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Scientific Dating

The Vicarage
Moat Lane (Chantry Lane)
Towcester
Northamptonshire

Tree-ring Analysis of Oak Samples

Martin Bridge and Cathy Tyers

Discovery, Innovation and Science in the Historic Environment

Research Report Series no. 13-2021

Front Cover: The Vicarage, Towcester. Photogaph by Martin Bridge

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NGR: SP 69382 48672

ISSN 2059-4453 (Online)

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SUMMARY
A ground-floor fireplace lintel from a tree felled in the period AD 1574–9 may give an indication of the time when a house was originally constructed on this plot. The felling date of winter AD 1689/90 for timber in the roof fits well with the known history of the vicarage, which is thought to have been built by the vicar, Charles Palmer, who took up his position in AD 1688. A single rafter was found to be from a tree felled in winter AD 1824/5, giving a date for a previously unrecognised renovation or repair at the property.

CONTRIBUTORS
Martin Bridge and Cathy Tyers

ACKNOWLEDGEMENTS
We are grateful to Brian Giggins, Chair of the Historic Towcester Survey, for coordinating this work and supplying drawings and background information, and to Rebecca Lane the local projects coordinator for Historic England (South West Region, Architectural Investigation). The diocese kindly allowed the sampling to take place, and we are grateful to the vicar and her family. Shahina Farid (Historic England Scientific Dating Team) commissioned the work and supplied the maps used, and Alex Bayliss (Historic England Scientific Dating Team) read through earlier drafts of this report.

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DATE OF INVESTIGATION
2020–1

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CONTENTS

INTRODUCTION

The Early Fabric in Historic Towns: Voluntary Group Projects, funded by Historic England, have been developed in the recognition and acknowledgement of the excellent work being undertaken by local vernacular groups in the study of local architectural trends and fabrics. The intention of these projects is to encourage this type of study through the provision of support and facilitate training of more people in building analysis and recording. The local projects are coordinated by Rebecca Lane (Historic England South West Region: Architectural Investigation).

Early Fabric in Towcester Project

Whilst there have been many local investigations of historic buildings in the town over a number of years, no systematic research had been undertaken before this project, coordinated by Brian Giggins.

The project examines vernacular historic buildings in Towcester, aiming to improve understanding of the morphology and development of the historic town plan and to understand this within the framework of economic and social change. It aims to identify early plan forms and to understand the dates of the introduction of vernacular architectural details (eg in materials, carpentry, fenestration, and decorative features), thus mapping the survival of early (pre-1750) fabric and revealing the architectural evolution of the town's buildings.

Initially, properties were identified that were thought to be key to understanding the town's architectural development for a programme of comprehensive investigation. These properties were assessed for their suitability for dendrochronology and those that contained oak timber considered suitable for analysis were sampled and analysed.

The Vicarage

Situated just east of the town's main north-south axial road, Watling Street, adjacent to the Church of St Lawrence (Fig 1), the Vicarage (List Entry Number 1189926) was originally a three-unit house (as shown in Fig 2) built of coursed squared limestone, with two storeys and an attic. It has a collar-truss roof (Fig 3). On architectural grounds, it is thought to have been constructed in the late-seventeenth century, and was extended to the rear in AD 1854, and to the east between AD 1855 and 1884. These extensions were demolished in the 1980s.

METHODOLOGY

An initial assessment of the timbers for dendrochronological potential sought accessible oak timbers with more than 50 rings and where possible traces of sapwood, although slightly shorter sequences are sometimes sampled if little other material is available. Those timbers judged to be potentially useful were cored in March 2020 using a 16mm auger attached to an electric drill. The samples were labelled, and stored for subsequent analysis.

The cores 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 (2004a). Cross-matching was attempted by a process of qualified statistical comparison by computer, supported by visual checks. 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 in the range 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 12–45 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.

RESULTS AND DISCUSSION

Eight timbers were sampled from the roof, and a fireplace lintel on the ground floor, at the east end of the building, was also sampled (Table 1; Figs 2 and 4). All samples were measured and the ring-width data is given in the Appendix.

