

Ancient Monuments Laboratory
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TREE-RING ANALYSIS OF OAK
TIMBERS FROM THE THAMES
FORESHORE PROJECT, GREATER
LONDON

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Summary

A single sample from Syon Reach (site FHL06) proved unsuitable for analysis but two of the timbers from Old Palace Lane (site FRM11) were dated to give a tree-ring chronology for the period AD 1358-1584. The timbers, probably from the same tree, were felled in the winter/early spring of AD 1584/5 and may be the remnants of Crane Wharf, the Tudor quay which served Richmond Palace.

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TREE-RING ANALYSIS OF OAK TIMBERS FROM THE THAMES FORESHORE PROJECT

INTRODUCTION

This document is a technical archive report on the tree-ring analysis of the timbers from two sites surveyed as part of the Thames Foreshore Project. It is beyond the dendrochronological brief to describe the sites in detail or to undertake the production of detailed drawings. As part of a multifaceted and multidisciplinary study, elements of this report may be combined with detailed descriptions, drawings, and other technical reports at some point in the future to form either a comprehensive publication or an archive deposition on the sites. The conclusions presented here may therefore have to be modified in the light of subsequent work.

A survey of the Thames foreshore in the Borough of Richmond upon Thames was carried out by Richmond Archaeological Society between November 1994 and December 1995. During this period they joined forces with the Thames Archaeological Services to take part in a pilot study of London's foreshore. This larger study, partially funded by English Heritage, was undertaken by teams from local societies and the Institute of Archaeology, co-ordinated by Thames Survey Officer, Mike Webber from the Museum of London. The survey discovered the remains of numerous timber structures. Apparently, most of the timbers had too few rings for tree-ring dating (Bayliss pers comm 1997). The exceptions were at Syon Reach (site code FHL06) and Old Palace Lane (site code FRM11) where one and seven timbers respectively were sampled. They were sent for analysis to the Sheffield Dendrochronology Laboratory at the request of Ellen Barnes from English Heritage.

Syon Reach in Brentford, Middlesex (NGR TQ17597649), was the site of Syon Abbey which was moved there in the early fifteenth century. After the Dissolution the monastery was given to the Duke of Somerset who built Syon House on the site in AD1547. A timber from the wharf at Syon Reach was sampled for tree-ring analysis to determine whether the wharf was related to the monastery or the later Syon House. However, it should be noted that tree-ring dates from single timbers often present difficulties in interpretation.

The timbers at the end of Old Richmond Lane, Richmond, Surrey (NGR TQ17317480), are on the site of Crane Wharf, the Tudor quay which served Richmond Palace. Richmond Palace began life as Shene Palace in the early fourteenth century when there may also have been a quay on the site. The Palace was rebuilt by Henry VII who renamed it Richmond after his earldom in Yorkshire. It continued to be well used by the nobility until the Commonwealth (AD 1649-1653) when all but its gatehouse and a few other buildings were demolished. The timbers seem to represent the remains of several structures (Fig 1). Closest to the shore are timbers from a revetment A104. Three horizontal timbers immediately in front of

the revetment may have been steps (A103). The majority of the timbers are posts representing a broad landing stage with a narrower jetty extending out into the river (A102). A102 is tentatively thought to be the earliest phase with revetment A104 perhaps added after A102 fell out of use. Stair foundation A103 may have been added last. Since other potential dating artefacts had been washed away, it was hoped that dendrochronology would provide a dating framework for these structures which could be integrated with the results from documentary evidence. Of the seven samples, one was from stair foundations A103, two from revetment A104, and four from the jetty end of A102.

METHODS

The cross-sections of the samples were prepared by freezing them for at least 48 hours and then cleaning the surfaces with a surform plane. The ring widths were measured to an accuracy of 0.01mm on a travelling stage which is connected to a microcomputer. The computer uses a suite of dendrochronology programs written by Ian Tyers (pers comm 1996). The measured ring sequences were plotted as graphs using a plotter, also connected to the computer. Crossmatching was carried out first visually by comparing the graphs on a light box, and then using a computer program to measure the amount of correlation between two ring sequences. The crossmatching routines are based on the Belfast CROS program (Baillie and Pilcher 1973; Munro 1984), and all the t values quoted in this report are identical to those produced by the first CROS program (Baillie and Pilcher 1973). Generally t values of 3.5 or above indicate a match provided that the visual match between the tree-ring graphs is acceptable (Baillie 1982, 82-5).

