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DYDDIO HEN DAI CYMREIG | DATING OLD WELSH HOUSES

PROSIECT DENDROCRONOLEG GOGLEDD ORLLEWIN CYMRU | NORTH WEST WALES DENDROCHRONOLOGY PROJECT

Oxford Dendrochronology Laboratory
Report 2010/54

THE TREE-RING DATING OF 34 CASTLE STREET, BEAUMARIS, ANGLESEY (NGR SH 605 760)

Summary

Seven timbers were sampled from the roof, of which two were dated, one retaining complete sapwood was found to have been felled in winter 1482/83, the other timber having a likely felling date range that incorporated this date. It seems likely therefore that the roof was constructed in 1483, or soon thereafter. Two beams from the inserted floor were sampled, one retained complete sapwood and was found to have been from a tree felled in summer 1709, the other sample fragmented, but parts of the series overlapped with the dated series, suggesting that both trees were felled at around the same time. Two samples were taken from the rear range, but these failed to date.

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The Tree-Ring Dating of 34 Castle Street, Beaumaris, Anglessey (NGR SH 605 760)

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).

34 CASTLE STREET

No. 34 Castle Street, also known as the Red Boat Ice Cream Parlour, is a two-storey building with an open roof to the first floor, and a cellar. Upstairs, the plan consisted of a two-bay chamber with arch-braced roof and a single bay room on the other side of a closed truss. The open truss is notable for the refined carpentry and the carved boss of one rose inside another, similar to a Tudor rose. The ground floor ceiling was reputed to have some old timbers surviving, but they were not accessible during the assessment and sampling visits. Similarly the cellar was not assessed. An inserted floor was added to form a second floor upstairs in the eighteenth century.

At the rear a two storey wing projected which had been mainly rebuilt, but a tiebeam, or transverse beam, was sampled along with a rail or wall plate.

SAMPLING

Sampling took place in October 2010. 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 **angj.** 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).

