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WARREN HOUSE, WARREN SPINNEY, KIMBOLTON, CAMBRIDGESHIRE
TREE-RING ANALYSIS OF OAK TIMBERS

SCIENTIFIC DATING REPORT

Martin Bridge

ARCHAEOLOGICAL SCIENCE

ENGLISH HERITAGE

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SUMMARY

A total of six samples from the original timber-frame were measured. Three exhibited similarities, including one exceptionally narrow ring, and hence were combined to make a site sequence. Neither this, nor any of the other measured individual sequences gave acceptable consistent matches with dated reference material, and the site therefore remains undated.

CONTRIBUTOR
Dr M C Bridge

ACKNOWLEDGEMENTS
The sampling and analysis of these timbers was funded by English Heritage (EH), and requested by Ian Harper (EH Historic Buildings Architect). The work was commissioned by Dr Peter Marshall (EH Scientific Dating Team). I am grateful to Jaideep Chakrabarti (Caroe Architecture) for arranging access, accompanying me on site, and supplying drawings. Cathy Tyers (Sheffield University) and Peter Marshall (EH) are thanked for their comments on an earlier draft of this report.

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DATE OF INVESTIGATION
2010

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INTRODUCTION

Warren House is set in a remote location about 1km north east of Kimbolton (Fig 1). Now a ruin, it is thought to have been built as a sixteenth-century timber-framed cottage that was later clad in brick and stone to become a late eighteenth-century 'vista' building facing Kimbolton Park. The property is on the Heritage at Risk Register but grant-aided repairs are underway to secure its immediate future as a Landmark Trust holiday home. Dendrochronological investigation of the scant remains of the timber framing was requested to inform these repairs. Initial surveys by Colin Briden for the Landmark Trust suggested that the framing was basically mostly from the primary construction, but the east purlin on the south pitch and a long oak plate in the south wall were both thought to be later timbers introduced to the building.

METHODOLOGY

The timbers were assessed and sampling was carried out in December 2010. Cores were taken from *in-situ* timbers using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis.

The cores were polished on a belt sander using 80 to 400 grit abrasive paper to allow the ring boundaries to be clearly distinguished. The samples had their tree-ring sequences measured to an accuracy of 0.01mm, using a specially constructed system utilising a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC, which recorded the ring widths into a dataset. The software used in measuring and subsequent analysis was written by Ian Tyers (2004). Cross-matching was attempted by a combination of visual matching and a process of qualified statistical comparison by computer. The ring-width series were compared for statistical cross-matching, using a variant of the Belfast CROS program (Baillie and Pilcher 1973). Ring sequences were plotted to allow visual comparisons to be made between sequences. This method provides a measure of quality control in identifying any potential errors in the measurements when the samples cross-match.

In comparing one sample or site master against other samples or chronologies, *t*-values over 3.5 are considered significant, although in reality it is common to find demonstrably spurious *t*-values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some *t*-value ranges of 5, 6, and higher, and for these to be well replicated from different, independent chronologies with both local and regional chronologies well represented, except where imported timbers are identified. Where two individual samples match together with a *t*-value of 10 or above, and visually exhibit exceptionally similar ring patterns, they may have originated from the same parent tree. Same-tree matches can also be identified through the external characteristics of the timber itself, such as knots and shake patterns. Lower *t*-values however do not preclude same tree derivation.