Dating is achieved by averaging the data from the matching sequences to produce a site master curve, and then testing that master for similarity against dated reference chronologies. A site master is used for dating whenever possible because it enhances the general climatic signal at the expense of the background noise from the growth characteristics of the individual samples. Single unmatched ring sequences are tested individually against the reference chronologies. All potential tree-ring dates are then checked by examining the quality of the visual match between the graphs.

If a sample has bark or bark edge, the date of the last measured ring is the year in which the tree was felled. If the outer ring is complete, the tree was felled during the period from late autumn to early spring. For convenience, this is termed "winter-felled". Where the ring is incomplete, the tree was felled during late spring to early autumn; this is known as "summer-felled". Often, particularly where rings are narrow, it is not possible to distinguish between winter- and summer-felled trees.

In the absence of bark edge, felling dates of oak timbers are calculated using the sapwood estimate of 10-55 rings. This is the range of the 95% confidence limits for the number of sapwood rings in British oak trees over 30 years old (Hillam *et al* 1987). Where sapwood is absent, felling dates are given as *termini post*

quem by adding 10 years, the minimum number of missing sapwood rings, to the date of the last measured heartwood ring. The actual felling date could be much later than the *terminus post quem* depending on how many heartwood rings have been removed during conversion.

Further details of the principles and methodology of dendrochronology can be found in Baillie (1982) and Hillam (forthcoming (a)).

RESULTS

Syon Reach

Sample **36** from the wharf/jetty structure at Syon Reach was a boxed-heart timber of oak (*Quercus* spp.) with cross-sectional dimensions, 180mm x 135mm. It had fewer than 50 rings and was therefore unsuitable for dating since such short ring patterns tend not to be unique in time. Dendrochronology therefore cannot help with the dating of this site.

Old Palace Lane

All the samples from Old Palace Lane were oak (*Quercus* spp.). Sample **22**¹ from steps A103 had only 42 rings and was unsuitable for dating. It was a halved trunk with 7 rings of sapwood remaining on one side (Table 1). Samples **23** and **26** from revetment A104 were a tangential plank and a quartered trunk respectively. They had 59 and 62 rings but there was no match between their ring patterns. The four samples from jetty A102 had 59 to 185 rings. All these timbers were from quartered trunks. **28** had 33 sapwood rings and bark edge; its outer ring was complete indicating that it was felled in winter. The remaining samples from A102 had only heartwood rings. **28** and **29** had very similar ring patterns. The match between them gave a *t*-value of 9.8. This, plus an almost identical visual match, suggests that the two timbers come from the same tree. The other ring sequences tended to be knotty which may explain why no cross matching was found between them.

The matching pair of ring sequences were combined to give a site master of 227 rings, FRM_S2 (Table 2). When the master and the unmatched sequences were tested against dated reference chronologies, a very strong match was found for the master over the period AD 1358-1584 (Table 3). No acceptable matches were found for the unmatched sequences. In view of their somewhat short and knotty ring patterns, it is unlikely that tree-ring dates will ever be provided for the remaining timbers. Dendrochronology cannot therefore help to interpret the relative chronology of structures A102-104.

¹ See Table 1 for timber numbers.

DISCUSSION

The presence of bark edge on **28** means that the timber was felled in the winter/early spring of AD 1584/5. Since **29** is probably from the same tree, it was felled at the same time (Fig 2). The tree was well over 200 years old when it was felled. The use of relatively long-lived trees in the decades following the Dissolution has been observed before (eg Tyers 1997).

A detailed documentary search is beyond the brief of this report. It is thought that the structure may be the remnants of Crane Wharf, the Tudor Quay which served Richmond Palace (Cowie and Eastmond forthcoming). *The History of the King's Works* (ed H M Colvin) records that major repairs in Elizabeth's reign began in AD 1573/4. It does not specify the structures by name but states that work in AD 1574/5 included "a new bridge (landing stage)", whilst in AD 1595/6 "a new 'bridge' (landing stage) was erected ..." (Colvin and Summerson 1982, 229-30). The dated timbers cannot belong to the first structure since the tree was still growing. If the dated timbers were used green, which was the norm until recently (Rackham 1990, 69), then they are also not associated with the later structure. It is of course possible that the new 'bridge' of AD 1595/6 was built re-using old foundations from a structure which is not mentioned in *The History of the King's Works*. Further documentary evidence may come to light as the Thames Foreshore Project proceeds.

