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TREE-RING ANALYSIS OF TIMBERS FROM HOWLEY HALL FARM, MORLEY, WEST YORKSHIRE

August 2013

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SUMMARY

Dendrochronological analysis was undertaken on timbers from the cottage, mistal, cartshed, and barn, resulting in the construction and dating of three site sequences and one individual sample. Site sequence HOWASQ01 contains three samples and spans the period 1263–1423, site sequence HOWASQ02 contains four samples and spans the period 1392–1452, and site sequence HOWASQ03 contains 12 samples and spans the period 1415–1635. Sample HOW-A19 has a first-measured ring date of 1356 and a last-measured ring date of 1412.
The cartshed and barn contain reused material dating to 1423 and 1462–87, respectively. The cottage and mistal both contain timber felled in 1635.

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INTRODUCTION

Howley Hall Farm buildings are situated within the grounds of Howley Hall golf club, 2.5 miles to the south-west of Morley (SE253 255, Figs 1–3). The farm comprises a north-south aligned cottage and attached mistal, to the north and west of which are three south-east facing farmyards, linked by a range of buildings on their western side (Fig 4).

Cottage & Mistal

The cottage consists of five bays and the mistal four; separating them is a short, projecting bay (Fig 5) and there are outshuts to the west of the main building. The roof over both the cottage and the mistal appear to be of the same construction, consisting of principal rafters, king post, struts, tiebeam, and braces rising from the king post to the ridge (Figs 6 & 7). There are single, trenched purlins to each slope. It had been suggested that some of the tiebeams might be reused although once on site no obvious signs of previous use were noticed. However, in contrast to the rest of the timber, one of the principal rafters of truss 6 appears to be adzed (Fig 8) and was thought likely to represent an earlier timber. The first floor frame of the mistal is exposed and consists of closely spaced joists (Fig 9).

Cartshed & Barn

Whilst the southern two south-east facing yards appear relatively recent in date, the third, northern yard appears older and comprises a barn and cartshed (Fig 10). The roof over the cartshed consists of seven trusses of principal rafters, tiebeam, king post, and queen posts from which struts run to principal rafters. There are two sets of purlins to each slope (Fig 11). The barn is of seven bays separated by six trusses of principal rafters, king post, tiebeam, and raking struts. Again, there are two sets of purlins to each slope (Fig 12).

The farm buildings are thought to be early eighteenth or nineteenth century in date but can be seen, especially in the cartshed and barn, to incorporate reused timber. It has been suggested that this timber may have come from one of the since demolished mansions on the estate.

The Mirfield family are known to have had a mansion here during the medieval period. In 1585 construction was begun on a new mansion, to the east of the present Howley Hall Farm, by Sir Robert Savile and completed by his son Sir John in 1590. Upon his death in 1630, Sir John's son Sir Thomas inherited the estate and undertook a degree of work on the house, extending and improving it. Upon his death in *c* 1660 the estate passed firstly to his son James, before being inherited by his daughter, Francis, who was married to the younger brother of the earl of Cardigan. The condition of the house declined rapidly and the mansion was blown down with gunpowder on the orders of the Earl of Cardigan in 1730.

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

A total of 28 timbers from the cottage, mistal, cartshed, and barn were sampled with each sample being given the code HOW-A and numbered 01–28. The location of samples was noted at the time of sampling and has been marked on Figure 13–15. Further details can be found in Table 1.

ANALYSIS & RESULTS

Sample HOW-A05, taken from a floor joist within the mistal was found to have too few rings for secure dating and so was discarded prior to preparation. The remaining 27 samples were prepared by sanding and polishing and their growth-ring widths measured. These growth-ring widths were then compared with each other resulting in the formation of three groups.

Firstly, three samples, all taken from the roof of the cartshed, matched each other and were combined at the relevant offset positions to form HOWASQ01, a site sequence of 161 rings (Fig 16). 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-measured ring date of 1263 and a last-measured ring date of 1423. The evidence for this dating is given by the *t*-values in Table 2.

Four samples, from the roof of the barn, matched each other and were combined to form HOWASQ02, a site sequence of 61 rings (Fig 17). This site sequence was found to match consistently and securely at a first ring date of 1392 and a last-measured ring date of1452. The evidence for this dating is given by the *t*-values in Table 3.

Twelve samples, taken from the roof of the cottage and the roof and floor joists of the mistal grouped and were combined to form HOWASQ03, a site sequence of 221 rings (Fig 18). This site sequence was matched against the reference chronologies at a first-ring date of 1415 and a last-measured ring date of 1635. The evidence for this dating is given by the *t*-values in Table 4.

Finally, attempts were made to date the remaining ungrouped samples by comparing them individually against the reference chronologies. This resulted in sample HOW-A19, from the cartshed, being found to span the period 1356–1412 (Table 5). The rest of the ungrouped samples could not be matched and are undated.

INTERPRETATION

To aid interpretation all dated samples have been organised by area (Fig 19).

Cartshed

Four of the samples taken from this roof have been dated. One of these samples, HOW-A18, taken from a tiebeam, has complete sapwood and the last-measured ring date of 1423, the felling date of the timber represented. Sample HOW-A19, taken from another tiebeam, has a similar heartwood/sapwood boundary ring date to HOW-A18 making it likely that it was also felled in 1423. The other two dated samples, both taken from wall-plates, do not have the heartwood/sapwood boundary ring date and so an estimated felling date range cannot be calculated for the timbers represented except to say that with last-measured ring dates of 1385(HOW-A20) and 1386 (HOW-A22) it is possible that these two timbers were also felled in 1423. Three of these timbers had been identified as having signs of reuse.

Barn

Four of the samples taken from the timbers of the barn roof have also been successfully dated. All of these have the heartwood/sapwood boundary ring date which is broadly contemporary and suggestive of a single felling. The average heartwood/sapwood boundary ring date is 1447, allowing an estimated felling date to be calculated for the four timbers represented to within the range 1462–87. All of these timbers were thought to be reused.

