

# ALL SAINTS' CHURCH, KINGTON MAGNA, DORSET

## TREE-RING ANALYSIS OF TIMBERS FROM THE BELFRY FLOOR

SCIENTIFIC DATING REPORT

Dr Martin Bridge



# ALL SAINTS' CHURCH, KINGTON MAGNA, DORSET

## TREE-RING ANALYSIS OF TIMBERS FROM THE BELFRY FLOOR

Dr Martin Bridge

NGR ST 768 231

© English Heritage

ISSN 1749-8775

*The Research Department Report Series incorporates reports from all the specialist teams within the English Heritage Research Department: Archaeological Science; Archaeological Archives; Historic Interiors Research and Conservation; Archaeological Projects; Aerial Survey and Investigation; Archaeological Survey and Investigation; Architectural Investigation; Imaging, Graphics and Survey; and the Survey of London. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, and the Architectural Investigation Report Series.*

*Many of these are interim reports which make available the results of specialist investigations in advance of full publication. They are not usually subject to external refereeing, and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation. Where no final project report is available, readers are advised to consult the author before citing these reports in any publication. Opinions expressed in Research Department Reports are those of the author(s) and are not necessarily those of English Heritage.*

Requests for further hard copies, after the initial print run, can be made by emailing:

[Res.reports@english-heritage.org.uk](mailto:Res.reports@english-heritage.org.uk)

or by writing to English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD  
Please note that a charge will be made to cover printing and postage.

## SUMMARY

A total of eight samples was taken from timbers in the belfry floor. Four timbers dated, including the two major east-west foundation beams. Both these timbers, which may be reused in their current positions, dated to the late-fifteenth, or early sixteenth century. Only two subsidiary beams dated, and these may have come from a single parent tree felled in the mid- to late-fifteenth century. It is suggested that the present floor comprises old timbers reset into their current positions at some time after the late-fifteenth century.

## CONTRIBUTORS

Dr Martin Bridge

## ACKNOWLEDGEMENTS

This work was commissioned by Dr Jane Sidell of the Scientific Dating Service, English Heritage. My thanks to William Dowling, churchwarden, who facilitated my access. I thank Cathy Tyers (Sheffield University) and Dr John Meadows (English Heritage) for useful comments on an earlier draft of this report.

## ARCHIVE LOCATION

Dorset Historic Environment Record  
Environmental Services  
Dorset County Council  
County Hall, Colliton Park  
Dorchester  
Dorset DT1 1XJ

## DATE OF INVESTIGATION

2008

## CONTACT DETAILS

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

## CONTENTS

|   |   |
|---|---|
| Introduction .....  | 1 |
| Methodology .....   | 1 |
| Figure 1: Map showing the location of All Saints' Church, Kington Magna, Dorset.....  | 2 |
| Results and Discussion .....  | 3 |
| Table 1: Details of oak ( <i>Quercus</i> spp.) timbers sampled from the belfry floor, All Saints' Church, Kington Magna, Dorset ..... | 3 |
| Figure 2: Plan of the belfry floor, showing the timbers sampled.....  | 4 |
| Table 2: Cross-matching between the dated elements from the belfry floor.....   | 4 |
| Table 3a: Dating evidence for the site series KNGTNMAG, AD 1367–1472.....   | 5 |
| Table 3b: Dating evidence for the site series ask02, AD 1418–1478 .....   | 6 |
| Figure 3: Bar chart showing the relative positions of overlap of the dated timbers along with their derived felling date ranges.....  | 6 |
| References .....  | 7 |
| Table 4: Ring width data for the site chronology KNGTNMAG AD 1367–1472, and ask02 AD 1418–78 .....                                    | 8 |

## INTRODUCTION

This grade II\*-listed parish church (NGR ST 768 231; Fig 1) has a late fifteenth-century tower, with much of the rest of the church being extensively rebuilt in the nineteenth century. Dating of the belfry floor was requested by the English Heritage Historic Buildings Inspector, Isla MacNeal, to inform ongoing repair work in the tower. The significance of the floor was a matter of some interest, as its removal was discussed. It is not clear whether the floor is all of one build, nor what its date of construction might be.

