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Summary

Analysis undertaken on 19 samples taken from timbers of the roof of this building resulted in the construction of two site sequences.

Site sequence HEXBSQ01 contains ten samples and spans the period AD 1244 - 1378. Two of these samples are from timbers felled in *c* AD 1379, with the other eight having an estimated felling date range also consistent with this felling. Seven of these samples come from timbers with obvious signs of reuse.

Site sequence HEXBSQ02 contains eight samples and spans the period AD 1341-1539. One of these samples is from a timber felled in AD 1539, with it likely that the other seven were also felled at this time.

This roof was previously thought to date *c* AD 1400. Tree-ring analysis has shown it to be constructed with timber felled in AD 1539 but incorporating a large amount of reused timber from *c* AD 1379, possibly from the original roof.

Keywords

Dendrochronology
Standing Buildings

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Introduction

The Moot Hall, located on the east side of the Market Place, Hexham (Fig 1; NY 936 641), is one of the best examples of a medieval courthouse in the north of England. It served as the entrance to the complex of administrative buildings belonging to the Archbishop of York, who held the Hexhamshire estates throughout the medieval period. The nearby fourteenth-century prison (built AD 1330-2) is thought to be the earliest purpose-built prison in the country.

An inverted letter 'T' in plan, the Moot Hall is a rectangular three-storied block aligned north-south, with a taller tower attached to the south end of each face. The basement consists of a single chamber with a segmental barrel vault and entrance on the east side beneath an external staircase. This L-shaped external stair is the main access to the upper floors of the building (Fig 2).

The ceiling of the first-floor apartment has four old transverse beams carrying joists of a much later appearance. The old beams are potentially reset as there are infilled sockets immediately below them and they also have empty mortices for a different set of joists. This first floor was a single apartment, but the north end is now partitioned off to form an entrance lobby and stairwell to the second floor (Figs 3 and 4). The second-floor hall has a largely rebuilt fireplace in its west wall and is open to the roof. The low-pitched roof is of eight bays with large tiebeams carrying deeply trenched purlins and ridge. This roof is thought to be the product of a single phase of construction, but it contains a number of timbers that show signs of reuse.

Construction of the Moot Hall has been dated on documentary sources to between AD 1355-1439, with a date of *c* AD 1400 thought probable, from fabric analysis. The roof is thought to be part of this initial construction.

Sampling and analysis by tree-ring dating was commissioned and funded by English Heritage to define more closely the date of the hall and to inform the proposed major conservation and presentation of this building and the prison by the Hexham Heritage Project. Investigations were extended to the reused timbers in an effort to gain a greater understanding of the building.

The Laboratory would like to thank Lynn Turner and Janet Goodridge of Tynedale District Council for their assistance in organising access and arranging scaffolding. Drawings used to illustrate this report and details for the above introduction were taken from an article written by Peter Ryder (1994).

Sampling

This site was sampled on two occasions. Firstly, 12 core samples were taken from tiebeams, the ridge, a purlin, and common rafters avoiding any timbers that appeared to show signs of reuse. In the light of the results produced it was then decided that it might be useful to sample the reused timbers and a further 12 core samples were taken. Each sample was given the code HEX-B

(for Hexham, site B) and numbered 01-24. The position of all samples was noted at the time of sampling and has been marked on Figure 5. Further details relating to the samples are recorded in Table 1. Initially, the timbers of the floor structure were not included in the sampling brief, however, when the Laboratory returned to undertake further sampling the first-floor ceiling beams were also inspected. These were seen to show signs of also having been reused, or moved at some time. Unfortunately, due to the wide ring width pattern these displayed they were deemed unsuitable for tree-ring analysis and so were not sampled.

Analysis and Results

At this stage it was noticed that five of the samples (HEX-B11, HEX-B16, HEX-B19, HEX-B21, and HEX-B22) had too few rings for secure dating and so were discarded prior to measurement. The remaining 19 samples were prepared by sanding and polishing and their growth-ring widths measured; the data of these measurements are given at the end of the report. These were then compared with each other by the Litton/Zainodin grouping procedure (see appendix). Sample HEX-B17 displays a very restricted growth pattern in the last few decades of growth which was thought might reflect a disturbance in the normal growing pattern. Although these rings could be measured, the last 22 years of growth pattern were removed as it was thought this might interfere with both the initial grouping process and any matching against reference chronologies.

At a least value of t=4.5, 18 of the samples had formed two groups. Firstly, ten samples matched each other and site sequence HEXBSQ01, of 135 rings, was constructed containing these samples at the offsets shown in the bar diagram (Fig 6). This site sequence was successfully matched against the relevant reference chronologies for oak at a first-ring date of AD 1244 and a last-ring date of AD 1378. The evidence for this dating is given by the t-values in Table 2.

Eight samples matched each other and site sequence HEXBSQ02, of 199 rings, was constructed containing these samples at the offsets shown in the bar diagram (Fig 6). This site sequence was matched against the relevant reference chronologies at a first-ring date of AD 1341 and a last-ring date of AD 1539. The evidence for this dating is given by the t-values in Table 3.

