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Summary
Of the 17 samples supplied from this waterlogged Bronze Age palaeochannel, eight had a sufficient number of rings to merit measurement. One pair of samples, from the same timber (W2) matched against each other. Similarly another pair of samples from timber W12 matched against each other. A further three samples cross-matched against each other. None of the tree ring sequences, from individual samples or the means calculated for these matched sequences, matched against previously dated, external chronologies.

Keywords
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TREE-RING ANALYSIS OF TIMBERS FROM YARNTON FLOODPLAIN, OXFORDSHIRE

Introduction

This document is a technical archive report on the tree-ring analysis of waterlogged oak timbers from the Yarnton Floodplain excavations carried out by Oxford Archaeological Unit in the upper Thames Valley in AD 1998 (SP4686010805). Samples were provided by staff from Flag Fen where the wood assemblage is being studied. The assemblage is thought to date to the Bronze Age.

As part of a multifaceted and multidisciplinary study of the site, 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 site. The conclusions may therefore have to be modified in the light of subsequent work.

Methodology

Methods employed at the Lampeter Dendrochronology Laboratory in general follow those described in English Heritage (1998). Details of the methods used for the analysis of these samples are described below.

The samples supplied were assessed to determine whether any contained sufficient rings to merit tree-ring width measurement. Samples of oak with more than 50 annual rings were selected for study. Samples were prepared for measurement by cleaning the end grain with a razor blade so that the most complete ring sequence available in the sample was clearly visible.

The complete sequences of growth rings in the samples that were selected for dating purposes were measured to an accuracy of 0.01mm using a micro-computer based travelling stage (Tyers 1999). The ring sequences were plotted onto semi-log graph paper to enable visual comparisons to be made between sequences. In addition cross-correlation algorithms (Baillie and Pilcher 1973; Munro 1984) were employed to search for positions where the ring sequences were highly correlated. These positions were checked visually using the graphs and, where these were satisfactory, new mean sequences were constructed from the synchronised sequences. The *t*-values reported below are derived from the original CROS algorithm (Baillie and Pilcher 1973). A *t*-value of 3.5 or over is usually indicative of a good match, although this is with the proviso that high *t*-values at the same relative or absolute position must be obtained from a range of independent sequences, and that satisfactory visual matching supports these positions. Timbers originally derived from the same parent tree generally have *t*-values greater than 10.0. Lower values from timbers obviously derived from the same parent tree (eg on morphological grounds) are however quite common. It is the visual similarity in medium term growth trends of the samples that is the critical factor in determining 'same tree' origin.

All the measured sequences from this assemblage were compared with each other and any found to cross-match were combined to form a site master curve. These, and any remaining unmatched ring sequences were tested against a range of reference chronologies, using the same matching criteria: high *t*-values, replicated values against a range of chronologies at the same position, and satisfactory visual matching. Where such positions are found these provide calendar dates for the ring-sequence.

The tree-ring dates produced by this process initially only date the rings present in the timber. The interpretation of these dates relies upon the nature of the final rings in the sequence. If the sample ends in the heartwood of the original tree, a *terminus post quem (tpq)* for the felling of the tree is indicated by the date of the last ring plus the addition of the minimum expected number of sapwood rings which are missing. This *tpq* may be many decades prior to the real felling date. Where some of the outer sapwood or the heartwood/sapwood boundary survives on the sample, a felling date range can be calculated using the maximum and minimum number of sapwood rings likely to have been present. The sapwood estimates applied throughout this report are a minimum of 10 and maximum of 46 annual rings, where these figures indicate the 95% confidence limits of the range. These figures are applicable to oaks from the British Isles (Tyers 1998). Alternatively, if bark-edge survives, then a felling date can be directly utilised from the date of the last surviving ring. The dates obtained by the technique do not by themselves necessarily indicate the date of the structure from which they are derived. It is necessary to incorporate other specialist evidence concerning the re-use of timbers and the repairs of structures before the dendrochronological dates given here can be reliably interpreted as reflecting the construction date of phases within the structure.

Results

A total of 17 samples was submitted for analysis. Nine of these had insufficient rings to merit analysis (18062, 18073, 18073, 18078, 18089, 18104, 18115, 20000, and 20002). The eight samples with sufficient rings were numbered **YFPB01-YFPB08** inclusive (Table 1).

These eight samples were measured and the resultant ring sequences compared. Crossmatching was identified between three sets of samples (Table 2). Mean sequences calculated for these matching groups and the sequences from unmatched, individual timber measurements were then compared with dated reference chronologies from throughout the British Isles and northern Europe (Table 3). None of the sequences could be dated against external chronologies.

