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# THE CONFERENCE CENTRE, WHALLEY ABBEY, WHALLEY, LANCASHIRE TREE-RING ANALYSIS OF TIMBERS

# SCIENTIFIC DATING REPORT

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# The Conference Centre, Whalley Abbey, Whalley, Lancashire Tree-Ring Analysis of Timbers

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## Summary

A total of 28 timbers was sampled from various areas within the Conference Centre, of which nine had ring series too short for further analysis. Only six timbers could be dated, all of which appear to form a single group of timbers most likely felled in the period AD 1478–1508. This is later than the AD 1440s date by which it is thought the original Abbot's lodgings had been completed, and earlier than the known remodelling by Bishop Paslew in c. AD 1520, but may relate to the building of the north-west gateway in AD 1480. Two joists from the cellar of the ground floor south-east corner room matched each other well, but their combined series did not date.

## Keywords

Dendrochronology Standing Building

#### Introduction

The Conference Centre at Whalley Abbey (NGR SD 731 360; Fig 1) is part of a complex of buildings remaining on the site of the one-time Cistercian monastery (Fig 2), the other buildings including the North Range (a post-Dissolution building), and the monastic Gateway and West Cloister (a Building at Risk). Building work at the Abbey began in around AD 1320 and carried on throughout most of the fourteenth century. The Abbot's lodgings were completed by the AD 1440s and the north-east gateway was built in AD 1480. The Abbey was dissolved in AD 1537 and was bought by the Assheton family, who subsequently converted parts of the Abbot's house and Infirmary into a residence, which was complete by around AD 1680. The southern part of the west wing of the mansion is now roofless, and much of the north-west wing of the mansion is thought to be of nineteenth-century origin. There is a first-floor hall open to the roof, with trusses which have king posts rising from high collars and moulded arch braces. Between the purlins and the principal rafters are carved triangular braces. This hall is supported on huge beams visible from the ground floor, and the structure is thought to date to around AD 1500. The east wing has two dates associated with it, a date stone carved '1588' and a lead rainwater hopper with '1698' on it.



Figure 1: Map showing the location of Whalley Abbey (centre).



Figure 2: Map showing the Whalley Abbey complex.

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#### **Methodology**

The site was visited twice in April 2005, when the Conference Centre (Fig 2) was investigated. Also on these occasions, assessments were carried out on the roof of the now-disused West Cloisters (a Building at Risk, thought to have been roofed in c AD 1730–60), and the Gateway. It was hoped to visit on a subsequent occasion to sample the North Range, which had been assessed as suitable, but this could not be scheduled to suit the various occupants. In the initial assessment, accessible oak timbers with more than 50 rings and traces of sapwood were sought, although slightly shorter sequences are sometimes sampled if little other material is available. Those building timbers judged to be potentially useful were cored using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis. Some slices of timbers removed during renovation work were also collected.

The cores were prepared for measuring by sanding, using an electric belt-sander with progressively finer grit papers down to 400 grit. Any further preparation necessary, eg where bands of narrow rings occurred, was done manually. Suitable samples had their tree-ring sequences measured to an accuracy of 0.01mm, using a specially constructed system utilising a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC, which recorded the ring widths into a dataset. The software used in measuring and subsequent analysis was written by lan Tyers (2004). Cross-matching and dating was accomplished by a combination of visual matching and a process of qualified statistical comparison by computer. The ring-width series were compared for statistical cross-matching, using a variant of the Belfast CROS program (Baillie and Pilcher 1973). Ring sequences were plotted to allow visual comparisons to be made between sequences on a light table. This method provides a measure of quality control in identifying any errors in the measurements when the samples cross-match.

In comparing one sequence or site sequence against another, *t*-values over 3.5 are considered significant, although in reality it is common to find *t*-values of 4 and 5 which are demonstrably spurious because more than one matching position is indicated. For this reason, it is necessary to obtain some *t*-values of 5, 6, and higher, and for these to be well replicated with different, independent chronologies and with local and regional chronologies well represented, unless the timber is imported. Where two individual sequences match with a *t*-value of 10 or above, and visually exhibit exceptionally similar ring patterns, they may have been derived from the same parent tree.

