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

TREE-RING ANALYSIS OF TIMBERS FROM LOW FARMHOUSE, CHURCH LANE, MAPLEBECK, NOTTINGHAMSHIRE

June 2007

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SUMMARY

Dendrochronological analysis undertaken at this building on timbers of the main roof, the roof of the stair turret, and several timbers from the ground and first-floor, resulted in the dating of 17 of them.

The earliest date gained was for a beam in the upstairs hall which was felled some time within the range AD 1301–21. Three roof timbers in the main roof, including one from the remains of the smoke hood, were dated to AD 1587, with many of the other roof timbers also thought to be this date. The stair turret roof is now known to contain one timber felled within the range AD 1519–39, a second timber was felled in AD 1570, and a third has a felling date range consistent with it having been felled in AD 1587. Two wall posts, one from within the main range and one in the stair turret are also thought to have been felled in AD 1587. Several components of wall framing have also been dated to *terminus post quems* (date after which) of AD 1537 (one sample) and AD 1553 (three samples). A ground-floor ceiling beam has a *terminus post quem* felling of AD 1555.

Prior to tree-ring analysis being undertaken at this building it was believed to date to the seventeenth century. It is now thought likely that the structure and roof of both the main range and the stair turret are constructed from timbers felled in the late-sixteenth century. It has also been shown to contain a fourteenth-century timber which is thought most likely to represent a reused timber. There is also evidence for reused and/or stockpiled timber in the stair turret roof.

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Introduction

This Grade II listed farmhouse, located within the district of Newark and Sherwood (Figs 1 and 2), is basically of L-shaped plan with two gabled rear wings. The building is of timber-framed and rubble construction with brick noggin and underbuild,

The main range is orientated broadly north-south, is of two storeys, and hipped at the north end. To the rear left (or south) is a further range, orientated east-west. To the rear right (north) is a stair turret (Fig 3) within which is a seventeenth-century dogleg staircase with turned balusters. There is a relatively recent single storey addition to the right of this.

The main north-south range is covered by a single roof of eight common rafter trusses with collars, and single purlin to each slope (Fig 4). Between trusses five and six are the remains of a smoke hood (Fig 5). The roof over the stair turret consists of a single principal rafter truss with collar, common rafters between, and a single purlin to each slope. The roof over the second gabled rear wing appears to be a relatively recent replacement.

In its listing description the building is dated to the seventeenth century with nineteenth-century additions.

Tree-ring Sampling

A total of 25 timbers were sampled from various areas in the building. Each core sample was given the code MPB-A (for Maplebeck, site 'A') and numbered 01–25. Thirteen of these samples (MPB-A01–12 and MPB-A17) were taken from the main roof, including one from the smoke hood (MPB-A11) and one from a floor joist (MPB-A12). A further four samples were taken from the small roof over the stair (MPB-A13–16). The remaining samples (MPB-A18–25) were taken from timbers of the main structure of the building and ceiling beams. The location of each sample was noted at the time of sampling and these have been marked on Figures 6–10. Further details can be found in Table 1.

Principles of Tree-ring Dating

Tree-ring dating relies on a few simple, but quite fundamental, principals. 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 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, 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 is 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 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 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 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.

Analysis and Results

At this point it was found that four of the samples taken from the main roof and one from the stair roof had too few growth rings to make secure dating a possibility and so these were discarded prior to preparation and analysis. The other 20 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 18 samples forming three groups.

Firstly, 12 samples matched each other and were combined at the relevant offset positions to form a site sequence of 203 rings (Figs 11). This site sequence, MPBASQ01, was then compared against a series of relevant reference chronologies where it was found to have a consistent match at a first ring date of AD 1385 and a last-ring date of AD 1587. The evidence for this dating is given by the *t*-values in Table 2.

Secondly, four samples matched each other and were combined at the relevant offset positions to form a site sequence of 142 rings (Fig 12). This site sequence, MPBASQ02, was again compared against the reference chronologies where it was found to span the period AD 1429–1570. The evidence for this dating is given by the *t*-values in Table 3.

Two samples, taken from common rafters in the main roof, grouped to form a site sequence, MPBASQ03, of 56 rings (Fig 13). Attempts to match this site sequence against the reference material proved unsuccessful and it remains undated.

Attempts to date the remaining two ungrouped samples by individually comparing them against the reference material resulted in sample MPB-A19, from the ceiling of the upstairs hall, being found to have a first-ring date of AD 1165 and a last-measured ring date of AD 1286 (Table 4). The other sample could not be matched and remains undated.

