Ancient Monuments Laboratory
Report 47/87

TREE-RING ANALYSIS OF TIMBERS FROM BILLINGSGATE LORRY PARK, CITY OF LONDON, 1982. THE PERIOD IV TIMBERS.

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September 1986

Summary

The analysis of 137 oak timbers from the first medieval development of the site is described. Seventy timbers were dated and, because many of the samples contained bark, the dating is often very precise.

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Tree-ring analysis of timbers from Billingsgate Lorry Park, City of London, 1982. The Period IV timbers.

Introduction

Excavations at Billingsgate (site code, BIG'82) by the Museum of London's Department of Urban Archaeology, directed by Steve Roskams, revealed detailed stratigraphy of Roman and medieval levels. Many of the phases contained timbers, over 500 of which were sampled for dendrochronology. The results for the Roman timbers have already been presented (Hillam 1986). This report outlines the results from the first of the medieval periods.

Following the silting of the Roman levels, the bank on either side of the inlet was consolidated with timber and clay (phase IV.1 to the west, IV.2 to the east). After the inlet had been in use for some time (phase IV.3), a stave front was added to the west bank effectively sealing most of IV.1 and IV.2 levels (phase IV.4). This phase IV.4 revetment is known as the large stave Saxon revetment. The area was then further used and consolidated (phases IV.5, 6, 7) before a new revetment (period V) was built above the collapsed staves of IV.4.

Oak timbers (*Quercus* spp) were uncovered from phases IV.1, 2, 4 and 7, and most were sampled for tree-ring dating. A

total of 137 samples were examined: 62 from phase IV.1, 53 from IV.2, 21 from IV.4 and 1 from IV.7. It was hoped that the analysis of this relatively large number of samples would produce a detailed chronology for period IV. (The results of the tree-ring analysis for later periods will be presented, period by period, in separate reports.)

The timbers

The phase IV.1 timbers were sub-divided into four groups:

a) timbers related to apparently primary tie-backs,

b) north-south elements in the main body of the timber and clay bank,

c) east-west and random timbers in the main bank, and

d) timbers from the east side of the revetment.

The phase IV.2 timbers sub-divided into three groups:

a) an initial pile in the clay bank, 7576,

b) timber lacing in the clay bank, and

c) plank cladding on the west side of the revetment.

The phase IV.4 timbers were all from the same revetment, although they were not all sampled for dendrochronology at the same time. Only three of the timbers (7536, 7540, 7542) were sampled on site. The remainder were sampled at the Museum of London where they had been taken for conservation. These samples were examined in 1985 along with samples from

other well-preserved revetments at Billingsgate, and full details of the results are given elsewhere (Hillam & Groves 1985).

The IV.7 timber came from a period when the bank was again modified.

The phase IV samples taken at the time of excavation were examined in 1986, and the results from these and the conservation samples are summarised below.

Methods

The samples were prepared, measured and crossdated following the method given in Hillam (1985). They were examined phase by phase in groups of about ten. Any samples with less than 40 rings were rejected, along with any that had knots obscuring the ring pattern or that had very narrow, unreadable rings (Appendices A, C). Usually the rings along only one radius per sample were measured, but occasionally two or even three radii were measured. This might be done if 1) the ring sequence was particularly knotty or difficult to measure; 2) the ring sequence was relatively short but had sapwood or bark edge; or 3) if the sequence was undated but was considered particularly important, such as when there were only a few samples from a particular phase.

The measured ring sequences were plotted as graphs to facilitate visual comparison, and each sequence was compared by computer with other medieval reference chronologies from London. At the start of the study, the three chronologies used for comparison were CITY MED - made up of tree-ring data from the City of London (Hillam unpubl), SOUTHWARK - tree-ring data from Southwark (Tyers unpubl), and BIG - the chronology produced during the study of the Billingsgate conservation samples (Hillam & Groves 1985). As the work progressed, various working masters were constructed from the period IV samples. These were also used for dating purposes. Although the computer program (Baillie & Pilcher 1973) was used to save time, the results were checked visually. Each ring sequence was checked against the other ring sequences as well as against the reference chronologies. A match was only accepted if the ring sequence crossmatched at least two others. Such careful checking prevents the inclusion of spurious matches which may occur, especially if the initial matching is done by computer.

The results were set out as a bar diagram (Fig 1) to make it easier to estimate felling dates (Appendix C). It was not always necessary to estimate felling dates because a few of the samples had bark or bark edge, so that the felling date is exact to the year, eg 7104, or occasionally the season, eg 7119. (If the outer ring is completely formed, the tree

was felled in winter or early spring whilst it was dormant, but if there is only spring wood present, then it was felled in late spring or early summer.) On some samples, eg 7105, the bark edge was present but the outer rings were too narrow to measure. Instead a rough count of the unmeasured rings was made, and an approximate felling date given. Where the sapwood was incomplete, a sapwood estimate of 10-55 rings was used to calculate the 95% confidence limits for the period of felling (Hillam et al 1986). In the total absence of sapwood, the probable terminus post quem for felling is given by adding ten years to the date of the last measured heartwood ring.

