

Ancient Monuments Laboratory
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TREE-RING ANALYSIS OF TIMBERS
FROM THE LAW LIBRARY, AND 8 - 9,
THE CLOSE, EXETER, DEVON

C D Litton
R E Howard
R R Laxton

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Summary

Fourteen samples from the roof of the front range of 8 - 9, the Close, Exeter, were analysed by tree-ring dating. This analysis produced two site chronologies. The first, consisting of two samples, has 183 rings, the second site chronology, composed of three samples, has 123 rings. Although a tentative date was produced for the first site chronology the t-values are rather low. No great confidence should be placed in this dating, it is given here simply for future reference. The second site chronology failed to date. This site must remain undated for the moment.

Authors' addresses :-

R E Howard
UNIVERSITY OF NOTTINGHAM
University Park
Nottingham
NG7 2RD

Dr R R Laxton
UNIVERSITY OF NOTTINGHAM
University Park
Nottingham
NG7 2RD

Dr C D Litton
UNIVERSITY OF NOTTINGHAM
University Park
Nottingham
NG7 2RD

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Introduction

The building at 8-9, The Close, Exeter, (SX 921926; Figs 1 and 2) forms a single range facing onto the Cathedral Green. To the rear of this front range runs a further range at right angles which contains an open hall. It is believed that the front range and the open hall are of the same date. Access to the hall is via an ally-way on the northwest side of the building plot. A second entrance from the Close further to the east leads via a shorter arched passage to an enclosed rear courtyard. The courtyard gives access to the Notaries House. The archway is decorated with carved spandrels and the passageway itself has two blocked stone door openings. It is believed that these buildings were at one time the Canon's House. A plan of the ground floor of the building is provided in Figure 3.

The front range is of two storeys, coursed in Heavitree stone masonry below, with half timbering above. The upper floor oversails the lower and is supported on curved oak brackets resting on stone corbels. The roof of the front range is of principal rafter trusses with collars and arch-braces with double purlins. An illustrative example of a truss type is given in Figure 4.

The open hall to the rear contains a hammer-beam roof of three bays with five trusses. Between the main trusses are intermediate frames. This roof is exceptionally decorative, even by the standards of the Exeter group, of which there are four or so other examples (the Guildhall, the Deanery, the Archdeacons house etc, Howard *et al* forthcoming). The hammer-beams, arch-braces, coved rafters, and purlins, etc, are all highly moulded and carved, as is the open-work tracery. The ends of the hammerbeams are decorated with angels, and ornately carved bosses hide the joints between timbers. An illustrative example of a truss and elevation of a bay are given in Figure 5.

While there is currently no internal access between the front range and the rear open hall, at one time however, there was. This was through an ornately carved multi-cusped and foiled doorway in a partition wall, which is now blocked up (Fig 6).

Sampling and analysis by tree-ring dating of timbers from 8-9, The Close was commissioned by English Heritage. Sampling was to include the roofs of the front range and the open hall, and the now blocked doorway between the two. The purpose of analysis was to establish the absolute and relative date of each element of the building and to more accurately place the roofs, for comparative purposes, within a group of similar roofs in Exeter. These include other buildings that the Nottingham Laboratory has analysed by dendrochronology, the Deanery, Exeter Guildhall, and the Archdeacon of Exeter's House (Howard *et al* forthcoming). The research into the group of roofs in Exeter is being undertaken in connection with a major programme of recording and repair at Bowhill in Devon, which is being funded by English Heritage (Groves forthcoming).

A further purpose of sampling was to obtain additional tree-ring data for this region. Exeter, and the southwest in general, have relatively few dated reference chronologies. This is in part due to the fact that samples in this area have relatively few rings, caused by the wide rings found on many trees and timber, and in part due to the complacency of the growth-ring patterns. It was believed that Exeter Law Library would provide a substantial amount of timber with more rings on them and with a distinctive regional climatic signature.

The Laboratory would like to take this opportunity to thank all those who assisted with the sampling of the timbers. In particular thanks are due to the Dean and Chapter of Exeter Cathedral, and to Colonel Woodcock, the Chapter Clerk. Thanks are also due to the partners and staff of the prestigious West Country firm Ford Simey Daw Roberts, Solicitors who, rather aptly, are the current tenants of the hall range. In particular Mr Simon Sanger-Anderson, managing partner, and Mrs Maureen Greenaway, head of administration, were extremely helpful in facilitating viewing of the Hall timbers.

Thanks are also due to Stuart Blaylock of Exeter Archaeology who undertook considerable liaison duties between all the parties concerned, and assisted with viewing, interpretation, and sampling. Thanks are also due to John Allan Curator of the Royal Albert Memorial Museum, Exeter.

Sampling

The roofs and other timbers of the front range, that is 8-9 the Close, and open hall, that is the Law Library, were viewed and initially assessed for their accessibility and their suitability for tree-ring dating. While the timbers of the front range were both relatively easily accessible and suitable, those of the Law Library were not. Access to the timbers was made difficult by the presence of computers, photocopiers, desks, shelves, and other office equipment, and by the great height of the roof timbers.

The timbers of the Law Library were viewed from an extension ladder. They were assessed as not being especially suitable for tree-ring analysis, appearing to have wide rings and being so highly moulded and carved that they are unlikely to retain any sapwood or the heartwood/sapwood boundary, except possibly at the apex or on the hidden upper faces of the timbers.

The timber of the doorway between the two ranges was also assessed. While it was felt that the tree from which the doorway was carved possibly did have a sufficient number of rings, access to the optimum coring position to gain the maximum number of rings available was made impossible by the partition wall. Furthermore, the highly decorated nature of the doorway makes coring a slightly unsuitable method of sampling at the moment. This might better be done if and when the door is unblocked and a more discreet site for coring is revealed.

Following the initial viewing assessment of the Law Library roof, core samples were obtained from six timbers of the two northern-most trusses in an attempt to more accurately verify their growth-ring count. Given the difficulty of access, the awkwardness of operating from an extension ladder and a precarious roof of an upper-floor store, it is not surprising that satisfactory samples could not be obtained, the cores having too few rings. This was despite the best efforts of all who assisted, particularly Stuart Blaylock and the staff of Ford Simey Daw Roberts.

It should be stressed, however, that the poor quality of the samples from a dendrochronological point of view is due to the difficulty of attaining the correct coring angle. It is likely that towards the apex of the roof the timbers are cut from whole trees rather than made up of thin applied moulded pieces, and may contain a greater number of rings. Should the floor-space of the office in the hall ever be cleared and high-level scaffolding and secure flooring be installed, perhaps as part of some future decoration or renovation, it is strongly advised that the timbers be cored again.