Interpretation

High computer correlations between two pairs of sequences (**YFPB01** and **YFPB04**, **YFPB03** and **YFPB06**) suggest each pair represents samples from the same parent tree. Indeed, documentation (Table 1, sample details) indicates that samples **YFPB01** and **YFPB04** both come from the same timber (W2). Similarly, samples **YFPB03** and **YFPB06** come from timber W12. Samples from three separate pieces of wood (**YFPB02**, **YFPB05**, and**YFPB08**) cross-matched (Table 2c) although no significant computer correlation was noted between samples **YFPB02** and**YFPB08**. The relative dating between these three groups of sequences is indicated graphically in Figure 1.

Acknowledgements

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References

Baillie, M G L, and Pilcher, J R, 1973 A simple crossdating program for tree-ring research, *Tree Ring Bulletin*, **33**, 7-14

English Heritage, 1998 *Dendrochronology: guidelines on producing and interpreting dendrochronological dates*, London

Munro, M A R, 1984 An improved algorithm for crossdating tree-ring series, *Tree Ring Bulletin*, **44**, 17-27

Tyers, I, 1998 *Tree-Ring analysis and wood identification of timbers excavated on the Magistrates Court Site, Kingston upon Hull, East Yorkshire*, ARCUS Rep, **410**

Tyers, I, 1999 *Dendro for Windows program guide 2nd edition*, ARCUS Rep, **500**

Figure 1 Bar diagram showing the chronological positions of groups of cross-matched timbers. Note that there are no matches between the three separate groups.