Results

Details of the samples are provided in Appendix A, whilst sketches of the cross-sections showing how the timbers were cut are illustrated in Appendix B. Full details of the results are given in Appendix C, but they are summarised in Fig 1, and will be described below phase by phase. The ring width data from all the measured samples are stored in the Sheffield Dendrochronology Laboratory.

Phase IV.1

Thirty-four samples from phase IV.1 were dated (Fig 1a), whilst 18 were rejected and ten remain undated. Timbers were

dated from all the four sub-groups, although the majority were from group (c).

a) timbers related to primary tie-backs

Five samples from this group were dated, but only one had sapwood. This sample (7233) has 19 sapwood rings, and its outer ring dates to AD 1039. Its estimated felling date range therefore is AD 1039-1076. The remaining samples (7259, 7406, 6656, 6282) were felled after 944, 973, 975 and 1015 respectively. All but 6282 could have been re-used.

b) the north-south timbers

Six of the seven dated timbers from this group appear contemporary. One of these (6448) was complete to the bark edge, giving a felling date range for the group of the winter or early spring of 1039/1040.

The seventh timber (6527) ends in 897, and has no sapwood. It was therefore probably felled some time after 907, and could have been re-used.

c) the east-west and random timbers

7126, 6113 and 6108 were felled after 963, 964 and 973 respectively, and may be re-used. It is noticeable that they have similar end dates to 7259, 7406 and 6656 from group (a).

The remaining 17 dated timbers are probably contemporary. Four of them had bark edge, although the outer rings of 7105 could not be measured. 7100 and 7119 were felled in the winter or early spring of 1039/1040; 7104 was felled in 1039 or 1040 but the season of felling could not be determined.

d) east side of the revetment

Of the two dated timbers in this group, 7634 was felled after 1014, and may be contemporary with those timbers felled in 1039/1040. 6717, however, has a heartwood-sapwood transition which dates to about 1087. This indicates that it cannot have been felled before about AD 1097 because its estimated felling date range is approximately 1097-1142. Since phase IV.1 is sealed by phase IV.4, this timber at this east side of the revetment must be intrusive.

Phase IV.2

The three sub-groups from the east side of the inlet seem from the tree-rings to have a more complicated chronology than those of phase IV.1 to the west. Twenty-five timbers in all were dated, 13 were rejected and 14 remain undated. There is also a tentative date for another timber, which needs further checking before being accepted or rejected.

a) initial piles in clay bank

The only timber to be dated from this group was 7576. Its last measured heartwood ring dates to AD 998, so that it was felled some time after 1008.

b) the timber lacing

Most of the dated timbers belong to this group, and there are at least two phases of felling. There is an early group of timbers (Fig 1b: 7412 to 7500), one of which has sapwood (7183). This has a felling date of 954-999, but if the group is regarded as a single felling phase (see Baillie 1982 56), the date becomes 983-990.

7168 was felled after 1005, and may be of similar date to 7576 from group (a).

The other six timbers are later still in date. 7167 ends in 1039, and the last ring appears to be the bark edge. This timber then is probably the same date as many of the timbers from the other side of the inlet. 7164 also has sapwood, but its outer measured ring is 1042, giving a felling date in the period 1042-1070. 7163 and 7181 were felled after about 1027 and after 1026 respectively. There is therefore no way of knowing if they were felled in 1039/1040 or at the later date of 1042-1070. The last measured heartwood ring of the remaining timbers, 7172 and 7188, is 1037. These timbers cannot have been felled in 1039/1040, since the terminus

post quem for felling is 1047. They may belong to the same phase of felling as 7164 which would give a felling date of 1047-1070 for this phase.

c) the plank cladding

Of the five dated timbers from this group, three had very narrow rings which were difficult to measure, so that the outer few rings were counted rather than measured. Despite this difficulty, two felling phases are indicated. The heartwood-sapwood transition of 7218 is about 982, which gives a felling date of approximately 992-1037. 7228 and 7561 were felled in the period 1045-1090, and are therefore of similar date to 7172, 7188, and possibly 7164 from the timber lacing. 7221 and 7558 were felled after about 1010 and 1027 respectively, and could belong to either felling phase.

Finally 7565 has a tentative date of 1045 to about 1146 which, if correct, would give a felling date after about AD 1156. This is very much later than expected for a timber from IV.2, but the date cannot be properly checked until timbers from the later periods at Billingsgate are examined.

Phase IV.4

Nine of the conservation samples from the large stave Saxon embankment were dated in 1985 (Hillam & Groves 1985). A combined felling date of 1049-1071 was indicated, although

it was suggested that there could be two phases of felling if there was archaeological evidence to support it: one in 1040-1071, the other 1049-1091.

Three new timbers were examined in 1986. 7536 and 7542 remain undated, but 7540 has a heartwood-sapwood transition of 1030. This falls roughly in the middle of the range of heartwood-sapwood dates produced for the conservation samples, and therefore the result supports the theory that there was just one felling phase rather than two. The date of felling is 1049-1070.

Phase IV.7

The only timber to be examined from the later modification of the bank was 5976. Although the sample was dated, it contained no sapwood, and the terminus post quem for felling (AD 1024) does not help with the dating of the later development of the bank.