Thus, successful sampling was restricted to the roof of the front range, 8-9 the Close. From here a total of fourteen different oak timbers was sampled by coring. Each sample was given the code EXT-D (for Exeter, site "D") and numbered 01-14. The positions of these cores were recorded at the time of sampling on plans provided by English Heritage. They are reproduced here as Figure 7. On these plans the trusses have been numbered from east to west. Details of the samples are given in Table 1.

Analysis

Each sample was prepared by sanding and polishing and the growth-ring widths of all fourteen samples measured. The data of these measurements are given at the end of the report. The growth-ring widths of the samples were compared with each other by the Litton/Zainodin grouping procedure (see appendix). At a minimum *t*-value of 4.5 two groups of samples formed.

The two samples of the first group cross-matched with each other at relative positions as shown in the bar diagram Figure 8. The growth-ring widths of the two samples were combined at these relative off-set positions to form EXTDSQ01, a site chronology of 143 rings. Site chronology EXTDSQ01 was compared

with a series of relevant reference chronologies for oak, suggesting a first ring date of AD 1324 and a last measured ring date of AD 1466. Evidence for this possible dating is given in the *t*-values of Table 2. It will be seen from this table that the *t*-values are rather low, and, given that there are only two samples in this site chronology, caution must be expressed as to its reliability. Also, even if correct, it might not represent the felling date of the rest of the timber used in the building as a whole as it represents only two timbers.

The three samples of the second group cross-matched with each other at relative positions as shown in the bar diagram Figure 9. The growth-ring widths of these three samples were combined at these relative offset positions to form EXTDSQ02, a site chronology of 83 rings. Site chronology EXTDSQ02 was compared with a series of relevant reference chronologies for oak but there was no satisfactory cross-matching.

The two site chronologies were compared with each other, and with the remaining ungrouped samples. In neither case was there any satisfactory cross-matching. Each of the nine remaining ungrouped samples was compared individually with a full range of reference chronologies, but again there was no satisfactory cross-matching.

Conclusion

Due to the lack of cross-matching, this site must remain undated for the moment. Encouragingly there are a number of timbers with over 100 rings and so it is possible that it might date against the other material from Exeter in due course.

None of the undated samples shows any sign of stress or complacency that might make cross-matching and dating difficult. It is possible that the timbers represented are from a small climatic niche which is unrepresented in any of the available reference chronologies.

Should the roof of the hall in the Law Library become more easily accessible it is strongly advised that the timbers there be re-sampled.

Bibliography

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Table 1: Details of samples from 8-9, The Close, Exeter,

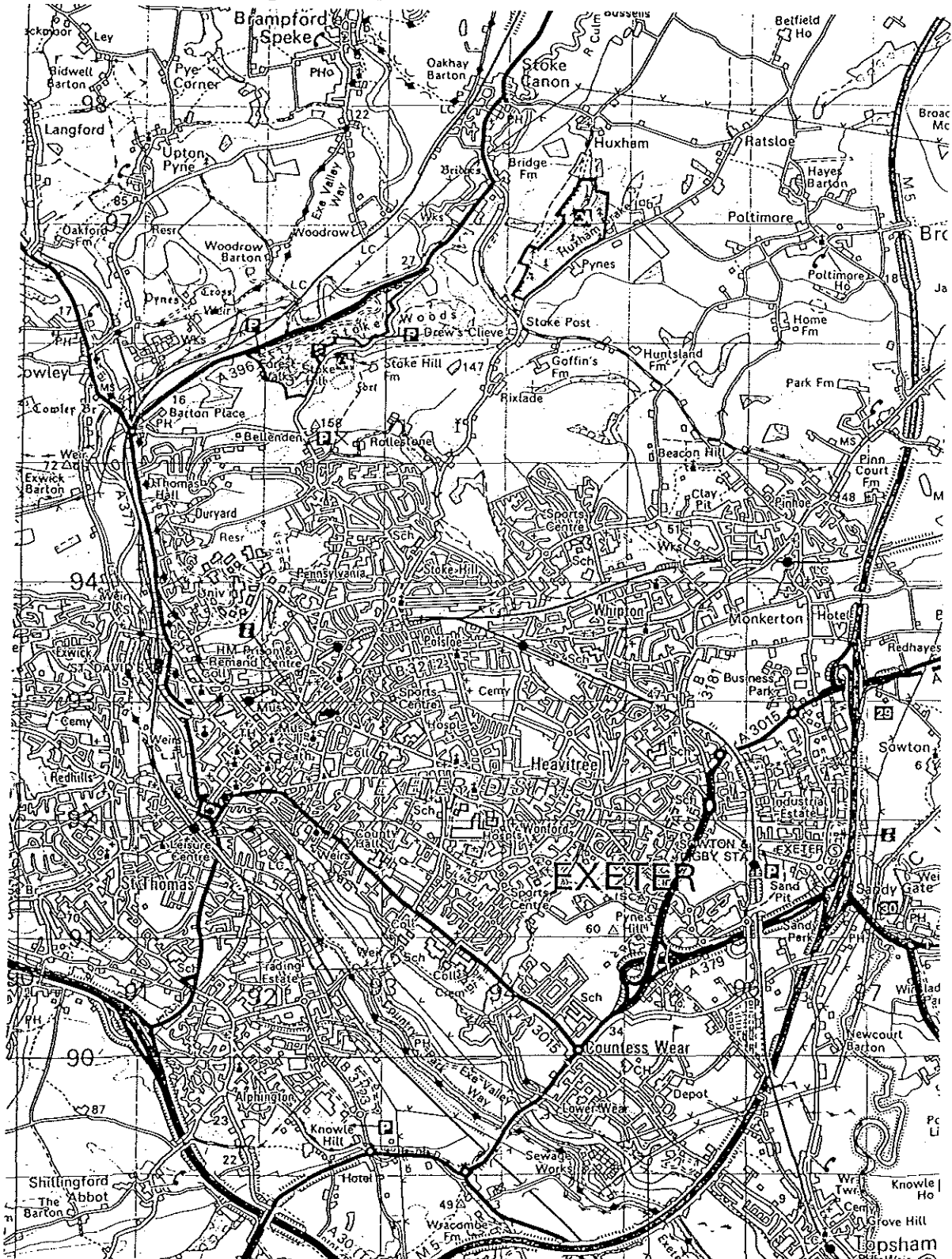
Sample no.	Sample location	Total rings	*Sapwood rings	First measured ring date	Last heartwood ring date	Last measured ring date
EXT-D01	South principal rafter, truss IV	54	no h/s	-----	-----	-----
EXT-D02	Collar, truss IV	54	no h/s	-----	-----	-----
EXT-D03	South principal rafter, truss V	103	h/s	-----	-----	-----
EXT-D04	North principal rafter, truss V	99	no h/s	-----	-----	-----
EXT-D05	South principal rafter, truss VI	146	h/s	-----	-----	-----
EXT-D06	North principal rafter, truss VI	122	no h/s	-----	-----	-----
EXT-D07	Collar, truss VI	54	h/s	-----	-----	-----
EXT-D08	South purlin, truss V-VI	54	h/s	-----	-----	-----
EXT-D09	North purlin, truss V-VI	80	h/s	-----	-----	-----
EXT-D10	South common rafter 1, truss V-VI	56	no h/s	-----	-----	-----
EXT-D11	North common rafter 3, truss V-VI	80	h/s	-----	-----	-----
EXT-D12	South purlin, truss VIII-IX	118	h/s	-----	-----	-----
EXT-D13	South purlin, truss IX-X	98	h/s	-----	-----	-----
EXT-D14	North purlin, truss IX-X	54	no h/s	-----	-----	-----

