Oxford Dendrochronology Laboratory
Report 2010/61

THE DENDROCHRONOLOGICAL INVESTIGATION OF TY FRY MANOR, PENTREATH ANGLESEY (NGR SH 516 768)

Summary

Records suggest that the house was built in 1679 by Owen Williams, although it is unclear whether the east end of the main front range and the block to the north-west are older of younger than this. Samples were taken from both these areas, but no samples could be dated.

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December 2010

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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 1997).

TY FRY MANOR (based on RCHAMW 1937; 139)

The house, with two storeys and attics, was built in 1679 by Owen Williams as a long rectangular main block with a central projecting wing at the back containing the stair, with a room behind at each floor. The NE end was reconstructed, probably in the early 18th century, with a large kitchen wing added to the north. The central wing contains the original staircase with turned balusters, moulded strings and handrail, and square newels with ball finials and pendants.

SAMPLING

Sampling took place in September 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 **angi**, and located on the plan (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. Measurements and subsequent analysis were carried out using DENDRO for WINDOWS, written by Ian Tyers (Tyers 2004).

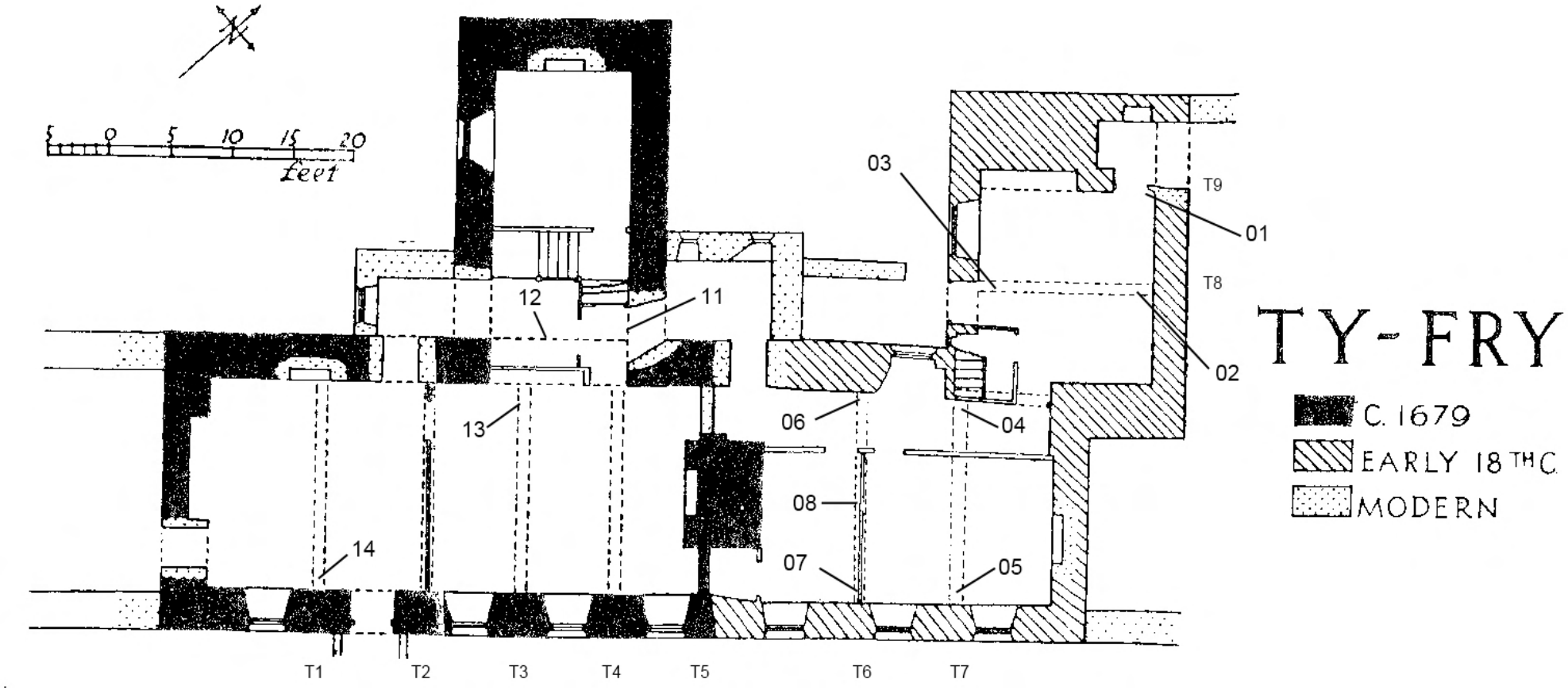

Figure 1: Plan of the property showing the timbers sampled for dendrochronology (adapted from an original in the RCHAMW Inventory 1937)

RESULTS AND DISCUSSION

Details of the samples and their locations are given in Table 1 and illustrated in Figure 1. Only two pairs of series matched each other very well (**angi02** and **angi03**, $t = 5.0$ with 81 years overlap, and **angi04** and **angi05**, $t = 8.2$ with 97 years overlap), both being pairs of principal rafters on respective trusses that may well have been from the same tree. Both pairs were combined for further analysis. No other series matched any other strongly, and all were therefore treated as individual series for comparisons with the dated reference material. None of the series analysed gave acceptable consistent matches