When cross-matching between samples is found, their ring-width sequences are averaged to form an internal 'working' site mean sequence. Other samples may then be incorporated after comparison with this 'working' master until a final site sequence is established. This is then compared with a number of reference chronologies (multi-site chronologies from a region) and dated individual site masters in an attempt to date it. Individual long series which are not included in the site mean(s) are also compared with the database to see if they can be dated.

The dates thus obtained represent the time of formation of the measured rings in each sample. These dates require interpretation for the construction date of the phase under investigation to be determined. An important aspect of this interpretation is the estimate of the number of sapwood rings missing. The sapwood estimates used here are based on those proposed for this area by Miles (1997a), in which 95% of oaks contain 11–41 rings. Where complete sapwood or bark is present, the exact date of tree felling may be determined.

The dates derived for the felling of the trees used in construction do not necessarily relate directly to the date of construction of the building. However, evidence suggests that, except in the reuse of timbers, construction in most historical periods took place within a very few years after felling (Salzman 1952; Hollstein 1965).



Figure 3: Ground-floor plan showing the approximate positions of samples taken for dendrochronology, adapted from an original drawing by the Ashworth Burke Partnership



Figure 4: First-floor plan showing the approximate positions of samples taken for dendrochronology, adapted from an original drawing by the Ashworth Burke Partnership



**Figure 5:** Plan of the second floor over the south-west corner of the north-west wing, showing the approximate positions of samples taken for dendrochronology, adapted from an original drawing by the Ashworth Burke Partnership



**Figure 6:** Field sketch of the east wing roof showing the timbers sampled for dendrochronology and the form of the trusses

#### **Results and Discussion**

The Gateway and West Cloister building were assessed as having too few timbers with enough rings to be useful for dendrochronology, and were therefore not sampled.

Many areas of the main Conference building were also assessed as having no timbers with sufficiently long ring series to be dated, and were therefore not sampled. These included the roof structure and floor joists to the main first-floor Hall, although the cross-beams supporting the floor were suitable, and the roof over the room West 6 and the lobby (see Fig 4). In other areas, some series were seen to be rather marginal in terms of their ring numbers, but it was felt that they may be worth sampling because of the potential number of other timbers with which their short series may match.

The approximate positions of the timbers sampled are shown in Figures 3–6 and described in Table 1, which also contains other information about the samples. Nine series were found to have too few rings to be analysed further, and several of the remaining series were shorter even than was thought in the assessment. Cross-matching between the series was generally poor, although some tentative matches were identified. The series were therefore compared with the dated reference material as individuals in an attempt to date them. Only six series gave satisfactory replicated results (Tables 2a–2f) which confirmed some of the tentative intra-site cross-matching (Table 3). Although WYA20 produced a *t*-value of 7.4 (63 years overlap) with WYA03, this could not be confirmed by any further intra-site cross-matching or by individual comparison against reference material and was therefore left out of further consideration. Samples WYA16 and WYA17 matched each other well (t = 9.3, 50 years overlap), but the combined series WYA1617m gave no consistent matches with reference material, and the series therefore remains undated.

The generally poor cross-matching between the dated series (Table 3) was perhaps because they are generally rather short, but also perhaps because the timbers came from a variety of sources. There is some evidence for this from the dating of the individual series (Tables 2a–2f). Some individual timbers have their strongest matches against chronologies a long way from Whalley, eg WYA05, which matches best against reference material from southern counties, whereas others give their strongest matches und/or the Welsh borders, although in several cases they do match well and consistently with reference data from the north-west and Yorkshire regions.

A 116-year site chronology, **WHALLEY1**, was produced from the dated series, which itself dated well (Table 4). This situation is not one where a site chronology would automatically be produced, since the timbers may have come from multiple sources and do not match each other well. However, there is no evidence for re-use of the timbers and they do seem to represent a single batch, most likely felled contemporaneously, and provide a robust site master which may be of use for dating other structures in the north-west. The relative cross-matching positions of the dated series are illustrated in Figure 6, which also shows their interpreted likely felling date ranges. The data for the site chronology are presented in Table 5. The mean heartwood-sapwood boundary date for the group is AD 1467, giving a likely felling date range for the group of AD 1478–1508.