*h/s = the heartwood/sapwood boundary is the last ring on the sample

Table 2: Results of the cross-matching of site chronology EXTDSQ01 and relevant reference chronologies when first ring date is AD 1324 and last ring date is AD 1466

Reference chronology	Span of chronology	t-value	
East Midlands	AD 882 – 1981	3.2	(Laxton and Litton 1988)
Southern England	AD 1083 – 1589	3.5	(Bridge 1988)
Kent-88	AD 1158 – 1540	3.9	(Laxton and Litton 1989)
England London	AD 413 – 1728	3.3	(Tyers and Groves 1999 unpubl)
Rectory Park, Horsmonden, Kent	AD 1313 – 1442	3.5	(Howard <i>et al</i> 1998)
Ware Priory, Herts	AD 1223 - 1416	4.3	(Howard <i>et al</i> forthcoming)

Figure 1: Map to show general location of Exeter



(based upon the Ordnance Survey 1:50000 map with permission of The Controller of Her Majesty's Stationery Office, ©Crown Copyright).

Figure 2: Map to show location of the Law Library in Exeter

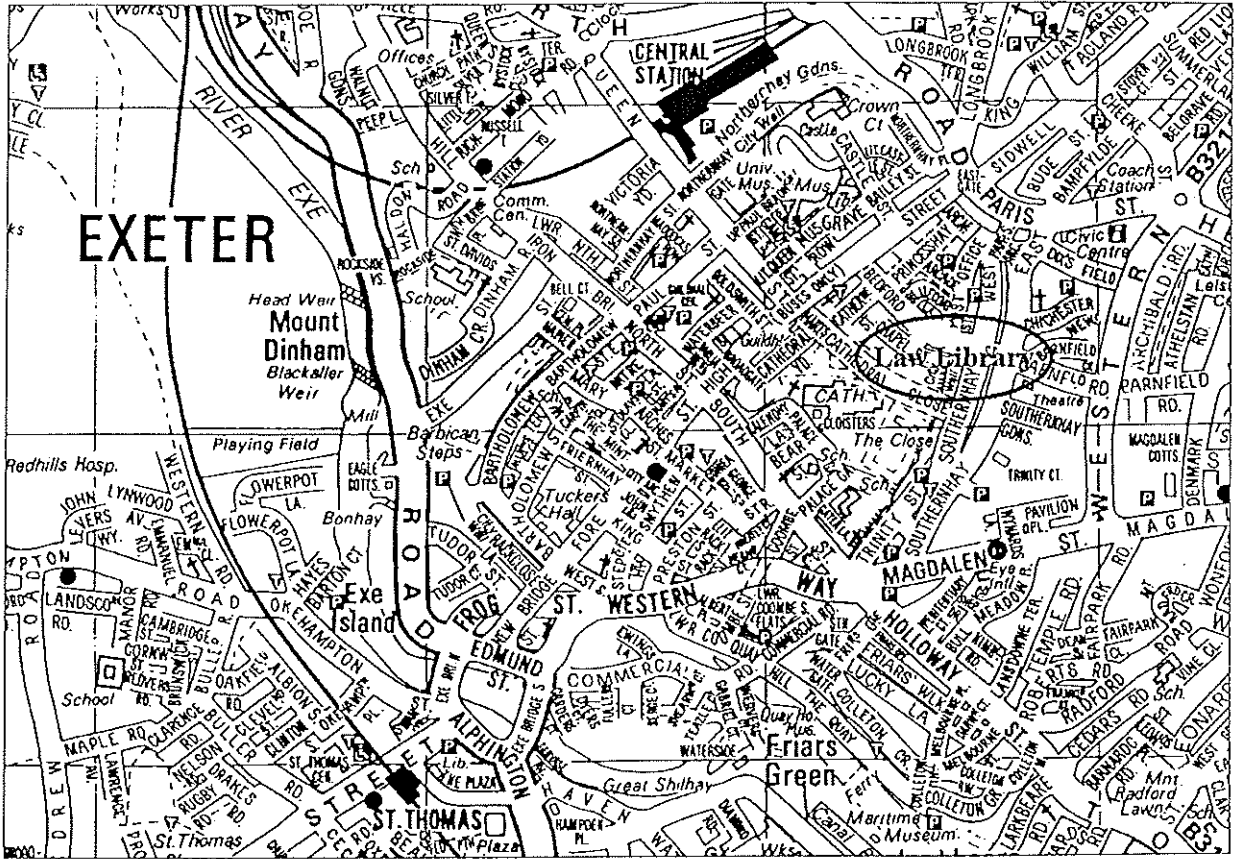


Figure 3: Ground-floor plan of 8 – 9, the Close, Exeter

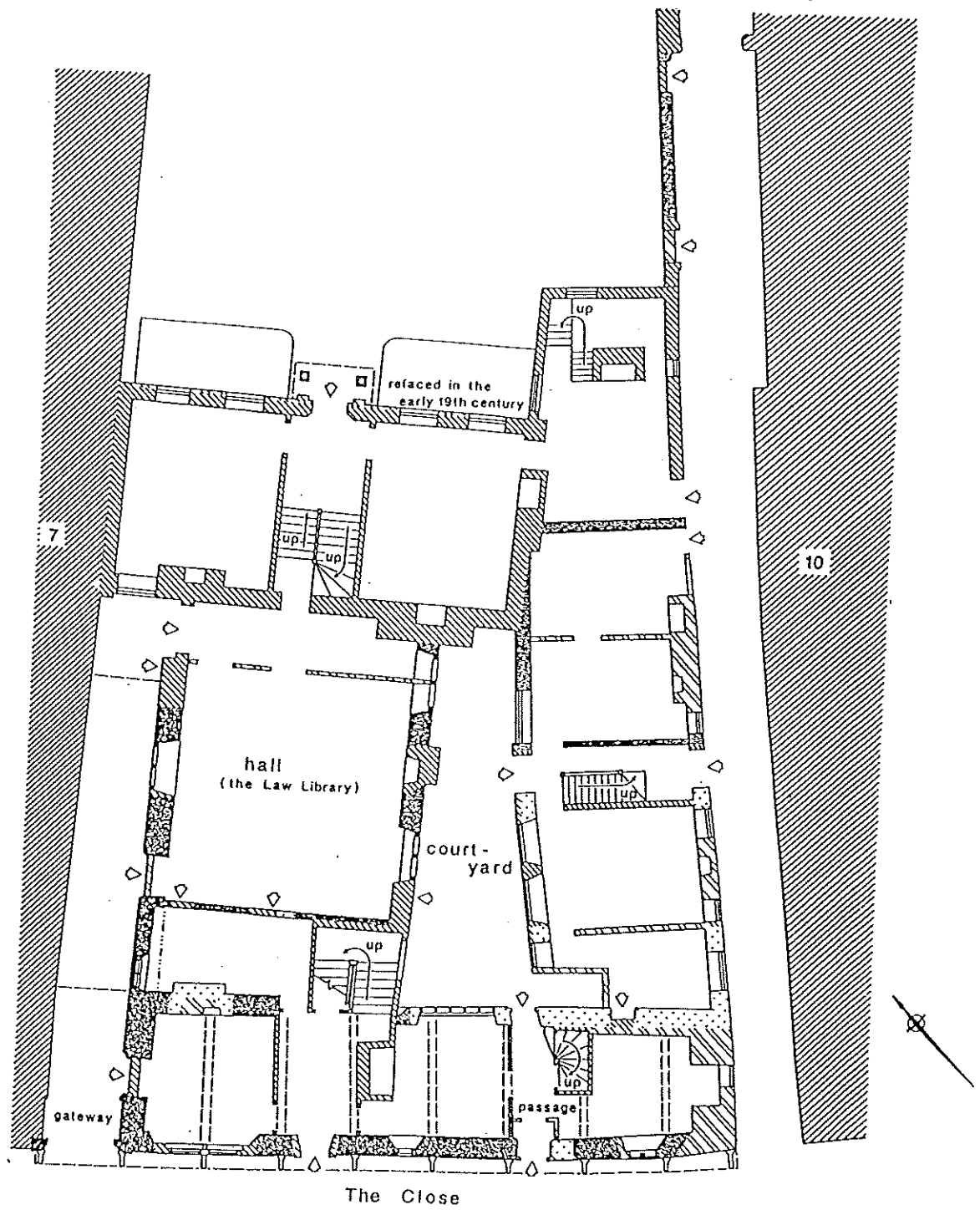


Figure 4: Example of a truss from 8 – 9, the Close, Exeter

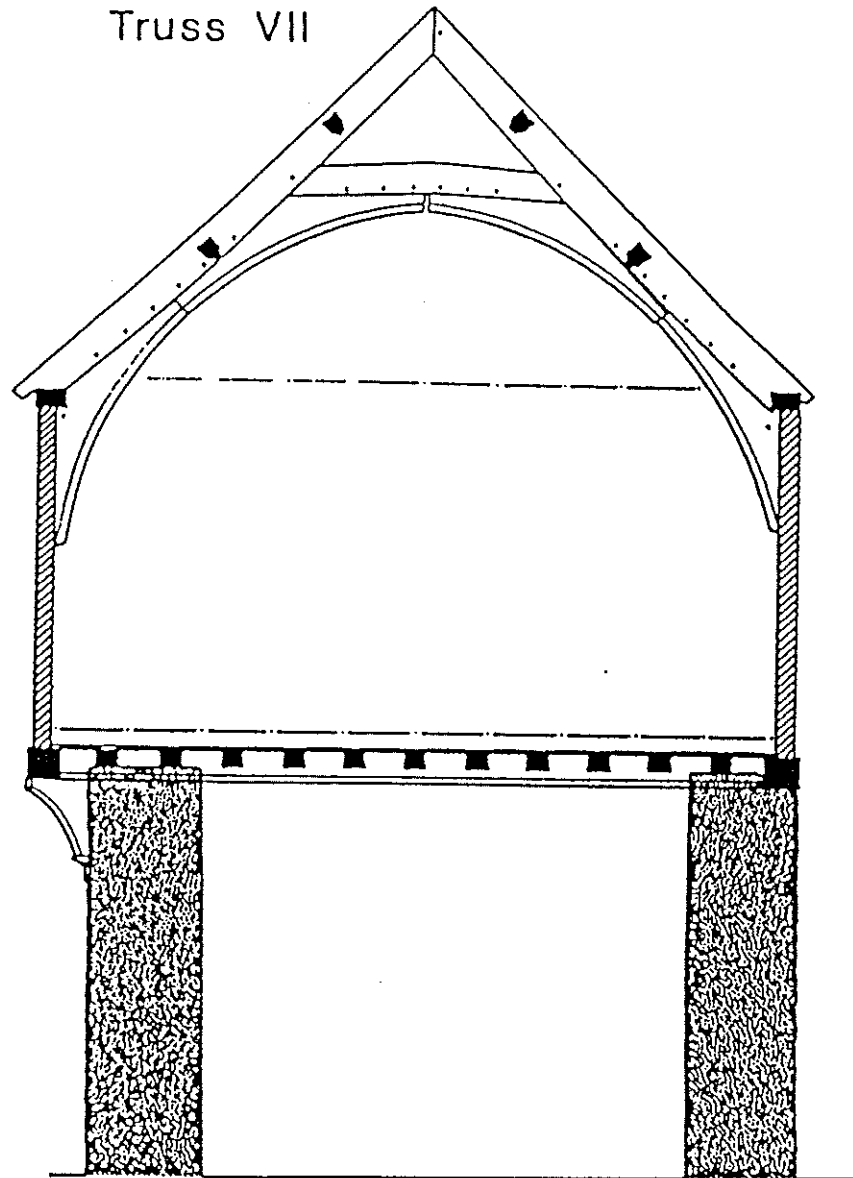
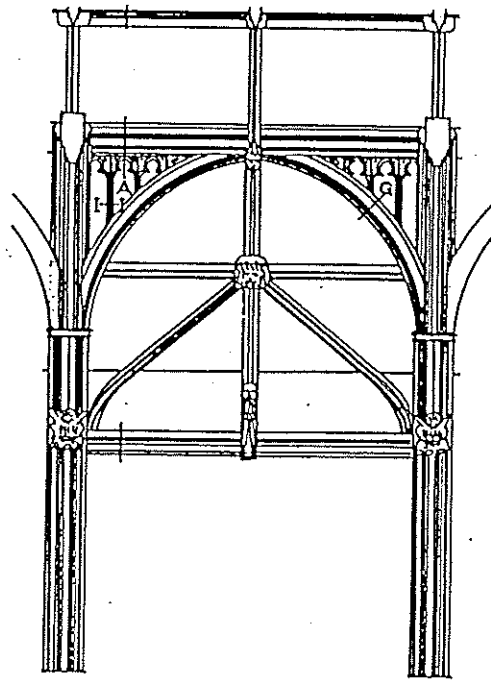
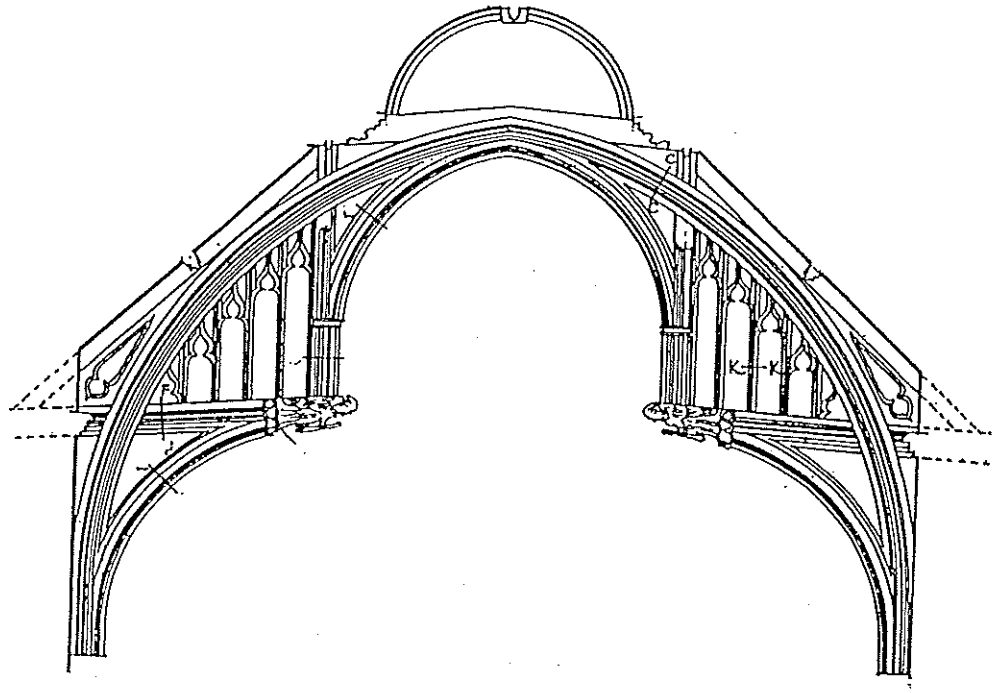


