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TREE-RING ANALYSIS OF TIMBERS FROM 64–72 GOODRAMGATE (LADY ROW), YORK

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SUMMARY

Dendrochronological analysis was undertaken on samples taken from timbers of the roof and north truss of number 64. This resulted in the construction of two site sequences.
Site sequence YRKKSQ01 contains nine samples and spans the period 1079–1316. The second site sequence, YRKKSQ02, contains two samples and spans the period 1239–1315.
Analysis of the sapwood indicates felling of timbers in 1311, 1315, and 1316, with the rest of the dated beams also likely to have been felled during the same period.
Prior to tree-ring analysis being undertaken the building had been dated stylistically to the early-fourteenth century. Further, it was thought to be the range for which a deed had been granted for its construction in 1316; a supposition now supported by these results.

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INTRODUCTION

The range of buildings under investigation is situated on the west side of Goodramgate, in front of the churchyard (Figs 1–3). It has been the subject of a number of investigations and these documents should be referred to for a full description of the building and roof (Short 1979, RCHME 1981, Rimmer 2007).

Briefly, the range is of two storeys, with the first floor jettied to the street frontage, and is thought to have originally consisted of 11 bays (Fig 4). Within the roof, there are eight surviving trusses of tall, un-jowled crown posts with braces to the tiebeams and collar purlins and raking struts between the tiebeams and the principal rafters (Fig 5).

This range is believed to be the oldest surviving row in York and is thought to be fourteenth century. It is known that a deed was granted in 1316 to build a range on the churchyard and it has been suggested that 64–72 Goodramgate is this building.

Principles of Tree-ring Dating

Tree-ring dating relies on a few simple, but fundamental, principles. Firstly, as is commonly known, trees (particularly oak trees) 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 to 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 determined pattern. Furthermore, and importantly, all trees growing in the same area at a 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 pattern of the tree. The pattern of a short period of growth, 20 or 30 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 60 years or so. In essence, a short period of growth, anything less than 50 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 millimetre. 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 a sample “cross-matches” repeatedly at the same date 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 the 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 phases 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.

SAMPLING

A total of 18 timbers was sampled with each sample being given the code YRK-K and numbered 01–18; samples YRK-K01–16 being taken from the roof and YRK-K17–18 from the north end wall of number 64 at first floor level. The location of samples was noted at the time of sampling and has been marked on Figures 6–11. Further details can be found in Table 1. Trusses have been numbered from south to north (Fig 4). It was not possible to gain access to all parts of the roof, therefore, sampling was restricted to accessible trusses.

ANALYSIS & RESULTS

At this stage, four of the samples were found to have too few rings for secure dating to be a possibility and so were discarded prior to measurement. The remaining 14 samples were prepared by sanding and polishing and their growth-ring widths measured. These growth-ring widths were then compared with each other, resulting in the formation of two groups.

Firstly, nine samples (eight from the roof and one from a stud post in the north end wall of number 64) matched each other and were combined at the relevant offset positions to form YRKKSQ01, a site sequence of 238 rings (Fig 12). This site sequence was compared against a series of relevant reference chronologies for oak where it was found to match consistently and securely at a first-measured ring date of 1079 and a last-measured ring date of 1316. The evidence for this dating is given by the *t*-values in Table 2.

Two further samples, both taken from roof timbers, also matched each other and were combined at the relevant offset positions to form YRKKSQ02, a site sequence of 77 rings (Fig 13). This site sequence was successfully matched against the reference material to the period 1239–1315.

Attempts to date the remaining, ungrouped samples by comparing them individually against the reference material were unsuccessful and these remain undated.

INTERPRETATION

Tree-ring analysis of timbers at this building has resulted in the successful dating of 11 samples. Three of these have complete sapwood and last-measured ring dates of 1311 (YRK-K17), 1315 (YRK-K02), and 1316 (YRK-K08), the felling dates of the timbers represented. A fourth sample (YRK-K03) was taken from a timber with complete sapwood but, unfortunately, one or two of these outer rings were lost during the sampling process. With a last-measured ring date of 1313 for this sample, this would give the timber represented a felling date of 1314/15. Another sample (YRK-K11) has the heartwood/sapwood boundary ring date of 1294, allowing an estimated felling date range to be calculated for the timber represented of 1309–34. This felling date range and the last-measured heartwood ring dates of the remaining dated samples also allow for these samples to have been felled at a similar time to the other timbers.

Felling date ranges have been calculated using the estimate that mature oak trees from Yorkshire have between 15 and 40 sapwood rings.

DISCUSSION

Prior to tree-ring analysis being undertaken numbers 64–70 Goodramgate were thought to date stylistically to the early-fourteenth century. Additionally, it had been suggested that this range of buildings was referred to within a deed of 1316 whereby the archbishop of York granted permission for the construction of buildings near to the church. This suggestion has now been supported by the tree-ring results which has dated several of the timbers used in its construction to 1311/15/16.

