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CHURCH OF ST LAWRENCE, CHURCH LANE, MICKLETON, GLOUCESTERSHIRE
TREE-RING ANALYSIS OF TIMBERS FROM THE BELLFRAME

SCIENTIFIC DATING REPORT

Martin Bridge

INTERVENTION
AND ANALYSIS

ENGLISH HERITAGE

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SUMMARY
A total of eight samples were taken from the bellframe and its supporting timbers. Several of these had well in excess of 100 rings, and some series matched each other. Comparisons with dated reference material failed to date any of the series, and the timbers remain undated.

CONTRIBUTORS
Dr M C Bridge

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The sampling and analysis of these timbers was funded by English Heritage (EH), and requested by Graham Pledger (EH). The work was commissioned by Dr Peter Marshall (EH Scientific Dating Team). I am grateful to John Kinchin for arranging access, and accompanying me on site. Cathy Tyers (Sheffield University Dendrochronology Laboratory) and Peter Marshall are thanked for their comments on an earlier draft of this report.

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INTRODUCTION

This church is located in the village of Mickleton, about 5km north of Chipping Campden (Figs 1 and 2). It has a ring of eight bells, of which three hang in an upper tier of cast iron and steel installed by Taylors of Loughborough in 1954. The remaining five bells hang in a timber frame, stylistically dating to around 1800 according to the English Heritage bellframe specialist Graham Pledger. A recent recommendation to replace this timber-framed bellframe led to a request from Graham Pledger to attempt to date the structure to provide more information on the history of the frame and hence inform consideration of the recommendation. The three large north-south foundation beams supporting the bellframe were thought possibly to pre-date the bellframe itself, and these were included in the dendrochronological brief for assessment and sampling.

METHODOLOGY

The timbers were assessed and sampling was carried out in October 2010. 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 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 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.

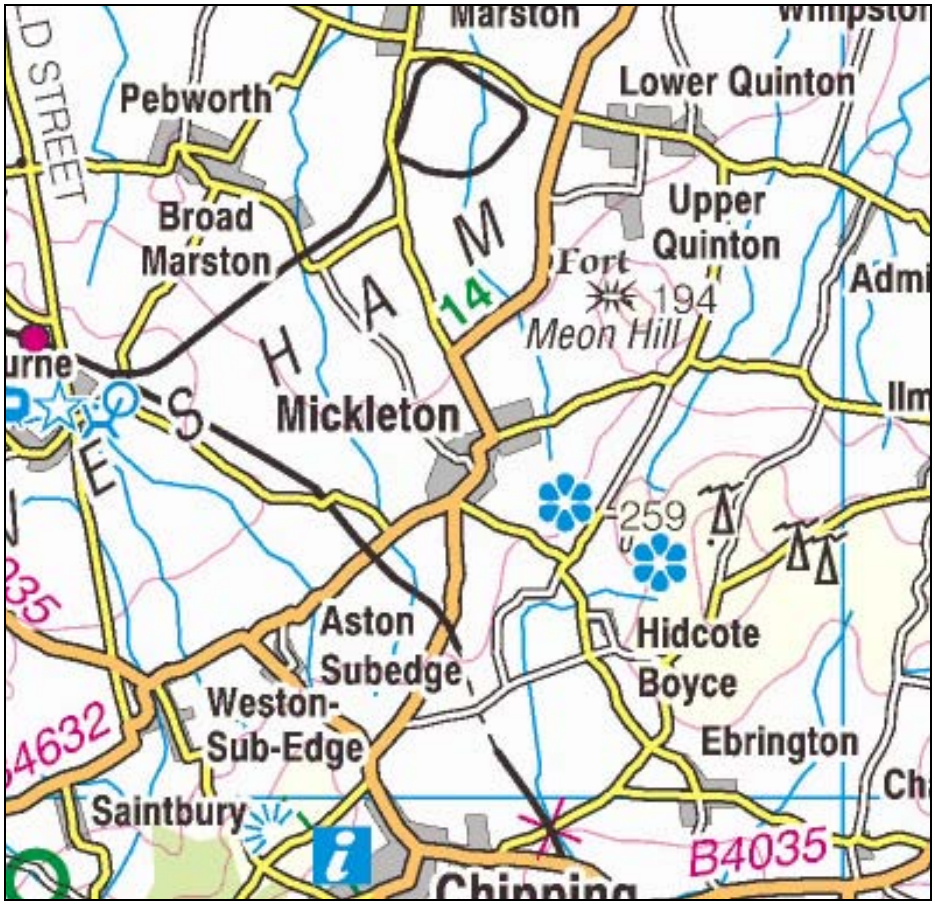

Figure 1: Map to show the location of Mickleton. © Crown Copyright. All rights reserved. English Heritage 100019088. 2012

