Darganfod Hen Dai Cymreig
Discovering Old Welsh Houses

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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.

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Oxford Dendrochronology Laboratory
Report 2016/11

THE DENDROCHRONOLOGICAL DATING OF TIMBERS FROM TYDDYN SAIS, TRAWSFYNYDD MERIONETH (NGR SH 708 334)

Photo: Margaret Dunn

Summary

This property was described by Peter Smith as an early storeyed 'Snowdonian' house. Most of the roof has been rebuilt in softwood, but timbers on the ground floor and a single purlin were sampled. Only two series dated, but these matched each other and had similar felling date ranges. One had complete sapwood, but this was detached from the main core, and a few rings may have been lost at the start of the sap, thus a narrow felling date range of **1547–57** was adopted for this timber. The second dated timber retained some sapwood, and had a likely felling date range which encompassed this date range.
The timber matched local chronologies, showing the importance of having local reference material, especially when only a couple of samples were datable.

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

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The Dendrochronological Dating of Timbers from Tyddyn Sais, Trawsfynydd, Merioneth (SH 708 344)

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.

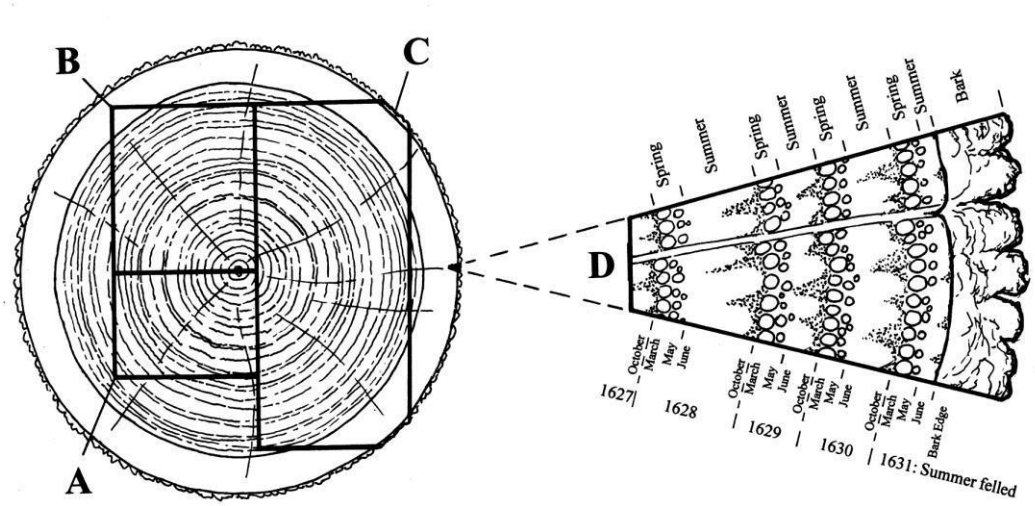
The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's *t*-test. The *t*-test compares the actual difference between two means in relation 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 1997a, 42)

TYDDYN SAIS

Tyddyn Sais (sometimes Tyddyn-y-sais) is a classic and rather early storeyed Snowdonian house. The plan is characteristic: a full cross-passage lies between the hall with end chimney and the twin outer rooms with post-and-panel partitions. The roof trusses (now altered) were originally of collar beam type with the principal rafters set over substantial wallplates. Empty slots in the purlins indicate that the roof was windbraced - a feature of early Snowdonian houses. The only uncertainty of the plan is the site of the original stair. The characteristic fireplace stair is absent but may have been lost in the reconstruction of the fireplace wall. Latterly the cross-passage has been adjusted to accommodate a stair and a pantry. R.F. Suggett/RCAHMW/March 2016. Extract from Coflein (NPRN 307011).

SAMPLES

Samples were of oak (*Quercus* spp.). Core samples were extracted using a 15mm diameter borer attached to an electric drill. They were labelled (prefix **tdss**) 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. Only three samples were taken, the few other original timbers being judged to have too few rings to be useful. The sample from the eastern beam (by the stairs) proved to be undatable, but the other two matched each other (t = 5.4, 63 years overlap) and were combined to make a 123-year site chronology, **TYDSAIS**. This was subsequently dated to the period 1405–1527, the strongest matches being shown in Table 2.

The head beam to the partition retained complete sapwood, but this became detached from the core during sampling, and therefore a range is given for the felling date in case any rings were lost at the start of the sapwood. A felling date range of 1547–57 is therefore given for this timber. The purlin also retained some sapwood, and has a likely felling date range which encompasses this first date range, making this the most likely time of construction of the property.

