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Oxford Dendrochronology Laboratory  
Report 2016/21

**THE DENDROCHRONOLOGICAL DATING OF  
TIMBERS FROM  
PLAS UCHAF,  
GLAN CONWY,  
CONWY (DENBIGHSHIRE)  
(SH 819 752)**



**Summary**

Seven timbers from the roof area were sampled, including one from the cross-wing, and six from the main range. Four were dated, one retaining complete sapwood was found to have been converted from a tree felled in spring 1570, with the other three having likely felling dates incorporating this date. It is likely the roof was constructed in **1570**, or within a year or two after this date, and the two roofs appear to be contemporaneous.

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## **The Dendrochronological Dating of Timbers from Plas Uchaf, Glan Conwy, Conwy (SH 819 752)**

### **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.

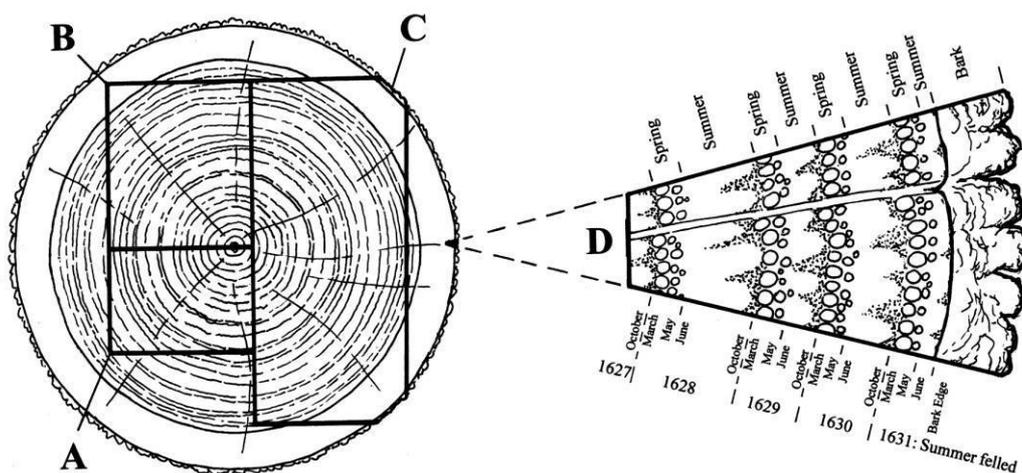
The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's *t*-test. The *t*-test compares the actual difference between two means in relation 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 1997a).



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 1997a, 42)

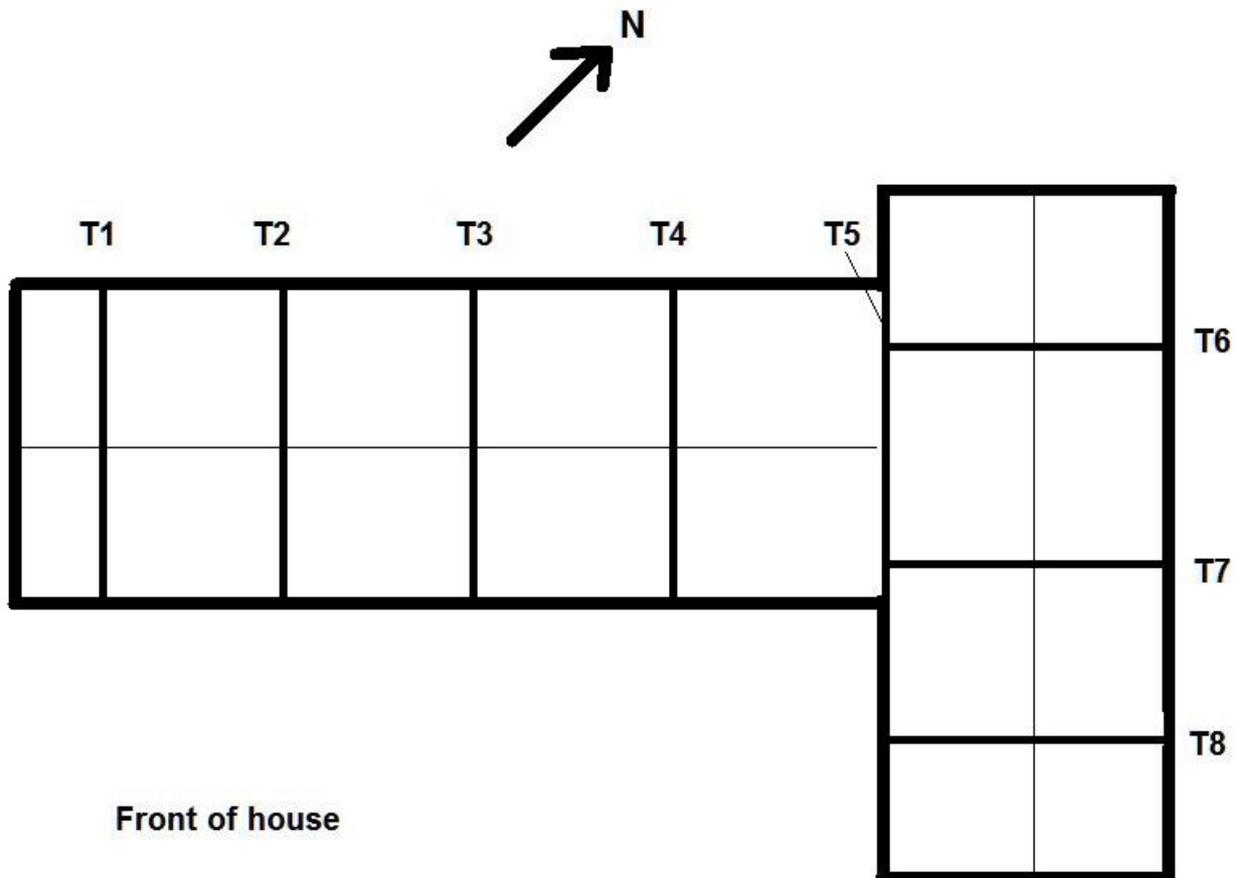
### **Plas Uchaf, Glan Conwy (NPRN 27778)**

