Centre for Archaeology Report 60/2001

Tree-Ring Analysis of Timbers from the Post Mill, Drinkstone, Suffolk

Dr Martin Bridge

ISSN 1473-9224

The Centre for Archaeology Reports Series incorporates the former Ancient Monuments Laboratory Report Series. Copies of Ancient Monuments Laboratory Reports will continue to be available from the Centre for Archaeology (see back of cover for details).

Centre for Archaeology Report 60/2001

Tree-Ring Analysis of Timbers from the Post Mill, Drinkstone, Suffolk

Dr Martin Bridge

Summary

Many of the timbers sampled were fast-grown oak, with relatively few rings, and they did not date. Three did however date, these included the main post on which the mill rotates, which retained complete sapwood and was found to have been felled in the winter of AD 1586-7, and two jowelled posts re-used in the front extension of the present mill, made from trees most likely felled in the period AD 1543-73. The mill is thought to have escaped major rebuilding in the nineteenth and twentieth centuries and therefore was considered a rare survival of an older-style mill, a carved date suggesting possible construction in AD 1689. If dendrochronology could substantiate this date, it would make the mill one of the oldest in the county. The present study suggests that part of the extant mill is at least a century older than that, reinforcing its historic importance within the region.

Keywords

Dendrochronology
Standing Building

Author's address
Institute of Archaeology, University College London, 31-34 Gordon Square, London WC1H 0PY. Tel: 020 7679 1540. Email: martin.bridge@ucl.ac.uk

Introduction

Drinkstone post mill, one of two surviving mills on the site (NGR TL 964622; Fig 1) has a timber-framed and weatherboarded buck of three floors. Dating of these structures is difficult on stylistic grounds alone, and being subject to great stresses during their working life, many mills of this type have undergone a number of major and minor rebuilds. A timber carved 'SS 1689' suggested a seventeenth-century origin for the present structure, which if substantiated, would make this one of the oldest surviving mills in the county. The dendrochronological work was requested by English Heritage as part of a wider study to reconsider its listed grading and to inform an application for grant-aided repairs. The timber-framed buck has clearly been extended to the front and rear at some stage, and dendrochronological sampling was requested to try and date the main post, the older timber-frame and extensions, and the quarter bars and crosstrees, all of which could potentially be of different ages.

Methodology

The site was visited during December AD 2000, and again in January AD 2001. The timbers were assessed for their potential use in dendrochronological study. Oak timbers with more than 50 rings, traces of sapwood, and accessibility were the main considerations in the initial assessment. Those timbers judged to be potentially useful were cored using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis. The second visit enabled re-used timbers, dismissed on the first visit because of their obvious re-use, to be sampled once the results of the first sampling exercise were known, as it was felt that they might add to the story of development of the mill.

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. 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 a PC. The software used in measuring and subsequent analysis was written by Ian Tyers (1999a).

Ring sequences were plotted 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 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 'working' site mean sequence. Other samples may then be incorporated after comparison with this 'working' master until a final site sequence is established, 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

