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SPRINGS WOOD BARN
LANGCLIFFE
NEAR SETTLE
NORTH YORKSHIRE
TREE-RING ANALYSIS OF TIMBERS

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SUMMARY

Analysis by dendrochronology was undertaken on seven core samples obtained from Springs Wood Barn in conjunction with those obtained from a number of other buildings in the Ingleborough area.

This analysis suggests that the lower northwest purlin, the south principal rafter and tiebeam of truss I, and the south principal rafter and tiebeam of truss II were felled at some point between 1516 at the earliest and 1541 at the latest, while the north principal rafters of truss I and II were felled between 1533 at the earliest and 1558 at the latest. Given that these felling date ranges overlap (between 1533 and 1541), it is possible that all seven trees were felled together at some point during this time.

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Introduction

Springs Woods is an L-shaped field barn of three bays built into a steep slope (SD 8229 6451, map Fig 1). The shippon forms the foot of the "L" and the widest part of the barn with standings for 6 cows. There are two roof trusses which are made from reused cruck timbers with typical half-lap joints and large peg holes (Fig 2a–d). One reused timber is a former cruck purlin with lap joints for wind braces at each end. Exterior walling has been heightened at the eaves when the old steep cruck roofs were replaced. The low end has a substantial plinth of three steps. Such a feature seems common with former cruck buildings. The west end purlin is a reused cruck blade. "EH" is carved on the upper east truss.

The barn is typical of many field barns which have been changed from cruck built structures to better and bigger structures with raised rooflines in stone. Old timber however was reused to make the new trusses for the slated roof. A shadow of a removed cruck blade is visible in the side wall.

Sampling

Sampling and analysis by dendrochronology of timbers to Springs Wood Barn were commissioned by the Yorkshire Dales Millennium Trust (YDMT) as part of the Ingleborough Dales Landscape Partnership *'Stories in Stone'* project H8, and fully funded by the National Lottery Heritage Fund, this being undertaken as an adjunct to a wider study of vernacular agricultural buildings in the Ingleborough area. In total, 15 individual buildings were sampled for tree-ring dating, Springs Wood Barn being one of them. It was hoped that tree-ring analysis might establish the date of the timbers here, and provide some information on the history of this particular building. A full overall report on the wider survey, with more detailed descriptions of this and the other buildings sampled, will be published separately by the Yorkshire Dales Millennium Trust.

Thus, from the timbers available at Springs Wood Barn, a total of seven samples was obtained by coring. Each sample was given the tree-ring code LGC-B (for Langcliffe site 'B'), and numbered 01–07. Details of the seven samples are given in Table 1, including the timber sampled, the total number of rings each sample has, and how many of these, if any, are sapwood rings. The individual date span of each dated sample is also given. The locations of the sampled timbers are identified on a plan/photograph, this shown here as Figure 3.

The Nottingham Tree-ring Dating Laboratory would firstly like to thank the Yorkshire Dales Millennium Trust for promoting this programme of tree-ring analysis, and particularly Alison Armstrong and David Johnson, managers for the Stories in Stone team, for their help in arranging access to the sites, and for the provision of plans, background information, and additional help besides. We would also like to thank the owner of Springs Wood Barn, Mr R. Bell, and the tenant farmer, Mr Alan Lodge, for permitting access to the building for sampling. Finally we would like to thank the National Lottery Heritage Fund for their generous support for this analysis.

Tree-ring dating

Tree-ring dating relies on a few simple, but quite fundamental, principles. Firstly, as is commonly known, 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–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. Trees growing in widely different areas (Kent–v–Cumbria for example), even if growing at the same time, might experience a slightly different climate and thus produce different tree-ring patterns, but the difference is usually reduced the nearer trees are to each other.

Secondly, because the weather over a certain number of consecutive years is unique, so too is the growth-ring pattern of the tree. The pattern of a shorter period of growth, 40, 50, or even 60 consecutive years, might conceivably be repeated two or even three times in the last one thousand years, and is considered less reliable. 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. In essence, a short period of growth, anything less than, say 50 rings for oak, is not fully reliable, and the longer the period of time under comparison the better.