Cottage

Seven of these roof timbers have been dated. One of the dated samples, HOW-A15, taken from a king post has complete sapwood and the last-measured ring date of 1635, the felling date of the timber represented. Five other dated samples have similar heartwood/sapwood boundary ring dates, suggestive of a single felling. The average of these is 1609 which, allowing for sample HOW-A09 having a last-measured ring date of 1628 with incomplete sapwood, gives an estimated felling date for the timbers represented of 1629-49, consistent with these timbers also having been felled in 1635. The seventh sample does not have the heartwood/sapwood boundary ring date but with a last-measured ring date of 1560 it is possible that this sample was felled in 1635 with the rest of the timber. Two of these samples were taken from timbers previously marked as potentially reused but the other five are from beams which looked primary.

Mistal

Five of the timbers sampled from the mistal have been dated, two tiebeams, a wall-plate, and two joists. Four of these dated samples have similar heartwood/sapwood boundary ring dates. The average heartwood/sapwood boundary ring date for these four samples is 1611, allowing an estimated felling date to be calculated for the three timbers represented of 1626–51. The fifth sample does not have the heartwood/sapwood boundary ring date but with a last-measured ring date of 1581 it is possible that this timber was also felled in 1626–51.

Felling date ranges have been calculated using the estimate that mature oak trees from this region have between 15 and 40 sapwood rings.

DISCUSSION

The earliest timber identified by the tree-ring dating is to be found in the Cartshed, where two wall-plates and two tiebeams have been dated to 1423. Three of these beams were thought to be reused (*pers comm* Paul Gwilliam) and the fourth is only a short length of wall-plate which could very easily have had all signs of reuse removed.

Also dating to the fifteenth century, although slightly later, are four of the tiebeams in the barn. The trees from which these were cut are now known to have been felled in 1462–87. All of these beams had previously been identified as being reused.

Stylistically, these two buildings were thought to be eighteenth or nineteenth century in date and given that the Savile mansion is known to have been demolished in 1730 it had been thought possible that the reused timber identified within the roofs had come from the remnants of this house. With this reused timber being dated to the fifteenth century it can now be said that the source of this timber cannot be the sixteenth-century Savile mansion. However, it may be that the medieval Mirfield house provided the timber, raising the possibility of the survival of at least part of

this house until the eighteenth or nineteenth century. Alternatively, the possibility remains that the timber utilised has come from one or two totally different buildngs.

It was hoped that tree-ring dating would clarify the relationship between the cottage and the mistal and provide construction dates for these elements. Additionally, some timbers had been identified as potentially being reused and it was hoped to be able to see how these related to those reused timbers in the barn and cartshed.

It is now known that the roof over the cottage contains timber felled in 1635 whilst timbers of the roof and floor frame of the mistal have been dated to 1626–51. It can be seen that this felling date range encompasses the felling date of timbers from the cottage. Furthermore, it can be seen (Fig 20) that there is no great difference between heartwood/sapwood boundary ring positions between the two areas. Therefore, it does seem probable that the timber used within both areas is contemporary, all dating to 1635. This is further supported by the grouping of the samples which is irrespective of which part of the building they came from.

Some of the dated timbers were thought to potentially be reused whilst others were believed to be primary. However, this has not been supported by the dendrochronology with all dated timber being of the same date. It is unfortunate that sample HOW-A12, taken from the adzed principal rafter did not match any of the other samples and could not be dated individually. It could be argued that the reason why this sample did not match in with the rest of the timber is because it is of a different date. However, equally, it may simply be that the tree from which this beam was cut experienced non-climatic influences which have unduly affected its growth pattern.

Again, this building was thought to date to the early eighteenth or nineteenth century but is now known to contain timber felled in 1535. It may be that all of the dated timber is in fact reused but that during the conversation process signs of reuse have been removed from the majority of the beams. Alternatively, it may be that the timber is primary to the cottage/mistal and the buildings are, or incorporate, an earlier building than previously thought. It is known that during Sir Thomas Savile's ownership of the estate (1630–60), a period which encompasses the date of the timber, works were carried out on the Savile mansion. This could lend support to the suggestion that the source of the timber was the mansion and furthermore from a phase belonging to Sir Thomas' works or perhaps that the building itself was part of the improvements he commissioned.

It is hoped that these dates will provide a basis on which further investigation by buildings experts can finally unravel the history of these buildings.

Acknowledgements

This work was commissioned by Kevin Slattery of Aspect 4 Limited on behalf of his clients, Stone Hampton Limited, the owners of the buildings. The Laboratory would like to thank Paul Gwilliam of Archaeological Services for his *on-site* advice and for providing the drawings used to illustrate this report.

Table 1: Details of samples taken from Howley Hall Farm, Morley, Yorkshire

Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date (AD)	Last heartwood ring date (AD)	Last measured ring date (AD)
Mistal						
HOW-A01	Tiebeam, truss 1	118	h/s	1497	1614	1614
HOW-A02	Tiebeam, truss 2	111	h/s	1501	1611	1611
HOW-A03	Tiebeam, truss 3	66	h/s	----	----	----
HOW-A04	East wall plate, bay 3	94	h/s	1517	1610	1610
HOW-A05	Joist 12	NM	--	----	----	----
HOW-A06	Joist 14	95	08	1522	1608	1616
HOW-A07	Joist 15	56	--	1526	----	1581
Cottage						
HOW-A08	King post, truss 5	78	h/s	----	----	----
HOW-A09	East principal rafter, truss 5	79	11	1550	1617	1628
HOW-A10	King post, truss 6	146	--	1415	----	1560
HOW-A11	Tiebeam, truss 6 (reused?)	158	h/s	1436	1593	1593
HOW-A12	East principal rafter, truss 6 (reused)	54	h/s	----	(1445)	----
HOW-A13	West principal rafter, truss 6	87	h/s	1527	1613	1613
HOW-A14	Tiebeam, truss 7 (reused?)	165	h/s	1450	1614	1614
HOW-A15	King post, truss 7	221	31C	1415	1604	1635
HOW-A16	East principal rafter, truss 7	103	02	1509	1609	1611
Cartshed						
HOW-A17	Tiebeam, truss 3 (reused)	52	h/s	----	----	----
HOW-A18	Tiebeam, truss 4 (reused)	161	17C	1263	1406	1423
HOW-A19	Tiebeam, truss 7 (reused)	57	02	1356	1410	1412
HOW-A20	South wall plate, bay 6	85	--	1301	----	1385
HOW-A21	South wall plate, bay 7 (reused)	48	h/s	----	----	----
HOW-A22	North wall plate, bay 6 (reused)	108	--	1279	----	1386
Barn – reused tmbers						
HOW-A23	Tiebeam, truss 9	56	h/s	1397	1452	1452
HOW-A24	Tiebeam, truss 11	51	h/s	1394	1444	1444

