TREE-RING ANALYSIS OF TIMBERS FROM
8 – 9 THE PARADE, /
25 – 26 ST MARGARET'S STREET,
CANTERBURY,
KENT

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Summary

Samples were obtained from 12 timbers within the two ranges of this L-shaped building, which stands at an important crossroad in the centre of Canterbury, not far from the Cathedral. Analysis of the cores obtained produced a single site chronology, CBRCSQ01, comprising 10 samples and having an overall length of 128 rings. This site chronology was dated as spanning the years 1247 – 1374.

Interpretation of the sapwood on the dated samples indicates that both ranges are of a single phase of construction, the timbers represented being felled *ca.* 1377 – 78.

Introduction

The building which now forms 8 – 9 The Parade and 25 – 26 St Margaret's Street lies at the junction of the generally north-west aligned Parade and the north-east aligned St Margaret's Street, in the centre of Canterbury, only a hundred meters or so from the

Cathedral precincts (TR 1494 5778, Fig 1). It is one of a number of important and substantial medieval timber-framed buildings within this central part of the city. The building comprises two ranges set at right-angles to each other to form an L-shaped plan (Fig 2). The structure is three stories high, the upper floors jettied towards the street. Much of the medieval timber-framed fabric of this building survives, particularly on the upper floors and within the roof spaces. It is thus a good example of a large medieval urban building.

Both ranges of the building are four bays in length (Fig 3a/b) and each is covered by a conventional crown-post roof, general views of which are given in Figure 4a/b. The roofs of the two ranges terminate in gables at the corner of the property, the angle between the two roofs being turned by an unusual pyramidal arrangement of rafters. The joists and beams of the jettied floors of the building survive for the most part, although alterations and loses have occurred. A dragon beam is typically present at the corner, on each floor, turning the direction of the joists by 90°. Given that a full drawn survey and analysis of the building has been undertaken, and is the subject of a separate report (Austin and Sweetinburgh 2005), the descriptive and historical information contained therein is not repeated here.

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[Both ranges of this site, that to The Parade and that to St Margaret's Street (see simple plan Fig 3), are covered by a common rafter, crown-post with collar purlin roof, there being curved braces from the crown posts to the collar purlin. The trusses themselves have braces between crown posts and tiebeams. General views of the roofs are given in Figure 4a/b. The range to The Parade is three bays long, while that along St Margaret's is of four bays, these lengths not including the junction bay where the two ranges meet. The angle between the roofs of the two ranges is turned by an unusual pyramidal setting of principal rafters, while the roofs of both ranges terminate in 'dormer' gable ends. The lower floors are jettied, and although the ceiling joists of the ground floor have been reconfigured, they are extant still. The angled junction of the jetty joists of the two ranges is carried, as is usual, on 'dragon' beams. A full drawn survey of the building has been undertaken by Rupert Austin of Canterbury Archaeological Trust Ltd, this, along with the survey record, being produced as a separate report].

Sampling

A programme of sampling and analysis by tree-ring dating of the timbers within this building was commissioned by Canterbury Archaeological Trust Ltd on behalf of the current owners of the site prior to conservation and redevelopment. On the basis of general construction and form, the building had been dated, approximately, to the late-fourteenth century, but there were no architectural, stylistic, or decorative features by which its construction could be more accurately and reliably established. Analysis by dendrochronology was thus undertaken not only to determine when the building was erected, but also, as suggested by structural evidence, to confirm that both ranges were of the same date and that the building is of a single phase of construction.

Thus, from the timbers available a 12 core samples were obtained. An attempt was made to obtain samples from as wide a spatial distribution as possible, as well as selecting samples from a representative range of beam and timber types. Each sample was given the unique site identifier code of CBR-C (for Canterbury, site ‘C’), and numbered 01 – 12. The positions of the sampled timbers are shown on the plans drawn and provided by Rupert Austin of Canterbury Archaeological Trust Ltd, these being reproduced here as Figures 3a – c. Details of the samples are given in Table 1. In this report the frames and timbers have been numbered and identified from site north to south or east to west as appropriate.