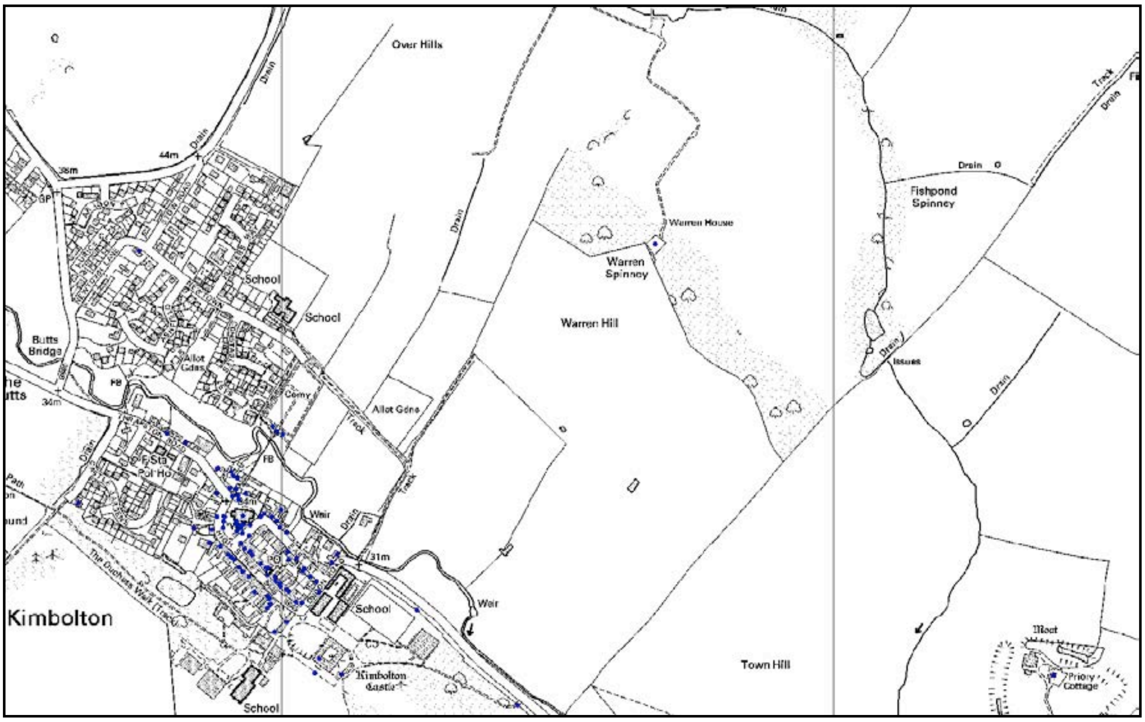

Figure 1. Map to show the location of Warren House (based on the Ordnance Survey map with permission of the Controller of Her Majesty's Stationery Office, ©Crown Copyright)

Ascribing felling dates and date ranges

Once a tree-ring sequence has been firmly dated in time, a felling date, or date range, is ascribed where possible. With samples which have sapwood complete to the underside of, or including bark, this process is relatively straightforward. Depending on the completeness of the final ring (ie if it has only the spring vessels or early wood formed, or the latewood or summer growth), a precise felling date and season can be given. If the sapwood is partially missing, or if only a heartwood/sapwood transition boundary survives, then an estimated felling date range can be given for each sample. The number of sapwood rings can be estimated by using an empirically derived sapwood estimate with a given confidence limit. If no sapwood or heartwood/sapwood boundary survives then the minimum number of sapwood rings from the appropriate sapwood estimate is added to the last measured ring to give a *terminus post quem* (*tpq*) or felled-after date.

A review of the geographical distribution of dated sapwood data from historic timbers has shown that a sapwood estimate relevant to the region of origin should be used in interpretation, which in this area is 9–41 rings (Miles 1997). It must be emphasised that dendrochronology can only date when a tree has been felled. Further interpretation is required to determine a likely construction date for the structure or object under study.

RESULTS AND DISCUSSION

Basic information about the samples taken is presented in Table 1, and illustrated in Figures 3–7. Both the east purlin on the south pitch, and the long oak plate in the south wall were assessed as having too few rings, and so not likely to be suitable for further analysis. Therefore, they were not sampled. The large ground-floor ceiling beam was not thought to be original to the main structure, but was sampled in the hope of gaining more information about the development of the building. It could not be easily assessed because of surface paint and other deposits, but it too turned out to have too few rings for further analysis. Thus none of the later insertions were suitable for analysis.

The south principal rafter of the central truss also turned out to contain fewer rings than required for dendrochronology. The north principal rafter was thought to have been derived from the same parent tree, and this was not therefore sampled.

The six samples that were subsequently measured are all thought to represent timbers from the primary framing. Three of these, 07, 04, and 01, produced relatively low but consistent cross-matching (Table 2). It was notable that all three sequences exhibited one very narrow ring (Fig 2). These sequences were combined at their relative positions of overlap to form a site master sequence kwh741m. The values for this sequence are given in the Appendix. Neither this, nor any of the individual sequences, gave acceptable consistent matches with dated reference material, and all the timbers therefore remain undated.

