Oxford Dendrochronology Laboratory
Report 2017/03

THE TREE-RING INVESTIGATION OF TIMBERS FROM THE OLD POST OFFICE, LLANASA, FLINTSHIRE,

(SJ 106 814)

Summary

Three timbers from the ground floor ceiling were sampled. Ring width sequences from the two main transverse beams matched each other, but both showed distinct abrupt growth rate changes, possibly resulting from management of the trees, and they could not be dated. The inner section of the third sample matched, but the outer section could not be satisfactorily resolved, having many very narrow rings.

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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. 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.

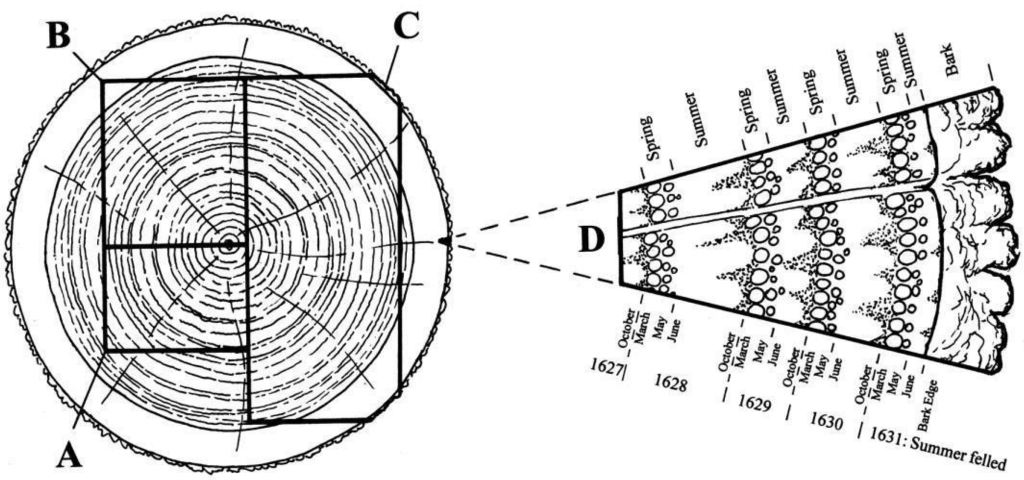
The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's *t*-test. The *t*-test compares the actual difference between two means in relation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

<u>Old Post Office, Llanasa</u>

Two-storey two-window house of rubble stone with bigger quoins and slate roof. Mullioned windows in the gable end suggest a C17 origin for the house. Altered during final quarter of the C19 when it was converted to a Post Office. Upper storey has 6-pane sash windows. Similar window on lower R. An enlarged window on L was used to light former Post Office (which closed c. 1990) (RAJ, RCAHMW, 3 November 2003; based on CADW listing description).

SAMPLING

Samples were taken in November 2016. The locations of the samples are described in Table 1. Core samples were extracted using a 15mm diameter borer attached to an electric drill. They were labelled (prefix **opl**) and 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 DENDRO for WINDOWS, written by Ian Tyers (Tyers 2004).

RESULTS AND DISCUSSION

Details of the samples are given in Table 1. Only three timbers were sampled (Fig 1) – but these looked promising, having good numbers of rings and complete sapwood.

