

**THE TREE-RING DATING OF  
LEATHERINGHAM LODGE,  
nr WICKHAM MARKET,  
SUFFOLK**

**(NGR: TM 276 570)**



**Summary**

A single timber from the primary phase dated – the north-west corner post. This looked to have complete sapwood, but since this could not be determined on the core itself, a few years have been added to the last measured ring to give a narrow range for the felling of **1472-75**. Clearly caution needs to be exercised in interpreting the date of a whole phase on this single timber, but it does imply a 15<sup>th</sup>-century date for the primary phase, rather than the 16<sup>th</sup>-century date previously ascribed.

Four roof timbers dated and appear to form a single group felled at the same time. One retained complete sapwood and was made from a tree felled in summer or autumn **1609**, corresponding to the carved date of 1610 on a door lintel below.

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## **The Tree-Ring Dating of Letheringham Lodge, nr Wickham Market, Suffolk (NGR: TM 276 570)**

### **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. These include chronologies made by colleagues in other countries, most notably areas such as modern Poland, which have proved to be the source of many boards used in the construction of doors and chests, and for oil paintings before the widespread use of canvas.

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.

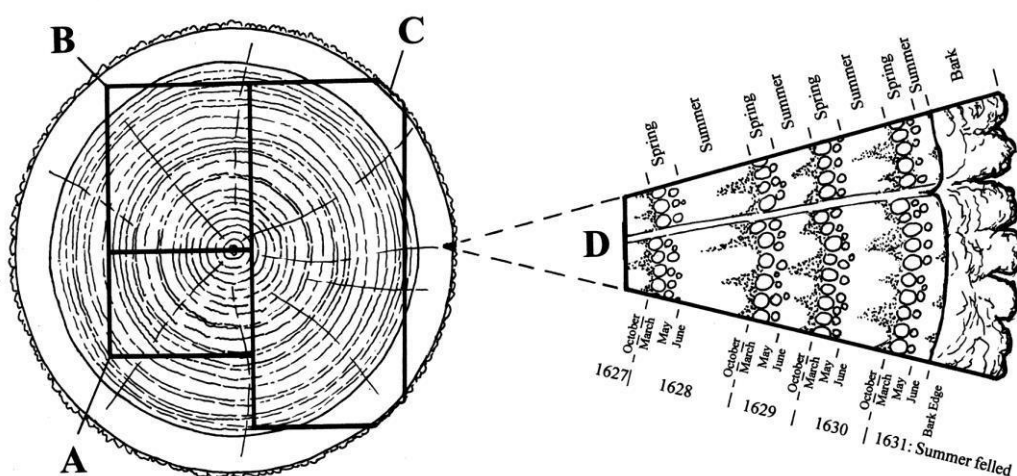
The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's *t*-test. The *t*-test compares the actual difference between two means in relation 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 in oak studies. Higher values are usually found with matching pine sequences. 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 9 – 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)

## LEATHERINGHAM LODGE

The listing description describes the property as originally a 16<sup>th</sup>-century hunting lodge, with large wooden jowelled corner posts, which has been subsequently extended. It notes a carving on an outside door lintel (now enclosed) bearing the text E W 1610, but notes that the roof visible in the attic rooms does not appear to be earlier than the late 17<sup>th</sup> century. The attic roof consists of two and a half bays, the half bay containing the stack. It has chamfered principal rafters, two rows of tenoned purlins with slots for windbraces, and is steeply pitched.

## SAMPLING

Samples were taken during December 2013, the locations of the samples being described in Table 1. Core samples were extracted using a 15mm diameter borer attached to an electric drill. They were labelled (prefix **tl**) and removed for further preparation and analysis. Cores were mounted on wooden laths, and these, along with the slices, were polished with 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 taken are given in Table 1. No matching could be found between the components of the primary phase, and only one series gave any acceptable matches when compared with the dated reference material. This dated the series from the north-west corner post to the period 1402–72, the best results being shown in Table 3a. Although these were not especially strong, this is a single tree. It is interesting that nearly all the results, which have the potential to be from anywhere in the country, are all, with one exception, from East Anglia. Figure 2 shows plots of the ring widths (on a logarithmic scale) from **lt101** and the site chronology from Abbey Farm, Thetford – the strongest match.

