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SILVERDALE BARN
STAINFORTH
NEAR SETTLE
NORTH YORKSHIRE
TREE-RING ANALYSIS OF TIMBERS

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May 2019

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SUMMARY

Analysis by dendrochronology was undertaken on a single core sample obtained from a lintel to the main cart entrance of Silverdale Barn in conjunction with those obtained from a number of other buildings in the Ingleborough area.

Although this sample was analysed in conjunction with all the other samples obtained from other local buildings as part of this project, there was no cross-matching. The single sample was, therefore, compared individually with the full corpus of reference data for oak held not only by the Nottingham Laboratory, but also by other establishments, but again there was no matching and this sample must, therefore, remain undated.

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Introduction

The barn at Silverdale, 3 kilometres north-east of Stainforth in North Yorkshire (SD 8394 6955, map Fig 1), is a large five-bay structure containing four roof trusses. It has a large and impressive central cart entry through a south-facing porch.

Sampling

Sampling and analysis by dendrochronology of timbers to Silverdale 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 Heritage Lottery Fund. The tree-ring analysis was 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, Silverdale 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, is to be published separately by the Yorkshire Dales Millennium Trust.

Thus, from the timbers available at Silverdale Barn, a single sample was obtained by coring (Figs 2 & 3). This sample was given the tree-ring code SIL-V (for 'Silverdale'), and numbered 01. Details of the sample are given in Table 1, including the timber sampled, the total number of rings in the sample, and how many of these, if any, are sapwood rings.

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 Silverdale Barn 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, the single core sample obtained from Silverdale Barn, along with all those obtained from all the other buildings included in this 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 the single Silverdale Barn sample could not be combined with other samples from other buildings sampled as part of this project to make a series of 'site chronologies'.

The single sample was, therefore, compared individually with the full corpus of reference data, but again there was no cross-matching. Hence, this sample must remain undated for the moment.

As may be seen from Table 1, the sample certainly does have sufficient number of rings for dating. These rings, however, do show a slight tendency towards compression, there being some slight distortion to the growth as well. Although this is not severe, it may have some impact on the climate signal of the rings by which a match is made with the reference data. It is also possible that the source tree for this timber was growing in a locality for which, as yet, no reference material is currently available. It is possible that as more local samples are collected and analysed, the Silverdale Barn sample itself will eventually be dated.

Table 1: Details of the tree-ring sample from Silverdale Barn, Stainforth, 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)
SIL-V01	Lintel to inner door	114	h/s	------	------	------

