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Oxford Dendrochronology Laboratory
Report 2015/49

THE DENDROCHRONOLOGICAL DATING OF COED-Y-FOEL, DERWEN, DENBIGHSHIRE (SJ 075 504)

Summary
Two timbers from the primary phase of the building, a tie beam and a purlin from different ends of the building, matched each other well and were combined to make a 76-year long site chronology, which was subsequently dated to the period 1436–1511. The tiebeam retained complete sapwood, and was made from a tree felled in winter **1511/12,** making construction most likely in 1512 or within a year or two after this date. Timbers from the later phase were assessed as having too few rings to be suitable for dendrochronological dating.

Author: Dr M. C. Bridge FSA
Oxford Dendrochronology Laboratory
Mill Farm
Mapledurham
Oxfordshire
RG4 7TX

November 2015

The Dendrochronological Dating of Coed-y-Foel, Derwen, Denbighshire (SJ 075 504)

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.

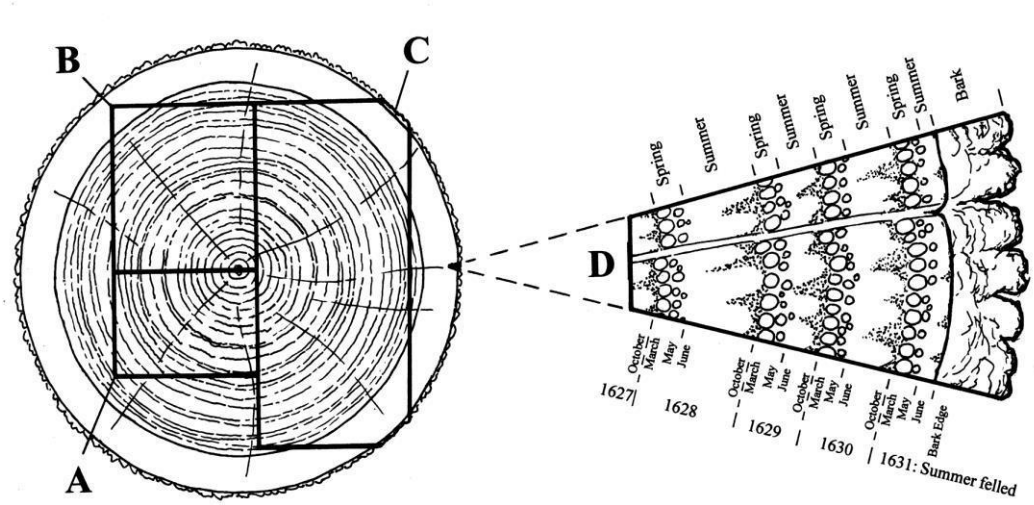
The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's *t*-test. The *t*-test compares the actual difference between two means in relation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

Coed-y-Foel (Notes by Richard Suggett)

Coed-y-foel is a stone-built vernacular house of regional lobby-entry plan type incorporating a substantial part of a late-medieval hall-house. Coed-y-foel, thatched and low-eaved, was illustrated in the Royal Commission *Denbighshire Inventory* (1914: plate 1 and no. 138A) as 'a representative example of the humble domestic structures' of the county. It still retains a thatched roof and is essentially one-and-a-half storeys. The house has two distinct phases:

(1) A downslope-sited late-medieval cruck-framed hall-house, probably originally timber-walled.

(2) A stone-walled house of regional lobby-entry type with inserted back-to-back fireplace, ceilings (concealed in the hall), and post-and-panel partitions.

1. Three crucks survive defining the hall and inner-room of a hall-house. The passage and outer bay are preserved by the baying of the sub-medieval house although the crucks have been lost. The late-medieval house was a timber hall-house of peasant type, i.e. having a hall of a single bay entered from

the passage bay. The surviving crucks are of the same type with tie-beam and cranked collar. The truss at the entry to the hall was enhanced with chamfers and by a post between collar and tie-beam. The dais partition truss incorporates a post-and-panel partition with separate headbeam but this relates awkwardly to the truss and is presumably later. In the lower end the ceiling of broad, closely spaced, flat joists (some replaced and originally with evidence for a stair) may belong to the first phase. The roof has been adjusted, with most joists re-set or replaced, but one purlin retains the mortice for a windbrace over the hall.

2. In a second phase (or series of phases) the timber walls were replaced in stone; a back-to-back fireplace inserted in the passage bay heating hall and kitchen. The two-door post-and-panel partition probably belongs to this phase. The partition has moulded posts with quarter-round mouldings on the hall side but the partition dividing the inner room is plain. The list description notes a reported date inscription of 1633 but this has been lost.

