Ancient Monuments Laboratory
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TREE-RING ANALYSIS OF TIMBERS
FROM THE CHURCH OF ST JOHN THE
BAPTIST, GREAT CLACTON, ESSEX

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Summary

The late-medieval nave roof covers a wide span and has larger rafters than is usual for a roof of this type. The rafters, collars, ashlars, inner and outer wallplates, and wallplate ties were all closely inspected but most were rejected for dendrochronological analysis as it was apparent that they contained few rings. Some limited sampling on the most promising samples found that these also contained too few rings for dating. Two pairs of series were combined but the resulting series did not date. The remnants of an older belfry are supported on tie beams at the west end of the nave. Some of the timbers of this belfry were accessible and were sampled. These yielded longer tree-ring series, two of which matched each other, but none of the series gave consistent cross matching against any of the available reference material, and this too remains undated.

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Introduction

The church of St John the Baptist, Great Clacton (NGR TM 177165) is a grade I listed building. The nave roof (Figs 1 and 2) is a seven-cant common rafter type, typically used in the region in both the fourteenth and fifteenth centuries. It has no particular diagnostic features with which to date it stylistically. At the west end of the roof are the remains of a belfry supported on tie beams, which pre-dates the fifteenth-century tower. This belfry also pre-dates the present roof, as can be seen by the way that present rafters intersect the truncated top of the belfry. The straight bracing on the north and south sides may suggest that it was erected in the thirteenth or early-fourteenth century (David Andrews pers comm) which would make it one of the earliest known surviving belfries.
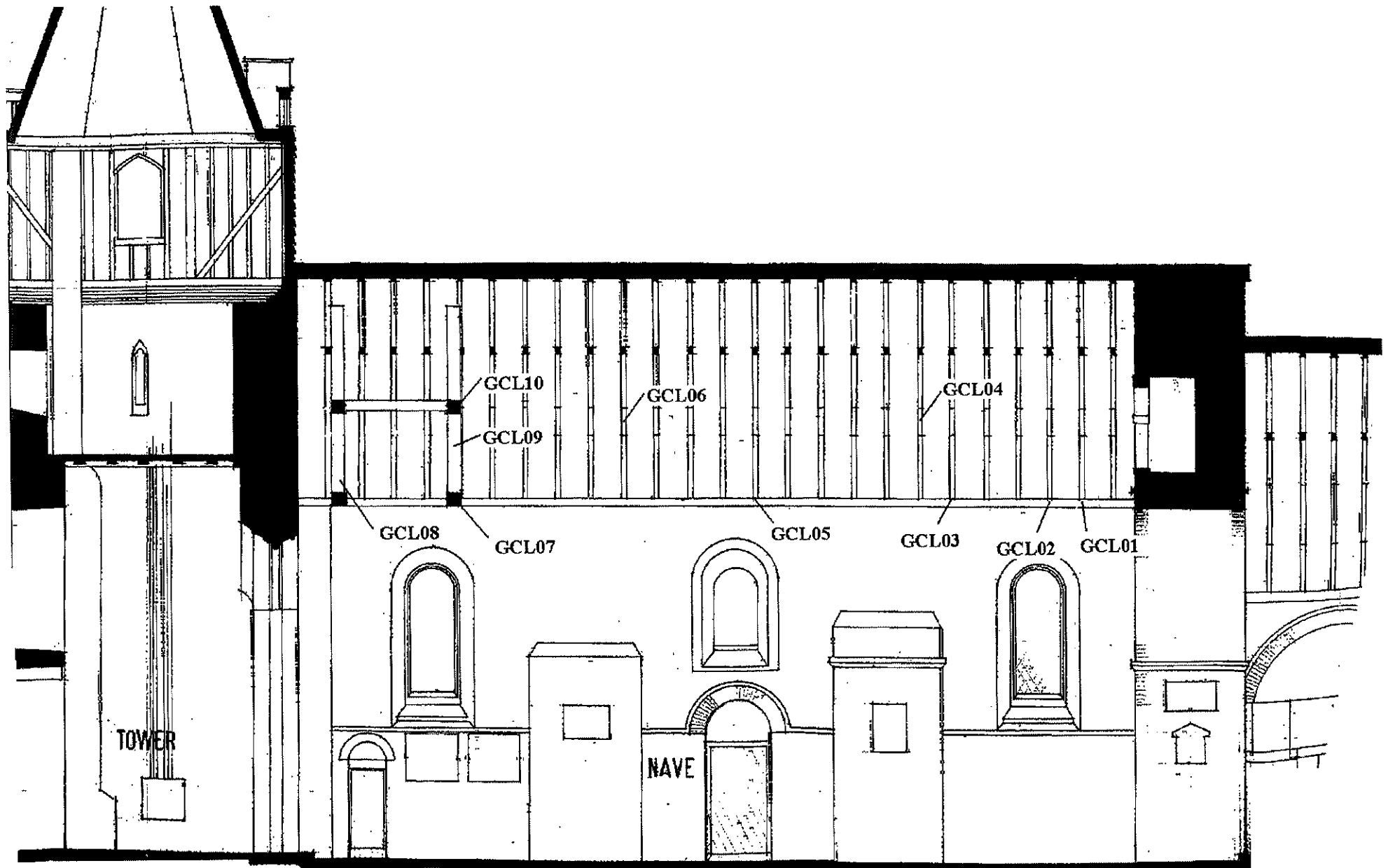
Dendrochronological dating of the nave roof and belfry timbers was requested by the Regional English Heritage Architect, Trudi Hughes, to coincide with repairs being carried out on the roof in order to help ascertain the historical importance of the extant structures.

