Ancient Monuments Laboratory
Report 2/98

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Summary

Thorpe Prebend House, Ripon, is a large building, consisting of a central hall and two cross-wings. Externally the building is of brick and render, but original timber framing survives in the hall and cross-wings. Two independent structural surveys had produced differing interpretations of the early phases of construction within the building. A report by RCHME considered that the east wing and central hall were contemporary, and the west wing was a later seventeenth century addition. In contrast, Yorkshire Archaeology Trust has suggested that the east wing dates to the late fifteenth or early sixteenth century, and the central hall and west wing were built at a later date. Tree-ring analysis was undertaken to date the original timber framing, and identify the order of phasing. The east wing was dated to AD 1516/17. This was the earliest part of the building. The hall and west wing were built at the same time in AD 1583/4.

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Introduction

This document is a technical archive report on the tree-ring analysis of timbers from Thorpe Prebend House, Ripon (SE 316 714). It is beyond the dendrochronological brief to describe the building in detail or to undertake the production of detailed drawings. As part of a multifaceted and multidisciplinary study of the building, 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 building. The conclusions presented here may therefore have to be modified in the light of subsequent work.

Thorpe Prebend House is a grade II* listed building located on High Saint Agnesgate, to the south of Ripon Minster, next to the river Skell. The house has an east-west alignment, and is comprised of a central hall flanked by two wings which extend to the south of the hall. The external fabric is primarily of brick and render but the original timber framing survives in all three parts of the house. Two historic building reports describing the structural history of the house have been produced independently by the Royal Commission on the Historical Monuments of England (Hook 1996) and Yorkshire Archaeology Trust (Smith 1997). Both reports suggest that there were two phases of timber framing, but have presented different interpretations about the order in which the house was built. Hook (1996) suggests that the central hall and east wing were built in the late-fifteenth or early-sixteenth century, and that the west wing is a seventeenth-century addition. In contrast, Smith (1997) considers that the east wing is the remains of a late fifteenth- or early sixteenth-century hall to which the hall and west wing were added in the sixteenth century. Tree-ring analysis was commissioned in order to date the original timber framing, and to determine the order of construction.

The following description of the building is derived from Hook (1996) and Smith (1997). The report follows the truss numbering used in Smith (1997); see Figures 1a-c which show the floor plans of the attic, first floor, and ground floor.

The East Wing

The east wing is two storied, with three bays. Most of trusses 1 and 3 and the west wall are intact. Collared-rafter roof trusses were used in this wing, and survive in truss 3. Hook (1996) considered that the east wing and central hall were structurally dependant on each other and were of contemporary build. However, the juxtaposition of principal posts from three trusses in the east wing, and truss 1 of the central range, suggested to Smith (1997) that these two parts of the building were structurally independent. Stylistic differences between the east wing and central hall suggested that the east wing was earlier in date.

<u>The Central Hall</u>

The hall is comprised of four bays with six trusses which have principal rafters and staggered butt purlins. The majority of the principal posts have been removed, most probably when alterations were made to the building in the seventeenth century. Truss 1 retains both north and south principal posts to ground-floor level and the south principal from truss 3 has been retained on the first floor. Extending west from the south post of truss 6 is a wall plate and mid-rail with empty mortices, indicating that the wall was infilled with braces and close studding. This is set between the trusses of the west wing and Hook (1996) has suggested that this feature is part of the exterior south wall of the central range, predating the west wing. Smith (1997) however, considered that this may have been an internal wall with access to south-facing rooms provided by a doorway located under the now absent braces.

<u>The West Wing</u>

The west wing has three bays with roof trusses is similar to the central range. Hook (1996) considered that the west wing incorporated the end bay of the central hall, providing additional domestic accommodation. At the same time the roof of the hall may have been raised and extensive alterations made to the external fabric of the house. In contrast, Smith (1997) suggests that the west wing and central hall are most probably contemporary. The west wing appears to be structurally dependant on the central range as the tiebeam of truss 1 (west wing) rests on the tiebeam of truss 6 (central hall).

Methodology

The timbers from the original framing were assessed to identify those which were suitable for dendrochronological analysis and which would assist in resolving the order of building phases. Samples with over 50 rings are required for tree-ring dating in order to ensure that the growth pattern is unique. Those samples with sapwood and bark edge were particularly sought, as these improve the precision of the results.

The timbers were sampled using a 15mm diameter corer attached to an electric drill. The cores were taken from the timbers in the most suitable direction for maximising the numbers of rings for subsequent analysis. The core holes were left open. The ring sequences in the cores were revealed by sanding. Those samples with less than 50 rings were rejected. 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. 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 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 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 these positions are supported by satisfactory visual matching.

