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Ancient Monuments Laboratory
Report 39/94

THE TREE-RING DATING OF THE PRIEST'S HOUSE MUSEUM, 23-27 HIGH STREET, WIMBORNE MINSTER, DORSET

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Summary

The Priest's House Museum, 23-27 High Street, Wimborne Minster, Dorset (SZ 010 000) was sampled on 2 October 1992. Fifteen cores were extracted, eight from the main range and seven from the northern cross-wing. Of these samples, four from the main range had complete sapwood while the cross-wing similarly had three. Two samples from the main range dated, one with complete sapwood giving a felling date in the late summer/autumn of AD 1634. Three samples from the cross-wing also dated, giving a last measured ring date of 1545. As none of these last three samples had any sapwood or heartwood-sapwood transition, a *terminus post quem* of 1555 has been offered for the felling date range, but it is likely the timbers were felled quite some time after this. Ten other samples, five of which formed two additional site sequences, failed to date either with the dated samples from the site or with the national and regional reference chronologies. Nevertheless, the site produced a 376 ring chronology which should prove useful in dating future sites in the area.

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THE TREE-RING DATING OF THE PRIEST'S HOUSE MUSEUM, WIMBORNE

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Table 1: PRIEST'S HOUSE MUSEUM, WIMBORNE - SUMMARY OF TREE-RING DATING
[for abbreviations see key below]

Sample number		timber & position	dates AD spanning	H/S bdry	sap-wood	no of rings	mean width mm	std devn mm	mean sens
Main range									
wim1	c	W uppr purlin T4-5	-		22½	105	1.24	0.73	0.329
* wim2	c	W uppr purlin T5-6	1411-1600	1600	h/s	190	1.01	0.63	0.139
wim3	c	W uppr purlin T6-7	-		24½	105	1.36	0.89	0.270
wim4	c	E uppr purlin T4-5	-		27½	94	1.21	0.68	0.326
wim5	c	W uppr purlin T3-4	-		3	36	2.68	0.50	0.186
* wim6	c	E strut/post T5	1522-1634	1604	29½	113	1.08	0.26	0.128
wim7	c	E princ rafter T5	-		h/s	76	2.89	1.49	0.169
wim8	c	W princ rafter T6	-		h/s	91	2.88	0.82	0.163
Cross-wing									
* wim11	c	N strut/post T3	1415-1534			120	1.64	0.53	0.202
wim12	c	N princ rafter T3	-		13¼	46	3.83	0.86	0.221
* wim13	c	Tiebeam T2	1259-1480			222	1.34	0.46	0.196
* wim14	c	N strut/post T2	1416-1545			130	1.54	0.48	0.183
wim15	c	Tiebeam T1	-		25¼	75	1.52	0.63	0.225
wim16	c	N princ rafter T1	-		25¼	84	1.76	0.89	0.281
wim17	c	N strut/post T1	-			83	1.19	0.27	0.167
WIMBORNE		site master	1259-1634			376	1.24	0.41	0.161

Key
* = sample included in site-master;
c,s = core, slice;
¼,½,C = bark edge present, partial or complete ring: ¼ = spring (ring not measured), ½ = summer/autumn, or C = winter felling (ring measured);
H/S bdry = heartwood/sapwood boundary - last heartwood ring date;
std devn = standard deviation;
mean sens = mean sensitivity

THE TREE-RING DATING OF THE PRIEST'S HOUSE MUSEUM, WIMBORNE

1. Introduction and objectives

The Priest's House Museum, 23-27 High Street, Wimborne Minster, Dorset (SZ 010 000) is a grade II* listed town house of considerable quality and interest. It is of flint and stone construction and is of several phases, the first of which appears to be the main range which runs parallel to the street. To the north is a cross-wing of similar construction, and to the south a second cross-wing which retains some timber-framing. These were thought to date from the C16/17th on stylistic grounds. In front of the main range a second range was built in the C18th bringing the building out to the line of the northern cross-wing. The roofs of the first two phases both have double butt purlins with collars and tiebeams, the struts/posts rising from them to the principal. It was the objective of the tree-ring dating to determine the chronological relationship of the first two phases of construction.

