Ancient Monuments Laboratory
Report 7/92

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Summary

Dendrochronological analysis of oak samples from the Tithe Barn at Siddington, near Cirencester, produced two dated site master chronologies spanning AD1122-1238 and AD1307-1398. Tree-ring dates were obtained for timbers from the main barn and the south porch which indicate a felling period in AD1245-47 and hence a construction date in the mid-thirteenth century for the barn. A later felling period was also identified indicating that alternations were carried out on the north and south porches during the fifteenth century.

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Dendrochronological analysis of oak timbers from the Tithe Barn, Siddington, near Cirencester, Gloucestershire, 1990-91

Introduction

Siddington Tithe Barn stands at the south-west edge of the churchyard in the village of Siddington, near Cirencester (SP034001). It is a stonewalled aisled barn consisting of five bays and a porch to both the north and south sides (Figure 1). In the main barn trusses 1 and 4 are aisled but the two central trusses (2 and 3) are base-crucks. (All trusses and bays are referred to according to the plans produced by Ferguson Mann Architects of Bristol). The timber framework in the south and north porches is similarly anomalous. Hewett (1972)) suggested that the barn was probably initially erected during the early thirteenth century, shortly after the site came into the ownership of the Knights Hospitalers. However a survey carried out about ten years later implied a date far earlier in the eleventh century (Charles 1981).

Charles (1981) hypothesises that the original barn may have been erected with seven bays, making the porches central rather than towards the western end as they are now. Following various adjustments to the basic structure during the 12-14th centuries, bays six and seven were demolished and the porches widened in the 15-16th centuries. The past 200 years have seen further modifications, such as the insertion of an upper floor throughout the barn and the conversion of the north porch into a separate dwelling (Charles 1981).

The restoration of this listed barn, instigated by the British Historic Buildings Trust and aided by a grant from English Heritage, was carried out during 1990-91. This provided an opportunity for a dendrochronological study to be undertaken at Sheffield in the English Heritage funded tree-ring laboratory. It was hoped that the analysis would produce precise dates for the timbers, hence providing more precise dating evidence for the construction

and subsequent development of the barn.

All accessible timbers in the main barn and south porch were briefly appraised but access was more limited in the north porch precluding any attempt at sampling during the site visit by the authors. The few exposed timbers in the north porch appeared unsuitable for dating purposes. The poor condition of the north cruck of trusses 2 and 3 and the south cruck of truss 3 at ground level in the main barn prevented the removal of core samples. However it was agreed that cross-sectional slices would be made available from these crucks, as well as from north porch timbers, as the restoration proceeded. This arrangement was not fulfilled but as the renovation continued access became possible to the north porch timbers and the upper parts of the crucks of trusses 2 and 3. A second series of core samples were removed by W Patrick and G Williams of Capps and Capps under the direction of Tish O'Connor from Ferguson Mann Architects. In addition to the newly accessible timbers, some timbers which had been previously sampled were resampled in the hope of obtaining longer ring sequences.

Method

In January 1991 thirty timbers from the main barn and south porch were considered worthy of closer examination and where appropriate *in situ* ring measurements were taken or core samples were removed. The position of each sample was marked on the plans of the barn held by Ferguson Mann Architects. The complete cross-section of some timbers was visible and where *in situ* measurements were possible the section was cleaned up using a Stanley knife. The ring widths were then measured using a hand lens with a scale accurate to 0.1mm. During July 1991 the second series of core samples, representing eight timbers, were removed. The cores were obtained by use of a corer attached to an electric drill which leaves a hole of approximately 0.5 inches diameter.

The holes, which will be filled by oak dowels during the restoration, were temporarily plugged with cotton wool. Each core was polished with an electric sander and then by hand using fine silicon carbide paper so that the annual growth rings were clearly defined.

Any samples considered unsuitable were rejected before measurement. These are usually samples with unclear ring sequences or less than 50 rings. However as the samples from Siddington all had relatively short ring sequences, samples with 30-49 rings were included for measurement unless the ring sequence was distorted or unclear.

The growth rings of all suitable samples from the first series of cores were measured to an accuracy of 0.02mm on a Henson travelling stage connected to an Apple II microcomputer. The ring width data were transferred to an Atari microcomputer with hard disk drive which uses a suite of dendrochronology programs written by Ian Tyers (pers comm 1990). The Apple II microcomputer and Henson stage were replaced in March 1991 by a travelling stage which is connected directly to the Atari microcomputer. The ring widths of the second batch of samples were measured to an accuracy of 0.01mm and all previously measured sequences were converted to units of 0.01mm for compatibility. The ring sequences were plotted on semi-logarithmic paper, either by hand or using a graphing program on the mainframe (Okasha 1987), to facilitate visual comparison of the patterns. The process of crossmatching and dating was carried out by visual inspection of the tree-ring curves. This procedure is aided by the Atari microcomputer. The crossdating programs are based on versions of CROS (Baillie & Pilcher 1973, Munro 1984) and measure the amount of correlation between two ring sequences. The Student's t test is then used as a significance test on the correlation coefficient. All t values quoted in this report are identical to those produced by the original CROS program

(Baillie & Pilcher 1973). Generally a *t* value of 3.5 or over represents a match, provided that the visual match is acceptable (Baillie 1982: 82-85).

