Northamptonshire Archaeology

Archaeological Buildings Recording and Watching Brief at Peddimore Hall Barns Sutton Coldfield, January-March 2010

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Report 10/75

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OASIS REPORT FORM

PROJECT DETAILS	
Project title	Archaeological Buildings Recording and Watching Brief at Peddimore Hall Barns Sutton Coldfield January-March 2010
Archaeological buildings recording consisted of the drawing and photography of the historic roof trusses in building 4/7 Peddimore Hall Barns. Recording demonstrated that the trusses had within them re-used elements. This was confirmed by the programme of dendrochronology which identified timbers dating from 1509 to 1766. The watching brief during the reduction of the floor level did not identify any pre-barn structures, but did allow for clearer photography of structural elements.	
Project type	Building recording
Previous work	Buildings assessment
Future work	Watching brief during further conversion work
Monument type and period	Later post-medieval buildings, Grade II listed
PROJECT LOCATION	
County	West Midlands
Site address	Peddimore Hall, Minworth, Sutton Coldfield
Easting / Northing	SP 1524 9368
PROJECT CREATORS	
Organisation	Northamptonshire Archaeology
Project brief originator	Birmingham City Council Planning Archaeologist Dr M Hodder
Project Design originator	Northamptonshire Archaeology
Director/Supervisor	Tim Upson-Smith
Project Manager	Iain Soden
Sponsor or funding body	Brown and Green Ltd
PROJECT DATE	
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End date	March 2010
BIBLIOGRAPHY	
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ARCHAEOLOGICAL BUILDINGS RECORDING AND WATCHING BRIEF AT PEDDIMORE HALL BARNS SUTTON COLDFIELD JANUARY-MARCH 2010

Abstract

Archaeological buildings recording consisted of the drawing and photography of the historic roof trusses in building 4/7 Peddimore Hall Barns. Recording demonstrated that the trusses had within them re-used elements. This was confirmed by the programme of dendrochronology which identified timbers dating from 1509 to 1766. The watching brief during the reduction of the floor level did not identify any pre-barn structures, but did allow for clearer photography of structural elements.

1 INTRODUCTION

Northamptonshire Archaeology were commissioned by CgMs Consulting to undertake archaeological recording of the roof trusses and the north-west elevation of Building 7 and the dividing wall between Building 7 and 4, Peddimore Hall Barns, Peddimore Lane, Minworth, Sutton Coldfield (Planning Application No: N/00702/07/FUL, NGR SP 1524 9368, Fig 1). The work was required as a condition of the planning permission.

A previous programme of historic building assessment was carried out by Birmingham Archaeology during 2006. This survey identified an amount of probable 17th-century fabric, which survived as upstanding remains or as re-used roof timbers (Birmingham Archaeology 2006). In the light of this previous work a brief was issued by Dr Michael Hodder, Birmingham City Council Planning Archaeologist, for the present phase of works (Hodder 2009). The work was carried out in accordance with this and a specification prepared by Northamptonshire Archaeology (N A 2010).

1.1 Background

The former agricultural buildings, are locally listed, and are associated with a Grade II statutorily listed building, Peddimore Hall, which dates from the 17th century. The hall is surrounded by a double moat, while documentary evidence suggests that the site of Peddimore Hall may have been occupied since the middle of the 13th century. The current hall dates to the mid 17th century and it is thought that the origins of the farm buildings may be contemporary with this.

The archaeological significance of the hall and moat are recognised in their designation as a Scheduled Monument (National ref 30031). Peddimore Hall has also been listed as a building of special historic or architectural interest (Grade II) since 1976. The following comprises the wording of the official listing, reproduced from the Images of England (IoE) website (www.imagesofengland.org.uk):

Peddimore Hall *(IoE number 216615)*

PEDDIMORE LANE Peddimore Hall SP 19 SE 4/19 Grade II. Mid C17, altered. May incorporate earlier structure. Stone dressed red brick, tiled roof. 2 storeys, C19 windows, some blocked stone mullioned and transomed C17 windows. Stone pedimented doorway inscribed "Deus Noster Refugium". An earlier house on this site was at one time owned by the Arden Family, from circa 1281 to after 1619. See VCH (Warwickshire), IV, pp 231, 240.

Further detailed background for the site can be found in the historic buildings, documentary and other research carried out by Birmingham Archaeology (Birmingham Archaeology 2006).

2 SCOPE OF RECORDING

2.1 Buildings recording

Structural recording was carried out during January 2010 and was confined to the timber framing, wall post, tie beam and braces surviving *in situ* between Buildings 4 and 7 and the surviving framing and any other structural timbers in the northern part of the west wall of Building 7 and timbers re-used in the roof trusses of Building 7. Figures 11, 13 and 14 were taken during the watching brief in March.

The structural recording consisted of the following:

- Measured drawings at 1:50 scale were prepared of elevations of timber framing, wall post, tie beam and braces surviving *in situ* between Buildings 4 and 7, and the surviving framing and other structural timbers in the northern part of the west wall of Building 7. The drawings also show the location of samples taken for dendrochronology, with the sample number.
- Measured drawings were undertaken at 1:50 scale of the roof trusses in Building 7 to show details and evidence for re-use of timbers.
- Photographs of all the drawn elevations were taken with appropriate scales, using black and white film, colour slide and supplemented with digital images.

Additional photographs of the interior of the barn were taken in March 2010, following re-covering of the barn roof and the removal of all internal subdivisions.

2.2 Archaeological observation and recording

A watching brief was undertaken in March 2010 during all groundworks for the development and conversion of Building 4 and 7.

3 RESULTS

3.1 Buildings recording

The survey was carried over three days in January 2010, when the trusses were recorded. At the same time samples were taken for dendrochronology (See Appendix 1 for the results).

Building 7 comprises a large 18th-century threshing barn, aligned north-south, with the main doors aligned east–west. The building is constructed in red brick (9”x2½”x4¼”) laid in an irregular bond. A portion of the barn sits on a row of squared, shaped sandstone blocks, which may indicate an earlier, timber-framed building, on the site. This is further suggested by the presence of a large number of reused timber-framed elements incorporated into the fabric of the present building.

Building 7 would have originally been one large open space, reflecting its use as a threshing barn. At the time of the survey the building was divided by partition walls and workshops. The barn was at least five bays in length, being formed by six trusses of varying form (Fig 2). It is also clear, from the evidence of redundant mortices, peg holes, and lap joints, and also from the varying dimensions of the timber, the poor quality of the jointing, and the variation in form of the trusses, that the timbers represent more than one phase of construction, with a number of them having been used at least once, and some possibly twice, in an earlier timber-framed building or buildings. Building 4 comprised a two storey extension on the southern end of Building 7, access being gained to the first floor by an external brick stair (Front cover).

Further detailed description of the buildings can be found in the historic buildings assessment carried out by Birmingham Archaeology (Birmingham Archaeology 2006).

The trusses were numbered 1 to 6, counting from north to south (Fig 2), the same numbering was used for the dendrochronology report (Appendix 1).

Truss 1 (Figs 2, 3 & 4)

Truss 1 is 16th to 17th-century in style. Four dendrochronological samples were taken from this truss (1-3 and 7); the tie beam was dated to 1650 and the two principal rafters were dated to 1700-35 as was the purlin on the eastern side (Fig 3).

The principal rafters have trenches for the purlins, but the purlins do not sit in these trenches, so therefore the struts do not support the purlins. The western strut is re-used and has four mortices with two peg holes for each.

An additional strut had been inserted on the eastern side to act as a further support for the principal rafter after a hole had been cut into it for a drive shaft between Trusses 1 and 2. On the western side of the tie beam there was the remnant of a brace to the wall post which had been cut off (Fig 4).

Truss 2 (Figs 2, 5, 6 & 7)

Truss 2 represents the most complete of all of the trusses within the building, and it is 15th to 16th-century in style. Four dendrochronological samples were taken from this truss (4-6 and 8), two of which could not be dated (See Appendix 1). The remaining two produced the same date of 1509-34 (Fig 5).

The truss is a variation of the Queen Post roof, (the eastern strut was dated to 1509-34, but was itself a replacement timber), with the addition of a central strut from the tie beam to the collar. The truss was connected to the wall post on the western side by a brace (dated to 1509-34 by dendrochronology) (Fig 6). The wall post was in turn linked to the wall plate by a further brace, making this truss integral to the building (Fig 7). Attached to the wall post was a horizontal mid-rail which was joined to the tie beam by a vertical post morticed in at both ends (Fig 5). The western principal rafter was joined to the purlin by a wind brace. The other brace was missing although joint evidence remained.

The principal rafters, collar, tie beam and mid-rail all had stave holes, with the mid-rail having three mortices as well, which may suggest that this truss had formed a partition wall, with wattle infill.

Truss 3 (Figs 2, 8 & 9)

Truss 3 was a King Post truss, (Fig 8), only one dendrochronological sample was taken from this truss from the King Post (9) which was undated (See Appendix 1). The tie beam and the eastern principal rafter were marked with the same carpenter's

mark, (a vertical line with three diagonal lines scored through it followed by a B), suggesting that they were part of a set (Fig 9). The eastern purlin was trenched into the principal rafter, although a chock had been added as a support (Fig 8). The western purlin was not trenched into the principal rafter and was supported by a wooden chock (Fig 8). This rafter was likely to have been a replacement as it was in pine.

Wall 1 (Figs 2, 7 & back cover)

On the north-western side of the building there was a surviving section of timber framing, which joined elements of Trusses 1 to 3 (Fig 7). The timber in this wall was not suitable for dendrochronological sampling, due to there not being enough surviving rings. The section of framing consisted of the wall posts for Trusses 1 and 2 with the wall plate, purlins and ridge piece joining Trusses 1 to 3. Between Trusses 2 and 3 was a mid-rail with three vertical beams between it and the wall plate, in the panels adjacent to Trusses 2 and 3 were diagonal braces. The panels were in-filled with brick.

Truss 4 (Figs 2 & 10)

This truss was a King Post truss. Two dendrochronological samples were taken, one from the eastern purlin (10), producing a date of 1509-34, the other was from the eastern strut which produced a date of 1741-66 (16), (Fig 10). The tie beam on its eastern side had a mortice for a missing brace. The eastern principal rafter had been trenched for the purlin, but the purlin was supported by wooden blocks and a chock (Fig 10). The western principal rafter had a slot for a missing wind brace.

Truss 5 (Figs 2 & 11)

This truss was mid 19th-century machine sawn pine and is likely to have been inserted when an engine was installed which powered the aforementioned drive shaft. This truss was not drawn and no samples were taken for dendrochronological dating. Two samples were taken, however, from the purlins, which both produced dates of 1547.

Truss 6 (Figs 2, 12 & 13)

The gable above the tie beam in Truss 6 had been replaced with modern block-work. Two dendrochronological samples were taken from this truss (14 and 15) but both were undated due to insufficient rings (See Appendix 1). This truss had a greater element of timber framing surviving below the tie beam which formed the end wall between Building 7 and the later extension Building 4 (Fig 12). Here the wall post survived on the western side. Three further vertical timbers were morticed into both

the tie beam and sill beam. Four horizontal mid-rails sections survived, forming box framing. A doorway was set into the eastern side at ground floor level. The remaining panels were nogged with whitewashed brick. The sill beam had an edge-halved scarf joint, to the west of the door. The watching brief during the reduction of the floor level in front of this wall demonstrated that the sill beam sat on red sandstone blocks (Fig 12). There were several empty peg holes in the timberwork of this wall suggesting that several of the timbers had been reused.

