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Tree-Ring Analysis of Timbers from St George's Church, Great Bromley, Essex

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Summary

A number of timbers in the westernmost bay of the seven-bay double hammerbeam nave roof were investigated for their potential for dendrochronological dating. Four cores were taken to confirm the impressions gained from examination of the outside of the timbers. Only two samples taken had sufficient ring numbers to warrant further study, and these remained undated. The opinion was presented that this site should be considered marginal in its likelihood of being dated dendrochronologically, nevertheless it may yield sufficient timbers with a minimum number of rings as work progresses along the length of the nave, and further assessment is recommended.

Keywords

Dendrochronology
Standing Building

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Introduction

St George's Church, Great Bromley (NGR TM 083263; Fig 1) is a grade I listed church. Of particular interest to this study is the roof of the nave, a seven-bay double hammerbeam construction thought stylistically to date to around AD 1500. The main timbers are moulded and there are curved braces below the collars and hammerbeams (Fig 2). The hammerbeams are either embattled or crested, and the spandrels of the braces contain carved foliage. Access became possible as the result of the start of a programme of repair to the roof, with scaffolding giving access to the westernmost bay, and the two west end trusses, at the time of inspection. Dating was requested by the English Heritage Architect Colin Jeffries to date the primary phase of construction of the roof and inform the ongoing repairs.

Methodology

The site was visited in June AD 2000. The timbers were assessed for their potential use in dendrochronological study. The trusses were numbered in agreement with previous surveys of the church, starting at the east end. Hence only trusses 7 and 8 were accessible on this occasion. Oak timbers with more than 50 rings, traces of sapwood, and accessibility were the main considerations in the initial assessment. Those 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 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 utilizing a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC. The software used in measuring and subsequent analysis was written by Ian Tyers (1999).

Ring sequences were plotted 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 when the samples crossmatch. Statistical comparisons were made using Student's *t*-test (Baillie and Pilcher 1973; Munro 1984). The *t*-values quoted below were derived from the original CROS program (Baillie and Pilcher 1973). Those *t*-values 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.

When crossmatching between samples is found, their ring-width sequences are meaned 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, which 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 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. Where bark is present on the sample the exact date of felling of the tree used may be determined.

The dates derived for the felling of the trees used in construction do not necessarily relate directly to the date of construction of the building. 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 inspected in bay 7 were of oak (*Quercus* sp.). The timbers were judged to be largely marginal in their potential usefulness for dendrochronological dating as most had relatively few rings. Four of the most promising timbers accessible were cored and details of the locations of these timbers and the results obtained are given in Figure 2 and Table 1. The applied decoration to the hammerbeams was damaged in a small area and a piece already broken off was removed for study (GBY05). This proved to have only 41 rings.

No significant crossmatching was found between the two measured sequences, and no consistent crossmatching was found between these individual sequences and a large range of regional and site chronologies. The data for these two series are given in Table 2.

Interpretation and Discussion

It was not possible to date the few samples taken on this occasion. The samples were taken to confirm the impression gained from inspection of the timbers that most had too few rings to warrant further intervention but to also to show what potential might exist in the remaining timbers of the roof which were to become accessible in later stages of the repair programme.

The two best looking timbers did yield sufficient rings to justify potential further study, but the two other cores confirmed that remaining timbers were unlikely to be of use. Although the sample from the applied decoration did not itself have sufficient rings to warrant further study, it was felt that if this material could be sampled in other parts it may be worthy of further study.

The recommendation was made that this site must be considered marginal in its potential for dendrochronological dating as work progresses along the roof, but that detailed assessment of the timbers in trusses 1-6 is undertaken when access becomes available in order to decide whether further dendrochronological work is justified.

Acknowledgements

I would like to thank Mr J Clapham for facilitating my access to the roof and his interesting discussion about the roof, the church and the village. Dr Peter Murphy of the University of East Anglia was also present during the sampling and gave interesting observations on the site.