One sample from a purlin went through the centre of the tree, and the two radii measurements were combined (t = 4.0 with 34 years overlap), but only yielded a 48-year long sequence (tvic02), which did not match the other samples, or date individually. Another sample (tvic04) had only 38 rings and did not cross-match satisfactorily. Two samples were taken from another purlin (tvic05) to maximise the numbers of rings and extract as much sapwood as possible. The two ring series from this timber were also combined (t = 10.9 with 58 years overlap). Samples from a principal rafter (tvic07) and from the fireplace lintel (tvic09) both fractured towards the outer end and were measured as two separate sections, but subsequent analysis proved that the break was clean in both cases, and single sequences were derived from both cores.

The 178-year long series from the ground-floor fireplace lintel (tvic09) dated individually to the period AD 1397–1574 (Table 3a). It retained 26 sapwood rings and the outer ring may represent the complete sapwood, but this was not clear across the full width of the core, and so, conservatively, a felling date range of up to five years (AD 1574–9) has been allowed for (Fig 5; Table 1). This would put this timber into the period when Sampson Hawkhurst was vicar, and an advowson granted by Edward VI to the Bishop of Coventry and Lichfield in AD 1547 contained the condition that a house or manse had to be provided for the vicar (Baker 1822–41, supplied by Brian Giggins). This raises questions such as, did it take nearly fifty years to build the vicarage, was this beam inserted into an existing building, or did the beam come from somewhere else? (Giggins pers comm). It may well give some indication of the original date when a vicarage was built on this site.

Five samples from the roof cross-matched with each other (Table 2) and were combined into a single 156-year long site chronology, which was subsequently dated to the period AD 1534–1689 (Table 3b). The relative positions of overlap of the dated sequences are shown in Figure 5. One timber retained complete sapwood, and was felled in the winter of AD 1689/90 (Fig 5; Table 1). Two other series were noted as having lost very few rings during coring, and were therefore given relatively short felling date ranges which agree well with this precise felling date obtained (Fig 5; Table 1). The remaining two samples from this group of five have felling date ranges that also incorporate this precise felling date (Fig 5; Table 1). It seems likely therefore that the present roof was constructed, shortly after felling, in AD 1690, or within a year or two after this date. This fits well with the known history of the building, with the Revd Charles Palmer, vicar from AD 1688 being credited in the Glebe Terrier of AD 1730 with building the house, spending some £500 (Giggins pers comm).

A 64-year long sequence from a common rafter (tvic06), assumed to be part of the original construction of the roof, dated individually to the period AD 1761–1824

(Table 3c). This timber was from a tree felled in winter AD 1824/5 (Fig 5; Table 1), and is clearly therefore part of a later renovation or repair phase to the roof.

Cross-dating for individual samples and the site chronology against reference chronologies was found over quite a large geographical area, which centres on Northamptonshire, suggesting that the timbers are likely to be local in origin.

The Vicarage is a complex building, which may have started as a timber-framed building with a stone-built east gable end, was rebuilt in the late-seventeenth century, and heavily renovated in the nineteenth century (Giggins pers comm). The dendrochronological results provide some dates to inform this structural sequence.

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TABLES

Table 1: Details of the tree-ring samples taken from the Vicarage, Towcester, Northamptonshire

Sample No	Location	Number of rings	Date of sequence (AD)	Sapwood	Mean ring width (mm)	Mean sensitivity	Felling date range (AD)
Roof							
tvic01	North upper purlin, west end bay	71	1615–85	8	1.79	0.19	1689–1722
tvic02a	*North lower purlin, west end bay*	*48*	-	*?h/s*	*1.85*	*0.23*	-
tvic02b	*ditto*	*34*	-	-	*1.31*	*0.25*	-
tvic02	Mean of 02a and 02b	48	-	?h/s	1.80	0.22	-
tvic03	North principal rafter, truss 1	96	1575–1670	4+ 15CNM	1.25	0.20	1685–90
tvic04	South lower purlin, west end bay	38	-	-	3.41	0.20	-
tvic05a	*South upper purlin, middle bay*	*58*	*1619–76*	*?h/s*	*1.38*	*0.17*	
tvic05b	*ditto*	*90*	*1596–1685*	*8 +2NM+≤5C*	*1.26*	*0.18*	
tvic05	Mean of 05a and 05b	90	1596–1685	8 +2NM+≤5C	1.36	0.17	1687–92
tvic06	North common rafter, 3rd east of truss 2	64	1761–1824	19C	1.19	0.17	winter 1824/5
tvic07i	*North principal rafter, truss 2*	*101*	*1534–1634*	-	*1.47*	*0.20*	
tvic07ii	*ditto*	*28*	*1635–62*	*2*	*0.77*	*0.18*	
tvic07	07i and 07ii combined	129	1534–1662	2	1.31	0.20	1672–1705
tvic08	South common rafter, first west of truss 2	73	1617–89	24C	1.19	0.19	winter 1689/90
Ground floor							
tvic09i	*Fireplace lintel at east end of original building*	*115*	*1397–1511*	-	*1.43*	*0.17*	
tvic09ii	*ditto*	*63*	*1512–74*	*26+≤5C*	*0.75*	*0.15*	
tvic09	09i and 09ii combined	178	1397–1574	26+≤5C	1.19	0.17	1574–9

