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THE BELLFRAME
CHURCH OF ST JOHN THE EVANGELIST
CARLTON-IN-LINDRICK
NOTTINGHAMSHIRE

SURVEY, RECORDING AND
TREE-RING ANALYSIS OF TIMBERS

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SURVEY, RECORDING, AND TREE-RING ANALYSIS OF TIMBERS FROM THE BELLFRAME OF THE CHURCH OF ST JOHN THE EVANGELIST, CARLTON-IN-LINDRICK, NOTTINGHAMSHIRE

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SUMMARY

Dendrochronological analysis was undertaken on samples taken from timbers of the bellframe at this church.

Site sequence NBFOSQ01, contains six samples and spans the period AD 1486–1633.

Interpretation of the sapwood suggests felling of the timbers occurred in AD 1633.

A second site sequence is undated.

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INTRODUCTION

The church of St John is situated a few miles north of Worksop (Figs 1 & 2) and is mentioned in the Domesday Book, although it is not until AD 1646 that it became known as St John's. The end of the eleventh century saw the demolition and rebuilding of the nave and chancel with work also being carried out on the tower arch. In AD 1190 a chapel was constructed at the east end of the north aisle in dedication to Thomas a Becket. Further major work was undertaken between AD 1425–53 with the nave walls being raised, windows being inserted, and new roofs for the nave and aisle; the tower was also raised by a further stage at this time. Another period of restoration occurred in the nineteenth century, including the erection of a gallery at the west end, a south aisle with a small vestry and porch at its east end constructed and the Becket chapel rebuilt. The north aisle was increased in width and all roofs 'under ceiled'. (http://southwellchurches.nottingham.ac.uk/carlton-in-lindrick/hintro.php).

The Bell frame

The oak bellframe for three bells is of double jack-braced design, Pickford Group 6.D, plan type 3.1 (Figs 3 & 4). It is of a piece, built in one phase, and seems to include some re-used timbers. Of great interest is the incised: E P 1634 on the top cill of frame E, which may indicate the date, whilst the initials are probably those of the carpenter, though this piece of timber may be re-used, note the redundant mortise below the date with two large pegs. The bottom sills of the four trusses are connected to the gate ends by lapped dovetail joints. Stylistically the frame dates to the second quarter of the seventeenth century.

The Bells

[71] [71] [71]

1. [76] VIRGINIS [ ] EGREGIS [ ] VOCOR[ ] CAMPANA [ ] MARIE [ ] DNS WILLIS CHAWMBIR

31.5" c 5 cwt

2. DANIEL HEDDERLY FOUN. VAL WILSON C:W 1732

35.25" c 7 cwt

3. HEC [50] CAMPANA [50] SACRA [50] TRINITATE BEATA [50] [ ]H TH 1623

38" c 9.5 cwt

Badge numbers are taken from the Church Bells of Nottinghamshire.

The treble is an interesting bell of the Somercotes type which appear to have been cast by John Smith, founder of Louth. It is the only example of the type to be found outside Lincolnshire. The donor, William Chamber was parson from AD 1417 to AD 1443. These dates tie in with the Somercotes bell, dated AD 1423, and the Somerby pair, dated AD 1431. The word spacers on this bell are figures from the centres of different letters.

The second bell is by Daniel Hedderly. The third bell is a bit of a puzzle for it bears a swastika used by the Heathcotes of Chesterfield. However, the lettering, date and word spacers are Nottingham stamps. The initials may well indicate Thomas II Heathcote, grandson of Ralph Heathcote and nephew of Godfrey. It is certainly the last known bell with any Chesterfield connections.

Bell ringing certainly appear to have been popular in the parish, for in 1573 (79) and in 1620 (80) parishioners appeared before the Archdeacons Court for ringing excessively.

The fittings are of nineteenth-century date, the wheels and hanging straps showing similarities with those made by Taylors of Loughborough, but this place does not occur in their Records. The plain bearings are housed in cast iron holders with caps of interesting design.

Physical data:

	Diameter(cm)	Weight
Treble.	80	c 5 cwt
2.	82	c 7 cwt
Tenor.	96.5	c 9.5 cwt

PRINCIPLES OF TREE-RING DATING

Tree-ring dating relies on a few simple, but fundamental, principles. Firstly, as is commonly known, trees (particularly oak trees) grow by adding one, and only one, growth-ring to

their circumference each, and every, year. Each new annual growth-ring is added to the outside of the previous year's growth just below the bark. The width of this annual growth-ring is largely, though not exclusively, determined by the weather conditions during the growth period (roughly March to September). In general, good conditions produce wider rings and poor conditions produce narrower rings. Thus, over the lifetime of a tree, the annual growth-rings display a climatically determined pattern. Furthermore, and importantly, all trees growing in the same area at the same time will be influenced by the same growing conditions and the annual growth-rings of all of them will respond in a similar, though not identical, way.

Secondly, because the weather over any number of consecutive years is unique, so too is the growth pattern of the tree. The pattern of a short period of growth, 20 or 30 consecutive years, might conceivably be repeated two or even three times in the last one thousand years. A short pattern might also be repeated at different time periods in different parts of the country because of differences in regional micro-climates. It is less likely, however, that such problems would occur with the pattern of a longer period of growth, that is, anything in excess of 60 years or so. In essence, a short period of growth, anything less than 50 rings, is not reliable, and the longer the period of time under comparison the better.

