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# PENGERICK CASTLE, PENGERICK LANE, PRAA SANDS, PENZANCE, CORNWALL TREE-RING DATING OF OAK TIMBERS

## SCIENTIFIC DATING REPORT

Martin Bridge



INTERVENTION  
AND ANALYSIS



ENGLISH HERITAGE

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Research Report Series 38-2012

PENGERICK CASTLE,  
PENGERICK LANE,  
PRAA SANDS,  
PENZANCE,  
CORNWALL

## TREE-RING DATING OF OAK TIMBERS

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## **SUMMARY**

Four ceiling beams associated with the original construction of the tower of Pengersick Castle were dated. All four are clearly coeval, and the three that retained the heartwood/sapwood boundary were found to have been from trees felled in the mid-sixteenth century, indicating this as the likely date of construction of this building. The trees used have quite widely spread heartwood/sapwood boundary dates, and may have been felled over a number of years, the poor cross-matching between them also suggesting that they were from different, or at least disparate, woodland sources.

## **CONTRIBUTORS**

Dr M C Bridge

## **ACKNOWLEDGEMENTS**

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## **ARCHIVE LOCATION**

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## **DATE OF INVESTIGATION**

2012

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## INTRODUCTION

This 'castle' is a Grade 1 listed building sitting within the site of a Scheduled Ancient Monument, though not itself scheduled. Though called castle, it is a fortified manor house that sits about 0.5km from the south coast of Cornwall, some 11km east of Penzance (Figs 1 and 2). There is some dispute as to the date of the extant tower and associated service buildings. A building platform to the north east of the current building was probably the site of a substantial building thought to be associated with Henry Lord of Pengrysek [sic] at the start of the fourteenth century. A John of Pengersick was given the 'capteynshippe' of nearby St Michael's Mount in AD 1522. It is thought that the present buildings were started in the early sixteenth century after the land passed by marriage into the Millaton family, with the tower probably being built in the mid-sixteenth century by William Millaton shortly before his death, and the breakup of the estate following his son's premature death. Later, the buildings became largely uninhabitable, and in the eighteenth century had become barns and other farm buildings. The large ceiling beams supporting the first and second floors in the tower are thought to be original, those on the first floor being notable for their elaborate chamfer stops (Fig 3). The tower was converted into a dwelling in the early twentieth century, and underwent extensive renovation in AD 1968. The building is now owned by the Pengersick History and Education Trust.

Dendrochronological dating of two beams on the first floor, and two on the second floor, and any other useful timbers in the tower potentially associated with the initial construction was requested by Francis Kelly, English Heritage Historic Buildings Inspector, in order to inform an ongoing repair scheme, and settle an academic dispute which suggests possible dates of construction of the tower from the mid-fifteenth to the mid-sixteenth centuries.

## METHODOLOGY

This investigation was undertaken in 2012. 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, and shorter sequences from duplicate cores from a single timber will be measured. Those timbers judged to be potentially useful were cored using a 15mm auger attached to an electric drill. The cores were labelled, and stored for subsequent analysis.

The cores were polished on a belt sander using 80 to 400 grit abrasive paper to allow the ring boundaries to be clearly distinguished. The 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 (2004a). Cross-matching was attempted 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 on the computer monitor to allow visual comparisons to be made between sequences. This method provides a measure of quality control in identifying any potential errors in the measurements when the samples cross-match.

In comparing one sample or site master against other samples or chronologies,  $t$ -values over 3.5 are considered significant, although in reality it is common to find demonstrably spurious  $t$ -values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some  $t$ -value ranges of 5, 6, and higher, and for these to be well replicated from different, independent chronologies with both local and regional chronologies well represented, except where imported timbers are identified. Where two individual samples match together with a  $t$ -value of 10 or above, and visually exhibit exceptionally similar ring patterns, they may have originated from the same parent tree. Same-tree matches can also be identified through the external characteristics of the timber itself, such as knots and shake patterns. Lower  $t$ -values however do not preclude same tree derivation.

