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Ancient Monuments Laboratory
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Summary

The present building has a medieval core which has been extensively added to, especially during the eighteenth and nineteenth centuries. This study has dated the felling of the oak timbers used in the medieval trusses to the winter of AD 1490-1. The construction is of particular interest for the amount of elm used. The posts, collars, and queen struts were of oak (Quercus spp.), whilst the ties, principal and common rafters, and purlins were of elm (Ulmus spp.). No tree-ring crossmatching was found between the oak and elm, and some of the smaller oak timbers were not dated.

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Introduction

Addington House is situated in Addington Village near Croydon (NGR TQ373642). The primary building phase of interest is the smoke-blackened remains of an open hall house thought to be of the late fifteenth or early sixteenth century on stylistic grounds. The dendrochronological study was requested by Richard Bond of English Heritage in an attempt to provide accurate dating for this building and assist in assessing its significance as a rare survival in this part of Greater London. The analysis dates a style of roof which is found throughout the wider region but rarely in buildings with good dating evidence. The roof style (Fig 1) is similar to Gentleman's Row in Enfield (Bond 1993) dated AD 1465 - 1494 (Bridge 1997).

This report is a record of the tree-ring investigation and forms only part of a wider study. It is not meant to form a definitive record of the structure, neither does it form a detailed discussion of other aspects of the building and its relationship to others of a similar style.

Methodology

The site was visited in February 1998 at which time the building was unoccupied. Inspection of the timbers and assessment of their suitability for dendrochronological study was made difficult by the fact that all those in the roof space were heavily smoke-blackened. The two posts which were accessible were painted over, but the waney edge of the timbers was still evident. The purlins had been sawn through previously and were identified as being of elm.

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 holes were left open. 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. The 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. Statistical comparisons were made using Student's *t*-test (Baillie and Pilcher 1973; Munro 1984). Any internal site mean sequences produced are then compared with a number of reference chronologies (multi-site chronologies from a region) and dated individual site masters in an attempt to date them.. The *t*-values quoted below were derived from the original CROS program (Baillie and Pilcher 1973) in which *t*-values in excess of 3.5 are taken to be indicative of acceptable matching positions provided that they are supported by satisfactory visual matches (Baillie 1982, 82-5). Any timbers not included in the site mean are tested against it to see if they crossmatch, and in this case the elm (*Ulmus* spp.) sequences were compared with the oak (*Quercus* spp.) to see if there was any crossmatching between the two species.

The dates thus obtained represent the time of formation of the rings available on each sample, and in this case, the dated sequences had bark on them which meant that the felling date for the trees was also known. Interpretation of these dates then has to be undertaken to relate these findings to the construction date of the phase under investigation.

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

Results

Ten core samples were taken from various timbers (Table 1; Fig 1). Three of the samples were found to be of elm - this could not be determined before sampling because of the smoke-blackening of the timbers. The purlins and principal rafters were observed to be of elm before sampling took place.

The two samples from the posts (ADD08 and ADD09) were both from quartered trunks and superficial similarities were noted at the time of sampling. Both displayed the waney edge, although the outermost rings broke during sampling of ADD09. The similarity between these samples was reflected in their ring sequences, which matched each other well ($t = 9.9$). The two posts were considered to have been fashioned from the same tree and the two ring sequences were therefore combined and treated as a single sequence for subsequent analysis.

Sample ADD01 crossmatched with the combined ADD08+09 series with a value of $t = 6.0$, and these two series were combined into the site mean ADDINGTON. This was subsequently dated by comparison with a number of regional and site chronologies (Table 2).

Sample ADD06 (38 rings) was too short to be crossmatched statistically, but its plot gave a very strong visual match with ADD05, each sample coming from a queen strut of the same truss. Both timbers had bark on them, but ADD05 had a complete ring indicating winter-felling of the tree, whilst ADD06 had earlywood vessels of the next year's growth, indicating felling in the early summer and also indicating that the two samples were from different trees. The combined 50 year sequence (ADD05+06 in Table 3) failed to give consistent crossmatching with either the site mean or other reference material.

The other oak samples, ADD02 (57 rings) and ADD04 (35 rings) could not be crossmatched with each other or either of the other two new sequences (ADD08+09 or ADD05+06).

The two oak sequences ADDINGTON and ADD05+06 are shown in Table 3.

The three elm sequences did not match each other well, nor did they crossmatch individually with the oaks.

