TREE-RING ANALYSIS OF ROMAN TIMBERS FROM TANNER ROW, YORK

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Summary: Sixty of the larger Roman oak timbers from Tanner Row in York were examined at the Sheffield Dendrochronology Laboratory. Many of the samples were unsuitable for dating purposes and, although a site master curve of 70 years was constructed from five matching ring sequences, no absolute dating has yet been obtained.

Introduction

In 1983 and 1984, large quantities of Roman and medieval timbers were revealed when excavations were carried out by the York Archaeological Trust, under the supervision of Nick Pearson, at the corner of Tanner Row and Rougier Street in York. Although sometimes called General Accident Site, the site will be referred to herewith as Tanner Row.

A total of 396 timbers were recorded but many were unsuitable for tree-ring dating, either because they were not oak (Quercus spp), or because they seemed to have insuffucient rings. Sixty of the larger Roman timbers were sampled in the hope of obtaining dates for some of the Roman phases. Most of the samples were from upright timbers, but two (2, 177) were sections of planks and four (155, 159, 168, 173) were from sill-beams (Buckingham 1985).

Method

The samples were prepared for measurement following the method given in Hillam (1985a). Any sample with more than 30 rings was measured. Ring sequences with less than 30 rings are generally not unique and so cannot be dated reliably. Those with 30-50 rings are also difficult to date, and great care is needed to avoid producing spurious dates. However since there was a relatively large number of samples, many still retaining their bark surface, it was thought worthwhile attempting to date any with more than 30 rings.

Results

Thirty-two samples had over 30 rings (Table 1), but relatively few had more than 50 rings and only two had more than 60

(Fig 1). These were two uprights, 34 and 94, which had 67 and 97 annual growth rings respectively.

The ring patterns were represented as graphs, known as tree-ring curves. The graphs were examined for similarities in the pattern of wide and narrow rings, and a group of five curves was found to be synchronous (Fig 2). The comparison process was also carried out using a computer program. The program (Baillie & Pilcher 1973) compares two sets of ring width data at each position of overlap, and calculates the amount of correlation between them. The correlation is expressed by the Student's *t* value, where any value over 3.5 signifies a tree-ring match provided the accompanying visual match is acceptable. The computer runs confirmed the results obtained from the comparison of the graphs (the visual matching) in that five sequences matched well (Table 2), but no similarites could be found between the other 27 sequences that had been measured. The graphs of some of the five matching ring patterns were so similar that the timbers may have been split from the same tree; for example, 68 and 70 gave a *t*-value of 9.4, and 65 was also very similar.

A site master curve of 70 years (Table 3) was produced by averaging the ring widths of the five matching curves. This process inceases the chances of dating the timbers since it enhances the climatic signal present in the tree-rings at the expense of the 'background noise' which is due to the local growth conditions of the individual trees. However, the Tanner Row master could not be dated, although it was tested against all the available dated Roman chronologies (see Appendix for details). The two longer ring sequences (34, 94) were also compared with the

reference chronologies but no acceptable crossdating was found. The ring width data are stored at Sheffield, and are available on request.

Discussion

Examination of the temporal relationship between the matching sequences (Fig 2) shows that the timbers with bark edge (62, 70) were felled in the winter or early spring of year 70/71 on the arbitrary scale, and that the other three were probably felled at the same time. If the master sequence is ever dated, it will therefore be possible to give an exact date of felling. Lack of dating at present is probably due to the shortness of the ring sequences and the lack of Roman reference chronologies for northern England. The only other Roman timbers from York to be examined dendrochronologically were three from Parliament Street, and these also remain undated (Hillam 1981). Most Roman timbers examined so far come from London (eg Hillam 1985b; Sheldon & Tyers 1983).

The timbers themselves were very variable in quality, size and the way in which they had been worked. The rings of several of the samples (eg 21, 47) were distorted, perhaps indicating that they were near to knots. Many of the uprights retained full sapwood, and were unworked (eg 7); others had been hewn from halved or quartered trunks (eg 32, 65). One of the planks was radially split; the other was intermediate between a radial and a tangential plank. The sill beams were worked from whole, halved or quartered trunks.

