



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.

The copyright of most of these reports belongs to Discovering Old Welsh Houses. Where copyright resides with others, we have made every effort to obtain their permission to reproduce reports on our site. Our policy is to allow free access to our research documents as part of the public benefit we provide as a registered charity. You are welcome to reproduce this material but if you do so, please acknowledge the source

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.



©Discovering Old Welsh Houses Group

Rhif Elusen Gofrestredig: No: 1131782: Registered charity

www.discoveringoldwelshhouses.co.uk

Oxford Dendrochronology Laboratory
Report 2018/36

**DENDROCHRONOLOGICAL INVESTIGATIONS
OF TIMBERS AT PWLLHALOG,
CWM,
FLINTSHIRE
(SJ 088 777)**



Summary

Samples were taken from the western crosswing (roof and ground floor), the main range, and a single timber in the northern extension at the east end. A number of the western crosswing roof timbers showed signs of the trees having been managed, and none of the timbers dated. A ring-width series from the fireplace mantel in the main range, and a ground-floor ceiling beam in the northern extension each gave a number of consistent matching positions at credible date, but neither were considered strong enough to be considered dated at this stage. It may be that as other chronologies are made in the area, that these two timbers will be dated.

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

September 2018

Dendrochronological Investigations of timber at Pwllhalog, Cwm, Flintshire (SJ 088 777)

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.

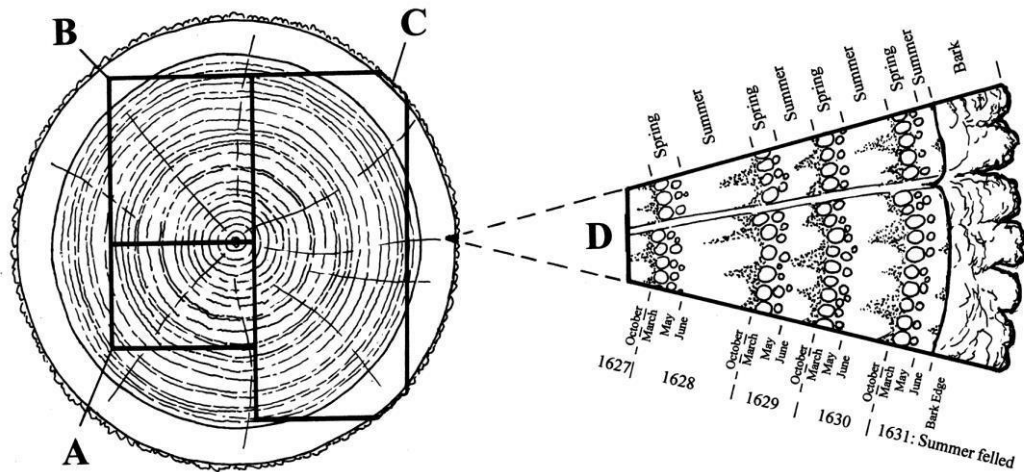
One can develop long reference chronologies by cross-matching the innermost rings of modern timbers with the outermost rings of older timbers successively back in time, adding data from numerous sites. Data now exist covering many thousands of years and it is, in theory, possible to match a sequence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

PWLLHALOG

A sub-mediaeval house, with later western cross-wing having a crow-stepped north gable characteristic of the closing years of the sixteenth-century. It was the birthplace of Bishop Parry, translator of the Welsh Bible 1623). The main range is of two units lying East-West with the kitchen range at the west end having an unusually large kitchen fireplace. There is a later northern extension on the west side. The house has been surveyed by Ric Tyler (Architectural Record 2018 available online at the DOWH website).

SAMPLING

The timbers were investigated during August 2018 (Fig 1). Core samples were extracted using a 15mm diameter borer attached to an electric drill. They were labelled with the prefix **pwlg**, 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 and illustrated in Figs 1 & 2. Initial analysis showed that samples 03 and 04, each studs in the central roof truss of the west crosswing, matched very well, and were probably converted from the same tree. In common with all the crosswing timbers however, there were bands of narrow rings present, as shown in Fig 3, which make the samples undatable. These generally have a sudden decline in ring-width followed by a slow recovery, usually seen when branches are lopped. The sudden growth changes are reflected in the mean sensitivity values.

Table 1: Details of samples taken from Pwllhalog.