Three of the dated samples have last-measured heartwood ring dates in the twelfth century (Fig 12) but are still thought to have probably been felled in *c* 1316. For this to be the case these timbers would have to represent the inner portions of much longer lived trees, over 200 years old at felling. It is known that trees of this age were used in this building as evidenced by sample YRK-K16 which has 190 years worth of measured growth without the heartwood/sapwood boundary.

It is believed that the usual practice during the medieval period would be to obtain all the timber necessary for a building in one felling from a single source. The fact that the felling date of some of the beams vary slightly by a few years is a little unusual but may simply indicate the use of stockpiled material or timber leftover from a previous project. Timber was, as is now, a valuable resource and any not used would have been saved until it was required. Additionally, although consistent and secure the intra-site matching of these samples, ie., how well they match each other, is not particularly high which might point towards more than one source of timber. It is known that later in the fourteenth century, during the construction of two other rows in York, the necessary timber was obtained from various sources including a nearby woodland, the builders involved, and beams from a dismantled building (Rimmer 2007).

With the possibility being raised that the timber used at Goodramgate was not simply supplied by the nearest woodland an attempt to identify the origin of the wood by looking at the location of the highest matching reference chronologies was made (dendroprovencing). The reference chronologies producing the highest *t*-value matches for site sequences YRKKSQ01 and YRKKSQ02 can be seen in Tables 2 and 3 and in Figure 14. In the case of YRKKSQ02 the best matches (with the exception of a site in Awliscombe in Devon) are clustered around the Nottinghamshire and Derbyshire area whereas the highest matches with YRKKSQ01 are more diverse, although generally they could be said to be in the north-west of the country. The fact that this site sequence has less affinity to one particular area may be to do with the fact that there are more components in this sequence (nine compared to two) and that these components possibly come from a number of locations. However, caution should be taken when trying to identify timber source in this way. It has been suggested (Bridge 2000) that although it is likely that sites closest in origin to the source of the timber will give the best matches this may be an over-simplification and that of equal, if not greater, importance may be the site environment, such as soil type or geomorphology. This might explain the occurrences of seemingly anomalies matches sometimes, such as site sequence YRKKSQ02 and the Devon site.

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Table 1: Details of samples from 64–72 Goodramgate (Lady Row), York

Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date (AD)	Last heartwood ring date (AD)	Last measured ring date (AD)
YRK-K01	Collar purlin, truss 3–4	152	--	1123	----	1274
YRK-K02	West brace (tiebeam to crown post), T4	77	30C	1239	1285	1315
YRK-K03	South brace (crown post to collar purlin), T4	72	14c	1242	1299	1313
YRK-K04	East common rafter 3, T3–4	NM	--	----	----	----
YRK-K05	East common rafter 5, T3–4	NM	--	----	----	----
YRK-K06	North brace (crown post to collar purlin), T2	119	h/s	----	----	----
YRK-K07	West common rafter 5, T4–5	63	--	1091	----	1153
YRK-K08	West common rafter 2, T4–5	93	27C	1224	1289	1316
YRK-K09	West common rafter 1, T4–5	62	--	1191	----	1252
YRK-K10	West common rafter 3, T4–5	NM	--	----	----	----
YRK-K11	Collar, frame 1, T4–5	87	01	1209	1294	1295
YRK-K12	Collar, frame 2, T4–-5	48	--	1084	----	1131
YRK-K13	East raking strut, T7	46	--	1111	----	1156
YRK-K14	East brace (tiebeam to crown post), T7	66	--	----	----	----
YRK-K15	Tiebeam, T7	NM	--	----	----	----
YRK-K16	Collar purln, T6–7	190	--	1079	----	1268
YRK-K17	West stud post, north gable wall (1st floor)	142	40C	1170	1271	1311
YRK-K18	West mid stud post, north gable wall (1st floor)	75	--	----	----	----

*NM = not measured

**h/s = the heartwood/sapwood boundary ring is the last-measured ring on the sample

c = complete sapwood on timber, 1 or 2 rings lost during the sampling process

C = complete sapwood retained on sample, last ring is the felling date.

