Tree Ring Dating

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 2015/52

THE DENDROCHRONOLOGICAL INVESTIGATION OF CYSULOG, MAERDY, CORWEN CONWY (DENBIGHSHIRE) (SJ 0099 4510)

Summary

Fifteen samples were taken from various elements of the house, including the roof, doorways, stairs, window lintels and a fireplace lintel. In addition, five samples were taken from roof timbers to the adjoining 'cart-shed' roof. Four series from the cart-shed roof matched each other, and were combined to make a single series representing all four. Neither this, nor any of the other samples could be dated. Although many of the series were shorter than would be normally hoped for, it is unusual not to be able to date at least some timbers considered suitable for sampling.

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

November 2015

Commissioned jointly by Dating Old Welsh Houses, and Conwy County Borough Council

The Dendrochronological Investigation of Cysulog, Maerdy, Corwen, Conwy (Denbighshire) (SJ 0099 4510)

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.

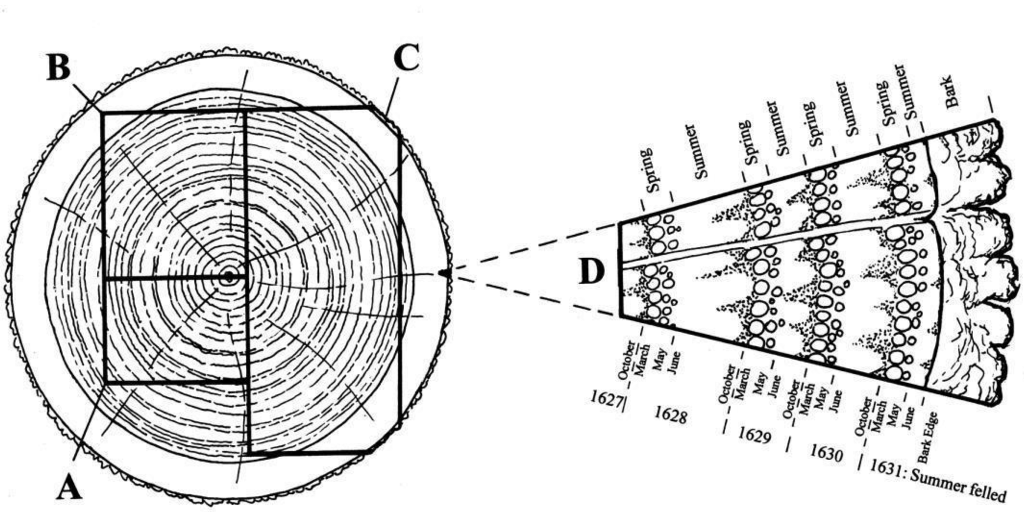
The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's *t*-test. The *t*-test compares the actual difference between two means in relation 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)

CYSULOG

Cysulog is a well-preserved mid C17th farmhouse with rare date panels for both 1650 and 1652. The attached cart-shed probably dates to the early C19 and around this time, the house was re-arranged internally with the addition of the wooden dogleg stair. The house was probably used as a farm outbuilding after the construction of the new house circa 1900.

The house is a one-and-a-half storey mainly stone built property, with slate roofs and some weatherboarding. The house has a large rectangular stone chimney to the right and a gabled dormer. On the ground floor, there is a boarded door to the left and a window to the right with later doorways in the left gable end. The right side of the house is linked to the cart-shed by an extending roof to form a covered open bay. The lofted cart-shed consists of a block of two bays with a weather-boarded upper storey with two small windows. There is also a stone stair leading up to a doorway with a boarded door at loft level.
Source:- Cadw listed buildings, NJR 08/09/2008

SAMPLING

Samples were taken in September 2015. The locations of the samples are described in Table 1, and included several different elements of the house, including the roof, inserted staircase, and various lintels. The roof timbers in the adjoining cart-shed were also sampled. Core samples were extracted using a 15mm diameter borer attached to an electric drill. They were labelled (prefix **cysg**) and 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 DENDRO for WINDOWS, written by Ian Tyers (Tyers 2004).

RESULTS AND DISCUSSION

Details of the samples are given in Table 1. Many of the series had fewer rings than hoped for, and the sensitivity values show great that there was great variation in the rings, with several showing bands of narrow rings. No cross-matching could be found between samples from the house, and neither did any of them date individually. In the 'cart-shed' roof four timbers did match each other, and were combined into a 67-year long site chronology, but this too failed to date.