Methodology

The site was visited in November AD 1999, when the timbers were assessed for their potential use in dendrochronological study. Scaffolding was only in place on the south side of the nave, and access was therefore restricted to this area, including only the southern half of the belfry. Oak timbers which appeared to have 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. Only samples with more than 45-50 rings were measured and used in subsequent analyses as sequences with fewer than this number of rings rarely give reliable crossmatching. 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 site mean sequence which is then compared with a number of reference chronologies

Figure 1: Nave roof and belfry of St John the Baptist, Great Clacton, Essex, from the south side, showing locations of samples taken for dendrochronology

SOUTH

GCL 04, 06

GCL 01, 02, 03, 05
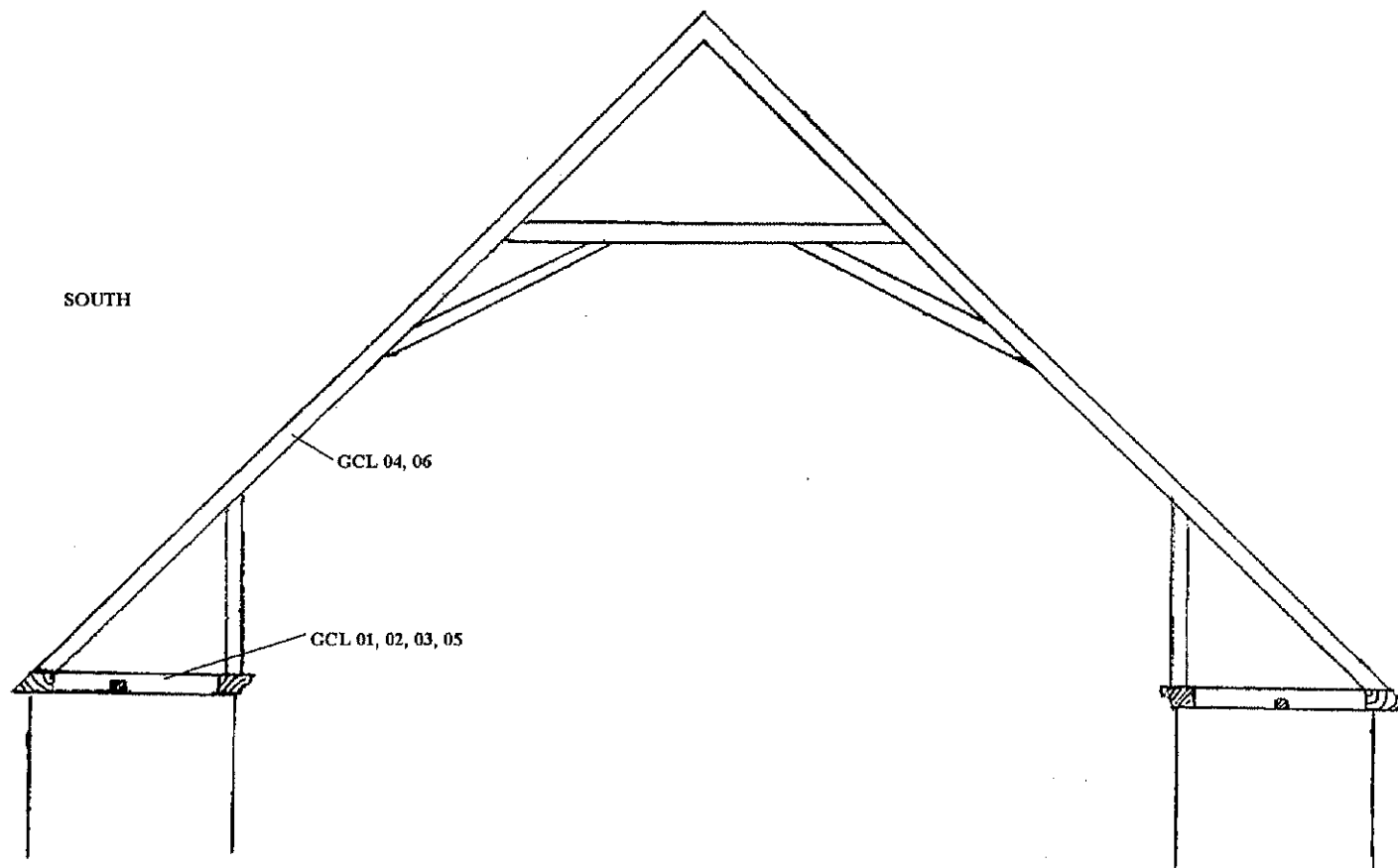
Figure 2: Sketch of the nave roof of St John the Baptist, Great Clacton, Essex, showing timbers sampled for dendrochronology. Based on a sketch supplied by David Andrews (Essex County Council)