Attempts to date the remaining sample, HEX-B20, by individually comparing it against the reference material were unsuccessful and this sample remains undated.

Interpretation

Analysis of samples from the timbers of the roof of the Moot Hall has resulted in the production of two dated site sequences.

Site sequence HEXBSQ01, contains ten samples, and spans the period AD 1244-1378. The heartwood/sapwood boundary ring of all of these samples is broadly contemporary suggestive of a single felling. Two of the samples (HEX-B03 and HEX-B05) were from timbers with complete sapwood, however *c* 5mm of sapwood was lost during the sampling process in both cases. Taking into account the average width of the last intact 5mm of ring pattern on these samples it is possible to estimate that for both samples *c* 5 sapwood rings have been lost, which added to the last ring date of AD 1374 gives both timbers a felling date of *c* AD 1379. The average heartwood/sapwood boundary ring date of the other eight samples is AD 1357, which, allowing for sample HEX-B01 having a last measured ring date of AD 1378 with incomplete sapwood, gives an estimated felling date for the eight timbers represented to within the range AD 1379-97, also consistent with a felling of *c* AD 1379. Evidence of reuse was noted on seven of these samples.

Site sequence HEXBSQ02 contains eight samples and spans the period AD 1341-1539. One of the samples in this sequence is HEX-B15. This sample has complete sapwood and the last measured ring date of AD 1539, the felling date of the timber represented. Another four samples have the heartwood/sapwood boundary ring. In the case of three of these, this is broadly contemporary with that of HEX-B15, and therefore, also consistent with a felling date of AD 1539. The fourth sample with this ring (HEX-B17) has a heartwood/sapwood sapwood ring date of AD 1494. This calculates to an estimated felling date for this sample within the range AD 1509-34, slightly earlier than the others. However, sample HEX-B17 has a tight ring (ie, narrow rings) pattern and is noticeably slower grown, the last 22 years of growth were removed prior to analysis, which might suggest this sample would have more than the usual maximum number of sapwood rings, also allowing a felling date of AD 1539 with the rest of the samples in this site sequence.

The other three samples in this site sequence do not have the heartwood/sapwood boundary ring and so an estimated felling date range cannot be calculated for them except to say that with last measured ring dates ranging from AD 1430 (HEX-B24) to AD 1500 (HEX-B13) it is possible that they were also felled in AD 1539 with the rest of the samples. However, it is also possible that they represent a totally separate felling/s.

All felling date ranges have been calculated using the estimate that 95% of mature oak trees in this area have between 15-40 sapwood rings.

Discussion

Dendrochronological analysis of the roof timbers of this building has identified at least two separate fellings. The earliest felling is represented by ten timbers, (five tiebeams and five common rafters), all thought to have been felled in *c* AD 1379, many of which show signs of reuse. The second felling relates to at least five (and probably eight) timbers, all felled in AD 1539. These later timbers do not show signs of previous use.

Prior to the tree-ring analysis being carried out this roof was thought to date to *c* AD 1400. It is now known that it contains at least two sets of timbers, the earlier of which are reused timbers felled in *c* AD 1379 with the later group felled in AD 1539.

The important point to remember when interpreting these dates is that, although this roof obviously contains timber dated to *c* AD 1379 and AD 1539, all indications point to it being the result of a single phase of construction. This effectively eliminates the possibility that this roof was built with reused timber at some time after *c* AD 1379 but before AD 1539 with the sixteenth century timbers being later insertions.

From the tree-ring evidence it appears likely that this roof was built in or soon after AD 1539 utilising a large amount of reused timber dating from *c* AD 1379. Documentary sources indicate a late fourteenth/early fifteenth century date, therefore, it seems likely that the present roof is not the original one. The style of roof is simple and, therefore, not necessarily associated with a specific period in time. Given the date of the earlier material it is a possibility that these timbers were reused from the original roof.

Why it might be necessary to erect a new roof 150 or so years after the construction of the original one is not specifically known although the sixteenth century was very much a period of discord in this area. Further, it is known that in AD 1538 the nearby prison was attacked and the prisoners released (Ryder 1994), raising the possibility that perhaps the Moot Hall was itself subject to assault at this time.

Although common rafters with signs of reuse were noted throughout the length of the roof, only those from the southern section were successfully dated. It can be seen from Figure 5 that the early, reused tiebeams, dated to *c* AD 1379, are also all in the southern half of the roof (beams 5-9) with the later AD 1539 tiebeams being in the northern half (beams 1-4; although other dated AD 1539 material occurs throughout the roof). Whether this suggests the timbers of the southern half of the roof were in a better state of repair, allowing the heavy tiebeams to be left in situ to form the basis of the new roof or perhaps that construction began at this southern end with any suitable timber being reused first and only when this was exhausted new timber brought in, would have to be investigated by a buildings specialist.