Interpretation

Tree-ring analysis undertaken on 20 timbers from the main and stair roofs and from a number of other timbers throughout this building has resulted in the dating of two site sequences and one individual sample. In an attempt to clarify these results they have been dealt with by area below.

The main roof:

Six samples taken from the roof over the main building were successfully dated. Three of these have complete sapwood and the last measured ring date of AD 1587, the felling date of the three timbers represented. Two further dated samples have the heartwood/sapwood boundary ring which is broadly contemporary suggesting they were felled at the same time as each other. The average heartwood/sapwood boundary ring date for these two samples is AD 1560, which allows an estimated felling date to be calculated for them of AD 1575–95, consistent with these timbers also having been felled in AD 1587. The final dated sample from the main roof (MPB-A17), taken from a wallplate, does not have the heartwood/sapwood boundary ring and so a felling date cannot be calculated, except to say that with a last-measured ring date of AD 1561 this would be estimated to be AD 1577 at

the earliest.

Stair turret roof:

Three samples from the timbers of this roof have been dated. One of these (MPB-A13), taken from a principal rafter, has complete sapwood and the last measured ring date of AD 1570, the felling date of the timber represented. The other two dated samples both have the heartwood/sapwood boundary ring, the dates of which suggests separate fellings for the two timbers. Sample MPB-A15, taken from a purlin, has the heartwood/sapwood boundary ring date of AD 1504, giving an estimated felling date range of AD 1519–39. Sample MPB-A14, taken from a principal rafter, has the heartwood/sapwood boundary ring date of AD 1563, giving an estimated felling date range of AD 1578–98, consistent with a felling of AD 1587.

Structure:

Two wall posts, one from within the main building and one from within the stair turret, have been dated. Both these samples have the heartwood/sapwood boundary ring which is broadly contemporary, suggestive of single felling. The average of these two heartwood/sapwood boundary ring dates is AD 1567, giving an estimated felling date for the two timbers represented of AD 1582–1602, consistent with an AD 1587 felling. One sample (MPB-A20), taken from a stud in the bathroom, has a last measured ring date of AD 1522, but without the heartwood/sapwood boundary ring date a felling date cannot be calculated for the timber represented, except to say this would be estimated to be AD 1538, at the earliest. Three samples, taken from wall framing between bedrooms 1 and 2, also do not have the heartwood/sapwood boundary ring date. With the assumption that these three timbers would have been felled at the same time, if we take the one with the latest last-measured ring date (MPB-A23) of AD 1538, this would give an earliest possible felling date of AD 1554 for the three timbers represented. The four *terminus post quem* fellings estimated for these samples do not preclude them also having been felled in AD 1587.

The last two dated samples are MPB-A19 from the upstairs hallway and MPB-A25 from a ground-floor ceiling beam. Sample MPB-A19 has the heartwood/sapwood boundary ring date of AD 1286 which gives an estimated felling date range of AD 1301–21 for the timber represented. Sample MPB-A25 does not have the heartwood/sapwood boundary ring date but with a last measured ring date of AD 1540, this is estimated to be AD 1555 at the earliest.

All felling dates have been calculated using the estimate that 95% of mature oak trees in this area have between 15–35 sapwood rings.

Discussion

Tree-ring analysis has shown that the roof over the main range of the building contains at least three timbers which were felled in AD 1587, with a number of the other roof timbers having a felling date or *terminus post quem* consistent with them also having been felled in AD 1587. Roof timbers have been dated from along the whole length of this roof with the results pointing to it being a single structure rather than being the result of several phases of construction. One of the timbers dated to AD 1587 is from the remains of the smoke hood, which suggests that the smoke hood is original to the extant roof. Therefore, it is thought

likely that both the roof and the smoke hood were constructed in or soon after AD 1587.

Timbers were also dated in the roof over the stair turret. One of these, taken from a principal rafter, has been dated to a felling of AD 1570 with a second principal rafter having a felling date range consistent with it having been felled in AD 1587. A purlin has been dated to a felling of AD 1519–39. A possible explanation for the different dates gained for the timbers of this roof could be that construction occurred in or soon after AD 1587, as demonstrated by one of the principal rafters, at the same time as the main roof, but utilised some stockpiled and/or reused timber. Although obvious signs of reuse were not noted on the purlin it may be that further inspection might identify this. It is unfortunate that only three samples have been dated from this roof with each being thought likely to have a different felling. If the opportunity arises in the future it might be useful to see if further samples can be taken from this roof or from timbers lower down within the stair turret structure in an effort to clarify the date of this part of the building.