Extract from Coflein (RCAHMW's on-line database). NPRN 27038. R.F. Suggett/RCAHMW/2015

SAMPLING

Samples were taken in November 2015. 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 **cofy**) 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. One sample turned out to be too short to be useful, and was discarded from further analysis. Two samples matched each other well (t = 7.2 with 52 years overlap) and were combined to form a 76-year long site master, COEDYFL. This was subsequently dated to the period 1436–1511, the strongest matches being shown in Table 2. The other two series could not be matched to this, nor did they date independently. The tiebeam from the northernmost truss (over the screen) retained complete sapwood, and the east purlin from the second bay from the south end retained the heartwood-sapwood boundary (Figure 1). The tree used to form the tiebeam was felled in the winter of 1511/12, and had the same heartwood-sapwood boundary date as that of the purlin, making construction most likely in 1512, or within a year or two after this date. Unfortunately, timbers from the later phases had too few rings to be datable, except the fireplace lintel, but this could not be cored from a satisfactory position.

ACKNOWLEDGEMENTS

This study was commissioned by the owners Mr and Mrs Hankin, and I am grateful to them for their hospitality. Richard Suggett (RCAHMW) was present at the time of sampling and kindly provided the description used in this report. I thank my fellow dendrochronologists for permission to use their data.

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Table 1: Details of samples taken from Coed-y-Foel, Derwen.

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
* cofy01	Tiebeam to N truss (above screen)	1436-1511	1487	24C	76	2.08	0.70	0.26	Winter 1511/12
cofy02	NE upper purlin	-	-	h/s	<50	NM	-	-	-
* cofy03	East purlin, second bay from south	1436-1487	1487	h/s	52	2.04	0.82	0.22	1498–1528
cofy04	East cruck to south truss	-	-	h/s	51	2.49	0.90	0.22	-
cofy05	W upper purlin, 3rd bay from S	-	-	h/s (+17C NM)	50	2.53	0.94	0.23	-
* = included in site master **COEDYFL**		**1436-1511**			**76**	**2.02**	**0.52**	**0.23**	

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.

Table 2: Dating evidence for the site sequence **COEDYFL** **AD 1436–1511** against dated reference chronologies

County or region	*Chronology name*	*Reference*	*File name*	*Spanning*	*Overlap (yrs)*	*t-value*
Regional Chronologies						
Wales/borders	Hillside oaks	(Siebenlist-Kerner 1978)	**GIERTZ**	1341–1636	76	8.7
Shropshire	Shropshire Master Chronology	(Miles 1995)	**SALOP95**	881–1745	76	8.4
Site Chronologies						
Denbighshire	Glas Hirfryn,	(Bridge *et al* 2014)	GHN	1404–1557	76	10.2
Radnorshire	Ffinnant, Llansantffraid-ym-Machain	(Bridge *et al* 2013)	FFINNANT	1394–1609	76	9.9
Denbighshire	Caerfallen, Ruthin	(Bridge *et al* 2015)	CAERFLLN	1415–1559	76	9.5
Radnorshire	Old Impton Norton	(Miles and Worthington 1998)	OLDIMTN2	1415–1542	76	9.4
Shropshire	Clungunford Master Chronology	(Miles 2002 unpubl)	**CLNGNFRD**	1273–1653	76	9.3
Staffordshire	Sinai Park	(Tyers 1997)	SINAI	1227–1750	76	9.0
Montgomeryshire	Kerry Church	(Miles *et al* 2011)	KERRY	1402–1567	76	8.8
Shropshire	Old Hall Farm, All Stretton	(Miles and Haddon-Reece 1996)	OLDHLLFM	1379–1630	76	8.6

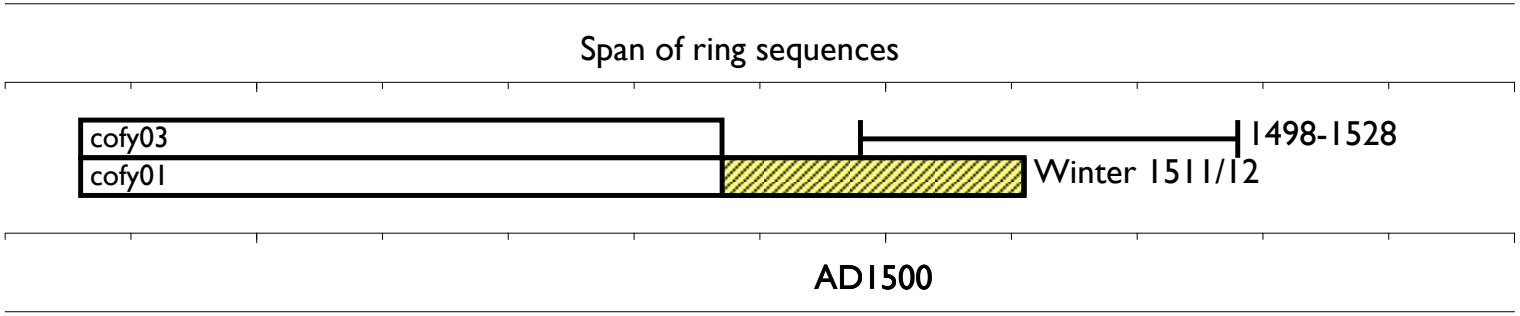

Figure 1: Bar diagram showing the relative positions of overlap of the dated samples, with their actual or likely felling dates / date ranges. White sections represent heartwood rings and yellow hatched sections represent sapwood.