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Tree-Ring Analysis of Further Oak Timbers from the Old Chapel, Sinnington, North Yorkshire

Ian Tyers

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Summary

The Old Chapel at Sinnington is a two-storey barn-like building of stone located adjacent to the hall and church in the village of Sinnington, between Pickering and Kirbymoorside in the North Yorkshire district of Ryedale. The property is listed grade I and listed on the Building at Risk register. The area is a Scheduled Ancient Monument. The building has recently had an English Heritage grant-aided programme of repair. This report covers the dendrochronological analysis of a further series of samples mostly taken from the roof tiebeams, principal rafters, and common rafters. This analysis was undertaken to clarify the dating of the roof identified as being from the first half of the sixteenth century in an initial sampling programme (Tyers 1999a). The new results indicate that the present roof timbers were felled in late AD 1516 or early AD 1517.

Keywords

Dendrochronology
Standing Buildings

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TREE-RING ANALYSIS OF FURTHER OAK TIMBERS FROM THE OLD CHAPEL, SINNINGTON, NORTH YORKSHIRE

Introduction

This document is a technical archive report on the tree-ring analysis of an additional series of samples from oak timbers from the Old Chapel, Sinnington, North Yorkshire (NGR SE 74608610). It is beyond the dendrochronological brief to describe the building in detail or to undertake the production of detailed drawings. As part of a multifaceted and multidisciplinary study of the building, elements of this report may be combined with detailed descriptions, drawings, and other technical reports at some point in the future to form either a comprehensive publication or an archive deposition on the building. The conclusions may therefore have to be modified in the light of subsequent work.

The Old Chapel is an enigmatic two-storey barn-like building located 50m north-west of All Saints church, Sinnington (Figs 1 and 2). The building is grade I listed and on the Buildings at Risk register (English Heritage 1999), whilst also being a Scheduled Ancient Monument (SM 30134). The building has recently been in receipt of substantial remedial works. The roof above consists of seven simple oak trusses. These are of simple collar type with two tiers of trenched purlins held in place by the common rafters. There are straight wind-braces from the lower purlins arranged in a diamond pattern. The southernmost truss has had its tiebeam cut (Figs 3a and 3b). Although not apparently noted elsewhere there is surviving truss-numbering evidence that suggests that there was a further truss to the northern end.

An earlier programme of dendrochronological sampling (Tyers 1999a) demonstrated that surviving lintels and transverse beams are derived from an earlier fifteenth-century phase of construction. This may identify the structure as that mentioned in a document of AD 1431/2 that refers to the payment for works at the 'Chapel at Sinnington' (Hall and Thomas 1914, 253-6). The difficulties of access to the roof during the initial sampling programme prevented the collection of samples complete to bark-edge from the roof timbers despite the obvious presence of such material. The earlier programme of sampling dated the roof to the period AD 1508-44 inclusive (Tyers 1999a).

A further tree-ring dating programme of the roof timbers was requested by Giles Proctor from English Heritage to utilise the improved access available during the grant-aided repair programme. During the repair programme the fragmentary remains of a timber floor was revealed in part of the building. An assessment of its potential for analysis was also requested.

Methodology

The general methodology and working practises used at the Sheffield Dendrochronology Laboratory are described in English Heritage (1998). The methodology used for this building was as follows.

A brief survey identified those oak timbers with the most suitable ring sequences for analysis. Those with more than 50 annual rings and some survival of the original sapwood and bark-edge were sought. The dendrochronological sampling programme attempted to obtain cores from as broad a range of timbers, in terms of structural element types, scantling sizes, and carpentry features, as was possible within the terms of the request.

The most promising timbers were sampled using a 15mm diameter corer attached to an electric drill. The cores were taken as closely as possible along the radius of the timbers so that the maximum number of rings could be obtained for subsequent analysis. The core holes were left open. The ring sequences in the cores were revealed by sanding.

The complete sequences of growth rings in the samples that were selected for dating purposes were measured to an accuracy of 0.01mm using a micro-computer based travelling stage (Tyers 1999b). The ring sequences were plotted onto semi-log graph paper to enable visual comparisons to be made between sequences. In addition cross-correlation algorithms (Baillie and Pilcher 1973) were employed to search for positions where the ring sequences were highly correlated. These positions were checked visually using the graphs and, where these were satisfactory, new mean sequences were constructed from the synchronised sequences. The *t*-values reported below are derived from the original CROS algorithm (Baillie and Pilcher 1973). A *t*-value of 3.5 or over is usually indicative of a good match, although this is with the proviso that high *t*-values at the same relative or absolute position must be obtained from a range of independent sequences, and that these positions are supported by satisfactory visual matching.