2. Methods of sample collection, preparation and dating

Normal practice in tree-ring sampling offers a choice of three possible methods: measurements _in situ_ on a well-polished beam end (normally by sanding); cores drilled with a hollow auger; or slices cut from the timbers. At Wimborne, cores were used to extract samples with the minimum of disturbance. All timbers sampled were of oak, _Quercus_ sp.

As all timbers were dry, the samples could therefore be sanded without pretreatment on a linisher through several grades of abrasive paper ranging from 60 grit to 1200 grit. This prepared a sufficiently clean view of the transverse section of the wood for the ring boundaries to be distinguished and for the ring-widths to be measured. Once polished, all samples were measured under a x10/x30 microscope using a travelling stage electronically displaying displacement to a precision of 0.001mm. Where they contained breaks, cores were measured in sections for eventual alignment against other samples.

Dendrochronology is based on the principal that the annual growth rings of trees reflect regional climatic conditions and because of this it is possible to match a sequence of growth rings from a sample of wood against regional reference chronologies to establish the date of the last measured ring in calendar years. If the sample has its sapwood complete, ie to the underside of the bark, then the date of when the tree was felled can be determined to the year and in many instances the season. The usual procedure is to match two or more individual samples from a phase together, make a mean of these, and then try to match any other matched samples, repeating the process of intermediate means until all of the samples from a phase have either been dated together relatively into a floating chronology or have failed to match. The resulting site master or sub-master is then compared with other reference chronologies which have been unequivocally dated in time, thereby dating the floating chronology or sample.

This is accomplished by using a combination of both visual matching and a process of qualified statistical comparison by computer. The ring-width series are recorded on an Amstrad PC2386 computer for statistical cross-matching using a variant of the Baillie and Pilcher (1973) CROS program. A version of this and other programs were written in BASIC by D Haddon-Reece, late of the Ancient Monuments Laboratory. The programs measure the amount of correlation between two sequences and the Student's 't' test is then used as a significance test on the correlation coefficient. Generally a 't'-value of 3.5 or over represents a match, provided that the visual match between the tree-ring graphs is acceptable. In addition to our own databank, the site data has been compared against the databank at the Dendrochronology Laboratory of Sheffield University.

After measurement, the ring-width series for each sample are drawn in the usual fashion as a graph of width against year on log-linear graph paper. This paper is translucent so that graphs ("curves") can be visually compared by overlaying. Samples which originated from the same tree are first combined into a single sequence for the purposes of the analysis. Although there is no precisely defined limit, studies on modern samples suggest that those which cross-match with 't' values over approximately 10.0 are likely to have been derived from the same tree. All pairs of tree-ring curves in the group are then compared visually at the positions indicated by the computer matching and, if found satisfactory and consistent, are averaged to form a mean of the two. This operation removes 'noise' due to the individual behaviour of the trees such as their response to pollarding or thinning out of their woodland neighbours, and reinforces the common climatic signal.

As previously mentioned, once a tree-ring sequence has been firmly dated in time, a felling date needs to be ascribed. With samples which have sapwood complete to the underside or including bark, this process is relatively simple. In measuring, if the whole ring is complete, ie both spring-wood and summer-wood has been fully formed, then the tree was felled in the winter from the October of the last measured ring date to the March of the following year. If the spring vessels only have formed, signified by a '¼' (this is not measured), then the tree was felled from between March and May of the year following the last measured ring. If there is some summer-wood but this is not complete, then this is signified by a '½' (this is measured) and the tree was felled between June and September of the year of the last measured ring date (Baillie 1982, 46-51). Care must be taken to not misread the 'dates spanned' or 'last measured ring' as a <u>felling date</u>. These are two very different things. Also, months can only be used a guide, as there is considerable variation in the complex relationships between climate and the changes in wood growth.