### Ascribing felling dates and date ranges

Once a tree-ring sequence has been firmly dated in time, a felling date, or date range, is ascribed where possible. With samples which have sapwood complete to the underside of, or including bark, this process is relatively straightforward. Depending on the completeness of the final ring, ie if it has only the spring vessels or early wood formed, or the latewood or summer growth, a precise felling date and season can be given. If the sapwood is partially missing, or if only a heartwood/sapwood transition boundary survives, then an estimated felling date range can be given for each sample. The number of sapwood rings can be estimated by using an empirically derived sapwood estimate with a given confidence limit. If no sapwood or heartwood/sapwood boundary survives then the minimum number of sapwood rings from the appropriate sapwood estimate is added to the last measured ring to give a *terminus post quem* (tpq) or felled-after date.

A review of the geographical distribution of dated sapwood data from historic timbers has shown that a sapwood estimate relevant to the region of origin should be used in interpretation, which in this area is 9–41 rings (Miles 1997a). It must be emphasised that dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure or object under study.





*Figure 3: One of the elaborate chamfer-stops to the first-floor beams at Pengersick Castle. Photograph Martin Bridge*

## RESULTS AND DISCUSSION

The four large beams, two each at first-floor and second-floor level were sampled, along with the inner lintel of the north window at first-floor level. The latter core revealed that there were too few rings for further analysis. The two beams at second-floor level had the sapwood on the upper side, adjacent to later floor joists, and in addition to one long core taken from the lower edge up through the bulk of the timbers, additional shorter cores were taken at shallow angles into the top corners of the beams in order to try and extract maximum information.

Details of the location of the cores are given in Table 1, and illustrated in Figures 4 and 5. The multiple cores from timbers pgk04 and pgk05 were compared with each other and a single series was produced representing each timber. The raw ring-width data for each core is given in the Appendix.

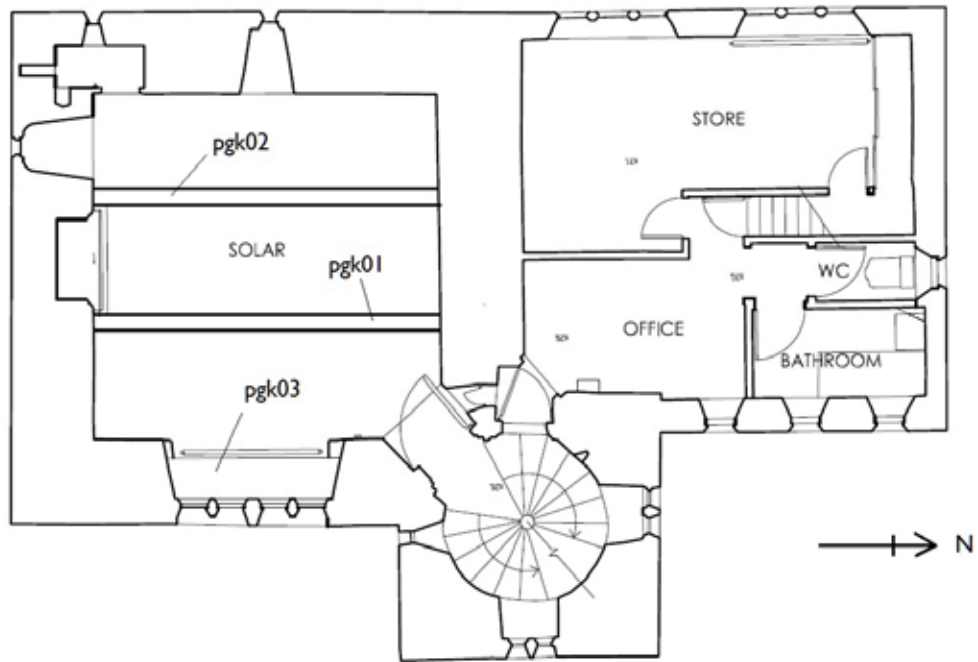


Figure 4: Plan of the first floor, showing the locations of the two beams and the window lintel sampled for dendrochronology