All the measured sequences from the 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 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 may be 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 55 annual rings, where these figures indicate the 95% confidence limits of the range. These figures are applicable to oaks from the British Isles (Hillam *et al* 1987). Alternatively, if bark-edge survives, then a felling date can be directly utilised from the date of the last surviving ring. The season of felling can sometimes be identified based on the presence or absence of late spring/summer growth in the final ring. This will indicate whether the tree was felled during the growing period (incomplete ring), or in winter during dormancy (complete ring).

The dates obtained by the technique do not by themselves necessarily indicate the date of the structure from which they are derived. Considerations should be given to the delayed use of timber caused by seasoning, stockpiling, or reuse as these factors may affect the interpretation of tree-ring results. In general, timber was used while still green and easily worked, so that structures using primary timbers would have been built soon after felling (Rackham 1990). The possibility of repairs being made to the structure should also be taken into account. Tree-ring dating provides precise dates for the tree-ring sequences and is a completely independent process but the interpretation of the results may be refined through study of other archaeological and documentary evidence.

Tree-ring analysis may also result in the identification of timbers derived from the same tree, which can be helpful in linking different parts of a building. The comparison of timbers within a structure may identify similarities in patterns of branching or knots. The occurrence of high levels of matching between samples, very similar long-term growth trends or similar anatomical anomalies may also indicate that timbers originated from the same tree.

Results

All the samples obtained from Thorpe Prebend House were oak (*Quercus* spp.). These are described in Table 1 and their location is shown in Figures 1a-c. Fifteen cores were taken from the central range and fifteen timbers were suitable for sampling in the west wing. Halved and quartered timbers of a similar style of conversion were used in both parts of the building. The majority of tiebeams and principal posts in the east wing were made from halved trees, but the framing here is more substantial. The wall plate from which sample **40** was obtained, was made from a whole tree. Ten cores were obtained from timbers on the ground and first floor of the east wing.

After preparation, eight cores (samples **02**, **06**, **14**, **15**, **17**, **30**, **33**, and **37**) were found to be unsuitable for further analysis as they did not contain enough rings. The remainder contained 57-161 rings.

The measured samples from the whole building were compared against each other with the result that two site master chronologies were established. Six samples from the east wing cross-matched to form the site chronology, PREBEND EW (Fig 2 and Table 2). A second site master, PREBEND WW/CH, was established from 16 samples from the west wing and central hall. Ring width data for the two site chronologies is presented in Tables 3a and 3b.

The chronology PREBEND WW/CH contains two sub-groups (Table 2). Cross-matching within each group is good and there is some cross-matching between groups. This, as well as independent dating, indicates that they are contemporary. Three samples **08**, **27**, and **28** showed high correlations against each other, indicative of the timber being derived from the same tree. The ring-widths from these samples were averaged together before inclusion in PREBEND WW/CH. Similarly, samples **21** and **23** also showed a high level of internal matching and a mean-tree sequence was also produced for this group.

Eight timbers could not be cross-matched against the two site chronologies. Of these, **05** and **13** matched each other with t=10.28. Good visual matching between the ring sequence indicates that these two samples were probably derived from the same tree. These two samples were combined to form the sequence, 5+13.

The two site master chronologies and the unmatched sequences were tested against a range of reference chronologies from the last millennia. As a result, PREBEND EW was dated to AD1356-1516 and PREBEND WW/CH to AD1408-1583 (Table 4). Although the site chronologies overlap in time, cross-matching between them was poor (t=3.29). The remaining sequences, including 5+13, could not be dated.

Interpretation

East wing

The dated timbers from the east wing were all included in PREBEND EW. They included the west principal posts associated with truss 2 and truss 3, and a stud from the west wall. Two timbers had heartwood/sapwood transition and two other samples (**35** and **39**) retained sapwood. Sample **39** was complete to bark edge and, because the final ring had both spring and summer growth, this indicates that the tree was felled during dormancy in late AD 1516 or early AD 1517. The distribution of heartwood/sapwood boundaries within this group is consistent with timbers which were felled at the same time (Baillie 1982, 57). Assuming that the timber was used whilst it was still green, as was usual in the late medieval period (Rackham 1990, 69), this gives a construction date of AD 1516/17, or very soon after, for the east wing.

West wing and central hall

Hook (1996) suggested that the west wing may have been built onto the end bay of the central hall in the seventeenth century. The results of tree-ring analysis show, however, that the wing and hall are of contemporary build as the chronology PREBEND WW/CH contains samples from both areas. The dated timbers include the principal rafters from the hall and wing, as well as three samples from trusses integral to both areas (samples **23**, **24**, and **25**). Timbers derived from the same tree have been used in both the central hall and west wing. Samples **08** and **27** were from tiebeams in the central hall, whilst sample **28** was from a floor joist in the west wing. Although not dated, it is probable that samples **05** and **13**, rafters cut from the same timber and used in the central hall and west wing respectively, are also contemporary with the PREBEND WW/CH chronology.

