DYDDIO HEN DAI CYMREIG | DATING OLD WELSH HOUSES

PROSIECT DENDROCRONOLEG GOGLEDD ORLLEWIN CYMRU | NORTH WEST WALES DENDROCHRONOLOGY PROJECT

Oxford Dendrochronology Laboratory
Report 2011/30

THE TREE-RING DATING OF HAFODYSBYTY FFESTINIOG GWYNEDD (NGR SH 725 432)

Summary
Two timbers from the cruck roof were dated. The likely felling date range for these two timbers is **1509–33**. This date could be refined with further samples. A single sample from the floor inserted into the Hall failed to date.

Author: Dr M. C. Bridge FSA
Oxford Dendrochronology Laboratory
Mill Farm
Mapledurham
Oxfordshire
RG4 7TX

October 2011

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 Hafodysbyty, Ffestiniog, Gwynedd
(NGR SH 725 423)

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.

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. 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.

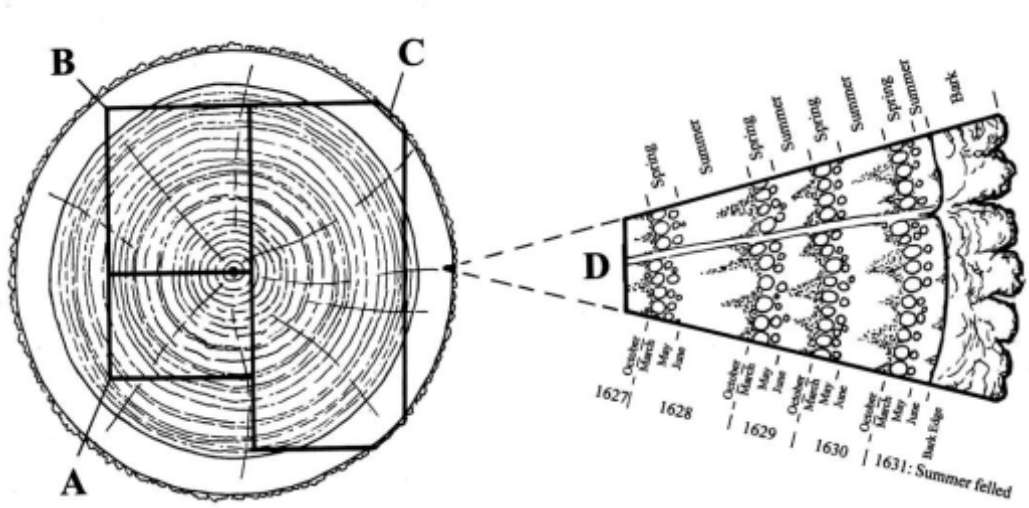
One can develop long reference chronologies by cross-matching the innermost rings of modern timbers with the outermost rings of older timbers successively back in time, adding data from numerous sites. Data now exist covering many thousands of years and it is, in theory, possible to match a sequence 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)

HAFODYSBYTY

Hafod Ysbyty is a classic upland hallhouse of north-western (Gwynedd) type, i.e. cruck-framed and stone-walled. There are two main phases:
(1) c. 1500. A three-unit hallhouse of 'gentry' type with a two-bay hall with central, open truss with cusped apex and double-pegged archbrace. The two-door dais-end partition survives. The partition is of post-and-panel type survives and the inner-rooms appear to have had a ceiling of post-and-panel type.
(2). c. 1600 Inserted hall ceiling and chimney with fireplace stair creating a house of lobby-entry type.

See the plan and description by Peter Smith in The History of Merioneth, Vol. II: The Middle Ages (2001), ed. J & Ll. Beverley Smith, pp. 450 & 482. R.F. Suggett/RCAHMW/October 2011. Extract from Coflein (RCAHMW's on-line database), NPRN 28478.

SAMPLING

Sampling took place in August 2011. 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 **cgb**. 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. The samples were measured under a binocular microscope on a purpose-built moving stage with a linear transducer, attached to a desktop computer allowing the measurement of ring-widths to the nearest 0.01 mm using DENDRO for WINDOWS, written by Ian Tyers (Tyers 2004), which was also used for subsequent analysis, along with other programs written in BASIC by D Haddon-Reece, and re-written in Microsoft Visual Basic by M R Allwright and P A Parker.