Key: h/s = heartwood/sapwood boundary; NM = not measured; C = complete sapwood, winter felled

Table 2: Cross-matching between the dated series from the roof of the Vicarage, Towcester (t-values of 3.5 and above are considered significant)

	t-value (number of years overlap)			
Sample No	tvic03	tvic05	tvic07	tvic08
tvic01	2.5 (56)	8.1 (71)	0.9 (48)	3.4 (69)
tvic03		3.8 (75)	9.9 (88)	6.5 (54)
tvic05			2.2 (67)	5.2 (69)
tvic07				3.1 (46)

Table 3a: Dating evidence for the site sequence tvic09, AD 1397–1574

Source region	Chronology	Publication reference	Filename	Span of chronology (AD)	Overlap (years)	*t*-value
London	Hays Wharf, Southwark	Tyers 1996a; 1996b	HAYS_W85	1248–1647	178	7.5
Hertfordshire	Bull Inn, Redbourn	Bridge *et al* 2019	REDBOURN	1399–1554	156	7.3
Derbyshire	Hardwick Old Hall, Doe Lea	Howard *et al* 2002	HDWBSQ01	1397–1625	178	7.0
London	Wolsey Buttery Roof, Hampton Court	Miles and Bridge 2013	HMPTNCT4	1340–1516	120	6.8
Warwickshire	Bell Cottages, Tanworth-in-Arden	Miles and Worthington 2000	TANWRTH2	1352–1560	164	6.6
Hampshire	Winchester Street, Overton	Miles and Worthington 1997	OVERTON3	1397–1543	147	6.5
East Sussex	Hempstead House, Framfield	Bridge and Miles 2016	HMPSTDHO	1373–1501	105	6.4
Warwickshire	Glebe Farm, Wilmcote	Miles and Worthington 2000	ARDEN1	1370–1513	117	6.2
West Sussex	Warhams, Rudgwick	Miles *et al* 2009	WARHAM3	1342–1606	178	6.1
London	Whitewebbs Barn, Enfield	Arnold *et al* 2019	WHTWSQ01	1390–1566	170	6.1

Table 3b: Dating evidence for the site chronology TVICt5, AD 1534–1689

Source region	Chronology	Publication reference	Filename	Span of chronology (AD)	Overlap (years)	*t*-value
Staffordshire	Black Ladies, nr Brewood	Tyers 1999	B-LADIES	1372–1671	138	7.4
Northamptonshire	Kirby Hall, Deene	Arnold *et al* forthcoming	KRBHSQ01	1409–1795	156	7.1
Oxfordshire	Fellow's Quad, Merton College	Miles and Worthington 2006	MER16	1553–1693	137	6.9
Suffolk	Buck's Head, Debenham	Arnold *et al* 2003	SDSASQ02	1561–1620	60	6.7
Oxfordshire	Old Clarendon Building, Oxford	Worthington and Miles 2006	CLRNDNOX	1539–1711	151	6.5
Worcestershire	Wribbenhall buildings	Tyers 2007	WRIBBENA	1380–1665	132	6.4
Oxfordshire	St John's College Barn, Oxford	Miles *et al* 2007	STJBARN	1576–1673	98	6.4
Oxfordshire	Wardington Manor, Wardington	Miles *et al* 2006	WRD-B	1547–1738	143	6.4
Oxfordshire	Christ Church Great Hall	Miles and Bridge 2016	CHCHGH4	1552–1749	138	6.3
Suffolk	Ballingdon Bridge	Cooper *et al* 2012	BALLNGDN	1484–1790	156	6.3

