Ancient Monuments Laboratory
Report 59/98

TREE-RING ANALYSIS OF TIMBERS FROM THE CHICHELEY CHAPEL, ST ANDREW'S CHURCH, WIMPOLE, CAMBRIDGESHIRE

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Summary

Two phases of the roof were dated, allowing better interpretation of the extant fabric. The earliest phase dated was shown to include the two central tie beams and the hammerbeam brackets, made from timbers probably all felled in AD 1615-16, about a year before the death of Sir Thomas Chicheley, after whom the chapel is named. Subsequent work on the church necessitated the replacement of the hammerbeam brackets on the southern end of the two central tie beams, the replacement supports being made from trees felled in the period AD 1738-1769, making them almost certainly part of the work undertaken by Flitcroft in AD 1748.

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Introduction

This report details the dendrochronological investigation of the timber used in the roof of the Chicheley Chapel (North chapel) of St Andrew's Church, Wimpole Cambridgeshire (NGR TL 336510). The roof has recently been investigated by Dr Tony Baggs of the Cambridge Historic Buildings Group, University of Cambridge, and much of the following background information has been taken from a letter from him to the architect.

The tie beams to the roof of the chapel (numbered from the west end) were thought by Baggs to be possibly of early sixteenth-century origin, but the false hammerbeam brackets (Fig 1) to the ends of the trusses were thought more likely to be contemporary with the monument to Sir Thomas Chicheley, who died in AD 1616. Other evidence suggests that the roof was substantially dismantled at that time. A plaque on the wall suggests further repair work in AD 1732. Flitcroft rebuilt the main body of the church in AD 1748 and it was thought that the hammerbeam brackets at the southern end of the central trusses were replaced with the simpler end supports during this work (Fig 1). There was another phase of restoration in AD 1887 and is not entirely clear what work was done then.

Dr Baggs suggested at the end of his report on the roof that some of the timbers being removed in the repairs being carried out at the time he was writing (June 1998) should be marked and set aside for dendrochronological study, since the documented sequence of repairs could not be directly related to the to the existing timber fabric. The dating work was requested and funded by English Heritage in order to help inform the ongoing programme of grant-aided repairs, determine whether the roof was of late-sixteenth or early-seventeenth century date, or possibly earlier, and establish the time of some of the later repairs. The AD 1887 phase was thought to be clearly identified, and did not require dendrochronological dating.

Methodology

The site was visited in July 1998.

Core samples were obtained using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis. A number of slices were available from timbers which had been removed during the repair work. The samples 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. Those samples with more than 45 annual rings had their sequences measured to an accuracy of 0.01 mm using a specially constructed system utilizing a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to an Atari desktop computer. Samples with less than 45 rings can only very rarely be reliably crossmatched and are generally rejected from further analysis. The software used in measuring and subsequent analysis was written by Ian Tyers (pers comm 1992).

Ring sequences were plotted on translucent semi-log graph paper to allow visual comparisons to be made between sequences on a light table. This activity also acts as a measure of quality control in identifying any errors in the measurements. Statistical comparisons were made using Student's *t*-test (Baillie and Pilcher 1973; Munro 1984). Any internal site mean sequences produced are then compared with a number of reference chronologies (multi-site chronologies from a region) and dated individual site masters in an attempt to date them. The *t*-values quoted below were derived from the original CROS program (Baillie and Pilcher 1973). Those *t*-values

