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THE WHEAT (BLACK) BARN, SANDON BURY FARM, SANDON, HERTFORDSHIRE

TREE-RING ANALYSIS OF TIMBERS

Martin Bridge

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SUMMARY

Twenty-two oak samples were taken from various elements thought likely to be associated with the primary construction of the Wheat Barn. Nineteen series were dated, producing a site chronology of 114 years, dated as spanning the period AD 1152–1265. All dated samples except one retain the heartwood/sapwood boundary. Several timbers retained complete sapwood, though varying amounts were lost during sampling. This allowed a felling date range of *c* AD 1266–8 to be derived and this is, therefore, the likely construction date of the barn.

CONTRIBUTORS

Dr M C Bridge

ACKNOWLEDGEMENTS

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ARCHIVE LOCATION

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DATE OF INVESTIGATION

2012

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INTRODUCTION

This Grade II* listed barn, known as the Wheat Barn or the Black Barn, is situated on the east side of the village of Sandon, about 4 km east of the town of Baldock, at one of the highest points in Hertfordshire (Fig 1).

Figure 1: Location of the barn (central, marked with a triangle) in relation to its immediate environs. © Crown Copyright and database right 2015. All rights reserved. Ordnance Survey Licence number 100024900

It is an important example of an early high-quality timber-framed building and was thought likely to date from the early thirteenth century. It is a timber-framed, aisled barn with passing-brace truss framing, which is the system also used for early high-status domestic buildings, including the halls of royal palaces (Essex County Council, undated). It has a rendered brick base, and is weather boarded and red brick clad with a slate roof. The building is described by Hewett (1976), from which much of the following detail has been extracted. It is believed that the barn was formerly six bays in length with aisles at both the sides and ends. In its current form it consists of six bays with a shorter bay nearest the road. Both ends were originally hipped and angle-tied. There is now no evidence of the type of roof it had although the tiebeams remain extant. The passing-braces stopped on

the tiebeam flanks in housings, whilst those axially aligned in the end frames occupy notched-laps of refined form. One post shows undisturbed evidence for the former existence of two rare details: the fitting of double outshut ties that clasped the eaves plates, and the sole-braces that maintained the right-angle between posts and plates. A hint of curvature is visible in the major braces and the top plate scarf is splayed and tabled, and has sallied-butts.

The current position of the threshing doors is thought to be an original opening, although the framing in the south wall of bays 1 and 2 has been replaced. There is evidence for an original opening in the south wall of bay 5 suggested by an old beam above mid-rail height with a modern timber frame beneath.

Indication of possible rebuilding of the north aisle is suggested by the presence of jowls to the principal posts in the lower half of the north aisle that do not exist on the principal posts elsewhere in the barn. A sixteenth-century date for these rebuilds is suggested by the presence of wattle grooves, edge halved scarf joints, and the jowled posts.

Whilst several features indicate that the original barn might be post-thirteenth century, a construction date of AD 1239 is suggested by dimensions logged in the lease of that year and the survey compiled between AD 1239 and AD 1259.

Dendrochronological dating was requested by Malcolm Starr (English Heritage Heritage at Risk Architect/Surveyor), to provide a precise date for its primary construction and hence inform conservation and protection during planned repair and renovation works.

METHODOLOGY

Fieldwork for the present study was carried out in October 2012, following an initial assessment of the potential for dating some weeks beforehand. In the initial assessment, accessible oak timbers with more than 50 rings and where possible traces of sapwood were sought, although slightly shorter sequences are sometimes sampled if little other material is available. Those timbers judged to be potentially useful were cored using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis.

The cores were polished on a belt sander using 80 to 400 grit abrasive paper to allow the ring boundaries to be clearly distinguished. The samples had their tree-ring sequences measured to an accuracy of 0.01mm, using a specially constructed system utilising a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC, which recorded the ring widths into a dataset. The software used in measuring and subsequent analysis was written by Ian Tyers (2004). Cross-matching was attempted by a combination of visual matching and a process of qualified statistical comparison by computer. The ring-width series were compared for statistical cross-matching, using a variant of the Belfast CROS program (Baillie and Pilcher 1973). Ring sequences were plotted on the computer monitor to allow visual comparisons to be

made between sequences. This method provides a measure of quality control in identifying any potential errors in the measurements when the samples cross-match.