Because many of the timbers had been worked (Table 1), it is difficult to estimate the age and size of the trees used with any

accuracy. However, with the exception of 94, and possibly 64, it is unlikely that they were over 100 years old when felled, and many were considerably younger (eg 67, 159). The size of tree used varied from around 100mm in diameter (13) to at least 400mm (23). The growth rate of the trees was also variable, although it tended to be average to fast growth: none of the measured timbers had average ring widths of less than 1.5mm, whilst that of 55 was 5.18mm. (Further details of all the Tanner Row timbers can be found in the site timber report - Buckingham 1985.)

Conclusion

The shortness of the ring patterns, and the lack of Roman reference chronologies for northern England, are probable reasons for the lack of tree-ring dating at Tanner Row. Although tree-ring dating of Roman timbers from southern England, especially London, is now almost routine, more work is urgently needed on such timbers from the north of the country to compensate for this bias.

The age and size of tree used at Tanner Row are much younger and smaller than those used in some of the Roman structures along the Thames waterfront in London (eg Bateman & Milne 1983 Plate 24). On the other hand, Tanner Row shows a more efficient use of timber.

Acknowledgements

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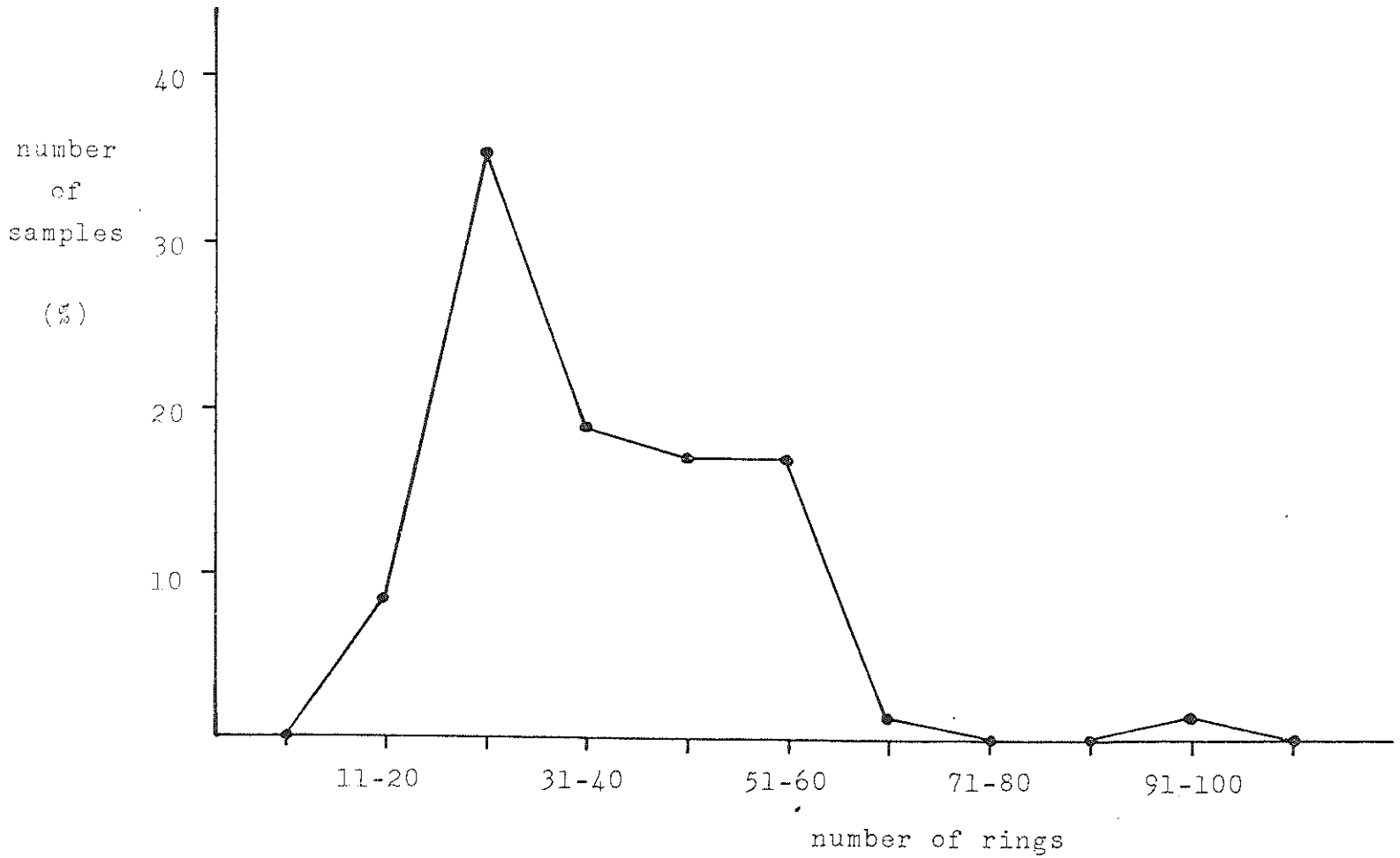


