Darganfod Hen Dai Cymreig
Discovering Old Welsh Houses

Reports: Welcome to the many Discovering Old Welsh Houses Reports which are available here on our website. All the reports - House Histories, Building Reports and Tree-ring Dating reports - can be accessed - *here*

Discovering Old Welsh Houses studies and celebrates the traditional houses of North Wales and the lives of the people who lived in them.

If you find the content useful, please consider becoming a *Member* to access the many benefits available.

Please note that these reports are being updated as part of an ongoing programme of revision. Older reports sometimes refer to the old names of the Group. Between 2005 and 2012 also known as The Snowdonia Dendrochronology Project, then the N W Wales Dendrochronology Project and then the Dating Old Welsh Houses Group.

New reports will be added from time to time. Keep an eye on our website for updates.

Oxford Dendrochronology Laboratory
Report 2014/26

THE TREE-RING DATING OF PARADWYS, CLOCAENOG, RUTHIN, DENBIGHSHIRE (NGR SJ 083 540)

Summary
Four timbers, two crucks, a tiebeam and a purlin, were sampled at this property. The four series appeared to have been felled at about the same time, and one retained complete sapwood, being from a tree felled in Summer 1574. It seems likely therefore that construction took place in **1574**, or within a year or two after this date.

Authors: Dr M. C. Bridge FSA and Dr. D. Miles FSA
Oxford Dendrochronology Laboratory
Mill Farm
Mapledurham
Oxfordshire
RG4 7TX

September 2014

A report commissioned by Dating Old Welsh Houses Project in partnership with
The Royal Commission on the Ancient and Historical Monuments in Wales (RCAHMW).

The Tree-Ring Dating of Paradwys, Clocaenog, Ruthin, Denbighshire
(NGR SJ 083 540)

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.

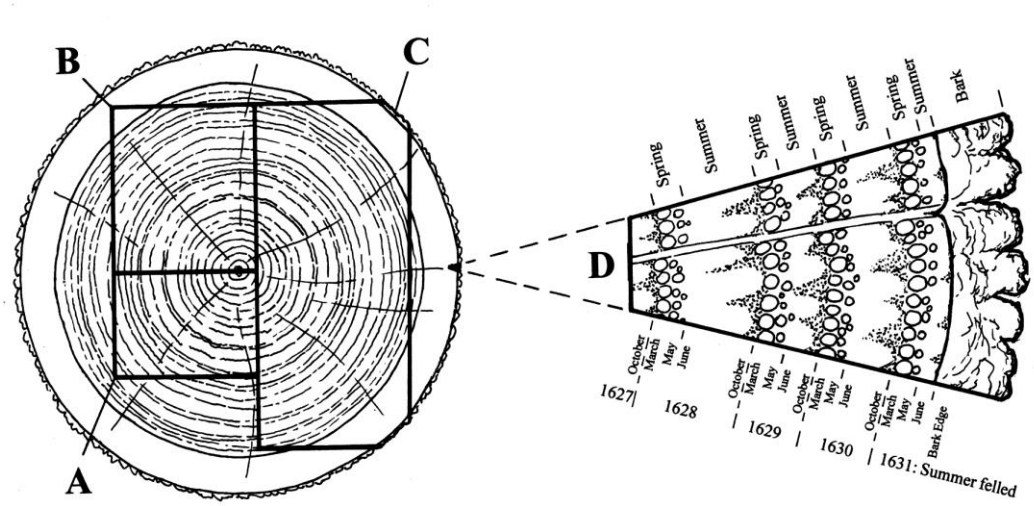
One can develop long reference chronologies by cross-matching the innermost rings of modern timbers with the outermost rings of older timbers successively back in time, adding data from numerous sites. Data now exist covering many thousands of years and it is, in theory, possible to match a sequence 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 1997a, 42)

PARADWYS (notes by Richard Suggett)

