

**Oxford Dendrochronology Laboratory
Report 2020/29**

**The Tree-Ring Dating of the Chantry House,
Church Avenue, Henley-on-Thames, Oxfordshire**

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Summary:

HENLEY-ON-THAMES, The Chantry House, Church Avenue (SU 76294 82694)

Main Range *Felling dates: **Spring ?1458, Spring 1461***

Joists 1460(4¼C², 11¼C, 15¼C); Studs 1457(19¾C), 1451(13). *Site Master* HENLEY14 1380-1460 (*t* = 8.38 TUDORHS1; 8.04 OXON93; 7.89 HANTS02).

The Chantry House has had a variety of dates ascribed to it over the past century, as early as 1400, although stylistically it was thought to date more in the middle of the fifteenth century, or more towards 1500 (Hall and Moir 2003). It is of three stories and five bays, double jettied on the river front, but only two stories on the opposite side, which includes a fine doorway in the north bay. It is known that a building and vacant land was purchased in 1445 by John Elmes and John Devene. In 1552 a building called a School House was sold, and four tenements or chambers called the priests' chambers. Although the extent of its use as priests' lodgings is under discussion, it definitely continued in use as a school until the 1770s (Townley 2009). In 2003 the building was assessed by English Heritage who concluded that the timbers were too fast grown to be dateable, therefore it was not sampled. In 2020 Ruth Gibson for the Henley Archaeological and Historical Group (HA&AG) commissioned sampling for isotopic dendrochronology. During the sampling for this, a number of timbers were noted with bark edge and some dating potential. Therefore, conventional ring-width dendrochronology was carried out and produced the felling dates of spring 1461, suggesting a likely construction period of 1461.

Date sampled: 26th August 2020

Owner & Commissioner: St. Mary's Church; Ruth Gibson for HA&HG

Historical Research: Linda Hall and Ruth Gibson

Summary published: Miles, D H, and Bridge, M C, 2021 Tree-ring dates, *Vernacular Architecture* **52**, (forthcoming)



West elevation



East elevation (river)

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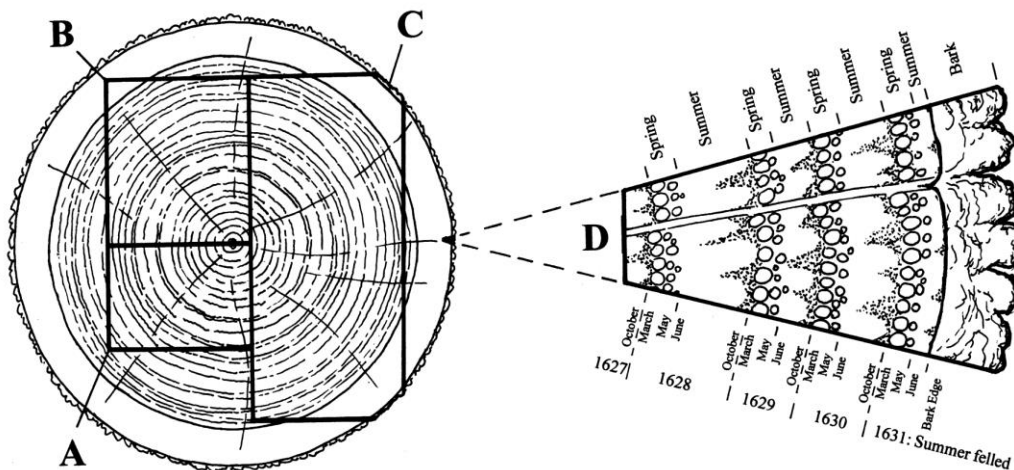
How Dendrochronology Works

Dendrochronology has over the past 30 years become one of the leading and most accurate scientific dating methods. Whilst not always successful, when it does work, it is precise, often to the season of the year. Tree-ring dating is well known for its use in dating historic buildings and archaeological timbers to this degree of precision. However more ancillary objects such as doors, furniture, panel paintings, and wooden boards in medieval book-bindings can sometimes be successfully dated.

The science of dendrochronology is based on a combination of biology and statistics. Fundamental to understanding how dendrochronology works is the phenomenon of tree growth. Essentially, trees grow through the addition of both elongation and radial increments. The elongation takes place at the terminal portions of the shoots, branches, and roots, while the radial increment is added by the cambium, the zone of living cells between the wood and the bark. In general terms, a tree can be best simplified by describing it as a cone, with a new layer being added to the outside each year in temperate zones, making it wider and taller.