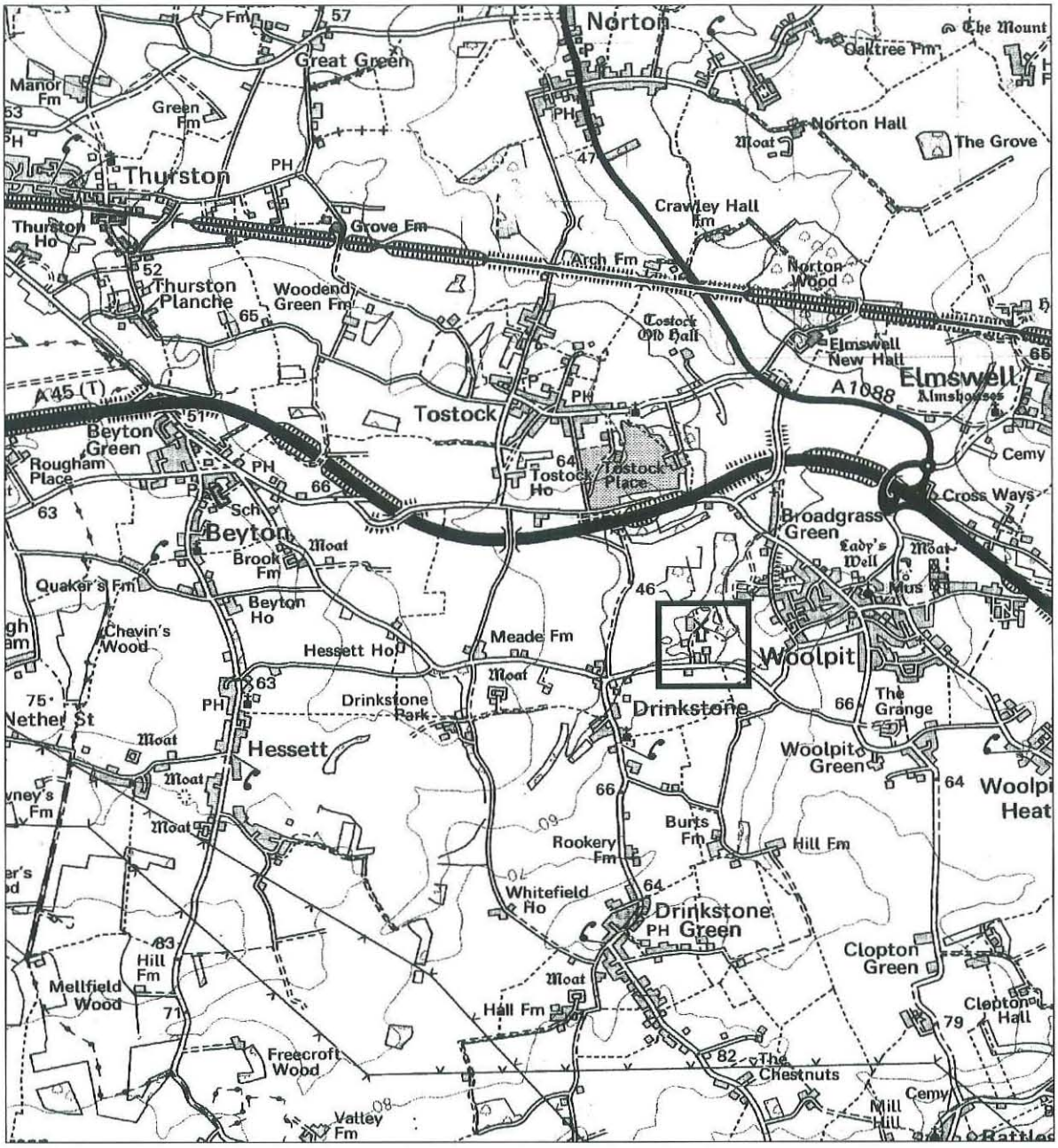

Figure 1: Map to show the general location of the Post Mill at Drinkstone, Suffolk

Table 1: Oak (*Quercus* spp.) timbers sampled from the Post Mill, Drinkstone, Suffolk. h/s = heartwood-sapwood boundary

Sample number	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
DRS01	South-west cross-tree	52	2.27	-	unknown	undated
DRS02	South-east cross-tree	52	2.53	h/s	unknown	undated
DRS03	North-east cross-tree	67	2086	-	unknown	undated
DRS04	South-east quarter bar	90	1.93	9	unknown	undated
DRS05	North-east quarter bar	82	2.43	16 complete	unknown	undated
DRS06	Main post	?	unmeasured	unknown	unknown	undated
DRS07	Main post	123	2.11	21 complete	1464-1586	Winter 1586/7
DRS08	North-west quarter bar	50	2.86	4	unknown	undated
DRS09	South-west quarter bar	50	2.97	-	unknown	undated
DRS10	Upper floor, right mid vertical post	77	2.07	-	unknown	undated
DRS11	Upper floor, right top rail	<50	unmeasured	-	unknown	undated
DRS12	Upper floor, left mid vertical post	<50	unmeasured	-	unknown	undated
DRS13	Upper floor, left top rail	<50	unmeasured	-	unknown	undated
DRS14	Wind shaft	89	2.89	-	unknown	undated
DRS15	Central cross beam	101	2.49	20 complete	unknown	undated
DRS16	Lower floor, right mid vertical post	80	1.19	-	unknown	undated

Table 1 continued:

Sample number	Origin of core	Total no of years	Average growth rate (mm yr^{-1})	Sapwood details	Date of sequence AD	Felling date of timber AD
DRS17	Right bottom rail	<50	unmeasured	-	unknown	undated
DRS18	Rear rail	<50	unmeasured	-	unknown	undated
DRS19	Left front post	86	1.81	-	unknown	undated
DRS20	Right front post	56	2.02	h/s	unknown	undated
DRS21	Right jowelled front post	68	1.99	10	1476 - 1543	1543 - 74
DRS22	Right front corner post	57	2.29	-	unknown	undated
DRS23	Left jowelled front post	76	1.88	9	1466 - 1541	1541 - 73
DRS24	Front bottom rail (*Ulmus* sp.)	?	unmeasured	-	unknown	undated

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 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

All the timbers sampled were oak (*Quercus* spp.), except core DRS24, which was of elm (*Ulmus* spp.). Details of the samples and their origins within the building are given in Table 1, and illustrated, where practicable, in Figures 2 - 4.