This date range encompasses AD 1480, which is thought to be the date of the gateway, and it may be that this represents the main building phase of the earliest remains of the building that now forms the Conference Centre. Though the lack of complete sapwood does not allow precise dates to be found, there is a strong suggestion that these timbers pre-date the remodelling of the Abbot's house carried out by Bishop Paslew *c*. AD 1520, and are after the AD 1440s date generally accepted as the completion date of the original Abbot's lodgings. Although few timbers dated, they represent three different areas of the building, the ceiling of the ground-floor south-east room, the supports for the first-floor hall, and the ceiling of the entrance hall, and suggest that the majority of the existing structure dates to this time.

The North Range was assessed as having the most promising timbers available for dendrochronology on the whole site, and there was a long delay in reporting this work whilst attempts were made to arrange access to this range. This has so far not proved practical because of the needs of the commercial enterprises using this range, but it is hoped that it will be possible to date the North Range in the future.

#### **Acknowledgements**

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Sample	Timber and position	No of	Mean	Mean	Dates AD	H/S	Sapwood	Felling seasons		
Number		rings	width	sens	Spanning	bdry AD	complement	and dates/date		
			(mm)	(mm)				ranges (AD)		
North-wes	st wing: first-floor room West 8, window W	/1.25								
WYA01	East support to south bay window	<45	NM	-	-	-	-	unknown		
WYA02	Middle support to south bay window	<45	NM	-	-	-	-	unknown		
East wing: ground-floor main bedroom (south-east corner room)										
WYA03	Ceiling beam 2	90	1.97	0.26	1380-1469	1469	H/S	1480-1510		
WYA04	Ceiling beam 3	72	1.69	0.25	undated	-	I	unknown		
WYA05	Ceiling beam 4	61	1.32	0.20	1359-1419	-	-	after 1430		
WYA06	Moulded ceiling beam I	<45	NM	-	-	-	-	unknown		
WYAI5	South joist in cellar	89	1.02	0.17	undated	-	?H/S	unknown		
WYAI6	Middle joist in cellar	80	1.44	0.19	undated	-	?H/S	unknown		
WYAI7	North joist in cellar	50	1.46	0.21	undated	-	?H/S	unknown		
Conference	e hall: first-floor Manager's Office					•		•		
WYA07	Floor beam on south side of room	<45	NM	-	-	-	-	unknown		
Conference	e hall: beams supporting the first-floor hall			·		·		·		
WYA08	Beam third from east end	<45	NM	-	-	-	-	unknown		
WYA09	Beam at east end	<45	NM	-	-	-	-	unknown		
WYAI0	Beam third from west end	69	2.33	0.20	1387–1455	1455	H/S	1466–96		
WYAII	Beam second from west end	<45	NM	-	-	-	-	unknown		
WYAI2	Beam at west end	77	3.11	0.14	1393-1469	1469	H/S	1480-1510		
WYAI3	Beam fifth from west end	63	1.74	0.24	undated	-	-	unknown		
WYAI4	Beam fourth from west end	74	2.87	0.22	undated	-	-	unknown		
Conference	e hall: ground-floor entrance hall		-	•						
WYAI8	North central beam	97	1.38	0.23	1371–1467	1467	H/S	1478–1508		
WYAI9	South central beam	84	1.08	0.20	39 - 474	1474	H/S	1485-1515		

Table 1: Details of oak (Quercus spp.) timbers sampled from the Conference Centre, Whalley Abbey, Lancashire

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# Table 1 continued:

Sample Number	Timber and position	No of rings	Mean width (mm)	Mean sens (mm)	Dates AD Spanning	H/S bdry AD	Sapwood complement	Felling seasons and dates/date ranges (AD)	
East wing roof									
WYA20	Principal rafter 1 east	70	1.93	0.17	undated	-	17'∕₄C	unknown	
WYA21	Tie I	50	3.19	0.13	undated	-	8	unknown	
WYA22	Upper east purlin, bay I	56	2.22	0.18	undated	-	16C?	unknown	
WYA23	Intermediate tie, bay I	<45	NM	-	-	-	-	unknown	
WYA24	Principal rafter 1 west	<45	NM	-	-	-	-	unknown	
WYA25	Principal rafter 3 east	59	1.81	0.16	undated	-	15C?	unknown	
WYA26	West upper purlin, bay 2	45	1.96	0.21	undated	-	-	unknown	
North-west wing: second floor, south-west corner room									
WYA27	Upper west purlin	66	1.70	0.20	undated	_	H/S?	unknown	
WYA28	Lower west purlin (re-used?)	52	2.48	0.15	undated	-	-	unknown	