HOW-A25	Tiebeam, truss 10	47	h/s	1399	1445	1445
HOW-A26	Tiebeam, truss 12	57	h/s	1392	1448	1448
HOW-A27	Tiebeam, truss 13	54	h/s	----	----	----
HOW-A28	King post, truss 13	72	h/s	----	----	----

**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 HOWASQ01 and relevant reference chronologies when the first-ring date is 1263 and the last-measured ring date is 1423

Reference chronology	*t*-value	Span of chronology
Barley Hall, 2 Coffee Yard, York	7.2	1198–1359
Newark Tithe Barn, Lovers Lane, Newark, Nottinghamshire	6.8	1249–1399
Kingswood Abbey, Gatehouse, Gloucestershire	6.6	1307–1428
Church of St James, Bristol	6.6	1209–1396
Droitwich, Worcestershire	6.5	1178–1415
St Leonard's Church, Apethorpe, Northamptonshire	6.2	1211–1403
The Commandery, Worcester, Worcestershire	6.1	1284–1473

Table 3: Results of the cross-matching of site sequence HOWASQ02 and relevant reference chronologies when the first-ring date is 1392 and the last-measured ring date is 1452

Reference chronology	*t*-value	Span of chronology
Tithe Barn, Bolton Abbey, West Yorkshire	8.1	1371–1518
Peny's Hey, Lowerhouses, Huddersfield, West Yorkshire	7.3	1386–1573
All Hallows Church, Kirkburton, Yorkshire	7.1	1306–1633
Nether Hall Barn, Dalton, Huddersfield, West Yorkshire	7.1	1376–1453
Hall Broom Farm, Dungworth, Derbyshire	6.4	1382–1495
Old Durham Farm, Durham	6.2	1390–1619
Witton Hall Farm, Wooton Gilbert, County Durham	6.1	1395–1475

Table 4: Results of the cross-matching of site sequence HOWASQ03 and relevant reference chronologies when the first-ring date is 1415 and the last-measured ring date is 1642

Reference chronology	*t*-value	Span of chronology
Mousley Bottom, New Mills, Derbyshire	8.9	1417–1566
All Hallows Church, Kirkburton, Yorkshire	8.6	1306–1633
Bramall Hall, Stockport, Cheshire	8.6	1359–1590
Hallgarth Pittington, County Durham	8.5	1336–1624
Raynor House,Bradfield, South Yorkshire	8.4	1468–1593
Wakelyn Old Hall, Hilton, Derbyshire	8.3	1415–1573
Staircase House, Stockport, Greater Manchester	7.9	1489–1656

Table 5: Results of the cross-matching of sample HOW-A19 and relevant reference chronologies when the first-ring date is 1356 and the last-measured ring date is 1412

Reference chronology	*t*-value	Span of chronology
Whitwood Farm, Bailiff Bridge, Yorkshire	6.4	1316–1444
Bramall Hall, Stockport, Cheshire	5.8	1359–1590
Witton Hall Farm, Wooton Gilbert, County Durham	5.8	1342–1441
All Hallows Church, Kirkburton, Yorkshire	5.6	1306–1633
Halesowen Abbey, West Midlands	5.2	1310–1535
Worcester Cathedral, Worcester, Worcestershire	5.0	1286–1424
Crook Hall, Sidegate, Durham	5.0	1354–1467

