COPTHALL AVENUE: TREE-RING DATING OF ROMAN TIMBERS FROM THE UPPER WALBROOK VALLEY, CITY OF LONDON

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ABSTRACT

Forty six oak timbers from the 1981-82 excavations at Copthall Avenue in the City of London were examined dendrochronologically. Many of these were unsuitable for ring-width measurement but 25 timbers were dated. Although the site was thought to be 2nd century AD in date, at least one timber was felled in the winter of AD 86/87, indicating that there was earlier activity at the site.

Copthall Avenue: tree-ring dating of Roman timbers from the Upper Walbrook Valley, City of London

INTRODUCTION

In 1981-82, excavations were carried out in the Walbrook valley by Cathy Maloney of the Museum of London's Department of Urban Archaeology. The controlled excavation took place at Copthall Avenue (site code: OPT'81; grid reference: TQ 3275 8148), where the remains of timber buildings, drains and revetments dating to the Roman period were found, representing the first Roman development of this marshy area of London. The site offered the first opportunity to excavate in the Walbrook valley, and the tree-ring analysis of 37 oak timbers was undertaken as a means of providing a firm dating framework for the early Roman development of the area. A further nine samples were sent to Sheffield in 1986.

THE SAMPLES

The original 37 Copthall Avenue samples were sub-divided by the excavator into nine groups according to their context (Table 1). These groups were labelled A-G and J at the Sheffield Dendrochronology Laboratory. 696 and 721 were small posts from the earliest, undated gulley. Although small, they were included in the tree-ring study because they were the only means of dating this particular feature, no pottery having been found. Group B consisted of two posts, 485 and 679, both of which were thought to be re-used, whilst group C was a group of posts (249, 250, 261, 318-320, 407, 408, 529), all dating to the first half of the second century. A post, 400, and a sill-beam, 411, from an early Roman building made up group D, and six timbers associated with a drain, group E (235, 237-8, 240-41, 245). The samples from group F were from another building: 242, 244 were planks, and 247-8, 298 posts. Stakes from a gully (262) and the construction phase of a second road (130) were from groups G and H respectively. The final group (263, 269-70, 272, 275-7) were not from particular structures, and were regarded as 'floating'. 270 and possibly 277 were thought to be re-used.

Duplicate samples were sent for context numbers 276 and 320, whilst 247 was made up of five pieces of wood. An additional sample, 413, from a brushwood raft, was also sent for analysis.

The 1986 tree-ring samples (Table 2) were sections of small oak timbers from various contexts. These samples were originally thought to be unsuitable for dating purposes, and were only

analysed in the hope that they would refine the dates obtained for the first group of samples.

TREE-RING DATING

The samples were prepared, measured and crossmatched as outlined by Hillam (1985). Twelve of the original samples were rejected prior to measurement, either because they had insufficient rings (130, 241, 408, 485, 529, 696), or because their rings were knotty or unclear (237, 249, 263, 272, 275, 277). None of the 1986 samples were suitable for measurment. The ring width data from all the measured samples are stored at the Sheffield Dendrochronology Laboratory, where they can be consulted.

Examination of the ring patterns from the duplicate samples showed that those from context 320 derived from the same timber, but those from 276 may have come from different ones. The ring widths of the 320 sequences therefore were averaged, and the mean (320M) used in subsequent analysis. The two 276 sequences were not meaned; they were labelled 276 and 276B. The five samples from 247 appeared to come from the same timber. Their ring sequences were also averaged, resulting in a 111-year sequence, known as 247M.

The measured samples had between 39 and 111 rings (Table 2), with the majority having 40 to 60 (Fig 1). Two radii from 721 were measured in order to obtain the maximum number of rings and the most representative ring sequence. The resulting 721M had 39 rings which it was hoped would be sufficient to date the sequence reliably.