Table 3c: Dating evidence for the site sequence tvic06, AD 1761–1824

Source region	Chronology	Publication reference	Filename	Span of chronology (AD)	Overlap (years)	*t*-value
Lincolnshire	Tattershall Castle	Arnold *et al* 2018	TATCSQ01	1759–1981	64	8.2
Buckinghamshire	Pitstone Windmill	Miles *et al* 2004	PITSTN1	1729–1823	63	7.4
Oxfordshire	Bayswater Mill, Headington	Miles *et al* 2013	BAYH	1744–1833	64	6.9
Bedfordshire	Chicksands Priory	Howard *et al* 1998	CHKSPQ02	1611–1814	54	6.7
Rutland	1 The Green, Caldecott	Arnold and Howard forthcoming	CCTCSQ01	1724–1810	50	6.6
South Yorkshire	Endcliffe Wood, Sheffield	Tyers 2004b	ENDCLIFF	1759–2003	64	6.6
South Yorkshire	Oughtibridge Hall, Bradford	Arnold *et al* 2020	OTIBSQ02	1745–1812	52	6.6
Cambridgeshire	Great Gransden Windmill	Bridge 2015	GRANSDEN	1706–1836	64	6.6
London	Eastcote House, Hillingdon	Arnold and Howard 2012	ECTASQ03	1720–1820	60	6.5
Buckinghamshire	Mill Pond planks, Stowe	Miles *et al* 2004	STOWE5	1712–1891	64	6.1