If the sapwood is partially missing, or if only a heartwood/sapwood boundary survives, then an <u>estimated felling date range</u> can be given for each sample. The number of sapwood rings can be estimated by using the accepted national sapwood estimate of between 10 and 55 rings. This is within the 95% confidence range for British oaks as determined by J Hillam et al, 1987. If more than one estimated felling date range has been given for a phase, than the area of common overlap of these ranges might be given to effect a reduced felling date range. However, this relies on the assumption that the samples have a common felling year, which may or may not be true. Whilst most structural phases tend to have trees which have been felled within a year or two of each other, this is not always the case and examples of some timbers having been felled ten or fifteen years previous to the main felling date have been known. It should also be noted that no probability estimate can be advanced for such a reduced felling date range.

As it was common practice to build timber-framed structures with green or unseasoned wood, it therefore follows that construction would generally commence within a year or so of felling. However, dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure which is being sampled. But apart from reuse, a timber can generally be identified as having been fashioned green by the distinctive shakes and deformed surfaces which would have been straight and square when initially cut by the saw. When these characteristics are present, one can be reasonably certain that construction would have taken place prior to seasoning which is generally accepted to be one year per inch in thickness.

3. Timbers sampled and analysis

The Wimborne tree-ring samples are designated as wim1, wim2, etc, with wim1-wm8 coming from the main range and wim11-wim17 were taken from the north cross-wing. The cores were drilled with a 5/8" hollow auger with hardened steel teeth. Figure 1 shows the location of timbers sampled in situ.

A summary of the timbers sampled and their relative dating is shown in Table 1.

3a. Main range (samples wim1-wim8)

Of the eight samples taken from this phase, one sample, wim5, was unsuitable for dating as it had only 36 rings. The remaining seven grouped together very well into three site sequences which surprisingly failed to match each other. The first sequence was made up of samples wim1, wim3 and wim4, which were all upper purlins, and was designated as wim134 (see Table 2 and Appendix). This had 107 rings and the constituent parts matched together so well that they most probably came from the same area of woodland if not from the same tree.

Table 2: t-values and overlaps for components of wim134

	wim3 105	wim4 105
wim1	7.32 103	8.39 94
wim3		9.36 94

This sequence was cross-matched against the national and regional reference chronologies but there was no conclusive match at any position. However, from the relative matching within the sequence (all three samples had complete sapwood), samples wim3 and wim4 were felled in the late summer/autumn of the same year while wim1 was felled at the same time two years later.

The second sequence was composed of samples wim7 and wim8, both principal rafters, which matched together at t=10.28, possibly coming from a single tree, with the heartwood/sapwood boundaries within two years of each other. These were combined to form a sequence wim78 with 91 rings (see Appendix) and was similarly compared with the reference chronologies, as well as first sequence, but again there was no conclusive match. The t-values match between the two samples is very high and may indicate they were from the same tree, indeed they would have been combined as such had not their respective pairs in each truss (which were not sampled), appeared to be the other half of the trees.

The third site sequence was made up from a strut/post (wim6) and an upper purlin (wim2). These matched together with t=5.51 and were combined to form site sequence wim26 with 224 rings. This was successfully dated with a last measured ring of AD1634. Although wim2 had only a heartwood/sapwood boundary at 1600 which gives an estimated felling date range of 1610-1655, wim6 did have complete sapwood and a felling date of late summer/autumn 1634 can be ascribed to this sample. Both the first two sequences were compared against this dated sequence but again there was no match at any position.

3b. North cross-wing (samples wim11-wim17)

Of the seven samples taken from this phase, two (wim11 and wim14) matched together so well with t=10.17 that they were considered to be from the same tree and were therefore combined into wim114 with 131 rings. This was compared with the reference chronologies and the last measured ring dated to AD1545.