An annual ring is composed of the growth which takes place during the spring and summer until about November when the leaves are shed and the tree becomes dormant for the winter period. For the European oak (*Quercus robur* and *Q. petraea*), as well as many other species, the annual ring is composed of two distinct parts - the spring growth or early wood, and the summer growth, or late wood. Early wood is composed of large vessels formed during the period of shoot growth which takes place between March and May, which is before the establishment of any significant leaf growth, and is produced by using most of the energy and raw materials laid down the previous year. Then, there is an abrupt change at the time of leaf expansion around May or June when hormonal activity dictates a change in the quality of the xylem and the summer, or late wood is formed. Here the wood becomes increasingly fibrous and contains much smaller vessels. Trees with this type of growth pattern are known as ring-porous, and are distinguished by the contrast between the open, light-coloured early wood vessels and the dense, darker-coloured late wood.

Dendrochronology utilises the variation in the width of the annual rings as influenced by climatic conditions common to a large area, as opposed to other more local factors such as woodland competition and insect attack. It is these climate-induced variations in ring widths that allow calendar dates to be ascribed to an undated timber when compared to a firmly-dated sequence which has shared a common period of growth with the sample being dated. If a tree section is complete to the bark edge, then when dated a precise date of felling can be determined. The felling date will be precise to the season of the year, depending on the degree of formation of the outermost ring. Therefore, a tree with bark which has the spring vessels formed but no summer growth can be said to have been felled in the spring, although it is not possible to say in which particular month the tree was felled.



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)

Another important consideration in dendrochronological studies is the presence (or absence) of sapwood. This is the band of growth rings immediately beneath the bark and comprises the living growth rings which transport the sap from the roots to the leaves. This sapwood band is distinguished from the heartwood by the prominent features of colour change and the blocking of the spring vessels with tyloses, the waste products of the tree's growth. The heartwood is generally darker in colour, and the spring vessels are blocked with tyloses. The heartwood is dead tissue, whereas the sapwood is living, although the only really living, growing, cells are in the cambium, immediately beneath the bark. In European oak (*Quercus* spp), the difference in colour is generally matched by the change in the spring vessels. Generally the sapwood retains stored food and is therefore attractive to insect and fungal attack once the tree is felled and therefore is often removed during conversion.

Sapwood in European oaks tends to be of a relatively constant width and/or number of rings. By determining what this range is with an empirically or statistically-derived estimate is a valuable aspect in the interpretation of tree-ring dates where the bark edge is not present (Miles 1997). The narrower this range of sapwood rings, the more precise the estimated felling date range will be.

Methodology: The Dating Process

All timbers sampled were of oak (*Quercus* spp.) from what appeared to be primary first-use timbers, or any timbers which might have been re-used from an early phase. Those timbers which looked most suitable for dendrochronological purposes with complete sapwood or reasonably long ring sequences were selected. *In situ* timbers were sampled through coring, using a 16mm hollow auger. Details and locations of the samples are detailed in the summary table.

The dry samples were sanded on a linisher, or bench-mounted belt sander, using 60 to 1200 grit abrasive paper, and were cleaned with compressed air to allow the ring boundaries to be clearly distinguished. They were then measured under a x10/x30 microscope using a travelling stage electronically displaying displacement to a precision of 0.01mm. Thus each ring or year is represented by its measurement which is arranged as a series of ring-width indices within a data set, with the earliest ring being placed at the beginning of the series, and the latest or outermost ring concluding the data set.

The principle behind tree-ring dating is a simple one: the seasonal variations in climate-induced growth as reflected in the varying width of a series of measured annual rings is compared with other, previously dated ring sequences to allow precise dates to be ascribed to each ring. When an undated sample or site sequence is compared against a dated sequence, known as a reference chronology, an indication of how good the match is must be determined. Although it is almost impossible to define a visual match, computer comparisons can be accurately quantified. Whilst it may not be the best statistical indicator, a variant of the Student's (a pseudonym for W S Gosset) *t*-value has been widely used amongst British dendrochronologists. The cross-correlation algorithms most commonly used and published are derived from Baillie and Pilcher's CROS programme (Baillie and Pilcher 1973), although a faster version (Munro 1984) giving slightly different Baillie-Pilcher *t*-values is sometimes used for indicative purposes.

Generally, *t*-values over 3.5 should be considered to be significant, although in reality it is common to find demonstrably spurious *t*-values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some *t*-value ranges of 5, 6, or higher, and for these to be well replicated from different, independent chronologies with local and regional chronologies well represented. Users of dates also need to assess their validity critically. They should not have great faith in a date supported by a handful of *t*-values of 3's with one or two 4's, nor should they be entirely satisfied with a single high match of 5 or 6. Examples of spurious *t*-values in excess of 7 have been noted, so it is essential that matches with reference chronologies be well replicated, and that this is confirmed with visual matches between the two graphs. Matches with *t*-values of 10 or more between individual sequences usually signify samples having originated from the same parent tree.