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Table 1: Details of tree-ring samples from the Moot Hall, Hexham

Sample number	Sample location	Total rings	Sapwood rings	First measured ring date (AD)	Last heartwood ring date (AD)	Last measured ring date (AD)
HEX-B01	Tiebeam, truss 5	74	18	1305	1360	1378
HEX-B02	®Tiebeam, truss 6	60	06	1310	1363	1369
HEX-B03	®Tiebeam, truss 7	70	22c(+c5)	1305	1352	1374
HEX-B04	Tiebeam, truss 8	130	15	1244	1358	1373
HEX-B05	®Tiebeam, truss 9	114	15c(+c5)	1261	1359	1374
HEX-B06	®West common rafter, bay 4	93	14	1282	1360	1374
HEX-B07	®West common rafter, bay 6	73	h/s	1275	1347	1347
HEX-B08	West common rafter, bay 7	99	h/s	1258	1356	1356
HEX-B09	®West common rafter, bay 7	94	h/s	1263	1356	1356
HEX-B10	®West common rafter, bay 8	87	h/s	1269	1355	1355
HEX-B11	®East common rafter 1, bay 2	NM	--	----	----	----
HEX-B12	Tiebeam, truss 2	69	h/s	1449	1517	1517
HEX-B13	Tiebeam, truss 3	111	--	1390	----	1500
HEX-B14	Tiebeam, truss 4	102	h/s	1418	1519	1519
HEX-B15	Ridge, bay 2	135	26C	1405	1513	1539
HEX-B16	Ridge, bay 7	NM	--	----	----	----
HEX-B17**	West purlin, bay 7	110 (132)	(12)	1375	(1494)	1484 (1506)
HEX-B18	East purlin, bay 8	108	--	1351	----	1458
HEX-B19	West common rafter 2, bay 2	NM	--	----	----	----
HEX-B20	West common rafter 4, bay 1	54	--	----	----	----
HEX-B21	East common rafter 4, bay 1	NM	--	----	----	----
HEX-B22	East common rafter 1, bay 3	NM	--	----	----	----
HEX-B23	West common rafter 1, bay 3	62	h/s	1453	1514	1514
HEX-B24	East common rafter 1, bay 8	90	--	1341	----	1430

NM = not measured
h/s = the heartwood/sapwood boundary is the last ring on the sample
c = complete sapwood on timber, all or part lost in sampling (number of rings estimated to have been lost)
C = complete sapwood retained on sample, last measured ring is the felling date
** = the last 22 years of growth pattern were removed, numbers/dates in brackets includes these 22 years
® = signs of reuse noted on timber

Table 2: Results of the cross-matching of site sequence HEXBSQ01 and relevant reference chronologies when the first-ring date is AD 1244 and the last ring date is AD 1378

Reference chronology	*t*-value	Span of chronology	Reference
South central Scotland	5.8	AD 946-1975	Baillie 1977
England	4.3	AD 401-1981	Baillie and Pilcher 1982 unpubl
Finchale Priory Farmhouse, Durham	5.9	AD 1174-1369	Howard *et al* 2002
Kepier Hospital, Tyne and Wear	5.6	AD 1304-1522	Howard *et al* 1996
Merchant Taylors Hall, York	5.2	AD 1240-1413	Howard *et al* 1992
Guildhall, Market Place (East Range), Carlisle, Cumbria	4.8	AD 976-1382	Howard *et al* 1994
Moorhouse Barn, Burgh by Sands, Cumbria	4.7	AD 1053-1434	Esling *et al* 1989
Guildhall, Market Place (South Range), Carlisle, Cumbria	4.6	AD 1054-1397	Howard *et al* 1994

Table 3: Results of the cross-matching of site sequence HEXBSQ02 and relevant reference chronologies when the first-ring date is AD 1341 and the last ring date is AD 1539

Reference chronology	*t*-value	Span of chronology	Reference
East Midlands	7.5	AD 882-1982	Laxton and Litton 1988
England	6.2	AD 401-1981	Baillie and Pilcher 1982 unpubl
Aydon Castle (Latrine block), Corbridge, Northumberland	12.0	AD 1406-1545	Arnold *et al* 2002a
1-2 The College, Cathedral Precinct, Durham	9.7	AD 1364-1531	Howard *et al* 1992
Aydon Castle (Kitchen range), Corbridge, Northumberland	8.9	AD 1424-1543	Hillam and Groves 1991
Witton Hall (house), Witton Gilbert, Tyne and Wear	8.9	AD 1395-1475	Howard *et al* 1996
35 The Close, Newcastle upon Tyne, Tyne and Wear	8.0	AD 1365-1513	Howard *et al* 1991
Bull Hole Byre, Durham	8.0	AD 1452-1620	Arnold *et al* 2002b

