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Interpretation of the sapwood on the samples indicates that all the timbers in the roofs of the three ranges, plus almost all the timbers of the first and attic floor-frames of the three ranges were felled in AD 1611. A single spine beam of the attic floor-frame is made from timber felled in AD 1664, while a bressummer beam in the outshut cellar is made of a timber cut in AD 1672 - 4. There is no evidence for any earlier timber, particularly any timber dating to the sixteenth century.

Keywords

Dendrochronology
Standing Building

Author's address

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Introduction

The Manor House at Alford, situated in West Street not far from the market place, has been described as the best house in the town (TF 454759; Figs 1 and 2). It is a grade II* listed building and is on the English Heritage Buildings at Risk Register. The Manor House is also described in the listing as being of sixteenth-century construction, a date about which there has been some debate, and it is now believed to be later. Recent documentary research indicates two possible historical contexts in which it might have been built, these being immediately either side of the English Civil War.

The house is of H-plan form having a central two-storey hall range with gabled cross-wings to each end. The building was originally timber-framed with mud and stud walls beneath a thatched roof. It is believed that the original building was encased in brick later on in the seventeenth century. A ground-floor plan of the Manor House is given in Figure 3.

Within the attic space is the remains of the original clasped purlin, common-rafter framed, roof. Although the roof of the central hall range was substantially altered during the restoration work of AD 1969, it still retains a large quantity of original timber. The roofs of the cross-wings appear to be wholly intact. On the ground and first floors substantial principal wall-posts are visible, as are moulded ceiling beams. Although much of the original work has been removed, or is hidden, it is believed that other primary material survives beneath the first and attic floors.

The building is currently used as a Folk Museum operated by Alford Civic Trust. Initial conservation work at the Manor House has consisted of opening up the structure for archaeological investigation by the extensive lifting of floorboards, and the opening up of roof spaces and attic voids. Such works have provided a unique opportunity to gain access to otherwise hidden timbers.

Alford Manor has been the subject of previous tree-ring analysis, this being undertaken with a very modest number of samples. This earlier work was hampered by the inaccessibility of many of the timbers and by the difficulty in obtaining sufficient useable samples. Although some results were obtained, the work was not satisfactory and the data were never published (Esling *et al* 1990).

Archaeological recording of the Manor House is being undertaken by York Archaeological Field Services. Prior to full examination of the structure it was initially suspected that the present roofs of the three wings might have been multi-phase replacements of earlier, original, roofs. It was also believed that some of the floor frames might also be later replacements. Subsequent examination of the revealed structure by Jonathan Clark of York Archaeological Field Services, suggested that in fact the whole building was probably of a single phase, though some movement of timbers during subsequent repairs and alterations might have taken place.

Sampling

Sampling and analysis by tree-ring dating were commissioned by English Heritage. The purpose of this was to provide a precise date for the construction of the building to inform the repair programme.

On-site deliberations with Jonathan Clark, and with the site archaeologist, Beryll Lott of East Lindsey District Council concerning areas of particular interest, concluded that sufficient samples should be obtained from the whole building to show conclusively whether or not the timbers throughout the central, east and west ranges were of a single phase of felling. Samples were to be taken from the roofs of the three ranges, from the frames of each room on the first and attic floors, and from other principal structural timbers. This included a sample from the one suitable timber available from the cellar of an outshut to the rear which, it was believed, might be a later addition.

Thus, from this extensive set of timbers, a total of forty-seven samples was obtained. This number includes those useable samples obtained during the earlier programme of analysis, or re-cored at the present time to provide more suitable material. Each sample was given the code ALF-A (for Alford, site "A"), and numbered 01 – 47. Timbers were selected for sampling on the basis of their appearing to have sufficient rings for satisfactory analysis by tree-ring dating, and for having complete sapwood or at least the heartwood/sapwood boundary.

The positions of the timbers sampled are shown on plans and drawings made by York Archaeological Field Services and provided by English Heritage. These are reproduced here, provisionally, as Figure 4a - *n* (to be provided). Details of the samples are given in Table 1. In this report the roof frames and the timbers of the frames of the first and attic floors have been numbered and described on a north to south, or east to west basis as appropriate. The timbers of the floor frames are further described as being either north or south, or east or west of the main central spinal beam found in the frame of each room.

The Laboratory would like to take this opportunity of thanking Jonathan Clark for not only providing a clear and precise interpretation as to the phasing of the building, but also, a full set of drawings (to be provided). The Laboratory would also like to thank the staff of Taskers, Builders, for assisting so enthusiastically in lifting the floorboards etc. We would also like to thank Beryll Lott for her valuable contribution to on-site discussions.

Analysis

Each of forty-seven samples considered in this analysis was prepared by sanding and polishing and their annual growth-ring widths were measured. The data of these measurements are given at the end of the report. These data were then compared with each other by the Litton/Zainodin grouping procedure (see appendix).

At a minimum *t*-value of 4.5 a single site chronology, ALFASQ01, consisting of forty-four samples of length 169 rings was formed. A bar diagram showing the relative positions of the samples in this site chronology is given in Figure 5. Site chronology ALFASQ01 was then compared with a large number of relevant reference chronologies for oak. This indicated a consistent cross-match when the date of its first ring is AD 1500 and the date of its last measured ring is AD 1668. The *t*-values for this cross-matching are given in Table 2.

Site chronology ALFASQ01 was then compared with the three remaining ungrouped samples but there was no further satisfactory cross-matching. Each of the three remaining ungrouped samples was then compared individually with the reference chronologies, but again there was no satisfactory cross-matching, and these samples must remain undated.

Interpretation

Analysis by dendrochronology has produced a single site chronology made up of material obtained from a wide spread of locations at this site. This site chronology consists of forty-four samples and is 169 rings long, these being dated as spanning the period AD 1500 to AD 1668.

Seven of the samples in site chronology ALFASQ01 retain complete sapwood. Such samples thus have the last growth ring produced by the trees they represent before they were felled. Six of these samples have the same last complete, sapwood ring date, this being AD 1611 in every case. This is thus the felling date of the timbers represented. The relative position of the heartwood/sapwood boundaries on

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the great majority of the other dated samples is also consistent with a felling date of AD 1611.

However, two other samples, however, ALF-A37 and ALF-A44, represent timbers with quite different felling dates. Sample ALF-A37, from the spine beam of the attic floor-frame, has a last measured complete sapwood ring date of AD 1664. This is thus the felling date for the timber represented.

