Oxford Dendrochronology Laboratory
Report 2011/14

**THE TREE-RING DATING OF
CYMRYD ISAF,
BACLAW LANE,
CONWY
(NGR SH 788 755)**

Summary
Four potential phases were identified within the property, and these were all sampled, though some had relatively few timbers with sufficient numbers of rings for dating. Two of these phases, the eastern half of the inserted hall floor and the cross-wing failed to yield any dates. Two other phases each yielded two dated sequences, but the dating of these were in conflict with each other. All gave dates not far from the *c*1500 date suggested previously for the date of the oldest part of the house.

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(NGR SH 788 755)

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).
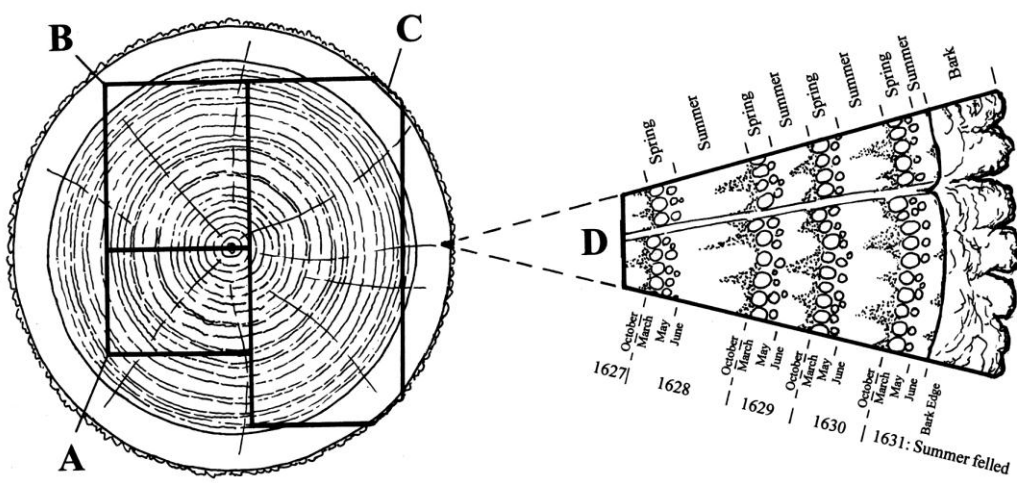
Section of tree with conversion methods showing three types of sapwood retention resulting in **A** *terminus post quem*, **B** a felling date range, and **C** a precise felling date. Enlarged area **D** shows the outermost rings of the sapwood with growing seasons (Miles 1997, 42)

CYMRYD ISAF (Notes from Royal Commission, 1956)

The eastern block is of one storey with inserted attics and thought to have been built around 1500. It probably extended further west, covering part of the space now occupied by the added cross-wing of two storeys with attics – which carries the inscription with a date of 1696.

The main elevation of the older block faces north. It is of three bays, the two on the west forming the hall, and the third a separate room. The partition between the passage and the east room is original. The doorheads have depressed pointed heads and that on the south is certainly original. The east room is ceiled with stop-chamfered joists, resting at one end on corbels inserted in the east wall, and at the other on a beam set against the partition and 2ft below its head. The hall was ceiled in two stages, the east half being the earlier (see Fig 1). The hall roof has a central truss of collar-beam type with cusped raking struts and curved wall and wind braces. The east truss is of simple collar-beam type, with the head of the partition acting as a tiebeam. The partition between the earlier house and the added wing has chamfered posts, and probably represents the original partition between the hall and the (now missing) solar. The stair is of 1696 with shaped strip balusters.

SAMPLING

Sampling took place in January 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 **deng**. 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 Fig 2. Despite obtaining several long ring series, cross-matching between the samples was generally very poor, accept in the case of **cryd 21** and **22** ($t = 10$), making it likely that these two joists were from the same parent tree. No samples from what was presumed to be the earliest phase (?phase 1) the east ceiling to the hall matched each other, or dated independently against reference material. Similarly, no samples from the cross-wing (phase 3) – supposed to date to 1696, matched each other well, or dated independently, though several of these had long series and no obvious signs of unusual growth.

Two timbers from the pantry ceiling (presumed phase 2) did date. One joist retained the heartwood-sapwood boundary, and clearly dated to 1512, giving a likely felling date range of 1523–53. A second joist had only 43 rings, but this matched against the dated joist with a very short (24-year) overlap, but comparison of the plots and independent dating of the short sequence confirmed this match. This short sequence was thought to have retained the heartwood-sapwood boundary, though less clearly than the former joist. If so, this would give an earlier felling date range of **1491–1521**. If the oldest part of the house is *c*1500, as suggested by the Royal Commission (1956), then this is either contemporary, or an early extension of the earliest phase.