Elements of the truss from this wall may have been taken to form a temporary structure to support the purlins when the block-work replaced the truss (Fig 13)

3.2 Archaeological observation

A watching brief was undertaken during ground works associated with the re-development of Buildings 4 and 7. The floors which were removed consisted of a 0.04m layer of concrete overlaying mixed crushed brick and concrete 0.1m thick, this overlaid a thin layer of sand over the natural red clay. The thin layer of concrete overlaid a brick floor in the central part of the barn. Although no archaeological features were observed when the floors were removed, (Fig 14), the stripping of modern features from the barn allowed for clearer photography of Truss 6 (Fig 12).

4 CONCLUSIONS

The survey of the roof trusses has demonstrated that much of the timber used within the roof structure had been re-used, either in whole or part, from other structures to build the barn as seen today. For example Truss 2 appears to form a coherent structure with its stave holes and mortices, suggesting that it was once an end wall of a building, although both braces and the central strut appear to be replacements. Truss 3 has a pair of matching carpenter's marks again suggesting that at least those parts had been reused from a common source; whilst the western principal rafter was a subsequent replacement in pine.

Four of the dendrochronology samples suggested an early 18th-century date for the assembly of the barn in its pre-development form. The general style of the barn and the brick noggin work would also suggest a date in this in this period for the construction of the building. Some elements were clearly over 200 years old when the reassembly took place. There is no indication of the source of the timbers.

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Web pages

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Northamptonshire Archaeology

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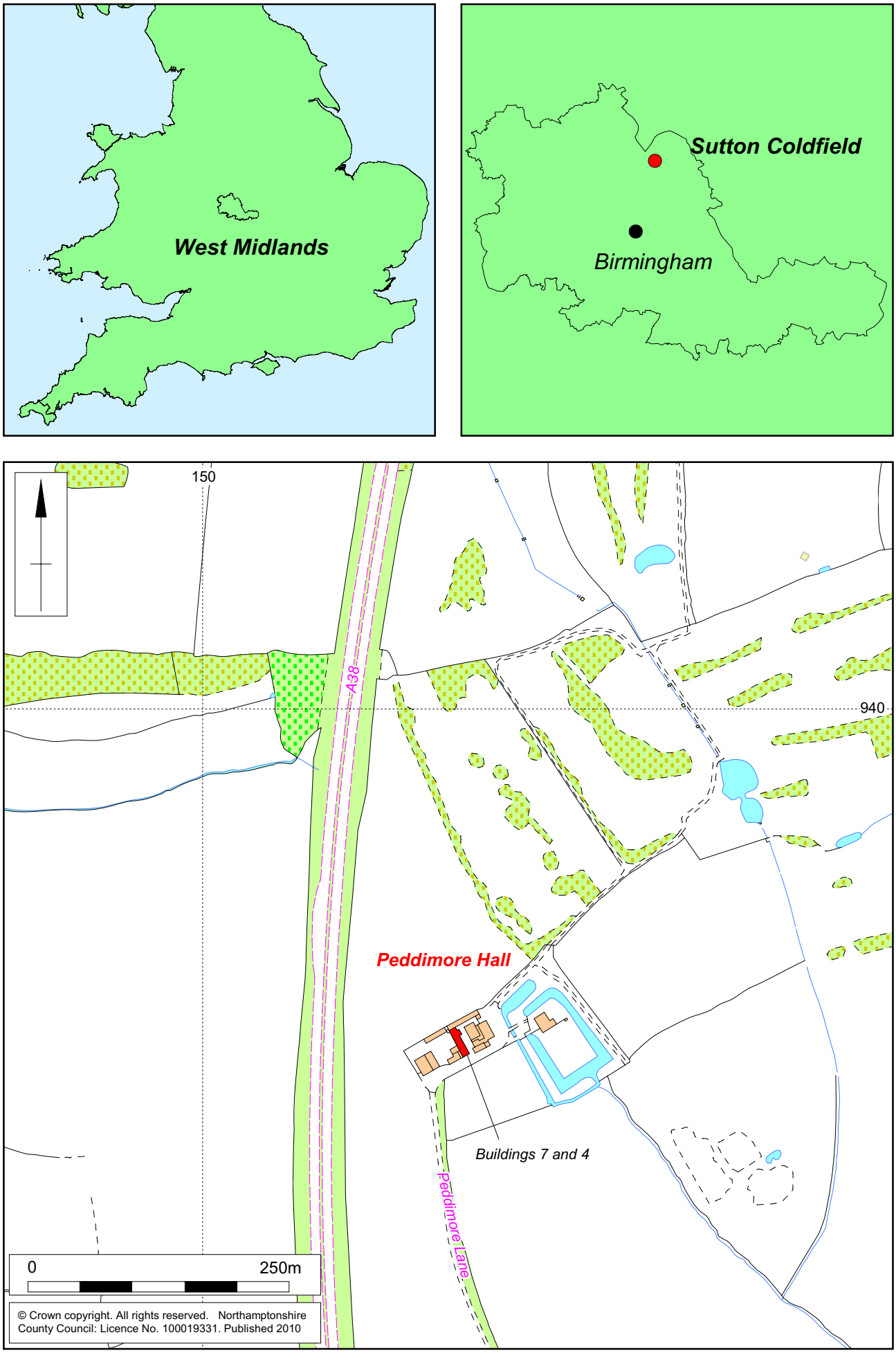
APPENDIX 1: TREE-RING ANALYSIS OF TIMBERS FROM PEDDIMORE HALL BARN, MINWORTH, WEST MIDLANDS