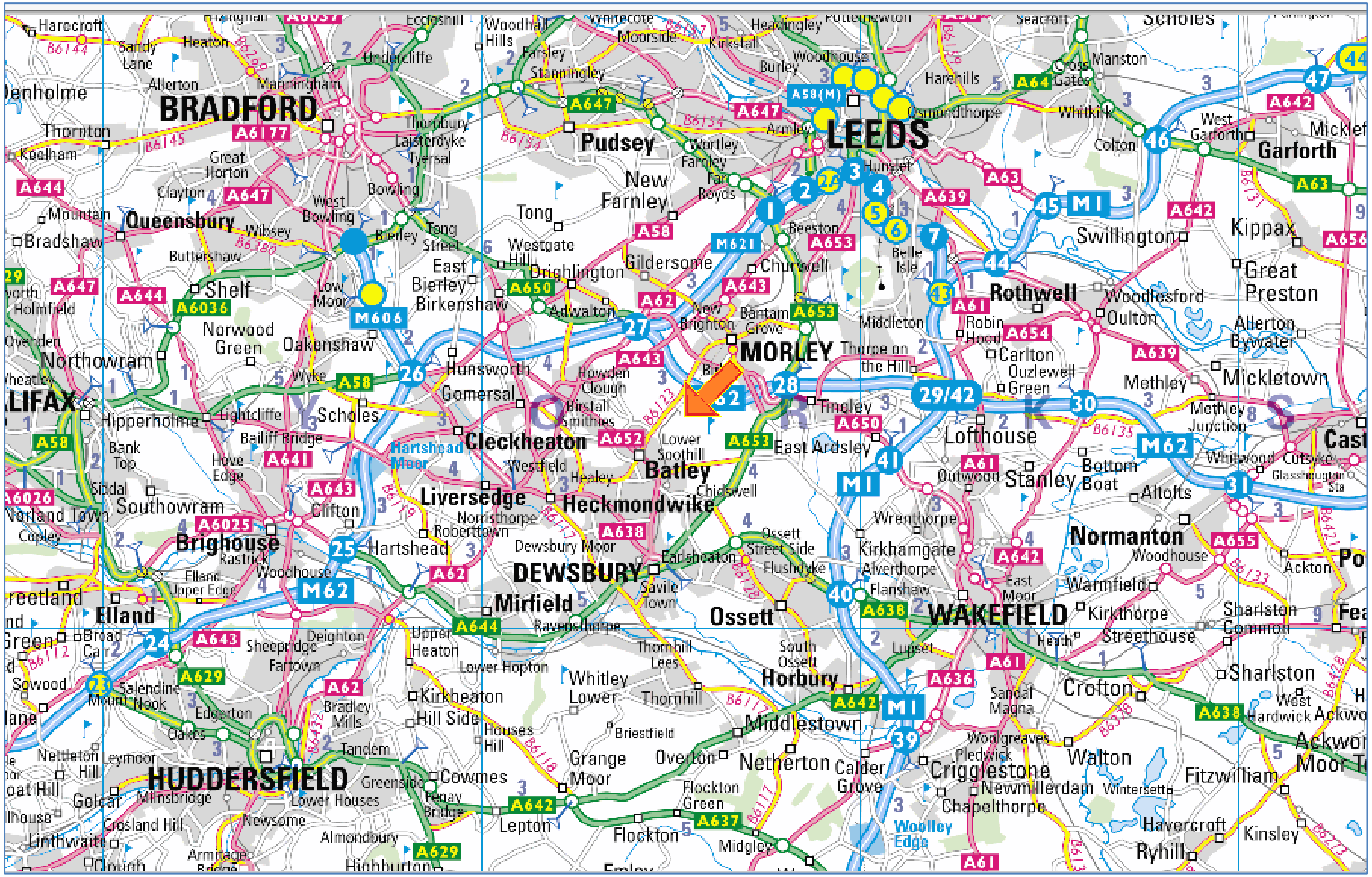

Figure 1: Map to show the general location of Howley Hall Farm, arrowed (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

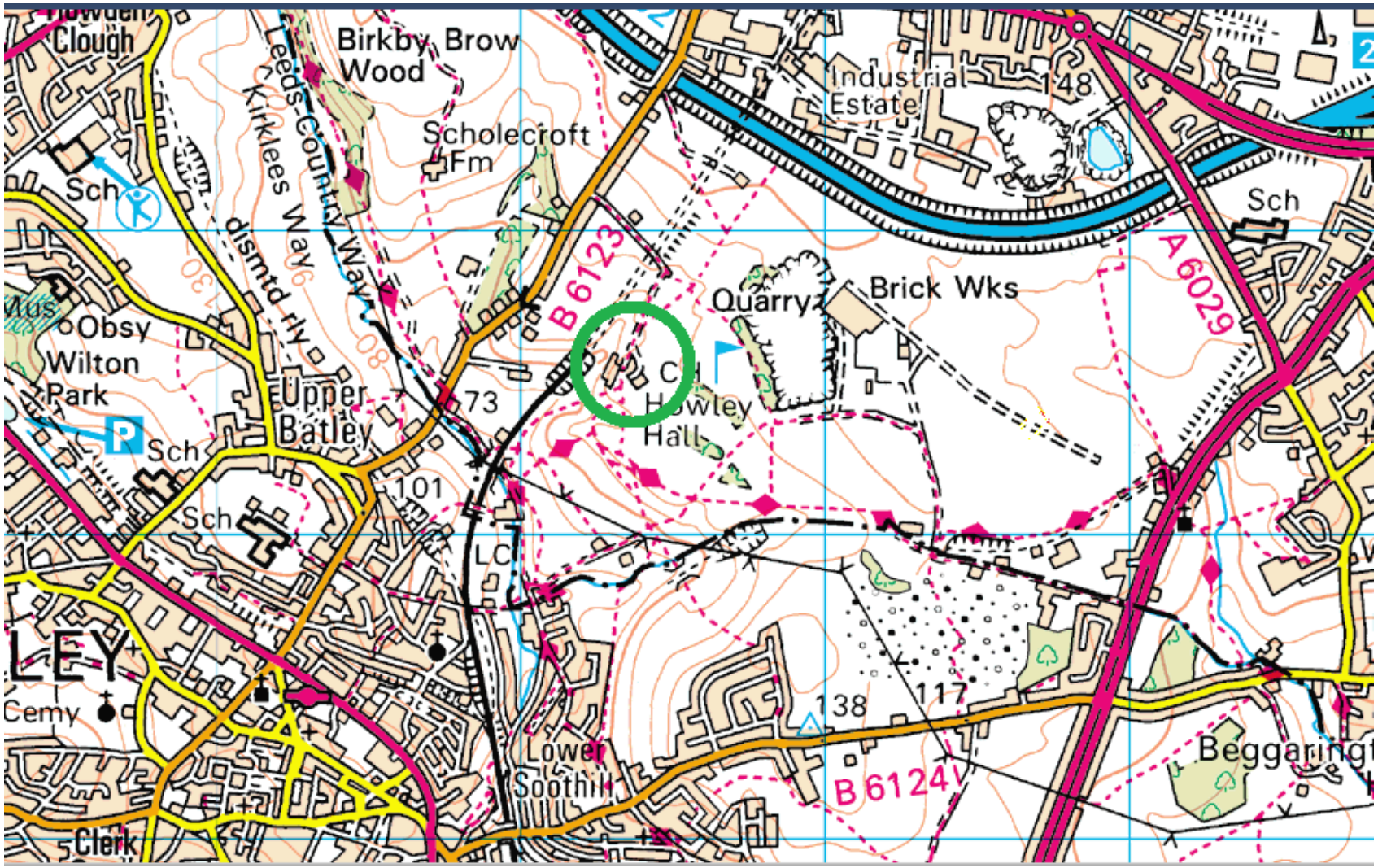

Figure 2: Map to show the general location of Howley Hall Farm,circled (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

Figure 3: Map to show Howley Hall Farm, the cottage/mistal and cartshed/barn hashed (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

Figure 4: Plan of farm buildings, with areas under investigation outlined in blue (cartshed/barn) and red (cottage/mistal)

Figure 5: The cottage (to the left) and the mistal (to the right), photograph taken from the east

Figure 6: The cottage, truss 5, photograph taken from the south-west

Figure 7: The mistal, truss 1, photograph taken from the south-west

Figure 8: The cottage, east principal rafter of truss 6 with adze marks

Figure 9: The mistal, first-floor frame, photograph taken from the north-east

Figure 10: The cartshed (to the left) and barn (to the right), photograph taken from the north-east