Sample wim13 was exceptional in that it had 222 rings and this also dated individually with a last measured ring at 1480. However, the degree of match between these two dated samples was poor and it would indicate that they came from a different part of the woodland if not a different source altogether. As none of the samples dated from this phase had any signs of sapwood, a terminus post quem of 1555 can only be offered on the assumption that all three dated samples are contemporary. However, the visual appearance of the timbers indicate that they were from well within the heart and the actual felling date is likely to be quite sometime after this. The dating of the different site sequences with the reference chronologies is shown in table 4.

Table 3: t-values and overlaps for components of WIMBORNE

	wim6 1634	wim13 1480	wim114 1545
wim2	5.51 79	1.95 70	4.63 131
wim6		0.00 0	2.49 24
wim13			2.72 66

The remaining four samples, three of which had complete sapwood, failed to either match each other, the other site sequences or any of the reference chronologies.

4. Dating results and conclusion

In all, five of the samples dated conclusively and were combined to produce a site master curve of 376 years, WIMBORNE (see Table 3 and Appendix), which spans the period AD1259-1634. Of these, only wim6 from the main range had complete sapwood and so the only felling date given can be the late summer/autumn of the year AD1634. It must be stressed that this is a felling date for the tree, not the construction date, and the latter must be determined in the light of other architectural or archaeological factors in addition to this felling date. The three samples from the cross-wing had no sapwood at all so a felling date range can be defined only with a felling date not likely to be before 1555. Due to the closeness of the rings of these samples, the felling date could well be in the next century or beyond; there is no way of telling unless more of the timbers were to become exposed which might reveal some sapwood or heartwood/sapwood boundary. The other samples and site sequences failed to date or to match each other. This problem is indicative of other sites in the south-west.

	wim26 1634	wim114 1545	wim13 1480	WIMBORNE 1634
DUBLIN2	5.62 146	2.34 131	2.59 124	3.63 200
BROOKGT	5.57 201	3.60 131	2.94 119	5.46 250
KENT88	3.33 130	4.87 126	5.25 222	6.04 282
NUFF	4.81 217	5.80 131	1.90 77	6.28 224
ENGLAND	3.80 224	4.15 131	5.30 222	6.55 376
GIERTZ	4.50 224	3.86 131	5.39 140	7.06 294
EASTMID	4.99 224	4.77 131	5.36 222	7.08 376
SENGLAND	3.80 179	5.52 131	6.89 222	7.04 331

Table 4: Table of t-values and overlaps with dated chronologies

5. Acknowledgements

The author is grateful to Miss Jennifer Hillam and Miss Cathy Groves of the English Heritage funded Sheffield University Dendrochronology Laboratory for practical assistance and advice on the production of this report. Further thanks are also given Mr S J Price, Curator of the Museum, who gave assistance during the sampling. Acknowledgements are also given to the Ancient Monuments Laboratory of English Heritage and Sheffield Dendrochronology Laboratory for both published and unpublished data.