The Nottingham Tree-ring Dating Laboratory would like to take this opportunity to thank Rupert Austin for his help and comments in interpreting the building and for the use of his drawings and photographs. The accuracy, clarity, and ready availability of these have without doubt enhanced the reliability and efficacy of the tree-ring analysis. We would also like to thank the Architects, Lee Evans De Moubray for their assistance, as well as the owners, City Property Holdings, for their generous funding of this programme of tree-ring dating.

Tree-ring dating

Tree-ring dating relies on a few simple, but quite fundamental, principles. Firstly, as is commonly known, trees (particularly oak trees, the most frequently used building timber in England) grow by adding one, and only one, growth-ring to their circumference each, and every, year. Each new annual growth-ring is added to the outside of the previous year’s growth just below the bark. The width of this annual growth-ring is largely, though not exclusively, determined by the weather conditions during the growth period (roughly March – September). In general, good conditions produce wider rings and poor conditions produce narrower rings. Thus, over the lifetime of a tree, the annual growth-rings display a climatically influenced pattern. Furthermore, and importantly, all trees growing in the same area at the same time will be influenced by the same growing conditions and the annual growth-rings of all of them will respond in a similar, though not identical, way.

Secondly, because the weather over any number of consecutive years is unique, so too is the growth-ring pattern of the tree. The pattern of a short period of growth, 20, 30 or even 40 consecutive years, might conceivably be repeated two or even three times in the last one thousand years. A short pattern might also be repeated at different time periods in different parts of the country because of differences in regional micro-climates. It is less likely, however, that such problems would occur with the pattern of a longer period of growth, that is, anything in excess of 54 years or so. In essence, a short period of growth, anything less than 54 rings, is not reliable, and the longer the period of time under comparison the better.

The third principal of tree-ring dating is that, until the early- to mid-nineteenth century, builders of timber-framed houses usually obtained all the wood needed for a given structure by felling the necessary trees in a single operation from one patch of woodland, or from closely adjacent woods. Furthermore, and contrary to popular belief, the timber was used "green" and without seasoning, and there was very little long-term storage as in timber-yards of today. This fact has been well established from a number of studies where tree-ring dating has been undertaken in conjunction with documentary studies. Thus, establishing the felling date for a group of timbers gives a very precise indication of the date of their use in a building.

Tree-ring dating relies on obtaining the growth pattern of trees from sample timbers of unknown date by measuring the width of the annual growth-rings. This is done to a tolerance of 1/100 of a millimeter. The growth patterns of these samples of unknown date are then compared with a series of reference patterns or chronologies, the date of each ring of which *is* known. When the growth-ring sequence of a sample "cross-matches" repeatedly at the same date span against a series of different relevant reference chronologies the sample can be said to be dated. The degree of cross-matching, that is the measure of similarity between sample and reference, is denoted by a "*t*-value"; the higher the value the greater the similarity. The greater the similarity the greater is the probability that the patterns of samples and references have been produced by growing under the same conditions *at the same time*. The statistically accepted fully reliable minimum *t*-value is 3.5.

However, rather than attempt to date each sample individually it is usual to first compare all the samples from a single building, or phase of a building, with one another, and attempt to cross-match each one with all the others from the same phase or building. When samples from the same phase do cross-match with each other they are combined at their matching positions to form what is known as a "site chronology". As with any set of data, this has the effect of reducing the anomalies of any one individual (brought about in the case of tree-rings by some non-climatic influence) and enhances the overall climatic signal. As stated above, it is the climate that gives the growth pattern its distinctive pattern. The greater the number of samples in a site chronology the greater is the climatic signal of the group and the weaker is the non-climatic input of any one individual.

Furthermore, combining samples in this way to make a site chronology usually has the effect of increasing the time-span that is under comparison. As also mentioned above, the longer the period of growth under consideration, the greater the certainty of the cross-match. Any site chronology with less than about 55 rings is generally too short for satisfactory analysis.

Analysis

Each of the 12 samples obtained from this building was prepared by sanding and polishing and their annual growth ring widths were measured. The data of these measurements were then compared to each other allowing a single group of 10 cross-matching samples to be formed. The relative positions of these 10 samples are shown in the bar diagram, Figure 5.