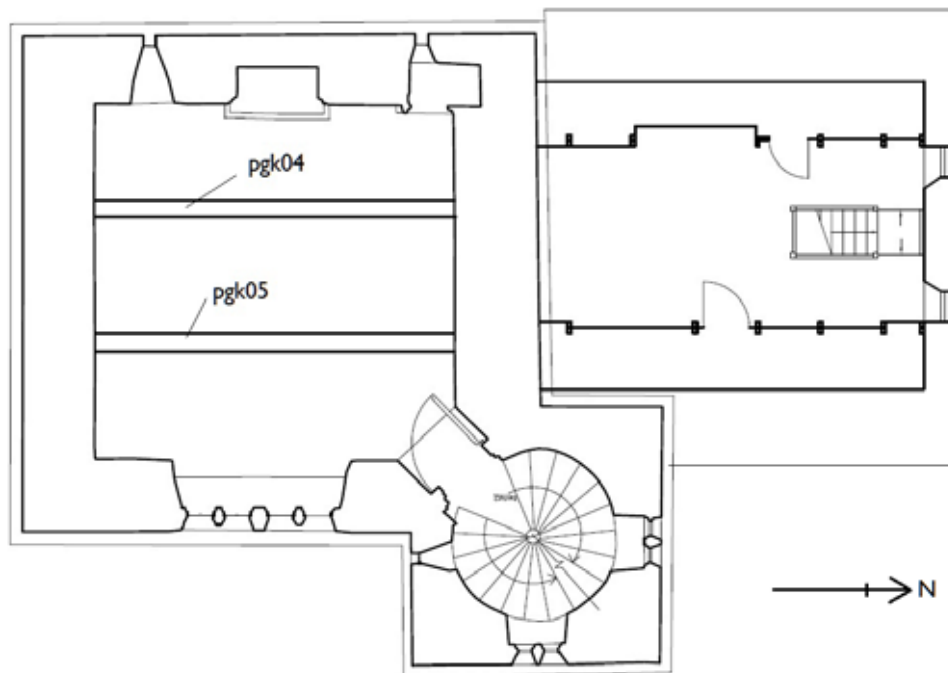


Figure 5: Plan of the second floor, showing the location of the two beams sampled for dendrochronology

The cross-matching between the individual series is shown in Table 2. Although the cross-matching between the individual series is relatively poor, it is consistent, and all four series can be dated independently against the reference material. These four series were combined into a single 188-year site chronology, PENGRSK, which was then compared with the available dated reference material, resulting in it being dated to the years AD 1344–1531. A selection of the strongest matches is shown in Table 3, and the relative positions of overlap are shown, along with the interpreted likely felling date ranges in Figure 6.

All four timbers are clearly of similar date, although there is a difference of 26 years between the heartwood/sapwood boundary dates of the three timbers that retained that boundary. Although this does not rule out that the timbers were all felled at the same time, it does suggest that they may have been felled at slightly different times, some years apart. The relatively poor matching between the series may also suggest different woodland sources for the timbers. The date ranges do however settle the date of the construction of the castle tower, assuming that these timbers were associated with the primary construction, with a mid sixteenth-century date for construction likely. If they are considered as a single group felled at the same time, the mean heartwood/sapwood boundary date is AD 1516, which would give a likely felling date range for the group of AD 1532–57.

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Table 1: Details of the samples taken from Pengersick Castle

| Sample Number       | Timber and position        | No of rings | Mean HW ring width (mm) | Dates Spanning (AD) | H/S boundary AD | Sapwood rings | Mean sensitivity | Felling date ranges (AD) |
|---------------------|----------------------------|-------------|-------------------------|---------------------|-----------------|---------------|------------------|--------------------------|
| <b>First Floor</b>  |                            |             |                         |                     |                 |               |                  |                          |
| pgk01               | East beam                  | 120         | 1.39                    | 1402–1521           | 1521            | h/s           | 0.27             | 1530–62                  |
| pgk02               | West beam                  | 121         | 0.95                    | 1344–1464           | -               | -             | 0.27             | after 1473               |
| pgk03               | Inner window lintel        | <40         | NM                      | -                   | -               | -             | -                | -                        |
| <b>Second Floor</b> |                            |             |                         |                     |                 |               |                  |                          |
| Pgk04a              | West beam                  | 124         | 1.29                    | 1351–1474           | -               | -             | 0.21             |                          |
| Pgk04b              | <i>ditto</i>               | 122         | 0.93                    | 1365–1486           | -               | -             | 0.23             |                          |
| Pgk04c              | <i>ditto</i>               | 38          | 0.64                    | 1464–1501           | 1500            | 1             | 0.27             |                          |
| pgk04               | Mean of 04a, 04b, and 04c  | 151         | 1.10                    | 1351–1501           | 1500            | 1             | 0.21             | 1509–41                  |
| Pgk05ai             | East beam                  | 90          | 1.56                    | 1352–1441           | -               | -             | 0.24             |                          |
| Pgk05aai            | <i>ditto</i>               | 40          | 0.88                    | -                   | -               | -             | 0.26             |                          |
| Pgk05b              | <i>ditto</i>               | 138         | 1.08                    | 1357–1494           | -               | -             | 0.25             |                          |
| Pgk05c              | <i>ditto</i>               | 68          | 0.93                    | 1464–1531           | 1526            | 5             | 0.27             |                          |
| pgk05               | Mean of 05ai, 05b, and 05c | 175         | 1.17                    | 1352–1531           | 1526            | 5             | 0.24             | 1535–67                  |