enabling them to be considered dated. The 93-year long series **angi12**, from the beam at the top of the stairs, gave some weak matches against local material, but the level of replication was too low to be acceptable as an independent date. It may be possible to confirm the dating of this series in the future, when more local material becomes available.

The lack of dating is disappointing, but the sensitive nature of the series (ie high year-to-year variation in ring width) seems to be fairly common on Anglesey, and makes dating very difficult, even with some established local chronologies.

ACKNOWLEDGEMENTS

Margaret Dunn and Richard Suggett both provided assistance on site and provided background information on the building. We thank the owners, Mr and Mrs Barker, for their assistance.

This study was funded by the North-West Wales Dendrochronology Project, co-ordinated by Margaret Dunn, in partnership with the Royal Commission on Ancient and Historic Monuments of Wales.

Table 1: Details of samples taken from Ty Fry Manor, Pentreath, Anglesey. Trusses (T) are numbered from west to east (see plan).

Sample number	Timber and position	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens
angi01	North principal rafter, T9	1	86	0.97	0.41	0.28
angi02	North principal rafter, T8	H/S	*81*	*1.09*	*0.60*	*0.29*
angi03	South principal rafter, T8	1	*97*	*1.27*	*0.56*	*0.29*
angi32m	Mean of **02** and **03**	1	97	1.20	0.53	0.23
angi04	NW principal rafter, T7	H/S	*97*	*1.12*	*0.68*	*0.23*
angi05	SE principal rafter, T7	H/S	*105*	*1.15*	*0.69*	*0.25*
angi54m	Mean of **04** and **05**	H/S	105	1.14	0.66	0.23
angi06	NW principal rafter, T6	18	121	1.02	0.52	0.25
angi07	SE principal rafter, T6	+28C (NM)	83	0.95	0.61	0.23
angi08a	Collar, T6	-	*67*	*1.36*	*0.40*	*0.23*
angi08b	*ditto*	H/S	*51*	*0.87*	*0.29*	*0.23*
angi08	Mean of **08a** and **08b**	H/S	67	1.18	0.36	0.21
angi11	Tie, T4	43C	145	1.38	0.86	0.27
angi12	NW-SE beam T3-T4	32C	93	2.16	1.08	0.25
angi13	NW principal rafter, T3	15¼C	41	3.09	0.76	0.16
angi14	SE principal rafter, T1	H/S	66	2.18	0.98	0.27

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; ¼C = bark edge present, felled the following spring; NM = not measured.

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