The ring sequences were compared visually, one against the other, as a means of establishing crossmatching. At the same time, they were also tested against dated reference chronologies using a computer program (Baillie & Pilcher 1973). The Roman chronology, City/Southwark, which covers the period 252BC to AD255 was used for this latter process, although the Swan Lane Roman master was occasionally used as a check. (City/Southwark is made up from sequences from various sites in the City and Southwark; it was compiled by Ian Tyers, and contains data supplied by Fletcher, Hillam, Morgan & Tyers - see also Sheldon & Tyers 1983. Swan Lane is an unpublished sequence, prepared at Sheffield from the Swan Lane Roman timbers.) The visual and computer comparisons resulted in two groups, each containing ring sequences which crossmatched each other. These were averaged to give two site master curves, OPT1 and OPT2. These two curves matched each other with a t-value of 5.1. They, along with 679, were then combined to produce a single site master, OPT3. Unmatched sequences were tested against OPT3, and four more found to crossmatch. A final site master curve of 15

sequences (OPT4) was then made (Table 3). Two, and possibly three, other sequences were later found to match. These were 235 and 238, both of which matched other sequences from group E better than they did OPT4, and the short sequence from group A, 721M, which gave a t-value of 5.5 with OPT4. Despite this relatively high value, and the fact that it seems to match with some of the individual ring sequences (Table 4), the dating of 721 must be regarded as tentative because of its short ring pattern.

The Copthall Avenue ring sequences generally showed good correlation with the City/Southwark chronology (Table 5), although agreement with the Swan Lane master was not as high, and agreement between the individual Copthall sequences was sometimes low (Table 4).

OPT4 gave t-values of 9.3 and 4.6 with City/Southwark and Swan Lane respectively when the Copthall curve covered the period 45BC-AD96. From this, dates for the individual samples could be deduced (Fig 2).

INTERPRETING THE TREE-RING DATES

The tree-ring results are summarised in Fig 2. The interpretation of the tree-ring dates (ie the estimation of felling and construction dates) is hampered by the lack of sapwood on all but two of the dated timbers. Lack of sapwood is a common problem, particularly in the analysis of Roman timbers from the City of London (eg Hillam 1986). Where a few sapwood rings remain, the date of felling is calculated using the sapwood allowance of 10-55 rings (Hillam et al 1986). In the complete absence of sapwood, the felling date is quoted as a terminus post quem by adding the minimum sapwood allowance of 10 rings.

Both of the dated Copthall samples with sapwood were thought to be re-used. 679 seemed to have its complete complement of sapwood rings, ie only the bark was missing, and was therefore felled in the winter of AD 86/87. 270 has 7 sapwood rings, giving a felling date of AD 69-114. The timber from the earliest gulley on the site (721) has a tentative date of 15BC-AD24. This would give a terminus post for felling of AD 34. Group B is represented by 679, which was felled in AD 86/87, but was probably re-used. Four timbers were dated from group C; they were felled after AD 106, whilst the sill-beam from group D (411) was felled after AD 66. The four dated timbers from the drain (group E) have outer rings dating between AD 70 and 86. This suggests that only the sapwood was removed when the timber was converted into posts or planks (see also Baillie 1982 56), which would give a felling date after AD 96 and probably before AD

138. Similarly the group F timbers were felled after AD 81 and probably before AD 125. Of the 'floating' group J, 270 was felled between AD 69 and 114, but was probably re-used, whilst 276 and 276B was felled after AD 81 and 75 respectively. Finally 413, which was not assigned to any group, was felled some time after AD 69.

CONCLUSION

Although only 25 out of the 37 samples from Copthall Avenue were suitable for measurement, 17 of these (18, if 721 is included) have been dated, despite the fact that most of them have less than 100 rings. Estimation of felling and construction dates has again proved difficult because of lack of sapwood. A terminus post quem for felling has been calculated for each of the groups, and at least one timber was felled in AD 86/87, although it was probably re-used. When other dating evidence from the site, such as pottery or stratigraphy, is considered, it may be possible to further refine the tree-ring dates.