Table 2: Results of the cross-matching of site sequence YRKKSQ01 and relevant reference chronologies when the first-ring date is 1079 and the last-measured ring date is 1316

Reference chronology	*t*-value	Span of chronology
East Midlands	9.9	882–1981
Church of St Mary, Stockport, Manchester	9.9	1099–1293
Hansacre Hall, Staffordshire	9.5	965–1279
'Severns', Castle Road, Nottinghamshire	8.9	1030–1334
Baxby Manor Farm, Baxby, North Yorkshire	8.6	1161–1307
Breadsall Old Hall, Breadsall, Derbyshire	8.0	970–1236
Manor House, Abbey Green, Burton-on-Trent, Staffordshire	8.0	1162–1339

Table 3: Results of the cross-matching of site sequence YRKKSQ02 and relevant reference chronologies when the first-ring date is 1239 and the last-measured ring date is 1315

Reference chronology	*t*-value	Span of chronology
East Midlands	5.2	882–1981
Sandiacre Tithe Barn, Derbyshire	6.9	1147–1332
'Severns', Castle Road, Nottinghamshire	6.6	1030–1334
40-44 Cartergate, Newark, Nottinghamshire	5.5	1134–1353
Manor House, Abbey Green, Burton-upon-Trent, Staffordshire	5.9	1162–1339
Wadhayes, Awliscombe, Devon	5.5	1179–1331
Flore's House, Oakham, Rutland	5.2	1173–1392

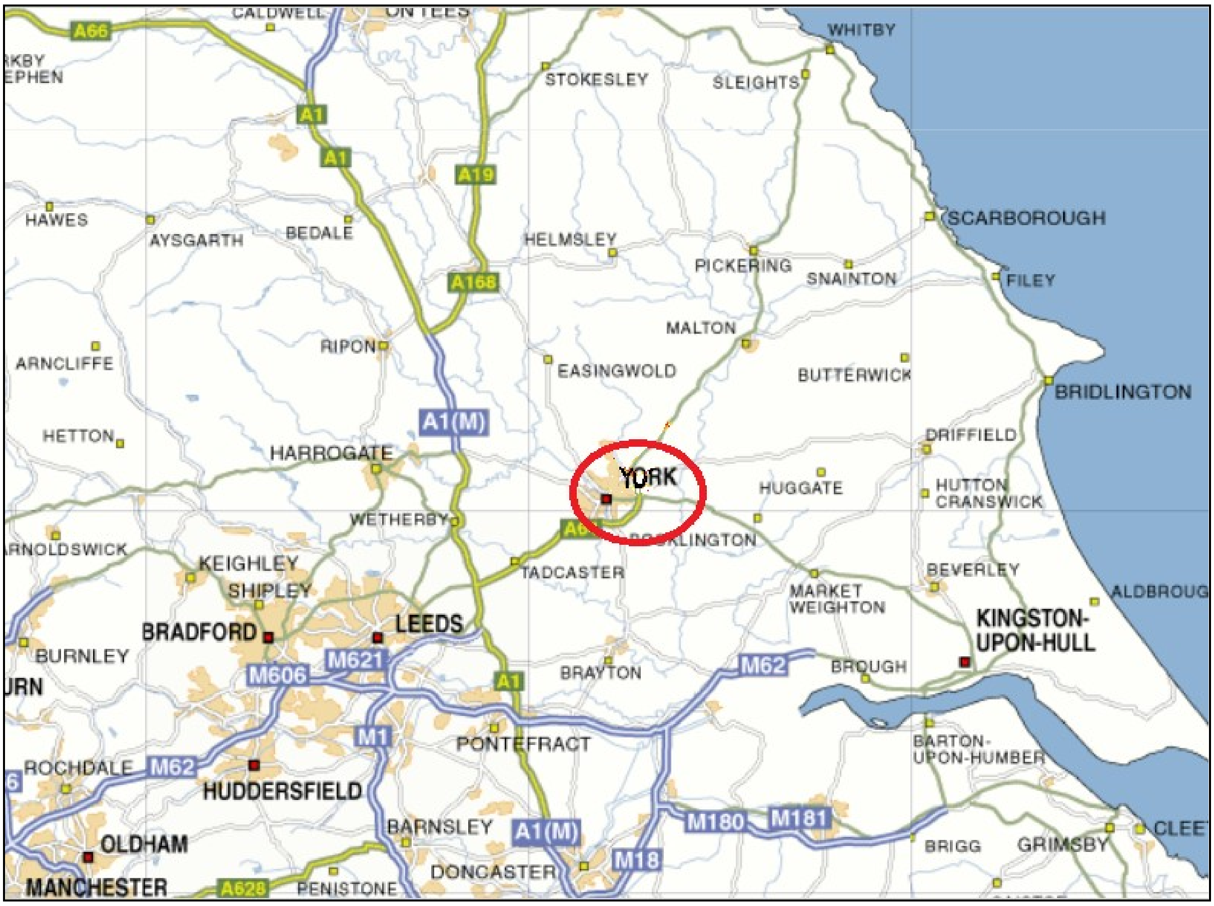

Figure 1: Map to show the general location of York, circled (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

