Ancient Monuments Laboratory
Report 19/91

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Summary

Although the ten cores and one timber slice taken from this aisled barn had less than 60 rings, seven crossmatched to produce a short master curve for the period 1384-1444. The timbers had a felling date range of 1448-1490.

Authors' address :-

Miss Jennifer Hillam & Miss Cathy Groves

Department of Archaeology & Prehistory
Sheffield University
Clarke House Lane
Sheffield, South Yorkshire
S10 2TN

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Stank Hall Barn (SE285294) was recently renovated by Leeds City Council, aided by a grant from English Heritage. During this work, the building was surveyed by the West Yorkshire Archaeology Service (1989). On stylistic grounds, the aisled barn (Fig 1) was thought to date to the late 15th/early 16th century.

During renovation work a slice of ridge timber was submitted to Sheffield Dendrochronology Laboratory for tree-ring dating. The sample had 52 rings and it was felt that dating would best be achieved if additional samples were obtained. The timbers were sampled by coring in December 1990, and all the samples analysed in January 1991.

Methods

Cores were taken using a corer attached to an electric drill. The cross-sections of the cores and the timber slice were prepared using a sander. 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 (pers comm 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 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. A complete outer ring indicates that the tree was felled during its dormant period in winter or early spring. This is referred to as "winter felled". If the ring is incomplete, felling took place during the growing season in late spring or summer (referred to as "summer 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 during conversion.

Results

Ten cores and one timber slice were taken for analysis; all were oak (*Quercus* spp). Usually eight timbers are sampled but the samples from Stank Hall Barn had relatively few rings and extra samples were taken to increase the chances of achieving a date. Three of the cores were rejected because they were broken. The remainder had 38-55 rings (Table 1).

The timbers had been converted from young oak trees. The ridge timbers, for example, had 52 rings, including the centre and 9 sapwood rings. It must have come from a tree which was less than 100 years old when felled. All the timbers were from complete trunks which had been squared.

Normally samples with less than 50 rings are rejected. However during measurement it became apparent that the cores had similar ring patterns. When the ring patterns were plotted as graphs, visual and computer matching confirmed this (Table 2). The ring sequences crossmatched to give a 61-year master sequence (Fig 2; Table 3).

When the master curve was tested against dated reference chronologies, high t values were obtained for the period AD1384-1444 (Table 4). These were the only consistently high values over the period AD404 to the present day. The computer results were checked and confirmed by examining the quality of the visual matching.

Details of the tree-ring dates are given in Table 5. Three of the samples (5, 8, 11) had sapwood rings; the dates of the heartwood-sapwood transitions are 1436, 1436 and 1439. Using the sapwood estimate of 10-55 rings, a felling date range of 1448-1490 is produced for the timbers. This date is consistent with that produced from the architectural evidence.