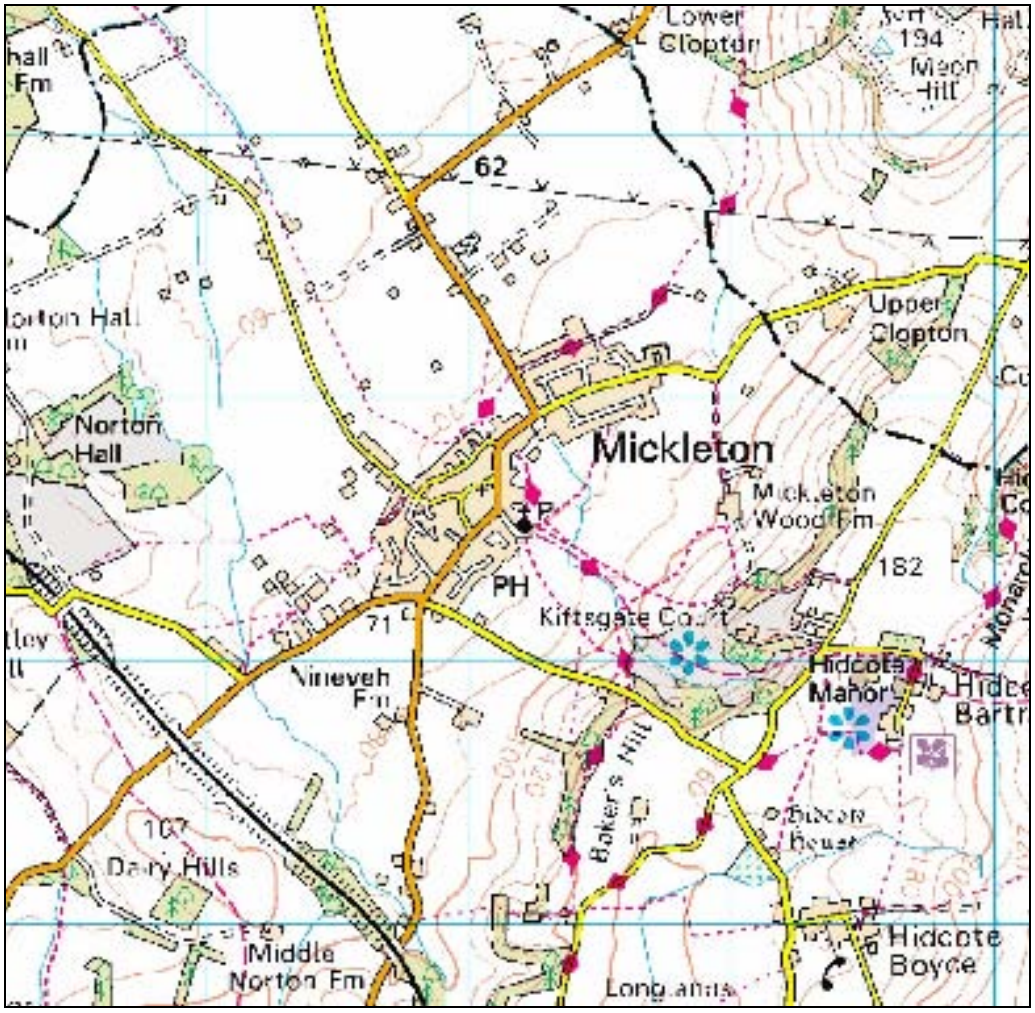

Figure 2: Map showing the location of the church within its immediate environs. © Crown Copyright. All rights reserved. English Heritage 100019088. 2012

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.

RESULTS AND DISCUSSION

Basic information about the samples taken is presented in Table 1 and their location within the structure is illustrated in Figures 3 and 4. All samples were measured and the data for each of the individual series presented in the Appendix.

