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TREE-RING ANALYSIS OF TIMBERS FROM CHURCH FARM HOUSE, CHURCH STREET, OCKBROOK, DERBYSHIRE

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SUMMARY

Dendrochronological analysis was undertaken on a number of timbers at this building resulting in the dating of two site sequences.

Site sequence OCKASQ01 contains eight samples and spans the period AD 1491–1631. Seven of these samples are from structural timbers and a roof timber of Building A. One of these is now known to have been felled in AD 1622, with it thought likely that the other six timbers were also felled at this time. The eighth sample in this site sequence is from Building B and has a *terminus post quem* felling of AD 1646.

Site sequence OCKASQ02 contains seven samples, all from the roof of Building B, and spans the period AD 1560–1672. One of these samples was felled in AD 1672 with the heartwood/sapwood boundary rings of the other six samples making it likely that they were also felled in AD 1672.

The tree-ring dating suggests construction of Building A occurred in or soon after the felling of its timbers in AD 1622, some 50 years prior to Building B being erected, in or soon after the felling of its timbers in AD 1672.

A sample taken from a first-floor ceiling beam in Building C is undated.

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Introduction

Church Farm House is located on the east side of Church Street in the parish of Ockbrook, approximately four miles to the east of the City of Derby (Figs 1 and 2). As can be seen clearly from the rear of the building (Fig 2), this structure was once two separate cottages, with these cottages thought to date to the seventeenth century.

The building to the north (Building A) is a single bay structure of two storeys, with square panel timber framing and corner bracing to the top. Unfortunately, the roof has been removed with only the truncated remains of one truss remaining (Truss 2). These remains consist of the west principal and east and west struts and can just be seen in Figure 2.

The building to the south (Building B) is also of one bay with two storeys plus attic and cellar. The exterior has similar square panel timber framing and corner bracing to Building A. The roof is of two trusses which consist of principal rafters, tiebeams, collars, and queen posts (Fig 4).

These two cottages were converted to a single dwelling by the construction of a brick infill (Building C). This is thought to have occurred in the eighteenth century. There were further nineteenth and twentieth-century additions and alterations which have recently been removed (Fig 5).

Tree-ring Sampling

A total of 16 samples were taken from Church Farm House. Each sample was given the code OCK-A (for Ockbrook, site 'A') and numbered 01–16. It had been suggested that Buildings A and B were of different dates, with Building A being slightly older (*pers comm*. Richard Sheppard) and, therefore, were to be treated as separate phases. In accordance with this, seven samples were taken from the structural and framing timbers and from one of the roof struts of Building A (OCK-A01–07). A further eight samples were taken from the roof of Building B (OCK-A08–15), and finally a single sample was taken from a ceiling beam on the first floor of Building C (OCK-A16). The location of each sample was noted at the time of sampling and these have been marked on Figures 6 and 7. 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 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 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, Results, and Interpretation

All 16 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 15 samples forming two groups.

Firstly, eight samples grouped and were combined at the relevant offset positions to form OCKASQ01, a site sequence of 141 rings (Fig 8). 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 AD 1491 and a last-measured ring date of AD 1631.

Seven of these samples are from Building A. One of these (OCK-A04) has complete sapwood and the last-measured ring date of AD 1622, the felling date of the timber represented. A further four have the heartwood/sapwood boundary ring, interpretation of which suggests that these were also felled in AD 1622. The remaining two samples from Building A do not have the heartwood/sapwood boundary ring. However, with last measured ring dates of AD 1590 (OCK-A03) and AD 1593 (OCK-A02), they would be estimated to have been felled at the earliest in AD 1606 and AD 1609, respectively, making it possible that they were also felled in AD 1622.

The eighth sample in this site sequence (OCK-A10) is taken from Building B. This sample does not have the heartwood/sapwood boundary ring and so an estimated felling date cannot be calculated for it, except to say that with a last-measured ring date of AD 1631, this would be estimated to be AD 1647 at the earliest.

Secondly, seven samples, all taken from Building B, grouped and were combined at the relevant offset positions to form OCKASQ02, a site sequence of 113 rings (Fig 9). Attempts to date this site sequence by comparing it against the reference chronologies resulted in it matching at a first-ring date of AD 1560 and a last-measured ring date of AD 1672.

