

HOLY TRINITY CHURCH, NORTH TIDWORTH, WILTSHIRE TREE-RING ANALYSIS OF TIMBERS FROM THE BELFRY FLOOR AND BELLFRAME

SCIENTIFIC DATING REPORT

Martin Bridge



**HOLY TRINITY CHURCH,
NORTH TIDWORTH,
WILTSHIRE**

**TREE-RING ANALYSIS OF TIMBERS
FROM THE BELFRY FLOOR AND BELLFRAME**

Dr M C Bridge

NGR: SU 23447 49017

© English Heritage

ISSN 1749-8775

The Research Department Report Series incorporates reports from all the specialist teams within the English Heritage Research Department: Archaeological Science; Archaeological Archives; Historic Interiors Research and Conservation; Archaeological Projects; Aerial Survey and Investigation; Archaeological Survey and Investigation; Architectural Investigation; Imaging, Graphics and Survey, and the Survey of London. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series and the Architectural Investigation Report Series.

Many of these are interim reports which 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 Department 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

A total of eight timbers, representing seven trees, were dated from both the belfry floor and the bellframe. These appear to form a single group of timbers most likely all felled at the same time, although there is a spread of some fourteen years in their heartwood-sapwood boundary dates. Likely felling date ranges for timbers from both the belfry floor and bellframe are therefore in the early decades of the sixteenth century making the construction of the belfry and bellframe, or at least a major phase of work, likely in this period.

CONTRIBUTOR

Dr M C Bridge

ACKNOWLEDGEMENTS

I would like to thank the Revd Malcolm Freeman for his patient assistance in allowing my access. The work was commissioned by Isabelle Parsons (EH). Cathy Tyers (Sheffield University) and John Meadows (EH) are thanked for their comments on an earlier draft of this report.

ARCHIVE LOCATION

Wiltshire and Swindon Sites and Monuments Record
Wiltshire County Archaeology Service
The Wiltshire and Swindon History Centre
Cocklebury Road
Chippenham SN15 3QN

DATE OF INVESTIGATION

2009

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	1
Methodology	1
Ascribing felling dates and date ranges	2
Results and Discussion	5
Bibliography.....	10
Appendix.....	11

INTRODUCTION

The church sits just to the west of the A338 in North Tidworth, around 5km to the west of Andover, and close to the Wiltshire-Hampshire border (Figs 1 and 2).

This Grade II* listed church is mostly of the late fourteenth and early fifteenth centuries, with later, mostly nineteenth-century restoration. The tower is squat and broad, with three stages and an angle buttress on the south-west corner. It has brick quoining to the upper stages. Proposed work to alter the bell hanging and use of the tower prompted an inspection of the bellframe and belfry floor, and dendrochronological dating of the five-pit king-posted bellframe and belfry floor were requested by the EH Historic Buildings Inspector Isla Macneal, to accompany the report by Graham Pledger, the EH Bells and Bellframes specialist, and inform future work on the site. The ten north-south spanning support beams to the belfry floor are readily accessible. Those to the west side are framed around a bell trap and were thought possibly to be older than those to the east. The beams have been strengthened by the addition of a central beam, but this has since rotted at its west end.

METHODOLOGY

The site was visited in February 2009. 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 removed were polished on a belt sander using 60 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 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. For this region, the sapwood estimate used is 9–41 (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.

