TREE-RING ANALYSIS OF TIMBERS FROM COACH ROAD COTTAGE, STAUNTON HAROLD, LEICESTERSHIRE

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Core sample STH-F03 from the north-west purlin.
Its 94 rings span the years 1393 - 1486

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SUMMARY

Tree-ring analysis of nine out of 10 samples obtained from Coach Road Cottage (one sample having too few rings for reliable analysis) supports the view that the house has undergone periods of redevelopment, and that some timbers are reused.

Whilst the latest phase of alteration to Coach Road Cottage detected in this programme of tree-ring analysis uses timber felled between 1709 and 1734, there are also other timbers felled in the mid-seventeenth century and in the late-seventeenth century present. A further timber was felled between 1575 and 1600, and yet another as long ago as between 1501 and 1526. It is almost certain that some of these timbers are reused.

Two timbers, however, were felled in 1603, only three years earlier than the leasing of a local coal mine and the believed construction of houses in this area to accommodate colliers. It is possible, therefore, that the primary phase of the cottage must now be some 404 years of age.

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Introduction

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This is a one-and-a-half storey house built of brick and thatched (Fig 1). It began as a two-cell cottage and has been extended at both ends in several stages. It was built in the seventeenth century, perhaps about 1650, and has an internal door latch inscribed '1679'.

The house stands a little way back from the coach road, and faces west. The present entrance is on the east side which was originally the back of the house. At the north end a former stable or byre has been converted into a garage by extending it, and later the garage has become part of the house. At the south end an added kitchen has been converted by the present owner into a study.

From the north end (Fig 2a/b) of the west front the single-storey wall is of brick laid in a loose irregular bond; there is one window under a segmental arch and a blocked doorway at the end adjoining the 1½ storey house. A straight joint can be seen above the position of the south jamb of this doorway, but the blocking has been carefully tied in. The bricks of the next part of the house are smaller, measuring about 230 x 100 x 65mm, laid mostly in stretcher bond with short runs of headers here and there.

There is a three-light downstairs window with a two-light dormer set above the wall plate under the swept thatch. There is no recognisable break in the brickwork south of this and the eaves line is constant although the apex of the roof is something like 50cm higher. In this part of the house there is a blocked doorway, scarcely perceptible, and another similar three-light window and a door, with two more dormer windows - two-light and one-light - above the wall plate but not over the downstairs openings. This marks the end of the thatched roof beyond which is a single-storey tile-roofed room with a gable end chimney and a big glazed door between full-height lights to the west. The south end of the tile-roofed extension has a pair of single lights flanking the chimney; the gable of the main house can be seen above the tiled roof but has no openings.

The thatched part of the house is wider than the tiled part which has a small east window. In the main house is a small modern east window followed by a three-light window, and immediately north of that, a stone lintel marking the position of a fire-window into the inglenook that is now blocked. There are no upper windows at all on this side. The line of the house wall is now 1½m further back, and this is this place where the top of the roof becomes lower. At the junction the wall of the wider part extends further north at ground-floor level only and then slopes back over what may once have been a bread oven behind the fireplace. The next part of the house further north has a three-light window and a door put in by the present occupant. Then the wall turns east by a short distance and is built of brick on a stone plinth about 40cm high; there is one modern window in this part and two blocked slit vents. At the north end of the house an extension of about a metre long but narrowed to three metres wide has been made to take garage doors, now replaced by a window. Above this extension in the gable wall is a blocked opening, perhaps for a pitching door.

The back door in the east wall leads into the present kitchen, lit by windows east and west. There is a fireplace, now a cooking stove, in the southeast corner of the room, and the ceiling is built on a north-south beam which is very deep and quite narrow (Fig 3). The

common joists are set in with barefaced face tenons, a system Hewett dates to the fifteenth century but will here be later as we are further north, the beam is narrow and the house is unimportant.