The post itself looked to have complete sapwood, but since this was not evident on the core itself, and since there is the possibility that one or more rings may be missing, the felling date is given as 1472–75. It is clearly necessary to interpret this single date with great caution – it could just be that a valuable old timber was recycled, or had been stored before use – but this large carved timber has all the appearance of being used in its primary use. This suggests that the primary phase is fifteenth century – earlier than had been expected for what has often been described as a sixteenth-century building.

Four series from the roof timbers matched each other (Table 2), although the overlaps were very short and the individual dates were checked for each individual timber. That they do indeed match is shown by the plot (Figure 1) of the four series. When combined, the resulting 119-year site chronology, **LTHRNHGM**, matches very well with the reference material, dating the series to 1490–1608 (Table 3b). One timber retained complete sapwood, and was found to have a near complete ring following the last measured ring, giving a felling date of summer/autumn 1609. This accords well with the carved date on the door lintel to the former outside door – bearing the text E W 1610. This roof is therefore an early 17<sup>th</sup> century roof, not a late-17<sup>th</sup> century roof as suggested in the Listing description. Again, the strongest matches are mostly with East Anglian sites.

Figure 3 shows the relative positions of overlap of the dated timbers, with their actual or interpreted felling dates.

## **ACKNOWLEDGEMENTS**

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**Table 1:** Details of samples taken from Letheringham Lodge, the roof bays are numbered from the south

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
<b>Primary phase</b>									
lt101	North-west corner post	<b>1403-1472</b>	1456	16?C	<b>70</b>	<b>1.86</b>	<b>0.77</b>	<b>0.20</b>	<b>1472-75</b>
lt102	Sill in east wall, NE corner	-	-	H/S	40	2.20	0.87	0.27	-
lt103	Common joist	-	-	3+8NM	37	NM	-	-	-
lt104	Sill in north wall, NE corner	-	-	H/S	54	3.16	0.81	0.23	-
lt105	North-east corner post	-	-	-	125+44	1.07	0.60	0.25	-
<b>Roof over secondary phase</b>									
lt106	South-west principal rafter	-	-	4	60	1.18	0.36	0.19	-
*lt107	South-east principal rafter	1490-1590	1590	H/S	101	1.61	0.53	0.22	1599-1631
lt108	Bay 1, common rafter 2 east	-	-	22½C	44	1.32	0.36	0.17	-
lt109	Bay 2, common rafter 2 east	-	-	-	56	0.99	0.24	0.18	-
*lt110	Bay 2, east upper purlin	1553-1608	1584	24½C	56	1.49	0.55	0.17	Summer/Autumn 1609
*lt111	Principal rafter 3 east	1511-1564	-	-	54	1.74	0.44	0.21	after 1573
lt112	Principal rafter 2 west	-	-	H/S	59	1.62	0.57	0.21	-
*lt113	Bay 1, west upper purlin	1555-1596	1593	3	42	1.53	0.50	0.27	1602-34
* = included in site master <b>LTHRNGHM</b>		<b>1490-1608</b>			<b>119</b>	<b>1.60</b>	<b>0.50</b>	<b>0.20</b>	

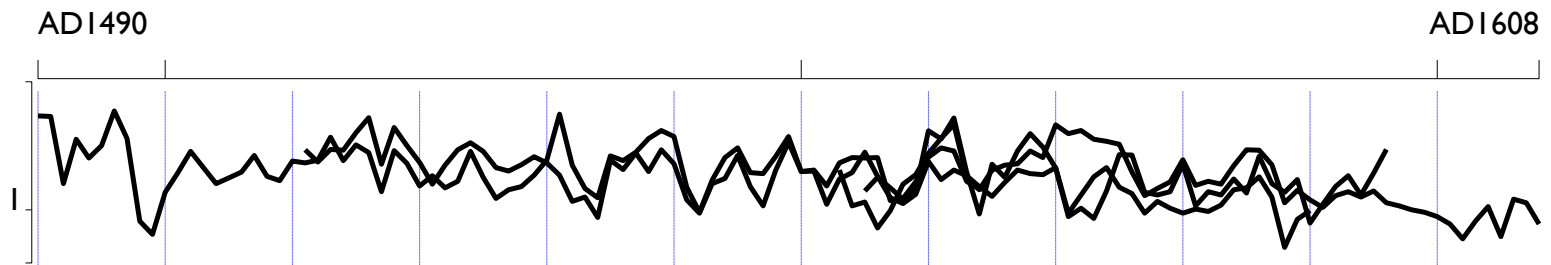
Key: H/S bdy = heartwood/sapwood boundary - last heartwood ring date; C= complete sapwood, winter felled; ½C = complete sapwood, felled the following summer/autumn; std devn = standard deviation; mean sens = mean sensitivity; NM = not measured

