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R E Howard[1], Dr R R Laxton[2] and Dr C D Litton[2]

Summary

Twenty samples were obtained from the roof of numbers 1 and 3 Hallgarth Manor Cottages (number 2 being unavailable for sampling), and analysed by dendrochronology.

This analysis produced two site chronologies. The first site chronology, consisting of seventeen samples, has 289 rings spanning the period AD 1336 - AD 1624. Interpretation of the sapwood would indicate that the timbers of number 1 Hallgarth Manor Cottage, the southern cottage, have an estimated felling date in the range AD 1660 - 70. The timbers of number 3, the northern cottage, are earlier, having an estimated felling date in the range AD 1565 - 70.

The second site chronology consists of two samples having 125 rings. This site chronology cannot be dated, but there are structural reasons to believe that the timbers represented are of a different, probably later, phase of felling.

Keywords

Dendrochronology
Standing Buildings

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TREE-RING ANALYSIS OF TIMBERS FROM HALLGARTH MANOR COTTAGES, HALLGARTH PITTINGTON, CO DURHAM

Introduction

Hallgarth Manor, Hallgarth Pittington (NZ 328 437; Fig 1), is a large agricultural site and although its date is uncertain, it is probably of ancient origin. It may be a survivor of the medieval monastic manor house and grange farm belonging to the Priory of Durham Cathedral, which developed north of the Church of St Lawrence, which itself dates from the eleventh century. The surviving monastic records show considerable building activity here and indicate a large farm group attached to a manor house; works to over thirty different buildings or parts of buildings are mentioned. A plan of the site and the surrounding area is provided in Figure 2.

In AD 1550 the site was described as comprising two back courts and a front court. The front court was occupied by the principal manorial hall, whilst the back courts would have been enclosed by the farm buildings.

Of particular interest to this report is a single-storey range of three cottages, standing in what would have been one of the back courts. The site history and evidence of the roof structure suggest that this building is a rare survivor of the Prior's estate farm. It may have been a barn, but its small size, as originally built, suggests it may have had an unknown agricultural function. Given the greater survival of the larger barns, its small size gives this building a greater rarity value.

The three cottages reveal an almost complete roof structure, with only the north and south gable trusses missing. The building comprises nine bays of eight trusses, the southern four trusses having carpenters marks I – IIII running consecutively from north to south, while the northern four trusses are numbered I – IIII running consecutively from south to north. It is thus suggested that the building began as a five-bay structure, enlarged later to nine bays by being added to on the south side.

Sampling and analysis by tree-ring dating was commissioned by English Heritage, the purpose of this being to inform a listing proposal. Evidence from the roof trusses suggests that the building is a very rare late medieval agricultural survival and its dating and chronological development are important for the wider significance of the site.

The Laboratory would like to take this opportunity to thank Michael Phillips of number 1 Hallgarth Manor Cottages, and Frances Clough of number 3, for allowing sampling and for their enthusiasm for the project. We would also like to thank Martin Roberts of English Heritage North East Region for arranging access and for assisting during sampling, and for providing notes used in the above introduction.

Sampling

The site was divided into three separate cottages, only two of which, those at either end, numbers 1 and 3, were accessible at the time of sampling. The timbers of the middle cottage, number 2, were not available for sampling. Only three trusses were available in number 1, the southern cottage, and only two trusses available in number 3, the northern cottage. For the purposes of identification in this report the trusses have been numbered 1 - 8 from south to north. A simple plan of the cottages is given in Figure 3.

Thus, from the timbers available a total of twenty core samples was taken. Each sample was given the code PIT-A (for Pittington, site "A"), and numbered 01 – 20. Ten samples, PIT-A01 – 10, were obtained from trusses 1-3 in the southern cottage (Cottage number 1) with a further ten samples, PIT-A11 – 20, being taken from trusses 7 and 8 in the northern cottage (number 3). The positions of these samples are marked on sketch drawings made by Martin Roberts and provided by English Heritage. These are reproduced here as Figures 4a-e. Details of the samples are given in Table 1.

Analysis

Each of the twenty samples was prepared by sanding and polishing and their growth-ring widths measured. These were then compared with each other by the Litton/Zainodin grouping procedure and at a minimum *t*-value of 4.5 two groups of samples formed. Sixteen samples from trusses in both the sampled cottages cross-matched with each other at relative positions as shown in the bar diagram Figure 5. The growth-ring widths of these sixteen samples were combined at these relative off-set positions to form PITASQ01, a site chronology of 289 rings. Site chronology PITASQ01 was compared with a series of relevant reference chronologies for oak, giving it a first ring date of AD 1336 and a last measured ring date of AD 1624. Evidence for this dating is given in the *t*-values of Table 2.

The second group to form at a *t*-value of 4.5 consists of two samples, PIT-A06 and A07, both from struts in trusses 1 and 2 respectively. These cross-match with each other at positions as shown in the bar diagram of Figure 6. The growth-ring widths of these two samples were combined at these relative off-set positions to form PITASQ02, a site chronology of 125 rings. Site chronology PITASQ02 was compared with a series of relevant reference chronologies for oak, but there was no satisfactory cross-matching at any position and these samples must remain undated. Interestingly there is structural evidence, by way of differences to the joints of these timbers with the tiebeams and rafters, to suggest that they might not be of the same phase of felling as all the other timbers.

For the purpose of checking each site sequence was compared with the other, and with the remaining single ungrouped sample, PIT-A16, but there was no further satisfactory cross-matching. Sample PIT-A16 was compared individually with the reference chronologies but again there was no further satisfactory cross-matching.

Interpretation and conclusion

The bar diagram of site chronology PITASQ01 in Figure 5 strongly suggests that there are two quite distinct phases of felling represented in the timbers of this building; there is a distinct step or time-gap between the last rings of one group of samples and the last rings of the other. The earliest heartwood/sapwood boundary of the later group of timbers is at relative position 269, on sample PIT-A04. The latest heartwood/sapwood boundary on the earlier group of timbers is only at relative position 209, on sample PIT-A12. This is a minimum difference of 60 years and it is very unlikely to be accounted for by a very large number of sapwood rings in the early group of timbers and a very small number of sapwood rings in the later group. Furthermore, each phase of felling is related distinctly to the two phases of construction proposed by the carpenters marks on the timbers, with the timbers of each distinct group all being felled at the same time.

The earliest phase of felling is represented by the cross-matched samples (A11 – 20) entirely from the timbers of the northern cottage, number 3, that is, trusses 7 and 8. The average last heartwood ring date on these samples is AD 1538. Using a 95% confidence limit of 15 – 40 rings for the amount of sapwood on mature oaks from northern England would give these timbers an estimated felling date in the range AD 1553 – 78 (Howard *et al* 1996a).

