

Ancient Monuments Laboratory  
Report 23/93

TREE-RING DATING OF OAK TIMBERS  
FROM LANGLEY GATEHOUSE, SHROPSHIRE

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Summary

Analysis of eight samples removed during recent renovation work indicated that the post-medieval timbers had been felled in the winter of AD1606/7. A tree-ring chronology spanning the period AD1491-1600 was also produced.

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## TREE-RING DATING OF OAK TIMBERS FROM LANGLEY GATEHOUSE, SHROPSHIRE

### Introduction

Langley Gatehouse (NGR SO539002) is a Grade II\* listed building of two storeys. It was once the entrance to the part-moated and part-walled Langley Hall which was demolished in the 19th century. The building, which was recently acquired by the Landmark Trust, is currently undergoing renovation work. During renovation, sections of some of the post-medieval timbers were replaced. The thirteen original sections were kept by the City of Hereford Archaeological Unit who made these available for dendro-chronological analysis. Since the sections were a representative selection of the post-medieval timbers, it was not necessary to remove cores from the *in situ* timbers.

A full report on the building can be obtained from the City of Hereford Archaeological Unit (Morris 1992).

### Methods

The sections of timber removed during renovation were cut down into slices of 50-100mm thickness. The cross-sections were polished using a sander with paper of medium grit, and then finished by hand polishing with fine silicon carbide paper. The ring widths were measured to an accuracy of 0.01mm on a travelling stage which is connected to an Atari microcomputer. The Atari uses a suite of dendrochronology programs written by Ian Tyers (pers comm 1992). The measured ring sequences were plotted as graphs using an Epson HI-80 plotter. The longest ring sequence was selected, and each of the remaining graphs slid past this on a light box until the position of best fit was found. The process was repeated using the next longest sequence and so on until all the samples had been crossmatched. The Atari was used to provide a measure of the level of correlation between the matching sequences. 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 was achieved by averaging the data from the matching sequences to produce a site master curve, 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. Potential tree-ring dates are then checked by examining the quality of the visual match between the graphs.

If a sample has bark or bark edge, the date of the last measured ring is the date in which the tree was 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.

### **Results**

Thirteen offcuts were available for study. Some of these had knotty ring sequences or insufficient rings (less than 50 - see Hillam et al 1987). The eight samples selected for further study came from four purlins, one post, two wallplates, and two soleplates (Table 1). When the cross-sections had been polished, sample 5 was rejected because its ring sequence was obscured by knots. The remaining samples had 54-95 rings. Sapwood was present on three of the samples, one of which was complete to the bark surface. Unfortunately the sapwood of the latter (sample 6/WP6) had been badly attacked by insects, making ring measurement difficult.

The seven ring sequences crossmatched each other (Table 2) and their ring widths were averaged to produce a master chronology of 110 years (Table 3). When it was tested against dated reference chronologies, a strong match was found over the period AD1491-1600 (Table 4).

The results are summarised in Figure 1 and Table 5. The last measured sapwood ring on sample 6 dates to AD1600 and there were a further 6 unmeasured rings before the bark surface. The outermost ring appeared to be complete indicating that the timber was felled in the winter or early spring of AD1606/7. The tree-ring dates from the other dated timbers suggest that they were probably also felled at this time.

#### Acknowledgements

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#### References

- Baillie MGL 1982** *Tree-Ring Dating and Archaeology*, London: Croom Helm.
- Baillie MGL 1977** An oak chronology for south central Scotland, *Tree Ring Bulletin* 37, 33-44.
- Baillie MGL & Pilcher JR 1973** A simple crossdating program for tree-ring research, *Tree Ring Bulletin* 33, 7-14.
- Groves C 1990** Tree-ring analysis of timbers from Beverley Gate, Hull, Humberside, 1986-90. *Ancient Monuments Laboratory report series* 78/90.
- Groves C & Hillam J 1992a** Tree-ring analysis and dating of timbers from Upwich, Droitwich, Hereford & Worcester, 1983-84. CBA Research Report (forthcoming).
- Haddon-Reece D & Miles DH 1993** The tree-ring dating of upper House Farm, Nuffield. *Ancient Monuments Laboratory report series* (forthcoming).
- Hillam J, Morgan RA & Tyers I 1987** Sapwood estimates and the dating of short ring sequences. In RGW Ward (ed), *Applications of tree-ring studies: current research in dendrochronology and related areas*, BAR S333, 165-85.

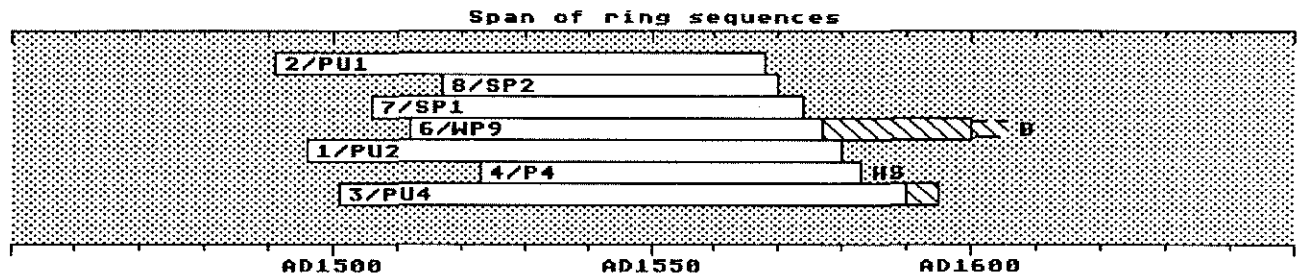
**Laxton RR & Litton CD 1988** *An East Midlands master tree-ring chronology and its use for dating vernacular buildings.* University of Nottingham, Dept of Classical & Archaeological Studies, Monograph Series III.