Period IV chronology

Most of the activity in period IV occurs in the mid 11th century, but at least some of the timbers were felled in the late 10th century. The only timber with sapwood from this earlier period is 7183 which was re-used in the timber lacing on the east bank of the inlet (IV.2). It was felled in AD 954-999, but if the other re-used timbers in the

lacing are grouped together, the felling date becomes 983–990. Re-used timbers, probably of the same date, were also found in the west bank (IV.1): associated with the apparently primary tie-backs (eg 7406), as north-south timbers (eg 6527), or east-west or random timbers (eg 6108).

On the west side of the inlet, most of the remaining timbers were felled in the winter or early spring of 1039/1040, and presumably used very soon afterwards. In 1049–1071, a stave front (IV.4) was added to this part of the waterfront, and on the east of the revetment a timber pile (7617) was added in about 1097–1142. This last timber probably relates to a later period of activity.

Development along the east bank of the inlet probably took place at the same time. 7167 from the timber lacing seems to have been felled in 1039/1040, whilst other timbers were felled in 1047–1070.

Conclusion

This study demonstrates the value of sampling as many timbers as possible for not only were over 70 of the 137 oak timbers from Billingsgate dated, but many had sapwood and several had bark or bark edge. It has therefore been possible to provide an often very precise chronology for waterfront activity in the late 10th - early 11th centuries.

The period IV inlet was developed on both sides in 1039/1040, or shortly afterwards, using recently felled timber plus re-used timbers which were felled in the late 10th cenutry, probably 983-990. In about 1047-1070, a stave front was added to the west side, and the east side of the bank was also modified.

Acknowledgements

The Sheffield Dendrochronology Laboratory is funded by the Historic Buildings and Monuments Commission for England. I am also grateful to Steve Roskams and Alan Vince for providing information about the site, to Ian Tyers for making available tree-ring data from Southwark, and to all those who collected the samples.

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Legend to Fig 1

Fig 1: Bar diagram showing the relative positions of the dated ring sequences from a) phase IV.1, b) phase IV.2 and c) phases IV.4 and IV.7. The accession numbers are given in brackets for the IV.4 sequences for comparison with the diagram in Hillam & Groves (1985).