North of the kitchen is a dining room in the former garage, which before that housed horses or cattle. There was no ceiling except a modern suspended one in spite of having a loft opening at the north end, but Mr Blunt has built a load bearing ceiling to a massive north-south beam and hopes to add a bedroom above. Along the east wall is a stone plinth rising to a height over a metre, unlike the plinth outside which is very much lower.

On the south side of the kitchen is the main living room. There was an outside door in the west wall and opposite to it is a cupboard under the stairs which run up beside the inglenook fireplace. The doorway to the stairs has a beautiful iron latch inscribed '1679', and H-hinges. From above the western end of the hearth bressummer a substantial ceiling beam runs south across this and the next room. It is a remarkable beam with bold roll mouldings that could not be later than the sixteenth century and compares with fifteenth century examples in Cambridge and late-fourteenth century examples in Essex (Hewett, English Historic Carpentry, fig 368, p 396) (Fig 4). Such a very fine beam in a relatively lowly building suggests that it is re-used from a bigger house and the present house has been built to take it. The common joists are re-set above earlier housings which have been blocked; the common joists are quite plain.

The hearth beam is a true bressummer with a splayed back scorched on the inside, but it is a re-used ceiling beam (or part of one) with housings for joists on the front which have been blocked with pieces of a former mantleshelf that had been attached to it. Inside the hearth is a modern brick fireplace replacing an earlier one and on each side of that an oak cupboard door in the back wall of the hearth. There is no sign of the former bread oven.

The adjoining room to the south, now divided into an entrance lobby near the west door and a bathroom east of it, is crossed by the moulded ceiling beam, but the common joists in the lobby, which are original, run parallel to the beam. Modern joists have been used, running the same way, to ceil the bathroom.

Finally at the south end is the added room built as a kitchen; the fireplace has been removed to convert it into a study.

The stairs go up to a landing from which a bathroom has been made on the east side, where the brick chimney hood can be seen. On the south side of the landing is a bedroom with a west dormer window, and on the north side another bedroom over the present kitchen. Here both a pair of purlins and a ridge piece are exposed, but there are no trusses, all the purlins running from wall to wall.

Historical development

The house is believed to have been built in the early-seventeenth century to house one of the colliers who leased nearby mines in 1606; the lease was only for three years and unless it was regularly renewed it is difficult to believe the colliers would have been able to afford the outlay, although the mines were very profitable. A track known as the coal road runs west on the south side of the house, and is joined by another coal road from Lount where miners also lived.

The earliest part of the house is that with the highest roofline and spanned by the re-used moulded beam; this part of the building could easily be early-seventeenth century. Two cottages recorded in Lount (DBR 111 and DBR 114) also have seventeenth century origins and are built of brick which was produced locally. This may be significant because George Shirley granted the colliers permission to build up to six cottages with some help from his estate. It is unlikely that this house was built as early as 1606 (the date of the lease) but a date near the middle of the century would be more acceptable. The re-used beams could have come from Staunton Harold Hall. There is a date on the latch of the staircase door, 1679, which is not impossible, but it was common for the shell of a house to be occupied before all the internal, non structural, fitments were in place, partly because of the need to finance the work a little at a time in the days before banking. We do not know how often the 3-year lease of the mines was renewed, but they continued to be worked for some time. Later tradition suggests that this cottage was occupied by the estate gamekeeper.

The room now the kitchen was probably part of the house from the start but perhaps not originally for domestic use. Either it was a stable or byre, or possibly a kitchen in the days when that meant a room to prepare but not to cook meals. The living room hearth, as we see from probate inventories, was often still the cooking hearth well into the eighteenth century. The kitchen was narrower and lower than the dwelling rooms, which indicates an inferior function. On the other hand, the very small southern room is hardly big enough to be a parlour, so it may have been a buttery and the present kitchen a parlour. Whatever its use was, the lower roof line cannot be easily explained.

However, this room became part of the dwelling even if it was not so originally. Then another stable was added onto the north end, probably in the early-nineteenth century, keeping the west front to the same line. This had ventilation slits and a pitching door, more appropriate for horses for the coal wagons, perhaps.