Figure 11: The cartshed, photograph taken from the west

Figure 12: The barn, photograph taken from the north

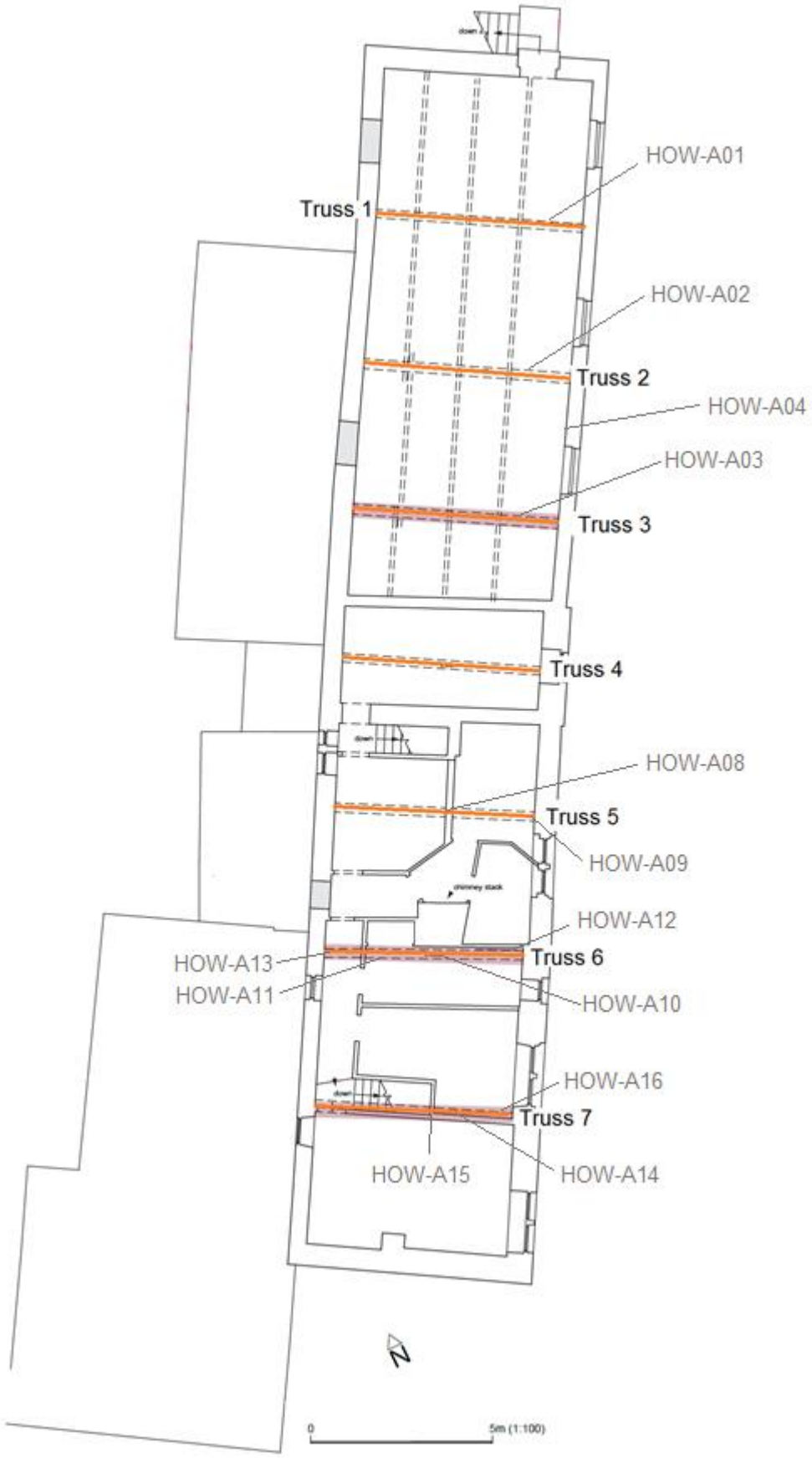

Figure 13: First-floor plan of the cottage and mistal, showing truss numbering and the location of samples HOW-A01–04 and HOW-A08–16 (Archaeological Services WYAS)