In comparing one sample or site master against other samples or chronologies, *t*-values over 3.5 are considered significant, although in reality it is common to find demonstrably spurious *t*-values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some *t*-value ranges of 5, 6, and higher, and for these to be well replicated from different, independent chronologies with both local and regional chronologies well represented, except where imported timbers are identified. Where two individual samples match together with a *t*-value of 10 or above, and visually exhibit exceptionally similar ring patterns, they may have originated from the same parent tree. Same-tree matches can also be identified through the external characteristics of the timber itself, such as knots and shake patterns. Lower *t*-values however do not preclude same tree derivation.

Ascribing felling dates and date ranges

Once a tree-ring sequence has been firmly dated in time, a felling date, or felling date range, is ascribed where possible. With samples which have sapwood complete to the underside of, or including bark, this process is relatively straightforward. Depending on the completeness of the final ring, ie if it has only the spring vessels or early wood formed, or the latewood or summer growth, a precise felling date and season can be given. If the sapwood is partially missing, or if only a heartwood/sapwood transition boundary survives, then an estimated felling date range can be given for each sample. The number of sapwood rings can be estimated by using an empirically derived sapwood estimate with a given confidence limit. If no sapwood or heartwood/sapwood boundary survives then the minimum number of sapwood rings from the appropriate sapwood estimate is added to the last measured ring to give a *terminus post quem* (*tpq*) or felled-after date.

A review of the geographical distribution of dated sapwood data from historic timbers has shown that a sapwood estimate relevant to the region of origin should be used in interpretation, which in this area is 9–41 rings (Miles 1997). It must be emphasised that dendrochronology can only date when a tree has been felled, not when the timber was used to construct the structure or object under study.

RESULTS AND DISCUSSION

A total of 22 cores were obtained from various structural elements associated with the primary construction of the barn (Table 1; Figs 2 and 3). One sample (sbbb22) came out in several fragments, and was not measured. The trusses were assigned letters beginning at A at the southern end of the barn. Nineteen of the 21 samples analysed cross-matched with each other (Table 2; Fig 4). Within this group it can be seen that the overall cross-matching is variable (eg sbbb02 is a relatively short sequence of just 48 years; sbbb20 has distorted growth, with a band of very wide rings mid-sequence) but it is supported by

comparison of the individual series with reference chronologies. Thus these 19 timbers were combined to form a well-replicated 114-year site master sequence, SANDON1, that was subsequently dated to the period AD 1152–1265, the strongest matches being shown in Table 3. Although the site master chronology matches well over a wide area, the timbers appear to be of local origin.

Four of the dated timbers retained complete sapwood, which was partially or completely lost during coring. Measurement of the width of sapwood lost, however, enabled an estimate of the likely felling date range. One core (sbbb11) was, at the time of sampling, thought to have retained complete sapwood. However it subsequently appeared possible that a very small amount (upto 1mm) of the outermost part of the core had been lost. The likely felling date range of this timber is therefore given as *c* AD 1266–8. For the three other series (sbbb02, sbbb03, and sbbb20) where complete sapwood was present on the timber at the point of coring, the measured width of the lost sapwood was divided by the mean ring width of the outer 10 rings of the heartwood, and this date was taken as the centre of a small range of rings to provide a likely felling date range. These estimates all fall in the late AD 1250s or early/mid AD 1260s and are thus likely to be coeval with the *c* AD 1266–8 felling date. All but one of the remaining dated samples retain the heartwood/sapwood boundary. The date of this heartwood/sapwood boundary varies from AD 1238 (sbbb08) to AD 1256 (sbbb20). This relatively limited range, and the fact that it is consistent with those timbers that had retained bark edge, suggests that the timbers represent a single phase of felling, most likely in the period *c* AD 1266–8, thus also indicating this as the likely date of construction of the barn.

The two remaining samples did not match the other samples and could not be dated independently. One of these (sbbb09) was from the wallplate of the southern aisle wall, which was thought possibly to have come from a different phase. One could argue that the failure of its ring sequence to match the majority of the others supports the view that it could be of a different phase, but against this is the fact that one other sequence (sbbb06) from a post, also failed to match the other series, and this post is part of the primary construction of the barn.