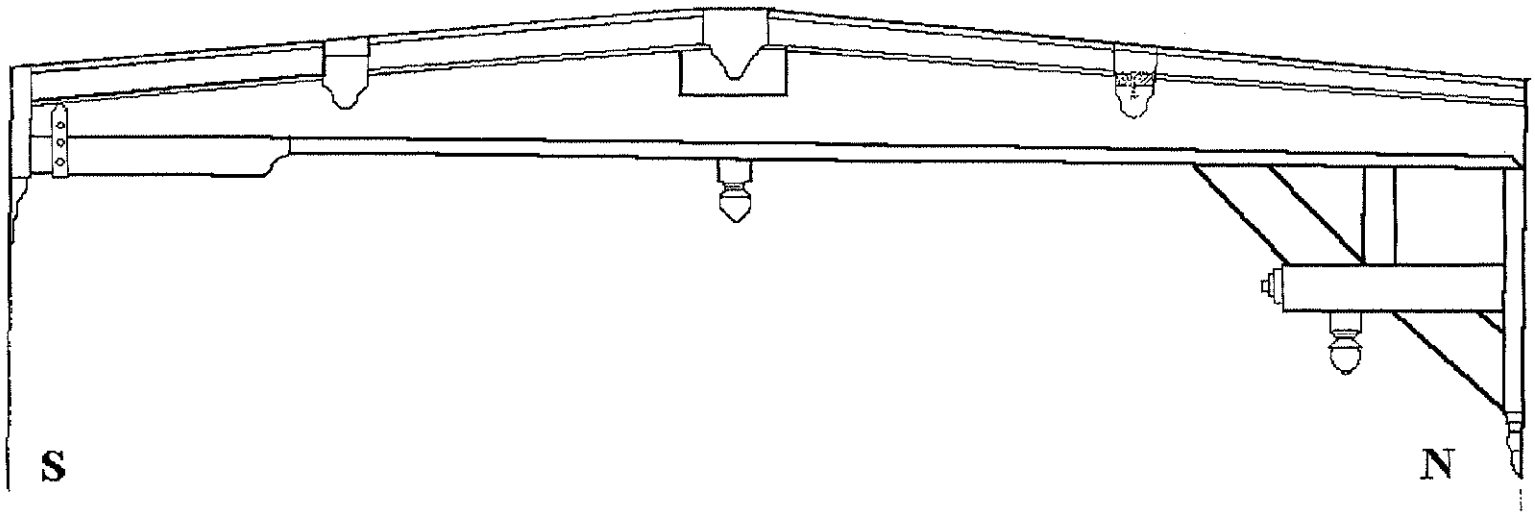

Figure 1: Cross-section of the central trusses of the roof of the Chicheley Chapel, St Andrew's Church, Wimpole, Cambridgeshire, showing the form of the false hammerbeam remaining on the north side and its replacement by a single support on the south side.

in excess of 3.5 are taken to be indicative of acceptable matching positions provided that they are supported by satisfactory visual matches, and give consistent matching positions against a range of independent chronologies (Baillie 1982, 82-5). Any timbers not included in the site mean are tested against it to see if they crossmatch.

The dates thus obtained represent the time of formation of the rings available on each sample. Interpretation of these dates then has to be undertaken to relate these findings to the construction date of the phase under investigation. An important aspect of this interpretation is the estimate of the number of sapwood rings missing. In this instance, the sapwood estimates are based on those proposed for this area by Miles (1997), in which 95% of samples are likely to have from 9 to 41 sapwood rings.

The dates derived for the felling of the trees used in construction do not necessarily relate directly to the date of construction of the roof or subsequent alterations or repairs. However, evidence suggests that, except in the re-use of timbers, construction in most historical periods took place within a very few years after felling (Salzman 1952; Hollstein 1965).

Results

All the timbers sampled were of oak (*Quercus* spp.) and details of their origin within the construction, rings, and sapwood are given in Table 1. The cores from tie beams 1 (WPC01) and 4 (WPC03) did not yield sufficient numbers of rings to be used further in the analysis, although the core from tie beam 2 (WPC02), and the slice from tie beam 3 (WPC05), gave long sequences which were subsequently dated (Table 1). All the slices chosen on site from the available timbers were subsequently dated. The degree of crossmatching between the samples from the tie beams and hammerbeam bracket components is shown in Table 2, along with the level of crossmatching between the two later supports added to the southern ends of the central tie beams.

Both the supports to the southern ends of trusses 3 and 4 (Fig 1) were of boxed heart conversion from the tree, but both exhibited a double centre, indicating that the tree was forking or branching at this level.