The third principal of tree-ring dating is that, until the early-to mid-nineteenth century, builders of timber-framed houses usually obtained all the wood needed for a given structure by felling the necessary trees in a single operation from one patch of woodland or from closely adjacent woods. Furthermore, and contrary to popular belief, the timber was used "green" and without seasoning, and there was very little long-term storage as in timber-yards of today. This fact has been well established from a number of studies where tree-ring dating has been undertaken in conjunction with documentary studies. Thus, establishing the felling date for a group of timbers gives a very precise indication of the date of their use in a building.

Tree-ring dating relies on obtaining the growth pattern of trees from sample timbers of unknown date by measuring the width of the annual growth-rings. This is done to a tolerance of 1/100 of a millimetre. The growth patterns of these samples of unknown date are then compared with a series of reference patterns or chronologies, the date of each ring of which is known. When a sample "cross-matches" repeatedly at the same date against a series of different relevant reference chronologies the sample can be said to be dated. The degree of cross-matching, that is the measure of similarity between sample and reference is denoted by a "*t*-value"; the higher the value the greater the similarity. The greater the similarity the greater is the probability that the patterns of the samples and

references have been produced by growing under the same conditions at the same time. The statistically accepted fully reliable minimum *t*-value is 3.5.

However, rather than attempt to date each sample individually it is usual to first compare all the samples from a single building, or phases of a building, with one another, and attempt to cross-match each one with all the others from the same phase or building. When samples from the same phase do cross-match with each other they are combined at their matching positions to form what is known as a "site chronology". As with any set of data, this has the effect of reducing the anomalies of any one individual (brought about in the case of tree-rings by some non-climatic influence) and enhances the overall climatic signal. As stated above, it is the climate that gives the growth pattern its distinctive pattern. The greater the number of samples in a site chronology the greater is the climatic signal of the group and the weaker is the non-climatic input of any one individual.

Furthermore, combining samples in this way to make a site chronology usually has the effect of increasing the time-span that is under comparison. As also mentioned above, the longer the period of growth under consideration, the greater the certainty of the cross-match. Any site chronology with less than about 55 rings is generally too short for satisfactory analysis.

SAMPLING STRATEGY

A total of 11 samples was taken from various timber elements of this bellframe with each sample being given the code NBF-O and numbered 01–11. The location of all samples was noted at the time of sampling and has been marked on Figures 5–10. Further details can be found in Table 1.

ANALYSIS & RESULTS

One of these samples (NBF-O05) was found to have too few rings for secure dating and so was rejected. The other ten samples were prepared by sanding and polishing and their growth-ring widths measured. These measurements were then compared with each other resulting in eight samples matching to form two groups.

Firstly, six samples matched each other and were combined at the relevant offset positions to form NBFOSQ01, a site sequence of 148 rings (Fig 11). This site sequence was then compared against a series of relevant reference chronologies for oak where it was found to match consistently and securely at a first-ring date of AD 1486 and a last-measured ring date of AD 1633. The evidence for this dating is given by the *t*-values in Table 2.

Two other samples also matched each other and were combined to form NBFOSQ02, a site sequence of 78 rings (Fig 12). Attempts to date this site sequence and the remaining two ungrouped samples were unsuccessful and all remain undated.

INTERPRETATION

Six of the samples have been successfully dated. One of these, NBF-O02, has complete sapwood and the last-measured ring date of AD 1633, the felling date of the timber represented. Three of the other dated samples have the heartwood/sapwood boundary ring which can be seen to be broadly contemporary (Fig 11). The average heartwood/sapwood boundary ring date of these three samples is AD 1615, allowing an estimated felling date to be calculated for the three timbers represented to within the range AD 1633–55, consistent with these timbers also having been felled in AD 1633. The felling date range allows for sample NBF-O10 having the last-measured ring date of AD 1632 with incomplete sapwood. The other two dated samples do not have the heartwood/sapwood boundary ring and so an estimated felling date range cannot be calculated for them. However, with last-measured ring dates of AD 1597 (NBF-O04) and AD 1598 (NBF-O06) these would be estimated to be, at the earliest, AD 1613 and AD 1614, respectively and therefore also likely to have been felled with the rest of the timber in AD 1633.

Felling date ranges have been calculated using the estimate that 95% of mature oak trees from this region have 15–40 sapwood rings.

DISCUSSION

The tree-ring analysis has demonstrated that the bellframe includes timber felled in AD 1633. This would lend support to the idea that an incised '1634' refers to the construction date of the frame. It had been postulated that this timber and perhaps others may have been used previously. However, the tree-ring dating, coupled with the stylistic dating of the frame to the second quarter of the seventeenth century, does not support this. Furthermore, in a document from AD 1635 churchwardens refer to the sum of £26 13s 4d being spent the previous year on church repairs which may possibly relate to the rehanging of the bells (AN/PB 341/2/10), further supporting an AD 1634 construction for the frame.

Samples NBF-O09 and NBF-O10, both from top cills, match each other at a value of *t*=10.2, demonstrating that the two timbers represented were almost certainly cut from the same tree.

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The Laboratory and George Dawson would like to thank Richard Smith for facilitating access and John Kitchen, Professor John Beckett and Dr Chris Brooke for the information on the Southwell and Nottingham Church History website. Thanks are also given to Dr Chris Brooke for his comments on early drafts of this report. The research was undertaken as part of the Southwell and Nottingham Church History Project and this element was joint funded by The Heritage Lottery Fund and Nottinghamshire County Council.

