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Ancient Monuments Laboratory
Report 38/94

THE TREE-RING DATING OF ST MARY'S CHURCH, FROME ST QUINTIN, DORSET

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Summary

Six samples were obtained from St Mary's Church, Frome St Quintin, Dorset (ST 599 026) during recent repairs. Of these, two matched together to form a site master of 60 rings but this failed to date. The other four samples were also tested against the reference chronologies but they too failed to date conclusively.

Author's address :-

Daniel W H Miles

2 Well Cottages
The Hamlet
Gallows Tree Common
Oxfordshire
RG4 9DD

Table 1: FROME ST QUINTIN - SUMMARY OF TREE-RING DATING
[for abbreviations see key below]

Sample number		timber & position	dates spanning	H/S bdry	sap-wood	no of rings	mean width mm	std devn mm	mean sens
Nave Roof									
* q01	c	Collar T1	-		h/s	54	1.43	0.49	0.193
* q02	c	S ashlar piece T1	8-60		h/s	53	2.68	1.04	0.248
* q03	c	N ashlar piece T7	-		h/s	41	1.86	1.15	0.145
* q04	c	N ashlar piece T6	-		h/s	54	1.85	0.49	0.152
* q05	c	N ashlar piece T1	1-53		h/s	53	2.17	1.38	0.187
* q06	s	N ashlar piece T2	-		h/s	73	1.82	0.80	0.220

Key: * = sample included in site-master;
c,s,f = core, slice, face measured;
¼,½,C = bark edge present, partial or complete ring: ¼ = spring (ring not measured), ½ = summer/autumn, or C = winter felling (ring measured);
H/S bdry = heartwood/sapwood boundary - last heartwood ring date;
std devn = standard deviation;
mean sens = mean sensitivity

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1. Introduction and objectives

The Church of St Mary, Frome St Quinton, has been described in the RCHM volume as

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(1) Parish Church of St. Mary stands in the S. part of the parish. The walls are of local rubble and flint with freestone dressings; the roofs are tiled. There are indications that a 12th-century church existed on the site, but the *Chancel* and *Nave* of the existing fabric were built in the 13th century. The *North Tower* was added in the 14th century, the chancel-arch rebuilt *c.* 1400 and the *South Porch* added in the 15th century. The church was restored in 1881, when the S. and W. walls of the nave were refaced.

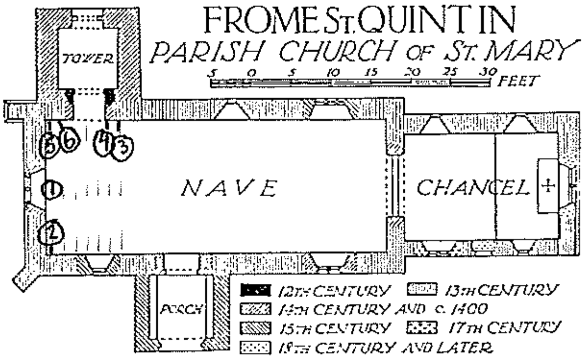

Figure 1: location of samples, from RCHM, 1952 Dorset Vol I (West): An Inventory of the Historical Monuments

Whilst repairs were being carried out to the nave roof, it was decided that the opportunity should be taken to tree-ring date the roof structure which had been uncovered.

2. Methods of sample collection, preparation and dating

Normal practice in tree-ring sampling offers a choice of three possible methods: measurements in situ on a well-polished beam end (normally by sanding); cores drilled with a hollow auger; or slices cut from the timbers. At Frome St Quintin, all were cores with the exception of one ashlar piece, sample q06. This had been removed and a slice cut by the contractors, St Blaise.

The main problem with this site was the few number of rings in the remaining timbers and the lack of sound sapwood. All timbers sampled were of oak, Quercus sp.

As all timbers were dry, the samples could therefore be sanded without pretreatment on a linisher through several grades of abrasive paper ranging from 60 grit to 1200 grit. This prepared a sufficiently clean view of the transverse section of the wood for the ring boundaries to be distinguished and for the ring-widths to be measured. Once polished, all samples were measured under a x10/x30 microscope using a travelling stage electronically displaying displacement to a precision of 0.001mm. Where they contained breaks, cores were measured in sections for eventual alignment against other samples.

