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TREE-RING ANALYSIS OF TIMBERS FROM 'PARKER'S FIELD', NORTH PETHERTON, BRIDGWATER, SOMERSET

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SUMMARY

Dendrochronological analysis was undertaken on timbers taken from the roofs of the main, south, and north ranges, and from ground-floor ceiling beams at this building, resulting in the construction and dating of three site sequences.
Site sequence NPTASQ01, contains 15 samples and spans the period 1529-1640. Site sequence NPTASQ02, contains two samples, and spans the period 1520-1614, and finally, sequence NPTASQ03 contains four samples and spans the period 1692-1796.
Interpretation of the sapwood suggest construction of the main range roof shortly after felling of the timbers utilised in *c* 1632. The south range roof contains at least two timbers which were felled in *c* 1617/1622 and other timbers felled in 1651-76; the earlier beams may represent the use of stockpiled or reused timber. The latest dates were found for the timbers of the north range roof, where timbers were felled in 1797-1813.
A ground-floor ceiling beam in the kitchen (north range) has a *terminus post quem* felling of AD 1602.

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INTRODUCTION

The building known as 'Parker's Field' is located at the edge of the village of North Petherton in Somerset (Figs 1 & 2; ST 298 331). It is a two storey structure with the main (and oldest) range aligned east-west. At a later date, a southern range was added at the west end and then later still a short northern range was also added. There are further additions and alterations which probably date to the late-nineteenth and twentieth centuries (Fig 3).

Main range roof

This consists of four trusses of principal rafters, lapped and pegged at the apex, two sets of purlins to each slope, tiebeams, and posts (Fig 4).

South range

The roof above this part of the building consists of three trusses of principal rafters, collars, and through purlins. The ridge purlin is set in a short horizontal timber nailed across the apex of the principal rafters (Fig 5). On the ground-floor are two chamfered ceiling beams (Figs 6 and 7).

North range

This roof is constructed of much 'squarer cut' beams and is of a not so ancient appearance. There are two trusses of principal rafters, collars, ridge purlin, and two sets of through purlins (Fig 8). On the ground floor, in the kitchen is a ceiling beam of historic appearance (Fig 9).

Principles of Tree-ring Dating

Tree-ring dating relies on a few simple, but fundamental, principles. Firstly, as is commonly known, trees (particularly oak trees) grow by adding one, and only one, growth-ring to their circumference each, and every, year. Each new annual growth-ring is added to the outside of the previous year's growth just below the bark. The width of this annual growth-ring is largely, though not exclusively, determined by the weather conditions during the growth period (roughly March to September). In general, good conditions produce wider rings and poor conditions produce narrower rings. Thus, over the lifetime of a tree, the annual growth-rings display a climatically determined pattern. Furthermore, and importantly, all trees growing in the same area at a the same time will be influenced by the same growing conditions and the annual growth-rings of all of them will respond in a similar, though not identical, way.

Secondly, because the weather over any number of consecutive years is unique, so too is the growth pattern of the tree. The pattern of a short period of growth, 20 or 30 consecutive years, might conceivably be repeated two or even three times in the last one thousand years. A short pattern might also be repeated at different time periods in different parts of the country because of differences in regional micro-climates. It is less likely, however, that such problems would occur with the pattern of a longer period of growth, that is, anything in excess of 60 years or so. In essence, a short period of growth, anything less than 50 rings, is not reliable, and the longer the period of time under comparison the better.

The third principal of tree-ring dating is that, until the early-to mid-nineteenth century, builders of timber-framed houses usually obtained all the wood needed for a given structure by felling the necessary trees in a single operation from one patch of woodland or from closely adjacent woods. Furthermore, and contrary to popular belief, the timber was used "green" and without seasoning, and there was very little long-term storage as in timber-yards of today. This fact has been well established from a number of studies where tree-ring dating has been undertaken in conjunction with documentary studies. Thus, establishing the felling date for a group of timbers gives a very precise indication of the date of their use in a building.

Tree-ring dating relies on obtaining the growth pattern of trees from sample timbers of unknown date by measuring the width of the annual growth-rings. This is done to a tolerance of 1/100 of a millimetre. The growth patterns of these samples of unknown date are then compared with a series of reference patterns or chronologies, the date of each ring of which is known. When a sample "cross-matches" repeatedly at the same date against a series of different relevant reference chronologies the sample can be said to be dated. The degree of cross-matching, that is the measure of similarity between sample and reference is denoted by a "t-value"; the higher the value the greater the similarity. The greater the similarity the greater is the probability that the patterns of the samples and references have been produced by growing under the same conditions at the same time. The statistically accepted fully reliable minimum *t*-value is 3.5.

However, rather than attempt to date each sample individually it is usual to first compare all the samples from a single building, or phases of a building, with one another, and attempt to cross-match each one with all the others from the same phase or building. When samples from the same phase do cross-match with each other they are combined at their matching positions to form what is known as a "site chronology". As with any set of data, this has the effect of reducing the anomalies of any one individual (brought about in the case of tree-rings by some non-climatic influence) and enhances the overall climatic signal. As stated above, it is the climate that gives the growth pattern its distinctive pattern. The greater the number of samples in a site chronology the greater is the climatic signal of the group and the weaker is the non-climatic input of any one individual.

Furthermore, combining samples in this way to make a site chronology usually has the effect of increasing the time-span that is under comparison. As also mentioned above, the longer the period of growth under consideration, the greater the certainty of the cross-match. Any site chronology with less than about 55 rings is generally too short for satisfactory analysis.

SAMPLING

A total of 28 timbers was sampled with each sample being given the code NPT-A and numbered 01-28; samples NPT-A01-11 being taken from the main range roof, NPT-A12-20 from the south range roof, NPT-21-5 from the north range roof, and NPT-A26-8 from ground-floor ceiling beams (NPT-A26 from the north range and NPT-A27-8 from the south range). Trusses have been numbered from north-south and east-west (Fig 10). The location of samples was noted at the time of sampling and has been marked on Figures 11-20. Further details can be found in Table 1.

Interest had also been expressed in the string course of the stairs but it was not possible to get samples from this due to restrictions in space.

ANALYSIS & RESULTS

At this stage, three of the samples (one from the main range, one from the north range, and one of the ceiling beams in the south range) were found to have too few rings for secure dating to be a

possibility and so were discarded prior to measurement. The remaining 25 samples were prepared by sanding and polishing and their growth-ring widths measured. These growth-ring widths were then compared with each other.

Firstly, 15 samples (eight from the main range roof, six from the south range roof, and one of the ceiling beams) matched each other and were combined at the relevant offset positions to form NPTASQ01, a site sequence of 112 rings (Fig 21). This site sequence was then compared against a series of relevant reference chronologies for oak where it was found to match consistently and securely at a first-measured ring date of 1529 and a last-measured ring date of 1640. The evidence for this dating is given by the *t*-values in Table 2.

Secondly, two samples, both from the south range roof, grouped to form a site sequence of 95 rings (Fig 22). When compared against the reference material this site sequence matched at a first-ring date of 1520 and a last-measured ring date of 1614. The evidence for this dating is given by the *t*-values in Table 3.