Paradwys (formerly the Paradise tavern) is a roadside vernacular house of sixteenth-century origin. The timber walls have been replaced in stone but the lobby-entrance has been retained. The core of the house is a cruck-framed hall-house, probably of 'peasant' type with a single-bayed hall. Two cruck-trusses survive from the hall (upper end) and passage ends of a hall-house. The truss between them at the entrance to the hall has been lost with the insertion of the fireplace. The cruck-trusses are of middling size (some 16 feet high) and have now been shown to have a relatively late felling date. The

hall fireplace, which is constructed from large, hand-made bricks, may have been inserted relatively early. This has been adapted as a back-to-back fireplace, with the second fireplace heating an outer parlour. The framing of the ceiling relates awkwardly to the fireplace and may predate it.

Coflein (RCAHMW's on-line database) entry: NPRN 27614. R.F.Suggett/RCAHMW/November 2014.

SAMPLING

Sampling took place in June 2014. 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 **prds**. Locations of the samples are illustrated in Fig 1. 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. The ring-width series were compared on an IBM compatible computer for statistical cross-matching using a variant of the Belfast CROS program (Baillie and Pilcher 1973). A version of this and other programmes were written in BASIC by D Haddon-Reece, and re-written in Microsoft Visual Basic by M R Allwright and P A Parker. Subsequent analyses were carried out using DENDRO for WINDOWS, written by Ian Tyers (Tyers 2004).