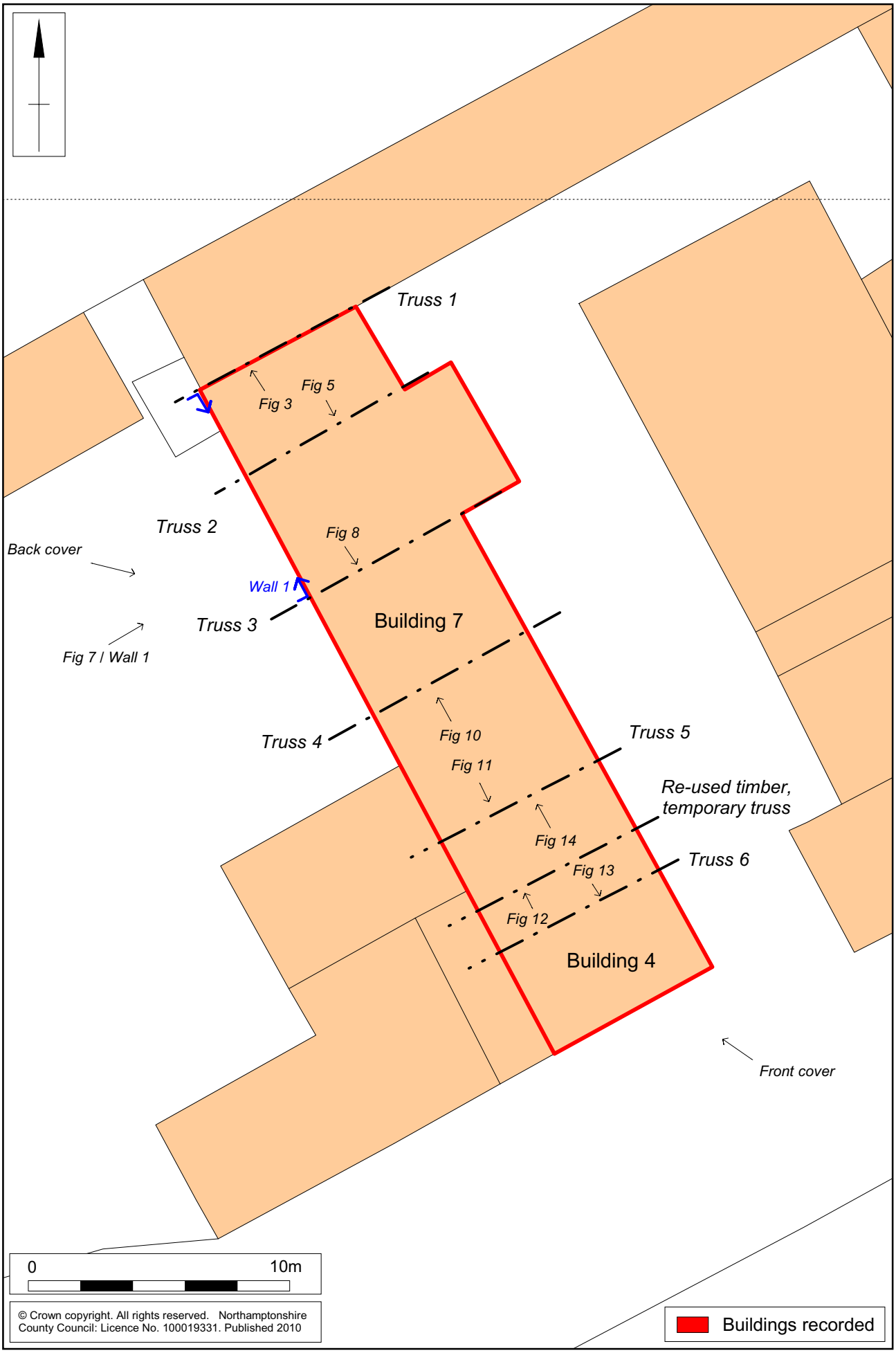
A J Arnold and R E Howard

Figures



Scale 1:5000

Site location Fig 1



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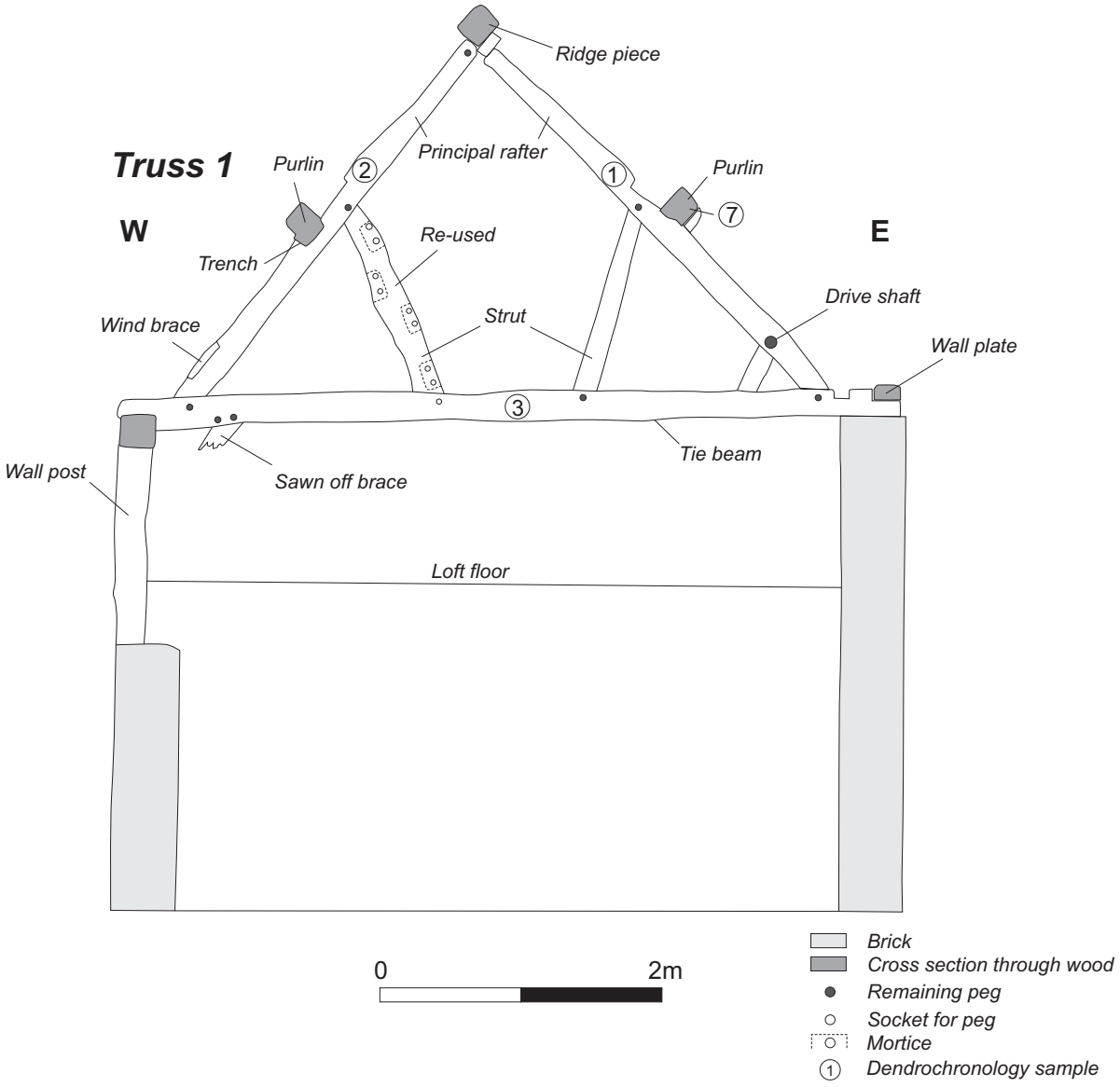
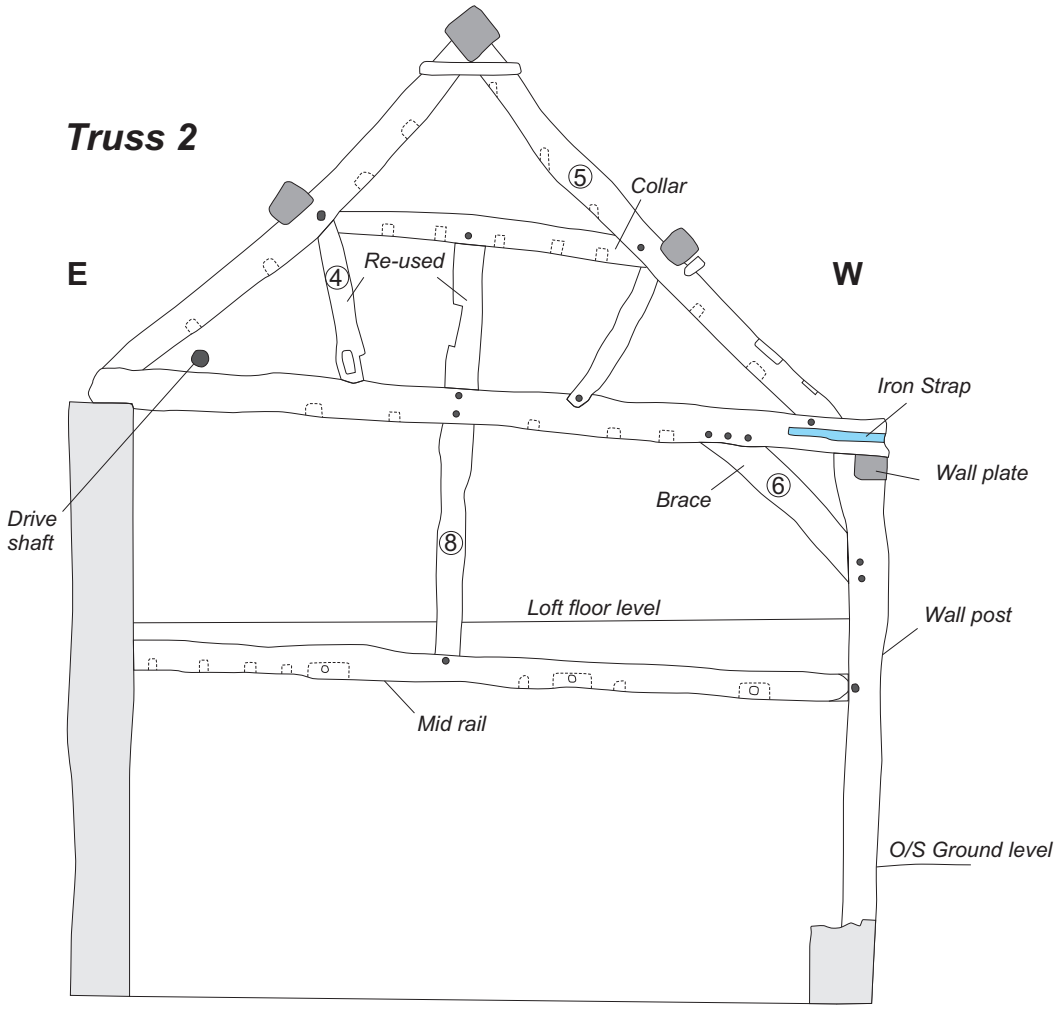
Truss locations Fig 2



Truss 1, elevation and photograph Fig 3

200mm scale

Detail of Truss 1 Fig 4

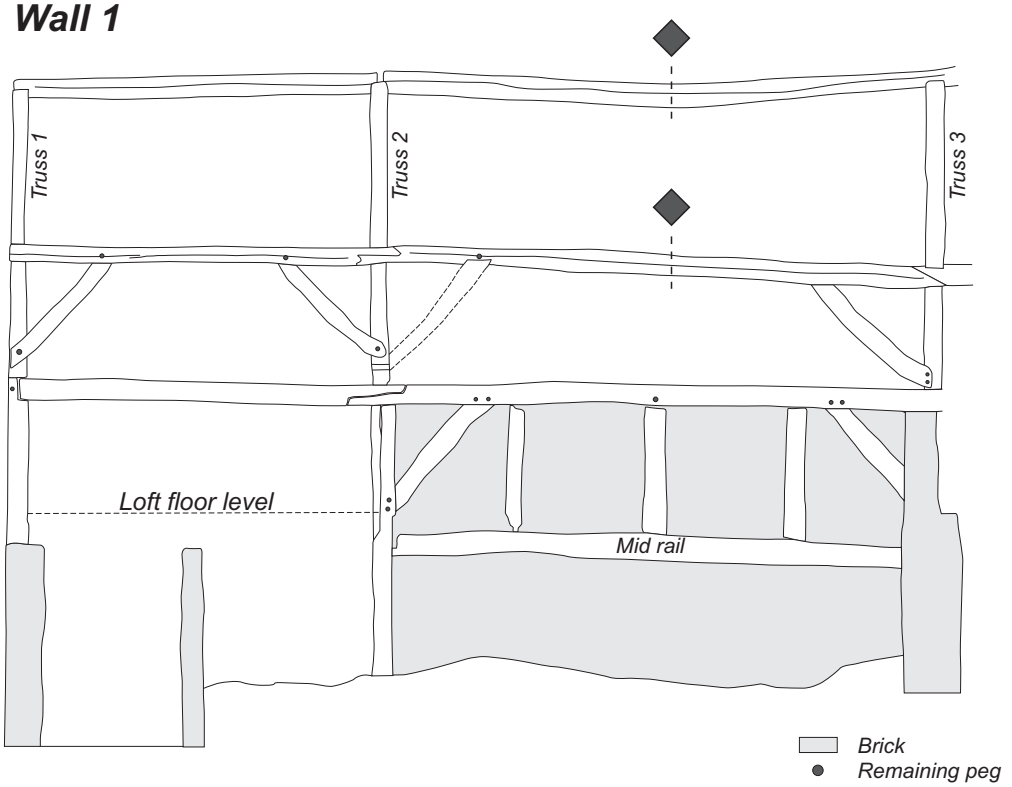


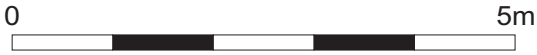
Brick
Cross section through wood
Remaining peg
Socket for peg
Mortice
① Dendrochronology sample