Crossmatching within all the individual samples resulted in some timbers being combined into new series as follows:

DRS10 *v* DRS16 $t = 9.2$ (42 years overlap) combined to give DRS1016m (114 years)

DRS5 *v* DRS15 $t = 11.7$ (82 years overlap) combined to give DRS0515m (101 years)

The crossmatching between samples DRS07, DRS21, and DRS23 is given in Table 2.

Each of these new series, along with the remaining individual series, was compared with the databank of dated reference material, but only that for DRS07, 21, and 23 (subsequently called DRINKSTONE) gave consistent acceptable matches (Table 3). The data for this site chronology are presented in Table 4.

Table 2: Crossmatching between the dated timbers in the site chronology DRINKSTONE

	t-value	
Sample	**DRS21**	**DRS23**
DRS07	5.8	3.6
DRS21		7.4

The relative crossmatching positions and felling date estimates for the components of the site chronology are illustrated in Figure 5.

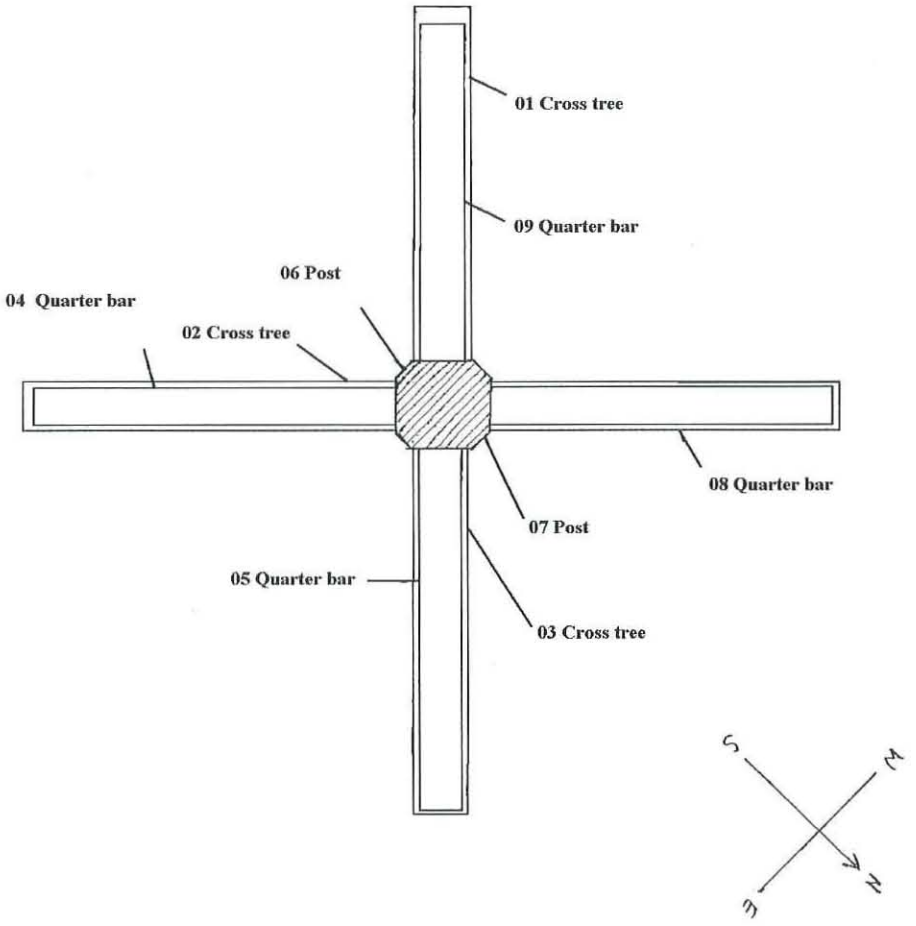

Figure 2: Plan of the lower section of the mill showing the positions of samples taken for dendrochronology. Adapted from a field sketch by Richard Bond (English Heritage)