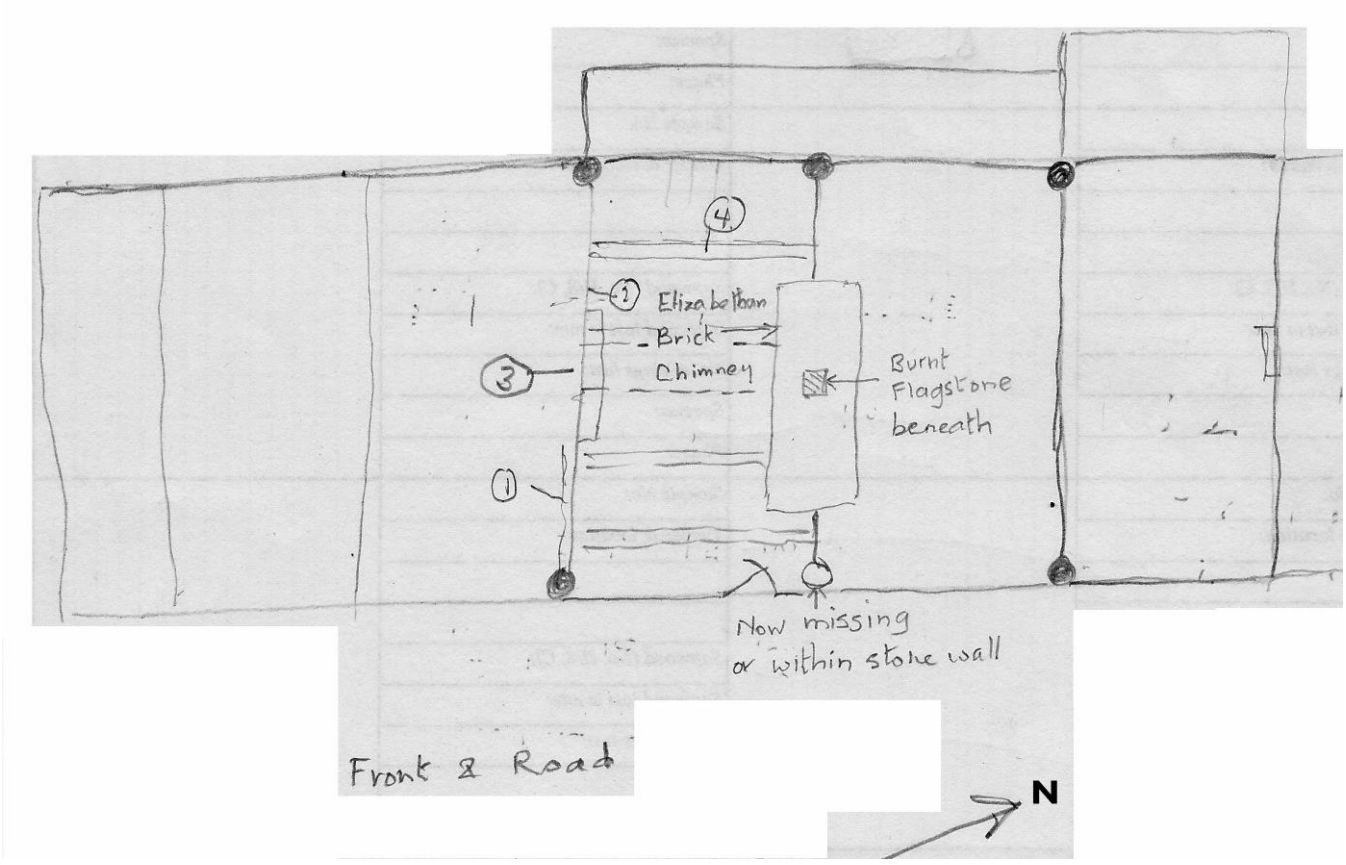


Figure 1: Field sketch of the site, showing locations of samples (DM)

RESULTS AND DISCUSSION

Basic information about the samples and their origins are shown in Table 1. The cross-matching between series is shown in Table 2. Whilst there were matches, those for sample 4 were rather lower than the others, and as an independent check, this series was dated individually, the results being shown in Table 3a. This sample had its strongest matches with sites to the east, mostly in Shropshire, and its poorer matching with the other series may possibly indicate a different source for this individual timber. The relative positions of overlap are shown in Fig 2, and the four series were combined into a 162-year long chronology, **PARADWYS**. This was subsequently dated to the period 1412–1573, the strongest matches being shown in Table 3b.

The four timbers appear to form a group most likely felled at around the same time. One timber retained complete sapwood and was from a tree felled in Summer 1574. It seems likely therefore that the construction of the property was undertaken in **1574**, or within a couple of years after this date.

ACKNOWLEDGEMENTS

This study was commissioned by Margaret Dunn of the charity Dating Old Welsh Houses (who supplied the cover photo) in collaboration with Richard Suggett of the Royal Commission on Ancient and Historic Monuments of Wales who assisted in the interpretation on site, and provided useful background information. We thank the owners, Mr & Mrs Naisby, for allowing the work to take place. We thank our fellow dendrochronologists for permission to use their data.

Table 1: Details of samples taken from Paradwys, Clocaenog.

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
***prds1**	Cruck T1 east	1442-1546	1541	5 +23NM	105	2.06	1.06	0.27	1569–74
***prds2**	Cruck T1 west	1412-1540	1540	H/S	129	1.05	0.51	0.22	1551–81
***prds3**	Tiebeam T1	1457-1538	1538	H/S	82	1.65	1.05	0.32	1549–79
***prds4**	West lower purlin	1434-1573	1549	24½C	140	1.04	0.58	0.20	Summer 1574
* = included in site master **PARADWYS**		**1412-1573**			**162**	**1.40**	**0.63**	**0.22**	

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 samples (values over 3.5 are significant)