FIGURES

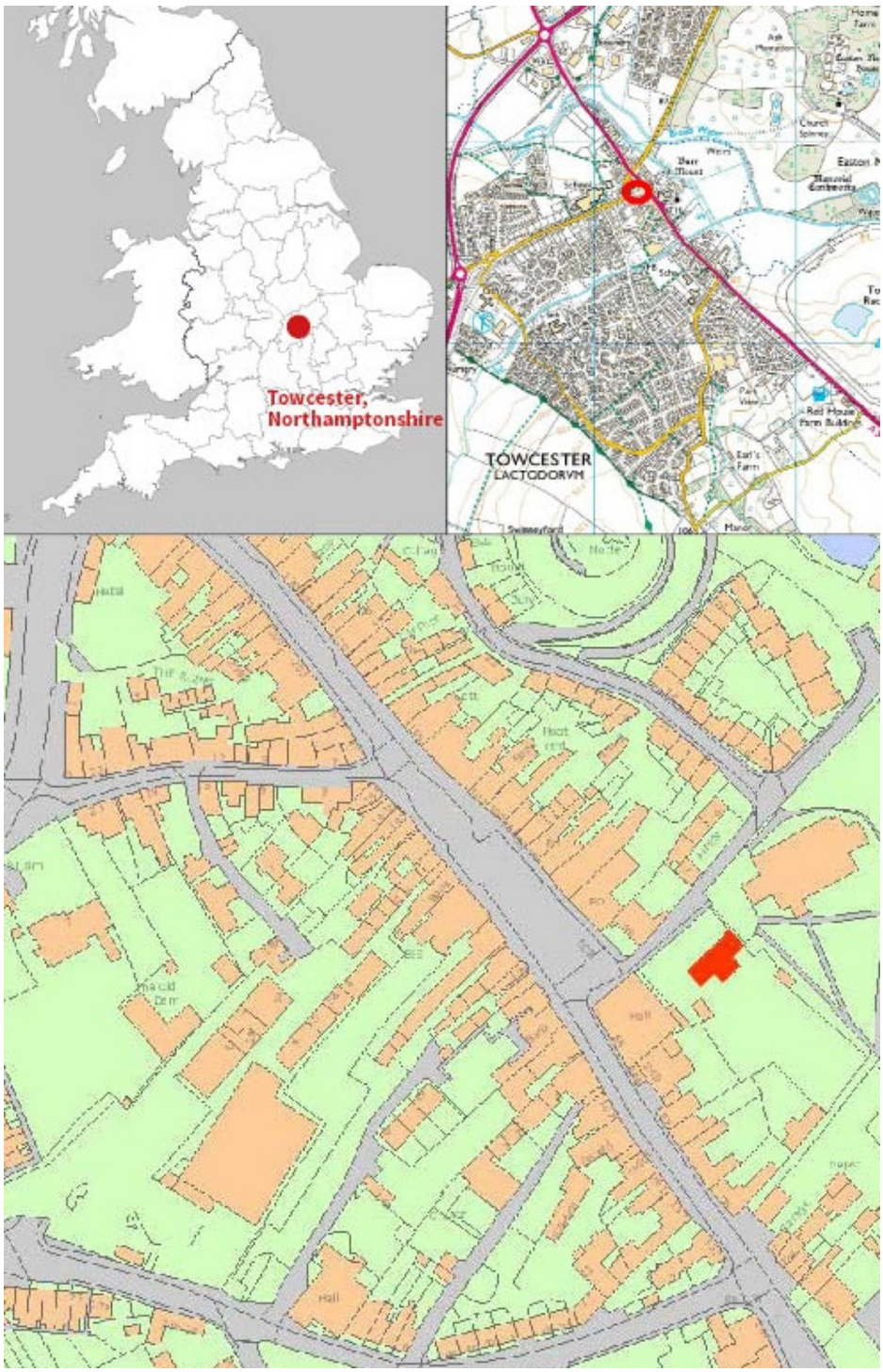

Figure 1: Maps to show the location of The Vicarage in Towcester, Northamptonshire, marked in red. Scale: top right 1:25000; bottom 1:1654. © Crown Copyright and database right 2022. All rights reserved. Ordnance Survey Licence number 100024900. © British Crown and SeaZone Solutions Ltd 2022. All rights reserved. Licence number 102006.006. © Historic England