All the measured sequences from this assemblage were compared with each other and any found to cross-match were combined to form a site master curve. These, and any remaining unmatched ring sequences were tested against a range of reference chronologies, using the same matching criteria: high *t*-values, replicated values against a range of chronologies at the same position, and satisfactory visual matching. Where such positions are found these provide calendar dates for the ring-sequence.

The tree-ring dates produced by this process initially only date the rings present in the timber. The interpretation of these dates relies upon the nature of the final rings in the sequence. If the sample ends in the heartwood of the original tree, a *terminus post quem (tpq)* for the felling of the tree is indicated by the date of the last ring plus the addition of the minimum expected number of sapwood rings which are missing. This *tpq* may be many decades prior to the real felling date. Where some of the outer sapwood or the heartwood/sapwood boundary survives on the sample, a felling date range can be calculated using the maximum and minimum number of sapwood rings likely to have been present. The sapwood estimates applied throughout this report are a minimum of 10 and maximum of 46 annual rings, where these figures indicate the 95% confidence limits of the range. These figures are applicable to oaks from England and Wales. Alternatively, if bark-edge survives, then a felling date can be directly utilised from the date of the last surviving ring. The dates obtained by the technique do not by themselves necessarily indicate the date of the structure from which they are derived. It is necessary to incorporate other specialist evidence

concerning the re-use of timbers and the repairs of structures before the dendrochronological dates given here can be reliably interpreted as reflecting the construction date of phases within the structure.

A further important element of the tree-ring analysis of buildings and archaeological assemblages is the identification of 'same tree' groups within the sampled material. Inspection of timbers, both in buildings and archaeological sites, often suggests that the patterns of knots or branching in timbers are so similar that they appear to be derived from a single tree. Tree-ring analysis is often used to support these suggestions. The identification of 'same tree' groups is based on a combination of high levels of matching between samples, extremely similar longer term growth trends, and individual anatomical anomalies within the timbers. High *t*-values are not by themselves necessarily indicative of two series being derived from a single tree. Conversely low *t*-values do not necessarily exclude the possibility. It is the balance of a range of information that provides the evidence.

Results

Originally access to the roof timbers in this building was difficult. The floor-to-tiebeam height is *c* seven metres, with the collars a further three metres higher. The floor is mostly earthen and at that stage it was scattered with modern junk. The extreme height and lack of good stable footings combined to limit access to the higher structural elements. The two areas of later inserted flooring were both suffering from weathering and the accumulation of debris. The northern one of these was felt too unsafe to work from, whilst the southern one could only be safely used along the western and southern edges. Long ladder access allowed sampling of two of the central roof trusses, short ladders provided access from the southern inserted floor to the two southern trusses. No sampling was originally undertaken on a further three trusses. The sampling locations on the principal rafters were particularly constrained by access difficulties since the sapwood and bark appeared more common above the collars but it was felt these positions were unsuitably high for sampling purposes at least without the provision of scaffold towers. In late AD 2000 during the repair programme a scaffold platform was present along the internal eastern side providing safe access where none had previously been available, the new roof sampling is thus confined to this side of the structure.

During the original sampling two original truss numbers were identified that formed a coherent sequence, the present central truss has a tagged V on the east side, whilst the southern truss has an untagged VIII on the west side. This sequence suggests that a further truss, now lost, previously existed at the northern end of the building (Fig 3a), this numbering scheme has been following throughout both this report and the earlier report (Table 1).

A total of 8 further timbers were selected as most suitable for sampling (Table 1; Fig 3a). Sample **13** was obtained by coring the western lintel of the three over the eastern ground-floor door. Sample **14** was collected from a purlin replaced during the restoration programme. Seven other timbers were cored, one being a repeat of a previously sampled and dated timber but this was at a different position in an attempt to recover more sapwood. These new roof samples were numbered **15-20** inclusive. In addition the

further sample was obtained from a timber previously cored as sample **2**, the new core from this timber was labelled **2b**. All the roof timbers accessible from the platform were assessed for their suitability for dating. The selected material was felt to be the most appropriate for attempting to refine the date of the roof.

All the new samples when examined in the laboratory were suitable for analysis. The nine new series were measured and then compared with each other. Seven sequences were found that either matched together to form an internally consistent group or matched pre-existing data from the building (Table 2). The two series from the same timber (samples **2** and **2b**) were combined into a single series (**2+2b**) before the new 221-year site mean chronology was calculated, named SINNEW (Fig 4) that incorporates both the earlier dated material and the new dated samples. Table 3 shows the correlation of the mean sequence at the dating position identified for it, AD 1296 - 1516 inclusive. Table 4 lists the updated site mean chronology.

