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**DENDROCHRONOLOGICAL INVESTIGATION
OF TIMBERS AT COCHWILLAN,
TAL-Y-BONT, BANGOR
(NGR SH 606 694)**



Summary

Close inspection of the timbers revealed that they were too fast-grown, containing too few rings for dendrochronology to be considered appropriate at this site. A sample was taken from the screen that may be used for radiocarbon analysis at a future date.

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The Dendrochronological Investigation of Timbers at Cochwillan, Tal-y-bont, Bangor (NGR SH 606 694)

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.

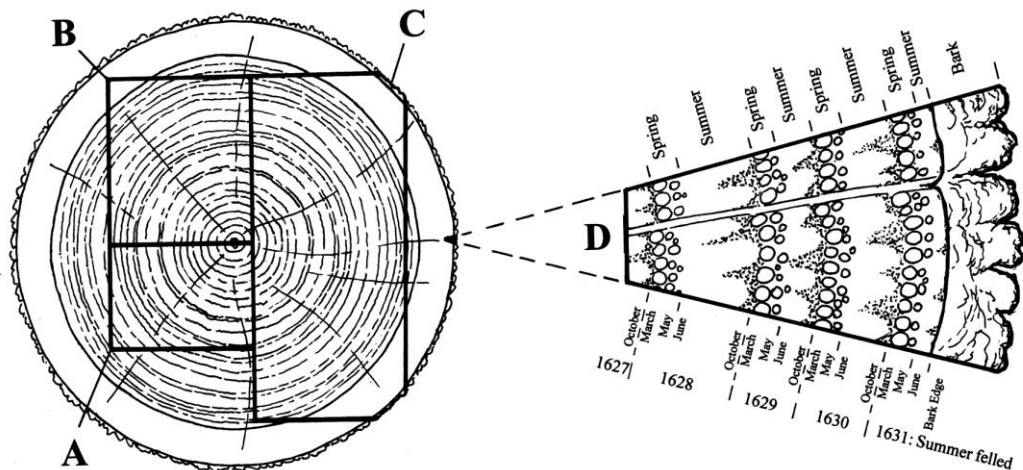
The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's *t*-test. The *t*-test compares the actual difference between two means in relation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

COCHWILLAN (notes by Richard Suggett)

Cochwillan is a high-status hallhouse of refined craftsmanship and outstanding historical interest. The medieval house had a large hall of three bays with a hammer-beam roof and dais canopy, and was heated by a lateral fireplace; the partitions between hall and storeyed inner and outer bays are moulded post-and-panel partitions with enriched doorheads. Smith, *Houses of the Welsh Countryside*, p. 102, suggests that William Gruffydd built Cochwillan after his appointment as sheriff of Caernarvonshire by Henry VII in the post-Bosworth political settlement. Smith suggests: 'It is a fair surmise that [William ap] Gruffydd built his great hall to support his newly exalted position in society, and he built it in the latest fashion for a great gentleman, with an outstanding hammer-beam roof, glazed windows and a side chimney.'

Reconstructed plans and perspective drawing in Smith, *Houses of the Welsh Countryside* (London, 1975 & 1988), p. 130-1 (figs. 69-70). Coflein (RCAHMW's on-line database) entry: NPRN 26298. R.F. Suggett/RCAHMW/November 2014.

ASSESSMENT, SAMPLING AND DISCUSSION

Although a previous brief assessment had suggested that this site was unlikely to be suitable for dendrochronological analysis because of the fast-grown nature of the timbers, it had not previously been possible to get close to the roof timbers. The erection of a scaffold tower made it possible to assess the roof timbers close-up, and this confirmed that the timbers of the magnificent hammerbeam roof did indeed contain too few rings to be viable for dendrochronological work. However, the advances in radiocarbon analysis in recent years have meant that this is often a useful technique for getting a statistically reliable narrow date range under certain circumstances. For this reason a single oak (*Quercus* spp.) sample was extracted from a readily accessible timber in the screen (Figure 1), using a 15mm diameter borer attached to an electric drill. It was labelled and returned to the laboratory to be kept for future radiocarbon analysis should funds for this research be made available in the future.



Figure 1: View of the screen, showing the approximate position of the sample taken for future radiocarbon analysis.

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