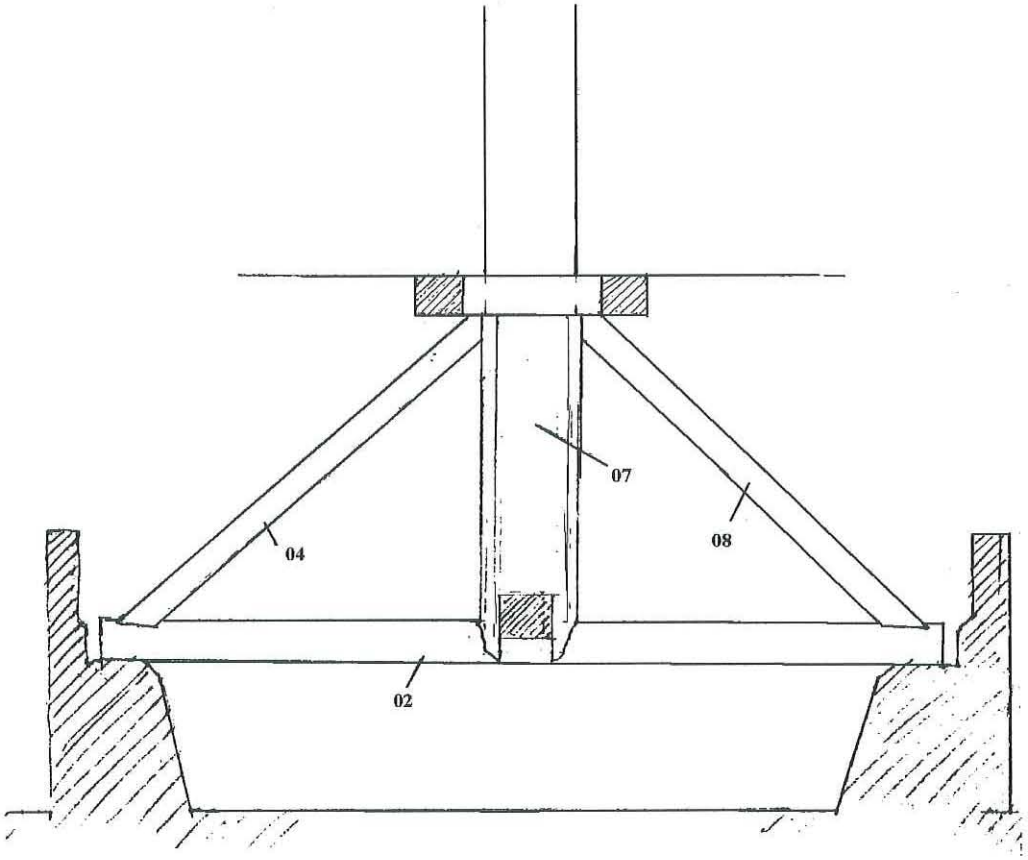

Figure 3: Cross section looking towards the south-west of the lower part of Drinkstone Mill showing the positions of samples taken for dendrochronology. Adapted from a field sketch by Richard Bond (English Heritage)