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

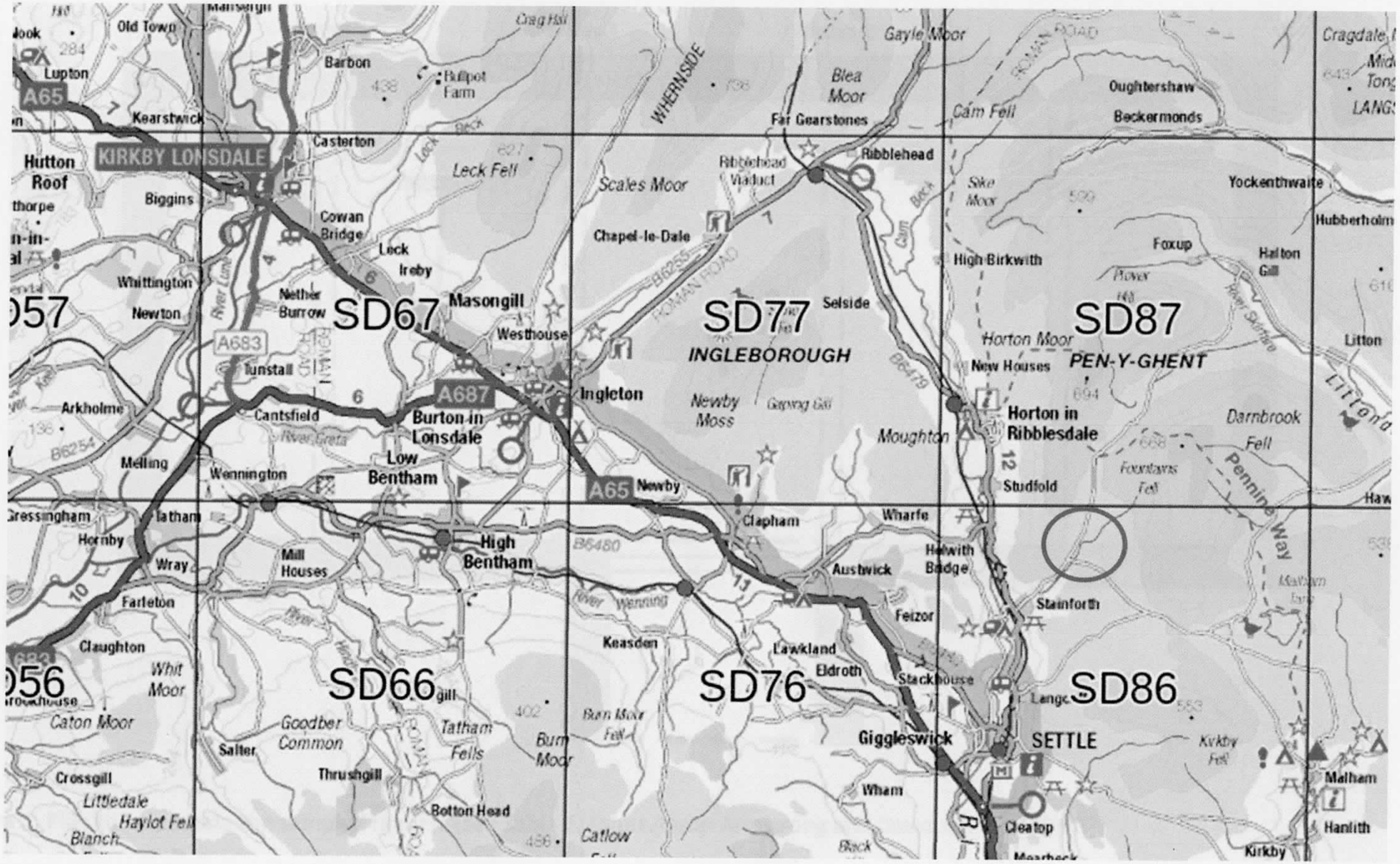

Figure 1: Map to show approximate location of Silverdale Barn

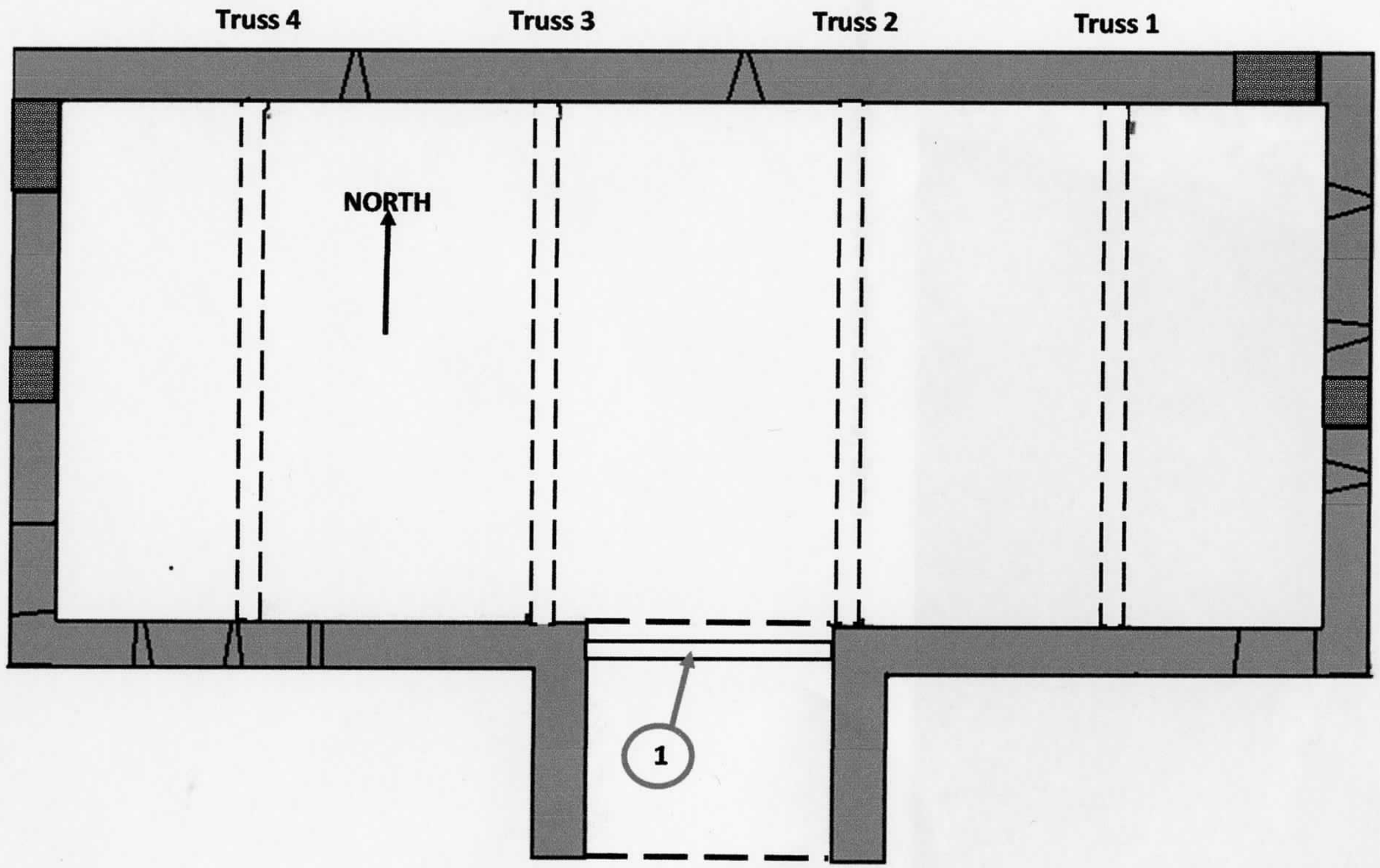

