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OLD MANOR HOUSE, MANNINGHAM, BRADFORD DENDROCHRONOLOGICAL ANALYSIS OF OAK TIMBERS

SCIENTIFIC DATING REPORT

Ian Tyers

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MANNINGHAM
BRADFORD

DENDROCHRONOLOGICAL ANALYSIS OF OAK TIMBERS

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SUMMARY

A tree-ring dating programme was commissioned on timbers from Manningham Old Manor House. The results identified that timbers in cross-wing were datable by tree-ring dating techniques, with this area using timbers felled during the early seventeenth century. No dating evidence was produced for the timbers of the earlier aisled hall. This dating programme was commissioned on this Building at Risk to inform future planning decisions. This report archives the dendrochronological results.

CONTRIBUTORS

Ian Tyers

ACKNOWLEDGEMENTS

The sampling and analysis of timbers at Manningham Old Manor House was funded by English Heritage (EH). Valuable discussions and the figures used here were provided by Simon Taylor and Allan Adams from EH York Office; practical assistance on site was provided by Allison Borden, EH EPPIC trainee.

ARCHIVE LOCATION

West Yorkshire Historic Environment Record
Registry of Deeds
Newstead Road
Wakefield WF1 2DE

DATE OF INVESTIGATION

2008-9

CONTACT DETAILS

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CONTENTS

INTRODUCTION

This document is a technical archive report on the tree-ring analysis of oak timbers from the Old Manor House, 23 Rosebery Road, Manningham, Bradford. It is beyond the dendrochronological brief to describe the building in detail or to undertake the production of detailed drawings. Elements of this report may be combined with detailed descriptions, drawings, and other technical reports at some point in the future to form either a comprehensive publication or an archive deposition on the building.

The Old Manor House stands in the suburb of Manningham to the north-west of Bradford (NGR SE 1507 3471), within the Unitary Authority of Bradford (Figure 1). It is a T-shaped Grade II stone-walled hall and cross-wing. The cross-wing is two storeyed, the hall is lower and arcaded (Figs 2–4).

METHODOLOGY

Tree-ring dating employs the patterns of tree-growth to determine the calendar dates for the period during which the sampled trees were alive. The amount of wood laid down in any one year by most trees is determined by the climate and other environmental factors. Trees over relatively wide geographical areas can exhibit similar patterns of growth, and this enables dendrochronologists to assign dates to some samples by matching the growth pattern with other ring-sequences that have already been linked together to form reference chronologies.

The building was visited in August 2008. An assessment of the dendrochronological potential of timbers in several areas of the structure had been requested by Trevor Mitchell, Historic Buildings Inspector at EH's York Office, to inform grant-aided repair decisions and/or statutory action. The tree-ring assessment aimed to identify whether oak timbers with sufficient numbers of rings for analysis existed in any part of the structure. This assessment concluded that the timbers in the cross-wing contained suitable material, although it was noted that the damp condition of the property might cause problems for sampling. The aisled hall structural timbers were assessed to be of fairly marginal potential with very few tree-rings present in this material.

The sampling took place during November 2008, and was undertaken using a portable generator and in association with recording work undertaken by Simon Taylor and Allan Adams from EH York Office Architectural Investigation and architectural graphics and survey teams respectively, and Allison Borden, EPPIC trainee in architectural graphics. The selected timbers were sampled using a 15mm diameter corer attached to an electric drill. The cores were taken as closely as possible along the radius of the timbers so that the maximum number of rings could be obtained for subsequent analysis. The ring sequences in the cores were revealed by sanding.

This preparation revealed the width of each successive annual tree ring. Each prepared sample could then be accurately assessed for the number of rings it contained, and at this stage it was also possible to determine whether the sequence of ring widths within it could be reliably resolved. Dendrochronological samples need to be free of aberrant anatomical features, such as those caused by physical damage to the tree, which may prevent or significantly reduce the chances of successful dating.

