HALIFAX, WOOLSHOPS

Tree-ring dating of floorboards from a Yorkshire half-timbered building

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Summary

A dendrochronological study was carried out on nine floorboards from the half-timbered building at 3-5 Woolshops, Halifax. One floorboard was made of pine, but the remainder were of oak, seven of which were dated to give a tree-ring chronology for the period AD 1553-1648. None of the samples had sapwood so the exact date of felling is unknown. However the timber cannot have been felled before AD 1658. This is compatible with the date stone of 1670, although the floorboards and date stone could be additions to an earlier building.

Introduction

In 1982, the West Yorkshire Metropolitan Council's Archaeology Unit carried out a survey of the half-timbered building at 3-5 Woolshops in Halifax (SE 0939 2523) prior to its restoration and incorporation into a new shopping centre. Samples from nine floorboards were removed during the survey, and sent to the Sheffield Dendrochronology Laboratory for dating. Although the building contained a date stone of 1670, David Michelmore of the Unit considered on stylistic grounds that it might be 16th century in date. Dendrochronology was undertaken to test this theory, since it is an independent dating method, relying only on the relative ring widths of the timbers (see Baillie 1982; Eckstein *et al* 1984 for a general introduction).

Method and Results

Examination of the floorboards showed that eight were of oak (*Quercus* spp) and one was of pine (*Pinus sylvestris* L). The conifer was rejected for dating purposes since adequate reference chronologies are not available in the British Isles. The oak samples, labelled HW1 to HW8 at Sheffield, contained 54 to 96 growth rings (Table 1). The ring widths were measured on a travelling stage which is connected to an Apple microcomputer (Hillam 1985, Fig 4), following the method given by Hillam (1985). HW1 was difficult to measure because of narrow rings which were almost impossible to resolve. The ring pattern of this sample therefore may not be reliable. (Ring widths of all the samples are listed in the Appendix.)

The ring patterns were represented as graphs, and were compared with each other in an attempt to establish similarity.

HW 3, 4, 5 and 6 proved to crossmatch well, and their ring widths were averaged to produce a site master curve. The remaining unmatched sequences were then tested against this. All but HW1 were found to match. The visual matching was quantified by the use of a computer program which calculates the degree of similarity between two ring sequences (Baillie & Pilcher 1973). The results are expressed as Student's t values; a value greater than 3.5 indicates a match, provided the visual match is acceptable. Given a group of samples, not all the comparisons will produce high t-values, but each ring sequence should match well with at least two others. This is true of the Halifax samples (Table 2).

A final site master curve of 96 years was produced from the seven matching sequences, HW2-8 (Table 3). It was tested against dated reference chronologies from the British Isles and north-west Europe (Table 4). The chronologies from Yorkshire (Hillam & Ryder 1980), England (Baillie & Pilcher pers comm), and Scotland (Baillie 1977a) gave t-values of 5.8, 4.5 and 4.3 respectively, when the Halifax curve covered the period AD 1553-1648. When the visual matches were checked, this crossdating was confirmed, and calender years could then be assigned to the rings of each sample used in the master curve (Fig 1; Table 5).

Interpretation of the tree-ring dates

The dates of the outer rings range from 1626 for HW3 to 1648 for HW6 and HW8. These dates however do not represent felling dates since wood was removed from the timbers when they were converted into floorboards. None of the samples had sapwood, which is the outer part of a tree, and which in oak was often removed because of its susceptibility to insect and fungal

attack. The number of sapwood rings in oak is relatively constant at 10-55 rings (Hillam *et al* forthcoming), so that if a tree-ring sample retains some sapwood, its felling date can be estimated with some accuracy. In the absence of sapwood, the *terminus post quem* is quoted. The Halifax samples therefore have at least ten sapwood rings missing, and possibly some heartwood rings as well. All the dated timbers end within 23 years of each other, whilst four of them (HW5-8) finish within six years. It is possible that only the weaker sapwood band was removed when the floorboards were produced, which would give an estimated felling date of AD 1658-1703. The timber was certainly not felled before 1658. It may then have been seasoned for a few years, but the warping of several of the boards, for example HW2 and HW7 (Table 1), suggests that the timber was still green when it was used.

Conclusion

The *terminus post quem* for the felling of the timber is AD 1658. This is compatible with the stone dated to 1670, indicating that the floorboards and the date stone were inserted at the same time. Tree-ring analysis of timbers known to be primary in origin should determine whether the floorboards were original, or whether they were added to an earlier 16th century building.