The remaining two newly measured samples did not match either the rest of the material from Sinnington nor dated reference chronologies.

Interpretation

The 221-year chronology SINNEW is dated AD 1296 to AD 1516 inclusive. It was created from seventeen samples from sixteen timbers, ten from the previous work and seven from the new sampling. Two of the newly dated samples are complete to bark-edge, and four new samples and ten dated samples overall retain either some sapwood or are complete to the heartwood/sapwood boundary (Table 1 for new samples; Figure 4 includes all dated samples from the building). Inspection of the bar diagram (Fig 4) suggests they may be derived from three different groups. Three timbers form an early group (samples **8**, **11**, and **12**). None of these retains any sapwood but all were complete, or were apparently complete, to the heartwood/sapwood boundary. Combining the interpretation of these samples suggests they were felled between AD 1420 and AD 1449. A lintel from the east ground floor door (sample **13**) was felled sometime after AD 1442, it thus appears to be part of a later modification to the building, however the slab-like conversion of this particular timber, and the possibility that there was a significant number of outermost rings removed during this may mean that it is contemporary with the roof. The final group is formed by thirteen samples from twelve roof timbers. Here two samples, both from common rafters (samples **16** and **18**), retain the complete sapwood and bark-edge (Table 1; Fig 4). These timbers were both felled in late AD 1516 or early AD 1517.

Discussion

The report on the earlier sampling suggested a link between the building and the documented works at the 'Chapel at Sinnington' around AD 1431/2. This documentary reference derives from a Latin *compotus* roll for estates belonging to Matilda of York for that year. This specifically mentions inserting joists and mending doors (information derived from the summarised translation in Hall and Thomas 1914, 255), and the results reported previously identified one of the two extant joists, the decorated rerearch, and a door

lintel were made from trees which were felled in the early to middle years of the fifteenth century. This link suggested the building should perhaps be identified as the former Chapel, although it did and continues to seem extraordinary that the surviving year of the records relates to a remodelling of an extant building. If that link is genuine then the lintel from the eastern door cannot be part of the same remodelling since it is still growing heartwood in AD1432 and thus is probably felled some decades, and possibly much, later.

The new results demonstrate the roof is pre-Dissolution in origin. This is a somewhat earlier date than expected, since dates for the roof in the later-sixteenth or early-seventeenth centuries have hitherto been suggested on typological grounds.

Conclusion

The dendrochronological analysis of further timbers from this enigmatic building at Sinnington indicates timbers from at least two and possibly three phases of repair or remodelling are present within this supposedly twelfth-century masonry structure. Clearly many of the internal features, as well as important parts of windows and door structures are early- or mid-fifteenth century and may be part of the documented work of AD 1431/2. The roof is from AD 1516/17, and thus pre-Dissolution. A door lintel may be part of this or another modification phase. The recently revealed floor fragments were identified as a mixture of oak and elm. Following discussions with Ian Panter, the English Heritage Yorkshire and Humberside regional archaeological science advisor, and Cathy Groves, the English Heritage dendrochronological dating advisor based at Sheffield University, the analysis of this material is not considered appropriate at this stage pending conservation and display decisions.

Acknowledgements

The sampling and analysis programme was funded by English Heritage. The requirement to assess the floor provided an opportunity for detailed on-site discussions with Colin Breiden, the site archaeologist, who provided a great many useful insights into the building. This meeting also provided the impetus to have both Ian Panter and Cathy Groves to the site partly for consideration of the intervention necessary to analyse the floor but also to provide Ian with a greater insight into the nature of dendrochronological assessment and sampling work in a building. Mrs Susan Burn of Sinnington Hall kindly allowed access to the property, and gave permission to use her power supply.