In reality, the probability of a particular date being valid is itself a statistical measure depending on the *t*-values. Consideration must also be given to the length of the sequence being dated as well as those of the reference chronologies. A sample with 30 or 40 years growth is likely to match with high *t*-values at varying positions, whereas a sample with 100 consecutive rings is much more likely to match

significantly at only one unique position. Samples with ring counts as low as 50 may occasionally be dated, but only if the matches are very strong, clear and well replicated, with no other significant matching positions. This is essential for intra-site matching when dealing with such short sequences. Consideration should also be given to evaluating the reference chronology against which the samples have been matched: those with well-replicated components which are geographically near to the sampling site are given more weight than an individual site or sample from the opposite end of the country.

It is general practice to cross-match samples from within the same phase to each other first, combining them into a site master, before comparing with the reference chronologies. This has the advantage of averaging out the 'noise' of individual trees and is much more likely to obtain higher *t*-values and stronger visual matches. After measurement, the ring-width series for each sample is plotted as a graph of width against year on log-linear graph paper. The graphs of each of the samples in the phase under study are then compared visually at the positions indicated by the computer matching and, if found satisfactory and consistent, are averaged to form a mean curve for the site or phase. This mean curve and any unmatched individual sequences are compared against dated reference chronologies to obtain an absolute calendar date for each sequence. Sometimes, especially in urban situations, timbers may have come from different sources and fail to match each other, thus making the compilation of a site master difficult. In this situation samples must then be compared individually with the reference chronologies.

Therefore, when cross-matching samples with each other or against reference chronologies, a combination of both visual matching and a process of qualified statistical comparison by computer is used. 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.

Ascribing and Interpreting Felling Dates

Once a tree-ring sequence has been firmly dated in time, a felling date, or date range, is ascribed where possible. For samples which have sapwood complete to the underside of, or including bark, this process is relatively straightforward. Depending on the completeness of the final ring, i.e. if it has only the early wood formed, or the latewood, a *precise felling date and season* can be given. If the sapwood is partially missing, or if only a heartwood/sapwood transition boundary survives, then an *estimated felling date range* can be given for each sample. The number of sapwood rings can be estimated by using a statistically derived sapwood estimate with a given confidence limit. A review of the geographical distribution of dated sapwood data from historic building timbers has shown that a 95% range of 9-41 rings is most appropriate for the southern counties of England (Miles 1997), which will be used here. If no sapwood or heartwood/sapwood boundary survives, then the minimum number of sapwood rings from the appropriate sapwood estimate is added to the last measured ring to give a *terminus post quem (tpq)* or *felled after* date.

Some caution must be used in interpreting solitary precise felling dates. Many instances have been noted where timbers used in the same structural phase have been felled one, two, or more years apart. Whenever possible, a *group* of precise felling dates should be used as a more reliable indication of the *construction period*. It must be emphasised that dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure under study. However, it is common practice to build timber-framed structures with green or unseasoned timber and that construction usually took place within twelve to eighteen months of felling (Miles 2006).

Details of Dendrochronological Analysis

The results of the dendrochronological analysis for the building under study are presented in a number of detailed tables. The most useful of these is the summary **Table 1**. This gives most of the salient results of the dendrochronological process, and includes details for each sample, its location, and its felling date or date range, if successfully tree-ring dated. This last column is of particular interest to the end user, as it gives the actual year and season when the tree was felled, if the final ring is present, or an estimated felling date range if the sapwood is incomplete. Occasionally it will be noted that the felling date ranges may not coincide with the precise felling dates. This is nothing to be overly concerned about so long as these are not too far apart. It must be remembered that the estimated felling date ranges are calculated at a 95% confidence level, which means that statistically one sample in 20 will have felling dates which actually fall *outside* the predicted range.

It will also be noticed that often the precise felling dates will vary within several years of each other. Unless there is supporting archaeological evidence suggesting different phases, all this would indicate is either stockpiling of timber, or of trees which have been felled or died at varying times but not cut up until the commencement of the particular building operations in question. When presented with varying precise felling dates, one should always take the *latest* date for the structure under study, and it is likely that construction will have been completed for ordinary vernacular buildings within twelve or eighteen months from this latest felling date (Miles 1997).

Table 2 gives an indication of the statistical reliability of the match between one sequence and another. This shows the *t*-value over the number of years overlap for each combination of samples in a matrix table. It should be borne in mind that *t*-values with less than 80 rings overlap may not truly reflect the same degree of match and that spurious matches may produce similar values.