Nine samples from both areas had heartwood sapwood transition or retained sapwood. Samples **25** (west wing/central hall) and **29** (central hall) were complete to bark edge (sample **25** still had bark attached to the timber). Both samples had spring and summer growth in the final ring, indicating that the trees were felled during dormancy in late AD 1583 or early AD 1584. The close range of heartwood/sapwood transitions on samples from both areas indicates that the timbers were felled at the same time. Assuming the timber was used whilst still green this produces a construction date of AD 1583/84, or very soon after, for the central hall and west wing.

Discussion

The results of the tree-ring analysis support the interpretation of the building phases presented by Smith (1997). The east wing is the earliest phase, dating to AD 1516/17. At the time, the house was still part of the Thorpe Prebend, an ecclesiastical living and one of several Prebends associated with Ripon Minster (Anon 1914). The central hall and west wing were built at the same time in, or shortly after, AD 1583/84. This is after the abolition of the Prebendary livings in the mid-sixteenth century. There is no dendrochronological evidence of the reuse of timber from an earlier hall. In a 1609 inquisition, all the properties associated with Thorpe Prebend are recorded as being owned by Mr. George Dawson, Gentleman. He is reputed to have rebuilt Thorpe Prebend House (Anon 1914).

The samples from Thorpe Prebend House are an interesting assemblage dendrochronologically. The clustering of samples in to sub-groups may indicate either that tree growth in the Vale of York was strongly affected by local growth conditions; or, the timbers were being derived from several sources. Tree-ring analysis of sites such as Coppergate in York, have shown that from the early medieval period, structures can contain timber derived from several different sources (Hillam 1987). It is possible that when the later phase of building was added, there may have been a lack of suitable building timber available in sufficient quantities from a single woodland. Therefore, timber may have been obtained from separate woodlands in the Ripon region.

Alternatively, the timber may have been obtained from a single source, but variations in microenvironments within a woodland may have reduced the potential for cross-matching between trees from different parts of the same site. Elsewhere in Britain, in counties such as Essex and Devon, the suitability of timber for dendrochronological dating appears to have been affected by the local conditions in which the trees grew. The construction of local chronologies has been undertaken in such areas to improve the potential for tree-ring dating. The Vale of York appears to be similarly problematic but in the future, further research may result in long, local chronologies being established which can assist in dating structures from this region.

Conclusion

Tree-ring analysis of timbers from Thorpe Prebend House, Ripon, resulted in chronologies for the periods AD 1356-1516 and AD 1408-1583. The east wing is the earliest part of the building, dating to AD 1516/17 or soon after. The hall and west wing were constructed at the same time in, or shortly after, AD 1583/84, when the Prebend had become privately owned. This supports the interpretation presented by Smith (1997) after recording and structural analysis. The clustering of samples from the later phase into sub-groups was particularly interesting. This suggests that the timber may have been obtained from several different sources. Alternatively, the timber may have come from a single woodland where local variations in microenvironment were affecting tree growth. Tree-ring analysis of other buildings from the Vale of York may show similar timber groups. As more site chronologies are established it may be possible to further understand the cause of such patterns.

Acknowledgements

The analysis was funded by English Heritage. My thanks to Mrs. J. Younge of Hill Rowe Architects who assisted with access to the House. My colleagues Ian Tyers, Cathy Groves and Jennifer Hillam provided useful help and advice.

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Figure 1a: location of samples obtained from the attic, Thorpe Prebend House, Ripon (after Smith 1997).