Truss 2, elevation and photograph Fig 5

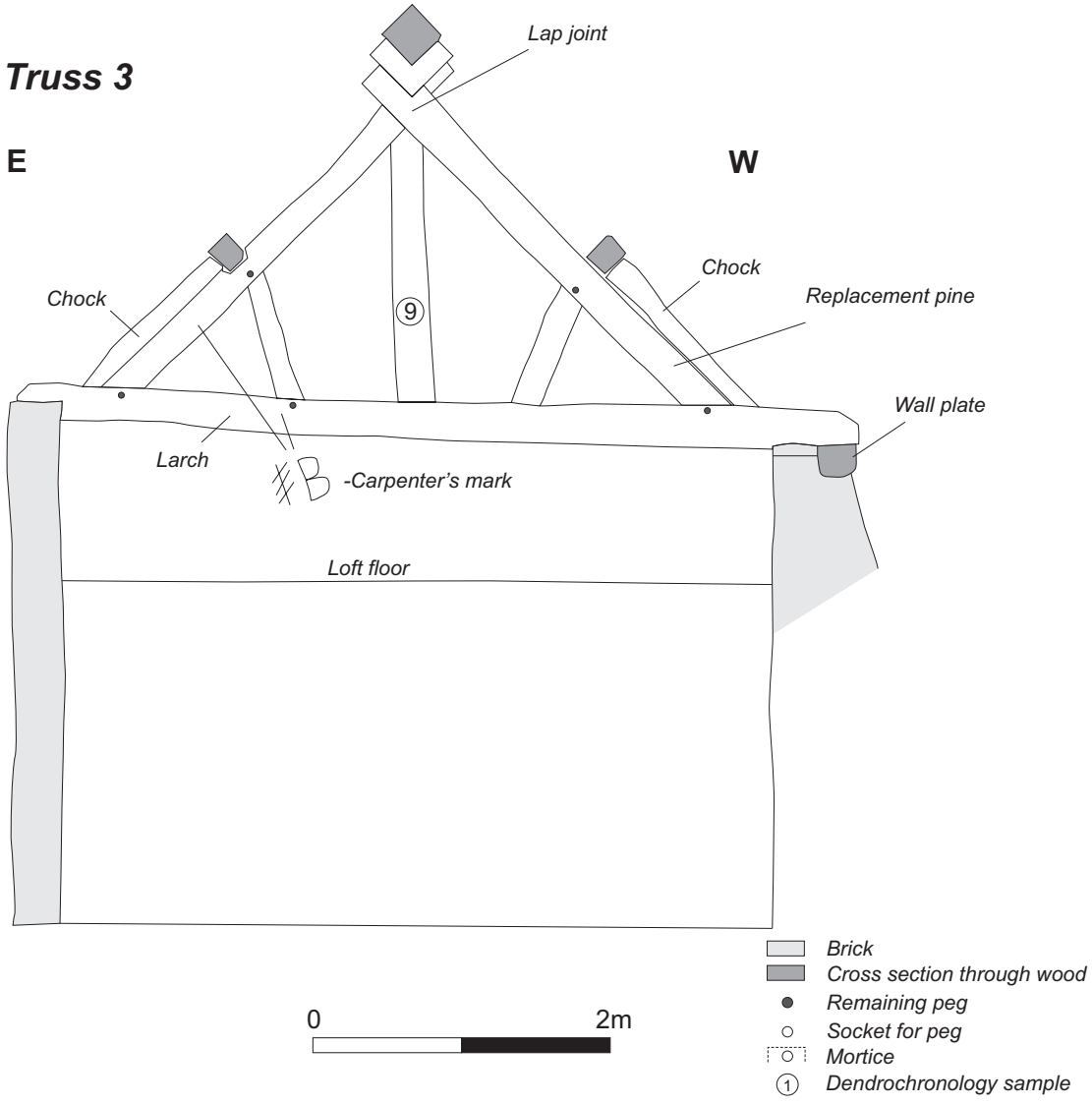
Detail of Truss 2 Fig 6

Wall 1





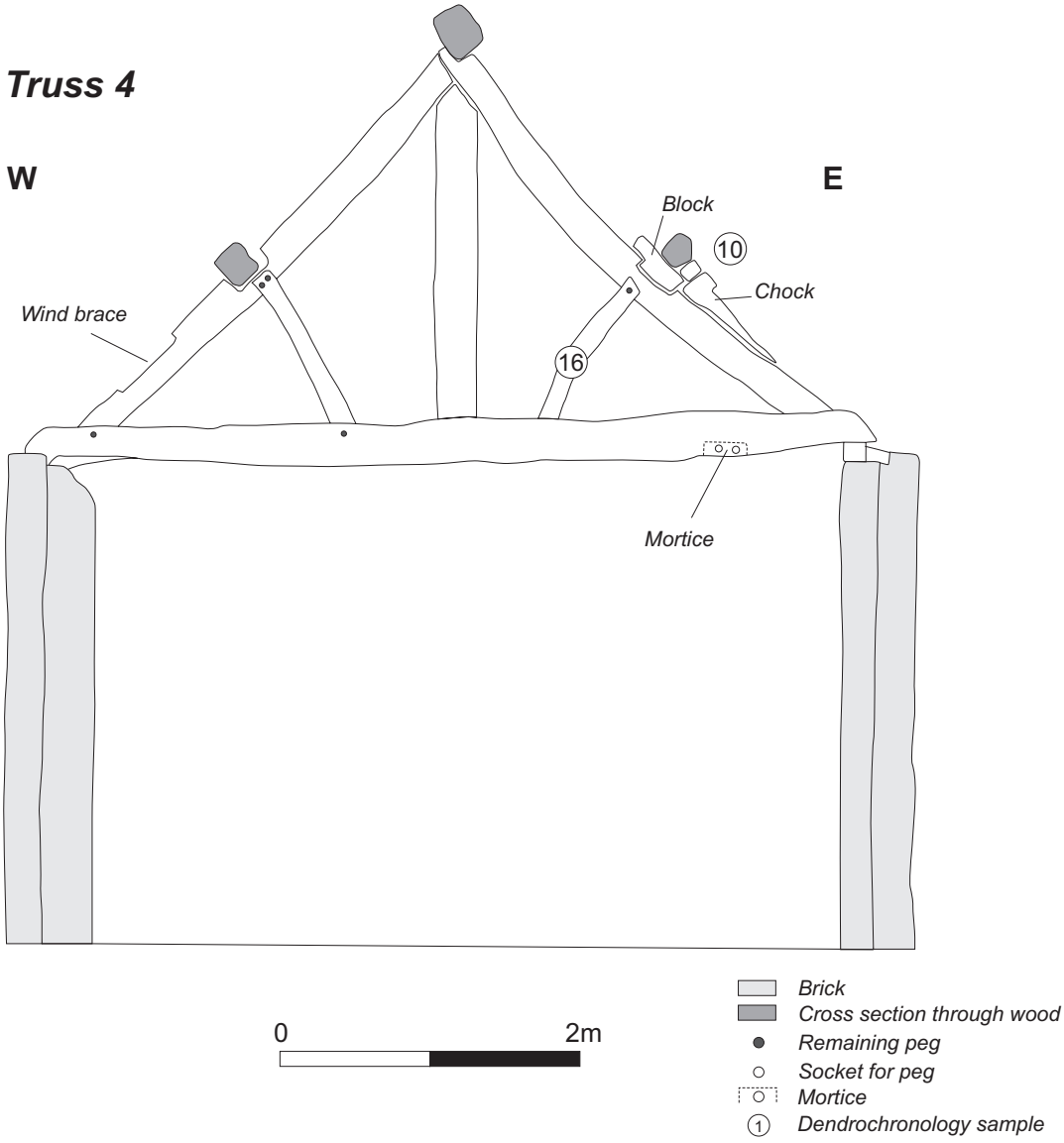
Wall 1, elevation and photograph Fig 7



Truss 3, elevation and photograph Fig 8

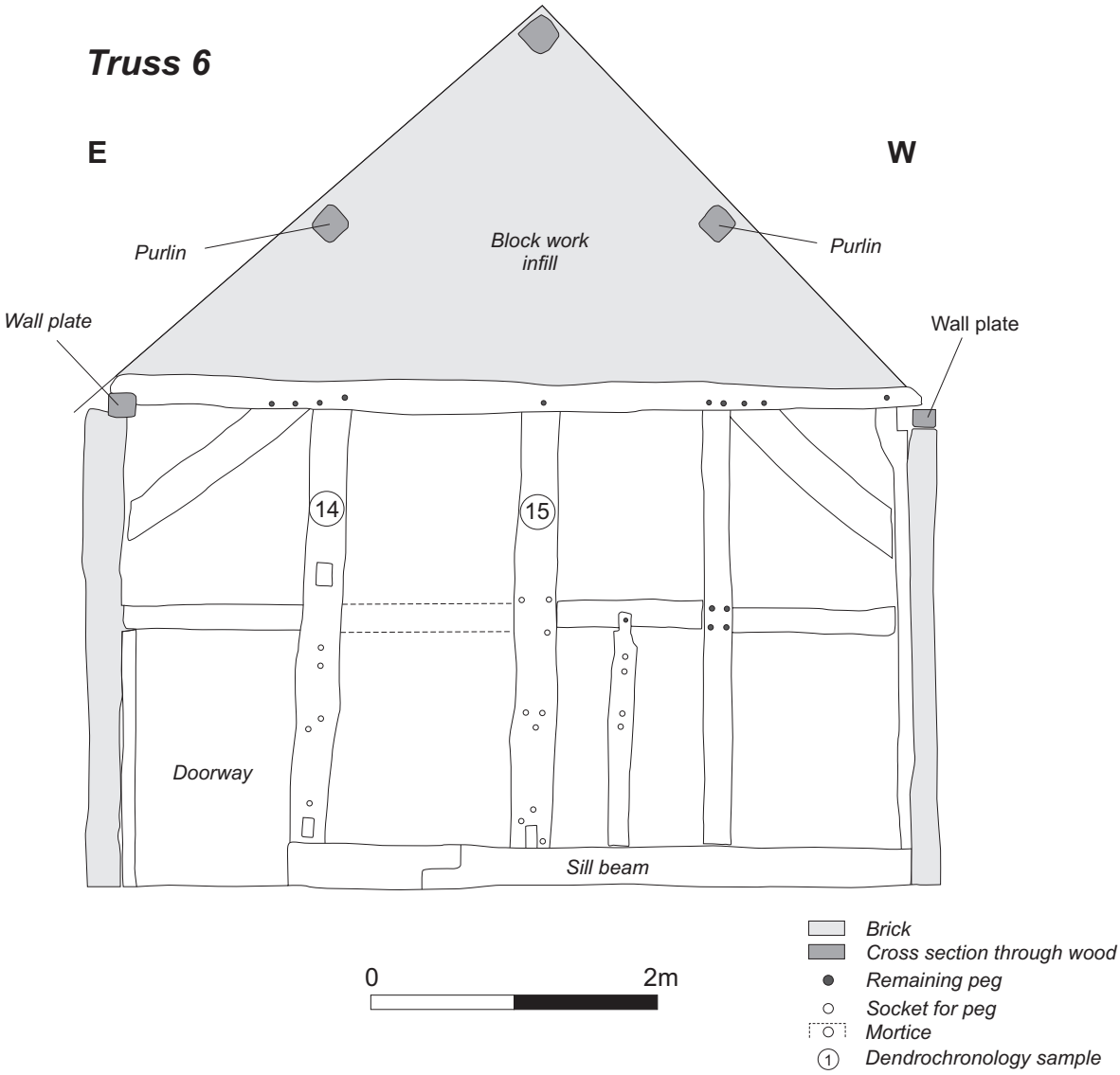
200mm Scale

Detail of Truss 3 Fig 9



Truss 4, elevation and photograph Fig 10

Truss 5 Fig 11



Truss 6, elevation and photograph Fig 12

Re-used temporary timber truss Fig 13

General view of the barn interior during the watching brief, looking north Fig 14

Nottingham Tree-ring Dating Laboratory
Dendrochronology, timber analysis, and historic building consultants

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TREE-RING ANALYSIS OF TIMBERS FROM PEDDIMORE HALL BARN, MINWORTH, WEST MIDLANDS,

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SUMMARY

Samples were obtained from 16 different timbers within the timber-framed barn element of the agricultural buildings to the west of Peddimore Hall, Minworth, in the West Midlands. Analysis of 14 of these samples (two of the 16 having too few rings) resulted in the production of three dated and one undated site chronologies, these four accounting for ten of the 14 samples measured. A further four samples were dated individually.

Interpretation of the results obtained clearly show that timbers felled at different times are to be found here. The earliest timbers were felled at some time between 1509 and 1534. Two other timbers were probably felled at the same time as each other in 1547. A further single timber was felled in 1650, with another three timbers being felled at some time in the period 1700–35. A final single timber was felled some time in the period 1742–66.

Given the historical context of the site, and allowing for evidence of possible earlier structures here, it seem probable that the present barn was largely built in the early eighteenth century, incorporating and reusing timbers which had been felled earlier. Such a date would suggest that the barn was built after Peddimore Hall proper, which is believed to have been constructed in 1659. It is very likely, given the dating evidence of a later timber, and the use of conifer in some of the trusses, that the barn has undergone subsequent repair or alteration.

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Introduction

Peddimore Hall, and the mainly brick-built with some timber-framing former agricultural buildings which lie to its west, is located on Peddimore Lane, approximately 1 mile to the northwest of Minworth, West Midlands, and is centred on NGR SP 153 937

According to the Birmingham Archaeology report from which this introduction is taken almost verbatim (Lobb, 2006), Peddimore Hall itself (SMR 01122) was the site of a medieval moated manor house of which only the moat now survives (SMR 02250) (Fig 1). The site is known to have been a manor from 1281, and lies within an area assarted in 1241, as an area reclaimed from wasteland. In 1288 the owners of Peddimore Hall were granted the right to

enclose and improve their estates by the Earl of Warwick and it is likely that the construction of the moat dates from this period. In 1361 Peddimore Hall was granted a licence to establish a chapel, which was most likely built on the moated site along with the hall.

By the seventeenth century the medieval moated site had been abandoned. The antiquarian William Dugdale visited the site in 1656, and noted that nothing remained of the site but a large moat (Spolton 1977, p6). The site was also visited by Campden in the early seventeenth century, who noted that the area within the moat was level with the ground (Spolton 1977, p6).

Despite the date of c. 1600 given in the VCH (1947), the current Peddimore Hall dates from the later-seventeenth century and comprises a double-pile brick building with sandstone dressings. The west elevation of the building has a central doorway at ground floor level with an inscription on the pediment reading 'DEUS NOSTER REFUGIM' – 'God is our refuge'. The building is thought to have been built in 1659 by William Wilson of Sutton Coldfield, for William Wood, a prominent royalist and Warden of Sutton Coldfield Corporation in 1662 & 1676 (Spolton 1977, p6). Re-building on earlier medieval sites appears to have been a feature of the seventeenth century around Birmingham with several large houses being added to or re-built in brick, including several which were constructed on medieval moated sites, such as Sheldon Hall and Rectory Hall (Hodder 2004, p157).

The first evidence for buildings associated with the hall is William Wood's will of 1685 which bequeathed to his wife Anne his 'mansion or dwelling house wherein I now dwell called by the name of Peddimore, together with all barns and edifices, buildings, gardens, orchards and backsides…..together with all those my lands, meadowes, pastures and hereditaments.' (Spolton 1977, p6); unfortunately the accompanying inventory, which may have given an indication of the nature of the barns and their function, has been lost.