Dendrochronology is based on the principal that the annual growth rings of trees reflect regional climatic conditions and because of this it is possible to match a sequence of growth rings from a sample of wood against regional reference chronologies to establish the date of the last measured ring in calendar years. If the sample has its sapwood complete, ie to the underside of the bark, then the date of when the tree was felled can be determined to the year and in many instances the season. The usual procedure is to match two or more individual samples from a phase together, make a mean of these, and then try to match any other matched samples, repeating the process of intermediate means until all of the samples from a phase have either been dated together relatively into a floating chronology or have failed to match. The resulting site master or sub-master is then compared with other reference chronologies which have been unequivocally dated in time, thereby dating the floating chronology or sample.

This is accomplished by using a combination of both visual matching and a process of qualified statistical comparison by computer. The ring-width series are recorded on an Amstrad PC2386 computer for statistical cross-matching using a variant of the Baillie and Pilcher (1973) CROS program. A version of this and other programs were written in BASIC by D Haddon-Reece, late of the Ancient Monuments Laboratory. The programs measure the amount of correlation between two sequences and the Student's 't' test is then used as a significance test on the correlation coefficient. Generally a 't'-value of 3.5 or over represents a match, provided that the visual match between the tree-ring graphs is acceptable. In addition to our own databank, the site data has been compared against the databank at the Dendrochronology Laboratory of Sheffield University.

After measurement, the ring-width series for each sample are drawn in the usual fashion as a graph of width against year on log-linear graph paper. This paper is translucent so that graphs ("curves") can be visually compared by overlaying. Samples which originated from the same tree are first combined into a single sequence for the purposes of the analysis. Although there is no precisely defined limit, studies on modern samples suggest that those which cross-match with 't' values over approximately 10.0 are likely to have been derived from the same tree. All pairs of tree-ring curves in the group are then compared visually at the positions indicated by the computer matching and, if found satisfactory and consistent, are averaged to form a mean of the two. This operation removes 'noise' due to the individual behaviour of the trees such as their response to pollarding or thinning out of their woodland neighbours, and reinforces the common climatic signal.

As previously mentioned, once a tree-ring sequence has been firmly dated in time, a felling date needs to be ascribed. With samples which have sapwood complete to the underside or including bark, this process is relatively simple. In measuring, if the whole ring is complete, ie both spring-wood and summer-wood has been fully formed, then the tree was felled in the winter from the October of the last measured ring date to the March of the following year. If the spring vessels only have formed, signified by a '¼' (this is not measured), then the tree was felled from between March and May of the year following the last measured ring. If there is some summer-wood but this is not complete, then this is signified by a '½' (this is measured) and the tree was felled between June and September of the year of the last measured ring date (Baillie 1982, 46-51). Care must be taken to not misread the 'dates spanned' or 'last measured ring' as a felling date. These are two very different things. Also, months can only be used a guide, as there is considerable variation in the complex relationships between climate and the changes in wood growth.

If the sapwood is partially missing, or if only a heartwood/sapwood boundary survives, then an estimated felling date range can be given for each sample. The number of sapwood rings can be estimated by using the accepted national sapwood estimate of between 10 and 55 rings. This is within the 95% confidence range for British oaks as determined by J Hillam *et al*, 1987. If more than one estimated felling date range has been given for a phase, than the area of common overlap of these ranges might be given to effect a reduced felling date range. However, this relies on the assumption that the samples have a common felling year, which may or may not be true. Whilst most structural phases tend to have trees which have been felled within a year or two of each other, this is not always the case and examples of some timbers having been felled ten or fifteen years previous to the main felling date have been known. It should also be noted that no probability estimate which can be advanced for such a reduced felling date range.

As it was common practice to build timber-framed structures with green or unseasoned wood, it therefore follows that construction would generally commence within a year or so of felling. However, dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure which is being sampled. But apart from reuse, a timber can generally be identified as having been fashioned green by the distinctive shakes and deformed surfaces which would have been straight and square when initially cut by the saw. When these characteristics are present, one can be reasonably certain that construction would have taken place prior to seasoning which is generally accepted to be one year per inch in thickness.

3. Timbers sampled and analysis

The cores were drilled with a 5/8" hollow auger with hardened steel teeth. Figure 1 shows the location of timbers sampled *in situ*. The Church was sampled on the 29th of April 1992. A summary of the timbers sampled is shown in Table 1.

