Ancient Monuments Laboratory
Report 64/98

TREE-RING ANALYSIS OF TIMBERS FROM KING'S HEAD COTTAGE, BANHAM, NORFOLK

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Summary

King's Head Cottage, Banham retains elements of a medieval timber-framed building including rare carved queen-posts with a raised-aisle roof truss. The rarity of these features have made the building difficult to date on purely stylistic grounds. The structure has undergone a whole series of subsequent alterations including the insertion of a new first floor over the hall, the replacement of some earlier first-floor framing, and the insertion of a new roof truss of jointed tiebeam construction adjacent to the chimney stack. These alterations have been dated on stylistic grounds to the late-seventeenth century. Dendrochronological sampling and analysis of these two phases of construction were commissioned to inform a planned restoration programme for this grade II* building-at-risk. Unfortunately none of the timbers sampled have dated.

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Introduction

This document is a technical archive report on the tree-ring analysis of oak timbers from King's Head Cottage, Banham, Norfolk (NGR TM066880). 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.

King's Head Cottage is a two-storey building located on the southern side of the small village of Banham. The following description is based on Heywood (1997). The building originally consisted of a central hall with service rooms to the south and private rooms to the north. The hall truss has rare carved queen-posts with solid bracing carved out of a single timber (Fig 1). There are several other unusual features surviving in the building, a rare smoke hood, and the so called raised-aisle truss which seems an extremely localised feature of this part of East Anglia. There were extensive modification over subsequent centuries including insertion of a stack, and the insertion of a floor over the hall.

A tree-ring dating programme of the timbers of King's Head Cottage was requested by Paul Edwards from English Heritage in an attempt to provide a date for its original construction, and to attempt to identify the date of the insertion of the floor, and hence inform the forthcoming programme of repairs.

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 powered by a portable generator. 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 1997). 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; Munro 1984) 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 55 annual rings, where these figures indicate the 95% confidence limits of the range. These figures are applicable to oaks from the British Isles (Hillam *et al* 1987). 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.

Results

The assessment of the timbers of the building showed that there were few structural timbers that were suitable for analysis. The original construction used quite small timbers, whilst the later floor used massive but fast-grown timbers. The smoke blackening in the roof prevented good views of the roof timbers but it seemed possible that the queen-posts were the best two timbers in the building from a dendrochronological perspective. The problem with many buildings in Suffolk and Norfolk is the absence of timbers with reasonable numbers of rings. This problem has resulted in relatively few reference tree-ring chronologies being constructed from buildings in the area and sadly results in all attempts to date structures being caught

in the difficult problem of having buildings with both poor timbers and poor likelihood of dating through the absence of localised reference data. Although it was felt less than likely that a date would be forthcoming from the King's Head Cottage material a decision was taken by English Heritage to sample the building in the hope of obtaining some dating evidence.

Normally timbers with surviving bark or at least partial sapwood survival are preferentially selected for sampling where possible, here the paucity of suitable timbers meant that any timber with more than 40-50 rings was a potential candidate for sampling. A total of nine timbers were selected as most suitable for sampling (Table 1, Fig 2). These samples were numbered **1-9** inclusive. The initial core in two timbers fragmented badly and a second core was taken from each of these, in these cases labelled **1B** and **6B**. The two timbers felt to have the greatest dendrochronological potential, the decorated queen posts, were left till last. Further disaster struck at this point when coring through the smoke blackening it became apparent that these timbers were not oak (*Quercus* spp) but ash (*Fraxinus excelsior*). This species is not good for coring since it fragments too easily. Its usefulness for dendrochronological analysis is unproved. There are no suitable medieval ash reference tree-ring chronologies, at least partly because it is rarely found and even more rarely sampled. However, modern ash trees have been found to cross-match well with neighbouring oaks (Groves and Hillam 1988), and for the Neolithic Sweet Track structural ash was cross-matched successfully with the oak timbers (Hillam *et al* 1980). At Banham the attempt to core the decorated post (sample **9**) was abandoned after it fragmented a number of times and no attempt was made to sample the second decorated post.