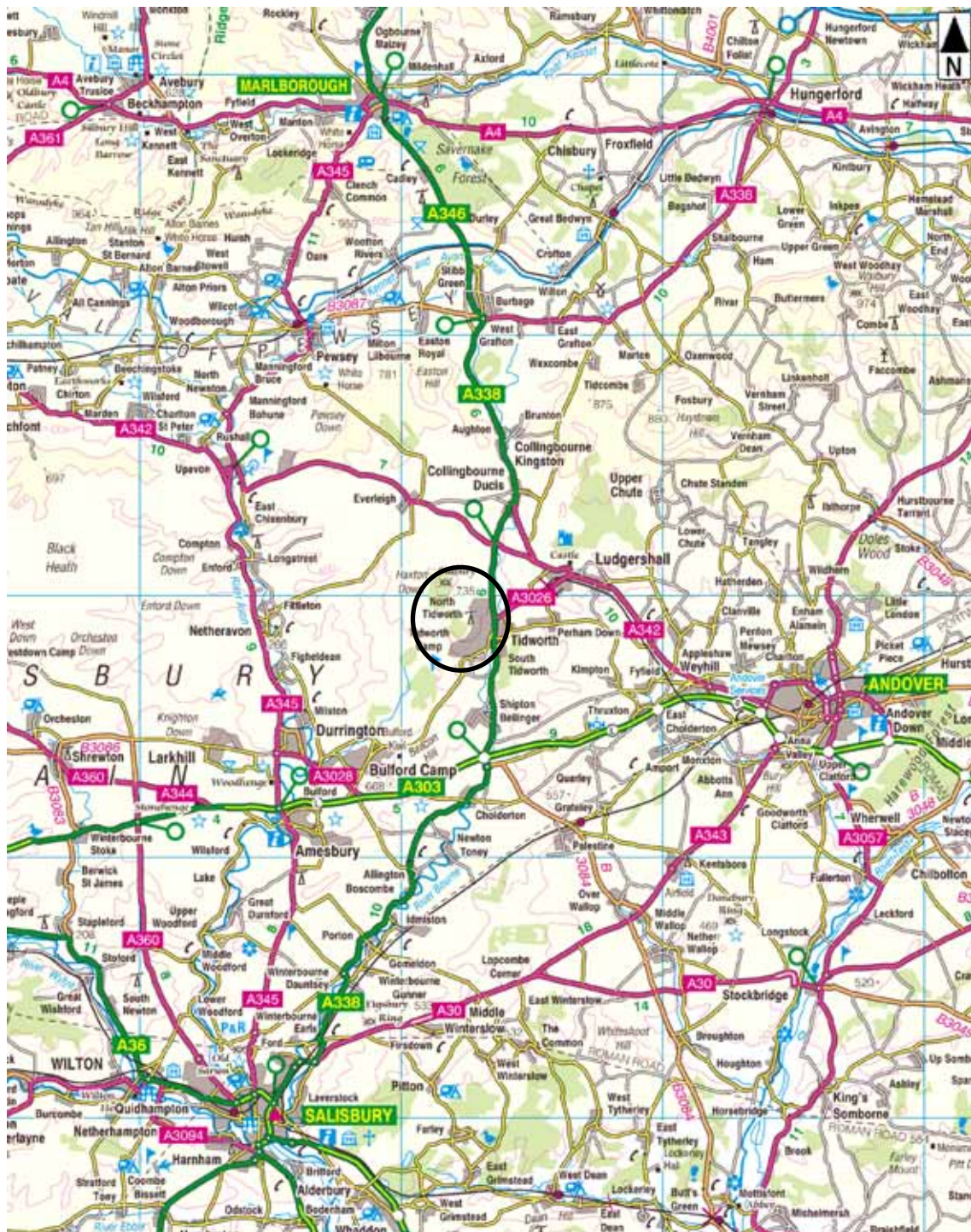


Figure 1. Map to show the location of the church (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