First, multiple radii have been cross-matched with each other and combined to form same-timber means. These are then compared with other samples from the site and any which are found to have originated from the same parent tree are again similarly combined. Finally, all samples, including all same timber and same tree means are combined to form one or more site masters. Again, the cross-matching is shown as a matrix table of *t*-values over the number of years of overlap. Reference should always be made to **Table 1** to clearly identify which components have been combined.

Table 3 shows the degree of cross-matching between the site master(s) with a selection of reference chronologies. This shows the county or region from which the reference chronology originated, the common chronology name together with who compiled the chronology, a publication reference and the years covered by the reference chronology. The number of years overlap of the reference chronology and the site master being compared are also shown together with the resulting *t*-value. It should be appreciated that well-replicated regional reference chronologies, which are shown in **bold**, will often produce better matches than with individual site masters or indeed individual sample sequences.

Figures include a bar diagram which shows the chronological relationship between two or more dated samples from a phase of building. The site sample record sheets are also appended, together with any plans showing sample locations, if available.

Publication of dated sites are published in *Vernacular Architecture* annually, and the entry, if available, is shown on the summary page of the report. This does not give as much technical data for the samples dated, but does give the *t*-value matches against the relevant chronologies, provide a short descriptive paragraph for each building or phase dated, and gives a useful short summary of samples dated. These summaries are also listed on the web-site maintained by the Laboratory, which can be accessed at www.Oxford-dendroLab.com. The Oxford Dendrochronology Laboratory retains copyright of this report, but the commissioner of the report has the right to use the report for his/her own use so long as the authorship is quoted. Primary data and the resulting site master(s) used in the analysis are available from the Laboratory on request by the commissioner and *bona fide* researchers. The samples form part of the Laboratory archives.

Summary of Dating

The Chantry House has had a variety of dates ascribed to it over the past century, as early as 1400, although stylistically it was thought to date more in the middle of the fifteenth century, or more towards 1500 (Hall and Moir 2003). It is of three stories and five bays, double jettied on the river front, but only two stories on the opposite side, which includes a fine doorway in the north bay. It is known that a building and vacant land was purchased in 1445 by John Elmes and John Devene. In 1552 it was sold, and four tenements or priests' chambers. Although the extent of its use as priests' lodgings is under discussion, it definitely continued in use as a school until the 1770s (Townley 2009).

It was substantially restored in 1923, and again in 2004. In late 2003 the building was assessed for English Heritage by the Nottingham University Tree-Ring Dating Laboratory who concluded that the timbers were too fast grown to be dateable, and therefore it was not sampled. In 2020 Ruth Gibson for the Henley Archaeological and Historical Group (HA&AG) suggested isotopic dendrochronology and sampling was commissioned for this work. During the sampling for this a number of timbers were noted with bark edge and some dating potential. Therefore, conventional ring-width dendrochronology was performed on the samples instead.

Six timbers were selected for sampling – two studs on the west elevation (**hch1** and **hch2**), and four second-floor floor joists (**hch3** – **hch6**, table 1). All retained bark edge, except for sample **hch1**, which had incomplete sapwood, and **hch2** which appeared to have bark edge, but on such a small area, the completeness could not be confirmed with certainty.

Samples **hch1** and **hch2** appeared to be cut from a single tree, the external face of the timbers suggested this, and confirmed as likely due to the *t*-value match as shown in Table 2. These two were therefore combined to form the same-tree mean **hch12**. Joist samples **hch5** and **hch6** also appeared visually to have originated from the same parent tree, and whilst the *t*-value match was much lower (Table 2), the fact that both retained only 4¼ rings of sapwood to the bark edge support this conclusion. Therefore, these two samples were combined to form the same-tree mean **hch56**.

These same-tree means and the remaining four sample sequences were compared with each other and all were found to match, albeit poorly, as showing in Table 2. However, these matching positions were confirmed by comparing the individual sample sequences individually with the reference chronologies. Virtually all gave *t*-values of 5s with different reference chronologies at the relevant positions.

The sample sequences were all combined to form the 81-year site master **HENLEY14**, and was compared with the reference chronologies (Table 3). The matches noted above were substantially increased with the best match of *t* = 8.38 with a chronology from Southampton.

One question of the analysis was whether dendro-provenancing could be used to locate the origins of the timbers used to construct the building. One likely source was from Hambleden, however as will be shown in Table 3, a well-replicated from Burrow Farm, Hambleden, produced only a *t* = 4.51 with many better matches from different other directions, including Hampshire. However, dendro-provenancing is not an exacting science and considerable caution should be used in interpreting the geographical spread of *t* – value results (Bridge 2012). It is most likely that the timber originated in the areas surrounding Henley and the Thames Valley, which consists of varied geographical growing situations.

