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The Tree-Ring Dating of Whitefriars, Coventry

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Summary

Twenty timbers were sampled from the roof of the main range of Whitefriars, Coventry, as well as from wall-framing elements of the south-west wing. Of these, all but four samples dated, and were combined to form three independent site master chronologies. The first site master ***WHTFRS1*** spanned the years AD 1334-1474 and was composed of six rafters from the northern four bays and produced two precise felling dates of spring AD 1475. A second site master ***WHTFRS2*** spanning the years AD 1349-1493 was composed of three rafters and a collar from the centre bays of the main range roof. Here three precise felling dates of winter AD 1491/2, spring AD 1493, and winter AD 1493/4 were produced. Finally, two inserted timbers at the south end of the main range together with four samples from the south-west wing were combined to produce the third site master ***WHTFRS3*** spanning the years AD 1445-1547. Here a felling date of summer/autumn AD 1547 and three more from the winter of AD 1547/8 were found. This analysis suggests that either the main cloister roof is all pre-Dissolution, having been rebuilt in two phases about AD 1475 and AD 1494, or that it had been reconstructed about AD 1494 using some secondhand timbers from another roof. After the Dissolution, in about AD 1548, the south-west wing was reconstructed with new timbers to form a staircase and series of smaller rooms, and the end bay of the main range altered.

Keywords

Dendrochronology
Standing Building

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The Tree-Ring Dating of Whitefriars, Coventry

Description of building:

Whitefriars, Gulson Road, Coventry comprises the eastern side of the former cloister, the sole surviving portion of the Carmelite friary, founded in 1342 (Fig 1). At the Dissolution the cloister and a smaller cloister or 'inner court' at the southern end was purchased by John Hales who converted the east range of the cloister into a house, known as 'Hales Place'. The remainder of the cloister was demolished at this time, although the two short returns of the cloister at the north and south ends were retained and a certain amount of timber-framing added to the upper portions of the remainder of the cloister at the south-west end of the main range (RCHME 1997).

The roof over the main eastern range clearly is not the original structure since the truss positions do not respect the bays as delineated by the buttresses below. Despite this observation, the twelve trusses along the 150 ft length of the main range are consistent in design and comprise a substantial tiebeam, three struts up to a lower collar, and two queen struts between the lower and the upper collars. The roof is double-purlined, the lower ones tenoned and the upper ones clasped with the principals which are diminished, and both tiers have curved plank windbraces (Fig 2). The trusses and bays have been numbered from north to south and rafters have been similarly numbered within each of the eleven bays (Fig 3). There are six common rafters in bay 1, seven rafters in bays 2 - 4 and 10, and eight rafters in bays 5 - 9 and bay 11. The southern-most truss, T12, is slightly different in design in that the tiebeam has been severed by two posts rising to the collars which frame the great west window, a prominent feature which would otherwise have been obscured by the tiebeam. It may be significant that this structural solution was not employed at the north end where the roof truss at T1 does obscure the upper part of the north window. Some assembly marks were noted on the rafters - for instance a complete sequence of 1 - 13 runs north to south through bays 1 and 2, and a sequence numbered 1 - 8 runs from south to north in bay 8. Opinions have differed as to whether the roof was constructed for its present situation, or whether a second-hand agricultural roof was re-used at Whitefriars.

The south-west wing is constructed out of the truncated eastern end of the south cloister, and here the alterations appear to consist primarily of square-panel timber-framing to the south walls at first-floor level (Fig 4). Similar framing has been employed in constructing internal partitions, needed to convert the building for domestic use following the Dissolution.

The building continued to be used as a large house for the Hales family until AD 1717 when it sold. Over the next fifteen years the house changed hands several times, after which it had gone out of domestic use and became associated with the weaving industry. In AD 1801 the building was sold to the Guardians and Directors of the Poor of Coventry and became a work house. In 1948 part of the building was used as a Salvation Army Hostel. In 1965 the original buildings were extensively restored to form part of the Herbert Art Gallery and Museum, and in recent years it has been used for storage by the Coventry Archaeological Unit (RCHME 1997).

Objectives of dating:

A number of different theories have been put forward as to the dating of the roof structure. One school of thought is that the roof is a new replacement dating from just after the Dissolution, while another theory is that it was constructed re-using an earlier roof, possibly from an agricultural context. It is unlikely that it is the original roof from the fourteenth-century foundation in that the east cloister is of twelve equal bays, whilst the roof is of eleven, resulting in the trusses bearing over some of the windows, not to mention cutting across the full-height window at the north end.

Therefore, dendrochronology was to be used to try and date elements throughout the length of the roof, firstly to determine if the roof was all of one date, whether the rafters were of the same date as the trusses, and whether the truss at the south end, which is of a different form to that others at the north, are of the same date. It was also hoped to date some of the timber-framing in the south-west wing to confirm whether this had been re-built at the same time as the main range roof.

The dendrochronology programme was commissioned by the scientific Dating Service of English Heritage. The work was requested by John Yates, Historic Buildings Inspector, and the dendrochronology was organised by Ms Alex Bayliss, Scientific Dating Co-ordinator.

Assessment:

The roof timbers were assessed for their dendrochronological potential, and it was noted that virtually all of the man structural timbers were very fast grown and converted from whole trees, resulting in less than 50 growth rings, making most of them unsuitable for tree-ring analysis. Many of the timbers have been subsequently defrassed, making production of precise felling dates impossible except in rare instances. However, some suitable timbers were noted, with a number of rafters having ring patterns of between 75 and 125 rings and occasionally complete sapwood. Many of these were converted from quartered trees (Fig 5). The studs and rails from the south-west wing appeared to have longer ring counts, and several retained complete sapwood. The southern-most truss, T12, was assessed, and most of the timbers were either inaccessible due to display cases obstructing the safe use of the scaffold tower, or the lack of sapwood or suitable ring counts. The two longitudinal beams spanning between the posts either side of the window to the tiebeam of truss 11 had good ring counts and heartwood/sapwood boundaries.

Methodology:

Sampling of selected primary-phase timbers was carried out with a 16mm hollow coring bit, the holes were afterwards plugged and stained to match the surrounding surface. The locations of the samples are shown in Table 1 and are located in Figure 3. The samples were numbered using the prefix ***wfr*** followed by numbers 1 - 20, with multiple samples from the same timber being labelled ***a***, ***b***, etc. The dry samples were sanded on a linisher 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 0.001mm, rounded to the nearest 0.01mm.

After measurement, the ring-width series for each sample was plotted as a graph of width against year on log-linear graphs. 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. 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 latterly re-written in Microsoft Visual Basic by M R Allwright and P A Parker.