Plas Uchaf, Glan Conwy, is an L-shaped 2-storeyed farmhouse built of rubble with slate roofs. It has a 7-bay main front with a 5 bay range and further 2-bay projecting cross-range to right. The central entrance has a late 17th or early 18th century raised and fielded 2-panel door. There are casement windows with transoms and leaded lights, a gabled stair projection to the rear and a 19th century lean-to with corrugated iron roof to the south gable end. Internally there is a wooden staircase with a dog gate, wooden partitioning and wattle and daub walls.

The large roof timbers retain some wattle and daub infill, and one collar bears a central burn mark, whilst a purlin bears a hexafoil (daisy-wheel). There is a ridge piece and three sets of chamfered and stopped purlins.

## SAMPLING

Samples were taken in June 2016. The locations of the samples are described in Table 1, and shown in Fig 1. Core samples were extracted using a 15mm diameter borer attached to an electric drill. They were labelled (prefix **pugc**) 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).



**Figure 1:** Sketch of the plan of the roof area showing the truss numbering used in this report.

## **RESULTS AND DISCUSSION**

Details of the samples taken are given in Table 1. The basic plan of the house is shown in the sketch in Fig 1, making clear the truss numbering used in this report. Cross-matching between the series is shown in Table 2. The strong match between the two principal rafters from trusses 1 and 4 may indicate that they were formed from the same tree, but this is by no means certain. The series are quite ‘sensitive’ – that is, there is a lot of year-to-year variation in ring width. Possible matches were found for both **03** and **04**, but whereas the other individuals dated quite well independently, these each gave a number of weak potential matches, and it was decided that leaving them undated was the safest interpretation. Four samples were therefore dated (Table 1, Fig 2), and combined into a 155-year site chronology, **PLASUCGC**, that was dated to the period 1415–1569, the best matches being shown in Table 3.

Series **02** has a slightly earlier heartwood-sapwood boundary than the others, with a likely felling date range a little earlier than the felling date of the one core that retained complete sapwood. It could be that this was a stockpiled timber, or it may have simply been from a tree that had relatively more sapwood rings than 95% of the population of oaks.

The one felling date of spring 1570 is likely to represent the felling of all the trees used, and this therefore dates the likely construction of the roof to **1570**, or within a year or two after this date. Only one sample was dated from the cross-wing roof, showing it to be contemporaneous, as suggested by the identical style of the carpentry used.

## **ACKNOWLEDGEMENTS**

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**Table 1:** Details of samples taken from Plas Uchaf, Glan Conwy.

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
* pugc01	West principal rafter, T1	1427–1548	1545	3 +10NM	122	1.61	0.46	0.20	1558–86
* pugc02	West upper purlin, bay 1	1441–1523	1523	H/S	83	1.69	1.02	0.28	1534–64
pugc03	Collar, T2	-	-	?H/S	91	0.98	0.42	0.30	
pugc04	E jamb to doorway in T2	-	-	1	86	1.65	0.78	0.23	
pugc05	Middle E purlin, bay T3-T4	-	-	1	<40	NM	-	-	
* pugc06	West principal rafter T4	1415–1569	1538	3¼C	155	1.13	0.53	0.22	Spring 1570
* pugc07	South principal rafter T7	1451–1538	1538	H/S	88	1.64	0.36	0.23	1549–79
* = included in site master <b>PLASUCGC</b>		<b>1415–1569</b>			<b>155</b>	<b>1.41</b>	<b>0.53</b>	<b>0.20</b>	