**Table 2:** Cross-matching between the dated elements in series **LTHRNGHM**

SAMPLE	t-value		
	lt110	lt111	lt118
lt107	1.8	7.1	1.8
lt110		*	3.8
lt111			*

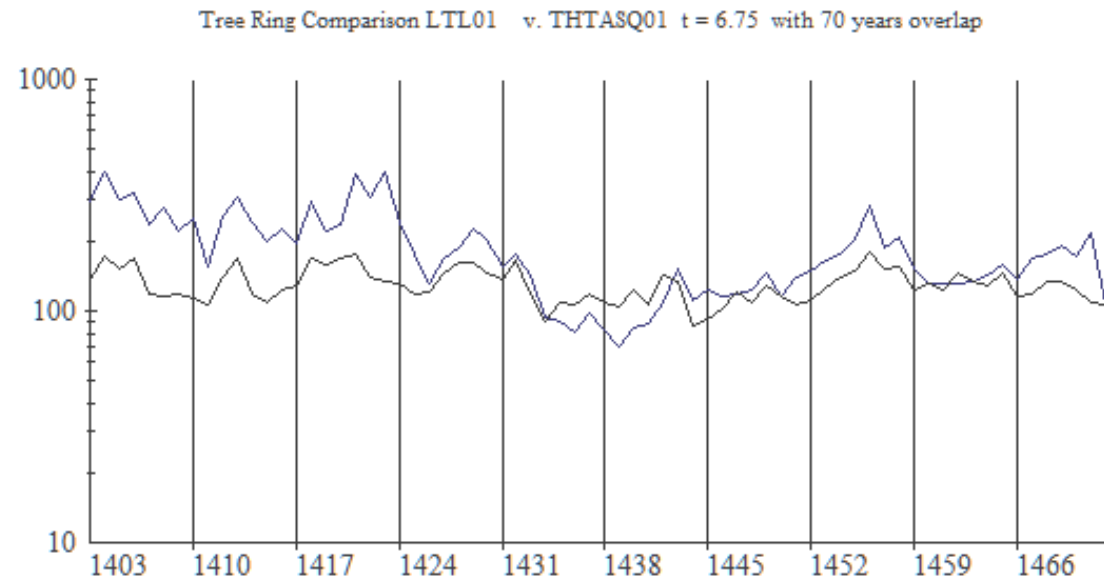
\* = overlap less than 15 years, no t-value calculated

**Figure 1:** Plots of the four matching series in the master sequence **LTHRNHGM** showing their similar growth patterns



**Table 3a:** Dating evidence for the site sequence **ltl01 AD 1403–1472** against dated reference chronologies

<i>County or region:</i>	<i>Chronology name:</i>	<i>Reference</i>	<i>File name:</i>	<i>Spanning:</i>	<i>Overlap (yrs):</i>	<i>t-value:</i>
Norfolk	Abbey Farm, Thetford	(Howard <i>et al</i> 2000)	THTASQ01	1332–1536	70	6.8
Essex	Bentfield Bury barn	(Bridge 2002)	BENTFLD	1380–1452	50	4.9
Suffolk	Hengrave Hall, Hengrave	(Bridge 2001a)	HENGRAVE	1367–1512	70	4.8
Wales	St Winefride's Well, Holywell	(Miles <i>et al</i> 2010)	HOLYWELL	1388–1524	70	4.8
Essex	Minchins, Dunmow	(Miles and Bridge 2013)	MINCHINS	1367–1543	70	4.8
Cambridgeshire	Soham Church	(Bridge 2008a)	SOHAM	1306–1477	70	4.5
Essex	St Mary's, Saffron Walden	(Bridge 2001b)	SAFFRON1	1305–1475	70	4.5
Essex	Thaxted Church	(Tyers 1990)	THAXTED2	1345–1526	70	4.4