Key: HW = heartwood; Mean sens = mean sensitivity; H/S = heartwood/sapwood boundary

Table 2: Cross-matching between the dated series from Pengersick Castle

| SAMPLE | <i>t</i> -values |       |       |
|--------|------------------|-------|-------|
|        | pgk02            | pgk04 | pgk05 |
| pgk01  | 4.2              | 3.5   | 4.0   |
| pgk02  |                  | 3.6   | 2.2   |
| pgk04  |                  |       | 3.7   |

Table 3: Dating evidence for the site chronology PENGERSK AD 1344–1531. File names in bold are regional chronologies

| County/region   | Chronology name                       | Short publication reference      | File name      | Spanning (yrs AD) | Overlap (yrs) | <i>t</i> -value |
|-----------------|---------------------------------------|----------------------------------|----------------|-------------------|---------------|-----------------|
| Cornwall        | Pendennis Castle, near Falmouth       | (Tyers 2004b)                    | PEN_T17        | 1358–1541         | 178           | 10.2            |
| Devon           | Wareleigh House, Tamerton Foliot      | (Howard <i>et al</i> 2006)       | TMFASQ01       | 1367–1539         | 157           | 8.5             |
| Devon           | The Ship Inn, Morwellham Quay         | (Tyers <i>et al</i> forthcoming) | MWQASQ01       | 1361–1508         | 188           | 7.9             |
| Cornwall        | St Ildierna/Ildiane Church, Lansallos | (Arnold and Howard 2006)         | LANASQ03       | 1355–1514         | 188           | 7.8             |
| Wales           | St Woolos Cathedral, Newport          | (Miles <i>et al</i> 2011)        | WOOLOS2        | 1318–1482         | 139           | 7.6             |
| Wales           | Welsh Master Chronology               | (Miles 1997b)                    | <b>WALES97</b> | 404–1981          | 188           | 7.4             |
| Herefordshire   | Wigmore Abbey                         | (Tyers 2002)                     | WIGALL46       | 1055–1729         | 188           | 6.8             |
| Devon           | Alwington Church                      | (Arnold and Howard 2009)         | ALWCSSQ02      | 1342–1490         | 147           | 6.8             |
| Buckinghamshire | White House, Vowchurch                | (Nayling 2000)                   | WVT9           | 1364–1602         | 168           | 6.7             |
| Cornwall        | St Martin's Church, East Looe         | (Arnold <i>et al</i> 2006)       | LOOASQ01       | 1363–1518         | 156           | 6.6             |