The earliest cartographic evidence for Peddimore Hall is from a sixteenth century map of Minworth, which illustrates 'the lodge of the waste of Arden Hill in Mynworth'. However, the map does not show either the moat or any associated buildings. The first map to show the associated buildings is the Corn Rent map of 1824 which depicts two main ranges built along the north and west sides of a central fold yard and a smaller group of buildings at the southeast corner. By 1857, when the Poor Rate Valuation Map appeared, a gap on the east side of the complex had been filled so that the fold yard was entirely enclosed except for an entrance at the southwest corner. The Ordnance Survey maps of the site show no significant change to this pattern. A number of small blocks appear to have been added during the course of the twentieth century. However, it is unclear whether these were permanent structures or merely temporary lean-tos.

The threashing barn

Of particular concern to this report, amongst the agricultural buildings on the site, is a large eighteenth century threshing barn, aligned north-south, with the main doors aligned east–west (Upson-Smith, forthcoming) . The building is composed of red brick (9"x2½"x4¼") laid in an irregular bond. A portion of the barn sits on a row of squared, shaped sandstone blocks, indicative of an earlier, timber-framed building, on the site. This is further intimated by the presence of a large number of reused timber-framed elements incorporated into the

fabric of the present building which, on the basis of stylistic evidence, are believed to date to the seventeenth century.

Although originally one large open space, reflecting its use as a threshing barn, the building is now divided by partition walls and workshops, these, and the other accretions of modern farming, obscure much of the lower portions of the timberwork. It is clear, however, that the barn was at least five bays in length, being formed by six trusses of varying form (Fig 2). It is also clear, from the evidence of redundant mortices, peg holes, and lap joints, and also from the varying dimensions of the timber, the poor quality of the jointing, and the variation in form of the trusses, that the timbers found here represent more than one phase of felling, with a number of them having been used at least once, and some possibly twice, in an earlier timber-framed building or buildings (Fig 3a/b).

Truss 1, for example, at the north end of the barn, comprises a principal rafter and tiebeam truss, with main posts, there being, to the east, a straight strut, and to the west, a slightly curved strut, between the tiebeam and the principals.

Truss 2 comprises a further principal rafter and tiebeam truss, this truss also having a curved brace between the west wall post and the tiebeam, a central post rising from the tiebeam to a collar, and diagonal struts, clearly reused or inserted later, between tiebeam and principals. A central stud post, also inserted later, drops from the centre of the tiebeam to the floor.

Truss 3 and 4 appear to be identical to each other, both being of principal rafter and tiebeam type, with king posts (that to truss three showing a distinct bow), both probably later inserts or reused timbers. Both trusses have slightly curved struts, one to either side of the crown post, rising from the tiebeam to the principal rafters.

Truss 5 comprises what appears to be a typical nineteenth century principal rafter with tiebeam truss. A shouldered king post rises from the tiebeam to the ridge, small diagonal braces springing from the shoulders to the principal rafters. All these timbers are of conifer.

Truss 6, in what was probably the original south gable wall, appears to have been mutilated, the principal rafters it once probably had, now missing. A tiebeam, wall posts and lower stud posts still survive.

The trusses carry single purlins to each pitch of the roof, some of the trusses having curved braces between principal rafter and purlin. In some cases, the east purlin between trusses 4 and 6, the purlins are made up of shorter sections, occasionally being supported by further timber 'splints'. The evidence of these timbers would again suggest the reuse of older timbers.

There is also some timber framing to the lower levels of the barn, particularly to the north end of the west wall. This comprises sections of square panelled stud and rail framing, presumably much more extensive in the past than now, having been replaced by later brickwork. Much of that which remains is partially obscured by farm equipment.

Sampling

A programme of historic building recording and research on the former agricultural buildings in 2006 as part of the design of the residential conversion revealed a continuing pattern of development from the seventeenth century onwards, with the earliest part of the former agricultural buildings thought likely to be contemporary with the seventeenth century house. Because the development will affect historic buildings and may affect below-ground archaeological remains, planning permission was granted on condition that dendrochronological dating, structural recording and observation and recording be carried out in advance of and during development. The timber framing surviving in situ and timbers re-used in roof trusses are thought possibly to be parts of a seventeenth century timber-framed barn. Dendrochronological dating was requested to obtain a precise date for these and to find whether the reused timbers are of seventeenth century date or earlier.

All the timbers found in the barn were initially closely inspected and assessed as to their potential for tree-ring analysis. From these, a total of 16 oak core samples was obtained, each sample being given the code PDM-A (for Peddimore, site "A") and numbered 01–16. Given the nature of the timbers used in this building, ie, the reuse of substantial numbers of timbers, and the requirement to determine the historic nature of this material, those timbers which displayed evidence for reuse were sampled along with those which did not.

The positions of these samples were marked on a sketch plans made at the time of coring, these then being worked-up to those produced here as Figures 4a-g. Details of the samples are given in Table 1. In this Table, and in the plan, the trusses have been numbered 1–6 from north to south, with individual timbers being further located and/or identified on a north–south, or east–west basis, as appropriate.

The barn contains a large number of further timbers which were not sampled. The main reason for not sampling these timbers was that, although the timbers were sometimes of a substantial size, often 150 X 150 mm and sometimes more, they were derived from very fast grown trees which were unlikely to contain the minimum number of rings required for reliable analysis, here set at 48 rings. This hypothesis was confirmed by the test coring of samples PDM-A14 and A15 (the two samples having only 35 and 38 rings respectively), and the counting of rings exposed in mortices and lap joints of other timbers. The maximum number of rings seen on any timber being 40, in the west wall post of truss 1, all other timbers, both in the roof and to the lower levels having fewer than this.

An additional reason for not sampling some timbers is that they were of conifer, all of truss 5, and everything but the king post of truss 3, being of this material. Whilst the dating of conifers is sometimes possible, it is usually necessary to obtain a high number of single-species samples, at least 20, from each single-phase element of the building under consideration. In the case of Peddimore barn, not only were there insufficient single-species timbers available, but it was felt very likely that the timbers which were present, as with the oak timbers, represented more than one phase of felling.

The Nottingham Tree-ring Dating Laboratory would like to take this opportunity to pay thanks to Myk Flitcroft of CgMs Consulting's Newark Office for commissioning this programme of tree-ring analysis and for arranging access to the site, etc, to Mike Hodder of Birmingham City Council's Development Directorate, for his guidance and help with this programme of analysis, and to Tim Upson-Smith, buildings recording archaeologist of Northamptonshire Archaeology, for his on-site help and guidance (and for use of drawings/plans etc?). The Laboratory would also like to thank Nathan Evans, of Brown and Green Limited, development contractors, for his cooperation and practical assistance during

sampling. Finally, the Tree-ring Laboratory would also like to acknowledge and thank Michael Lobb of Birmingham Archaeology at the University of Birmingham, for the wholesale use of their notes in the introduction above.

Tree-ring dating

Tree-ring dating relies on a few simple, but quite fundamental, principles. Firstly, as is commonly known, trees (particularly oak trees, the most frequently used building timber in England) 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 – 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 influenced 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-ring pattern of the tree. The pattern of a short period of growth, 20, 30 or even 40 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 54 years or so. In essence, a short period of growth, anything less than 54 rings, is not reliable, and the longer the period of time under comparison the better.

The third principle 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 millimeter. 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 the growth-ring sequence of a sample "cross-matches" repeatedly at the same date span 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 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 phase 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 reliable dating.

Having obtained a date for the site chronology as a whole, the date spans of the constituent individual samples can then be found, and from this the felling date of the trees represented may be calculated. Where a sample retains complete sapwood, that is, it has the last or outermost ring produced by the tree before it was cut, the last measured ring date is the felling date of the tree.

Where the sapwood is not complete it is necessary to estimate the likely felling date of the tree. Such an estimate can be made with a high degree of reliability because oak trees generally have between 15 to 40 sapwood rings. For example, if a sample with, say, 12 sapwood rings has a last sapwood ring date of 1400, it is 95% certain that the tree represented was felled sometime between 1403 (1400+3 sapwood rings (12+3=15)) and 1428 (1400+28 sapwood rings (12+28=40)).

Given that in a timber-framed building the trees required for each phase are almost certainly to have been cut in a single felling operation especially for that building, it is usual to calculate the average date of the heartwood/sapwood boundary from *all* the dated samples from each phase of a building and add 15 to 40 rings to this average to get the likely overall felling date of all the timbers used. In this calculation, wide variations in the position/date of the heartwood/sapwood boundary (possibly suggesting different felling dates) must be noted and taken into consideration.

Analysis

In the case of the 16 samples obtained from Peddimore barn, each was prepared by sanding and polishing. It was seen at this time that two samples had less than 48 rings, the minimum considered necessary in this instance for reliable dating, and they were rejected from this programme of analysis. The annual growth-ring widths of the remaining 14 samples were, however, measured, and were then compared with each as described in the notes above.

At a minimum value of t=4.2 four groups, accounting for 10 of the 14 measured samples, could be formed. The cross-matching samples of each group were combined at their indicated off-set positions to form a site chronologies, PDMASQ01, PDMASQ02, PDMASQ03, and PDMASQ04, with overall lengths of 60, 76, 122, and 121 rings, respectively. Each of the four site chronologies was then compared to an extensive series of reference chronologies for oak, this indicating cross-matches and dates for three of the site

sequences, PDMASQ0, SQ02, and SQ03. The evidence for this dating is given in the *t*-values of Table 2–4.

The four remaining measured but ungrouped single samples were then compared individually with the reference chronologies, this indicting satisfactory cross-matches and date for all four of these samples. The evidence for this dating is given in the *t*-values of Tables 5–8.

This analysis may be summarised as below:

Site chronology	Number of samples	Number of rings	Date span (where dated)
PDMASQ01	2	60	1438–1493
PDMASQ02	2	76	1472–1547
PDMASQ03	3	122	1568–1689
PDMASQ04	3	121	undated
Single samples	4	various	various
Unmeasured	2	---	---

Interpretation

Analysis by dendrochronology of 14 measured samples from the barn element of Peddimore Farm has resulted in the dating of three site chronologies, PDMASQ01, PDMASQ02, and PDMASQ03 (accounting for seven measured samples), and the dating of a further four samples individually. As intimated by the structural evidence, the interpretation of the results supports the view that timbers with different felling dates are to be found in this building.
The earliest phase of felling is represented by samples PDM-A04 and A06 in site chronology PDMASQ01, and the individually dated sample, PDM-A10. None of these samples retains complete sapwood and thus the precise felling date of the trees cannot be given. The samples do, however, retain the heartwood/sapwood boundary, meaning that only the outermost sapwood rings are missing. Although the exact number of missing sapwood rings on any sample cannot be determined, it is known that the 95% confidence limit for this lies between 15–40 rings. By taking the average date of the heartwood/sapwood boundary on these three samples, in this case 1494, and adding 15–40 rings to this, we estimate that the timbers are likely to have been felled some time between 1509–34.

The next phase of felling is represented by samples PDM-A12 and A13 in site chronology PDMASQ02. Sample PDM-A12 retains complete sapwood (indicated by 'C' in Table 1 and the bar diagram Fig 5). This means that it has the last ring produced by the tree represented before it was cut down. In this instance this last, complete, sapwood ring, and thus the felling of the tree, is dated to 1547. The position of the heartwood/sapwood boundary on the other sample in this site chronology, PDM-A13, is such as to suggest that the tree from which the timber was derived is likely to have been felled in 1547 as well.

A third phase of felling is represented by the individually dated sample PDM-A03. This sample also retains complete sapwood. In this instance the last, complete, sapwood ring, and thus the felling of the tree, is dated to 1650.

The next phase of felling is represented by samples PDM-A01, A02, A07, in site chronology PDMASQ03 and the individually dated sample, PDM-A11. None of these samples retains complete sapwood and again the precise felling date of the trees represented cannot be give. The samples do, however, retain the heartwood/sapwood boundary, the average date of this being, 1685. Adding the usual 95% confidence estimates of 15–40 sapwood rings to these samples would give the timbers an estimated likely felling date of 1700–35.