WEST   Rafter

GCL10

GCL09

GCL08

GCL07
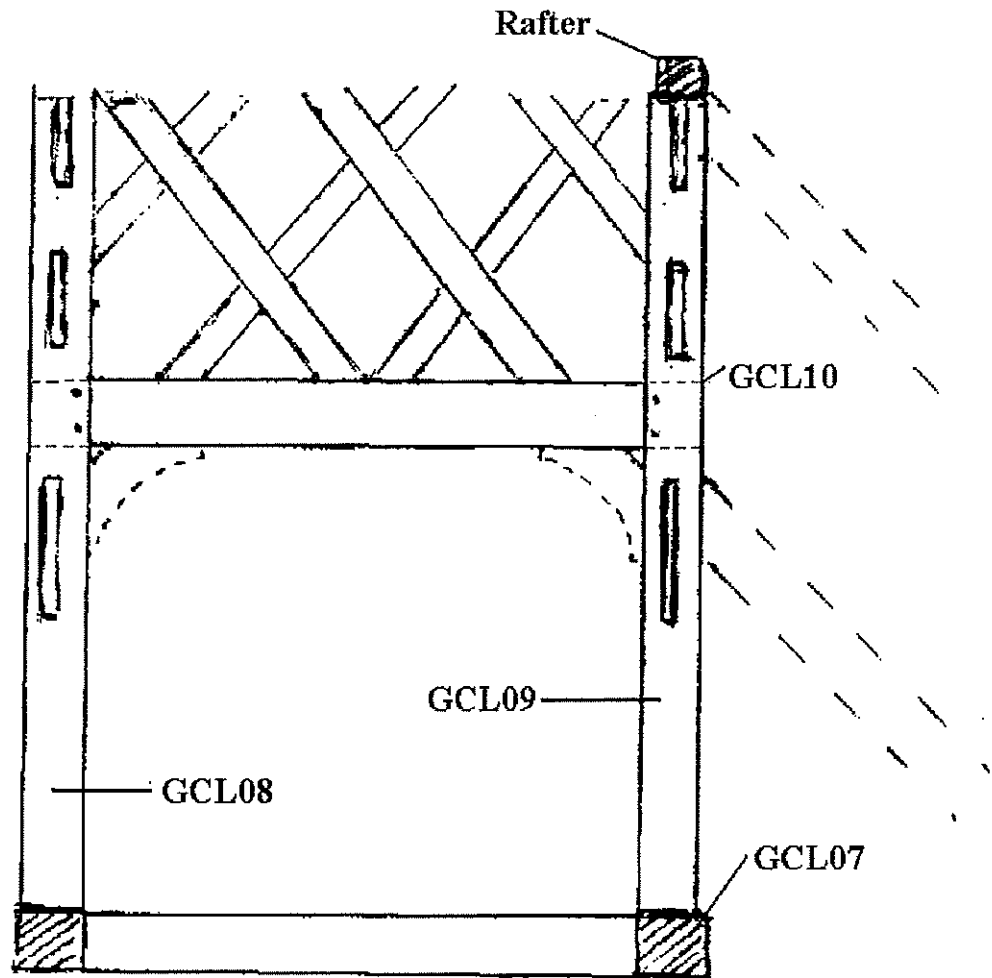
Figure 3: Sketch of the old belfry, St John the Baptist, Great Clacton, Essex, showing the timbers sampled for dendrochronology. Adapted from a drawing supplied by David Andrews (Essex County Council)

(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 and Discussion

All the timbers sampled were oak (*Quercus* spp.). The initial assessment suggested that few timbers were suitable for sampling, all the collars, wallplates, and ashlar pieces were rejected. Some of the rafters and wallplate ties looked as if they may contain sufficient rings and had sapwood visible. The decision was made to undertake limited sampling of these timbers to judge their suitability more accurately. The timbers of the old belfry looked to be more suited to dendrochronological study, but only those on the south side were readily accessible from the scaffolding. Although only a limited number of timbers were accessible, sampling of these was undertaken to try and date this historically important structure. More extensive sampling of this structure would have been preferable, but was not possible on this occasion. Details of the samples and their origins within the building are given in Table 1, and illustrated in Figures 1, 2, and 3.

