Centre for Archaeology Report 94/2003

Tree-Ring Analysis of Timbers from Freston Tower, Freston Park, Ipswich, Suffolk

Dr Martin Bridge

ISSN 1473-9224

The Centre for Archaeology Report 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 cover for details).

Centre for Archaeology Report 94/2003

Tree-Ring Analysis of Timbers from Freston Tower, Freston Park, Ipswich, Suffolk

Dr Martin Bridge

Summary

This rare six-storey brick tower was thought to have been built around AD 1550 and displays a mixture of classical pediments and medieval angle turrets, coupled with an odd brick parapet balustrade. The ceilings of the lower floors have oak joists running east-west and laid flat, whilst those in the fifth-floor run north-south and are laid on-edge. The fifth-floor joists could not be dated. Joists from the lower ceilings were constructed from trees cut in winter AD 1578/9 or spring AD 1579 suggesting a construction date for the tower of AD 1579 or very soon thereafter. The tower thus provides a late example of the use of flat-laid joists.

Keywords

Dendrochronology
Standing Building

Author's address

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

Introduction

Freston Tower (NGR TM 178 397; Fig 1) is a grade II* listed building recently acquired by the Landmark Trust, who are carrying out a programme of repairs. It is a six-storey brick building, thought to have been built as a look-out tower, its commanding view of the Orwell estuary being a useful vantage point for a merchant of the nearby (3-4 km) port of Ipswich. It has traditionally been thought to have been built for the Latymer family, or the subsequent landowner, Thomas Gooding, during the AD 1550s or early 1560s. Pevsner and Radcliffe (1974) quote a visitation book of AD 1561 which contains a note thought to refer to the tower as 'being built within twelve years' and a second reference that it was built twenty years after the death of Cardinal Wolsey (AD 1530). A recent report prepared by Wilson Compton Associates (2003) discusses the problems of dating in some detail, and also draws parallels with the Clifton Tower at King's Lynn in Norfolk. One feature recognised in that report is that the floor joists in the lower floors have been laid flat, a technique thought to have gone out of use by the AD 1570s, and superseded by the on-edge style employed on the fifth floor, which is therefore thought to be a later replacement floor.

Dendrochronological dating was requested by Trudi Hughes (English Heritage) in order to provide a more precise construction date, date the floor changes on the fifth floor, and inform the current repair programme.

Methodology

The site was visited in August AD 2003. 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 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 utilising a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC. This sometimes includes samples with less than 50, but more than 40 rings, which may crossmatch with other, longer series from the same site. The software used in measuring and subsequent analysis was written by Ian Tyers (1999).

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.