However, one sample, PIT-A19 (last ring date AD 1537), was obtained from a timber that had complete sapwood, that is, it had the last growth-ring produced by the tree from which the timber was taken, before it was felled. Although this sapwood was lost in coring, observations and estimates made on site at the time of sampling suggest that the lost portion represented approximately 30 sapwood rings. On the basis of this, and allowing for a modest five year margin of error, it is estimated that the felling of the timber represented, and indeed all the other timbers from this phase of construction, took place in the range, say, AD 1565 – 70. It will be seen that this date lies within the estimated felling date range based on the 95% confidence limit for the number of sapwood rings.

The later phase of felling is represented by the cross-matched samples (A01 – 10) entirely from the timbers of the southern cottage, number 1, trusses 1 - 3. The average last heartwood ring date on these samples is AD 1616. Using the same sapwood estimate as above, 15 – 40 rings, would give these timbers an estimated felling date in the range AD 1631 – 56.

Again, however, one sample, PIT-A09, last ring date AD 1624, was obtained from a timber that had complete sapwood. Although this sapwood was also lost in coring, observations and estimates made at the time of sampling suggest that the lost portion represented approximately 40 sapwood rings. On the basis of this loss of sapwood greater than that observed on sample PIT-A19, and thus perhaps requiring a wider margin of error, it is estimated that the felling of the timber represented took place in the range, say, AD 1660 – 70. Given the relative positions of the heartwood/sapwood boundaries on the other samples of this phase this is likely to be the felling date of the other timbers also.

It will be seen that this date, AD 1660 – 70, lies outside the estimated felling date range based on the 95% confidence limit for the number of sapwood rings, AD 1631 – 56. This well illustrates the point that such felling dates ranges are only estimates and that some groups of timbers have a number of sapwood rings greater than the 95% confidence limit.

It thus appears that we do indeed have two phases of construction represented in these cottages. The first is in the mid- to later sixteenth century, the second in the mid- to late seventeenth-century. This supports the suggestion based on structural evidence that the northern structure was later extended

Two observations might be made about the timbers. The first is the number of rings they contain. In many cases these are close to and in one case, in excess of 200. The timbers, while substantial are not particularly large and they must represent trees that were close to 250 years of age when felled. Such an age at felling for oak trees may be considered unusual for the late sixteenth, and particularly the seventeenth centuries when demand for timber meant that trees tended to be felled when younger than this.

The second observation considers the cross-matching between samples. The highest cross-matching occurs between samples of the same felling phase, ie between samples PIT-A01 – 10 and between samples PIT-A11 – 20, rather than between the samples from the two groups. While an exception to this could be found it might suggest that the two sets of timbers are from two separate woods. However, the reduced degree of cross-matching between samples from the two different groups may reflect that they have shorter overlaps.

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Table 1: Details of samples from Hallgarth Manor Cottages, Hallgarth Pittington, Co Durham

Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date	Last heartwood ring date	Last measured ring date
	Southern cottage					
PIT-A01	Tiebeam, truss 3	177	h/s	AD 1443	AD 1619	AD 1619
PIT-A02	Tiebeam, truss 2	167	h/s	AD 1445	AD 1611	AD 1611
PIT-A03	Tiebeam, truss 1	175	h/s	AD 1443	AD 1617	AD 1617
PIT-A04	Collar, truss 3	75	h/s	AD 1530	AD 1604	AD 1604
PIT-A05	Lower west purlin, truss 1-2	102	h/s	AD 1520	AD 1621	AD 1621
PIT-A06	East strut, truss 1	61	h/s	------	------	------
PIT-A07	West strut, truss 2	118	no h/s	------	------	------
PIT-A08	East rafter, truss 1	110	h/s	AD 1501	AD 1610	AD 1610
PIT-A09	Upper west purlin, truss 3-4	156	h/s(+40C)	AD 1469	AD 1624	AD 1624
PIT-A10	Lower west purlin, truss 3-4	186	h/s	AD 1438	AD 1623	AD 1623
	Northern cottage					
PIT-A11	Lower west purlin, truss 8-north gable	203	h/s	AD 1336	AD 1538	AD 1538
PIT-A12	Tiebeam, truss 8	169	h/s	AD 1376	AD 1544	AD 1544
PIT-A13	Tiebeam, truss 7	147	h/s	AD 1392	AD 1538	AD 1538
PIT-A14	West strut, truss 8	136	h/s	AD 1401	AD 1536	AD 1536
PIT-A15	Upper west purlin, truss 8-north gable	119	h/s	AD 1418	AD 1536	AD 1536
PIT-A16	East strut, truss 7	56	no h/s	------	------	------
PIT-A17	East strut, truss 8	77	h/s	AD 1465	AD 1541	AD 1541
PIT-A18	Upper east purlin, truss 7-8	91	h/s	AD 1453	AD 1543	AD 1543
PIT-A19	Lower west purlin, truss 7-8	173	h/s(+30C)	AD 1365	AD 1537	AD 1537
PIT-A20	Collar truss 8	75	h/s	AD 1461	AD 1535	AD 1535

*h/s = the heartwood/sapwood boundary is the last ring on the sample
(+*n*C) = the sapwood is complete on the timber but all or part of this has been lost from the sample; the approximate number of sapwood rings lost is estimated

Table 2: Results of the cross-matching of site chronology PITASQ01 and relevant reference chronologies when first ring date is AD 1336 and last ring date is AD 1624

Reference chronology	Span of chronology	t-value	
East Midlands	AD 882 – 1981	7.7	(Laxton and Litton 1988)
England	AD 401 – 1981	9.4	(Baillie and Pilcher 1982 unpubl)
Seaton Holme, Co Durham	AD 1375 – 1489	9.4	(Howard *et al* 1988 unpubl)
35 The Close, Newcastle	AD 1365 – 1513	11.7	(Howard *et al* 1991)
Nether Levens Hall, Cumbria	AD 1395 – 1541	7.4	(Howard *et al* 1991)
1-2 The College, Durham	AD 1364 – 1531	10.6	(Howard *et al* 1992)
Ingleby Greenhow, N Yorks	AD 1429 – 1563	7.3	(Howard *et al* 1993)
Kepier Hospital, Durham	AD 1304 – 1522	10.5	(Howard *et al* 1996b)