Standard dendrochronological analysis methods (see eg English Heritage 1998) were applied to each suitable sample. The complete sequence of the annual growth rings in the suitable samples were measured to an accuracy of 0.01mm using a micro-computer based travelling stage. The sequence of ring widths were then plotted onto semi-log graph paper to enable visual comparisons to be made between sequences. In addition, cross-correlation algorithms (eg Baillie and Pilcher 1973) were employed to search for positions where the ring sequences were highly correlated. Highly correlated positions were checked using the graphs and, if any of these were satisfactory, new composite sequences were constructed from the synchronised sequences. Any *t*-values reported below were derived from the original CROS algorithm (Baillie and Pilcher 1973). A *t*-value of 3.5 or over is usually indicative of a good match, although this is with the proviso that high *t*-values at the same relative or absolute position need to have been obtained from a range of independent sequences, and that these positions were supported by satisfactory visual matching.

Not every tree can be correlated by the statistical tools or the visual examination of the graphs. There are thought to be a number of reasons for this: genetic variations; site-specific issues (for example a tree growing in a stream bed will be less responsive to rainfall); or some traumatic experience in the tree's lifetime, such as injury by pollarding, defoliation events by caterpillars, or similar. These could each produce a sequence dominated by a non-climatic signal. Experimental work with modern trees shows that 5–20% of all oak trees cannot be reliably cross-matched, even when enough rings are obtained.

Converting the date obtained for a tree-ring sequence into a useful date requires a record of the nature of the outermost rings of the sample. If bark or bark-edge survives, a felling date precise to the year or season can be obtained. If no sapwood survives, the date obtained from the sample gives a *terminus post quem* for its use. If some sapwood survives, an estimate for the number of missing rings can be applied to the end-date of the heartwood. This estimate is quite broad and varies by region. This report uses a minimum of 10 rings and a maximum of 46 rings as a sapwood estimate (see eg English Heritage 1998, 10–11).

Where bark-edge or bark survives, the season of felling can be determined by examining the completeness or otherwise of the terminal ring lying directly under the bark. Complete material can be divided into three major categories:

- 'early spring', where only the initial cells of the new growth have begun – this is equivalent to a period in March/April, when the oaks begin leaf-bud formation;

- 'later spring/summer' where the early wood is evidently complete but the late wood is evidently incomplete, which is equivalent to May-through-September of a normal year, and
- 'winter' where the latewood is evidently complete and this is roughly equivalent to September-to-March (of the following year) since the tree is dormant throughout this period and there is no additional growth put on the trunk.

These categories can overlap as, for example, not all oaks simultaneously initiate leaf-bud formation. It should also be noted that slow growing or compressed material cannot always be safely categorised.

Timber technology studies demonstrate that many of the tool marks recorded on ancient timbers can only have been done on green timber. There is little evidence for long-term storage of timber or of widespread use of seasoned, rather than green, timber in the medieval period (see eg English Heritage 1998, 11–12).

Reused timbers can only provide tree-ring dates for the original usage date, not their reuse. Identifying reused timbers requires careful timber recording which notes the presence of features which are not functional in the structure. It is always possible that some timbers exhibit no evidence of earlier usage, and are thus 'hidden reused' timbers. The dendrochronological impact of this problem is particularly acute where only single timbers have been dated from a structure.

The analysis may highlight potential same-tree identifications if two or more tree-ring sequences are obtained that are exceptionally highly correlated. Such pairs, or sometimes more, are then used as a same-tree group and each can be given the interpreted date of the most complete of the samples. They are most useful where several timbers date but only one has any sapwood, or where same-tree identifications yield linkages between different areas.