The 10 samples were combined at their indicated off-set positions to form site chronology CBRCSQ01, this having an overall length of 128 rings. Site chronology CBRCSQ01 was then compared to an extensive range of reference chronologies for oak, cross-matching consistently with a number of these when the date of its first ring is 1247 and the date of its last measured ring is 1374. Evidence for this dating is given in the *t*-values of Table 2.

Site chronology CBRCSQ01 was also compared with the two remaining ungrouped samples. There was, however, no further satisfactory cross-matching. Both the ungrouped samples were then compared individually to a full range of reference chronologies for oak but there was no satisfactory cross-matching. These two samples must, therefore, remain undated.

Interpretation and conclusion

Analysis by dendrochronology of material from this building has produced a single site chronology, CBRCSQ01, comprising 10 samples, its 128 rings dated as spanning the years 1247 to 1374. Three of the dated samples, CBR-C02, C04, and C05 have some sapwood with two of these, samples CBR-C02 and C05, coming from timbers which retain complete sapwood. This means that the two timbers have the last ring produced by the trees represented before they were felled, ie they would indicate the felling date of the timber. Unfortunately portions of the sapwood elements of the two samples were lost during coring. However, observations and notes made at the time, suggest that the loss from sample C02 represents only 3 – 4 rings. Given that the last extant sapwood ring on sample C02 is dated 1374, this would suggest a felling date for the timber represented of 1377 – 78. The sapwood portion lost from sample CBR-C05, whilst larger and more difficult to estimate, would certainly be consistent with a felling date of 1377 – 78.

Furthermore, six other dated samples retain the heartwood/sapwood transition. The relative position on these six is very similar to that seen on samples CBR-C02 and C05 and as such would strongly indicate that the timbers they represent were also felled in 1377 – 78. Overall the relative position of the heartwood/sapwood boundary varies by only eight years from relative position 102 (1348) on sample CBR-C05 to relative position 110 (1356), on sample CBR-C02. This similarity is highly consistent with a group of timbers having a single felling date, increasing the likelihood that the timbers of both ranges were all felled at the same time.

This programme of tree-ring dating has thus achieved the aims set out in the 'sampling' section, above. Not only has the date of the building been more accurately and reliable established by the Nottingham Laboratory, this being slightly earlier than was perhaps previously expected, but dendrochronology has established that, as expected, both ranges are of the same date and the building is of a single phase of construction. No doubt the interpretation obtained here will have some impact on the interpretation and dating of other buildings in Canterbury, but it is recommended that should any other similar buildings in the town undergo redevelopment, they to undergo tree-ring dating.

It may be of interest to note that, perhaps not unexpectedly, the timber used in this building appears to be of local, Kentish, origin. As may be seen from Table 2, which shows the reference chronologies by which site chronology CBRCSQ01 has been dated, the highest *t*-values (ie, the best or closest matches) are found with those made up of material from other buildings in Kent, even though site chronology CBRCSQ01 was compared with reference data from every other part of England as well. The data obtained from 8 – 9 The Parade / 25 – 26 St Margaret's Street will itself now be added to this data bank and will make a valuable contribution to the reference material available for this part of England spanning the mid-thirteenth to late fourteenth centuries.

2 undated samples? Fig 7 view of?

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Table 1: Details of samples from the 8 – 9 The Parade / 25 – 26 St Margaret's Street, Canterbury