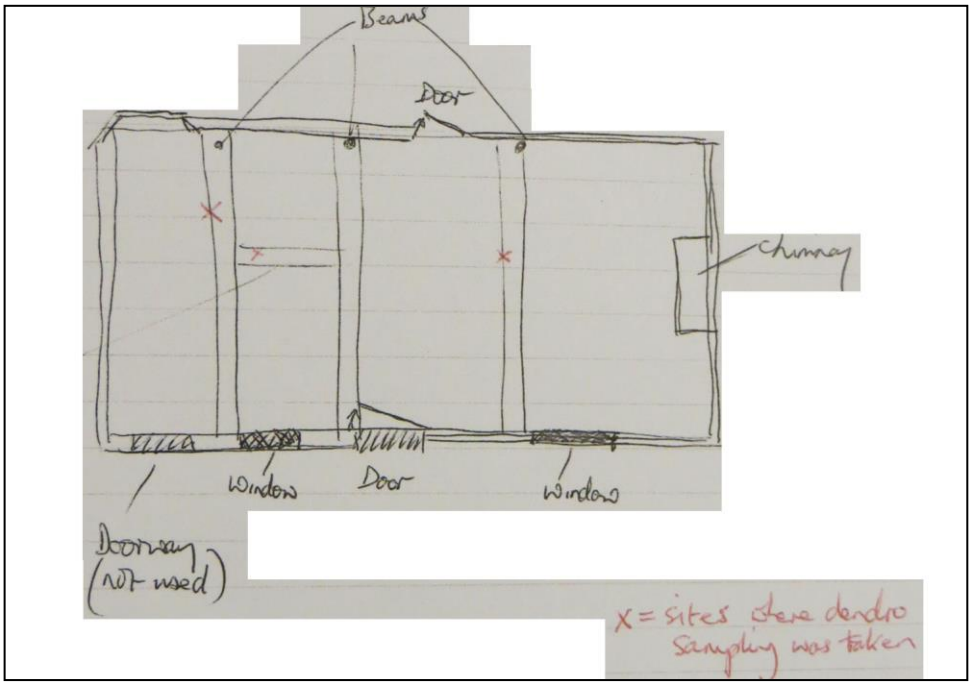


Figure 1: Sketch plan of the ground floor showing the timbers sampled

The two longer series from the transverse beams matched each other well (t = 6.6 with 121 years overlap, Fig 2), and the series were combined to make a site master **opl21m**, but this failed to date, probably because of the abrupt growth rate changes visible in the plots.

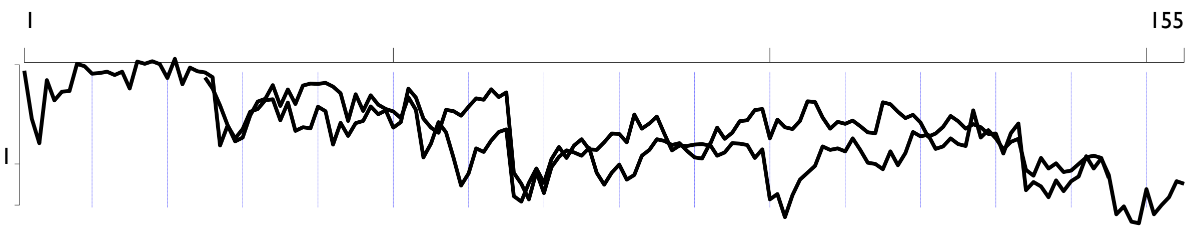


Figure 2: Plots of the ring-width series from the two transverse beams, showing abrupt growth rate changes

The third sample had split along a medullary ray, and was measured in two parts. The inner 49 rings matched the combined series from the two transverse beams (t = 4.7) and was added into the site master, but the outer section contained some extremely narrow rings, and this could not be satisfactorily resolved.

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Table 1: Details of samples taken from the Old Post Office, Llanasa.

Sample number	Timber and position	Date of series	H/S boundary date	Sapwood complement	No of rings	Mean width (mm)	Std devn (mm)	Mean sens	Felling date range
* **opl01**	South transverse beam, ground floor	-	-		131	1.72	0.81	0.19	-
* **opl02**	North transverse beam, ground floor	-	-		145	1.95	1.20	0.19	-
* **opl03i**	7th joist from west, centre bay	-	-		49	1.22	0.61	0.29	-
opl03ii	*ditto* outer section	-	-	*c*29C	*c*53	-	-	-	-
* = combined to form site master **opl321m**		-	-		**155**	**1.89**	**1.13**	**0.17**	

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