Ancient Monuments Laboratory
Report 25/2000

TREE-RING ANALYSIS OF TIMBERS FROM CROXLEY HALL FARM BARN, RICKMANSWORTH, HERTFORDSHIRE

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Summary

The dendrochronological study of this barn revealed that fast-grown young oaks were used in its construction. Five timbers dated, with one retaining complete sapwood. This timber was felled in the winter of AD 1397/8 and the others have estimated felling dates which include this date. It seems most likely therefore that the barn was constructed during the short abbacy of John Moote (AD 1396-1401), as had been thought. This result has important implications for other stylistically similar barns in the vicinity, including Kingsbury Manor Farm Barn, The study has also showed that the cruck-like intermediate arcade shores were original features of the barn.

Author's address :-

DR M C Bridge
INSTITUTE OF ARCHAEOLOGY (LONDON)
University College London
31-34 Gordon Square
London
WC1H OPY

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Introduction

Croxley Hall Farm Barn (NGR TQ 070946) is today found in the grounds of the St Joan of Arc School (Fig 1). This grade II* listed timber-framed aisled barn with a crown-post roof (Figs 2 and 3) is one of a group of stylistically similar barns in the vicinity of St Albans, thought to have been built during the abbacy of John Moote (AD 1396 - 1401). Moote is known to have spent one hundred marks "for making a very large barn at Crosley, and other buildings there" (quoted in Castle and Rigold 1973). It is a large 5-bay structure, measuring 101ft 6in long by 40ft 6in wide (approximately 30.9m by 12.3m).

Although the barn underwent restoration in AD 1975, it is remarkably very complete. It is of particular interest in that it has a number of cruck-like intermediate arcade shores set at half-bay intervals (Fig 3) which look a little like base-crucks. They are braced back to the aisle wall posts by 'stub-ties' that appear original, but at their tops they only cradle the arcade plates. There remains some doubt about whether or not these features are original. The passing-braces rise to stop at tie beam level. The crown-post/purlin support was apparently only set over the midstrey bay. All the tie beams are slightly cambered, though the collars are not.

Dating was therefore commissioned by English Heritage in order to try and establish the date for this barn, thus effectively dating the other similar barns in the vicinity, and to see if dendrochronology would be able to settle the discussion about whether or not the intermediate arcade shores were original.

Methodology

The site was visited in March 1999, when the timbers were assessed for their potential use in dendrochronological study. Samples were taken from twelve timbers, the locations of which are described in Table 1 and illustrated in Figure 2.

Core samples were obtained using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis. The cores were prepared for measuring by sanding using an electric belt-sander with progressively finer grit papers down to 400 grit. Any further preparation necessary, eg where bands of narrow rings occurred, was done manually. Only samples with more than 45-50 rings were measured and used in subsequent analyses as sequences with fewer than this number of rings rarely give reliable crossmatching. Suitable samples had their tree-ring sequences measured to an accuracy of 0.01 mm using a specially constructed system utilizing a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to an Atari desktop computer. The software used in measuring and subsequent analysis was written by Ian Tyers (pers comm 1992).

Ring sequences were plotted on translucent semi-log graph paper to allow visual comparisons to be made between sequences on a light table. This activity also acts as a measure of quality control in identifying any errors in the measurements when the samples crossmatch. Statistical comparisons were made using Student's *t*-test (Baillie and Pilcher 1973; Munro 1984). The *t*-values quoted below were derived from the original CROS program (Baillie and Pilcher 1973). Those *t*-values in excess of 3.5 are taken to be indicative of acceptable matching positions