In comparing one sample or site master against other samples or chronologies, t-values over 3.5 are considered 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, and higher, and for these to be well replicated from different, independent chronologies with local and regional chronologies well represented. Where two individual samples match together with a t-value of 10 or above, this may suggest they originated from the same tree.

Once a tree-ring sequence has been firmly dated in time, a felling date, or date range, is ascribed where possible. With samples which have sapwood complete to the underside of, or including bark, this process is relatively straight forward. Depending on the completeness of the final ring, ie if it has only the spring vessels or early wood formed, or the latewood or summer growth, 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 empirically derived sapwood estimate with a given confidence limit. A recent 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 part of England (Miles 1997a).

It should be remembered that dendrochronology can only date when the tree died, not the date of construction for a building or artefact. The interpretation of a felling date relies on having a good number of precise felling dates rather than just one or two. Nevertheless, it was common practice to build timber-framed structures with green or unseasoned timber and construction usually took place within twelve months of felling (Miles 1997a).

Sampling strategy:

Because of the extreme length of the roof (150 ft), it was felt desirable to take samples from varying points along the length to try and identify any phasing, even though the roof trusses were identical throughout its length. Ideally, samples with complete sapwood were selected, both to assist in the interpretation of the felling date, and secondly in that the sapwood rings added enough extra rings to make otherwise marginal datable. Apart from one lower collar to truss 6, none of the trusses or purlins retained sapwood, so it was decided to concentrate on common rafters which had better dating potential. Again, only a limited number of these were suitable for dendrochronology. Five samples were taken from a series of rafters within bay 2 which were from a coherent set which were numbered sequentially through two bays. This numbering suggested that these rafters were primary timbers in the present roof, and therefore a good choice for sampling. Other selected samples from rafters in bays 4, 6, 7, 8, and 9 were taken to confirm whether the rafters were all of one phase or if some were re-used. None of the other rafters remaining had either sapwood or sufficient rings.

Although it was not possible to get safe access to the upper reaches of truss 12 at the south end, one of the posts was sampled which had a heartwood/sapwood boundary. Although this had only 70 rings, reducing its chances of cross-matching, it would help greatly in the interpretation of the south end bay if it were to match any of the other samples. Both of the longitudinal beams at tiebeam level between trusses 11 and 12 were sampled, and although they had less than 70 rings, again it was hoped they would match other samples even though the sapwood had been lost.

A number of samples from the south-west wing were selected for sampling. To get the widest range of samples, both studs and rails were chosen, from both external and internal wall frames. All had about 100 rings and complete sapwood.

Details of all samples taken are shown in Table 1 and located in Figures 3 and 5.

Cross-matching and site chronologies:

Because there was no clear indication of possible phasing in the roof, all samples were cross-matched with each other. Before this operation, all multiple radii from single timbers were compared and, if the matches were found to be satisfactory, they were averaged together to from a single-timber mean. Samples ***wfr1a*** and ***wfr1b*** were found to match each other with a *t*-value of 9.24 and were combined to form the mean ***wfr1***. Similarly, samples ***wfr4a*** and ***wfr4b*** were found to match together with a *t*-value of 11.93 and were combined to form the mean ***wfr4***. Samples ***wfr7a1*** and ***wfr7a2*** were both from a single core which had broken at the heartwood/sapwood transition, and were successfully matched with a second core from the same timber ***wfr7b*** with *t*-values of 22.55 and 12.47 respectively, and were combined to form the mean ***wfr7***. Similarly samples ***wfr8b1*** and ***wfr8b2*** were combined with ***wfr8a*** to form the mean ***wfr8*** with respective *t*-values of 14.00 and 9.35. Finally, samples ***wfr12a*** and ***wfr12b*** were combined to form the mean ***wfr12*** with a *t*-value of 12.14, and samples ***wfr16a*** and ***wfr16b*** were combined to form the mean ***wfr16*** with a *t*-value of 23.05.

Once all the data was combined into single timber data sets, these were combined with each other and it became evident that certain pairs of timbers had originated from the same parent trees. These were then combined to form a single-tree mean before any further cross-matching was carried out with the other samples from the site. This was determined partly on the basis of high *t*-values as well as visual correlation of matching graphs. Therefore, samples ***wfr2*** and ***wfr4*** were found with a *t*-value of 11.36 to have originated from the same tree, and were combined to form the mean ***wfr24***. Similarly samples ***wfr17*** and ***wfr18*** were matched together with a *t*-value of 9.38 to form the mean ***wfr178***. This then ensured that the resulting site masters would not be artificially weighted.

These samples were then compared both visually as well as statistically with each other and three clear groups emerged, as shown in the Appendix. The first group comprised samples ***wfr1***, ***wfr24***, ***wfr3***, ***wfr5***, and ***wfr6***, all from the first four bays of the roof. These five sequences from six timber samples were combined to form the site master ***WHTFRS1*** of 141 rings.

A second group composed of samples ***wfr7***, ***wfr8***, ***wfr10***, and ***wfr11*** were all from the middle four bays of the roof. These four sequences were therefore combined to form a second site master ***WHTFRS2*** with 145 rings.

Finally, a third group matched well together and included samples ***wfr15***, ***wfr16***, ***wfr178***, ***wfr19***, and ***wfr20***, all from the south-west wing and from the longitudinal beams in bay 11. These five sequences were therefore combined to form a third site master ***WHTFRS3*** with 103 rings. The three site masters thus produced are shown in the Appendix.

All individual samples were compared with the site masters, but no significant correlation was found either with samples from other groups, or the resulting site masters.

Absolute dating:

The three site masters were then compared with a database of 1000 local, regional, and national reference chronologies. The first site master, ***WHTFRS1***, was found to match, spanning the years AD 1334-1474. This matched with very respectable *t*-values as shown in the Appendix, with site chronologies from the West Midlands region well represented. The second site master ***WHTFRS2*** was also found to match, spanning the years AD 1349-1493. The quality of matches here was not as outstanding as those of the first site master, with only a handful of *t*-values above 5, and from a wider geographical spread of site chronologies. Similarly, the last site master ***WHTFRS3*** matched, spanning the years AD 1445-1547, again with relatively low *t*-values but with some more local site chronologies represented.

There was not any significant cross-matching between the three site masters. Part of the problem with the two later site masters is that the data used in their composition was significantly 'bouncy' and distressed, resulting from some degree of woodland management.

Undated samples:

Four samples failed to date, probably for a variety of reasons. Sample ***wfr9*** had two areas of sudden decline of growth rate indicative of pollarding, whilst samples ***wfr12***, ***wfr13***, and ***wfr14*** failed to date primarily due to shorter and complacent ring sequences. An area of distortion on sample ***wfr13*** certainly did not help in the cross-matching.