All parts of two of the nine sampled timbers when examined in the laboratory were rejected either due to an insufficient number of rings for reliable analysis (sample **8**) or due to excessive fragmentation (sample **9**). The remaining seven timbers all included some sections with forty or more rings, with two suitable fragments from timber **1**. The measured series from these timbers were initially compared with each other. None, except the two sections of sample **1**, were found that matched together to form an internally consistent group. No site chronology was produced as a result. The individual series were then compared with dated reference chronologies from throughout the British Isles and northern Europe. No consistent correlation was observed between any of the data and the reference chronologies. No absolute dating is forthcoming from this analysis.

Conclusion

The dendrochronological analysis of timbers from King's Head Cottage has failed to produce any reliable tree-ring dates to assist with the interpretation of this somewhat enigmatic structure. This failure may be due to either the fast-grown nature of most of the timbers that have sufficient rings for reliable analysis, or to use of timbers from varied sources, or to a combination of these factors.

Acknowledgements

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Figure 1 The carved queen posts with solid bracing from Kings Head Cottage, Banham (after Heywood 1997)

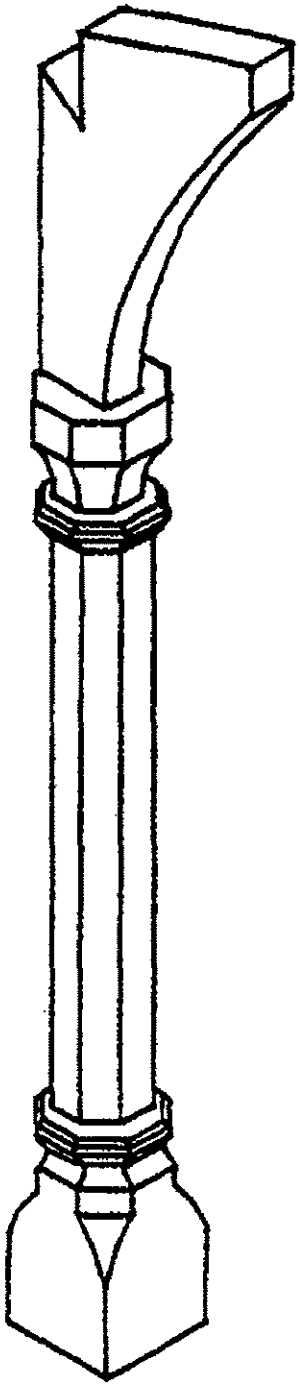

Figure 2 Plan of Kings Head Cottage, Banham indicating sample locations (after Heywood 1997)