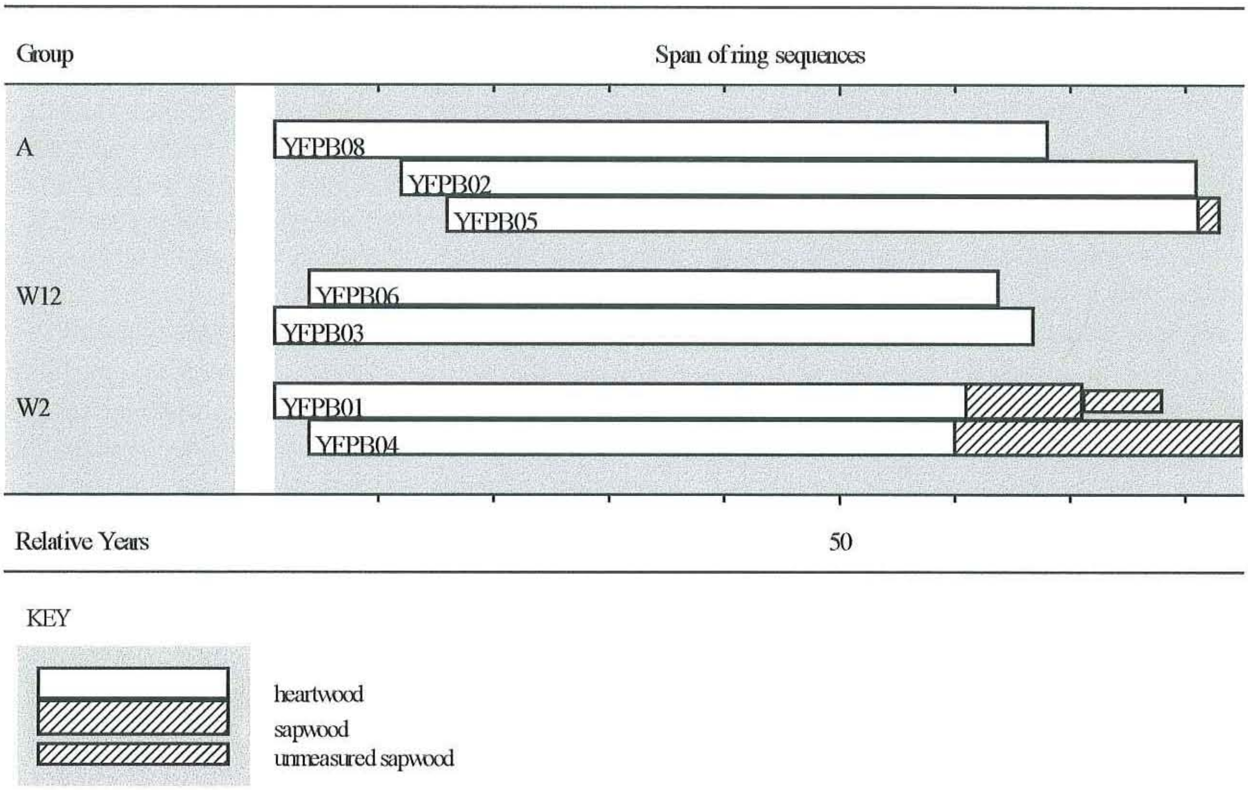

Table 1

Table 1. List of samples

Sample code	Sample details	Conversion	Dimensions (mm)	Species	Total rings	Sapwood rings	ARW (mm)
YFPB01	YFPB98 18006 W2	Radial	72 x 28	Oak	71	10+7s	0.90
YFPB02	YFPB98 18023 W14	Radial	75 x 26	Oak	70	-	1.05
YFPB03	YFPB98 18027 W12/2	Radial	66 x 20	Oak	67	-	0.96
YFPB04	YFPB98 18006 W2/1	Radial	72 x 28	Oak	82	25	0.86
YFPB05	YFPB98 18105 W36	Radial	65 x 28	Oak	68	2	0.79
YFPB06	YFPB98 18027 W12	Radial	63 x 14	Oak	61	-	1.02
YFPB07	YFPB98 18031 W26	Half	55 x 48	Oak	50	31+?B	1.03
YFPB08	YFPB98 18067 W24	Radial	65 x 14	Oak	68	-	0.93

'Total rings' = all measured rings, +value means additional rings were only counted.'Sapwood rings': ?B = possible bark edge. 'ARW' = average ring width of the measured rings

Table 2. Computer correlations (t-values) between tree-ring sequences from samples. The high t-values between samples 1 and 4, and 3 and 6 indicates derivation from the same tree (or sample -see Table 1)

a) t-value matrix for samples **YFPB01** and **YFPB04**.

Samples	YFPB04
YFPB01	9.42

b) t-value matrix for samples **YFPB03** and **YFPB06**.

Samples	YFPB06
YFPB03	10.44

c) t-value matrix for samples **YFPB02**, **YFPB05** and**YFPB08**.

Samples	YFPB05	YFPB08
YFPB02	4.83	-
YFPB05	*	6.95

Table 2. Ring-width data for mean sequences calculated for cross-matched sample groups:

a) site master **YFPB01_4**, undated

Date	Ring widths (0.01mm)										No of samples									
1	167	143	159	150	135	144	129	156	145	121	1	1	1	2	2	2	2	2	2	2
-	84	75	65	55	71	53	53	79	75	93	2	2	2	2	2	2	2	2	2	2
-	64	134	129	111	116	86	55	68	64	88	2	2	2	2	2	2	2	2	2	2
-	89	87	124	119	172	108	114	141	150	114	2	2	2	2	2	2	2	2	2	2
-	141	95	91	98	68	51	49	62	77	79	2	2	2	2	2	2	2	2	2	2
51	45	65	77	83	88	87	76	57	62	67	2	2	2	2	2	2	2	2	2	2
-	82	66	61	71	66	66	83	91	71	72	2	2	2	2	2	2	2	2	2	2
-	64	39	62	36	46	38	52	59	55	51	2	1	1	1	1	1	1	1	1	1
-	52	51	42	61	73							1	1	1	1	1				

b) site master **YFPB03_6**, undated

Date	Ring widths (0.01mm)									
1	81	87	76	107	67	64	71	109	118	90
-	110	131	85	127	81	73	88	65	86	92
-	103	109	113	90	130	100	90	72	91	96
-	106	116	151	112	137	117	91	129	104	127
-	66	58	67	77	78	101	125	109	94	75
51	90	80	122	114	105	120	96	130	106	114
-	77	105	104	85	86	92	99			

c) site master **YFPB02_5_8**, undated

Date	Ring widths (0.01mm)														No of samples				
1	170	176	88	120	129	104	79	61	87	100	1	1	1	1	1	1	1	1	1	1
-	167	86	105	117	112	105	82	136	112	105	1	2	2	2	2	3	3	3	3	3
-	108	127	109	92	102	82	150	86	73	104	3	3	3	3	3	3	3	3	3	3
-	104	108	108	94	109	79	107	106	84	80	3	3	3	3	3	3	3	3	3	3
-	77	76	58	52	69	56	65	82	59	61	3	3	3	3	3	3	3	3	3	3
51	55	85	94	75	62	70	64	89	69	60	3	3	3	3	3	3	3	3	3	3
-	42	78	81	77	89	100	103	118	133	125	3	3	3	3	3	3	3	3	2	2
-	120	115	96	130	93	112	98	83	90	75	2	2	2	2	2	2	2	2	2	2
	115	111	106								2	1	1							