Only three timbers from the nave roof had sufficient rings to be worth measuring (Table 1), but two of them did crossmatch with each other (GCL01 and GCL02), $t = 6.2$ with 40 years of overlap, and were combined to form a 62-year long sequence GCL0102M. This sequence, and that for GCL04, failed to give consistent crossmatching against reference material.

The few timbers which could be sampled on this occasion from the remains of the belfry did yield longer sequences (Table 1) and two (GCL08 and GCL10) crossmatched, $t = 11.2$ with 73 years of overlap, suggesting that they may possibly have come from the same tree. These were combined to form a 94-year long sequence GCL0810M which failed to give consistent matched against the available reference material, as did sample GCL09. It was noted at the time of sampling that the posts of the belfry were very knotty and may have been hedgerow trees, which were roughly finished.

The ring-width series for the two undated sequences GCL0102M and GCL0810M are presented in Table 2.

The limited sampling of the nave roof timbers confirmed that most indeed contained too few rings for dating, which is why sampling ceased. It is possible that if access was available to the remaining belfry timbers that further long series may become available, although the knotty

timbers of this construction may not represent typical growth forms which would date. If access becomes available to the northern half of this structure it would warrant further investigation.

Acknowledgements

I would like to thank David Andrews (Essex County Council) for discussion about this building and for sending me an unpublished report and drawings relating to the site. The contractors, Bakers of Danbury, kindly allowed access to the site.

References

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Table 1: Oak (*Quercus* spp.) timbers sampled from the church of St John the Baptist, Great Clacton, Essex.

h/s = heartwood-sapwood boundary

Sample number	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD
Late-medieval nave roof					
GCL01	Wallplate tie 2	46	not measured	h/s	unknown
GCL02	Wallplate tie 3	56	2.70	h/s	unknown
GCL03	Wallplate tie 6	20	not measured	h/s	unknown
GCL04	Rafter 6	48	2.04	h/s	unknown
GCL05	Wallplate tie 12	30	not measured	h/s	unknown
GCL06	Rafter 16	35	not measured	h/s	unknown
Vestigial belfry					
GCL07	Tie supporting belfry	48	not measured	h/s	unknown
GCL08	South-west post	88	1.89	h/s	unknown
GCL09	South-east post	67	1.67	h/s	unknown
GCL10	East rail	79	1.91	h/s	unknown

Table 2: Ring-width data for combined sequences GCL0102M and GCL0810M, church of St John the Baptist, Great Clacton, Essex

Year	ring widths (0.01mm)	no of samples
GCL0102M		
1	167 148 220 169 248 200 126 192 324 316	1 1 1 1 1 1 1 1 1 1
	367 197 156 262 407 391 520 359 280 273	1 1 1 1 1 1 2 2 2 2
	237 451 369 398 388 234 246 332 332 556	2 2 2 2 2 2 2 2 2 2
	260 320 295 365 336 476 404 155 216 298	2 2 2 2 2 2 2 2 2 2
	311 362 291 218 265 320 284 446 314 358	2 2 2 2 2 2 2 2 2 2
51	289 208 349 324 181 248 314 297 192 212	2 2 2 2 2 2 1 1 1 1
	267 266	1 1
GCL0810M		
1	303 219 218 339 338 251 213 324 266 296	1 1 1 1 1 1 2 2 2 2
	346 407 430 230 201 225 362 284 267 329	2 2 2 2 2 2 2 2 2 2
	269 227 164 163 225 213 232 302 215 252	2 2 2 2 2 2 2 2 2 2
	231 131 191 178 285 159 124 92 211 203	2 2 2 2 2 2 2 2 2 2
	175 231 175 140 134 264 246 231 254 151	2 2 2 2 2 2 2 2 2 2
51	117 101 206 154 157 129 129 117 127 136	2 2 2 2 2 2 2 2 2 2
	152 149 138 109 194 120 149 102 64 74	2 2 2 2 2 2 2 2 2 2
	75 148 185 157 97 71 83 113 166 133	2 2 2 2 2 2 2 2 2 1
	87 96 148 125 127 130 227 132 116 82	1 1 1 1 1 1 1 1 1 1
	95 191 222 151	1 1 1 1