Table 1: Details of samples taken from the bellframe at the Church of St John The Evangelist, Carlton-in-Lindrick, Nottinghamshire

Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date (AD)	Last heartwood ring date (AD)	Last measured ring date (AD)
NBF-O01	Top cill, truss D	55	h/s	----	----	----
NBF-O02	East jack brace, truss C	88	21C	1546	1612	1633
NBF-O03	East brace, truss C	84	h/s	----	----	----
NBF-O04	West jack brace, truss C	112	--	1486	----	1597
NBF-O05	Top cill, truss B	NM	--	----	----	----
NBF-O06	West jack brace, truss B	57	--	1542	----	1598
NBF-O07	Top cill, truss A	68	h/s	----	----	----
NBF-O08	East brace, truss A	75	10	----	----	----
NBF-O09	Top cill, truss F	83	06	1543	1619	1625
NBF-O10	Top cill, truss E	86	13	1547	1619	1632
NBF-O11	South brace, truss E	104	20	1625	1608	1628

*NM = not measured

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

C = complete sapwood retained on sample, last-measured ring is the felling date

Table 2: Results of the cross-matching of site sequence NBFOSQ01 and relevant reference chronologies when the first-measured ring date is AD 1486 and the last-measured ring date is AD 1633

Reference chronology	*t*-value	Span of chronology	Reference
Church of St Nicholas (bellframe), Bringhurst, Leicestershire	8.0	AD 1502–1687	Arnold *et al* 2005
Meeting House Cottage, Carlton in Lindrick, Nottinghamshire	7.8	AD 1502–1651	Arnold *et al* 2003 unpubl
Sinai Park, Burton on Trent, Staffordshire	7.0	AD 1227–1750	Tyers 1997
White House, Main Road, Blyth, Nottinghamshire	7.0	AD 1453–1595	Howard *et al* 1994
40–44 Castlegate, Newark, Nottinghamshire	6.2	AD 1523–1620	Arnold *et al* 2002
101 Meeting Street, Quorn, Leicestershire	6.5	AD 1489–1658	Arnold *et al* 2008a
Aisled barn, Yew Tree Farm, North Leverton, Nottinghamshire	6.3	AD 1476–1618	Arnold *et al* 2008b

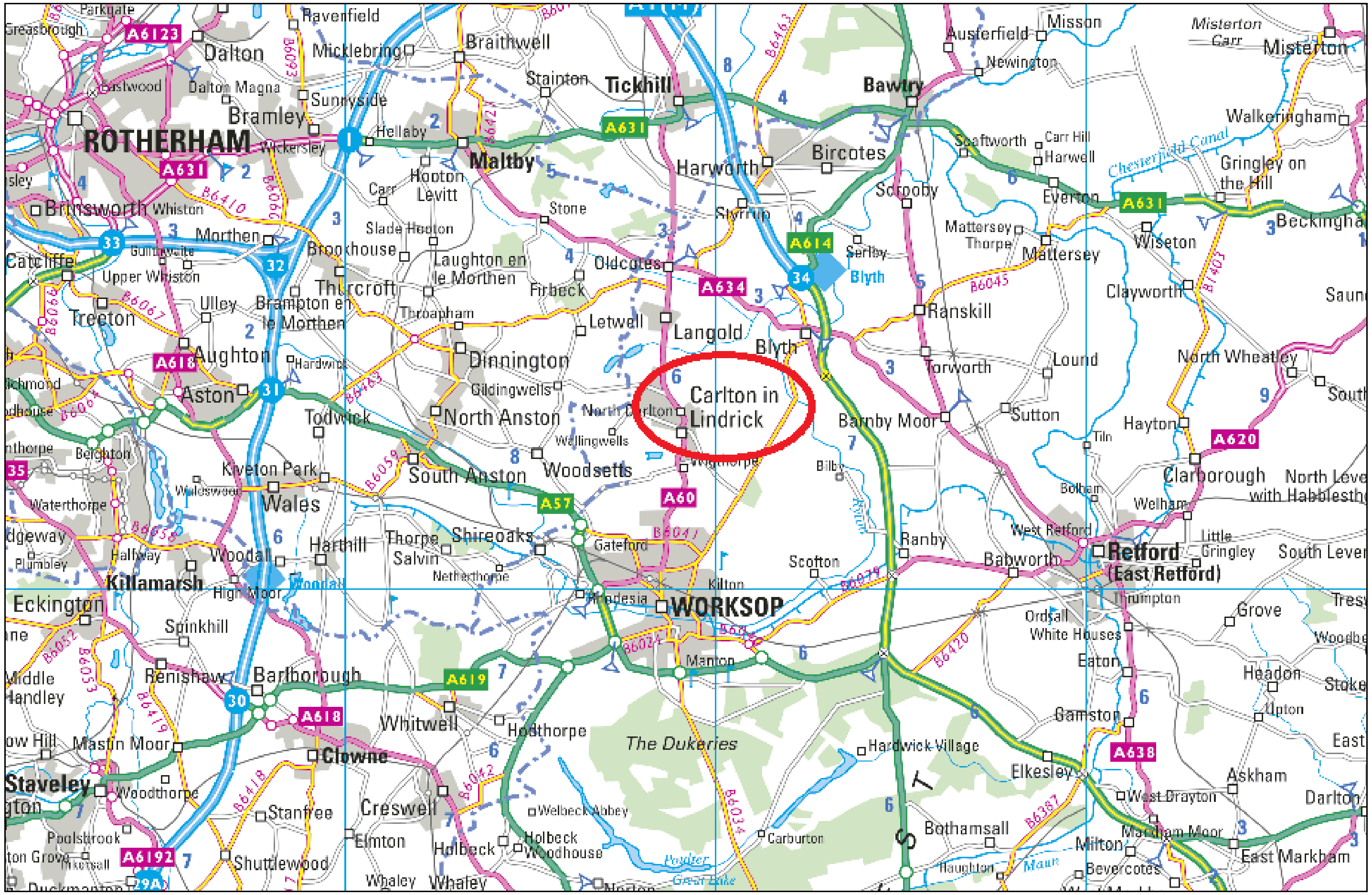

Figure 1: Map to show the general location of Carlton-in-Lindrick, circled (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright

Figure 2: Map to show the location of the Church of St John The Evangelist, arrowed (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

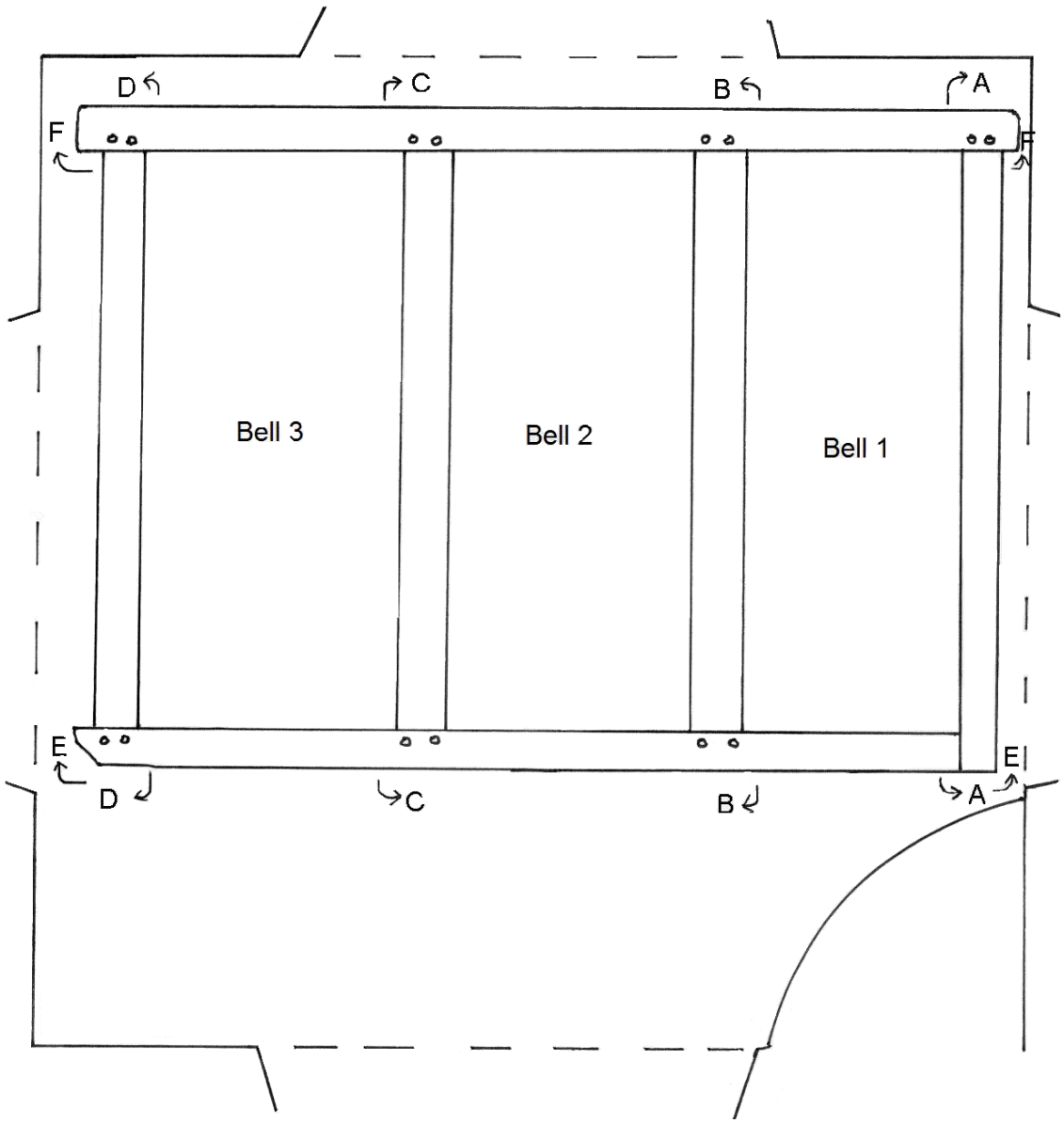

Figure 3: Plan, showing truss labelling

Figure 4: The bellframe, photograph taken from the north-west

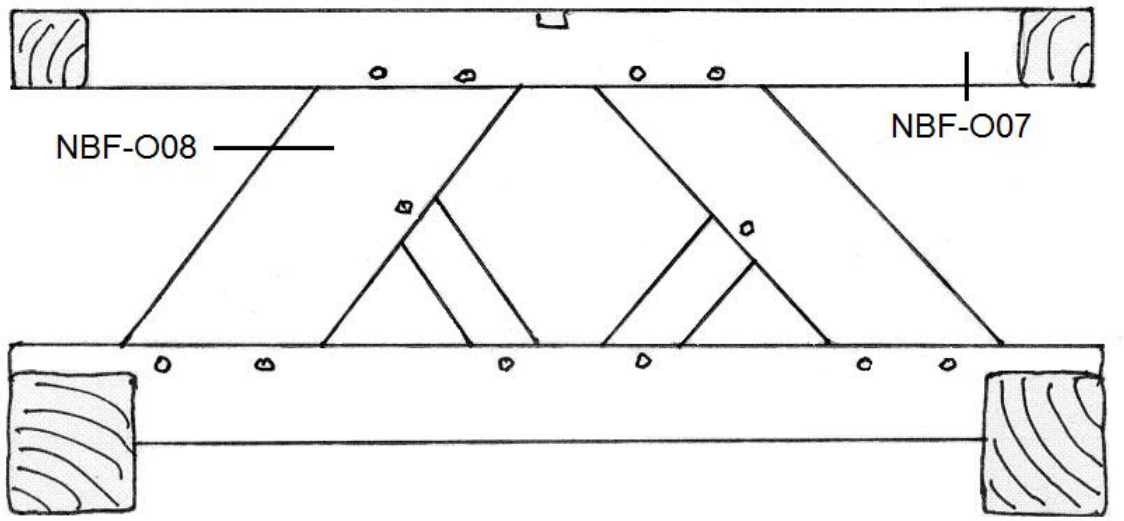

Figure 5: Truss A, showing the location of samples NBF-O07 and NBF-O08

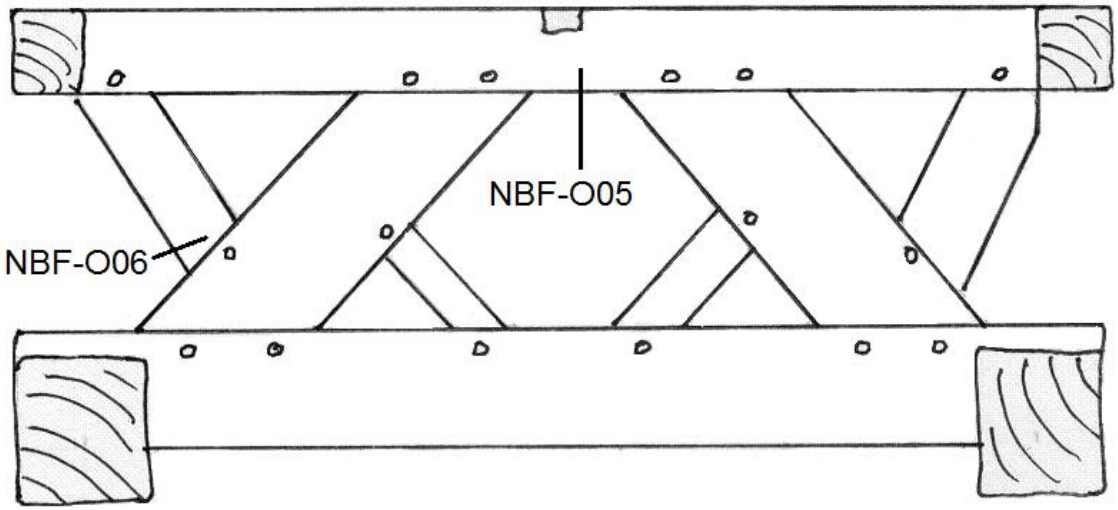

Figure 6: Truss B, showing the location of samples NBF-N05 and NBF-N06

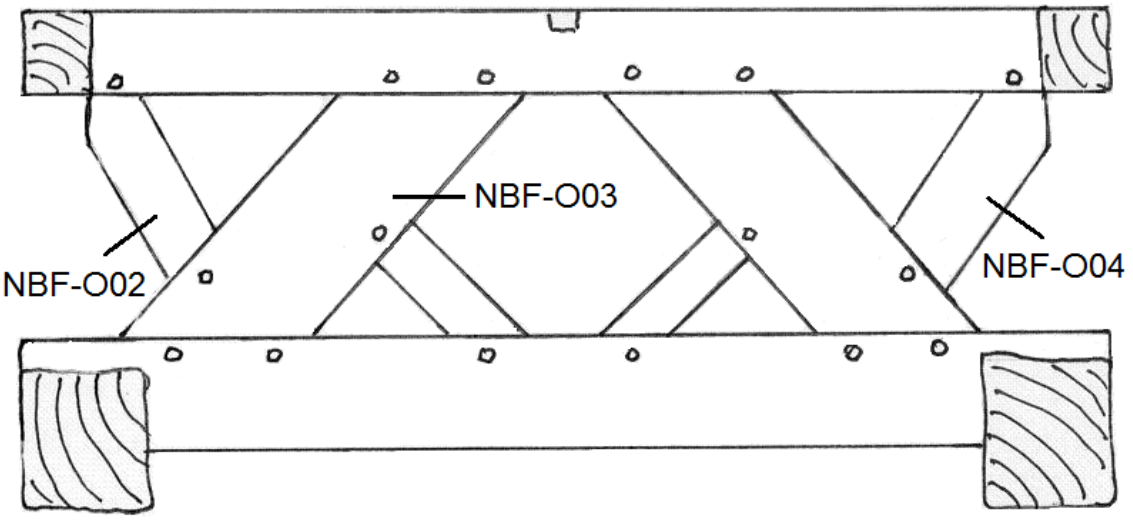

Figure 7: Truss C, showing the location of samples NBF-O02–04

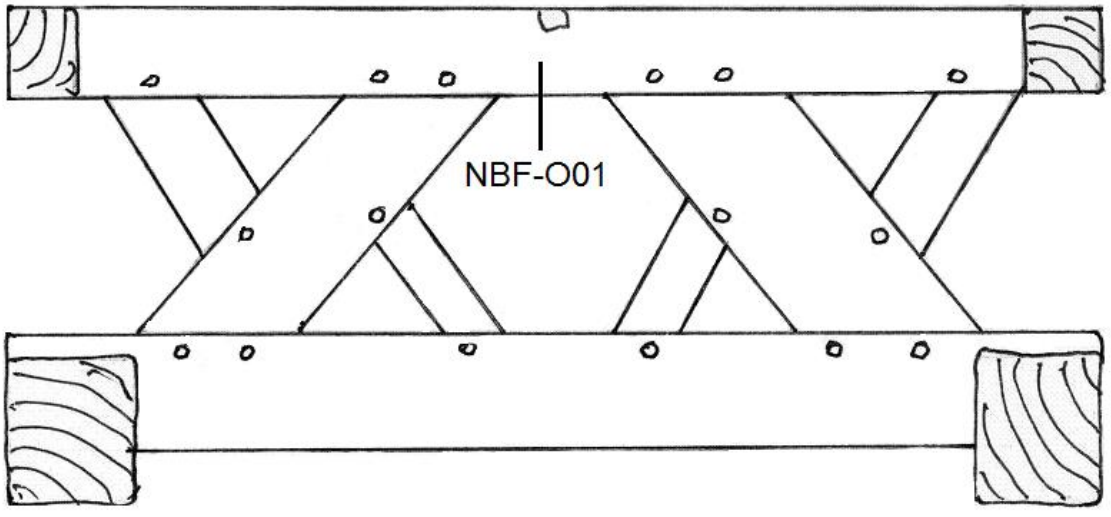

Figure 8: Truss D, showing the location of sample NBF-O01

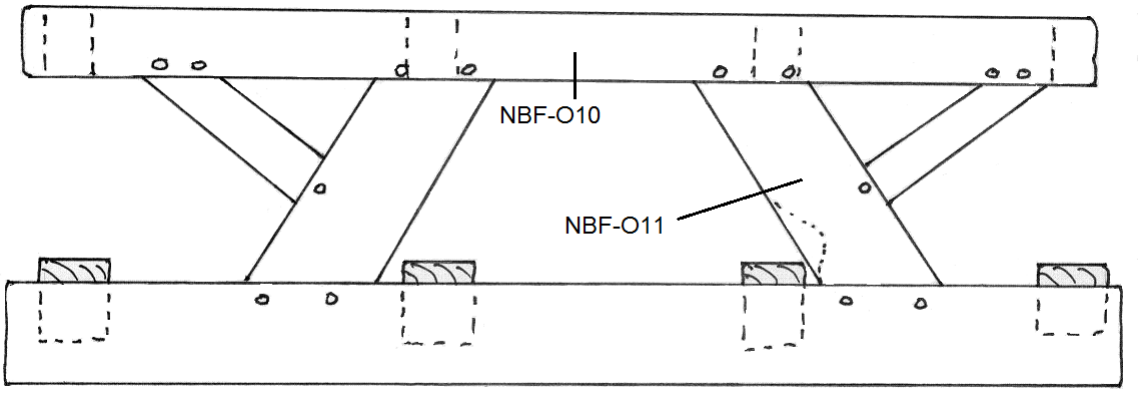

Figure 9: End frame E, showing the location of samples NBF-O10 and NBF-O11

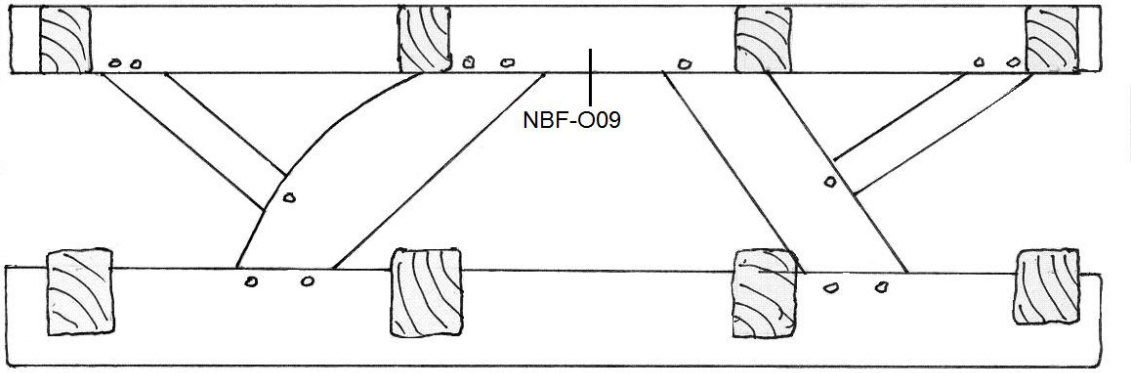