RESULTS

In November 2008, nine timbers of the building were cored; these cores were labelled 1–9 inclusive. Eight timbers were sampled in the cross-wing, and one test sample was obtained from the aisled hall to confirm this material was unsuitable for analysis (Figs 2–4). Each sample was assessed for the wood type, the number of rings it contained, and whether the sequence of ring widths could be reliably resolved. This assessment confirmed that all the sampled timbers were oak (*Quercus* spp.) and that six were suitable for dendrochronological analysis. The three exceptions were samples 6 and 7, which are probably two parts of the same original wall plate, subsequently cut through, and sample 9 from the aisled hall. These three timbers had too few rings for analysis. There was some survival of sapwood in all of the targeted areas, although the timbers in the main truss had been badly scorched by fire. The details of these samples are provided in Table 1.

The samples were prepared for analysis, measured and the resultant ring series were compared with each other. Five of the six suitable samples from the cross-wing were found to cross-match each other well (Table 2). These were then combined into a single composite data set. This was then compared with medieval and later tree-ring data from throughout England and Wales. The composite sequence was found to cross-match strongly against data from sites in the Yorkshire and the surrounding counties (Table 3). This cross-matching provided consistent calendar dates for the sequence of AD 1532–1613. A summary of the results for the component samples of this chronology are provided in Table 1 and Figure 5.

The remaining measured series was not found to form part of this group and failed to provide any consistent dating evidence.

The measurement data for all the measured samples are listed in Appendix 1.

DISCUSSION

The dated samples are derived from the cross-wing, four from the roof, and one from a section of internal timber framing.

The roof comprises a large central truss (Fig 3). The four dated samples from this area comprised the tie beam, the king post, a principal rafter, and a purlin. This material comprised fairly short-lived fast-growing oaks.

The tree-ring analysis dates the rings present in the cores. The correct interpretation of those dates relies upon the characteristics of the final rings in them. No bark-edge survived on these timbers, but a significant amount of sapwood survived on one, lesser amounts on two more, and the heartwood/sapwood boundary was present on the remaining one. Making allowances for minimum and maximum likely amounts of missing sapwood provides individual felling date ranges for each of the datable timbers. Figure 5 and Table 1 includes the interpreted felling date ranges for each of the datable samples.

The calculation of the common felling period from the dated timbers from this roof suggests a construction date between AD 1617 and *c* AD 1649. The mathematical combination of estimated sapwood distributions is statistically complex, and to achieve a tighter interpretation would require reliable sapwood data for the area, period, and the specific character of these oaks. Such data are not presently available. Until that point, the use of robust combinatorial methods, or alternative statistical approaches might sacrifice a broad and indicative date for a narrower one of potentially spurious precision. It is clear, however, that this roof utilises timbers felled in the first half of the seventeenth century.

The single timber from the wall framing also retains the heartwood/sapwood boundary; making allowances for minimum and maximum likely amounts of missing sapwood on this provides an individual felling date range for this of AD 1614 to *c* AD 1650 (Fig 5 and

Table 1). This suggests the internal framing and the roof of the cross-wing are contemporaneous.

The low number of rings present in sample 9 from the aisled hall range shows that this part of the building did not contain timbers that were suitable for dating, as this timber was assessed to be the most suitable of the timbers in this area.