Figure 1: Map to show general location of Hallgarth Manor

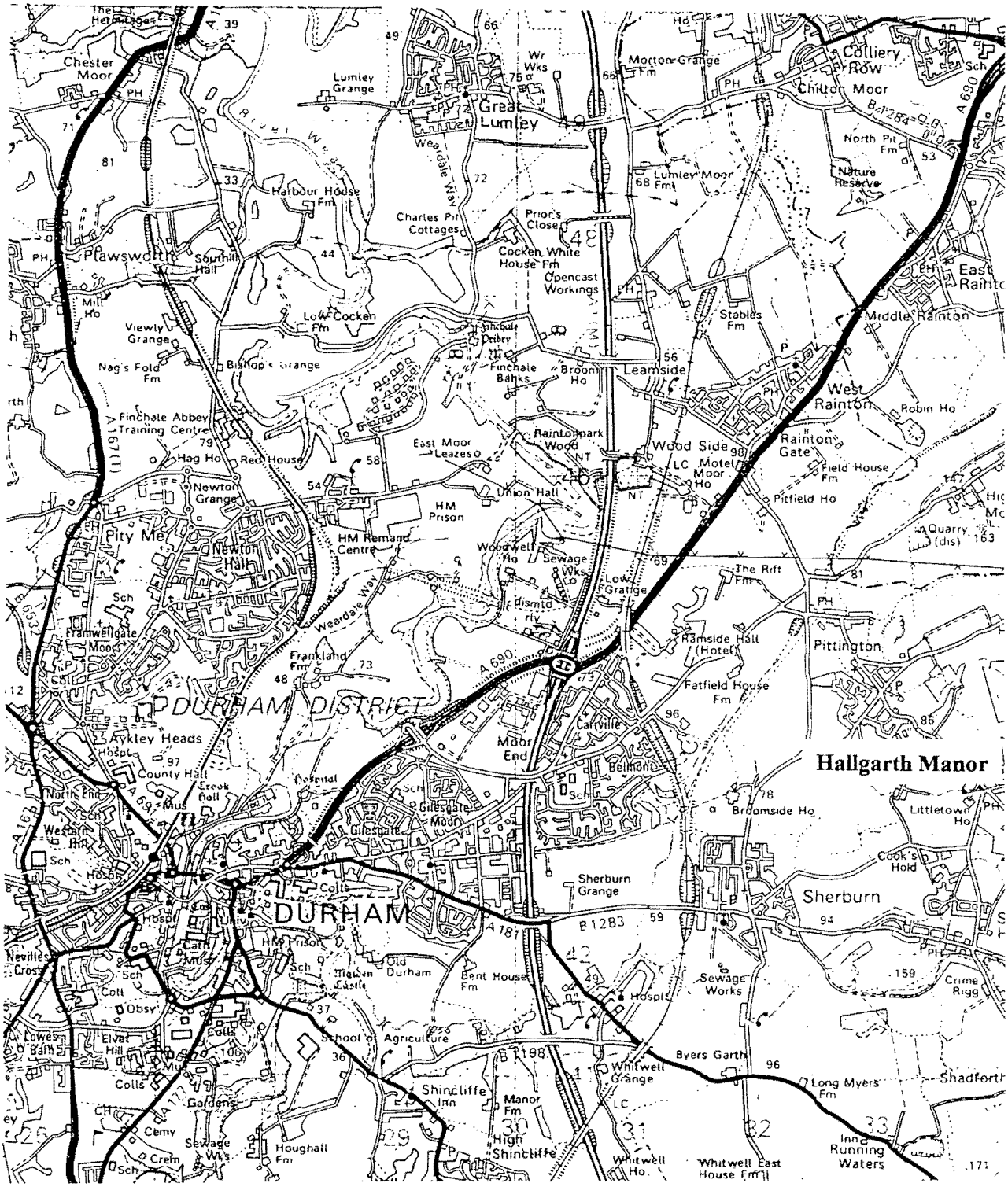


Figure 2: Site plan of Hallgarth Farm, Pittington

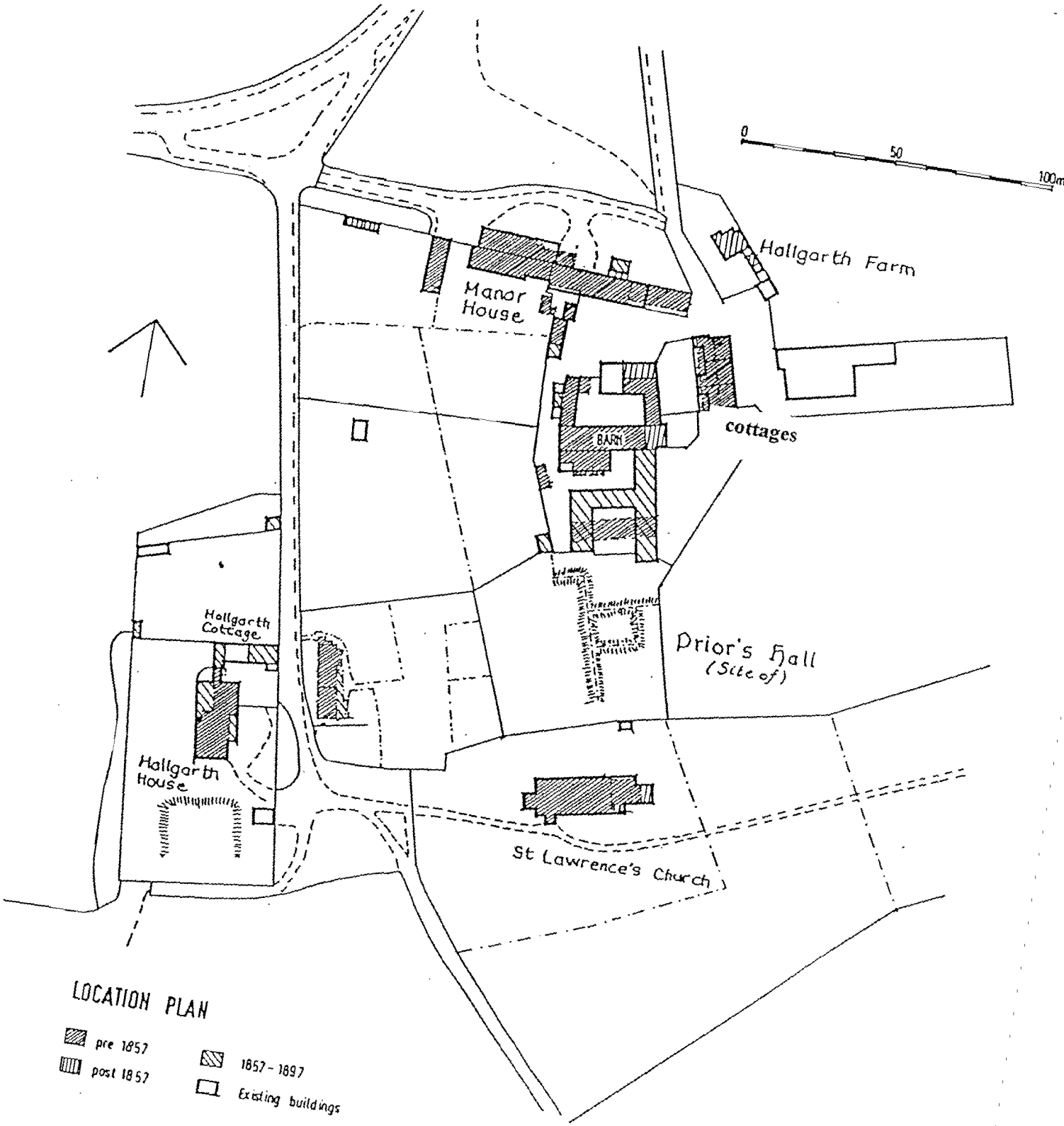


Figure 3: Plan of 1 - 3 Hallgarth Farm Cottages showing position of trusses and carpenters marks
(truss numbers used for the purposes of sample location in this report are in italics)