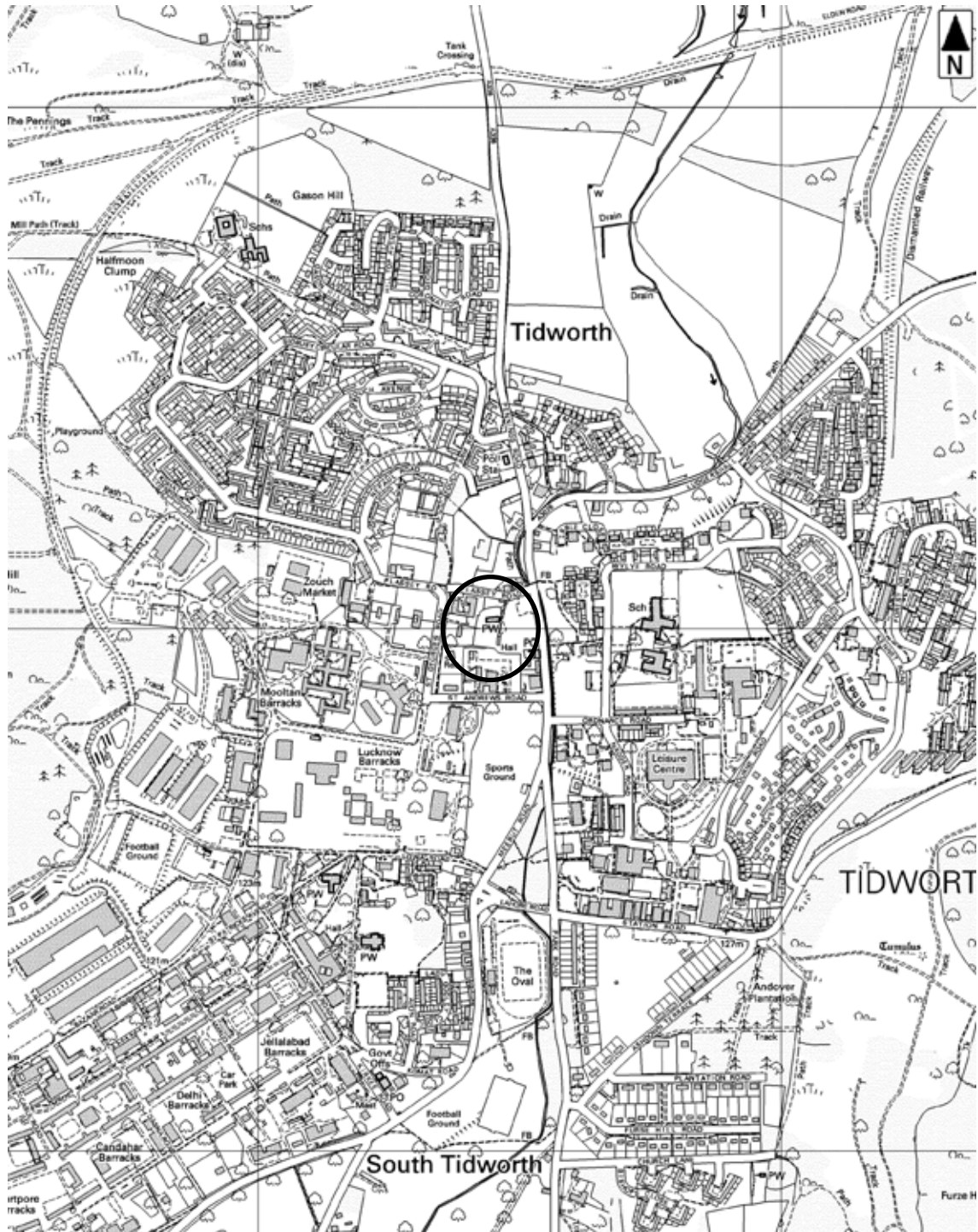


Figure 2. Map showing the location of the church within its immediate environs (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

RESULTS AND DISCUSSION

Details of the samples taken are shown in Table 1. One sample, tid01 from the beam supporting the belfry floor joists, contained too few rings for dendrochronological dating and was rejected from further analysis. This may be significant, in that it was very different in nature to the other timbers sampled, which may suggest that it was inserted at a much later date to support the floor, though this can not be determined dendrochronologically.

Cross-matching between the remaining samples revealed that tid07 and tid08 cross-matched with a t -value of 12.4, and this, combined with a comparison of the plots of the two curves made it seem highly probable that these two timbers were derived from the same tree. The two series were therefore combined to make a new series, tid78m, which was used in subsequent analysis. A further six series cross-matched with tid78m (Table 2).