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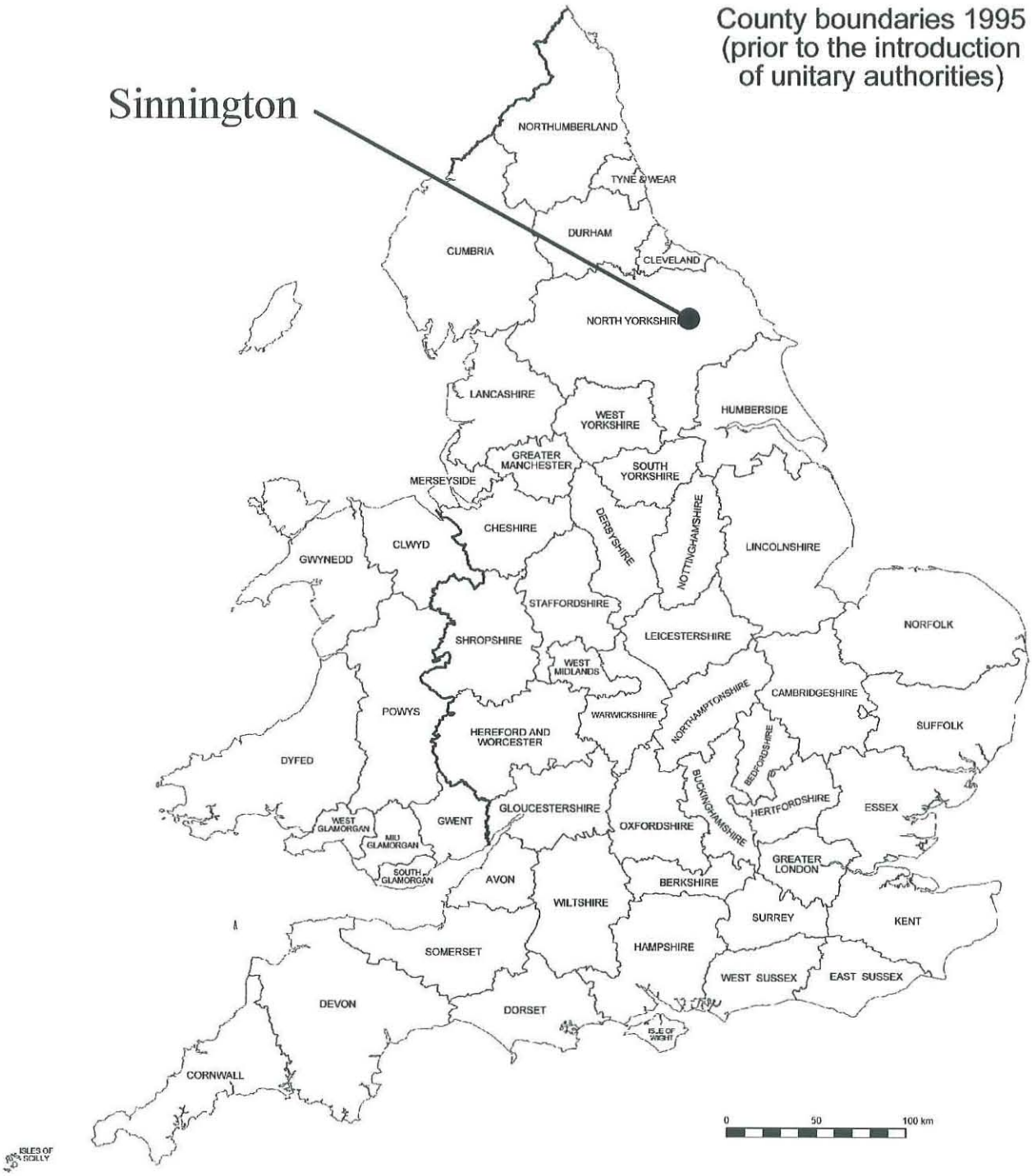

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Figure 2 Location of the Old Chapel, Sinnington (based upon the Ordnance Survey 1:10,000 map

