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Tree Ring Dating

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Sheffield Dendrochronology Laboratory

THE TREE-RING DATING OF
Pennarth Fawr
Llanarmnon , Gwynedd

Report
Cae029-trd-Pennath Fawr

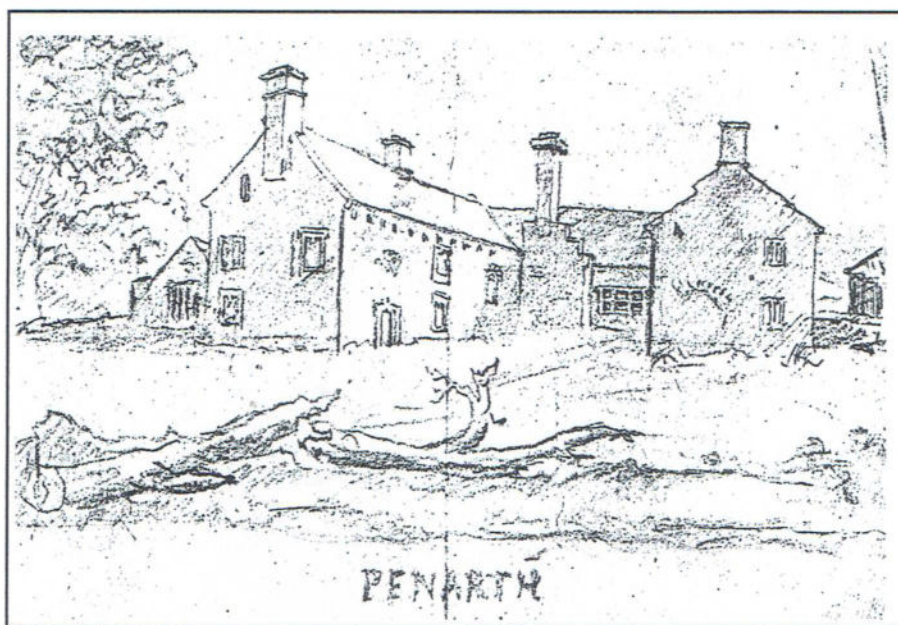


Authors: Jennifer Hillam & Cathy Groves

January 1991

A Dendrochronological Survey
of Timbers from
Penarth Fawr,
Llanarmon, Gwynedd

(A report prepared for CADW Welsh Historic Monuments)



(Drawing by Moses Griffith - 1791)

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January 1991

DENDROCHRONOLOGICAL SURVEY OF TIMBERS
From
PENNARTH FAWR, LLANYSTUMDY, GWYNEDD
(A Report Prepared For Cadw - Welsh Historic Monuments)

Jennifer Hillam & Cathy Groves
January 1991

Abstract

Seven cores were taken from the surviving part of this hall-house but only two proved suitable for dating purposes. One of the aisle posts from the spere truss was dated; it was felled sometime after 1476.

The reused timber along the screen passage could not be dated.

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Introduction

A dendrochronological survey was undertaken at Pennarth Fawr near Criccieth (SH 419 376) so as to provide a precise date for the construction of this stone hall-house. Only the hall and service end survive today but they contain a fine spere truss and original purlins over the hall.

Other dating evidence had suggested a date of about the mid-15th century for its construction.

A core was taken from the reused first floor beam at the south side of the screen passage since it is thought that this timber may have belonged to the original dais. Samples were also taken from the two purlins over the hall, the two aisle posts and two uprights of the spere truss.

Full details of the house and its history can be found in the Guide Book produced by CADW.

Methods

Cores were taken using a corer attached to an electric drill. The holes left by the sampling were filled with half inch dowelling. The cores were roughly surfaced on site using the drill with a sander attachment so as to check that the cores had been taken at the correct angle and that they had sufficient rings. Preparation was completed in the laboratory using sand paper of finer grit.

The ring widths of those samples with more than 50 rings were measured on a travelling stage connected to an Apple II microcomputer (Hillam 1985, Fig 4). (Ring patterns with less than 50 rings are unlikely to be unique and might not produce reliable dates - see Hillam et al 1987 for further details.) The ring sequences were plotted as graphs using a graphing program on the Prime mainframe (Kasha 1987). The graphs were then compared with each other on a light box to check for any similarities between the ring patterns which might indicate contemporaneity. For crossmatching purposes, the ring width data were also transferred to an Atari ST microcomputer with hard disk. The tree-ring software for the Atari was written and developed by Ian Tyers (pers comm 1990). The crossmatching routines are based on the Belfast CROS program (Baillie & Pilcher 1973; Munro 1984), and all the *t* values quoted in this report are identical to those produced by the first CROS program (Baillie & Pilcher 1973). Generally, *t* values of 3.5 or above indicate a match provided that the visual match between the tree-ring graphs is acceptable (Baillie 1982, 82-5).