All four samples were compared with the reference chronologies individually, but no consistently significant matches were found.

Interpretation and discussion:

At least three clear periods of felling were identified, suggesting at least three different phases of building activity (Fig 6). The earliest phase consists of six rafters from the first four bays, 1-4. Here two precise felling dates of spring AD 1475 were produced, one from a timber with surviving bark edge (***wfr4***) and the second from a timber with incomplete sapwood (***wfr2***) but known to have originated from the same tree and would therefore logically have the same felling date. Three other rafters ***wfr1***, ***wfr3***, and ***wfr5*** produced felling date ranges of AD 1474-97, AD 1474-85, and AD 1471-81 respectively. As very little was lost off the ends of these three cores during the extraction process, the felling dates would be very much at the earlier part of these ranges and wholly consistent with the AD 1475 felling date. Sample ***wfr6*** is somewhat more problematical in that the clear heartwood sapwood boundary date of AD 1416 produces a felling date range of AD 1425-57, over fifteen years earlier than the felling date/date ranges of the other five timbers from the group. Occasionally one might encounter a band of sapwood inclusion, but here the waney edge was clearly noted before drilling, and only about 25mm of sapwood disintegrated during drilling. Very occasionally more sapwood rings than lies within the 95% probability range is encountered, and it is quite possible that this rafter could still have been felled in AD 1475. However, it is equally likely that this rafter may have been re-used or stockpiled, and without further collaborating samples it is not possible to decide at this time. Certainly, rafter ***wfr6*** is from bay 4, whereas all the other five rafters are from bay 2, which has the added archaeological evidence of coming from a set of rafters with consistent assembly marks.

The second set of dated timbers come from the middle bays of the roof, between bay 6 and bay 9 inclusive. Here three precise felling dates of winter AD 1491/2, spring AD 1493, and winter AD 1493/4 were produced. The earliest date of AD 1491/2 is from the lower collar of truss 6, whilst the other two dates are from bays 6 and 8. Another rafter from bay 7 (***wfr10***) produced a felling date range of AD 1492-1500, and given that very little of the core was lost during extraction, the felling date would have been very much towards the early part of the range, again making it entirely consistent with the other three precise felling dates. The rafters within bay 8 are again consecutively numbered with carpenter's assembly marks, and the rafter within bay 6 which dated also had an assembly mark, although is not part of an obvious sequence.

The third group of timbers included four from the south-west wing, where a felling date of summer/autumn AD 1547 and three more from the winter of AD 1547/8 were found. In addition, the two longitudinal beams in bay 11 matched with felling date ranges of AD 1531-63 and AD 1534-66, entirely consistent with the AD 1547/8 felling dates from the adjoining south-west wing.

The interpretation of these three phases of construction is not entirely straight forward given the consistent design of the roof trusses throughout 11 bays of the main range. Several hypothesis present themselves, the favourite being that there are still three phases of construction represented in the standing building. This would suggest that the original AD 1340s roof had begun to fail and was replaced in stages during the later fifteenth century, with the northern four or five bays being replaced in AD 1475, the northernmost truss unfortunately cutting across the gable-end window. Then, in about AD 1493/4 the rest of the main range was replaced all the way to the south end, this time care being taken to not obscure the large gable-end window to the south.

One argument against the theory that the roof was re-used from some other building is that this would have necessitated a roof of exactly the right span and length being found, or as the dendrochronology would suggest, two phases of roof of exactly the same design. The carpentry would suggest that the roof has not been reduced in width because the two tiers of struts between the tiebeam and the upper and lower collars are almost exactly the same, and if the lower struts had been cut shorter to enable the span to be reduced, this would have been very obvious in the existing carpentry. It is also unlikely that the roof would have been reduced in length either, in that the only noticeably shorter bay, bay 1, has rafters numbered consecutively starting with number 1 at the north gable end, and continuing through the second bay at least. It is highly unlikely for a roof to be re-used in a new location and for the rafters to be put back in entirely the same position. Indeed, many medieval roofs have assembly marks on rafters and trusses which do not run in sequence, even though they are clearly still in their original position. However, what does not make sense is that the trusses do not line up with the bays as delineated by the stone buttresses in the walling below, resulting in the tiebeam ends bearing over windows, albeit on substantial wall plates.

An alternative hypothesis is that the whole roof was replaced in about AD 1493/4, reusing a number of rafters from another building. This would logically explain why the trusses are all the same design, and the fact that the only members to have dated from the AD 1475s were rafters and not trusses. Regrettably, only one sample from the truss structure of the roof, a lower collar, dated. It does however, seem unlikely that the re-used rafters would have been placed in the original numbered order as bays 1 and 2 would suggest.

Certainly, it is most likely that the present roof structure was in position by the time the 1547/8 alterations were carried out, as the two longitudinal beams in bay 11 were let into large slots cut in the side of the tiebeam of truss 11, an awkward jointing technique which generally indicates these being inserted as an afterthought. If they were well framed together, then it would have been normal for these to have been morticed and tenoned into the side of the tiebeam.

There can be no question that the timber-framed first-floor framing to the south-west wing dates from AD 1547/8, in that all four timbers with complete sapwood gave such consistent felling dates. The fact that timbers from both the inner wall frame between the staircase and the room to the west match well with the identical wall framing of the south external wall of the wing beyond clearly indicates that this was part of the alterations commenced by John Hales after acquiring the property in AD 1544 (RCHME 1997).

Further recommendations:

Given the complex and somewhat inconclusive interpretation of the tree-ring results, further sampling would be worthwhile. Elements worth targeting would include tiebeams and other structural members, even if lacking in sapwood, to try and determine whether they date to two phases of *c* AD 1475 and AD 1493-4, or from AD 1547-8. If the southernmost bay were cleared of exhibits, more sampling of truss 12 adjacent to the south window could also help determine which phase it relates to. Should the building's use change, or any conversion works or re-wiring be implemented, then that would be an ideal time to gain further access to more timbers to confirm the proposed phasing.

Until such time as further sampling can be implemented, further study of the roof carpentry, together with the results of the tree-ring analysis, would greatly help in interpreting the building's development. The assembly marks in particular would be very useful to record, both on the rafters as well as the main trusses, as they should help to identify individual sequences of construction and enable the identification of possible re-used elements.