Both the south end kitchen and the conversion of the north end into a garage appear to be late-twentieth century.

Sampling

Sampling and analysis by dendrochronology of timbers from Coach Road Cottage were commissioned as part of a larger programme of research in Staunton Harold parish undertaken by the local heritage group. Under the auspices of this group a number of buildings in the locality have already been dated by dendrochronology and a fuller picture of the parish will be developed (Arnold and Howard 2007). The project has been funded by a grant from the Local Heritage Initiative.

Thus, from the roof and ground-floor ceiling timbers available a total of 10 core samples was obtained. Each sample was given the code STH-F (for Staunton Harold, site "F") and numbered 01 – 10. Given the possible historical development of the building, and the strong evidence that at least some timbers may have been re-used (ie, the moulded main ceiling beam of the living room) it was improbable that all the timbers sampled were primary and representative of the original building, but much more likely that timbers representing different phases of felling were present.

The positions of these samples were marked on the plan made by Barbara Hutton and Irene Brightmer as part of the DBR survey 276. This is reproduced here as Figure 5a/b. Details of

the samples are given in Table 1. In this Table, all trusses and the individual timbers have been numbered and/or identified on a north – south, or east – west basis, as appropriate.

The Nottingham Tree-ring Dating Laboratory would like to take this opportunity to thank Mr and Mrs Cook, for their enthusiasm with this programme of analysis and their hospitality shown during sampling. We would also like to thank Barbara Hutton and Irene Brightmer, not only for the use of their notes in the introduction above and their drawings elsewhere, but also for making arrangements for sampling.

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 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 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 10 samples obtained from Coach Road Cottage, each was prepared by sanding and polishing. It was seen at this time that one sample, STH-F08, had less than 54 rings, too few for reliable dating, and it was rejected from this programme of analysis. The annual growth-ring widths of the remaining nine samples were, however, measured, and the data were then compared with each other.

At a minimum value of *t=4.5* a single group comprising five samples could be formed, cross-matching with each other at the positions indicated in the bar diagram, Figure 6. The five cross-matching samples were combined at these indicated off-set positions to form a site chronology, STHFSQ01, with an overall length of 150 rings. Site chronology STHFSQ01 was then satisfactorily dated by repeated and consistent comparison with a number of relevant reference chronologies for oak as spanning the years 1456 to 1605. The evidence for this dating is given in the *t*-values of Table 2.

Site chronology STHFSQ01 was then compared with the four remaining measured but ungrouped samples, but there was no further satisfactory cross-matching. Each of the four remaining measured but ungrouped samples was then compared individually with the full range of reference chronologies for oak. This indicated cross-matches and dates four three of these, the evidence for these dates being given in the *t*-values of Tables 3 – 5.

Interpretation

Analysis by dendrochronology of nine measured samples from the roofs and ground-floor ceiling of Coach Road Cottage has resulted in five of them being combined to form a single dated site chronology, STHFSQ01 (150 rings long dated as spanning the years 1456 to 1605) and another three samples being dated individually.

As expected from the survey of the building and its historical development as deduced by Barbara Hutton and Irene Brightmer, and as evidenced by some of the beams, timbers representing different phases of felling have been found here.

The earliest phase of felling detected is represented by the individually dated sample STH-F03, from the north-west purlin in the main bedroom. This sample has a heartwood/sapwood transition date (ie, only the sapwood rings are missing) of 1486. Given that most oak trees have between 15 and 40 sapwood rings it is estimated that this timber was felled sometime between 1501 and 1526.

The next phase of felling is represented by sample STH-F09, from a ceiling joist in the rear entry lobby, and a constituent of site chronology STHFSQ01. This sample again retains only the heartwood/sapwood boundary (ie only the outer sapwood rings are missing), this boundary ring being dated to 1560. Again, given that most oak trees have between 15 and 40 sapwood rings it is estimated that this timber was felled sometime between 1575 and 1600.