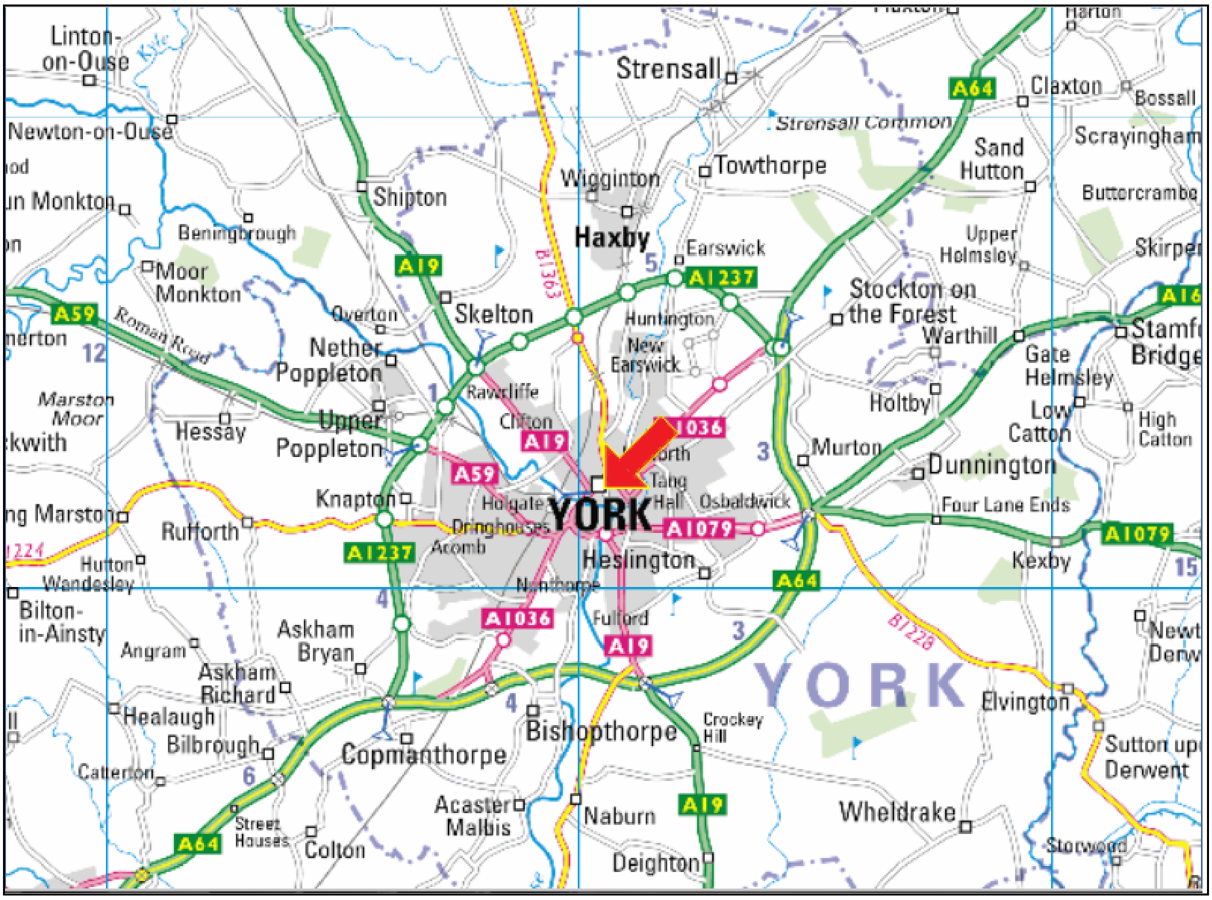

Figure 2: Map to show the location of Goodramgate, arrowed (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

Figure 3: Location of 64–72 Goodramgate, York, arrowed (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