One of these samples, OCK-A09 has complete sapwood and the last-measured ring date of AD 1672, the felling date of the timber represented. The other six samples in this site sequence all have the heartwood/sapwood boundary ring. Interpretation of this suggests that it is likely that these samples were also felled in AD 1672.

Attempts were then made to date the remaining ungrouped sample, OCK-A16, by individually comparing it against the reference chronologies, however, this was unsuccessful and this timber remains undated.

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

Prior to the tree-ring analysis being undertaken, these two cottages were thought to date to the

seventeenth century with it having been suggested that Building A might be the older of the two.

A post from Building A is now known to have been felled in AD 1622, with a further five of its structural and one of its roof timbers also thought likely to have been felled in AD 1622. A principal rafter from the roof of Building B was felled in AD 1672, with the heartwood/sapwood boundary ring position of a further six roof timbers making it likely that they were also felled in AD 1672. An eighth roof timber has a *terminus post quem* felling date of AD 1646 which makes it possible it was felled at the same time as the rest of the dated timbers.

The dendrochronological analysis has demonstrated that both cottages do indeed date to the seventeenth century. Further, it is likely that Building A was constructed in or soon after the felling of its timbers in AD 1622, some 50 years prior to that of Building B in or soon after the felling of its timbers in AD 1672. Therefore, the tree-ring analysis has supported and strengthened the conclusions gained on structural analysis. Additionally, although only one of the roof timbers of Building A was sampled and dated, it has shown that the recently removed roof was contemporary with the construction of the building rather than being a later re-roofing.

It is unfortunate that no timbers were dated from the brick infill (Building C) which could have provided a date for the incorporation of the two cottages into one dwelling.

Acknowledgements:

This work was commissioned by R W Oxley, Architect on behalf of the owner of the property, Mr K Stevenson, as part of a wider programme of research. Figures 5–7 were produced by Richard Sheppard of Trent and Peak Archaeology.

Table 1: Details of samples from Church Farm House, Ockbrook, Derbyshire

Sample number	Sample location	Total rings	*Sapwood rings	First measured ring date (AD)	Last heartwood ring date (AD)	Last ring date (AD)
Building A						
OCK-A01	East post, truss 1	126	24C	1496	1597	1621
OCK-A02	West post, truss 1	99	--	1495	----	1593
OCK-A03	East post, truss 2	88	--	1503	----	1590
OCK-A04	West post, truss 2	130	30C	1493	1592	1622
OCK-A05	West strut, truss 2	98	04	1511	1604	1608
OCK-A06	South stud, east wall, bay 1	106	h/s	1491	1606	1606
OCK-A07	Mid stud, west wall, bay 1	128	24	1494	1597	1621
Building B						
OCK-A08	East principal rafter, truss 3	58	15	1598	1640	1655
OCK-A09	West principal rafter, truss 3	76	26C	1597	1646	1672
OCK-A10	East strut, truss 3	83	--	1549	----	1631
OCK-A11	West strut, truss 3	97	09	1560	1647	1656
OCK-A12	East purlin, bay 3	68	12	1596	1651	1663
OCK-A13	West purlin, bay 3	65	13	1596	1647	1660
OCK-A14	East principal rafter, truss 4	60	07	1609	1661	1668
OCK-A15	West principal rafter, truss 4	50	07	1619	1661	1668
Building C						
OCK-A16	Ceiling beam, bay 2	58	h/s	----	----	----

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

Table 2: Results of the cross-matching of site sequence OCKASQ01 when the first-ring date is AD 1491 and a last-ring date of AD 1631

Reference chronology	Span of chronology (AD)	*t*-value
Church of St Andrew (bellframe), Welham, Leics	AD 1443–1633	11.7
East Midlands	AD 882–1981	11.2
St Stephen's Church (bellframe), Sneinton, Notts	AD 1484–1654	10.6
Keyworth barn, Notts	AD 1465–1628	10.1
Wakelyn Old Hall, Hilton, Derbys	AD 1415–1573	9.2
61 Long Acre, Bingham, Notts	AD 1478–1617	9.0
Brook Farm, Knutsford, Cheshire	AD 1402–1585	8.7
Middleton Hall, Warwicks	AD 1390–1646	8.1