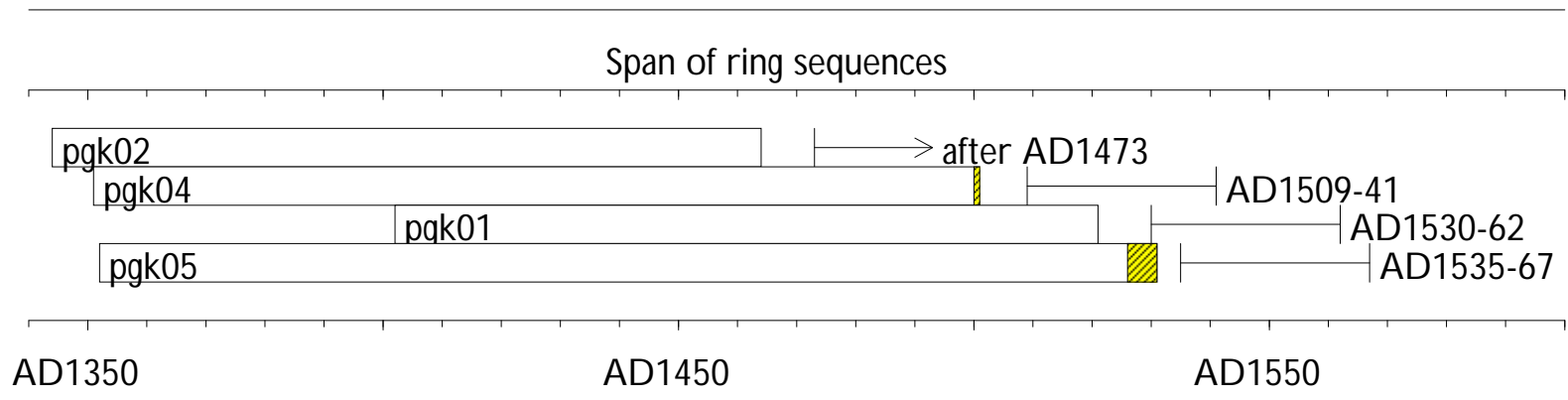


Figure 6: Bar diagram showing the relative positions of overlap of the dated timbers included in the site chronology PENGGRSK from Pengersick Castle, Cornwall. White portions of the bars represent heartwood, whilst yellow hatched portions represent sapwood

## APPENDIX

Ring width values (0.01mm) for the sequences measured

### pgk01

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 217 | 507 | 434 | 398 | 444 | 195 | 341 | 161 | 121 | 93  |
| 157 | 213 | 303 | 189 | 197 | 163 | 141 | 110 | 199 | 196 |
| 93  | 145 | 186 | 161 | 197 | 197 | 274 | 243 | 217 | 186 |
| 183 | 190 | 185 | 213 | 161 | 170 | 148 | 93  | 181 | 170 |
| 90  | 147 | 96  | 133 | 135 | 136 | 148 | 149 | 132 | 107 |
| 94  | 99  | 210 | 148 | 101 | 116 | 93  | 71  | 126 | 61  |
| 65  | 80  | 45  | 79  | 123 | 143 | 97  | 91  | 88  | 59  |
| 63  | 52  | 52  | 96  | 128 | 90  | 92  | 81  | 72  | 89  |
| 75  | 108 | 127 | 176 | 171 | 190 | 139 | 125 | 121 | 129 |
| 63  | 93  | 95  | 66  | 144 | 102 | 55  | 79  | 75  | 64  |
| 87  | 72  | 89  | 127 | 121 | 138 | 147 | 128 | 72  | 114 |
| 151 | 107 | 149 | 98  | 86  | 89  | 50  | 51  | 48  | 112 |

### pgk02

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 141 | 125 | 106 | 117 | 137 | 175 | 160 | 181 | 95  | 122 |
| 110 | 96  | 113 | 146 | 172 | 179 | 83  | 86  | 157 | 115 |
| 113 | 98  | 129 | 107 | 51  | 80  | 123 | 88  | 75  | 74  |
| 39  | 56  | 65  | 82  | 59  | 97  | 75  | 77  | 61  | 76  |
| 93  | 51  | 92  | 87  | 87  | 111 | 49  | 57  | 48  | 46  |
| 48  | 97  | 107 | 61  | 40  | 72  | 64  | 42  | 65  | 83  |
| 70  | 63  | 71  | 79  | 88  | 63  | 55  | 38  | 69  | 91  |
| 120 | 120 | 87  | 68  | 63  | 42  | 36  | 71  | 29  | 47  |
| 65  | 49  | 99  | 122 | 170 | 145 | 148 | 126 | 114 | 102 |
| 144 | 194 | 170 | 193 | 116 | 114 | 89  | 69  | 62  | 81  |
| 98  | 96  | 103 | 81  | 138 | 111 | 87  | 155 | 89  | 94  |
| 135 | 85  | 91  | 130 | 136 | 79  | 87  | 73  | 66  | 90  |
| 54  |     |     |     |     |     |     |     |     |     |