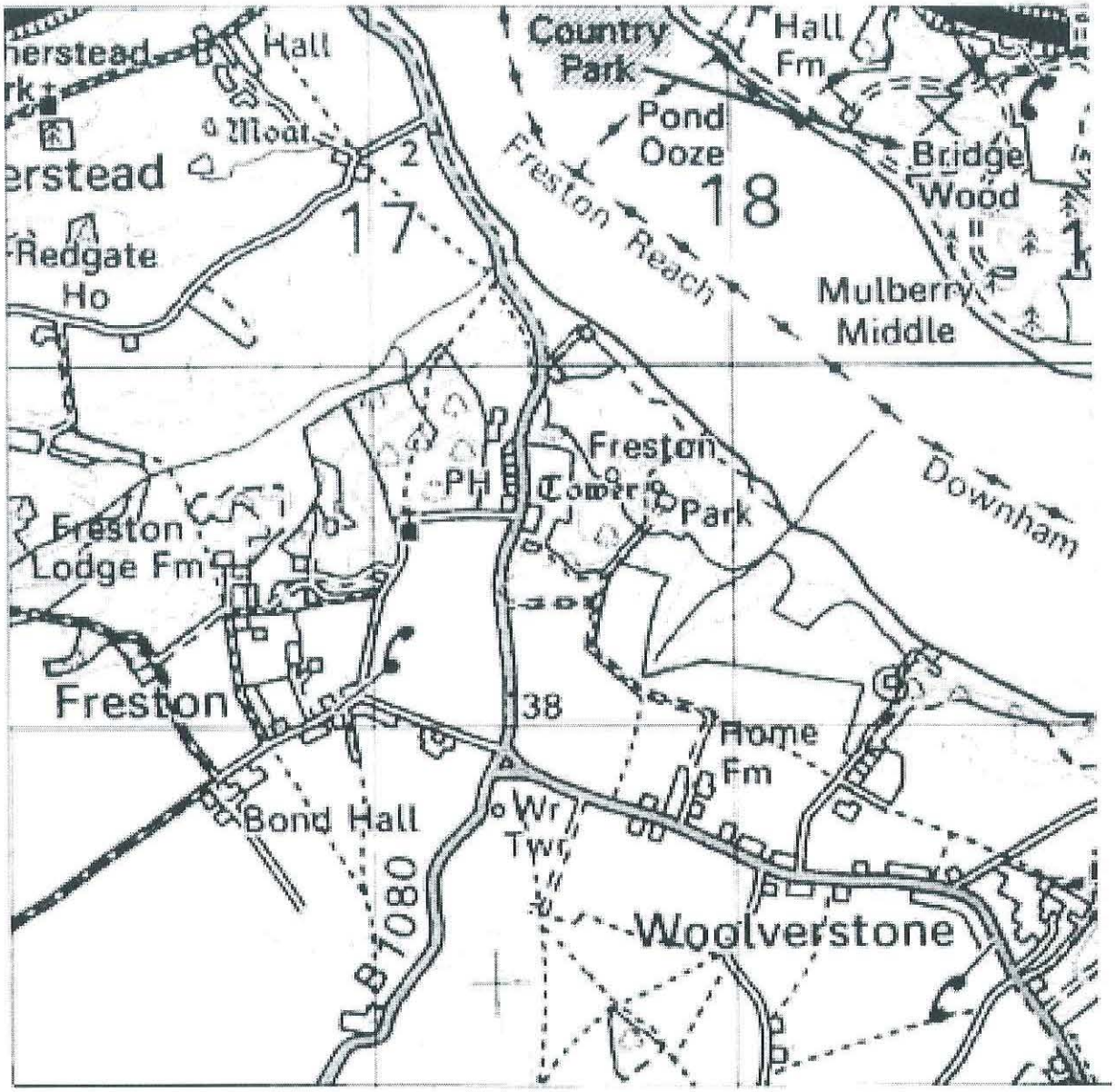

Figure 1: Map showing the general location of Freston Tower, beside the River Orwell,