Several timbers within the structure of the building have also been dated. Two wall posts, one from the main range and one from the stair turret have a felling date range consistent with them having been felled in AD 1587. A stud from wall framing in the bathroom has a *terminus post quem* of AD 1536 and three timbers from wall framing between bedrooms 1 and 2 have a *terminus post quem* felling of AD 1568. These *terminus post quem* fellings do not preclude these timbers also having been felled in AD 1587. A beam in the upstairs hallway has been dated to within the range AD 1301-21. The most plausible explanation for the discovery of such a substantially earlier beam is that it is reused from another building. Finally, a ground-floor ceiling beam has also been dated to a *terminus post quem* felling of AD 1555. Again, this date does not eliminate the possibility that this timber was also felled in AD 1587 and is, therefore, contemporary with the rest of the building.

Conclusion

Tree-ring dating has shown that rather than dating to the seventeenth century, it now seems likely that the majority of the structure and roof of both the main range and the stair turret of this building are actually built from timbers felled in the late-sixteenth century. It has also been shown to contain at least one timber from the fourteenth century which it is suggested is reused. There is further evidence for the use of reused and/or stockpiled timber in the stair turret roof. It is hoped that these results will have shed some light on the origins of this interesting property, having clearly shown it to be somewhat earlier than previously believed.

Acknowledgements:

This work was commissioned and funded by Mr and Mrs Thurgarland, the owners of the building who wished to have a greater understanding of the development of their home.

Table 1: Details of samples from Low Farmhouse, Maplebeck, Nottinghamshire

Sample number	Sample location	*Total rings	**Sapwood rings	First measured ring date (AD)	Last heartwood ring date (AD)	Last ring date (AD)
Main Roof						
MPB-A01	East principal rafter, truss 4	56	27C	1532	1560	1587
MPB-A02	West principal rafter, truss 5	NM	--	----	----	----
MPB-A03	Hip rafter 7	53	07	1521	1566	1573
MPB-A04	West purlin, bay 1	NM	--	----	----	----
MPB-A05	East common rafter 3, bay 1	44	22	1532	1553	1575
MPB-A06	West common rafter 3,bay 2	60	13	----	----	----
MPB-A07	East common rafter 1, bay 6	50	18	----	----	----
MPB-A08	East common rafter 1, bay 7	48	27C	1540	1560	1587
MPB-A09	West common rafter 2, bay 8	NM	--	----	----	----
MPB-A10	East common rafter 2, bay 8	NM	--	----	----	----
MPB-A11	Smoke hood, mid beam	86	12C	1502	1575	1587
MPB-A12	Attic floor joist	44	--	----	----	----
MPB-A17	East wallplate	119	--	1443	----	1561
Stair Roof						
MPB-A13	North principal rafter, truss 1	111	18C	1460	1552	1570
MPB-A14	South principal rafter, truss 1	86	06	1484	1563	1569
MPB-A15	South purlin	94	h/s	1411	1504	1504
MPB-A16	North purlin	NM	--	----	----	----
Ground and First-Floor Timbers						
MPB-A18	Bedroom 3, wall post (VI)	82	04	1497	1574	1578
MPB-A19	Upstairs hall, ceiling beam	122	h/s	1165	1286	1286
MPB-A20	Bathroom, east wall, mid stud	87	--	1436	----	1522
MPB-A21	Bedroom 1, south wall, mid stud	111	--	1385	----	1495
MPB-A22	Bedroom 1, south wall, east stud	71	--	1440	----	1510
MPB-A23	Bedroom 1, south wall, west brace	59	--	1480	----	1538
MPB-A24	Stairwell, north-east post	99	h/s	1461	1559	1559

MPB-A25	Study, main north-south ceiling beam	112	--	1429	----	1540

*NM = not measured; **h/s = the heartwood/sapwood boundary is the last ring on the sample; C = complete sapwood on sample, last measured ring is the felling date

Table 2: Results of the cross-matching of site sequence MPBASQ01 when the first-ring date is AD 1385 and a last-ring date of AD 1587

Reference chronology	Span of chronology (AD)	*t*-value
East Midlands	AD 882–1981	10.4
England	AD 401–1981	8.6
21 Church St, Mansfield, Notts	AD 1439–1584	9.5
Mansfield Woodhouse Priory, Notts	AD 1432–1579	9.4
5 Church Street, Newark, Notts	AD 1403–1655	8.5
Moor Farm Cottage, Shardlow, Derbys	AD 1434–1614	8.0
Manor House, Sutton in Ashfield, Notts	AD 1441–1656	8.1
Sherwood Trees	AD 1426–1981	8.1

