Oxford Dendrochronology Laboratory
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THE DENDROCHRONOLOGICAL INVESTIGATION OF TYN-Y-LLWYN, PARTRISHOW, MONMOUTHSHIRE (NGR SO 280 223)

Summary

A number of potential phases were assessed. The front range of the house is dated by a carved lintel and was not thought to be contentious. A total of only five samples were taken from the rear wing of this property, the other timbers having insufficient rings to warrant sampling, and matching was found between two of the samples, resulting in a 70-year series. This failed to give consistent matches to dated reference material, and the timbers remain undated.

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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 1997a).

TYN-Y-LLWYN

Description from Coflein (RCAHMW's on-line database):

A cruciform house of two storeys with attics, built on ground falling to the south. The walls are of limewashed rubble, battered with a plinth on the south, under stone-tiled gabled roofs, with diagonal chimneys.
It is thought that this was originally a longhouse, rebuilt from the late sixteenth century. The earliest section is the upper end. This comprises a hall with two inner rooms. At the lower end of the hall is a large fireplace with a turning stair rising beside it. There are indications of a contemporary, lower range below the hall, probably a cross passage and byre. In the mid seventeenth century these were replaced by the present cross passage and kitchen block. The kitchen chimney has a datestone of 1649. Small two storey wings were added at either end of the cross passage probably in the later seventeenth century. On the ground floor these were a dairy on the west and a porch to the east. The interior retains much original details and some mullioned windows remain.
The house ceased to be a gentry seat after 1703. It was restored in the middle years of the twentieth century.
A terraced seventeenth century garden has been identified to the east (NPRN 86132).
The farm buildings on the south and east include: a stable, probably sixteenth century; a cowhouse, probably seventeenth century, and an eighteenth century barn.

Sources: Jones and Smith 'Houses of Breconshire IV' in *Brycheiniog* XII (1966-7)1-90 [34-6]

This isolated property set high on a hillside contains more than one phase of construction, the front of the house being of mid-seventeenth century origin. The rear wing was of particular interest in terms of dating, with three rafter couple trusses, having two tiers of purlins, the upper tier resting on the collar (Figure 1).

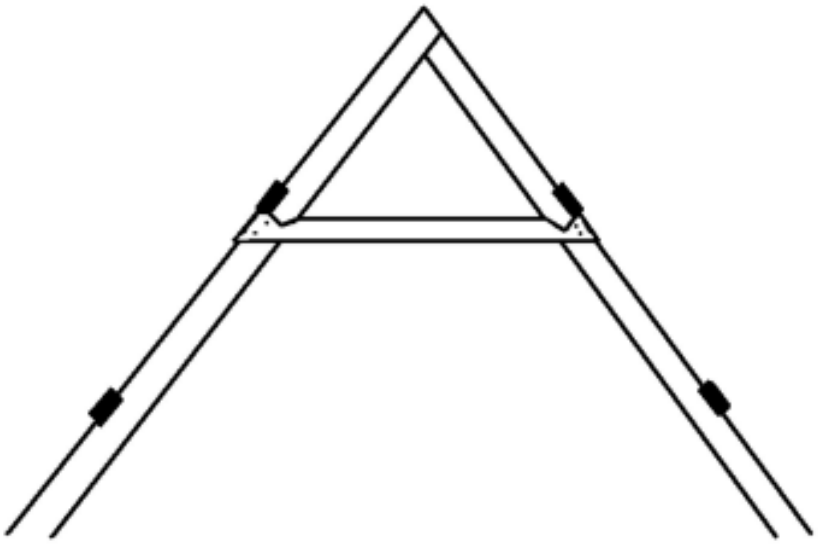

Figure 1: Sketch of the truss form in the rear wing

SAMPLING

Sampling took place in August 2010. 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 **tll**. 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. Measurements and subsequent analysis were carried out using DENDRO for WINDOWS, written by Ian Tyers (Tyers 2004).

RESULTS AND DISCUSSION

Details of the samples and their locations are given in Table 1. Two series matches each other (t = 5.4 with 42 years overlap, Figure 2) and were combined to make a new series, **tll13m**. Neither this series, nor any of the individual series gave acceptable consistent matches with the extensive reference material available. The samples had low mean sensitivity (a measure of the relative year-to-year variation in ring width) and few timbers in the range had sufficient numbers of rings to make them good candidates for sampling.

ACKNOWLEDGEMENTS

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Table 1: Details of samples taken from Tyn-y-Llwyn, Partrishow. Trusses (T) numbered from the south end

Sample number	Timber and position	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens
tll 01	West principal rafter, T1	16C	70	1.88	0.47	0.18
tll 02	East principal rafter , T1	3	45	1.64	0.77	0.17
tll 03	Collar, T1	H/S	42	2.05	0.87	0.19
tll 04	West principal rafter, T2	21C	98	1.38	0.40	0.14
tll 05	East upper purlin, bay 2-3	C	<40	NM	-	-
tll13m	Mean of **01** + **03**	-	70	1.91	0.57	0.18

Key: H/S bdry = heartwood/sapwood boundary - last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity; C = bark edge present, winter felled; ½ C = bark edge, felled the following winter; NM = not measured.

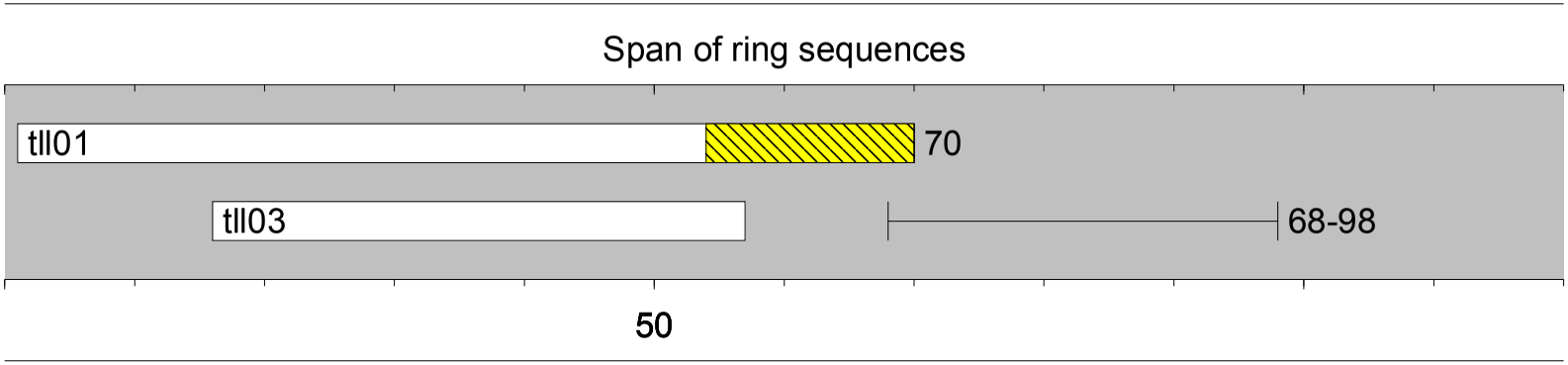

Figure 1: Bar diagram showing the relative positions of overlap of the two matched series. Yellow hatched sections represent sapwood rings, and the felling date or likely range are shown in relative years.

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