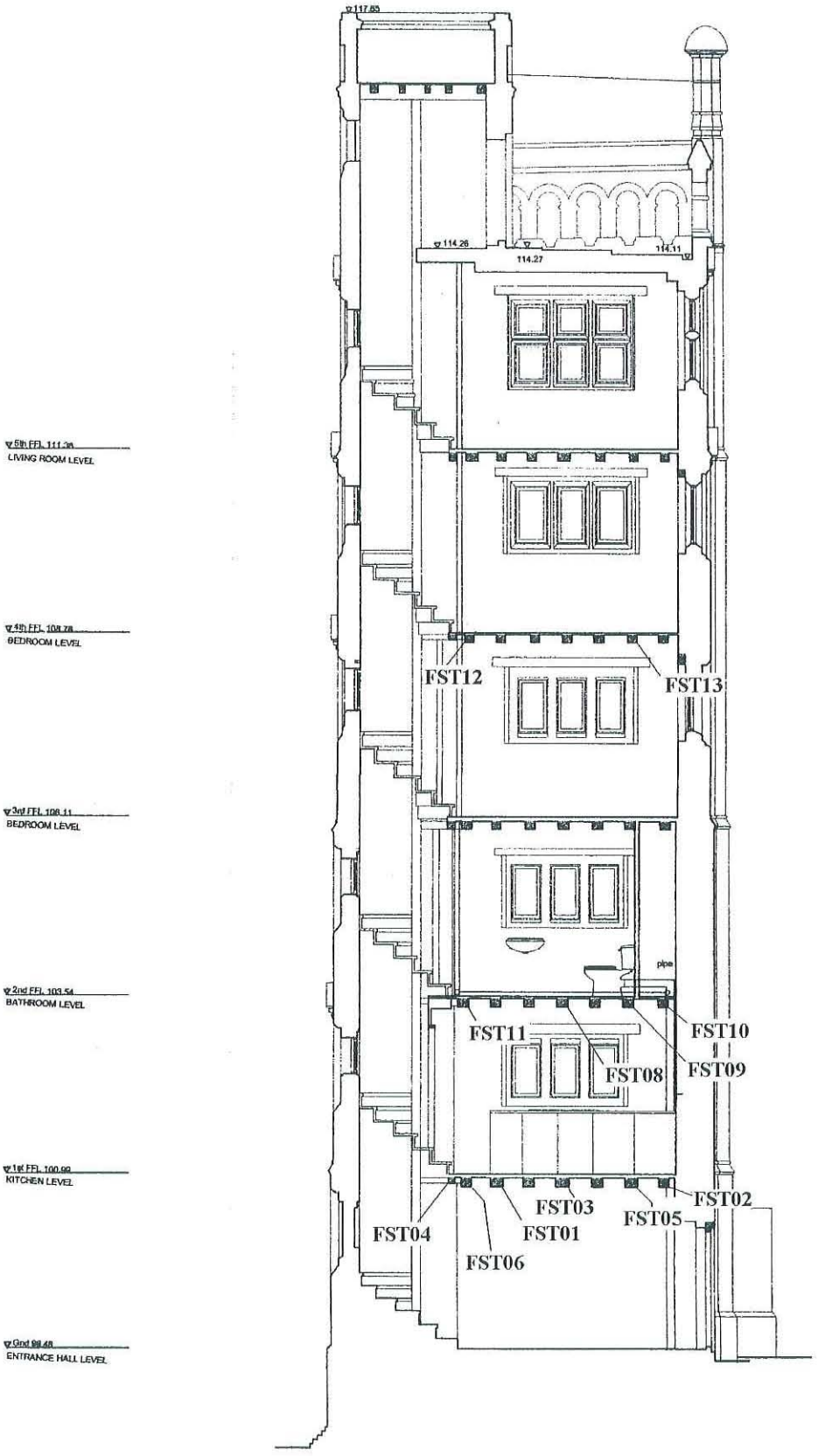

Figure 2: Cross section through the tower, looking south-east, showing the locations of a number of timbers sampled for dendrochronology, adapted from an original drawing by Richard Griffiths Architects