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Table 1: Details of the samples taken from The Wheat (Black) Barn, Sandon Bury Farm, Hertfordshire

Sample number	Timber and position	No of rings	Mean HW ring width (mm)	Dates spanning (AD)	h/s Boundary (AD)	Sapwood rings	Mean sensitivity	Felling date ranges (AD)
sbbb01	South sill plate from arcade post to wall, truss B	86	3.28	1157–1242	1242	h/s	0.19	1251–83
sbbb02	South post, truss B	48	3.86	1214–1261	1249	12 +	0.20	*c* 1262–66*
sbbb03	South post, truss A	70	2.47	1174–1243	1242	1 +	0.22	*c* 1257–60*
sbbb04	North post, truss A	64	3.00	1164–1227	-	-	0.21	after 1236
sbbb05	North post, truss B	99	2.34	1152–1250	1241	9	0.24	1251–82
sbbb06	North post, truss C	79	2.68	-	-	1	0.20	unknown
sbbb07	North post, truss E	64	3.03	1184–1247	1247	h/s	0.17	1256–88
sbbb08	South post, truss D	70	2.73	1169–1238	1238	h/s	0.21	1247–79
sbbb09	South wallplate to aisle wall, bay D - E	51	2.50	-	-	15	0.26	unknown
sbbb10	South post, truss E	73	2.60	1174–1246	1246	h/s	0.25	1255–87
sbbb11	South post, truss F	111	3.19	1155–1265	1247	18 +	0.20	*c* 1266–68*
sbbb12	South post, truss G	93	2.72	1153–1245	1245	h/s	0.26	1254–86
sbbb13	South arcade plate, west of scarf, bay C - D	91	2.45	1155–1245	1245	h/s	0.21	1254–86
sbbb14	South arcade plate, west of scarf, bay D - E	53	2.90	1194–1246	1246	h/s	0.24	1255–87
sbbb15	East brace from south post D to arcade plate	87	1.91	1159–1245	1245	h/s	0.20	1254–86
sbbb16	South arcade plate, bay E - F	67	2.44	1187–1253	1253	h/s	0.29	1262–94
sbbb17	Tiebeam, truss E	77	2.37	1165–1241	1239	2	0.28	1248–80
sbbb18	Lower brace south post F to tiebeam	68	2.10	1182–1249	1245	4 (+3NM)	0.28	1254–86
sbbb19	Tiebeam, truss F	73	2.61	1171–1243	1243	h/s	0.16	1252–84
sbbb20	North arcade plate, west of scarf, bay C - D	53	2.70	1204–1256	1256	h/s +	0.29	*c* 1265–68*
sbbb21	East brace from north post C to arcade plate	70	1.89	1171–1240	1240	h/s	0.21	1249–81
sbbb22	North arcade plate, east of scarf, bay C - D	*c* 47	NM	-	-	-	-	unknown

Key: HW = heartwood; NM = not measured; h/s = heartwood-sapwood boundary; * indicates timbers that were thought to have complete sapwood present but that the sapwood was partially, or wholly, lost from the core during sampling