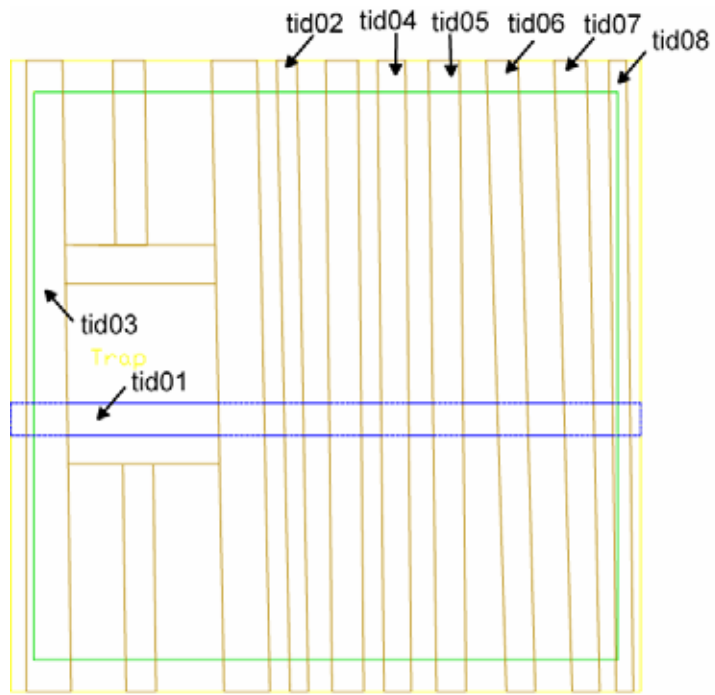
These seven series were combined to produce a site master chronology of 150 years, TIDWORTH, which was dated to the period AD 1363–1512 by comparison with reference material, the strongest matches being shown in Table 3. The mean heartwood-sapwood boundary date for these series is AD 1499, which would give a likely felling date range of AD 1508–40. Figure 3 shows the relative positions of overlap of the dated samples, and also shows that timbers from the two structures have similar heartwood-sapwood boundary dates, which combined with their cross-matches, suggests that all the timbers form a single group felled at the same time. The felling date range for the group can be modified to AD 1513–40 given a last ring date of AD 1512 for two of the samples. As construction was likely to have taken place in the same year, or within one or two years after felling, this dates the construction of both belfry and bellframe to the early decades of the sixteenth century, after AD 1512.

Of the remaining series, tid02 and tid03, matched each other well ($t = 9.0$ with 80 years overlap) but they did not give sufficiently robust consistent matches with the other dated series, nor did they date against the reference material, and they remain undated. Samples tid09 and tid12 have the widest rings of the whole group (Table 1), and neither of these timbers cross-matched with others in the group, nor did they date independently against reference material.

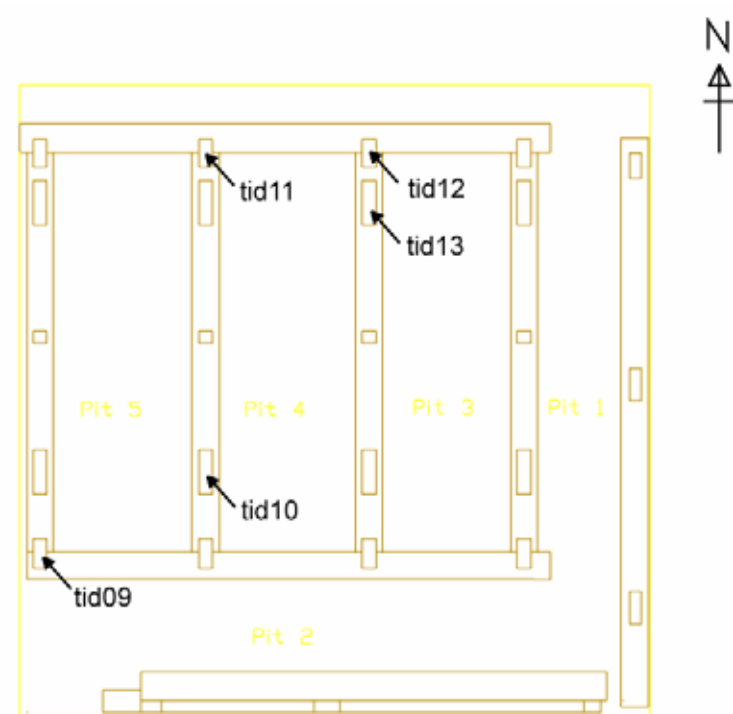
Table 1. Details of oak (*Quercus spp.*) timbers sampled from the belfry floor and bellframe, Holy Trinity Church, North Tidworth. Joists are numbered from east to west