Sample ALF-A44, from the bressumer beam of the cellar outshut, has a last sapwood ring date of AD 1668. Although the timber from which this sample was taken had complete sapwood, a small portion of it, about 5 mm, was lost during sampling. It is estimated that such a loss represents 4 - 6 growth rings, and would give the timber represented a felling date range, it is estimated, of between AD 1672 - 74.

Conclusion

Analysis by dendrochronology has produced a single site chronology of forty-four samples, 169 rings long, and dated as spanning the period AD 1500 to AD 1668. It is highly likely that the dated samples represent a single phase of construction, with a number of timbers known to have been felled in AD 1611. Such a felling date would be generally consistent with the possible pre-Civil War historical context suggested by documentary evidence, but is earlier, by perhaps 20 or 30 years, than might have been expected.

Analysis has shown, however, that some other timbers used at Alford Manor were felled at different times. One spine beam at least was felled in AD 1664, during the later stages of the Civil War, and one timber from the cellar was felled between AD 1672 - 4. This dating suggests that, as suspected, some of the floor frames timbers may have been moved about during later repairs. The dating also suggests that, though based on the dating of only one timber, the cellar is probably not an original feature. It is perhaps possible that the cellar belongs to the phase that saw the original timber-framed building encased in brick.

Three samples remain undated. All three have low, though not insufficient, numbers of rings for analysis. None of them show signs of distorted or stressed or complacent rings. In this context it may be worth noting that the cross-matching between some of the samples, with values of $t=30.0$ being found, that a number of timbers almost certainly come from the same tree.

The results obtained here thus reinforce the benefits of applying tree-ring analysis even to buildings which are thought to be accurately and reliably dated on the basis of architectural features. The analysis shows no evidence of any sixteenth-century timber but clearly shows that the main phase of construction pre-dates the Civil War. The material obtained is also of particular benefit to a region of the East Midlands that has few long and well replicated reference chronologies for the post-medieval period.

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Table 1: Details of samples from the Manor House, West Street, Alford, Lincolnshire

Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date	Last heartwood ring date	Last measured ring date
	Roof of central range					
ALF-A01	North common rafter, frame 14	54	h/s	AD 1541	AD 1594	AD 1594
ALF-A02	South common rafter, frame 11	59	10	AD 1545	AD 1593	AD 1603
ALF-A03	North common rafter, frame 16	84	4	AD 1509	AD 1588	AD 1592
ALF-A04	South common rafter, frame 12	56	no h/s	AD 1522	------	AD 1577
ALF-A05	South common rafter, frame 14	62	23	AD 1544	AD 1582	AD 1605
ALF-A06	North purlin, frame 14 - 16	71	h/s	AD 1516	AD 1586	AD 1586
ALF-A07	North purlin, frame 11 - 14	88	h/s	AD 1500	AD 1587	AD 1587
ALF-A08	South common rafter, frame 19	77	no h/s	AD 1503	------	AD 1579
ALF-A09	Collar, frame 11	62	21C	AD 1550	AD 1590	AD 1611
ALF-A10	South purlin, frame 11 - 16	90	h/s	AD 1505	AD 1594	AD 1594
ALF-A11	Collar, frame 7	54	no h/s	AD 1518	------	AD 1571
ALF-A12	South common rafter, frame 7	54	h/s	AD 1545	AD 1598	AD 1598
ALF-A13	South purlin, frame 1 - 11	54	h/s	AD 1538	AD 1591	AD 1591
	Roof of east cross-wing, north bay					
ALF-A14	East common rafter, frame 7	77	h/s	AD 1507	AD 1583	AD 1583
ALF-A15	West common rafter, frame 11	54	h/s	AD 1514	AD 1567	AD 1567
ALF-A16	East common rafter, frame 3	58	3	------	------	------
ALF-A17	East common rafter, frame 2	73	h/s	AD 1521	AD 1593	AD 1593

Table 1: continued

Sample number	Sample location	Total Rings	*Sapwood rings	First measured ring date	Last heartwood ring date	Last measured ring date
	Roof of east cross-wing, south bay					
ALF-A18	East common rafter, frame 2	64	6	AD 1540	AD 1597	AD 1603
ALF-A19	East common rafter, frame 10	72	h/s	AD 1520	AD 1591	AD 1591
ALF-A20	East common rafter, frame 12	55	6	AD 1550	AD 1598	AD 1604
ALF-A21	West common rafter, frame 5	64	h/s	AD 1531	AD 1594	AD 1594
	Roof of west cross-wing, north bay					
ALF-A22	East common rafter, frame 2	82	h/s	AD 1502	AD 1583	AD 1583
ALF-A23	East common rafter, frame 3	80	h/s	AD 1520	AD 1599	AD 1599
ALF-A24	East common rafter, frame 7	62	2	AD 1531	AD 1590	AD 1592
ALF-A25	East common rafter, frame 9	54	h/s	AD 1542	AD 1595	AD 1595
	Central range, first-floor frame					
ALF-A26	North joist no 8	59	no h/s	AD 1527	------	AD 1585
ALF-A27	North joist no17	55	3	AD 1542	AD 1593	AD 1596
ALF-A28	North joist no 9	54	h/s	AD 1543	AD 1596	AD 1596
ALF-A29	North joist no11	54	no h/s	AD 1526	------	AD 1579
ALF-A30	South joist no 20	54	h/s	------	------	------
ALF-A31	Main east-west spine beam	104	19C	AD 1508	AD 1592	AD 1611
ALF-A32	South joist no 14	54	2	AD 1538	AD 1589	AD 1591

Table 1: continued

Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date	Last heartwood ring date	Last measured ring date
	East cross-wing, first-floor frame					
ALF-A33	East joist no 11	73	21C	AD 1539	AD 1590	AD 1611
ALF-A34	East joist no 2	68	21C	AD 1544	AD 1590	AD 1611
ALF-A35	East joist no 6	60	no h/s	------	------	------
ALF-A36	West joist no 14	74	22C	AD 1538	AD 1589	AD 1611
	Central range, attic floor-frame					
ALF-A37	Main east-west spine beam	138	42C	AD 1527	AD 1622	AD 1664
ALF-A38	South joist no 9	80	h/s	AD 1508	AD 1587	AD 1587
	West cross-wing, attic floor-frame					
ALF-A39	Main north-south beam, south bay	91	24c	AD 1518	AD 1584	AD 1608
	East cross-wing, attic floor-frame					
ALF-A40	West joist no 5, south bay	81	17C	AD 1531	AD 1594	AD 1611
ALF-A41	East joist no 5, south bay	54	h/s	AD 1539	AD 1592	AD 1592
ALF-A42	West joist no10, north bay	68	h/s	AD 1532	AD 1599	AD 1599
ALF-A43	West joist no 4, north bay	58	h/s	AD 1537	AD 1594	AD 1594