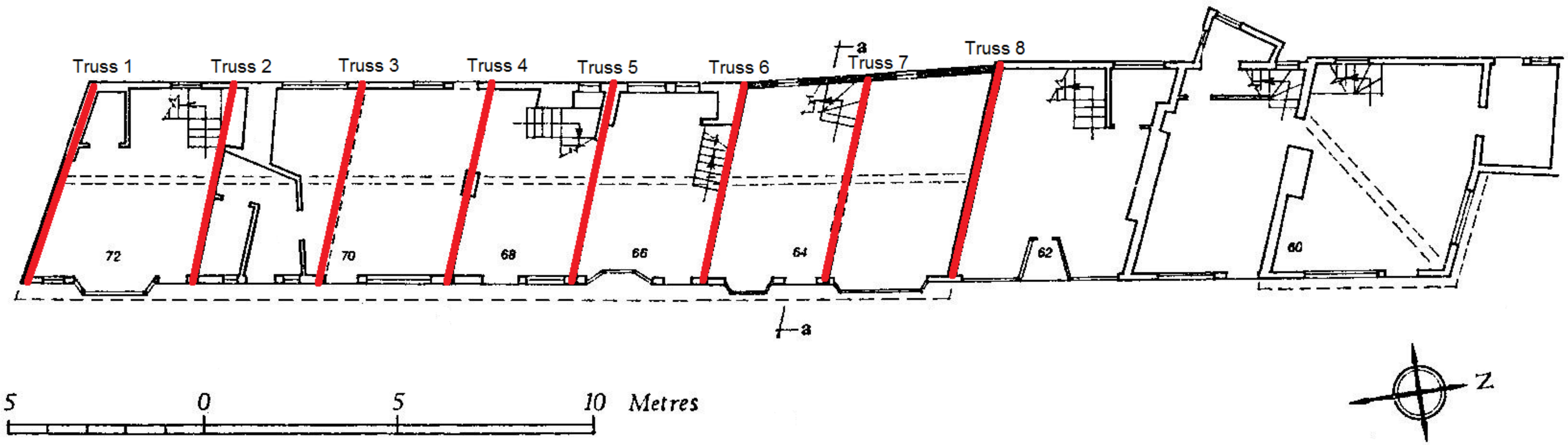

Figure 4: Ground-floor plan, showing the location of trusses (RCHME 1981)

Figure 5: Truss 3 (north face)

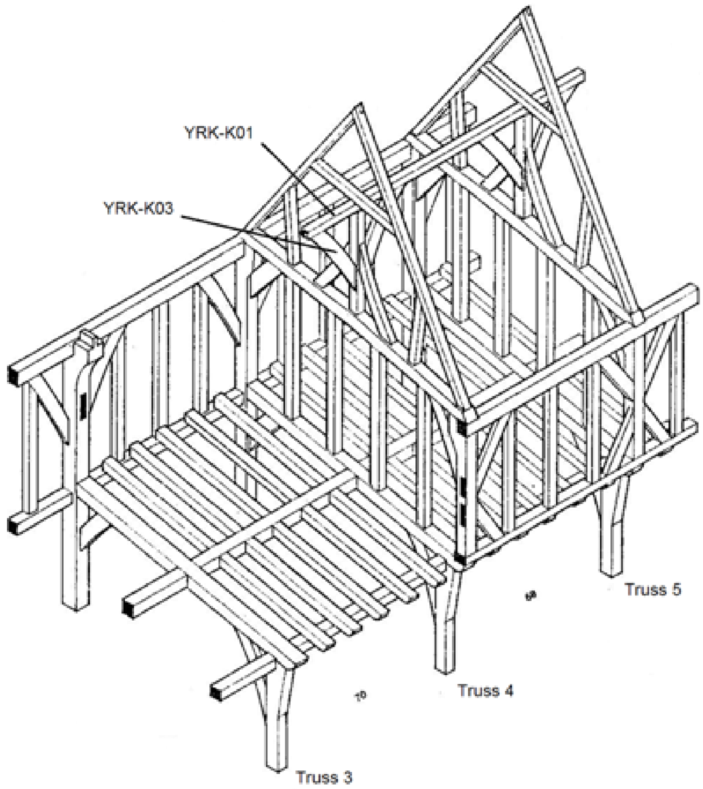

Figure 6: Isometric projection of Nos 68 and part 70, showing the location of samples YRK-K01 and YRK-K03 (RCHME 1981)