### pgk04a

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 451 | 100 | 273 | 207 | 251 | 272 | 235 | 203 | 297 | 242 |
| 218 | 170 | 157 | 179 | 152 | 145 | 123 | 87  | 102 | 111 |
| 110 | 106 | 136 | 130 | 102 | 115 | 124 | 136 | 130 | 110 |
| 151 | 166 | 205 | 215 | 137 | 204 | 197 | 170 | 168 | 116 |
| 127 | 163 | 137 | 102 | 104 | 130 | 100 | 94  | 115 | 114 |
| 91  | 112 | 158 | 152 | 85  | 111 | 101 | 94  | 109 | 83  |
| 60  | 85  | 109 | 136 | 134 | 83  | 102 | 98  | 60  | 98  |
| 172 | 128 | 128 | 158 | 139 | 122 | 91  | 141 | 122 | 118 |
| 97  | 147 | 177 | 173 | 131 | 99  | 147 | 124 | 72  | 88  |
| 67  | 81  | 63  | 95  | 98  | 113 | 105 | 98  | 109 | 104 |
| 94  | 87  | 94  | 92  | 103 | 90  | 94  | 118 | 82  | 93  |
| 59  | 98  | 67  | 85  | 112 | 107 | 111 | 125 | 109 | 155 |
| 121 | 78  | 92  | 64  |     |     |     |     |     |     |

### pgk04b

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 127 | 162 | 122 | 122 | 87  | 108 | 95  | 96  | 147 | 152 |
| 126 | 127 | 147 | 106 | 170 | 138 | 108 | 145 | 210 | 176 |
| 148 | 106 | 83  | 123 | 126 | 84  | 128 | 158 | 116 | 103 |

|     |     |     |     |     |     |    |     |     |     |
|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|
| 123 | 170 | 114 | 99  | 89  | 100 | 59 | 52  | 73  | 89  |
| 88  | 152 | 85  | 103 | 124 | 103 | 55 | 71  | 89  | 97  |
| 93  | 69  | 54  | 74  | 52  | 76  | 74 | 69  | 59  | 71  |
| 95  | 95  | 98  | 120 | 133 | 103 | 81 | 101 | 119 | 105 |
| 68  | 54  | 77  | 63  | 48  | 79  | 64 | 65  | 59  | 86  |
| 57  | 66  | 63  | 68  | 78  | 91  | 51 | 75  | 69  | 74  |
| 78  | 72  | 66  | 88  | 58  | 50  | 36 | 63  | 48  | 58  |
| 97  | 86  | 79  | 91  | 73  | 95  | 62 | 48  | 62  | 58  |
| 118 | 112 | 60  | 62  | 56  | 79  | 68 | 70  | 78  | 154 |
| 134 | 148 |     |     |     |     |    |     |     |     |

pgk04c

|    |     |    |    |    |    |    |    |    |    |
|----|-----|----|----|----|----|----|----|----|----|
| 59 | 75  | 72 | 67 | 86 | 67 | 83 | 69 | 57 | 55 |
| 53 | 94  | 94 | 55 | 52 | 38 | 55 | 55 | 62 | 56 |
| 91 | 104 | 83 | 62 | 75 | 52 | 71 | 55 | 49 | 50 |
| 56 | 50  | 55 | 56 | 50 | 38 | 42 | 88 |    |    |

pgk05ai

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 160 | 239 | 244 | 231 | 159 | 203 | 245 | 301 | 194 | 205 |
| 158 | 217 | 234 | 223 | 196 | 212 | 134 | 183 | 162 | 89  |
| 141 | 141 | 186 | 178 | 105 | 124 | 98  | 143 | 96  | 159 |
| 182 | 195 | 208 | 259 | 267 | 219 | 254 | 175 | 126 | 135 |
| 117 | 131 | 135 | 174 | 246 | 147 | 148 | 160 | 147 | 213 |
| 180 | 228 | 218 | 156 | 212 | 141 | 189 | 186 | 168 | 71  |
| 93  | 99  | 127 | 125 | 89  | 101 | 89  | 84  | 112 | 107 |
| 62  | 156 | 152 | 176 | 101 | 124 | 132 | 59  | 67  | 66  |
| 133 | 123 | 68  | 91  | 117 | 146 | 123 | 105 | 179 | 122 |

