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Summary

Dendrochronological analysis of oak timbers from St Mary's Hall, Coventry, West Midlands, has resulted in the production of a felling date range for one part of the building of AD 1422 to *c* AD 1460. A part of the building on a different alignment has proved difficult to date using the tree-ring techniques. The trees utilised for these different parts of the building are presumed to be of a different date or origin.

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Introduction

The purpose of the study was to carry out dendrochronological analyses of a variety of elements in order to assist the interpretation of the sequence of construction of the Hall complex. The initial approach, from Nicholas Molyneux, the English Heritage Historic Buildings Inspector, was subsequent to the funding of a major photogrammetric survey of this Grade I building. This survey had revealed a number of issues of interpretation which it was hoped dendrochronological analysis could resolve.

St Mary's Hall, Coventry, West Midlands (NGR SP337790) consists of a range of buildings surrounding a central courtyard. The buildings on the west side of the courtyard, including the Great Hall, Armoury, and associated undercrofts, are aligned almost precisely north-south, however the eastern range, including the Kitchen, Ante-Room, and Galleries is aligned about 10° eastwards (Figure 1). Where the structures abut there are noticeable discontinuities in the construction, but it is not clear from the surviving structure which part is primary.

Methodology

All accessible timbers were assessed for suitability. Unsuitable samples are usually those with unclear ring sequences or fewer than 50 rings, or timbers from non-oak trees (at least for the provision of routine dates). The oak (*Quercus* spp.) timbers that looked most suitable, and could be sampled both without major disfigurement and without affecting their structural integrity, were selected for sampling and study. Cores were taken using a 15mm diameter hollow borer attached to an electric drill. The core-holes in timbers in the public parts of the building were filled with doweling and painted so as to match the rest of the timber as closely as possible. Each core was polished using sand paper of a number of grades until the boundaries of the annual growth rings were clearly defined.

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 good 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 this building were compared with each other and those that were found to cross-match were combined to form a site master curve. This master curve and the remaining unmatched ring sequences were then 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.

These tree-ring dates can initially only date the rings present in the timber. Their interpretation 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 that 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. Alternatively, if bark-edge survives, then a felling date can be directly utilised from the date of the last surviving ring. The sapwood estimates applied through-out 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). The dates obtained by the technique do not by themselves necessarily indicate the date of the structure from which they are derived. It is necessary to incorporate other specialist evidence concerning the re-use of timbers and the repairs of structures before the dendrochronological dates given here can be reliably interpreted as reflecting the construction date of phases within the building.

Results

A large number of timbers in the Hall range proved to be suitable for the technique, but it was notably more difficult to locate suitable timbers in the Kitchen range. This was due primarily to the lack of rings present in the timbers as, for example, the Kitchen range roof included many remarkably fast-grown large timbers. A total of 22 samples were obtained from the building, seven from the Hall range, and 15 from the Kitchen range (Table 1).

Hall Range

The seven samples from this area consisted of five from the highly moulded storey posts from the Armoury, and two studs from the staircase below the Armoury. Two storey post samples were unsuitable. Sample **7** was abandoned due to the presence of nails within the timber, whilst

sample **9** appears to be a modern replacement. The five successful samples cross-matched to create a 107-year master chronology (Table 2 and Figure 2) dated by reference to a range of chronologies to the period AD 1316 - 1422 inclusive (Table 3). Two samples included sapwood (Figure 2). Contemporaneous sampling notes indicate that sample **10** may have been complete to bark-edge, although since the sample was taken at floor level and was particularly vulnerable to damage (feet, vacuum cleaners, etc), this is by no means a positive identification. Applying a 10-55 sapwood estimate to these two cores indicates felling in the range AD 1422-60. The additional evidence from sample **10** could be taken to indicate felling sometime in the AD 1420's (at least after 1422) or perhaps in the AD 1430's.

Kitchen Range

Fifteen samples were obtained from the Kitchen range - seven samples were taken from the roof over the Kitchen, five from the Ante-room, and three from an unnamed room between the Ante-Room and the Tanners Suite. However only nine of these were suitable for analysis. Several of the rest were derived from exceptionally fast grown trees which included too few rings for reliable analysis, and several fragmented badly during sampling. The difficulties of obtaining suitable material highlights a major difference between the timbers used for the different parts of the building. None of the analysed timbers were found to cross-match reliably with each other or with reference chronologies. No tree-ring date is therefore forthcoming from the Kitchen range of the Hall.