Table 1. Details of the samples taken for dendrochronology

Sample	Description	Rings	Sapwood	Mean ring-width (mm)
kwh01	Mid-rail, north side of east wall	58	-	2.04
kwh02	Mid-rail, north side of west wall	93	26¼C	1.00
kwh03	South-west corner post	77	-	2.04
kwh04	Collar to central truss	62	26C	1.41
kwh05	South principal rafter, central truss	<40	-	NM
kwh06	Tie in east wall	70	-	1.21
kwh07	South wallplate	61	-	1.56
kwh08	West-East ground floor ceiling beam	<40	h/s	NM

h/s = heartwood-sapwood boundary; NM = not measured; C = complete sapwood, winter felled; ¼C = complete sapwood, felled the following winter

Table 2. Cross-matching between the three samples with an exceptional narrow ring

t-values		
SAMPLE	kwh04	kwh01
kwh07	3.0	5.0
kwh04		4.1

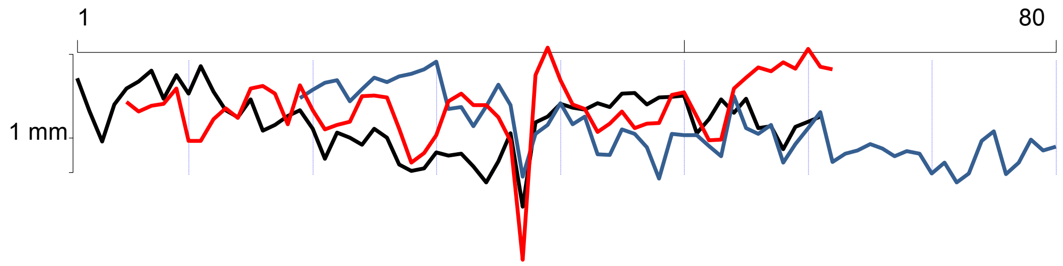

Figure 2. Plots of the three samples (07, 01, and 04) with one exceptionally narrow ring in their sequences shown aligned. Note, the y-axis is ring width in mm on a logarithmic scale

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Tyers, I, 2004 *Dendro for Windows Program Guide 3rd edn*, ARCUS Report, 500b

Figure 3. Photograph of the interior without scaffold in place, showing two of the timbers sampled for dendrochronology (adapted from an original supplied by Caroe Architecture)

Figure 4. Photograph (by author) of the central truss, showing timbers sampled for dendrochronology

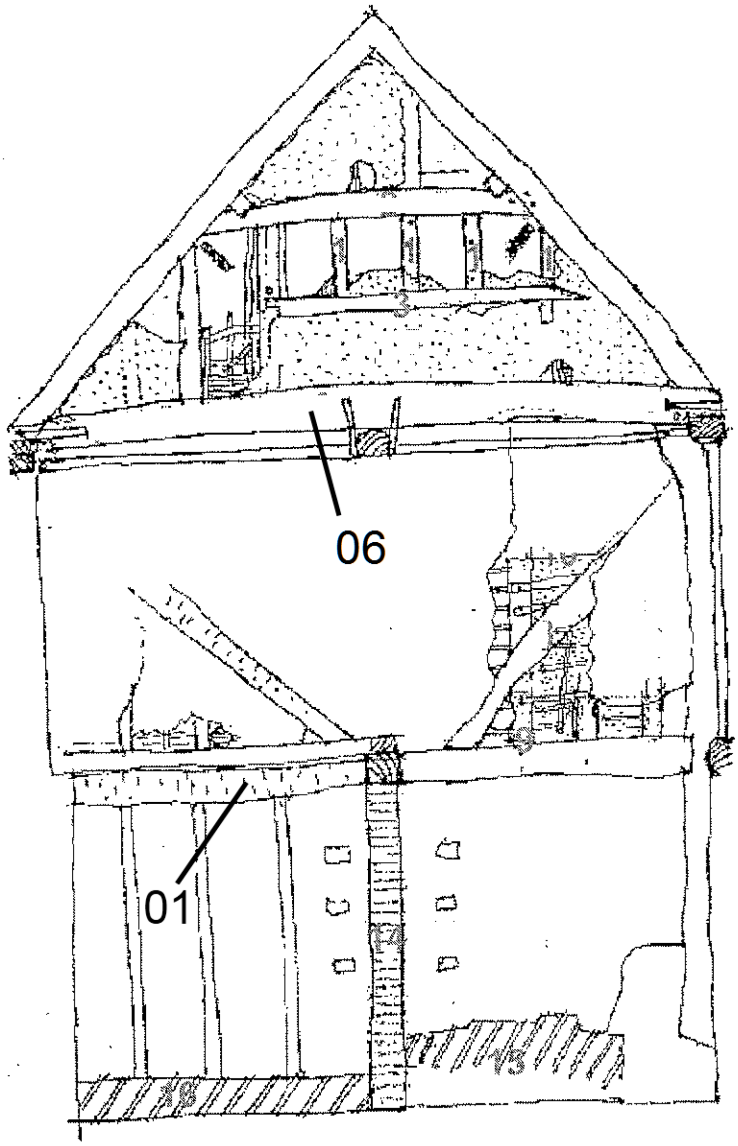


Figure 5. Drawing of the east internal wall, showing timbers sampled for dendrochronology (adapted from an original drawing by Caroe Architecture)

