Darganfod Hen Dai Cymreig
Discovering Old Welsh Houses

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DYDDIO HEN DAI CYMREIG | DATING OLD WELSH HOUSES

PROSIECT DENDROCRONOLEG GOGLEDD ORLLEWIN CYMRU | NORTH WEST WALES DENDROCHRONOLOGY PROJECT

Oxford Dendrochronology Laboratory
Report 2011/6

THE TREE-RING DATING OF BRON GORONWY CWM CYNFAL, LLAN FFESTINIOG, GWYNEDD (NGR SH 718 411)

Summary

A total of ten timbers were sampled in this building. One timber showed several growth depressions and could not be dated. Of the remaining nine series, one – a collar – was found to have been from a tree felled in **summer 1477**, whilst all the other roof timbers, and the top plate of a ground-floor screen appear to form a single group of timbers, most likely felled at the same time. Only one timber retained complete sapwood, and was found to have been from a tree felled in **winter 1530/31**. It seems likely therefore that construction took place in **1531**, or within a year or two after this date.

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January 2011

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A report commissioned by The North West Wales Dendrochronology Project in partnership with The Royal Commission on the Ancient and Historical Monuments in Wales (RCAHMW).

The Tree-Ring Dating Of Bron Goronwy, Cwm Cynfal, Llan Ffestiniog, Gwynedd (NGR SH 718 411)

SAMPLING

Sampling took place in November 2010. All the samples were of oak (Quercus spp.). Core samples were extracted using a 15mm diameter borer attached to an electric drill. They were numbered using the prefix deng. The samples were removed for further preparation and analysis. Cores were mounted on wooden laths and then these were polished using progressively finer grits down to 400 to allow the measurement of ring-widths to the nearest 0.01 mm. The samples were measured under a binocular microscope on a purpose-built moving stage with a linear transducer, attached to a desktop computer.

ACKNOWLEDGEMENTS

We would like to thank the owner – Mr Lloyd – for allowing sampling to take place. This study was funded by the North-West Wales Dendrochronology Project, co-ordinated by Margaret Dunn, with support by the Royal Commission on Ancient and Historic Monuments of Wales. ACKNOWLEDGEMENTS We would like to thank the owner – Mr Lloyd – for allowing sampling to take place. This study was funded by the North-West Wales Dendrochronology Project, co-ordinated by Margaret Dunn, with support by the Royal Commission on Ancient and Historic Monuments of Wales.

Table 1: Details of samples taken from Bron Goronwy, Cwm Cynfal, Llan Ffestiniog.

Sample number	Timber and position	Date of series	H/S boundary date	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens	Felling date range
* **mrnb01**	Collar, truss 1	1412-1506	1506	H/S	95	3.35	0.98	0.28	1517–47
* **mrnb02**	South principal rafter, truss 1	1428-1505	1505	H/S	78	1.67	0.63	0.28	1516–46
* **mrnb03**	Top plate to upper floor screen	1456-1514	1514	H/S	59	2.41	1.35	0.32	1525–55
* **mrnb04**	Collar, truss 2	1424-1476	1459	17½C	53	2.47	1.39	0.28	Summer 1477
* **mrnb05**	South raking strut, truss?	1446-1521	1514	7	76	1.97	1.19	0.22	1525–55
* **mrnb06**	South lower purlin, bay 4	1436-1508	1508	H/S	73	1.16	0.68	0.27	1519–49
mrnb07	North principal rafter, truss 3	undated	-	-	100	1.77	0.86	0.22	
* **mrnb08**	Top plate to ground floor screen	1463-1530	1512	18C	68	1.93	1.18	0.28	Winter 1530/31
mrnb09a	West ceiling beam, ground floor	*1459-1506*	*1505*	*1*	*48*	*1.33*	*0.41*	*0.27*	
mrnb09b	*ditto*	*1433-1506*	*1505*	*1*	*74*	*1.24*	*0.36*	*0.24*	
* **mrnb09**	Mean of **09a** and **09b**	1433-1506	1505	1	74	1.29	0.36	0.25	1516–46
mrnb10	East ceiling beam, ground floor	1433-1498	-	6+12NM	66	2.37	0.95	0.19	
* = included in site mean **MRNB**		**1412-1530**			**119**	**1.96**	**0.59**	**0.23**	

Key: H/S bdry = heartwood/sapwood boundary - last heartwood ring date; ½C = complete sapwood, felled the following summer; std devn = standard deviation; mean sens = mean sensitivity; NM = not measured;

Table 2: Cross-matching between dated samples

	t - values						
Sample	**mrnb02**	**mrnb03**	**mrnb04**	**mrnb05**	**mrnb06**	**mrnb08**	**mrnb09**
mrnb01	6.3	8.1	3.1	3.9	1.9	3.5	6.0
mrnb02		5.7	1.5	5.5	4.9	4.3	5.5
mrnb03			1.7	2.9	1.9	2.6	5.6
mrnb04				1.6	1.6	-	1.3
mrnb05					4.6	4.3	3.4
mrnb06						1.2	3.0
mrnb08							1.6