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Table 1: Summary of tree-ring dating

SUMMARY OF TREE-RING DATING FOR COVENTRY WHITEFRIARS, GULSON ROAD, COVENTRY

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)
Roof rafters bays 1 - 4 (re-used?)										
wfr1a	c	2nd rafter E side bay 2	1358-1455	1455	H/S	98	1.11	0.87	0.278	
wfr1b	c	ditto	1355-1458	1456	2+15NM	104	1.36	1.16	0.267	
* *wfr1*		Mean of *wfr1a* + *wfr1b*	*1355-1458*	*1456*	*2+15NM*	*104*	*1.28*	*1.04*	*0.248*	*1474-97*
wfr2	c	3rd rafter E side bay 2	1334-1462	1455	7	129	1.15	0.63	0.208	(Spring 1475)
* *wfr3*	c	5th rafter E side bay 2	1343-1449	1444	5+24NM	107	1.18	0.79	0.180	1474-85
wfr4a	c	4th rafter W side bay 2	1339-1447	1447	H/S+23NM	109	1.11	0.71	0.256	
wfr4b	c	ditto	1340-1474	1442	32¼C	135	0.90	0.56	0.243	
wfr4		Mean of *wfr4a* + *wfr4b*	*1339-1474*	*1445*	*29¼C*	*136*	*0.96*	*0.62*	*0.234*	*Spring 1475*
* *wfr24*		Mean of *wfr2* + *wfr4*	*1334-1474*	*1450*	*24¼C*	*141*	*1.05*	*0.64*	*0.201*	*Spring 1475*
* *wfr5*	c	1st rafter W side bay 2	1359-1440	1440	H/S+30NM	82	1.65	1.06	0.193	1471-81
* *wfr6*	c	3rd rafter W side bay 4	1355-1416	1416	H/S	62	1.50	0.54	0.231	1425-57
*** = *WHTFRS1* Site Master**			**1334-1474**			**141**	**1.24**	**0.74**	**0.174**	
Roof bays 5 - 10										
wfr7a1	c	Lower collar T6	1378-1470	1470	H/S	93	1.13	0.41	0.220	
wfr7a2	c	ditto	1472-1491		+20C	20	1.09	0.22	0.169	
wfr7b	c	ditto	1383-1489	1470	19	107	1.06	0.34	0.199	
† *wfr7*		Mean of *wfr7a1* + *wfr7a2* + *wfr7b*	*1378-1491*	*1470*	*21C*	*114*	*1.10*	*0.36*	*0.199*	*Winter 1491/2*
wfr8a	c	2nd rafter E side bay 6	1349-1471	1471	H/S	123	1.45	1.30	0.224	
wfr8b1	c	ditto	1366-1406			41	1.42	0.51	0.217	
wfr8b2	c	ditto	1403-1493	1473	20C	91	0.91	0.59	0.202	
† *wfr8*		Mean of *wfr8a* + *wfr8b1* + *wfr8b2*	*1349-1493*	*1472*	*21C*	*145*	*1.45*	*1.17*	*0.205*	*Winter 1493/4*
wfr9	c	7th rafter W side bay 7	-		8	79	1.97	0.70	0.155	
† *wfr10*	c	6th rafter W side bay 7	1392-1491	1459	32	100	1.76	0.59	0.230	1492-1500
† *wfr11*	c	5th rafter W side bay 8	1369-1492	1467	25¼C	124	1.08	0.45	0.231	Spring 1493
wfr12a	c	8th rafter W side bay 8	1-72		H/S	72	2.13	0.70	0.156	
wfr12b	c	ditto	39-74		H/S	36	1.53	0.60	0.172	
wfr12		Mean of *wfr12a* + *wfr12b*	1-74		1	74	2.08	0.73	0.156	
wfr13	c	5th rafter E side bay 9	-		22C	68	2.30	1.57	0.254	
† = *WHTFRS2* Site Master			**1349-1493**			**145**	**1.59**	**1.00**	**0.183**	
South-West Wing and alterations to Bay 11										
wfr14	c	Post to E of S end window T12	-		H/S	70	1.93	1.08	0.239	
§ *wfr15*	c	Middle rail S wall SW wing	1445-1546	1524	22½C	102	1.35	0.84	0.253	Summer/Autumn 1547
wfr16a	c	Stud S wall SW wing	1449-1547	1524	23C	99	1.63	0.78	0.261	
wfr16b	c	ditto	1500-1546	1531	15	47	1.98	0.54	0.254	
§ *wfr16*		Mean of *wfr16a* + *wfr16b*	*1449-1547*	*1528*	*19C*	*99*	*1.58*	*0.72*	*0.257*	*Winter 1547/8*
wfr17	c	Middle rail staircase bay SW wing	1450-1547	1533	14C	98	1.52	0.60	0.198	Winter 1547/8
wfr18	c	Stud staircase bay SW wing	1453-1547	1532	15C	95	1.57	0.58	0.235	Winter 1547/8
§ *wfr178*		Mean of *wfr17* + *wfr18*	*1450-1547*	*1533*	*14C*	*98*	*1.57*	*0.60*	*0.207*	*Winter 1547/8*
§ *wfr19*	c	W longitudinal beam bay 11	1456-1522	1522	H/S	67	2.23	0.78	0.311	1531-63
§ *wfr20*	c	E longitudinal beam bay 11	1463-1525	1525	H/S	63	2.20	0.98	0.318	1534-66
§ = *WHTFRS3* Site Master			**1445-1547**			**103**	**1.75**	**0.56**	**0.211**	

Key: *,†,§: = sample included in relevant site-master; c = core; s = section; = pith included in sample, = pith within 5 rings of centre;
¼C, ½C, C = bark edge present, partial or complete ring: ¼C = spring (ring not measured), ½C = summer/autumn felling,
C = winter felling (ring measured); H/S bdry = heartwood/sapwood boundary - last heartwood ring date; std devn = standard deviation;
mean sens = mean sensitivity. NM = rings not measured but counted. Sapwood estimate of 9-41 rings used (Miles 1997a)

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Figure 1: Site plan (based on the Ordnance Survey 1:1250 map