Dating is achieved by crossmatching ring sequences within a phase or building, combining the matching sequences into a site master, and then testing that master for similarity against dated reference chronologies. A site master is used for dating whenever possible because it enhances the general climatic signal at the expense of the background noise from the growth characteristics of the individual samples. Any unmatched sequences are tested individually against the reference chronologies.

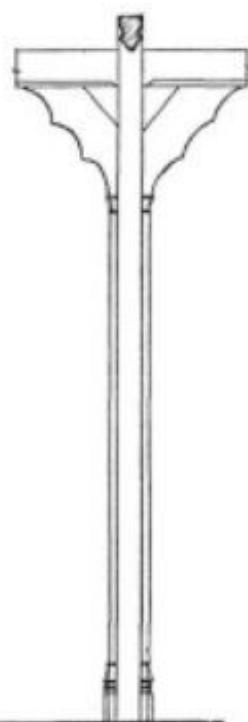
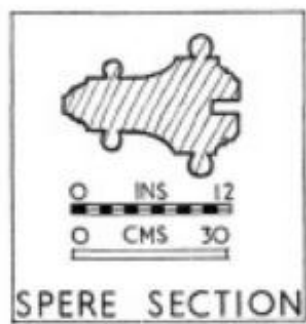
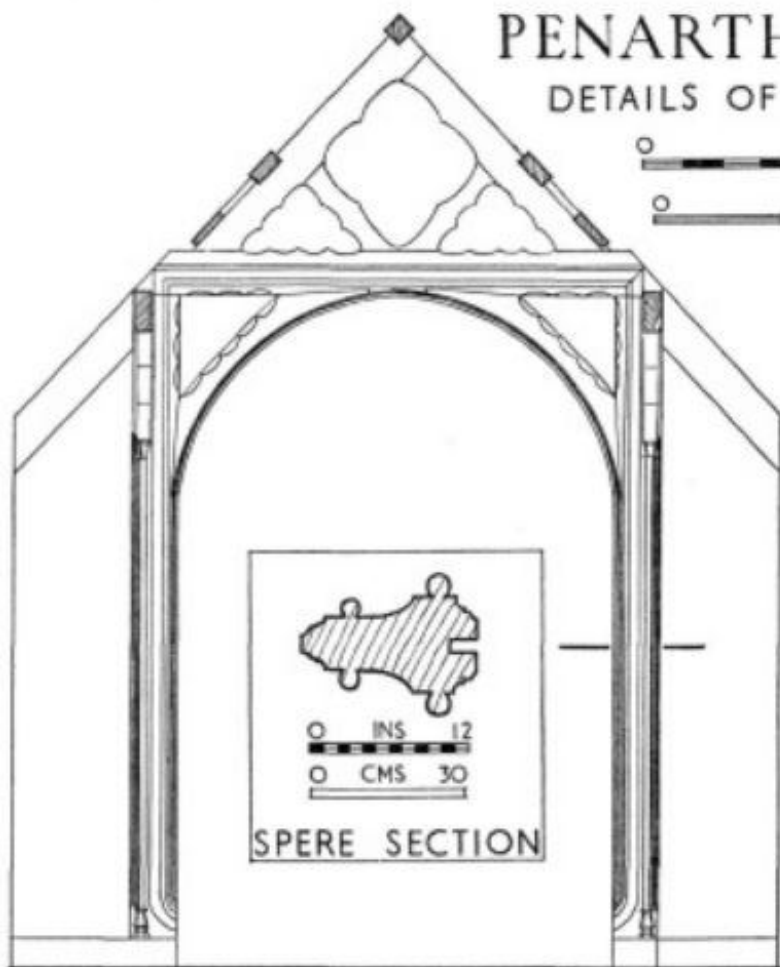
If a sample has bark or bark edge, the date of the last measured ring is the year in which the tree was felled. A complete outer ring indicates that the tree was felled during its dormant period in winter or early spring. This is referred to as "winter felled". If the ring is incomplete, felling took place during the growing season in late spring or summer (referred to as "summer felled"). In the absence of bark edge, felling dates are calculated using the sapwood estimate of 10-55 rings. This is the range of the 95% confidence limits for the number of sapwood rings in British oak trees over 30 years old (Hillam et al 1987).

Where sapwood is absent, felling dates are given as *termini post quem* by adding 10 years, the minimum number of missing sapwood rings, to the date of the last measured heartwood ring. The actual felling date could be much later depending on how many heartwood rings have been removed.