The second half of the inserted hall floor (phase 4) also had two joists that dated, and these too gave different likely felling date ranges, making interpretation difficult. One was most likely felled in the period 1474–88 (could this be a re-used timber from the earliest phase?), the other was most likely felled in the period 1519–43.

With so few individual timbers being dated, and with apparent different dates for two timbers in each of the two phases that did yield dates, it is not really possible to draw many conclusions with regard to dating, other than that the Royal Commission appear to have been about right with their suggested dating of around 1500.

If the four dated timbers are combined into a site master chronology, which some might criticise since there is little cross-matching between these individual sequences, they do seem to produce a chronology that dates very well against other sites in the region (Table 2), and may be useful in dating new sites in the area.

It is quite unusual to have so many good looking samples yield so little dating information. Some of the samples had bands of narrow rings, but nevertheless others looked like good candidates for dating by this methodology.
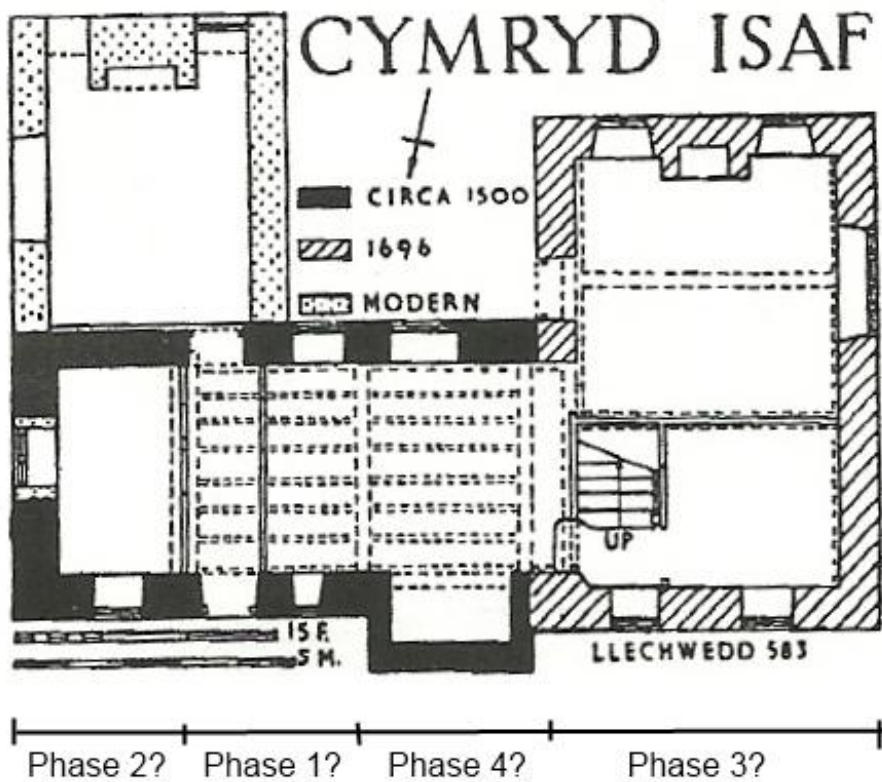
Figure 1: Royal Commission (1956) plan of the house, showing the possible phasing
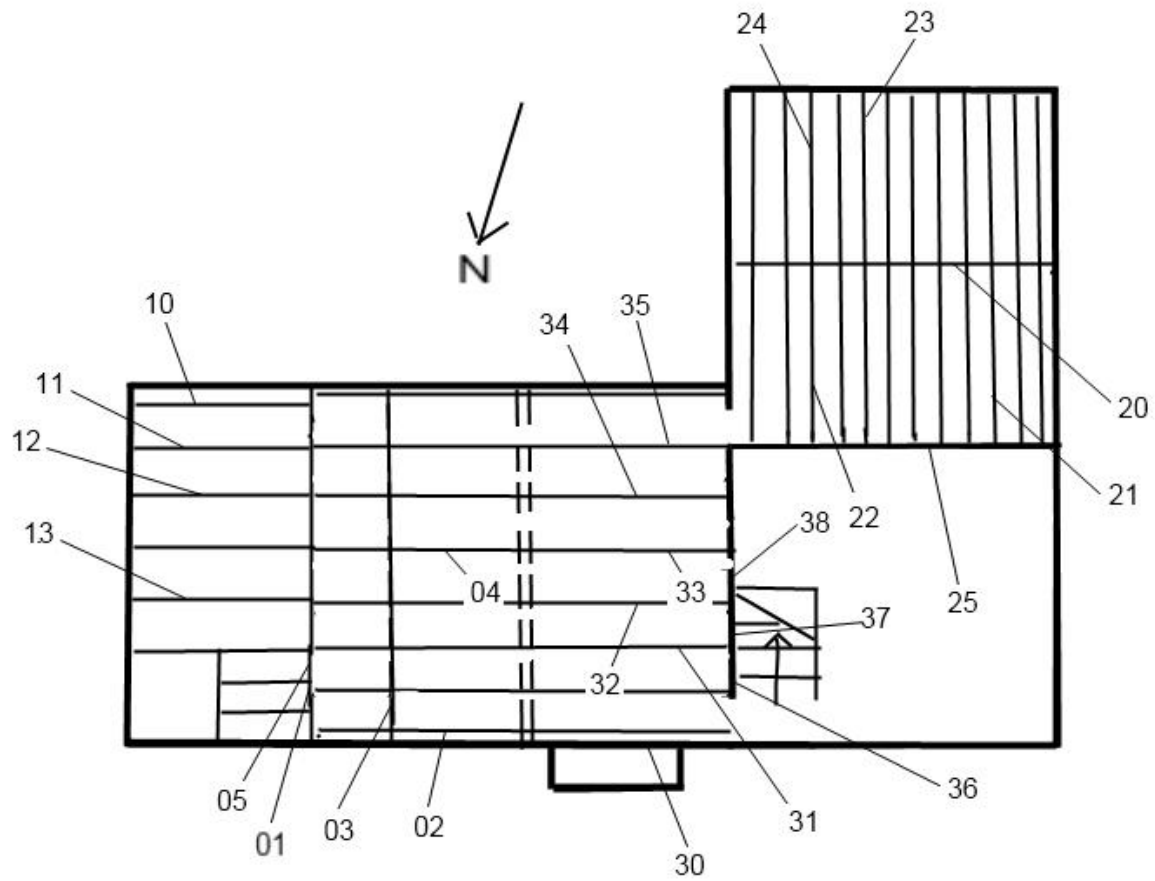
Figure 2: Field plan of the old parts of the house, showing the timbers sampled for dendrochronology