The application of tree-ring dating relies on obtaining core samples from beams of unknown date in the building under investigation (these beams having been derived from oak trees). Where possible, it is usual to obtain samples from a number of different timbers within a single building, particularly where it is thought that timbers of different date may be present, ie where some timbers are possibly reused older beams, or are replacement beams which have been inserted more recently. In addition, as in the case of this project, the prospect of dating is enhanced if groups of samples can be obtained from timbers in a number of different buildings in a particular distinct locality, the different samples from different local buildings providing a more representative regional pattern of tree growth. As part of this project, from the 11 individual buildings that were cored, an overall total of 73 samples was obtained.

The ring-width measurements of the growth patterns of all the samples obtained are then compared with one another in the hope that they will 'cross-match' with each other (ie, that they will have the same growth patterns). When the growth patterns 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 of the group (in effect making an 'average' of the cross-matching sample's growth pattern). 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 because of the way that samples often overlap with each other, with 'extensions' at either end where the rings on some samples are might be earlier or later than on other samples. As also mentioned above, the longer the period of growth under consideration, the greater the certainty of the cross-match. Any oak site chronology with less than about 50 rings is generally too short for reliable dating.

This (average) site chronology is then compared with thousands of different reference chronologies (each made up of many samples from different buildings) covering every part of England for all time periods, the calendar dates of these reference being known. When the site chronology cross-matches with the reference chronologies (ie, where the growth patterns of site and reference chronology match each other because the constituent trees were growing at the same time as each other), the samples of the site chronology 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.

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 (and therefore a heartwood/sapwood boundary ring date of 1388), 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)).

Analysis

Thus, each of the seven core samples obtained from the various timbers to Springs Wood Barn, along with all those obtained from the other buildings of the project, was prepared by sanding and polishing, and the widths of its annual growth rings were measured. These measured data, along with that of the measured samples from all the other sampled sites (ie, the growth patterns) were then compared with each other as described in the notes above. This comparative process indicated that all seven Springs Wood Barn samples could be combined with samples from other buildings to make a series of 'site chronologies'. These site chronologies were then dated by comparison with the 'reference chronologies', this then indicating a date for each individual sample from Springs Wood Barn. The relative positions and dates of the dated samples are shown in the bar diagram, Figure 4.

Interpretation

Interpretation of the sapwood and the heartwood/sapwood boundaries on the samples suggests (perhaps not unexpectedly, given the physical evidence of reuse on some beams) that timbers used at this building may have been felled at different times.

Earlier timbers

The earliest timbers appear to be represented by samples LGC-B01, B03, B04, B06 and B07 respectively the lower northwest purlin, the south principal rafter and tiebeam of truss I, and the south principal rafter and tiebeam of truss II. The average heartwood/sapwood boundary ring of these samples is dated 1501. Allowing for the minimum of 15 sapwood rings that most oak trees have, and a maximum of 40 sapwood rings (the 95% confidence interval), it is estimated that the five trees represented were felled together at some point between 1516 at the earliest and 1541 at the latest.

Later timbers

Two later timbers are represented by samples LGC-B02 and B05 from the north principal rafter of truss I and the north principal rafter of truss II respectively. The average heartwood/sapwood boundary ring of these two samples is dated 1518. Again allowing for the minimum and maximum number of sapwood rings the trees are likely to have had (15/40), it is estimated that the two trees represented were felled together at some point between 1533 at the earliest and 1558 at the latest.

It will thus be seen that although the seven timbers are presented as being of two different dates, with five being of one, earlier, date and two others being of later date, the possible felling dates of the two groups do in fact overlap, between 1533 and 1541. It is thus possible that all seven timbers were in fact felled together at some point during this time period.

Conclusion

Analysis by dendrochronology has, therefore, dated all seven samples which were obtained. Interpretation of the sapwood on these would suggest that some timbers were felled in the earlier to middle part of the sixteenth century, while others were felled nearer the middle sixteenth century. However, there is a possibility that all the timbers were felled at one and the same time at some point in the 1530s.