The third phase of felling is represented by samples STH-F01 and F04, also constituents of site chronology STHFSQ01. These samples are from the south-west purlin (on the landing) and the north-east purlin (in the main bedroom) respectively. Both these samples have complete sapwood. This means that they both have the last ring produced by the trees they represent before they were felled. In both cases the last complete sapwood ring date, and thus the felling date of the trees used, is the same at 1603.

The next phase of felling is represented by samples STH-F05 and F07 from ceiling joists of the lounge, and again constituents of site chronology STHFSQ01. Both these samples retain the heartwood/sapwood boundary. In this case the average date of this boundary ring is 1597. Allowing for the same possible number of missing sapwood rings as above, 15 – 40 rings, the timbers represented are estimated to have a felling date sometime between 1612 and 1637.

The penultimate felling is represented by sample STH-F06, also from a ceiling joist of the lounge. This sample retains complete sapwood, ie the last ring produced by the tree represented, this being dated to 1672.

The final phase of felling is represented by sample STH-F02 from the south-east purlin, on the upstairs landing. This sample retains the heartwood/sapwood boundary this being dated to 1694. Using the same missing sapwood estimate as above, 15 – 40 rings, would give this timber an estimated felling date sometime between 1709 and 1734.

This analysis can be summarised below:

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	Samples	**Sample location**	**Felling date (actual or estimated)**
Phase 1	STH-F03	South-west purlin	1501 – 1526
Phase 2	STH-F09	Rear entry ceiling	1575 – 1600
Phase 3	STH-F01 / 04	Purlins	1603
Phase 4	STH-F05 / 07	Lounge ceiling	1612 – 1637
Phase 5	STH-F06	Lounge ceiling	1672
Phase 6	STH-F02	Purlin	1709 – 1734

Conclusion

It is clear that the tree-ring dating supports the view obtained from the structural survey that this building has undergone a number of alterations and changes. Remarkably, however, we do have two timbers (STH-F01 and F04) which were felled in 1603, close to the date at which the cottage is believed to have been built to house one of the colliers who leased nearby mines. The earlier felling dates for two timbers (STH-F03 and F09), may represent older material salvaged and reused either in the primary early-seventeenth century construction, or in one of the subsequent alteration phases.

The use of material felled later (STH-F05, F07, and F06) may represent the date of subsequent developments to the building. It is possible, however, that these timbers represent material salvaged and reused in the early eighteenth century phase represented by sample STH-F02.

Given the wide date range of material detected here and the low number of samples per phase, it is not possible to be precise as to where the timbers used in this building have come from. However, as can be seen from Tables 2 – 5 which list the reference chronologies against which the samples have been dated, the best matches are with reference material from other sites in Leicestershire, Derbyshire and Nottinghamshire. The implication is that, not unexpectedly, the timbers are of reasonably local origin.

One sample, STH-F10, remains undated, despite having sufficient rings for reliable analysis. This is not uncommon in tree-ring dating. Although showing no signs of distressed, distorted, or compacted rings, it is not unusual to have some samples undated.

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Table 1: Details of tree-ring samples from Coach Road Cottage, Staunton Harold, Leicestershire

Sample number	Sample location	Total rings	Sapwood rings*	First measured ring date (AD)	Last heartwood ring date (AD)	Last measured ring date (AD)
STH-F01	South-west purlin (on landing)	137	34C	1467	1569	1603
STH-F02	South-east purlin (on landing)	105	h/s	1590	1694	1694
STH-F03	North-west purlin (in bedroom)	94	h/s	1393	1486	1486
STH-F04	North-east purlin (in bedroom)	148	31C	1456	1572	1603
STH-F05	Lounge ceiling, west joist 3 from north	131	h/s	1465	1595	1595
STH-F06	Lounge ceiling, west joist 4 from north	107	33C	1566	1639	1672
STH-F07	Lounge ceiling, west joist 5 from north	110	7	1496	1598	1605
STH-F08	Lounge ceiling, east joist 3 from north	nm	---	------	------	------
STH-F09	Rear hall ceiling, joist 1 from east	82	h/s	1479	1560	1560
STH-F10	Kitchen, main ceiling beam	98	3	------	------	------

