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Summary

Tree-ring analysis of oak cores from four cruck blades resulted in the production of a chronology covering the period AD1187-1316. The timbers have an estimated felling date range of AD1326-1368.

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Winterbourne Tithe Barn is a medieval barn with rubble stone walls and six trusses of raised cruck type. Cores were taken for tree-ring dating from four of the cruck blades by Roland Harris during recent survey work. The cruck blades appeared to be halved trees and all had waney edge. Unfortunately the sapwood was extremely powdery and did not survive coring (Harris pers comm). The cores were analysed and dated in the Sheffield Dendrochronology Laboratory during April 1991.

Methods

The surfaces of the cores were first polished using a sander with paper of medium grit and then finished by hand with fine silicon carbide paper. The ring widths were measured to an accuracy of 0.01mm on a travelling stage built in the Department of Geography, City of London Polytechnic. The stage is connected to an Atari microcomputer which uses a suite of dendrochronology programs written by Ian Tyers (pers comm 1990). The measured 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. The Atari is also used to aid the crossmatching process. 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 phase or building, 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. Any unmatched sequences are tested individually against the reference chronologies.

If a sample has bark or bark edge, the date of the last measured ring is the year in which the tree was felled. 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.

Results

The cores had 107-127 rings (Table 1). Sapwood was not present although the heartwood-sapwood transition was identified on core W2.

The ring patterns of the four cores were very similar (Table 2) and crossmatched to produce a 130-year master curve (Table 3). The degree of similarity between the ring patterns was not sufficiently good to suggest that any of the crucks sampled came from the same tree. The degree of similarity which indicates an origin in the same tree is impossible to quantify, but there are two general rules of thumb which can be used. If a tree-ring match can be detected by looking at the wood samples without measuring the rings and/or if comparison of the ring sequences results in a *t* value greater than 10, the timbers probably came from the same tree. (However it should be noted that failure to meet these criteria does not always indicate that the samples came from different trees.) The degree of similarity between the Winterbourne cores suggests that although none of the timbers were from the same tree, they

probably came from the same woodland.

When the master sequence was tested against dated reference chronologies, consistently high *t* values were obtained with over 30 independent regional chronologies over the period 1187-1316. The *t* values for some of these matches are given in table 4. As well as matching "local" chronologies, there was high correlation with chronologies from as far away as Beverley in Yorkshire and Carlisle in Cumbria.

The dates of the outer measured rings are 1311, 1313, 1316, and 1314 respectively for cores W1-W4, and that of 1313 for W2 is known to be the date of the heartwood-sapwood transition. Applying the sapwood estimate of 10-55 rings, the 95% confidence limits for the felling of the four timbers becomes AD1326-1368.

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Table 1: Details of the tree-ring samples. H/S - heartwood-sapwood transition.

core	timber	total no of rings	sapwood rings	average ring width (mm)	date span	felled
W1	truss F, north cruck	113	-	1.42	1199-1311	1321+
W2	truss B, south cruck	127	H/S	1.54	1187-1313	1323-1368
W3	truss D, south cruck	117	-	1.34	1200-1316	1326+
W4	truss B, North cruck	107	-	1.46	1208-1314	1324+

Table 2: t value matrix showing the correlation between each pair of ring sequences.

	W1	W2	W3	W4
W1	*	7.0	5.3	6.2
	W2	*	4.4	6.1
		W3	*	8.5
			W4	*

Table 3: The Winterbourne tree-ring chronology, AD1187-1316.

date	ring widths (0.01mm)										no. of samples									
AD1187							344	192	274	281							1	1	1	1
	269	391	458	394	405	397	351	236	223	362	1	1	1	1	1	1	1	1	2	3
AD1201	357	302	226	208	202	252	144	276	229	266	3	3	3	3	3	3	3	4	4	4
	177	200	248	212	234	249	345	267	257	283	4	4	4	4	4	4	4	4	4	4
	255	184	175	233	236	258	184	267	229	144	4	4	4	4	4	4	4	4	4	4
	107	99	163	177	157	114	199	155	140	142	4	4	4	4	4	4	4	4	4	4
	116	109	162	132	123	120	128	91	80	104	4	4	4	4	4	4	4	4	4	4
AD1251	109	84	120	98	140	122	87	60	96	113	4	4	4	4	4	4	4	4	4	4
	91	93	73	66	89	83	68	94	81	72	4	4	4	4	4	4	4	4	4	4
	93	89	117	91	54	74	79	84	96	117	4	4	4	4	4	4	4	4	4	4
	114	124	117	113	112	109	86	65	91	117	4	4	4	4	4	4	4	4	4	4
	116	147	165	159	119	89	90	91	82	117	4	4	4	4	4	4	4	4	4	4
AD1301	105	106	69	69	86	104	123	87	62	62	4	4	4	4	4	4	4	4	4	4
	83	76	71	72	135	93					4	3	3	2	1	1				

Table 4: Dating the Winterbourne chronology. t values with dated reference chronologies. All the chronologies are independent of each other.

chronology	t value
Beverley, Hall Garth (Hillam 1981)	6.4
Carlisle medieval (Baillie & Pilcher pers comm)	3.7
Droitwich, Upwich 2 (Groves & Hillam 1991)	5.8
East Midlands (Laxton & Litton 1988)	6.0
Exeter Catherdral, EXCATH2 (Mills 1988)	7.6
Glastonbury Abbey Barn, Somerset (Bridge 1983)	6.2
Great Coxwell Barn, Oxon (Haddon-Reece pers comm)	4.8
Kent 88 (Laxton & Litton 1989)	5.1
London, Trig Lane (Tyers pers comm)	4.5
Reading Abbey waterfront (Groves *et al* 1985)	6.0
Sompting Church, West Sussex (Tyers pers comm)	5.4
Yorkshire buildings, YORKS1 (Hillam unpubl)	4.4