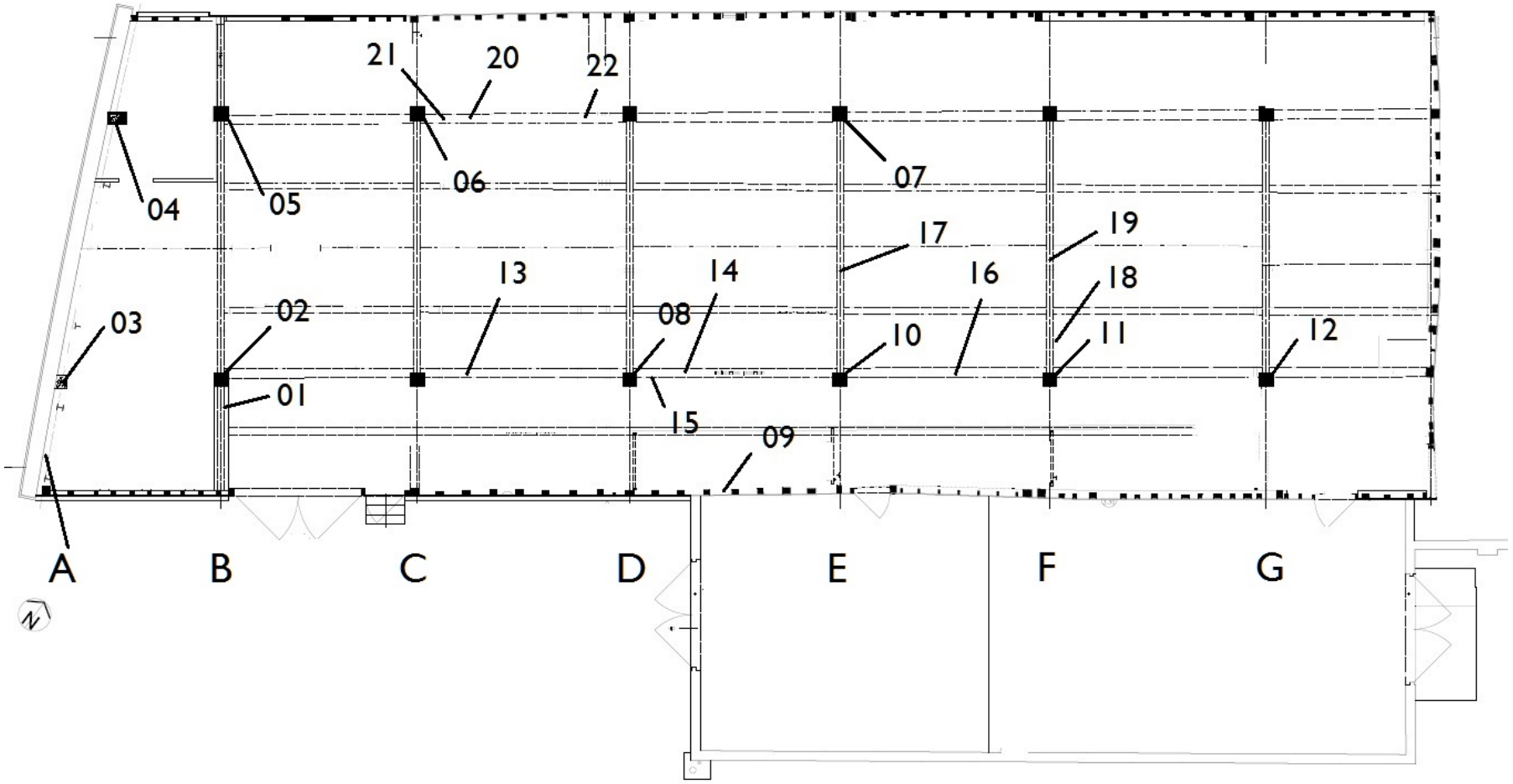

Figure 2: Plan of the barn showing the locations of the samples taken for dendrochronology. Adapted from an original drawing by Freeland Rees Roberts, Architects

