Darganfod Hen Dai Cymreig
Discovering Old Welsh Houses

Reports: Welcome to the many Discovering Old Welsh Houses Reports which are available here on our website. All the reports - House Histories, Building Reports and Tree-ring Dating reports - can be accessed - *here*

Discovering Old Welsh Houses studies and celebrates the traditional houses of North Wales and the lives of the people who lived in them.

If you find the content useful, please consider becoming a *Member* to access the many benefits available.

Please note that these reports are being updated as part of an ongoing programme of revision. Older reports sometimes refer to the old names of the Group. Between 2005 and 2012 also known as The Snowdonia Dendrochronology Project, then the N W Wales Dendrochronology Project and then the Dating Old Welsh Houses Group.

New reports will be added from time to time. Keep an eye on our website for updates.

Oxford Dendrochronology Laboratory
Report 2019/10

THE DENDROCHRONOLOGICAL DATING OF TIMBERS FROM LLENNYRCH, TALSARNAU, MERIONETH (SH 6632 3809)

Photo: Ross Cook

Summary

A total of eleven samples were taken from the main range and rear wing of this property. Unfortunately the damp conditions which this property has endured for several years meant that no complete sapwood could be obtained, as the sapwood had degraded on all timbers where it was present. There appears to be little or no difference in the age of the two ranges, and more samples would be needed to differentiate between the two on dendrochronological grounds, but with only one truss in the rear range, this was not possible. If there is any difference, there is a hint the rear range may be a few years earlier. The mean h/s boundary date for all samples is 1528, giving a likely felling date range of 1539–69, which can be modified in view of the rings present to **1542–69**. Bayesian modelling of the sapwood was attempted, but too many individuals did not conform to the model to give a better estimate of the felling date range.

Authors: Dr M. C. Bridge FSA and Ross Cook
Oxford Dendrochronology Laboratory
Mill Farm
Mapledurham
Oxfordshire
RG4 7TX

February 2019

A report commissioned by the Discovering Old Welsh Houses Group in collaboration with the Royal Commission on the Ancient and Historic Monuments Wales (RCAHMW)

The Dendrochronological Dating of Timbers from Llennyrch, Talsarnau, Merioneth (SH 6632 3809)

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 the sequences, maximise the common signal between trees. The resulting 'site chronology' may then be compared with existing 'master' or 'reference' chronologies. These include chronologies made by colleagues in other countries, most notably areas such as modern Poland, which have proved to be the source of many boards used in the construction of doors and chests, and for oil paintings before the widespread use of canvas.

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.

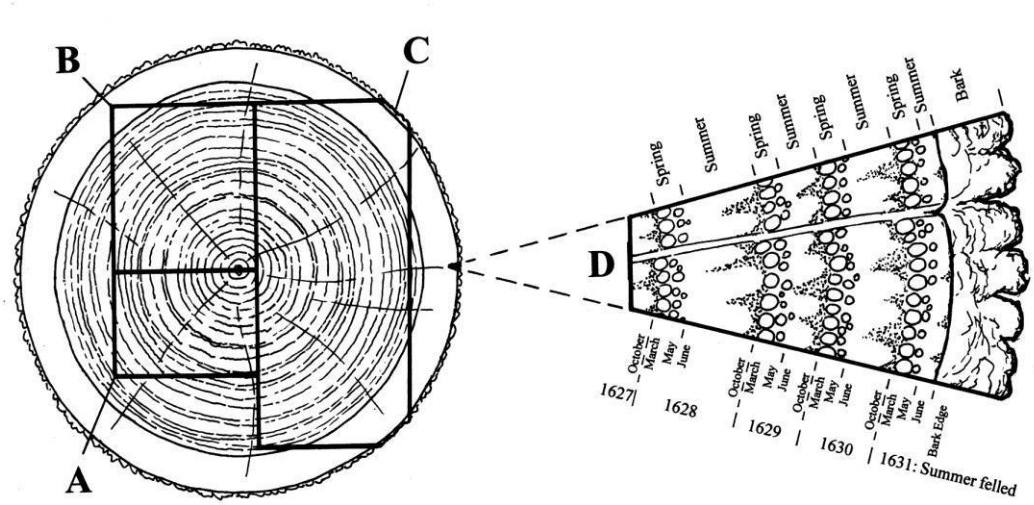
The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's *t*-test. The *t*-test compares the actual difference between two means in relation to the variation in the data, and is an established statistical technique for looking at the significance of matching between two datasets 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 in oak studies. Higher values are usually found with matching pine sequences. 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 1997).