## METHODOLOGY

The site was visited in February 2008. In the initial assessment, accessible oak timbers with more than 50 rings and where possible traces of sapwood were sought, although slightly shorter sequences are sometimes sampled if little other material is available. Those building 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 0.01mm, 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, which recorded the ring widths into a dataset. The software used in measuring and subsequent analysis was written by Ian Tyers (2004). Cross-matching was accomplished by a combination of visual matching and a process of qualified statistical comparison by computer. The ring-width series were compared for statistical cross-matching, using a variant of the Belfast CROS program (Baillie and Pilcher 1973). Ring sequences were plotted to allow visual comparisons to be made between sequences on a light table. This method provides a measure of quality control in identifying any errors in the measurements when the samples cross-match.

In comparing one sequence or site sequence against another,  $t$ -values over 3.5 are considered significant, although in reality it is common to find  $t$ -values of 4 and 5 which are demonstrably spurious because more than one matching position is indicated. For this reason, it is necessary to obtain some  $t$ -values of 5, 6, and higher, and for these to be well replicated from different, independent chronologies and with local and regional chronologies well represented, unless the timber is imported. Where two individual sequences match with a  $t$ -value of 10 or above and visually exhibit exceptionally similar ring patterns, they most likely came from the same parent tree.

When cross-matching between samples is found, their ring-width sequences are averaged 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. This 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.