Sample	Timber and position	No of rings	Mean width (mm)	Mean sens (mm)	Spanning Dates AD	H/S bdry AD	Sapwood	Felling seasons and dates/date ranges (AD)
Belfry floor								
tid01	East-west beam supporting belfry joists	22	NM	-	undated	-	h/s	unknown
tid02	Joist 7	110	1.64	0.23	undated	-	19½C	unknown
tid03	Joist 10	80	1.75	0.20	undated	-	4	unknown
tid04	Joist 5	120	1.34	0.21	1393–1512	1508	4	1517–49
tid05	Joist 4	138	1.57	0.19	1375–1512	1494	18	1513–35
tid06	Joist 3	134	1.69	0.22	1363–1496	1496	h/s	1505–37
tid07	Joist 2	121	1.61	0.19	1373–1495	1495	h/s	1504–36
tid08	Joist 1	122	1.62	0.22	1379–1500	1500	h/s	1509–41
tid78m	Mean of tid07 and tid08	126	1.62	0.19	1373–1500	1498	h/s	1507–39
Bellframe								
tid09	South-west corner post to pit 5	74	3.03	0.21	undated	-	h/s	unknown
tid10	South curved brace, east side of pit 5	91	1.85	0.24	1393–1483	-	-	after 1492
tid11	North-east corner post to pit 5	61	2.06	0.20	1441–1501	1501	h/s	1510–42
tid12	North-east corner post to pit 4	43	4.19	0.23	undated	-	h/s	undated
tid13	North curved brace to truss between pits 3 and 4	53	2.64	0.18	1446–98	-	-	after 1507

Key: NM = not measured; h/s = heartwood-sapwood boundary; C = complete sapwood, winter felled; ¼C = complete sapwood felled the following spring; ½C = complete sapwood, felled the following summer. Uses sapwood estimate 9–41 from Miles (1997)



Belfry floor beams



Bellframe at sill level.

Figure 3: Drawings of the belfry floor and bellframe, North Tidworth, showing the timbers sampled

Table 2. Cross-matching between the dated series; t-values over 3.5 are considered significant

Sample No	tid05	tid06	tid78m	tid10	tid11	tid13
tid04	6.6	5.1	6.6	5.5	3.2	4.7
tid05		4.6	6.3	5.0	4.3	3.7
tid06			7.7	2.7	0.5	1.4
tid78m				5.0	4.0	7.1
tid10					3.6	2.4
tid11						5.1
tid13						-

Table 3. Dating evidence for the series TIDWORTH, AD 1363–1512, file names in **BOLD** represent regional chronologies

County/ region:	Chronology name:	Short publication reference:	File name:	Spanning: (yrs AD)	Overlap (yrs)	t-value
Hampshire	Kimpton Manor, Kimpton	(Miles and Worthington 2002)	KIMPTON2*	1417–1559	96	8.8
Hampshire	Hampshire Master Chronology	(Miles 2003)	HANTS02	443–1972	150	8.0
Southern England	South Master Chronology	(Hillam and Groves 1994)	SOUTH	406–1594	150	7.6
Lancashire	Worden Old Hall, Chorley	(Bridge 2003)	OLDWORD2	1415–1531	98	7.5
Somerset	Wells Cathedral, Treasury Door	(Miles <i>et al</i> 2003)	WLSCATH4 §	1329–1447	85	7.5
Hampshire	Winchester College painted panels	(Miles and Haddon-Reece 1996)	WNCHSTR2*	1403–1537	110	7.0
Cheshire	Combermere Abbey, Whitchurch	(Howard <i>et al</i> 2003)	CBMASQ01	1371–1564	142	7.0
Hampshire	Church Farm, Barton Stacey	(Miles and Worthington 2002)	BRTNSTCY*	1381–1539	132	6.9
Hampshire	Winchester Street, Overton	(Miles and Worthington 1997)	OVERTON3*	1397–1543	116	6.8
Somerset	Somerset Master Chronology	(Miles 2004)	SOMRST04	770–1979	150	6.7