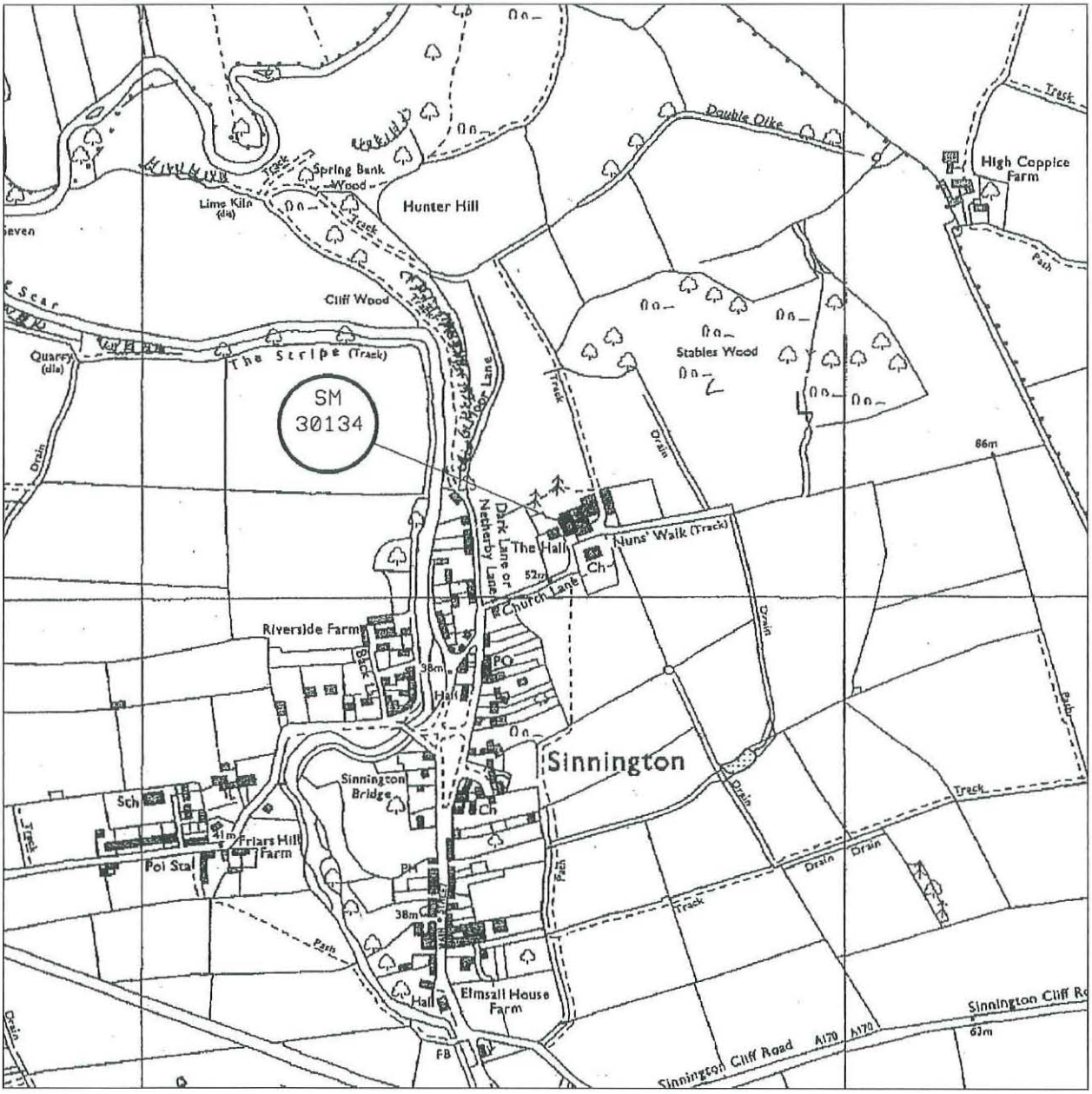

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Figure 3a Sketch plan of roof trusses showing truss numbering scheme used, and the approximate sample locations for both the previous and new sampling in the roof, the presence of truss 1 is deduced from frame numbering evidence. The truss 8 tiebeam has been cut and only survives as stub ends in the walls jointed to the principal rafters

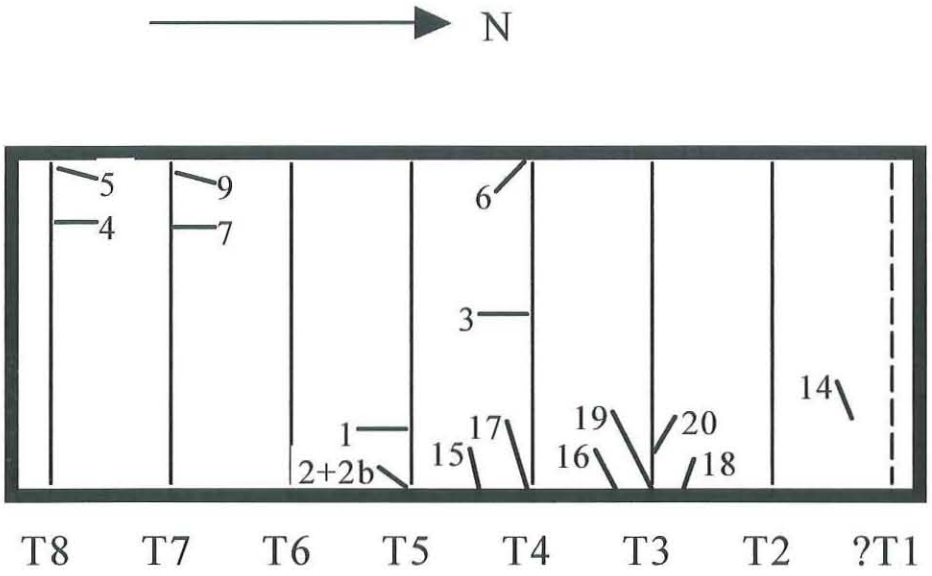


Figure 3b Sketch of roof truss type, with the nomenclature employed for its structural elements, based on an un-attributed drawing supplied by English Heritage