Finally, four samples (all from the north range roof) matched each other and were combined to form NPTASQ03, a site sequence of 105 rings (Fig 23). This site sequence was then compared against the reference chronologies where it was found to span the period 1692-1796. The evidence for this dating is given by the *t*-values in Table 4. It can be seen that the *t*-values gained for this site sequence are not as high as those for sequences NPTASQ01 and NPTASQ02. However, although somewhat on the low side, the matching at this date is consistent and thought to be secure.

Attempts to date the remaining ungrouped samples by comparing them individually against the reference chronologies were unsuccessful and all are undated.

INTERPRETATION

Main range roof

Eight of the samples taken from the roof of this part of the building have been successfully dated. One of these samples (NPT-A06) was taken from a timber which retained complete sapwood but due to the extremely friable nature of these outer rings, it is estimated that 3-4 of these rings were lost during the sampling process. Adding the estimated 3-4 lost sapwood rings to the last-measured ring date of 1628 gives a felling date for the timber represented of *c* 1632. Five further samples have the heartwood/sapwood boundary ring, which in all cases are broadly contemporary and suggestive of a single felling. The average of these is 1612, allowing an estimated felling date to be calculated for the five timbers represented to within the range AD 1630-52 (this allows for sample NPT-A04 having a last measured ring date of 1629 with incomplete sapwood), consistent with these timbers also having been felled in *c* 1632. The final two dated main range roof samples do not have the heartwood/sapwood boundary ring date and so an estimated felling date cannot be calculated for them. However, with last measured heartwood ring dates in the late-sixteenth century it is likely that these were also felled at the same time as the rest of the timber utilised.

South range

Eight of these timbers have been successfully dated, six within site sequence NPTASQ01 and two within NPTASQ02. One of the samples within NPTASQ02 (NPT-A19) retains complete sapwood but the last few growth rings are extremely compacted and cannot be measured accurately. It is estimated that *c* 8 rings are within this compacted band. With a last-measured ring date of 1614, the addition of these 8 rings gives the timber represented a felling date of *c* 1622. The other sample

in this site sequence (NPT-A13) also has complete sapwood and compacted rings but in this case the problem is much worse and the whole of the sapwood is affected; an estimated 38 rings. The addition of these 38 rings to the last-measured ring of 1579 on this sample gives the timber represented a felling date of *c* 1617.

Of the six timbers dated within site sequence NPTASQ01, four have broadly contemporary heartwood/sapwood boundary rings, suggestive of a single felling. The average heartwood/sapwood boundary ring date is 1636, allowing an estimated felling date to be calculated for the four timbers represented to within the range 1651-76. The last measured heartwood ring dates of the remaining two samples do not preclude these timbers also having been felled in 1651-76.

North range

Four of the roof samples have been dated within site sequence NPTASQ03, three of these have the heartwood/sapwood boundary ring. In all cases this is broadly contemporary and suggestive of a single felling. The average heartwood/sapwood boundary ring date is 1773, allowing an estimated felling date range to be calculated for the three timbers represented to within the range 1797-1813 (allowing for sample NPT-A25 having a last-measured ring date of 1796 with incomplete sapwood). The fourth sample (NPT-A22) has a last-measured heartwood ring date of 1750 which makes it possible that this sample was also felled in 1797-1813.

The sample taken from the ground-floor ceiling beam in the kitchen of this range has a last-measured ring date of 1587. Without the heartwood/sapwood boundary it is not possible to calculate an estimated felling date for the timber represented except to say that it would be after 1602.

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

DISCUSSION

Prior to tree-ring analysis being undertaken at this building the main range was thought to date to the sixteenth century with the south range being added in the seventeenth century, and the north range being later still.

It is now known that the main range roof is constructed from timber felled in *c* 1632 with it likely that construction followed shortly afterwards.

The south range roof contains two timbers of *c* 1617 and *c* 1622 but the greater number of dated timbers were felled in 1651-76. The inclusion of timber 30-50 years earlier may be the result of using stockpiled timber or perhaps, despite there being no obvious signs of reuse, these two beams may have been used previously. It is unfortunate that the heavily compacted nature of the outer rings in both these samples means it is not possible to measure or even simply count these with absolute certainty. By estimating how many rings are thought to be represented within these compacted bands it is possible to provide felling dates which appear to show *c* 5 years between them, however, it must be remembered that this is only estimation and it may be that they were actually felled at the same time. These compacted rings are not seen on any other samples from the building.

The north range roof is now known to be constructed from timber felled in 1797-1813, not unsurprising given the appearance of these beams. What is surprising is that the ground-floor ceiling beam found in the kitchen located in this range has a *terminus post quem* of 1602. Although it is possible that this sample represents the inner portion of a very long lived tree, we would have to have lost *c* 200 years for this timber to also date to the last few years of the eighteenth/early nineteenth century. Its discovery suggests either, earlier origins for this range than would be deduced from the age of the roof or reuse of an earlier beam.

Acknowledgements

This work was commissioned by Quentin Alder of Quentin Alder Architects on behalf of the owners of the building. Thanks are given to Quentin Alder Architects for providing the drawings used within this report.

Table 1: Details of samples from 'Parker's Field', North Petherton, Bridgwater, Somerset

Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date (AD)	Last heartwood ring date (AD)	Last measured ring date (AD)
Main range roof						
NPT-A01	North principal rafter, truss 1	59	--	1537	----	1595
NPT-A02	South principal rafter, truss 1	57	16	1573	1613	1629
NPT-A03	South principal rafter, truss 2	64	h/s	1546	1609	1609
NPT-A04	North principal rafter, truss 3	66	13	1564	1616	1629
NPT-A05	South principal rafter, truss 3	57	--	1533	----	1589
NPT-A06	North principal rafter, truss 4	72	14+3-4lost	1557	1614	1628
NPT-A07	South principal rafter, truss 4	62	h/s	1553	1614	1614
NPT-A08	North lower purlin, truss 1-2	75	--	----	----	----
NPT-A09	North upper purlin, truss 1-2	NM	--	----	----	----
NPT-A10	South upper purlin, truss 1-2	48	--	----	----	----
NPT-A11	South upper purlin, truss 3-4	50	h/s	1559	1608	1608
South range roof						
NPT-A12	East principal rafter, truss 5	88	--	1540	----	1627
NPT-A13	West principal rafter, truss 5	60+*c*38NM	h/s+*c*38NM to C	1520	1579	1579
NPT-A14	East principal rafter, truss 6	105	h/s	1529	1633	1633
NPT-A15	West principal rafter, truss 6	88	h/s	1546	1633	1633
NPT-A16	Collar, truss 6	58	18	----	----	----
NPT-A17	East principal rafter, truss 7	105	02	1536	1638	1640
NPT-A18	West principal rafter, truss 7	101	h/s	1539	1639	1639
NPT-A19	Collar, truss 7	90+*c*8NM	30+*c*8NM to C	1525	1684	1614
NPT-A20	East purlin, truss 6-7	58	--	1573	----	1630
North range roof						
NPT-A21	East principal rafter, truss 8	54	h/s	1720	1773	1773
NPT-A22	West principal rafter, truss 8	59	--	1692	----	1750
NPT-A23	Collar, truss 8	74	h/s	1696	1769	1769
NPT-A24	East principal rafter, truss 9	NM	--	----	----	----
NPT-A25	West principal rafter, truss 9	57	20	1740	1776	1796

Ground-floor ceiling beams						
NPT-A26	North range (kitchen) ceiling beam	50	--	1538	----	1587
NPT-A27	South range ceiling beam (north)	47	h/s	----	----	----
NPT-A28	South range ceiling beam (south)	NM	--	----	----	----

*NM = not measured

**h/s = the heartwood/sapwood boundary ring is the last-measured ring on the sample

xNM to C = complete sapwood retained on sample but some rings could not be measured due to their compact nature.