6. References

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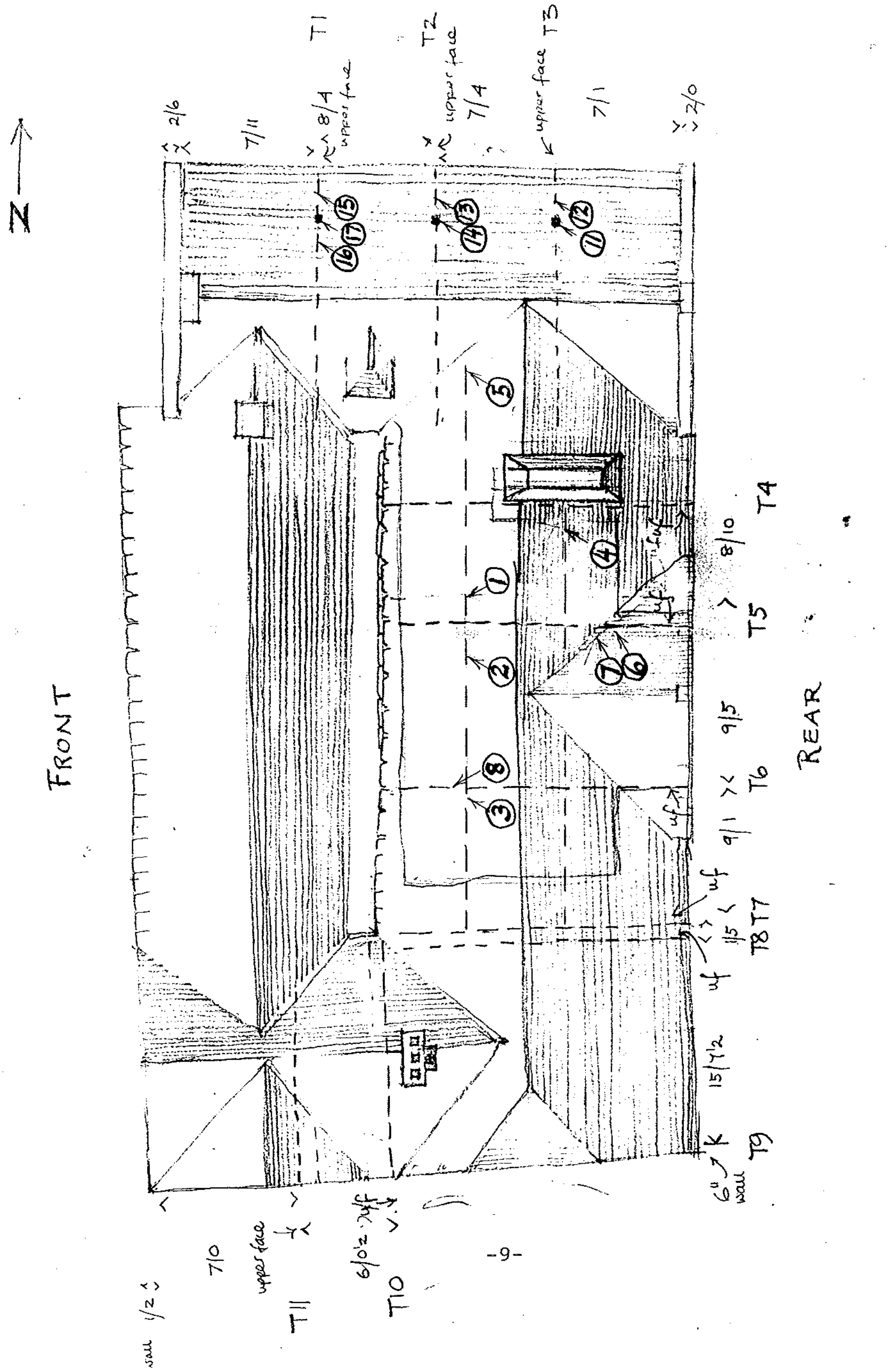
Figure 1: Plan showing position of samples