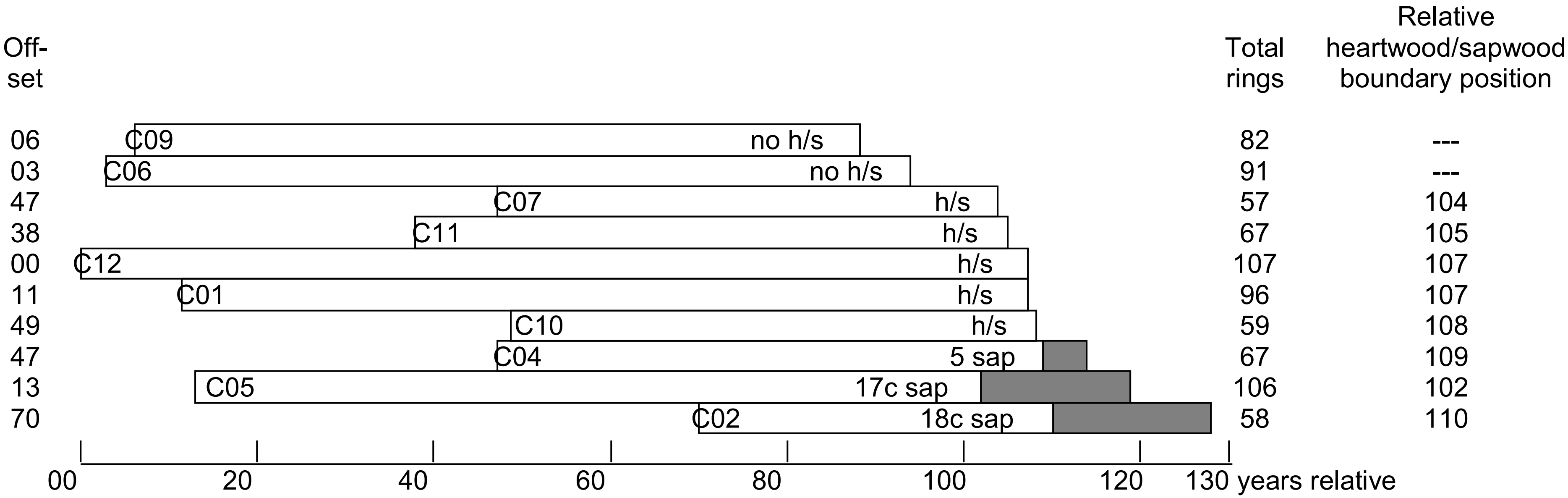
Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date	Last heartwood ring date	Last measured ring date
	8 - 9 The Parade					
CBR-C01	South brace, crown post truss 3 - collar purlin	96	h/s	1258	1353	1353
CBR-C02	East common rafter 1, bay 4	58	18c	1317	1356	1374
CBR-C03	East rafter to crown post, truss 3	84	14c	------	------	------
CBR-C04	Collar purlin, bay 3	67	5	1294	1355	1360
CBR-C05	North brace, crown post truss 3 - collar purlin	106	17c	1260	1348	1365
	25 St Margaret's Street					
CBR-C06	East brace, crown post to collar purlin, truss 1	91	no h/s	1250	------	1340
CBR-C07	Collar purlin, junction bay	57	h/s	1294	1350	1350
CBR-C08	North common rafter 5, bay 1	144	14	------	------	------
CBR-C09	Collar, frame 4, bay 1	82	no h/s	1253	------	1334
CBR-C10	North common rafter 2, bay 3	59	h/s	1296	1354	1354
CBR-C11	Crown post, truss 3	67	h/s	1285	1351	1351
CBR-C12	North common rafter 2, bay 4	107	h/s	1247	1353	1353

*h/s = the last ring on the sample is at the heartwood/sapwood boundary
c = complete sapwood is retained on the timber, a portion has been lost from the core during sampling

Table 2: Results of the cross-matching of site chronology CBRCSQ01 and relevant reference chronologies when first ring date is 1247 and last ring date is 1374

Reference chronology	Span of chronology	*t*-value	
Kent-88	1158 – 1540	6.8	(Laxton and Litton 1989)
England London	413 – 1728	6.4	(Tyers and Groves 1999 unpubl)
Lower Newlands, Teynham, Kent	1278 – 1366	6.3	(Howard *et al* 1988)
Church of St Mary, High Halden, Kent	1299 – 1462	5.7	(Bridge 1987)
Canterbury Cathedral, Kent	1309 – 1402	5.6	(Howard *et al* 1988 unpubl)
Church of St Mary Magdalene, Cowden, Kent	1257 – 1439	5.2	(Howard *et al* 1999)
Archbishop’s Palace, Charring, Kent	1239 – 1311	4.8	(Howard *et al* 1998)
Ightham Mote, Ivy Hatch, Kent	1158 – 1312	4.7	(Howard *et al* 1988)

Figure 5: Bar diagram of the samples in site chronology CBRCSQ02



white bars = heartwood rings, shaded area = sapwood rings
h/s = heartwood/sapwood boundary is last ring on sample
c = complete sapwood is retained on the timber, a portion has been lost from the core during sampling