Interpretation

The Armoury posts include one example felled after AD 1422 and probably before *c* AD 1460, and a further two posts that were felled after AD 1397 and after AD 1405. The stairwell below the armoury includes two timbers that may be from the same tree, felled between AD 1415 and *c* AD 1460. The similarity of interpretation of these two groups suggests these two structures are, not surprisingly, contemporary. The most logical interpretation therefore provides a construction date for the Armoury and stairs below of AD1422 to *c* AD 1460. The likely presence of bark-edge on sample **10** suggests that AD1422 or shortly after is possible. However, the deep carving on this post has resulted in an area of *c* 20 x 50 mm as the sole surviving area of sapwood, making convincing identification of bark-edge impossible. In addition the absence of any further sapwood on any of the other posts or stairwell studs makes it difficult to confirm this date by undertaking further sampling.

Discussion

The original intention of the sampling programme was to assist identification of the phasing of the two parts of the building set on slightly different alignments. The difficulty of obtaining

suitable samples from one of these parts prevents the phasing from being understood by this mechanism.

These difficulties presumably support indications that a different phase of construction is involved since even the studs in the armoury staircase produced useful samples but massive timbers in the roof of the kitchen did not. This would suggest that at the very least different groups of timber are involved, and that these are most probably utilised in different periods.

The lack of suitable samples is a common problem with buildings in the West Midlands region. Although such problems exist elsewhere in the country they are perhaps most intractable in this region because of a scarcity of buildings to sample. Other difficult regions have recently begun to yield to comprehensive sampling programmes (eg Essex), whilst other regions are beginning to be comprehensively sampled (eg Devon). Instead of gloom over the failure to provide dates for the Kitchen range here it may be more appropriate to regard the armoury/staircase group as an encouraging success that indicates that local chronologies can be constructed from the West Midlands.

Conclusion

The armoury/staircase area of St Mary's Guildhall, Coventry is dated by tree-ring analysis to the early/middle fifteenth-century period. The Kitchen range is undated despite extensive sampling. No indication is thus available regarding the relative phasing of these two separate parts of the complex.

The chronology produced is one of the first replicated sequences of dated material from Coventry and is probably of great value to future regional tree-ring projects.

Acknowledgements

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Figure 1 Plan of Second floor of St Mary's Guildhall, Guildhall. (Figure derived from Coventry City Council plan)