Table 3: Results of the cross-matching of site sequence MPBASQ02 when the first-ring date is AD 1429 and the last-ring date is AD 1570

Reference chronology	Span of chronology (AD)	*t*-value
Langhord by Holme Notts	AD 1451–1608	10.4
Sherwood Trees	AD 1426–1981	9.6
Mansfield Woodhouse Priory, Notts	AD 1432–1579	8.2
Church Farm, Main Street, Hayton, Notts	AD 1439–1567	6.8
Langford Manor, Notts	AD 1467– 1632	6.8
5 Church Street, Newark,Notts	AD 1403–1655	6.8
Moor Farm Cottage, Shardlow, Derbys	AD 1434–1614	6.5
All Saints, Fenton, L:incs	AD 1434– 1617	5.7

Table 4: Results of the cross-matching of sample MPB-A19 when the first-ring date is AD 1165 and a last-ring date of AD 1286

Reference chronology	Span of chronology (AD)	*t*-value
East Midlands	AD 882–1981	7.5
The Hollies, Bathley, Notts	AD 1150–1295	9.4
40-44 Castlegate, Newark, Notts	AD 1169–1330	9.2
Old White Hart	AD 1142–1312	7.8
40-44 Cartergate, Newark, Notts	AD 1134–1353	7.0
Kenilworth Castle Gatehouse	AD 1092–1332	5.9
Severns Castle Rd Nottm	AD 1030–1334	5.8
22/4 Kirkgate, Newark,Notts	AD 1177–1337	5.5