**Leggett PA 1980** *The use of tree-ring analyses in the absolute dating of historical sites and their use in the interpretation of past climatic trends,* PhD Thesis, CNA A (Liverpool Polytechnic).

**Morriss RK 1992** *Langley Gatehouse, Langley, Shropshire - an interim report,* Hereford Archaeology Series 143.

**Siebenlist-Kerner V 1978** *The chronology, 1341-1636, for certain hillside oaks from Western England and Wales.* In JM Fletcher (ed), *Dendrochronology in Europe*, BAR S51, 157-61.

**Munro MAR 1984** *An improved algorithm for crossdating tree-ring series,* *Tree Ring Bulletin* 44, 17-27.



**Key:**

- |              |                                |
|--------------|--------------------------------|
| white bars   | - heartwood rings              |
| hatching     | - sapwood                      |
| broken lines | - unmeasured rings             |
| B            | - bark edge                    |
| HS           | - heartwood-sapwood transition |

Fig 1: Bar diagram showing the relative positions of the dated ring sequences.

Table 1: Details of the tree-ring samples. Cross-sectional sketches are not to scale; HS - heartwood-sapwood transition; "+" - unmeasured rings.


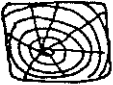






sample	timber	total no of rings	sapwood rings	average ring width (mm)	sketch	dimensions (mm)	comments
1	purlin PU2	85	-	2.38		190x160	
2	purlin PU1	78	-	1.75		195x155	
3	purlin PU4	95	5	1.46		180x150	
4	post P4	61	HS	1.73		215x105	
5	wallplate WP7	-	-	-		160x150	knotty; rejected
6	wallplate WP9	89+	23+	1.83		230x200	+6 to bark surface
7	soleplate SP1	69	-	2.59		235x190	
8	soleplate SP4	54	-	3.45		235x130	

Table 2: *t* value matrix showing the correlation between the matching ring sequences. Values less than 3.0 are not listed.

	1	2	3	4	6	7	8
1	*	7.5	3.1	6.9	4.4	6.3	3.7
2		*		5.6	4.2	5.5	3.2
3			*	3.8	4.9	3.3	4.1
4				*	3.6	7.5	4.1
6					*	4.1	
7						*	4.0
8							*



Table 3: Langley Gatehouse tree-ring chronology, AD1491-1600.

year	ring widths (0.01mm)											no of samples								
AD1491	352	215	227	369	343	276	247	196	278	362	1	1	1	1	1	2	2	2	2	2
AD1501	252	235	200	229	279	222	205	223	242	201	3	3	3	3	3	4	4	4	4	4
	276	301	326	317	253	265	245	302	395	322	4	5	5	5	5	5	6	6	6	6
	323	360	239	283	216	311	299	336	284	275	6	6	7	7	7	7	7	7	7	7
	365	267	255	278	265	307	318	292	286	291	7	7	7	7	7	7	7	7	7	7
	205	130	182	194	230	194	174	198	196	191	7	7	7	7	7	7	7	7	7	7
AD1551	209	177	181	151	142	102	104	167	162	194	7	7	7	7	7	7	7	7	7	7
	218	240	190	166	98	71	98	131	158	177	7	7	7	7	7	7	7	7	6	6
	132	111	88	111	111	110	78	85	103	128	5	5	5	5	4	4	4	4	4	4
	118	73	90	87	99	117	105	63	80	79	3	3	3	2	2	2	2	2	2	2
	75	76	73	105	130	91	61	71	81	71	2	2	2	2	2	1	1	1	1	1

Table 4: Dating the Langley chronology. t values with dated reference chronologies.

chronology	t value
Droitwich, Upwich 3 (Groves & Hillam 1993)	6.4
East Midlands (Laxton & Litton 1988)	6.8
Hull, Beverleygate 1 (Groves 1990)	5.0
London, Southwark (Tyers pers comm)	4.0
Nuffield (Haddon-Reece & Miles 1993)	4.9
Oxford (Haddon-Reece & Miles pers comm)	5.5
Peel Hall 2 (Leggett 1980)	5.2
Reigate (Tyers pers comm)	4.4
Scotland (Baillie 1977)	3.9
Welsh border (Siebenlist-Kerner 1978)	5.7
Winchester Round Table (Haddon-Reece pers comm)	7.1
Yorkshire 1 (Hillam unpubl)	4.6

Table 5: Summary of the tree-ring dates. A sapwood estimate of 10-55 rings is used to calculate the felling date ranges in the absence of bark edge. All dates are AD; H/S - heartwood-sapwood transition.

sample	date span of measured rings	sapwood rings	felled
1/PU2	1496-1580	-	1590+
2/PU1	1491-1568	-	1578+
3/PU4	1501-1595	5	1600-1645
4/P4	1523-1583	H/S	1593-1638
6/WP9	1512-1600+6	23+6	1606/7
7/SP1	1506-1574	-	1584+
8/SP2	1517-1570	-	1580+