The final phase of felling amongst the dated material is represented by sample PDM-A16, this sample having a heartwood/sapwood boundary date of 1726. Using the same sapwood estimate as above would give the timber represented an estimated likely felling date of 1741–66.

An attempt to show the likely differences in the felling dates of various groups of timbers is shown in the bar diagram, Figure 5. In this figure the samples are shown in last ring date order and in their site chronology grouping. The samples of the undated site chronology, PDMASQ04, are shown at their cross-matching positions in the bar diagram, Figure 6. This interpretation may be summarised as below:

Site chronology	Number of samples	Average heart/sap boundary date	Felling date (actual or estimated)
PDM-A04/06 & A10	2 + 1	1494	1509 –34
PDM-A12/13	2	1527	1547
PDM-A03	1	1626	1650
PDM-A01/02/07 & 11	3 + 1	1685	1700–35
PDM-A16	1	1726	1741–66
PDM-A05/08/09	3	undated	undated

Conclusion

The results obtained here clearly show that timbers felled at different times are to be found here, there being timbers dating to the earlier and middle part of the sixteenth century, one dating to the mid-seventeenth century, some to the earlier eighteenth century, and another single timber dating to the mid- to later-eighteenth century. Given that some of these timbers could have been inserted at any time after their felling, it is difficult, if not impossible, to determine exactly when the barn was built.

The latest sample, for example, PDM-A16, indicates an estimated felling date range of 1741–66. The timber, however, the east strut to truss 4, although morticed in to the tiebeam, is lapped and nailed to the south face of the east principal rafter, and could have been added to this truss any time in the last 250 years.

Many of the other timbers, some of the purlins, for example (samples PDM-A10, A12, and A13), although giving estimated felling dates in the sixteenth century, and the east strut in truss 2 (PDM-A04), are almost certainly reused in their present positions. Such an interpretation is less certain for the timber represented by sample PDM-A06, from the west archbrace of truss 2. Although this also gives an estimated felling date in the early sixteenth century, there is no clear evidence that it is reused in its present position.

Perhaps the most cohesive date is represented by samples PDM-A01, A02, A07, and A11 (the principal rafters and east purlin to truss 1, and a stud post in an intermediate partition wall – frame 5b). Although truss 1 incorporates an earlier timber as a tiebeam (PDM-A03), and the stud post in frame 5b appears to comprise a reused timber, it would appear possible that these timbers represent the construction phase of the present barn, the construction of which incorporated a quantity of earlier timber. This early eighteenth century structure was then reworked in the mid-to late-nineteenth century and later, when the presumably original oak trusses, were replaced by the conifer trusses.

Thus given the historical context of the site, and allowing for evidence of possible earlier structures here, it seem probable that the present barn was largely built in the early eighteenth century, incorporating and reusing timbers which had been felled earlier. Such a date would suggest that the barn was built after Peddimore Hall proper, which is believed to have been constructed in 1659. It is very likely, given the dating evidence of a later timber, and the use of conifer in some of the trusses, that the barn has undergone subsequent repair or alteration.

It may be of interest to note that, judging by the level of cross-matching between some of the samples, it is likely that the trees they represent were growing fairly close to each other in the same copse or stand of woodland. Indeed, it is possible that some timbers are derived from the same tree, samples PDM-A01 and A02, the principal rafters of truss 1, possibly being examples of this. These two samples cross-match each other with a value of t=10.8, and the two timbers do in fact look like two halves of the same tree. The trees represented by samples PDM-A05 and A09, respectively the west principal rafter of truss 2 and the king post of truss 3, cross-match with each other with a value of t=8.0, suggesting the possibility that the trees were growing close to each other in the same copse or stand of woodland.

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Table 1: Details of tree-ring samples from Peddimore Hall barn, Minworth, West Midlands

Sample number	Sample location	Total rings	Sapwood rings*	First measured ring date (AD)	Last heartwood ring date (AD)	Last measured ring date (AD)
PDM-A01	East principal rafter, truss 1	103	1	1585	1686	1687
PDM-A02	West principal rafter, truss 1	122	5	1568	1684	1689
PDM-A03	Tiebeam truss 1	130	24C	1521	1626	1650
PDM-A04	East queen strut, truss 2	60	h/s	1438	1497	1497
PDM-A05	West principal rafter, truss 2	101	h/s	------	------	------
PDM-A06	West archbrace, truss 2	48	h/s	1446		1493
PDM-A07	East purlin, truss 1–2	62	h/s	1625	1686	1686
PDM-A08	Lower stud post, truss 2	72	2	------	------	------
PDM-A09	King post truss 3	94	h/s	------	------	------
PDM-A10	East purlin, truss 4–5	73	h/s	1420	1492	1492
PDM-A11	East queen strut, truss 5b	79	h/s	1607	1685	1685
PDM-A12	East purlin, truss 5–6	66	20C	1482	1527	1547
PDM-A13	West purlin, truss 5–6	55	h/s	1472	1526	1526
PDM-A14	East stud post, truss 6	nm	---	------	------	------
PDM-A15	Central stud post, truss 6	nm	---	------	------	------
PDM-A16	East queen strut, truss 4	50	6	1683	1726	1732

*h/s = The last ring on the sample is at the heartwood/sapwood boundary, only the sapwood rings are missing

nm = sample not measured

C = complete sapwood is retained on the sample. Where dated this is the felling date of the tree represented

Table 2: Results of the cross-matching of site chronology PDMASQ01 and relevant reference chronologies when the first-ring date is 1438 and the last-ring date is 1497

Reference chronology	*t*-value	Reference
Leicester's Gatehouse, Kenilworth Castle, Warwicks	6.9	(Arnold and Howard 2007a)
Gorcott Hall, Warwickshire	5.7	(Nayling 2006)
Middleton Hall, Warwicks	5.7	(Arnold *et al* 2006a)
The White House, South Leverton, Notts	5.4	(Howard *et al* 1994)
The Gables, Little Carlton, Notts	5.4	(Howard *et al* 1986)
Primrose Hill, Kings Norton, Birmingham	5.3	(Arnold and Howard 2008a)
Naas House, Lydney, Gloucestershire	5.1	(Howard *et al* 1998a)
Ightham Mote, Ivy Hatch, Kent	5.2	(Howard 2002 unpubl)

Table 3: Results of the cross-matching of site chronology PDMASQ02 and relevant reference chronologies when the first-ring date is 1472 and the last-ring date is 1547

Reference chronology	*t*-value	Reference
Walhill Farm, Rushton Spencer, Staffs	7.0	(Howard *et al* 1998b)
Worcester Cathedral, Worcester	6.8	(Arnold *et al* 2003d)
Leicester's Gatehouse, Kenilworth Castle, Warwicks	6.1	(Arnold and Howard 2007a)
Court House, Shelsley Walsh, Worcs	6.0	(Arnold *et al* 2008)
Cromwell Cottage, Tile Hill, Coventry	6.0	(Arnold and Howard 2007b)
Pye Corner, Moulsford, Oxon	5.9	(Alcock *et al* 1991)
Gorcott Hall, Warwickshire	5.7	(Nayling 2006)
Kingsbury Hall, Kingsbury, Warwicks	5.6	(Arnold and Howard 2006)

Table 4: Results of the cross-matching of site chronology PDMASQ03 and relevant reference chronologies when the first-ring date is 1568 and the last-ring date is 1689

Reference chronology	*t*-value	Reference
Potterdyke House, Newark, Notts	6.5	(Arnold *et al* 2002)

England Master Chronology	5.8	(Baillie 1982)
Yew Tree Farm, Kirton, Notts	5.8	(Arnold *et al* 2001)
East Midlands Master Chronology	5.7	(Laxton and Litton 1988)
Rufford Mill, Notts	5.7	(Laxton and Litton 1984)
Combermere Abbey, Cheshire	5.5	(Howard *et al* 2003b)
Wren Wing, Easton Neston, Northants	5.5	(Arnold *et al* 2008)
Oak House (barn), West Bromwich	5.3	(Howard *et al* 1991)

Table 5: Results of the cross-matching of sample PDM-A03 and relevant reference chronologies when the first-ring date is 1420 and the last-ring date is 1492

Reference chronology	*t*-value	Reference
Staircase Cafe, Stockport, Greater Manchester	6.8	(Howard *et al* 2003a)
Sherwood Trees, Notts	5.8	(Laxton and Litton 1988)
England Master Chronology	5.5	(Baillie 1982)
5 -7 Regent Street, Hinckley, Leics	5.4	(Howard 2002 unpubl)
Sinai Park, Burton on Trent, Staffs	5.4	(Tyers 1997)
Stoneleigh Abbey, Stoneleigh, Warwicks	5.3	(Howard *et al* 2000)
Crowtrees, Ripley, Derbys	5.1	(Howard *et al* 1997)
East Midlands Master Chronology	5.0	(Laxton and Litton 1988)

Table 6: Results of the cross-matching of sample PDM-A10 and relevant reference chronologies when the first-ring date is 1521 and the last-ring date is 1650

Reference chronology	*t*-value	Reference
Chiddingly Palace, Chiddingly, East Sussex	5.8	(Arnold *et al* 2003a)
Leicester's Gatehouse, Kenilworth Castle, Warwicks	5.2	(Arnold and Howard 2007a)
Kingsholme, Didcot, Oxon	5.0	(Alcock *et al* 1989)
Worcester Guildhall, Worcester	4.8	(Arnold *et al* 2006b)
Ightham Mote, Ivy Hatch, Kent	4.7	(Howard 2002 unpubl)

Hampshire county chronology	4.6	(Miles 2003)
Naunton Court, Naunton Beauchamp, Worcs	4.6	(Arnold *et al* 2008)
19/20 High Street, Kinver, Staffs	4.4	(Howard *et al* 1995)

Table 7: Results of the cross-matching of sample PDM-A11 and relevant reference chronologies when the first-ring date is 1607 and the last-ring date is 1685

Reference chronology	*t*-value	Reference
Little Castle, Bolsover Castle, Derbys	6.7	(Arnold *et al* 2003b)
Middleton Hall, Warwicks	5.8	(Arnold *et al* 2006a)
Brocklesby Hall, Lincs	5.4	(Arnold and Howard 2007c)
Riding House, Bolsover Castle, Derbys	5.3	(Arnold *et al* 2005)
Hulme Hall, Alostock, Cheshire	5.3	(Arnold *et al* 2003c)
Church Farm House, Ockbrook, Derbys	5.3	(Arnold and Howard 2008b)
13 Hall Gate, Diseworth, Leics	5.2	(Arnold *et al* 2008)
Combermere Abbey, Cheshire	5.1	(Howard *et al* 2003b)

Table 8: Results of the cross-matching of sample PDM-A16 and relevant reference chronologies when the first-ring date is 1683 and the last-ring date is 1732

Reference chronology	*t*-value	Reference
Hampshire county chronology	7.2	(Miles 2003)
Worcester Cathedral, Worcester	7.0	(Arnold *et al* 2003d)
Kibworth post mill, Kibworth, Leics	6.7	(Arnold *et al* 2004a)
Croome Court, Croome D'Abitot, Worcestershire	6.5	(Arnold *et al* 2004b)
Court House, Shelsley Walsh, Worcs	6.0	(Arnold *et al* 2008)
Stoneleigh Abbey, Stoneleigh, Warwicks	5.8	(Howard *et al* 2000)
Quenby Hall, Quenby, Leics	5.5	(Howard 1995 unpubl)
East Midlands Master Chronology	5.2	(Laxton and Litton 1988)