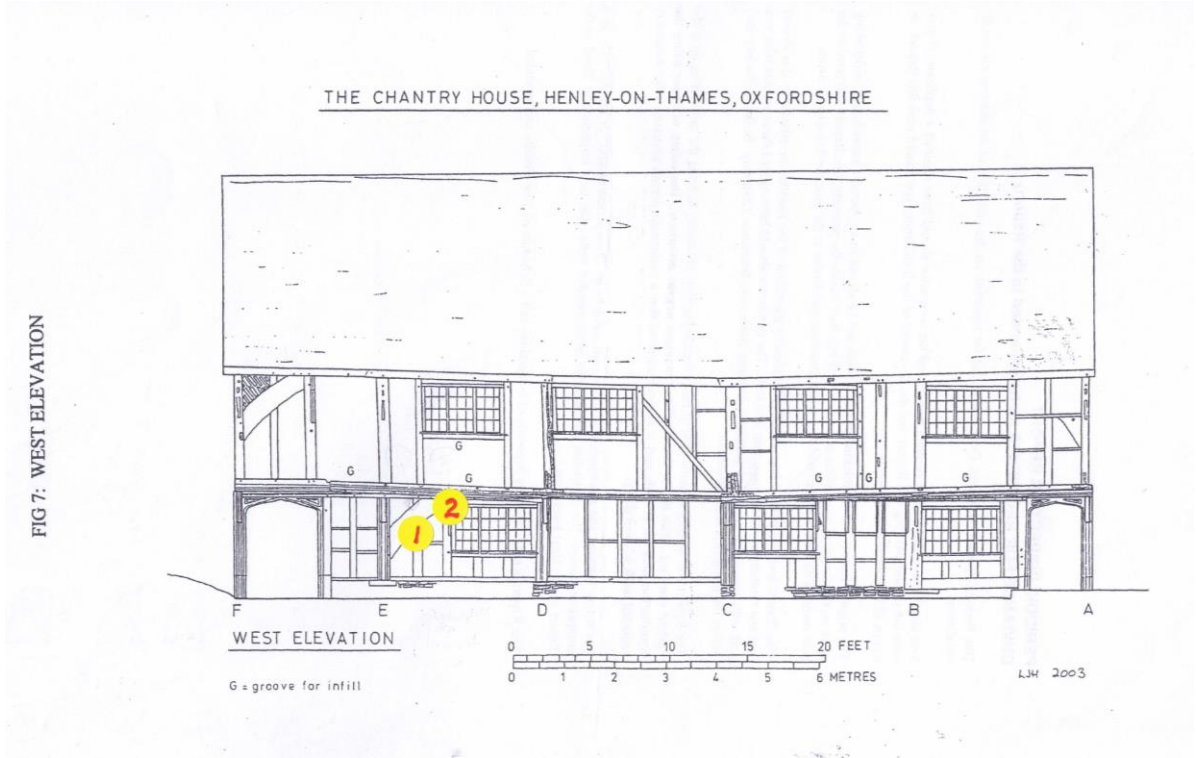
Given the clustering of felling dates from **spring 1461**, it is most likely that the building was constructed during 1461. Stud **hch2**, and by association stud **hch1**, appeared to be felled in **spring 1458**, but such a small area of sapwood was visible that a question must be applied as to whether the outside was actually complete. It is not unusual to find some timbers stockpiled by a year or two, but even if this was not actually the bark edge, these are consistent with the other four timbers, which were all felled in **spring 1461**.