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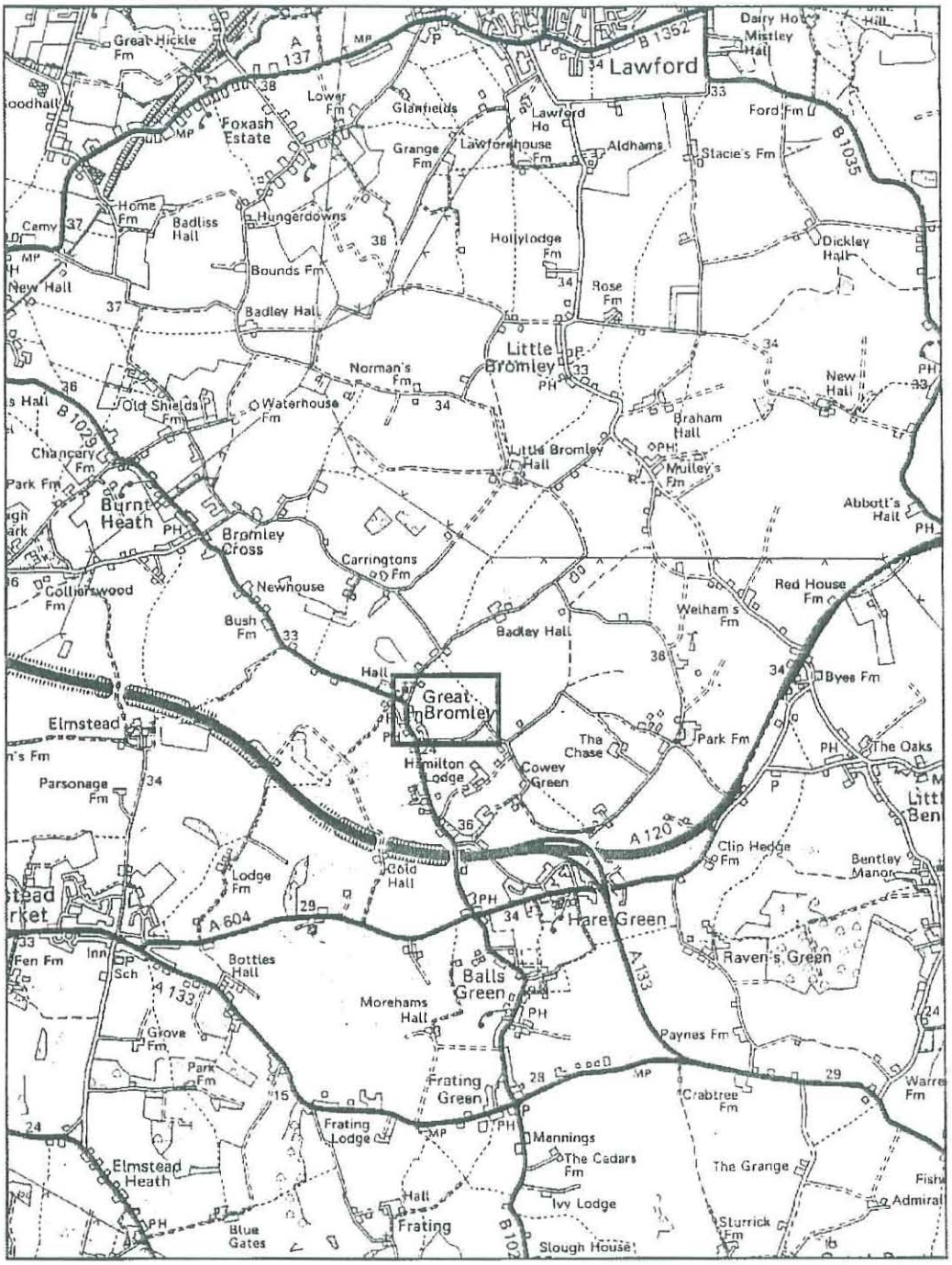

Figure 1: Map to show the general location of St George's Church, Great Bromley, Essex (based on the Ordnance Survey 1:50000 map with permission of the Controller of Her Majesty's Stationery Office © Crown Copyright)