Sample number	Timber and position	Sapwood complement	No of rings	Mean width (mm)	Std devn (mm)	Mean sens
Western crosswing						
pwlg01	Attic spine beam (N-S)	16C	68	2.29	1.27	0.32
pwlg02	East principal rafter, central truss	23¼C	110	0.78	0.34	0.19
pwlg03	East stud in central truss	H/S	75	1.97	1.06	0.33
pwlg04	West stud in central truss	1	51	2.03	1.38	0.33
pwlg05	Tiebeam, central truss	H/S	53	2.70	1.61	0.29
pwlg06	Ground-floor transverse beam	-	46	2.93	1.53	0.29
Main Range						
pwlg07	Fireplace mantel beam, west unit	10¼C	95	1.46	0.55	0.25
pwlg08	Kitchen axial beam	31C	118	1.00	0.56	0.21
pwlg09	Kitchen N-S beam	25½C	75	1.42	1.19	0.22
Northern extension						
pwlg10	Ceiling beam	12½C	78	2.73	1.18	0.19

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.

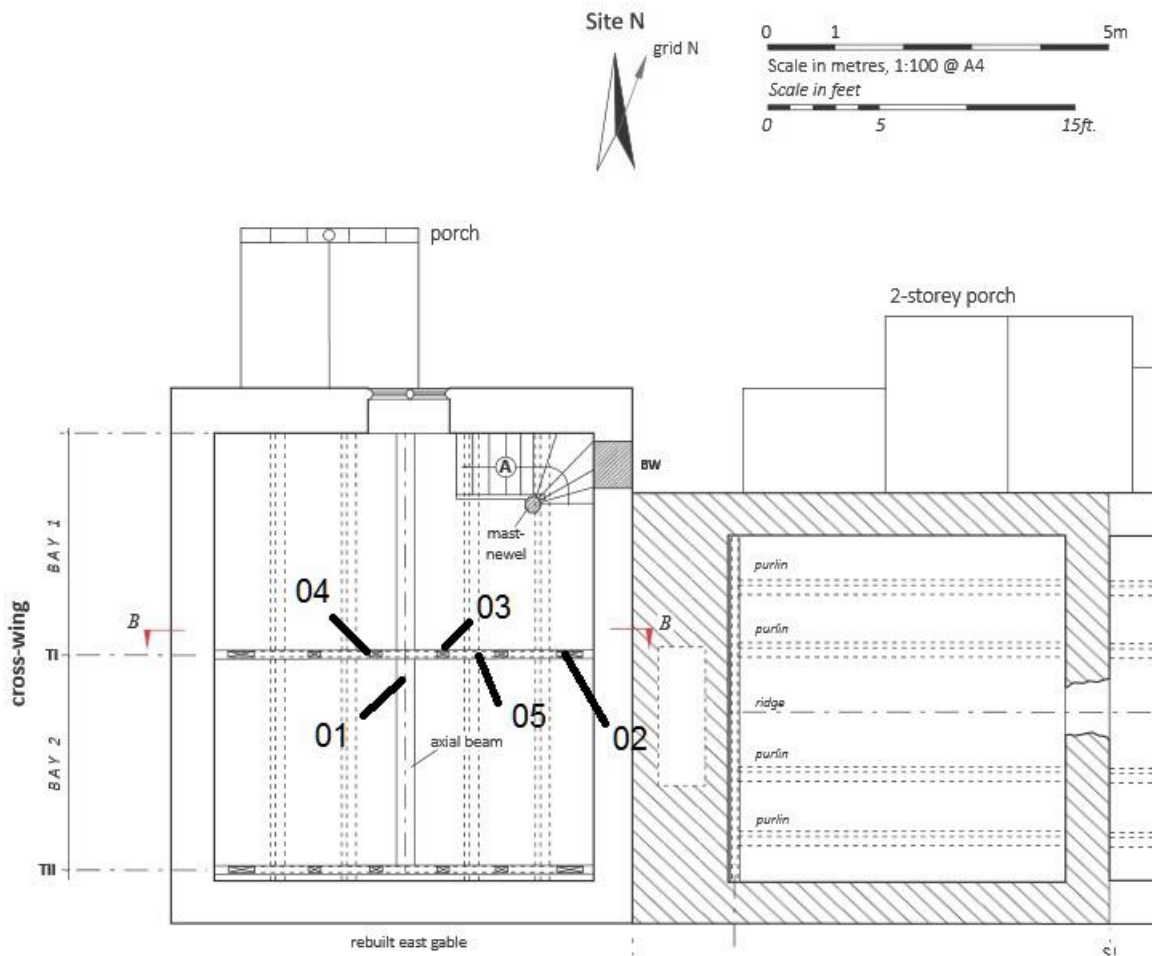


Figure 1: Plan of the west end of the attic level, showing the timbers sampled for dendrochronology. Adapted from an original drawing by Ric Tyler for DOWH