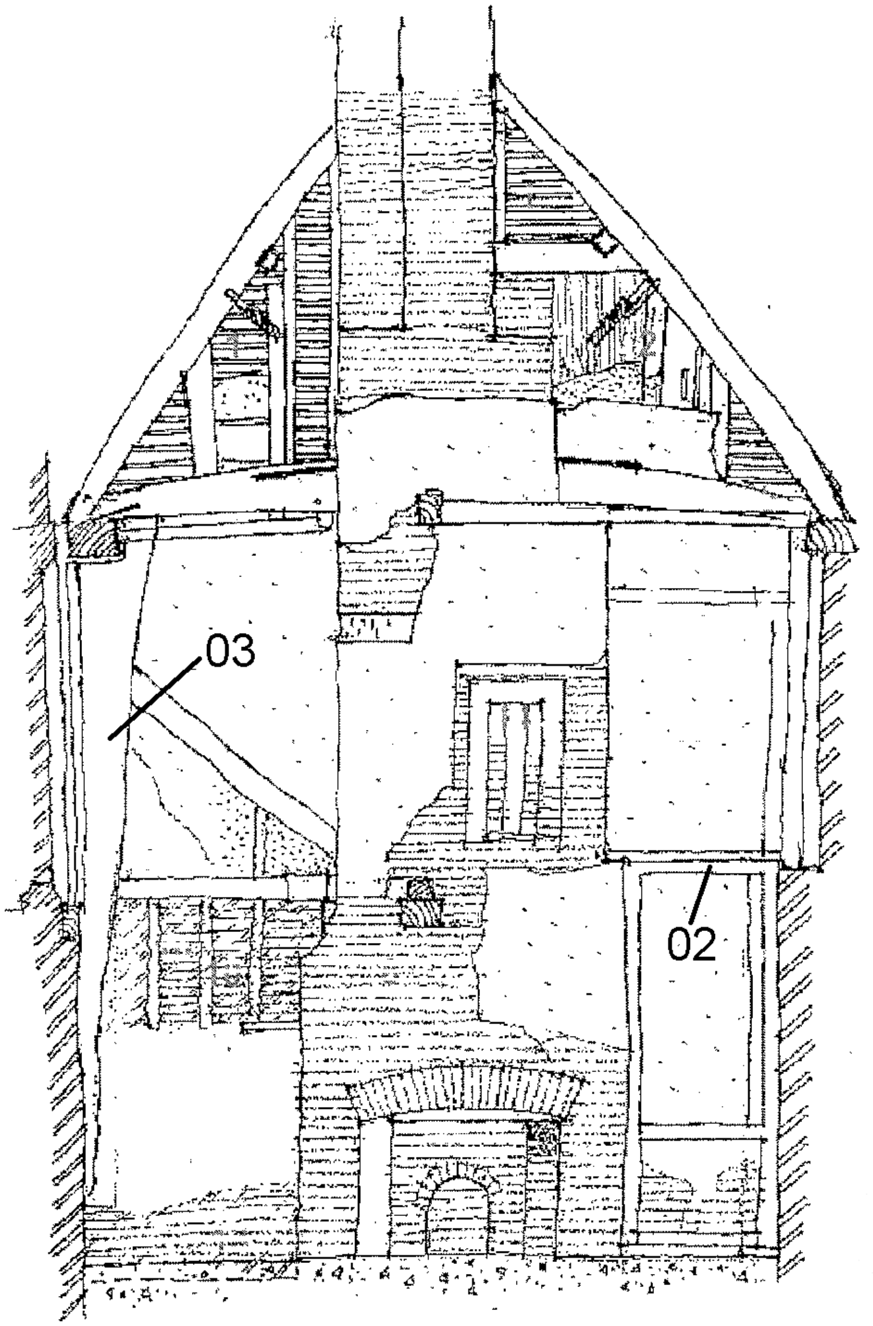


Figure 6. Drawing of the west internal wall, showing timbers sampled for dendrochronology (adapted from an original drawing by Caroe Architecture)