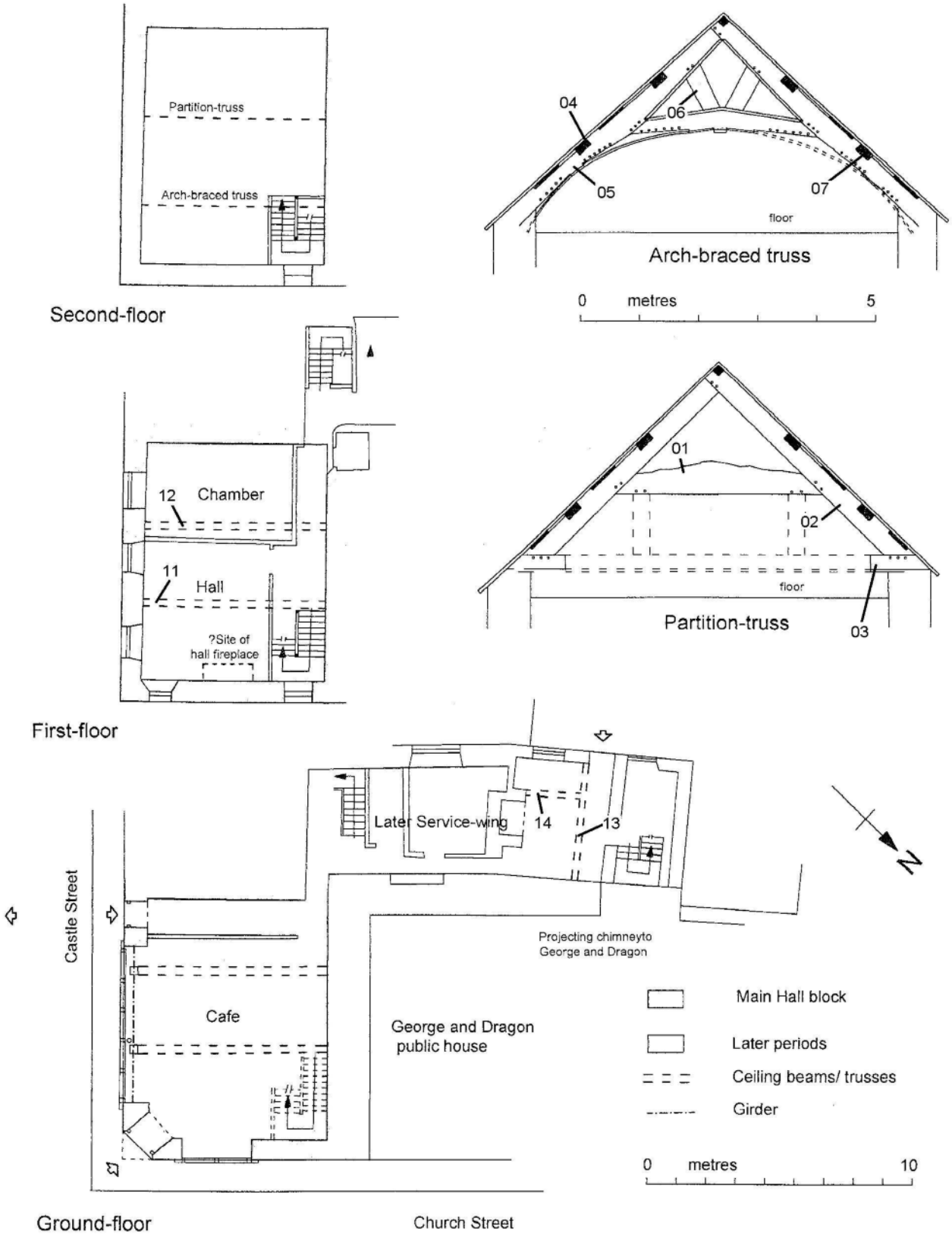

Figure 1: Drawings of the property showing the timbers sampled for dendrochronology (adapted from original drawings supplied by RCAHMW)

RESULTS AND DISCUSSION

Details of the samples and their locations are given in Table 1 and illustrated in Figure 1. Cross-matching between the sample series was generally poor, and therefore individual series were dated independently in the first instance. Three series were dated in this way, **angj01**, **angj04** and **angj11** were dated, the strongest matches being given in Tables 2 a-c. Samples **01** and **04** did match each other (t = 3.7 with only 43 years overlap), confirming the derived dates. Sample **angj12** was fragmented and the two longest sections did give reasonable visual matches against the series from the other similar dated ceiling beam **angj11**, but as these were not confirmed statistically, they have not been taken as dated. The two samples from the rear wing did not match each other, and neither did they date independently.

The dating of the roof timbers, with one tree being felled in winter 1482/83 and another having a likely felling date range incorporating this date, makes this a significant building within the town, being one of the earliest surviving roofs yet found. The dating of the inserted floor to summer 1709 also gives important additional information about the development of the building.

The date is interesting in that the carved boss on the open truss (Figure 2) is very similar to the Tudor rose, but predates the Battle of Bosworth Field in August 1485 by a couple of years. However, the carved boss has the outer rose with seven petals rather than the usual five, but nevertheless is an early example of what was later to become the symbol of the Tudor dynasty.

Figure 2: Photograph of carved boss to open truss

ACKNOWLEDGEMENTS

Margaret Dunn and Richard Suggett both provided assistance on site and provided background information on the building. The owners (Mr and Mrs Green) were very kind in allowing sampling in what is a busy retail environment (Red Boat Ice Cream Parlour). We would also thank our fellow dendrochronologists for permission to use their data.

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Table 1: Details of samples taken from 34 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)
Roof									
angj01	Collar, closed truss	1419-1482	1460	22C	64	2.39	0.97	0.28	Winter 1482/83
angj02a	Front principal rafter, closed truss			*20C*	*45*	*2.48*	*1.04*	*0.27*	
angj02bi	*ditto*			*H/S*	*34*	*3.33*	*1.12*	*0.29*	
angj02	**02a + 02bi**	undated	-	20C	55	2.78	1.20	0.27	unknown
angj03	Tie beam, closed truss	undated	-	H/S	<40	NM	-	-	unknown
angj04	Rear lower purlin, centre bay	1398-1461	1443	18	64	2.30	1.24	0.30	1462–84
angj05	Rear principal rafter, open truss	undated	-	16	59	2.56	0.70	0.18	unknown
angj06a	Rear raking strut, open truss		-	*4*	*41*	*1.66*	*0.46*	*0.23*	
angj06b	*ditto*		-	*13½ C*	*39*	*1.57*	*0.36*	*0.20*	
angj06	**06a + 06b**	undated	-	13½ C	64	1.65	0.40	0.21	unknown
angj07a	Front lower purlin, RH bay		-	*6*	*40*	*4.15*	*1.93*	*0.20*	
angj07b	*ditto*		-	*27*	*39*	*1.74*	*0.47*	*0.17*	
angj07	**07a + 07b**	undated	-	27	55	3.17	1.92	0.18	unknown
Inserted Floor									
angj11	Ceiling beam, sitting room	1589-1708	-	34½ C	120	0.89	0.34	0.25	Summer 1709
angj12ii	Ceiling beam, dining room	undated	-		*38*	*1.05*	*0.25*	*0.21*	unknown
angj12iv	*ditto*	undated	-	*39C*	*52*	*0.96*	*0.52*	*0.23*	
Rear Wing									
angj13	Transverse beam	undated	-	4+*c*30NM	50	0.90	0.68	0.35	unknown
angj14	Side beam	undated	-	27½ C	93	1.33	0.92	0.28	unknown