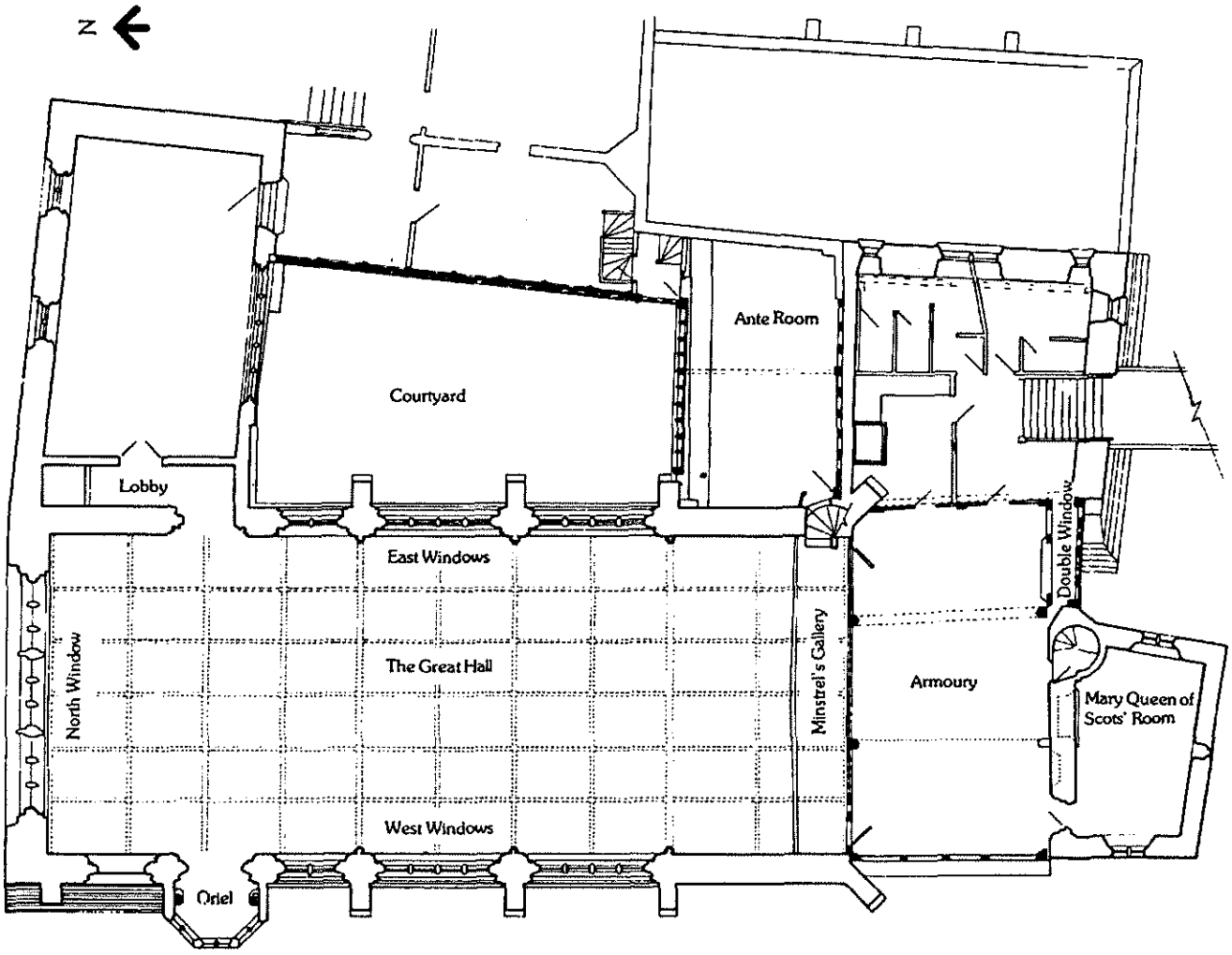

Figure 2. Bar diagram showing the relative positions of the dated ring sequences from the armoury of St Marys Guildhall, Coventry, West Midlands.

White bars - heartwood rings; Shaded bars - sapwood rings; ?B - possible bark-edge