Table 1: Details of the samples taken for dendrochronology

Sample	Description	Rings	Sapwood	Mean ring-width (mm)	Date of measured sequence (AD)
lwm01	East foundation beam	111	h/s	1.31	unknown
lwm02	Centre foundation beam	104	19?C	1.46	unknown
lwm03	East top-frame Pit 6	223	?h/s	0.85	unknown
lwm04	Cross-brace at north-east end of Pit 6 rising to south	117	?h/s	0.60	unknown
lwm05	Sill beam to north side Pit 6	160	-	1.23	unknown
lwm06	Vertical post to north-east side of Pit 8	59	-	1.37	unknown
lwm07i	East-most cross-brace on south frame to Pit 8	113	-	0.95	unknown
lwm07ii	ditto	69	-	0.87	unknown
lwm08	Sill beam at west end Pit 8	55	?h/s	1.27	unknown

h/s = heartwood-sapwood boundary, C = complete sapwood

Some of these long series matched each other well, eg 03 and 05 (t = 7.0, 141 years overlap, 05 and 06 (t = 5.6, 59 years overlap) and 04 and 07i (t = 6.3 with 80 years overlap) and various combinations of series were formed before attempting to date the series. None of the individual or combined series gave acceptable matches against independently dated reference material, and the timbers remain undated.

This lack of conclusive cross-matching was unexpected, given the length of the series and their apparent 'normal' growth characteristics with no evident unusual patterns resulting from management or disease. At the time of sampling, although the foundation beams were thought to be of a potentially slightly earlier date, the bellframe timbers were taken to be a coherent assemblage of similar timbers, assumed to have most likely come from the same source and have been cut at about the same time. It is surprising therefore that there were not more matches between the sample sequences. Long series such as these, with no evident growth anomalies, do generally date well now that well-replicated site chronologies are available for both different areas and different times. The only slightly unusual characteristic of the series sampled are that the ring widths tend to be slightly narrower than are usually encountered in this area. Given that stylistically the frame was

thought to date to around 1800, it is possible that the timbers had been imported, and although unsuccessful comparisons have been made with chronologies from Europe and North America, this process will continue in the hope of eventually dating the timbers.