Acknowledgements

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HALIFAX WOOLSHOPS

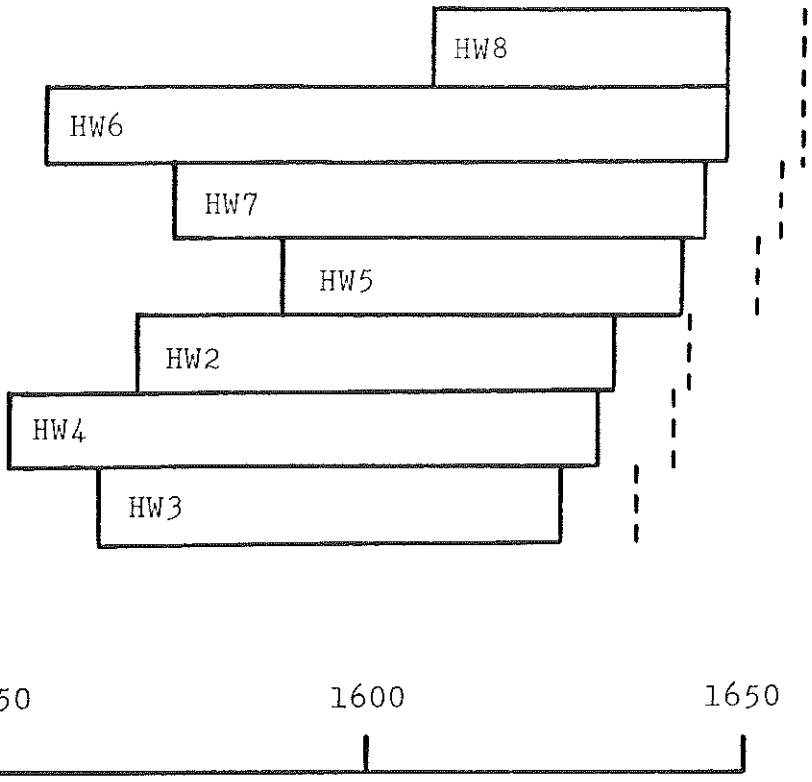

Fig 1: Bar diagram showing the relative positions of the dated ring sequences. Each bar represents the measured heartwood rings of one sample; dotted lines indicate the terminus post quem for felling.

Table 1: Details of the tree-ring samples. Sketches not to scale. Rings of HW9 (*Pinus*) were not measured; remaining samples are oak (*Quercus*).

sample no	number of rings	sapwood rings	mean ring width (mm)	maximum dimensions (mm)	sketch
HW1	96	-	2.00	234 x 23	
HW2	64	-	1.68	243 x 23	
HW3	62	-	1.91	247 x 21	
HW4	79	-	2.32	248 x 16	
HW5	54	-	1.07	230 x 21	
HW6	91	-	1.60	206 x 14	
HW7	71	-	1.43	243 x 24	
HW8	40	-	1.23	215 x 22	
HW9	128	-	-	220 x 25	

Table 2: Matrix of *t*-values. Asterisks represent overlaps of less than 30 rings.

HW	2	3	4	5	6	7	8
2	-	2.1	3.7	2.0	3.0	7.4	*
3		-	4.5	3.4	5.1	3.2	*
4			-	5.3	6.9	4.4	*
5				-	5.7	3.6	4.4
6					-	3.4	4.1
7						-	3.6
8							-

Table 3: Halifax Woolshops master curve, AD 1553-1648; seven matching sequences are included.

	ring widths (0.02mm)									
years	0	1	2	3	4	5	6	7	8	9
1550				227	231	267	179	197	196	205
1560	196	215	202	200	213	190	128	134	166	131
1570	160	143	137	130	127	144	85	78	84	114
1580	128	104	82	77	91	133	125	112	66	99
1590	63	44	58	82	74	95	84	85	96	87
1600	81	52	31	58	67	63	61	51	70	54
1610	66	45	56	69	50	62	51	41	65	64
1620	105	74	81	87	65	56	37	39	56	96
1630	76	66	74	77	49	72	35	30	51	56
1640	56	74	60	55	38	52	80	72	86	

Table 4: Dating the Halifax chronology. Results of comparisons with dated reference chronologies.

reference chronology	t-value
Belfast (Baillie 1977b)	2.7
Doncaster (Morgan pers comm)	0.8
East Midlands (Nottingham tree-ring group, pers comm)	3.4
England (Baillie & Pilcher pers comm)	4.5
Germany (Delorme 1972)	2.9
Germany, Schleswig (Eckstein pers comm)	0
Scotland (Baillie 1977a)	4.3
Wales (Siebenlist-Kerner 1978)	2.4
Yorkshire (Hillam & Ryder 1980)	5.8

Table 5: Summary of tree-ring dates. A minimum sapwood allowance of 10 rings has been added to give a terminus post quem for felling. The number of missing heartwood rings, if any, cannot be calculated.

sample	date span of rings	felled after (AD)
HW1	-	-
HW2	1570-1633	1643
HW3	1565-1626	1636
HW4	1553-1631	1641
HW5	1589-1642	1652
HW6	1558-1648	1658
HW7	1575-1645	1655
HW8	1609-1648	1658

Appendix

List of ring widths for oak samples HW1-8; the pine sample, HW9, was not measured.