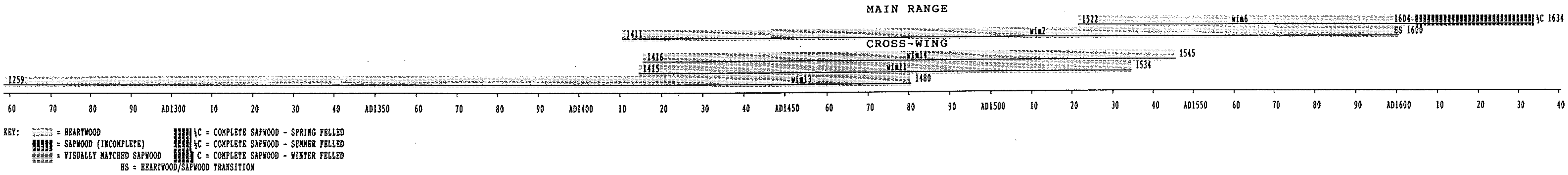
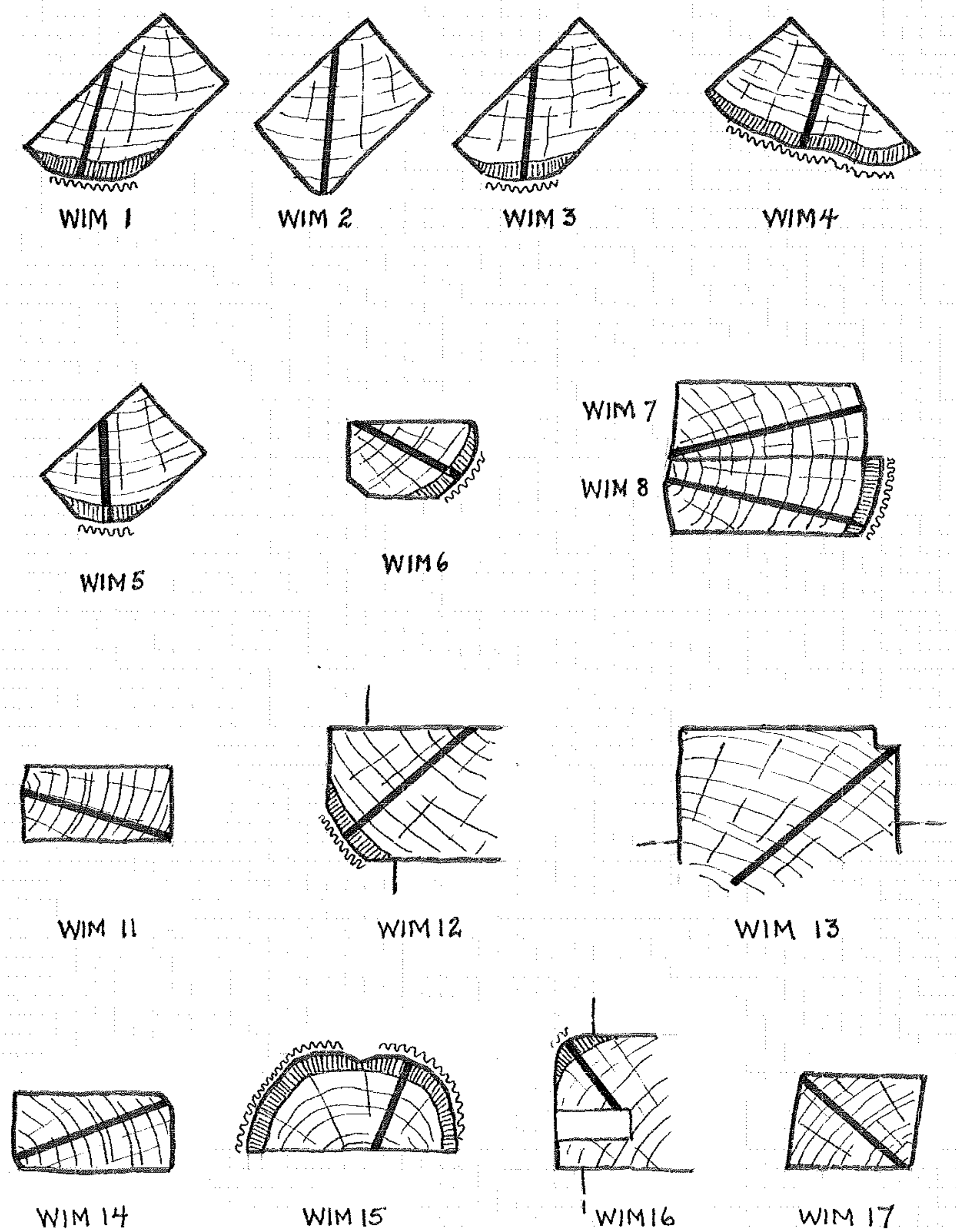


Figure 2: Samples in chronological position

Figure 3: Sections of timbers sampled at scale of 1:8.