Figure 1: Map to show the location of Hexham

Figure 2: The Moot Hall, East Elevation

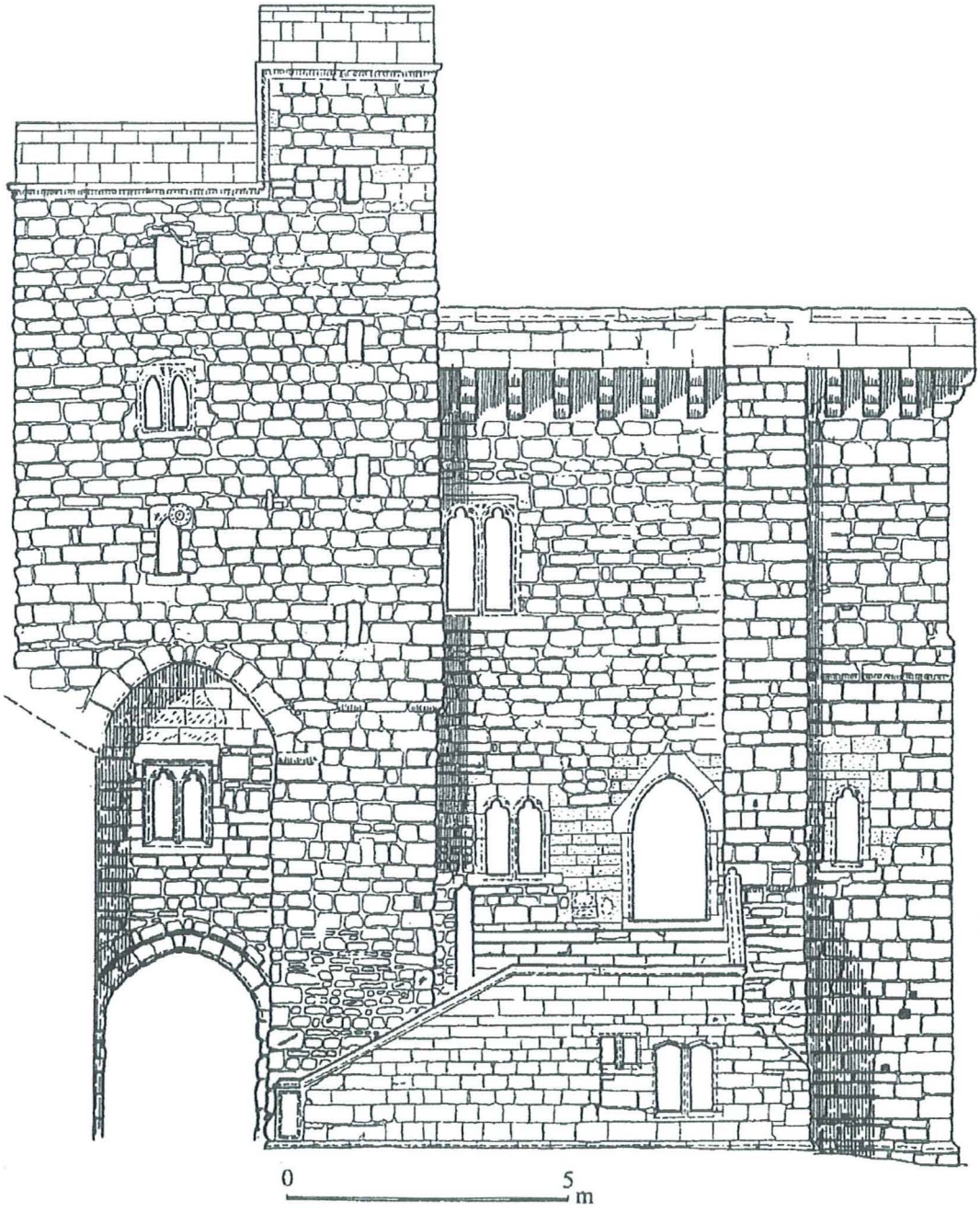


Figure 3: The Moot Hall, ground and first-floor plans (Ryder 1994)