Acknowledgements

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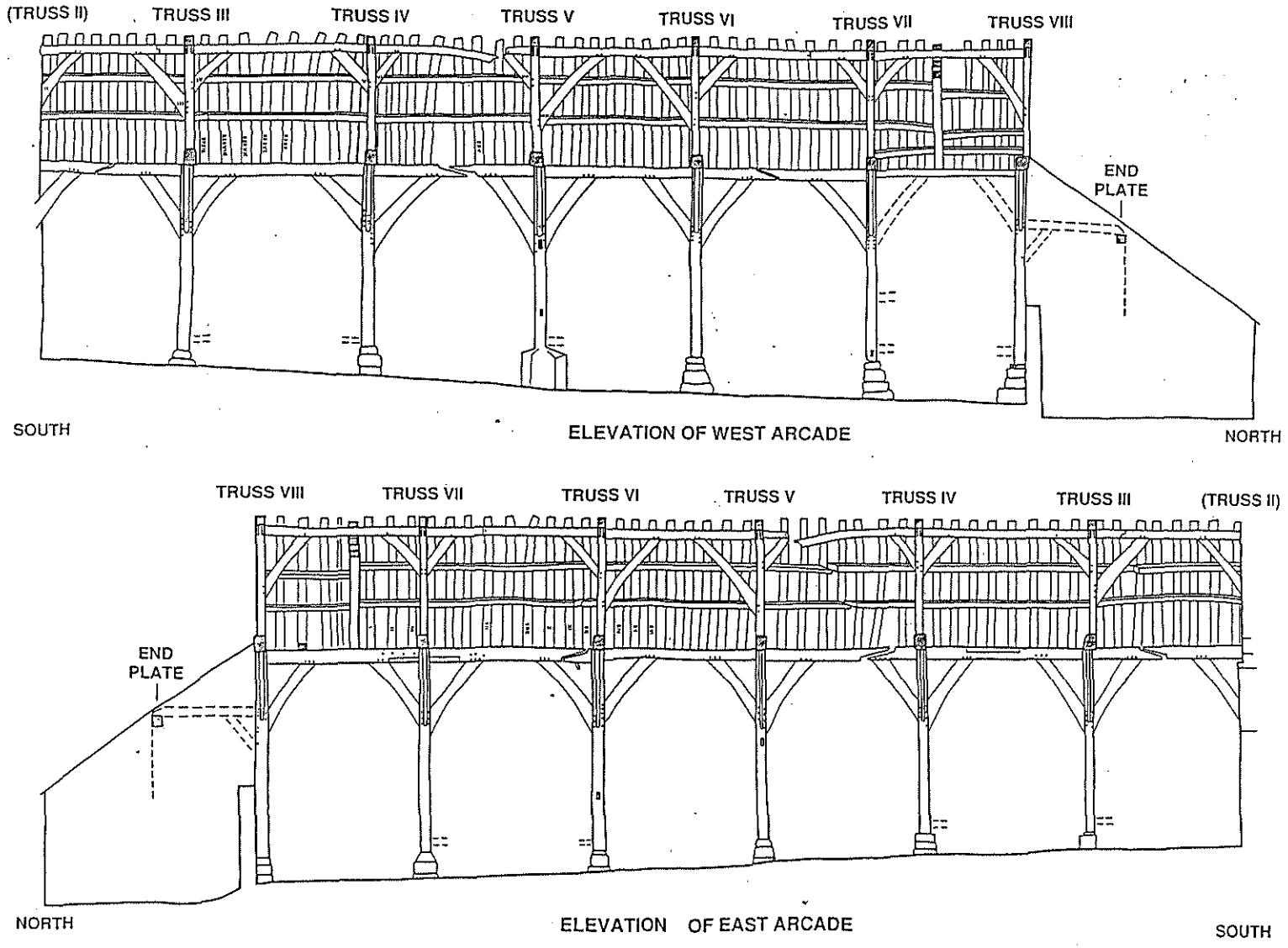

Fig 1: Elevations of the west and east arcades. (Drawing: West Yorkshire Archaeology Service)