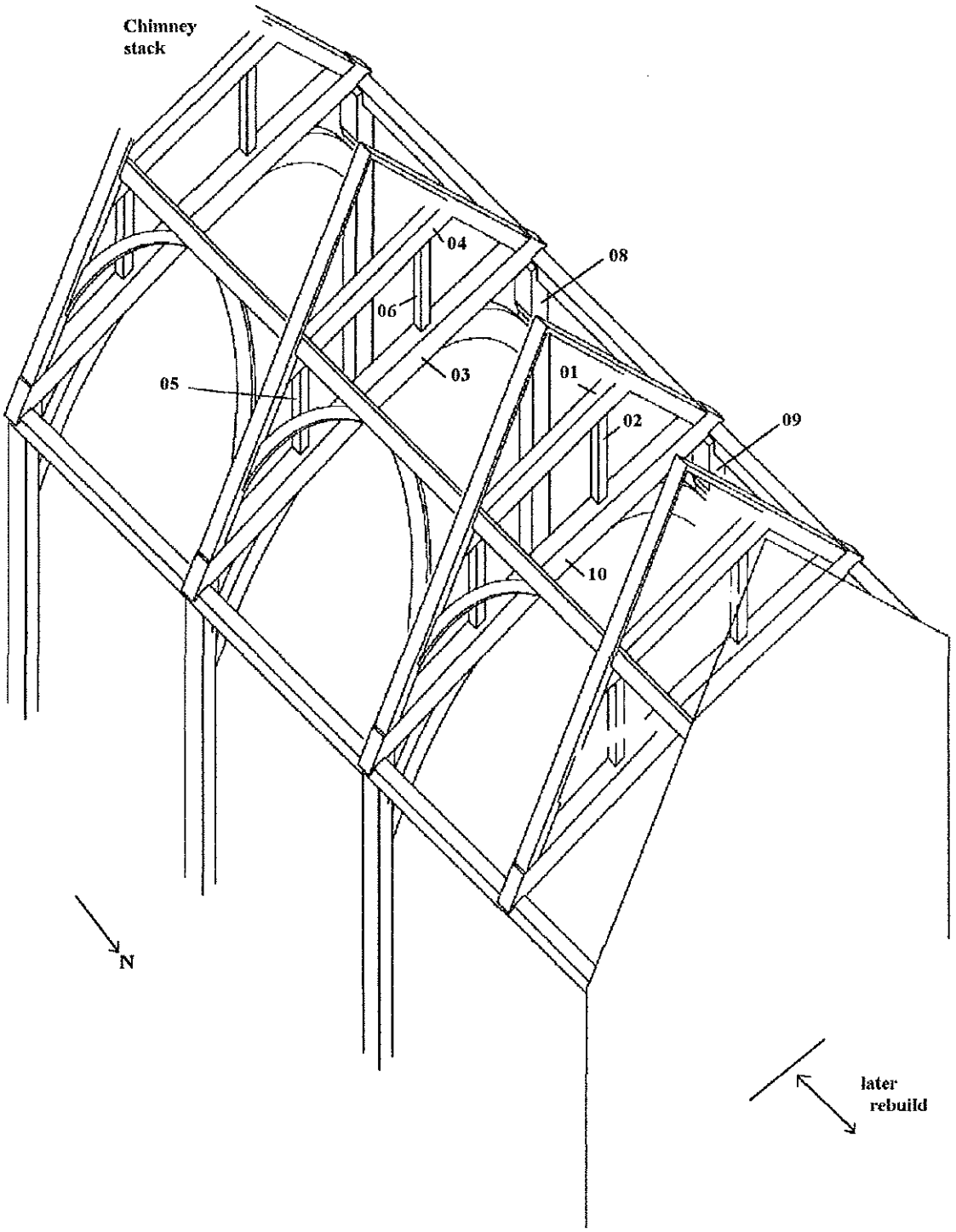

Figure 1: Sketch reconstruction by Richard Bond of the medieval roof of Addington House showing the location of dendrochronological samples (not to scale)

Table 1: List of samples taken from Addington House

Sample No.	Species	Origin of core	Total number of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence (AD)	Felling date of sequence (AD)
ADD01	oak	Collar to north intermediate truss	76	1.37	15 sapwood rings and bark	1415 - 1490	winter 1490-91
ADD02	oak	West queen strut to north intermediate truss	57	1.81	-	undated	-
ADD03	elm	Tie to south intermediate truss	50	3.11	3	undated	-
ADD04	oak	Collar to south intermediate truss	35	2.50	5	undated	-
ADD05	oak	East queen strut to south intermediate truss	50	2.33	14 sapwood rings and bark	undated	-
ADD06	oak	West queen strut to south intermediate truss	38	2.35	12 sapwood rings and bark	undated	-
ADD07	elm	Common rafter	76	1.60	13	undated	-
ADD08	oak	West post to south intermediate truss	122	1.84	16 sapwood rings and bark	1369 - 1490	winter 1490-91
ADD09	oak	West post to north intermediate truss	119	2.19	12	1370 - 1488	winter 1490-91
ADD10	elm	Tie to north intermediate truss	60	4.05	-	undated	-