Dating is achieved by crossmatching ring sequences within a building and combining the matching patterns to produce a site master curve. This master curve and all unmatched ring sequences from individual timbers are then tested against dated reference chronologies to obtain absolute dates. A master curve is used for dating purposes whenever possible as it enhances the common climatic signal and reduces the background noise resulting from the local growth conditions of individual trees.

The results only date the rings present in the timber and therefore do not necessarily represent the felling date. If the bark or bark edge is present on a sample the exact felling year can be determined. If the outermost ring has both early and latewood present and therefore appears to be complete, the timber was felled during late summer-early spring (ie out of the growing season) and is referred to as winter felled. If only the earlywood is present then the timber was probably felled during late spring-early summer (Baillie 1982, fig 2.1) which is referred to as summer felled.

In the absence of bark surface the felling date is calculated using the sapwood estimate of 10-55 rings (Hillam *et al* 1987). This is the range of the 95% confidence limits for the number of sapwood rings on British oak trees over 30 years old. In the total absence of sapwood, the addition of 10 rings (the minimum number of sapwood rings expected) to the date of the last measured heartwood ring produces a probable *terminus post quem* for felling. During timber conversion a large number of outer rings could be removed and as this number of missing heartwood rings is unknown, the actual felling date could be much later.

Once the felling date range or *terminus post quem* for felling has been calculated, factors such as stockpiling, re-use and seasoning of timber must be considered since they might affect the interpretation of the tree-ring dates. Seasoning of timber is thought to have been a fairly rare occurrence until relatively recent times. Evidence indicates that timber was generally felled as required and used whilst green (eg Rackham 1990: 69). Construction is therefore likely to have occurred shortly after felling. However the possibility of a timber structure having undergone repair work should also be taken into account. Thus, whilst the date obtained for the measured tree-ring sequence is precise and has been achieved by a completely independent process, the interpretation of tree-ring dates can be refined by studying other archaeological and documentary evidence.

Results

The timbers were all oak (*Quercus* spp) and were generally shaped from either a complete or halved trunk. The pith was probably present in the majority of timbers although it was not necessarily sampled. Sapwood or sapwood transition was detected on several timbers and one timber had bark edge (Table 1). The method of conversion suggests that many of the other timbers had only sapwood and a few heartwood rings missing. Where sapwood was present it was not possible to sample it due to its fragile nature. However the number of sapwood rings of sample 03 was counted from a partially exposed end section. The timbers had relatively wide average ring widths generally over 2.0mm, although some such as C2b had slower growth rates. Many of the timbers that were rejected during the initial appraisal (ie before sampling) were discarded as their rings were very wide and they contained less than the required number of rings. The majority of timbers probably originated from trees under 100 years old and less than approximately 400mm diameter when felled.

In the first series of samples analysed in January 1991, twenty cores from 18 timbers in the main barn and south porch were considered suitable for measurement in addition to the two timbers measured *in situ*. Timbers 01 and 06 were represented by duplicate samples. Two cores were taken from 01 as it was thought that it may be possible to obtain a longer ring sequence from another section of the timber. The ring pattern of the first sample from timber 06 appeared to be distorted, possibly due to the close proximity of a knot, so a second core was taken from another area of the timber. Samples 01a and 01b matched ($t = 12.2$) and were combined to produce a single ring pattern for the timber 01. However an acceptable match could not be found between samples 06A and 06b, probably because of the distortion to the ring pattern of 06a. These two samples were therefore treated separately throughout the rest of the analysis.

The ring sequences of all the measured timbers in the first series of samples from both the main barn and south porch were compared. Twelve timbers crossmatched and were combined to form a site master curve, Siddington/T12 (Figure 2). The master curve and all the unmatched tree-ring patterns from individual timbers were tested against reference chronologies from the British Isles spanning the period AD404 to present day. High *t* values and good visual matches were found for the site master curve when it covered the period AD1147-1238 (Table 2) but no consistent results were produced by any of the previously unmatched timbers.

The second set of cores were analysed in November 1991 and consisted of ten cores from eight timbers, including one (C1) from the north porch. Timbers C1 and C2 were represented by duplicate cores. Samples C6, C7 and C8 from the south porch were repeat samples from timbers 28, 23 and 26 respectively. These had been resampled in the hope of extending the ring sequences from 26

and 28 and obtaining a measureable core from 23. C4, C6 and C8 were discarded before measurement; although they contained over 30 rings, the cores were either too badly broken or the ring patterns so severely distorted that a reliable ring sequence could not be obtained. Samples C1a and C1b crossmatched (t = 7.2), as did C2a and C2b (t = 11.6). These pairs were therefore combined to produce a single ring pattern for timbers C1 and C2.

The ring sequences of all newly measured cores were compared with the existing Siddington/T12 master curve. C2 and C3 gave high t values and good visual matches with the master curve, its individual component timbers and reference chronologies at AD1122-1196 and AD1150-1228 respectively. These sequences were incorporated into the site master to produce a new master curve, Siddington/T14 containing fourteen timbers (Figure 2; Tables 2, 3).