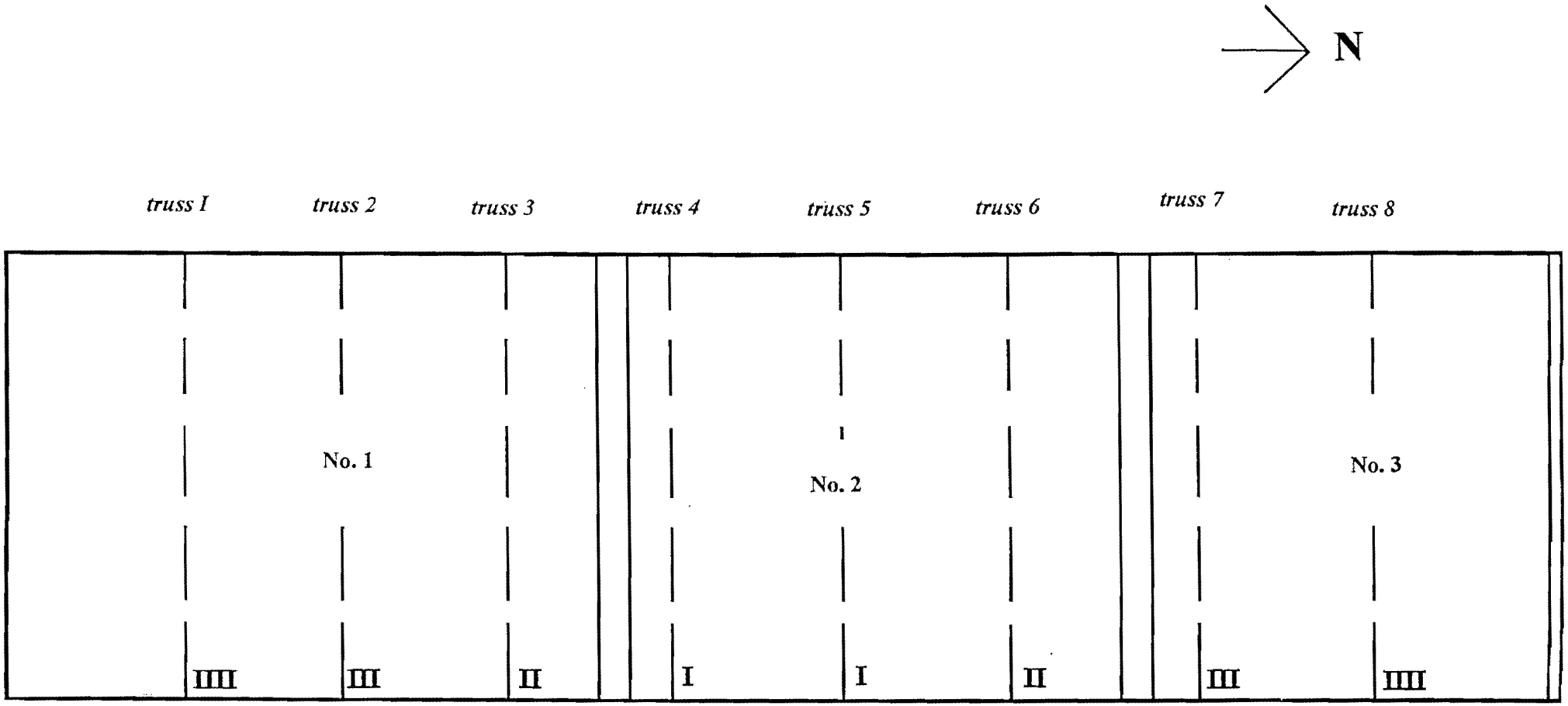


Figure 4a: Sketch drawing of truss 1 to show sample locations (viewed from the south)

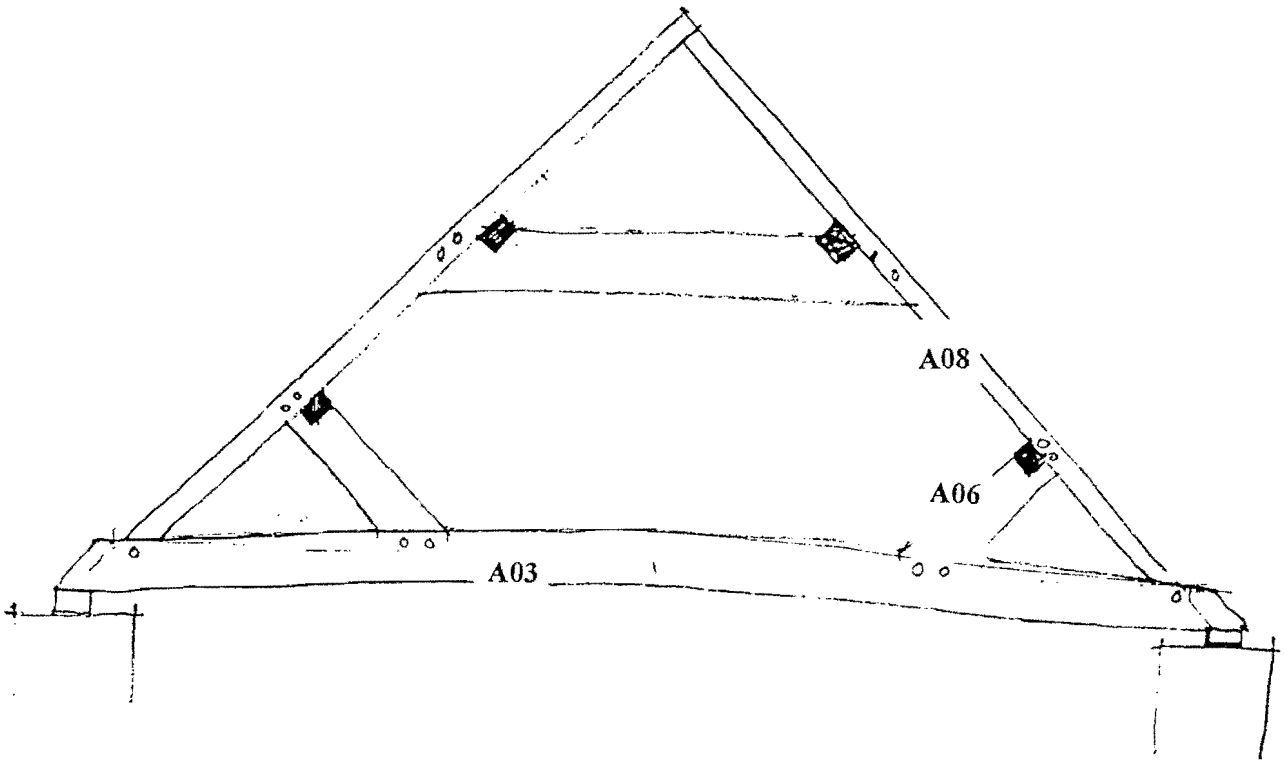


Figure 4b: Sketch drawing of truss 2 to show sample locations (viewed from the south)