PHASE IV.1

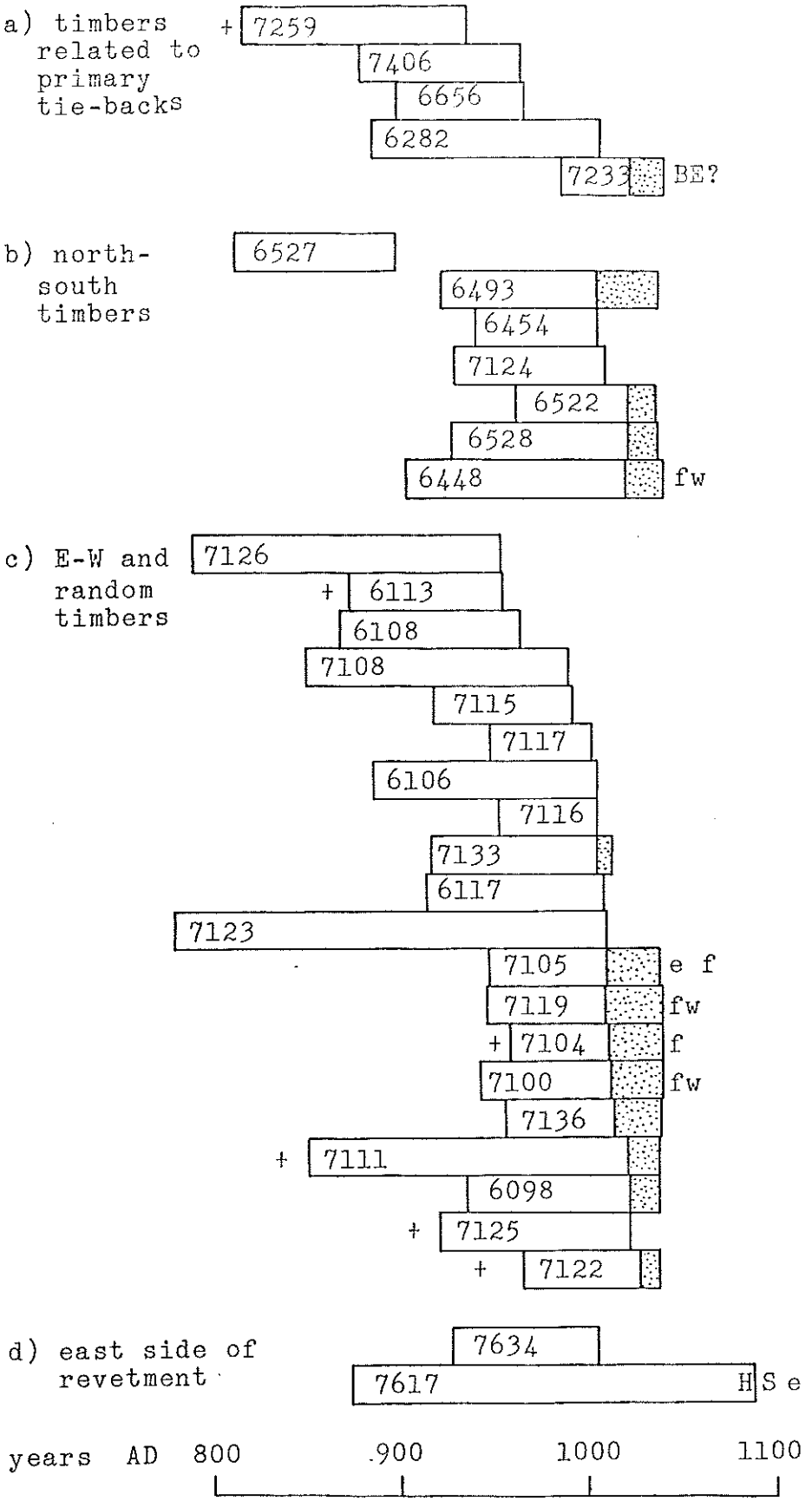


Fig 1a

PHASE IV.2

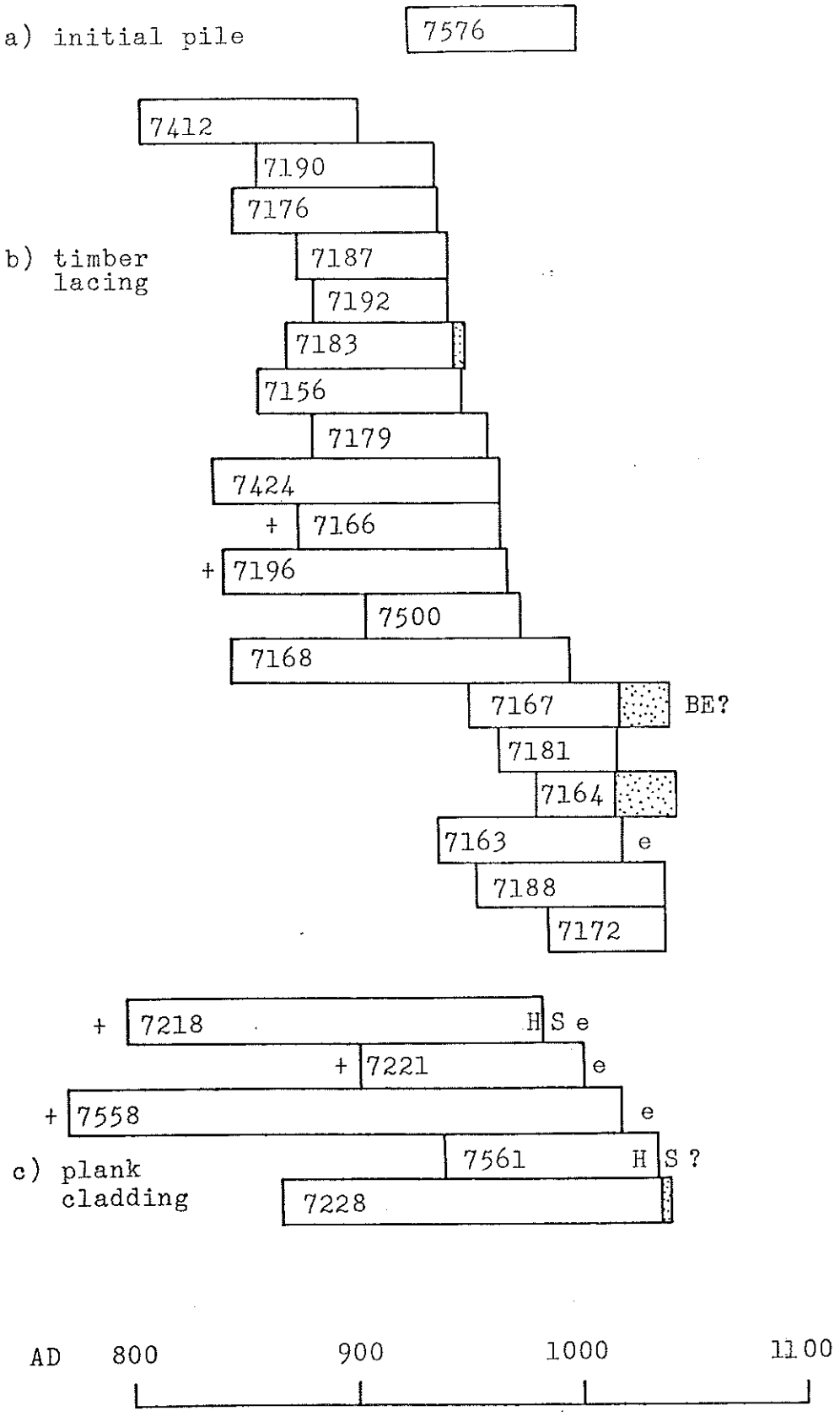
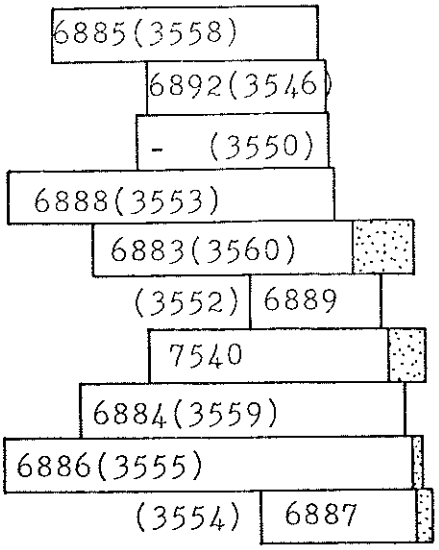