All unmatched timbers from both the first and second set of samples were compared with each other and a very good visual match, which gave a t value of 5.3, was found between C1 and 28. These two sequences were averaged together to produce a single curve, Siddington/T2 (Table 4), which was then tested against medieval reference chronologies from the British Isles. Consistent results were obtained for Siddington/T2 when it covered the period AD1307-1398 (Table 5). This date was confirmed by visual and statistical comparison of the individual ring sequences included in the master curve with dated reference chronologies (Table 5).

Interpretation of the tree-ring dates

One of the dated timbers (03) from truss 4 had retained its full complement of sapwood. Its heartwood-sapwood boundary dates to AD1232 and it had 13-15 sapwood rings which were counted *in situ* rather than actually measured. Timber 03 was therefore felled during AD1245-47 (Table 6).

Timber 08 (truss 2) has 4 sapwood rings and spans the period AD1160-1229 which indicates that it was felled after AD1235 but probably before AD1281. The heartwood-sapwood transition is also present on C2, the south cruck of truss 2. Its youngest heartwood ring dates to AD1196 which gives a felling date range of AD1206-1251. The date of the outermost measured ring on the remaining timbers varies from AD1221 to AD1238, apart from 15 whose last ring dates to AD1208 (Table 6). This range of end dates is characteristic of a group of timbers from which only the sapwood rings, and possibly a few outer heartwood rings (eg 15) have been removed (Baillie 1982: 56). This supports the information already noted from the method of timber conversion (see above). Thus it seems likely that the dated timbers from the main barn are contemporary and used in the construction of the barn shortly after felling in AD1245-47.

The only possible exceptions to this are samples 09 and C2. When the 10-55 sapwood estimate is applied to timber 09, it appears to have been felled after AD1248 (95% confidence limits). It may represent a later repair or alteration to the roof of the main barn but it is also possible for it to be contemporary with the AD1245-47 felling period. The sapwood statistics indicate that one out of every 20 samples is likely to have less than 10 or more than 55 sapwood rings. Consequently the amount of sapwood on two of the samples from Siddington barn would be expected to lie outside of the quoted range. The excellent visual match and high *t* value (8.2) produced between 09 and the north upright from truss 1 (13) supports the original interpretation of 09 being contemporary with the other dated timbers. It is feasible for C2 to be contemporary with the AD1245-47 felling date indicated by the majority of the timbers from the main barn. However its outermost heartwood ring, which marks the heartwood-sapwood transition, is noticeably earlier than those found on

any of the other samples. This suggests that it is possible for this timber to have been felled several years before the main AD1245-47 felling phase.

Two timbers, a purlin (21) and a collar beam (24) from the south porch were dated. Their ring sequences span the periods AD1159-1228 and AD1161-1231 indicating that they were felled after AD1238 and AD1241 respectively. The dates of the outermost measured rings of these two samples are very similar to those from the main barn and sample 21, in particular, matches the timbers from the main barn very well (Table 7). It seems likely from the tree-ring results that these two dated timbers from the south porch are contemporary with those from the main barn and were therefore also felled and originally used during AD1245-47.

Timber 28, a principal rafter from the south porch, has retained no sapwood and so has a *terminus post quem* for felling of AD1407. Its ring sequence is contemporaneous with that from the north porch timber C1, also a principal rafter, which was felled after AD1408. These two timbers indicate a felling phase at least 160 years after the initial construction of the barn, suggesting that repair work or modifications were carried out on the north and south porches.

Discussion

The study has provided dates for twelve timbers from the main barn, three from the south porch and one from the north porch. During the examination of the timbers in terms of size and age of their parent tree it becomes apparent that they originated from relatively small young trees. In general during the medieval period trees seem to have been felled under 100 years old (Rackham 1990: 67). The average ring widths indicate that they were probably from a relatively open environment rather than dense woodland where competition would have been more severe.

The site master curve Siddington/T14 matches dated reference chronologies from all over England (Table 2) but shows most similarity with those from Great Coxwell barn (t=8.98), which is about 17 miles east of Siddington, and the Upwich site in Droitwich (t=9.42) about 40 miles to the north. This suggests that the timbers used in the initial construction of the barn were obtained from local woodland. However the quality of the within site crossmatching indicates that there may be at least two groups of timbers (Table 7). The tree-ring sequences from timbers 01, 03, 06b and 07 do not crossmatch with 10, 15, 21 and 24. It is noticeable that the timbers from the first group probably originated from slightly younger trees than the latter group. This implies that the timbers were unlikely to have been derived from a single local source.

The master curve Siddington/T2 is less well replicated and only matches reference chronologies from southern England and London (Table 5). The level of agreement with the reference chronologies is generally lower than that produced by Siddington/T14 but this could be expected due to the later master curve consisting of data from only two timbers.

Timbers from all four trusses in the main barn have been dated as was the south arcade plate in bay 1. The construction date of AD1245-47 indicated by tree-ring analysis for the main barn is slightly later than the early thirteenth century date suggested by Hewett (1972). The dated timbers include a single upright/cruck from each of the trusses in the main barn. The felling dates obtained for these indicate that trusses 1, 3 and 4 are contemporary. The south cruck of truss 2 was felled after AD1206 but probably before AD1251. It could therefore be contemporary with the other three trusses but it is also possible for truss 2 to be of a slightly earlier date. The latter possibility

appears relatively unlikely unless there is any evidence that the cruck was re-used as no other timbers have indicated an earlier felling date than AD1245-47. It should also be noted that it is feasible for timber 09 from truss 3 to have been felled slightly later than the other dated timbers from the main barn. As such it could represent a repair or alteration to the barn.