* = constituent of **HANTS02**; § = constituent of **SOMRST04**

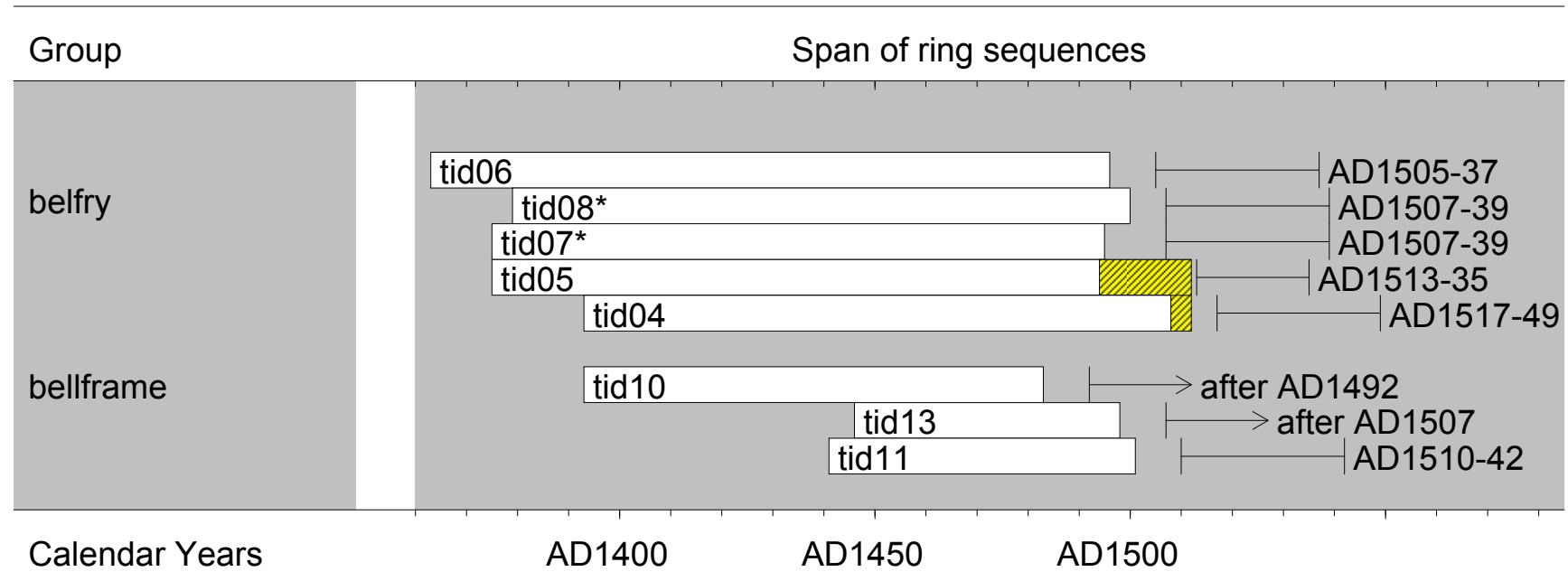


Figure 4: Bar diagram showing the relative positions of overlap of the dated samples, along with their interpreted felling date ranges; white bars are heartwood; yellow bars are sapwood. The felling date range for samples 07 and 08 () has been adjusted to represent that for the combined series 78m, as these are taken to represent a single tree*

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

Bridge, M C, 2003 *Tree-ring analysis of timbers from Worden Old Hall, Euxton Lane, Chorley, Lancashire*, Centre for Archaeol Rep, **47/2003**