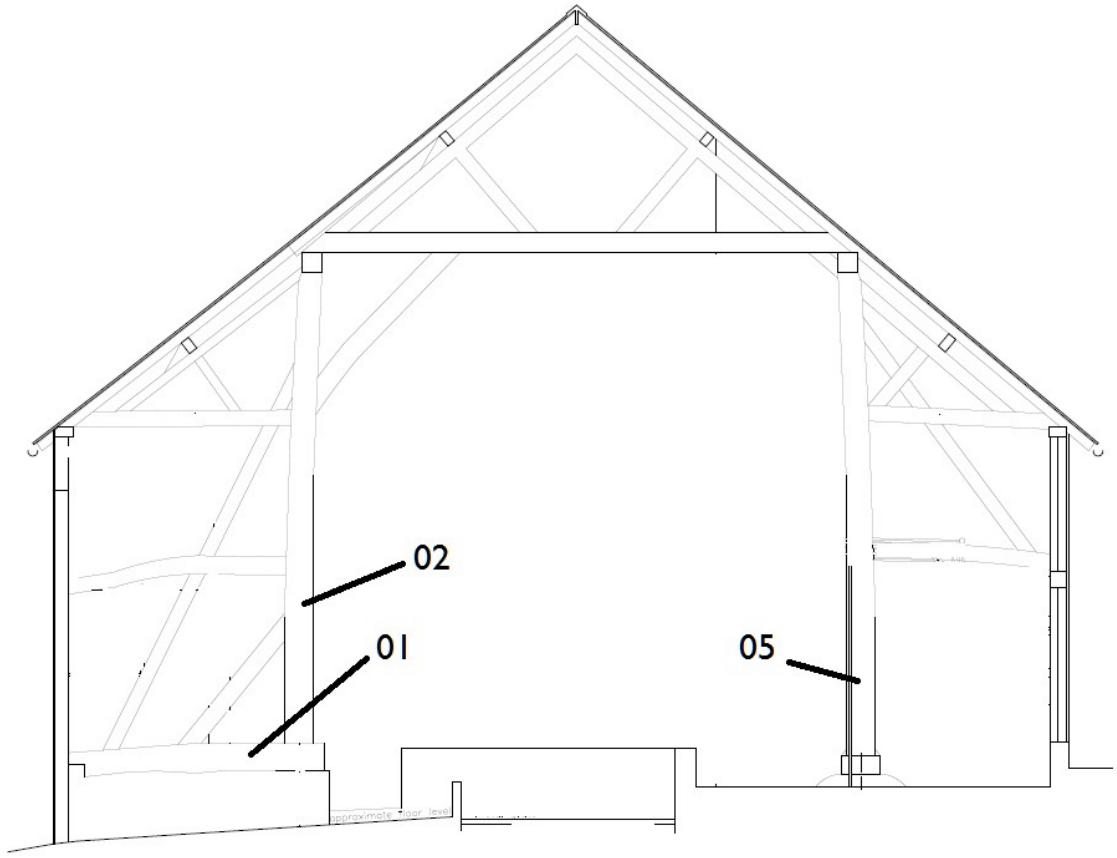

Figure 3: Drawing of truss B, showing typical truss form and the timbers sampled for dendrochronology. Adapted from an original drawing by Freeland Rees Roberts, Architects

*Table 2: Cross-matching between the dated series from Sandon Black Barn. The prefix sbbb has been left out before the number of each sample at the head of each column. t-*values of 3.5 and over are significant; * = less than 30 years overlap; negative t-values are indicated by a zero

	t-value																	
Sample	02	03	04	05	07	08	10	11	12	13	14	15	16	17	18	19	20	21
sbbb01	1.6	2.1	2.5	1.7	0.7	4.8	1.6	3.1	6.6	1.5	3.0	4.9	1.2	3.5	2.7	2.2	0.5	3.5
sbbb02		0.9	*	1.0	1.0	1.4	1.7	4.0	0.7	0.4	1.4	1.3	2.9	0	2.4	0.5	0	2.5
sbbb03			1.5	4.6	2.1	4.9	3.2	4.1	4.0	3.8	5.1	2.6	1.7	6.1	2.6	3.6	3.0	3.3
sbbb04				2.9	2.3	2.2	3.9	2.7	4.4	3.1	1.0	1.5	1.5	2.2	2.6	3.7	*	2.0
sbbb05					4.9	1.7	3.2	4.2	5.3	6.3	4.5	2.0	1.1	3.8	2.8	4.1	2.3	0.5
sbbb07						2.4	4.1	2.2	3.4	3.1	1.8	0.7	1.5	3.9	1.9	2.7	1.7	0.4
sbbb08							7.1	5.1	5.6	2.6	3.8	6.1	4.5	5.3	3.0	3.6	1.8	4.8
sbbb10								5.0	4.4	4.5	2.2	3.4	4.3	4.9	2.9	3.8	2.1	2.7
sbbb11									4.4	6.6	3.4	2.7	3.5	4.7	3.0	3.1	2.1	5.7
sbbb12										3.2	3.9	5.6	3.1	5.0	3.2	5.3	2.4	3.7
sbbb13											3.3	2.2	1.3	3.3	3.1	3.3	2.6	2.2
sbbb14												3.5	0.3	4.1	2.1	3.3	3.7	2.6
sbbb15													0.7	2.3	1.7	2.2	0.9	2.8
sbbb16														3.9	3.1	1.8	3.6	3.4
sbbb17															3.3	4.4	4.3	4.9
sbbb18																3.9	2.5	3.4
sbbb19																	2.8	2.7
sbbb20																		2.8