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Key: NM = not measured; H/S = heartwood sapwood boundary; C = complete sapwood, winter felled; <sup>1</sup>/<sub>4</sub>C = complete sapwood, spring felled the following year

Table 2a: Dating evidence for the series WYA03 AD 1380-1469

County/ region:	Chronology name:	Short publication reference:	File name:	Spanning:	Overlap	t-value
				(yrs AD)	(yrs)	
Shropshire	Upper Lake, Westbury	(Miles and Worthington 2000)	UPRLAKE	1418–1546	52	6.7
Birmingham	Saracen's Head, King's Norton	(Tyers, pers comm)	KINGNOSH	1367-1491	90	6.7
Wales	Ystumcolwyn Barn, Meifod	(Miles <i>et al</i> 2005)	YSTUMI	1416-1558	54	6.6
Cornwall	Cullacott	(Miles 1995)	CULACOTI	1394-1481	76	6.4

Table 2b: Dating evidence for the series WYA05 AD 1359-1419

County/ region:	Chronology name:	Short publication reference:	File name:	Spanning: (yrs AD)	Overlap (yrs)	t-value
Sussex	Parthings House	(Miles <i>et al</i> forthcoming)	PARTHNGS	1336-1479	61	6.1
Buckinghamshire	Baylins Farm	(Miles and Worthington 2002)	BAYLINSI	1352–1446	61	5.8
Hampshire	The Priory, Odiham	(Miles and Worthington 2000)	ODIHMPRY	1207-1448	61	5.5
Bedfordshire	Bellframe, Cranfield	(Bridge 1998a)	CRANFLD	1342-1469	61	5.2

Table 2c: Dating evidence for the series WYA10 AD 1387–1455 (regional multi-site chronologies have the file name in **bold**)

County/ region:	Chronology name:	Short publication reference:	File name:	Spanning:	Overlap	t-value
				(yrs AD)	(yrs)	
Wales	St Mary's, Abergeveny	(Miles and Worthington 1999)	ABERGVNY	1349-1482	69	6.3
Wales	Welsh Master Chronology	(Miles 1997)	WALES97	404-1981	69	5.9
Shropshire	Shropshire Master Chronology	(Miles 1995)	SALOP95	881-1745	69	5.9
Herefordshire	Booth Hall, Hereford	(Boswijk and Tyers 1997)	HIGHTOWN	1302–1487	69	5.8

Table 2d: Dating evidence for the series WYA12 AD 1393-1469

County/ region:	Chronology name:	Short publication reference:	File name:	Spanning: (yrs AD)	Overlap (yrs)	t-value
Buckinghamshire	Grove Farm, Chesham	(Miles and Worthington 1998)	GROVEFM	1368-1499	77	5.3
Cheshire	Combermere Abbey, Whitchurch	(Howard <i>et al</i> 2003)	CBMASQ01	1371-1564	77	5.2
Wiltshire	The Old Mansion, Clarendon	(Tyers 1999)	CL_TOM	1315-1625	77	5.1
Wiltshire	Queen Manor Granary	(Tyers 1999)	CL_QMFG1	1337–1602	77	5.1

Table 2e: Dating evidence for the series WYA18 AD 1371-1467

County/ region:	Chronology name:	Short publication reference:	File name:	Spanning: (yrs AD)	Overlap (yrs)	t-value
Gr Manchester	Lightshaw Hall, Golborne	(Groves 1998)	LGHTSHW2	1414–1552	54	5.5
Surrey	Maytree Cottage, Hambledon	(Miles and Worthington 2000)	MAYTREE	1413-1559	55	5.5
Shropshire	Upper Lake, Westbury	(Miles and Worthington 2000)	UPRLAKE	1418-1546	50	5.2
Surrey	Home Farm, Newdigate	(Bridge 1998b)	NEWDIGI	1261-1483	97	4.4