ACKNOWLEDGEMENTS

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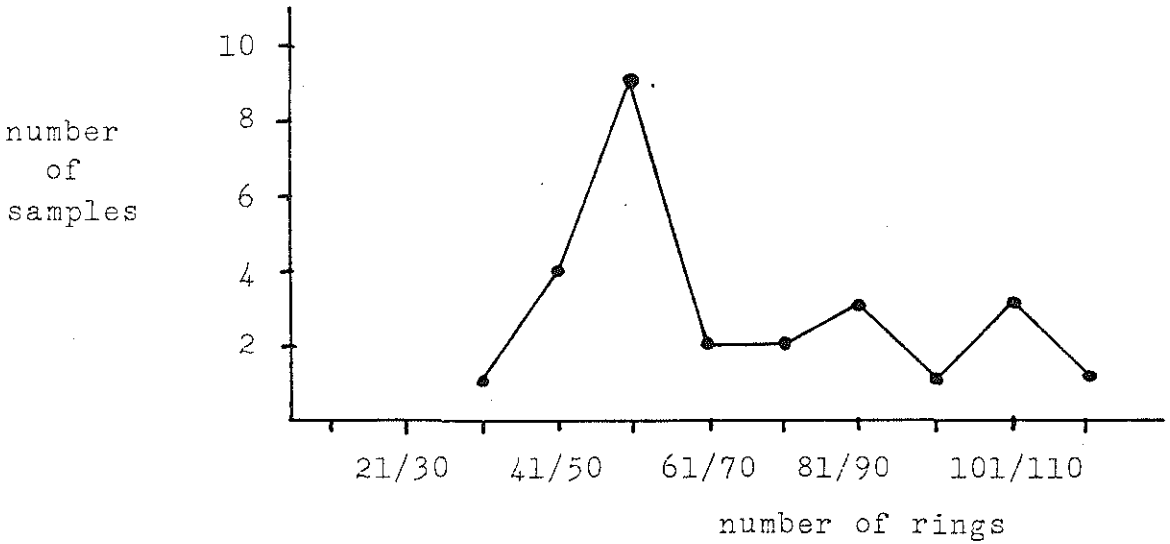