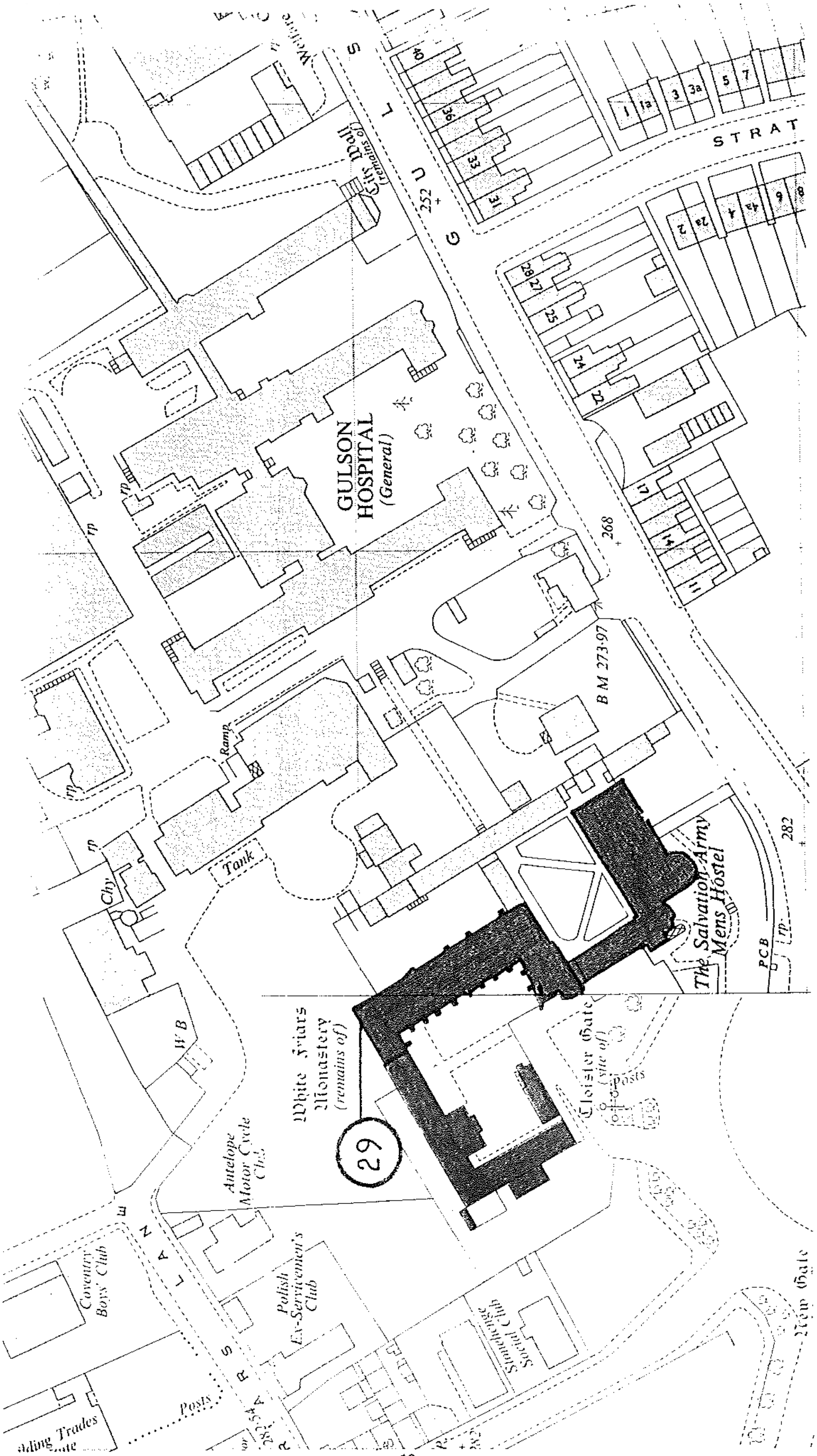


Figure 2: Main range roof from the south, showing truss 11 and the two inserted beams (RCHME 1996 - BB97/00431)

Figure 3: First floor plan showing location of samples *(RCHME 1997)*

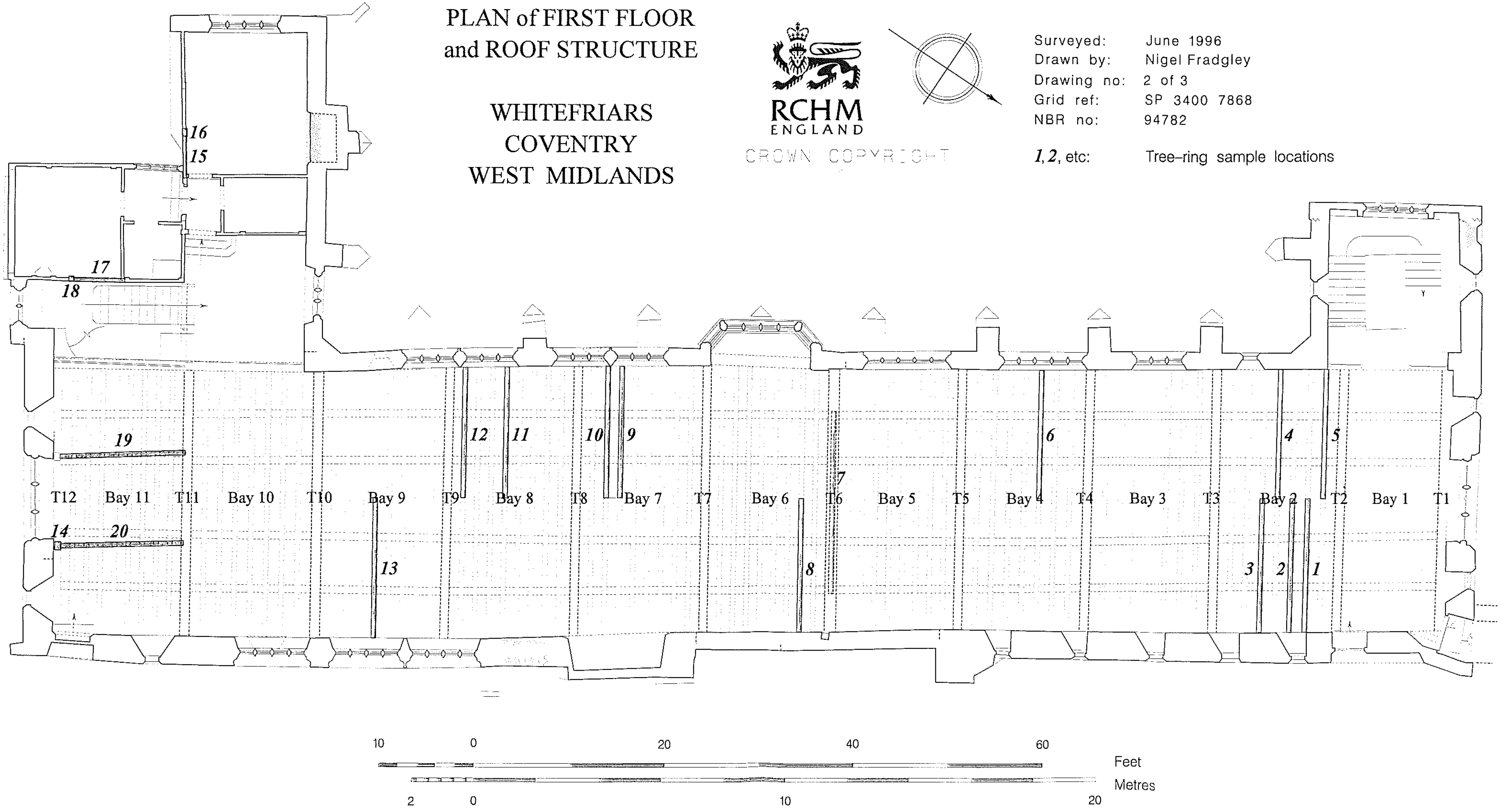


Figure 4: South walls of truncated south cloister range, and end of east range, from the south (RCHME 1997 - BB97/4365)