Table 2: Results of the cross-matching of site sequence NPTASQ01 and relevant reference chronologies when the first-ring date is 1529 and the last-measured ring date is 1640

Reference chronology	*t*-value	Span of chronology
Manor House, Templecombe, Somerset	10.5	1486-1591
26 Westgate Street, Gloucester, Gloucestershire	8.1	1399-1622
Hulme Hall, Allostock, Nr Northwich	7.5	1574-1689
Exeter Cathedral (Crosswing & Western Roof), Exeter, Devon	7.5	1481-1616
Hampshire County	7.3	443-1972
Poltimore House, Poltimore, Devon	7.3	1534-1725
The Market House, Ledbury, Herefordshire	6.9	1485-1617

Table 3: Results of the cross-matching of site sequence NPTASQ02 and relevant reference chronologies when the first-ring date is 1520 and the last-measured ring date is 1614

Reference chronology	*t*-value	Span of chronology
North Lees Hall, Outseats, Debyshire	6.8	1468-1578
Unthank Hall, Holmesfield, Derbyshire	6.7	1359-1589
Worcester Cathedral (composite chronology), Worcester, Worcestershire	5.5	1484-1772
40-44 Castlegate, Newark, Nottinghamshire	5.3	1523-1620
Hoarstone Farm, Bewdley, Worcestershire	5.3	1350-1617
Middridge Grange, Heighington, Durham	4.6	1470-1578
26 Westgate Street, Gloucester, Gloucestershire	4.3	1399-1622

Table 4: Results of the cross-matching of site sequence NPTASQ03 and relevant reference chronologies when the first-ring date is 1692 and the last-measured ring date is 1796

Reference chronology	*t*-value	Span of chronology
Somerset County	6.0	770-1979
Sweetapples Cafe, High Street, Marshfield, Gloucestershire	5.6	1706-1798
Exeter Cathedral (Crosswing & Western Roof), Exeter, Devon	5.4	1680-1766
Stoneleigh Abbey (modern trees), Stoneleigh, Kent	4.6	1701-1999
Basing	4.5	1684-1788
Oxford County	4.4	632-1987
Henley2	4.3	1668-1758

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

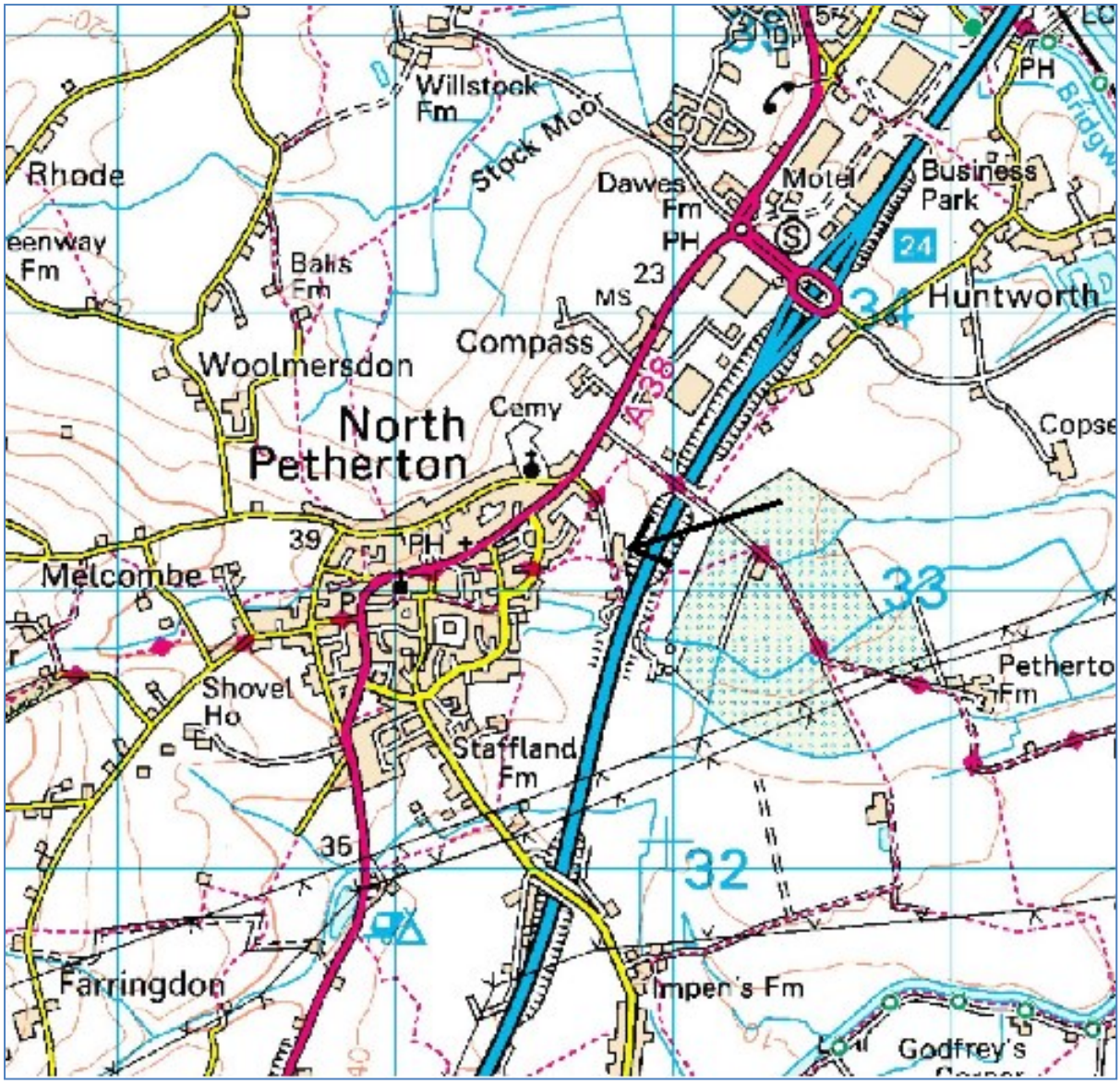

Figure 2: Map to show the location of 'Parker's Field', arrowed (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