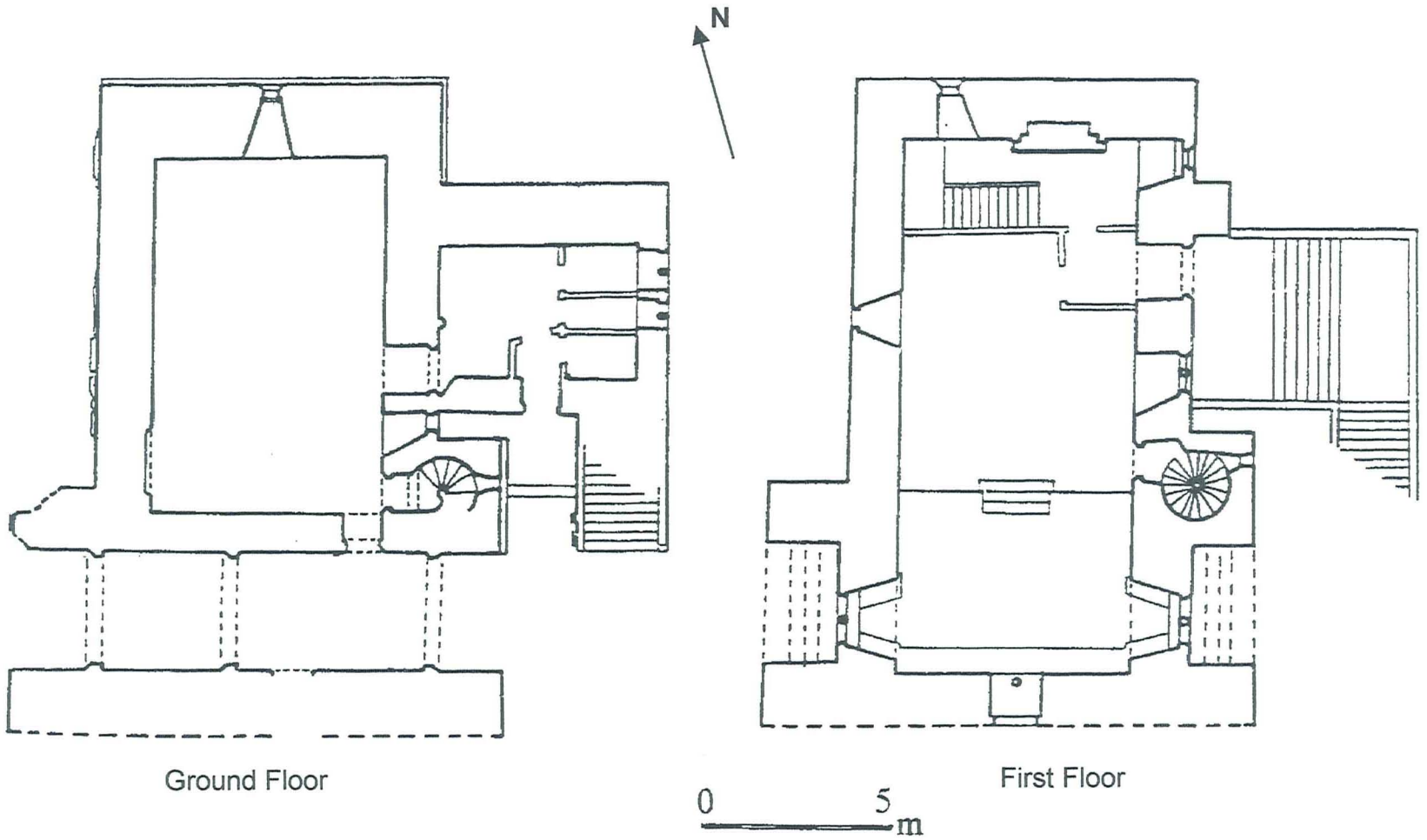
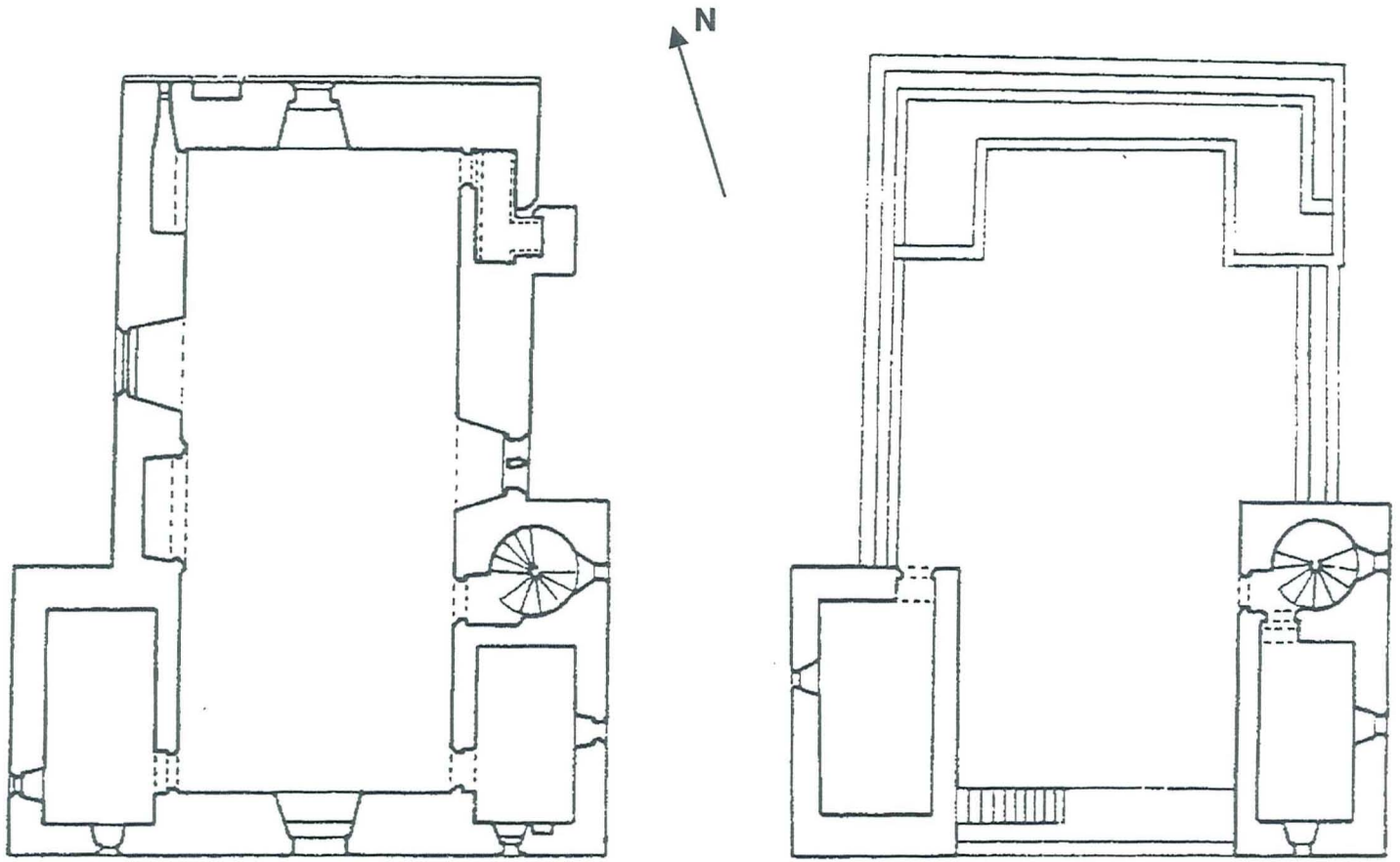