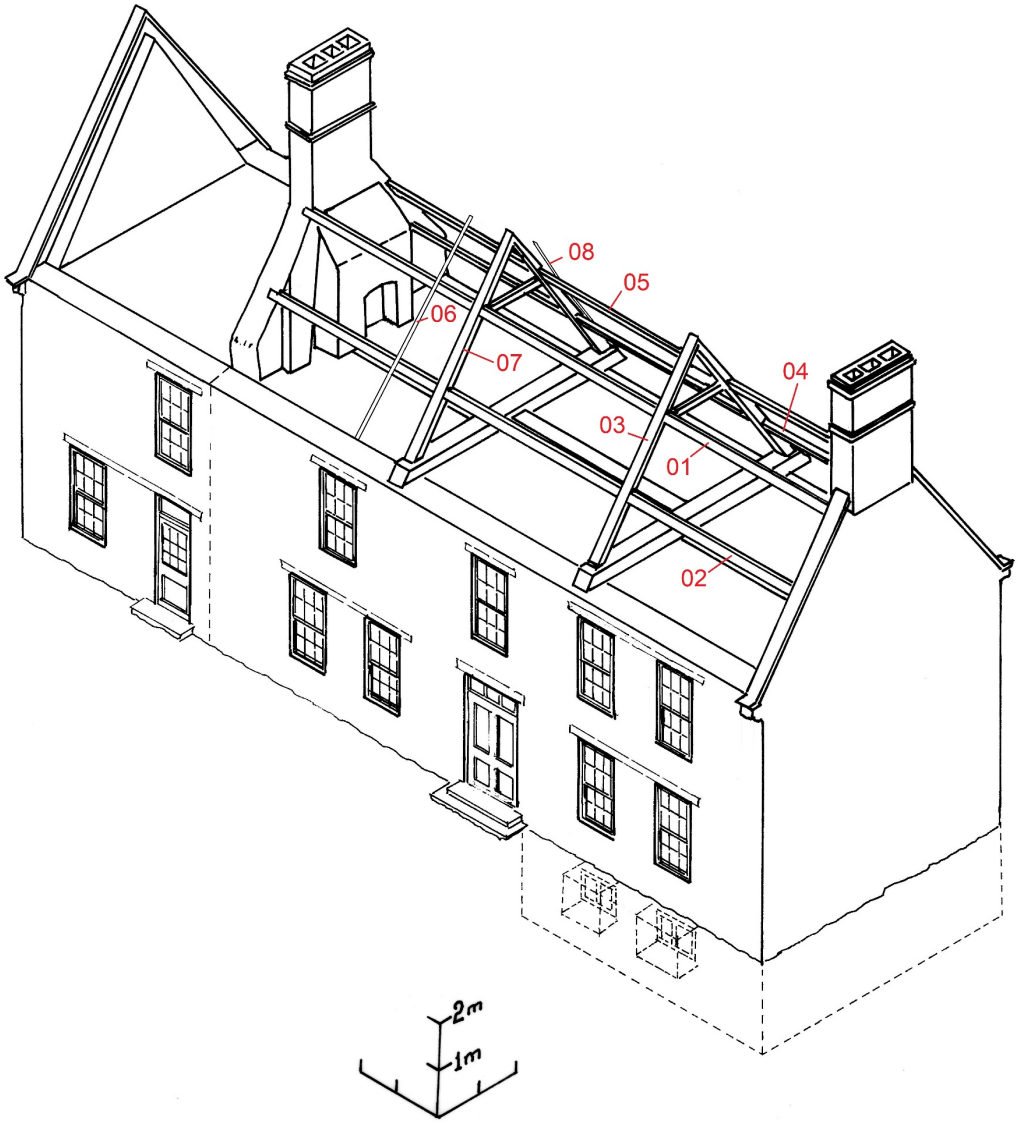

Figure 2: Isometric drawing of the Vicarage, showing the timbers sampled in the roof (adapted from an original by Brian Giggins)

Figure 3: View of the east end of the roof (looking east) showing the form of the old roof, and a later strengthening framework (photograph Martin Bridge)