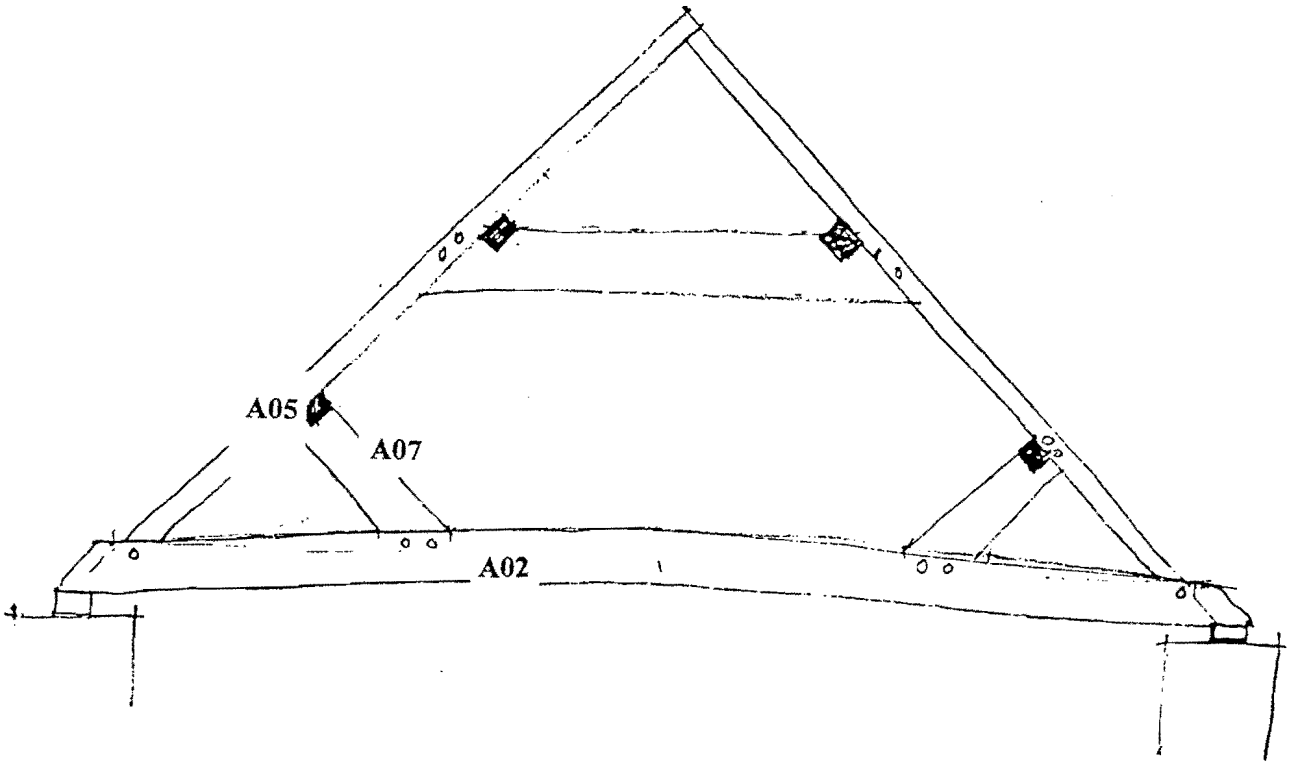


Figure 4c: Sketch drawing of truss 3 to show sample locations (viewed from the south)

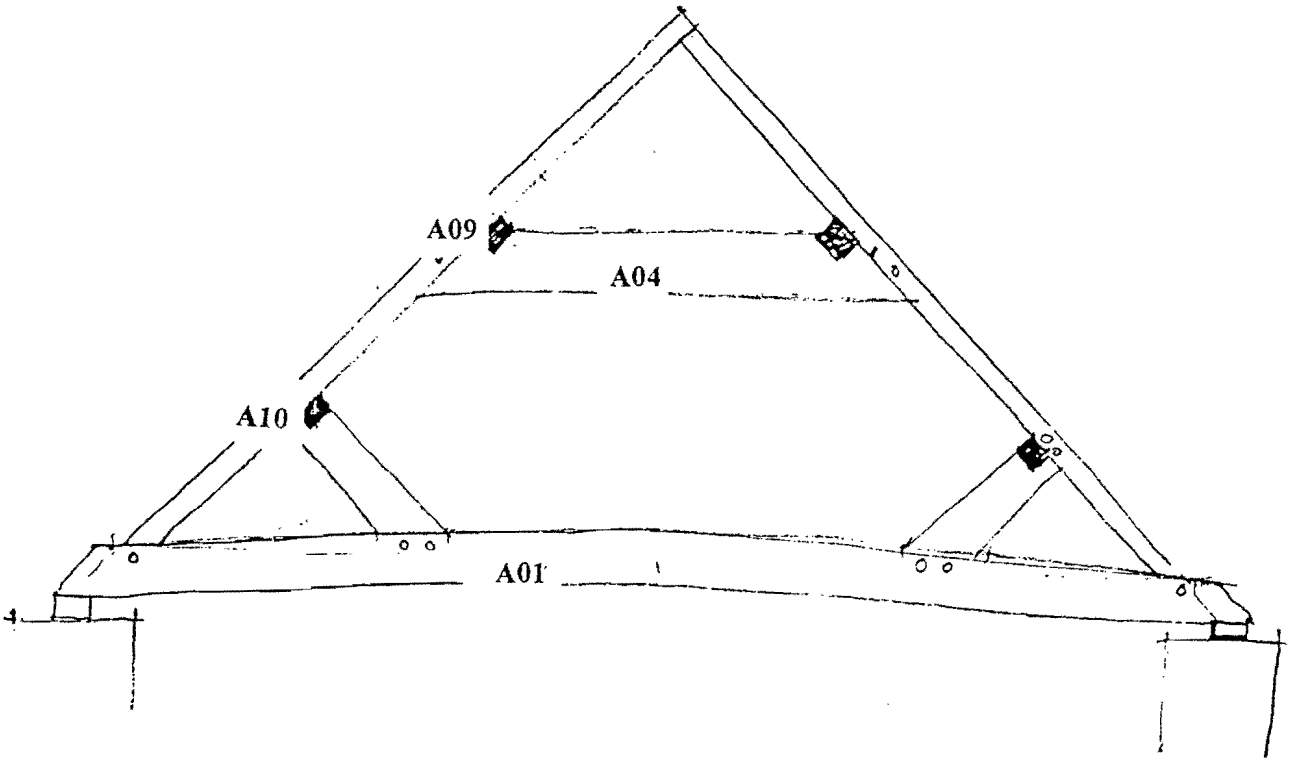


Figure 4d: Sketch drawing of truss 7 to show sample locations (viewed from the south)