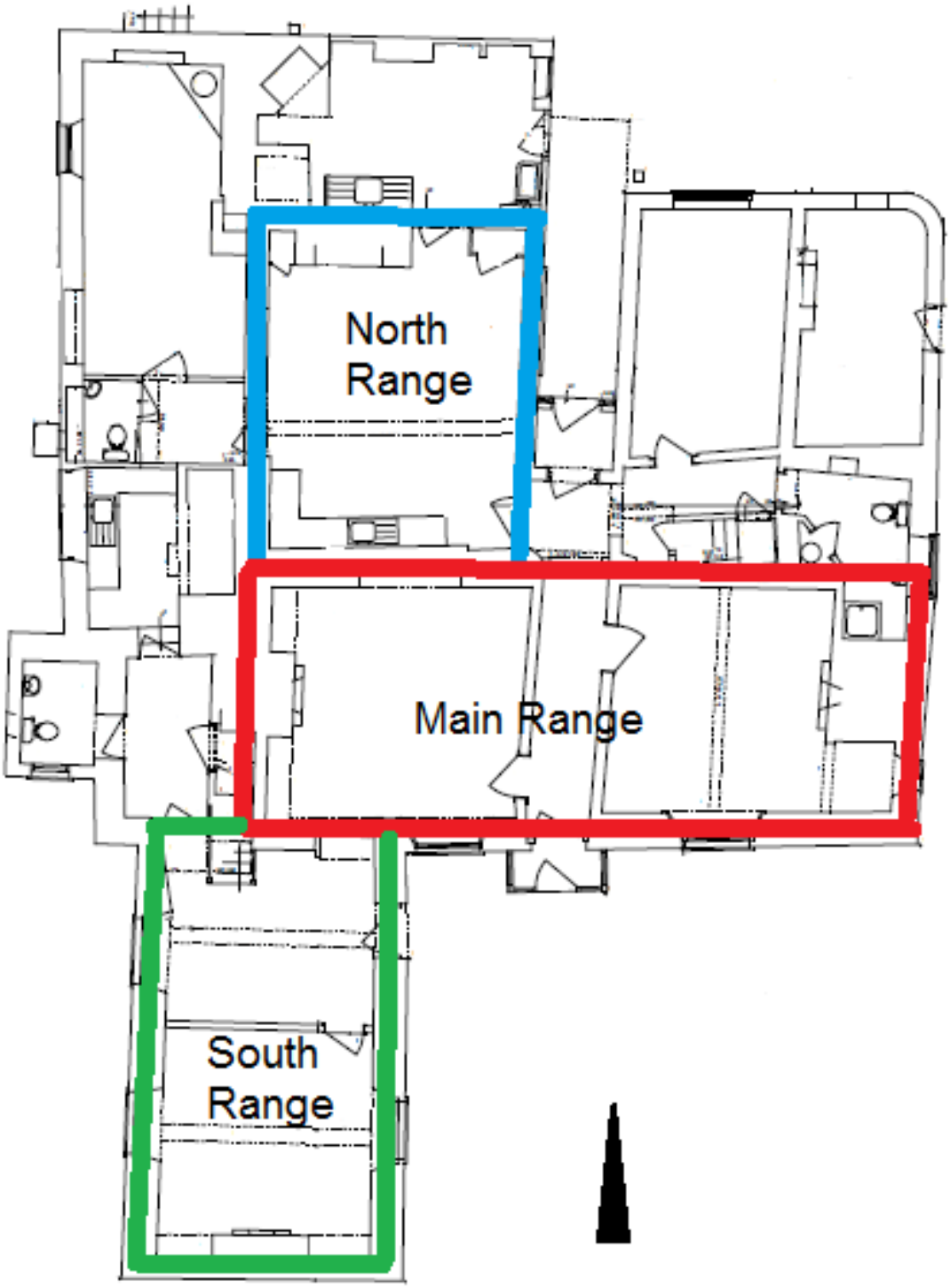

Figure 3: Ground-floor plan, showing the layout of the building (Quentin Alder Architects)

Figure 4: Main range roof, truss 4 (east face)

Figure 5: South range roof, truss 6 (north face)

Figure 6: South range; ground-floor ceiling beam (northern one)

Figure 7: South range; ground-floor ceiling beam (southern one)

Figure 8: North range roof, truss 8 (south face)

Figure 9: North range; ground-floor ceiling beam

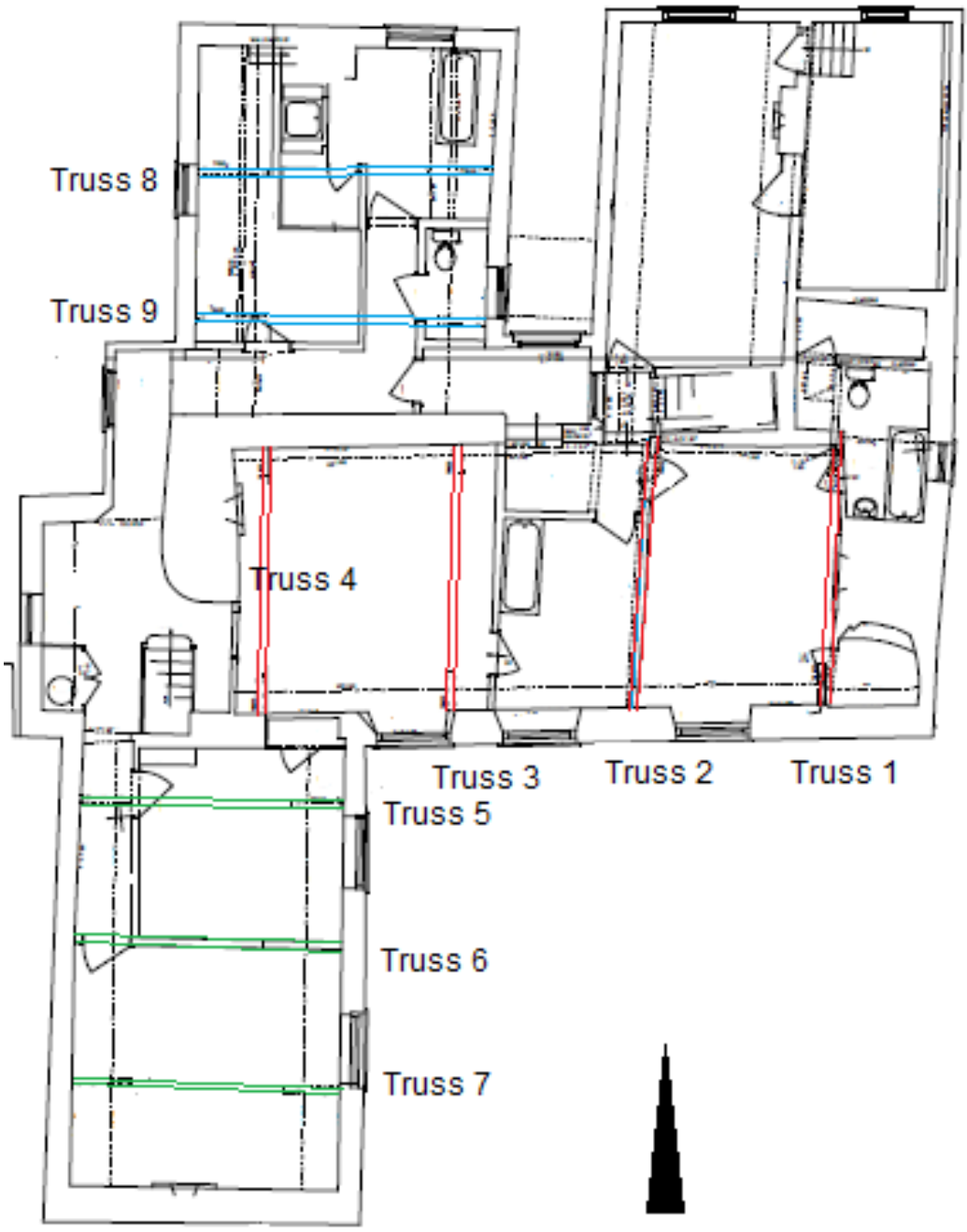

Figure 10: First-floor plan, showing truss location (Quentin Alder Architects)