Table 1: Details of samples taken from Cymryd Isaf.

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
Phase 1?									
cryd01	Jetty beam at W end	undated	-	24½C	88	1.51	0.77	0.23	unknown
cryd02	Joist at N end	undated	-	-	51	2.25	0.70	0.28	unknown
cryd03	E end beam	undated	-	-	<40	NM	-	-	unknown
cryd04	4th joist from S end	undated	-	3+3NM	67	1.69	0.97	0.32	unknown
cryd05	Screen muntin 3rd from S	undated	-	-	<40	NM	-	-	unknown
Phase 2? (Pantry)									
cryd10	Joist 1st from S	undated	-	20C	36	2.72	1.62	0.31	unknown
cryd11	Joist 2nd from S	1456-1512	1512	H/S	57	2.28	0.73	0.27	1523–53
cryd12	Joist 3rd from S	undated	-	-	<40	NM	-	-	unknown
cryd13	Joist 5th from S	1438-1480	?1480	?H/S	43	2.05	0.74	0.29	?1491–1521
Phase 3?									
cryd20	Ceiling beam in S room	undated	-	9½C	156	1.01	0.44	0.22	unknown
cryd21	Joist 3rd from W, N side of S room	undated	-	?H/S	86	1.12	-.38	0.31	unknown
cryd22	Joist 10th from W, *ditto*	undated	-	-	63	1.29	0.79	0.34	unknown
cryd23	Joist 10th from W, S side of S room	undated	-	17+11NM	98	0.80	0.40	0.26	unknown
cryd24	Joist 8th from W, *ditto*	undated	-	28½C	94	1.42	0.86	0.30	unknown
cryd25	North beam in crosswing	undated	-	H/S	64	1.53	0.60	0.24	unknown
Phase 4?									
cryd30	Mantel beam	undated	-	24C	109	0.98	0.54	0.23	unknown
cryd31	Joist 6th from S	1383-1468	1446	22+6NM	86	1.41	1.11	0.27	1474–88
cryd32	Joist 5th from S	undated	-	28+2NM	92	1.28	0.72	0.27	unknown
cryd33	Joist 4th from S	undated	-	19+14NM	79	1.39	1.23	0.28	unknown
cryd34	Joist 3rd from S	undated	-	H/S	52	1.62	0.93	0.31	unknown
cryd35	Joist 2nd from S	1460-1518	1501	17	59	1.68	0.75	0.30	1519–43
cryd36	South door jamb at screen end	undated	-	?H/S	70	0.96	0.35	0.17	unknown
cryd37	Screen muntin 3rd from N	undated	-	36C	72	0.76	0.37	0.22	unknown
cryd38	Screen, N jamb to upper door	undated	-	32C	66	1.11	0.71	0.24	unknown