None of the timbers from trusses 5 and 6 were absolutely dated. The dating of the south porch relies on three roof timbers, a purlin, a collar beam and a principal rafter. The purlin (21) and the collar beam (24) appear to be contemporary with the felling phase of AD1245-47 indicated by the timbers from the main barn. This implies that the initial erection of the south porch coincided with that of the main barn. However the principal rafter (28) was felled after AD1407. The pith of the tree is within approximately 5-10 rings of the innermost measured ring of sample 28. The timbers throughout the barn appear to be from relatively young trees (see above) so it seems likely that 28 was felled sometime during the fifteenth century. Consequently the tree-ring analysis indicates that some repairs or alterations were probably carried out on the south porch in the fifteenth century.

A principal rafter was also dated from the north porch. This timber was felled after AD1408, and like 28 may well have been primarily utilised during the fifteenth century. Only one timber was sampled from this porch so tree-ring analysis can only show that work was carried out in the fifteenth century and cannot indicate whether the north porch was originally constructed at the same time as the main barn.

Re-use of timber within the barn must be considered, particularly as Charles (1981) suspects that part of the barn was demolished and the porches widened during the 15th-16th centuries. It is therefore possible that, for instance, the 13th century roof timbers present in the south porch are re-used, but

further evidence such as redundant carpentry features is required to support this suggestion. The likelihood of two timbers from the north and south porches being primarily utilised during the 15th century does however support Charles suggestion of work being carried out on the barn in the 15th-16th centuries.

It is unlikely that sampling of additional timbers in the main barn will produce any further dating information. All the timbers which appeared likely to be suitable for dating purposes have now been sampled. The same can be said of the south porch, apart from the possible exception of the east upper purlin. It is suspected that sample 25 may have been removed near to a knot, causing distortion of the outer 30 rings. A duplicate sample from another section of the timber may confirm or refute a tentative 15th century date obtained for this purlin.

Conclusion

The dendrochronological analysis of timbers from Siddington Tithe Barn has been successful in producing felling dates for timbers from the main barn and both porches. The timbers associated with the initial erection of the barn were all probably felled during AD1245-47 which indicates that it was likely to have been built during this period shortly after the timbers were felled. Repairs or alterations were carried out on both porches using timber felled during the fifteenth century but no later phases were identified from the tree-ring results for the main barn. The analysis has also shown that all original major structural timbers were obtained from young oak trees probably of local origin.

Acknowledgements

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References

Baillie MGL 1982 *Tree-Ring Dating and Archaeology*, London: Croom Helm.

Baillie MGL & Pilcher JR 1973 A simple crossdating program for tree-ring research, *Tree Ring Bulletin* 33, 7-14.

Bridge MC 1988 The dendrochronological dating of buildings in southern England, *Medieval Archaeology* 32, 166-74.

Charles FWB 1981 *Siddington Barn 1981 - Survey Report to the Bathurst Estate, Cirencester.*

Groves C 1990 Tree-ring analysis of timbers from Eastgate, Beverley, 1984. *Ancient Monuments Laboratory report series* 48/90.

Groves C & Hillam J 1991 Tree-ring analysis and dating of timbers from Upwich, Droitwich, Hereford & Worcester, 1983-84. CBA Research Report (forthcoming).

Groves C, Hillam J & Pelling-Fulford F 1985 Reading Abbey: Tree-ring analysis and dating of the waterfront structures. *Ancient Monuments Laboratory report series* 4745.

Haddon-Reece D, Miles D, Tapper MC & Fletcher JM 1987 List 22: Tree-ring dates from the Ancient Monuments Laboratory, Historic Buildings and Monuments Commission for England. *Vernacular Architecture* 18, 54-55.

Hewett CA 1972 The Tithe Barn at Siddington, Gloucestershire, *The Archaeological Journal* 129, 145-47.

Hillam J 1983 Tree-ring analysis of four buildings. In M Millett, The History, Architecture and Archaeology of Johnson's Corner, Alton. *Proceedings of the Hampshire Field Club Archaeology Society* 39, 77-109.

Hillam J 1989 Tree-ring analysis of medieval and post-medieval timbers from 16-22 Coppergate, York, North Yorkshire. *Ancient Monuments Laboratory report series* 136/89.

Hillam J, Morgan RA & Tyers I 1987 Sapwood estimates and the dating of short ring sequences. In RGW Ward (ed), *Applications of tree-ring studies: current research in dendrochronology and related areas*, BAR S333, 165-85.

Laxton RR & Litton CD 1988 *An East Midlands master tree-ring chronology and its use for dating vernacular buildings*. University of Nottingham, Dept of Classical & Archaeological Studies, Monograph Series III.

Leggett PA 1980 *The use of tree-ring analyses in the absolute dating of historical sites and their use in the interpretation of past climatic trends*, PhD Thesis, CNAA (Liverpool Polytechnic).

Mills CM 1988 *Dendrochronology of Exeter and its application*. Unpubl PhD thesis, Sheffield University.