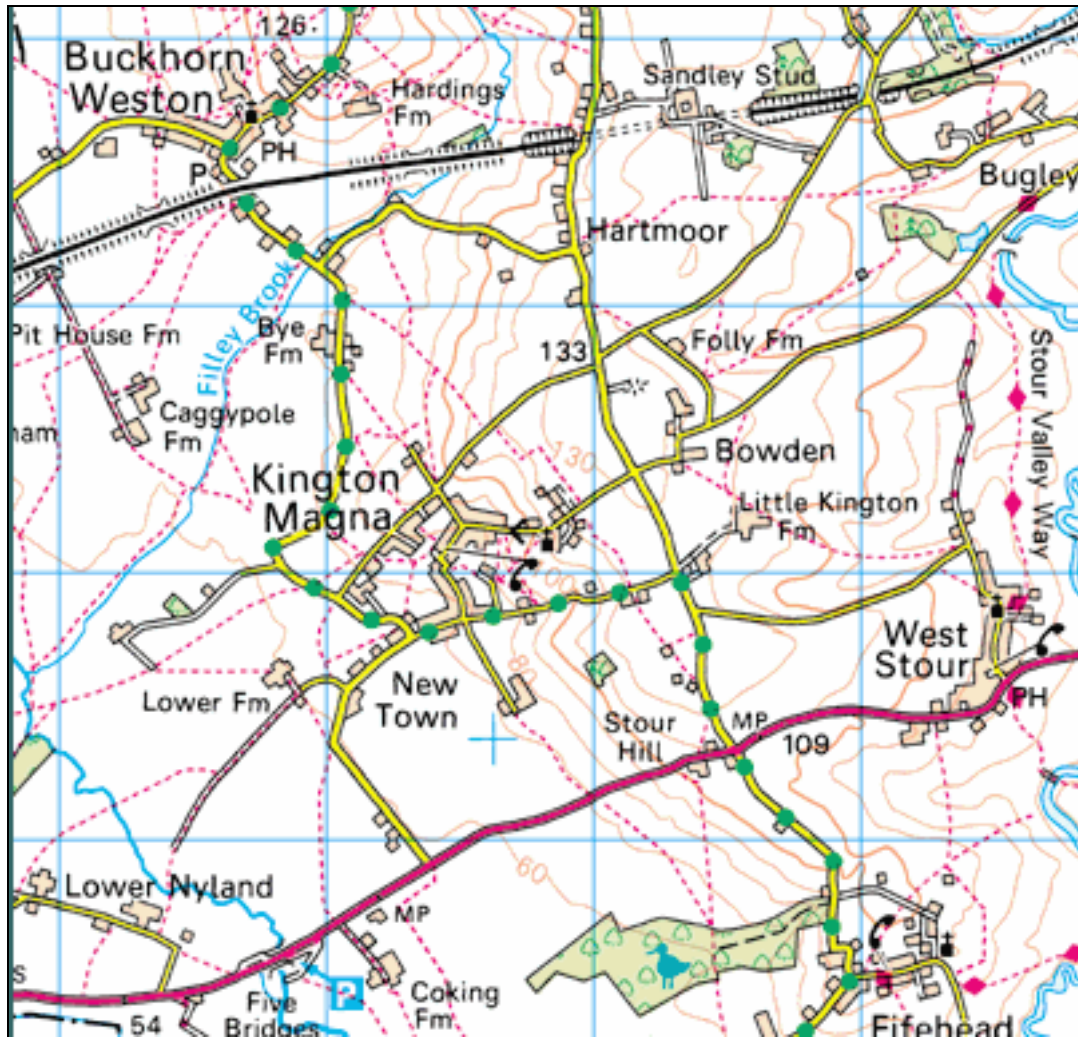


Figure 1: Map showing the location of All Saints' Church, Kington Magna, Dorset

© Crown Copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100024900

The dates thus obtained represent the time of formation of the measured rings in each sample. These dates require interpretation for the construction date of the phase under investigation to be determined. An important aspect of this interpretation is the estimate of the number of sapwood rings missing. The sapwood estimates used here are based on those proposed for this area by Miles (1997), in which 95% of oaks contain 9–41 rings. Where complete sapwood or bark is present, the exact date of tree felling 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 reuse of timbers, construction in most historical periods took place within a very few years after felling (Salzman 1952; Hollstein 1965).

## RESULTS AND DISCUSSION

Details of the samples taken, which were all oak (*Quercus* spp.), are given in Table 1, with their positions being indicated on Figure 2. Many of the timbers were assessed as having too few rings for dendrochronological study, including the south wall plate and the beam numbered 4 in Figure 2.

*Table 1: Details of oak (Quercus spp.) timbers sampled from the belfry floor, All Saints' Church, Kington Magna, Dorset*

| Sample number | Timber and position               | No of rings | Mean width (mm) | Mean sens (mm) | Spanning dates AD | H/S bdry AD | Sapwood complement | Likely felling date ranges (AD) |
|---------------|-----------------------------------|-------------|-----------------|----------------|-------------------|-------------|--------------------|---------------------------------|
| ask01         | Main east-west beam on south side | 77          | 2.00            | 0.20           | 1396–1472         | -           | -                  | after 1481                      |
| ask02         | Main east-west beam on north side | 61          | 2.20            | 0.28           | 1418–78           | 1478?       | ?h/s               | 1487–1519                       |
| ask03         | Diagonal beam                     | 66          | 2.22            | 0.14           | undated           | -           | ?h/s               | unknown                         |
| ask04         | Beam 6                            | 53          | 1.56            | 0.26           | undated           | -           | ?h/s               | unknown                         |
| ask05         | Beam 7 east                       | <45         | nm              | nm             | undated           | -           | h/s                | unknown                         |
| ask06         | Beam 8 west                       | 77          | 1.38            | 0.28           | 1367–1443         | 1443        | h/s                | 1452–84                         |
| ask07         | Beam 8 east                       | 46          | 1.31            | 0.26           | undated           | -           | h/s                | unknown                         |
| ask08         | Beam 9                            | 71          | 1.75            | 0.24           | 1379–1449         | 1449        | h/s                | 1458–90                         |

Key: h/s = heartwood/sapwood boundary; ?h/s = suspected heartwood/sapwood boundary; nm = not measured

Beams 3 and 5 (Fig 2) were identified as being of elm (*Ulmus* spp). The southern main east-west beam (ask01), coloured green in Fig 2, rested on a relatively new stone corbel and had sockets for joists spaced approximately 300mm apart. The northern main east-west beam (ask02) has a chamfer-stop at the east end, but not at the west end. These factors suggest that these two major beams could be reused in their current position.