First line - site name; second line - sample number given at Sheffield; third line - number of rings measured; fourth and subsequent lines - ring widths in units of 0.02mm, ten to a line. The mean ring width, plus additional comments are printed at the bottom of each listing. The dates for HW2-8 are given in Table 5.

HALIFAX WOOLSHOP
HWJ
96

1	-	304	304	293	301	201	258	284	260	269	263
11	-	212	253	222	242	209	183	223	297	267	252
21	-	249	214	149	145	194	74	26	38	42	52
31	-	52	53	59	59	25	28	20	19	32	36
41	-	64	55	65	54	47	42	22	20	15	30
51	-	24	14	21	23	21	15	30	19	40	29
61	-	28	22	53	51	82	84	71	105	67	56
71	-	60	111	128	174	103	153	160	96	58	33
81	-	34	18	27	29	34	42	26	39	29	43
91	-	71	39	39	25	32	68				

COMMENT - RING 49? RING 82?

MEAN RING WIDTH IN MM = 2.000625

HALIFAX WOOLSHOP
HW2
64

1	-	192	162	144	150	133	127	70	109	96	114
11	-	137	104	93	74	88	169	135	126	51	75
21	-	58	28	43	86	163	163	104	71	134	123
31	-	123	63	20	36	58	46	51	50	64	51
41	-	72	30	30	71	45	54	52	76	75	67
51	-	101	64	64	57	46	44	32	39	63	90
61	-	79	82	80	84						

COMMENT - PLUS 2 MORE OUTER RINGS

MEAN RING WIDTH IN MM = 1.6815625

HALIFAX WOOLSHOP
HWS
62

1	-	220	139	154	244	158	204	164	174	147	151
11	-	193	139	95	92	143	143	106	95	95	88
21	-	113	125	153	88	125	91	79	100	92	63
31	-	89	85	72	81	69	60	41	23	48	51
41	-	77	54	45	50	38	53	40	70	45	64
51	-	72	48	29	61	46	103	103	81	85	74
61	-	51	46								

COMMENT -

MEAN RING WIDTH IN MM = 1.91193549

HALIFAX WOOLSHOP
HW4
79

1	-	227	231	267	179	197	217	268	275	302	271
11	-	240	244	171	130	168	129	133	132	155	133
21	-	153	149	187	106	65	72	140	144	94	70
31	-	77	127	144	139	126	96	126	59	45	58
41	-	98	51	78	77	90	65	73	56	53	31
51	-	85	68	59	89	59	84	61	101	64	64
61	-	87	48	55	52	41	58	78	143	106	102
71	-	150	87	77	32	42	57	119	110	80	

COMMENT -

MEAN RING WIDTH IN MM = 2.32303798

HALIFAX WOOLSHOP
HWS
54

1	-	140	77	39	64	94	47	83	77	94	86
11	-	80	65	37	42	64	72	56	53	49	65
21	-	52	53	34	43	43	26	39	26	17	38
31	-	44	54	34	38	63	59	42	52	39	37
41	-	71	46	52	65	54	24	62	18	24	48
51	-	61	39	63	42						

COMMENT -

MEAN RING WIDTH IN MM = 1.06888889

HALIFAX WOOLSHOP
HWS
91

1	-	176	142	118	129	134	160	183	180	115	81
11	-	126	103	113	94	98	70	76	92	62	45
21	-	53	76	86	59	34	35	47	73	88	70
31	-	69	80	55	34	43	55	40	46	62	83
41	-	83	48	52	34	29	47	62	73	57	64
51	-	85	63	55	73	84	113	75	104	97	61
61	-	86	73	149	98	154	114	95	71	46	45
71	-	76	110	88	58	89	83	64	101	38	43
81	-	82	42	60	82	87	52	43	54	86	69
91	-	101									

COMMENT -

MEAN RING WIDTH IN MM = 1.60065934

HALIFAX WOOLSHOP
HW7
71

1	-	125	48	78	110	97	131	158	118	106	109
11	-	168	140	86	28	53	39	42	45	67	81
21	-	115	100	105	129	132	132	86	41	72	94
31	-	69	67	43	74	48	67	27	47	74	45
41	-	49	43	32	80	65	93	41	46	60	43
51	-	45	27	34	50	90	61	58	56	70	63
61	-	62	45	23	36	42	81	67	52	64	40
71	-	61									

COMMENT -

MEAN RING WIDTH IN MM = 1.42957747

HALIFAX WOOLSHOP
HW3
40

1	-	70	65	52	58	56	50	65	40	31	60
11	-	81	94	74	83	80	55	62	29	36	53
21	-	99	73	70	80	96	47	63	41	32	40
31	-	80	45	87	61	49	31	42	74	75	71

COMMENT -

MEAN RING WIDTH IN MM = 1.225