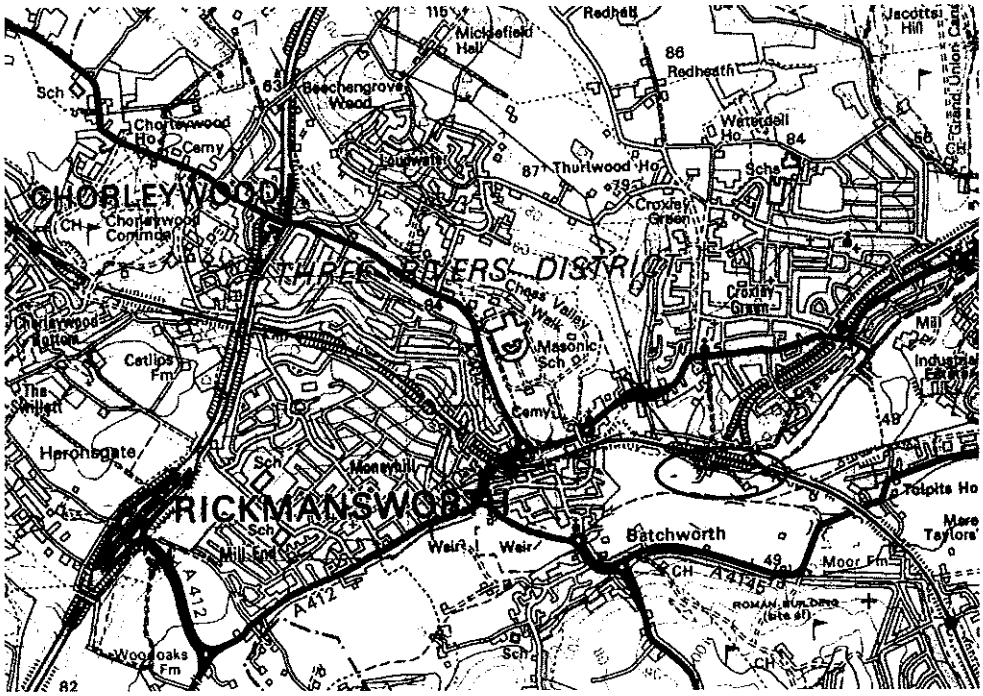

Figure 1: Map showing the location of Croxley Hall Farm Barn

provided that they are supported by satisfactory visual matches, and give consistent matching positions.

When crossmatching between samples is found, their ring-width sequences are meaned to form an internal site mean sequence which is then compared with a number of reference chronologies (multi-site chronologies from a region) and dated individual site masters in an attempt to date it. Individual long series which are not included in the site mean(s) are also compared with the database to see if they can be dated.

The dates thus obtained represent the time of formation of the rings available on each sample. Interpretation of these dates then has to be undertaken to relate these findings to the construction date of the phase under investigation. An important aspect of this interpretation is the estimate of the number of sapwood rings missing. In this instance, the sapwood estimates are based on those proposed for this area by Miles (1997), in which 95% of samples are likely to have from 9 to 41 sapwood rings. Where bark is present on the sample the exact date of felling of the tree used may be determined.

The dates derived for the felling of the trees used in construction do not necessarily relate directly to the date of construction of the building. However, evidence suggests that, except where re-used timbers are employed, construction in most historical periods took place within a very few years after felling (Salzman 1952; Hollstein 1965).

Results

All the timbers were of oak (*Quercus* spp.). All the timbers were from relatively fast-grown trees and thus exhibited few rings, despite their size. However, the most promising accessible timbers were sampled. It was not possible to gain access to tie beams or any higher timbers as no scaffold was avaialble. Details of the samples are given in Table 1, and their approximate locations are shown in Figure 2. For ease in description and clarity, the full trusses were numbered north to south with arabic numbers, the intermediate trusses were numbered with Roman numerals, and aisles and arcades were lettered west to east A - D (Fig 2).

Sample CXH05 (49 rings) showed a sudden growth change to narrow rings mid-way through the sequence, perhaps indicating that the tree was dying for many years before being felled. This atypical growth pattern would be unlikely to date.

Four of the ring-width sequences (CXH02, CXH03, CXH06, and CXH12) matched each other consistently with relatively strong statistical agreement (Table 2) and these were combined to form a preliminary site chronology CROX1. Sample CXH11 matched with this preliminary site chronology (t = 7.6, 70 years of overlap), although it only gave a significant match (t = 4.0, 65 years of overlap) against one of the individual components (CXH02). All five samples were combined to form the final 100-year long site chronology CROXLEY.

The evidence for the dating of this site chronology is presented in Table 3. The ring-width data for the site chronology, CROXLEY, is presented in Table 4.