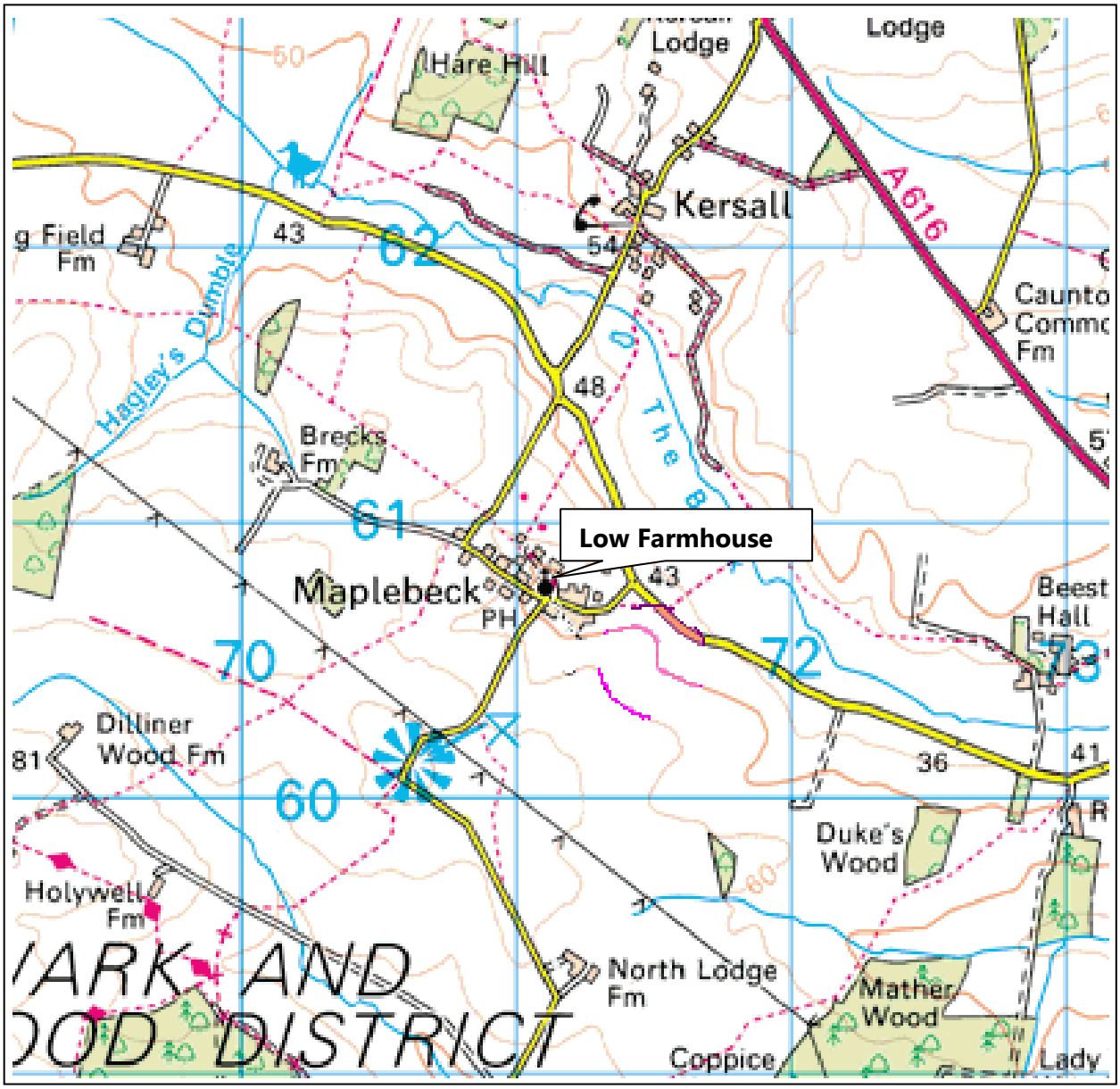


Figure 1: Map to show the general location of Low Farmhouse, Maplebeck, Nottinghamshire