- = no value calculated (less than 20 rings overlap)

Table 3: Dating evidence for the site master **MRNB AD 1412–1530** against dated reference chronologies, regional chronologies in **bold**

County or region:	***Chronology name:***	***Short publication reference:***	***File name:***	***Spanning:***	***Overlap (yrs):***	***t-value:***
Wales	Trefrechan barn	(Miles *et al* 2004)	TREFECHN	1423-1606	108	7.5
Herefordshire	Church House, Allensmore	(Miles *et al* 2006)	CHAM	1357-1551	119	7.4
Wales	Branas-Uchaf, Llandrillo	(Miles and Bridge 2010)	DENBY6	1388-1763	119	7.2
Northern England	Northern England Master	(Hillam and Groves 1994)	**NORTH**	440-1742	119	7.0
Herefordshire	Little Brockhampton Gatehouse	(Nayling 2001)	LBG-T10	1368-1543	119	7.0
Shropshire	Whittington Castle	(Miles *et al* 2004)	WHITNGTN	1351-1628	119	6.9
Wales	Royal House, Machynlleth	(Miles *et al* 2004)	ROYALHS1	1363-1560	119	6.9
Shropshire	Oswestry Old Grammar School	(Miles *et al* 2008)	OSWTRYOG	1356-1552	119	6.7
Wales	Plas Mawr House	(Miles and Haddon-Reece 1996)	PLASMWR2	1360-1578	119	6.7
Wales/borders	Hillside oaks	(Siebenlist-Kerner 1978)	**GIERTZ**	1341-1636	119	6.7
Shropshire	Brookgate Farm	(Miles and Haddon-Reece 1993)	BROOKGT	1362-1611	119	6.4
East Midlands	East Midlands Master	(Laxton and Litton 1988)	**EASTMID**	882-1981	119	6.4
West Sussex	Wenham Manor Barn, Rogate	(Miles 1998)	WENHAM2	1387-1586	119	6.3
Monmouthshire	Waun Farm	(Miles and Bridge 2010)	WAUNMN2	1335-1528	117	6.3

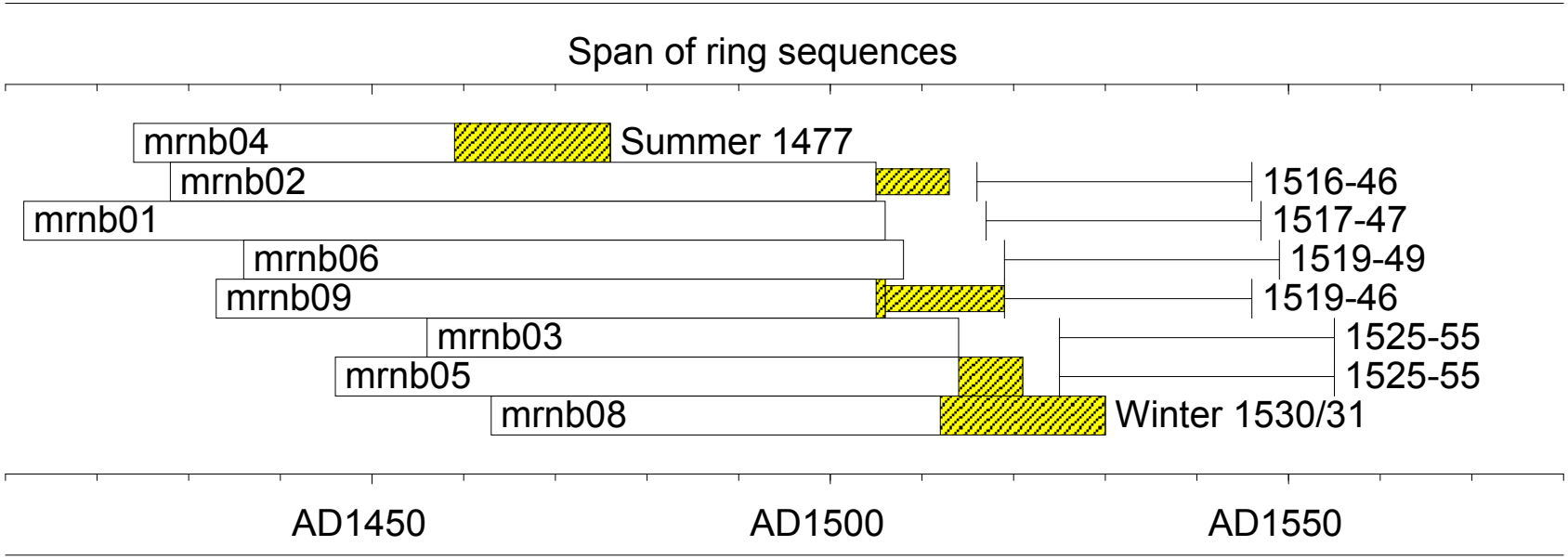
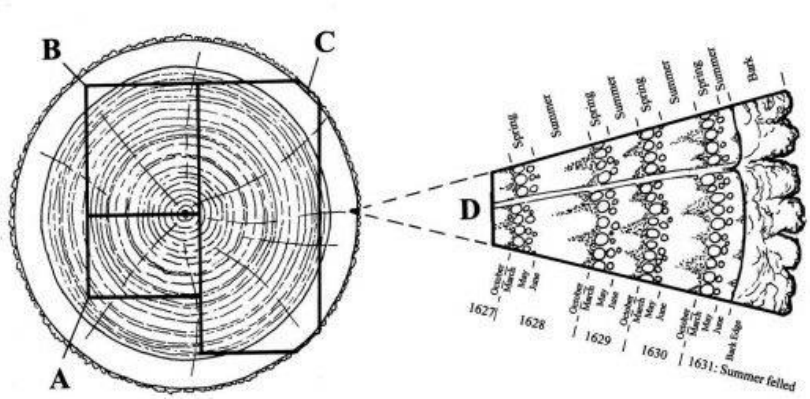