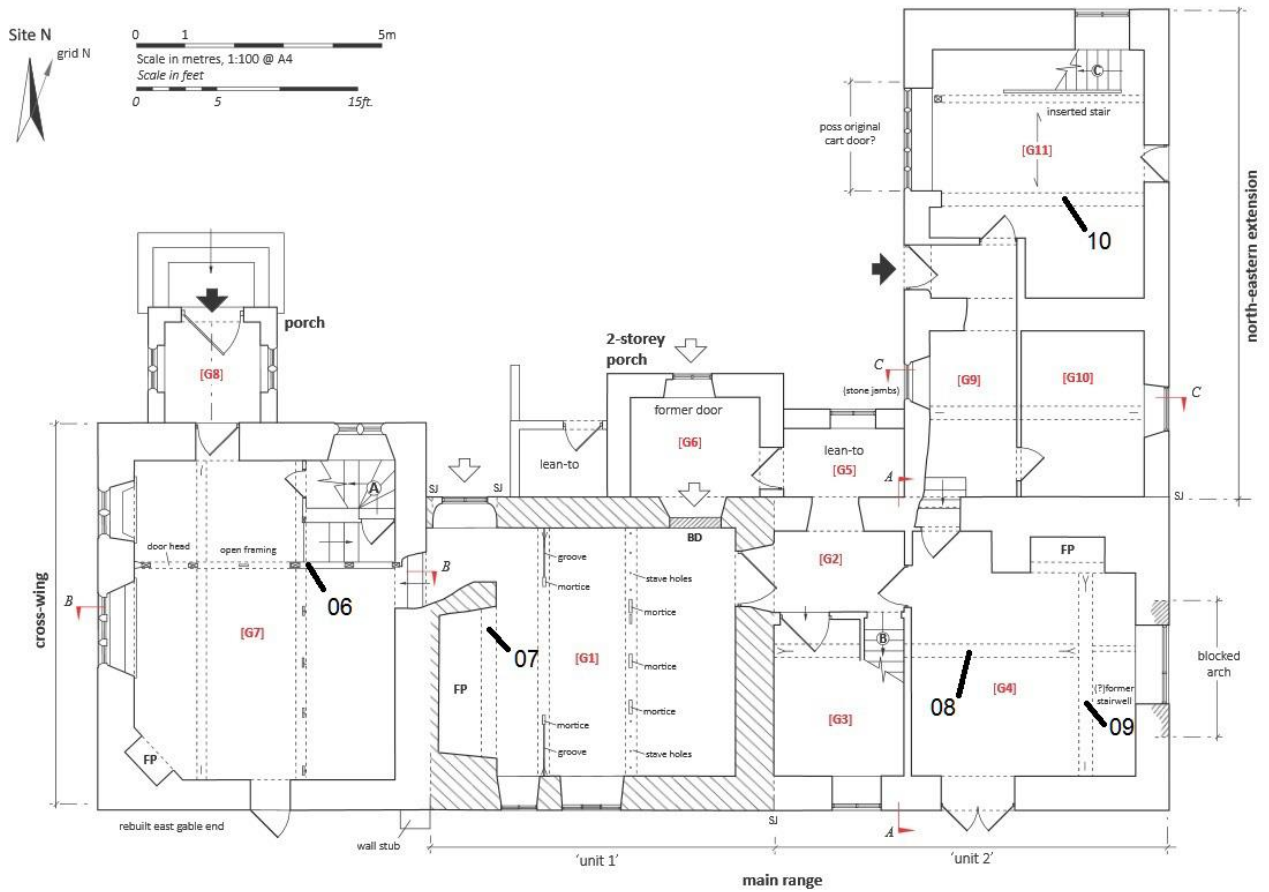


Figure 2: Drawing of the ground floor plan, showing the timbers sampled for dendrochronology. Adapted from an original drawing by Ric Tyler for DOWH

There were no matches between the three samples from the main range, the fireplace lintel and two ceiling beams in the kitchen. Attempts to date the series individually also failed, although there were a large number of consistent – but rather weak – matches in the late sixteenth-century for the fireplace lintel. Although judged undated at this stage, it is possible that the development of other more local chronologies may enable this 95-year long series in the future.

The same can be said about the series derived for sample **10**, from a ceiling beam in the north extension. This 78-year long sequence gave consistent but weak matches in the mid-seventeenth century, a credible position, but not acceptable as a date at this stage.

