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Summary

The analysis of three oak barrel staves is described. No firm dating was obtained, but tentative tree-ring dates in the 14th century were found for each stave. There was no match between the three ring sequences, possibly indicating that the staves came from different trees.

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Tree-ring analysis of an oak barrel from 48-54 High Street, Bagshot.

Introduction and methods

Tree-ring analysis of three barrel staves from the 1987 excavations at 48-54 High Street, Bagshot, was carried out in the Sheffield Dendrochronology Laboratory in 1988. The oak barrel (*Quercus* spp) was found underneath an occupation layer of late medieval date, and had been reused as a liquid storage container which was set into the ground.

Since it was hoped to display all or part of the barrel, the aim of the tree-ring study was to obtain a date with as little structural damage to the barrel as possible. Initial examination of the staves suggested that more than one tree had been used to construct the barrel since the average ring width varied markedly from stave to stave (Table 1). Three staves were selected for study: stave 6 had relatively wide rings, stave 14 had very narrow rings, and stave 5 had ring widths which fell between these two extremes.

The ends of the staves were very narrow and some contained cracks which ran lengthways down the timber. This made it impossible to clean up the end cross-sections as had originally been intended. Instead a complete slice was removed further down the three staves where the wood was sounder and thicker. When the sample cross-sections were gently sanded and cleaned with a soft brush, the ring boundaries became visible. (The samples and all the staves have now been returned to G Cole of the Surrey Heath Group, who undertook the excavation.)

The ring widths were measured using a travelling stage linked to an Apple II microcomputer (Hillam 1985a, Fig 4). Each sample was measured twice to check the initial measurements. The two sets of measurements were then averaged to

maximise the climatic information within the ring pattern and reduce the background "noise" caused by local growth conditions. This is always done if, as in the case of stave 14, the rings are difficult to measure or if, as with all the samples, the initial ring sequence does not appear to date.

The ring widths were plotted as graphs, known as tree-ring curves, as an aid to visual comparison of the ring patterns. The tree-ring data were also compared with dated reference chronologies from various parts of Britain and Europe using a computer program (Baillie & Pilcher 1973). This measures the quality of the crossmatching between two curves by calculating the correlation coefficient "r" at each position of overlap. The significance of each "r" is then tested using the Student's t test. A result of 3.5 or above indicates a match provided that the visual match betwen the graphs is acceptable (Baillie 1982, 82-5). This latter check by the dendrochronologist is necessary because the computer may produces spurious results, and in practice often produces more than one value higher than 3.5.

Results

Samples 5, 6 and 14 had 69, 111 and 187 rings respectively, and their average ring widths were 1.02mm, 1.73mm and 0.65mm (Table 2). There was no match between the three ring sequences, providing additional evidence that the barrel was not made from a single tree. Comparison with dated tree-ring chronologies was disappointing. Initially no consistent results were obtained for any of the staves. The possibility that the barrel had been imported from Europe was considered but no match was found with chronologies from France, Germany, Ireland or the Baltic.

The ring sequences have now been tested against all available reference chronologies at Sheffield. They have also been tested against other

chronologies by David Haddon-Reece at the Ancient Monuments Laboratory in London. The best results are set out in Table 3, but it should be stressed that these are tentative results which need to be checked against additional chronologies before they can be accepted without reservation. Stave 5 appears to match chronologies from London and Oxfordshire when its ring sequence spans the period AD1197-1307. Stave 6 produces its best t values for the period 1260-1328, and stave 14 for the period 1164-1350. The former gives t values over 3.5 with chronologies from Kent and Oxford, whilst the latter appears to match those from York, Exeter and Reading. Visual matches corresponding to the computer results for 6 and 14 are poor, but those for 5 are better. If any of these tentative matches is correct, it is likely to be that for stave 5.

None of the staves had sapwood, although it is possible that the outer rings of 14 could be the heartwood-sapwood transition. If the result for 5 is correct, the date of the outer ring would give a definite *terminus post quem* for felling of 1307 but, because there is likely to be at least 10 sapwood rings missing (Hillam *et al* 1987), this can be ammended to 1317. (The tentative results for staves 6 and 14 would similarly give felling dates after 1138 and 1260 respectively.)