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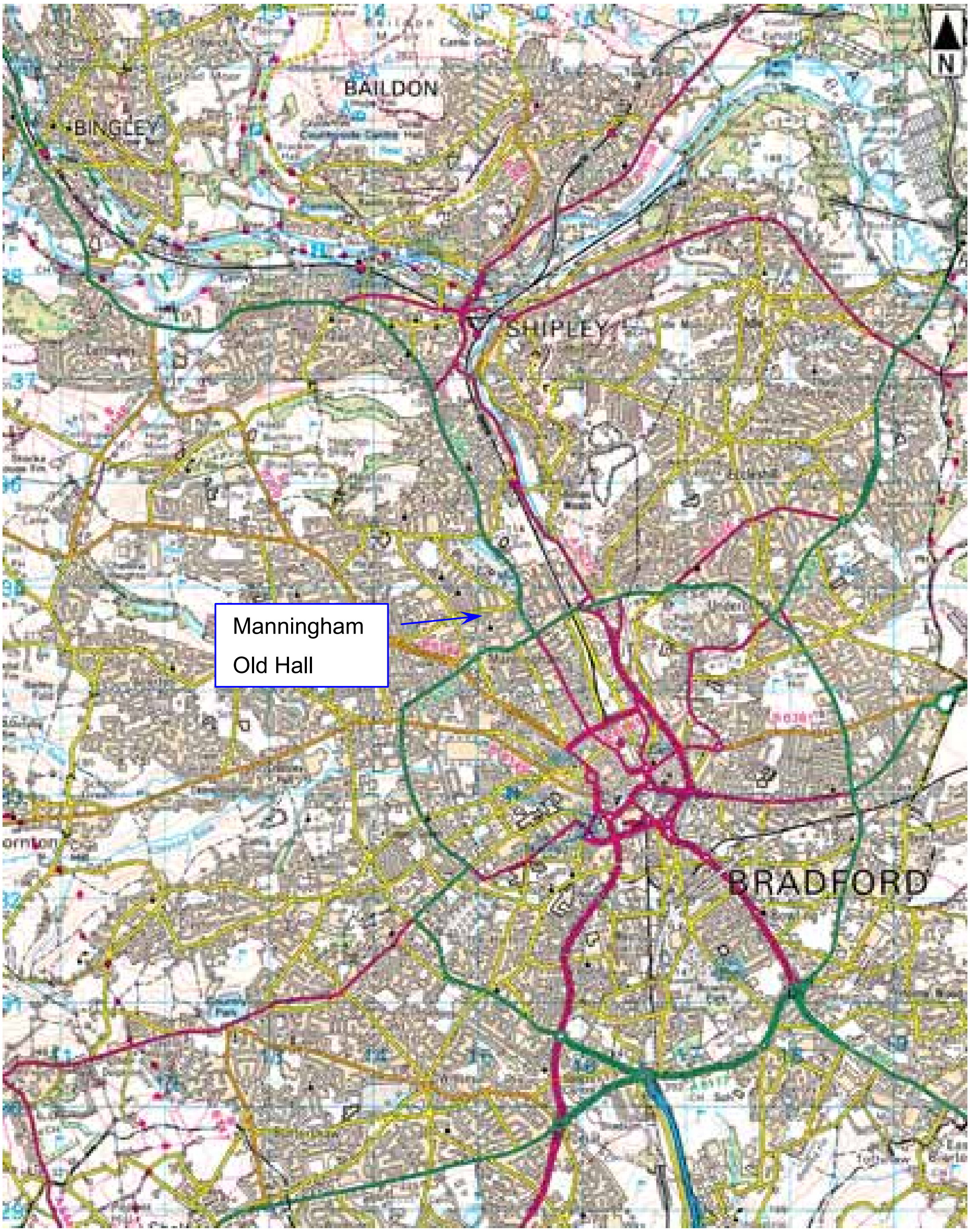


Figure 1. Location of Manningham Old Manor House. © Crown Copyright. All rights reserved. English Heritage 100019088. 2010