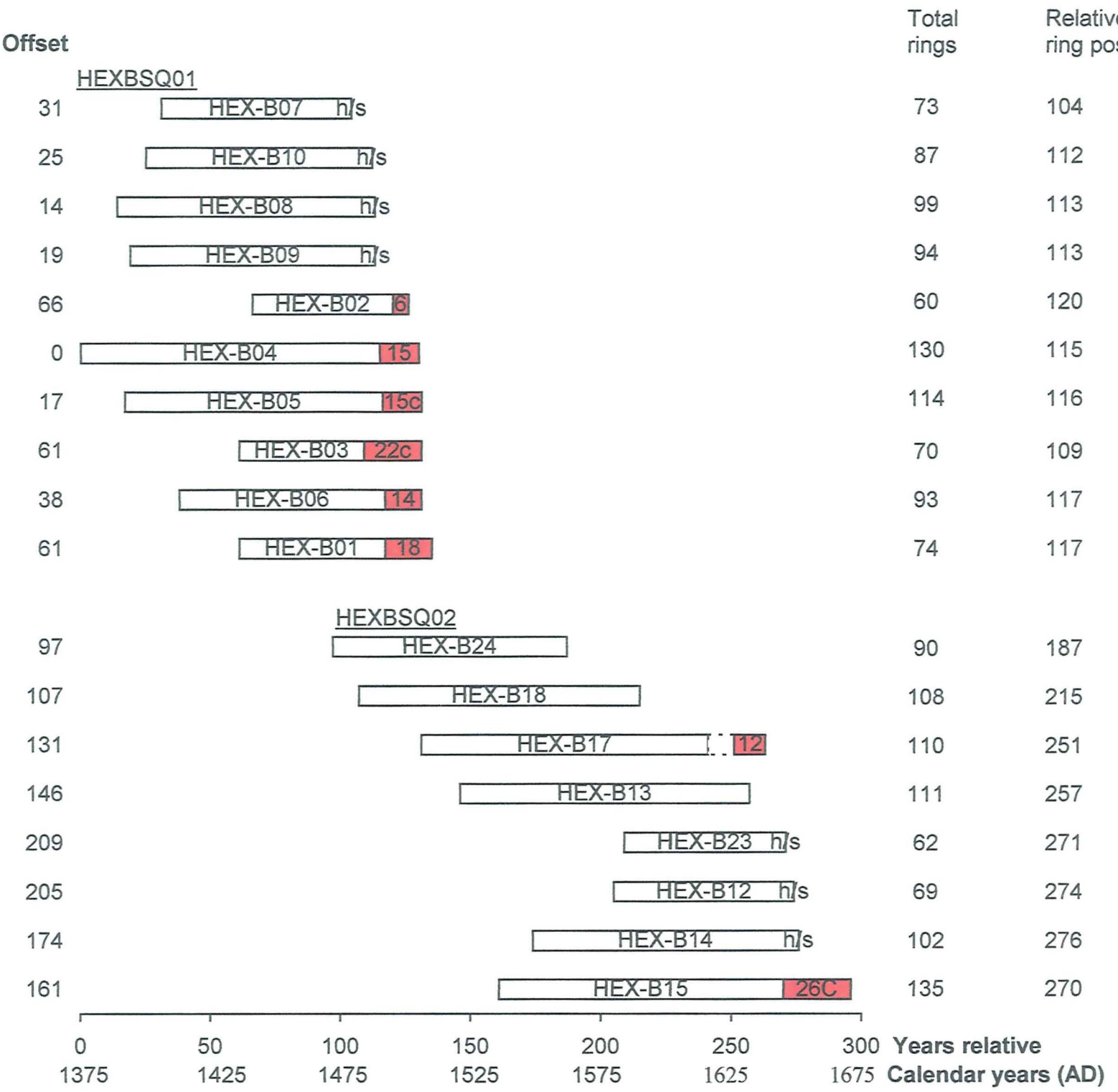
Figure 4: The Moot Hall, second floor and roof plans (Ryder 1994)



Second Floor

Roof

Figure 6: Bar diagram of samples in site sequences HEXBSQ01 and HEXBSQ02



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

Figure 5: The Moot Hall, sketch of roof timbers, showing the location of samples HEX-B01-24 (yellow timbers felled *c* AD 1379, green timbers felled AD 1539)