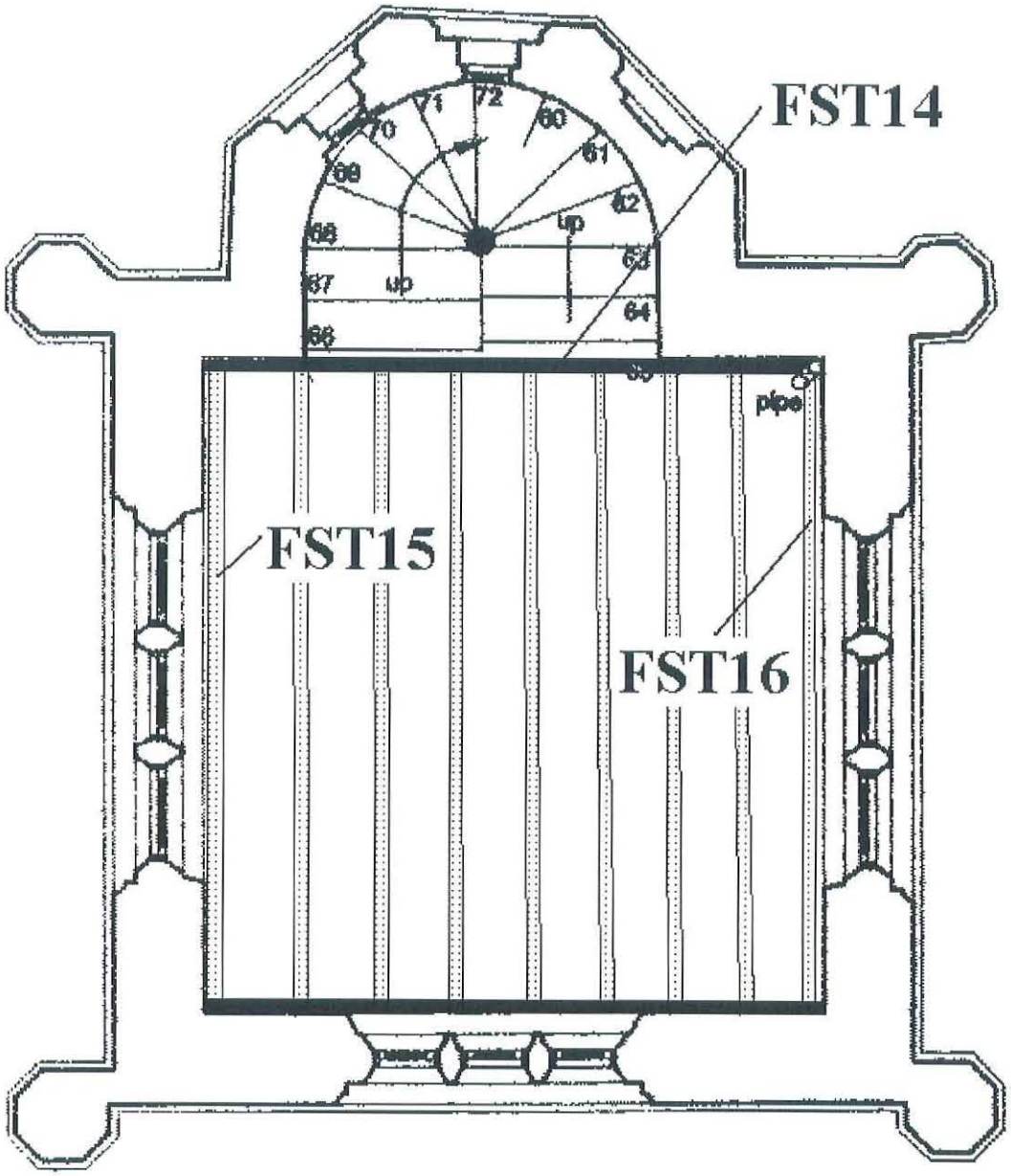

Figure 3: Floor plan of the fifth floor, showing ceiling joists sampled for dendrochronology, adapted from an original drawing by Richard Griffiths Architects

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 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 of oak (*Quercus* spp.). Many of the floorboards were covered during the repair work being undertaken and could not be seen, but those on the first-floor were of elm (*Ulmus* spp.) and were not further investigated. Most of the visible treads to the stairs were of oak and looked to contain many rings, but these were not sampled as this would have necessitated their removal, which went beyond the brief for this work, and few traces of sapwood were visible. Many of the risers were of elm.

Following a telephone discussion with Peter Marshall (English Heritage) from the site, sampling was carried out at ground floor, first-floor, third-floor, and fifth floor, and included joists, a support beam to the stairs, and a window lintel. Details of the samples are given in Table 1 and their positions illustrated (except for the window lintel FST07) in Figures 2 and 3. The only joists considered to contain sufficient rings for dating amongst those at fifth-floor level were those at either side, that on the east side retaining complete sapwood. Their close proximity to the wall however, meant that they could not be sampled in the most favourable direction to obtain the most rings in the sequence.

Many of the ring sequences are quite short (Table 1) but crossmatching between the samples was adequate (Table 2). A working site mean containing the best matching samples was first constructed, with other samples being subsequently matched against this working master. The final site master chronology, FRESTON, included eleven samples from three floors, and covered the period AD 1458 – 1578 (Table 3). Four timbers retained complete sapwood (Fig 4). The data for the site chronology are given in Table 4.

Table 1: Oak (*Quercus* spp.) timbers sampled from Freston Tower, Freston Park, Ipswich, Suffolk, h/s represents the heartwood-sapwood boundary, figures in brackets represent additional unmeasured rings, C represents complete sapwood, and ¼C records the presence of spring vessels after the last complete ring.