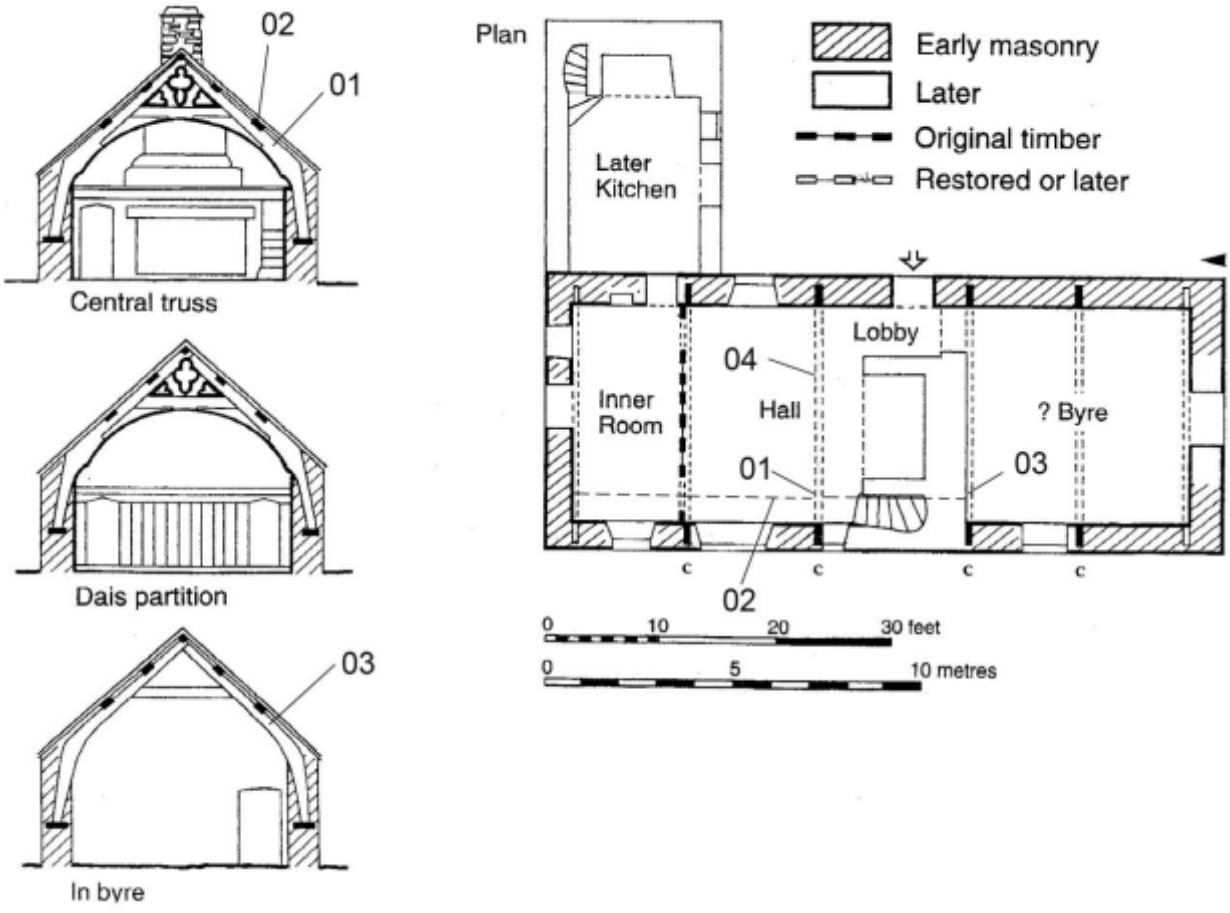


Figure 1: Drawings adapted from Smith (2001) showing the approximate positions of timbers sampled

Figure 2: Photograph of the elaborate central truss

RESULTS AND DISCUSSION

Basic information about the samples and their origins are shown in Table 1, and illustrated in Figure 1. Fig 2 shows the central truss with cusped braces. Only four samples were taken in compliance with the owner's wishes, three from the roof and one from the floor inserted into the Hall. Sample **01** contained an abrupt growth change with some unusually narrow rings in mid-sequence, which explains why it did not match the other samples, nor did it date independently. The ring-width series from samples **02** and **03** matched each other and the two series were combined to form a site master, **HDYSBYTY**, of 124 years. This was successfully dated to the period 1374–1497, the best matches being shown in Table 2. Both samples retained some sapwood, and gave a mean heartwood-sapwood boundary date of 1492, giving a likely felling date range of **1509-33**.

The relative positions of overlap of the two dated samples are illustrated in Fig 3. Further samples would help refine this large range. The single short (60-year) sequence from the inserted floor beam failed to date, this not being unusual for a single short sequence.

Table 1: Details of samples taken from Hafodysbyty, Ffestiniog.