7

Table 1: continued

Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date	Last heartwood ring date	Last measured ring date
	Other timbers					
ALF-A44	North-south bressumer in rear cellar	82	10c	AD 1587	AD 1658	AD 1668
ALF-A45	North ground-floor wall post, west wing	78	h/s	AD 1509	AD 1586	AD 1586
ALF-A46	North ground-floor wall post, central range	78	20	AD 1531	AD 1588	AD 1608
ALF-A47	North ground-floor wall post, east wing	70	h/s	AD 1522	AD 1591	AD 1591

*h/s = the heartwood/sapwood boundary is the last ring on the sample
C = complete sapwood on sample, last measured ring date is felling date of the timber
c = complete sapwood on timber, all or part lost during coring

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Table 2: Results of the cross-matching of site chronology ALFASQ01 and relevant reference chronologies
when first ring date is AD 1500 and last ring date is AD 1668

Reference chronology	Span of chronology	t-value	
East Midlands	AD 882 – 1981	8.8	(Laxton and Litton 1988)
Sutton in Ashfield, Notts	AD 1441 – 1656	7.1	(Howard *et al* 1996)
Wales and West Midlands	AD 1341 – 1636	7.0	(Siebenlist-Kerner 1978)
St Hugh's Choir, Lincoln Cathedral	AD 1575 – 1724	6.1	(Laxton and Litton 1988)
Angel Choir, Lincoln Cathedral	AD 1576 – 1669	6.0	(Laxton and Litton 1988)
England	AD 401 – 1981	5.8	(Baillie and Pilcher 1982 unpubl)
MC10---H	AD 1386 – 1585	5.0	(Fletcher 1978 unpubl)

Figure 1: Map to show general location of Alford
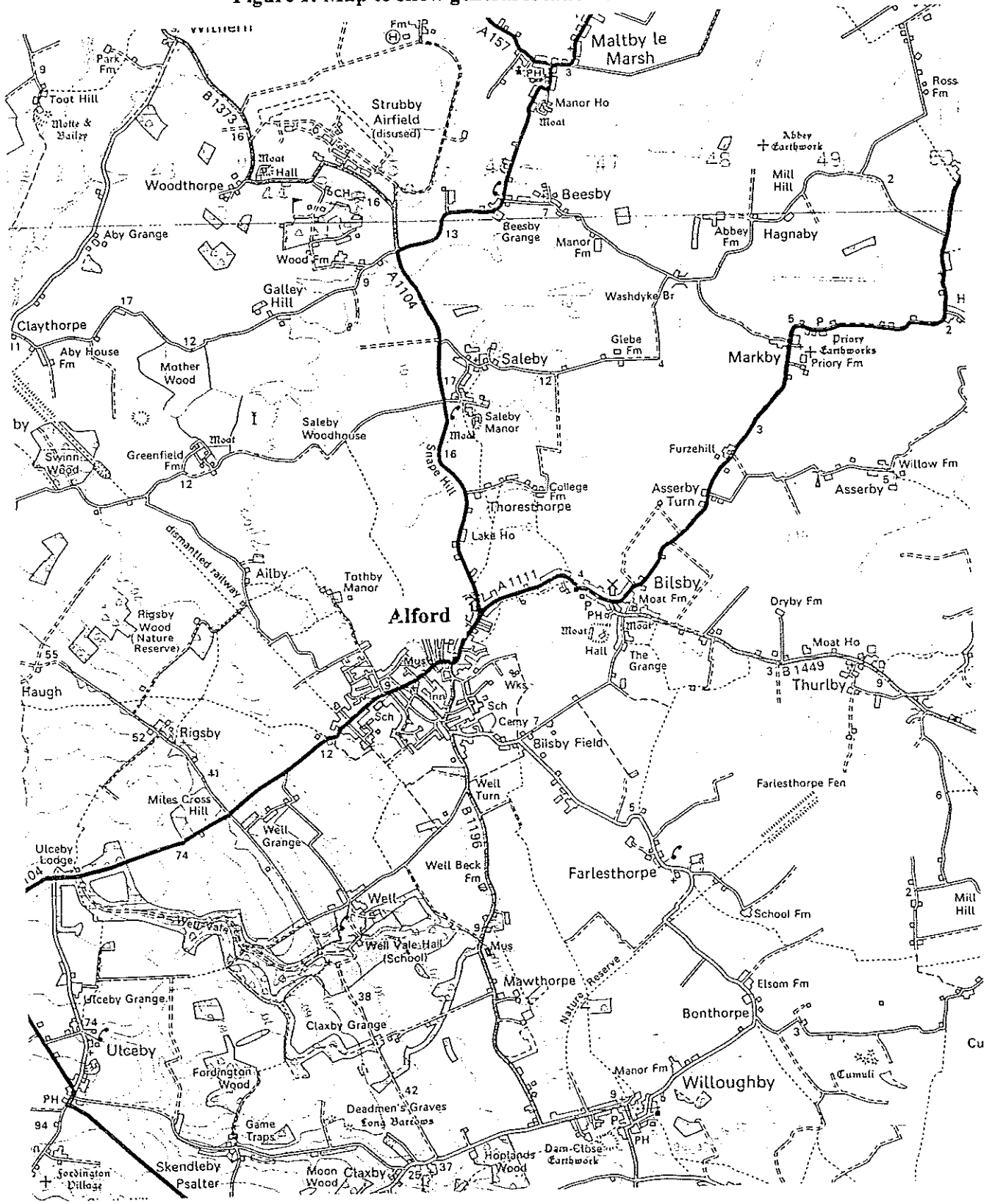
Figure 2: Map to show location of Alford Manor House
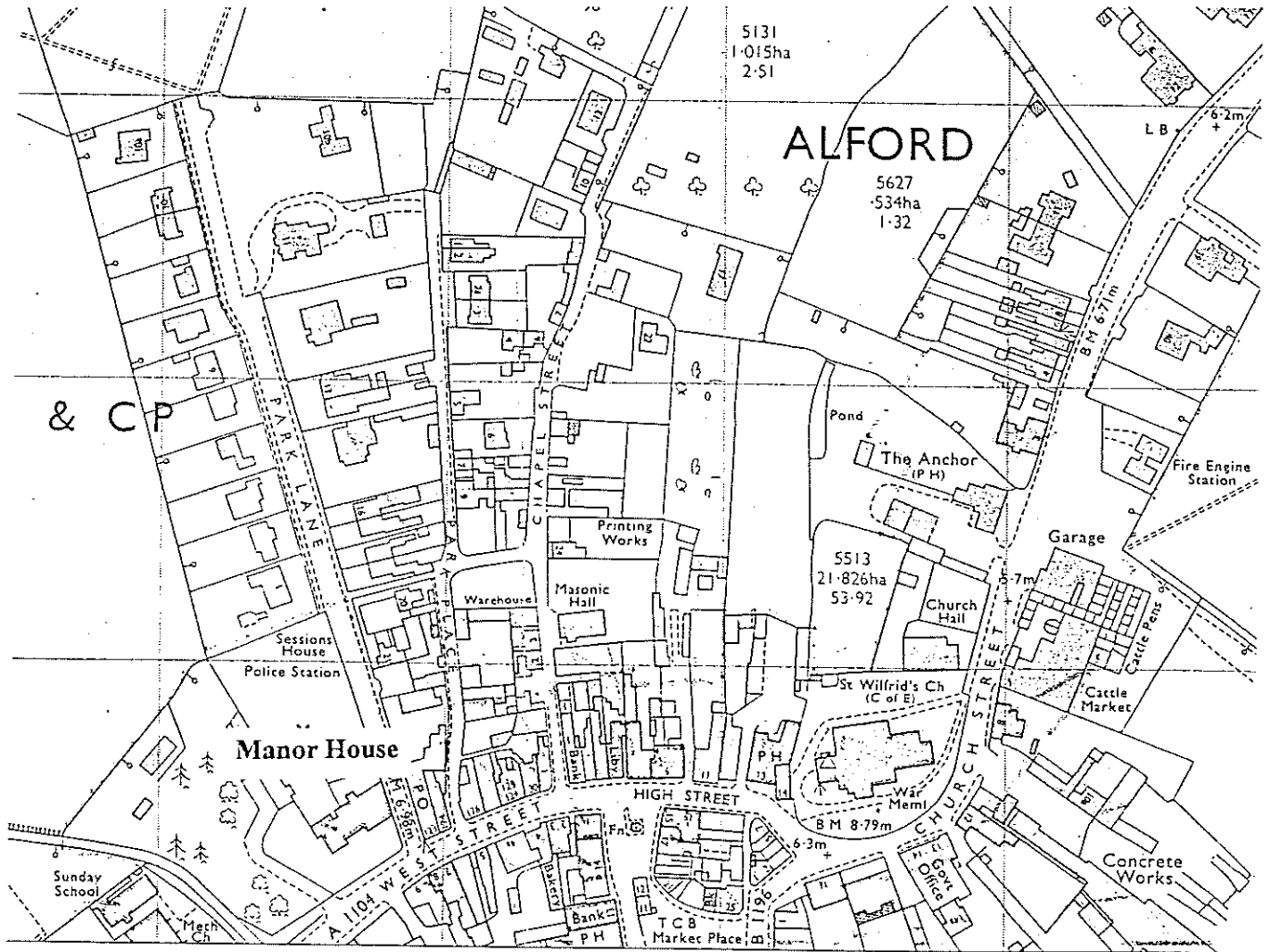
Figure 3: Ground-floor plan of Alford Manor