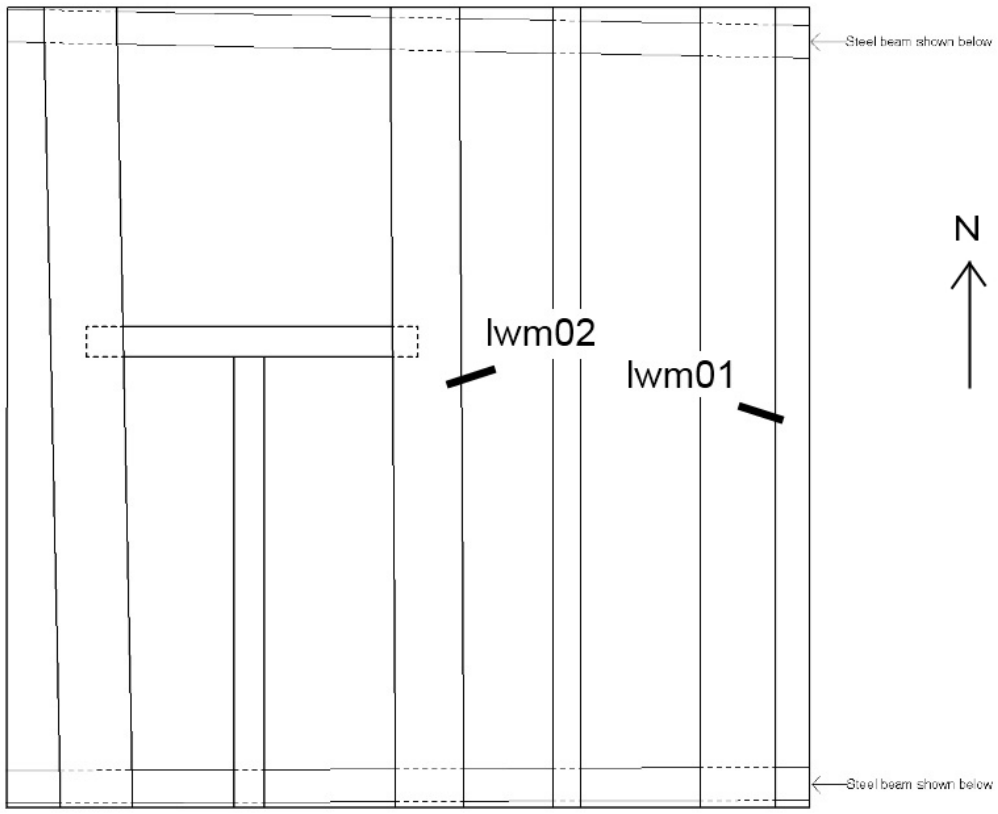

Figure 3: Plan of the foundation beams, showing the approximate locations of samples taken for dendrochronology, adapted from an original drawing by Nick Joyce Architects LLP

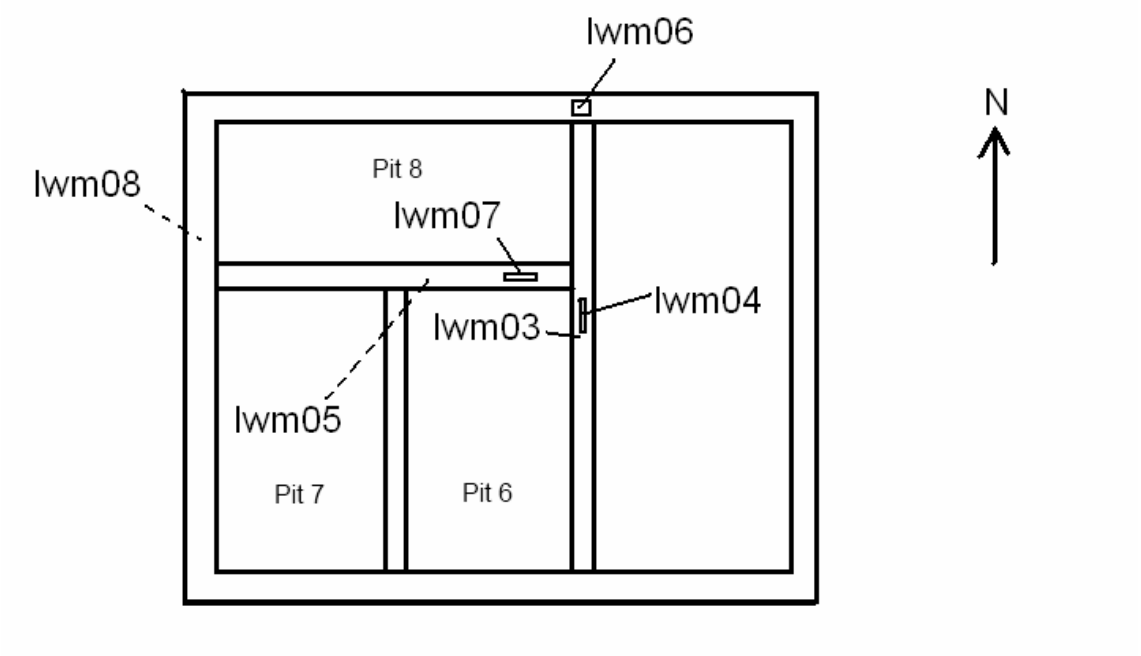

Figure 4: Sketch plan of the bellframe indicating the approximate positions of timbers sampled for dendrochronology. Dotted lines show timbers at sill level

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APPENDIX

Ring width values (0.01mm) for the sequences measured

lwm01

604	416	223	120	135	116	178	231	131	430
405	326	345	188	198	269	259	216	303	302
193	201	108	95	117	158	159	223	196	176
119	104	214	185	214	172	209	179	178	217
235	306	158	217	172	219	134	145	122	120
123	118	103	130	130	137	56	77	123	102
128	156	149	166	175	157	112	64	52	53
50	41	25	48	36	32	29	33	40	43
47	35	55	59	29	38	39	39	27	44
34	42	37	27	29	35	24	26	26	36
34	27	24	29	28	35	45	50	56	64
61									

lwm02

57	45	32	47	61	90	120	94	180	218
325	275	62	63	78	160	149	139	151	135
125	170	177	281	295	238	294	277	298	205
236	393	354	324	340	360	334	241	90	58
130	149	233	153	144	213	154	141	83	67
83	74	121	144	104	198	101	145	142	166
195	192	148	127	158	160	149	130	120	104
104	145	141	77	126	113	121	173	135	53
77	60	73	95	100	121	94	95	92	133
126	107	97	72	62	137	83	64	74	88
108	84	83	109						