Figure 10: End frame F, showing the location of sample NBF-O09

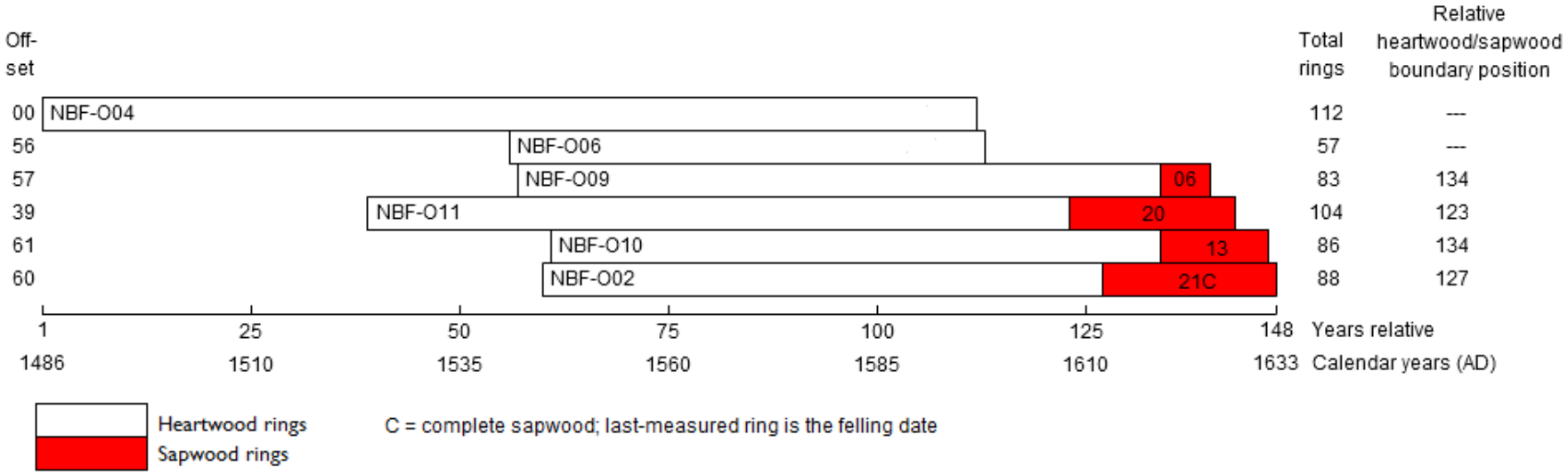

Figure 11: Bar diagram of samples in site sequence NBFOSQ01

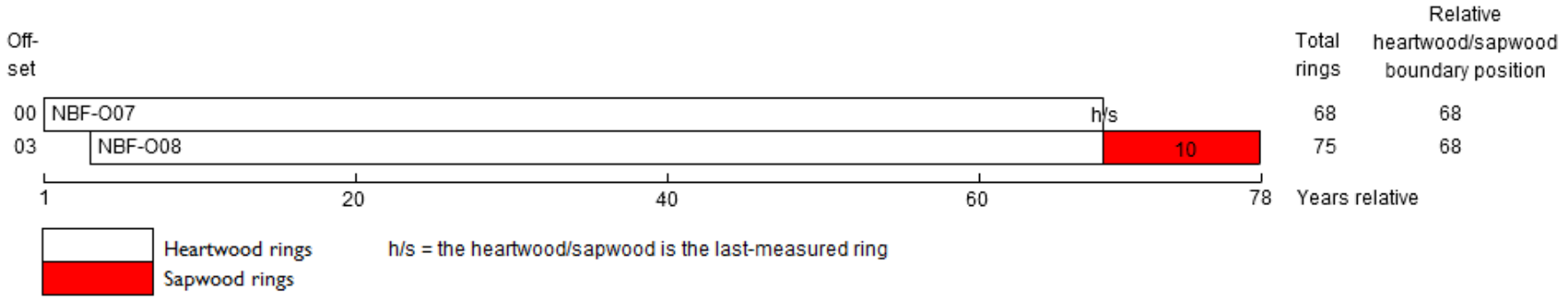

Figure 12: Bar diagram of samples in undated site sequence NBFOSQ02

DATA OF MEASURED SAMPLES

Measurements in 0.01mm units

NBF-O01A 55
75 71 39 56 62 98 217 231 345 315 243 407 398 417 498 363 311 205 155 137
221 220 217 267 302 254 293 287 195 131 189 241 271 215 237 227 276 254 276 232
236 180 187 213 205 148 147 142 89 118 123 161 184 249 204
NBF-O01B 55
62 70 38 52 68 88 219 242 343 305 249 390 421 414 382 361 259 211 136 136
197 240 232 258 315 254 296 285 196 136 189 239 275 217 230 234 273 254 280 226
238 182 185 216 196 150 149 141 94 92 143 167 181 246 173
NBF-O02A 88
94 81 97 126 113 191 134 182 241 365 254 182 231 269 241 200 306 271 274 344
352 401 434 347 247 251 212 227 242 246 136 173 143 167 192 226 249 292 253 255