N
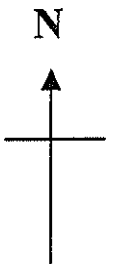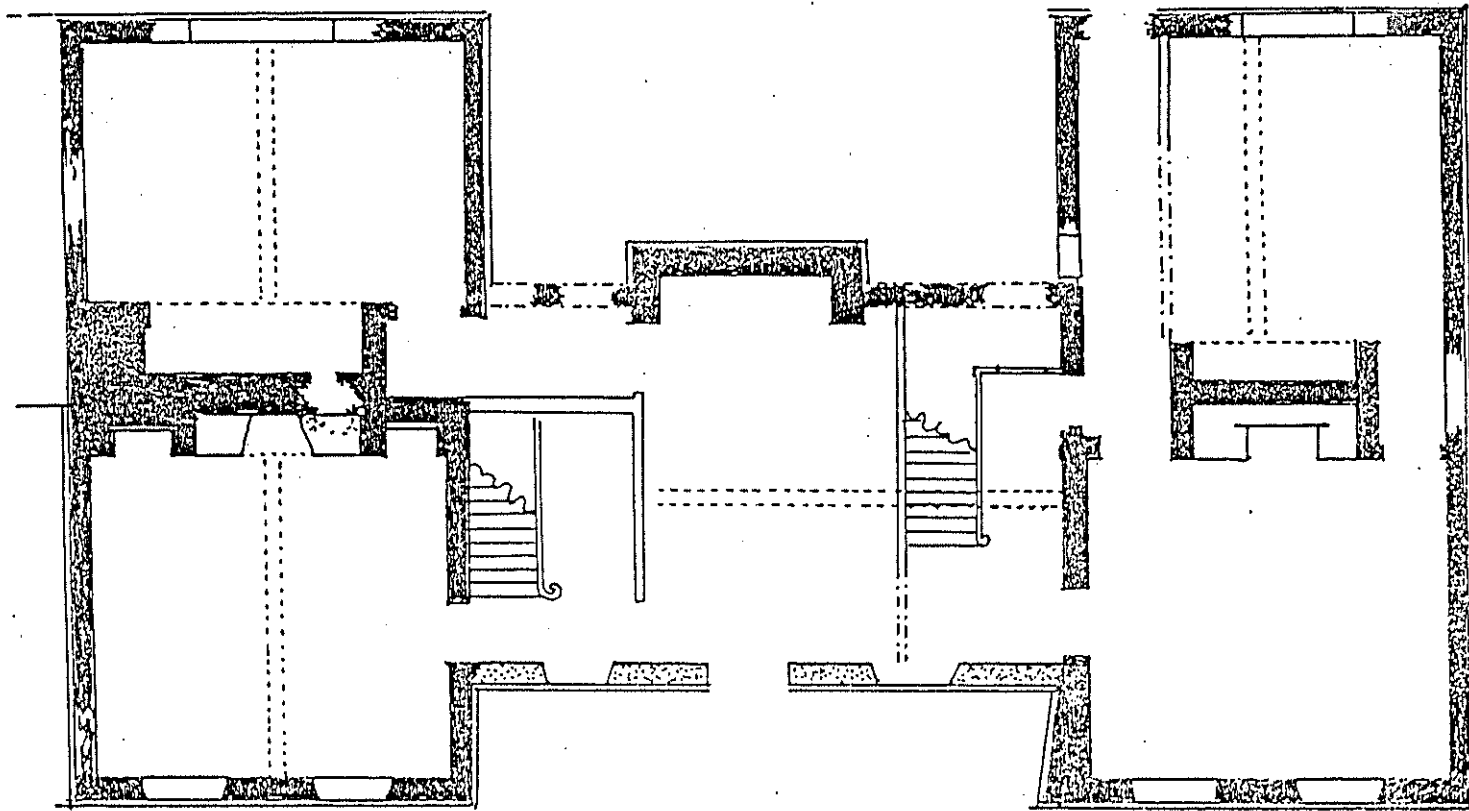
Figure 4a: Plan at attic level to show approximate position of roof and floor-frame timbers sampled