Fig 1b

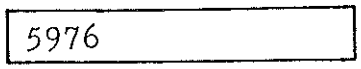
PHASE IV.4

Large stave Saxon revetment



PHASE IV.7

Modification of bank



KEY

	heartwood rings
	sapwood rings
HS	heartwood-sapwood transition
+	unmeasured rings present
e	rings too narrow to measure but have been counted approximately
f	felled
fw	felled in winter or early spring

Fig 1c

Appendix A

Details of the tree-ring samples

Context - context number

Accn - accession number

Rings - total number of rings

Sapwood - number of sapwood rings

Av. width - Average ring width in mm

Dimensions - maximum dimensions of cross-section in mm

BE - bark edge

+ - rings present but not measured

4.1 - phase IV.1

APPENDIX A - DETAILS OF SAMPLES

File: BILLINGSGATE

Report: BIG4.SAMPLES

Selection: PHASE is greater than 4
and PHASE is less than 5
and DENDRO is not blank

CONTEXT	ACCN	PHASE	RINGS	SAPWOOD	AV.WIDTH	DIMENSIONS	COMMENTS
6054	4032	4.1	68	17	1.11	155 x 140	?felled winter
6098	4053	4.1	103	17	1.42	155 x 80	-
6102	4233	4.1	37	1	-	150 x 95	-
6106	4704	4.1	120	-	1.05	130 x 85	-
6108	4365	4.1	97	-	1.13	130 x 105	-
6109	4300	4.1	64	46	0.94	120 x 100	felled - ?winter
6113	4348	4.1	+83	-	1.72	175 x 70	-
6114	4761	4.1	86	-	2.08	185 x 100	-
6117	4644	4.1	95	-	1.25	210 x 150	-
6234	4966	4.1	67+c19	-	1.41	225 x 175	-
6235	4294	4.1	33	-	-	75 x 55	-
6236	4703	4.1	45	-	-	170 x 110	-
6282	4927	4.1	121	-	1.08	145 x 50	-
6448	4402	4.1	138	21	0.89	135 x 75	felled winter
6452	4416	4.1	+71	-	1.31	230 x 150	very knotty
6454	4295	4.1	65	-	1.03	75 x 75	-
6492	4298	4.1	89+	23	0.67	135 x 70	6-10 rings to BE
6493	4603	4.1	116	28-33	-	245 x 45	-
6522	4647	4.1	75	16	2.37	185 x 40	-
6527	4613	4.1	+87	-	1.18	180 x 110	-
6528	3376	4.1	c110	c17	0.66	175 x 80	felled winter
6656	4404	4.1	69	-	1.37	85 x 65	-
6658	4275	4.1	69	34	1.14	130 x 100	felled summer
6750	4364	4.1	33	14	-	210 x 150	felled summer
7100	4438	4.1	98	29	2.00	230 x 105	felled winter
7101	4917	4.1	-	21	-	300 x 95	rings too narrow
7104	4433	4.1	+82	30	0.65	180 x 120	felled
7105	4439	4.1	80+	17+	1.46	230 x 180	c12 rings to BE
7108	4362	4.1	141	-	0.83	310 x 125	-
7108B	4417	4.1	-	-	-	185 x 110	knotty
7109	4428	4.1	35	9	-	155 x 125	-
7111	4925	4.1	+188	-	1.13	260 x 140	-
7113	4427	4.1	55	25	1.52	150 x 95	-
7114	4451	4.1	33	7	-	155 x 150	felled winter
7115	4280	4.1	75	-	1.73	170 x 75	-
7115B	4431	4.1	-	yes	-	180 x 170	narrow rings
7116	4274	4.1	53	-	2.79	170 x 80	-
7117	4446	4.1	55	-	1.69	105 x 50	-
7119	4443	4.1	95	32	1.65	180 x 110	felled winter
7121	4369	4.1	-	yes	-	165 x 75	rings unreadable
7122	4287	4.1	+73	12	0.63	155 x 105	-
7123	4273	4.1	231	-	0.70	170 x 60	-
7124	4445	4.1	81	-	1.77	165 x 70	-
7125	4396	4.1	102	1	0.74	150 x 75	-
7126	4394	4.1	165	-	1.41	245 x 75	-
7127	4430	4.1	-	-	-	90 x 65?	broken

APPENDIX A - DETAILS OF SAMPLES

File: BILLINGSGATE

Report: BIG4.SAMPLES

Selection: PHASE is greater than 4
and PHASE is less than 5
and DENDRO is not blank