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

Table 2: Dating evidence for the site master **CYMRYD AD 1383–1518** against dated reference chronologies, regional chronologies in **bold**

County or region:	Chronology name:	Short publication reference:	File name:	Spanning:	Overlap (yrs):	t-value:
Wales	Welsh Master Chronology	(Miles 1997b)	**WALES97**	404-1981	136	7.7
Wales	Rose and Crown, Gwydwn	(Miles and Worthington 2000)	GWYDWN	1411-1571	108	7.2
Wales	Ty Cerrig, Llanfwrog	(Miles *et al* 2011)	DENBY7a	1420-1500	81	7.2
Wales	Cefn Caer Pennal	(Miles and Worthington 1999)	CEFNCAR1	1404-1525	115	7.0
Warwickshire	Gorcott Hall	(Nayling 2006)	GORC_T17	1385-1531	134	7.0
Staffordshire	Sinai Park	(Tyers 1997)	SINAI	1227-1750	136	7.0
Wales	Tyn Celyn	(Miles *et al* 2004)	TYNCELYN	1375-1524	136	7.0
Shropshire	53 Broad Street, Ludlow	(Miles *et al* 2008)	LUDLOW13	1410-1597	109	6.9
Worcestershire	The Hyde, Stoke Bliss	(Miles *et al* 2004)	HYDE1	1413-1564	106	6.6
Shropshire	**Shropshire Master Chronology**	(Miles 1995)	**SALOP95**	881-1745	136	6.6
Gloucestershire	Westgate St, Gloucester	(Tyers and Wilson 2000)	WGATE1	1209-1518	136	6.6
Wales	Plas Mawr House	(Miles 1997c)	PLASMAWR	1360-1578	136	6.4
Wales	George and Dragon, Beaumaris	(Miles *et al* 2010)	ANGLSY1	1437-1540	82	6.4
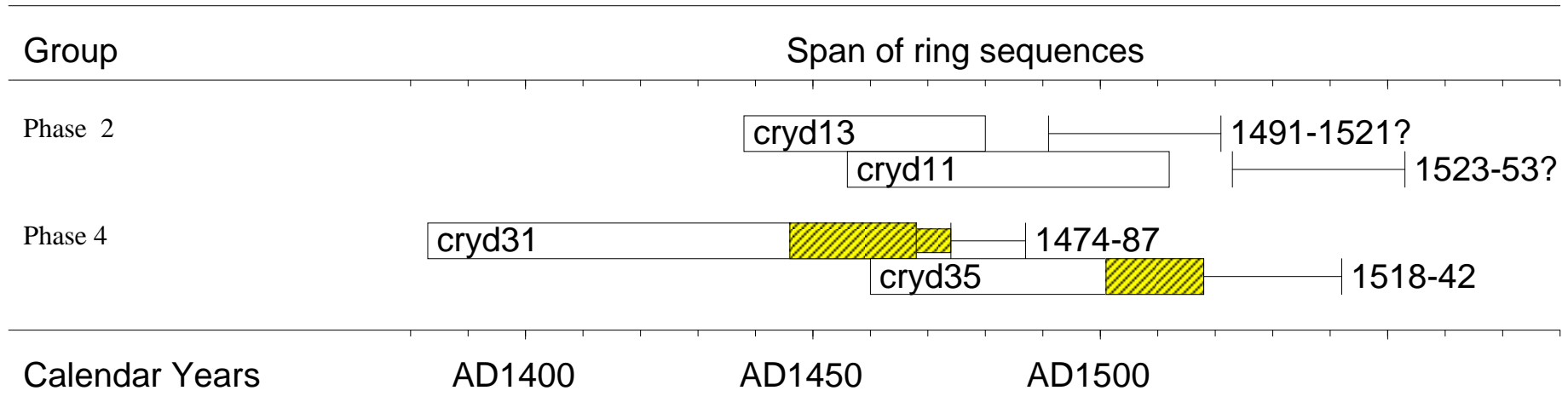
Figure 1: Bar diagram showing the relative positions of overlap of the dated series, along with their interpreted likely felling date ranges. Hatched yellow sections represent sapwood rings, and narrow sections of bar represent additional unmeasured rings

ACKNOWLEDGEMENTS

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