Table 3: Results of the cross-matching of site sequence OCKASQ02 when the first-ring date is AD 1560 and the last-ring date is AD 1672

Reference chronology	Span of chronology (AD)	*t*-value
Brewhouse Yard Museum, Notts	AD 1544–1701	9.0
Combermere Abbey, Whitchurch, Cheshire	AD 1602–1727	8.9
Bolsover Castle, Derbys (Riding house)	AD 1494–1744	7.9
Bolsover Castle, Derbys (Little Castle)	AD 1532–1749	7.9
Middleton Hall, Warwicks	AD 1593–1718	7.5
Cromford Bridge House, Derbys	AD 1550–1662	7.2
Rufford Mill, Notts	AD 1571–1727	7.1
Stowmarket Church, Suffolk	AD 1542–1671	6.8

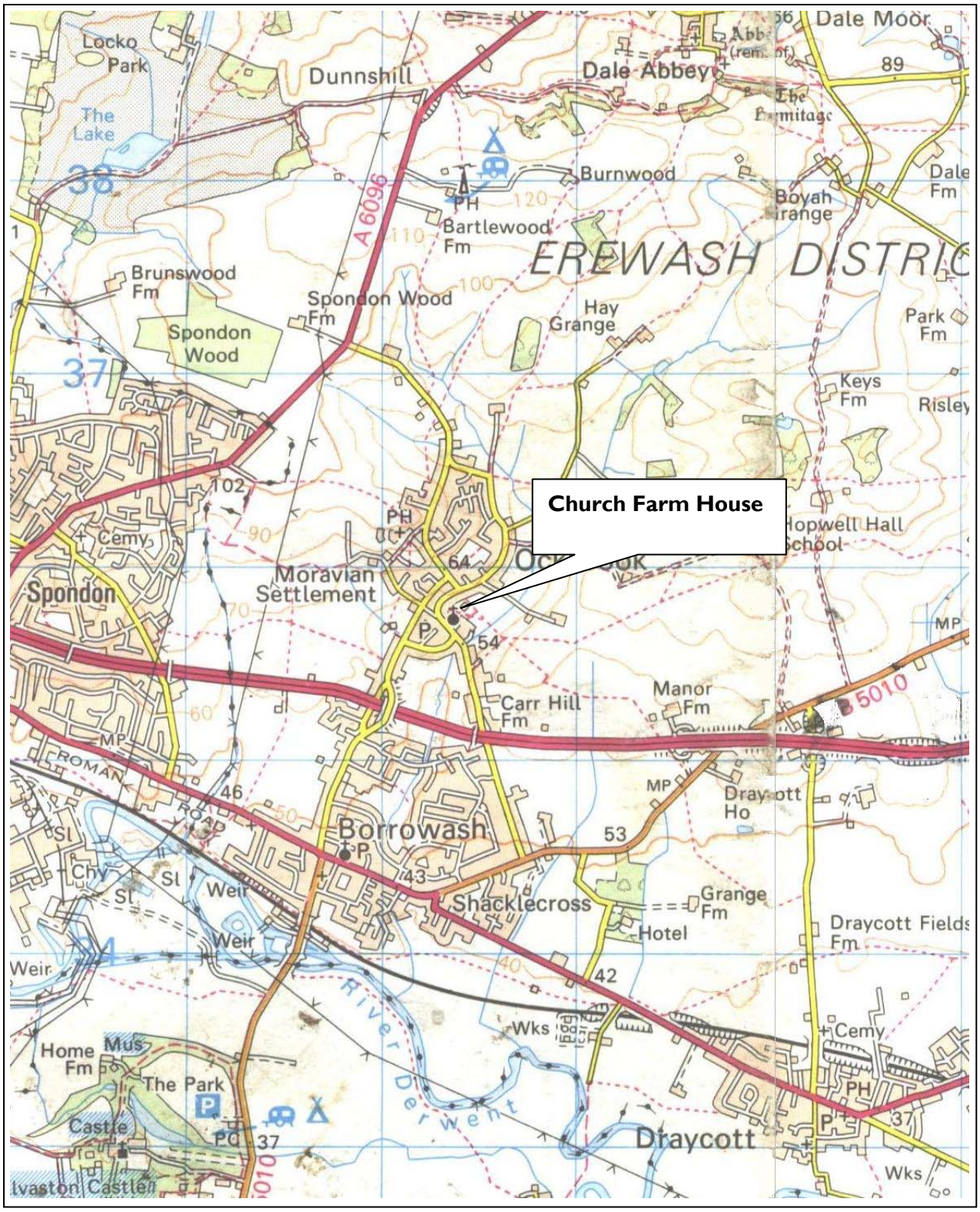


Figure 1: Map to show the general location of Church Farm House (Reproduced from OS Landranger map Kidderminster & Wyre Forest area 1:50000 scale by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown copyright. All rights reserved. Licence number WL10213)

Figure 2: Church Farm House; photograph taken from the north with Building A to the left, note the truncated remains of truss 2 (arrowed)