Acknowledgements

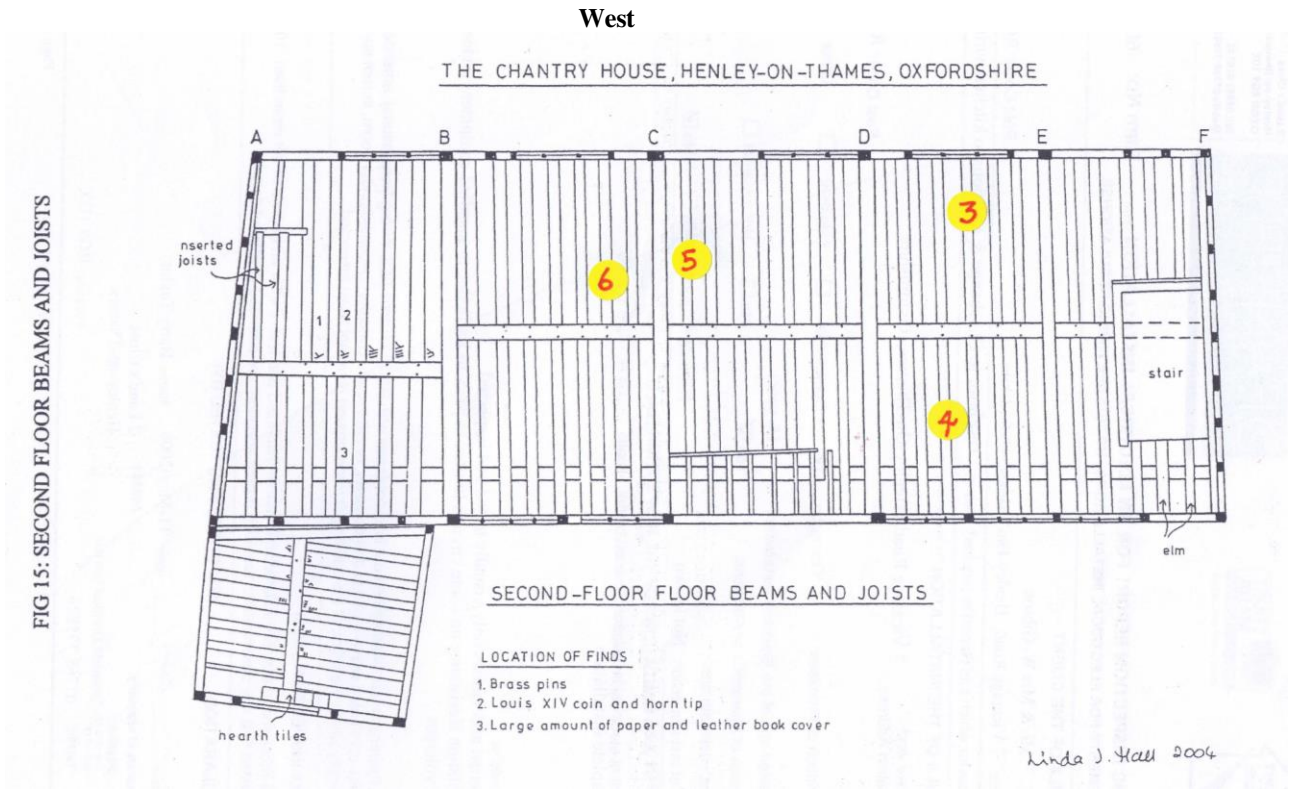
The dendrochronology was commissioned by Ruth Gibson on behalf of the Henley Archaeological and Historical Group, and who assisted on site. Dr Martin Bridge kindly assisted with the analysis and review of the data, construction of the site master, and produced the bar diagram.

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West elevation showing locations of timbers sampled (after Hall and Moir 2003)



East

Second floor plan showing locations of timbers sampled (after Hall and Moir 2003)

Table 1: Summary of Tree-Ring Dating

THE CHANTRY HOUSE, HENLEY-ON-THAMES, OXFORDSHIRE

Sample number & type	Timber and position	Dates AD spanning	H/S bdry	Sapwood complement	No of rings	Mean width mm	Std devn mm	Mean sens mm	Felling seasons and dates/date ranges (AD)
Main Range									
hch1	c 1 st floor stud 4, west elevation – Bay D-E	1375-1451	1438	13	77	2.36	0.88	0.173	(Spring 1458?)
hch2	c 1 st floor stud 3, west elevation – Bay D-E	1389-1457	1438	19¼C?	69	2.01	0.48	0.167	Spring 1458?
hch12	Same-tree mean of hch1 + hch2	1391-1457	1438	19¼C?	67	2.05	0.51	0.157	Spring 1458?
* hch12x	Truncated mean of hch1 + hch2	1375-1457	1438	19¼C	83	2.28	0.79	0.157	Spring 1458?
* hch3	c Second floor joist 4, Bay D-E, W side	1380-1460	1459	11¼C	81	1.72	0.50	0.214	Spring 1461
* hch4	c Second floor joist 3, Bay D-E, E side	1400-1460	1445	15¼C	61	2.07	0.96	0.175	Spring 1461
hch5	c Second floor joist 1, Bay C-D, W side	1396-1460	1456	4¼C	65	2.80	1.10	0.174	Spring 1461
hch6	c Second floor joist 6, Bay B-C, W side	1396-1460	1456	4¼C	65	3.26	1.34	0.169	Spring 1461
hch56	Same-tree mean of hch5 + hch6	1406-1460	1456	4¼C	55	2.64	0.67	0.167	Spring 1461
* hch56x	Truncated mean of hch5 + hch6	1396-1460	1456	4¼C	65	3.03	1.15	0.155	Spring 1461
* = HENLEY14 Site Master		1380-1460			81	2.07	0.46	0.138	1461

Key: * = sample included in site-master; c = core; ¼C = bark edge present, partial (spring) ring;
 boundary - last heartwood ring date; std devn = standard deviation; mean sens = mean sensitivity

Explanation of terms used in Table 1

The summary table gives most of the salient results of the dendrochronological process. For ease in quickly referring to various types of information, these have all been presented in Table 1. The information includes the following categories:

Sample number: Generally, each site is given a two or three letter identifying prefix code, after which each timber is given an individual number. If a timber is sampled twice, or if two timbers were noted at time of sampling as having clearly originated from the same tree, then they are given suffixes 'a', 'b', etc. Where a core sample has broken, with no clear overlap between segments, these are differentiated by a further suffix '1', '2', etc.