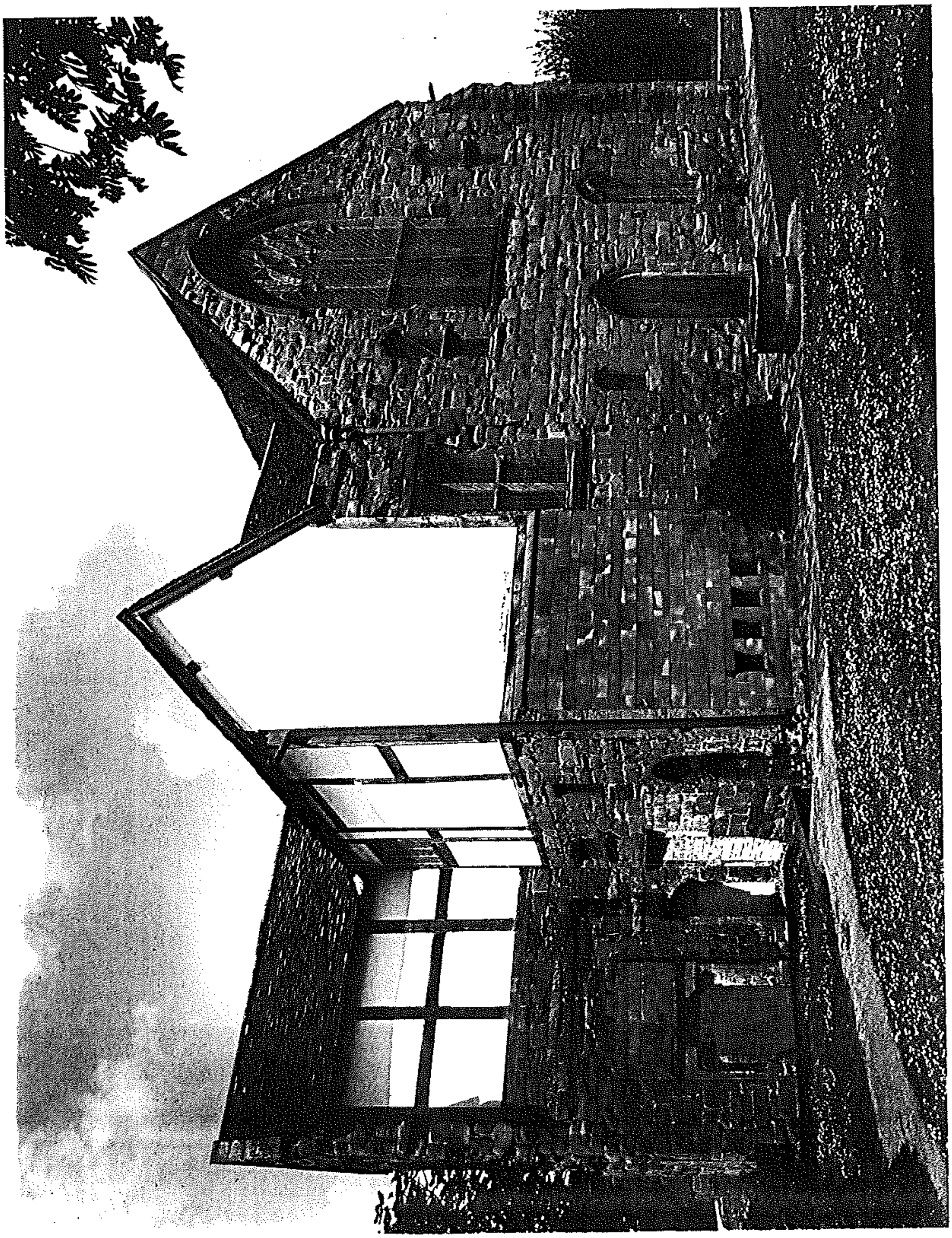


Figure 5: Sections of timbers sampled

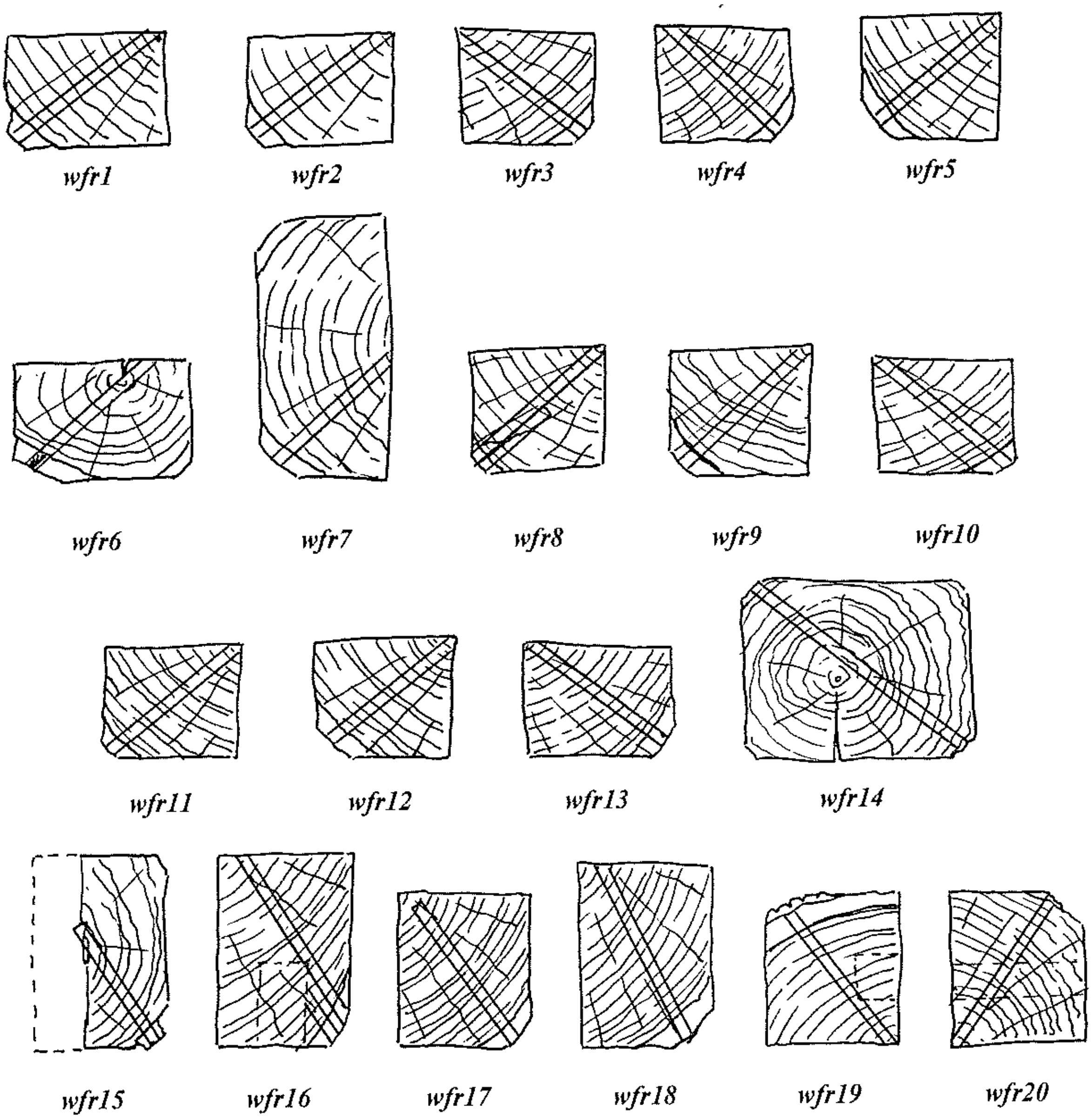
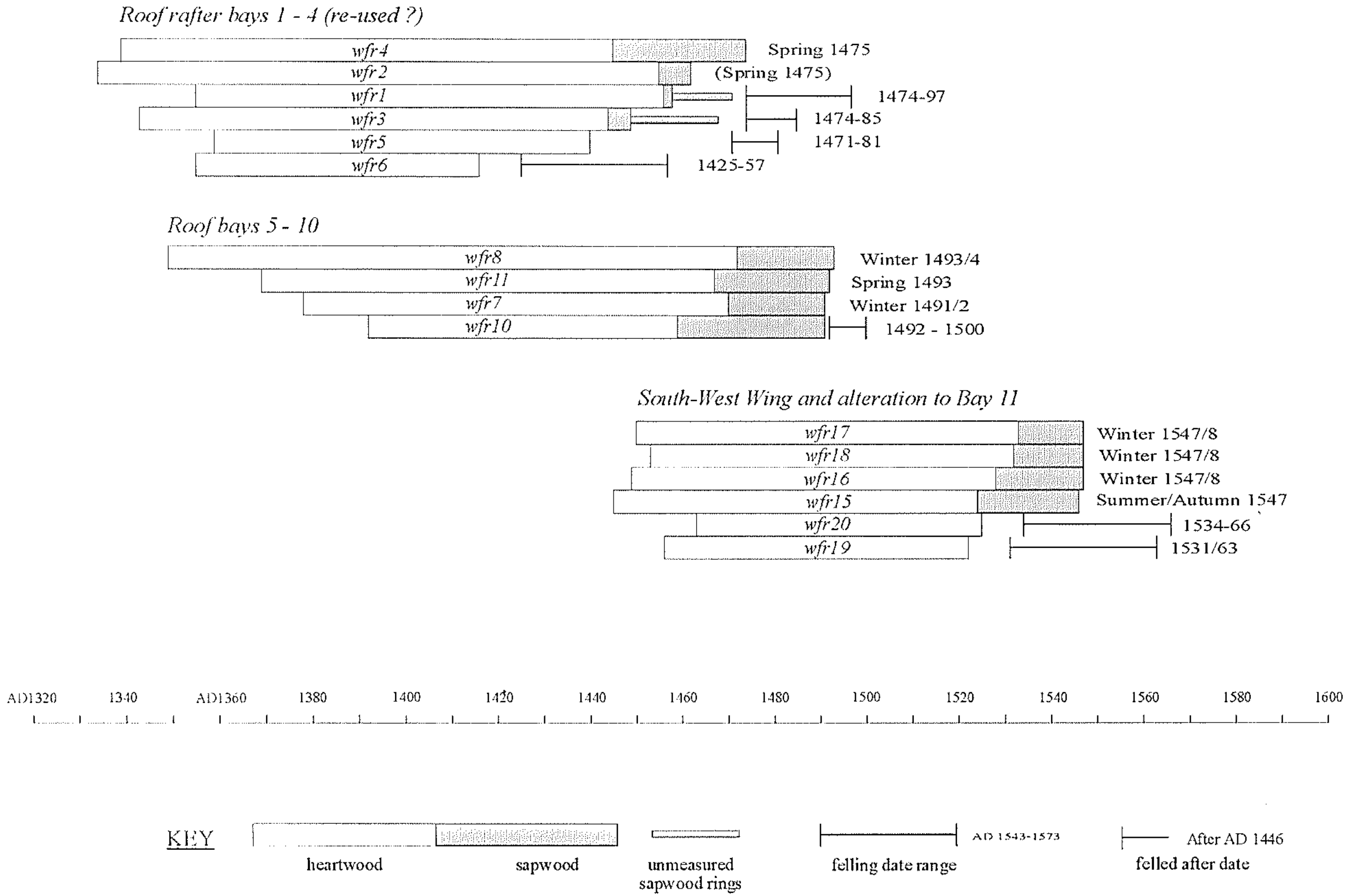


Figure 6: Dated sampled in chronological position



APPENDIX: Details of site master construction and dating

Matrix of *t* -values and overlaps for components of *WHTFRS1*

Sample:	*wfr24*	*wfr3*	*wfr5*	*wfr6*
Last ring date AD:	1474	1449	1440	1416
wfr1	5.69 **104**	4.62 **95**	3.63 **82**	5.35 **62**
	wfr24	3.61 107	1.98 82	4.84 **62**
		wfr3	4.27 **82**	4.91 **62**
			wfr5	3.56 **58**

Ring-width data for site master curve *WHTFRS1* AD 1334-1474 Coventry Whitefriars: Roof bays 1 - 4 samples ***wfr1*** + ***wfr24*** + ***wfr4*** + ***wfr5*** + ***wfr6***
141 rings, starting date AD 1334

ring widths (0.01mm)