Figure 3: Church Farm House; the rear of the building, Building A to the right

Figure 4: Church Farm House; Building B, truss 4, taken from the north

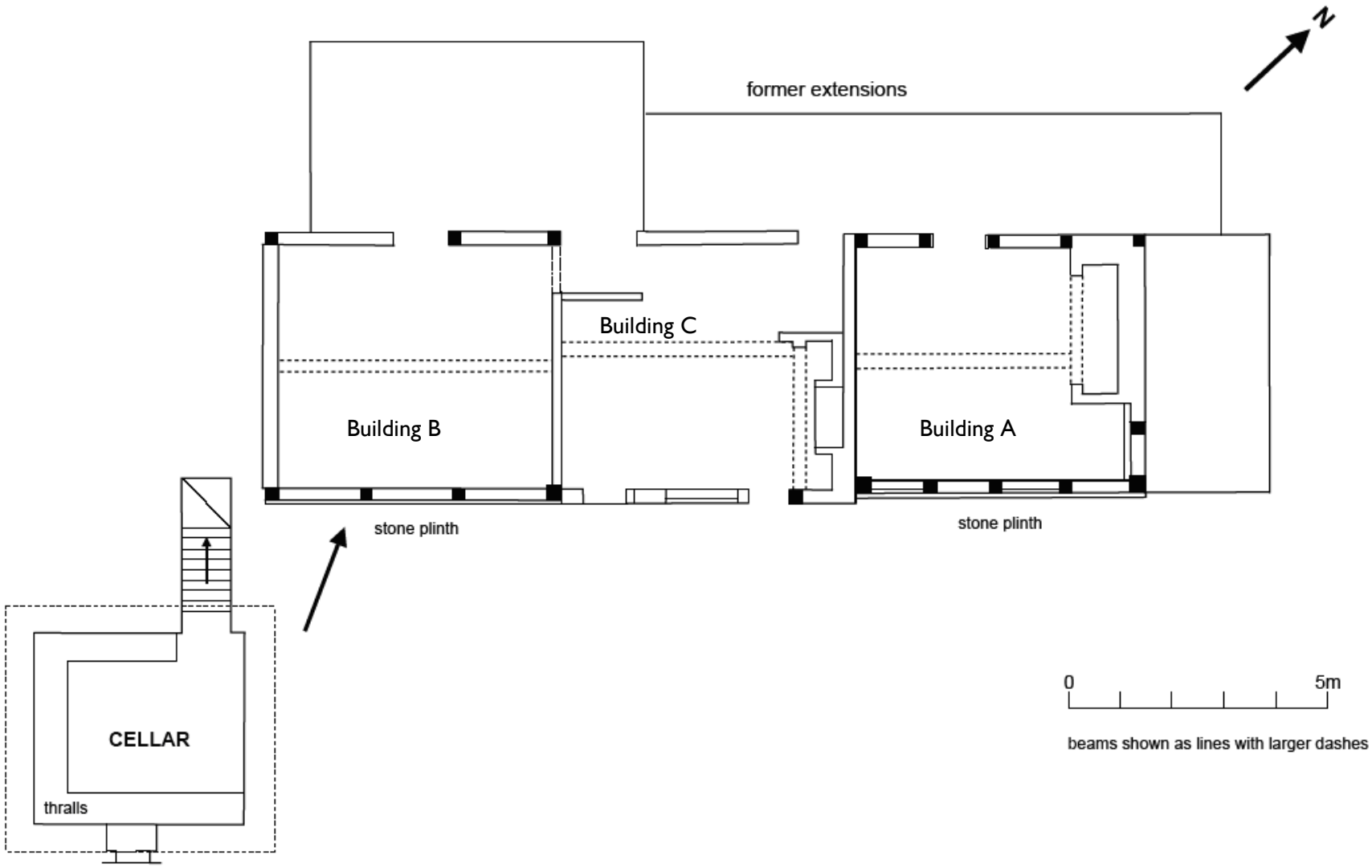