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
FST01	Ground floor ceiling, joist 2	93	1.26	30C	1486 - 1578	Winter 1578/9
FST02	Ground floor ceiling, joist 7	57	1.53	7	1503 – 59	1579-93
FST03	Ground floor ceiling, joist 4	52	2.37	-	1470 - 1521	after 1530
FST04	Ground floor stair support	58	1.62	7 ¼C	1521 - 78	Spring 1579
FST05	Ground floor ceiling, joist 6	75	2.16	-	1458 - 1532	after 1541
FST06	Ground floor ceiling, joist 1	68	2.26	h/s	1477 - 1544	1553 – 85
FST07	Ground floor, west window lintel	57	3.01	14C	undated	unknown
FST08	First-floor ceiling, joist 4	91	1.71	30 ¼C	1488 - 1578	Spring 1579
FST09	First-floor ceiling, joist 6	96	1.45	26 ¼C	1483 - 1578	Spring 1579
FST10	First-floor ceiling, joist 7	63	1.19	27	1515 - 77	1577 – 91
FST11	First-floor ceiling, joist 1	47	1.99	-	1504 - 50	after 1559
FST12	Third-floor ceiling, joist 6	<45	unmeasured	-	undated	unknown
FST13	Third-floor ceiling, joist 1	51	1.95	h/s (+21)	1500 - 50	1571 – 91
FST14	Fifth-floor ceiling, north beam	69	1.48	-	undated	unknown
FST15	Fifth-floor ceiling, joist 9	26	unmeasured	-	undated	unknown
FST16	Fifth-floor ceiling, joist 1	45	1.44	5	undated	unknown

Table 2: Crossmatching between the individual dated elements from Freston Tower. A (–) represents a *t*-value of less than 3.0, and (\) shows a case where there is insufficient overlap to calculate a *t*-value

	t - values									
Sample no	**FST02**	**FST03**	**FST04**	**FST05**	**FST06**	**FST08**	**FST09**	**FST10**	**FST11**	**FST13**
FST01	3.1	-	6.1	4.9	4.9	6.2	4.7	5.5	6.2	3.1
FST02		3.2	4.7	3.4	4.8	3.1	-	3.6	4.0	5.5
FST03			\	6.0	3.7	4.3	-	\	-	-
FST04				\	5.3	4.9	3.2	5.2	6.1	5.2
FST05					5.6	4.7	3.6	4.7	-	-
FST06						5.6	-	4.6	4.0	5.4
FST08							6.1	5.7	5.6	3.8
FST09								3.9	3.8	-
FST10									8.0	7.0
FST11										5.2

Table 3: Dating of the oak site chronology FRESTON

		FRESTON AD 1458 - 1578	
Dated reference or site master chronology	**Dates spanned (AD)**	***t*-value**	**Overlap (yrs)**
Anglia01 (Bridge unpubl)	944-1789	6.5	121
Salop95 (Miles pers comm)	881-1745	6.1	121
East Midlands (Laxton and Litton 1988)	882-1981	5.8	121
London (Tyers pers comm)	413-1728	5.7	121
Hants02 (Miles pers comm)	443-1972	5.6	121
Drinkstone, Suffolk (Bridge 2001a)	1464-1586	8.8	115
Otley Hall, Suffolk (Tyers 2000)	1380-1555	6.8	98
Elland Old Hall, Yorkshire (Hillam 1983)	1372-1574	6.6	117
Cobham Hall, Kent (Arnold *et al* 2003)	1317-1662	6.2	121
Hill Hall, Essex (Bridge 1999)	1425-1564	6.0	107
Boarstl2, Buckinghamshire (Miles and Worthington 1999)	1450-1614	5.6	121
Abcott Manor, Shropshire (Miles pers comm)	1422-1545	5.6	88
South Petherton, Somerset (Miles pers comm)	1447-1584	5.6	121
Little Wymondley, Hertfordshire (Bridge 2001b)	1450-1550	5.5	93
Chiddingly, Sussex (Arnold and Litton 2003)	1324-1576	5.5	119
Nuffield, Oxfordshire (Haddon-Reece *et al* 1989)	1404-1627	5.5	121
Bruce Castle, London (Bridge 1998)	1434-1542	5.4	85
Medmenham, Buckinghamshire (Miles pers comm)	1430-1564	5.4	107
Exton, Hampshire (Miles and Haddon-Reece 1995)	1376-1546	5.3	89
Odda's Chapel, Gloucestershire (Bridge 2001c)	1352-1593	5.0	121