Figure 2: Low Farmhouse, front of property

Figure 3: Rear of the property, with the gabled stair turret in the centre

Figure 4: Roof over the main range

Figure 5: Remains of the smoke hood

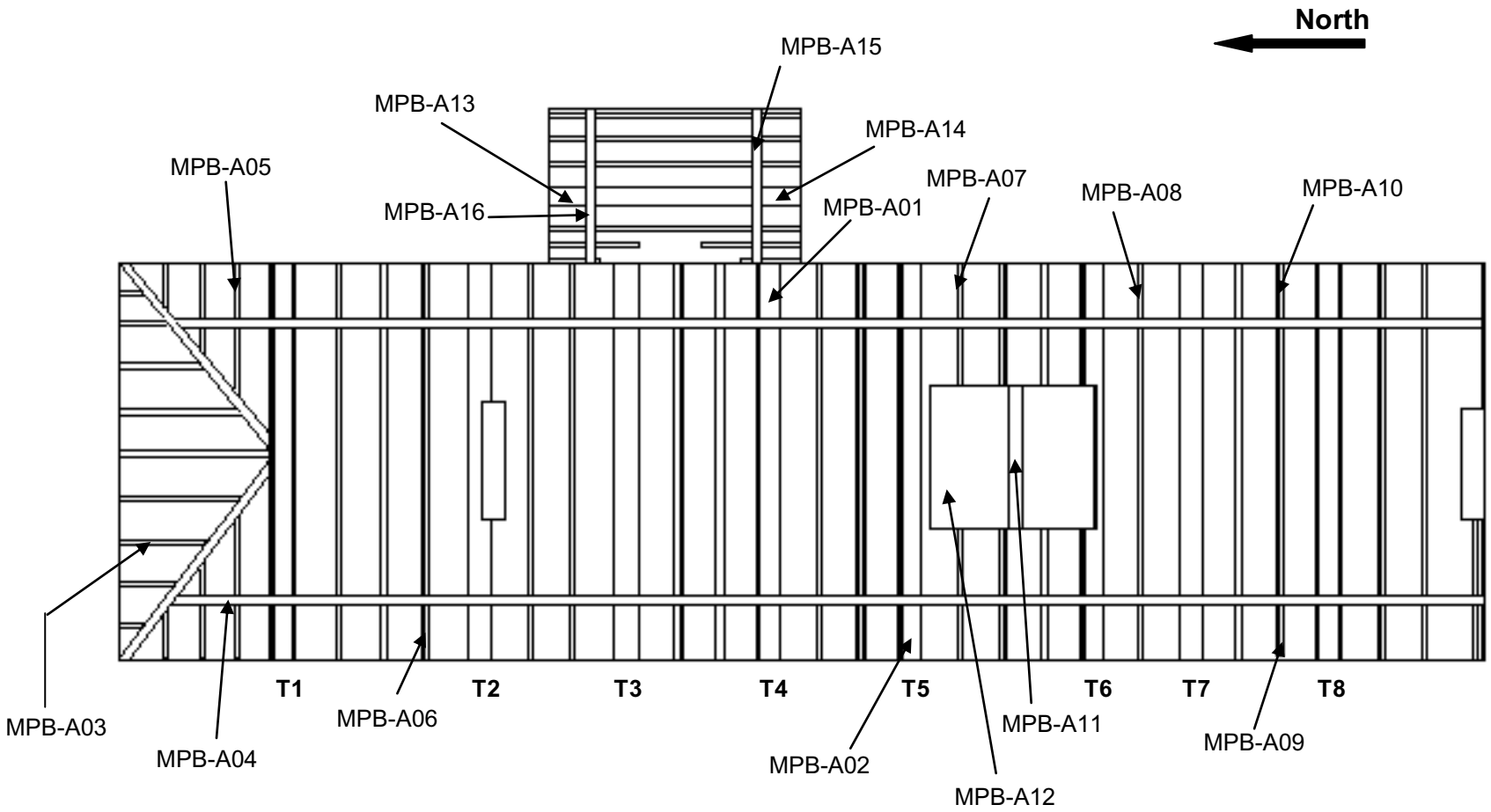


Figure 6: Sketch plan of the roof, showing the location of samples MPB-A01-16