CONTEXT	ACCN	PHASE	RINGS	SAPWOOD	AV.WIDTH	DIMENSIONS	COMMENTS
7128	4434	4.1	-	-	-	180 x 50?	broken
7129	4409	4.1	29	-	-	140 x 115	-
7130	4414	4.1	27	12	-	180 x 180	-
7133	4400	4.1	97	9	1.60	165 x 45	-
7134	4429	4.1	-	yes	-	130 x 90	narrow rings
7136	4479	4.1	84	20-26	1.26	110 x 60	-
7154	4931	4.1	44	10-20	-	110 x 70	-
7233	4423	4.1	55	19	2.71	160 x 80	-
7235	4458	4.1	39	9	-	115 x 60	-
7239	4239	4.1	29	-	-	100 x 65	-
7240	4256	4.1	60	-	1.82	120 x 50	-
7259	4952	4.1	+120	-	1.91	300 x 100	-
7406	4259	4.1	87	-	2.70	360 x 120	-
7611	4399	4.1	90	-	2.24	250 x 230	-
7617	4889	4.1	200+	yes	0.96	215 x 90	-
7634	4896	4.1	78	-	1.63	250 x 225	-
6760	4908	4.2?	70	14	1.39	130 x 120	not 4.2
7156	4421	4.2	92	-	1.07	110 x 85	-
7157	4252	4.2	-	-	-	240 x 170	knotty
7158	4457	4.2	128	-	1.07	145 x 50	-
7159	4418	4.2	-	-	-	250 x 140	narrow rings
7160	4926	4.2	26	8	-	150 x 115	-
7160	4963	4.2	20	6	-	130 x 125	-
7163	4436	4.2	54+	yes	1.43	135 x 35	-
7164	4382	4.2	63	28	1.65	105 x 55	-
7166	4397	4.2	+91	-	0.77	125 x 95	-
7167	4432	4.2	90	23	2.14	215 x 165	?felled
7168	4902	4.2	152	-	1.10	385 x 285	-
7169	4466	4.2	53	9	2.06	160 x 115	-
7170	4413	4.2	34	9	-	205 x 205	-
7171	4498	4.2	-	-	-	135 x 110	knotty/narrow ring
7172	4255	4.2	53	-	1.75	100 x 40	-
7174	3812	4.2	-	-	-	170 x 60	narrow bands
7175	4407	4.2	-	-	-	155 x 85	narrow band
7176	4408	4.2	92	-	1.25	130 x 90	-
7177	4281	4.2	48	15	1.30	140 x 120	-
7178	4462	4.2	55	6-16	0.80	80 x 80	-
7179	4453	4.2	79	-	1.24	110 x 65	-
7180	4483	4.2	c40	-	-	70 x 60	-
7181	4401	4.2	54	-	1.28	75 x 50	-
7182	4276	4.2	35	-	-	85 x 80	-
7183	4424	4.2	81	6	0.77	150 x 105	-
7187	4444	4.2	68	-	1.37	195 x 75	-
7188	4405	4.2	85	-	0.81	125 x 125	-
7189	4464	4.2	51	-	1.59	145 x 90	-
7190	4282	4.2	78	-	0.75	125 x 65	-

APPENDIX A - DETAILS OF SAMPLES
File: BILLINGSGATE
Report: BIG4.SAMPLES
Selection: PHASE is greater than 4
and PHASE is less than 5
and DENDRO is not blank

CONTEXT	ACCN	PHASE	RINGS	SAPWOOD	AV.WIDTH	DIMENSIONS	COMMENTS
7191	4403	4.2	-	-	-	95 x 85	narrow rings
7192	4437	4.2	61	-	1.29	120 x 75	-
7195	4426	4.2	59	-	1.10	115 x 70	-
7196	4258	4.2	+127	-	1.12	165 x 115	-
7218	4973	4.2	+136+	yes	-	215 x 205	-
7221	4936	4.2	+80+	-	0.71	100 x 85	-
7222	4886	4.2	32	6	-	160 x 150	-
7223	4887	4.2	90	-	1.27	240 x 215	-
7225	4897	4.2	74	-	1.64	220 x 200	-
7226	4985	4.2	24	8	-	185 x 170	-
7228	4890	4.2	174	5	1.31	500 x 135	-
7412	4289	4.2	98	-	1.22	260 x 150	-
7419	4463	4.2	138	-	0.91	130 x 85	-
7422	4367	4.2	39	15	2.24	115 x 95	felled winter
7424	4398	4.2	129	-	0.79	100 x 85	-
7426	4465	4.2	55	-	1.75	100 x 65	-
7469	4984	4.2	+75+	-	1.00	175 x 130	-
7500	4975	4.2	70	-	2.62	270 x 225	-
7558	4882	4.2	+172+	-	-	310 x 35	-
7561	4885	4.2	95	1?	1.73	185 x 50	-
7565	4978	4.2	86+	-	1.52	145 x 80	-
7573	4879	4.2	49	1	1.74	140 x 115	-
7576B	4876	4.2	76	-	1.49	205 x 195	-
7576	4906	4.2	64	-	1.19	180 x 165	-
7536	4953	4.4	82	-	2.79	305 x 90	-
7540	4950	4.4	105	15	1.47	335 x 115	-
7542	4942	4.4	125	-	1.75	390 x 155	-
5976	4628	4.7	132	-	0.80	100 x 90	-

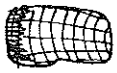
Appendix B

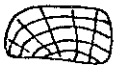
Cross-sectional sketches

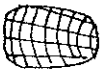
These are not drawn to scale, and are intended as a rough guide to the way in which the timbers were cut or split. Sapwood is represented by shading.