Table 3: Dating evidence for the site master sequence SANDON1 AD 1152–1265

Source region:	Chronology name:	Publication reference:	File name:	Span of chronology (AD)	Overlap (years)	*t*-value
Regional reference chronologies						
East Midlands	East Midlands Master	(Laxton and Litton 1988)	EASTMID	882–1981	114	9.4
Northern England	Northern England Master	(Hillam and Groves 1994)	NORTH	440–1742	114	9.3
Southern England	Southern England Master	(Bridge 1998)	SENG98	944–1790	114	8.9
Somerset	Somerset Master Chronology	(Miles 2004)	SOMRST04	770–1979	114	7.9
Oxfordshire	Oxfordshire Master Chronology	(Haddon-Reece *et al* 1993)	OXON93	632–1987	114	7.6
Individual site chronologies						
Oxfordshire	Manor Farm, Stanton St John	(Miles and Worthington 1998)	STNSTJN1	1131–1304	114	9.6
Hertfordshire	Presbytery Roof, St Albans	(Howard *et al* 2001)	STACSQ02	1151–1263	112	9.0
Wiltshire	Doom Panel, St James Church	(Tyers 2006)	DAUNTSEY	1154–1349	112	7.9
Hertfordshire	Wymondleybury	(Groves *et al* 2005)	WYMNDBRY	1184–1379	82	7.7
Northamptonshire	The Monastery, Shutlanger	(Miles *et al* 2006)	SHUTLNGR	1081–1294	114	7.7
Hampshire	Old Church House, Odiham	(Miles and Haddon-Reece 1996)	OLDCHRCH	1177–1365	89	7.6
Yorkshire	York Farm, West Hagbourne	(Miles and Haddon-Reece 1993)	YORKFARM	1200–1284	66	7.5
Hampshire	Rookley Farmhouse	(Miles and Worthington 1997)	ROOKLEY	1154–1387	112	7.3
Gloucestershire	Winterbourne Tithe Barn	(Miles and Worthington 2000)	WNTERBRN	1177–1341	89	7.2

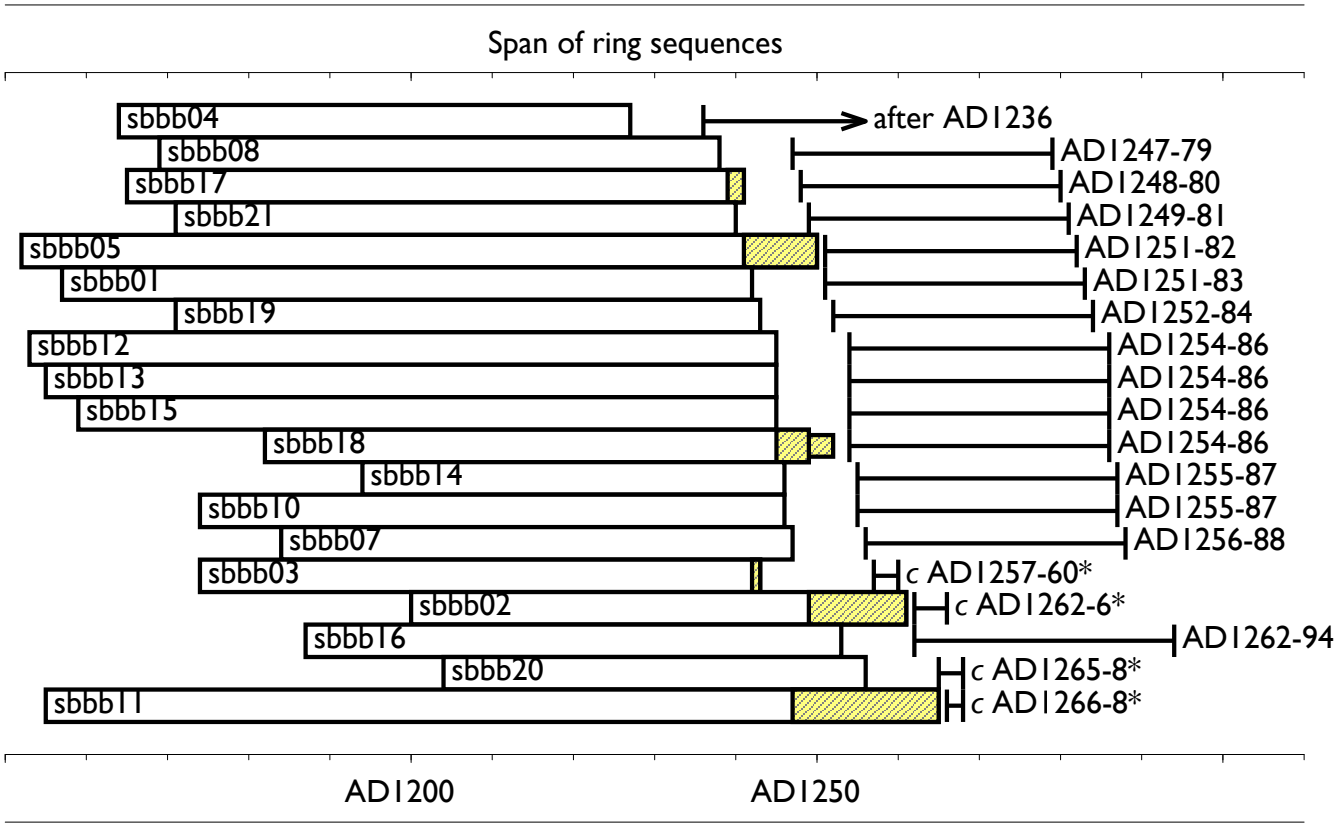

*Figure 4: Bar diagram showing the relative positions of overlap and likely felling date ranges for the dated samples from the Wheat (Black) Barn, Sandon Bury Farm, Hertfordshire. White bars represent heartwood rings; yellow hatched bars represent sapwood rings; narrow bars represent unmeasured rings present on the core; * indicates timbers that were thought to have complete sapwood present but that the sapwood was partially, or wholly, lost from the core during sampling*