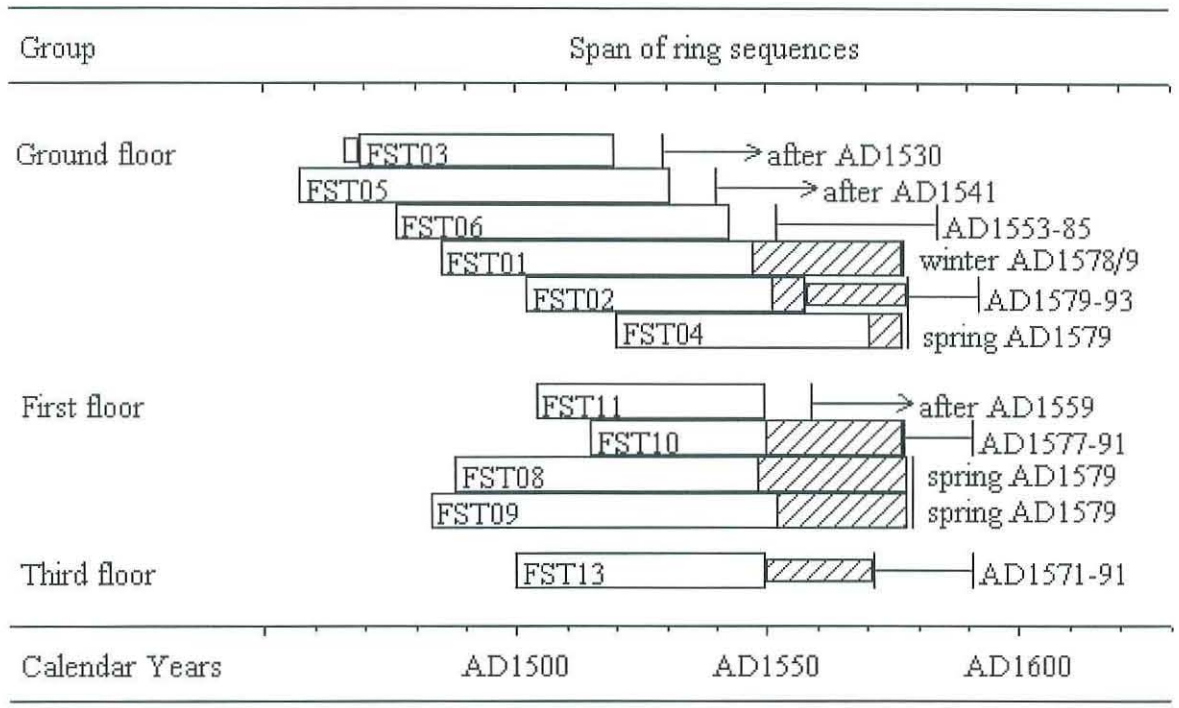

Figure 4: Bar diagram showing the relative positions of overlap of the dated timbers from Freston Tower along with their interpreted felling dates. Narrow bars represent additional unmeasured rings and hatching represents sapwood rings

Interpretation and Discussion

Timbers used in the ground, first-, and third-floor ceilings all appear to have come from trees felled during winter AD 1578/9 or spring AD 1579. The window lintel at ground floor level could not be dated.

Assuming that the lower floors were part of the original structure of the building, and it is difficult to come up with reasons why they should not be, then these results suggest a date of construction some 20 – 30 years later than most had previously thought. This not only gives important information about this particular rare building, but also provides an important marker for various styles used in the region. For example, flat joists are generally considered to have gone out of fashion about a decade earlier, and the pediments used in the brickwork are fairly early examples for the region. This result rules out construction of the tower by the Latymer family.

The site master gives good matching against chronologies from a wide geographical area, but the strongest matches are found with sites within 30km of Freston. Interestingly the site master matches well against panelling from Otley Hall, Suffolk (Tyers 2000), but not against a chronology from the structure of that hall (Bridge 2001d). Neither does it match well against contemporaneous timbers from buildings in the port of Ipswich (Bridge 2002), just a few kilometres away, though they themselves appeared to be local in origin, and did match structural timbers at Otley.

Another feature of interest is the low number of sapwood rings encountered on sample FST04 – which retained complete sapwood, but only had 7 complete sapwood rings. This is the lowest number encountered by the author, and lies outside the range covering 95% of oaks in the region.