Figure 5: Example of a truss and a bay elevation from the Law Library roof



**Figure 6: Illustration of the doorway (now blocked) between
The front and rear range of 8 - 9 the Close**

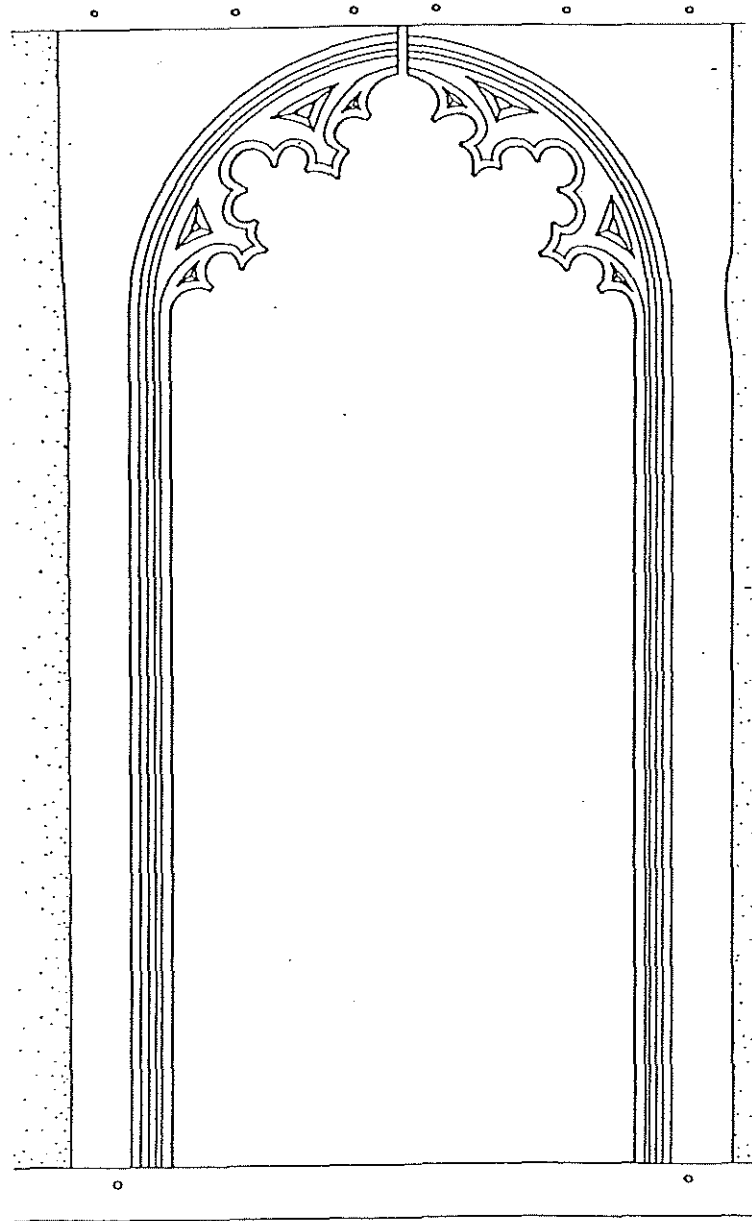