Okasha MKM 1987 *Statistical methods in dendrochronology*. PhD thesis, Sheffield University.

Rackham O 1990 *Trees and woodland in the British Landscape* (2nd edition). Dent: London.

Siebenlist-Kerner V, Schove D & Fletcher J 1978 The barn at Great Coxwell, Berkshire. In JM Fletcher (ed), *Dendrochronology in Europe*, BAR S51, 295-302.

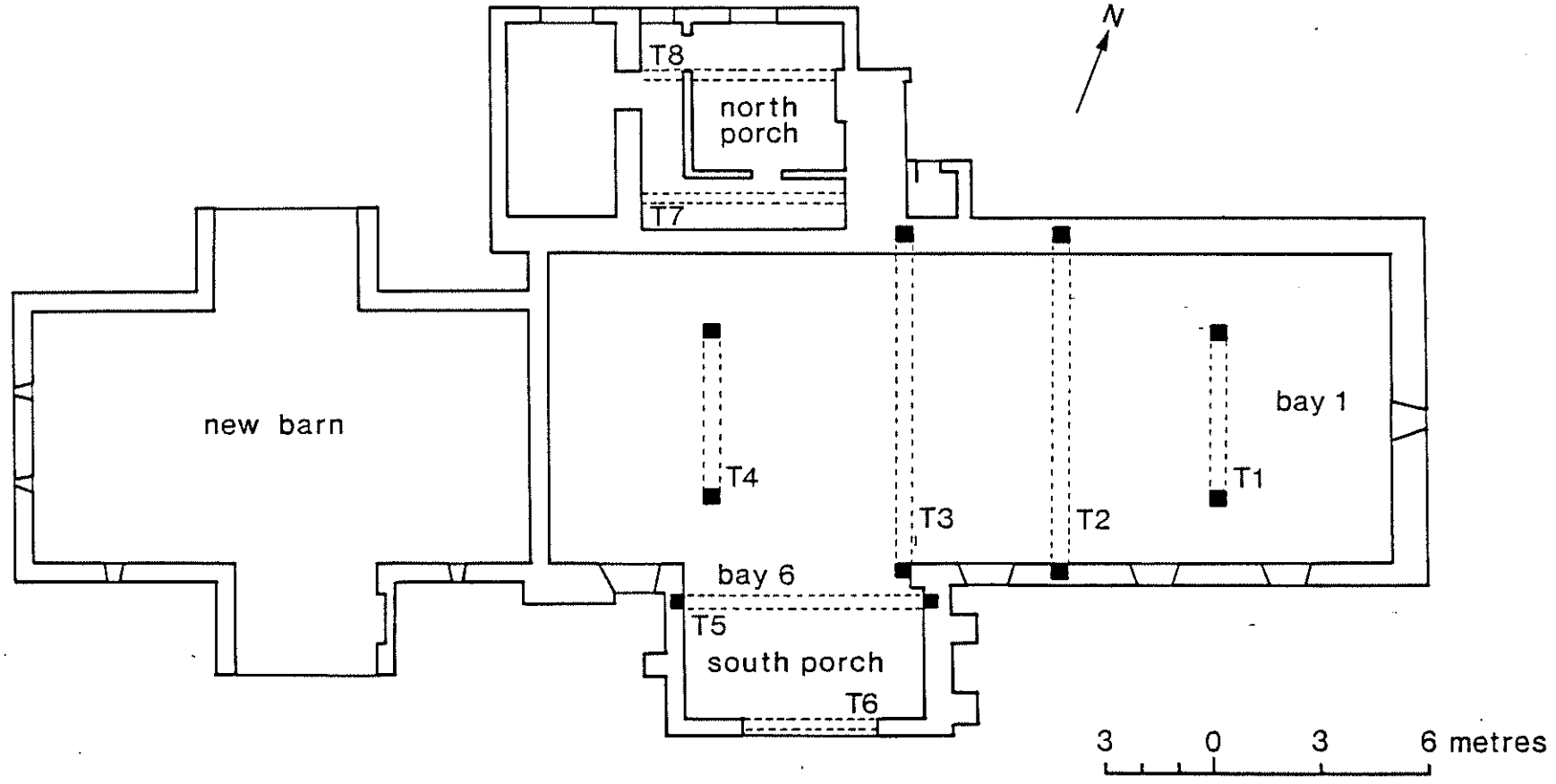

Figure 1: Plan of the barn reproduced from drawings by Charles (1981) and Ferguson Mann Architects.