Type shows whether the sample was from a core 'c', or a section or slice from a timber's'. Sometimes photographs are used 'p', or timbers measured *in situ* with a graticule 'g'.

Timber and position column details each timber sampled along with a location reference. This will usually refer to a bay or truss number, or relate to compass points or to a reference drawing.

Dates AD spanning gives the first and last measured ring dates of the sequence (if dated),

H/S bdry is the date of the heartwood/sapwood transition or boundary (if present). This date is critical in determining an estimated felling date range if the sapwood is not complete to the bark edge.

Sapwood complement gives the number of sapwood rings. The tree starts growing in the spring during which time the earlywood is produced, also known also as spring growth. This consists of between one and three decreasing spring vessels and is noted as *Spring* felling and is indicated by a ¼ C after the number of sapwood ring count. Sometimes this can be more accurately pin-pointed to very early spring when just a few spring vessels are visible. After the spring growing season, the latewood or summer growth commences, and is differentiated from the preceding spring growth by the dense band of tissue. This summer growth continues until just before the leaves drop, in about October. Trees felled during this period are noted as *summer* felled (½ C), but it is difficult to be too precise, as the width of the latewood can be variable, and it can be difficult to distinguish whether a tree stopped growing in autumn or *winter*. When the summer growth band is clearly complete, then the tree would have been felled during the dormant winter period, as shown by a single C. Sometimes a sample will clearly have complete sapwood, but due either to slight abrasion at the point of coring, or extremely narrow growth rings, it is impossible to determine the season of felling.

Number of rings: The total number of measured rings present on the samples analysed.

Mean ring width: This, simply put, is the sum total of all the individual ring widths, divided by the number of rings, giving an average ring width for the series.

Mean sensitivity: A statistic measuring the mean percentage, or relative, change from each measured yearly ring value to the next; that is, the average relative difference from one ring width to the next, calculated by dividing the absolute value of the differences between each pair of measurements by the average of the paired measurements, then averaging the quotients for all pairs in the tree-ring series (Fritts 1976). Sensitivity is a dendrochronological term referring to the presence of ring-width variability in the radial direction within a tree which indicates the growth response of a particular tree is "sensitive" to variations in climate, as opposed to complacency.

Standard deviation: The mean scatter of a population of numbers from the population mean. The square root of the variance, which is itself the square of the mean scatter of a statistical population of numbers from the population mean. (Fritts 1976).

Felling seasons and dates/date ranges is probably the most important column of the summary table. Here the actual felling dates and seasons are given for each dated sample (if complete sapwood is present). Sometimes it will be noticed that often the precise felling dates will vary within several years of each other. Unless there is supporting archaeological evidence suggesting different phases, all this would indicate is either stockpiling of timber, or of trees which have been felled or died at varying times but not cut up until the commencement of the particular building operations in question. When presented with varying precise felling dates, one should always take the *latest* date for the structure under study, and it is likely that construction will have been completed for ordinary vernacular buildings within twelve or eighteen months from this latest felling date (Miles 2006).

Felling date ranges are produced using an empirical estimates using the appropriate estimate (Miles 1997). However, these can sometimes be reduced using a new sapwood estimation methodology which uses the mean ring width, number of heartwood rings, known H/S boundary date, and the number of surviving sapwood rings, if present (Miles 2006). These are used after the empirical range and are shown in brackets (OxCal followed by date range). Combined felling date ranges for a phase of building is shown at the end of the phase to which it relates.