Table 2: Dating of the site master chronology for oak timbers from Addington House

	ADDINGTON AD 1369 - 1490	
Dated reference or site master chronology	*t*-value	Overlap (yrs)
London1175 (Tyers unpubl)	5.0	122
Oxon93 (Miles unpubl)	4.4	122
Southern England (Bridge 1988)	4.3	122
Windsor Castle Kitchen (Hillam unpubl)	5.3	122
Cowfold (Tyers unpubl)	5.1	114
Sinai (Tyers 1997)	4.9	122
Mary Rose 'refit' (Bridge unpubl)	4.6	119
Field Place Barn (Bridge unpubl)	4.4	97

Interpretation

The sequence ADDINGTON clearly dates to the period AD 1369 - 1490. The presence of the sapwood-bark interface on two of the cores, and its presence on the timber of the third, allows one to be certain about time the trees were felled. The ring for 1490 was complete and there were no signs of cells formed the following spring. The trees used in this roof construction were therefore felled during the winter of AD1490-1491. Sample ADD05, though undated, also showed a complete sapwood ring under the bark indicating winter-felling. Two undated samples, ADD06 and the elm sample ADD03 had earlywood vessels directly below the bark indicating that these trees were felled in early summer.

Apart from the two posts, which appear to have been fashioned from the same tree, the trees were very young, having been cut at between 40 and 80 years old. The mixture of oak and elm used within the construction may indicate either a preference for the different species for particular elements of the roof structure, or it may simply reflect the trees available for use. The larger timbers, the ties, purlins, and all rafters, were found to be of elm.

The suggested date for the construction of this roof (AD 1491 or within a very years after) is roughly contemporaneous with that for 17 Gentleman's Row, Enfield (Bridge 1997), a roof of broadly similar construction, dated to the period AD 1465 -1494. These two roofs together therefore help in the interpretation of other similar types in the London region.

The overall rather poor levels of crossmatching with a range of site and reference chronologies reflects the fact that this site chronology represents the growth of only two, relatively fast-grown trees. The failure of the other sequence (ADD05+06) to crossmatch, despite the presence of bark suggesting that its entire sequence is contemporaneous with the dated series, shows once again that such short sequences can provide a very unreliable climate signal, even within a single batch of timbers.

Acknowledgements

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Table 3: Ring-width data for the oak series ADDINGTON and ADD05+06

ADDINGTON AD 1369 - 1490

Year	ring widths (0.01mm)										number of trees per year									
AD 1369									622	559	1	1	1	1	1	1	1	1	1	1
	498	573	463	736	514	425	256	431	419	158	1	1	1	1	1	1	1	1	1	1
	87	320	216	249	145	407	418	360	211	229	1	1	1	1	1	1	1	1	1	1
	252	155	161	343	303	267	180	389	290	253	1	1	1	1	1	1	1	1	1	1
AD 1401	223	80	80	63	51	61	87	102	72	79	1	1	1	1	1	1	1	1	1	1
	103	94	70	86	125	172	157	209	117	165	1	1	1	1	2	2	2	2	2	2
	163	120	137	165	189	137	152	203	158	114	2	2	2	2	2	2	2	2	2	2
	168	297	217	381	235	262	238	307	84	192	2	2	2	2	2	2	2	2	2	2
	174	211	124	91	74	94	134	171	136	154	2	2	2	2	2	2	2	2	2	2
AD1451	151	141	153	204	176	169	139	139	143	233	2	2	2	2	2	2	2	2	2	2
	165	166	169	129	206	221	228	223	212	89	2	2	2	2	2	2	2	2	2	2
	61	62	55	86	94	101	75	84	107	93	2	2	2	2	2	2	2	2	2	2
	154	173	129	120	132	131	147	127	105	117	2	2	2	2	2	2	2	2	2	2

ADD05+06

Year	ring widths (0.01mm)									
1	208	150	222	345	271	315	326	398	511	514
	314	206	228	317	284	361	275	199	167	172
	243	261	221	175	229	330	259	258	172	168
	198	238	246	258	246	213	146	221	212	238
	230	191	252	203	156	205	155	199	158	97