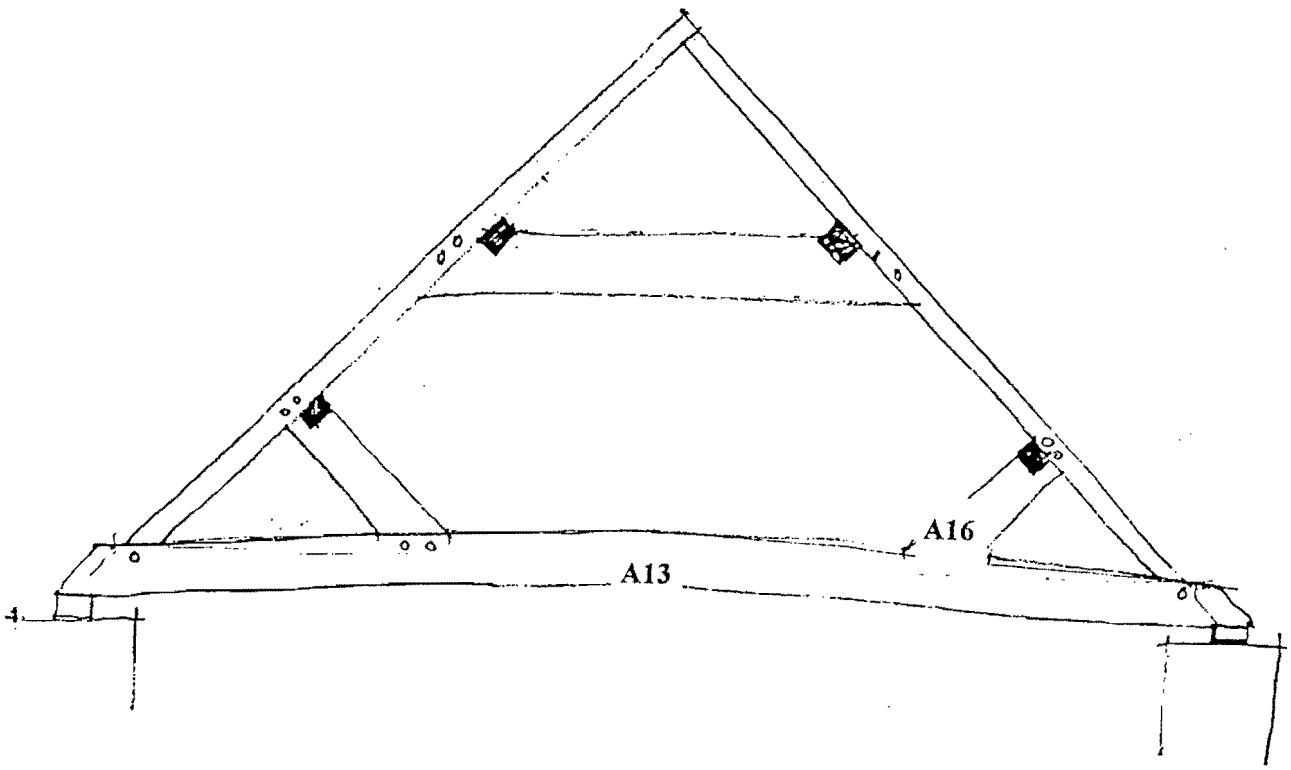


Figure 4e: Sketch drawing of truss 8 to show sample locations (viewed from the south)