Cross-matching was found between some of the timbers (Table 2), with the possibility that samples ask06 and ask08 may have come from the same parent tree. As some of these matches were relatively weak, and the overlaps were all relatively short, the four timbers shown in Table 2 were each dated independently against reference material as a way of confirming the internal matches found.

Although it is possible that samples 06 and 08 came from the same parent tree, they displayed heartwood/sapwood boundaries some six years apart, and there was no other evidence to link them. They were therefore kept as two separate trees when combined along with sample 01, with which they matched, to form a 106-year site chronology, KNGTNMAG. This chronology was dated to the period AD 1367–1472 by comparison with dated reference material, the best results being shown in Table 3a. Sample ask02 did not match well with the other timbers (Table 2), but did date individually, the best results being shown in Table 3b. The data for the site chronology and sample ask02 are given in Table 4. With only heartwood/ sapwood boundaries remaining on the timbers, no precise felling dates can be given for any of the timbers.

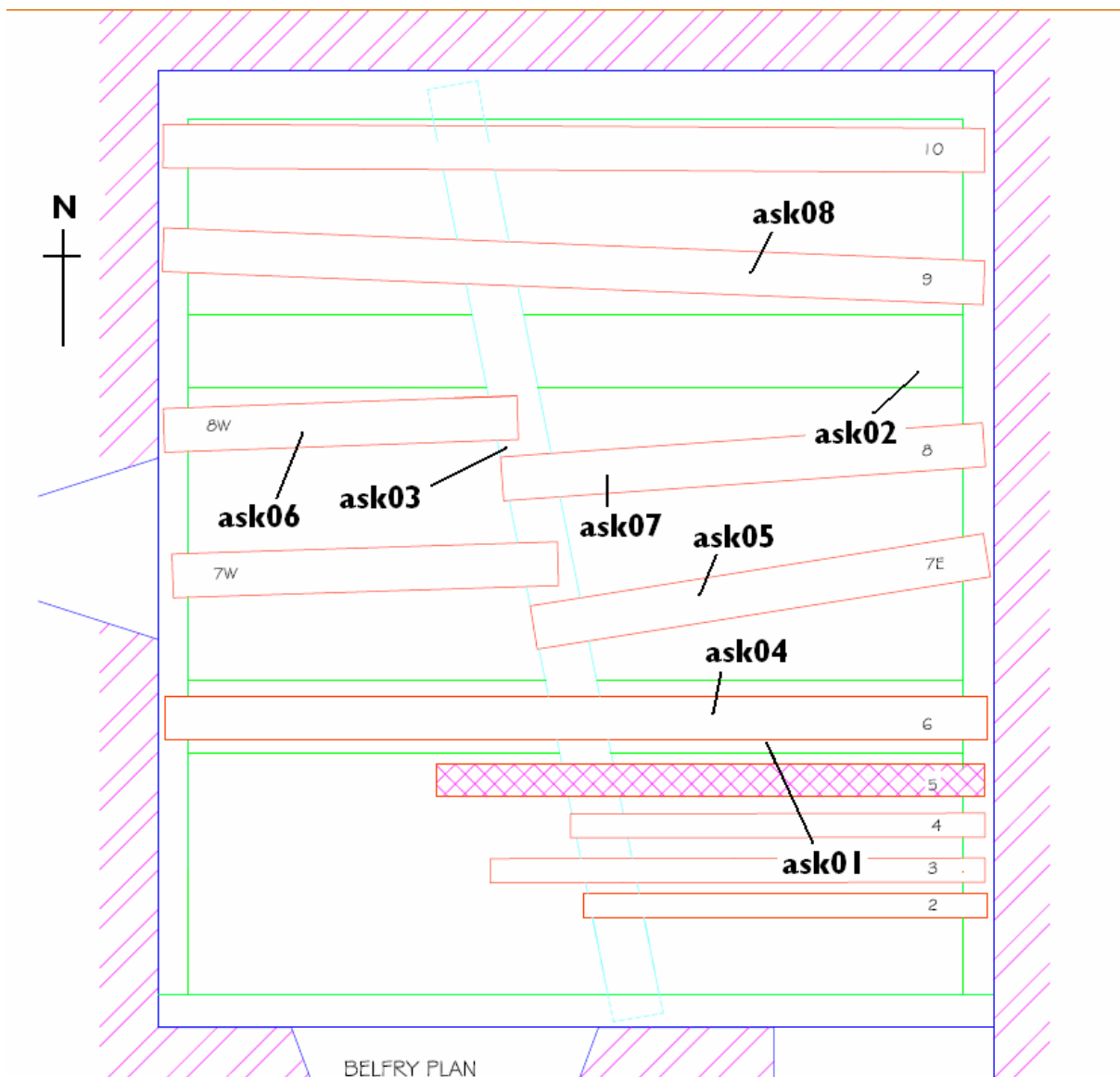


Figure 2: Plan of the belfry floor, showing the timbers sampled.

Adapted from an original drawing supplied by English Heritage

Other timbers showed potential cross-matches with the site chronology and with the reference material, but none of these were accepted because of the shortness of the overlaps and the relative weakness of the matches.

Table 2: Cross-matching between the dated elements from the belfry floor

Values over 3.5 are significant

| Sample No | t-values |       |       |
|-----------|----------|-------|-------|
|           | ask02    | ask06 | ask08 |
| ask01     | 2.8      | 4.5   | 4.7   |
| ask02     |          | 4.2   | 3.3   |
| ask06     |          |       | 10.1  |



Dendrochronology has been successful in showing that a number of the timbers in the belfry floor are of fifteenth- (or early sixteenth-) century origin. It would appear that the floor contains timbers representing at least two different felling phases. Evidence has already been presented that suggests that the two major east-west foundation beams may be