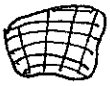
Phase IV.1

6054 

6098 

6102 

6106 

6108 

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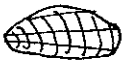
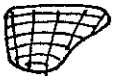
6114 

6117 

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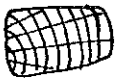
6235 

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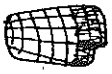
6448 

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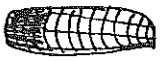
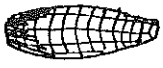
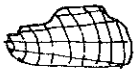
6493 

6522 

6527 

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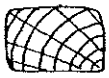
6656 

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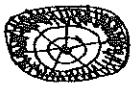
6750 

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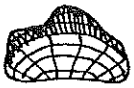
7104 

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7108B 

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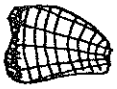
7115B 

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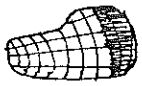
7119 

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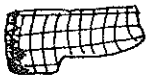
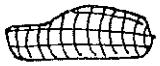
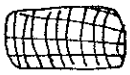
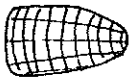
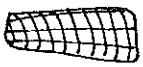
7122 

7123 

7124 

7125 

7126 

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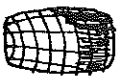
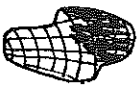
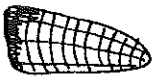
7136 

7154 

7233 

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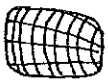
7239 

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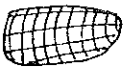
7259 

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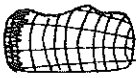
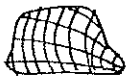
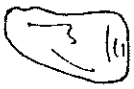
7617 

7634 

Phase IV.2

6760 

7156 

7157 

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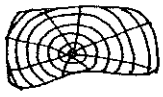
7159 

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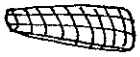
7163 

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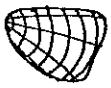
7166 

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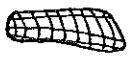
7174 

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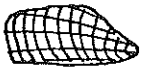
7176 

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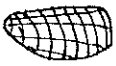
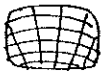
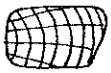
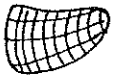
7179 

7180 

7181 

7182 

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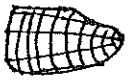
7191 

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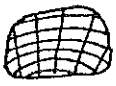
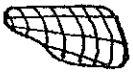
7195 

7196 

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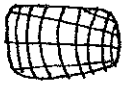
7221 

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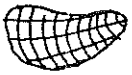
7419 

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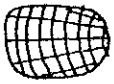
7424 

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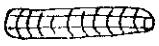
7558 

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7576B 

Phase IV.4 (see also Hillam & Groves 1985)

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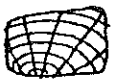
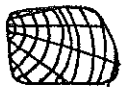
7542 

Phase IV.7

5976 

Appendix C

Results

Context - context number

Accn - accession number

BE - bark edge

\+ - rings present but not measured

4.2 - phase IV.2

Dates of heartwood-sapwood transitions, where present, are given in brackets. 95% confidence limits for the felling date range can be obtained by adding 10-55 rings to this date. In the absence of sapwood, add 10 to the date of the last measured heartwood ring to obtain the probable *terminus post quem* for felling. (Note that one in twenty samples are likely to have either more than 55 or less than 10 sapwood rings - see Hillam *et al* 1986 for further details on sapwood estimates).

Where bark or bark edge is present, the felling date is known exact to the year, and does not have to be estimated.

APPENDIX C - RESULTS

File: BILLINGSGATE

Report: BIG4.RESULTS 9/24/86

Selection: PHASE is greater than 4
and PHASE is less than 5
and DENDRO is not blank

CONTEXT	ACCN	PHASE	RESULT 1	RESULT 2	COMMENTS
6054	4032	4.1	undated	-	?felled winter
6098	4053	4.1	dated	935-1037(1021)	-
6102	4233	4.1	rejected	-	-
6106	4704	4.1	dated	885-1004	-
6108	4365	4.1	dated	867-963	-
6109	4300	4.1	undated	64	felled - ?winter
6113	4348	4.1	dated	+872-954	-
6114	4761	4.1	undated	-	-
6117	4644	4.1	dated	913-1007	-
6234	4966	4.1	undated	-	-
6235	4294	4.1	rejected	-	-
6236	4703	4.1	rejected	-	-
6282	4927	4.1	dated	885-1005	-
6448	4402	4.1	dated	902-1039(1019)	felled winter
6452	4416	4.1	undated	-	very knotty
6454	4295	4.1	dated	940-1004	-
6492	4298	4.1	undated	-	6-10 rings to BE
6493	4603	4.1	dated	921-1036(1004-8)	-
6522	4647	4.1	dated	961-1035(1020)	-
6527	4613	4.1	dated	811-897	-
6528	3376	4.1	dated	927-1036(1020)	felled winter
6656	4404	4.1	dated	897-965	-
6658	4275	4.1	undated	-	felled summer
6750	4364	4.1	rejected	-	felled summer
7100	4438	4.1	dated	942-1039(1011)	felled winter
7101	4917	4.1	rejected	-	rings too narrow
7104	4433	4.1	dated	+958-1039(1010)	felled
7105	4439	4.1	dated	946-1025(1009)+	c12 rings to BE
7108	4362	4.1	dated	849-989	-
7108B	4417	4.1	rejected	-	knotty
7109	4428	4.1	rejected	-	-
7111	4925	4.1	dated	+850-1037(1020)	-
7113	4427	4.1	undated	-	-
7114	4451	4.1	rejected	-	felled winter
7115	4280	4.1	dated	917-991	-
7115B	4431	4.1	rejected	-	narrow rings
7116	4274	4.1	dated	952-1004	-
7117	4446	4.1	dated	947-1001	-
7119	4443	4.1	dated	945-1039(1008)	felled winter
7121	4369	4.1	rejected	-	rings unreadable
7122	4287	4.1	dated	965-1037(1026)	-
7123	4273	4.1	dated	779-1009	-
7124	4445	4.1	dated	928-1008	-
7125	4396	4.1	dated	+920-1021(1021)	-
7126	4394	4.1	dated	789-953	-
7127	4430	4.1	rejected	-	broken