Table 2f: Dating evidence for the series WYA19 AD 1391–1474 (regional multi-site chronologies have the file name in **bold**)

County/ region:	Chronology name:	Short publication reference:	File name:	Spanning: (yrs AD)	Overlap (yrs)	t-value
Wales	Royal House, Machynlleth	(Miles <i>et al</i> 2004)	ROYALHSI	1363-1560	84	5.6
West Yorkshire	Barns at Headley Hall Farm	(Tyers 2001)	HEADLEYI	1381-1604	84	4.9
Wales/borders	Hillside oaks	(Siebenlist-Kerner 1978)	GIERTZ	1341-1636	84	4.8
Southern England	Southern England Master	(Bridge 1988)	SENGLAND	1083-1589	84	4.7

<i>t</i> -values									
Sample no	wya05	wyal0	wyal2	wyal8	wyal9				
wya03	-	-	-	4.3	5.1				
wya05		3.7	-	-	-				
wyal0			-	-	3.9				
wyal2				-	-				
wyal3					-				
wyal8					-				

**Table 3:** Cross-matching between the dated series. A '- ' represents no significant match (ie t = >3.5)

 Table 4: Dating evidence for the site chronology WHALLEY1, AD 1339–1474

County/ region:	Chronology name:	Short publication reference:	File name:	Spanning: (yrs	Overlap	t-value
				AD)	(yrs)	
Berkshire	Round Tower, Windsor Castle	(Miles and Haddon-Reece 2003)	WINDSOR2	1385-1468	84	7.7
Worcestershire	St Andrew's Church, Pixley	(Bridge 2006)	PIXPORCH	1388–1467	80	6.4
Cheshire	Combermere Abbey, Whitchurch	(Howard <i>et al</i> 2003)	CBMASQ01	1371–1564	104	6.3
West Yorkshire	Barns at Headley Hall Farm	(Tyers 2001)	HEADLEYI	1381-1604	94	6.3
Warwickshire	Kingsbury Hall	(Arnold <i>et al</i> 2006)	KNGHSQ01	1391–1564	84	6.2
Warwickshire	Gorcott Hall	(Nayling 2006)	GORC_TI7	1385-1531	90	6.1
Manchester	Stayley Hall	(Nayling 2000)	STAY20	1387–1565	88	6.1
Surrey	Maytree Cottage, Hambledon	(Miles and Worthington 2000)	MAYTREE	1413-1559	62	6.0
Lancashire	Taunton Hall	(Bridge 2003a)	TAUNHALL	1401–95	74	5.5
Shropshire	All Stretton	(Miles <i>et al</i> forthcoming)	ALLSTRET	1386-1509	89	5.5
Lancashire	Stubley Hall	(Bridge 2003b)	STUBLEY	1382-1490	93	5.3



Figure 7: Bar diagram showing the relative positions of overlap of the dated samples, along with their interpreted likely felling date ranges

Table 5: Ring width data for the site chronology WHALLEYI (AD 1339–1474)

	Ring widths (0.01mm)						no of trees			
WH	ALLE	ΥI								
189	242	287	251	250	349	294	308	297	247	
237	271	402	385	440	348	325	297	319	213	
225	235	88	237	325	366	333	180	172	162	
144	180	265	294	283	300	260	193	158	176	2 2 2 2 2 2 2 2 2
148	218	256	226	127	158	127	175	249	211	2 3 3 3 3 3 3 4 4
229	203	236	191	308	259	263	271	205	268	4 4 5 5 6 6 6 6 6 6
248	277	248	185	253	233	219	227	193	213	666666666
248	206	187	185	168	143	159	137	140	158	666666666
133	233	193	188	187	177	177	174	193	199	6 5 5 5 5 5 5 5 5 5 5
206	206	200	222	161	218	197	190	165	153	5 5 5 5 5 5 5 5 5 5 5
116	118	134	136	166	188	170	129	158	155	5 5 5 5 5 5 5 5 5 5 5
148	130	158	135	118	144	122	114	102	100	5 5 5 5 5 5 5 4 4 4
98	118	117	120	138	105	112	137	167	156	4 4 4 4 4 4 4 4 3
154	78	95	64	70	76					3

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