At this stage of the study, factors such as reuse, stockpiling, or repairs have also to be taken into account. Thus whilst the tree-ring dates for the measured rings are precise and independent, the interpretation of these dates often requires other evidence.

PENARTH FAWR

DETAILS OF SPERE TRUSS



LLANARMON 1090

Results

The cores proved either to have insufficient rings or to be broken due to internal weaknesses in the timbers. The reused beam from the screen passage had 53 annual rings, 3 of which were sapwood (Table 1); the remaining sapwood did not remain intact when cored. The cores from the purlins over the hall were both badly broken and the two upright posts of the spere truss had less than 40 rings. The west aisle post in the spere truss had 47 rings and the east post 80 rings. Other original timbers were either unsuitable or inaccessible.

The three measured ring sequences (1, 1, 5) did not appear to match each other. Sample 5 was excluded from further analysis since its 47-year ring sequence is too short for reliable absolute dating. It is difficult to draw any conclusions about the size and age of tree used at Pennarth. The reused beam probably came from a tree less than 100 years old when felled. The purlins and spere truss timbers were probably from trees older than 100. Sapwood was removed from the original timbers. When 1 and 1 were tested against dated chronologies, no consistent results were found for 1, the reused beam. Sample 4 from the east aisle post (Table 2), gave several t values over 3.5 for the period 1387-1466 (Table 3). Visual comparison of the graphs confirmed that the crossmatching was acceptable. The aisle post, like all the other original timbers, had no sapwood. It was therefore felled some time after 1476. This terminus post quem suggests a slightly later date for the construction of Pennarth Fawr than had previously been believed.

Conclusion

The only timber to be dated was the east aisle post of the spere truss which was felled after 1476. No date could be found for the reused beam at the south side of the screen passage and the remaining cores proved unsuitable.

Acknowledgements

The work was commissioned and funded by CADW. We are grateful to Ian Tyers for making available computer software.

Table 1: Details of the tree-ring samples and other timbers. H/S - heartwood-sapwood transition.

| no | function | total no of rings | sapwood rings | average ring width (mm) | comments |
|----|---|----------------------|------------------|----------------------------|--|
| 1 | reused beam along screen passage (33cm from west side) | 53+ | 3+ | 2.4 | plus at least 15 more sawpoor rings |
| 2 | purlin over hall, east side (77cm north of spere truss) | - | - | - | core broken |
| 3 | purlin over hall, west side (104cm north of spere truss) | - | - | - | core broken |
| 4 | spere truss, east aisle post (137cm from floor) | 80 | - | 1.5 | |
| 5 | spere truss, west aisle post (137cm from floor) | 47 | - | 3.5 | |
| 6 | spere truss, west upright post (138cm from floor) | 26 | - | - | centre present; insufficient rings |
| 7 | spere truss, east upright (143cm from floor) | - | - | - | less than 40 rings; probably not original |

Table 2: Ring width data from sample 4, AD1387-1466.

| <u>year</u> | <u>ring widths (0.02mm)</u> | | | | | | | | | |
|-------------|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| AD1387 | | | | | | | 75 | 32 | 54 | 62 |
| | 44 | 57 | 62 | 44 | 102 | 88 | 83 | 66 | 87 | 106 |
| AD1401 | 112 | 51 | 145 | 118 | 88 | 110 | 118 | 101 | 113 | 44 |
| | 54 | 108 | 135 | 91 | 101 | 74 | 103 | 88 | 44 | 76 |
| | 120 | 62 | 92 | 84 | 68 | 56 | 48 | 87 | 106 | 87 |
| | 66 | 57 | 90 | 47 | 57 | 54 | 42 | 58 | 44 | 120 |
| | 101 | 62 | 77 | 59 | 111 | 62 | 37 | 47 | 68 | 28 |
| AD1451 | 52 | 74 | 50 | 29 | 41 | 58 | 63 | 32 | 39 | 110 |
| | 126 | 74 | 116 | 33 | 59 | 89 | | | | |

Table 3: Absolute dating of Pennarth Fawr 4. t values with dated reference chronologies. (All the chronologies are independent of each other.)

| <u>chronology</u> | <u>t value</u> |
|--|----------------|
| Dublin 2 (Baillie 1977) | 3.0 |
| Droitwich, Upwich (Groves & Hillam 1990) | 3.9 |
| East Midlands (Laxton & Litton 1988) | 3.6 |
| Exeter, Bowhill (Hillam 1991) | 4.7 |
| Hafoty, Anglesey (Hillam & Groves 1991) | 4.6 |
| St Cuthberts, Wick (Bridge 1983) | 4.5 |
| Welsh Border (Siebenlist-Kerner 1978) | 4.7 |

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