ACKNOWLEDGEMENTS

This report was commissioned by The Discovering Old Welsh Houses Group. I thank the members of DOWHG who made arrangements for our visits, and assisted during the fieldwork. I thank the owners (Mr and Mrs Vaughan), and also my fellow dendrochronologists for permission to use their data.

DOWHG wishes to acknowledge the assistance of the Woodtiger Fund, Clwydian Range and Dee Valley AONB, and the Marc 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.
- 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.

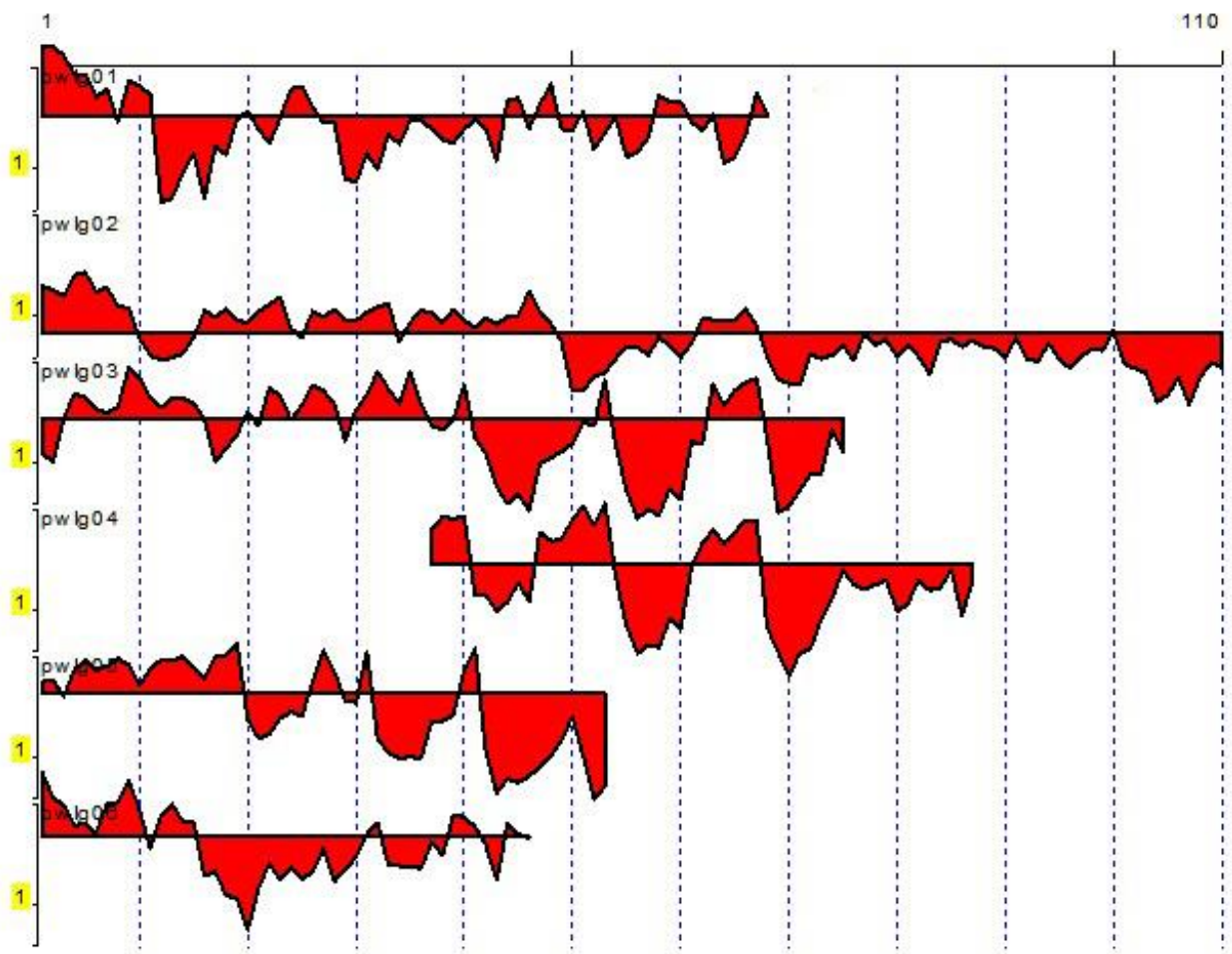


Figure 3: Plots of the ring width indices (see text) of the six roof timbers from the western cross-wing, with **03** and **04** aligned where they match, showing the bands of narrow rings occurring – which are probably the result of management of the trees, preventing dating.