

Ancient Monuments Laboratory
Report 75/88

TREE-RING ANALYSIS OF TWO OAK
TIMBERS FROM BRISTOL CASTLE.

Jennifer Hillam

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Summary

Tree-ring analysis of the two timbers from the edge of the castle ditch or river indicated that they were contemporary. They did not appear to date either to the late 11th century when the original construction of the Castle was thought to take place, or to the 17th century when the present river bank was reclaimed, but a tentative felling date was found in the 14th century.

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Tree-ring analysis of two oak timbers from Bristol Castle

Jennifer Hillam

Excavations at Bristol Castle by Mike Ponsford for Bristol Museum and Art Gallery produced two oak timbers (Quercus spp) for tree-ring analysis. The timbers came from a double row of posts which seemed to define the edge of the castle ditch or river. They were thought to belong to the earliest period of the castle's history which dates to approximately the late 11th century. However the present river bank around the posts was reclaimed in the late 17th century, and it is possible that the timbers were added at that time. Tree-ring analysis was undertaken to determine the date of the posts, and possibly a date for the original construction of the castle.

Methods

The samples, three slices from timber 1 and four from timber 2, were deep frozen for at least forty eight hours. Their cross-sections were then cleaned using a surform plane. This gave a smooth surface on which the ring boundaries were clearly distinguishable. The ring patterns of some of the slices were obscured by knots and were discarded. The two best slices from each timber were selected, and their ring widths measured. The measuring equipment at Sheffield consists of a travelling stage connected to an Apple II microcomputer (Hillam 1985, fig4). This automatically records the ring widths as the sample is moved along from one ring boundary to the next.

The ring widths from the two slices of timber 1 were averaged to give a single sequence, as were those from timber 2. Each ring sequence was then represented as a graph, or tree-ring curve, on transparent paper so that the two sequences could be compared together. As well as testing for similarity between the two sequences, both sequences were also tested against dated reference chronologies in order to obtain a date for the ring sequences. A computer program CROS (Baillie & Pilcher 1973) was used as an aid to the crossmatching process. The program calculates the correlation coefficient between two curves for each position of overlap and tests the significance of the results by converting them to values of Student's t. Values of 3.5 or above generally indicate a match

provided that the visual match between the two graphs is acceptable (Baillie 1982 82-5).

Results

Timber 1 had a total of 91 rings, of which 21-26 were sapwood rings, whilst timber 2 had 75 rings with 11-14 sapwood rings (Table 1). Both timbers had bark edge on sections of the samples. Timber 1 was measured to within one year of bark edge, and timber 2 to within four years. Comparison of the ring patterns showed that the two were similar, and that the timbers had been felled at the same time. The computer program gave a t -value of 4.5 for the agreement between them, but this would probably have been higher without the presence of knots.

A site master sequence was made by averaging the ring widths of the two timbers (Table 2). The ring sequences from the master and the two individual samples were tested against dated reference chronologies starting with those covering the late 11th century. No similarities were found with chronologies of this date, even with those made up from other Bristol timbers, such as those from Dundas Wharf (Nicholson & Hillam 1988). The sequences were next compared with post-medieval chronologies to test whether the timbers had been added at the time of the reclamation of the river bank. No consistent results were found.

Consistent results were found with some of the chronologies when sequences 1 and 2 ended in years 1320 and 1317 respectively, and the master ended in 1320 (Table 3). If correct, this result would give a felling date of 1321/1322 for the two timbers. The visual matches between the Bristol Castle sequences and the chronologies listed in Table 3 were examined. These looked acceptable, indicating that the results are probably correct. However, until more chronologies are found to match, the dating should be regarded as tentative.

Conclusion

The two timbers from Bristol Castle were contemporary, but do not appear to date to the late 11th century when the castle was originally constructed, nor were they added when the river bank was reclaimed. However a tentative felling date of 1321/1322 was found for the timbers.

Further evidence is needed before this result can be accepted without reservation.

Acknowledgements

The Sheffield Dendrochronology Laboratory is funded by HBMC(E). I am also grateful to C Mills; M Baillie and J Pilcher; and to R Laxton, C Litton and G Simpson for making available unpublished data.

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Table 1: Details of the tree-ring samples.



	<u>timber 1</u>	<u>timber 2</u>
total rings	91	75
sapwood rings	21-26	11-14
average ring width	1.96mm	1.62mm
dimensions	290 x 195mm	215 x 185mm
ring pattern	knotty	knotty
sketch		

Table 2: Ring widths for the site master chronology, which combines the ring widths from timbers 1 and 2.

years	ring widths (0.02mm)									
	0	1	2	3	4	5	6	7	8	9
1	112	118	57	82	146	221	171	227	221	262
11	248	179	233	220	152	190	181	120	88	113
21	105	136	100	147	138	206	114	74	64	62
31	94	98	103	135	125	93	129	95	123	109
41	104	78	100	85	68	51	44	71	67	60
51	85	72	57	72	83	59	54	37	23	42
61	52	62	34	51	58	45	41	52	34	32
71	37	47	72	55	76	63	64	63	91	44
81	38	49	74	64	68	70	81	70	90	74
91	85									

Table 3: Tentative dating of Bristol Castle timbers.

<u>chronology</u>	<u>t-values</u>		
	<u>timber 1</u> <u>1230-1320</u>	<u>timber 2</u> <u>1243-1317</u>	<u>master</u> <u>1230-1320</u>
Beverley Eastgate 858-1310 (Groves 1987)	2.5	2.1	3.1
Beverley Hall Garth 1002-1324 (Hillam 1981)	4.1	2.8	4.2
East Midlands 882-1976 (Laxton <u>et al</u> pers comm)	5.1	3.0	4.9
England 404-1981 (Baillie & Pilcher pers comm)	3.0	2.2	3.3
Exeter Cathedral 1137-1332 (Mills pers comm)	3.5	2.9	3.8
Reading 1160-1407 (Groves <u>et al</u> 1985)	3.8	3.4	4.3
Yorkshire 1 1192-1648 (Hillam unpubl)	2.6	2.2	3.1