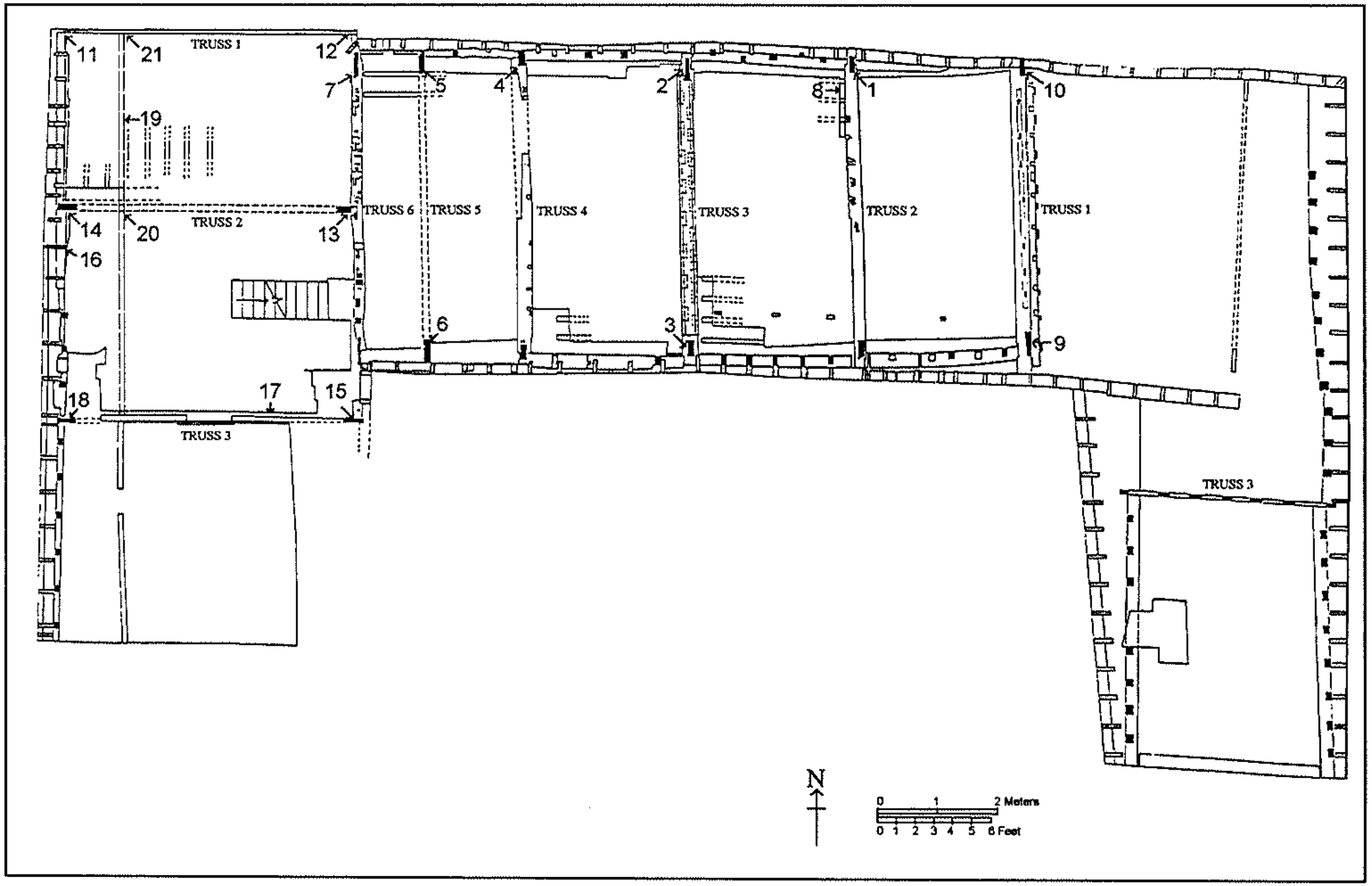

Figure 1b: location of samples obtained from the first floor, Thorpe Prebend House, Ripon (after Smith 1997).