ACKNOWLEDGEMENTS

This study was commissioned jointly by Dating Old Welsh Houses and Conwy County Borough Council, with input from Richard Suggett (RCAHMW) who was present when the initial assessment was carried out. I thank my fellow dendrochronologists for permission to use their data.

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.

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

Table 1: Details of samples taken from Cysulog, Maerdy, Conwy.

Sample number	Timber and position	Sapwood complement	No of rings	Mean width (mm)	Std devn (mm)	Mean sens
House						
cysg01	Door lintel over south end doorway	h/s	42	2.02	0.91	0.27
cysg02	Horizontal beam to west side of southern doorway	h/s	49	2.29	1.04	0.26
cysg03	Stair bearer on east side of stair	28C	49	1.73	0.78	0.17
cysg04	Stair support beam in under-stair cupboard	17C	<40	NM	-	-
cysg05	Main N-S floor beam at south end	-	74	2.20	1.06	0.26
cysg06	Main E-W beam by partition	-	58	1.86	1.44	0.27
cysg07	Main N-S beam in central living room	23C	83	2.34	1.04	0.25
cysg08	Fireplace lintel	45C	112	1.45	0.86	0.26
cysg09	Inner window lintel to 1st flr south window	-	<40	NM	-	-
cysg10	NW upper purlin	-	<40	NM	-	-
cysg11	East principal rafter	23C	83	1.96	1.00	0.20
cysg12	West principal rafter	-	76	2.35	1.07	0.27
cysg13	NW lower purlin	-	<40	NM	-	-
cysg14	SW lower purlin	-	<40	NM	-	-
cysg15	Ridge piece in south bay	-	<40	NM	-	-
Cart-Shed						
cysg16	E-W floor beam	-	<40	NM	-	-
cysg17	East principal rafter	18¼C	63	2.33	0.91	0.20
cysg18	West principal rafter	6 + (11¼C NM)	41	1.84	0.99	0.19
cysg19	Collar	1	43	1.65	0.72	0.25
cysg20	NW upper purlin	h/s	43	1.67	0.71	0.18
cysgFOUR	Mean of **17**, **18**, **19** and **20**		67	1.93	0.67	0.16

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

Table 2: Cross-matching between elements from the cart-shed roof

	t-value		
Sample	**cysg18**	**cysg19**	**cysg20**
cysg17	5.5	6.8	4.1
cysg18		*	*
cysg19			4.8

* = overlap less than 30 yrs, no *t*-value calculated (but plots compared)

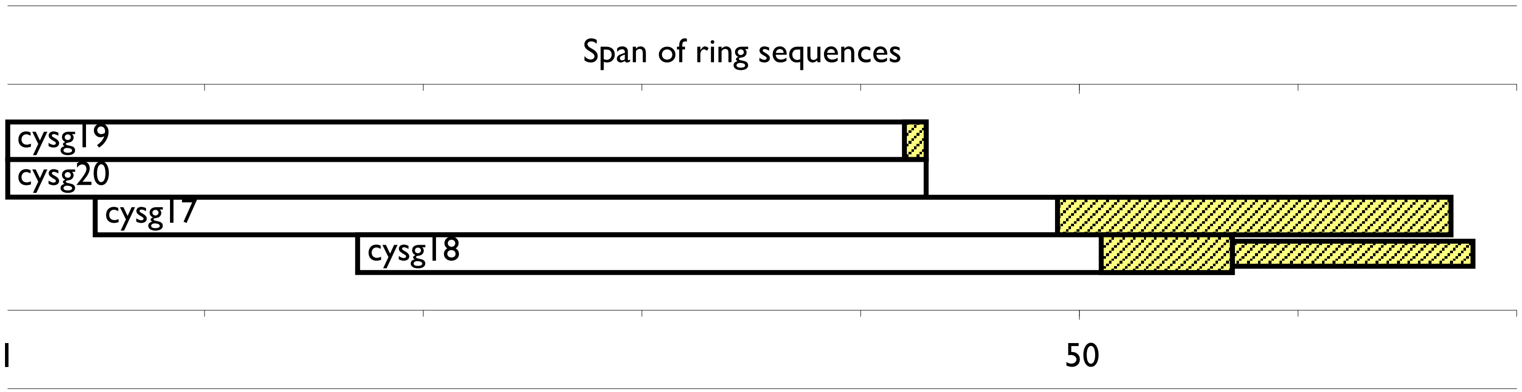


Figure 1: Bar diagram showing the relative positions of overlap of the relatively dated samples. White sections represent heartwood rings and yellow hatched sections represent sapwood.