Two site chronologies were formed from the timbers, Wimpole 1 and Wimpole 2, and these were dated by comparison with a number of regional and site chronologies as shown in Tables 3 and 4. The series data are given in Table 5.

Interpretation

The high level of crossmatching between the two central tie beam timbers, the hammerbeam bracket to truss 3, and the ridge piece (Table 2), along with their similar probable felling dates, show that these may be considered as a single group of timbers. The two tie beams crossmatch with a value of $t = 11.4$, a value which is sometimes taken to suggest that they could even come from the same tree, although this would seem most unlikely in this case since they are both substantial timbers. The critical sample to the determination of the likely felling date for this group of timbers is WCP06, which appears to have complete sapwood, but which does not actually have any bark on the sample. If the sapwood is accepted as being complete, it gives a felling time for the group of timbers as AD 1615-1616. Without this timber the felling period would be derived as AD 1606 - 1636. Given the known history of the Chicheley Chapel, the evidence from the dendrochronology suggests that all these components were put up at the same time, sometime after Sir Thomas Chicheley's death in AD 1616. This seems remarkably quick after his death, and may suggest that plans were already in place to alter the roof. It may be possible to clarify this point further from documentary sources.

Table 1: Details of the samples taken from the Chicheley Chapel, St. Andrew's Church, Wimpole, Cambridgeshire

h/s = heartwood - sapwood boundary, C? = possibly complete sapwood, but no bark on sample

Sample no	Type of sample	Origin of sample	Total number of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence (AD)	Felling date of sequence (AD)
WPC01	core	Truss 1, tie beam	29	unmeasured	-	unknown	unknown
WPC02	core	Truss 2, tie beam	104	2.11	h/s	1492 - 1595	1604 - 1636
WPC03	core	Truss 4, tie beam	33	unmeasured	-	unknown	unknown
WPC04	slice	Truss 3, support on south side	63	1.63	h/s	1667 - 1729	1738 - 1770
WPC05	slice	Truss 3, tie beam	123	1.53	3	1469 - 1591	1597 - 1639
WPC06	slice	Truss 3, brace	104	1.46	20 (C?)	1512 - 1615	1615?
WPC07	slice	Truss 4, support on south side	53	2.51	h/s	1676 - 1728	1737 - 1769
WPC08	slice	Ridge	96	1.64	-	1494 - 1589	after 1598
WPC09	slice	Truss 3, vertical post	105	1.61	h/s	1493 - 1597	1606 - 1638

Table 2: Correlation between the dated series of the site chronologies

WIMPOLE1 and WIMPOLE2

***t* - values**

Sample	WCP05	WCP06	WCP08	WCP09
WCP02	11.4	8.5	5.7	11.5
WCP05		6.7	6.2	10.7
WCP06			6.2	9.3
WCP08				7.7

WCP04 vs WCP07 t = 4.1 (overlap 53)

Table 3: Dating evidence for the chronology from the earliest dated phase of the roof of the Chicheley Chapel, St Andrew's Church, Wimpole, Cambridgeshire

	WIMPOLE 1 AD 1469 - 1615	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**
Oxon93 (Miles pers comm)	9.2	147
Hereford and Worcester (Siebenlist-Kerner 1978)	8.0	147
London1175 (Tyers pers comm)	7.5	147
Hants 97 (Miles pers comm)	7.0	147
Nuffield (Miles pers comm)	7.9	147
Broomfield (Bridge 1997)	7.7	94
Gosfield (Bridge 1998)	7.7	69
Windsor Castle kitchen (Hillam and Groves 1996)	6.9	105
Fenny (Bridge unpubl)	5.4	123
Newdigate1 (Bridge forthcoming)	5.1	124

Table 4: Dating evidence for the chronology from the second dated phase of the roof of the Chicheley Chapel, St Andrew's Church, Wimpole, Cambridgeshire

	WIMPOLE 2 AD 1667 -1729	
Dated reference or site master chronology	***t*-value**	**overlap (yrs)**
Oxon93 (Miles pers comm)	6.0	63
Hants 97 (Miles pers comm)	5.6	63
London1175 (Tyers pers comm)	5.3	62
Mapledurham3 (Miles pers comm)	7.4	63
Claydon (Tyers 1995)	7.1	63
H.M.S. Victory (Barefoot 1975)	7.0	63
Chatham Wheelwrights Shop (Bailey 1997)	6.2	63
Thaxted3 (Tyers pers comm)	5.5	63

Although it is difficult to determine the geographical origin of the timbers from simple crossmatching of the ring-width series, it is clear that the series match best with sites to the west of Wimpole (Table 3).