264 163 143 172 173 209 183 189 240 250 221 252 167 160 171 192 200 281 298 264
244 248 206 62 43 47 42 50 51 27 51 69 93 124 127 152 139 135 108 108
63 61 71 91 122 96 118 118
NBF-O02B 88
87 88 93 126 124 209 134 192 230 381 267 190 238 268 232 189 309 274 274 343
353 403 411 361 229 238 212 223 242 252 141 167 145 171 199 222 271 315 264 265
282 141 144 138 146 163 156 184 257 222 220 230 155 158 172 187 192 301 305 249
231 280 220 52 48 43 44 47 47 39 40 61 88 125 128 142 131 150 89 101
70 67 60 93 126 84 121 98
NBF-O03A 84
306 286 349 342 314 263 294 334 315 326 427 449 333 529 357 358 455 572 150 93
77 99 118 118 146 186 205 175 182 217 240 242 329 319 269 257 298 124 79 90
86 63 55 74 59 65 91 120 99 153 141 104 112 130 143 131 165 172 160 146
124 125 134 128 173 161 189 92 74 64 46 84 73 96 132 142 149 104 142 231
248 213 234 249
NBF-O03B 84
324 258 293 331 329 261 300 321 321 320 418 439 338 524 351 356 449 586 149 92
79 102 109 118 150 184 209 173 183 211 259 228 309 340 255 254 293 126 80 88
89 64 51 63 68 63 89 134 95 144 130 105 113 133 140 132 156 176 164 145
121 125 134 130 170 166 187 90 76 65 43 91 65 105 125 143 153 107 144 221
256 210 239 236
NBF-O04A 112
198 201 142 95 84 72 73 99 74 82 172 124 76 112 88 134 162 128 78 107
95 112 84 112 84 103 97 116 80 71 82 81 182 391 370 366 382 207 204 180
263 319 475 404 304 425 330 260 233 235 299 275 207 167 176 215 85 203 215 181
195 191 202 254 195 177 131 129 138 150 164 101 153 217 208 141 135 163 149 150
130 125 131 148 70 76 89 90 94 98 67 94 81 119 150 163 210 248 186 188
243 169 178 159 143 149 125 198 309 323 318 259
NBF-O04B 112
195 201 148 95 82 67 79 102 76 74 165 123 70 101 84 132 174 124 73 88
92 107 104 104 84 96 109 105 84 74 83 80 186 418 364 366 392 210 209 187