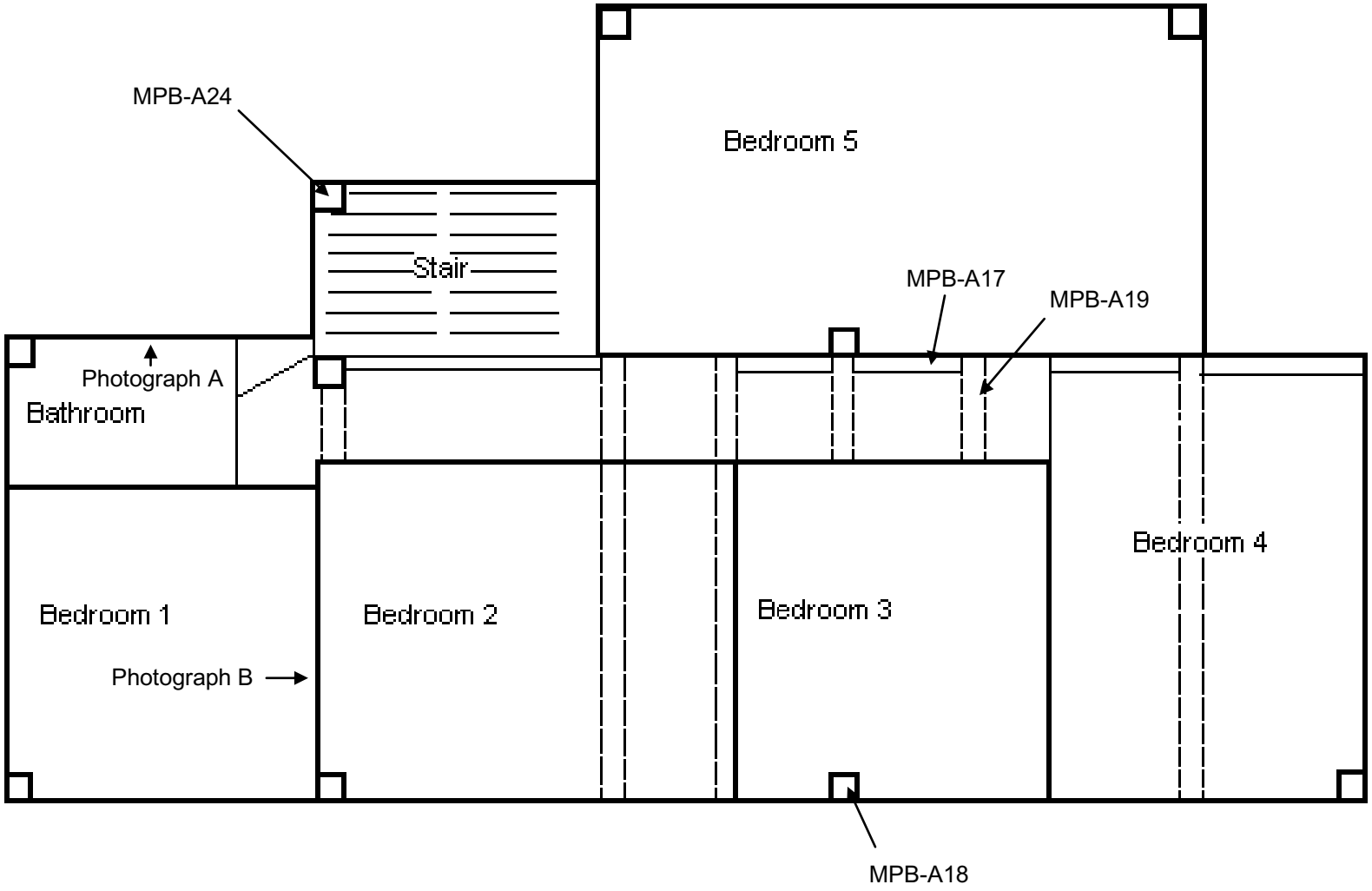
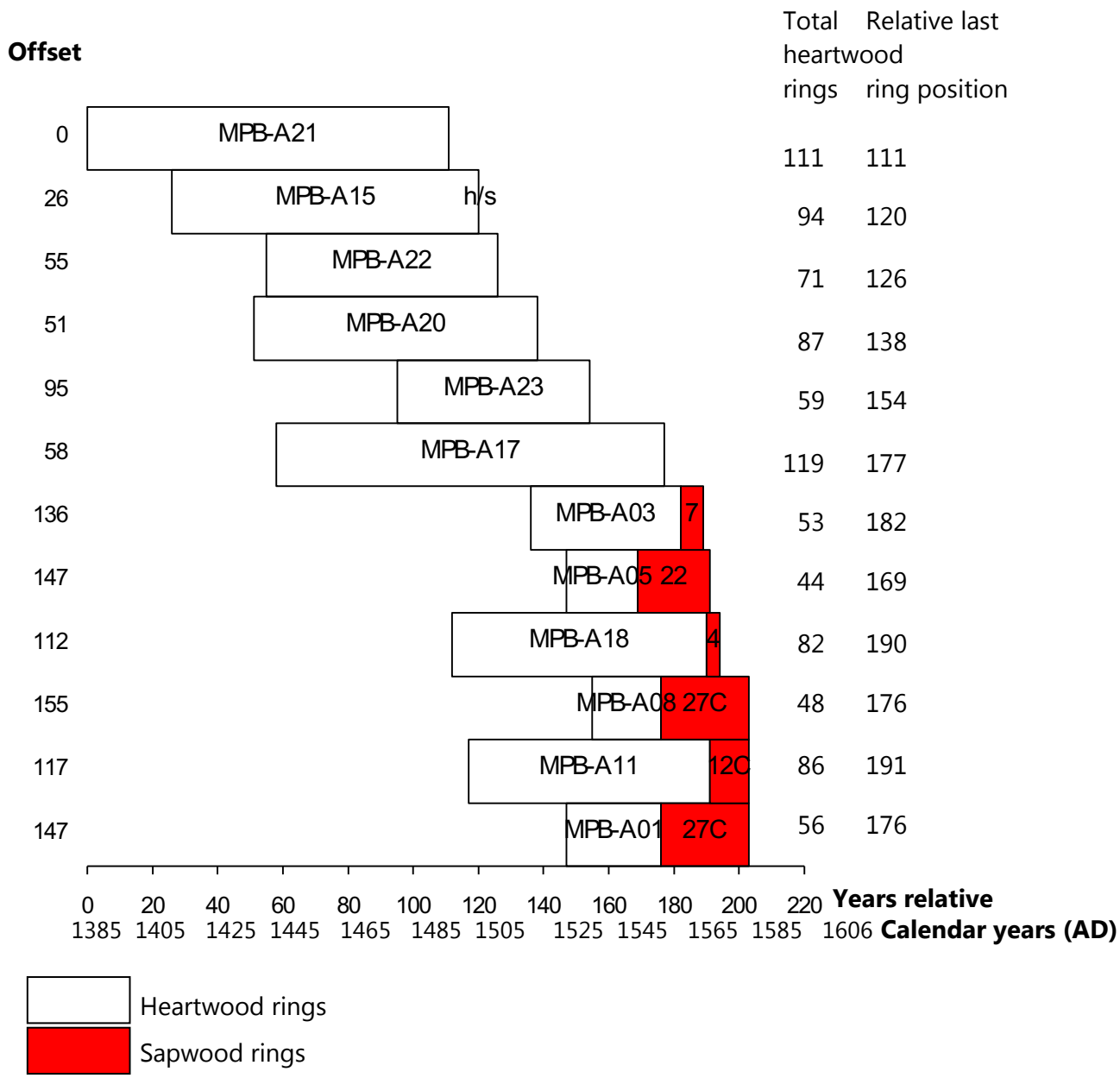


Figure 7: Schematic plan of the first floor, showing the location of samples MPB-A17-19 and MPB-A24

Figure 8: Photograph A, framing in bathroom, showing the location of samples MPB-A20