Figure 5: Church Farm House; ground plan and cellar plan (Richard Sheppard)

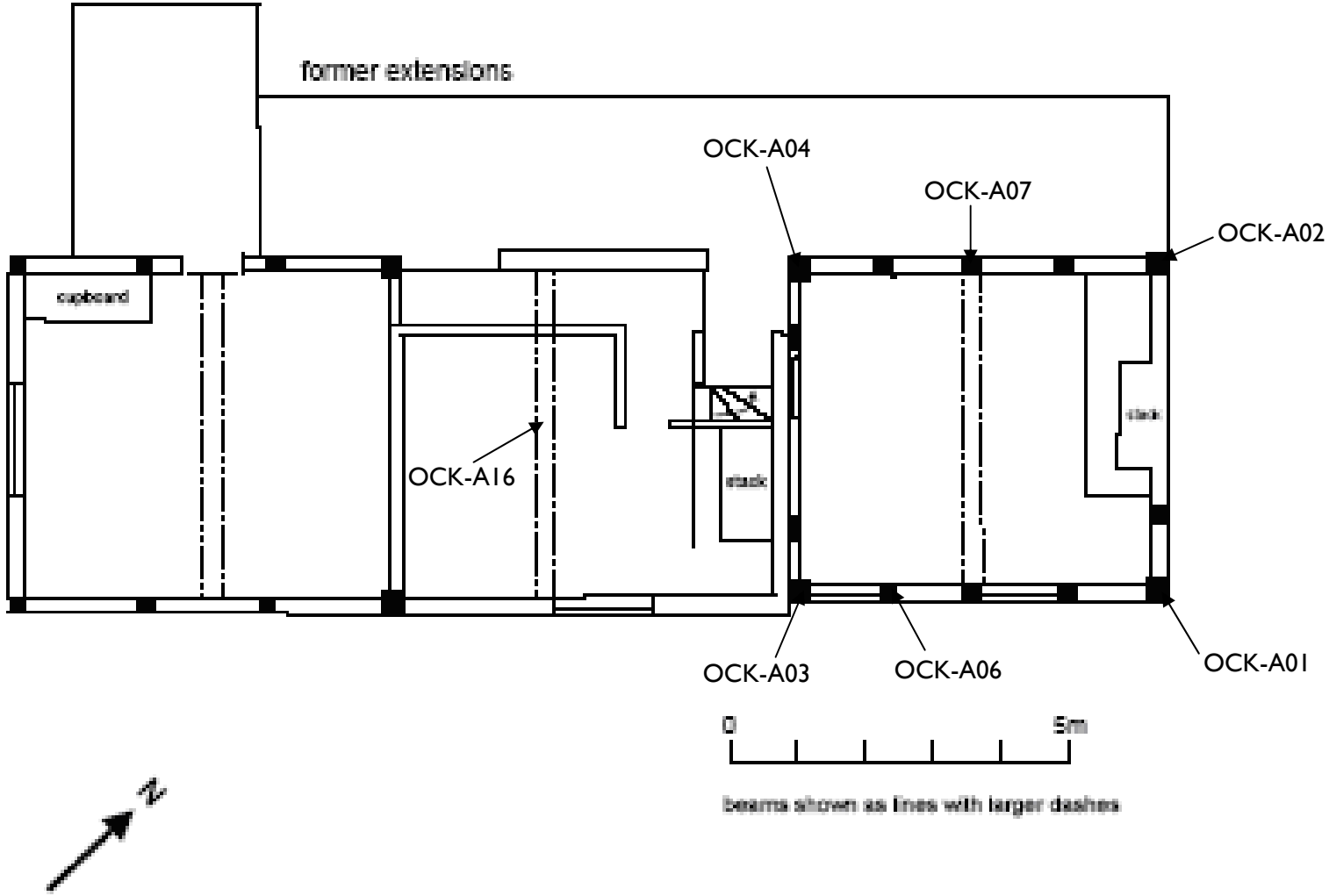


Figure 6: Church Farm House; first-floor plan, showing the location of samples OCK-A01–4, OCK-A06–07, and OCK-A16 (Richard Sheppard)