Although only two timbers dated, the material appears to have grown locally, and the results show the importance of having local reference material when establishing dates for sites with so few samples available.

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Table 1: Details of samples taken from Tyddyn Sais, Trawsfynydd

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
* tdss01	Head beam to west partition	1405-1524	1524	H/S +23CNM	120	1.26	0.49	0.20	1547–57
tdss02	Main transverse beam, east (by stairs)	-	-	19	101	2.29	0.53	0.23	-
* tdss03	South west purlin	1462-1527	1512	15	66	2.20	0.81	0.25	1528–53
* = included in site master **TYDDSAIS**		**1405-1527**			**123**	**1.57**	**0.50**	**0.20**	

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

Table 2: Dating evidence for the site master **TYDDSAIS** **AD 1405–1527** against dated reference chronologies

County or region	*Chronology name*	*Reference*	*File name*	*Spanning*	*Overlap (yrs)*	*t-value*
Regional Chronologies						
Somerset	Somerset Master Chronology	(Miles 2004)	**SOMRST04**	770–1979	123	6.7
Wales	Welsh Master Chronology	(Miles 1997b)	**WALES97**	404–1981	123	6.0
Site Chronologies						
Merioneth	Pengwern Old Hall	(Miles *et al* 2003)	PENGWERN	1353–1521	117	9.0
Merioneth	Bryn yr Odyn, Gwynedd	(Miles and Bridge 2010)	BRYNRDYN	1388–1586	123	7.7
Merioneth	Brynmaenllwyd, Trawsfynydd	(Bridge *et al* 2013)	TRAWSFYN	1381–1587	123	7.7
Lancashire	Whalley Abbey	(Arnold and Howard 2015)	WHLYSQ01	1362–1559	123	7.6
Merioneth	Cae Canol Mawr, Ffestiniog	(Miles *et al* 2012)	CAECANLM	1417–1531	111	7.5
Kent	Old Leigh Place, North Leigh	(Miles *et al* 2007)	OLP68m	1411–1533	117	7.1
Merioneth	Cwrt Plas yn Dre	(Bridge *et al* 2013)	CWRTPLAS	1397–1508	104	7.1
Merioneth	Plas y Dduallt, Maentwrog	(Miles *et al* 2011)	GWYNEDD5	1355–1604	123	7.0
Glamorgan	Newton Nottage Church	(Miles *et al* 2004)	NWTNNTTG	1362–1535	123	7.0

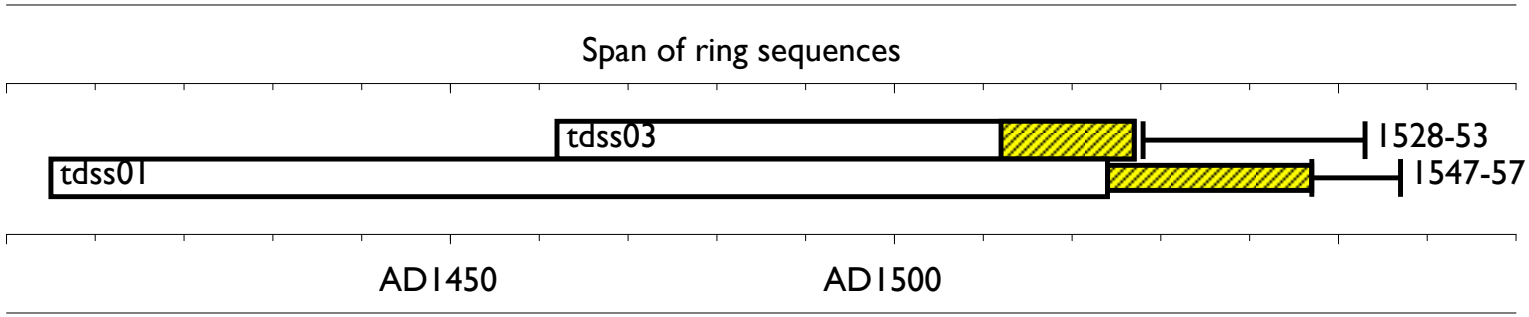

Figure 1: Bar diagram showing the relative positions of overlap of the dated timbers. White bars represent heartwood rings, yellow hatched sections represent sapwood, narrow sections represent additional unmeasured/undated rings