

Oxford Dendrochronology Laboratory
Report 2014/30

**THE DENDROCHRONOLOGICAL INVESTIGATION OF
BRYN DINAS,
TYWYN,
MERIONETH
(NGR SN 635 986)**



Summary

Only four timbers were sampled from this property before it was decided to halt sampling after a cruck base was found to be largely hollow, and there were concerns over further intervention. None of the samples could be dated, despite some being long sequences, and the site remains undated at this stage.

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The Dendrochronological Investigation of Bryn Dinas, Tywyn, Merioneth (NGR SN 635 986)

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.

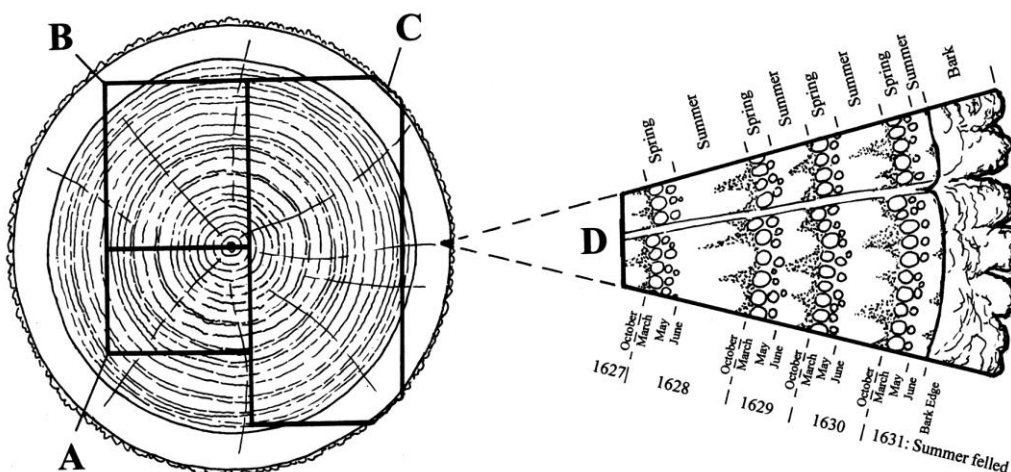
One can develop long reference chronologies by cross-matching the innermost rings of modern timbers with the outermost rings of older timbers successively back in time, adding data from numerous sites. Data now exist covering many thousands of years and it is, in theory, possible to match a sequence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

BRYN DINAS (notes by Richard Suggett)

Bryndinas is a downslope-sited, stoned-walled, three-unit cruck-framed hall-house of gentry type. The two-bay hall, set between rather narrow inner and outer bays, has a refined central truss with a boss (cut back). In a second phase, the fireplace was inserted against the central truss and the hall ceiling with curved stops and bar inserted. The house was undergoing repairs in 2014 when sampled.



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RCAHMW Survey. Plan and account in Peter Smith, 'Houses c. 1415 – c. 1642', *History of Merioneth, Vol. II: The Middle Ages*, ed. J & Ll. Beverley Smith (Cardiff, 2001), pp. 450, 483 (fig. 10.25). Coflein (RCAHMW's on-line database) entry: NPRN 41593. R.F.Suggett/RCAHMW/November 2014.

SAMPLING

Sampling took place in June 2014. 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 **bds**. Locations of samples 1 – 6 are shown in Fig. 1. 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 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. The ring-width series were compared on an IBM compatible computer for statistical cross-matching using a variant of the Belfast CROS program (Baillie and Pilcher 1973). A version of this and other programmes were written in BASIC by D Haddon-Reece, and re-written in Microsoft Visual Basic by M R Allwright and P A Parker. Subsequent analyses were carried out using DENDRO for WINDOWS, written by Ian Tyers (Tyers 2004).

RESULTS AND DISCUSSION

Basic information about the samples and their origins are shown in Table 1. Four good sequences were obtained from timbers in this building, but sampling was cut-short over concerns for the integrity of the structure when the base of a cruck on the central truss was found to be hollow, and it was decided that more careful scrutiny of the structure was desirable by someone qualified to assess the situation.

Despite the sequences being long and with no particularly unusual growth patterns within them, no satisfactory cross-matching was found between the individual sequences, nor were they datable when compared with the independent dated reference chronologies. The building therefore remains undated at this stage, further sampling may be possible in the future.

ACKNOWLEDGEMENTS

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Table 1: Details of samples taken from Bryn Dinas, Tywyn.

| Sample number | Timber and position | Sapwood complement | No of rings | Mean width mm | Std devn mm | Mean sens |
|---------------|---|--------------------|-------------|---------------|-------------|-----------|
| bds01 | North purlin in west bay | 15 | 55 | 1.63 | 0.58 | 0.30 |
| bds02 | North cruck to west truss | 31C | 131 | 0.98 | 0.64 | 0.26 |
| bds03 | Inserted? floor beam in west grd flr room | 41C | 105 | 1.07 | 0.44 | 0.25 |
| bds04 | W-E beam in central room | H/S | 60 | 2.03 | 0.64 | 0.26 |

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;

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