Key: Sapwood Bark edge

APPENDIX - RING WIDTH DATA OF SITE MASTER AND SUB-MASTERS

wim134 Priest's House Wimborne purlins wim1+3+4
107 rings, undated

ring widths (0.01mm)

240	291	408	130	71	123	110	164	183	252
310	225	105	86	156	109	230	278	242	147
249	317	294	262	73	83	104	101	90	120
158	262	324	127	91	97	99	106	116	123
100	92	66	68	55	74	93	139	163	142
155	131	181	216	91	69	88	79	114	102
95	75	44	40	41	64	62	84	106	143
176	147	115	118	136	118	78	64	66	86
66	78	90	119	149	114	150	113	142	117
125	114	120	204	65	48	63	41	53	74
93	116	162	118	90	56	80			

number of trees per year

1	1	2	2	2	2	2	2	2	2
2	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	1	1			

wim78 Priest's House Wimborne princ rafters wim7+8
91 rings, undated

300	345	304	346	229	288	261	185	179	193
280	374	431	497	491	341	415	397	487	460
504	469	436	402	451	524	433	388	473	391
503	418	452	402	307	430	465	215	218	293
340	311	290	236	231	209	155	169	218	217
235	252	230	199	291	256	221	324	249	201
229	198	242	297	287	276	257	216	228	175
195	216	225	204	227	192	205	199	175	176
200	158	132	174	131	155	222	174	190	196
201									

1	1	1	1	1	1	1	1	1	1
1	1	1	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	1
1									

WIMBORNE <1259-1634> Priest's House Museum Wimborne
376 rings, starting in year AD1259

ring widths (0.01mm)

152	169	190	162	154	135	97	121	106	131
159	124	112	112	162	110	65	78	127	95
125	135	81	104	50	44	48	88	85	99
131	103	87	113	174	333	267	234	172	174
162	189	198	228	129	74	117	167	119	103
76	64	45	70	87	99	96	122	108	116
131	147	146	167	113	75	53	87	115	131
156	98	81	77	106	84	91	68	92	147
228	215	192	196	105	95	116	120	136	142
175	89	99	96	133	130	121	138	157	149
143	93	95	228	264	367	290	231	229	187
165	140	119	137	116	112	130	117	109	132
142	125	123	107	100	85	89	117	110	147
110	118	91	115	107	100	136	132	155	157
131	132	156	114	141	152	134	119	112	194
158	121	155	208	224	187	235	188	213	199
140	194	208	197	205	202	161	143	145	169
157	128	141	174	140	140	141	112	124	151
114	106	122	133	128	136	116	133	121	96
109	101	124	127	120	135	99	102	106	125
111	129	116	116	144	112	125	140	132	131
130	150	143	141	146	143	162	130	69	76
94	102	125	143	155	209	174	154	181	175
161	189	182	148	92	170	132	167	150	153
155	145	141	194	174	171	148	118	64	93
112	128	160	167	156	169	168	144	126	151
182	131	123	151	129	135	114	118	121	117
115	96	138	106	120	125	95	109	110	107
148	159	157	117	133	114	106	74	78	90
96	90	95	83	102	106	118	102	107	110
122	110	120	145	111	114	108	109	131	140
117	116	112	104	93	89	96	83	75	71
84	90	88	90	111	103	111	98	85	76
94	82	83	90	75	99	93	101	78	69
71	78	99	101	94	92	84	91	110	62
87	74	78	86	84	68	71	90	97	114
124	114	122	153	98	97	96	88	81	93
96	105	104	121	128	158				

number of trees per year

1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
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1	1	1	1	1	1				