DYDDIO HEN DAI CYMREIG | DATING OLD WELSH HOUSES

PROSIECT DENDROCRONOLEG GOGLEDD ORLLEWIN CYMRU | NORTH WEST WALES DENDROCHRONOLOGY PROJECT

Oxford Dendrochronology Laboratory
Report 2011/11

THE TREE-RING DATING OF 60 CASTLE STREET BEAUMARIS, ANGLESEY (NGR SH 604 759)

Summary

Eight timbers were sampled from two trusses and associated purlins in the roof, and the rear ground floor ceiling. Six timbers were dated, and three retained complete sapwood. The east post to the front (south) truss was from a tree felled in summer 1496, whilst two ground floor ceiling joists were felled in the spring and summer of 1516 respectively. Careful analysis and recording of the building will be required in order to see if the whole structure was likely to have been built in 1516, or within a year or two after this date, making use of a timber felled around twenty years previously as the post to one of the main trusses, or whether the building was constructed around 1496 and the rear bay was added a couple of decades later.

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April 2011

A report commissioned by The North West Wales Dendrochronology Project in partnership with The Royal Commission on the Ancient and Historical Monuments in Wales (RCAHMW).

The Tree-Ring Dating of 60 Castle Street, Beaumaris, Anglesey (NGR SH 604 759)

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).

60 CASTLE STREET

A late-medieval box-framed town-house lies behind the Georgian facade of 60 Castle Street. It has four bays defined by fragmentary posts-and-trusses and was probably storeyed throughout. The range appears similar in plan and construction to 6 Palace Street, Caernarfon, tree-ring dated 1506/7 (VA 41: 113), but sampling revealed unexpected complexities. The east post to the front (south) truss was from a tree felled in summer 1496, while two ground-floor ceiling joists in the rear bay gave felling dates in spring and summer 1516. It is not yet clear if the building is of two phases or one, with an earlier post.