262 318 479 398 288 412 327 274 225 231 327 271 221 163 176 217 95 202 211 181
185 190 202 257 190 176 116 132 133 154 166 98 155 206 218 160 131 153 158 134
142 114 131 155 62 82 82 89 89 98 80 89 79 113 152 151 220 243 162 179
241 170 168 172 145 154 144 207 282 330 283 287
NBF-O06A 57
31 40 37 63 89 81 222 305 236 347 226 217 300 421 327 189 284 457 479 439
617 454 474 383 466 573 836 645 439 345 188 168 152 116 118 183 161 213 335 307
270 318 239 323 397 219 198 217 221 164 144 168 288 191 274 259 201
NBF-O06B 57
24 42 38 61 76 83 205 292 234 343 240 205 306 421 293 190 285 459 484 434
601 437 483 397 464 595 792 667 454 411 209 153 134 136 139 155 140 250 348 333
286 283 230 271 294 221 207 229 238 213 157 203 343 218 329 297 226
NBF-O07A 67
212 181 167 166 204 142 138 90 139 218 210 238 154 133 180 129 115 103 108 120
139 148 95 90 181 211 154 231 163 148 160 136 225 347 274 306 257 339 285 334
215 277 291 152 71 44 58 64 83 91 97 60 108 100 118 82 124 163 137 91
112 183 225 109 93 100 415
NBF-O07B 68
216 174 172 149 187 133 152 74 147 215 204 271 147 135 164 117 107 91 115 118
142 151 97 88 189 219 148 235 163 156 154 145 220 328 278 315 246 326 274 311
194 284 286 156 59 43 73 48 72 96 99 59 106 90 113 81 132 175 124 106
104 188 212 115 104 92 400 255
NBF-O08A 75
514 433 262 70 52 138 244 305 290 268 194 245 62 100 104 100 100 166 140 140
124 154 172 162 278 231 319 310 223 268 329 351 353 392 417 385 354 303 471 423
226 86 70 98 123 161 193 109 100 223 154 111 153 123 144 130 171 156 195 305
170 162 113 314 236 158 208 319 161 186 250 200 154 159 140
NBF-O08B 75
531 487 249 60 69 153 268 297 286 256 199 231 57 111 105 104 109 172 143 140
124 157 187 164 318 244 337 331 221 267 330 363 380 399 421 401 373 299 471 411
239 80 67 91 138 158 172 111 114 216 151 103 157 112 160 136 174 147 188 297
163 172 117 316 234 154 182 320 163 188 244 202 153 147 148
NBF-O09A 83
199 196 287 202 187 258 302 275 312 289 305 396 409 259 163 296 401 373 396 459
399 365 483 388 329 511 511 481 483 468 385 362 323 227 193 252 305 340 360 325
382 341 392 411 304 214 176 205 166 109 141 248 258 258 243 262 289 217 166 137
129 183 165 185 295 317 274 245 227 288 357 205 204 243 217 243 234 240 253 303
269 254 190
NBF-O09B 83
197 198 274 210 189 250 295 266 304 298 301 391 412 248 171 293 387 371 402 460
418 373 498 389 322 499 514 476 478 462 384 368 322 222 192 241 303 327 373 335
359 337 388 407 300 188 180 198 172 103 162 233 267 248 245 271 265 212 174 131
137 180 170 176 295 304 279 249 234 286 366 214 196 256 220 226 241 240 256 288
276 213 204
NBF-O10A 86
152 199 364 276 367 351 333 401 457 348 172 259 479 389 300 349 317 357 420 335
305 397 417 397 494 422 419 427 336 273 197 291 222 386 294 358 369 262 255 371

349 343 314 277 269 124 167 292 245 262 214 213 204 166 156 139 107 179 123 167
182 188 174 188 172 194 368 179 174 236 296 336 280 246 279 410 293 228 198 184
142 180 250 147 147 136
NBF-O10B 86
149 201 362 264 371 357 335 395 452 352 184 266 466 404 313 356 338 369 421 338
302 402 420 400 493 417 422 436 342 260 206 290 263 380 317 374 361 273 250 360
342 350 301 265 279 121 150 273 250 285 193 198 197 147 153 135 106 166 133 176
214 227 185 180 155 198 323 171 185 231 312 315 269 244 277 402 289 221 200 176
159 166 269 138 146 136
NBF-O11A 104
253 227 206 401 437 395 560 434 210 271 313 276 252 191 178 256 121 66 102 103
89 86 77 109 164 178 203 96 91 153 154 173 108 180 343 295 229 232 198 198
154 129 103 98 153 124 141 163 190 144 141 97 78 78 108 217 155 280 236 159
139 140 79 64 52 41 52 37 87 149 235 233 239 234 260 270 255 257 237 190
127 144 216 146 113 79 95 71 93 120 101 74 99 141 132 151 158 107 117 110
120 119 157 123
NBF-O11B 104
247 225 194 398 441 374 569 429 226 263 315 273 240 188 191 258 116 68 97 110
89 88 87 96 164 180 200 101 83 160 153 177 114 181 354 287 223 239 198 208
146 122 109 107 155 127 139 168 208 160 135 85 85 74 115 204 153 269 228 146
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126 144 227 133 119 74 96 71 98 121 108 76 108 147 127 149 160 100 121 91
128 104 152 127