Figure 4b: Plan at first-floor level to show approximate position of floor-frame timbers sampled

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28 26

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14

N

Figure 4c: Plan at ground-floor level to show approximate position of timbers sampled

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47

N

Figure 5: Bar diagrams of the samples in site chronology ALFASQ01

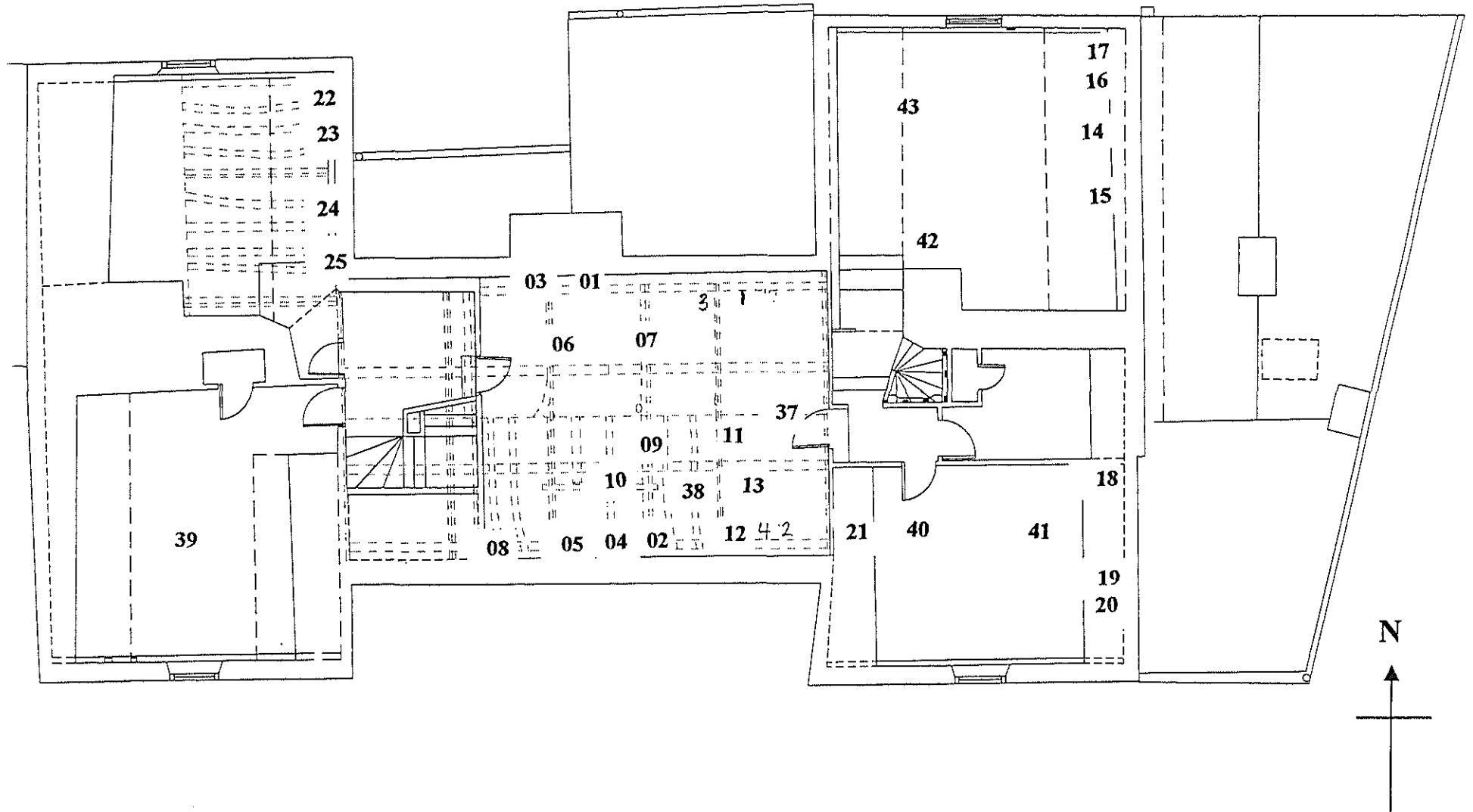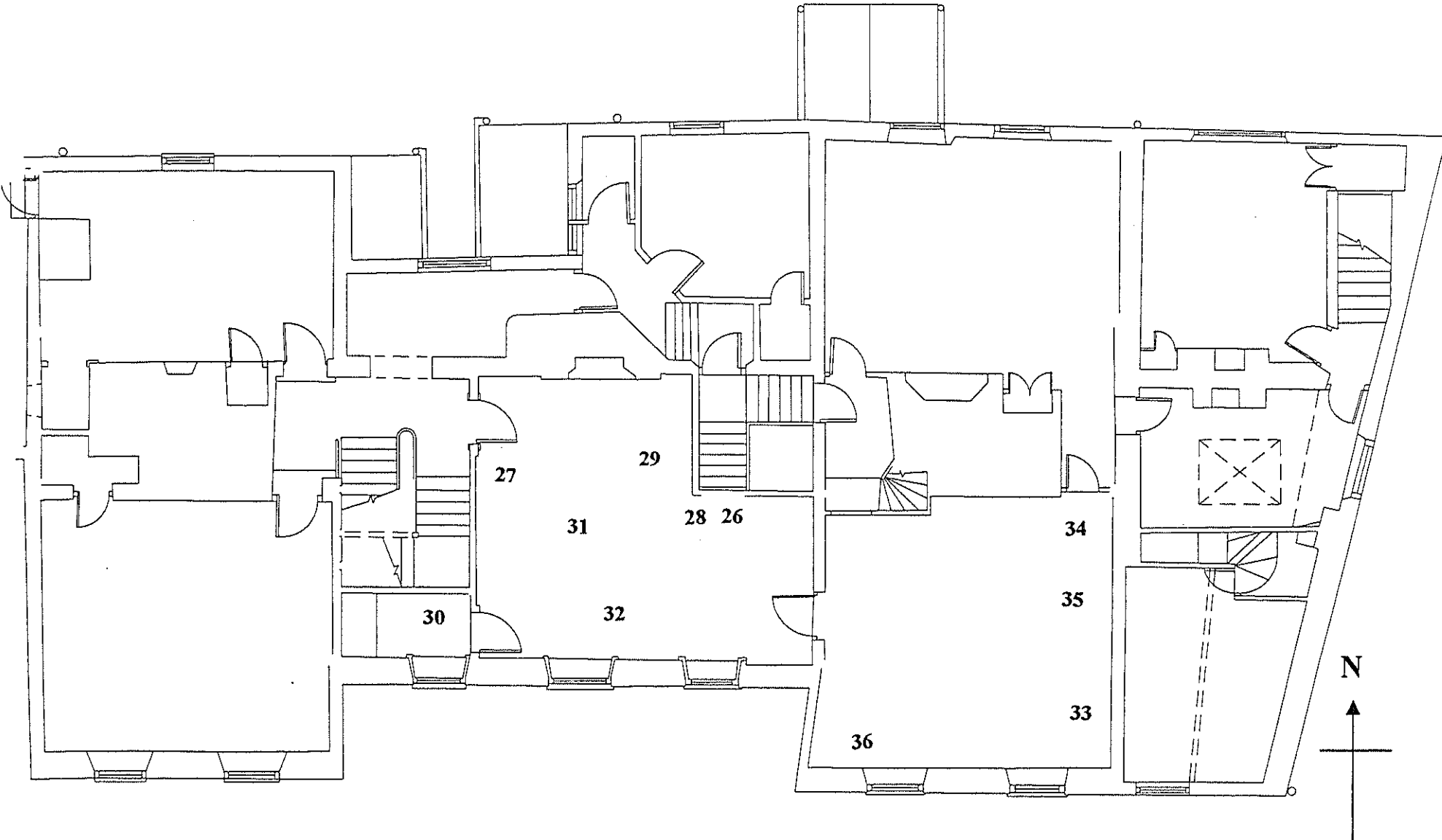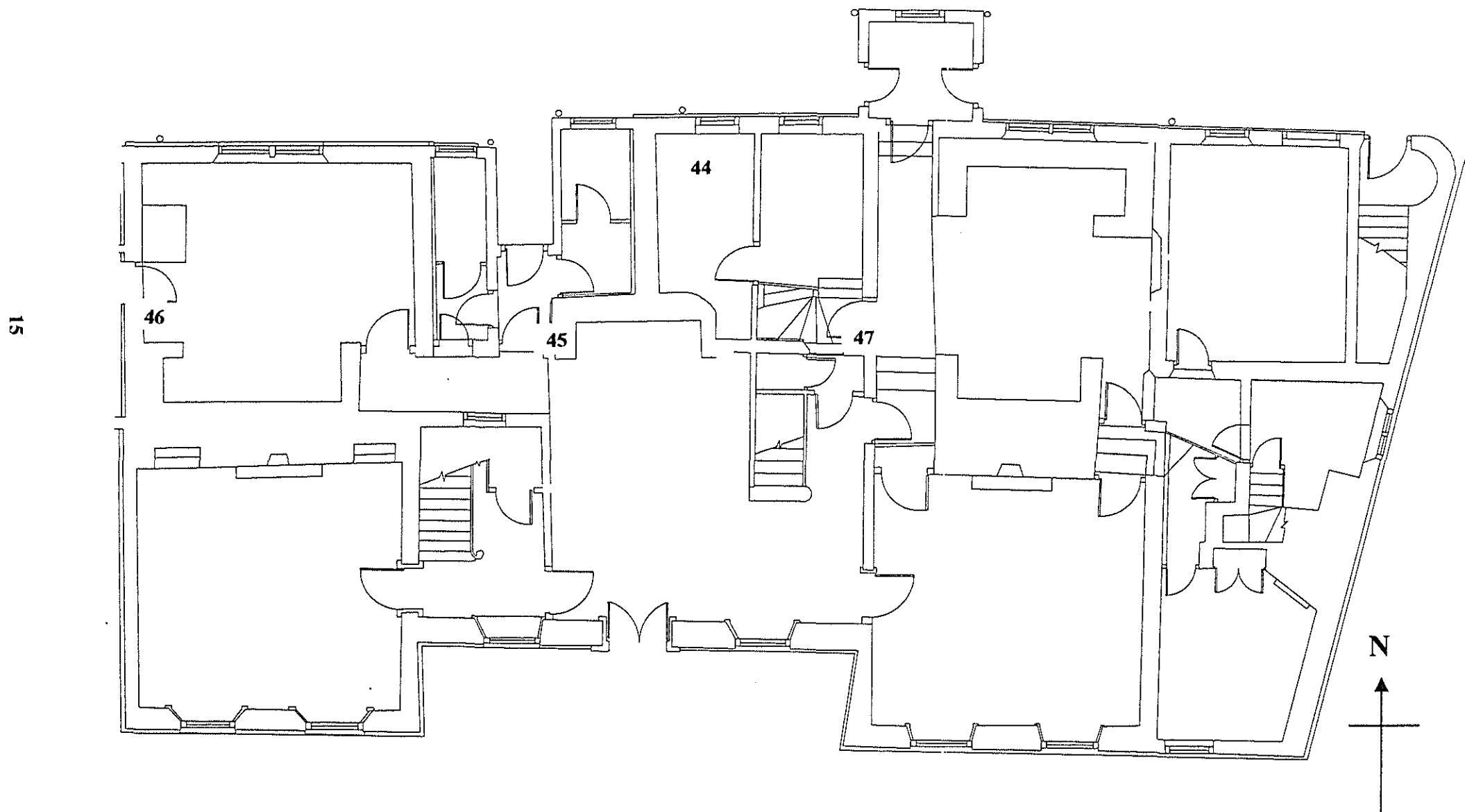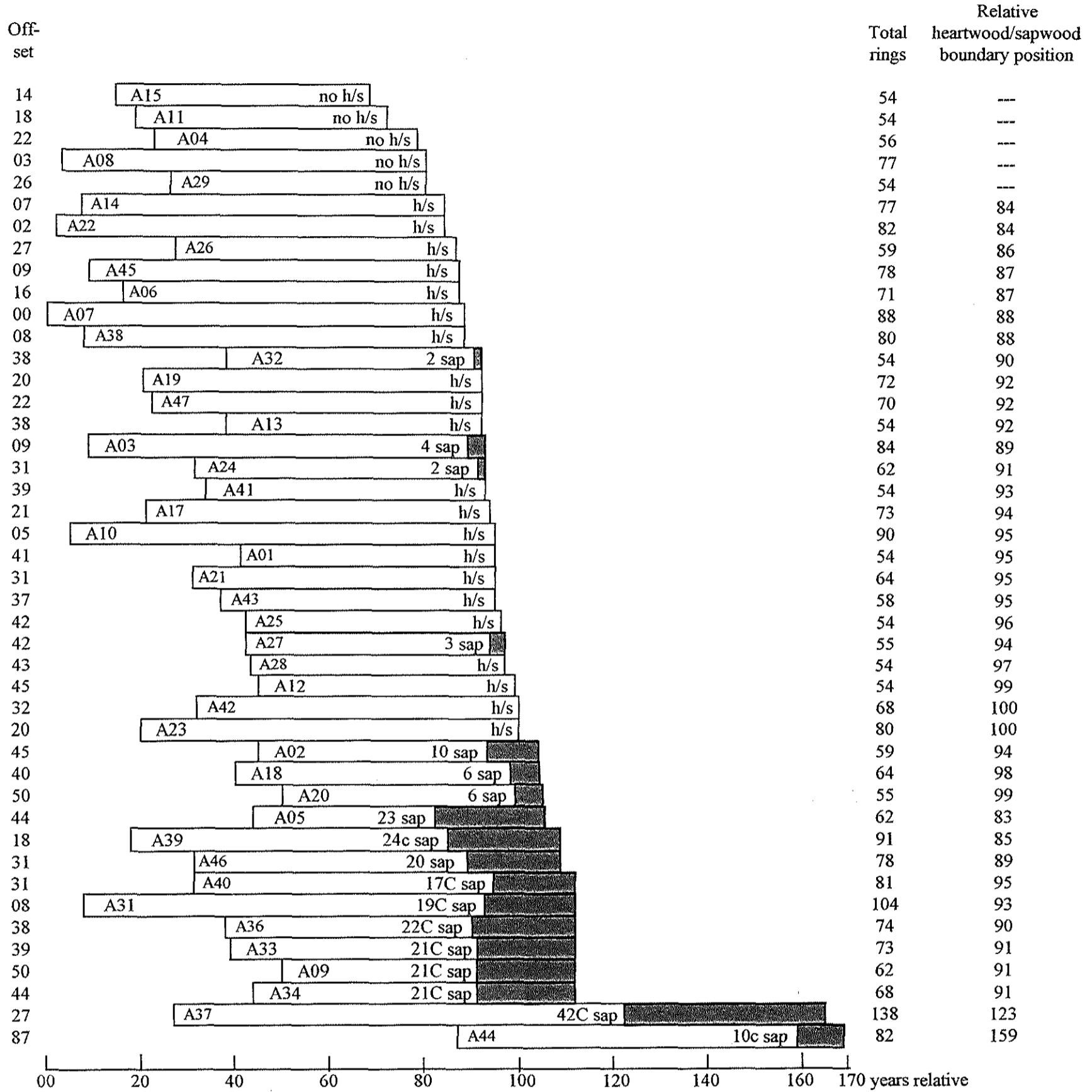| Off-set			Total rings	Relative heartwood/sapwood boundary position
14	A15	no h/s	54	---
18	A11	no h/s	54	---
22	A04	no h/s	56	---
03	A08	no h/s	77	---
26	A29	no h/s	54	---
07	A14	h/s	77	84
02	A22	h/s	82	84
27	A26	h/s	59	86
09	A45	h/s	78	87
16	A06	h/s	71	87
00	A07	h/s	88	88
08	A38	h/s	80	88
38	A32	2 sap	54	90
20	A19	h/s	72	92
22	A47	h/s	70	92
38	A13	h/s	54	92
09	A03	4 sap	84	89
31	A24	2 sap	62	91
39	A41	h/s	54	93
21	A17	h/s	73	94
05	A10	h/s	90	95
41	A01	h/s	54	95
31	A21	h/s	64	95
37	A43	h/s	58	95
42	A25	h/s	54	96
42	A27	3 sap	55	94
43	A28	h/s	54	97
45	A12	h/s	54	99
32	A42	h/s	68	100
20	A23	h/s	80	100
45	A02	10 sap	59	94
40	A18	6 sap	64	98
50	A20	6 sap	55	99
44	A05	23 sap	62	83
18	A39	24c sap	91	85
31	A46	20 sap	78	89
31	A40	17C sap	81	95
08	A31	19C sap	104	93
38	A36	22C sap	74	90
39	A33	21C sap	73	91
50	A09	21C sap	62	91
44	A34	21C sap	68	91
27	A37	42C sap	138	123
87	A44	10c sap	82	159