Figure 2: Bar diagram showing the relative positions of overlap of the dated series, along with their interpreted likely felling date ranges. Hatched yellow sections represent sapwood rings, and narrow sections of bar represent additional unmeasured rings

BACKGROUND TO DENDROCHRONOLOGY

The basis of dendrochronological dating is that trees of the same species, growing at the same time, in similar habitats, produce similar ring-width patterns. These patterns of varying ring-widths are unique to The period of growth. Each tree naturally has its own pattern superimposed on the basic 'signal', resulting from genetic variations in the response to external stimuli, the changing competitive regime between trees, damage, disease, management etc. In much of Britain the major influence on the growth of a species like oak is, however, the weather conditions experienced from season to season. By taking several contemporaneous samples from a building or other timber structure, it is often possible to cross-match the ring-width patterns, and by Averaging the values for these sequences, maximise the common signal between trees .The resulting 'site Chronology' may then be compared with existing 'master' or 'reference' chronologies. This process can be done by a trained dendrochronologist using plots of the ring-widths and comparing them visually, which also serves as a check on measuring procedures. It is essentially a statistical process, and therefore requires sufficiently long sequences for one to be confident in the results. There is no defined minimum length of a tree-ring series that can be confidently cross-matched, but as a working hypothesis most dendrochronologists use series longer than at least fifty years. The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's t-test. The t-test compares the actual difference between two means in relation to the variation in the data, and is an established statistical technique for looking at the significance of Matching between two data sets that has been adopted by dendrochronologists. The values of 't' which give an acceptable match have been the subject of some debate; originally values above 3.5 being regarded as acceptable (given at least 100 years of overlapping rings) but now 4.0 is often taken as the base value. It is possible for a random set of numbers to give an apparently acceptable statistical match against a single reference curve – although the visual analysis of plots of the two series usually shows the trained eye the reality of this match. When a series of ring-widths gives strong statistical matches in the same position against a number of independent chronologies the series becomes dated with an extremely high level of confidence. One can develop long reference chronologies by cross-matching the innermost rings of modern timbers with the outermost rings of older timbers successively back in time, adding data from numerous sites. Data now exist covering many thousands of years and it is, in theory, possible to match a sequence of unknown date to this reference material. It follows from what has been stated above that the chances of matching a single sequence are not as great as for matching a tree-ring series derived from many individuals, since the process of aggregating individual series will remove variation unique to an individual tree, and reinforce the common signal resulting from widespread influences such as the weather. However, a single sequence can be successfully dated, particularly if it has a long ring sequence. Growth characteristics vary over space and time, trees in south-eastern England generally growing comparatively quickly and with less year-to-year variation than in many other regions (Bridge, 1988). This means that even comparatively large timbers in this region often exhibit few annual rings and are less useful for dating by this technique. When interpreting the information derived from the dating exercise it is important to take into account such factors as the presence or absence of sapwood on the sample(s), which indicates the outer margins of the tree. Where no sapwood is present it may not be possible to determine how much wood has been removed, and one can therefore only give a date after which the original tree must have been felled. Where the bark is still present on the timber, the year, and even the time of year of felling can be determined. In the case of incomplete sapwood, one can estimate the number of rings likely to have been on the timber by relating it to populations of living and historical timbers to give a statistically valid range of years within which the tree was felled. For this region the estimate used is that 95% of oaks will have a sapwood ring number in the range 11 – 41 (Miles 1997a)



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