Sample	prds2	prds3	prds4
prds1	5.9	5.0	3.3
prds2		3.8	2.4
prds3			3.0

Table 3a: Dating evidence for series **prds4 AD 1434–1573**

County or region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning:*	*Overlap (yrs):*	*t-value:*
Individual site chronologies						
Worcestershire	Crowle Abbey	(Hillam 1997)	CROWLE2	1412–1496	63	7.4
Wales	Ucheldref Rhug, Corwen	(Miles *et al* 2010)	DENBY4	1373–1597	140	7.0
Shropshire	Bryn Cambric, Clun	(Worthington and Miles 2003)	BRYNCAM	1371–1500	67	7.0
Shropshire	Bank Farm, Aston Piggot	(Bridge 1996)	ASTONPIG	1418–1581	140	7.0
Shropshire	St Swithin's Church, Clunby	(Tyers 2000)	CLUNBY	1239–1494	61	6.9
Shropshire	Brookgate Farm	(Miles and Haddon-Reece 1993)	BROOKGT	1362–1611	140	6.4

Table 3b: Dating evidence for the site master **PARADWYS AD 1412–1573** against dated reference chronologies, regional chronologies in **bold**

County or region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning:*	*Overlap (yrs):*	*t-value:*
Regional chronologies						
Wales	Welsh Master Chronology	(Miles 1997b)	**WALES97**	404–1981	162	6.6
Individual site chronologies						
Wales	Glas Hirfryn, Denbighshire	(Bridge *et al* 2014)	GHN	1404–1557	146	8.7
Wales	Ucheldref Rhug, Corwen	(Miles *et al* 2010)	DENBY4	1373–1597	162	7.9
Wales	Tyn-Llyn Gwyddelwern	(Miles *et al* 2010)	DENBY5	1410–1518	107	7.6
Worcestershire	Bower Court, Rock	(Bridge 2002)	BOWERCT	1359–1475	64	7.1
Wales	Rose and Crown, Gwydwn	(Miles and Worthington 2000)	GWYDWN	1411–1571	160	7.0
Shropshire	Roseleigh, All Stretton	(Miles *et al* 2007)	ALLSTRET	1386–1509	98	6.6
Herefordshire	Church Ale House, Colwall	(Hillam 1991)	COLWALL5	1401–1509	98	6.4
Wales	Cwrt Plas yn Dre	(Bridge *et al* 2013)	CWRTPLAS	1397–1508	97	6.4
Shropshire	Bryn Cambric, Clun	(Worthington and Miles 2003)	BRYNCAM	1371–1500	89	6.3
Wales	St Idloes Church, Llanidloes	(Miles *et al* 2003)	LNYDLOS2	1384–1593	162	6.3
Shropshire	28 Watergate, Whitchurch	(Miles and Worthington 2001)	WHGHWHIT	1416–1596	158	6.3