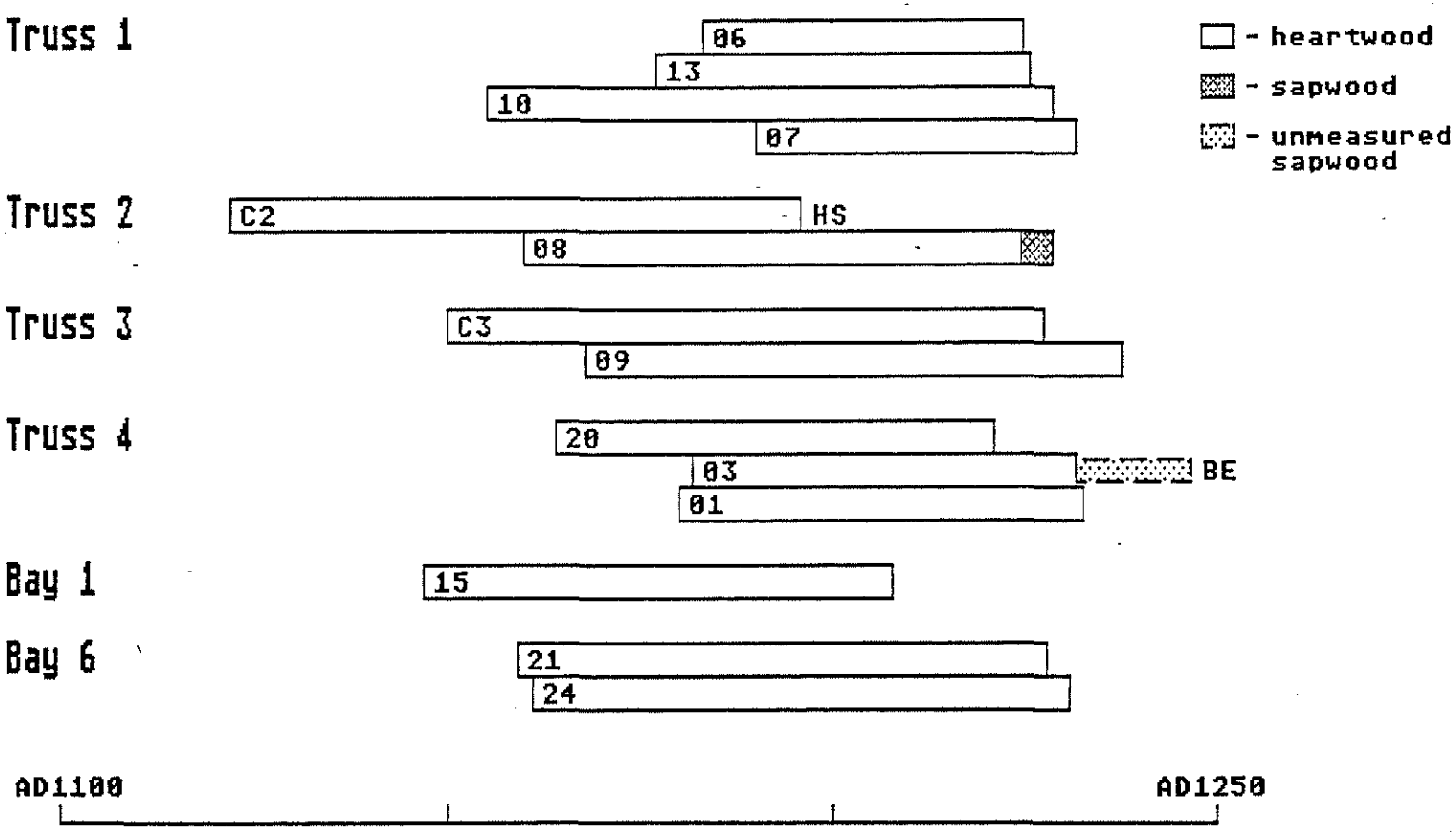

Figure 2: Bar diagram showing the relative positions of the dated samples included in the master curve Siddington/T14.

Table 1: Details of the samples; hs - heartwood/sapwood transition present.

Sample number	Location	Number of rings	Sapwood	Mean ring width (mm)	Comment
Main barn					
01a	Truss 4 upper tie beam	42	-	2.75	core, duplicate of 01b
01b	Truss 4 upper tie beam	54	-	2.65	core, duplicate of 01a
02	Truss 4 lower tie beam	16	-	-	core, broken, rejected
03	Truss 4 lower tie beam	51	hs	2.83	core, +13-15 rings to bark
04	Truss 3 tie beam	37	-	3.18	core
05	Truss 2 tie beam	13	-	-	core, rejected
06a	Truss 1 upper tie beam	36	-	2.08	core, pith, duplicate of 06b
06b	Truss 1 upper tie beam	43	-	2.24	core, +circa 5 rings to pith, duplicate of 06a
07	Truss 1 lower tie beam	43	-	3.12	core
08	Truss 2 north brace	70	4	2.45	measured in situ
09	Truss 3 north brace	71	-	2.25	measured in situ
10	Truss 1 north brace	75	-	1.68	core, +circa 10 rings to pith
11	Truss 1 south brace	22	-	-	core, rejected
12	Bay 1 north arcade plate	51	hs	2.09	core, +circa 5 rings to pith
13	Truss 1 north upright	50	-	2.62	core
14	Truss 1 south upright	-	-	-	core, broken, rejected, wood in poor condition

Table 1: Details of the samples (cont).