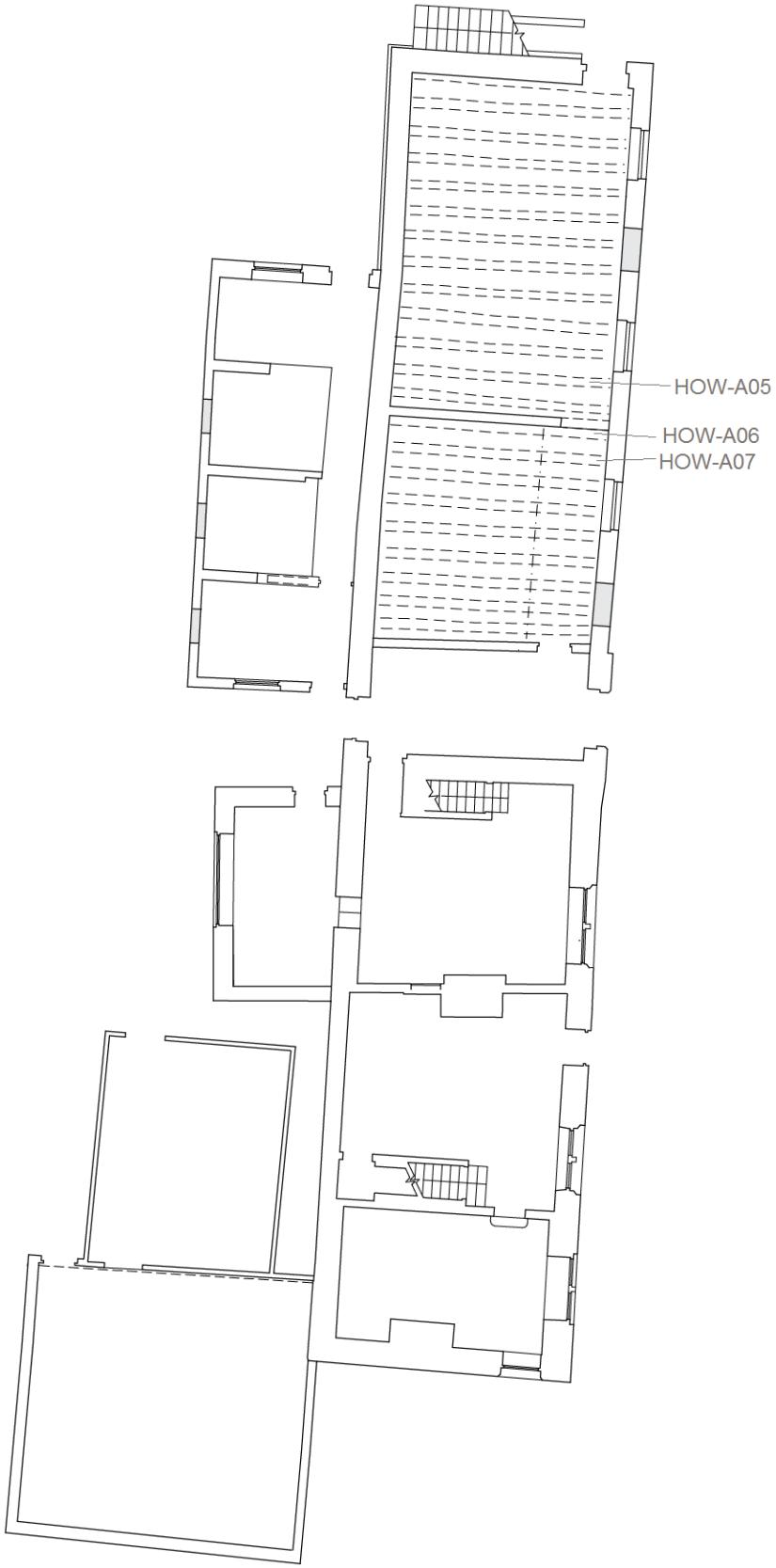

Figure 14: Ground-floor plan of the cottage and mistal, showing the location of samples HOW-A05–07 (Archaeological Services WYAS)

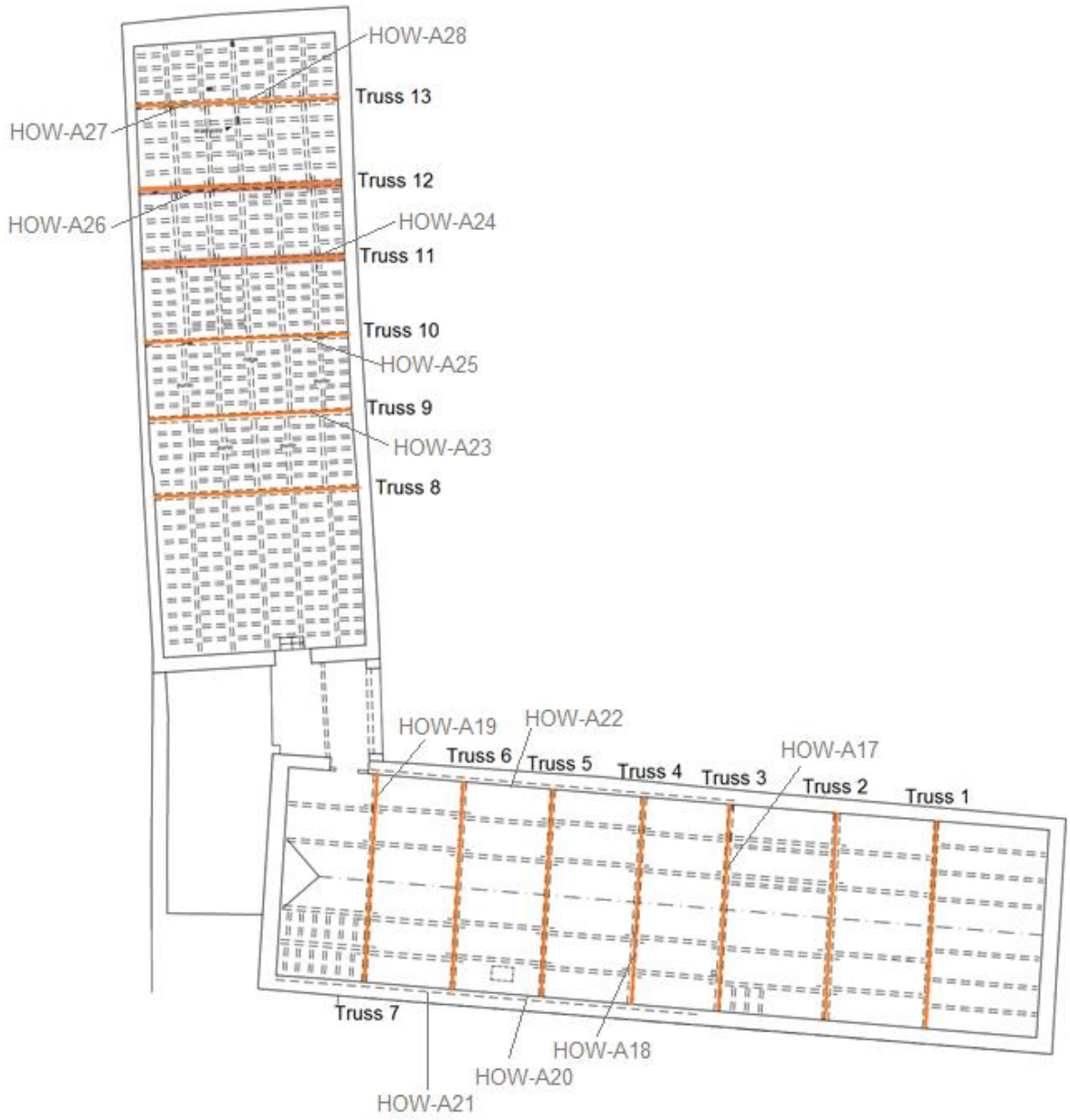

Figure 15: Plan of barn and cartshed, showing truss numbering and location of samples HOW-A17–28 (Archaeological Services WYAS)