Table 2: Matrix of *t*-values and overlaps for same-timber means and site masters

Components of timber **hch12**

Sample: **hch2**
Last ring 1083
date AD:

hch1 $\frac{8.06}{63}$

Components of timber **hch56**

Sample: **hch6**
Last ring 1460
date AD:

hch5 $\frac{5.95}{65}$

Components of site master **HENLEY14**

Sample: **hch3** **hch4** **hch56**
Last ring 1460 1460 1460
date AD:

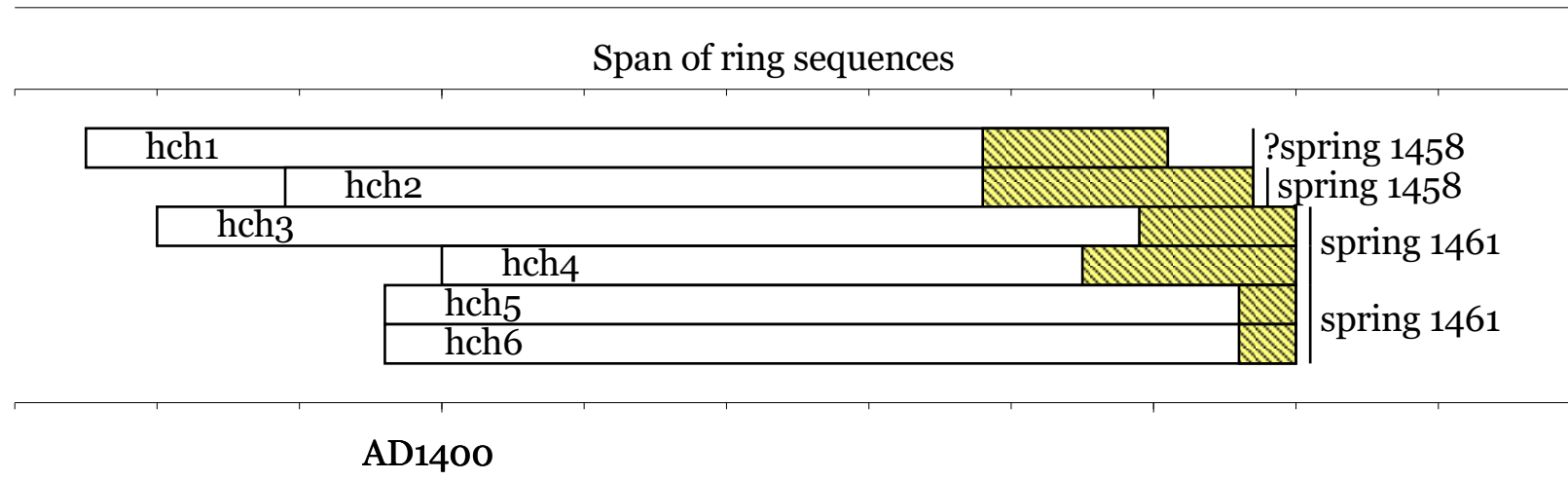
hch12 $\frac{2.06}{67}$ $\frac{2.77}{58}$ $\frac{1.84}{52}$

hch3 $\frac{0.00}{61}$ $\frac{3.83}{55}$

hch4 $\frac{1.31}{55}$

Table 3: Dating of site master **HENLEY14** (1380-1460) against reference chronologies at 1460

County or region:	Chronology name:	Short publication reference:	File name:	Spanning:	Overlap:	t-value:
Buckinghamshire	Burrow Farm, Hambleden	(Miles and Haddon-Reece 1995)	BURROWFM	1350-1494	81	4.51
Berkshire	Maidenhead Bridge	(Miles <i>et al</i> 2003)	MDNHEAD1	1395-1458	64	5.72
Hampshire	Manor Farm, Hambleden	(Miles and Worthington 1999)	HMBLDN1	1387-1461	74	5.82
Oxfordshire	Pithouse, Mapledurham	(Miles and Haddon-Reece 1993)	MDM9	1340-1454	75	6.48
Oxfordshire	Greys Court, Rotherfield Greys	(Miles <i>et al</i> 2009)	GREYSCTB	1640-1758	81	6.51
Berkshire	Song School, Windsor Castle	(Bridge and Miles 2016)	WINDSOR5	1316-1478	81	6.67
Berkshire	Windsor Castle kitchen	(Hillam and Groves 1996)	WC KITCH	1331-1573	81	6.79
Oxfordshire	Queens Head, Crowmarsh Gifford	(Haddon-Reece <i>et al</i> 1989)	QUEEN2	1352-1454	75	6.95
S Central England	South Central England	(Wilson <i>et al</i> 2012)	SCENG	663-2009	81	7.20
London	London Master Chronology	(Tyers <i>pers comm</i>)	LONDON	413-1728	81	7.78
Hampshire	Hampshire Master Chronology	(Miles 2003)	HANTS02	443-1972	81	7.89
Oxfordshire	Oxfordshire Master Chronology	(Haddon-Reece <i>et al</i> 1993)	OXON93	632-1987	81	8.04
Hampshire	Tudor House, Southampton	(Miles <i>et al</i> 2009)	TUDORHS1	1331-1492	81	8.38



Bar diagram showing dated timbers in chronological position