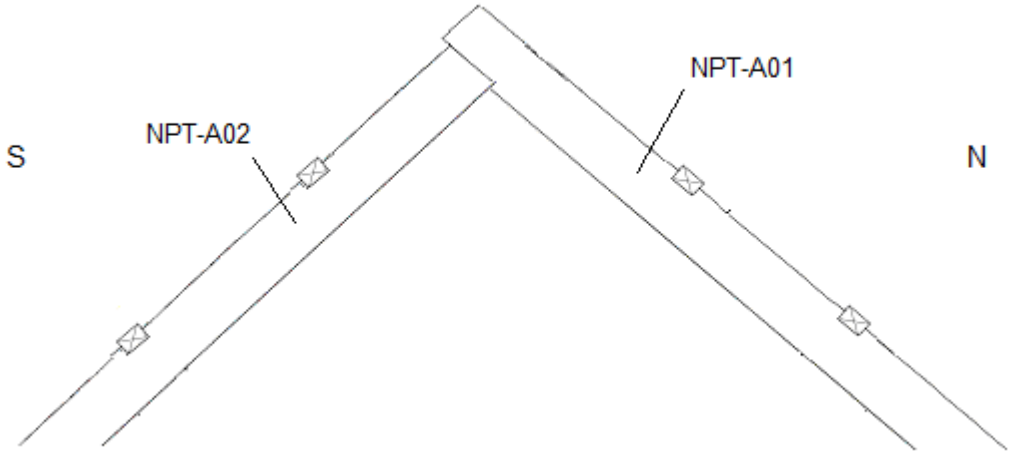

Figure 11: Sketch of truss 1, showing the location of samples NPT-A01 and NPT-A02

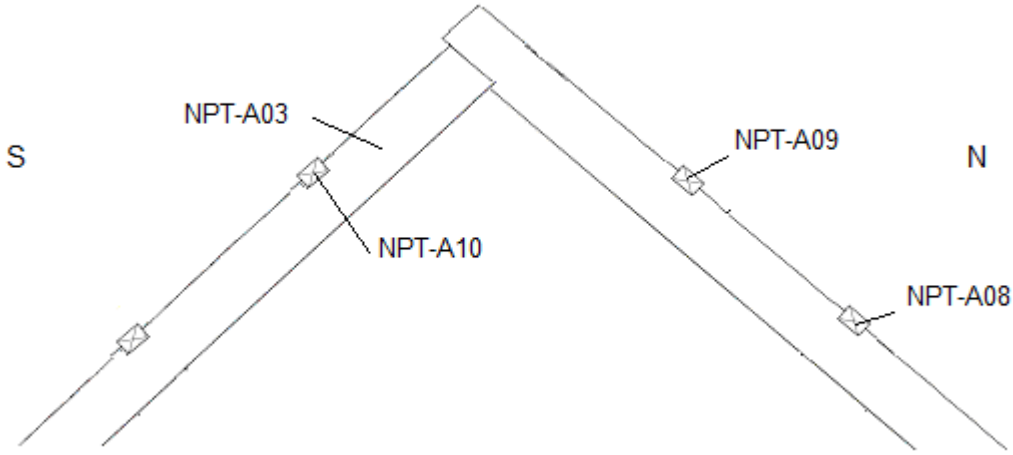

Figure 12: Sketch of truss 2, showing the location of samples NPT-A03 and NPT-A08-10

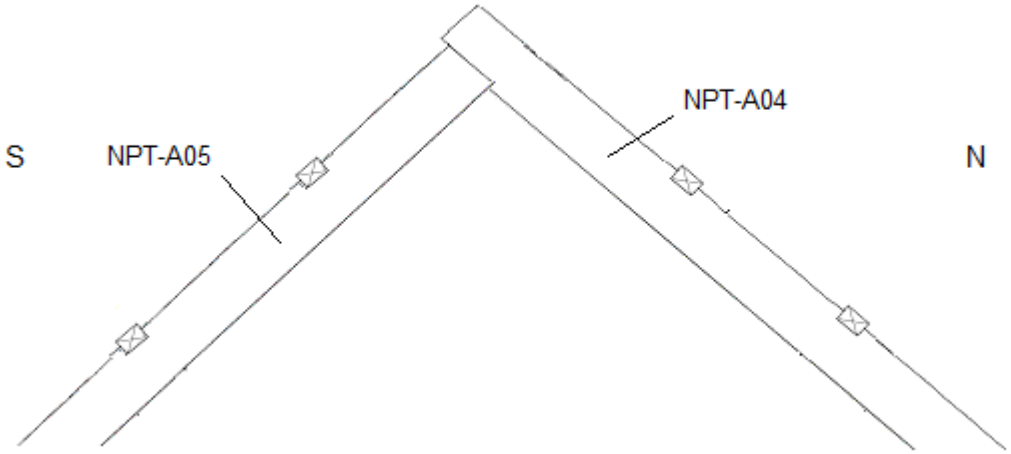

Figure 13: Sketch of truss 3, showing the location of samples NPT-A04 and NPT-A05

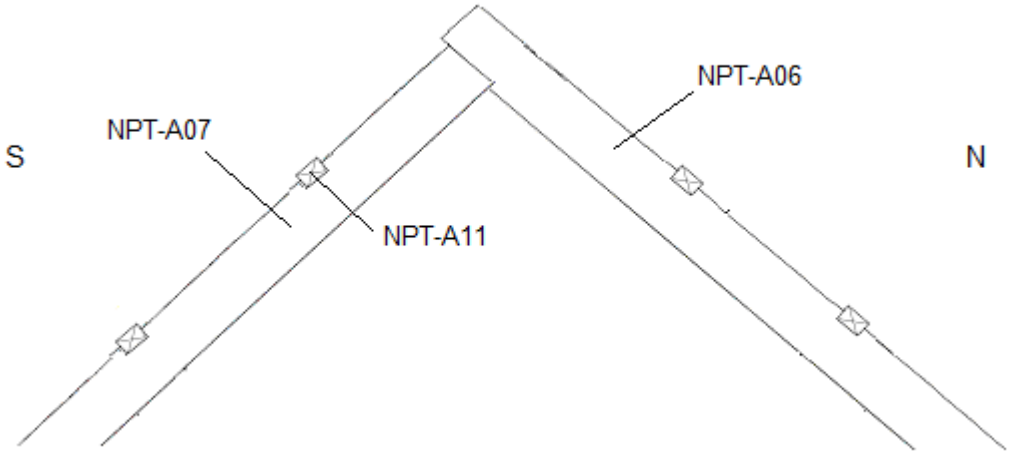

Figure 14: Sketch of truss 4, showing the location of samples NPT-A06, NPT-A07, and NPT-A11