reused in their current positions. Interestingly, the tree-ring series from these two major beams did not give significant cross-matches with each other. These were found to be of a later date than the only other two timbers dated, although the possibility remains that these came from a single tree. These two minor beams were most likely felled in the second half of the fifteenth century.

The mix of species used, the strange angles and spacing of the beams relative to each other, and the lack of reliable cross-matching between the beams all suggest that the current floor is an amalgam of late fifteenth-century or possible early sixteenth-century timbers and possibly some from other periods too.

*Table 3a: Dating evidence for the site series KNGTNMAG, AD 1367–1472*

| County/ region  | Chronology name              | Short publication reference  | File name | Spanning (yrs AD) | Overlap (yrs) | t-value |
|-----------------|------------------------------|------------------------------|-----------|-------------------|---------------|---------|
| Shropshire      | Milk Street, Shrewsbury      | (Miles 1996a)                | MILKST2   | 1392–1565         | 81            | 6.2     |
| Somerset        | George Inn, Norton St Philip | (Miles and Worthington 1998) | GEORGIN2  | 1290–1509         | 106           | 6.2     |
| Devon           | Prowse Barn St Andrew's      | (Groves 2005)                | PROWSEBN  | 1380–1473         | 93            | 5.8     |
| Gloucestershire | Chapel, Frocester            | (Fletcher <i>et al</i> 1985) | FROC247   | 1385–1476         | 88            | 5.7     |
| Hampshire       | Mottisfont Abbey             | (Miles 1996b)                | MOTISFNT  | 1388–1538         | 85            | 5.6     |
| England         | Ref3 Master Chronology       | (Fletcher 1977)              | REF3      | 1399–1687         | 74            | 5.5     |
| Berkshire       | Shaw House, Newbury          | (Miles <i>et al</i> 2004)    | SHAWI     | 1391–1579         | 82            | 5.4     |
| Worcestershire  | Mere Hall, Hanbury           | (Miles <i>et al</i> 2005)    | MEREHALL  | 1408–1610         | 65            | 5.4     |
| Worcestershire  | The Commandery, Worcester    | (Arnold <i>et al</i> 2006)   | WORDSQ01  | 1284–1473         | 106           | 5.4     |