Two apparently contemporary structures have recently been dated from another site along the Thames waterfront. The east-west and north-south revetments at Victoria Wharf, Tower Hamlets (MOLAS site code VIT96), both have timbers felled in AD 1584/5, although it is possible that the AD 1584/5 phase was actually a modification rather than primary construction (Tyers and Hall in prep).

CONCLUSION

Although the sample from Syon Reach proved unsuitable for dating, two of the timbers from jetty A102 at Old Palace Road were dated. The chronology spans AD 1358-1584, and the timbers were felled in the winter/early spring of AD 1584/5. There is no reference in *The History of the King's Works* to the construction of a landing stage or jetty during this time, but the possibility that the timbers were reused cannot be ruled out.

ACKNOWLEDGEMENTS

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Figure 1: Location of the samples adapted from a drawing by Robert Cowie.

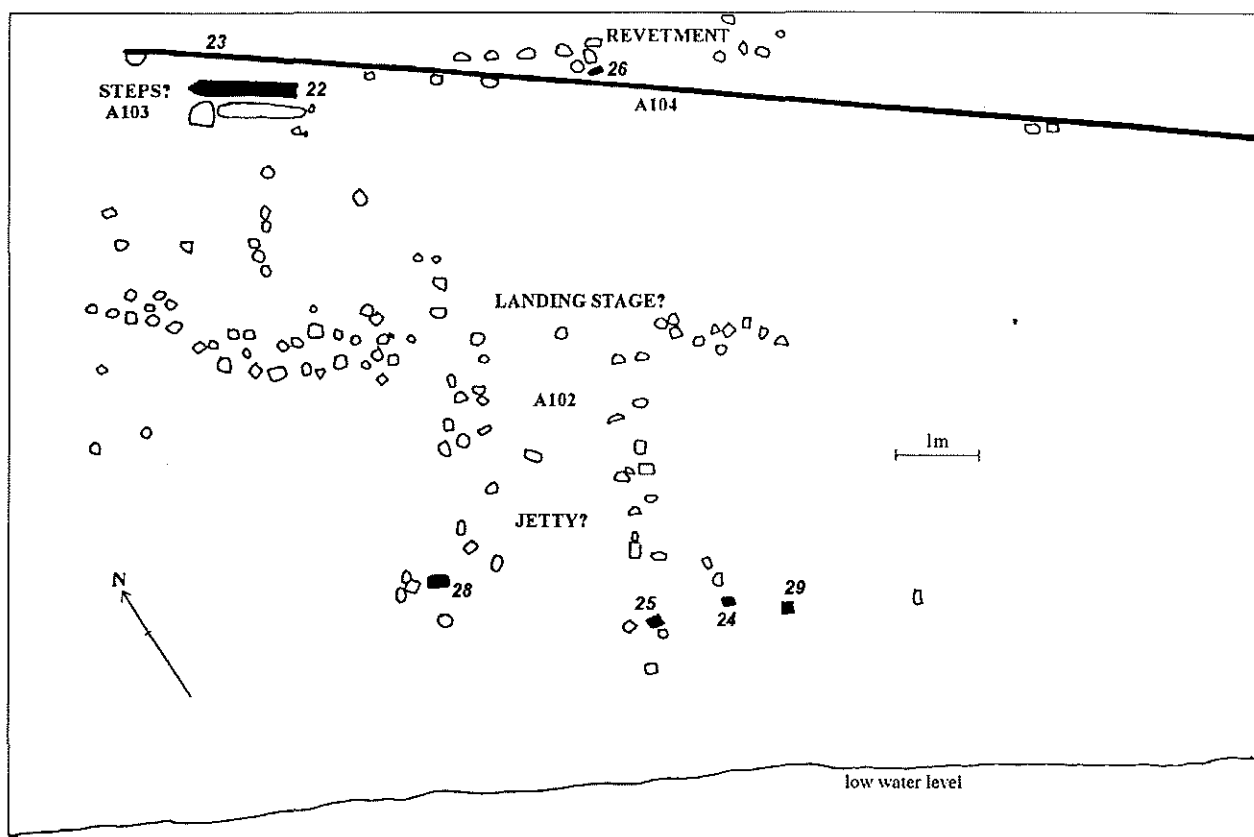


Figure 2: Bar diagram showing the relative positions of the two dated ring sequences. White bars - heartwood; hatching - sapwood; B - bark edge.