Table 1: Details of tree-ring samples from Springs Wood Barn, Langcliffe, near Settle, North Yorkshire

Sample number	Sample location	Total rings	Sapwood Rings*	First measured ring date (AD)	Heart/sap boundary (AD)	Last measured ring date (AD)
LGC-B01	Lower northwest purlin	108	8	1396	1495	1503
LGC-B02	North principal rafter, truss I	92	h/s	1429	1520	1520
LGC-B03	South principal rafter, truss I	105	h/s	1403	1507	1507
LGC-B04	Tiebeam, truss I	96	h/s	1400	1495	1495
LGC-B05	North principal rafter, truss II	115	h/s	1401	1515	1515
LGC-B06	South principal rafter, truss II	94	no h/s	1394	------	1487
LGC-B07	Tiebeam, truss II	102	h/s	1404	1505	1505

*h/s = the sample retains the heartwood/sapwood boundary, ie, only the sapwood rings have been lost

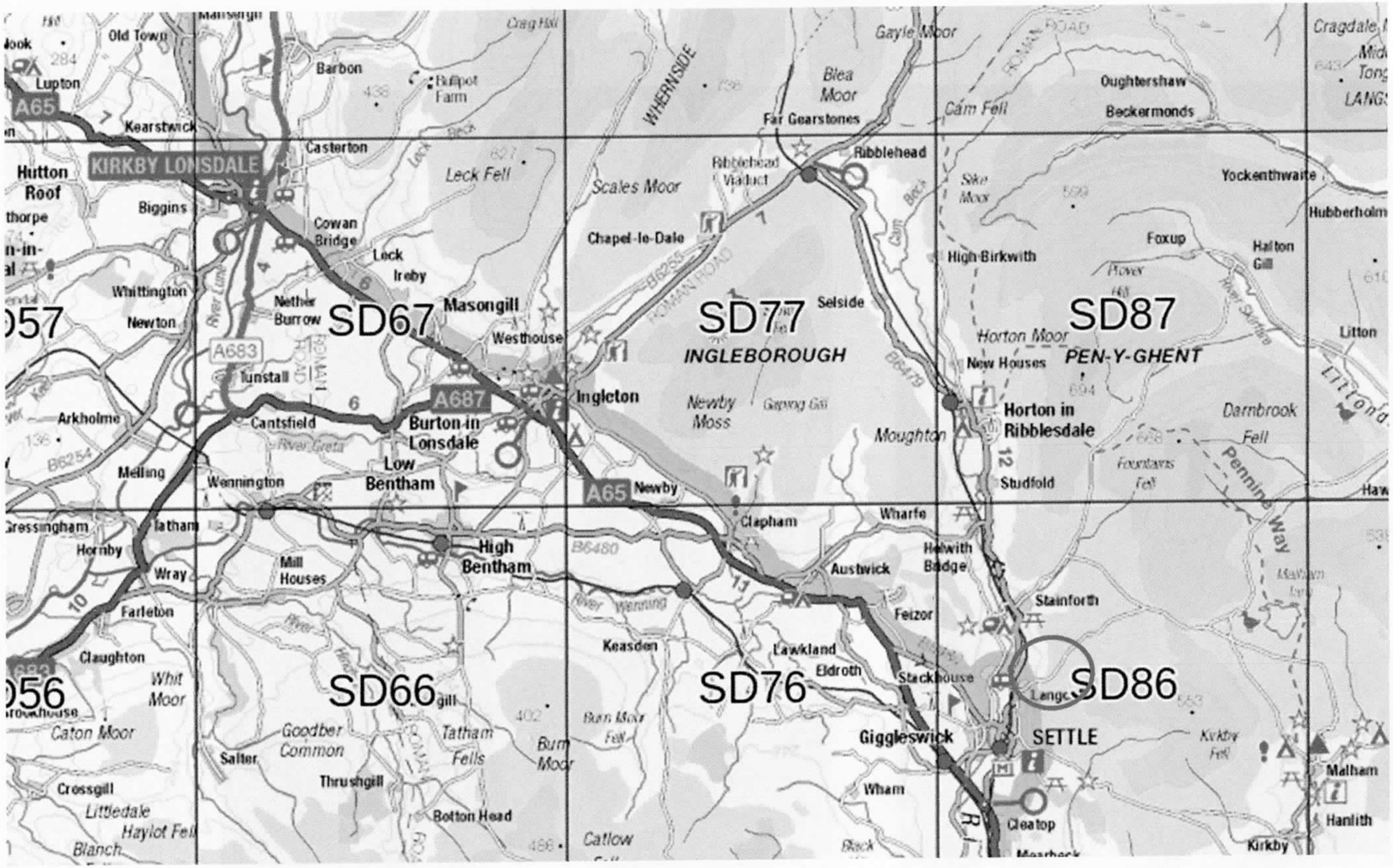


Figure 1: Map to show approximate location of Springs Wood Barn

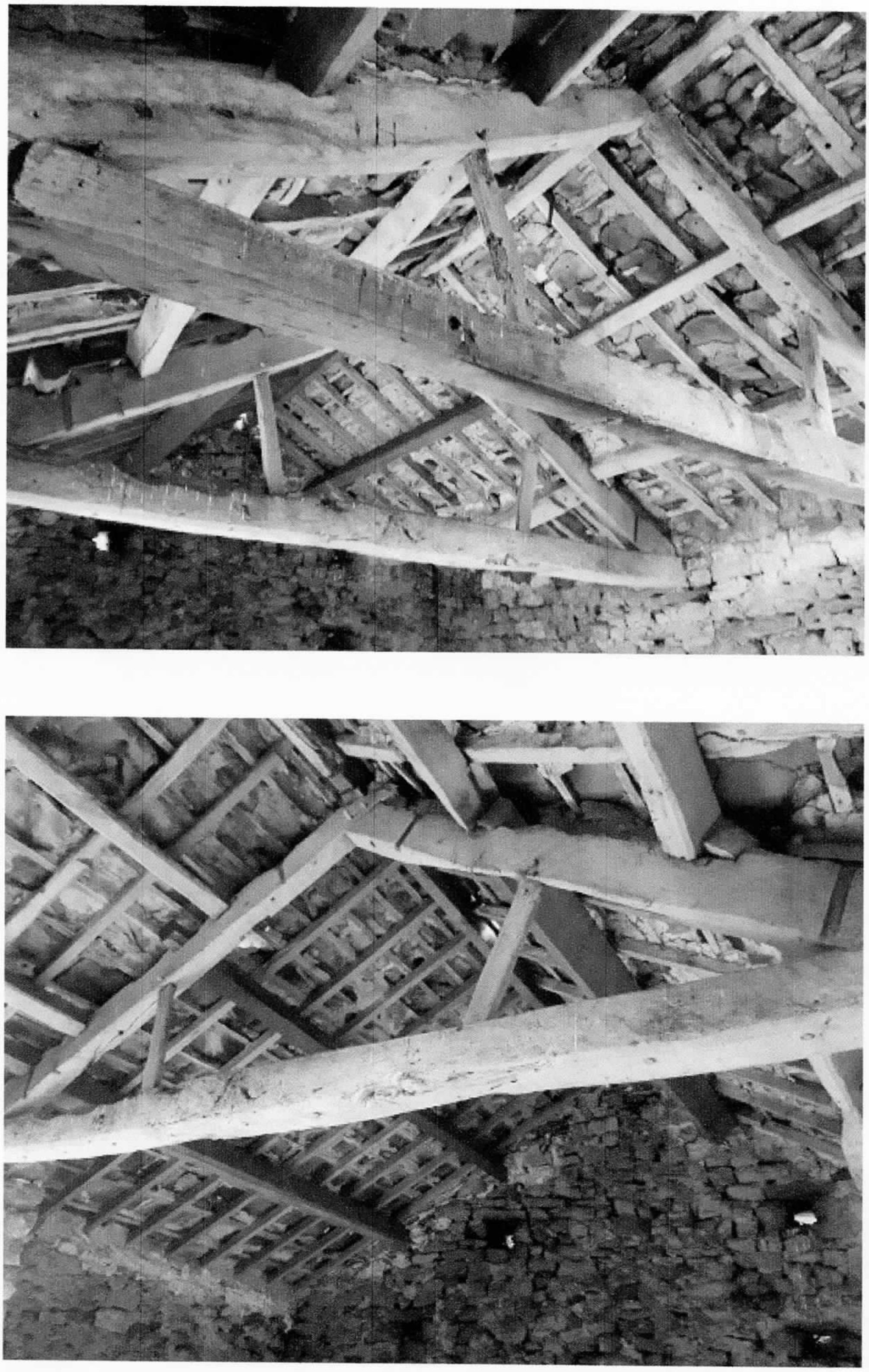


Figure 2a/b: General views of the trusses

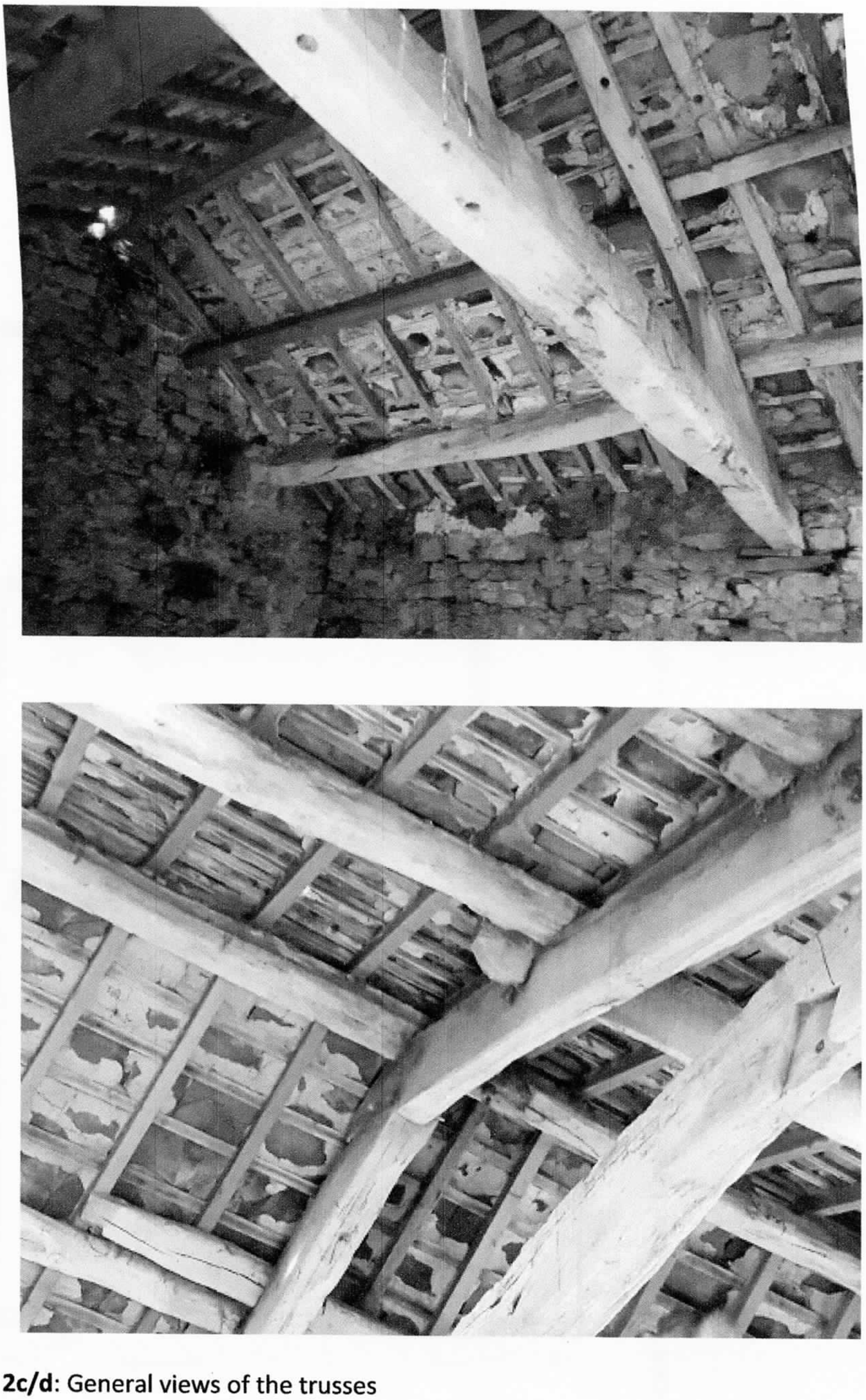