lwm03

71	73	59	54	71	68	34	42	50	54
59	63	66	76	51	82	92	81	67	70
53	52	64	49	65	60	49	44	57	61
61	87	65	68	55	66	62	74	67	80
71	178	183	107	51	61	45	34	49	48
57	59	55	50	73	70	75	60	60	58
64	37	46	45	57	43	62	55	51	40
47	57	46	36	46	39	51	62	55	57
136	82	60	64	62	80	100	76	76	66
70	85	65	88	99	89	82	102	94	104
102	89	71	71	74	95	83	99	73	97
102	105	77	86	85	79	86	89	87	78
85	98	120	93	74	117	121	84	81	95
107	99	99	110	115	119	102	88	74	80
58	87	73	88	96	76	83	94	90	98
81	102	113	100	105	107	94	89	92	100
118	104	98	121	112	117	95	78	107	118
107	119	120	109	109	82	76	94	109	106
99	109	105	80	95	92	94	108	105	114
102	113	103	103	126	127	106	127	111	122
100	101	106	113	115	110	101	115	99	89
103	143	121	134	122	135	97	106	103	112
131	109	127							

lwm04

155 126 156 109 78 76 63 73 52 55
53 46 57 68 56 50 65 44 32 34
37 43 44 46 65 56 67 80 84 101
62 68 64 54 79 61 62 77 41 42
49 37 34 44 41 36 42 44 49 41
44 51 65 72 61 49 79 84 78 67
59 48 42 52 75 82 80 50 66 43
52 45 64 53 57 55 58 46 49 48
60 53 48 48 46 35 55 48 62 46
50 48 66 43 53 41 51 58 49 51
67 62 59 57 75 80 61 81 67 69
67 76 68 52 66 76 84

lwm05

145 121 88 113 105 77 80 180 114 105
67 84 111 95 55 79 55 61 66 62
64 65 67 65 73 91 52 107 139 133
129 83 74 87 78 67 54 36 35 43
53 53 52 85 99 80 84 116 141 114
134 126 157 143 174 166 132 152 122 124
110 115 135 132 127 139 121 153 136 179
175 167 120 118 94 125 118 112 125 119
133 133 146 169 127 119 141 154 139 150
157 135 122 73 65 72 100 113 118 143
150 141 140 155 177 167 197 187 185 178
167 167 185 156 174 177 179 167 171 176
163 172 167 166 152 148 170 180 164 194
149 173 181 184 160 152 141 133 152 91
94 134 131 139 135 101 111 116 120 133
107 95 107 93 108 97 108 120 101 112

lwm06

82 111 114 134 156 171 170 153 167 183
168 173 214 204 185 211 215 199 164 141
171 149 150 145 164 153 142 146 134 149
118 115 146 138 141 183 121 115 131 168
128 121 116 117 119 75 72 86 107 121
82 81 71 92 106 113 100 94 103

lwm07i

141 118 106 86 73 85 84 77 83 84
77 101 98 64 141 97 92 118 131 129
108 108 111 80 78 91 134 97 73 96
116 113 105 133 117 122 107 97 120 95
112 61 72 70 66 77 97 98 96 114
84 70 75 106 95 131 111 160 90 98
112 123 125 108 110 92 92 137 100 92
115 73 57 50 64 72 95 76 74 90
84 82 78 93 91 139 148 101 87 102
112 95 90 95 105 65 73 75 102 94
73 65 89 82 83 85 85 93 85 77
87 58 69

lwm07ii

68 85 79 88 76 92 92 90 86 84
62 70 63 75 66 55 73 93 55 83
73 83 91 104 103 120 83 91 68 86
81 91 96 125 110 106 96 99 99 109

78 90 97 110 127 94 78 97 119 73
89 97 117 99 112 93 98 84 104 78
54 68 70 79 45 81 74 73 79
lwm08
118 174 157 156 118 125 97 119 80 116
107 93 125 113 129 145 106 121 156 141
164 137 146 134 117 68 76 80 81 117
121 146 115 92 115 144 127 160 165 147
133 158 158 139 177 138 150 128 110 113
119 119 145 116 128

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