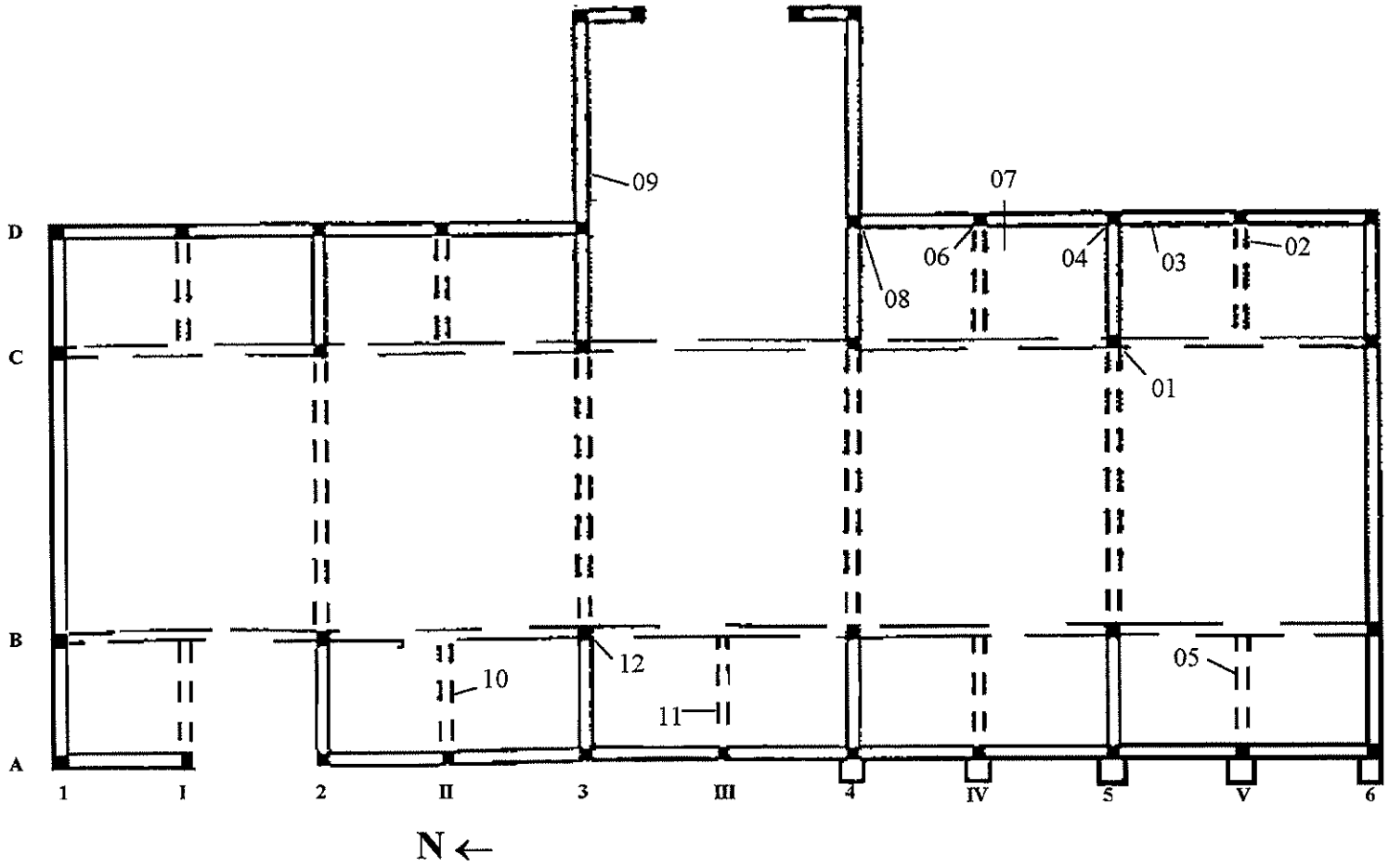

Figure 2: Plan of Croxley Hall Farm Barn showing the approximate locations of the samples taken for dendrochronology