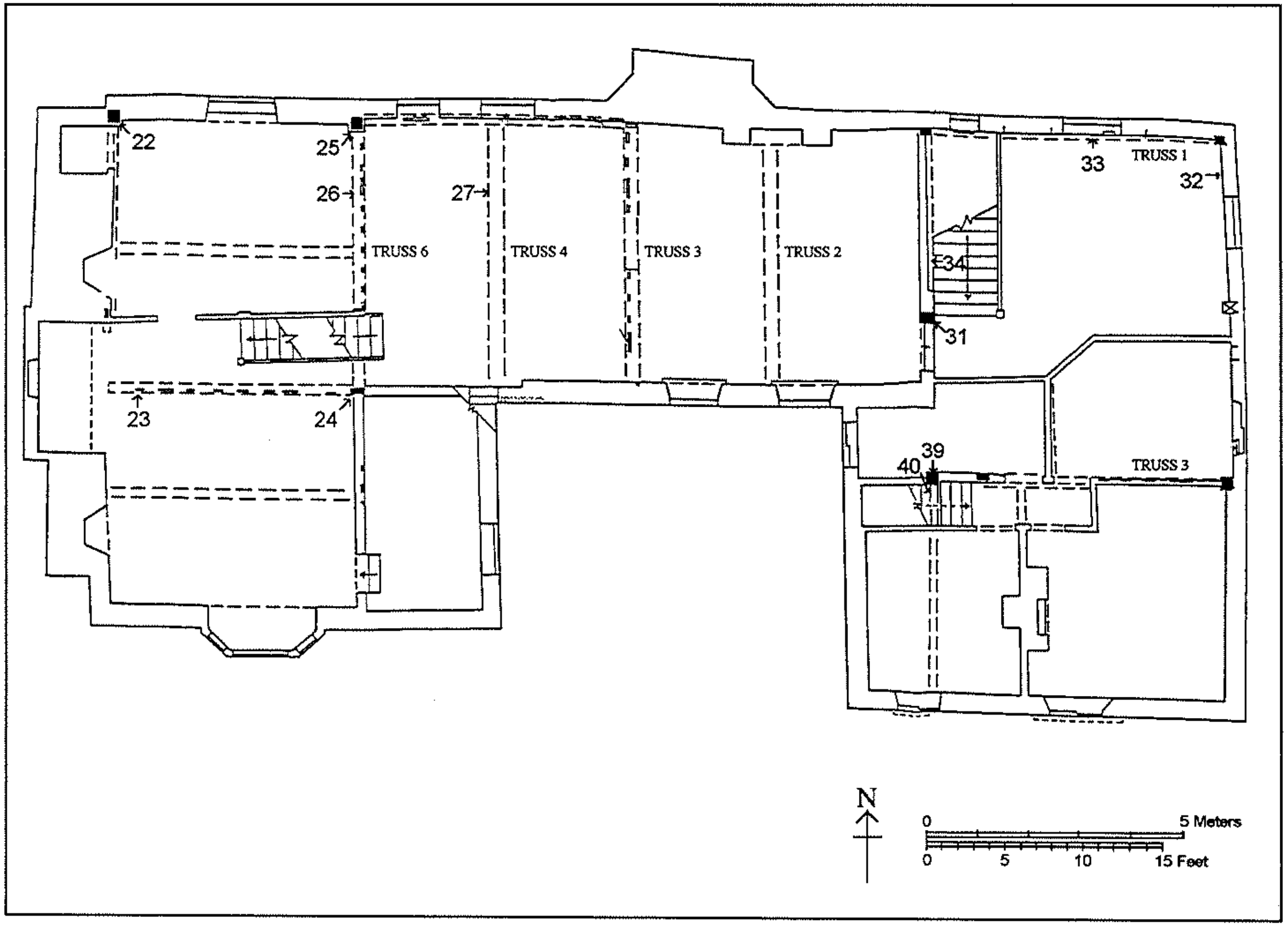

Figure 1c: location of samples obtained from the ground floor, Thorpe Prebend House, Ripon (after Smith 1997).