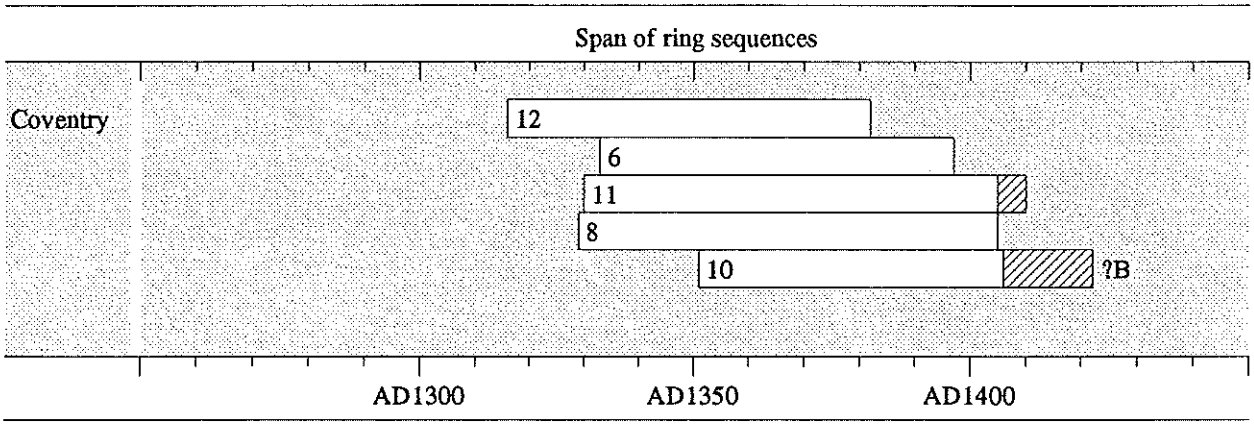

Table 1

St Marys Guildhall, Bayley Lane Coventry West Midlands SP336790

Sample	*Description*	*Species*	*Pith*	*RingNo*	*SapNo*	*Bark*	*ARW*	*Result*	*StartDate*	*EndDate*
1	Kitchen Roof ridge	Quercus spp. (Oak)	V	51	0	N	3.48	Measured but undated		
2	Kitchen Roof west king post	Quercus spp. (Oak)						Not measured		
3	Kitchen Roof west tiebeam	Quercus spp. (Oak)	G	119	21	!	1.09	Measured but undated		
4	Kitchen Roof NE corner post	Quercus spp. (Oak)	G	45	0	N	3.01	Measured but undated		
5	Kitchen Roof east tiebeam	Quercus spp. (Oak)	F	51	0	N	3.44	Measured but undated		
6	Armoury post	Quercus spp. (Oak)	C	65	0	N	2.46	Measured and dated	AD1333	AD1397
7	Armoury post	Quercus spp. (Oak)						Not measured		
8	Armoury post	Quercus spp. (Oak)	G	77	0	N	3.05	Measured and dated	AD1329	AD1405
9	Armoury post (probably modern)	Quercus spp. (Oak)						Not measured		
10	Armoury post	Quercus spp. (Oak)	G	72	16	!	3.28	Measured and dated	AD1351	AD1422
11	Stairwell stud	Quercus spp. (Oak)	F	81	5	N	2.33	Measured and dated	AD1330	AD1410
12	Stairwell stud	Quercus spp. (Oak)	C	67	0	N	2.70	Measured and dated	AD1316	AD1382
13	Ante-room stud	Quercus spp. (Oak)	F	87	0	N	2.23	Measured but undated		
14	Ante-room tiebeam	Quercus spp. (Oak)	C	101	3	N	1.58	Measured but undated		
15	Kitchen Roof NE corner post (lower)	Quercus spp. (Oak)	G	40	6	N	2.49	Measured but undated		
16	Kitchen Roof SW corner post	Quercus spp. (Oak)						Not measured		
17	Ante-room S wall post	Quercus spp. (Oak)						Not measured		
18	Ante-room S wall stud	Quercus spp. (Oak)						Not measured		
19	Unnamed Room NS west top plate	Quercus spp. (Oak)						Not measured		
20	Unnamed Room EW south top plate	Quercus spp. (Oak)	C	60	16	N	2.08	Measured but undated		
21	Unnamed/Tanners west door brace	Quercus spp. (Oak)	G	67	0	N	1.84	Measured but undated		
22	Ante-room/Unnamed east door post	Quercus spp. (Oak)						Not measured		

Table 2

Correlation's between the dated material from St Mary's Guildhall, Coventry. (- = *t*-values below 3.5)

			***t*-values**	
sample			**samples**	
	8	*10*	*11*	*12*
6	4.3	-	3.6	3.8
8		4.3	3.8	-
10			-	-
11				6.7

Table 3

Dating of the master curve from St Mary's Guildhall, Coventry. *t*-values with dated reference chronologies. All the reference curves are independent.

Area	Reference chronology	*t*-values
Here & Worcs	King's Pyon (Groves and Hillam 1993)	4.4
	Colwall (Hillam 1991b)	5.6
	Upwich chronology 2 (Groves and Hillam forthcoming)	4.9
Devon	Exeter Bowhill (Hillam 1991a)	5.0
London	Southwark Boats chronology 3 (Tyers unpubd)	4.6
Hampshire	Alton (Hillam 1983)	4.7
Essex	Essex chronology 2 (Tyers unpubd)	5.1

Table 4

Ring-width data of the site master curve for oaks from the armoury of St Mary's Guildhall, Coventry, West Midlands, dated AD 1316-1422 inclusive.

year	ring widths (0.01mm).										number of trees per year									
AD 1316						143	125	154	174	132						1	1	1	1	1
	180	198	271	294	262	270	542	326	360	439	1	1	1	1	1	1	1	1	2	3
	276	337	290	285	294	212	289	288	318	312	3	3	4	4	4	4	4	4	4	4
	302	329	369	292	360	310	147	146	192	167	4	4	4	4	4	4	4	4	4	4
AD 1351	323	230	346	422	358	320	337	195	267	198	5	5	5	5	5	5	5	5	5	5
	241	410	360	384	312	290	293	261	278	302	5	5	5	5	5	5	5	5	5	5
	234	286	230	281	240	300	328	350	354	336	5	5	5	5	5	5	5	5	5	5
	290	329	288	196	241	272	310	293	246	187	5	5	4	4	4	4	4	4	4	4
	178	202	234	218	218	346	256	267	291	307	4	4	4	4	4	4	4	3	3	3
AD 1401	268	235	325	297	211	193	191	239	233	183	3	3	3	3	3	2	2	2	2	2
	101	189	209	138	163	179	124	214	122	255	1	1	1	1	1	1	1	1	1	1
	164	145									1	1								