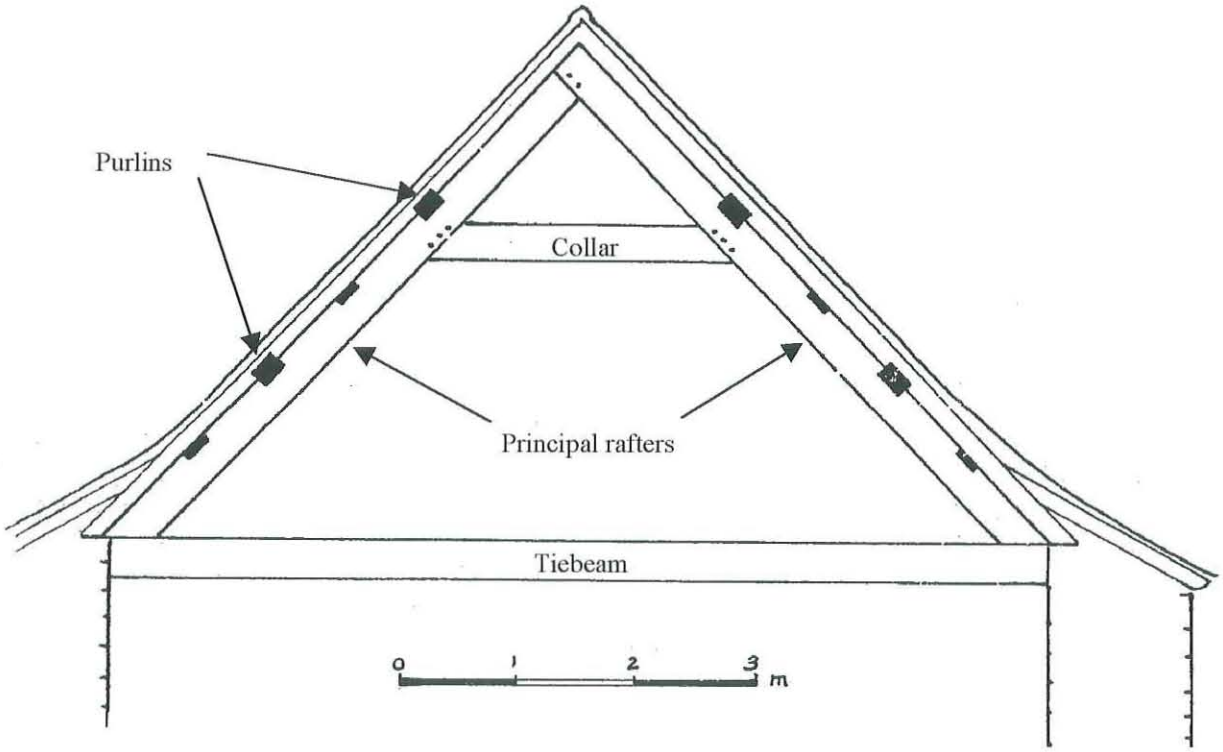
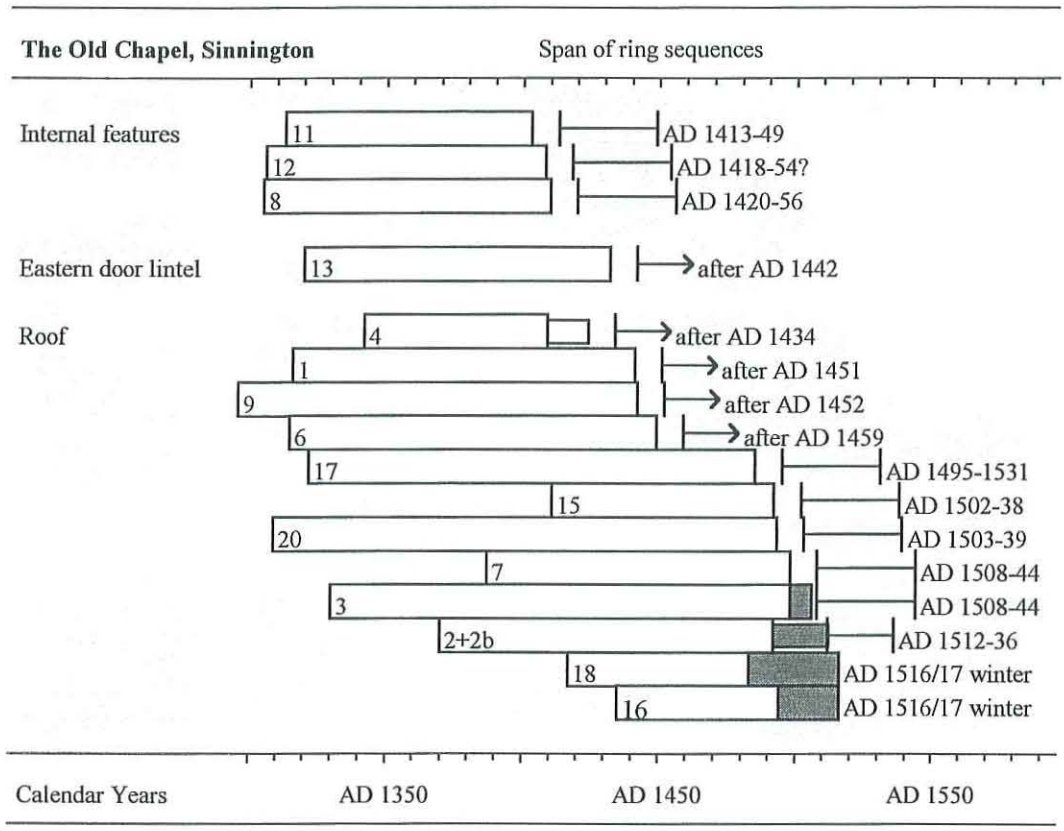