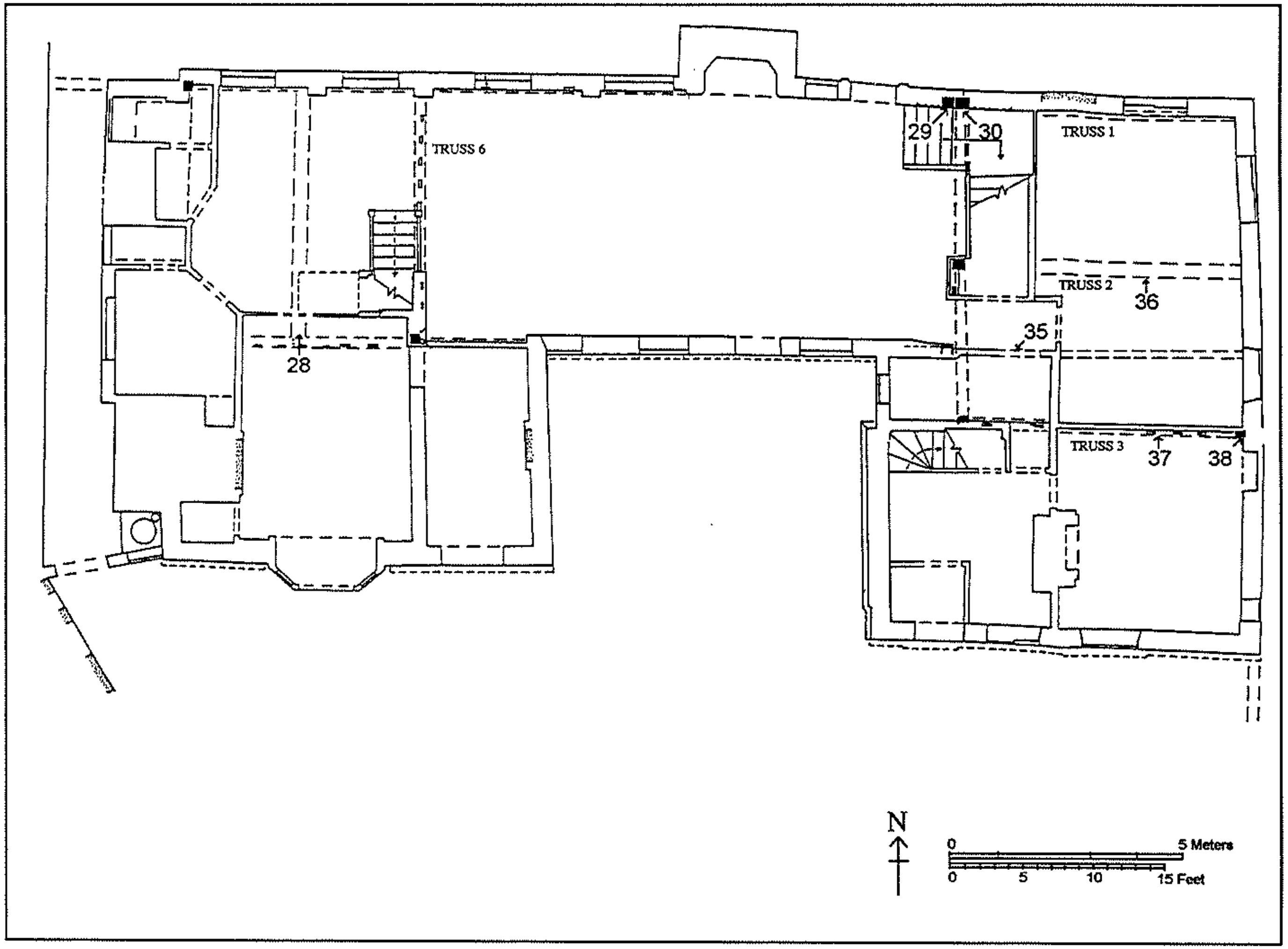

Figure 2: bar chart showing the position of the dated timbers from the east wing, central hall, and west wing of Thorpe Prebend House.