Sample number	Location	Number of rings	Sapwood	Mean ring width (mm)	Comment
15	Bay 1 south arcade plate	62	-	2.04	core
16	Bay 4 south arcade plate	34	-	3.35	core
17	Bay 3 north arcade plate	29	-	-	core, broken, rejected, wood in poor condition
18	Truss 3 brace in Bay 4	39	-	3.58	core
19	Truss 4 brace in Bay 4	53	-	1.60	core, +circa 5 rings to pith
20	Truss 4 south upright	58	-	2.71	core
30	Truss 2 south cruck	-	-	-	abandoned as core crumbled, wood in poor condition at base
31	Bay 2 north arcade plate	<30	-	-	cross-section cleaned in situ, rejected
C2a	Truss 2 south cruck	+70	hs	1.17	core, broken, +circa 40 inner rings, duplicate of C2b and 30
C2b	Truss 2 south cruck	+47	-	1.08	core, broken, +circa 40 inner rings, duplicate of C2a and 30
C3	Truss 3 south cruck	79	-	1.20	core
C4	Truss 3 north cruck	50	-	-	core, broken, rejected, rings distorted by knots
C5	Truss 3 north cruck support	40	-	1.77	core
<u>North porch</u>					
C1a	Truss 7 west principal rafter	53	-	1.69	core, duplicate of C1b
C1b	Truss 7 west principal rafter	82	-	1.44	core, duplicate of C1a

Table 1: Details of the samples (cont).

Sample number	Location	Number of rings	Sapwood	Mean ring width (mm)	Comment
South porch					
21	Bay 6 west upper purlin	70	-	2.23	core
22	Truss 5 west principal rafter	44	-	-	core, rejected
23	Truss 5 west cruck	-	-	-	abandoned as core crumbled, wood in poor condition
24	Bay 6 collar beam	71	-	2.00	core
25	Bay 6 east upper purlin	99	hs	1.34	core
26	Truss 5 east cruck	46	hs	2.62	core
27	Truss 5 tie beam	39	-	-	core, rejected
28	Truss 6 west principal rafter	48	-	1.84	core
29	Truss 5 east brace	22	-	-	core, rejected
C6	Truss 6 west principal rafter	37	-	1.80	core, duplicate of 28
C7	Truss 5 west cruck	40	-	2.28	core, duplicate of 23
C8	Truss 5 east cruck	36	-	-	core, broken, rejected, rings distorted by knots

Table 2: Results of comparisons between the master chronologies Siddington/T12 (AD1147-1238) and Siddington/T14 (AD1147-1238) with dated reference chronologies spanning the medieval period. The East Midlands, Oxford and Southern England chronologies are composite chronologies containing data from many sites and are not necessarily independent. All other reference chronologies used are independent.

reference chronology	t value	
	Siddington/T12	Siddington/T14
East Midlands (Laxton & Litton 1988)	8.18	8.94
Oxford (Haddon-Reece & Miles pers comm)	9.09	9.05
Southern England (Bridge 1988)	8.18	8.41
Beverley: Eastgate (Groves 1990)	3.48	4.54
Bredon Barn, Worcestersire (Giertz & Haddon-Reece pers comm)	5.88	5.96
Carlisle (Baillie & Pilcher pers comm)	3.47	4.18
Chichester: Bishops Kitchen (Tyers pers comm)	5.45	5.70
Cressing Temple barns, Essex (Tyers pers comm)	4.77	4.45
Droitwich: Upwich (Groves & Hillam 1991)	9.04	9.42
Dunstable: Middle Row (Bridge 1988)	5.93	5.94
Exeter: Cathedral (Mills 1988)	5.94	5.56
Glastonbury: Abbey barn (Bridge 1988)	6.43	6.28
Great Coxwell Barn, Berkshire (Siebenlist-Kerner, Schove & Pletcher 1978)	8.42	8.98
London: Southwark post-Roman (Tyers pers comm)	4.49	5.13
Nantwich (Leggett 1980)	4.50	5.68
Reading (Groves, Hillam & Pelling-Pulford 1985)	6.19	6.42
York: Coppergate (Hillam 1989)	4.74	5.05

Table 3: Ring width data of the site master chronology Siddington/T14, AD1122-1238.

years	ring widths (0.01mm)										number of samples per year									
AD1122		135	218	257	200	145	106	89	62	94		1	1	1	1	1	1	1	1	1
	113	102	96	77	88	66	72	97	106	135	1	1	1	1	1	1	1	1	1	1
	148	146	128	86	100	127	128	201	294	176	1	1	1	1	1	1	2	2	2	3
AD1151	166	123	194	164	152	221	237	229	285	350	3	3	3	3	4	4	4	4	5	6
	280	316	220	299	360	242	220	255	288	198	7	7	7	8	8	8	8	9	9	9
	208	203	177	207	227	248	228	265	252	185	9	9	9	9	9	9	10	10	10	11
	206	268	230	182	278	263	311	194	267	322	11	12	13	13	13	13	13	13	13	14
	232	269	301	221	244	235	210	197	226	252	14	14	14	14	14	14	13	13	13	13
AD1201	246	205	164	162	212	198	151	205	170	226	13	13	13	13	13	13	13	13	12	12
	228	170	156	179	178	175	178	162	244	242	12	12	12	12	12	12	12	12	12	12
	231	138	110	112	164	218	164	165	178	147	12	11	11	11	11	10	9	9	7	5
	155	179	194	201	341	271	461	521			5	4	2	1	1	1	1	1		

Table 4: Ring width data of the site master chronology Siddington/T2, AD1307-1398.