Figure 2c/d: General views of the trusses

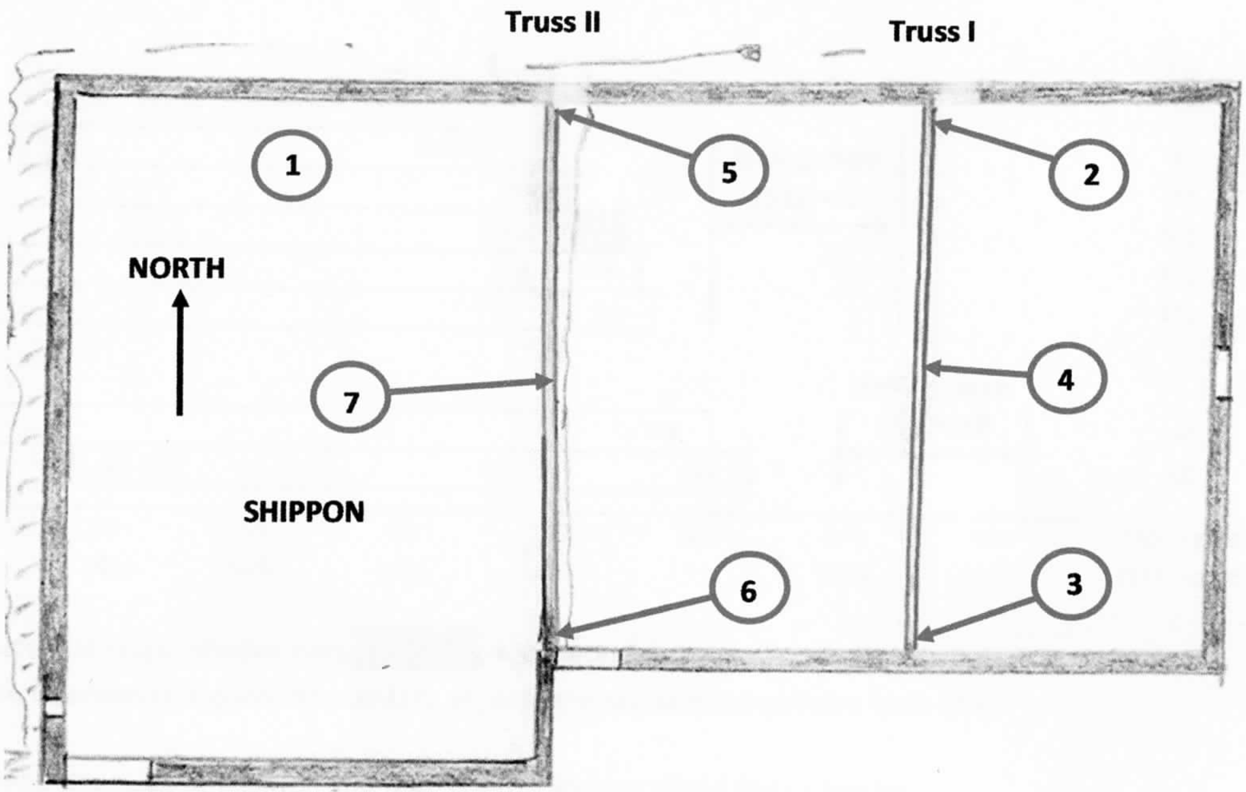
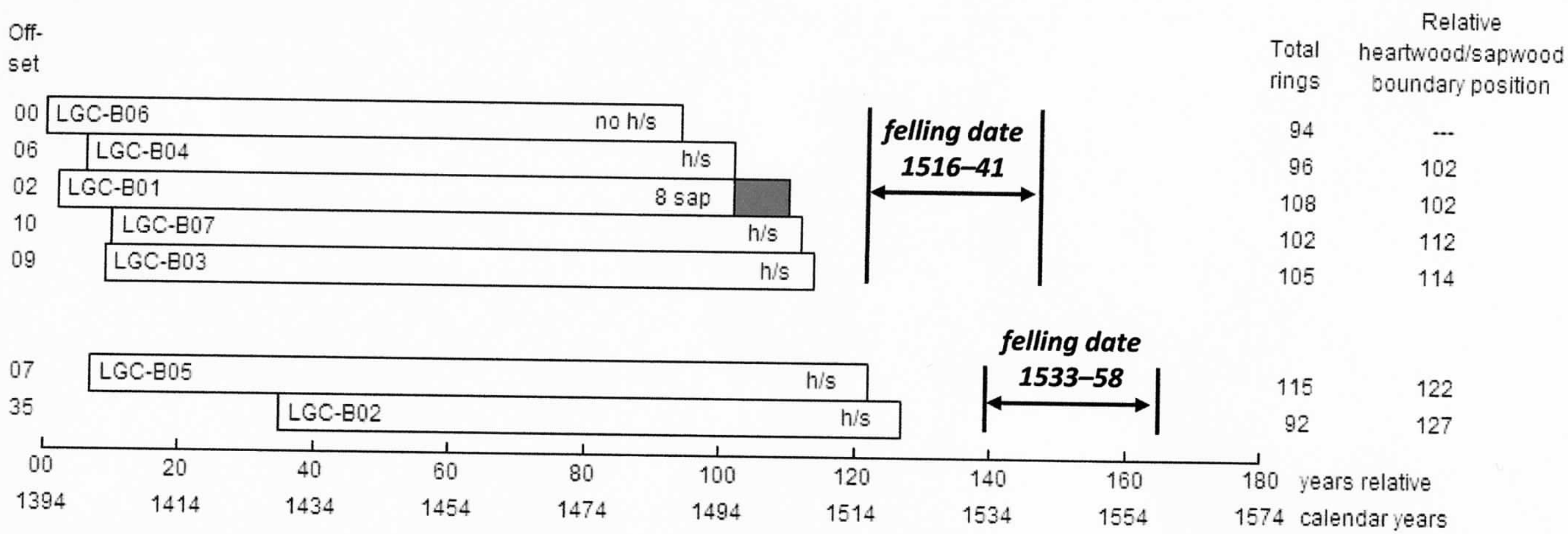


Figure 3: Plan to help locate the sampled timbers (see Table 1) (after Alison Armstrong and David Johnson YDMT)



blank bars [ ] = heartwood rings; shaded bars [ ] = sapwood rings

h/s = the sample retains the heartwood/sapwood boundary, ie, only the sapwood rings have been lost

Figure 4: Bar diagram showing the relative position and dates of the Springs Wood Barn samples

The seven dated samples are shown here in the form of 'bars' at positions relative to each other where the growth rings of the timbers cross-match with all the other samples obtained as part of this programme of tree-ring analysis, the similarity being caused by the trees growing at the same time and general area as each other. These seven samples, along with all the other cross-matching samples from timbers in the other buildings which were sampled, have been combined to form site chronologies which have been dated by comparison with the 'reference' chronologies. Taking into account the heartwood/sapwood boundary on the samples, and the likely number of sapwood rings the trees might originally have had, it is estimated that five timbers were felled at some point between 1516–41, while two other trees were felled between 1533–58 (although it is in fact possible that all seven trees were felled together at some point where their possible felling date ranges overlap between 1533–41).