Fig 1 Distribution of the number of rings per sample. Total tree-ring samples - 60.

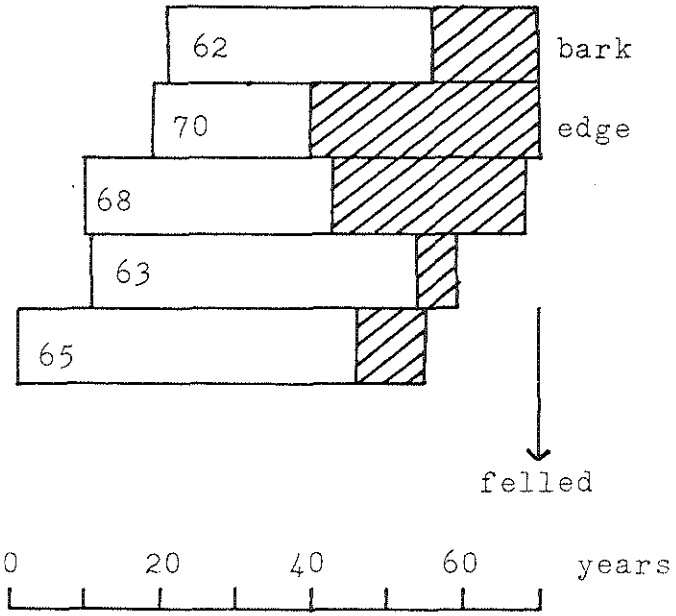


Fig 2 Relative positions of the matching Tanner Row ring sequences. Timbers were felled in year 70/71 on the arbitrary scale, and were winter felled. Hatching - sapwood.

Table 1: Details of the timbers. Sketches are not to scale; those with the bark edge present are marked with an asterisk; "+" indicates the presence of rings which have not been measured. Sapwood is represented by shading on the sketches.

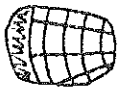
sample number	context number	total no of rings	sapwood rings	mean ring width (mm)	sketch	maximum dimensions (mm)
2	1182	c.30	c.3	-		140x45
*6	1207	c.30	c.19	-		135x95
*7	1218	c.17	9	-		150x140
*13	1284	33	12	2.04		110x100
14	1277	18	-	-		220x190
16	1279	19	-	-		90x75
17	1280	51	-	2.23		240x180
18a	1281	52	-	2.33		195x195
18b	1281	52	-	2.07		200x180
19	1276	42	12	2.20		180x145
21	1179	53	-	2.59		235x165
*23	1178	53	16	3.43		195x170
25	1322	c.33	sample badly cracked			115x95
28	1292	48	-	2.30		105x75
30	1294	56	-	2.16		175x155
*31	1177	c.20	8	-		145x125

