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Summary

Thirteen samples of oak timbers uncovered during excavations in the moat of Spargrove Manor, Batcombe, Somerset (NGR ST671397) were submitted for analysis. The timbers comprised three, articulated elements of a baseplate, presumably for a bridge over the moat, and ten timbers found within overlying sediment which could have formed braces and other, upper elements of the same structure.

Three timbers have dated, two from the *in situ* baseplate, and one from the timbers in the overlying, dumped fill. One baseplate sample had possible bark edge surviving on one corner indicating a possible felling date of AD 1289. This is consistent with the dating of a further baseplate sample for which a felling date range of AD 1287-1317 is given. Cross-matching, and absolute dating of one sample from the overlying timbers to after AD 1274 supports interpretation of this group of timbers as redeposited elements of the bridge's original superstructure.

Keywords

Dendrochronology

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Introduction

This document is a technical archive report on the tree-ring analysis of oak timbers from excavations in the moat of Spargrove Manor, Batcombe, Somerset (NGR ST671397). Analysis of the surviving timbers was requested by Rob Iles of English Heritage to inform scheduled monument consent for a proposal to re-flood part of the moat.

It is beyond the dendrochronological brief to describe the site in detail or to undertake the production of detailed drawings. As part of a multidisciplinary assessment of the site (Leach 2000) elements of this report may be combined with detailed descriptions, drawings, and other specialist reports at some point in the future to form either a comprehensive publication or an archive deposition on the site. The conclusions may therefore have to be modified in the light of subsequent work.

Methodology

Methods employed at the Lampeter Dendrochronology Laboratory in general follow those described in English Heritage (1998). Details of the methods used for the dating of this site are described below.

A total of thirteen samples, taken as slices during the excavations, were submitted for assessment. Three samples (F105A-C) were derived from *in situ* timbers forming a base-plate, presumably for a bridge over the moat. These timbers all had sufficient rings to merit analysis, with two timbers retaining possible bark edge offering the potential for precise dating. Ten samples came from timbers within context 1002, a dumped mineral and organic layer overlying basal silts within the moat. The timbers may have formed upstanding elements of the bridge. These samples contained relatively few rings with only one sample meriting analysis. The selected samples were frozen for 48 hours and then cleaned with a 'Surform' plane and razor blades to reveal the tree-ring sequences.

The complete sequences of growth rings in the samples that were selected for dating purposes were measured to an accuracy of 0.01mm using a micro-computer based travelling stage (Tyers 1999). The ring sequences were plotted onto semi-log graph paper to enable visual comparisons to be made between sequences. In addition cross-correlation algorithms (Baillie and Pilcher 1973; Munro 1984) were employed to search for positions where the ring sequences were highly correlated. These positions were checked visually using the graphs and, where these were satisfactory, new mean sequences were constructed from the synchronised sequences. The *t*-values reported below are derived from the original CROS algorithm (Baillie and Pilcher 1973). A *t*-value of 3.5 or over is usually indicative of a good match, although this is with the proviso that high *t*-values at the same relative or absolute position must be obtained from a range of independent sequences, and that satisfactory visual matching supports these positions. Timbers originally derived from the same parent tree generally have *t*-values greater than 10.0. Lower values from timbers obviously derived from the same parent tree (eg on morphological grounds) are, however, quite common. It is the visual similarity in medium term growth trends of the samples that is the critical factor in determining 'same tree' origin.

All the measured sequences from this assemblage were compared with each other and any found to cross-match were combined to form a site master curve. These, and any remaining unmatched ring sequences were tested against a range of reference chronologies, using the same matching criteria: high *t*-values, replicated values against a range of chronologies at the same position, and satisfactory visual matching. Where such positions are found these provide calendar dates for the ring-sequence.

The tree-ring dates produced by this process initially only date the rings present in the timber. The interpretation of these dates relies upon the nature of the final rings in the sequence. If the sample ends in the heartwood of the original tree, a *terminus post quem (tpq)* for the felling of the tree is indicated by the date of the last ring plus the addition of the minimum expected number of sapwood rings which are missing. This *tpq* may be many decades prior to the real felling date. Where some of the outer sapwood or the heartwood/sapwood boundary survives on the sample, a felling date range can be calculated using the maximum and minimum number of sapwood rings likely to have been present. The sapwood estimates applied throughout this report are a minimum of 10 and maximum of 46 annual rings, where these figures indicate the 95% confidence limits of the range. These figures are applicable to oaks from the British Isles (Tyers 1998). Alternatively, if bark-edge survives, then a felling date can be directly utilised from the date of the last surviving ring. The dates obtained by the technique do not by themselves necessarily indicate the date of the structure from which they are derived. It is necessary to incorporate other specialist evidence concerning the re-use of timbers and the repairs of structures before the dendrochronological dates given here can be reliably interpreted as reflecting the construction date of phases within the structure.

Results

The results of initial assessment and subsequent, selective measurement and dating are given in Table 1. Of the four samples which contained enough rings for measurement, three cross-matched (Table 2), and a three-timber, 99-year mean was calculated. Significant computer correlations were noted between this sequence and a number of site masters (Table 3) dating the sequence to AD 1191-1289 inclusive. The dating of the sequences from individual timbers is indicated graphically in Figure 1.

Three timbers have dated, two from the *in situ* baseplate, and one from the timbers in the overlying, dumped fill 1002. Sample F105B had possible bark edge surviving on one corner of the sample indicating a possible felling date of AD 1289? This is consistent with the dating of sample F105C for which a felling date range of AD 1287-1317 is given. Cross-matching, and absolute dating of sample 1002/10 to after AD 1274 supports interpretation of the group of timbers in context 1002 as redeposited upper elements of the bridge's original superstructure. The analysis suggests the bridge was constructed in AD 1289 or shortly thereafter.