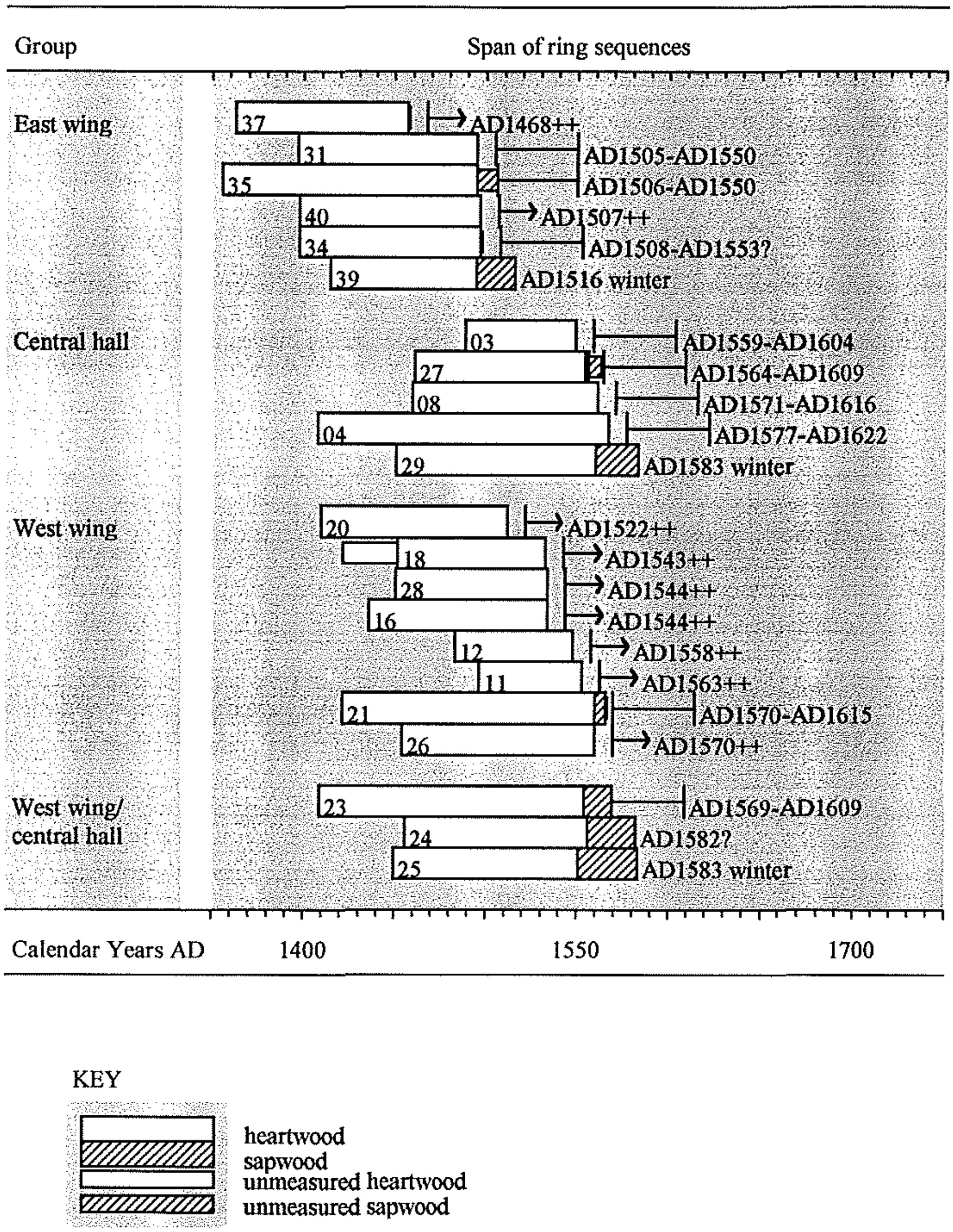

Table 1: list of samples obtained from Thorpe Prebend House

Core	Origin	Location	Total rings	Sapwood rings	mm/year	Date of sequence (AD)	Felling date range
	Central Hall						
01	North principal rafter	Truss 2	107	6	1.15		
02	North principal rafter	Truss 3	35	-	-		
03	South principal rafter	Truss 3	61	h/s	2.46	1489-1549	1559-1604
04	North principal rafter	Truss 4	160	h/s	1.02	1408-1567	1577-1622
05	North principal rafter	Truss 5	88	-	2.13		
06	South principal rafter	Truss 5	41	-	-		
07	North principal rafter	Truss 6	105	1	0.85		
08	Tie-beam	Truss 2	102	h/s	1.91	1460-1561	1571++
09	South principal rafter	Truss 1	73	?h/s	.90		
10	North principal rafter	Truss 1	84	?h/s	.86		
27	Tie-beam	Truss 4	96	2	1.34	1461-1556	1564-1609
29	North principal post	Truss 1	133	23+b winter	1.91	1451- 1583	
	West Wing						
11	West principal rafter	Truss 1	57	-	1.93	1497-1553	1563 ++
12	East principal rafter	Truss 1	65	-	1.79	1484-1548	1558 ++
13	East principal rafter	Truss 2	93	4	2.00		
14	West principal rafter	Truss 2	48	-	2.38		
15	East principal rafter,	Truss 3	39	-	-		
16	Common rafter, west side	Truss 2	99	-	1.65	1436-1534	1544 ++
17	Butt purlin	Nr truss 3	46	-	-		
18	'False' tie-beam	Truss 3	82+h30	-	0.89	1452-1533	1543 ++
19	Purlin	Truss 1-2	57	-	1.52		
20	Tie-beam/floor joist	Truss 2	103	-	1.31	1410-1512	1522 ++
21	Tie-beam/floor joist	Truss 1	145	6	1.38	1422-1566	1570-1615
22	West principal post	Truss 1	62	-	2.93		
26	Tie-beam	Truss 6	106	-	1.71	1455-1560	1570 ++
28	Floor joist	Truss 1-3	84	-	1.37	1451-1534	1544 ++

Core	Origin	Location	Total rings	Sap rings	mm/year	Date of sequence	Felling date range
	West wing/central hall						
23	Tie-beam/girding beam	Truss 2/6	161	15	1.87	1409-1569	1569-1609
24	East principal post	Truss 2/6	127	26+?b	2.20	1456-1582	1582?
25	East principal post	Truss 1/6	134	32+b winter	1.94	1450-1583	1583/4
	East Wing						
30	North principal post	Truss 1	19	-	-		
31	West principal post	Truss 2	99	h/s	1.45	1397-1495	1505-1550
32	Wall plate	Truss 1-2	43	-	-		
33	Tie-beam	Truss 1	66	-	1.84		
34	Stud	West Wall	100	-	1.37	1398-1497	1508-1553
35	Floor joist	-	139	+s11	1.45	1357-1495	1506-1545
36	Lower tie-beam	Truss 2	44	-	-		
37	Lower tie-beam	Truss 3	95	-	1.59	1363-1457	1468 ++
38	East principal post	Truss 3	76	-	1.77		
39	West principal post	Truss 3	102	27+b winter	1.27	1415-1516	1516/17
40	Wall plate	Truss 3-?4	100	-	1.25	1398-1497	1507 ++

Key:
Felling date: in the absence of bark edge, felling date ranges or *terminus post quem* for felling (indicated by ++) are estimated using the sapwood estimate of 10-55 rings (see Hillam *et al* 1987).
+h*n* indicates unmeasured heartwood rings
+s*n* indicates unmeasured sapwood rings
h/s indicates heartwood sapwood boundary
+b indicates bark or bark edge

Table 2a: *t*-value matrix for samples included in PREBEND EW

	31	**34**	**35**	**37**	**39**	**40**
31		-	6.04	3.30	3.41	-
34			4.05	-	5.88	5.59
35				7.78	3.54	-
37					3.71	-
39						4.86

Table 2b: *t*-value matrix for sample included in PREBEND WW/CH

	03	**04**	**11**	**12**	**16**	**18**	**20**	**21**	**23**	**08**	**27**	**28**	**24**	**25**	**26**
03		-	8.80	7.24	-	3.62	-	4.14	3.77	-	-	-	-	-	-
04			-	-	4.95	-	4.13	4.07	4.34	-	-	-	-	3.05	4.42
11				4.40	-	-	-	-	-	-	-	-	-	-	-
12					4.11	3.44	4.40	4.49	4.28	-	-	-	-	-	-
16						3.26	4.98	4.60	4.01	-	-	-	-	-	-
18							3.83	3.11	-	3.56	4.71	4.64	-	-	-
20								8.77	9.76	-	-	-	-	3.55	-
21									**13.75**	-	-	-	-	-	3.03
23										-	-	-	-	-	-
08											**9.64**	**9.61**	-	-	-
27												**10.04**	4.99	3.43	-
28													4.51	-	-
24														7.84	3.11
25															5.00