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

Table 2a. Dating evidence for series **angj01,** AD 1419–1482 against regional (**bold**) individual site chronologies

County or region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning:*	*Overlap (yrs):*	*t-value:*
Wales	Branas-Uchaf, Llandrillo	(Miles and Bridge 2010)	DENBY6	1388-1763	64	6.5
Shropshire	Oldfields Farm	(Miles and Haddon-Reece 1994)	OLDFIELD	1404-1572	64	6.4
Staffordshire	Biddulph Old Hall	(Miles *et al* 2005)	BIDDULPH	1404-1524	64	6.2
Wales	Rose and Crown, Gwydwn	(Miles and Worthington 2000)	GWYDWN	1411-1571	64	5.9
Shropshire	Shropshire Master Chronology	(Miles 1995)	**SALOP95**	881-1745	64	5.9
Cheshire	Combermere Abbey, Whitchurch	(Howard *et al* 2003)	CBMASQ01	1371-1564	64	5.8
Yorkshire	Kirkburton Church	(Arnold and Howard 2007)	KRKCSQ02	1306-1633	64	5.8
Lancashire	Hurstwood Great Barn	(Nayling 1998)	HRSTWOOD	1402-1544	64	5.8
Yorkshire	Yorkshire Buildings Chronology	(Hillam pers comm)	**YORKS2**	1192-1663	64	5.7
Yorkshire	Elland Old Hall	(Hillam 1983)	ELLAND	1372-1574	64	5.7

Table 2b. Dating evidence for series **angj04,** AD 1398–1461 against regional (**bold**) individual site chronologies

County or region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning:*	*Overlap (yrs):*	*t-value:*
Hampshire	Thatched Cottage, N Warnborough	(Miles and Worthington 1997)	tcnw12	1347-1444	47	6.7
Wales	Parliament House	(Miles *et al* 2004)	PARLMNT1	1306-1451	54	6.5
Hampshire	Kimpton Manor, Kimpton	(Miles and Worthington 2002)	KIMPTON1	1350-1444	47	6.3
Hampshire	10 The Close, Winchester	(Miles *et al* 2003)	WCCLOSE2	1284-1443	46	6.0
West Sussex	Wenham Manor Barn, Rogate	(Miles 1998)	WENHAM2	1387-1586	64	5.4
Shropshire	Aston Eyre, gatehouse	(Miles and Worthington 1998)	ASTNEYR3	1357-1612	64	5.2
Yorkshire	Nostell Priory	(Tyers 1998)	NOSTELL1	1263-1536	64	5.2
Wales	Tyddyn Cynnar Llansilin	(Miles *et al* 2003)	TYDDYNC1	1348-1471	64	5.2
Wiltshire	Bishop's Palace, Salisbury	(Miles and Worthington 2000)	bps26	1361-1451	54	5.2
Hampshire	Alton	(Hillam pers comm)	ALTON_t4	1348-1555	64	5.1

Table 2c. Dating evidence for series **angj11,** AD 1589–1708 against regional (**bold**) individual site chronologies

County or region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning:*	*Overlap (yrs):*	*t-value:*
Wales	Beudy Cae-glas, Llanfrothen	(Miles *et al* 2006)	BDGLRT4	1578-1703	115	5.8
Anglesey	Hafoty Llansadwen	(Hillam and Groves 1991)	HAFOTY2	1568-1708	120	5.6
Wales	Welsh Master Chronology	(Miles 1997)	**WALES97**	404-1981	120	5.1
Wales	Gelli, Llanfrothen	(Miles *et al* 2006)	BDGLRT8	1391-1662	74	5.0
Wales	Garreg-fawr, Llanfrothen	(Miles *et al* 2006)	BDGLRT9	1590-1758	119	4.9
Warwickshire	Middleton Hall	(Arnold *et al* 2006)	MIDHSQ02	1390-1646	58	4.6
Cheshire	Hulme Hall, nr Northwich	(Arnold *et al* 2003)	ALSASQ01	1574-1689	101	4.6
Ireland	Belfast Master Chronology	(Baillie, pers comm)	**BELFAST**	1001-1970	120	4.4
Lancashire	Storeton Hall Farm	(Tyers 2010)	STORETON	1572-1682	94	4.3
Herefordshire	Hergest Court, Kington	(Miles and Worthington 1997)	HERGEST4	1451-1665	77	4.3