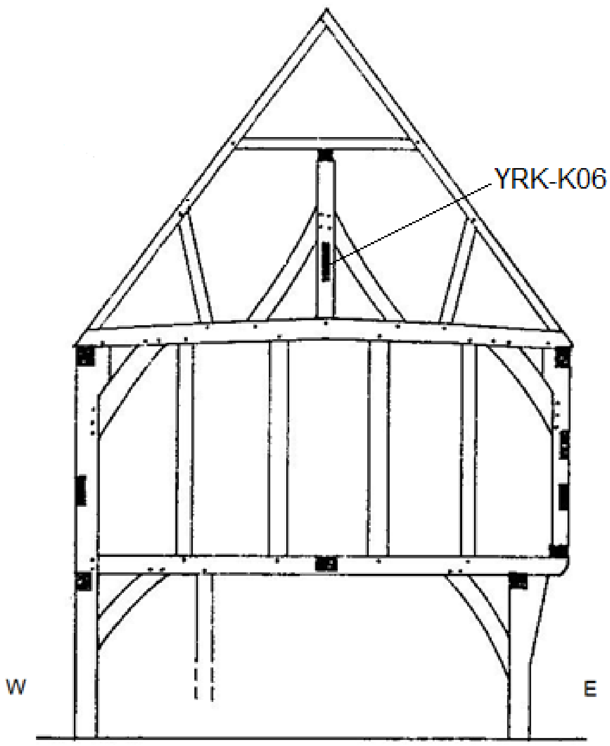

Figure 7: Truss 2, showing the location of sample YRK-K06

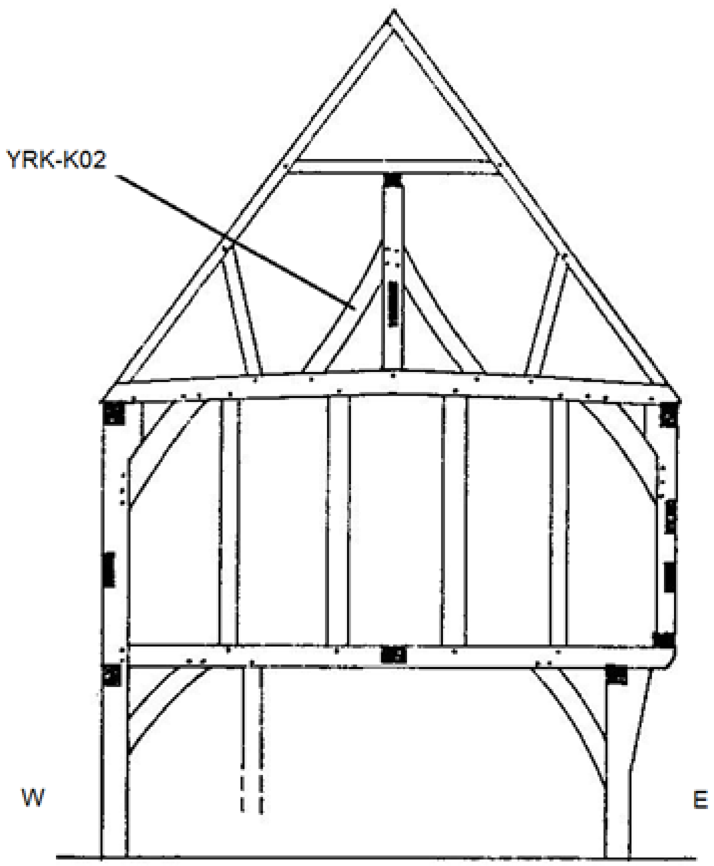

Figure 8: Truss 4, showing the location of sample YRK-K02

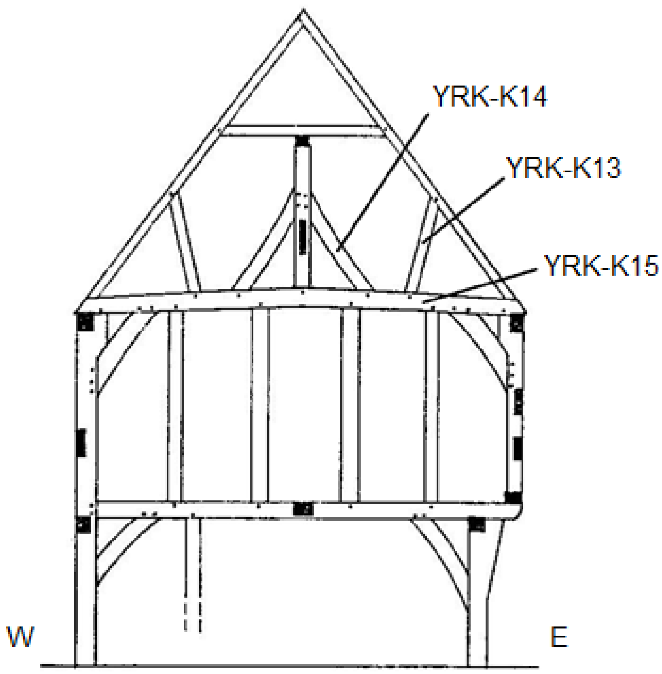

Figure 9: Truss 7, showing the location of samples YRK-K13–15