Conclusion

The ring sequences from staves 5, 6 and 14 of the Bagshot barrel, which probably come from different trees, cannot be firmly dated at present. Tentative tree-ring dates in the 14th century have been found for each stave, but evidence from additional reference chronologies is needed before these can be confirmed or rejected.

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Table 1: Details of the timbers. Samples measured are indicated by asterisks.

sample	(mm) maximum width	(mm) maximum length	ring widths	comments
bottom plank	145	630	wide	
bottom plank	115	555	wide	
stave 1	110	685	average	centre hoop
2	130	645	average	
3	135	660	average	centre hoop
4	110	600	average	
5*	120	605	average 1.02mm	111 rings
6*	125	675	wide 1.73mm	69 rings
8	135	635	narrow	
9	120	620	narrow	
10	115	605	narrow	
11	120	630	narrow	
12	130	610	narrow	
13	70	630	wide	
14*	125	635	narrow 0.65mm	187 rings
15	125	660	average	

Table 2: Ring width data.

STAVE 5 (111 rings)

years	ring widths (0.02mm)									
1	70	55	64	61	67	66	62	66	65	51
	58	68	47	65	65	67	74	75	79	73
	64	46	62	53	63	45	81	54	60	64
	64	65	44	35	36	45	45	48	34	44
	53	42	52	51	46	45	45	67	37	52
51	60	49	57	61	62	58	71	63	62	55
	61	47	56	66	61	55	54	41	56	49
	47	45	36	39	34	28	48	46	36	31
	50	42	39	48	42	38	34	42	51	49
	44	42	46	42	38	51	43	47	47	50
101	50	37	39	40	35	48	41	44	34	36
	29									

STAVE 6 (69 rings)

years	ring widths (0.02mm)									
1	92	133	102	110	94	155	143	92	54	104
	141	92	126	122	158	145	116	134	69	69
	64	40	45	52	35	62	74	58	35	53
	54	57	81	135	113	82	92	65	108	137
	121	103	123	95	74	93	106	133	164	126
51	78	81	88	91	93	84	56	52	46	49
	44	44	45	53	44	46	38	52	49	

STAVE 14 (187 rings)

years	ring widths (0.02mm)									
1	54	48	40	32	32	35	42	43	45	50
	54	42	43	38	32	41	40	37	42	30
	27	32	39	46	34	37	33	36	43	45
	37	35	25	22	24	29	32	32	36	42
	42	36	33	28	35	28	27	33	38	33
51	26	38	43	37	35	28	28	32	30	25
	26	31	41	39	33	34	33	30	24	22
	20	24	23	21	27	27	29	26	33	41
	28	22	28	27	17	24	33	23	31	37
	48	43	32	38	29	26	17	16	21	23
101	23	32	23	21	31	37	29	30	31	23
	39	33	38	48	35	33	39	38	35	27
	35	45	35	45	31	52	31	38	31	27
	32	32	33	35	28	32	36	32	33	25
	19	33	44	45	33	23	18	29	32	25
151	22	31	32	35	33	23	31	25	28	35
	21	37	29	33	48	28	22	26	33	26
	36	51	61	49	26	42	24	29	34	29
	20	25	29	31	41	23	27			

Table 3: Tentative dating of staves 5, 6 and 14 - t values with reference chronologies. Values of less than 2.5 are not printed. SDL - Sheffield Dendrochronlogy Laboratory unpublished data.

	5	6	14
chronology	1197-1307	1260-1328	1164-1350
Bedern Hall, York (Hillam 1982)	-	-	3.6
Bradwell Abbey, Milton Keynes (Bridge 1983)	3.6	-	2.9
Droitwich, Upwich (Hillam 1985b)	3.0	-	-
Exeter (SDL)	-	-	4.2
London, Trig Lane (Tyers pers comm)	4.0	-	-
Nantwich (Leggett 1980)	-	-	3.2
Reading (SDL)	3.5	3.3	3.8
Ship Street, Oxford (Haddon-Reece & Miles pers comm)	4.7	3.8	2.7
Sompting, Worthing (Tyers pers comm)	3.7	3.4	-
Wick, St Cuthberts (Bridge 1983)	3.6	-	-
Zachs, Oxford (Haddon-Reece & Miles pers comm)	4.9	-	-