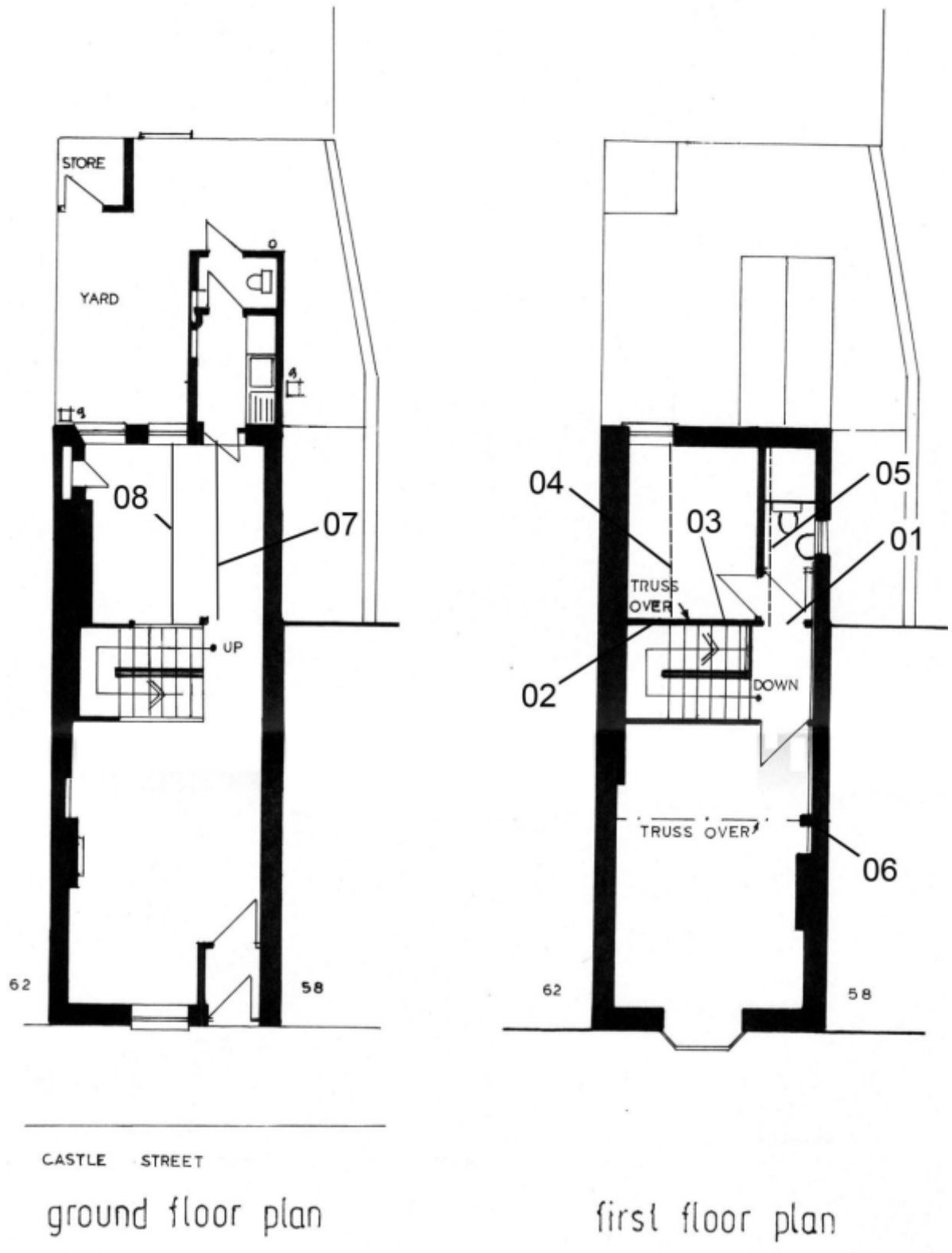

Figure 1: Plan of 60 Castle Street showing the approximate locations of samples taken for dendrochronology, adapted from an original drawing by Mr O'Dell

SAMPLING

Sampling took place in March 2011. 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 **csbm**. 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 and illustrated in Figure 1. The shortest sequence, from a purlin in the rear bay (furthest from the road), was too short to be useful and was not measured. The sequence from the other purlin in this bay only had 40 rings, and did not match any of the other sequences, nor did it date. The remaining six samples, from roof trusses, a post, and floor joists, matched each other (Table 2) and were combined into a 125-year site master, **ANGK**, which was subsequently dated to the period 1391–1515, the dating evidence being presented in Table 3.

Three timbers retained complete sapwood, the east post to the front (south) truss was from a tree felled in summer 1496, whilst the two joists in the rear ground floor bay (kitchen) were from trees felled in the spring and summer of 1516. Other felling date ranges are consistent with these dates. Careful recording and analysis of the structure may reveal whether the rear bay is actually an addition made a few years after the main body of the building, or whether the post was perhaps stockpiled for a few years before use.

The relative positions of overlap of the dated timbers is shown, along with their actual felling dates, or likely felling date ranges, in Figure 2.

ACKNOWLEDGEMENTS

I would like to thank the owners, Mr and Mrs O'Dell for allowing the sampling and supplying drawings of the site, Margaret Dunn for introducing me to the property and supplying the cover photograph, and Richard Suggett for supplying a description of the building.

I would also thank my fellow dendrochronologists for permission to use their data.

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

Table 1: Details of samples taken from 60 Castle Street, Beaumaris, Anglesey.

Sample number	Timber and position	Dates AD spanning	H/S bdry	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens	Felling seasons and dates/date ranges (AD)
* csbm01	Rear truss, east principal rafter	1393-1490	1490	H/S	98	0.73	0.22	0.21	1501–1531
* csbm02	Rear truss, west principal rafter	1396-1495	1495	H/S	100	1.12	0.43	0.21	1506–1536
* csbm03	Rear truss, collar	1403-1489	1489	H/S	87	1.23	0.42	0.24	1500–1530
csbm04	Rear bay, west purlin	undated	-	H/S	<40	NM	-	-	unknown
csbm05	Rear bay, east purlin	undated	-	-	40	1.43	0.62	0.29	unknown
* csbm06	Front truss, east post	1391-1495	1484	11½C	105	1.23	0.96	0.23	Summer 1496
* csbm07	Rear Grd Flr, 2nd joist from east	1401-1515	1474	41½C	115	1.05	0.37	0.23	Summer 1516
* csbm08	Rear Grd Flr, 3rd joist from east	1411-1515	1489	26¼C	105	1.18	0.38	0.23	Spring 1516
* = included in site master **ANGK**		**1391–1515**			**125**	**1.13**	**0.40**	**0.17**	

Key: H/S bdry = heartwood/sapwood boundary - last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity; ¼C = bark edge present, felled the following spring; ½C = bark edge present, felled the following summer; NM = not measured