Selection: PHASE is greater than 4
and PHASE is less than 5
and DENDRO is not blank

CONTEXT	ACCN	PHASE	RESULT 1	RESULT 2	COMMENTS
7128	4434	4.1	rejected	-	broken
7129	4409	4.1	rejected	-	-
7130	4414	4.1	rejected	-	-
7133	4400	4.1	dated	916-1012(1004)	-
7134	4429	4.1	rejected	-	narrow rings
7136	4479	4.1	dated	955-1038(1013-19)	-
7154	4931	4.1	rejected	-	-
7233	4423	4.1	dated	985-1039(1021)	-
7235	4458	4.1	rejected	-	-
7239	4239	4.1	rejected	-	-
7240	4256	4.1	undated	-	-
7259	4952	4.1	dated	+815-934	-
7406	4259	4.1	dated	877-963	-
7611	4399	4.1	undated	-	-
7617	4889	4.1	dated	873-1072(c1087)	-
7634	4896	4.1	dated	927-1004	-
6760	4908	4.2?	dated	1037-1106(1093)	not 4.2
7156	4421	4.2	dated	856-947	-
7157	4252	4.2	rejected	-	knotty
7158	4457	4.2	undated	-	-
7159	4418	4.2	rejected	-	narrow rings
7160	4926	4.2	rejected	-	-
7160	4963	4.2	rejected	-	-
7163	4436	4.2	dated	936-989(c1018)	-
7164	4382	4.2	dated	980-1042(1015)	-
7166	4397	4.2	dated	+874-964	-
7167	4432	4.2	dated	950-1039(1017)	?felled
7168	4902	4.2	dated	844-995	-
7169	4466	4.2	undated	-	-
7170	4413	4.2	rejected	-	-
7171	4498	4.2	rejected	-	knotty/narrow rings
7172	4255	4.2	dated	985-1037	-
7174	3812	4.2	rejected	-	narrow bands
7175	4407	4.2	rejected	-	narrow band
7176	4408	4.2	dated	845-936	-
7177	4281	4.2	undated	-	-
7178	4462	4.2	undated	-	-
7179	4453	4.2	dated	881-959	-
7180	4483	4.2	rejected	-	-
7181	4401	4.2	dated	963-1016	-
7182	4276	4.2	rejected	-	-
7183	4424	4.2	dated	869-949(944)	-
7187	4444	4.2	dated	874-941	-
7188	4405	4.2	dated	953-1037	-
7189	4464	4.2	undated	-	-
7190	4282	4.2	dated	858-935	-

APPENDIX C - RESULTS

File: BILLINGSGATE

Report: BIG4.RESULTS 9/24/86

Selection: PHASE is greater than 4
and PHASE is less than 5
and DENDRO is not blank

CONTEXT	ACCN	PHASE	RESULT 1	RESULT 2	COMMENTS
7191	4403	4.2	rejected	-	narrow rings
7192	4437	4.2	dated	881-941	-
7195	4426	4.2	undated	-	-
7196	4258	4.2	dated	+841-967	-
7218	4973	4.2	dated	+797-932(c982)	-
7221	4936	4.2	dated	+901-980+c20	-
7222	4886	4.2	rejected	-	-
7223	4887	4.2	undated	-	-
7225	4897	4.2	undated	-	-
7226	4985	4.2	rejected	-	-
7228	4890	4.2	dated	866-1039(1035)	-
7412	4289	4.2	dated	804-901	-
7419	4463	4.2	undated	-	-
7422	4367	4.2	undated	-	felled winter
7424	4398	4.2	dated	836-964	-
7426	4465	4.2	undated	-	-
7469	4984	4.2	undated	-	-
7500	4975	4.2	dated	904-973	-
7558	4882	4.2	dated	+771-942+c75	-
7561	4885	4.2	dated	938-1032(?1033)	-
7565	4978	4.2	dated?	1045-1130+16?	-
7573	4879	4.2	undated	-	-
7576B	4876	4.2	dated	923-998	-
7576	4906	4.2	undated	-	-
7536	4953	4.4	undated	-	-
7540	4950	4.4	dated	940-1044(1030)	-
7542	4942	4.4	undated	-	-
5976	4628	4.7	dated	883-1014	-