3: Dating evidence for the site series CRATFLD2, AD 1503–1639

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
London	White Tower, Tower of London	(Miles 2007)	WHTOWR7	1463–1616	114	10.9
Suffolk	Bedfield Hall	(Miles <i>et al</i> 2007)	BEDFLD2	1473–1627	125	10.2
East Anglia	East Anglia Master Chronology	(Bridge 2003)	ANGLIA03	944–1789	137	8.8
Suffolk	Nettlestead Chace	(Miles <i>et al</i> 2007)	NETTLE1	1466–1562	60	8.4
Suffolk	Crow's Hall, Debenham	(Miles <i>et al</i> 2007)	CROWSHLI	1406–1559	57	8.3
Suffolk *	Mill House, Alpheton	(Bridge 2002a)	aphfbm	1501–1616	114	8.0
Essex *	Hill Hall, Theydon Mount	(Bridge 1999)	HILLHALI	1425–1564	62	8.1
Oxfordshire	Chazey Court	(Miles <i>et al</i> 2004)	CHAZEY1	1507–1614	108	7.9
Suffolk *	Model Farm, Linstead Magna	(Bridge 2002b)	MODELFM	1497–1614	112	7.7
Cambridge-shire*	St Andrew's Church, Wimpole	(Bridge 1998)	WIMPOLE1	1469–1615	113	7.6

* = component of **ANGLIA03**

Table 4: Ring width data for the site chronology CRATFLD2 AD 1503–1639

Ring widths (0.01mm)										no of trees									
147	309	299	237	281	159	288	256	425	387	1	1	1	1	1	1	1	1	2	2
388	386	499	471	338	582	466	381	357	409	2	2	2	2	2	2	2	2	2	2
390	422	353	393	378	337	284	217	326	216	2	3	3	3	3	3	3	3	3	3
192	191	260	216	229	196	254	283	252	169	4	4	4	4	4	4	4	4	4	4
154	141	174	143	132	220	276	208	218	182	4	4	4	4	4	4	4	4	4	4
212	239	274	185	174	132	182	274	242	303	4	4	4	4	5	5	5	5	5	5
235	144	142	125	157	193	240	221	151	128	5	6	6	6	6	6	6	6	6	6
146	136	151	140	128	106	117	155	126	124	6	6	6	6	6	6	6	6	6	6
113	171	206	183	145	109	134	106	141	141	6	6	6	6	6	6	6	6	6	6
158	163	179	147	150	143	122	125	113	146	6	6	6	6	6	6	6	6	6	5
181	172	139	177	200	205	173	153	175	166	5	5	5	5	5	5	5	5	5	5
206	175	137	145	147	148	144	183	190	92	5	5	5	5	5	5	5	5	5	5
81	63	63	55	58	64	64	67	68	82	5	4	4	4	4	4	4	4	4	4
79	77	85	92	92	154	213	4	4	4	4	4	4	3						