Table 3b: Dating evidence for the site series ask02, AD 1418–1478

Regional multi-site chronologies have the file name in bold

| County/ region   | Chronology name            | Short publication reference | File name      | Spanning (yrs AD) | Overlap (yrs) | t-value |
|------------------|----------------------------|-----------------------------|----------------|-------------------|---------------|---------|
| Herefordshire    | Booth Hall, Hereford       | (Boswijk and Tyers 1997)    | HIGHTOWN       | 1302–1487         | 61            | 7.7     |
| Herefordshire    | Cradley Village Hall       | (Miles <i>et al</i> /2004)  | CRADLEY        | 1347–1530         | 61            | 7.6     |
| Southern England | Southern England Master    | (Bridge 1998a)              | <b>SENG98</b>  | 944–1790          | 61            | 7.6     |
| Worcestershire   | Church House, Areley Kings | (Miles <i>et al</i> /2003)  | ARELEY         | 1365–1535         | 61            | 7.5     |
| Surrey           | East barn, Newdigate       | (Bridge 1998b)              | EASTBARN       | 1312–1483         | 61            | 7.3     |
| Worcestershire   | St Andrew's Church, Pixley | (Bridge 2006)               | PIXPORCH       | 1388–1467         | 50            | 7.3     |
| East Midlands    | East Midlands Master       | (Laxton and Litton 1988)    | <b>EASTMID</b> | 882–1981          | 61            | 7.1     |
| Warwickshire     | Gorcott Hall               | (Nayling 2006)              | GORC_T17       | 1385–1531         | 61            | 7.0     |
| Warwickshire     | Saltisford                 | (Howard <i>et al</i> 1996)  | SALTIS         | 1412–99           | 61            | 7.0     |
| London           | Fulham Palace              | (Bridge and Miles 2004)     | FULHAMI        | 1356–1494         | 61            | 6.9     |



Figure 3: Bar chart showing the relative positions of overlap of the dated timbers along with their derived felling date ranges

## REFERENCES

- Arnold, A J, Howard, R, and Litton, C, 2006 *Tree-ring analysis of timbers from The Commandery, Worcester*; EH Res Dept Rep Ser, **71/2006**
- Baillie, M G L, and Pilcher, J R, 1973 A simple cross-dating program for tree-ring research, *Tree Ring Bulletin*, **33**, 7–14
- Boswijk, G, and Tyers, I, 1997 *Tree-ring analysis of Booth Hall and 16–18 High Town, Hereford*, Anc Mon Lab Rep, **101/97**
- Bridge, M C, 1998a Compilation of master chronologies from the South, unpubl computer file SENG98, University College London Dendrochronology Laboratory
- Bridge, M C, 1998b *Tree-ring analysis of timbers from the Home Farm complex, Newdigate, Surrey*, Anc Mon Lab Rep, **37/98**
- Bridge, M C, 2006 *The tree-ring analysis of timbers from the church of St Andrew, Pixley, Herefordshire*, Centre for Archaeol Rep, **81/2006**
- Bridge, M C, and Miles D H W 2004 *Tree-ring analysis of timbers from the Hall roof, west gateway, and gates at Fulham Palace, London Borough of Hammersmith and Fulham*, Centre for Archaeol Rep, **79/2004**
- Fletcher, J M, 1977 Tree-ring Chronologies for the 6th to the 16th centuries for oaks of Southern and Eastern England, *J Archaeol Sci*, **4**, 335-52
- Fletcher, J M, Tapper, M, and Morris, J J, 1985 List 17 – Tree-ring dates, *Vernacular Architect*, **16**, 41
- Groves, C, 2005 *Dendrochronological Research in Devon: Phase I*, Centre for Archaeol Rep, **56/2005**
- Hollstein, E, 1965 Jahrringchronologische von Eichenholzern ohne Walkande, *Bonner Jahrbuecher*, **165**, 12–27
- Howard, R, Laxton, R R, Litton, C D, 1996 *Tree-ring analysis of timbers from The Master's House, Salisford, Warwickshire*, Anc Mons Lab Rep, **30/96**
- Laxton, R R, and Litton, C D, 1988 *An East Midlands Master Tree-Ring Chronology and its use for dating Vernacular Buildings*, Univ Nottingham, Dept of Classical and Archaeol Studies, Monograph Ser, **3**
- Miles, D H, 1996a *Tree-ring dating of 2 Milk Street, Shrewsbury, Shropshire*, Anc Mon Lab Rep, **25/96**
- Miles, D H, 1996b *The tree-ring dating of Mottisfont Abbey, Romsey, Hampshire*, Anc Mon Lab Rep, **23/96**