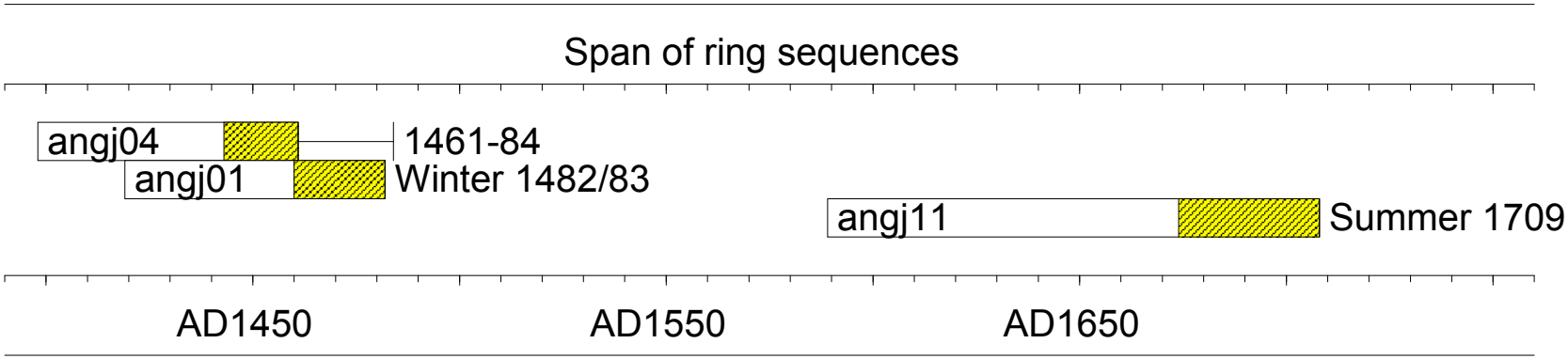

Figure 1: Bar diagram showing the relative positions of overlap of the dated timbers from 34 Castle Street, Beaumaris, along with their interpreted felling dates/date ranges. Yellow hatched sections represent sapwood rings.

REFERENCES

Arnold, A. J., Howard, R E, and Litton, C. D. (2003) *Tree-ring analysis of timbers from Hulme Hall, Allostock, Cheshire*, **Centre for Archaeology Rep**, 84/2003.

Arnold, A. J., Howard R, and Litton, C. D. (2006) *Tree-ring analysis of timbers from Middleton Hall, Warwickshire*, **EH Research Dept Rep Ser**, 13/2006.

Arnold, A. J. and Howard, R. (2007) *Tree-ring analysis of timbers from All Hallows Church, Kirkburton, West Yorkshire*, **EH Research Dept Rep Ser**, 49/2007.

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.

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

Hillam, J. (1983) Tree-ring dates, **Vernacular Architecture**, 15, 69.

Hillam, J. and Groves, C. (1991) *Dendrochronological survey of timbers from Hafoty, Llansadwrn, Anglesey*, unpublished Report, for CADW.

Howard, R, E,, Laxton, R. R., and Litton, C. D. (2003) *Tree-ring analysis of timbers from Combermere Abbey, Whitchurch, Cheshire,* **Centre for Archaeology Rep**, 83/2003.

Miles, D. H. (1995) Working compilation of 71 reference chronologies centred around Shropshire by various researchers, unpublished computer file SALOP95, Oxford Dendrochronology Laboratory.

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

Miles, D H, (1998) *The tree-ring dating of Wenham Manor Barn, Rogate, West Sussex*, **Anc Mon Lab Rep**, 62/98.

Miles, D. H. and Haddon-Reece, D. (1994) List 56 - Tree-ring dates, **Vernacular Architecture**, 25, 28-36.

Miles, D. H. and Worthington, M. J. (1997) Tree-ring dates, **Vernacular Architecture**, 28, 159-181.

Miles, D. H. and Worthington, M. J. (1998) Tree-ring dates, **Vernacular Architecture**, 29, 111-129.

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

Miles, D. H. and Worthington, M. J. (2002) Tree-ring dates, **Vernacular Architecture**, 33, 81-102.

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. (2004) Tree-ring dates, **Vernacular Architecture**, 35, 95-113.

Miles, D. H., Worthington, M. J. and Bridge, M. C. (2005) Tree-ring dates, **Vernacular Architecture**, 36, 87-101.

Miles, D. H., Worthington, M. J. and Bridge, M. C. (2006) Tree-ring dates, **Vernacular Architecture**, 37, 118-132.

Miles, D. H. and Bridge, M. C. (2010) Tree-ring dates, **Vernacular Architecture**, 41, in prep.

Nayling, N. (1998) *Tree-ring analysis of timbers from Hurstwood great Barn, Lancashire*, **Anc Mon Lab Rep**, 67/98.

Tyers, I, (1998) *Tree-ring analysis of oak timbers from the "Brewhouse" and "Refectory" at Nostell Priory, Near Wakefield, West Yorkshire*, **Anc Mon Lab Rep**, 20/98.

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

Tyers, I. (2010) *Storeton Hall Farm, Storeton, Wirral, Dendrochronological analysis of oak timbers*, **EH Research Dept Rep Ser**, 2-2010.