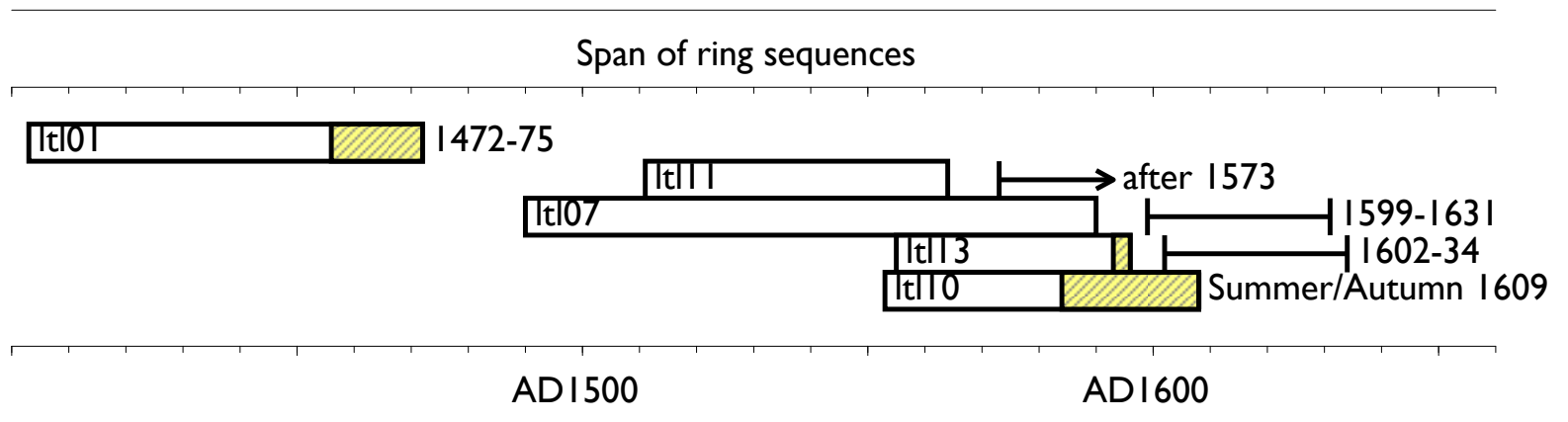


**Figure 2:** Plot (logarithmic scale) of **ltl01** and Abbey Farm, Thetford, showing the similarity in growth curves



**Table 3b:** Dating evidence for the site chronology LTHRNHGM AD 1490–1608

<i>County or region:</i>	<i>Chronology name:</i>	<i>Reference</i>	<i>File name:</i>	<i>Spanning:</i>	<i>Overlap (yrs):</i>	<i>t-value:</i>
<b>Regional chronologies</b>						
East Anglia	East Anglia Master Chronology	(Bridge 2003)	<b>ANGLIA03</b>	944–1789	119	8.1
Southern England	Southern England Master	(Bridge 1998a)	<b>SENG98</b>	944–1790	119	6.5
<b>Individual site chronologies</b>						
Suffolk	7/9 Gracechurch St., Debenham	(Miles <i>et al</i> 2009)	DEBNHM2	1433–1588	99	8.6
Suffolk	Crow's Hall	(Miles <i>et al</i> 2007)	CROWSHL1	1406–1559	70	8.3
Suffolk	Cratfield bellframe	(Bridge 2008b)	CRATFLD1	1503–1639	106	7.7
Cambridgeshire	Forehill, Ely	(Nottingham Lab pers comm)	ELY-A	1480–1611	119	7.6
Oxfordshire	Bodleian Library	(Miles and Worthington 1999)	BDLEIAN3	1395–1610	119	7.1
Suffolk	12 Aspall Rd, Debenham	(Miles <i>et al</i> 2009)	DEBNHM3	1433–1574	85	7.0
Oxfordshire	Wadham College	(Miles and Bridge 2010)	WADHAM	1426–1610	119	6.9
Cambridgeshire	St Andrew's Church, Wimpole	(Bridge 1998b)	WIMPOLE1	1469–1615	119	6.8
Oxfordshire	Fellow's Quad, Merton College	(Miles and Worthington 2006)	MERTON2	1442–1608	119	6.8
Suffolk	Mill House, Alpheton	(Bridge 2002)	aphfbm	1501–1616	108	6.7



**Figure 3:** Bar diagram showing the relative positions of overlap of the dated sequences from Letheringham Lodge, along with the actual or interpreted felling dates. Yellow sections represent sapwood rings.