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

Miles, D H, and Worthington, M J, 1998 Tree-ring dates, *Vernacular Architect*, **29**, 111–29

Miles, D H, Worthington, M J, and Bridge, M C, 2003 Tree-ring dates, *Vernacular Architect*, **34**, 109–13

Miles, D H, Worthington, M J, and Bridge, M C, 2004 Tree-ring dates, *Vernacular Architect*, **35**, 95–113

Miles, D H, Worthington, M J, and Bridge, M C, 2005 Tree-ring dates, *Vernacular Architect*, **36**, 87–101

Nayling, N, 2006 *Tree-ring analysis of timbers from Gorcott Hall, Warwickshire*, EH Res Dept Rep Ser, **54/2006**

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

Tyers, I, 2004 *Dendro for Windows program guide 3rd edn*, ARCUS Rep, **500b**

*Table 4: Ring width data for the site chronology KNGTNMAG AD 1367–1472, and ask02 AD 1418–78*

|          | Ring widths (0.01 mm)               | no of trees       |
|----------|-------------------------------------|-------------------|
| KNGTNMAG |                                     |                   |
| 136      | 170 284 314 190 160 128 217 319 185 | 1 1 1 1 1 1 1 1 1 |
| 228      | 115 63 46 53 81 103 95 67 123       | 1 1 2 2 2 2 2 2 2 |
| 145      | 135 158 174 188 115 109 103 124 306 | 2 2 2 2 2 2 2 2 3 |
| 259      | 292 315 308 297 139 140 130 172 317 | 3 3 3 3 3 3 3 3 3 |
| 233      | 224 258 180 161 203 188 145 177 152 | 3 3 3 3 3 3 3 3 3 |
| 163      | 199 135 166 180 173 293 241 238 159 | 3 3 3 3 3 3 3 3 3 |
| 131      | 194 150 103 139 189 174 116 200 162 | 3 3 3 3 3 3 3 3 3 |
| 194      | 182 131 126 155 156 135 167 161 156 | 3 3 3 3 3 3 3 2 2 |
| 161      | 116 120 94 96 129 108 115 129 136   | 2 2 2 1 1 1 1 1 1 |
| 116      | 118 153 146 102 96 115 99 125 132   | 1 1 1 1 1 1 1 1 1 |
| 131      | 155 129 163 132 142                 | 1 1 1 1 1         |
| ask02    |                                     |                   |
| 358      | 202 347 341 263 379 364 305 217 246 |                   |
| 370      | 165 182 201 463 208 240 361 266 278 |                   |
| 211      | 144 144 241 150 287 229 141 150 219 |                   |
| 245      | 144 186 283 214 196 215 186 293 271 |                   |
| 203      | 115 155 130 157 166 131 255 246 211 |                   |
| 311      | 210 227 128 93 93 108 175 131 129   |                   |
| 125      |                                     |                   |