pgk05aii

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 40  | 56  | 44  | 48  | 50  | 79  | 159 | 83  | 92  | 61  |
| 81  | 72  | 61  | 67  | 64  | 82  | 67  | 83  | 109 | 88  |
| 125 | 105 | 124 | 123 | 164 | 117 | 108 | 123 | 117 | 71  |
| 92  | 59  | 80  | 113 | 86  | 43  | 57  | 56  | 109 | 146 |

pgk05b

|     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 124 | 151 | 116 | 94  | 105 | 69  | 114 | 104 | 75  | 91  |
| 112 | 97  | 94  | 108 | 70  | 63  | 64  | 93  | 86  | 70  |
| 54  | 52  | 84  | 77  | 78  | 96  | 105 | 100 | 107 | 115 |
| 116 | 114 | 96  | 93  | 97  | 83  | 84  | 85  | 105 | 161 |
| 89  | 87  | 120 | 108 | 118 | 102 | 124 | 178 | 119 | 189 |
| 127 | 146 | 138 | 107 | 74  | 119 | 129 | 134 | 121 | 70  |
| 106 | 126 | 93  | 162 | 90  | 74  | 132 | 120 | 146 | 91  |
| 80  | 91  | 107 | 116 | 119 | 210 | 189 | 115 | 130 | 139 |
| 173 | 140 | 48  | 132 | 100 | 108 | 142 | 106 | 106 | 141 |
| 92  | 102 | 109 | 126 | 75  | 120 | 102 | 190 | 120 | 120 |
| 136 | 181 | 155 | 109 | 94  | 97  | 124 | 73  | 103 | 99  |
| 74  | 102 | 88  | 131 | 103 | 108 | 91  | 112 | 139 | 141 |
| 79  | 73  | 36  | 58  | 37  | 114 | 110 | 57  | 87  | 121 |
| 160 | 139 | 115 | 82  | 78  | 92  | 74  | 127 |     |     |

pgk05c

|     |     |     |     |     |    |     |     |     |     |
|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|
| 123 | 112 | 112 | 98  | 94  | 81 | 135 | 102 | 66  | 154 |
| 162 | 194 | 117 | 128 | 148 | 56 | 66  | 55  | 147 | 128 |

|    |     |     |     |     |     |     |     |    |     |
|----|-----|-----|-----|-----|-----|-----|-----|----|-----|
| 71 | 90  | 166 | 181 | 160 | 99  | 147 | 117 | 82 | 28  |
| 36 | 40  | 52  | 49  | 62  | 61  | 70  | 70  | 65 | 123 |
| 95 | 99  | 88  | 93  | 96  | 64  | 55  | 73  | 99 | 60  |
| 99 | 108 | 100 | 120 | 65  | 82  | 60  | 82  | 68 | 49  |
| 64 | 62  | 47  | 77  | 72  | 105 | 179 | 150 |    |     |



## ENGLISH HERITAGE RESEARCH AND THE HISTORIC ENVIRONMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for the protection and sustainable management of the resource, and to promote the widest access, appreciation and enjoyment of our heritage. Much of this work is conceived and implemented in the context of the National Heritage Protection Plan. For more information on the NHPP please go to <http://www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/>.

The Heritage Protection Department provides English Heritage with this capacity in the fields of building history, archaeology, archaeological science, imaging and visualisation, landscape history, and remote sensing. It brings together four teams with complementary investigative, analytical and technical skills to provide integrated applied research expertise across the range of the historic environment. These are:

- \* Intervention and Analysis (including Archaeology Projects, Archives, Environmental Studies, Archaeological Conservation and Technology, and Scientific Dating)
- \* Assessment (including Archaeological and Architectural Investigation, the Blue Plaques Team and the Survey of London)
- \* Imaging and Visualisation (including Technical Survey, Graphics and Photography)
- \* Remote Sensing (including Mapping, Photogrammetry and Geophysics)

The Heritage Protection Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support community engagement and build this in to our projects and programmes wherever possible.

We make the results of our work available through the Research Report Series, and through journal publications and monographs. Our newsletter *Research News*, which appears twice a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities.

A full list of Research Reports, with abstracts and information on how to obtain copies, may be found on [www.english-heritage.org.uk/researchreports](http://www.english-heritage.org.uk/researchreports)

*For further information visit [www.english-heritage.org.uk](http://www.english-heritage.org.uk)*