Fig 1: Distribution of the number of rings for the measured samples

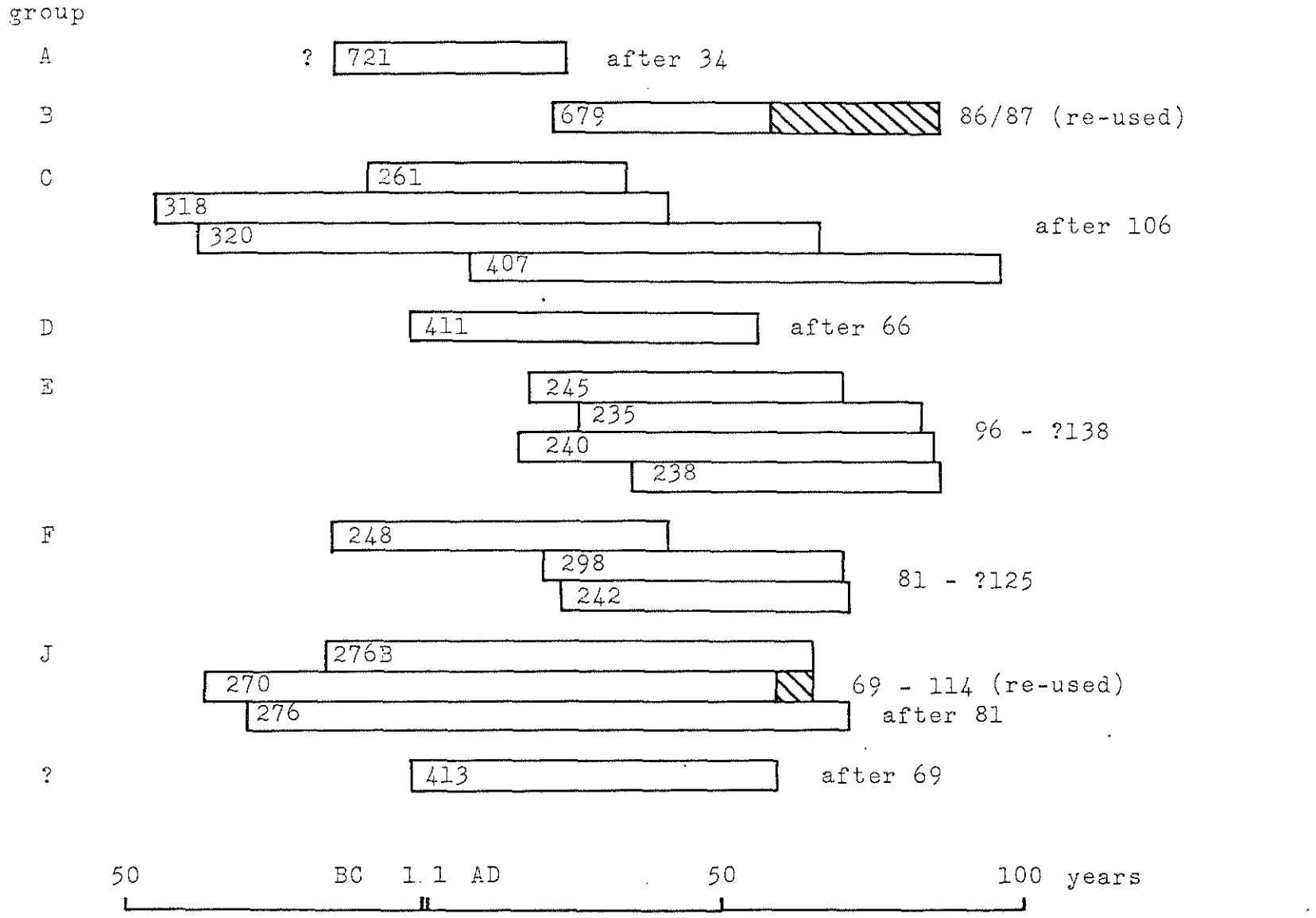


Fig 2: Bar diagram showing the relative positions of the dated ring sequences, plus felling dates for each group. Note that 721 is not firmly dated. White bars - heartwood; hatching - sapwood.

Table 1: Copthall Avenue tree-ring samples and accompanying information.

context	group	comments
1. 1982 samples		
696	A	post from earliest gulley
721	A	"
485	B	re-used post
679	B	"
249	C	post, first half 2nd century AD
250	C	"
261	C	"
318	C	"
319	C	"
320	C	"
407	C	"
408	C	"
529	C	"
400	D	post
411	D	sill-beam
235	E	base plank of drain
237	E	side plank of drain
238	E	"
240	E	retaining post of drain
241	E	"
245	E	"
242	F	plank
244	F	plank
247	F	post
248	F	post
298	F	post
262	G	stake from gulley
130	H	stake from construction of second road, mid 2nd century
263	J	'floating' group
269	J	"
270	J	" , re-used

cont/

Table 1/cont

context	group	comments
272	J	'floating' group
276	J	"
275	J	"
277	J	" , possibly re-used
411	?	part of brushwood raft
2. 1986 samples		
239	-	drain post
246	-	-
273	-	post
274	-	post
263	-	-
393	-	baseplate
410	-	-
556	-	stake
573	-	stake

Table 2: Details of samples. Sketches not to scale; + - unmeasured rings present; * - sample not measured.

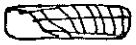
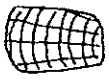
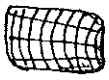
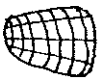
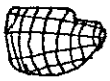
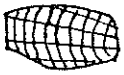
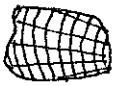
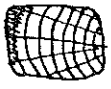
context no	total no of rings	sapwood rings	average ring width(mm)	sketch	dimensions (mm)
130*	28	15	-		75 x 70
235	58	-	1.99		210 x 30
237*	-	-	-		210 x 30
238	52	-	1.66		195 x 45
240	+70	-	1.80		130 x 70
241*	33	14	-		105 x 65
242	49	-	2.57		140 x 110
244	48	-	2.35		120 x 110
245	53	-	2.68		160 x 95
247	111	-	1.28		various
248	57	-	1.14		70 x 40
249*	-	-	-		180 x 150
250	77	-	1.86		200 x 145
261	44	-	2.62		115 x 65
262	55	-	2.46		145 x 70
263*	-	-	-		130 x 130
269	53	-	2.07		120 x 90
270	102	7	1.13		115 x 90

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Table 2/cont

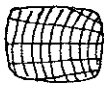
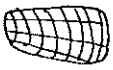
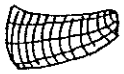
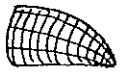
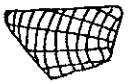
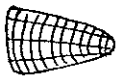
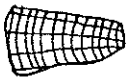
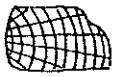
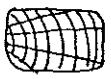
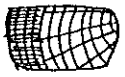
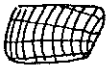
272*	-	-	-	badly broken	-
275*	-	-	-	"	-
276	101	-	1.25		120 x 90
276B	82	-	1.31		115 x 50
277*	-	-	-	badly broken	-
298	51	-	2.58		130 x 70
318	86	-	2.72		240 x 85
319	42	-	5.46		235 x 140
320	+100+	-	2.14		230 x 110
400	59	-	2.55		155 x 130
407	89	-	2.32		220 x 130
408*	34	-	-		145 x 100
411	59	-	2.05		115 x 75
413	62	-	2.05		165 x 90
485*	37	-	-		130 x 65
529*	c.30	-	-		80 x 70
679	65	29	2.07		140 x 65
696	12+½	12+½	-		75 x 65
721	39	-	1.89		70 x 55