183	245	250	267	302	285	164	187	177	311
237	280	197	173	133	108	94	93	111	117
144	253	253	285	229	268	191	225	336	301
264	242	252	218	191	262	229	179	139	113
110	102	94	143	175	196	174	153	187	124
126	136	186	193	169	145	105	93	76	68
68	55	91	99	121	134	142	145	105	142
144	147	147	107	118	119	96	84	78	71
53	61	53	52	56	54	69	97	99	111
125	84	71	67	101	106	87	82	106	64
52	52	41	34	40	39	46	64	49	64
77	63	49	54	51	57	67	68	58	61
70	94	112	81	97	79	105	92	69	59
36	51	54	52	48	44	44	33	41	40
55									

number of samples in master

1	1	1	1	1	1	1	1	1	2
2	2	2	2	2	2	2	2	2	2
2	4	4	4	4	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	3	3	3
3	3	3	3	3	3	2	2	2	2
2	2	2	2	2	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1									

Dating of *WHTFRS1* (AD 1334-1474) against reference chronologies at AD 1474

	Reference chronology	Spanning	Overlap	t-value
	WALES97 *(Miles 1997b)*	404-1981	141	5.10
	ARDEN2 *(Miles and Worthington 2000)*	1371-1568	141	5.37
	SALOP95 *(Miles 1995)*	881-1745	141	6.48
†	SEECHEM1 *(Miles and Haddon-Reece 1995)*	1365-1474	110	6.60
	BADESLEY *(Miles unpubl)*	1367-1629	108	7.13
	HIARDEN2 *(Miles unpubl)*	1293-1493	106	7.15
	COATSFM *(Miles and Haddon-Reece 1996)*	1346-1485	129	7.20
	MASTERAL *(Haddon-Reece and Miles 1993)*	404-1987	141	7.31
	EASTMID *(Laxton and Litton 1988)*	882-1981	141	7.42
	BAYTON *(Bridge 1996)*	1348-1525	127	8.05

† Component of SALOP95

Matrix of *t* -values and overlaps for components of ***WHTFRS2***

Sample:	*wfr8*	*wfr10*	*wfr11*
Last ring date AD:	1493	1491	1492
wfr7	**4.30** / **114**	**5.28** / **100**	**4.16** / **114**
	wfr8	3.38 / 100	3.40 / 124
		wfr10	**5.50** / **100**

Ring-width data for site master curve ***WHTFRS2*** AD 1349-1493 Coventry Whitefriars: Roof bays 5 - 10 samples ***wfr7 + wfr8 + wfr10 + wfr11***
145 rings, starting date AD 1349

ring widths (0.01mm)

193	241	319	300	454	422	552	320	295	293
497	430	523	585	454	484	250	144	129	203
266	246	162	121	157	159	240	169	182	192
196	173	170	174	155	124	126	139	135	172
166	145	99	110	143	155	154	162	163	184
193	156	158	152	177	152	177	171	144	100
121	141	131	106	85	103	143	88	90	102
102	126	155	137	141	142	86	63	82	101
123	86	119	153	109	80	89	74	100	80
82	106	124	109	88	101	73	70	92	74
95	93	131	128	137	120	94	126	96	75
90	86	97	101	108	87	78	74	82	93
75	62	77	87	104	84	103	150	123	126
143	133	189	162	149	169	124	151	190	149
140	150	125	124	209					

number of samples in master

1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	3
3	3	3	3	3	3	3	3	3	3
3	3	3	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	4	4	4	4	4	4	4
4	4	4	2	1					

Dating of ***WHTFRS2*** (AD 1349-1493) against reference chronologies at AD 1493

	Reference chronology	Spanning	Overlap	t-value
	UPPRSPON *(Miles and Worthington 1999)*	1327-1454	106	4.23
	CATESBY *(Bridge pers comm)*	1352-1579	142	4.38
	EASTMID *(Laxton and Litton 1988)*	882-1981	145	4.69
	ARDEN2 *(Miles and Worthington 2000)*	1371-1568	145	4.85
	SENG98 *(Bridge 1998)*	944-1790	145	4.97
	HERECC *(Tyers 1996)*	1385-1594	109	5.19
	SACM2 *(Nayling 1999)*	1375-1493	119	5.31
	HANTS97 *(Miles 1997c)*	1041-1972	145	5.35
	FALCONER *(Bridge 1996)*	1324-1457	109	5.51
‡	ALTON *(Hillam 1983)*	1348-1504	145	5.86

‡ Component of HANTS97

Matrix of *t* -values and overlaps for components of ***WHTFRS3***

Sample:	*wfr16*	*wfr178*	*wfr19*	*wfr20*
Last ring date AD:	1547	1547	1522.	1525
wfr15	**6.00**	**6.09**	**8.09**	**5.34**
	98	**97**	**67**	**63**
	wfr16	**3.79**	3.46	2.46
		98	67	63
		wfr178	**4.33**	**4.60**
			67	**63**
			wfr19	3.49
				60

Ring-width data for site master curve ***WHTFRS3*** AD 1445-1547 Coventry Whitefriars: South-east wing and bay 11 alterations ***wfr15 + wfr16 + wfr178 + wfr19 + wfr20***
103 rings, starting date AD 1445

ring widths (0.01mm)

401	213	220	258	170	206	166	301	303	317
333	314	288	223	185	172	187	213	259	209
143	224	158	158	156	213	281	187	215	140
189	251	168	175	147	149	188	160	155	200
131	118	203	149	90	93	138	198	130	132
151	151	93	125	185	141	173	175	175	143
150	143	185	206	225	175	192	222	173	143
111	167	138	158	149	145	172	203	165	167
135	170	178	153	144	116	169	87	93	120
203	171	135	163	160	124	119	85	112	103
160	108	106							

number of samples in master

1	1	1	1	2	3	3	3	3	3
3	4	4	4	4	4	4	4	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	4	4
4	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3	3
3	3	2							

Dating of ***WHTFRS3*** (AD 1445-1547) against reference chronologies at AD 1547

Reference chronology	**Spanning**	**Overlap**	**t-value**
SALOP95 *(Miles 1995)*	881-1745	103	3.71
EASTMID *(Laxton and Litton 1988)*	882-1981	103	4.10
WALES97 *(Miles 1997b)*	404-1981	103	4.21
WIGBORO *(Miles and Worthington 1997)*	1447-1584	101	4.32
HLSCROFT *(Miles and Worthington 1999)*	1429-1648	103	4.35
ENGLAND *(Baillie and Pilcher 1982)*	404-1981	103	4.57
OLDFIELD *(Miles and Haddon-Reece 1994)*	1404-1572	103	4.74
HLSCRFT1 *(Miles and Worthington 1999)*	1429-1612	103	5.45
BDLEIAN3 *(Miles and Worthington 1999)*	1395-1610	103	5.51
lea3 *(Miles and Worthington 1998)*	1410-1559	103	5.56