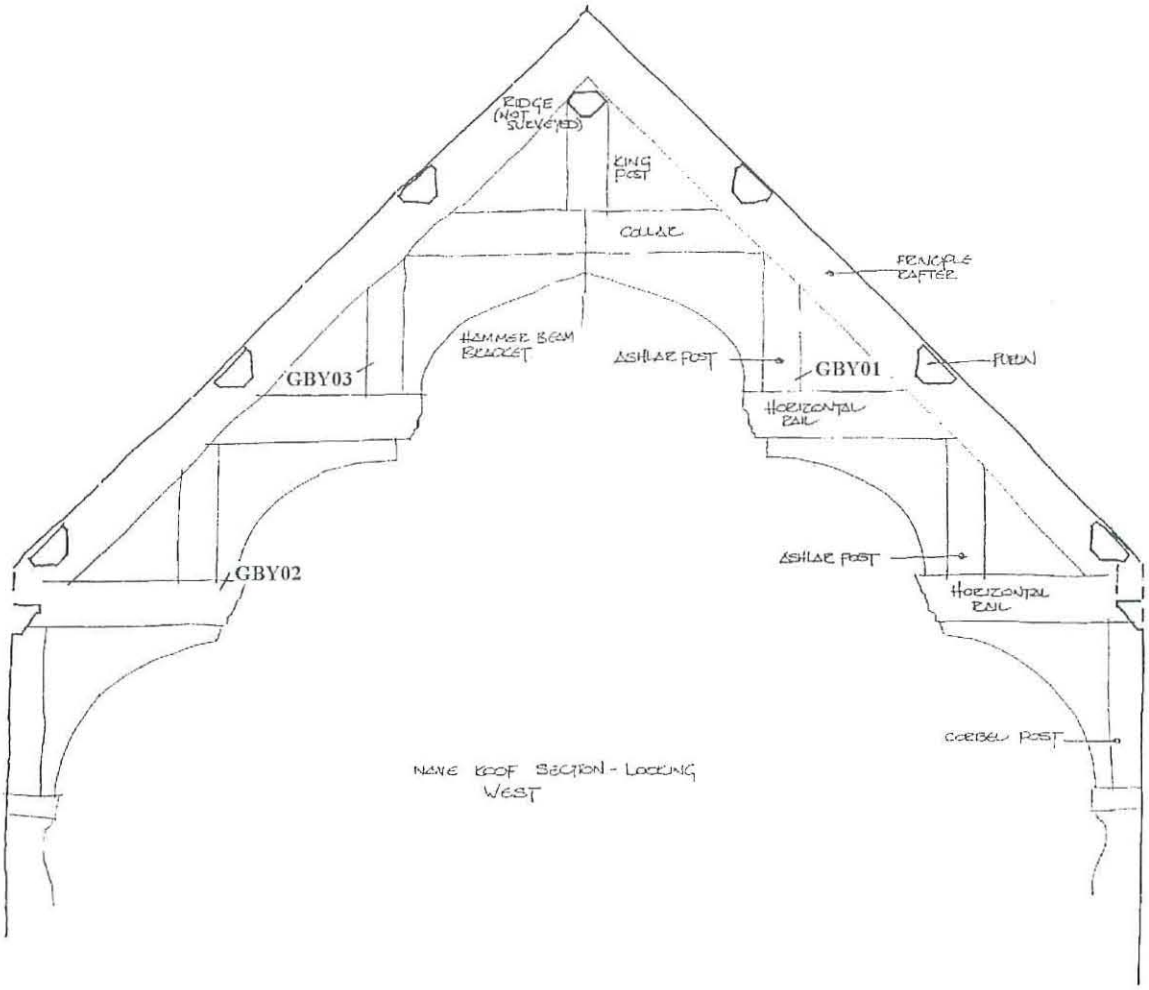

Figure 2: Drawing of a typical truss showing the approximate positions of the cores taken for analysis (adapted from an original by Purcell, Miller, Tritton, and Partners). Samples GBY 01 and 03 were from truss 7, and GBY02 from the westernmost truss (truss 8)

Table 1: Oak (*Quercus* spp.) timbers sampled from the nave roof, St George's Church, Great Bromley, Essex. h/s = heartwood-sapwood boundary

ample umber	Origin of core/sample	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details
GBY01	Upper ashlar post, north side truss 7	<40	unmeasured	-
GBY02	Lower hammerbeam, south side truss 8	64	3.30	-
GBY03	Upper ashlar post, south side truss 7	<40	unmeasured	-
GBY04	Common rafter, north side bay 7	74	1.33	-
GBY05	Applied embattling from hammerbeam truss 8	41	unmeasured	-

Table 2: Ring-width data for the undated series from St George's Church, Great Bromley, Essex

ring widths (0.01mm)									
GBY02									
133	72	152	125	172	198	282	208	198	205
371	392	207	381	228	266	295	383	254	343
327	316	326	231	279	296	352	366	348	304
375	377	381	359	398	361	334	415	278	444
385	163	279	418	478	449	292	303	337	256
336	422	371	425	411	316	448	313	410	571
633	430	458	454						
GBY04									
123	131	119	123	120	127	124	130	127	164
150	138	128	112	156	131	140	99	110	114
102	126	140	127	130	142	227	167	144	154
126	136	129	129	103	129	118	119	131	138
114	119	165	160	148	128	113	106	117	121
128	125	115	142	152	152	154	129	147	154
145	157	162	121	127	143	152	161	123	112
90	125	131	130						