Figure 4 Bar diagram showing the chronological positions of the dated timbers from the new sampling and the previous work at this building. The felling period for each sequence is also shown



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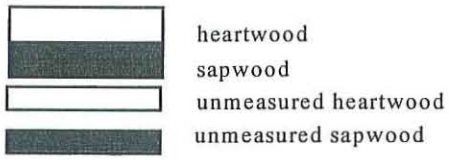

Table 1

List of new samples from Sinnington Old Hall

Core No	Origin of core	Cross-section size (mm)	Cross-section of tree	Total rings	Sapwood rings	ARW mm/year	Date of sequence	Felling period
2b	Truss 5 east principal rafter	390 x 110	Plank	121	h/s+*22s*	1.01	AD 1370-1490	AD 1512-36
13	East Door west lintel	220 x 70	Plank	113	-	1.11	AD 1320-1432	after AD1442
14	Bay 1 upper west purlin (replaced)	150 x 130	Quarter	113	h/s	1.20	undated	-
15	Bay 4 east common rafter 3rd from N	120 x 85	Quarter	82	h/s	0.90	AD 1411-1492	AD 1502-38
16	Bay 3 east common rafter 2nd from N	125 x 80	Quarter	82	22+Bw	1.35	AD 1435-1516	AD 1516/17 winter
17	Truss 4 east principal rafter	360 x 105	Plank	164	h/s	1.23	AD 1322-1485	AD 1495-1531
18	Bay 2 east common rafter 4th from N	135 x 100	Quarter	100	33+Bw	1.31	AD 1417-1516	AD 1516/17 winter
19	Truss 3 east principal rafter	385 x 110	Plank	67	-	2.22	undated	-
20	Truss 3 tiebeam	370 x 240	Half	185	h/s	1.44	AD 1309-1493	AD 1503-39

Total rings = all measured rings, +*value s* = additional sapwood rings were only counted, the felling period column is calculated using these additional rings.
Sapwood rings: h/s heartwood/sapwood boundary, Bw bark edge with complete ring indicating winter felling.
ARW = average ring width of the measured rings

Table 2

t-value matrix for the timbers forming the chronology SINNEW, divided into the three suggested phase groups. KEY: - = *t*-values under 3.0