Data of measured samples – measurements in 0.01mm units

HEX-B01A 74
254 190 254 198 252 348 184 199 150 110 131 163 151 163 137 141 140 147 155 135
116 92 111 126 126 135 126 137 148 144 172 191 180 200 259 214 199 251 186 90
119 168 197 178 251 173 235 234 187 236 186 211 216 181 178 169 124 152 351 418
360 326 236 186 223 251 223 370 306 407 305 346 207 152
HEX-B01B 74
253 183 271 235 230 350 201 202 142 138 152 156 152 186 129 166 108 146 152 123
123 94 128 123 132 120 136 130 158 136 169 183 176 201 237 230 203 234 178 84
155 144 188 172 263 161 243 236 190 220 182 214 215 174 191 165 133 122 400 419
349 326 201 176 224 260 212 336 285 399 301 293 227 179
HEX-B02A 60
449 311 373 348 366 233 294 344 359 311 343 299 320 286 222 258 210 315 346 345
260 315 300 361 371 447 470 413 353 382 308 247 288 179 139 202 228 257 296 475
305 309 299 260 304 221 272 275 227 268 230 264 302 296 249 184 201 130 141 159
HEX-B02B 60
454 321 364 347 370 232 293 343 357 318 339 298 316 279 230 265 207 312 338 340
262 317 287 383 366 451 469 406 355 374 319 245 289 187 141 202 225 257 299 474
313 302 291 269 297 221 273 274 226 274 227 259 292 304 243 181 206 131 138 151
HEX-B03A 70
249 188 359 189 305 388 294 254 182 168 213 293 315 316 252 269 197 195 209 182
110 91 92 110 151 131 161 181 188 160 186 202 218 265 216 203 192 217 108 74
95 124 138 149 196 140 128 181 145 182 198 228 246 181 169 164 215 207 212 241
261 244 176 88 114 159 190 269 246 191
HEX-B03B 70
248 194 351 200 296 403 304 253 190 157 189 296 328 309 254 260 196 194 212 173
102 82 96 106 151 152 149 182 180 173 182 201 221 247 207 195 183 208 96 87
92 127 125 156 182 131 132 181 143 175 201 229 238 179 158 166 213 201 213 248
246 253 156 99 112 153 185 268 249 237
HEX-B04A 130
265 237 189 365 199 240 310 323 255 235 252 216 224 174 219 283 386 336 134 178
190 182 168 188 184 185 115 145 125 114 162 137 141 148 113 103 155 139 141 194
171 166 156 118 163 111 151 183 166 201 209 261 180 198 121 79 89 102 135 129
105 153 109 89 112 99 130 124 85 96 115 82 93 95 101 83 88 106 97 94
77 64 79 68 96 62 50 52 59 63 62 56 44 51 49 58 51 46 47 43
34 52 40 37 34 52 38 38 41 45 53 59 52 71 43 52 55 73 56 57
84 90 67 56 45 64 64 71 94 123
HEX-B04B 130
186 242 184 317 199 235 318 274 275 225 258 192 244 190 215 292 382 332 135 175
178 208 184 185 179 184 112 158 118 120 158 128 146 153 116 101 150 139 143 183
172 170 157 111 163 107 145 212 167 187 219 255 177 189 134 65 91 109 142 114
110 159 111 93 94 98 136 119 82 100 114 70 87 100 104 86 90 101 94 98
67 74 81 70 95 80 60 47 54 64 54 59 52 43 56 56 49 39 55 37
38 52 44 32 37 47 39 41 47 45 52 52 54 61 41 57 48 69 57 62
89 78 74 55 39 60 75 54 110 120