Acknowledgements

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Figure 1 Bar diagram showing the chronological positions of the three dated timbers. The felling period is also shown

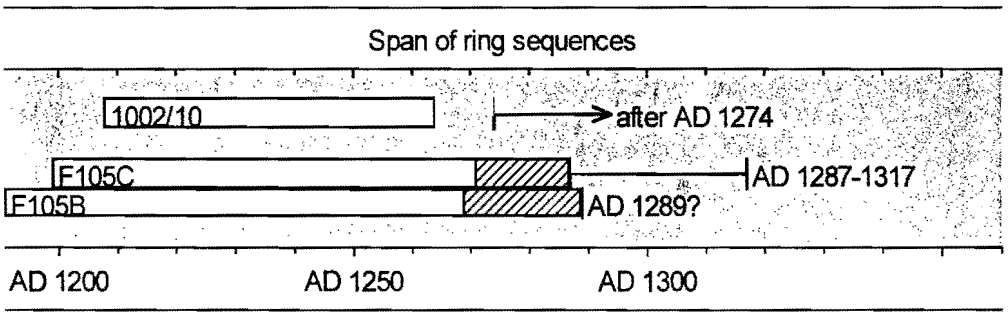

Table 1

List of samples

Core No	Origin of sample	Cross-section of tree	Cross-section size (mm)	Total rings	Sapwood rings	ARW mm/year	Date of sequence	Felling period
1002/1	Timber, context 1002	Quarter	375 x 300	43	9S			Unmeasured
1002/2	Timber, context 1002	Quarter	390 x 295	44	H/S			Unmeasured
1002/3	Timber, context 1002	Quarter	210 x 140	42				Unmeasured
1002/4	Timber, context 1002	Quarter	180 x 140	43				Unmeasured
1002/5	Timber, context 1002	Quarter	210 x 140	22	H/S?			Unmeasured
1002/6	Timber, context 1002	Quarter	220 x 135	33	H/S			Unmeasured
1002/7	Timber, context 1002	Quarter	175 x 140	39	H/S			Unmeasured
1002/8	Timber, context 1002	Half	210 x 145	33	H/S			Unmeasured
1002/9	Timber, context 1002	Quarter	160 x 150	32	H/S			Unmeasured
1002/10	Timber, context 1002	Half	135 x 130	57		2.06	AD 1208-AD 1264	after AD 1274
F105A	Baseplate timber, feature F105	Half	340 x 260	129	24S+Bw	2.12		Undated
F105B	Baseplate timber, feature F105	Whole	260 x 195	99	20S+?B	1.43	AD 1191-AD 1289	AD 1289?
F105C	Baseplate timber, feature F105	Whole	240 x 220	89	16S	2.07	AD 1199-AD 1287	AD 1287-1317

Total rings = all measured rings, +value means additional rings were only counted, the felling period column is calculated using these additional rings
Sapwood rings: h/s heartwood/sapwood boundary, ?h/s possible heartwood/sapwood boundary, +bw = bark-edge winter felled, +bs = unmeasured spring growth also present
ARW = average ring width of the measured rings

Table 2 *t*-value matrix for samples **1002/10**, **F105B**, and **F105C**

	F105B	**F105C**
1002/10	-	4.22
F105B		4.03

Table 3

Dating the mean sequence **SPART3**, AD 1191-1289 inclusive. *t*-values with independent reference chronologies

Area	**Reference chronology**	***t*-values**
Essex	Clavering The Bury Essex 2 timbers (Tyers *et al* 1997)	4.63
Worcestershire	Droitwich (Groves and Hillam 1997)	5.12
Lancashire	Lancaster Castle (Groves 1994)	4.62
Hampshire	Marwell Hall nr Winchester (Groves and Hillam 1994)	4.23
Somerset	Bridge Farm Butleigh (Miles and Worthington 1997)	5.10
Devon	Exeter Bishops Throne (Bridge 1986)	4.82
Devon	Rudge Morchard Bishop (Tyers *et al* 1997)	4.27
Devon	Discovery Wharf, Plymouth (Nayling unpubl)	4.48
Devon	Thorne Clannaborough (Tyers *et al* 1997)	4.17

Table 4

Ring-width data from site master **SPART3**, dated to AD 1191-1289 inclusive.

Date	**Ring widths (0.01mm)**										**No of samples**									
AD 1191	197	138	94	61	89	163	36	67	135	150	1	1	1	1	1	1	1	2	2	
AD 1201	137	59	67	56	90	83	59	170	136	154	2	2	2	2	2	2	2	3	3	3
-	118	125	146	158	170	200	248	260	226	234	3	3	3	3	3	3	3	3	3	3
-	197	183	218	227	278	291	282	302	287	249	3	3	3	3	3	3	3	3	3	3
-	192	189	206	221	193	125	250	282	309	253	3	3	3	3	3	3	3	3	3	3
-	186	143	191	211	207	242	244	170	157	189	3	3	3	3	3	3	3	3	3	3
AD 1251	180	104	123	147	165	137	149	128	111	92	3	3	3	3	3	3	3	3	3	3
-	166	226	128	101	99	100	221	256	242	152	3	3	3	3	2	2	2	2	2	2
-	98	91	131	188	125	164	234	196	212	213	2	2	2	2	2	2	2	2	2	2
-	282	203	235	263	205	209	157	163	55		2	2	2	2	2	2	2	1	1	