Sample number	Timber and position	Date of series	Heartwood-sapwood boundary date	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens	Felling date range (relative years)
Cruck roof									
hys01	West cruck, central truss	-	-	-	72	1.75	0.87	0.24	-
* **hys02**	West lower purlin, N of central truss	1425-1497	1497	H/S +11NM	73	1.82	0.50	0.20	1509–1537
* **hys03**	West cruck, south cruck	1374-1494	1487	7 +3NM	121	1.64	1.06	0.24	1498–1528
Inserted floor									
hys04	Inserted floor beam in Hall	-	-	18C	60	2.53	1.28	0.26	-
* = included in site master **HDYSBYTY**		**1374-1497**	**1492**		**124**	**1.78**	**0.99**	**0.20**	**1509–1533**

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

hys02 *vs* **hys03,** t = 5.8 with 70 years overlap

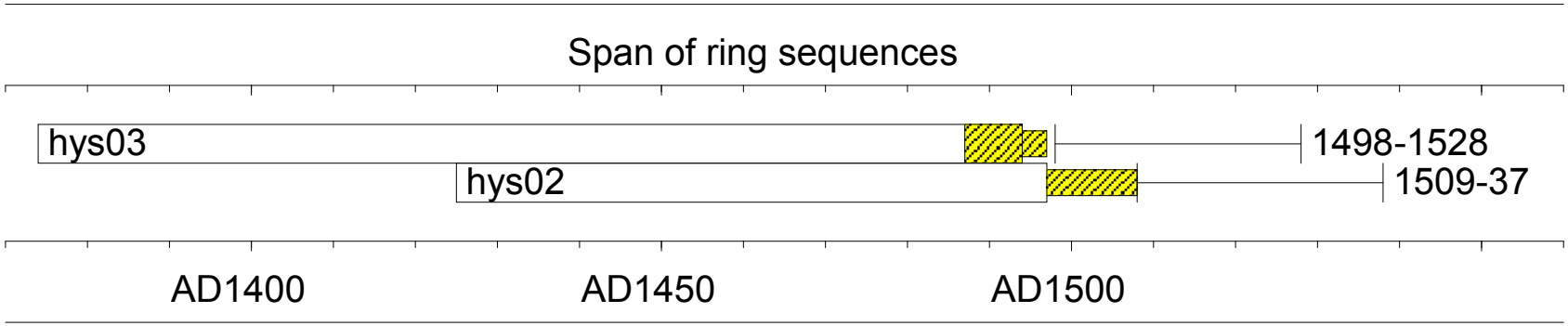


Figure 3: Bar diagram showing the relative positions of overlap of the dated series, along with their interpreted likely felling date ranges. Hatched yellow sections represent sapwood rings, and narrow sections of bar represent additional unmeasured rings

Table 2: Dating evidence for the site master **HDYSBYTY AD 1374–1497** against dated reference chronologies

County or region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning:*	*Overlap (yrs):*	*t-value:*
Wales	Plas ym Mhenrhos, Penrhos	(Miles *et al* 2012)	PLASMNRS	1413-1607	84	8.7
Wales	Pengwern Old Hall	(Miles *et al* 2003)	PENGWERN	1353-1521	124	7.9
Wales	Cae'nycoed-uchaf, Maentwrog	(Miles *et al* 2006)	BDGLRT17	1407-1592	91	7.5
Wales	Beddgelert	(Nayling pers comm)	BEDD_T6	1302-1529	124	7.4
Wales	Parc Llanfrothen	(Miles *et al* 2006)	BDGLRT22	1386-1669	112	7.1
Wales	Plas y Dduallt, Maentwrog	(Miles *et al* 2011)	GWYNEDD5	1355-1604	124	6.7
Wales	Cwm Farm, Cwm Cynfal	(Miles *et al* 2012)	CWMFM1	1364-1567	124	6.5
Wales	Y Gesail Gyfarch, Dolbenmaen	(Miles *et al* 2006)	BDGLRT6	1384-1609	114	6.3
Wales	Newton Nottage Church	(Miles *et al* 2004)	NWTNNTTG	1362-1535	124	6.1
Wales	Gelli, Llanfrothen	(Miles *et al* 2006)	BDGLRT8	1391-1662	107	6.0
Wales	Clenennau, Dolbenmaen	(Miles *et al* 2006)	BDGLRT10	1406-1570	92	6.0
Wales	Bryn yr Odyn, Gwynedd	(Miles *et al* 2010)	BRYNRDYN	1388-1586	110	5.7
Wales	Rhos, Minfordd, Penrhyndeudraeth	(Miles *et al* 2006)	BDGLRT13	1434-1571	64	5.7

ACKNOWLEDGEMENTS

This study was commissioned by Margaret Dunn of the North-West Wales Dendrochronology Project. We are grateful to the owner, Dr Helen Ford, for allowing access to her building, and to Richard Suggett of the Royal Commission on Ancient and Historic Monuments of Wales who assisted in the interpretation on site, and provided useful background information.

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.

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., Worthington, M. J. and Bridge, M. C. (2003) Tree-ring dates, **Vernacular Architecture**, 34, 109-113.

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., Bridge, M. C., Suggett, R. and Dunn, M. (2010) Tree-ring dates, **Vernacular Architecture**, 41, 110-118.

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

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

Smith, P. (2001) *History of Merioneth, Vol 2*. **University of Wales Press**.

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