Table 1 (cont)

sample number	context number	total no of rings	sapwood rings	mean ring width (mm)	sketch	maximum dimensions (mm)
32	1394	45	17	1.89		150x105
*33	1400	27	11	-		150x120
34	1402	67	-	2.24		260x205
35	1417	29	13	-		130x115
45	2108	35	-	3.65		200x180
46	2109	29	2	-		215x170
47	2110	25	5	-		190x150
48	2111	37	6	2.33		160x120
50	2113	55+	5+	2.86		185x175
*51	2114	A 41 B 42	12 12	3.37 2.89		215x195
52	2115	45	8	2.00		185x155
53	2116	28	-	-		185x155
54	2117	42	-	3.30		220x200
55	2118	30	-	5.18		250x225
57	2120	27	8	-		140x115
*58	2121	25	10	-		205x175
59	2122	24	-	-		210x190

Table 1 (cont)

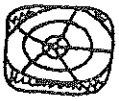
sample number	context number	total no of rings	sapwood rings	mean ring width (mm)	sketch	maximum dimensions (mm)
*61	2124	37	13	2.03		160x145
*62	2125	50	15	2.04		160x110
63	2126	49	6	3.20		150x90
64	2127	24	-	-		135x135
65	2128	55	10	2.05		145x80
66	2129	26	-	-		130x85
67	2130	28	9	-		140x130
68	2131	59	26	1.90		150x75
69	2132	31+	7+	2.77		150x145
*70	2133	44+	23+	1.98		175x95
72	2135	46	14	1.50		125x105
74	2137	29	2	-		95x90
75	2138	27	9	-		125x115
76	2139	c.30	14	-		110x95
93	2204	56+	-	1.57		195x195
94	2205	97	-	1.73		255x190
96	2207	41	2	3.38		300x220

Table 1 (cont)

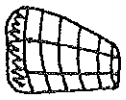
sample number	context number	total no of rings	sapwood rings	mean ring width (mm)	sketch	maximum dimensions (mm)
155	3336	33	-	complacent rings		140x95
159	3341	19	6	-		155x80
168	2290	29	3	-		170x85
173	2295	35	-	3.66		160x130
177	2302	-	-	badly broken		-
199	2365	22	4	-		120x115
*200	2366	34	13	2.11		150x125
331	2509	40+	yes	3.62		160x145
*336	2466	27	9	-		225x170
*396	2504	23	7 bark present	-		radius 75

Table 2: t-values between the five matching ring sequences. The number of rings per sample is given in brackets.

	62	63	65	68	70
62 (50)	-	3.3	4.7	6.1	6.4
63 (49)		-	4.6	5.1	3.5
65 (55)			-	9.4	8.9
68 (59)				-	9.4
70 (44)					-

Table 3: Tanner Row master curve of 70 years (undated).

years	ring widths (0.02mm)									
	0	1	2	3	4	5	6	7	8	9
0		133	77	107	75	144	180	91	82	112
10	159	123	166	133	66	75	99	149	104	143
20	169	157	109	64	67	73	100	109	120	167
30	179	87	81	114	223	148	110	146	152	113
40	199	177	72	81	72	90	106	100	101	92
50	106	94	113	97	93	101	84	86	111	113
60	106	124	86	42	39	27	32	42	41	45
70	49									

Appendix

Details of the dated reference chronologies used to attempt to date the Tanner Row timbers.

Carlisle: 247BC-AD90 (Baillie pers comm)

Droitwich, Old Bowling Green: 215BC-AD25 (Crone pers comm)

London, Bridgehead master: 252BC-AD86*

City/Southwark: 252BC-AD255 (contains data from Fletcher, Hillam, Morgan & Tyers; chronology constructed by Tyers)

New Fresh Wharf/Seal House: 23BC-AD209*

Roman London: 159BC-AD171*

Roman London, late: AD117-294*

Swan Lane Roman: 56BC-AD169*

Germany, Munich area: 370BC-AD400 (Becker 1981)

Trier area: 700BC-1965 (Hollstein 1980 - data converted from indices by Haddon-Reece & Tyers)

* Sheffield Dendrochronology Laboratory data