APPENDIX

Ring width values (0.01mm) for the sequences measured

sbbb01

579	438	324	435	453	374	371	395	359	317
445	371	358	254	277	333	387	366	347	458
407	392	356	331	394	475	486	317	337	335
421	303	263	401	376	337	437	415	445	423
264	317	329	264	213	292	418	258	341	395
346	426	316	332	260	320	520	350	310	238
316	238	311	308	321	220	337	284	292	268
345	238	287	233	249	199	222	210	315	188
154	238	213	174	137	128				

sbbb02

496	288	142	195	122	170	317	439	540	456
391	347	471	655	465	449	410	478	344	313
271	322	486	540	548	598	571	505	557	497
426	390	231	197	297	337	313	523	424	407
404	296	348	532	322	358	490	522	288	291
313	496	345	347	313	263	205	240	127	158
162	152								

sbbb03

540	517	510	375	400	383	352	445	464	506
359	530	600	580	328	320	455	351	330	517
278	387	246	192	119	143	159	193	165	150
157	289	222	215	271	195	218	132	109	228
232	251	138	130	66	122	120	170	162	166
107	169	193	113	133	150	157	124	119	94
96	89	97	151	173	186	166	133	140	132

sbbb04

260	419	429	459	299	409	277	281	202	286
276	456	507	376	281	238	326	384	260	310
185	232	261	402	177	191	190	211	322	479
341	479	428	377	333	288	214	286	325	320
244	257	280	275	318	259	354	328	275	257
187	167	207	223	262	283	282	248	252	291
297	242	401	223						

sbbb05

189	222	236	241	153	122	162	182	192	152
284	267	201	191	125	140	175	247	308	187
177	93	102	158	258	249	171	228	249	333
385	503	228	332	337	368	272	198	218	234
252	300	300	318	351	197	172	133	168	256
348	517	303	421	312	241	347	274	374	368
143	241	267	253	258	215	155	194	312	332
189	214	211	219	206	118	158	215	218	140
114	95	105	179	174	282	249	246	185	141
174	174	147	138	164	187	98	140	133	

sbbb06

130	179	149	208	217	140	107	163	193	195
136	131	182	294	257	280	182	272	338	437
437	446	404	415	325	345	484	381	403	477
427	436	362	281	349	394	215	473	363	343
285	397	392	303	309	321	213	219	184	298
287	287	283	201	268	290	226	264	190	230
298	257	315	258	235	157	176	225	174	207
186	125	146	157	147	164	131	115	74	

sbbb07

204	213	212	376	298	349	454	392	368	572
502	497	538	430	308	301	354	410	324	436
360	410	455	432	383	287	455	474	315	399
338	348	359	370	237	257	230	258	186	211
259	215	213	206	193	289	293	204	195	170
157	226	246	367	241	164	180	175	195	211
200	171	149	167						

sbbb08

251	183	164	225	285	355	265	230	212	230
198	201	231	341	380	231	325	449	449	274
261	436	332	229	309	248	278	264	249	207
263	199	362	298	339	240	403	422	334	325
262	324	221	221	444	403	326	290	317	293
276	183	178	178	250	241	186	278	244	243
281	243	238	204	261	219	218	175	279	177

sbbb09

268	192	165	348	311	292	277	325	324	342
338	342	269	304	369	403	316	216	250	358
245	204	181	186	185	316	120	127	206	119
157	182	275	134	153	195	146	134	254	204
217	247	194	178	318	151	76	106	153	187
167									

sbbb10

296	264	307	187	203	157	135	288	287	378
229	335	398	437	252	384	499	234	295	322
304	506	510	331	277	208	186	375	254	313
271	327	432	288	242	200	330	305	208	372
253	221	222	244	278	237	181	184	156	244
301	238	262	192	198	245	229	201	177	273
218	182	147	259	158	194	180	155	137	203
126	159	203							