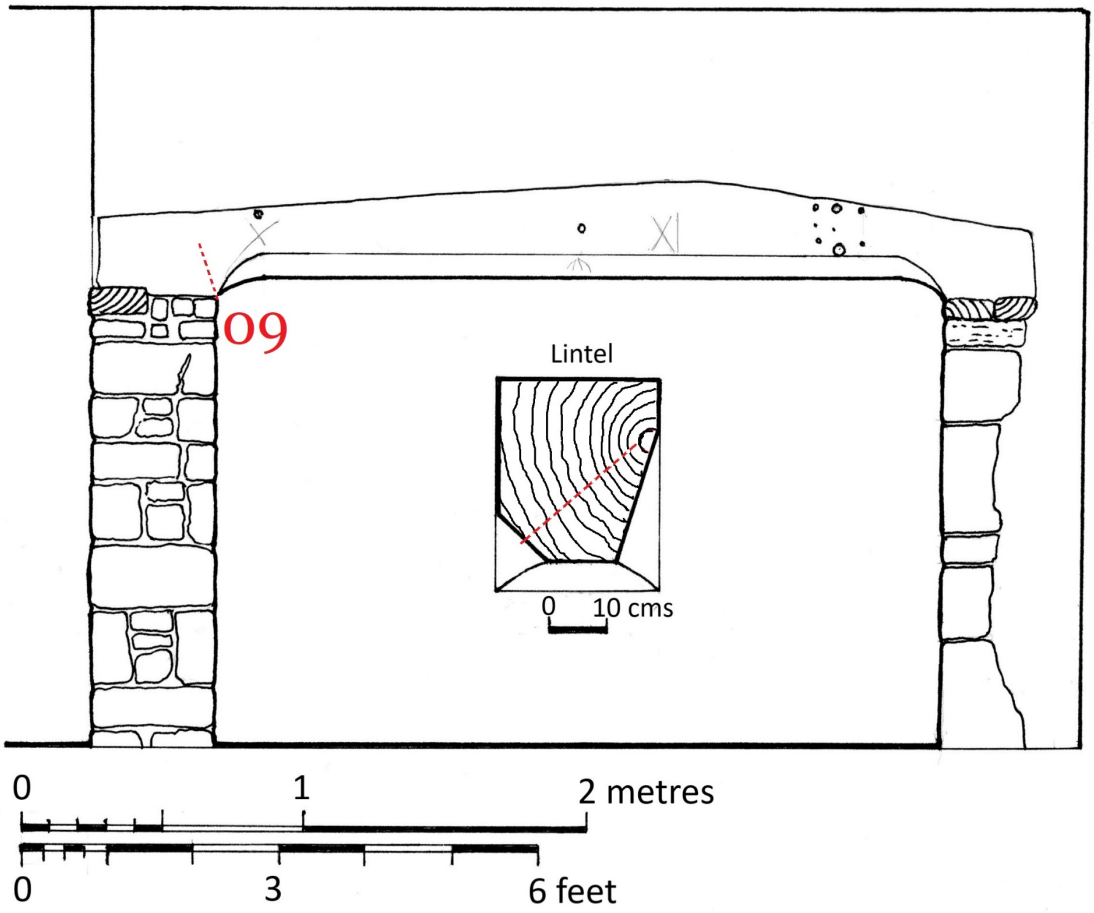

Figure 4: Drawing of the ground-floor fireplace, facing east, showing the approximate position of the core extracted from the lintel (adapted from an original by Brian Giggins); inset shows the angle of coring

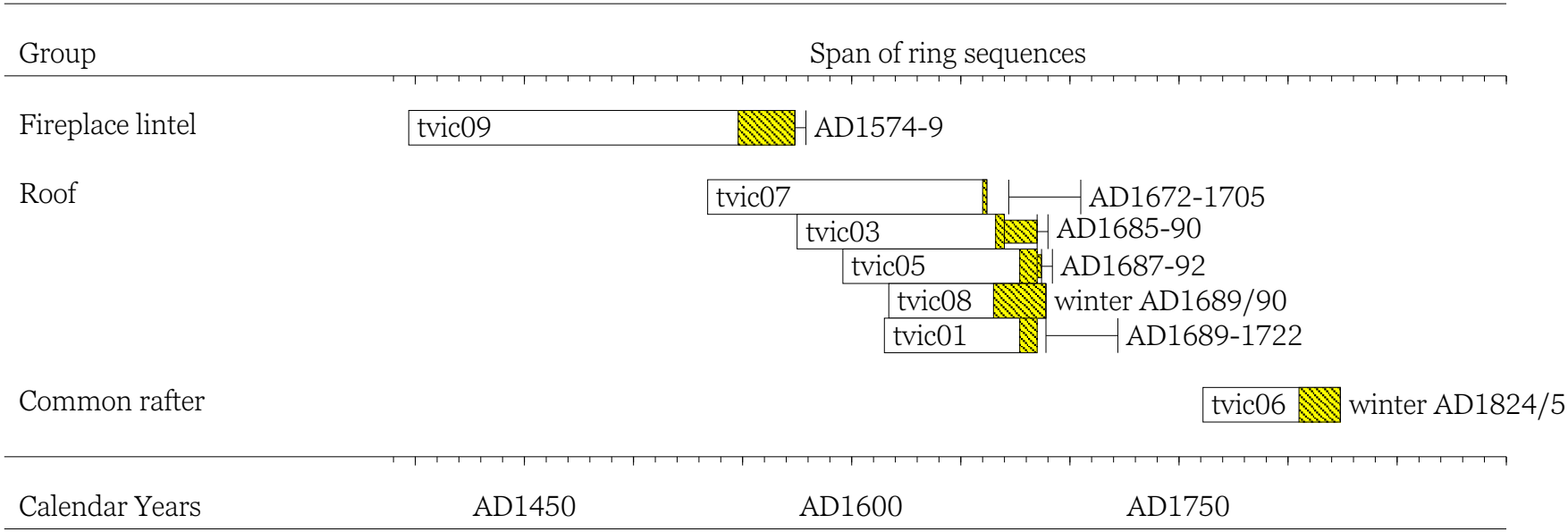

Figure 5: Bar diagram showing the relative positions of overlap of the dated samples, along with their individual interpreted felling date or felling date range. White bars represent heartwood rings; yellow hatched bars represent sapwood rings; narrow sections of bars represent additional unmeasured rings

APPENDIX

Ring width values (0.01mm) for the sequences measured

tvic01

185	161	239	241	161	174	159	175	158	152
198	208	258	220	237	165	209	254	234	175
270	254	173	154	195	216	211	117	149	179
244	214	154	239	173	128	141	120	97	184
150	188	130	175	140	171	180	217	185	151
152	148	192	165	157	145	138	152	142	163
141	133	176	149	188	227	160	187	177	162
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tvic02a