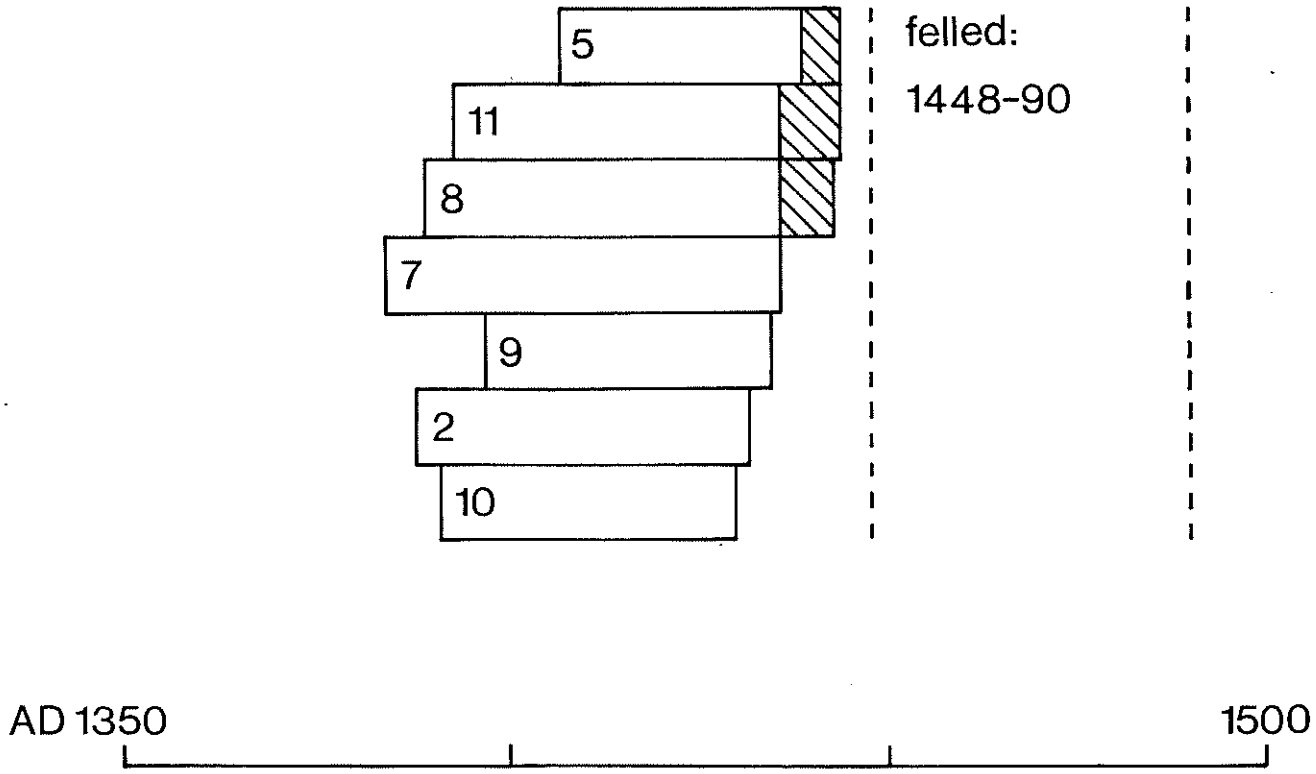

Fig 2: Bar diagram showing the relative positions of the matching ring sequences. White bars - heartwood rings; hatching - sapwood.

Table 1: Details of the tree-ring samples.

no	timber	total no of rings	sapwood rings	average ring width (mm)	comments
1	west arcade plate between truss III and IV	34	-	-	core broken; insufficient rings
2	west arcade post, truss IV	45	-	3.1	core
3	west post, truss III	-	-	-	rejected; core broken
4	truss IV tiebeam	-	-	-	rejected; core broken
5	east post, truss IV	38	6	3.7	core
6	east arcade plate between truss III and IV	41	-	2.2	core
7	east arcade plate between truss IV	53	-	2.5	core
8	east post, truss V	55	8	2.9	core
9	truss V tiebeam	39	-	3.5	core
10	west arcade plate between truss V and VI	40	-	2.4	core
11	ridge	52	9	2.1	slice

Table 2: Relative dating. t value matrix for the matching ring sequences. Values less than 3.0 are not printed.

	t value						
no	2	5	7	8	9	10	11
2	*		3.3	3.4		3.4	
5		*	4.9	3.5			3.0
7			*	4.4		4.8	
8				*	4.0	3.8	
9					*		3.2
10						*	
11							*

Table 3: Stank Hall Barn master chronology, AD1384-1444.

year	ring widths (0.02mm)										no of samples									
AD1384				167	105	167	137	112	158	215				1	1	1	1	2	3	3
AD1391	180	166	172	156	144	149	157	149	147	168	4	4	5	5	5	5	6	6	6	6
AD1401	124	152	161	189	184	194	153	142	156	156	6	6	6	6	6	6	7	7	7	7
AD1411	115	177	152	120	111	76	94	109	103	201	7	7	7	7	7	7	7	7	7	7
AD1421	137	122	172	143	132	85	90	106	147	103	7	7	7	7	7	7	7	7	7	7
AD1431	151	221	114	94	114	172	146	146	137	159	6	6	5	5	5	4	3	3	3	3
AD1441	182	124	172	169							3	3	3	2						

Table 4: Absolute dating of Stank Hall Barn master curve. t values with dated reference chronologies. (All the chronologies are independent of each other.)

chronology	t value
Doncaster buildings "Doncmed" (Morgan pers comm)	6.0
Dublin 2 (Baillie 1977)	4.1
East Midlands (Laxton & Litton 1988)	5.9
Elland Old Hall, West Yorkshire (Hillam 1984)	4.5
Exeter "Exmed" (Mills 1988)	3.8
Peel Hall, near Manchester (Leggett 1980)	4.8
Welsh Border (Siebenlist-Kerner 1978)	3.9
Yorkshire buildings "Yorkmed" (Hillam unpubl)	6.6

Table 5: Details of the tree-ring dates. The number of sapwood rings is taken to be 10-55 (95% confidence limits).

no	date span	date of first sapwood ring	felling date
2	1388-1432	-	1442+
5	1407-1444	1439	1448-1493
7	1384-1436	-	1446+
8	1389-1443	1436	1445-1490
9	1397-1435	-	1445+
10	1391-1430	-	1440+
11	1393-1444	1436	1445-1490