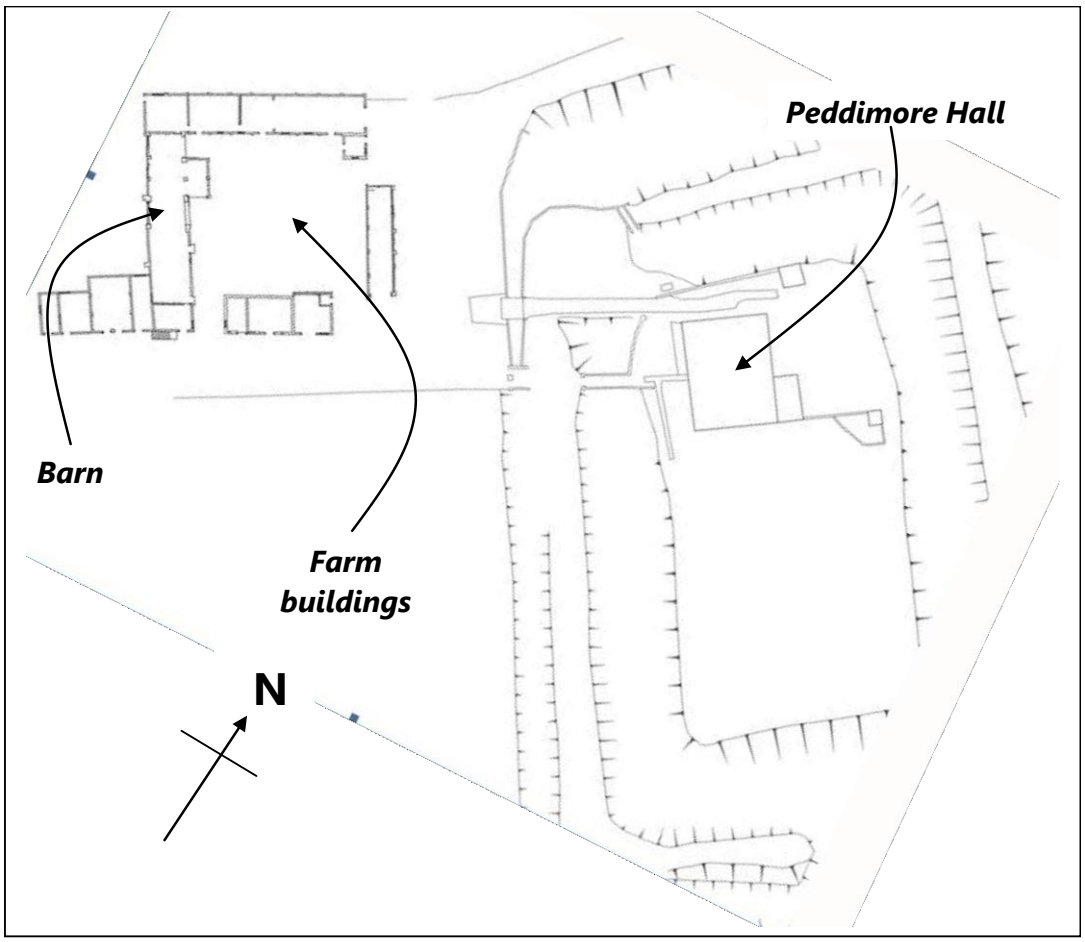


Figure 1: Arrangement of the Peddimore Hall site, showing the Hall surrounded by the double moat, with the agricultural buildings to its west (after Michael Lobb, Birmingham Archaeology)

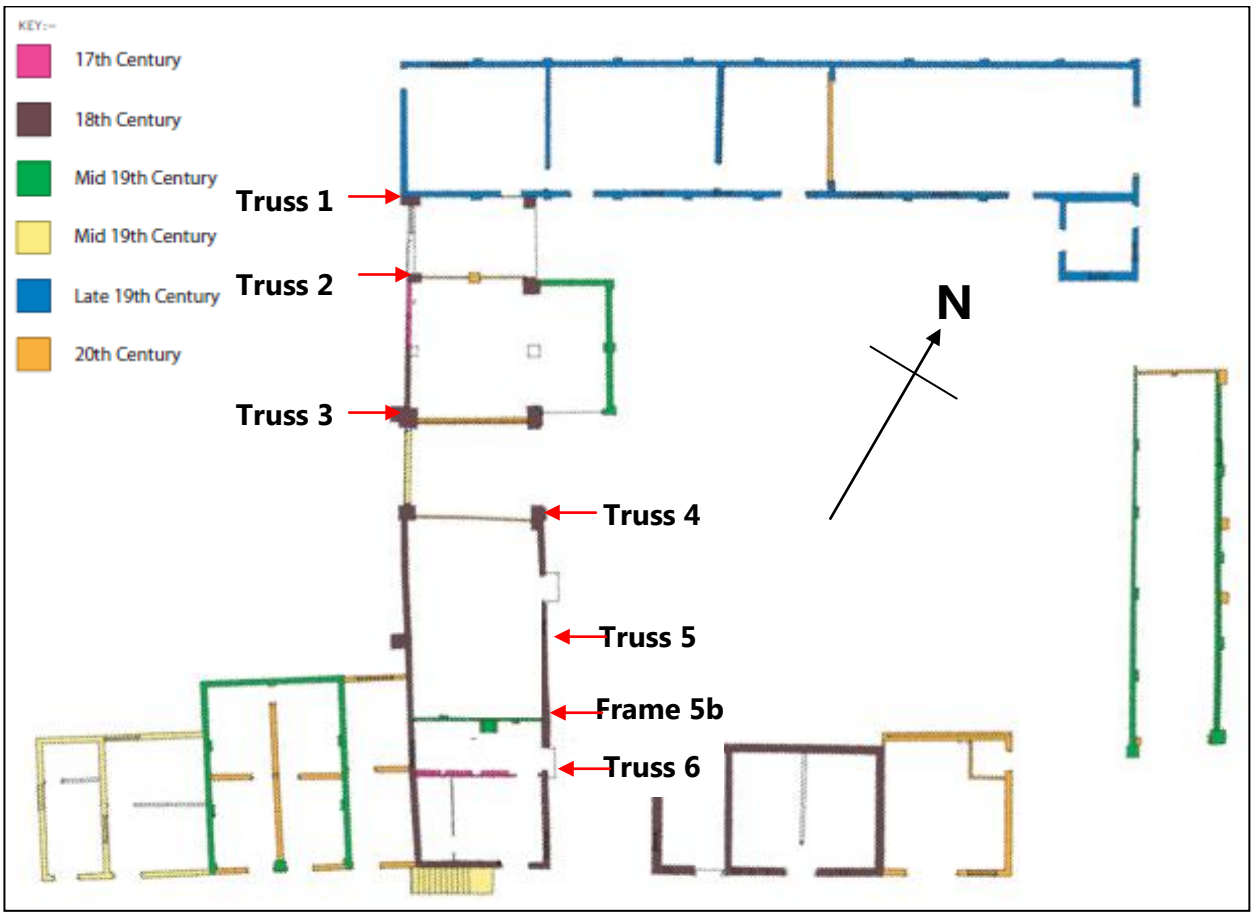
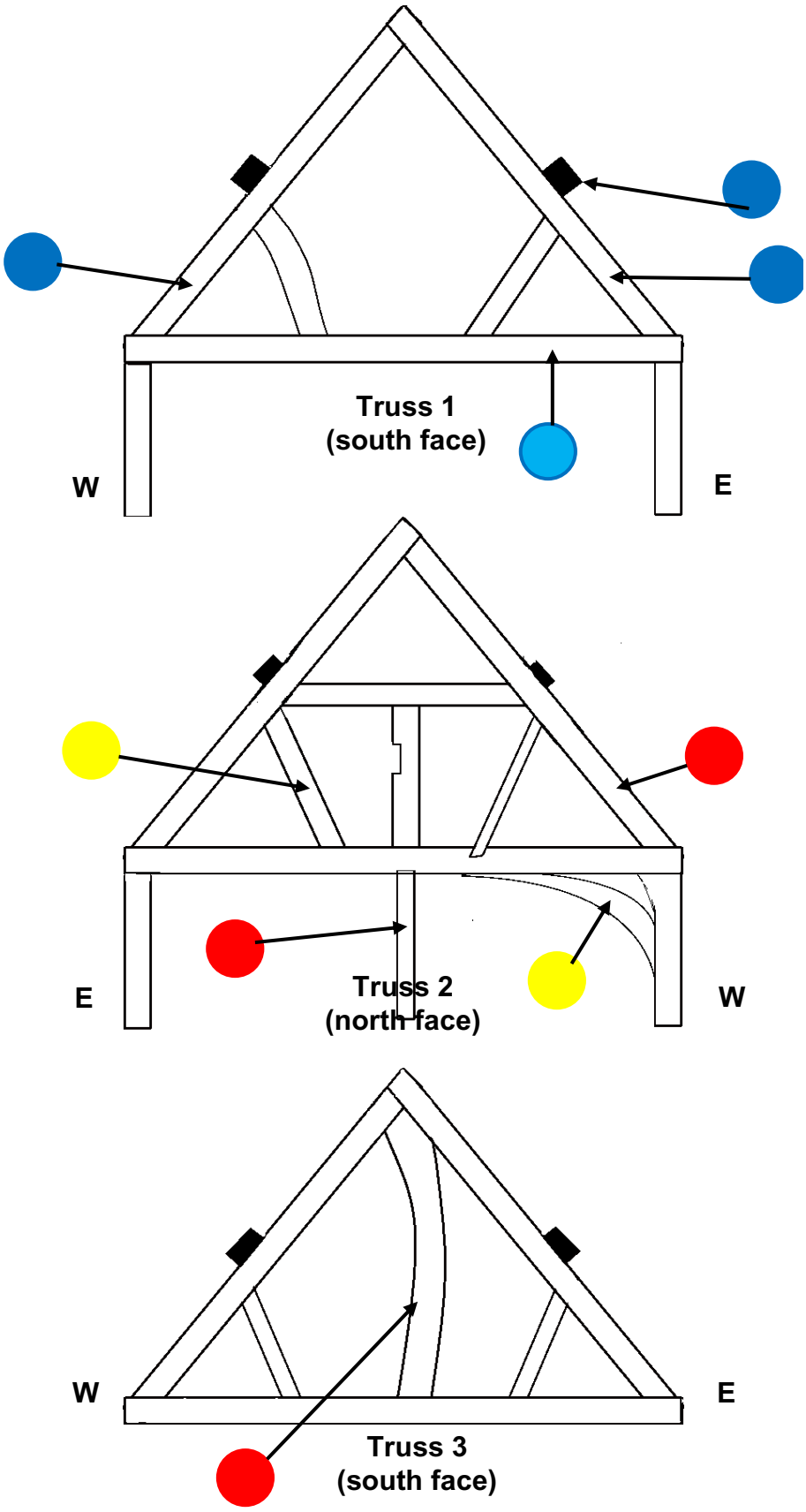
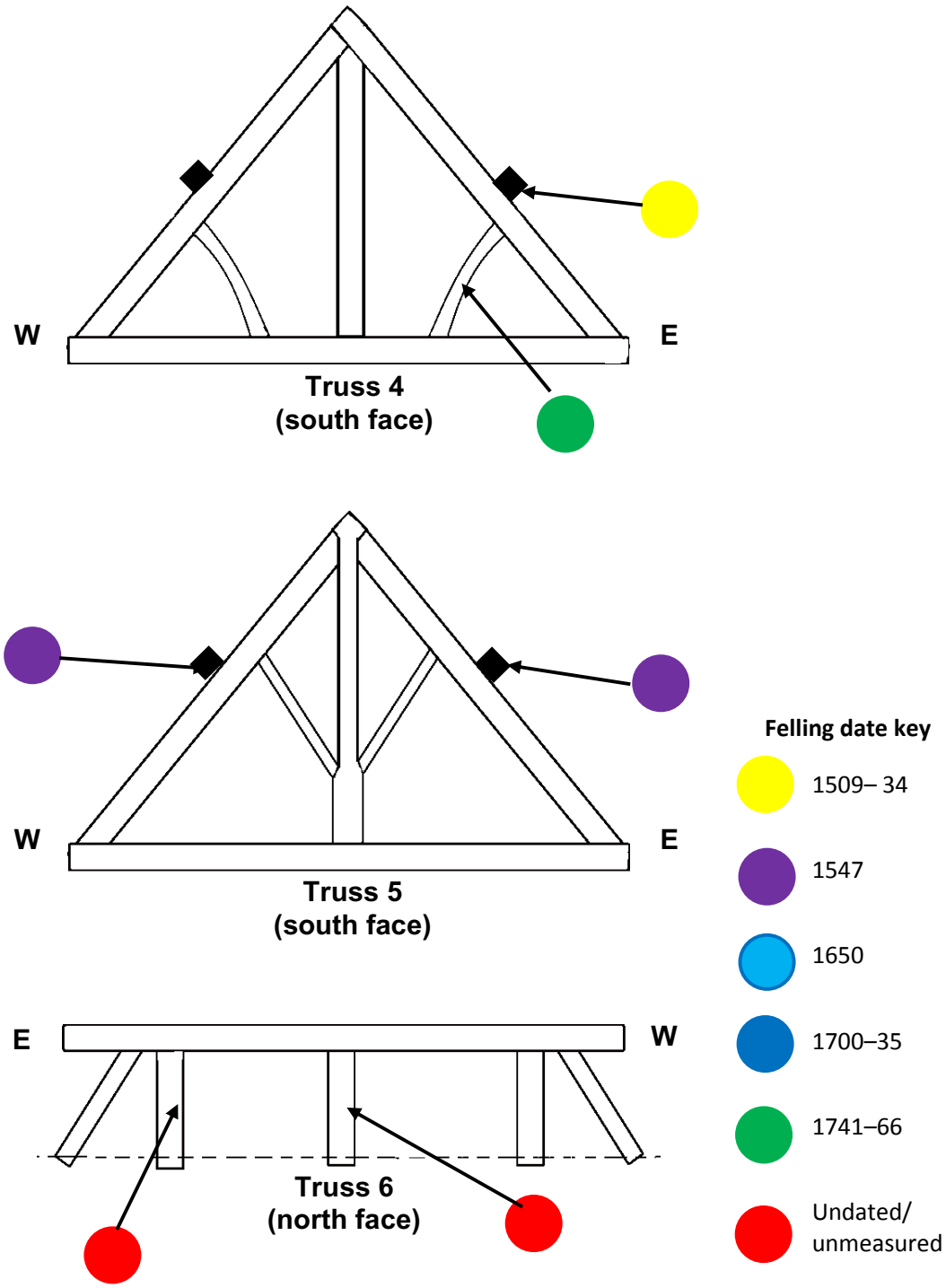


