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Report 117/90

TREE-RING ANALYSIS OF WELL TIMBERS  
FROM WEST HESLERTON,  
NORTH YORKSHIRE.

Miss Jennifer Hillam

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Summary

Tree-ring analysis of seven oak timbers from a well at West Heslerton indicated that the well was Saxon in date. A precise felling date of AD724/5 was obtained for the timbers which were probably from the same tree, and a tree-ring chronology was produced for the period AD455/707.

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## TREE-RING ANALYSIS OF WELL TIMBERS FROM WEST HESLERTON, NORTH YORKSHIRE

### Introduction

Excavations in 1990 at West Heslerton revealed the remains of a shallow timber-lined well (context 11AD18). The well had probably consisted of only one course of timbers; samples were taken from the north, south, east and west timbers. Several remnants of wood associated with the well were found and these were also sampled for analysis. The tree-ring dating was undertaken to provide a date for the well, and in particular to indicate whether it was Saxon or Roman in date.

### Methods

The samples were prepared by freezing them for at least 48 hours and then cleaning their cross-sections with a surform plane. The ring widths were measured on a travelling stage connected to an Apple II microcomputer (Hillam 1985, Fig 4). The ring sequences were plotted as graphs using a graphing program on the Prime mainframe (Okasha 1987). The graphs were then compared with each other on a light box to check for any similarities between the ring patterns which might indicate contemporaneity. For crossmatching purposes, the ring width data were also transferred to an Atari ST microcomputer with hard disk. The tree-ring software for the Atari was written and developed by Ian Tyers (1990). The crossmatching routines are based on the Belfast CROS program (Baillie & Pilcher 1973; Munro 1984), and all the  $t$  values quoted in this report are identical to those produced by the first CROS program (Baillie & 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 crossmatching ring sequences within a site or structure,

combining the matching sequences into a site master, 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.

If a sample has bark or bark edge, the date of the last measured ring is the year in which the tree was felled. A complete outer ring indicates that the tree was felled during its dormant period in winter or early spring. If the ring is incomplete, felling took place during the growing season in late spring or summer. In the absence of bark edge, felling dates 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 depending on how many heartwood rings have been removed.

At this stage of the study, factors such as reuse, stockpiling, or repairs have also to be taken into account. Thus whilst the tree-ring dates for the measured rings are precise and independent, the interpretation of these dates often requires other archaeological evidence.

### Results

All the timbers were oak (*Quercus* spp). The four main well timbers were tangentially split planks, 50-65mm thick and 190-240mm in width (Table 1). The small fragments were also tangentially split. Examination of the prepared cross-sections revealed that the ring patterns were very similar, possibly indicating that the wood came from the same tree. Since the ring patterns

looked so similar, only the east, south and west timbers were selected for ring measurement. The north timber was not used because it was broken and the fragments of timber associated with the well were not included because their exact context was unknown. (None of the unmeasured samples had sapwood.)

The east timber had 170 rings and the south timber 233 rings, the outer ring of which was the heartwood-sapwood transition. The west timber had a total of 270 rings including 39 sapwood rings and bark edge. However only the inner 253 rings were measured because the outer 17 rings were too narrow for accurate measurement. The average ring width of all the timbers was less than 1mm; the west timber, for example, with the longest ring sequence, had an average width of 0.65mm, which represents very slow growth. Both the south and west timbers were split to within about 15 rings of the centre of the tree, making the tree about 285 years old when felled, but because growth was so slow, its diameter would have been only about 0.5m.

Comparison of the ring sequences confirmed that they were very similar with t values between the pairs of 9.2, 11.9 and 13.6. There is therefore little doubt that the timbers are from the same tree. The fragments of wood are probably pieces of the well lining since they also appeared to come from the same tree.

The matching ring sequences were combined to give a single site chronology of 253 years (Table 2). When it was tested against dated reference chronologies of Saxon and Roman date, there was consistent agreement with Saxon chronologies for the years AD455-707 (Table 3). There were no matches with the Roman chronologies. The West Heslerton sequence matched particularly well with a chronology from Hamwic, Six Dials (Hillam 1984).

A precise felling date can be obtained since bark edge was present on the west timber. The last measured ring dates to 707 and there were another 17 unmeasured rings. The timber was therefore felled in 724/725 although the outer ring is too narrow for the season of felling to be determined. The tree started growing in about 440 (Fig 1).