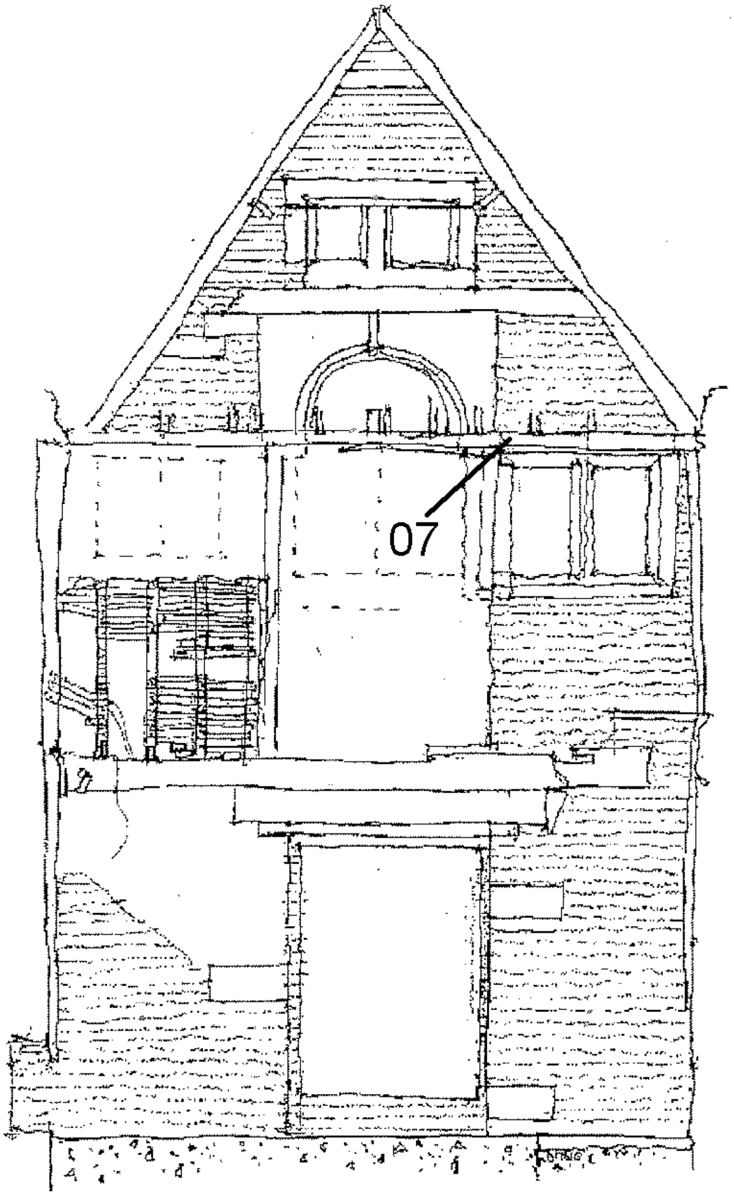
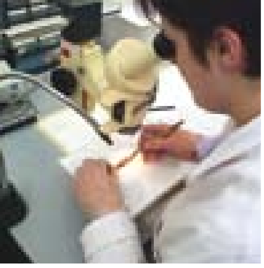
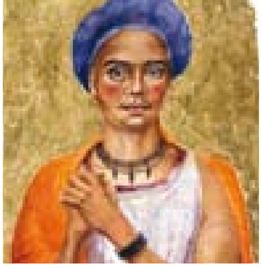


Figure 7. Drawing of the south internal wall, showing timbers sampled for dendrochronology (adapted from an original drawing by Caroe Architecture)

APPENDIX

Ring width values (0.01mm) for the site chronology KWH741m, with the number of samples present for each year shown

305	166	93	186	223	225	268	198	287	161	1	1	1	1	2	2	2	2	2	2
238	189	171	146	228	188	178	139	214	177	2	2	2	2	2	2	2	2	3	3
154	177	144	184	216	199	164	149	165	199	3	3	3	3	3	3	3	3	3	3
147	160	122	135	160	129	28	187	273	224	3	3	3	3	3	3	3	3	3	3
163	162	125	126	169	153	133	130	181	186	3	3	3	3	3	3	3	3	3	3
121	107	123	210	211	201	200	184	192	262	3	3	3	3	3	3	3	3	3	3
229	213	74	78	88	81	70	77	74	51	3	2	1	1	1	1	1	1	1	1
62	43	51	94	112	50	62	96	78	84	1	1	1	1	1	1	1	1	1	1



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