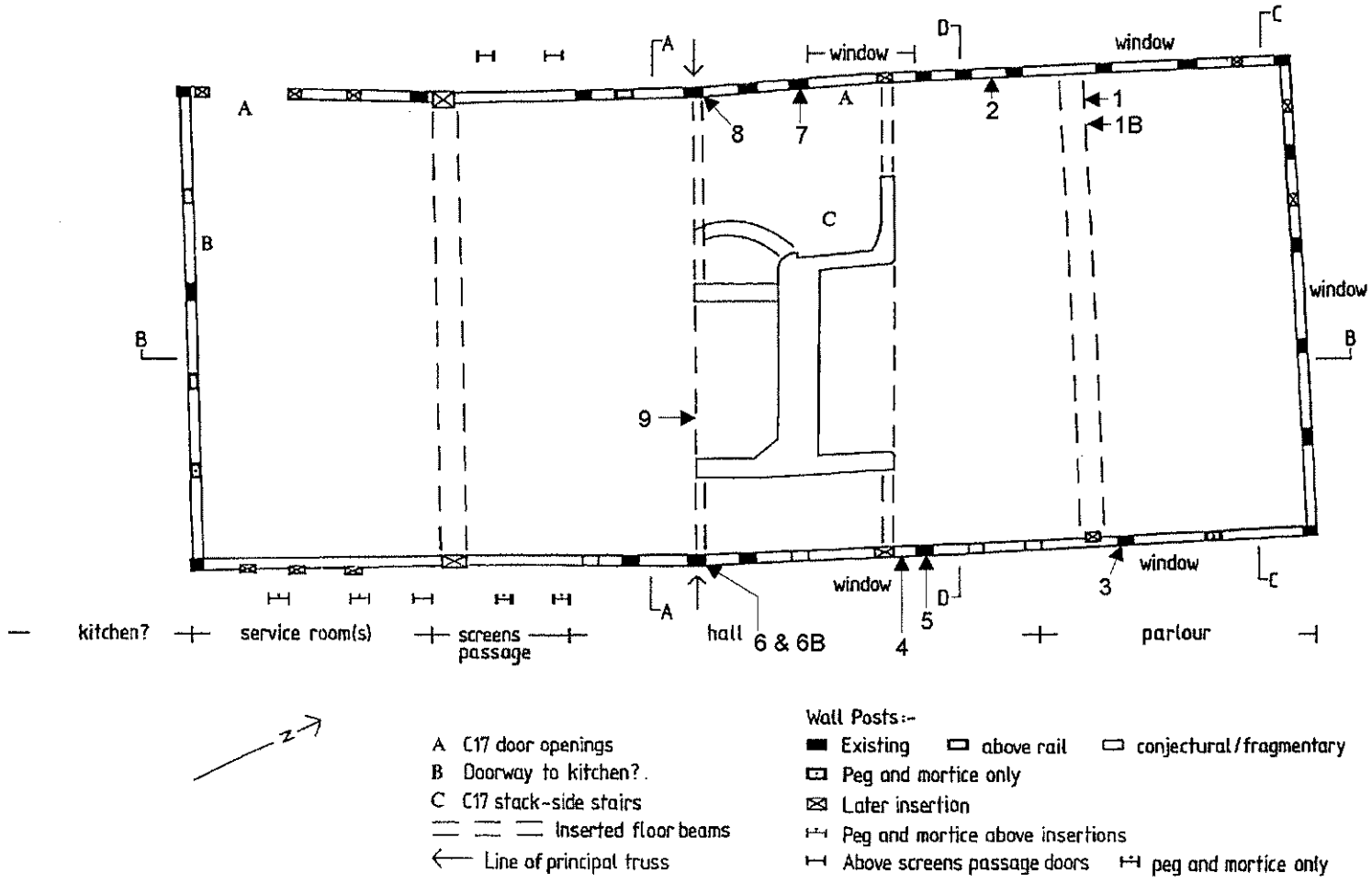

Table 1

List of samples

Core No	Origin of core	Wood type	Cross-section size (mm)	Cross-section of tree	Total rings	Sapwood rings	ARW mm/year	Date of sequence
1	Inserted floor girding beam, north end	Oak	280 x 260	Whole	47	-	4.28	undated
1B	Inserted floor girding beam, north end (repeat)	Oak	280 x 260	Whole	45	-	3.99	undated
2	West ground sill, replacement?	Oak	150 x 150	Quarter	57	6	2.14	undated
3	North east wall post, replacement?	Oak	255 x 155	Half	66	-	2.20	undated
4	East ground sill	Oak	240 x 140	Half	91	h/s+5	1.65	undated
5	East wall post	Oak	160 x 130	Half	43	-	3.18	undated
6	East wall post, fragmented sample	Oak	190 x 140	Quarter	?	-		unmeasured
6B	East wall post (repeat)	Oak	190 x 140	Quarter	83	-	1.49	undated
7	West wall post	Oak	200 x 150	Quarter	45	-	2.87	undated
8	West wall frame post	Oak	300 x 230	Whole	*c* 23	-		unmeasured
9	East decorated post, core abandoned	Ash	-	-	?	-		unmeasured

Total rings = all measured rings
sapwood rings = h/s heartwood/sapwood boundary, +value means additional sapwood rings were only counted
ARW = average ring width of the measured rings