Key:
- value below 3.0
n indicates same tree matches

Table 3a: ring-width data from PREBEND EW

Date	Ring widths										No. of samples									
AD1356						355	296	277	333	285						1	1	1	1	1
-	249	397	330	286	248	251	237	203	230	226	1	1	2	2	2	2	2	2	2	2
-	231	296	272	324	315	236	322	278	277	237	2	2	2	2	2	2	2	2	2	2
-	188	205	206	215	171	132	213	182	135	162	2	2	2	2	2	2	2	2	2	2
-	212	189	157	163	150	181	144	207	202	187	2	2	2	2	2	2	3	5	5	5
AD1401	173	144	227	203	192	157	151	147	172	203	5	5	5	5	5	5	5	5	5	5
-	158	155	133	95	144	116	131	170	126	174	5	5	5	5	6	6	6	6	6	6
-	188	159	196	138	117	125	163	189	196	149	6	6	6	6	6	6	6	6	6	6
-	155	144	121	163	162	160	130	92	88	113	6	6	6	6	6	6	6	6	6	6
-	135	111	148	135	91	93	117	123	132	122	6	6	6	6	6	6	6	6	6	6
AD1451	132	151	128	143	111	109	109	85	91	95	6	6	6	6	6	6	6	5	5	5
-	86	77	77	78	81	73	67	61	76	87	5	5	5	5	5	5	5	5	5	5
-	88	84	105	107	150	122	98	104	109	120	5	5	5	5	5	5	5	5	5	5
-	119	116	103	88	107	92	111	79	104	97	5	5	5	5	5	5	5	5	5	5
-	84	88	96	93	98	96	94	97	152	193	5	5	5	5	5	3	3	1	1	1
AD1501	119	135	118	120	133	132	113	106	106	89	1	1	1	1	1	1	1	1	1	1
-	128	93	71	70	94	104					1	1	1	1	1	1				

Table 3b: ring width data from PREBEND WW/CR

Date	Ring widths										No. of samples									
AD1408								81	141	213								1	1	2
-	186	230	213	220	215	208	205	136	99	205	2	2	2	2	2	2	2	2	2	2
-	162	159	184	180	212	182	119	161	194	205	2	2	2	2	2	2	2	2	2	2
-	195	202	161	196	213	168	165	148	136	152	2	2	2	2	2	3	3	3	3	3
-	137	113	187	250	226	153	178	109	163	243	3	3	3	3	3	3	3	3	3	4
AD1451	280	325	279	354	249	325	287	248	212	230	6	7	7	7	8	9	9	9	9	9
-	238	262	262	257	226	238	186	188	176	231	9	9	9	9	9	9	9	9	9	9
-	212	206	182	179	281	204	162	159	143	150	9	9	9	9	9	9	9	9	9	9
-	168	127	160	199	191	199	236	158	172	139	9	9	9	10	10	10	10	10	11	11
-	107	143	161	147	186	205	166	152	177	182	11	11	11	11	11	11	12	12	12	12
AD1501	155	188	153	188	168	194	146	171	196	165	12	12	12	12	12	12	12	12	12	12
-	176	142	165	168	145	166	139	142	159	129	12	12	12	12	12	12	12	12	12	12
-	149	134	114	121	123	144	132	138	134	118	12	12	12	12	12	12	12	12	12	12
-	145	125	113	134	154	174	163	149	153	190	12	12	12	11	10	10	10	10	10	10
-	140	131	144	163	165	172	163	125	106	144	10	10	10	10	10	10	10	10	9	8
AD1551	167	140	120	105	152	111	93	84	86	95	8	8	8	7	7	7	7	7	7	7
-	90	85	93	94	74	73	65	70	93	116	6	5	5	5	5	5	4	3	3	3
-	96	103	99	111	84	87	107	112	137	132	3	3	3	3	3	3	3	3	3	3
-	101	116	88								3	3	2							

Table 4: dating the chronologies PREBEND EW and PREBEND WW/CH

Area	Reference chronology	PREBEND EW *t*-value	PREBEND WW/CH *t*-value
Herefordshire	Hereford (Tyers 1996)	4.48	6.66
	Lower House Farm, Tupsley (Tyers 1997a)	3.98	5.56
London	Victoria Wharf (Tyers and Hall 1997)	5.18	-
Staffordshire	Sinai Park (Tyers 1997b)	5.85	5.63
Yorkshire	Elland Old Hall (Hillam 1984)	4.55	6.51
	Golden Cock, Wakefield (Hillam and Groves unpubl)	4.05	6.72
	Gunthwaite Hall Barn (Boswijk unpubl)	4.36	4.98
Welsh borders	Welsh Border (Siebenlist-Kerner 1978)	5.06	7.64