Timber-lined Saxon wells of this period are not unknown, and several have been dated by dendrochronology (Table 3; see also Hillam 1990; Tyers et al 1990). The well at Hamwic, Six Dials, which matches so well with West Heslerton, is also of similar date. It was constructed from trees which started growing about the same time, although growth was faster than that of the West Heslerton tree.

#### Conclusion

Tree-ring analysis revealed that the timbers were Saxon in date. They were tangentially split planks taken from a single slow-grown oak tree of about 285 years old and a diameter of approximately 0.5m. The tree started growing in about AD440 and was felled in AD724/5.

#### Acknowledgements

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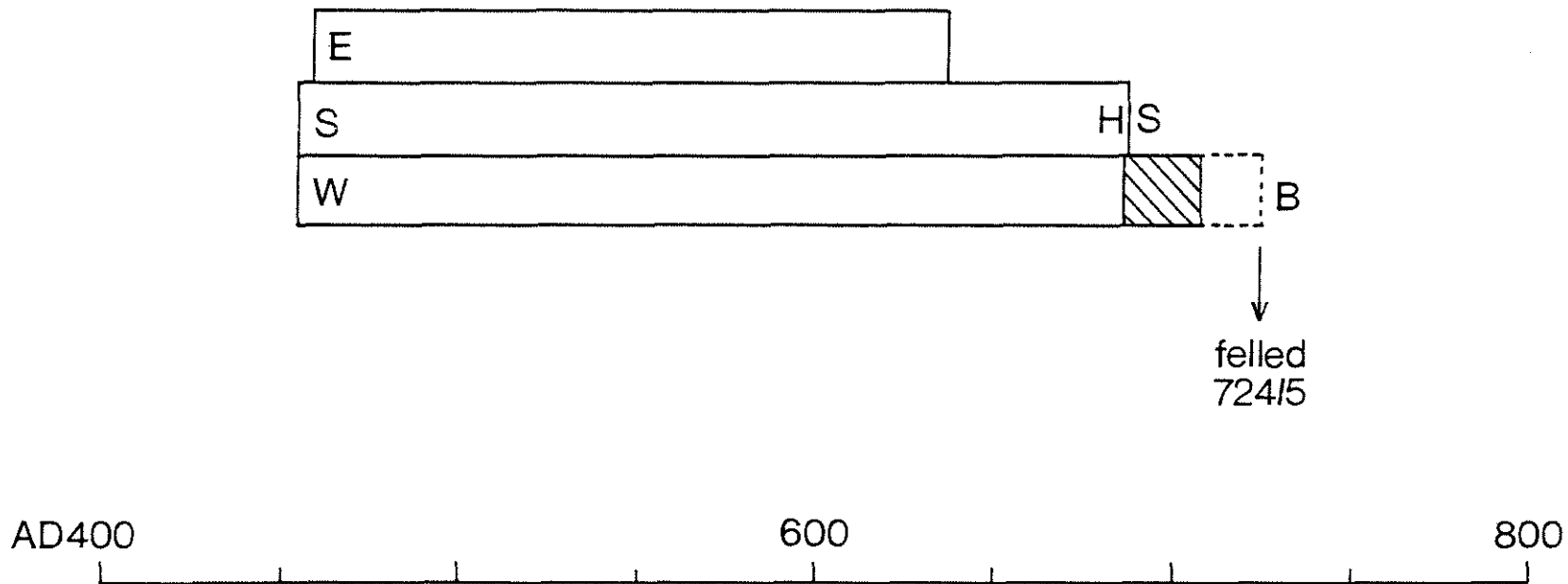


Fig 1: Bar diagram showing the relative positions of the ring sequences from the three measured samples. White bars - heartwood rings; hatching - sapwood. Dotted lines indicate the presence of unmeasured sapwood; B - bark edge; HS - heartwood-sapwood transition. The south and west timbers are probably within about 15 rings of the centre of the tree.



Table 1: Details of the tree-ring samples. Cross-sectional sketches are not to scale; shading indicates sapwood; H/S - heartwood-sapwood transition. The smaller fragments were labelled at Sheffield.