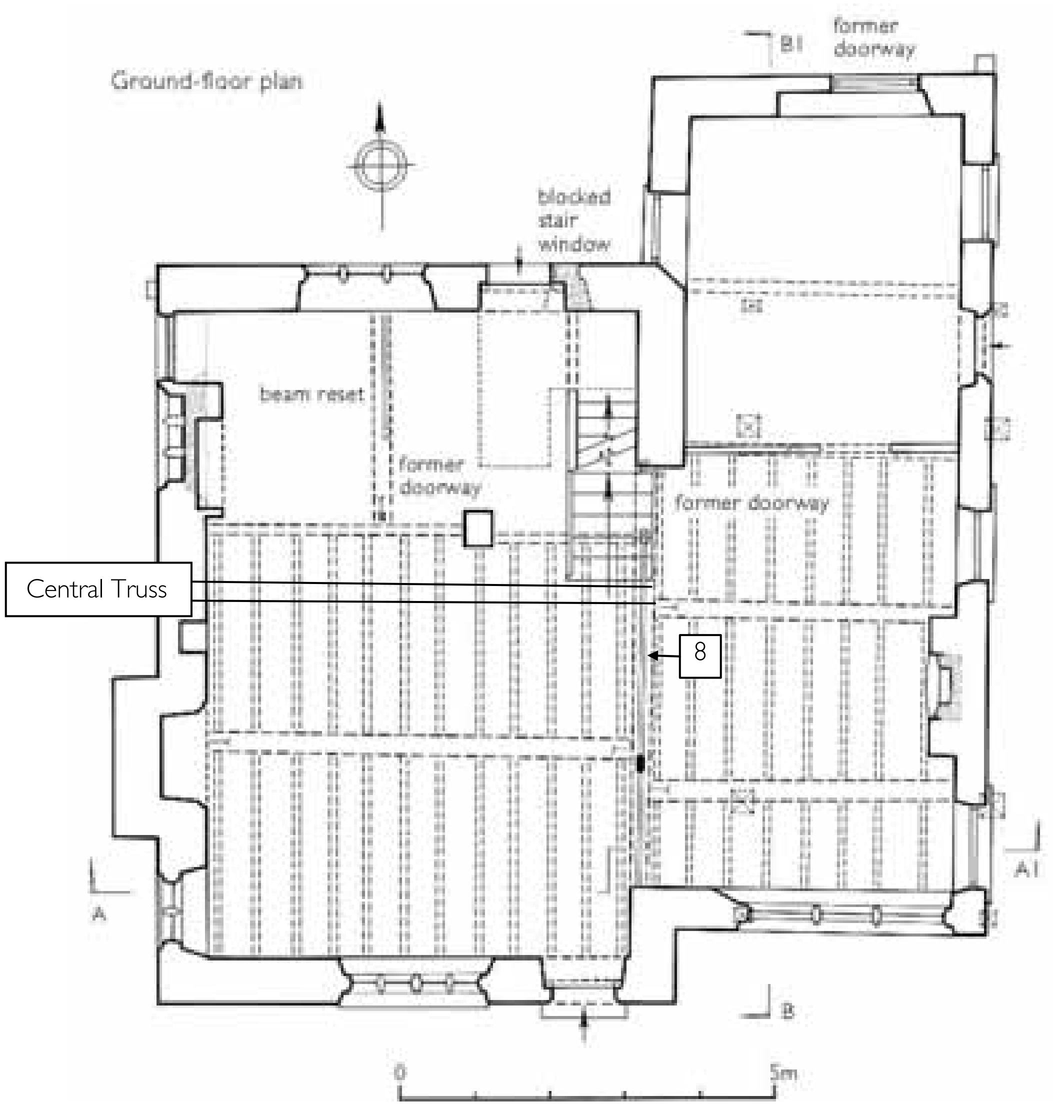


Figure 2. Ground-floor plan of Manningham Old Manor House, showing the location of sample 8 and the position of the central truss in the cross-wing roof