Table 2: Cross-matching between the dated series forming site chronology **ANGK**

	t - values				
Sample	**csbm02**	**csbm03**	**csbm06**	**csbm07**	**csbm08**
csbm01	4.5	5.4	2.6	4.7	3.2
csbm02		7.6	2.9	5.5	3.9
csbm03			4.0	7.8	3.8
csbm06				5.1	4.5
csbm07					3.6

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Table 3. Dating evidence for the site chronology **ANGK,** AD 1391–1515 against individual site chronologies

County or region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning:*	*Overlap (yrs):*	*t-value:*
Wales	Tudor Rose, Beaumaris	(Miles *et al* 2010)	ANGLSY3b	1383-1485	95	7.8
Wales	Plas Mawr House	(Miles 1997b)	PLASMAWR	1360–1578	125	6.6
Wales	Pengwern Old Hall	(Miles *et al* 2003)	PENGWERN	1353–1521	125	6.6
Wales	Bwthyn Cae-glas, Llanfrothen	(Miles *et al* 2006)	BDGLRT7	1386–1547	125	6.4
Wales	Pen Y Bryn, Abergwyngregyn	(Miles *et al* 2010)	GWYNEDD4	1403–1585	113	6.3
Oxfordshire	Whittles Farm	(Miles and Haddon-Reece 1993)	MDM11	1355–1471	81	6.2
Herefordshire	Farmer's Club, Hereford	(Tyers 1996)	HEREFC	1313–1640	125	6.0
Wales	Plas Coch, Anglesey	(Miles *et al* 2011)	PLASCOCH	1402–1591	114	5.8
Wales	11 Castle Street, Conwy	(Miles *et al* 2010)	CONWY1	1385–1441	51	5.6
Wales	Trefrechan barn	(Miles *et al* 2004)	TREFECHN	1423–1606	93	5.6
Wales	Parc Llanfrothen	(Miles *et al* 2006)	BDGLRT22	1386–1669	125	5.6

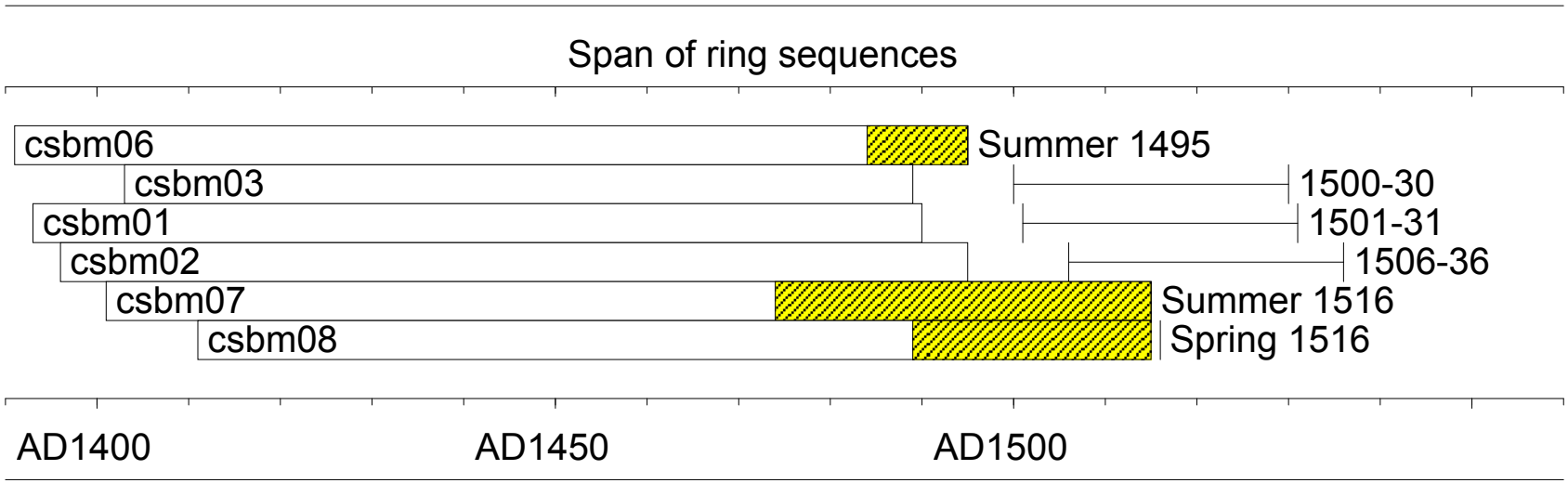

Figure 2: Bar diagram showing the relative positions of overlap of the dated timbers from 60 Castle Street, Beaumaris. Yellow hatched sections represent sapwood rings.

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