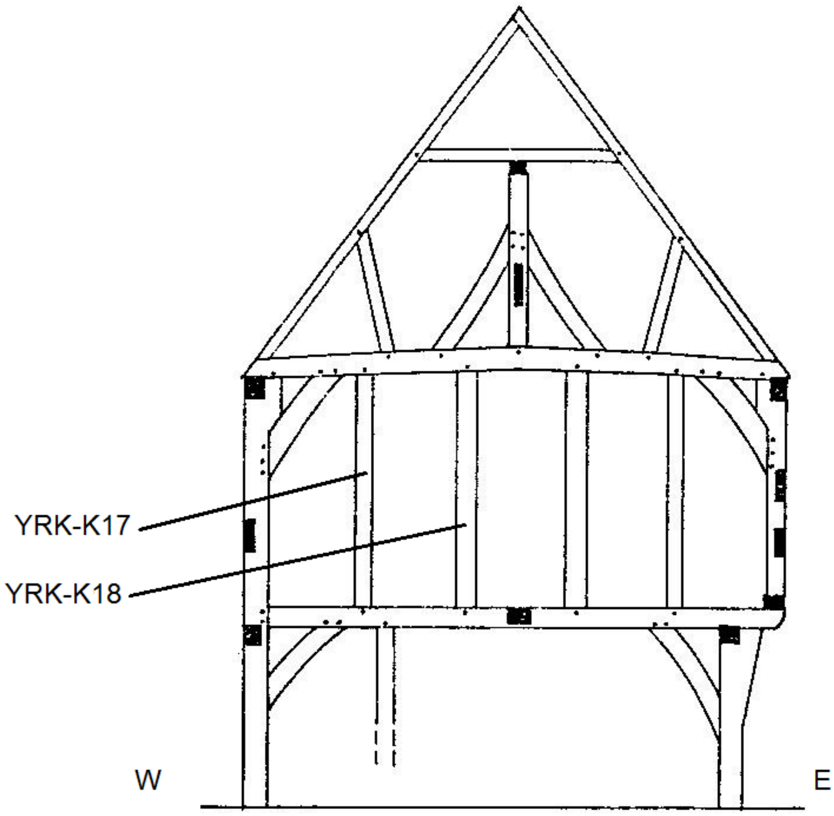

Figure 10: Truss 8, showing the location of samples YRK-K17 and YRK-K18

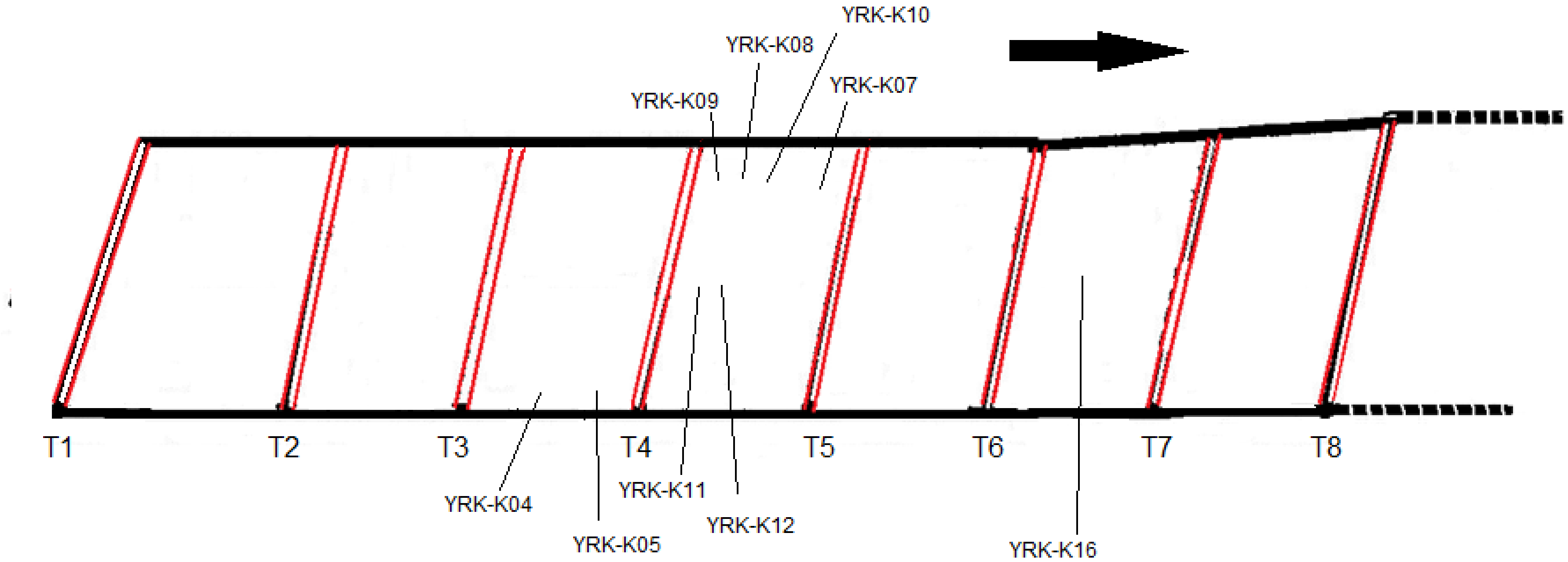

Figure 11: Sketch plan, showing the location of samples YRK-K04, YRK-K05, and YRK-K07–12