Figure 2: Plan to help locate the sampled timbers (see Table 1) (after Alison Armstrong and David Johnson YDMT)

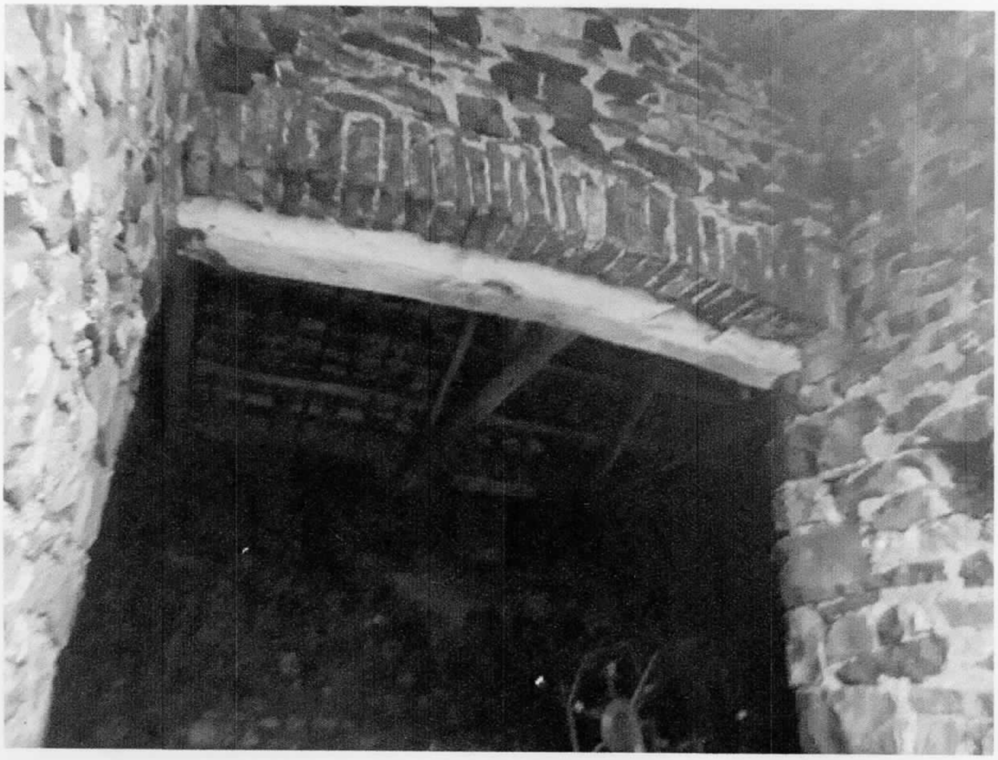

Figure 3: General view of the doorway lintel