Section of tree with conversion methods showing three types of sapwood retention resulting in **A** *terminus post quem*, **B** a felling date range, and **C** a precise felling date. Enlarged area **D** shows the outermost rings of the sapwood with growing seasons (Miles 1997, 42)

Llennyrch

This derelict property, owned by the Woodland Trust since 2015, Llennyrch is a substantial house of Snowdonian plan-type of with fireplace stair, former post-and-panel partition between entrance passage and outer rooms (mortices in the beam only now), and a rear kitchen wing. It was remodelled in the C19th when new partitions were created including an astonishing slate partition between parlour and service-room. There are collar-beam trusses concealed by C19th ceilings. Noted RFS/RCAHMW/2015, NPRN 28532.

SAMPLING

Samples were taken from timbers in the roof structure during February 2019. Core samples were extracted using a 15mm diameter borer attached to an electric drill. They were labelled with the prefix **ych**, and taken away for subsequent analysis, where they were glued to laths.

The samples were polished with 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. Measurements and subsequent analysis were carried out using programs by Ian Tyers (Tyers 2004).

RESULTS AND DISCUSSION

The locations and details of the samples are described in Table 1. Cross-matching between the dated samples is shown in Table 2. One timber, **07**, whilst rather sensitive (i.e. showing a lot of year-to-year variation in ring-width), did not appear significantly different to the other series. However, it failed to give consistent matches, and could not be dated individually. It was therefore excluded from further analysis. The relative positions of overlap of the samples (Fig 1) suggest that both wings may be contemporaneous. More samples from the rear wing may help confirm this, but few timbers were available from the single truss. If there is a difference in construction date, the two h/s boundary dates for the rear wing samples might suggest a slightly earlier date for this wing. Further fabric analysis might help resolve this minor issue.

The mean heartwood-sapwood boundary date for all samples is 1528 (1529 for just the main range samples). This suggests a likely felling date range for the whole group of 1539–69, but this can be modified in the light of rings actually present to **1542–69**. An attempt was made to use Bayesian modelling of the sapwood using OxCal, but this revealed that several samples did not fall into a coherent group for such modelling, and no further analysis was undertaken.

The matches for the 120-year site master chronology (Table 3) suggest a very local origin for the trees used, with which it matches very well.

Whilst working at this site RC noticed a possible medieval building platform downslope from the present building position, which may suggest an earlier occupation.

ACKNOWLEDGEMENTS

This report was commissioned by The Discovering Old Welsh Houses Group. We thank the members of DOWHG who made arrangements for our visits, and assisted during the fieldwork, especially at this site, Peter Thompson. We thank the owners, the Woodland Trust, for allowing the work to be carried out. We also thank our fellow dendrochronologists for permission to use their data.

DOWHG wishes to acknowledge the assistance of grant support from the Cambrian Archaeological Association & the March Fitch Fund towards this work.

REFERENCES

Baillie, M.G.L. and Pilcher, J.R. (1973) *A simple cross-dating program for tree-ring research.* **Tree Ring Bulletin**, 33, 7-14.

Bridge, M. C. (1988) *The dendrochronological dating of buildings in southern England,* **Medieval Archaeology**, 32, 166-174.

Bridge, M. C., Miles, D., Suggett, R. and Dunn, M. (2013) Tree-Ring Dating Lists, **Vernacular Architecture**, 44, 105-111.

English Heritage (1998) *Guidelines on producing and interpreting dendrochronological dates,* **English Heritage, London.**

Miles, D. (1997) *The interpretation, presentation, and use of tree-ring dates*, **Vernacular Architecture**, 28, 40-56.

Miles, D. H. and Worthington, M. J. (1999) Tree-ring dates, **Vernacular Architecture**, 30, 98-113.

Miles, D. H., Worthington, M. J. and Bridge, M. C. (2004) Tree-ring dates, **Vernacular Architecture**, 35, 95-113.

Miles, D. H., Worthington, M. J. and Bridge, M. C. (2006) Tree-ring dates, **Vernacular Architecture**, 37, 118-132.