Hillam, J, and Groves, C, 1994 Compilation of master chronologies from the South, unpubl computer file SOUTH, Sheffield Dendrochronology Laboratory

Howard, R E, Laxton, R R, and Litton, C D, 2003 *Tree-ring analysis of timbers from Combermere Abbey, Whitchurch, Cheshire*, Centre for Archaeol Rep, **83/2003**

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

Miles, D, 2003 Dating buildings and dendrochronology in Hampshire, in *Hampshire Houses 1250 - 1700: Their Dating and Development* (ed E Roberts), 220–6, Southampton (Hampshire County Council)

Miles, D H, 2004 Working compilation of reference chronologies centred around Somerset by various researchers, unpubl computer file SOMRST04, Oxford Dendrochronology Laboratory

Miles, D H, and Haddon-Reece, D, 1996 List 72 – Tree-ring dates, *Vernacular Architect*, **27**, 97–102

Miles, D H, and Worthington, M J, 1997 Tree-ring dates, *Vernacular Architect*, **28**, 159–81

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, 2003 Tree-ring dates, *Vernacular Architect*, **34**, 109–13

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

APPENDIX

Ring width values (units of 0.01mm)

tid02

401	263	474	376	59	71	62	85	103	113
155	436	192	178	264	288	355	254	184	355
261	293	305	329	233	192	230	223	341	276
226	191	323	308	164	205	154	148	100	161
165	233	234	251	155	240	244	265	214	181
144	118	95	129	219	138	149	162	136	123
108	108	84	47	47	74	66	67	69	58
80	99	112	120	96	114	118	106	136	133
114	136	108	73	56	56	51	84	87	87
104	102	108	122	129	149	116	100	104	130
128	134	154	139	164	173	83	94	115	103

tid03

270	240	315	300	402	257	235	318	256	271
356	467	306	214	210	248	370	300	222	196
280	321	176	167	133	171	186	275	219	398
350	302	226	274	242	279	208	189	177	179
99	120	193	144	135	144	121	94	100	105
42	41	49	70	66	71	65	63	79	82
110	102	95	102	92	102	109	109	87	77
67	41	38	43	65	79	65	65	76	78

tid04

146	110	169	277	246	393	400	337	267	180
114	160	131	114	83	113	156	141	125	122
128	74	74	69	68	69	55	103	96	93
199	92	101	94	89	115	121	103	102	131
157	146	197	179	181	154	125	119	175	104
238	159	158	149	176	156	149	149	200	138
169	200	198	209	172	102	92	98	105	135
150	111	132	134	136	177	141	136	122	114
118	106	72	59	43	42	61	80	110	120
118	88	106	80	101	118	113	120	116	64
104	107	105	173	144	89	105	105	122	197
149	146	101	106	61	73	117	125	164	179

tid05

78	78	92	99	105	100	135	161	180	172
196	340	264	263	247	211	246	177	171	118
196	227	185	282	372	262	266	193	207	232
174	192	173	162	145	157	215	274	172	183
145	117	134	115	60	100	99	92	155	141
173	155	130	210	157	129	167	245	231	192
185	163	252	235	179	141	197	131	252	176
161	146	176	127	109	109	121	118	138	191
160	175	150	134	115	132	123	151	178	134
116	146	155	222	202	182	147	165	150	169
167	114	83	82	104	123	148	146	132	134

164	127	122	133	138	151	164	119	135	148
129	129	135	96	121	90	118	105	92	122
170	118	71	80	95	91	99	103		

tid06

295	357	200	252	316	349	314	387	378	420
324	265	281	312	341	215	256	182	200	170
293	298	356	384	372	449	296	281	283	183
238	165	200	266	178	201	230	203	199	153
117	157	136	126	97	71	68	66	68	128
99	76	97	108	119	103	68	162	128	101
165	134	214	213	167	127	112	101	124	138
116	137	143	137	141	127	93	71	109	93
154	142	121	92	139	156	121	147	159	102
222	247	124	157	127	76	60	86	78	96
126	136	233	107	147	170	197	127	123	93
121	131	90	84	100	92	70	147	139	136
138	96	95	101	102	117	125	128	97	113
130	116	147	120						