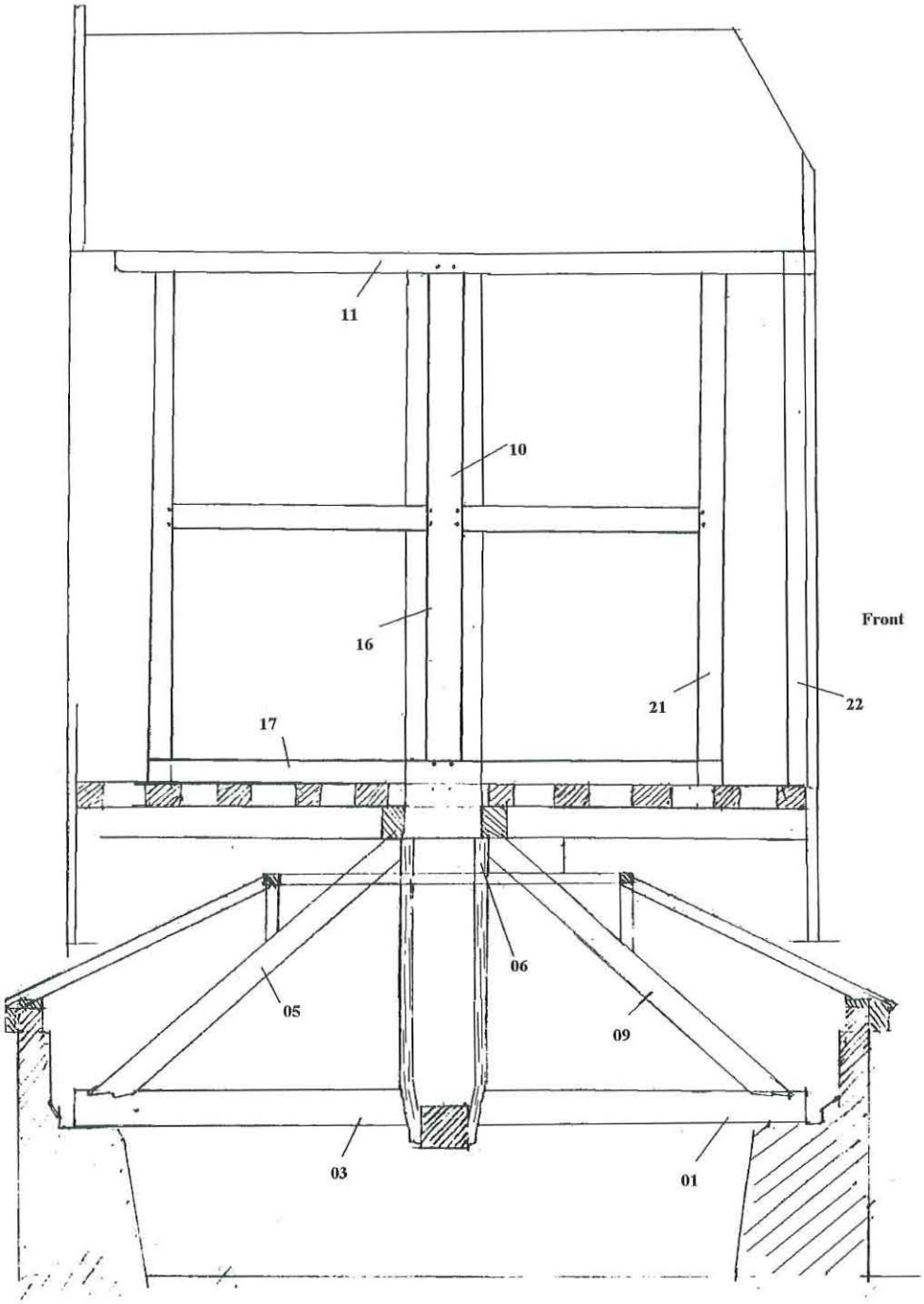

Figure 4: Cross section looking towards the south-east of Drinkstone Mill showing the locations of samples taken for dendrochronology. Adapted from a field sketch by Richard Bond (English Heritage)

Table 3: Dating of the oak site chronology DRINKSTONE

	DRINKSTONE AD 1464 - 1586	
Dated reference or site master chronology	*t*-value	Overlap (yrs)
Anglia00 (Bridge unpubl)	6.9	123
Hants97 (Miles pers comm)	5.9	123
London1175 (Tyers pers comm)	5.5	123
Kent88 (Laxton and Litton 1989)	5.3	123
Gosfield, Essex (Bridge 1998)	6.3	74
Little Wymondley2, Hertfordshire (Bridge 2001)	5.9	77
Marriots, Norfolk (Tyers 1999b)	5.8	120
Hill Hall, Essex (Bridge 1999)	5.6	101

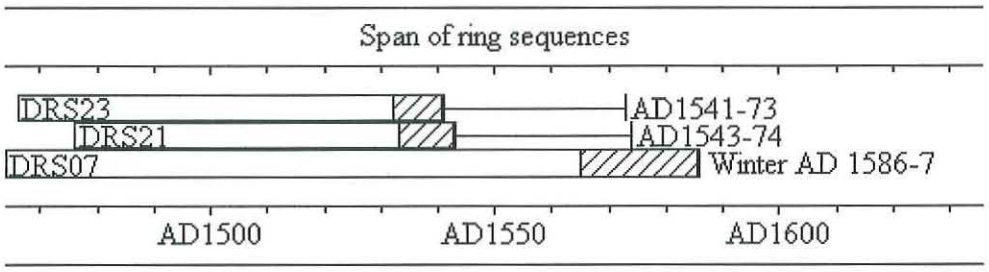

Figure 5: Bar chart showing the relative positions of overlap and likely felling dates of the timbers in the dated site mean DRINKSTONE

Interpretation and Discussion

The tree felled to form the main post on which the mill rotates was felled in the winter of AD 1586-7, far earlier than anyone had expected prior to this study. It seems very unlikely that the timber had seen any previous use, it being an exceptionally large timber with no visible mortices or other features not matching its present role. Prior to this the mill was thought to date to the mid-seventeenth century, which would make it a rare survival of a mill of this age, most such mills having been extensively re-built in the nineteenth and early twentieth centuries. The two jowelled posts which dated were clearly re-used in their present position. Their most likely felling dates suggest that they may have come from an earlier building than the date of the main post, possibly something on the same site.