00   20   40   60   80   100   120   140   160   170 years relative

*white bars = heartwood rings, shaded area = sapwood rings
h/s = the heartwood/sapwood boundary is the last ring on the sample
C = complete sapwood retained on sample, last measured ring date is felling date of tree
c = complete sapwood on timber, all or part lost in sampling

Data of measured samples – measurements in 0.01 mm units

ALF-A01A 54
226 277 284 310 266 296 317 357 302 250 284 201 280 163 103 121 131 105 164 172
172 244 228 217 223 200 244 310 268 278 280 184 146 148 222 171 99 125 125 136
152 143 189 198 173 203 154 107 135 77 93 104 162 92
ALF-A01B 54
202 274 288 315 272 264 304 377 309 242 309 213 279 155 108 120 140 105 175 181
185 254 216 225 221 195 232 299 254 271 254 200 124 130 216 165 108 100 129 145
141 160 184 194 178 215 138 100 127 79 94 105 160 95
ALF-A02A 59
142 124 95 173 249 151 277 150 222 143 302 296 166 106 231 288 242 227 187 179
118 158 137 111 149 157 97 101 77 98 169 119 162 118 94 182 138 140 121 187
206 200 80 71 97 74 89 91 152 204 227 121 213 176 118 112 93 169 292
ALF-A02B 59
171 119 102 169 244 166 271 152 214 148 300 288 163 103 245 281 235 245 189 167
131 152 140 158 159 144 101 86 87 98 144 107 166 124 95 179 146 136 108 186
196 199 85 63 94 80 97 80 174 175 214 134 206 176 104 108 96 179 244
ALF-A03A 84
608 434 343 388 417 242 263 303 309 555 568 321 268 244 147 169 142 224 220 234
223 93 278 246 193 172 261 159 151 122 168 154 152 94 104 108 117 67 80 104
122 115 135 68 99 74 158 148 93 71 99 132 131 103 122 100 68 108 83 120
85 101 62 56 63 69 116 80 82 73 76 113 69 84 68 78 107 103 56 40
52 55 36 73
ALF-A03B 84
589 399 354 393 419 242 265 296 312 502 548 328 250 238 152 182 135 230 224 227
219 112 266 260 188 167 266 153 139 120 182 149 155 104 102 117 119 73 77 99
130 117 120 84 83 81 144 155 97 68 104 127 139 98 118 101 72 99 89 113
86 91 70 59 55 67 106 70 87 71 74 113 67 82 70 92 86 110 62 29
62 47 57 53
ALF-A04A 56
252 148 186 142 232 210 229 216 119 276 229 187 178 253 144 137 124 181 157 166
104 104 119 119 73 80 91 135 120 136 64 98 74 161 148 91 69 100 137 128
92 121 106 67 109 87 113 75 102 62 68 59 64 106 80 76
ALF-A04B 56
243 159 175 138 234 220 227 219 111 270 249 200 173 268 145 145 118 180 153 152
101 104 120 107 83 75 94 139 114 124 95 92 67 159 149 101 64 109 124 138
99 114 111 64 102 90 110 81 94 72 51 65 67 96 79 78
ALF-A05A 62
375 286 212 207 214 184 163 212 177 225 151 147 160 178 116 196 211 197 151 209
165 151 172 151 149 113 146 131 91 73 122 170 122 107 130 143 126 110 122 131
120 91 110 46 40 84 78 94 104 161 90 116 69 94 83 108 92 85 113 98
80 64
ALF-A05B 62
364 289 220 195 237 191 192 245 180 216 200 162 150 200 134 189 200 183 172 201
157 139 168 150 152 121 142 141 90 89 118 149 103 107 144 138 124 106 118 132
122 99 145 96 61 131 115 102 111 146 100 114 64 94 83 98 103 75 115 101
85 72
ALF-A06A 71
204 284 281 317 242 290 213 231 176 113 159 202 192 181 142 150 179 156 130 180
133 121 109 169 130 174 143 141 187 140 129 112 175 133 118 187 107 122 102 139
107 74 78 125 131 137 111 122 84 77 124 93 81 99 91 109 92 84 88 76
130 75 75 84 96 96 78 85 76 101 104

ALF-A06B 71
232 284 287 350 228 290 211 224 180 110 155 197 194 168 135 159 168 151 137 176
138 94 105 173 129 165 143 148 182 139 133 117 161 123 139 177 99 129 92 142
111 85 67 132 114 159 122 120 85 81 119 99 86 94 93 106 91 85 83 86
123 77 74 97 93 96 74 74 89 88 124
ALF-A07A 88
312 300 372 364 409 522 390 309 368 476 321 254 297 198 165 94 183 157 208 177
102 128 124 87 124 150 187 120 70 85 57 88 72 73 70 67 64 79 79 99
110 103 65 100 111 92 90 85 117 80 49 78 48 47 50 63 159 120 57 65
85 98 91 86 76 110 88 74 106 70 116 102 66 49 39 124 138 101 71 92
81 89 89 70 100 109 137 113
ALF-A07B 88
285 285 376 367 402 524 388 312 375 484 312 251 292 201 157 104 185 147 213 166
117 113 118 84 117 138 182 121 89 74 51 91 72 77 70 70 64 82 71 104
103 103 69 95 114 93 93 89 120 83 47 73 50 54 43 46 168 123 56 60
92 80 85 88 76 121 80 76 101 66 108 103 72 42 48 143 123 107 81 89
70 95 89 79 92 124 135 150
ALF-A08A 77
347 440 323 365 455 397 551 425 334 327 396 239 210 214 258 456 368 229 202 234
160 195 139 227 195 167 140 84 157 140 155 168 204 177 174 196 154 170 106 100
90 116 93 75 65 108 130 82 100 72 97 83 144 103 104 66 136 163 136 136
144 103 118 86 91 122 75 89 54 48 70 61 110 84 97 87 113
ALF-A08B 77
361 413 333 366 462 395 538 427 322 334 391 234 207 216 256 464 372 227 196 256
155 186 141 230 200 166 145 77 174 136 124 155 175 182 160 207 139 161 119 96
83 110 88 68 69 113 141 77 106 74 107 79 147 102 103 69 129 175 131 138
144 101 123 93 92 111 73 89 48 58 60 66 109 65 105 83 88
ALF-A09A 62
237 242 188 218 151 222 200 172 130 222 264 129 137 141 113 153 141 145 124 150
164 113 87 88 134 111 128 140 113 101 147 103 118 102 149 137 148 100 140 130
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