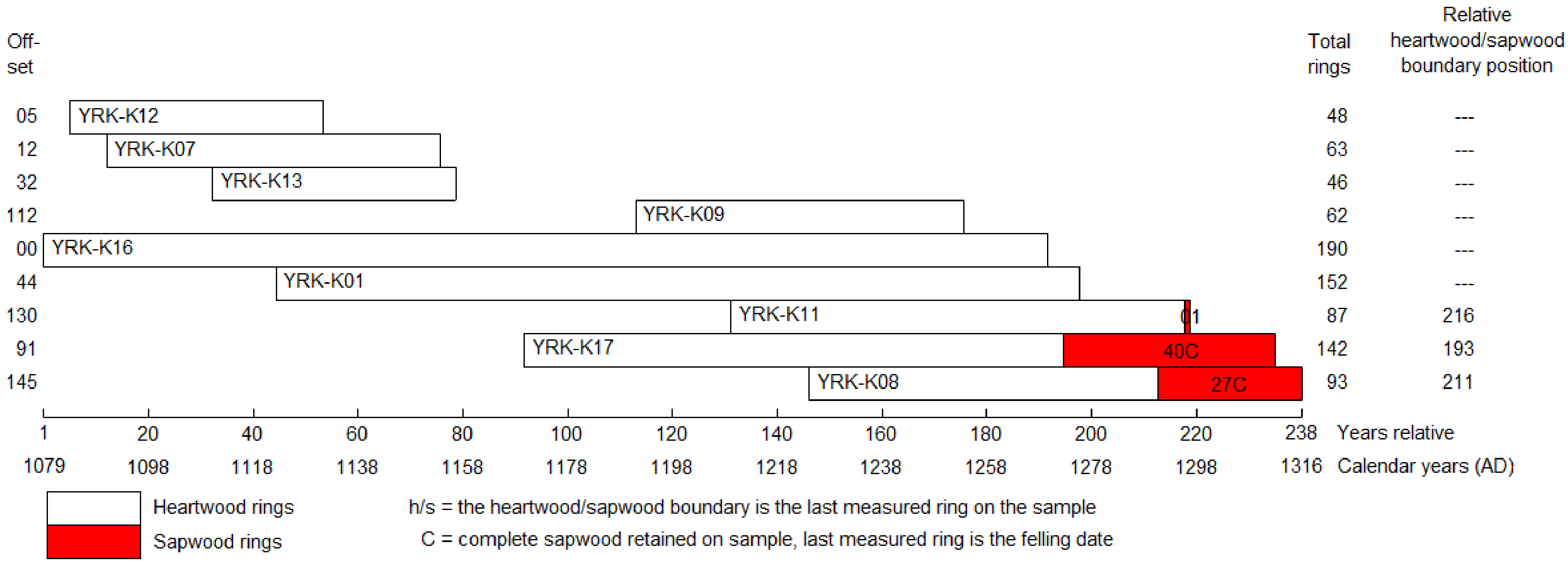

Figure 12: Bar diagram of samples in site sequence YRKKSQ01

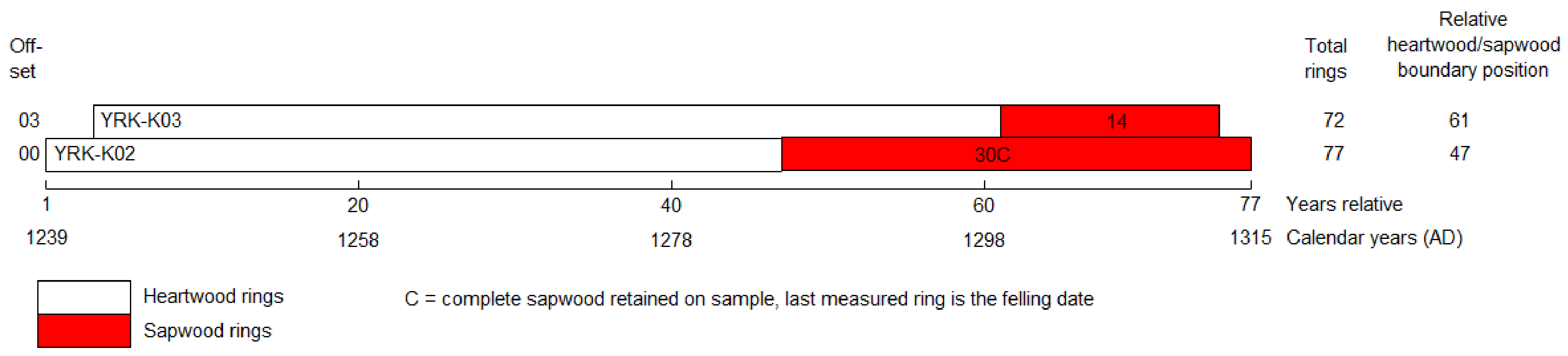

Figure 13: Bar diagram of samples in site sequence YRKKSQ02

a)

b)

Figure 14: Maps plotting the reference chronologies with the best matches with a) site sequence YRKKSQ01 and b) site sequence YRKKSQ02