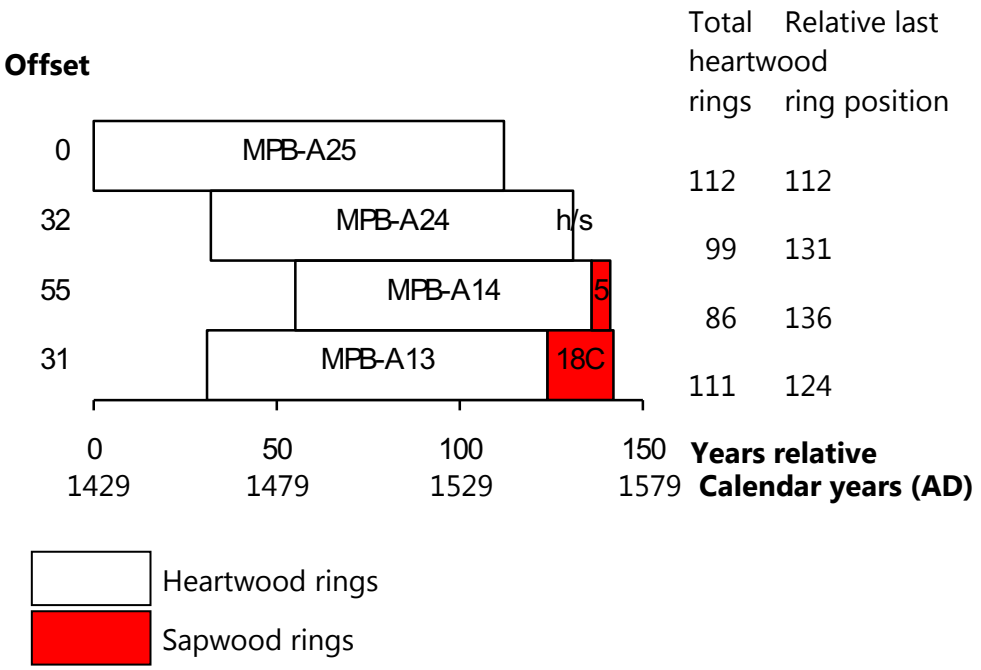
Figure 9: Photograph B, framing in bedroom 1, showing the location of samples MPB-A21-3

Figure 10: Study, ceiling, showing the location of sample MPB-A25



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

Figure 11: Bar diagram of samples in site sequence MPBASQ01



h/s = heartwood/sapwood boundary is the last measured ring
C = complete sapwood retained on sample, last measured ring is the felling date

Figure 12: Bar diagram of samples in site sequence MPBASQ02

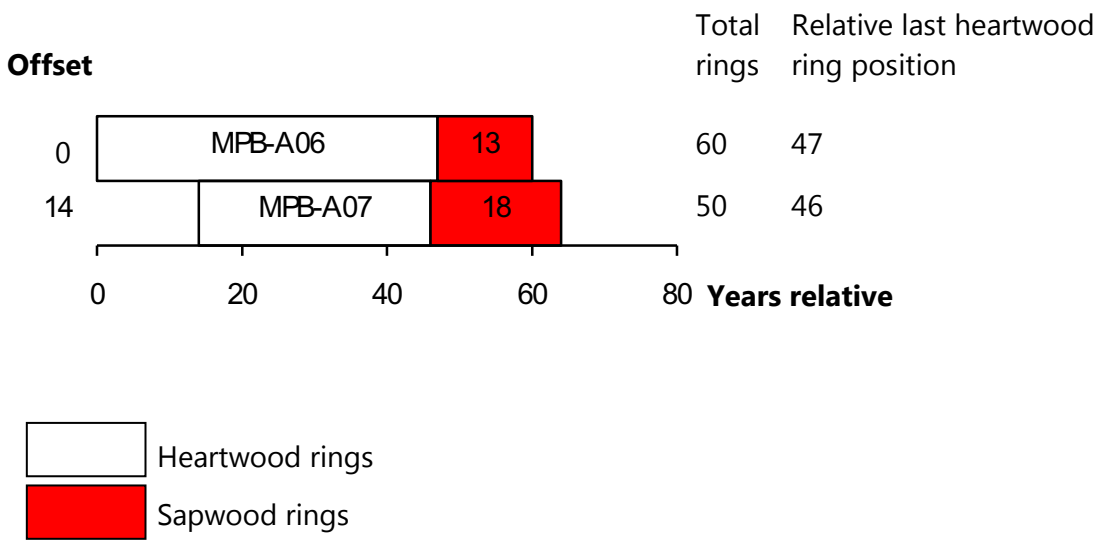


Figure 13: Bar diagram of samples in undated site sequence MPBASQ03