years	ring widths (0.01mm)										number of samples per year									
AD1307							254	306	278	182							1	1	1	1
	241	145	157	210	183	178	262	158	206	183	1	1	1	1	1	1	1	1	1	1
	191	192	183	191	142	122	132	140	156	168	1	1	1	1	1	1	1	1	1	1
	122	153	184	160	234	178	166	207	251	190	1	1	1	1	1	1	1	1	1	1
	169	159	141	146	165	230	248	117	101	270	1	1	1	1	1	1	1	1	1	2
AD1351	241	196	162	185	165	136	137	109	148	116	2	2	2	2	2	2	2	2	2	2
	109	154	209	180	128	119	95	108	180	156	2	2	2	2	2	2	2	2	2	2
	126	114	108	125	138	158	221	196	235	214	2	2	2	2	2	2	2	2	2	2
	172	189	187	96	138	238	179	193	185	152	2	2	2	2	2	2	2	2	2	2
	88	101	118	107	79	129	126	180			2	2	2	2	2	2	2	1		

Table 5: Results of comparisons between the master chronology Siddington/T2 (AD1307-1398) and its individual component sequences C1a (AD1307-1359), C1b (AD1317-1398) and 28 (AD1350-1397) with dated reference chronologies spanning the medieval period. The East Midlands, Oxford and Southern England chronologies are composite chronologies containing data from many sites and are not necessarily independent. All other reference chronologies used are independent. SDL - Sheffield Dendrochronology Laboratory.

reference chronology	t value			
	Siddington/T2	C1a	C1b	28
East Midlands (Laxton & Litton 1988)			3.67	
Oxford (Haddon-Reece & Miles pers comm)	4.18	3.08	5.22	
Southern England (Bridge 1988)	4.21		5.37	
Alton, Hampshire (Hillam 1983)	3.01		3.03	
Beaulieu Domas, Hampshire (SDL unpublished)	3.02		3.11	3.12
Cressing Temple barns, Essex (Tyers pers comm)	3.13		3.83	
Droitwich: Upwich (Groves & Hillam 1991)			3.96	3.46
Leominster Priory, (Haddon-Reece pers comm)			3.04	
London: Harmondsworth (Tyers pers comm)	4.57	3.40	4.95	3.13
Southwark post-Roman (Tyers pers comm)	3.75	4.56	5.71	
Mapledurham Hall, nr Reading (Haddon-Reece, Miles, Tapper & Pletcher 1987)			4.03	
Podington Church, nr Wellingborough (Tyers pers comm)	3.21	3.53	4.33	
Reading (Groves, Hillam & Pelling-Fulford 1985)	3.92		3.33	3.01
Wick: St Cuthberts (Bridge 1988)			3.95	
Worcester: Commandery (Pilcher pers comm)			3.64	

Table 6: Details of the tree-ring dates. The date of the heartwood-sapwood transition is given in brackets.

Sample number	Location	Date span of measured rings (AD)	Comment	Felling date (AD)
main barn				
01a	Truss 4 upper tie beam	1185-1226	duplicate of 01b	after 1243
01b	Truss 4 upper tie beam	1180-1233	duplicate of 01a	after 1243
03	Truss 4 lower tie beam	1182-1232 (1232)	+13-15 sapwood rings to bark	1245-47
06b	Truss 1 upper tie beam	1183-1225	-	after 1235
07	Truss 1 lower tie beam	1190-1232	-	after 1242
08	Truss 2 north brace	1160-1229 (1225)	-	1235-1280
09	Truss 3 north brace	1168-1238	-	after 1248
10	Truss 1 north brace	1155-1229	-	after 1239
13	Truss 1 north upright	1177-1226	-	after 1236
15	Bay 1 south arcade plate	1147-1208	-	after 1218
20	Truss 4 south upright	1164-1221	-	after 1231
C2a	Truss 2 south cruck	1122-1196 (1196)	duplicate of C2b	1206-1251
C2b	Truss 2 south cruck	1127-1173	duplicate of C2a	1206-1251
C3	Truss 3 south cruck	1150-1228	-	after 1238

Table 6: Details of the tree-ring dates (cont).

Sample number	Location	Date span of measured rings (AD)	Comment	Felling date (AD)
north porch				
C1a	Truss 7 west principal rafter	1307-1359	duplicate of C1b	after 1408
C1b	Truss 7 west principal rafter	1317-1398	duplicate of C1a	after 1408
south porch				
21	Bay 6 west upper purlin	1159-1228	-	after 1238
24	Bay 6 collar beam	1161-1231	-	after 1241
28	Truss 6 west principal rafter	1350-1397	-	after 1407

Table 7: Matrix of t values produced between the dated indivdual ring sequences included in the master curve Siddington/T14; values of less than 3.0 are not given; \ indicates an overlap of less than 30 years.

	03	06b	07	08	09	13	C3	10	15	20	C2	21	24
01	6.4	3.2	6.7	4.2	3.9	3.9	4.1		\		\		
03			4.4	3.2			4.6		\		\		
06b			4.1			3.3			\		\		
07					3.1	3.5	5.3		\		\		
08					4.0	4.0							
09						8.2		3.0	3.3		\	7.1	
13								3.4	3.7	3.2	\	5.0	3.6
C3									3.0	3.2	4.3	3.1	
10									3.7	3.7		6.9	5.1
15												4.3	
20												5.8	
C2												3.1	
21													4.1