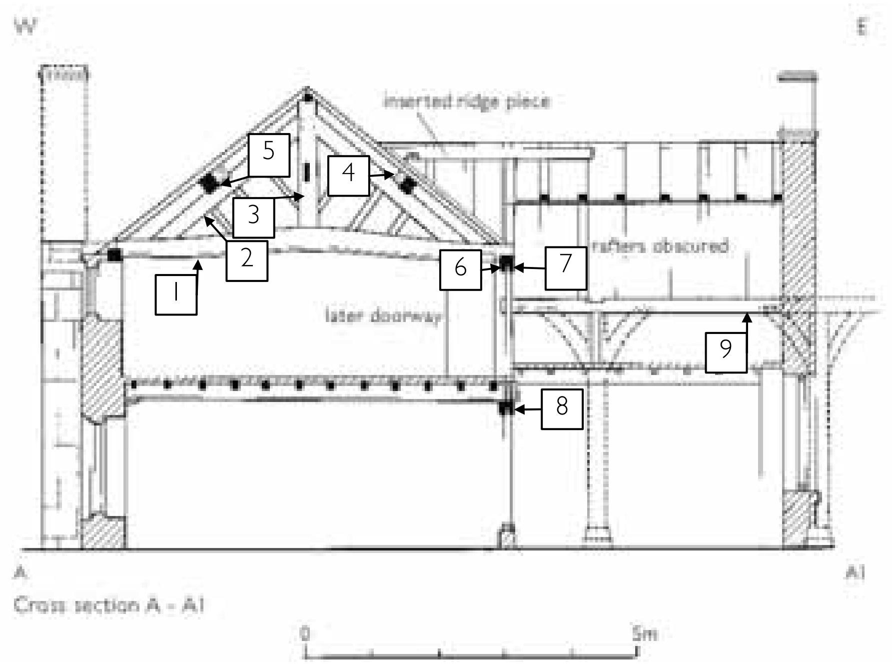


Figure 3. Section of the cross-wing of Manningham Old Manor House, showing the approximate location of the sampled timbers

Figure 4. Section of the hall range of Manningham Old Manor House, showing the approximate location of the sampled timbers

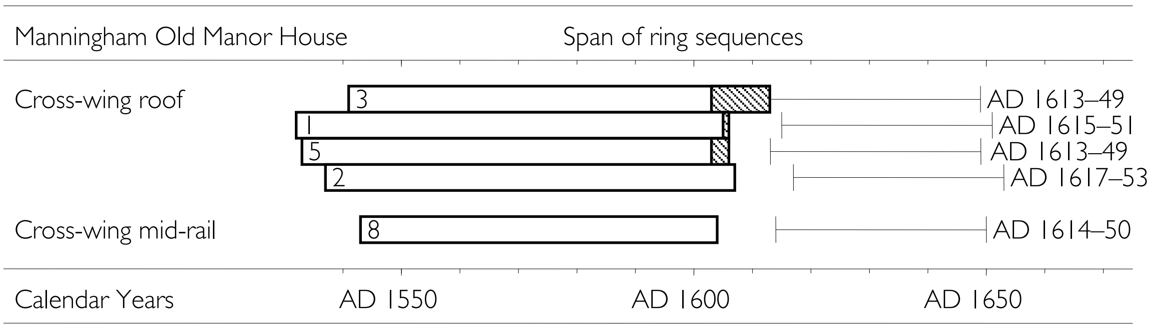


Figure 5. Bar diagram showing the absolute dating positions of the five dated tree-ring sequences for samples from Manningham Old Manor House. The interpreted felling dates are also shown for each sample

KEY White bars are oak heartwood, hatched bars are sapwood

Table 1. Details of the 9 samples from timbers from Manningham Old Manor House

Sample	Location	Rings	Sap	Date of measured sequence	Interpreted result
1	CW tie beam	75	1	AD 1532–1606	AD 1615–51
2	CW W principal rafter	71	H/S	AD 1537–1607	AD 1617–53
3	CW king post	73	10	AD 1541–1613	AD 1613–49
4	CW NE purlin	66	H/S	undated	-
5	CW SW purlin	74	3	AD 1533–1606	AD 1613–49
6	CW SE wall plate	*c* 30	-	unmeasured	-
7	CW NE wall plate	*c* 30	-	unmeasured	-
8	CW E mid-rail	62	H/S	AD 1543–1604	AD 1614–50
9	Hall S arcade plate	*c* 20	-	unmeasured	-

KEY For locations see Figures 2–4. CW: Cross-wing. N north, S south, E east, W west, H/S is heartwood/sapwood edge.