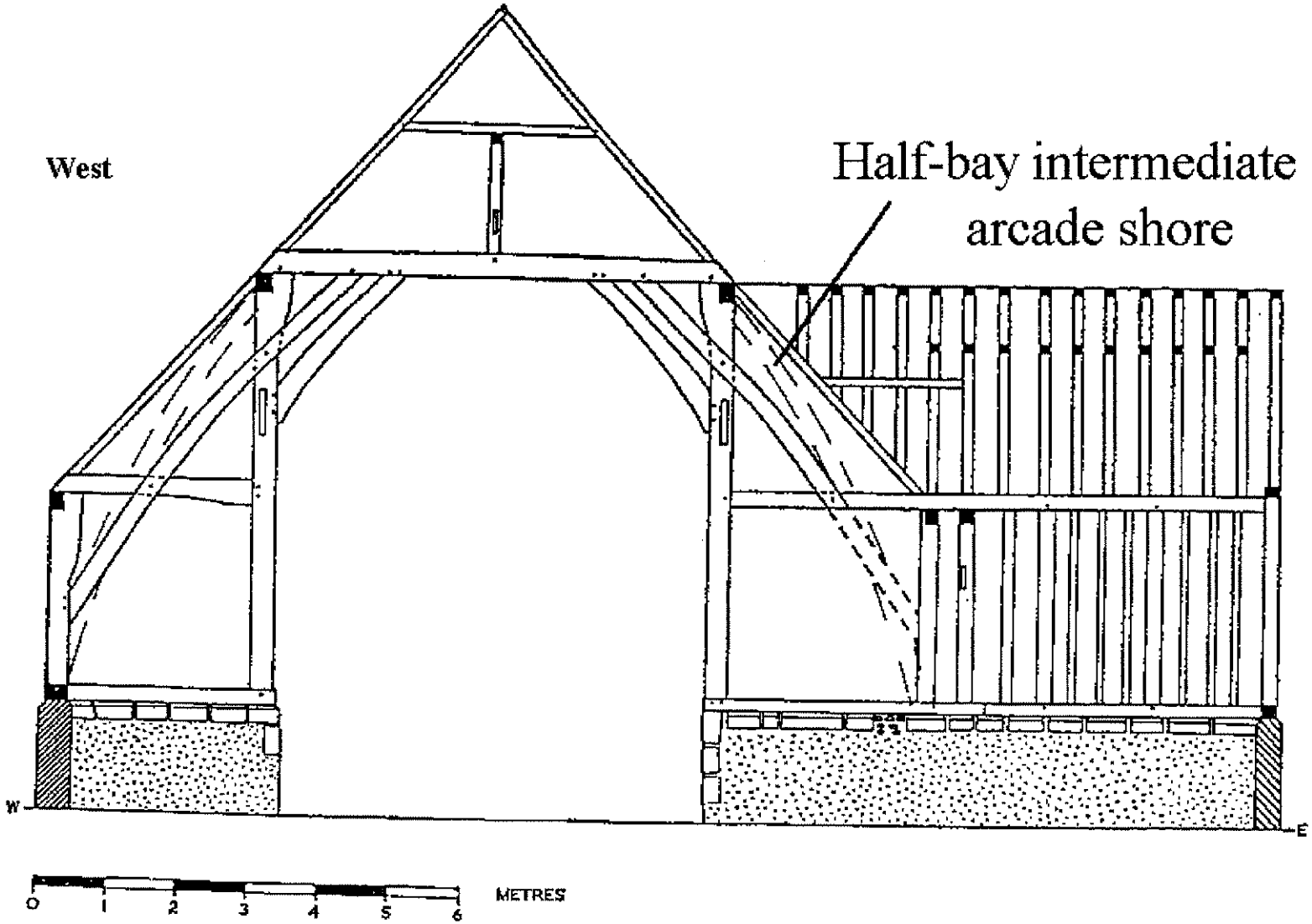

Figure 3: Cross-section of Croxley Hall Farm Barn showing truss form and position of the intermediate arcade shored)dashed lines)

Table 1: Oak (*Quercus* spp.) timbers sampled from Croxley Hall Farm barn

h/s = heartwood-sapwood boundary

Sample No	Origin of core	Total No of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
CXH01	Arcade post C5	50	4.10	5	unknown	unknown
CXH02	Intermediate arcade shore V east	81	1.94	13	1303 - 1383	1384 - 1411
CXH03	Wall plate, bay 5 east	58	1.86	h/s	1317 - 1374	1383 - 1415
CXH04	Aisle post 5 D	35	not measured	11	unknown	unknown
CXH05	Intermediate arcade shore V west	49	1.77	19 complete	unknown	unknown
CXH06	Aisle post IV D	76	2.23	21 complete	1322 - 1397	winter 1397/8
CXH07	Rafter, bay 4 east	39	not measured	-	unknown	unknown
CXH08	Aisle post 4 D	46	not measured	h/s	unknown	unknown
CXH09	Wall plate, north porch	40	not measured	13 + bark	unknown	unknown
CXH10	Intermediate arcade shore II west	46	not measured	h/s	unknown	unknown
CXH11	Intermediate arcade shore III west	70	2.29	-	1298 - 1367	after 1376
CXH12	Arcade post 3 B	69	2.34	h/s	1309 - 1377	1386 - 1418

Table 2: Crossmatching between dated oak samples from Croxley Hall Farm Barn forming preliminary site chronology CROX1

	t values		
Sample No	**CXH03**	**CXH06**	**CXH12**
CXH02	4.2	4.4	4.1
CXH03		5.2	5.0
CXH06			3.5