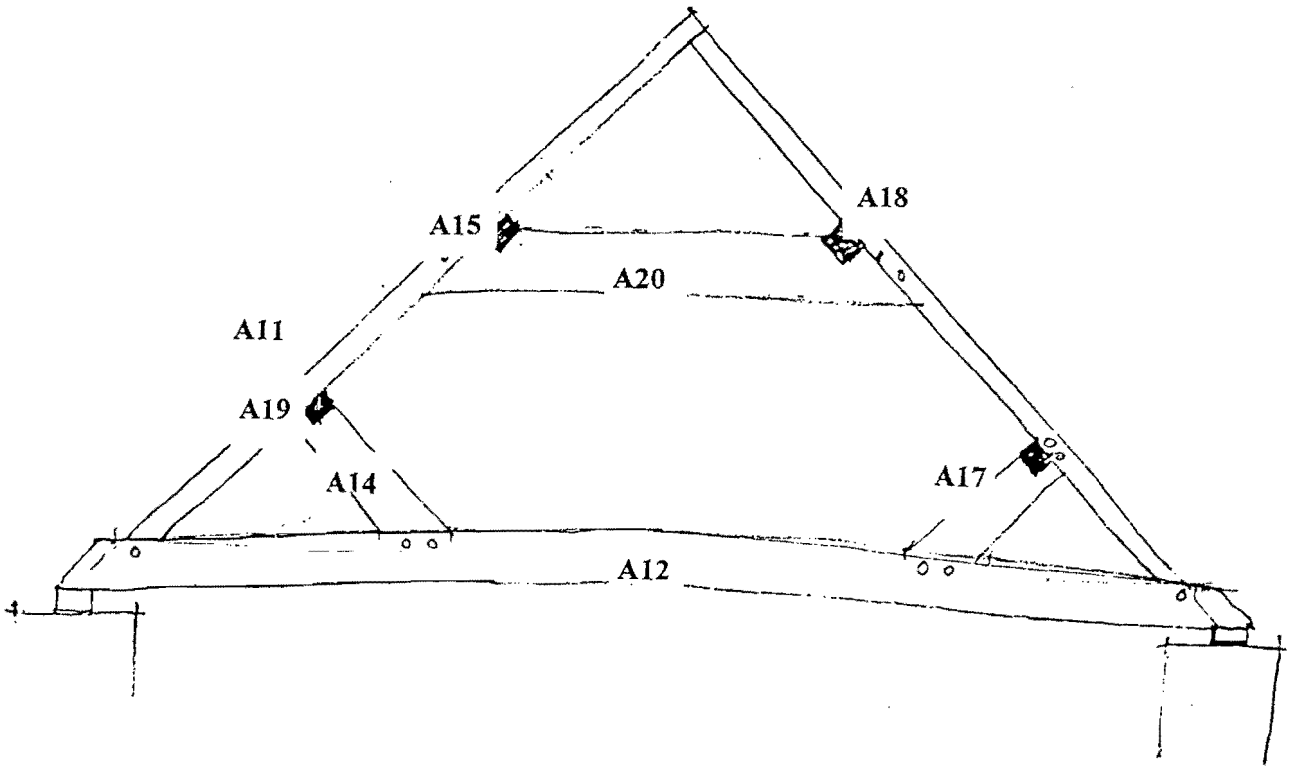
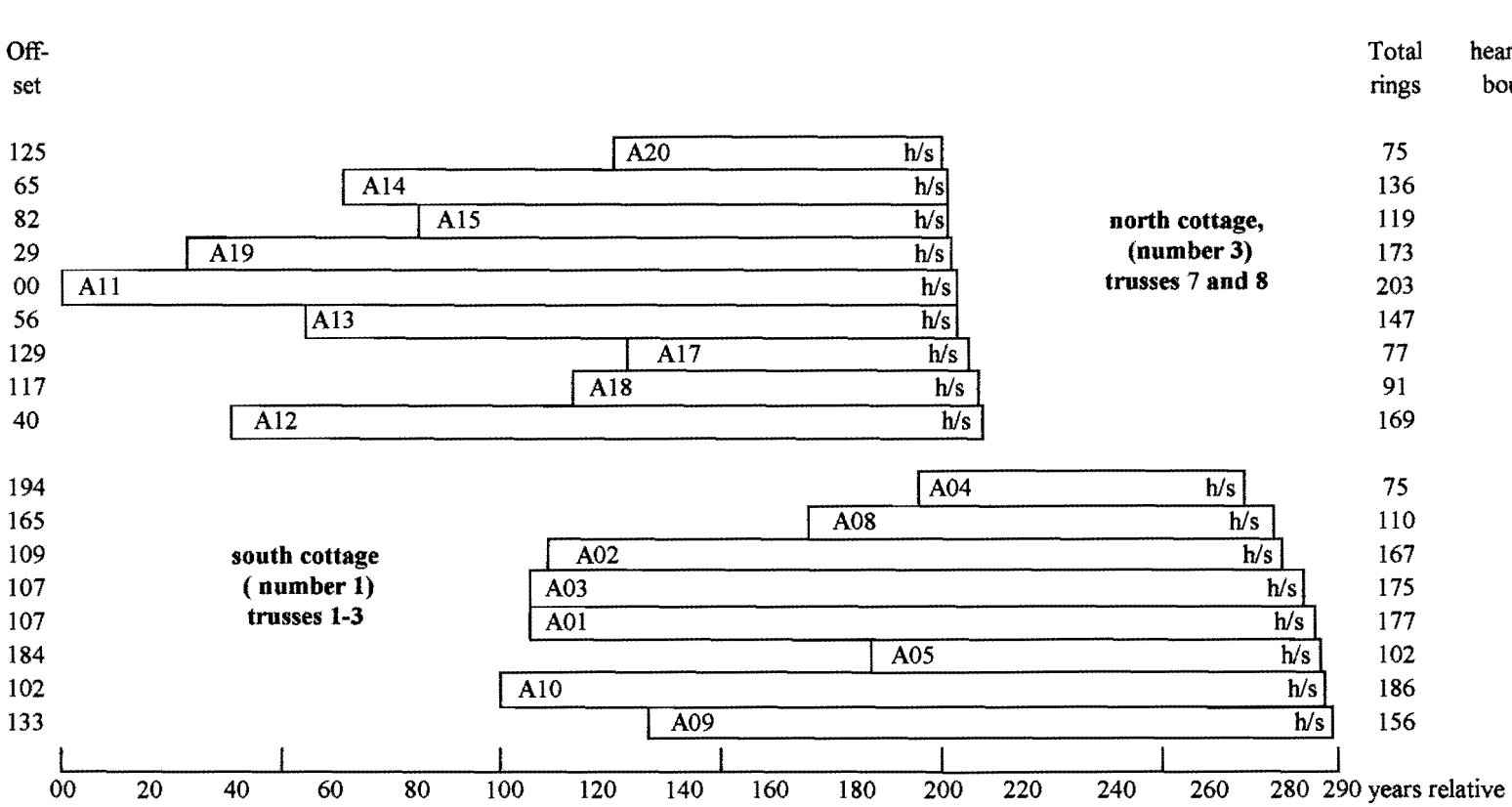
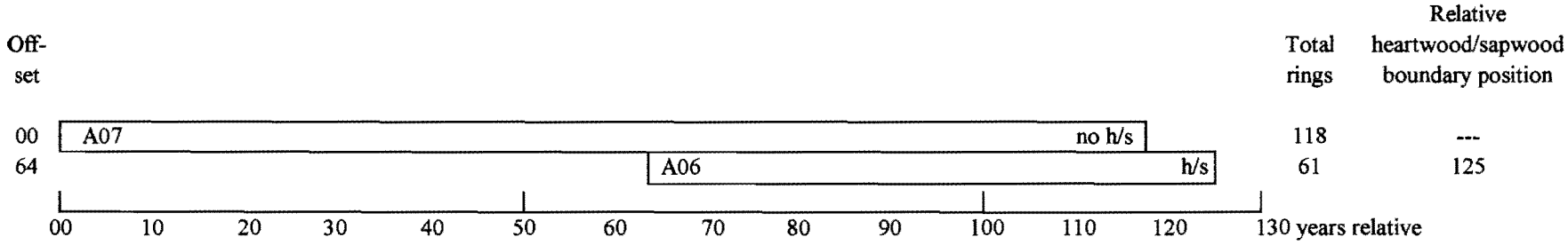


Figure 5: Bar diagram of samples in site chronology PITASQ01



White bars = heartwood rings
h/s = heartwood/sapwood boundary is last ring on sample

Figure 6: Bar diagram of samples in site chronology PITASQ02



White bars = heartwood rings
h/s = heartwood/sapwood boundary is last ring on sample