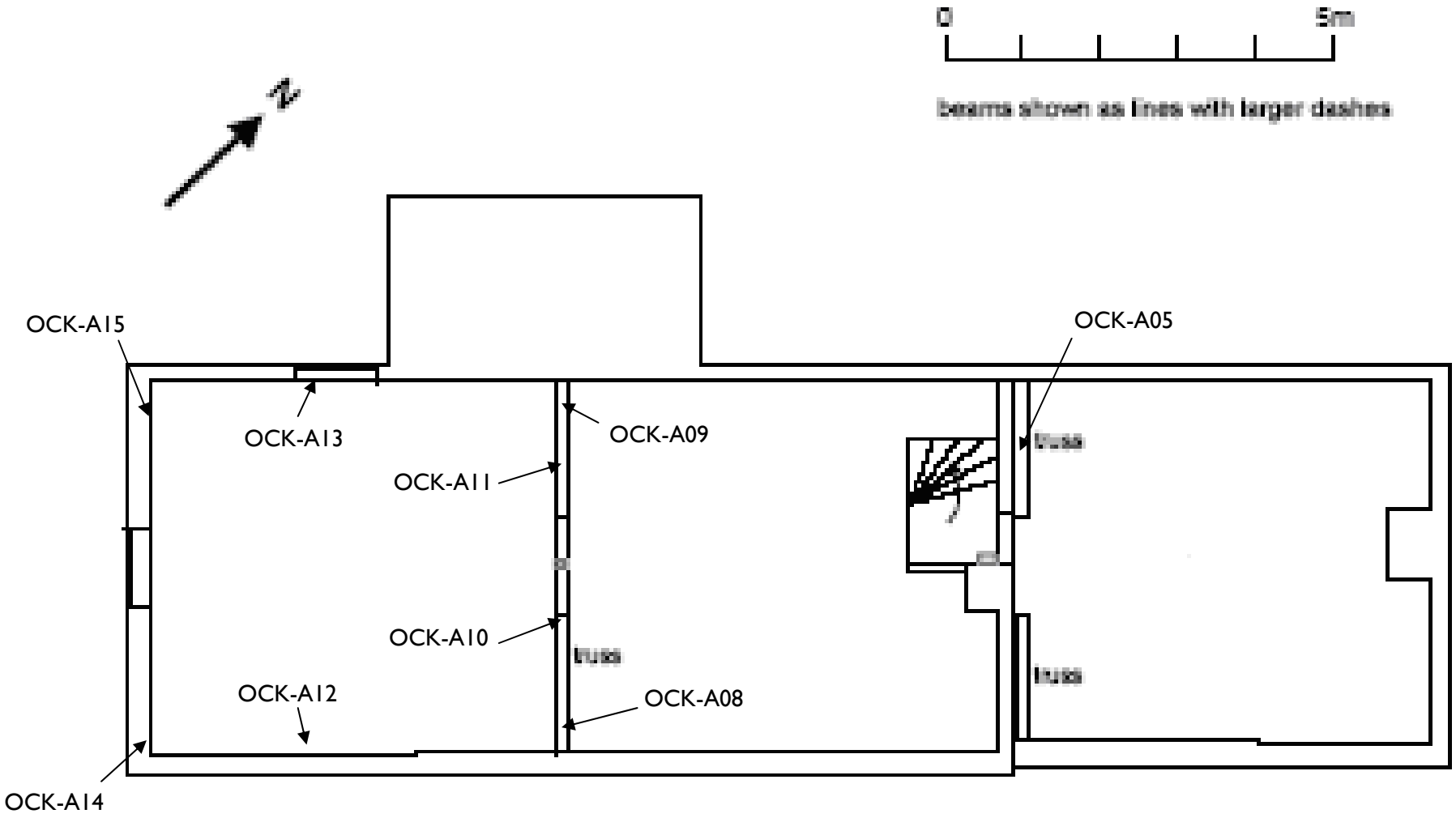
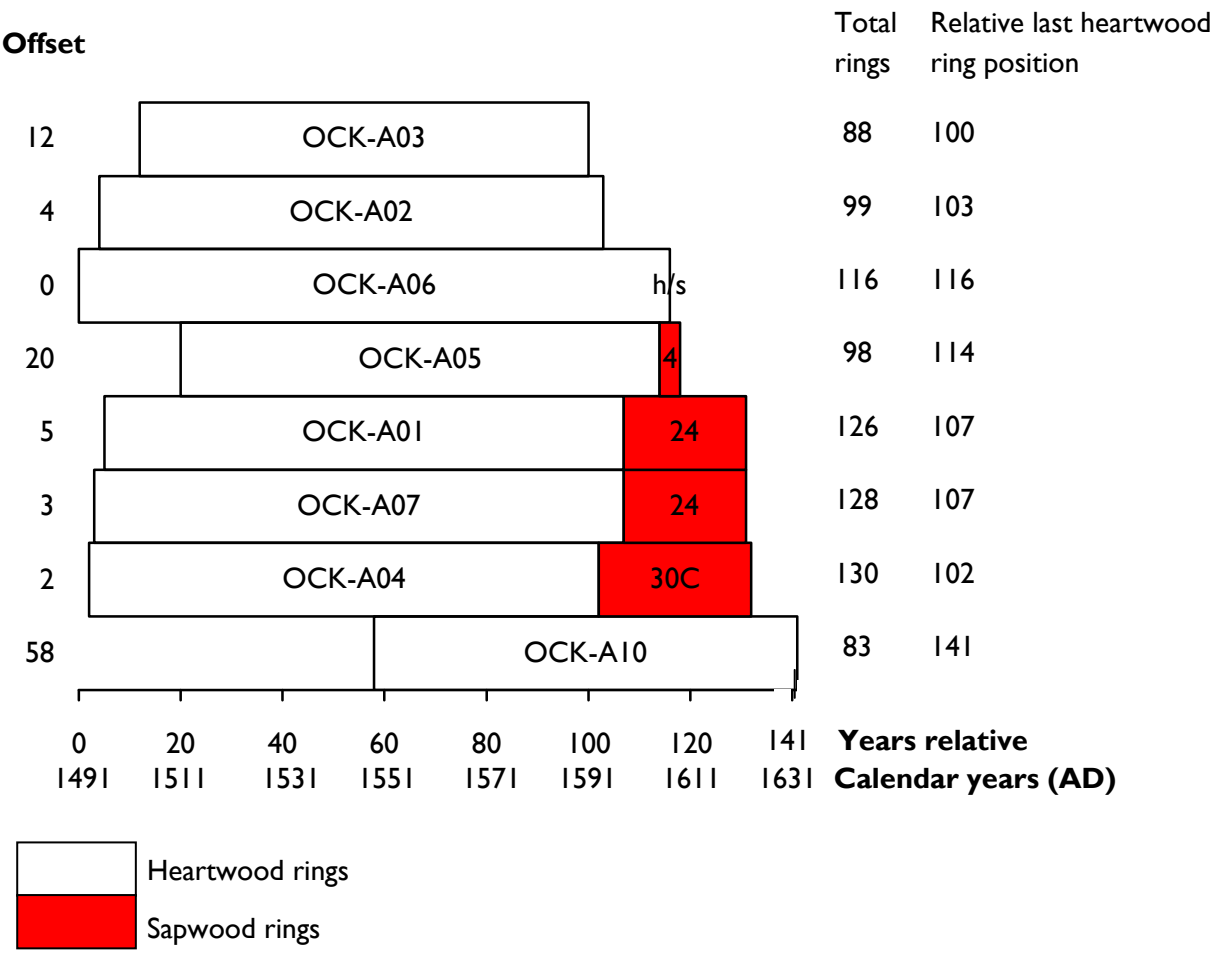
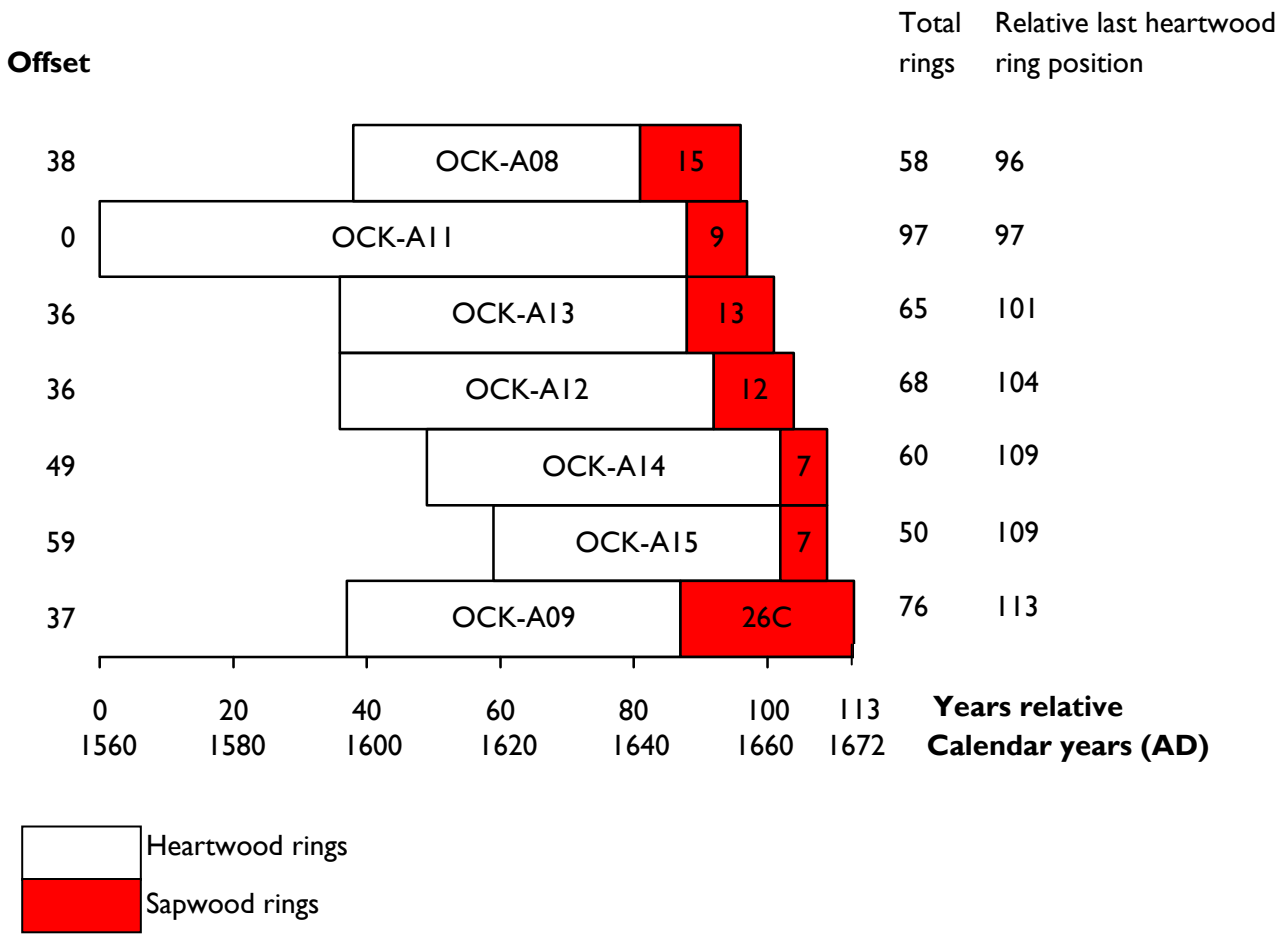


Figure 7: Church Farm House; Attic/garret level, showing the location of samples OCK-A05 and OCK-A08–15 (Richard Sheppard)



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

Figure 8: Bar diagram of samples in site sequence OCKASQ01



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

Figure 9: Bar diagram of samples in site sequence OCKASQ02