Miles, D. H., Worthington, M. J. and Bridge, M. C. (2007) Tree-ring dates, **Vernacular Architecture**, 38, 120-139.

Miles, D. H., Worthington, M. J. and Bridge, M. C. (2008) Tree-ring dates, **Vernacular Architecture**, 39, 135-146.

Miles, D. H., Bridge, M. C., Suggett, R. and Dunn, M. (2011) Tree-ring dates, **Vernacular Architecture**, 42, 109-116.

Miles, D. H., Bridge, M. C., Suggett, R. and Dunn, M. (2012) Tree-ring dates, **Vernacular Architecture**, 43, 103-106.

Tyers, I. (2004) *Dendro for Windows Program Guide 3rd edn*, **ARCUS Report,** 500b**.**

Table 1: Details of samples taken from Llennyrch, Talsarnau (trusses in the main range are numbered from south to north).

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
Main range									
*** yrch01**	North upper purlin, bay 4	1438–1540	1540	h/s+10NM	103	1.36	0.45	0.18	1551–81
*** yrch02**	South principal rafter, truss 3	1467–1532	1532	h/s	66	2.13	0.49	0.18	1543–73
*** yrch03**	South principal rafter, truss 2	1425–1542	1542	h/s+5NM	118	1.63	0.86	0.17	1553–83
*** yrch04**	South lower purlin, bay 3	1448–1531	1531	h/s+10NM	84	1.36	0.43	0.20	1542–72
*** yrch05**	North upper purlin, bay 1	1439–1541	1541	h/s	103	1.19	0.47	0.23	1552–82
*** yrch06**	North lower purlin, bay 2	1450–1524	1524	h/s	75	1.86	0.69	0.22	1535–65
*** yrch10**	Partition beam, ground floor	1425–1526	1524	2	102	1.78	0.72	0.13	1535–65
Rear (kitchen) range – only one truss									
yrch07	North principal rafter	-	-	6	101	1.55	0.59	0.29	-
*** yrch08**	Collar	1431–1487	-	-	57	1.84	0.45	0.16	After 1498
*** yrch09**	South principal rafter	1454–1525	1525	h/s	72	2.30	1.10	0.22	1536–66
*** yrch11**	Bressumer	1423–1518	1518	h/s	96	2.56	1.64	0.24	1529–59
*** =** included in site master **LLENYRCH**		**1423–1542**	*1528*		**120**	**1.92**	**0.85**	**0.14**	***1542–69***

Key: H/S bdry = heartwood/sapwood boundary - last heartwood ring date; ¼C = complete sapwood, felled the following spring; std devn = standard deviation; mean sens = mean sensitivity; NM = not measured.

Table 2: Cross-matching between the dated samples in site master **LLENYRCH** (* = overlap too short for meaningful comparison)

	t-values								
Sample	**yrch02**	**yrch03**	**yrch04**	**yrch05**	**yrch06**	**yrch08**	**yrch09**	**yrch10**	**yrch11**
yrch01	4.2	6.2	7.3	7.1	6.8	5.5	7.3	6.2	4.5
yrch02		4.6	3.7	4.1	2.9	*	3.3	2.1	2.9
yrch03			4.6	5.8	3.3	4.9	5.6	4.8	4.5
yrch04				8.4	3.4	7.6	6.3	2.6	2.5
yrch05					5.1	8.5	8.6	4.7	3.4
yrch06						2.5	6.0	3.6	2.7
yrch08							4.5	3.3	3.5
yrch09								4.9	4.5
yrch10									2.1

Table 3: Dating evidence for the site chronology **LLENYRCH AD 1423–1542** against dated reference chronologies