The felling period for the supports to the ends of the central tie beams (AD 1738 - 1769) show that these were not part of the AD 1732 repairs and strongly suggest that they were part of the Flitcroft rebuild of the church in AD 1748. Although only a short sequence (63 years), the Wimpole 2 series gives high *t* values with a number of chronologies from central southern and south-eastern England (Table 4).

This study has enabled some of the timbers of this roof to be assigned to known periods of work on the building with a high degree of certainty that was not otherwise possible, and should prove useful in informing subsequent renovation work on the roof.

Acknowledgements

I would like to thank Dr Tony Baggs (University of Cambridge) for his assistance in relating the history of the site and his knowledge of the roof to me on site, and Dr Anthony Fowler (University of Auckland) for his practical assistance during sampling. The carpenters from the contractors, Sindall, were very helpful in identifying and cutting samples from the timbers which had already been removed during repairs.

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Table 5: Tree-ring data from dated oak series of the Chicheley Chapel, St Andrew's Church, Wimpole, Cambridgeshire

Year	ring widths (0. 01mm)	No of trees
WIMPOLE 1 AD1469 to AD1615		
AD1469	214 212	1 1
	247 355 259 331 317 179 242 210 323 318	1 1 1 1 1 1 1 1 1 1
	341 244 208 215 185 142 217 222 212 200	1 1 1 1 1 1 1 1 1 1
	134 163 262 280 207 326 337 223 234 321	1 2 3 4 4 4 4 4 4 4
AD1501	277 279 235 230 252 193 213 256 248 225	4 4 4 4 4 4 4 4 4 4
	256 229 248 256 277 206 90 160 189 164	4 5 5 5 5 5 5 5 5 5
	153 182 177 160 108 164 195 224 187 146	5 5 5 5 5 5 5 5 5 5
	201 130 147 149 209 182 190 146 190 118	5 5 5 5 5 5 5 5 5 5
	135 97 130 116 151 102 81 138 152 106	5 5 5 5 5 5 5 5 5 5
AD1551	116 80 131 129 168 117 100 96 96 123	5 5 5 5 5 5 5 5 5 5
	84 161 119 108 128 96 80 113 120 107	5 5 5 5 5 5 5 5 5 5
	128 102 135 115 128 115 135 120 178 247	5 5 5 5 5 5 5 5 5 5
	151 131 143 178 207 202 177 192 194 124	5 5 5 5 5 5 5 5 5 4
	147 182 184 225 232 204 144 104 79 102	4 3 3 3 3 2 2 1 1 1
AD1601	73 65 96 116 71 81 99 73 63 74	1 1 1 1 1 1 1 1 1 1
	80 90 91 94 69	1 1 1 1 1
WIMPOLE 2 AD1667 to AD1729		
AD1667	197 324 185 120	1 1 1 1
	151 217 225 123 66 95 189 226 176 318	1 1 1 1 1 2 2 2 2 2
	217 340 273 169 209 247 200 202 197 143	2 2 2 2 2 2 2 2 2 2
	232 207 263 237 219 307 286 274 252 197	2 2 2 2 2 2 2 2 2 2
AD1701	174 118 244 210 114 130 123 130 265 213	2 2 2 2 2 2 2 2 2 2
	276 268 289 202 223 223 188 141 130 153	2 2 2 2 2 2 2 2 2 2
	166 168 119 185 148 182 255 214 199	2 2 2 2 2 2 2 2 1