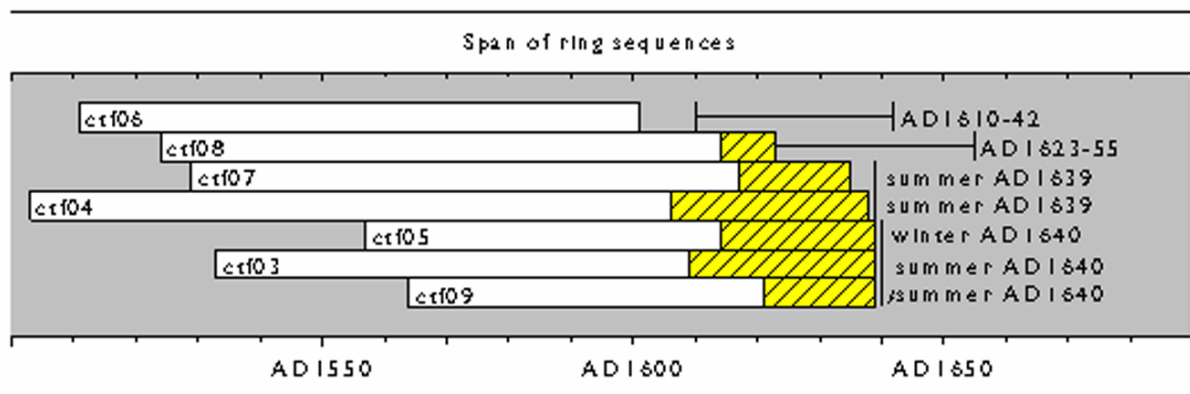


Figure 4: Bar chart showing the relative positions of overlap of the dated timbers, along with their derived felling date ranges

DISCUSSION

Most of the best matches are with local Suffolk chronologies, suggesting that the timber was sourced locally. The timbers were found to have been felled over a period from summer AD 1639 to summer AD 1640 – perhaps because the timbers are rather large in cross-section and could not be found all in one felling season, or perhaps they were just stockpiling material for a large project. This date is a little later than had been expected from the dates on the bells (AD 1585 to 1637), and later even than the c AD 1600 date suggested at the outset of this study.

Subsequent to this study, a chance remark to David Sherlock about working at Cratfield resulted in him directing me to Botelho (1999), a work covering the churchwardens' accounts for Cratfield during the period AD 1640–60. Pages 37 and 38 list items of expenditure for the period AD 1640–1, which include several entries such as:

'for beere to Howell at the bellframes at sundry times and often',
'more beere for the workmen at the fram',
'to [?]ames] Mills for making of a sawing pitt',
'for beere for the sawers, carpenters, masons and carters',
'to the masons for their worke about the steeple',
 and
'Item paid to John Howell for his worke about the frame and the bells, October 28th'.

These entries certainly reveal extensive works to the bellframe in AD 1640–1, in exact agreement with the date derived by dendrochronology.

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
- Botelho, L A, (ed) 1999 *Churchwardens' Accounts of Cratfield 1640–1660*, Suffolk Records Society, **XLII**
- Bridge, M C, 1998 *Tree-ring analysis of timbers from the Chicheley Chapel, St Andrew's Church, Wimpole, Cambridgeshire*, Anc Mon Lab Rep, **59/98**
- Bridge, M C, 1999 *Tree ring analysis of timbers from Hill Hall, Theydon Mount, Essex*, Anc Mon Lab Rep, **55/1999**
- Bridge, M C, 2002a *Tree-ring analysis of timbers from Mill House, Bridge Street, Alpheton, Suffolk*, Centre for Archaeol Rep, **2/2002**
- Bridge, M C, 2002b Tree-ring dates – List 124, *Vernacular Architect*, **33**, 74–8
- Bridge, M C, 2003 Compilation of master chronologies from East Anglia, unpubl computer file ANGLIA03, University College London Dendrochronology Laboratory
- Hollstein, E, 1965 Jahringchronologische von Eichenholzern ohne Walkande, *Bonner Jahrbuecher*, **165**, 12–27
- Miles, D, 1997 The interpretation, presentation, and use of tree-ring dates, *Vernacular Architect*, **28**, 40–56
- Miles, D, 2007 *The Tree-Ring dating of the White Tower, HM Tower of London (TOL99 and TOL100)*, London Borough of Tower Hamlets, EH Res Dept Rep Ser, **35/2007**
- Miles, D H, Worthington, M J, and Bridge, M C, 2004 Tree-ring dates, *Vernacular Architect*, **35**, 95–113
- Miles, D H, Worthington, M J, and Bridge, M C, 2007 Tree-ring dates, *Vernacular Architect*, **38**, 120–39
- Salzman, L F, 1952 *Building in England down to 1540*, Oxford
- Tyers, I, 2004 *Dendro for Windows program guide 3rd edn*, ARCUS Rep, **500b**