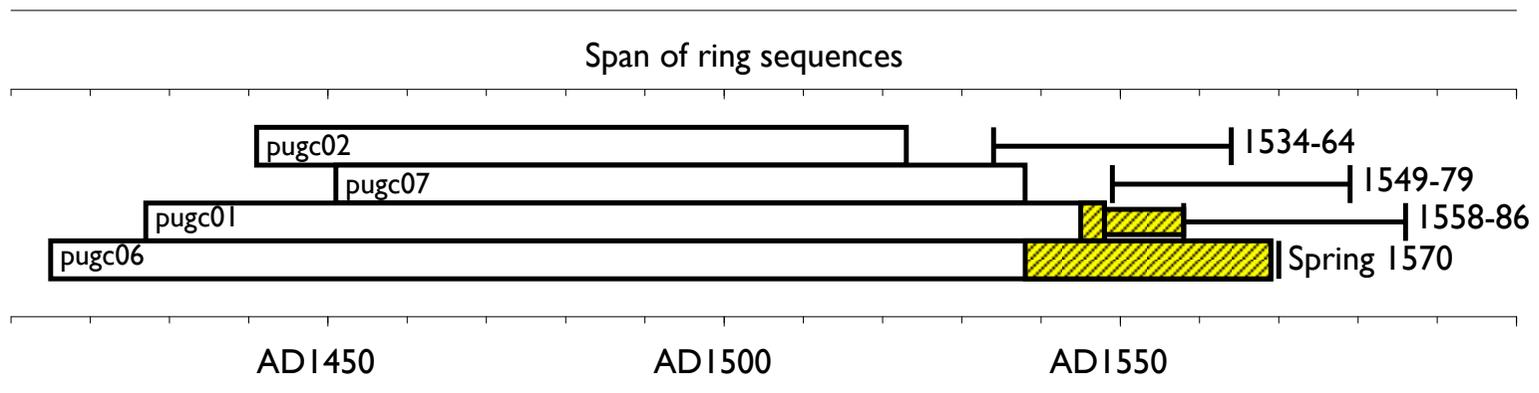
Key: H/S bdry = heartwood/sapwood boundary - last heartwood ring date; ¼C = complete sapwood, felled the following spring; std devn = standard deviation; mean sens = mean sensitivity; NM = not measured.

**Table 2:** Cross-matching between the dated samples (*t*-values above 3.5 are significant)

Sample	<i>t</i> -values		
	pugc02	pugc06	pugc07
pugc01	3.7	9.8	2.6
pugc02		4.5	3.5
pugc06			3.2

**Table 3:** Dating evidence for the site chronology **PLASUCGC AD 1415–1569** against dated reference chronologies

<i>County or region:</i>	<i>Chronology name:</i>	<i>Reference</i>	<i>File name:</i>	<i>Spanning</i>	<i>Overlap: (yrs)</i>	<i>t-value:</i>
<b>Regional Chronologies</b>						
Wales	Welsh Master Chronology	(Miles 1997b)	<b>WALES97</b>	404–1981	155	10.6
Shropshire	Shropshire Master Chronology	(Miles 1995)	<b>SALOP95</b>	881–1745	155	9.8
England	Southern Central England	(Wilson <i>et al</i> 2012)	<b>SCENG</b>	663–2009	155	8.7
<b>Site Chronologies</b>						
Denbighshire	Rose and Crown, Gwyddelwern	(Miles and Worthington 2000)	GWYDWN	1411–1571	155	10.1
Denbighshire	Llanelian-yn-Rhos church	(Miles <i>et al</i> 2011)	llnlnrs1	1410–1489	75	9.5
Montgomeryshire	Peniarth-Uchaf, Meifod	(Miles and Haddon-Reece 1996)	PENIARTH	1385–1550	136	9.2
Denbighshire	Caerfallen, Ruthin	(Bridge <i>et al</i> 2015)	CAERFLLN	1415–1559	145	9.2
Caernarvonshire	Plas Mawr House, Conwy	(Miles and Haddon-Reece 1996)	PLASMWR2	1360–1578	155	8.9
Montgomeryshire	St Idloes Church, Llanidloes	(Miles <i>et al</i> 2003)	LNYDLOS2	1384–1593	155	8.9
Denbighshire	Glas Hirfryn,	(Bridge <i>et al</i> 2014)	GHN	1404–1557	143	8.7
Caernarvonshire	Fedw Deg Old House, Penmachno	(Bridge <i>et al</i> 2015)	FEDWDEG	1417–1587	155	8.5
Denbighshire	Branas-Uchaf, Llandrillo	(Miles <i>et al</i> 2010)	DENBY6	1388–1763	155	8.3
Radnorshire	Ffinnant, Llansantffraid-ym-Machain	(Bridge <i>et al</i> 2013)	FFINNANT	1394–1609	155	8.1



**Figure 2:** Bar diagram showing the relative positions of overlap of the dated samples, with their actual or likely felling dates / date ranges. White sections represent heartwood rings and yellow hatched sections represent sapwood, narrow bars represent additional unmeasured rings.