Figure 2: Plan of the timber-framed barn at Peddimore Hall, showing the position of the trusses (after Michael Lobb, Birmingham Archaeology)

Figure 3a/b: View of the north face of truss showing to show evidence of possible insertion and reuse. Notice in the upper picture the diagonal strut nailed to the tiebeam, and the archbrace from the wall post not fully morticed. In the lower picture an empty mortice can be seen in the strut, and the lower stud post at centre is again not fully morticed into the tiebeam


Truss 1
(south face)
W
E
E
Truss 2
(north face)
W
W
Truss 3
(south face)
E



Figures 4a-f. Schematic drawings of the trusses to show, where possible, the sampled timbers, colour coded by felling date/range (where dated) (see also Table 1)

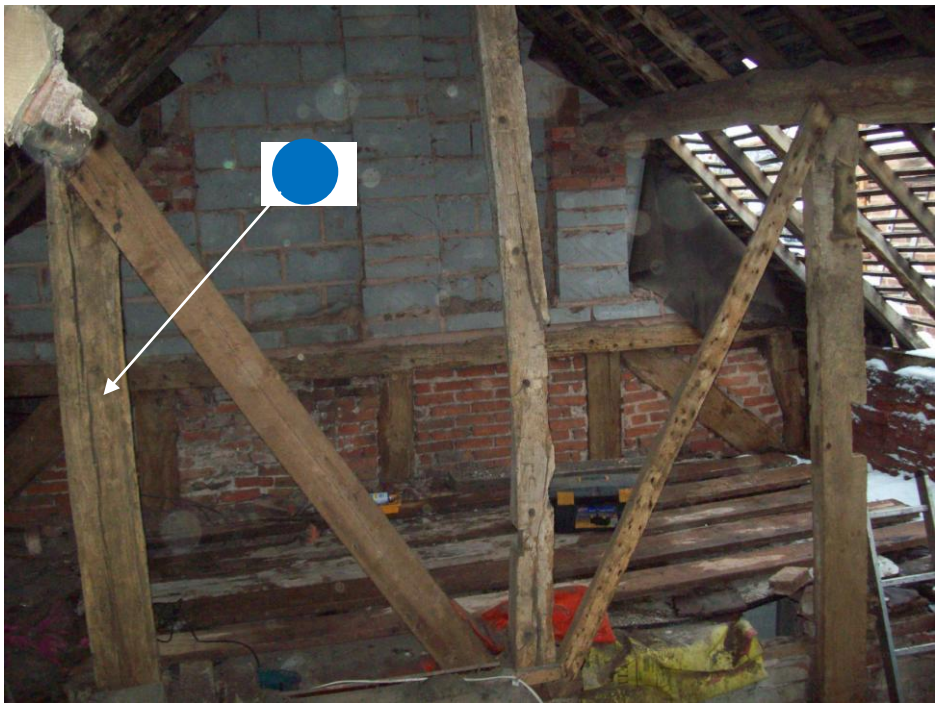
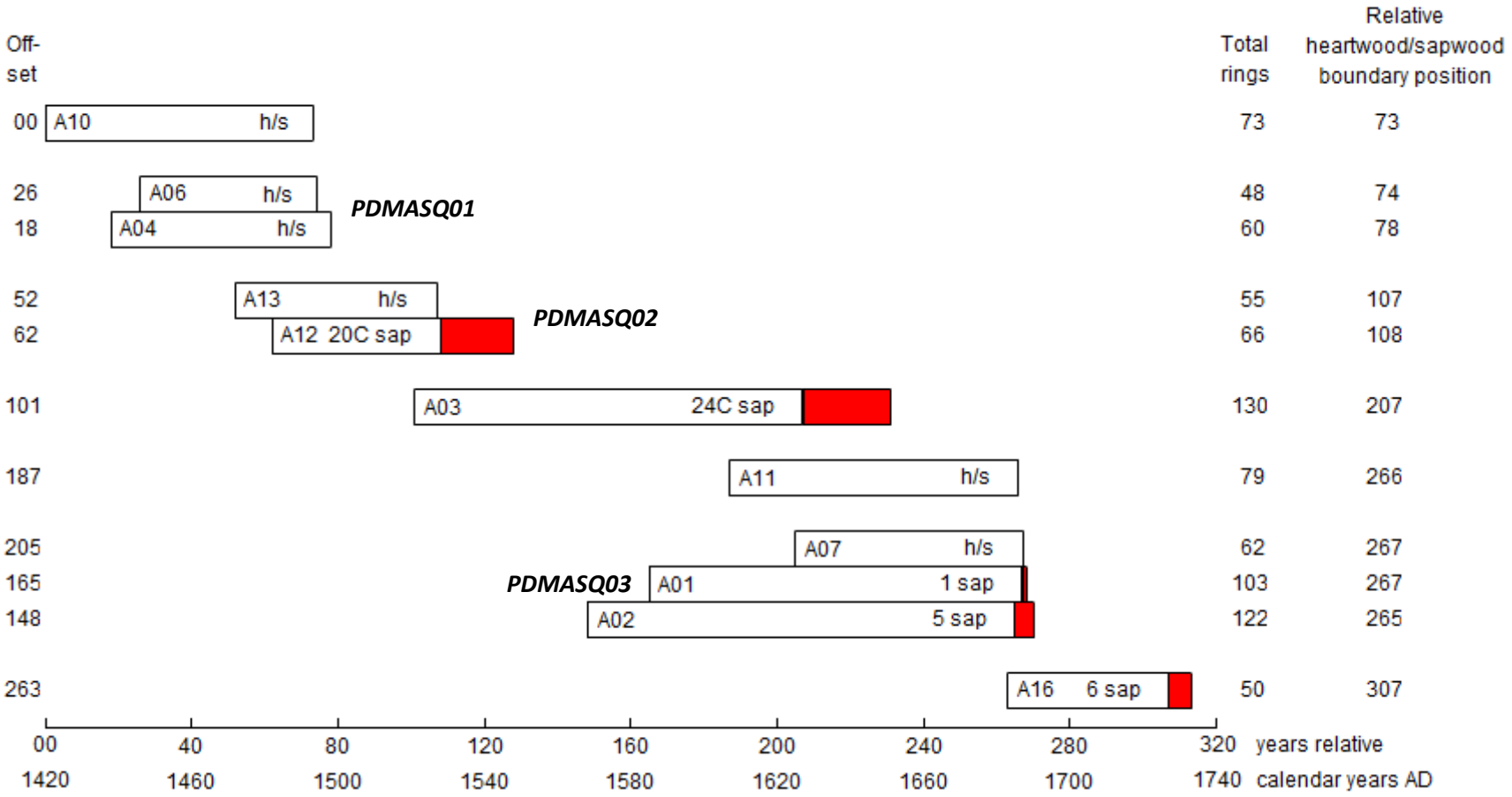


Figure 4g: View of partition frame 5b to show sampled timber (colour coded by felling date/range). Parts of the remaining portions of truss 6 may be seen just beyond it

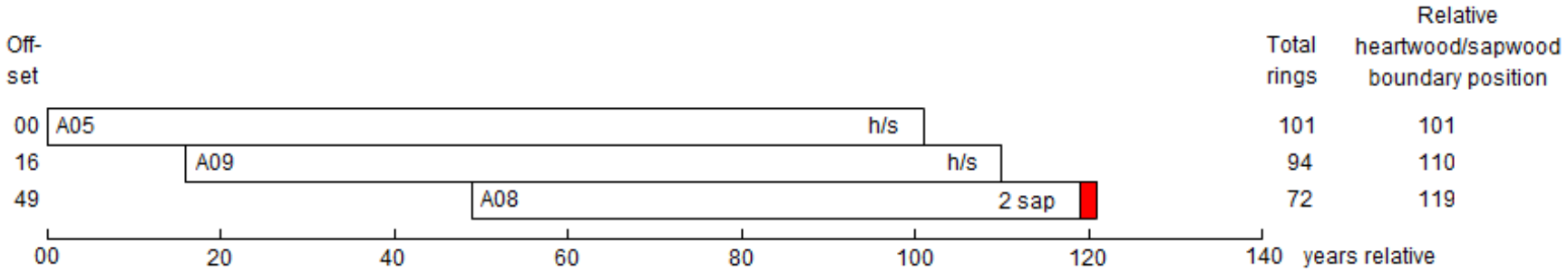


White bars ☐ *= heartwood rings, shaded bars* ■ *= sapwood rings*

h/s = the last ring of the sample is at the heartwood/sapwood boundary (only the sapwood rings are missing)

C = complete sapwood is retained on the sample. Where dated, the last measured ring is the felling date of the tree represented

Figure 5: Bar diagram of all dated samples in last ring date order



White bars ☐ *= heartwood rings, shaded bars* ■ *= sapwood rings*
h/s = the last ring of the sample is at the heartwood/sapwood boundary (only the sapwood rings are missing)

Figure 6: Bar diagram of the samples in undated site chronology PDMASQ04

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