HEX-B05A 108
280 271 163 135 137 122 110 148 127 72 84 87 86 59 95 126 162 162 153 162
72 73 113 158 227 294 207 225 98 175 266 195 209 173 208 241 178 213 147 228
314 303 233 303 249 204 218 149 200 310 213 130 151 208 217 269 245 249 223 209
177 135 163 76 94 67 98 131 113 107 112 102 133 83 71 85 73 147 151 167
145 184 82 66 77 81 84 75 77 56 70 88 62 81 79 112 106 68 66 74
84 98 145 98 93 70 54 80
HEX-B05B 71
243 296 221 231 141 166 267 178 153 95 152 177 213 206 214 174 139 132 114 106
73 60 76 83 91 94 108 96 93 108 75 71 100 93 122 161 141 109 100 59
65 67 74 87 76 86 52 65 77 75 63 64 115 95 70 56 84 63 66 87
87 121 83 66 48 100 103 132 192 173 114
HEX-B06A 93
158 260 410 378 297 188 208 195 208 348 244 208 168 202 266 249 214 159 212 176
209 304 342 312 328 223 197 259 251 190 186 207 166 130 185 189 197 142 173 132
112 104 55 62 72 68 114 74 108 97 87 92 82 82 77 81 91 109 102 81
91 41 69 67 89 82 97 143 102 79 107 68 118 83 123 122 86 96 66 99
84 121 147 169 165 98 131 158 168 113 111 256 192
HEX-B06B 93
135 268 396 379 311 203 163 192 224 335 244 229 180 192 262 244 221 157 205 172
211 297 345 311 329 224 212 228 239 186 179 212 180 139 190 184 200 148 177 139
116 122 62 57 80 70 101 94 107 98 85 97 70 82 84 76 96 106 113 80
90 45 64 72 82 85 89 152 103 73 111 64 111 89 131 118 85 87 68 96
84 109 171 168 174 90 118 161 165 108 129 216 229
HEX-B07A 73
96 142 118 91 86 100 90 98 172 180 177 165 114 93 115 107 231 171 235 201
230 240 185 152 129 139 154 141 125 98 132 91 88 93 128 142 94 94 102 63
107 139 165 154 120 118 126 122 131 111 77 67 54 57 101 76 85 81 94 107
89 104 103 113 84 95 84 84 67 83 97 90 120
HEX-B07B 73
133 139 122 91 83 99 85 84 171 177 179 162 113 95 88 101 221 142 223 207
222 239 187 146 129 149 158 145 127 97 130 91 81 83 129 144 88 96 106 67
98 145 168 152 132 111 127 106 120 108 77 53 59 73 99 86 85 87 97 106
100 96 102 107 86 89 92 85 61 91 91 100 108
HEX-B08A 96
304 374 472 426 328 187 189 170 145 119 184 133 69 82 112 124 111 99 121 118
79 85 89 83 70 93 175 240 224 109 85 61 76 111 134 162 131 151 143 185
174 150 228 269 282 192 228 255 223 238 213 271 451 158 75 28 73 78 109 111
130 98 106 107 95 112 51 61 54 39 70 71 69 60 86 60 65 78 61 78
90 106 108 101 112 61 50 58 66 77 97 130 99 104 115 61
HEX-B08B 60
153 182 116 159 195 161 99 111 147 163 158 175 245 336 243 135 63 140 136 189
255 242 212 192 173 159 196 118 109 94 72 116 114 87 123 109 160 126 145 152
119 167 157 175 136 163 94 56 92 94 127 146 193 128 132 183 99 110 140 150
HEX-B09A 94
249 327 251 250 219 316 285 188 209 202 227 190 168 206 171 133 103 118 108 73
111 191 241 219 111 94 66 55 81 92 117 100 108 105 160 121 94 185 229 186
118 132 194 213 274 262 291 144 87 66 86 58 72 110 148 210 164 151 142 131
129 63 61 36 48 84 76 77 73 81 81 73 95 93 85 127 114 113 108 144
78 57 101 99 92 126 149 117 126 146 95 106 125 121

HEX-B09B 94
218 324 249 248 217 306 291 191 206 209 224 191 171 185 172 135 111 112 101 74
121 174 242 225 110 93 65 53 86 93 123 101 104 103 165 102 100 183 248 184
128 133 191 222 267 266 295 144 84 83 61 77 73 106 148 218 163 154 142 144
132 50 64 46 44 78 79 74 74 83 85 66 93 100 81 118 123 112 99 155
73 66 85 107 86 131 146 133 116 144 103 103 132 119
HEX-B10A 87
242 160 151 211 263 211 230 245 286 154 171 218 157 121 245 249 229 188 95 171
95 169 285 247 292 249 244 253 257 180 116 124 137 151 102 93 139 130 98 88
156 181 154 74 72 127 135 163 138 127 114 99 120 128 106 67 44 44 29 73
89 96 95 107 91 75 84 67 96 102 129 94 58 81 76 47 48 59 47 62
76 60 68 92 75 92 84
HEX-B10B 87
235 170 153 208 263 204 240 262 290 175 173 218 158 121 245 243 233 185 97 163
100 174 279 273 288 243 243 243 255 172 107 125 144 146 97 86 144 129 87 87
173 177 146 83 79 112 137 140 143 124 113 110 107 135 110 68 43 40 33 65
88 87 95 109 93 80 87 59 108 103 121 95 56 87 65 43 60 47 47 70
74 55 63 100 70 100 87
HEX-B12A 69
315 262 350 288 339 472 318 370 331 356 334 336 338 376 431 424 408 461 457 340
324 336 356 329 234 197 399 342 348 308 332 292 289 340 336 371 375 411 420 333
359 329 280 305 186 209 187 275 212 223 241 201 116 87 76 127 188 210 198 172
201 177 129 129 109 82 99 102 134
HEX-B12B 69
304 278 340 298 352 481 325 371 321 337 342 327 346 382 426 428 412 461 462 338
306 333 360 297 227 199 410 333 346 312 334 276 290 340 341 371 386 415 411 330
370 317 273 307 183 204 189 229 217 210 245 201 124 89 79 121 184 198 202 173
215 174 133 139 101 93 99 102 119
HEX-B13A 111
380 480 345 578 422 429 355 345 366 260 403 333 205 326 291 291 250 313 281 272
232 205 185 213 192 203 209 190 207 137 191 201 188 226 223 217 126 152 217 220
172 150 177 125 161 129 141 130 132 106 110 151 109 125 136 121 94 113 100 114
111 141 121 135 155 136 167 175 161 151 140 137 115 139 117 136 123 166 166 139
119 155 104 83 88 94 96 110 87 97 133 115 134 126 117 140 145 179 149 158
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HEX-B13B 111
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