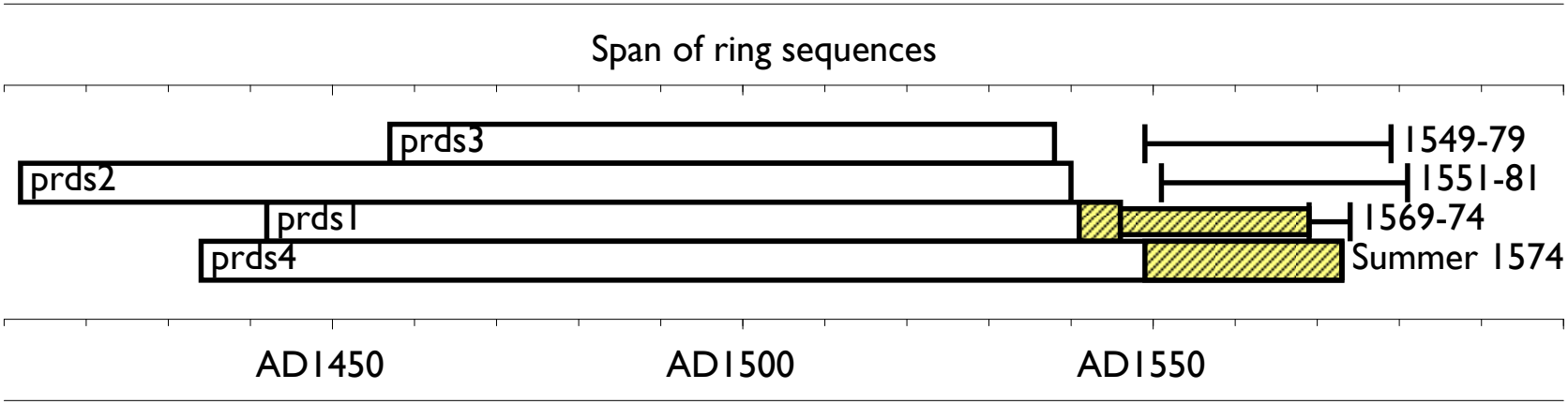


Figure 2: Bar diagram showing the relative positions of overlap of the dated series, along with their interpreted likely, or actual, felling date ranges. Hatched yellow sections represent sapwood rings, and narrow sections of bar represent additional unmeasured rings

REFERENCES

Baillie, M.G.L. and Pilcher, J.R. (1973) *A simple cross-dating program for tree-ring research*. **Tree Ring Bulletin**, 33, 7-14.

Bridge, M. C. (1988) The dendrochronological dating of buildings in southern England, **Medieval Archaeology**, 32, 166-174.

Bridge, M. C. (1996) List 69 - Tree-ring dates, **Vernacular Architecture**, 27, 91-92.

Bridge, M. C. (2002) Tree-ring dates -List 124, **Vernacular Architecture**, 33, 74-78.

Bridge, M. C., Miles, D., Suggett, R. and Dunn, M. (2013) Tree-Ring Dating Lists, **Vernacular Architecture**, 44, 105-111.

Bridge, M. C., Miles, D., Suggett, R. and Dunn, M. (2014) Tree-Ring Dating Lists, **Vernacular Architecture**, 45, in press.

English Heritage (1998) *Guidelines on producing and interpreting dendrochronological dates*, **English Heritage, London.**

Hillam, J. (1991) *Tree-ring analysis of oak timbers from The Church Ale House, Colwall, Hereford and Worcester*, **Anc Mon Lab Rep**, 106/91.

Hillam, J. (1997) *Tree-ring analysis of oak timbers from Crowle Court barn, near Worcester, Worcestershire*, **Anc Mon Lab Rep**, 96/97.

Miles, D. (1997a) The interpretation, presentation, and use of tree-ring dates, **Vernacular Architecture**, 28, 40-56.

Miles, D. H. (1997b) Working compilation of 58 reference chronologies centred around Wales by various researchers, unpublished computer file WALES97, Oxford Dendrochronology Laboratory.

Miles, D. H. and Haddon-Reece, D. (1993) List 54 - Tree-ring dates, **Vernacular Architecture**, 24, 54-60.

Miles, D. H. and Worthington, M. J. (2000) Tree-ring dates, **Vernacular Architecture**, 31, 90-113.

Miles, D. H. and Worthington, M. J. (2001) Tree-ring dates, **Vernacular Architecture**, 32, 74-86.

Miles, D. H., Worthington, M. J. and Bridge, M. C. (2003) Tree-ring dates, **Vernacular Architecture**, 34, 109-113.

Miles, D. H., Worthington, M. J. and Bridge, M. C. (2007) Tree-ring dates, **Vernacular Architecture**, 38, 120-139.

Miles, D. H., Worthington, M. J., Bridge, M. C., Suggett, R. and Dunn, M. (2010) Tree-ring dates, **Vernacular Architecture**, 41, 110-118.

Tyers, I. (2000) Tree-ring dates, **Vernacular Architecture**, 31, 123.

Tyers, I. (2004) *Dendro for Windows Program Guide 3rd edn*, **ARCUS Report,** 500b**.**

Worthington, M. J. and Miles, D. W. H. (2003) *The Tree-Ring Dating of Bryn Cambric, Chapel Lawns, Clun, Shropshire*, **Centre for Archaeology Report**, 92/2003.