*h/s = heartwood/sapwood boundary

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

nm = sample not measured

Table 2: Results of the cross-matching of site chronology STHFSQ01 and relevant reference chronologies when the first-ring date is 1456 and the last-ring date is 1605

Reference chronology	*t*-value	Reference
Donington-le-Heath Manor House, Leics	8.2	(Esling *et al* 1989)
Church of St Andrew, Welham, Leics	7.5	(Arnold *et al* 2005)
East Midlands Master Chronology	7.4	(Laxton and Litton 1988)
Gotham Manor, Gotham, Notts	7.4	(Howard *et al* 1991)
Chapel of the Holy Trinity (pews) Staunton Harold, Leics	7.4	(Howard *et al* 1996)
Moor Farm Cottage (south) Shardlow, Derbys	6.5	(Howard *et al* 1994)
England Master chronology	6.2	(Baillie and Pilcher 1982 unpubl)
Wales and West Midlands	5.1	(Siebenlist-Kerner 1978)

Table 3: Results of the cross-matching of sample STH-F02 and relevant reference chronologies when the first-ring date is 1590 and the last-ring date is 1694

Reference chronology	*t*-value	Reference
Bolsover Castle (riding house), Derbys	7.2	(Howard *et al* forthcoming)
East Midlands Master Chronology	6.8	(Laxton and Litton 1988)
Bolsover Little Castle, Bolsover, Derbys	6.5	(Arnold *et al* 2003)
Potterdike House, Lombard St, Newark, Notts	6.4	(Arnold *et al* 2002)
Hulme Hall, Allostock, Cheshire	6.0	(Arnold *et al* 2003)
England Master chronology	6.0	(Baillie and Pilcher 1982 unpubl)
Bretby Hall, Bretby, Derbys	5.9	(Howard *et al* 1999)
Leicester Castle Great Hall, Leics	5.3	(Laxton *et al* 1984)

Table 4: Results of the cross-matching of sample STH-F03 and relevant reference chronologies when the first-ring date is 1393 and the last-ring date is 1486

Reference chronology	*t*-value	Reference
Thatched Cottage, Melbourne, Derbys	7.6	(Howard *et al* 1997)
Hagworthingham Church, Lincs	7.3	(Laxton *et al* 1984)
Lounge opencast coal pit, Coleorton, Leics	7.0	(Howard *et al* 1992)
Gotham Manor, Gotham, Notts	6.5	(Howard *et al* 1991)
Leicester Castle Great Hall, Leics	6.5	(Laxton *et al* 1984)
SW Transept roof, Lincoln Cathedral	6.4	(Laxton *et al* 1984)
MC10---H	5.3	(Fletcher 1978)
Wales and West Midlands	5.2	(Siebenlist-Kerner 1978)

Table 5: Results of the cross-matching of sample STH-F06 and relevant reference chronologies when the first-ring date is 1566 and the last-ring date is 1672

Reference chronology	*t*-value	Reference
Stoneleigh Abbey, Stoneleigh, Warwicks	7.9	(Howard *et al* 2000)
Bretby Hall, Bretby, Derbys	6.8	(Howard *et al* 1999)
Lowdham Old Hall, Lowdham, Notts	5.9	(Howard *et al* 1992)
Old Hall, Church Broughton, Derbys	5.8	(Howard *et al* 1993)
Chapel of the Holy Trinity (pews) Staunton Harold, Leics	5.5	(Howard *et al* 1996)
Brewhouse Yard Museum, Nottm	5.4	(Howard *et al* 1994)
Sherwood Trees	5.0	(Laxton and Litton 1988)
East Midlands Master Chronology	4.7	(Laxton and Litton 1988)