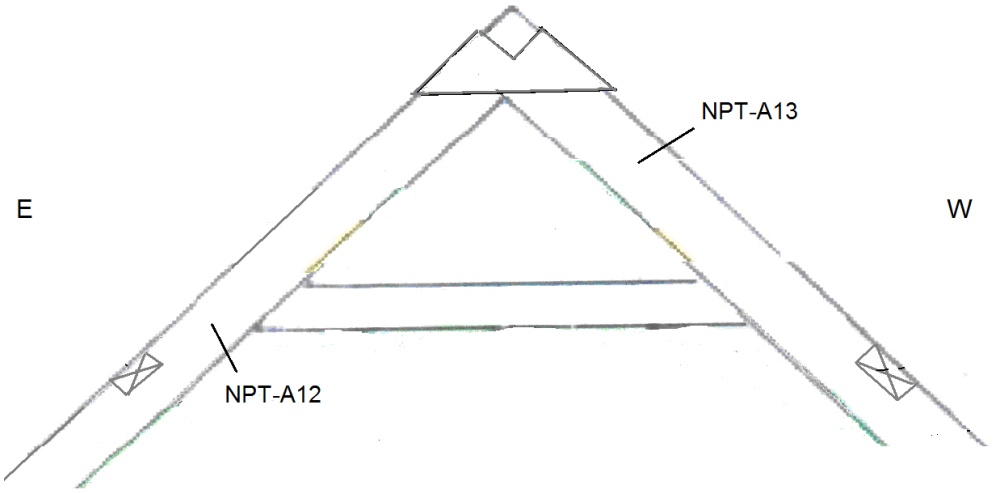

Figure 15: Sketch of truss 5, showing the location of samples NPT-A12 and NPT-A13