Table 3: Dating of the oak site chronology CROXLEY

	CROXLEY AD 1303 -1397	
Dated reference or site master chronology	*t*-value	Overlap (yrs)
London1175 (Tyers pers comm)	5.8	100
Southern England (Bridge 1988)	5.4	100
Oxon93 (Miles pers comm)	5.2	100
Woodham Walter, Essex (Tyers 1996)	6.0	74
Dunmow, Essex (Bridge 1999a)	5.7	62
New Inn, Oxford (Miles and Haddon-Reece 1996)	5.2	89
Fyfield2, Essex (Bridge 1998)	4.8	91
Braxted, Essex (Bridge 1999b)	4.2	80

Interpretation and Discussion

Despite the use of relatively fast-grown young oak trees to provide the large timbers in this barn, dendrochronological dating was possible. Some timbers exhibited unusual growth patterns (eg CXH05) and these could not be dated. This implies that some of the timbers may have been managed, suffered disease, or insect defoliation, during their lifetime.

Only one sample (CXH06) retained complete sapwood, giving a felling date of the winter AD 1397/8. Three of the other timbers which dated crossmatched well with each other (Fig 4) and appeared to have come from a single group of timbers, perhaps representing a single woodland source. Sample CXH11 did not match the others as strongly. The other dated timbers exhibited likely felling dates which incorporated winter AD 1397/8, and it seems likely that they were all felled at the same time.

This date agrees well with the information that the barn was most likely to have been constructed during the five-year abbacy of John Moote (AD 1396 - 1401), and may be taken as strong evidence that this was indeed the case. One intermediate arcade shore was dated, this being one of the four timbers in the site chronology. This shows that these unusual features were indeed part of the original build of the barn.

Dendrochronology has been able to answer the two specific questions posed about the Croxley Hall Farm Barn at the start of this investigation, and by implication, the other stylistically similar barns in the vicinity (including Kingsbury Manor Farm Barn) have become more reliably dated.

Acknowledgements

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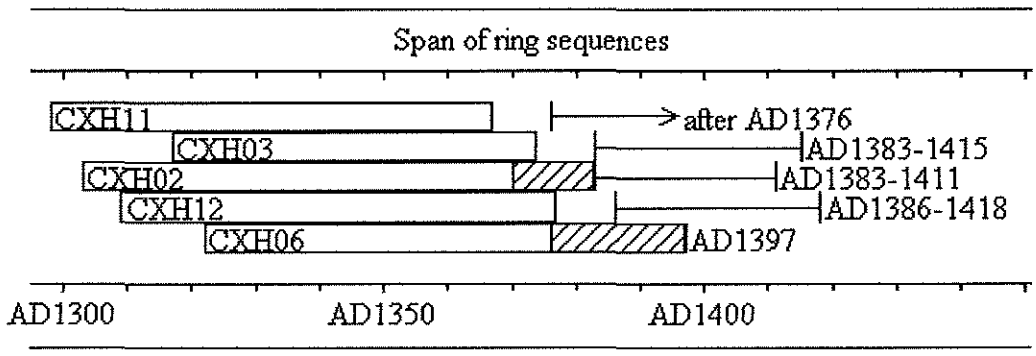

Figure 4: Bar diagram showing the relative positions of overlap of the dated timbers in the site chronology CROXLEY

Table 4: Ring-width data for the site chronology CROXLEY

Year	ring widths (0.01mm)										no of trees									
CROXLEY																				
AD 1298								512	481	479									1	1 1
AD 1301	528	578	217	221	210	209	330	343	272	259	1	1	2	2	2	2	2	2	3	3
	220	342	293	290	342	377	277	225	308	309	3	3	3	3	3	3	4	4	4	4
	324	370	365	376	280	264	327	287	264	204	4	5	5	5	5	5	5	5	5	5
	193	197	153	217	283	185	196	187	265	225	5	5	5	5	5	5	5	5	5	5
	195	187	158	174	205	224	239	189	189	164	5	5	5	5	5	5	5	5	5	5
AD 1351	229	181	175	166	143	120	145	137	156	134	5	5	5	5	5	5	5	5	5	5
	106	109	203	229	193	147	150	160	194	201	5	5	5	5	5	5	5	4	4	4
	158	171	151	134	158	141	128	138	162	131	4	4	4	4	3	3	3	2	2	2
	144	88	115	87	75	104	111	154	170	99	2	2	2	1	1	1	1	1	1	1
	192	112	140	134	213	213	224				1	1	1	1	1	1	1			