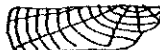

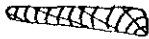


timber	total no of rings	sapwood rings	av. ring width (mm)	sketch	dimensions (mm)	comments
east	179	-	0.96		190x50	
north	-	-	-		240x55	unmeasured
south	233	H/S	0.77		240x65	
west	253+	22+	0.65		235x55	+17 rings to bark edge
frag1	-	-	-		195x40	unmeasured
frag2	-	-	-		110x35	unmeasured
frag3	-	-	-		95x25	unmeasured

Table 2: West Heselerton tree-ring chronology, AD455-707. Note that although three samples are included in the master, these are from a single tree.

<u>date</u>	<u>ring widths (0.02mm)</u>										<u>no. of samples</u>									
AD455					82	75	69	93	80	66					2	2	2	2	3	3
	61	60	89	66	50	67	51	58	49	48	3	3	3	3	3	3	3	3	3	3
	47	67	64	61	52	54	39	66	62	62	3	3	3	3	3	3	3	3	3	3
	44	50	59	54	30	30	20	31	43	34	3	3	3	3	3	3	3	3	3	3
	50	42	45	45	47	30	32	34	45	44	3	3	3	3	3	3	3	3	3	3
AD501	52	67	51	40	34	22	29	45	53	52	3	3	3	3	3	3	3	3	3	3
	38	55	35	45	35	48	66	67	66	47	3	3	3	3	3	3	3	3	3	3
	46	43	42	53	38	45	48	44	33	43	3	3	3	3	3	3	3	3	3	3
	66	47	61	54	44	37	48	43	41	38	3	3	3	3	3	3	3	3	3	3
	48	31	35	45	43	52	58	40	55	51	3	3	3	3	3	3	3	3	3	3
AD551	31	41	39	49	38	37	28	42	50	48	3	3	3	3	3	3	3	3	3	3
	41	29	33	36	29	28	40	43	45	48	3	3	3	3	3	3	3	3	3	3
	37	44	41	36	33	23	31	40	40	39	3	3	3	3	3	3	3	3	3	3
	41	38	45	38	37	37	38	36	41	36	3	3	3	3	3	3	3	3	3	3
	35	30	33	31	38	35	35	37	49	53	3	3	3	3	3	3	3	3	3	3
AD601	43	31	26	25	33	36	42	38	45	32	3	3	3	3	3	3	3	3	3	3
	30	27	32	33	29	30	35	29	23	21	3	3	3	3	3	3	3	3	3	3
	26	34	40	30	31	31	28	38	34	29	3	3	3	3	3	3	3	3	3	3
	33	36	34	36	30	33	37	29	38	40	3	3	3	3	3	3	3	2	2	2
	33	35	19	21	15	18	23	22	24	26	2	2	2	2	2	2	2	2	2	2
AD651	21	20	20	18	20	26	30	27	31	24	2	2	2	2	2	2	2	2	2	2
	31	26	31	26	30	33	26	27	17	16	2	2	2	2	2	2	2	2	2	2
	19	23	20	23	16	17	16	18	19	17	2	2	2	2	2	2	2	2	2	2
	23	18	23	28	20	23	26	30	27	20	2	2	2	2	2	2	2	1	1	1
	25	30	24	29	23	35	25	20	18	21	1	1	1	1	1	1	1	1	1	1
AD701	13	16	20	20	25	28	36				1	1	1	1	1	1	1			

Table 3: Dating the West Heselerton chronology. t values with dated reference chronologies. Asterisks indicate chronologies constructed from well timbers.

<u>chronology</u>	<u>date span (AD)</u>	<u>t value</u>
Carlisle, Tullie House (Hillam unpubl)*	454-741	4.6
Hamwic, Six Dials (Hillam 1984)*	458-710	6.7
Ipswich, Smart Street (Groves 1987)*	499-682	3.5
London, York Buildings (Tyers pers comm)	448-676	5.1
Odell, Bedfordshire (Hillam 1981)*	473-623	3.7
Old Windsor (Fletcher 1977)	419-668	5.9
Portchester (Fletcher 1977)*	471-737	4.3
Slough House Farm, Essex (Hillam 1990)*	406-602	4.1
Tamworth (Hillam 1981)	404-825	4.5
Whithorn, SW Scotland (Hillam unpubl)	278-680	3.8