Figure 7: Plan to show sample locations

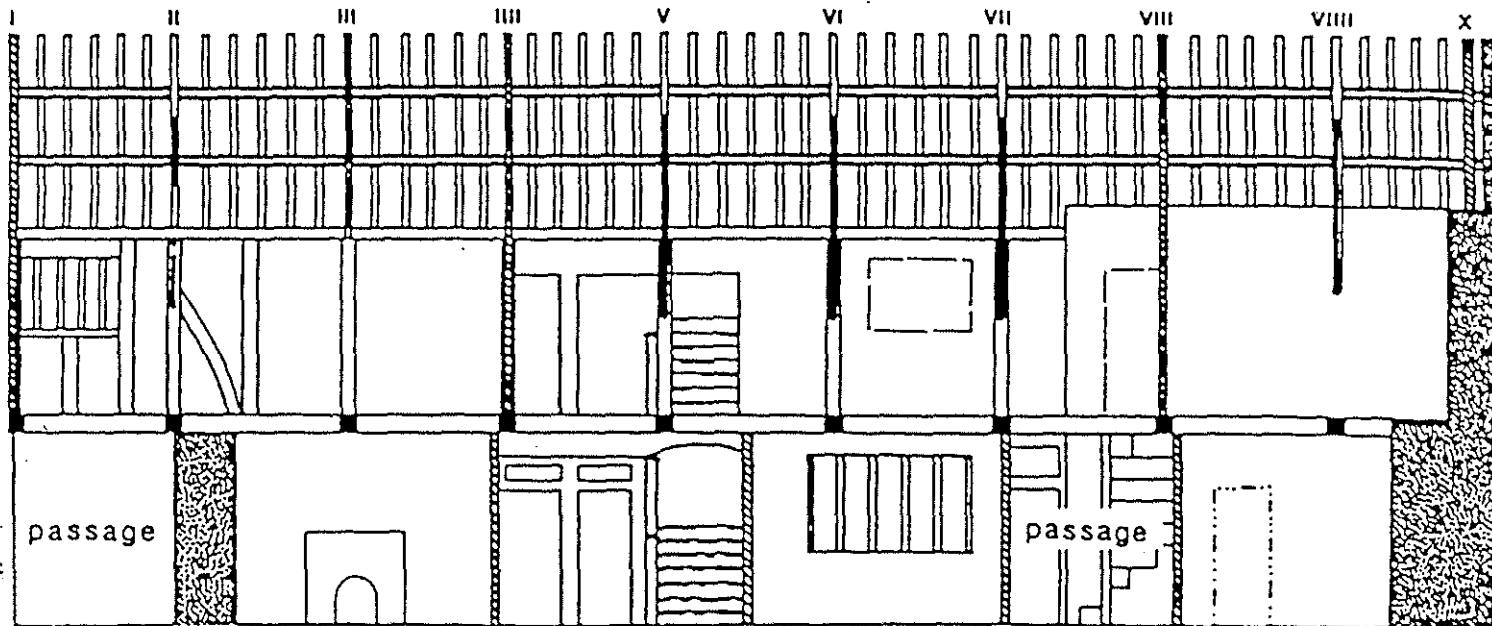
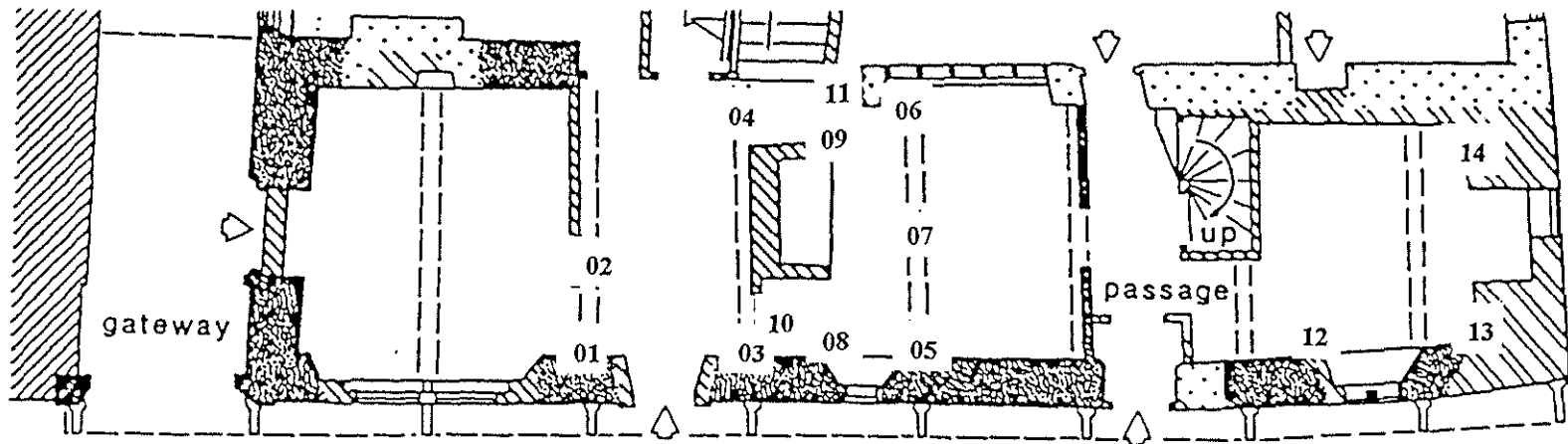


Figure 8: Bar diagram of samples in site chronology EXTDSQ01

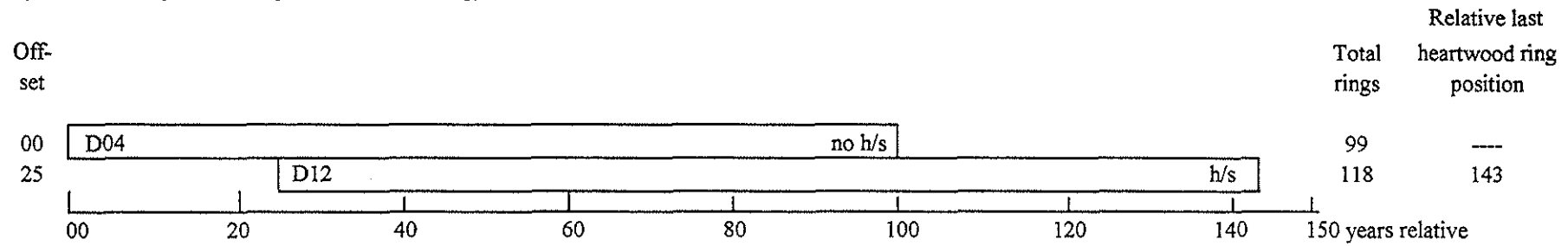
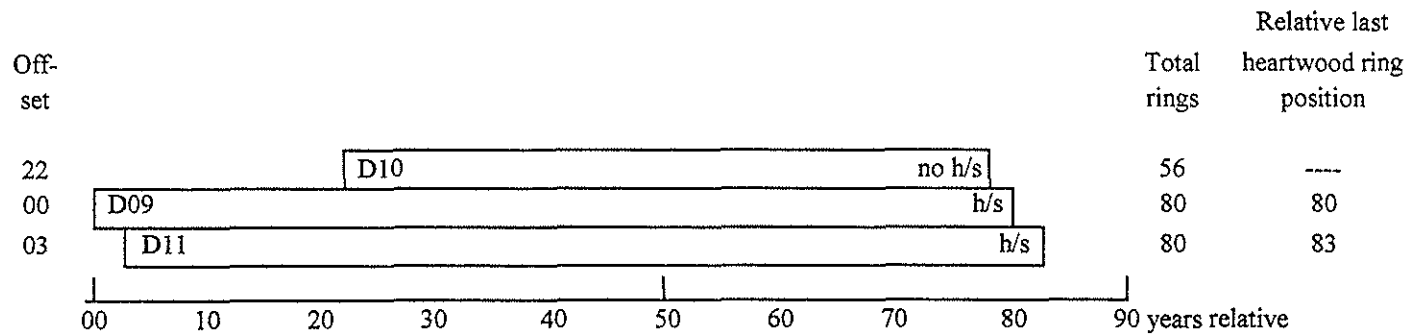