County or region:	***Chronology name:***	***Reference***	***File name:***	***Spanning***	***Overlap: (yrs)***	***t-value:***
Site Chronologies						
Merioneth	Plas y Dduallt, Maentwrog	(Miles *et al* 2011)	GWYNEDD5	1355–1604	120	11.7
Caernarvonshire	Cae'nycoed-uchaf, Maentwrog	(Miles *et al* 2007)	BDGLRT17	1407–1592	120	11.1
Merionethshire	Nant-Pasgan-Mawr, Llandecwyn	(Miles *et al* 2008)	HOH	1400–1564	120	10.1
Caernarvonshire	Clenennau, Dolbenmaen	(Miles *et al* 2007)	BDGLRT10	1406–1570	120	9.9
Caernarvonshire	Plas ym Mhenrhos, Penrhos	(Miles *et al* 2012)	PLASMNRS	1413–1607	120	9.5
Caernarvonshire	Dylasau Isaf	(Miles *et al* 2011)	DYLASAU1	1412–1592	120	9.1
Merioneth	Cefn Caer Pennal	(Miles and Worthington 1999)	CEFNCAR1	1404–1525	103	9.0
Caernarvonshire	Y Gesail Gyfarch, Dolbenmaen	(Miles *et al* 2006)	BDGLRT6	1384–1609	120	8.6
Merioneth	Brynmaenllwyd, Trawsfynydd	(Bridge *et al* 2013)	TRAWSFYN	1381–1587	120	8.3
Montgomeryshire	Royal House, Machynlleth	(Miles *et al* 2004)	ROYALHS1	1363–1560	120	8.2
Caernarvonshire	Oerddwr-isaf, Beddgelert	(Miles *et al* 2007)	BDGLRT21	1424–1494	71	8.1

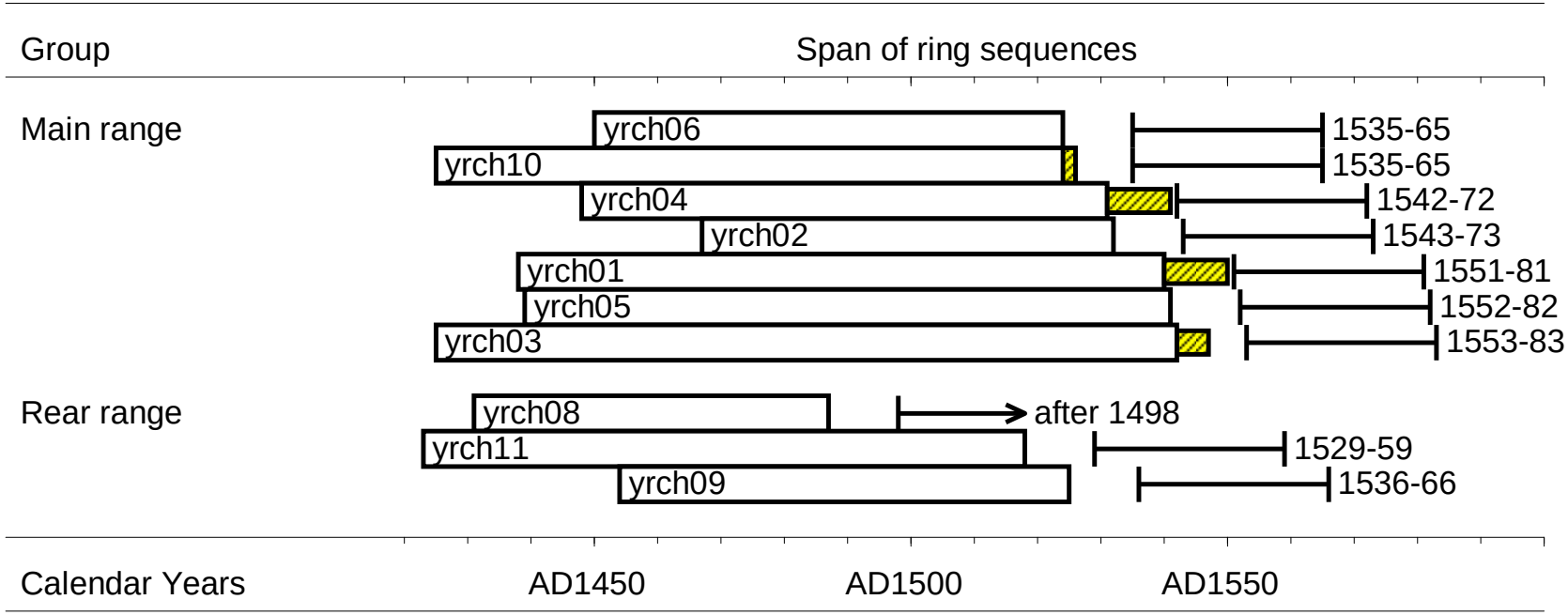


Figure 1: Bar diagram showing the relative positions of overlap of the dated samples, with their likely felling date ranges. White sections represent heartwood rings and yellow hatched sections represent sapwood, narrow bars represent additional unmeasured rings.