Data of measured samples – measurements in 0.01 mm units

PIT-A01A 177
112 91 91 57 66 41 89 107 118 113 67 57 74 88 47 48 37 52 74 98
83 79 69 94 156 185 127 142 154 111 62 35 47 73 65 87 120 111 77 46
36 49 45 43 56 66 75 62 68 75 42 45 63 75 66 73 81 64 43 40
38 61 116 169 193 159 197 162 116 86 74 58 59 63 56 61 64 57 44 29
33 46 49 56 53 68 72 49 58 48 53 67 70 96 105 84 87 85 67 58
71 107 88 99 73 51 43 44 76 71 83 74 98 70 66 55 66 76 79 117
121 90 92 72 45 41 34 59 80 74 111 82 89 60 45 50 83 73 74 87
65 69 74 78 84 67 55 54 43 35 55 83 84 68 76 99 77 73 73 66
82 59 72 87 80 87 80 81 68 58 69 80 81 67 53 59 72
PIT-A01B 177
105 98 86 62 71 45 93 116 118 124 58 64 62 93 42 51 43 46 67 111
74 87 69 99 176 188 140 132 160 108 44 43 61 75 70 80 116 118 85 39
36 45 61 40 48 59 58 55 65 67 46 42 55 76 68 72 92 58 33 37
45 57 118 163 186 145 181 153 115 73 72 58 63 59 54 64 67 57 43 28
34 45 52 52 53 68 79 46 59 55 58 64 75 91 106 84 93 82 66 63
76 94 99 86 75 51 39 44 74 69 78 69 108 82 60 55 67 74 89 112
124 94 88 78 50 32 44 55 90 69 113 89 82 64 51 45 75 88 72 78
67 72 71 79 90 69 53 53 37 38 54 83 88 68 73 95 85 75 71 59
84 57 71 89 83 81 83 79 70 61 63 84 85 62 46 66 74
PIT-A02A 167
126 172 214 159 158 180 190 182 160 160 152 166 178 128 122 128 158 147 153 151
141 159 132 186 146 131 187 134 91 76 128 148 148 141 151 127 159 160 153 124
121 147 198 162 153 165 127 159 90 124 111 132 104 112 130 75 63 46 59 78
117 129 120 139 147 128 93 96 95 97 106 126 105 96 104 101 93 73 67 88
135 125 114 90 90 89 99 90 73 67 98 102 83 70 72 86 64 87 88 86
101 91 95 87 98 107 114 101 81 85 104 85 68 59 93 81 82 88 87 92
75 73 51 59 76 65 66 54 84 68 73 60 68 63 70 90 80 74 78 69
66 84 84 68 76 52 38 44 65 56 67 68 89 76 93 91 49 50 59 57
65 72 58 58 51 54 73
PIT-A02B 167
144 171 198 162 164 177 184 186 158 140 154 163 169 138 117 129 162 147 166 149
141 159 130 179 147 128 186 141 96 80 134 159 139 154 160 130 157 162 147 126
107 149 203 162 154 172 138 149 101 118 115 135 115 124 125 90 66 47 56 78
115 130 123 143 150 123 96 94 98 95 103 119 111 101 109 96 100 71 68 88
96 122 109 85 83 99 99 92 76 65 98 92 89 76 79 86 70 89 91 104
92 93 86 89 99 107 120 82 88 78 113 81 67 53 88 91 74 93 86 93
70 72 59 53 70 77 55 62 76 77 73 65 65 58 66 94 66 81 77 70
62 85 84 74 75 52 46 35 60 62 67 68 84 76 96 90 60 45 44 71
64 69 76 49 52 56 77
PIT-A03A 175
184 184 181 136 159 128 120 121 127 134 108 105 105 115 141 95 71 82 101 122
134 119 103 110 118 174 117 139 144 103 59 61 96 112 114 113 109 104 129 129
134 106 95 112 134 100 105 101 91 100 78 92 89 127 97 87 91 85 56 46
56 62 76 101 99 95 83 69 69 70 82 75 75 94 75 71 94 70 70 61
51 68 66 77 84 69 62 85 85 63 58 57 70 70 70 72 61 65 60 65
63 60 66 67 66 71 63 73 86 68 72 46 70 59 45 58 84 74 77 69

79 88 79 74 47 58 68 75 64 58 72 66 52 74 55 56 67 78 66 73
68 77 77 85 79 63 65 59 51 51 49 56 78 87 78 93 86 87 70 55
74 82 75 66 73 70 60 71 71 65 78 52 60 53 80
PIT-A03B 175
176 187 183 127 169 128 119 131 121 116 113 109 108 119 131 98 65 90 99 116
130 119 108 111 119 164 127 133 149 100 66 60 94 115 115 107 105 116 127 132
128 100 98 110 133 99 111 106 82 106 77 94 91 112 97 90 83 91 64 38
49 61 74 111 88 107 93 83 61 66 82 68 73 88 80 75 93 75 68 64
52 68 58 89 84 67 66 77 86 59 62 58 77 62 68 72 65 67 53 69
63 63 70 68 60 65 71 71 90 70 67 51 65 61 54 52 88 73 75 74
79 79 81 81 50 49 64 73 67 58 58 77 61 69 55 56 66 83 65 75
60 73 70 87 80 62 73 61 42 56 57 71 103 86 94 96 85 89 62 62
72 84 74 71 68 72 68 51 79 65 77 56 52 43 71
PIT-A04A 75
127 189 148 107 95 117 149 157 113 143 170 168 128 129 153 177 171 159 165 152
155 221 134 125 145 159 129 166 171 259 257 192 166 159 146 112 168 110 75 131
110 77 83 88 90 117 81 94 77 64 133 85 111 85 75 83 88 95 54 84
61 37 40 43 53 79 65 94 109 91 91 68 60 64 80
PIT-A04B 75
132 181 147 112 98 121 146 149 124 142 181 176 128 125 142 161 180 154 152 158
173 225 131 120 146 159 144 168 178 257 219 205 179 193 162 117 129 97 70 135
111 78 85 86 101 113 100 89 74 68 125 93 101 90 79 74 97 114 59 90
62 42 31 47 49 68 56 88 96 90 89 74 51 66 80
PIT-A05A 102
84 82 91 80 99 105 107 90 101 107 77 89 79 76 98 102 115 108 69 105
116 99 57 83 100 100 89 78 108 97 101 107 92 80 78 91 118 88 85 155
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83 135
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108 130 131 89 136 98 115 90 70 85 142 120 94 128 106 102 88 87 74 100
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89 87 86 81 91 87 76 82 74 113 73 79 74 73 83 93 108 61 45 64
86
PIT-A06A 61
149 146 121 149 215 181 188 177 112 118 255 151 150 152 138 150 141 76 47 121
120 122 75 134 127 131 123 144 114 54 86 93 125 140 105 91 130 199 143 165
137 117 165 225 263 242 217 200 198 119 130 119 150 198 169 90 205 244 175 184
186
PIT-A06B 61
137 150 114 159 213 186 189 169 119 118 251 149 157 150 129 143 138 71 53 123
86 109 84 126 107 145 119 138 108 58 72 87 121 138 106 105 131 200 148 159
132 105 146 226 284 241 204 214 175 112 130 112 142 187 157 112 189 244 172 173
191
PIT-A07A 118
245 241 296 351 486 380 295 283 212 318 249 273 296 355 233 210 317 304 201 253
256 369 352 220 201 195 301 275 286 237 241 253 322 240 225 280 177 139 39 39
42 48 122 56 53 81 93 69 48 60 99 121 120 122 175 268 230 278 156 106

120 201 247 167 221 188 162 80 148 145 229 172 101 129 196 167 157 179 129 206
172 105 53 142 161 183 115 156 140 140 137 182 135 85 107 138 186 168 136 115
177 245 152 186 162 109 138 183 263 251 228 206 166 90 94 98 148 172
PIT-A07B 118
238 244 300 403 499 378 305 289 209 315 255 263 344 376 238 208 329 274 247 277
250 366 358 257 190 196 289 273 322 210 223 277 312 213 213 284 180 127 40 34
44 58 86 44 59 77 103 75 63 59 96 129 122 114 168 275 236 279 153 123
113 182 255 175 221 183 149 89 152 155 215 179 100 119 216 168 146 182 125 200
172 107 54 141 162 177 115 158 152 132 160 173 134 87 114 138 189 179 141 114
184 238 165 177 180 117 132 175 293 245 227 194 177 91 100 99 150 187
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