Figure 9: Bar diagram of samples in site chronology EXTDSQ02



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

Data of measured samples – measurements in 0.001 mm units

EXT-D01A 54

274 323 386 346 228 298 366 354 383 286 282 287 266 122 130 160 269 277 324 268
181 130 130 139 224 293 156 74 109 122 145 82 93 42 47 74 112 223 144 180
207 271 263 343 411 218 157 182 190 228 283 262 321 439

EXT-D01B 54

238 343 388 343 268 281 367 351 363 318 305 315 245 123 138 152 285 343 335 241
164 164 126 150 244 307 149 68 124 116 133 77 107 43 39 83 109 229 138 169
230 274 272 329 421 223 171 199 202 194 274 258 336 402

EXT-D02A 54

251 218 232 171 105 106 143 219 369 264 305 252 183 153 210 290 220 191 188 195
148 178 207 168 158 292 306 258 204 152 260 165 229 193 236 242 165 193 231 249
286 219 321 277 233 192 185 221 296 205 159 200 213 289

EXT-D02B 54

303 216 212 178 116 107 144 246 358 276 301 218 201 166 199 276 229 203 190 189
155 168 208 185 157 287 284 262 176 163 240 165 239 198 270 229 170 230 236 212
303 228 316 273 237 202 219 174 153 197 181 188 226 314

EXT-D03A 103

33 44 48 51 54 75 53 50 68 55 63 63 83 67 112 104 136 158 180 170
152 112 81 78 96 85 65 46 67 62 83 63 46 67 84 94 85 97 113 115
136 108 94 123 122 72 109 82 82 80 49 54 54 57 71 71 47 60 74 68
78 85 90 67 74 45 44 74 82 81 101 129 101 105 70 77 74 42 47 82
50 66 73 78 44 93 67 72 63 69 68 89 81 82 74 89 137 122 81 70
60 69 88

EXT-D03B 103

38 36 50 49 51 73 61 46 67 53 62 70 87 57 109 108 135 153 176 167
155 113 79 71 103 86 58 54 64 58 98 65 43 69 100 80 87 106 104 120
144 108 101 117 126 97 99 96 77 74 47 51 60 58 71 58 49 69 67 65
73 106 81 65 66 54 46 72 91 82 104 124 97 94 77 83 68 37 59 73
49 70 67 73 56 90 73 72 70 71 68 93 75 84 59 101 117 122 88 66
60 73 89

EXT-D04A 99

195 66 76 85 76 99 92 56 81 68 90 123 96 116 126 135 116 84 77 75
98 119 86 103 87 82 107 144 130 166 190 165 207 226 310 230 236 262 278 264
311 294 126 70 50 63 78 67 103 71 96 111 124 121 127 97 40 62 70 65
96 101 97 116 129 102 137 144 136 168 155 140 127 143 123 98 118 114 131 133
132 119 133 164 186 194 157 153 157 142 90 93 102 103 122 99 163 159 160

EXT-D04B 99

148 72 82 81 71 104 95 61 82 75 89 120 120 102 143 164 111 102 73 74
118 105 93 99 82 73 113 147 139 186 212 176 194 233 312 226 199 235 294 277
311 290 127 74 34 65 64 58 116 85 92 103 137 111 120 90 43 55 70 71
100 100 90 110 136 120 137 145 128 167 150 138 125 150 121 96 108 118 140 127
130 119 151 153 181 204 166 171 160 153 101 100 109 98 123 104 157 156 167

EXT-D05A 146

83 130 114 202 133 102 96 84 43 44 26 31 48 67 119 134 146 88 49 82
151 156 211 206 168 255 232 275 165 78 82 82 51 90 114 137 100 109 72 89
126 74 86 114 99 97 127 75 73 62 93 74 71 41 26 37 70 80 42 42
38 51 44 63 68 41 44 53 64 60 81 98 117 141 154 140 158 109 108 76
97 87 98 96 86 44 29 23 32 35 34 47 33 37 36 35 34 37 26 43
48 43 83 71 65 78 69 103 90 49 90 136 87 153 171 254 259 187 180 169
239 377 410 293 233 255 217 279 225 157 148 125 168 151 109 106 109 224 226 219
253 152 193 151 109 137

EXT-D05B 146

84 120 127 198 133 106 115 78 46 35 25 41 47 61 129 131 142 101 59 85
162 161 225 212 164 252 214 227 163 94 68 79 60 81 113 144 121 116 68 87
114 70 85 99 126 96 132 71 63 64 90 87 69 40 25 38 65 79 45 49
39 41 52 63 71 59 37 52 76 51 73 106 117 142 149 130 158 133 104 86
91 93 101 98 79 51 21 28 31 36 39 43 33 37 36 29 40 33 32 42
40 53 83 84 56 75 66 112 89 49 88 128 96 137 183 261 239 183 173 187
251 364 417 281 226 264 216 262 243 174 150 139 174 157 96 104 106 216 217 221
251 153 194 126 120 171

EXT-D06A 122

147 64 67 87 105 68 80 108 96 90 122 127 87 33 31 58 73 98 94 103
87 96 119 145 73 87 104 75 78 96 89 106 80 74 75 113 82 92 98 103
112 176 226 211 158 220 197 212 161 146 134 130 114 69 52 40 51 60 48 92
128 172 155 190 144 181 182 163 166 165 207 236 170 157 164 108 105 132 130 119
118 122 138 141 141 124 150 132 128 157 140 120 112 128 146 146 164 151 196 160
249 139 143 178 152 148 174 192 203 175 142 103 167 170 134 186 169 156 230 177
127 190