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Table 2/cont

1986 samples

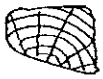
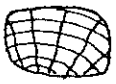
246	16	-	-		105 x 90
239	22	9	-	-	broken
263	-	-	-	rings very distorted - less than 30	
273	-	-	-	-	broken
274	21	-	-		105 x 75
393	-	-	-		160 x 125
410	34	-	-	-	broken
556	-	-	-	-	too small
573	37	-	-		90 x 40

Table 3: Copthall Avenue master chronology (OPT4), dating to 45BC-AD96, and made up from 15 ring sequences. n - number of sequences per decade.

year	ring width (0.02mm)										
	0	1	2	3	4	5	6	7	8	9	n
0		218	227	215	266	159	190	219	116	109	1
10	118	138	138	99	123	126	117	94	95	118	3
20	130	124	89	95	105	80	75	97	114	98	4
30	93	100	101	84	65	76	87	105	92	98	6
40	117	96	96	99	103	84	84	117	94	82	9
50	83	100	96	80	97	100	108	106	105	103	10
60	90	89	104	115	99	126	114	102	107	106	12
70	92	105	115	111	110	84	96	88	70	89	14
80	99	89	87	139	106	82	107	86	66	69	14
90	87	102	104	135	125	104	105	109	81	95	12
100	95	113	88	76	74	82	100	83	81	82	10
110	66	73	82	81	85	65	74	60	73	101	7
120	70	70	62	91	77	62	102	81	65	77	3
130	75	106	111	55	49	66	66	49	30	50	1
140	94	88									1

Table 4: Matrix of t-values. so - overlap less than 30 years; the high t-values for 721 may indicate random correlations.

	235	238	240	242	245	248	261	270	276	276B	298	318	320	407	411	413	679	721
235	-	5.8	2.4	1.4	2.1	so	so	0.1	2.1	1.5	5.8	so	1.0	2.2	0.5	3.4	2.8	so
238		-	2.3	2.8	4.7	so	so	1.0	2.1	1.7	5.2	so	so	4.9	so	so	4.3	so
240			-	3.1	4.1	so	so	2.1	0.8	1.5	3.3	so	0.0	3.7	1.0	1.8	1.5	so
242				-	8.1	so	so	2.8	3.3	3.0	3.8	so	1.3	3.1	2.3	2.4	1.6	so
245					-	so	so	3.9	2.0	2.5	5.0	so	2.2	4.5	2.7	2.6	2.2	so
248						-	0.3	1.5	2.9	3.1	so	1.6	1.8	0.0	0.0	4.9	so	2.1
261							-	2.4	2.3	2.0	so	6.2	2.8	so	3.2	0.2	so	4.1
270								-	2.7	4.1	2.1	1.5	1.8	2.9	3.5	0.3	1.5	1.6
276									-	7.6	2.4	3.0	1.1	1.2	3.5	2.7	4.4	4.8
276B										-	2.0	2.1	1.9	1.4	2.2	3.3	3.5	2.7
298											-	so	0.9	3.4	0.6	3.7	2.4	so
318												-	2.4	0.9	2.1	1.2	so	4.1
320													-	0.3	3.6	2.3	3.4	1.4
407														-	2.4	1.0	2.8	so
411															-	1.2	3.0	so
413																-	1.4	so
679																	-	so
721																		-

Table 5: Dating the Copthall timbers. CS - City/Southwark chronology; hs - heartwood-sapwood transition.

no	date span of rings	t with CS	other t-values
235	AD 26-83	2.9	3.8 OPT4
238	AD 35-86	4.2	4.6 OPT3; 3.5 Swan Lane
240	AD 16-85	2.7	matches other drain sequences
242	AD 23-71	4.2	
245	AD 18-70	4.9	
248	16BC - AD41	5.3	
261	10BC - AD34	3.8	
270	37BC - AD65 (hs 59)	4.0	
276	30BC - AD71	5.1	
276B	17BC - AD65	5.6	
298	AD 20-70	4.2	
318	45BC - AD41	5.6	3.5 OPT3; 4.0 Swan Lane
320	+38BC - AD62+3	4.5	3.6 Swan Lane
407	AD 8-96	4.1	4.2 OPT3
411	3BC - AD56	5.0	
413	3BC - AD59	6.3	
679	AD 22-86 (hs 58)	5.0	
?721	15BC - AD24	5.5	see Table 4