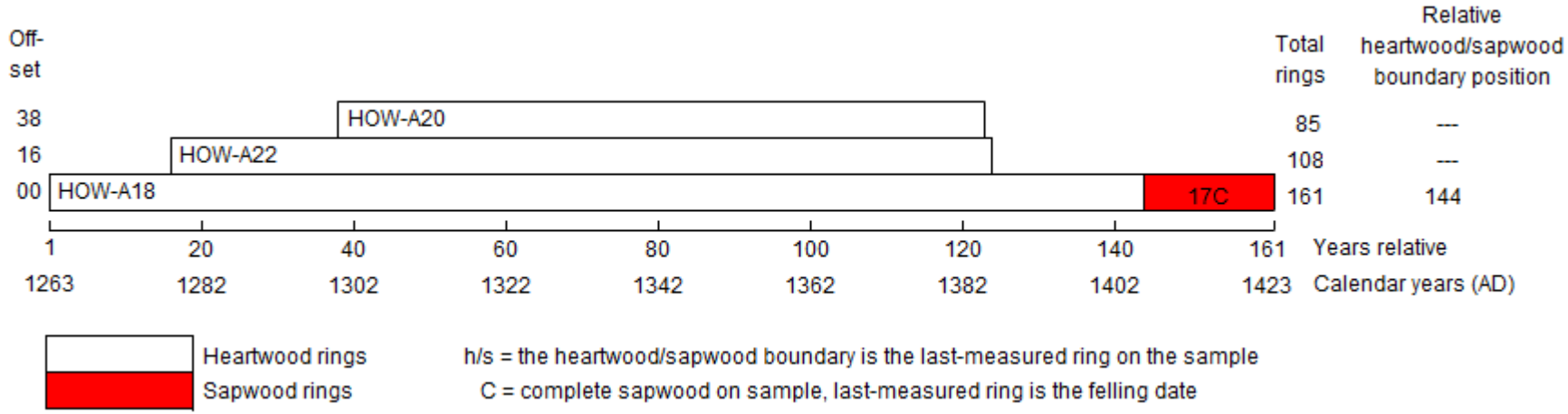

Figure 16: Bar diagram to show the position of samples in site sequence HOWASQ01

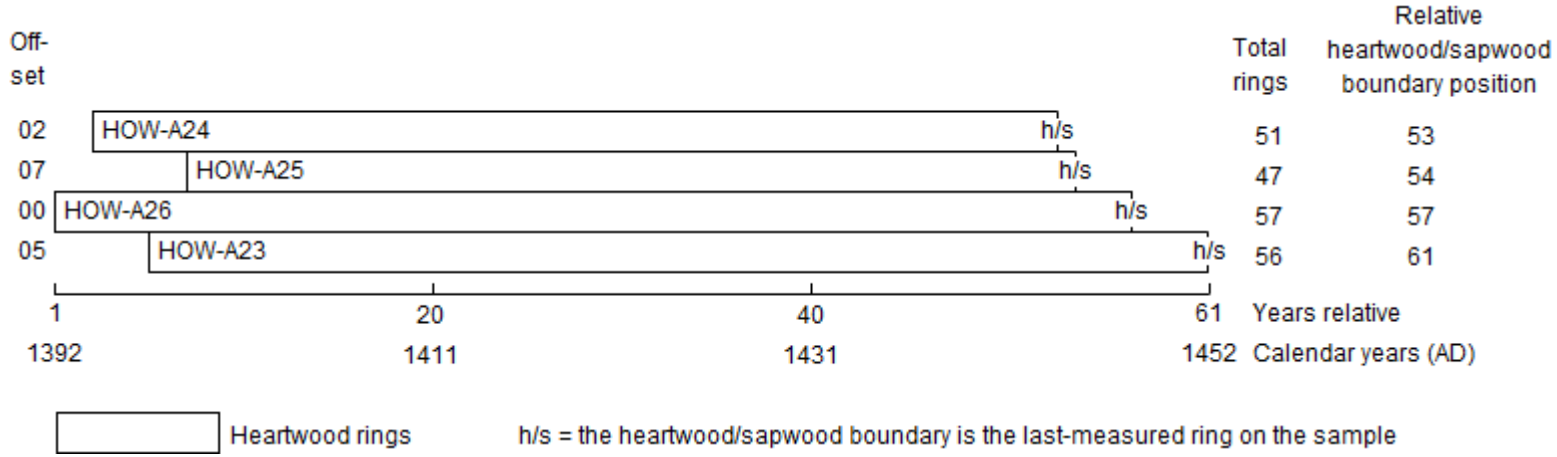

Figure 17: Bar diagram of samples in site sequence HOWASQ02