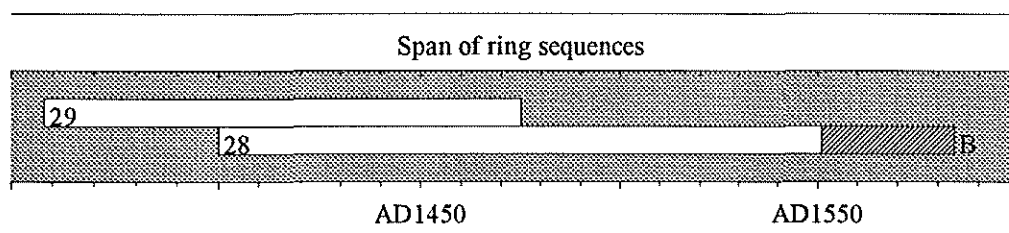
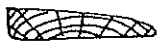
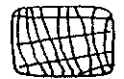


Table 1: Details of the tree-ring samples from Old Palace Lane (site code FRM11). Sketches are not to scale; shading on them represents sapwood.

Sample ² no	Structure	No. of rings	Sapwood rings	Bark edge	ARW ³ (mm)	Cross-section sketch	Dimensions (mm)	Date span (AD)	Felled (AD)	Comments
22 (521)	horizontal timber from steps A103	42	7	-	-		200x110	rejected	-	
23 (524)	revetment A104	59	-	-	1.17		215x40	undated	-	
24 (606)	post from jetty A102	87	-	-	1.56		140x110	undated	-	knotty
25 (598)	post from jetty A102	67	-	-	0.93		130x125	undated	-	knotty
26 (581)	revetment A104	62	-	-	2.23		145x100	undated	-	
28 (562)	post from jetty A102	185	33	yes	0.88		175x160	1400-1584	winter 1584/5	same tree as 29
29 (612)	post from jetty A102	118	-		1.56		155x110	1358-1475	winter 1584/5	same tree as 28

² Timber numbers given by Richmond Archaeological Society are given in brackets.

³ ARW - average ring width

Table 2: Tree-ring chronology FRM_S2, AD 1358-1584.

Year	Ring widths (0.01mm)									
AD1358								215	253	312
-	353	411	432	446	267	229	196	266	286	252
-	198	246	186	183	137	161	142	170	170	188
-	174	114	158	181	229	223	233	282	234	121
-	161	141	205	219	222	228	191	194	268	182
AD1401	150	121	164	196	139	185	150	147	124	116
-	154	166	114	139	111	97	98	147	119	150
-	159	137	186	149	118	69	58	89	121	81
-	93	110	127	78	130	80	147	154	92	97
-	89	112	101	62	71	86	88	78	89	70
AD1451	86	65	84	104	73	89	99	79	82	94
-	94	79	107	69	86	94	79	93	101	104
-	78	92	68	98	93	90	80	86	104	94
-	123	95	95	133	96	115	148	113	133	108
-	88	88	94	113	82	126	99	74	111	81
AD1501	108	93	108	91	104	64	91	70	107	64
-	84	87	83	85	58	78	56	87	75	47
-	69	69	59	86	55	61	81	72	65	74
-	83	63	64	67	114	76	71	72	77	62
-	59	36	79	55	73	60	51	59	84	60
AD1551	73	41	71	69	74	61	59	58	92	74
-	70	56	81	75	79	51	79	58	111	88
-	72	63	46	75	82	78	66	60	106	87
-	52	56	62	66						

Table3: Dating the master FRM_S2 to AD 1435-1586; *t*-values with independent reference chronologies.

Details of reference chronology	Date span (AD)	<i>t</i> -value with FRM_S2
Droitwich, Upwich 3 (Groves and Hillam forthcoming)	1454-1651	6.7
East Midlands (Laxton and Litton 1988)	882-1981	6.3
Essex chronology, 155 timbers (Tyers unpubl)	878-1622	8.0
Hereford City chronology (Tyers 1996)	915-1617	7.1
London, Hays Wharf (Tyers unpubl)	1248-1647	9.7
London, Southwark (Tyers unpubl)	847-1654	7.7
Sinai Park, Burton-on-Trent (Tyers forthcoming)	1227-1750	5.7
Windsor Castle Kitchen (Hillam forthcoming (b))	1331-1573	9.3