464	454	314	275	309	174	187	153	180	126
90	122	143	193	166	142	64	55	53	55
57	65	52	55	114	149	116	55	49	53
50	72	122	195	175	136	206	290	345	286
293	282	281	226	296	362	441	356		

tvic02b

272	184	153	147	140	87	109	118	129	107
70	77	121	129	167	146	94	54	56	58
60	95	106	162	328	189	146	85	72	82
111	168	192	231						

tvic03

46	76	75	79	99	225	139	197	151	180
200	192	158	184	225	127	133	153	219	243
227	224	174	183	140	140	128	111	135	221
201	230	172	148	133	252	191	190	234	216
116	57	56	62	61	63	68	53	41	66
65	59	72	69	79	45	69	53	52	47
73	66	87	82	82	93	88	56	81	107
131	164	121	135	102	105	99	94	79	79
126	96	138	156	99	111	128	116	174	141
125	109	142	152	124	133				

tvic04

496	383	344	351	308	476	407	333	371	361
312	264	411	302	198	245	315	306	224	298
353	276	248	274	303	281	241	224	294	394
326	390	368	469	499	363	296	671		

tvic05a

142	158	148	175	180	184	164	182	219	146
196	122	137	195	164	111	150	155	149	115
137	167	180	94	122	148	199	187	116	151
177	115	120	103	98	139	128	120	114	128
116	109	122	116	150	127	138	123	133	110
118	117	114	93	106	104	77	100		

tvic05b

206 306 312 246 190 178 173 239 255 167
181 180 142 136 162 126 103 135 139 155
143 186 205 147 130 125 144 154 118 110
135 164 116 161 105 109 136 121 96 122
129 128 81 92 140 137 70 85 98 109
129 74 104 126 72 81 83 88 126 112
95 93 112 73 84 119 111 115 105 92
65 110 80 88 76 86 87 95 86 76
78 91 98 86 98 91 125 126 95 91

tvic06

90 83 143 127 81 102 129 185 129 128
121 122 128 156 146 153 136 132 102 105
91 125 117 97 80 81 86 117 207 145
132 133 80 77 144 112 123 134 117 121
104 98 104 97 118 115 119 108 98 120
119 131 175 135 124 122 141 109 123 128
80 100 129 118

tvic07i

148 195 160 107 90 160 236 216 131 162
178 193 206 155 162 203 200 237 178 239
171 202 130 122 183 182 255 223 206 127
159 158 113 122 145 155 166 162 226 177
124 136 125 118 108 147 217 151 173 152
177 190 246 156 140 176 125 139 179 212
189 169 182 162 163 121 130 127 112 174
188 157 205 148 141 120 188 140 152 165
137 96 59 44 64 54 83 64 72 61
75 77 91 100 96 89 59 73 55 54
42

tvic07ii

62 61 72 76 61 73 61 74 71 105
111 137 96 100 70 70 74 67 58 48
87 86 118 87 55 49 58 55

tvic08

193 231 189 169 191 179 113 137 150 162
166 181 213 102 133 142 122 102 119 137
145 140 132 168 182 96 115 119 137 187
80 60 66 64 72 74 74 82 97 96
113 125 70 106 100 104 145 109 104 85
115 99 116 118 146 125 122 107 94 73
136 116 94 107 86 105 73 83 58 94
81 91 91

tvic09i

137 196 265 400 238 128 175 220 202 206
232 179 134 115 114 120 132 132 148 94
76 77 93 152 157 119 118 127 91 97
109 129 116 110 108 152 116 134 136 97

137 187 196 192 201 214 202 236 155 165
205 192 160 264 200 138 130 131 141 155
199 127 140 140 140 133 170 134 174 213
163 220 184 168 143 174 142 143 238 177
142 127 169 144 198 161 167 163 135 114
153 119 123 128 120 120 102 72 65 85
71 60 65 79 81 71 59 56 53 69
63 71 69 73 92

tvic09ii
118 83 79 68 81 63 97 107 99 124
122 107 73 75 91 90 66 100 80 110
86 87 89 94 98 102 121 84 93 61
59 63 62 62 60 56 58 55 50 64
57 56 73 84 73 42 46 61 53 46
38 48 51 55 62 61 72 77 74 75
60 70 68

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ISSN 2059-4453 (Online)