EXT-D06B 122

162 68 68 95 99 60 92 104 85 97 117 118 91 34 29 53 73 95 101 93
89 106 121 134 105 90 98 84 90 107 109 98 79 75 78 119 83 80 116 97
122 174 247 206 169 234 179 214 155 143 125 136 106 65 57 39 44 60 56 93
123 165 140 185 148 191 195 196 139 163 207 238 178 179 164 121 108 135 126 129
120 138 161 133 134 122 153 109 121 142 144 122 114 126 142 138 164 150 201 157
235 140 145 180 144 148 173 184 218 139 162 110 154 176 127 208 172 160 237 163
144 192

EXT-D07A 54

239 230 206 163 210 178 165 158 194 192 218 236 183 136 110 149 163 115 120 145
211 225 218 417 307 318 459 370 353 208 151 174 115 211 121 169 218 103 138 141
171 193 147 186 244 211 196 246 95 220 116 96 110 144

EXT-D07B 54

223 239 199 198 213 184 147 163 185 216 169 216 190 174 122 136 209 122 114 149
204 247 241 414 324 314 422 398 363 201 135 189 101 223 127 155 238 120 130 134
195 219 165 184 231 212 150 210 139 223 146 124 85 178

EXT-D08A 54

222 249 290 349 281 229 292 282 273 199 279 240 212 390 184 338 234 265 266 209
294 318 413 432 340 258 286 359 394 305 342 349 346 321 244 356 343 329 268 385
217 250 254 229 362 202 351 208 272 273 206 247 268 259

EXT-D08B 54

284 261 276 367 276 169 299 268 266 199 268 253 214 362 241 330 264 248 270 205
340 327 392 433 333 248 291 411 399 280 334 353 328 294 243 342 360 321 270 382
189 242 265 247 349 221 332 207 286 292 202 278 258 281

EXT-D09A 80

534 422 495 416 517 441 287 332 305 304 207 187 235 207 117 218 143 111 139 131
149 110 112 98 114 134 84 154 94 74 90 29 44 74 77 87 65 61 65 56
41 23 24 21 44 28 29 56 93 107 53 69 51 53 60 66 33 32 36 14
67 53 63 85 86 61 41 67 59 59 85 73 47 43 59 44 27 27 36 46

EXT-D09B 80

507 425 470 417 502 419 290 329 319 301 207 186 240 195 118 214 130 99 143 122
150 108 101 112 105 131 99 150 113 76 83 31 33 69 73 99 52 66 75 48
40 29 26 20 38 38 27 56 84 119 47 67 42 70 69 58 28 28 29 20
57 55 57 100 76 63 46 60 60 59 93 65 33 32 56 42 31 28 35 42

EXT-D10A 56

83 110 114 121 76 146 99 56 80 26 37 69 89 71 62 46 78 47 42 29
25 25 35 25 26 30 93 96 41 61 33 46 52 43 24 31 27 27 44 47
56 83 79 66 52 66 57 62 82 79 60 41 62 45 33 28

EXT-D10B 56

81 99 121 113 81 145 105 57 75 26 38 64 89 80 58 56 72 53 38 26
24 28 35 21 27 38 88 96 41 54 33 53 42 49 22 24 23 16 24 43
62 110 90 64 52 65 53 72 77 74 62 38 60 47 46 41

EXT-D11A 80

421 420 376 282 299 307 306 203 185 30 218 114 191 111 86 126 112 124 108 79
106 116 118 85 138 98 67 79 32 41 62 89 70 64 47 76 51 40 31 23
23 34 31 24 32 91 92 50 51 37 42 52 47 22 28 25 26 49 43 60
82 83 66 50 59 63 69 73 78 53 43 57 59 26 21 27 44 70 46 62

EXT-D11B 80

411 435 369 289 298 300 300 211 175 241 216 119 185 118 89 122 117 115 98 98
94 112 122 80 133 109 60 86 36 33 69 82 80 56 59 71 50 43 25 28
22 30 27 24 43 92 86 48 57 32 40 55 44 28 23 30 23 42 59 55
80 81 64 51 65 62 65 72 81 56 38 60 45 30 24 31 41 79 36 66

EXT-D12A 118

235 307 256 127 246 139 144 296 389 296 329 357 259 277 161 284 176 98 33 35
69 117 106 138 116 129 113 195 118 122 81 39 34 52 30 37 66 31 46 49
18 17 18 27 44 55 43 44 45 56 59 52 20 22 30 21 30 58 55 118
134 140 128 160 112 74 81 136 101 163 167 137 108 102 102 86 51 42 28 51
30 19 26 25 27 34 44 43 55 47 46 38 42 42 69 59 89 77 120 180
148 113 130 122 143 131 186 99 120 157 69 106 152 59 75 60 78 119

EXT-D12B 118

219 300 257 132 245 145 134 300 394 296 324 359 267 267 177 276 175 105 35 32
66 118 93 150 114 137 98 192 124 128 85 46 26 53 39 37 64 26 54 47
18 23 24 28 40 53 47 38 44 51 39 41 23 31 27 27 25 56 59 109
127 139 132 160 113 72 97 120 102 169 153 148 101 105 102 89 50 42 40 47
25 27 27 20 21 33 45 42 46 48 35 55 41 54 65 67 73 96 111 156
138 128 117 127 143 127 181 106 114 149 64 105 147 62 71 64 54 150

EXT-D13A 98

255 303 89 65 41 32 54 103 101 60 53 79 119 81 105 137 168 155 187 87
142 173 184 113 146 154 92 130 110 103 100 116 38 35 55 118 182 132 150 166
188 193 158 125 80 72 43 88 50 63 96 69 70 78 59 45 37 39 45 48
51 33 24 41 64 46 61 34 28 24 20 29 41 36 43 24 28 46 31 22
42 50 47 86 78 76 86 91 74 80 78 70 74 78 90 33 37 55

EXT-D13B 98

232 257 80 50 36 36 68 91 107 67 61 90 106 117 121 132 164 155 182 87
141 176 181 110 153 152 89 132 113 109 106 115 43 26 60 106 175 136 154 166
179 181 151 126 85 75 48 79 56 59 96 65 73 80 53 50 41 35 39 47
52 30 41 34 69 56 53 30 27 16 23 34 41 32 49 19 30 39 33 32
31 53 47 92 71 76 90 87 79 77 79 70 66 76 81 40 40 53

EXT-D14A 54

123 133 95 98 122 117 97 85 120 153 120 122 114 118 144 156 117 139 105 116
176 119 171 151 111 132 168 178 255 192 253 278 208 201 141 127 131 73 130 135
116 139 103 112 137 151 134 152 97 121 186 122 164 145

EXT-D14B 54

121 121 114 98 125 116 91 72 142 137 128 126 99 114 132 182 118 146 111 110
179 116 172 154 112 138 168 150 270 194 273 256 210 214 115 135 135 70 147 134
125 128 108 108 139 163 126 144 97 122 188 122 145 138