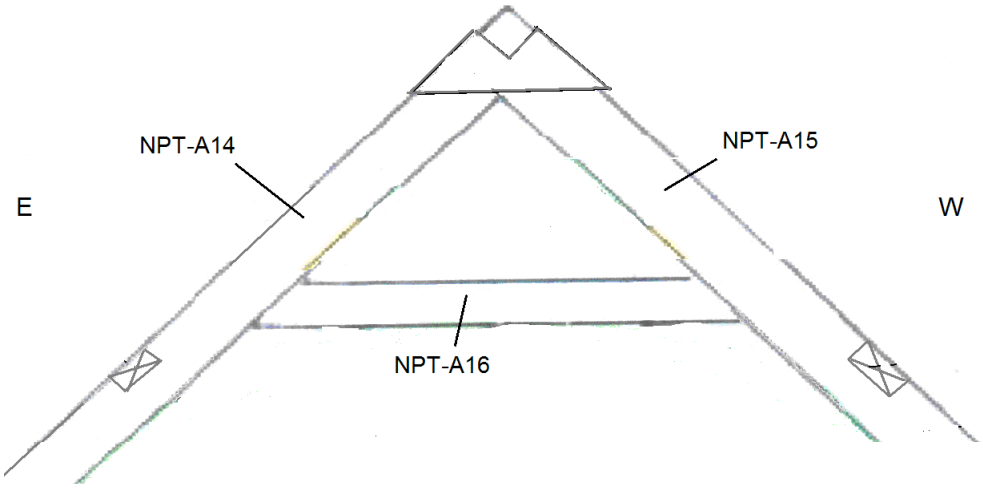

Figure 16: Sketch of truss 6, showing the location of samples NPT-A14-15

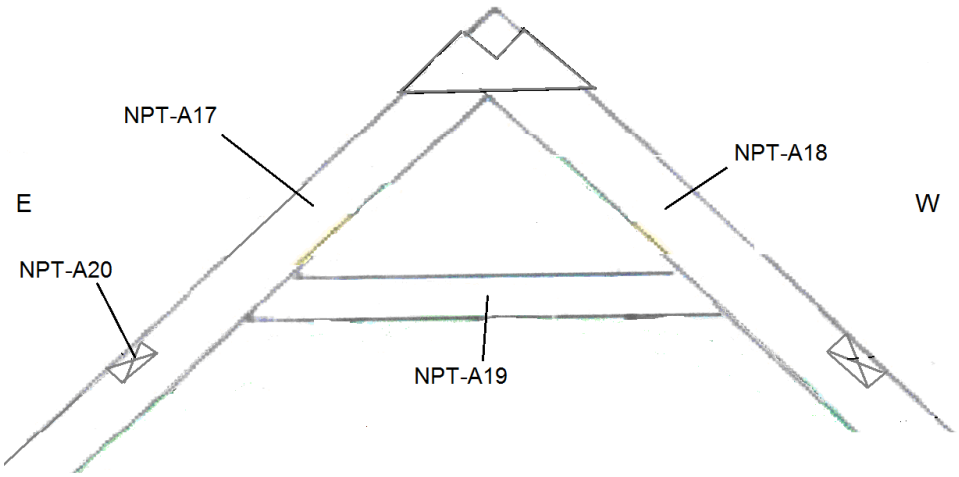

Figure 17: Sketch of truss 7, showing the location of samples NPT-A17-20

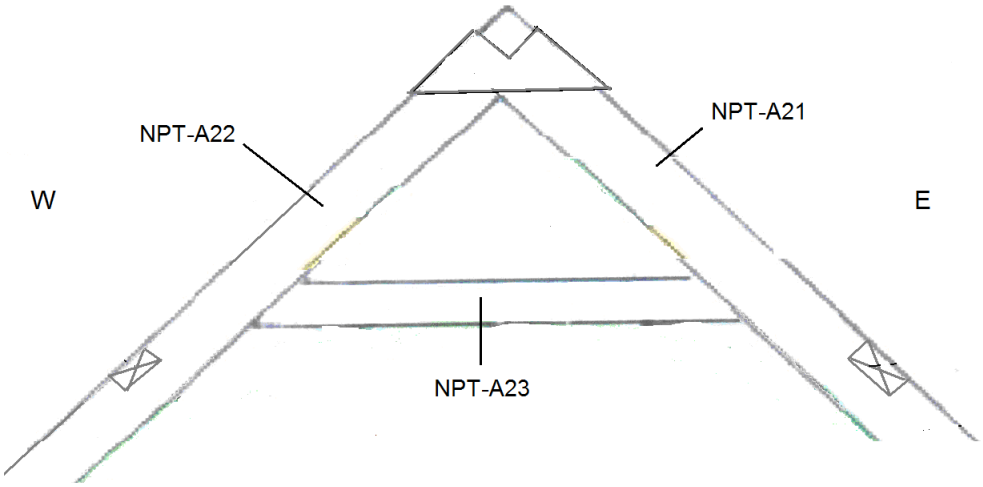

Figure 18: Sketch of truss 8, showing the location of samples NPT-A21-3

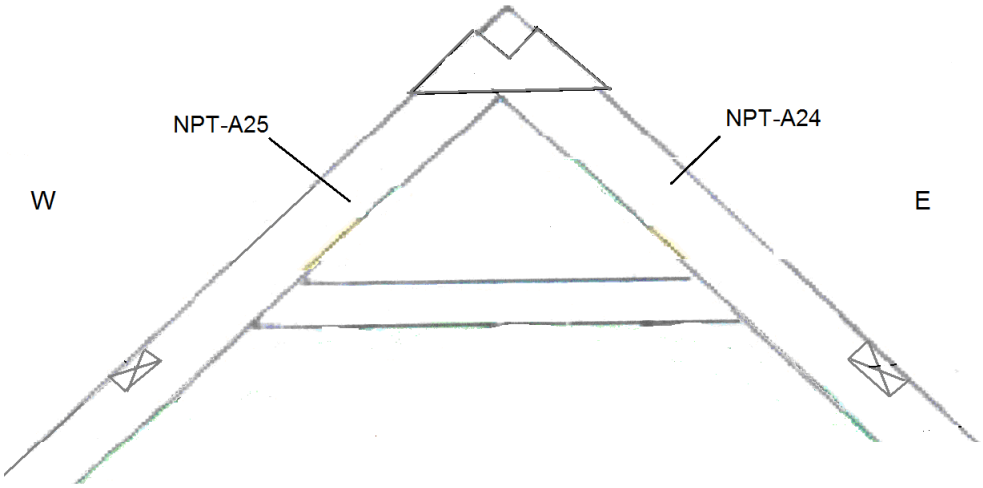

Figure 19: Sketch of truss 9, showing the location of samples NPT-A24 and NPT-A25

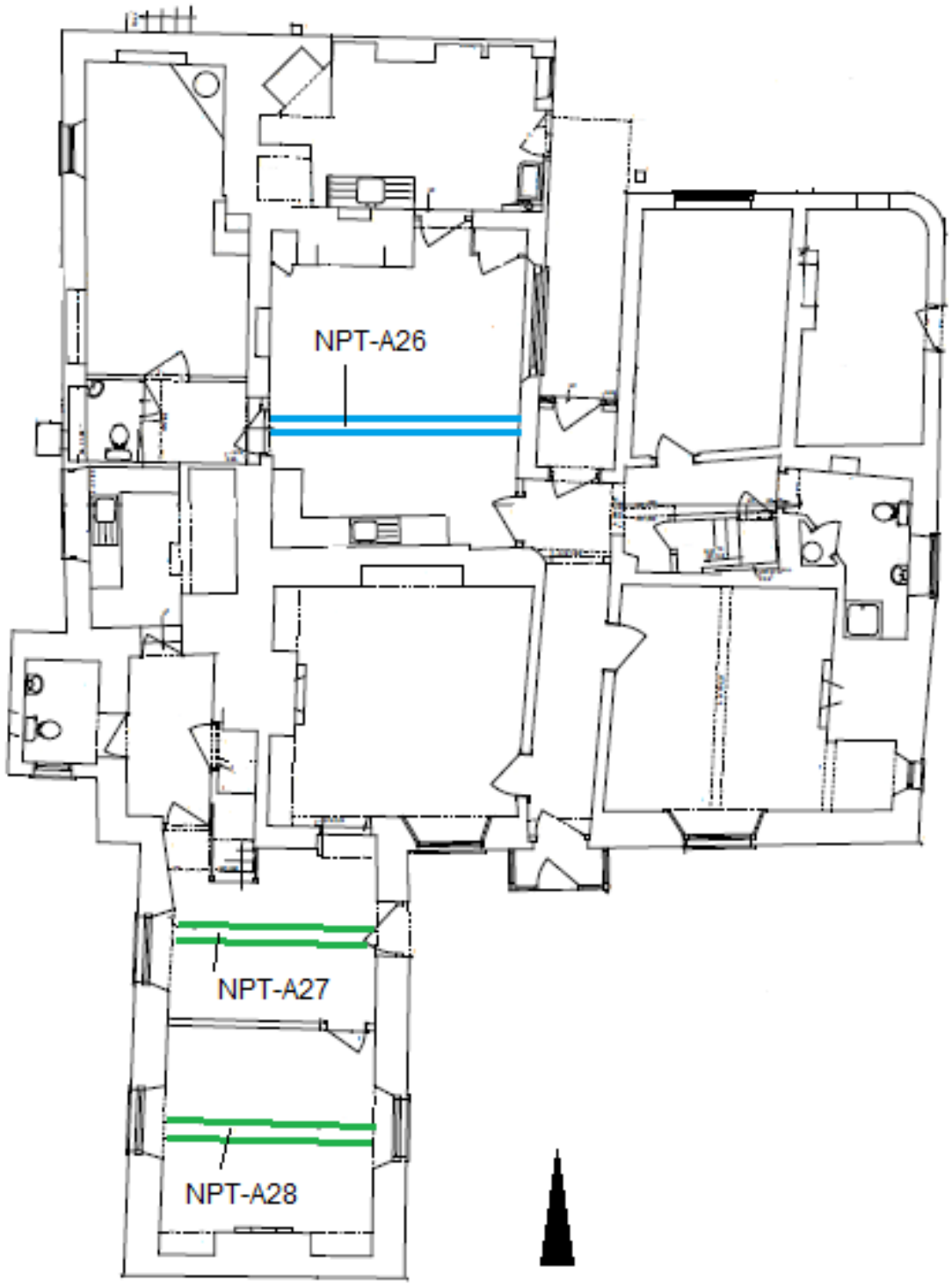

Figure 20: Ground-floor plan, showing the location of samples NPT-A26-8 (Quentin Alder Architects)