The majority of timbers, sampled from what is thought to be a much later rebuilding of the mill, failed to date. This was disappointing given that some of the combined series were quite long. The fast-grown oak, often exhibiting bands of somewhat narrower rings within the series, seems typical of this county, and the lack of internal crossmatching of the timbers is not uncommon.

Acknowledgements

I am grateful to the owners of the mill, Mr and Mrs Heywood, for allowing access to the property and their hospitality on my visits. Contractors working elsewhere on the property allowed me the use of their generator on my first visit. I would like to thank Mark Barnard (Suffolk County Council) and Richard Bond (English Heritage) for discussion on site, and Richard for supplying the drawings used in this report. Cathy Groves (Sheffield University) kindly took an independent look at the data for me to see whether she thought any further statistical matches for undated cores worthy of greater consideration. This work was funded by English Heritage.

References

Baillie, M G L, and Pilcher, J R, 1973 A simple cross-dating program for tree-ring research, *Tree Ring Bulletin,* **33**, 7-14

Bridge, M C, 1998 *Tree-ring analysis of timbers from Gosfield Hall, Essex,* Anc Mon Lab Rep, **19/98**

Bridge, M C, 1999 *Tree-ring analysis of timbers from Hill Hall, Theydon Mount, Essex*, Anc Mon Lab Rep, **55/1999**

Bridge, M C, 2001 *Tree-ring analysis of timbers from Priory Barn, Little Wymondley, Hertfordshire,* Centre for Archaeol Rep, **18/2001**

Hollstein, E, 1965 Jahrringchronologische von Eichenholzern ohne Walkande, *Bonner Jahrb,* **165,** 12-27

Laxton, R R, and Litton, C D, 1989 Construction of a Kent master chronological sequence for oak, 1158 - 1540 AD, *Medieval Archaeol,* **33**, 90-8

Miles, D, 1997 The interpretation, presentation, and use of tree-ring dates, *Vernacular Architect,* **28,** 40-56

Munro, M A R, 1984 An improved algorithm for crossdating tree-ring series, *Tree Ring Bulletin,* **44**, 17-27

Salzman, L F, 1952 *Building in England down to 1540,* Oxford

Tyers, I, 1999a *Dendro for Windows Program Guide 2nd edn*, ARCUS Rep, **500**

Tyers, I, 1999b *Tree-ring analysis of timbers from Marriot's Warehouse, King's Lynn, Norfolk,* Anc Mon Lab Rep, **11/99**

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

Year	ring widths (0.01mm)										no of trees									
AD1464				348	302	498	364	341	311	361				1	1	2	2	2	2	2
	316	328	338	324	396	203	169	215	304	284	2	2	2	2	2	3	3	3	3	3
	308	279	306	241	154	197	256	154	203	157	3	3	3	3	3	3	3	3	3	3
	103	122	88	118	165	200	130	122	130	135	3	3	3	3	3	3	3	3	3	3
AD1501	164	232	190	194	177	217	123	139	204	206	3	3	3	3	3	3	3	3	3	3
	219	241	176	216	195	232	136	201	163	156	3	3	3	3	3	3	3	3	3	3
	142	217	185	259	150	171	167	176	139	176	3	3	3	3	3	3	3	3	3	3
	211	172	187	207	210	204	187	153	207	227	3	3	3	3	3	3	3	3	3	3
	236	164	182	165	165	113	157	164	275	143	3	2	2	1	1	1	1	1	1	1
AD1551	164	267	269	272	212	319	199	192	185	223	1	1	1	1	1	1	1	1	1	1
	167	267	166	157	159	156	158	148	177	157	1	1	1	1	1	1	1	1	1	1
	159	139	184	152	147	135	134	138	143	182	1	1	1	1	1	1	1	1	1	1
	101	108	159	220	187	150					1	1	1	1	1	1				