Of the six samples taken from the roof, one was rejected and two (q02, q05) of the remaining were found to match with a t-value of 5.92. Samples q02 and q05 were combined to form a short master sequence (see Appendix). This and the other unmatched samples were compared against the national and regional reference chronologies but there was no consistent match at any date. It is hoped that future material from the area may in time match some of the Frome St Quintin sequences.

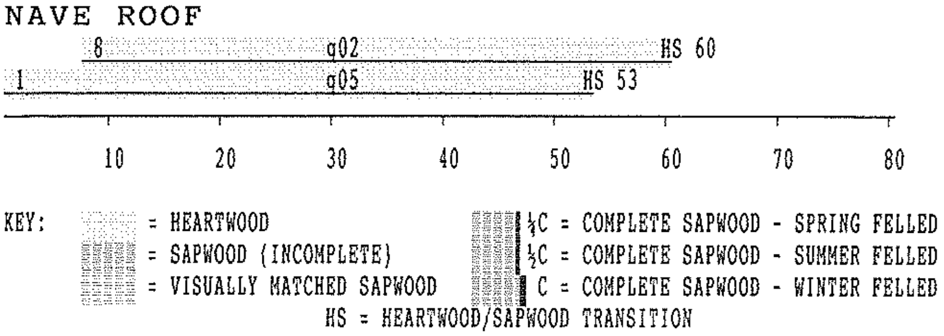

Figure 2: Samples in chronological position

4. Acknowledgements

The author is grateful to Miss Jennifer Hillam and to Miss Cathy Groves of the English Heritage funded Sheffield University Dendrochronology Laboratory for both practical assistance as well with the production of this report. Further thanks are given to Mr H Cursham of St Blaise for assistance on site and to Mr Arnold Root, English Heritage Architect and Mr N A D Molyneux, Inspector, for arranging the dendrochronology. Acknowledgements are also given to the Ancient Monuments Laboratory of English Heritage and Sheffield Dendrochronology Laboratory for both published and unpublished data.

5. References

General:

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Baillie, M G L, and Pilcher, J R, 1973 A simple cross-dating program for tree-ring research, Tree-Ring Bulletin 33, 7-14

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APPENDIX - RING WIDTH DATA (0.01mm)

q02+q05
60 rings, undated

<u>ring widths (0.01mm)</u>

426	534	414	491	462	486	609	525	344	388
389	330	332	294	350	256	466	269	293	276
140	150	99	197	154	162	174	170	208	185
257	202	219	269	200	225	207	222	185	148
125	104	116	116	143	217	190	185	216	233
161	208	232	254	199	138	252	179	105	133

<u>number of trees per year</u>

1	1	1	1	1	1	1	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
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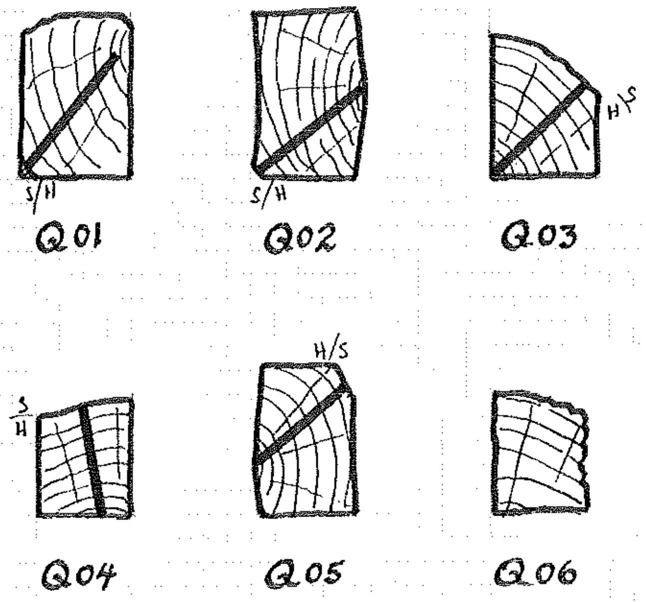

Key: Sapwood H/S = Heartwood/Sapwood boundary

Sections of timbers sampled at scale of 1:8.