	11	12	13	1	2+2b	3	4	6	7	9	15	16	17	18	20
8	-	6.88	4.76	3.12	-	3.17	4.60	4.61	-	4.41	\	\	4.24	\	3.61
11		3.39	4.27	5.43	3.69	5.67	3.89	6.07	-	4.18	\	\	3.69	\	4.75
12			3.36	3.75	-	3.07	3.86	4.07	-	5.58	\	\	3.89	\	-
13				-	-	4.87	-	-	3.57	4.62	-	\	-	-	4.67
1					-	6.19	3.31	3.73	-	4.96	4.37	\	3.78	-	4.52
2+2b						4.93	-	3.04	-	3.39	4.83	-	3.87	5.78	-
3							4.64	4.79	5.20	7.00	6.02	-	4.50	8.62	11.66
4								-	-	4.10	\	\	-	\	4.95
6										4.68	-	-	10.11	3.40	-
7										3.83	4.18	-	3.22	4.53	4.65
9											3.92	\	4.82	4.95	4.79
15												3.11	3.87	5.90	-
16													-	3.95	-
17														3.39	3.11
18															4.66

Table 3

Dating the mean sequence SINNEW, AD 1296-1516 inclusive. *t*-values with independent reference chronologies

Reference chronology	*t*-values
East Midlands regional master (Laxton and Litton 1988)	7.33
Gtr Manchester, Stayley Hall Stalybridge (Nayling 2000)	5.72
Herefordshire, Kings Pyon barn (Groves and Hillam 1993)	5.78
Northumberland, Aydon Castle (Hillam and Groves 1991)	5.81
Shropshire, Clunbury Church nr Ludlow (Tyers 2000)	5.55
Shropshire, Ightfield Hall Barn (Groves 1997)	6.03
Staffordshire, Black Ladies nr Brewood (Tyers 1999c)	6.68
Staffordshire, Sinai Park nr Burton-on-Trent (Tyers 1997)	5.27
N Yorkshire, Harome Hall (Morgan 1988)	5.98
N Yorkshire, Thorpe Prebend House Ripon (Boswijk 1998)	5.76
N Yorkshire, York Minster Central Tower (Morgan pers comm 1988)	5.72
W Yorkshire, Calverley Hall (Hillam 1982)	6.62
W Yorkshire, Elland Old Hall (Hillam 1984)	5.72
W Yorkshire, Wakefield Golden Cock (Groves and Hillam 1990)	6.08

Table 4

Ring-width data from site master SINNEW, dated AD 1296-1516 inclusive

Date	Ring widths (0.01mm)										No of samples									
AD 1296						250	180	199	239	209						1	1	1	1	1
AD 1301	154	118	161	188	197	174	122	150	185	172	1	1	1	1	2	3	3	3	4	4
	189	207	252	248	283	257	264	266	294	267	4	4	5	5	6	7	7	7	7	8
	231	228	232	187	226	177	196	188	188	209	8	9	9	9	9	9	9	9	9	10
	174	203	242	178	159	130	122	164	186	190	10	10	10	10	10	10	10	10	10	10
	192	197	195	182	223	182	157	190	178	155	10	11	11	11	11	11	11	11	11	11
AD 1351	187	159	167	171	165	178	173	158	184	139	11	11	11	11	11	11	11	11	11	11
	141	122	183	189	164	160	161	142	117	105	11	11	11	11	11	11	11	11	11	12
	111	145	132	172	138	120	103	99	126	139	12	12	12	12	12	12	12	12	12	12
	144	145	133	126	130	131	146	151	120	112	12	12	12	12	12	12	13	13	13	13
	125	113	124	111	114	121	104	147	132	162	13	13	13	13	13	13	13	13	13	13
AD 1401	146	127	159	141	136	139	131	152	151	147	13	13	13	12	12	12	12	12	11	10
	125	109	95	84	106	102	123	134	104	131	10	10	10	10	10	10	11	11	11	11
	142	118	148	123	130	97	94	113	121	121	11	11	11	11	11	11	11	11	11	11
	118	163	114	126	143	132	100	103	92	113	11	11	10	10	11	11	11	11	11	11
	124	111	117	105	85	73	92	103	133	139	11	10	9	9	9	9	9	9	9	8
AD 1451	138	140	126	133	121	129	135	115	110	112	8	8	8	8	8	8	8	8	8	8
	107	120	101	100	115	126	148	153	126	136	8	8	8	8	8	8	8	8	8	8
	133	95	98	79	121	157	153	123	113	117	8	8	8	8	8	8	8	8	8	8
	156	121	138	142	145	146	198	143	148	145	8	8	8	8	8	7	7	7	7	7
	131	159	216	211	185	199	157	123	122	137	7	7	5	4	4	4	4	4	3	3
AD 1501	124	100	116	121	118	127	62	57	74	76	3	3	3	3	3	3	2	2	2	2
	110	109	83	74	84	76					2	2	2	2	2	2				