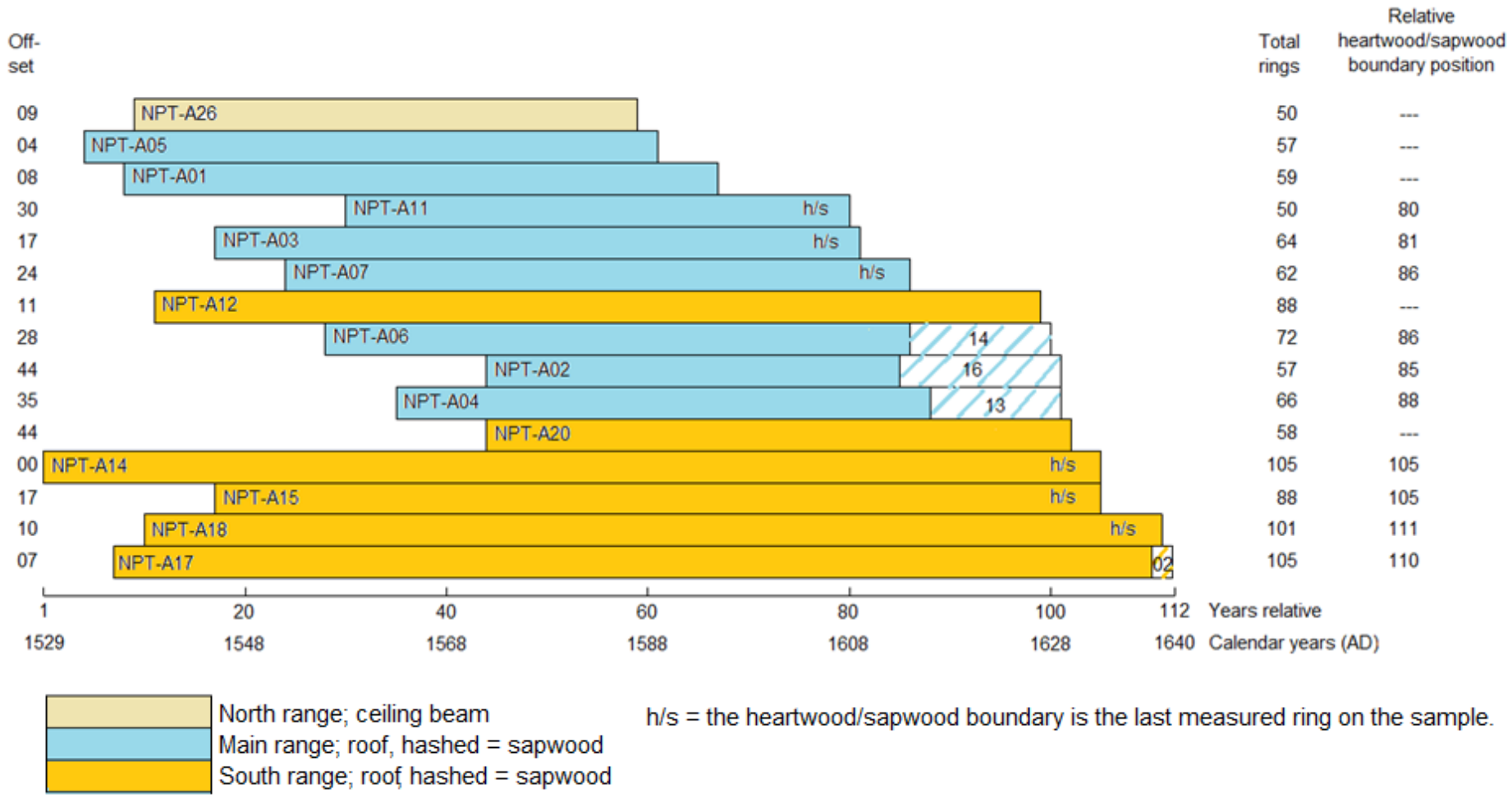

Figure 21: Bar diagram of samples in site sequence NPTASQ01

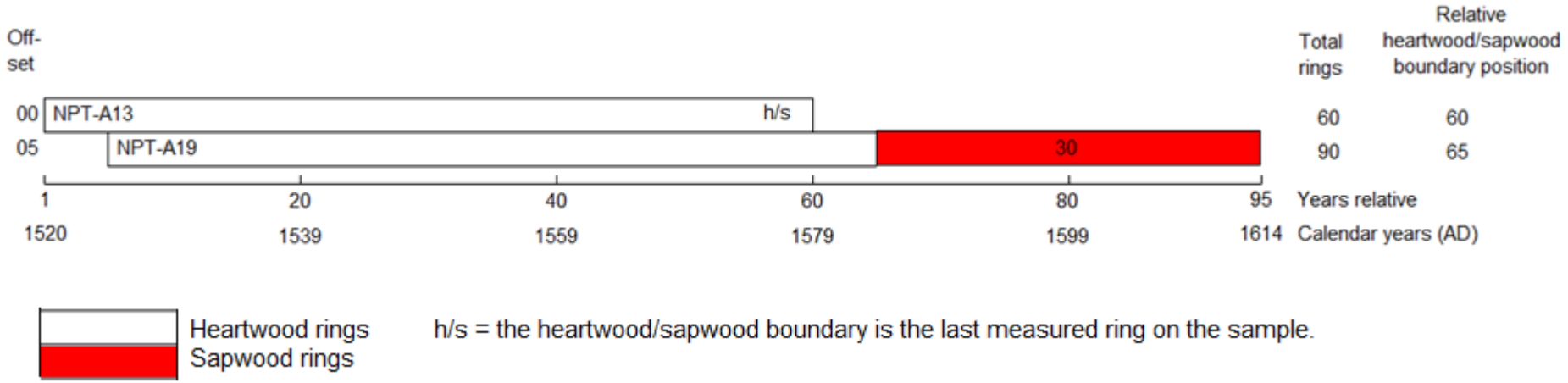

Figure 22: Bar diagram of samples in site sequence NPTASQ02

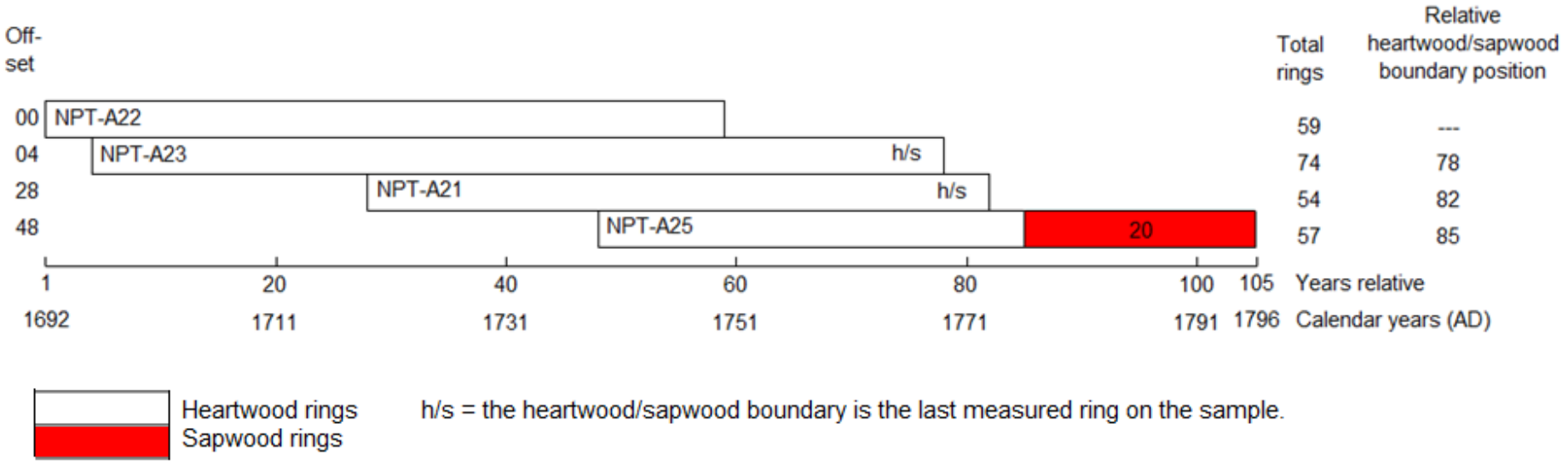

Figure 23: Bar diagram of samples in site sequence NPTASQ03