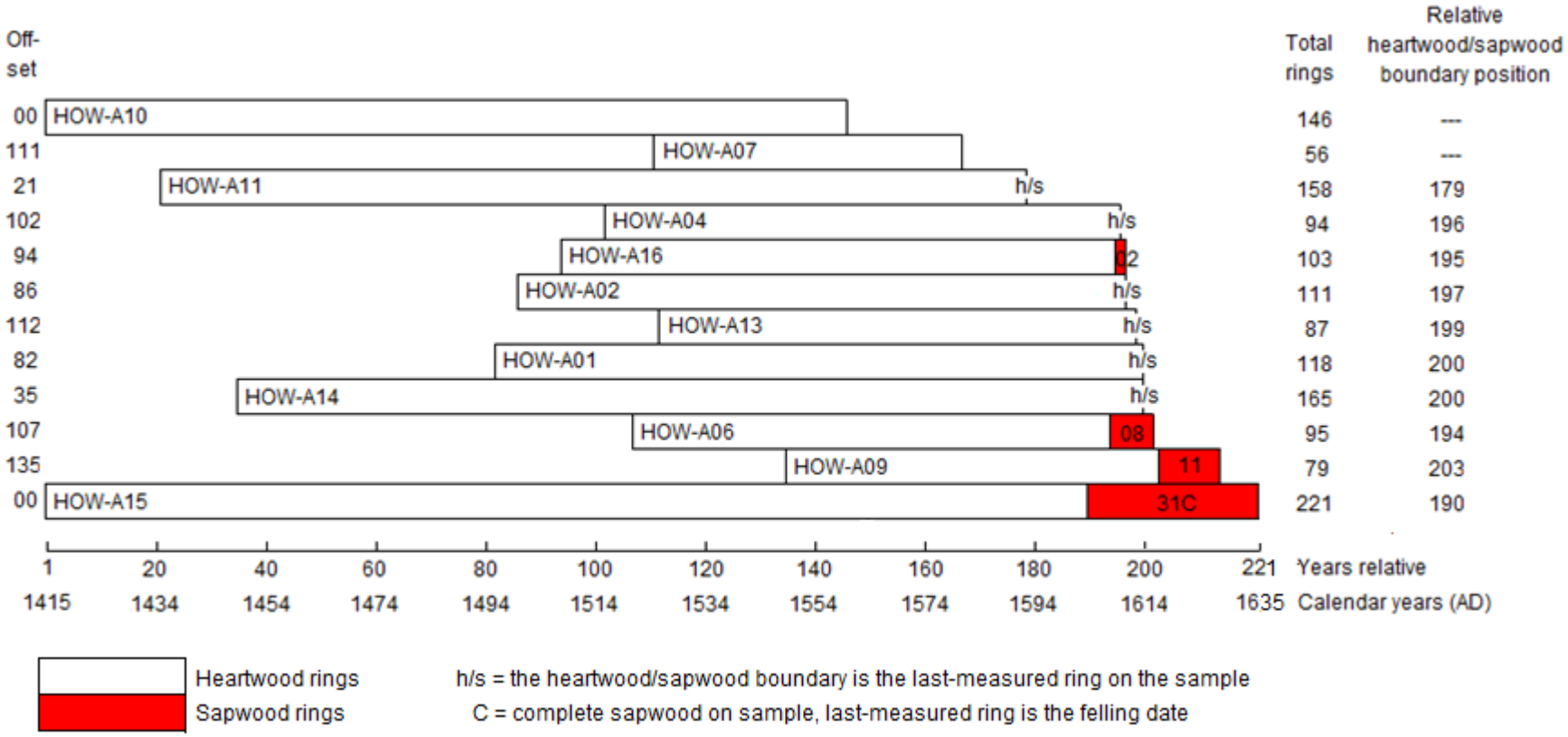

Figure 18: Bar diagram of samples in site sequence HOWASQ03

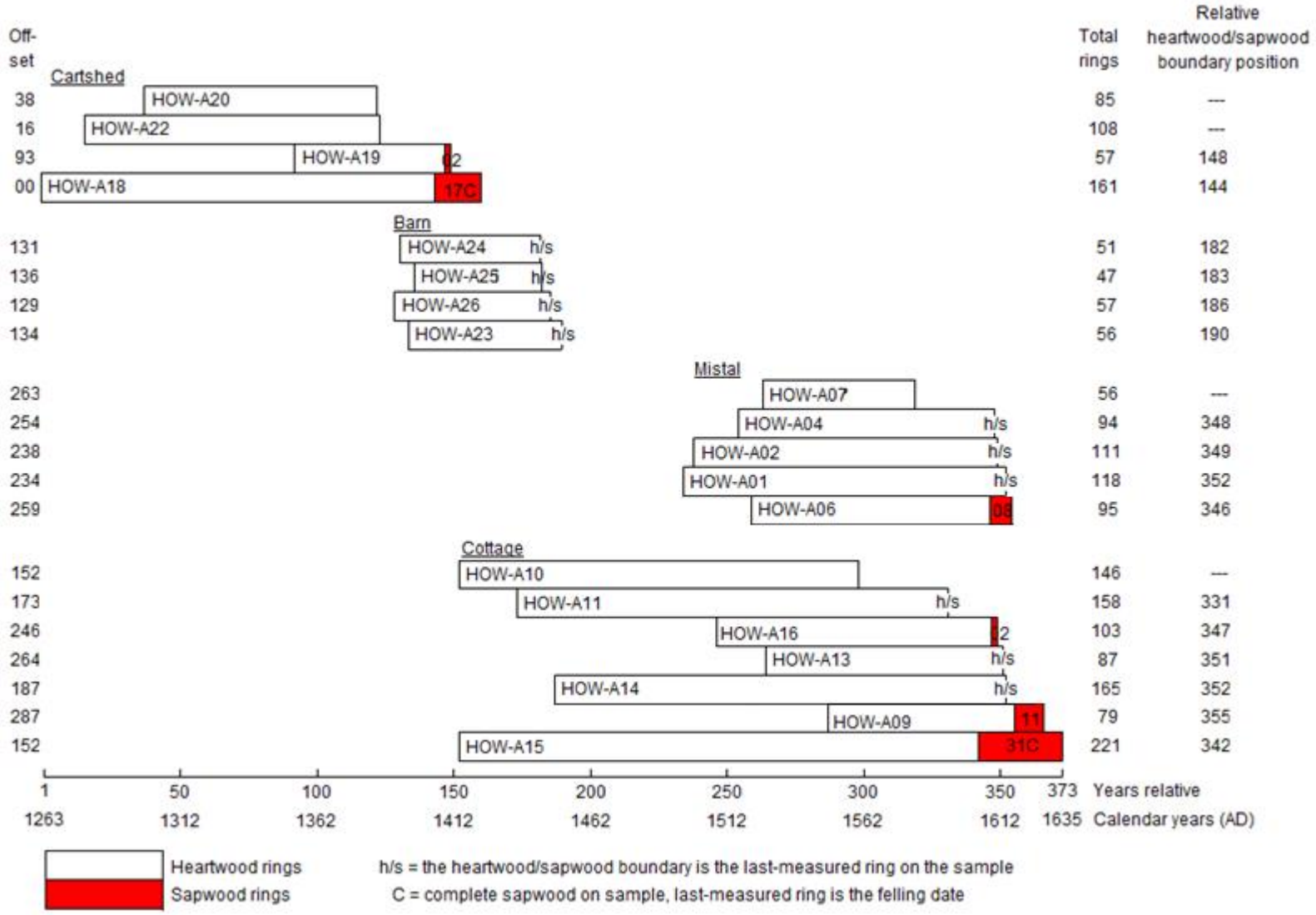

Figure 19: Bar diagram of all dated samples, sorted by area