Table 2. The t-values (Baillie and Pilcher 1973) between 5 sampled timbers from Manningham Old Manor House

	2	3	5	8
1	8.94	7.87	4.82	5.79
2		10.25	5.62	7.52
3			6.68	6.27
5				4.12

Table 3. Showing example t-values (Baillie and Pilcher 1973) between the composite sequence constructed from Manningham Old Manor House and oak reference data

Reference chronology	Manningham AD 1532–1613
Cumbria, Appleby weir (Groves pers comm)	5.42
Durham, Fell Close Healyfield (Arnold *et al* 2004)	5.16
Lincolnshire, Manor House West St Alford (Arnold *et al* 2003)	4.96
Staffordshire, Black Ladies near Brewood (Tyers 1999)	6.72
Yorkshire, Bank Newton Newton Hall Barn (Tyers 2007)	5.53
Yorkshire, Headley Hall Barns (Tyers 2001)	7.50
Yorkshire, Morley Stubley Farm (Tyers 2008a)	5.18
Yorkshire, Octon Glebe Farm Old House (Tyers 2008b)	5.20

APPENDIX 1

momh1

375	247	292	310	309	272	164	188	141	180
164	215	211	201	159	189	130	100	120	129
106	131	126	176	131	95	62	94	145	114
113	97	77	81	50	58	57	47	79	116
84	87	66	48	70	72	87	80	72	61
45	79	211	185	222	157	143	176	149	119
145	208	222	252	199	190	174	169	150	229
185	346	293	208	216					

momh2

246	264	207	202	174	199	269	254	202	109
118	100	82	98	108	135	166	168	296	241
112	67	118	173	184	179	205	170	144	98
64	106	100	163	244	133	176	119	66	187
270	269	229	254	123	78	72	129	231	344
304	168	246	125	96	146	330	334	348	291
254	216	194	154	162	171	399	399	265	201
308									

momh3

171	206	161	225	204	195	219	180	162	180
208	167	175	134	173	149	96	75	113	150
191	228	189	177	134	105	91	90	115	222
254	148	146	100	52	99	113	130	121	109
79	44	56	85	123	186	187	115	149	112
93	75	172	253	230	182	145	107	87	99
121	103	176	233	154	83	119	107	125	128
93	122	100							

momh4

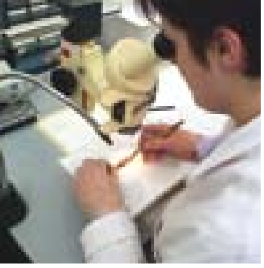
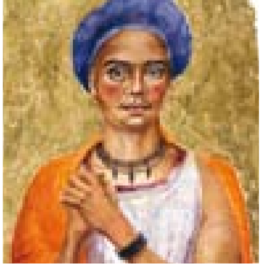
323	285	252	156	137	129	164	167	147	139
116	154	110	95	67	91	125	235	175	176
130	125	114	193	220	253	258	216	211	159
195	205	270	257	253	209	238	175	172	174
218	215	211	185	143	121	147	171	172	197
155	213	228	161	167	219	209	218	156	165
182	222	181	135	122	183				

momh5

217	235	283	272	297	303	313	298	251	199
248	277	229	260	257	282	252	303	228	178
233	222	278	220	223	113	111	174	167	150
148	131	73	93	92	97	87	112	80	60
63	49	39	54	50	53	72	71	62	43
42	48	67	78	61	40	75	54	58	35
78	87	115	81	70	70	48	44	45	41
79	94	67	94						

momh8

336	379	376	336	328	332	236	294	291	324
391	270	404	396	251	171	291	303	321	318
286	334	237	246	196	239	218	259	258	189
260	162	144	187	183	221	271	254	215	154
131	170	159	159	175	142	174	118	134	124
184	168	179	154	161	149	133	142	144	132
132	128								



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