tid07

266	284	275	235	296	231	192	171	217	251
266	281	283	455	386	266	312	153	208	150
192	239	157	176	217	233	205	211	185	186
176	130	128	115	128	108	102	155	138	148
125	137	122	102	84	169	143	117	146	129
190	209	190	182	178	136	151	181	115	146
97	119	146	148	136	114	159	125	177	172
146	149	168	180	154	179	193	138	204	310
232	267	202	146	107	122	99	129	188	97
108	89	123	154	160	182	152	169	136	143
121	102	77	98	104	90	106	110	124	134
87	81	71	62	69	71	80	55	68	60
70									

tid08

376	300	270	240	311	337	272	293	314	542
458	380	426	226	275	178	245	234	202	207
311	278	297	269	223	262	205	207	166	153
126	101	95	150	134	94	86	114	115	114
82	135	119	111	165	146	221	209	175	201
154	135	182	177	143	129	112	135	154	121
104	111	182	116	131	172	126	129	125	161
133	162	189	112	158	259	171	194	168	101
74	94	67	105	134	75	105	75	94	111
95	113	99	101	87	111	125	66	68	77
98	78	130	119	191	98	83	61	65	79
100	136	117	94	81	98	82	121	147	76
102	97								

tid09

388	331	601	522	650	211	618	630	530	461
447	698	616	631	706	190	145	257	363	379
354	492	411	385	433	304	407	318	212	210

261	192	217	249	231	258	234	226	297	284
301	229	206	167	191	293	277	206	196	244
199	189	196	183	197	206	231	251	207	249
187	193	170	158	249	222	307	312	196	174
132	114	126	146						

tid10

104	61	123	336	320	206	359	282	281	160
123	163	162	173	286	248	245	257	183	190
189	124	86	92	105	119	83	134	133	176
247	124	118	119	81	108	118	96	159	205
210	167	176	228	276	286	216	135	196	172
299	268	203	225	275	268	179	280	247	227
195	208	305	268	241	155	103	143	152	205
283	207	177	156	220	235	244	232	131	149
109	101	130	97	70	85	96	103	197	238
155									

tid11

324	464	409	568	237	217	182	170	158	182
240	214	193	267	236	281	319	226	164	210
161	171	206	173	182	237	176	224	192	177
169	180	191	226	342	229	149	141	168	147
164	188	197	164	212	163	176	150	139	158
156	127	100	161	212	268	191	152	135	100
144									

tid12

490	722	668	517	556	610	642	496	520	520
489	788	852	872	547	312	230	269	295	254
405	266	411	539	485	458	284	232	292	265
154	183	360	301	421	438	273	224	168	197
324	334	365							

tid13

262	412	360	345	440	419	290	327	442	375
367	511	359	285	315	322	354	408	269	233
270	243	316	244	245	225	265	252	319	287
175	143	160	212	210	211	212	239	206	133
129	194	188	209	214	164	120	118	140	183
278	235	136							



ENGLISH HERITAGE RESEARCH DEPARTMENT

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 sustainable management, and to promote the widest access, appreciation and enjoyment of our heritage.

The Research Department provides English Heritage with this capacity in the fields of buildings history, archaeology, and landscape history. It brings together seven teams with complementary investigative and analytical skills to provide integrated research expertise across the range of the historic environment. These are:

- * Aerial Survey and Investigation
- * Archaeological Projects (excavation)
- * Archaeological Science
- * Archaeological Survey and Investigation (landscape analysis)
- * Architectural Investigation
- * Imaging, Graphics and Survey (including measured and metric survey, and photography)
- * Survey of London

The Research 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 outreach and education activities and build these in to our projects and programmes wherever possible.

We make the results of our work available through the Research Department Report Series, and through journal publications and monographs. Our publication Research News, which appears three times 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 Department 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