sbbb11
218 97 93 197 215 220 326 378 354 343
347 298 355 599 570 381 462 380 387 320
354 359 275 284 207 163 263 344 460 221
308 389 397 224 289 425 365 325 403 301
421 362 400 379 380 273 456 411 433 324
368 320 303 439 381 337 307 339 453 323
341 471 485 287 377 349 298 314 307 365
353 451 340 393 470 302 187 207 161 212
192 166 224 199 170 199 207 191 240 149
206 228 282 180 234 241 256 249 248 291
240 234 244 143 200 257 225 272 227 212
199
sbbb12
337 279 169 212 238 175 192 323 264 344
324 349 293 183 276 333 433 276 292 258
253 270 304 283 293 244 251 331 425 399
517 245 428 414 579 296 232 449 426 390
497 383 561 384 342 279 274 151 188 264
304 211 287 265 226 254 145 195 168 106
237 188 148 153 182 152 241 243 229 134
214 285 212 279 152 186 234 269 218 241
208 203 331 216 252 220 258 238 212 139
300 160 327
sbbb13
200 136 63 87 107 109 149 246 277 393
295 283 266 287 427 340 362 266 229 275
324 352 301 207 204 161 331 427 378 271
348 370 371 322 339 328 308 274 374 252
390 311 211 254 245 208 258 312 360 266
354 229 224 226 184 262 235 189 229 222
192 214 216 150 142 250 242 221 216 169
151 192 159 187 243 186 138 190 237 248
211 227 328 250 203 142 143 159 222 150
127
sbbb14
460 642 441 295 190 374 206 332 316 368
183 319 284 243 329 400 468 260 208 351
281 327 338 375 204 263 241 344 272 316
315 403 478 297 254 317 274 254 246 205
179 209 186 261 276 277 236 182 176 172
141 181 197
sbbb15
440 419 307 337 316 291 284 230 272 405
416 375 254 237 262 311 228 189 182 138
133 121 165 177 171 144 183 193 192 119
120 142 127 171 240 291 259 166 133 122
156 112 128 128 198 156 313 229 146 174
174 246 150 163 244 196 181 155 231 203
163 139 138 139 173 192 162 175 193 161
184 201 132 99 90 90 111 78 72 97
135 160 128 90 151 108 138

sbbb16

377	269	255	473	356	314	523	409	510	459
559	475	250	195	411	180	287	212	203	347
317	322	234	217	128	160	365	260	241	175
141	161	253	251	190	130	131	223	120	208
186	208	138	125	146	191	258	214	146	146
214	178	200	171	169	135	308	191	195	186
253	131	169	168	209	142	258			

sbbb17

377	319	471	441	458	371	308	232	266	213
227	263	171	348	316	207	245	372	437	256
207	264	402	183	189	353	201	232	345	210
310	234	219	122	128	105	216	176	182	206
249	374	295	216	211	302	182	103	231	249
261	190	243	110	194	268	285	169	219	207
243	271	202	175	146	109	78	119	127	144
186	124	167	175	186	130	125			

sbbb18

459	237	247	218	319	427	283	262	285	260
301	312	204	264	186	272	182	242	145	151
111	233	146	228	171	171	176	127	242	135
188	283	260	226	230	150	146	217	194	241
146	191	161	173	95	121	161	182	116	153
125	224	207	235	129	337	249	253	148	154
154	210	183	211	274	227	128	148		

sbbb19

322	286	343	393	384	397	380	381	280	314
332	389	410	433	399	424	535	388	346	364
290	290	446	288	414	341	353	266	262	163
186	225	216	125	183	174	184	193	149	187
179	112	142	175	175	189	179	179	223	193
210	162	148	178	188	207	181	218	241	232
199	184	205	259	222	171	265	242	303	274
218	162	172							

sbbb20

164	180	199	189	245	258	355	202	172	245
240	337	336	274	131	224	192	278	191	251
361	347	458	259	239	219	261	252	468	948
556	444	242	393	385	253	297	136	99	143
209	242	175	277	144	169	202	230	202	318
185	237	280							

sbbb21

336	340	422	425	363	336	257	351	218	279
392	361	530	285	218	265	257	164	178	333
234	235	319	243	205	140	170	228	223	119
118	84	65	62	68	78	96	97	109	112
77	89	189	148	117	158	190	118	134	147
123	116	122	127	179	187	149	177	107	90
86	84	96	107	98	90	138	162	164	167

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