The joists at fifth-floor ceiling level are laid on-edge and run perpendicular to those on lower floors. They rest at their southern end on a re-used timber. Most of these were not suitable for dating, having too few rings. Those joists directly adjacent to the walls had more rings than the others and were sampled, although the desired angle for sampling could not be obtained because of the proximity of the walls. Neither of these sequences dated, but the timbers remain of interest, that on the east side retaining complete sapwood. Should these timbers ever be removed they would be worth investigating further, as would the treads from the stairs.

Acknowledgements

This work was commissioned by English Heritage, and we would like to thank Alex Bayliss and Peter Marshall for their work in support of our activities. The site manager, Henry Mann, and his colleagues from Reeds of Aldburgh were most helpful in allowing us to work around them on-site. I would like to thank Lynne Jones, University College London, for her assistance in carrying equipment, note taking, and encouragement. Cathy Groves (University of Sheffield) made valuable comments on an earlier draft of this report.

References

Arnold, A J, Howard, R E, Laxton, R R, and Litton, C D, 2003 Tree-ring analysis of timbers from Cobham Hall, Cobham, Kent, Centre for Archaeol Rep, **50/2003**

Arnold, A J, and Litton, C D, 2003 Tree-ring analysis of timbers from Chiddingly Place, Chiddingly, East Sussex, Centre for Archaeol Rep, **14/2003**

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 the Basement, Bruce Castle, Tottenham, London,* Anc Mon Lab Rep, **21/98**

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

Bridge, M C, 2001a *Tree-ring analysis of timbers from the Post Mill, Drinkstone, Suffolk*, Centre for Archaeol Rep, **60/2001**

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

Bridge, M C, 2001c *Tree-ring analysis of timbers from Odda's Chapel, Deerhurst, Gloucestershire,* Centre for Archaeol Rep, **114/2001**

Bridge, M C, 2001d List 115 - Tree-ring dates, *Vernacular Architect*, **32**, 70-4

Bridge, M C, 2002 *Tree-ring analysis of further timbers from the Isaac Lord Complex, Ipswich, Suffolk*, Centre for Archaeol Rep, **76/2002**

Haddon-Reece, D, Miles, D H, and Munby, J T, 1989 List 32 - Tree-ring dates, *Vernacular Architect*, **20**, 46-9

Hillam, J, 1983 Tree-ring dates, *Vernacular Architect,* **15,** 69

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

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

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

Miles, D H, and Haddon-Reece, D, 1995 List 64 - Tree-ring dates, *Vernacular Architect*, **26**, 60-74

Miles, D H, and Worthington, M J, 1999 Tree-ring dates, *Vernacular Architect* **30**, 98-113

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

Pevsner, N and Radcliffe, E, 1974 *The Buildings of England: Suffolk,* London

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

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

Tyers, I, 2000 *Tree-ring analysis of panelling from Otley Hall, Otley, Suffolk*, ARCUS Rep, **550**

Wilson Compton Associates, 2003 *Freston Tower, Freston, Suffolk, historical appraisal and analysis,* unpubl

Table 4: Ring width data for the date site chronology from Freston Tower, AD 1458-1578

ring widths (0.01mm)										no of trees									
406	434	458	552	446	395	270	291	375	266	1	1	1	1	1	1	1	1	1	1
293	275	406	329	295	332	280	433	201	194	1	1	2	2	2	2	2	2	2	3
327	340	329	299	266	361	320	248	236	327	3	3	3	3	3	4	4	4	5	5
207	238	214	170	207	168	266	213	263	166	6	6	6	6	6	6	6	6	6	6
187	142	183	125	205	209	284	260	297	223	6	6	7	7	7	8	9	9	9	9
198	233	181	221	189	199	193	196	207	196	9	9	9	9	9	9	9	10	10	10
181	176	143	155	193	174	221	164	172	164	10	10	10	11	10	10	10	10	10	10
181	115	132	152	99	139	124	207	183	216	10	10	10	10	10	9	9	9	9	9
197	213	224	204	123	123	115	164	105	112	9	9	9	9	9	9	9	8	8	8
149	151	107	131	111	135	105	87	89	71	8	8	8	6	6	6	6	6	6	6
73	82	75	62	66	54	48	48	45	36	6	6	5	5	5	5	5	5	5	5
39	44	51	69	84	99	100	87	79	69	5	5	5	5	5	5	5	5	5	5
81										4									