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Summary

Samples were removed for dendrochronological analysis from two principal posts in the Summer Pavilion during repair work in AD 2003-4. Although both samples were considered suitable for analysis neither could be dated. Thus the analysis has not been able to provide a date of construction for the Summer Pavilion.

Keywords

Dendrochronology
Standing Building

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Introduction

This document is a technical archive report on the tree-ring analysis of timbers from the Summer Pavilion, Swiss Cottage, Osborne House, Isle of Wight (SZ 52609492; Figs 1 and 2). It is beyond the dendrochronological brief to describe the structure in detail or to undertake the production of detailed drawings. The description and information provided below is summarised from Turner pers comm.

Osborne House is listed grade II* on the English Heritage *Register of Parks and Gardens of Special Historic Interest*. Summer Pavilion is a single-storey oak framed structure with eight principal posts set into the ground (Fig 3). An oak cusped cross-braced balcony looking over the Osborne Valley runs across the front, or north-wall, of the structure (Fig 4). The boarding is softwood, whilst the roof is of Welsh slate. The design of the pavilion is very similar to the fire engine shed at Osborne that dates from AD 1865. Documentary evidence suggests that the pavilion originated in AD 1868 as a carriage house at King's Quay, approximately 1.5km south-east of its current location, and was subsequently moved nearer to Swiss Cottage in AD 1875. However, apart from the potential impracticalities, paint analysis has not identified any differences in the paint finish on the principal posts and adjoining elements which implies that the entire structure was newly built in AD 1875.

Repair work undertaken in AD 2003/4 involved the replacement of decayed sections of the principal posts. Cross-sectional slices from two of the eight principal posts were retained for dendrochronological analysis which was subsequently commissioned by English Heritage. It was hoped that dendrochronological analysis would provide a precise felling date for the posts and hence determine when they were initially used. This would establish whether the pavilion was potentially originally a carriage house or whether the entire pavilion is of a later date.

Methodology

The general methodology and working practises used at the Sheffield Dendrochronology Laboratory are described in English Heritage (1998). The following summarises relevant methodological details used for the analysis of the timbers from the Summer Pavilion.

Oak (*Quercus* spp.) is currently the only species used for routine dating purposes in the British Isles, although research on other species is being undertaken (Groves 2000; Tyers 1998a). Timbers with less than 50 annual growth rings are generally considered unsuitable for analysis as their ring patterns may not be unique (Hillam *et al* 1987).

The ring sequence of each sample was revealed by sanding until the annual growth rings were clearly defined. Any samples that failed to contain the minimum number of rings or have unclear ring sequences were rejected. The sequence of growth rings in suitable samples were measured to an accuracy of 0.01mm using a purpose-built travelling stage attached to a microcomputer-based measuring system (Tyers 1999). The ring sequences were plotted onto semi-logarithmic graph paper to enable visual comparisons to be made between them with the aid of a lightbox. In addition, cross-correlation algorithms (Baillie and Pilcher 1973; Munro 1984) were employed to

search for positions where the ring sequences were highly correlated. The Student's *t*-test is then used as a significance test on the correlation coefficient. The *t*-values quoted 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 (Baillie 1982), provided that high *t*-values are obtained at the same relative or absolute position with a series of independent sequences and that the visual match is satisfactory.

Dating is usually achieved by comparing, or crossmatching, ring sequences within a phase or structure and combining the matching patterns to form a phase or site master curve. This master curve and any remaining unmatched ring sequences are then tested against a range of reference chronologies, using the same matching criteria as above. The position at which all the criteria are met provides the calendar dates for the ring sequences. A master curve is used for absolute dating purposes whenever possible as it enhances the common climatic signal and reduces the background 'noise' resulting from the local growth conditions of individual trees.

The crossdating process provides precise calendar dates only for the rings present in the timber. The nature of the final ring in the sequence determines whether the date of this ring also represents the year the tree from which the timber was derived died. Oak consists of inner inert heartwood and an outer band of active sapwood. If the sample ends within the heartwood of the original tree, a *terminus post quem* 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 that are missing. This is the date after which the timber was felled but the actual year of felling may be many decades later depending on the number of outer rings removed during timber conversion. 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 estimate applied throughout this report is a minimum of 10 and maximum of 46 rings, where these figures indicate the 95% confidence limits of the range and are applicable to oak trees of all periods from England and Wales (Tyers 1998b). Alternatively, if bark-edge survives, then a felling date can be directly obtained from the date of the last surviving ring. In some instances it may be possible to determine the season of felling according to whether the ring immediately below the bark is complete or incomplete. However the onset of growth can vary within and between trees and this, combined with the natural variation in actual ring width, means that the determination of felling season must be treated cautiously. The delicate nature of sapwood increases the likelihood of damage/degradation to the outermost surface of the sample and hence increases the difficulties of positive identification of bark-edge.

The felling dates produced do not by themselves necessarily indicate the construction date of the structure from which they are derived. At this stage, factors such as seasoning, reuse, and stockpiling have to be considered. Evidence suggests that seasoning of timber for structural purposes was a fairly rare occurrence until relatively recent times and timber was generally felled as required and used whilst green (Hollstein 1980; Rackham 1990; Charles and Charles 1995). However, the reuse of timber has been a common practice since prehistoric times and stockpiling, albeit potentially short-term, may occur. Therefore, although the production of tree-ring dates is an independent process, the interpretation of these dates may be refined by drawing on other archaeological evidence.

Results

It was not known which of the eight principal posts the two samples submitted for dendrochronological analysis represented. Both samples were oak and were considered suitable for measurement. Details of the timbers are presented in Table 1. It was noted that neither sample had retained bark edge or sapwood and thus a precise felling date would not be forthcoming. However, if successful, the analysis still had the potential to provide useful dating evidence and hence the analysis was continued. The resultant ring sequences were compared and found to crossmatch (Figs 5 and 6; Table 2). The ring sequences from these two matching samples were combined to produce a mean sequence, **OSBNH-SP**, for this structure (Table 3). This site master, **OSBNH-SP**, was then compared with a range of dated reference chronologies from Britain and elsewhere in northern Europe. Unfortunately no conclusive results were obtained so the timbers remain undated by dendrochronology.

Discussion

The dendrochronological analysis of samples from two of the principal posts has demonstrated that they are broadly coeval but has failed to produce absolute dates for them. The failure to produce dates is likely to be the result of a number of contributory factors. The ring sequences are relatively short and the resultant site master is poorly replicated. A well-replicated site master chronology would have significantly increased the likelihood of obtaining an absolute date. In addition the availability of local reference chronologies for the relevant period is relatively poor.

Acknowledgements

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Figure 1 Approximate location of Osborne House within England and Wales.

Figure 2 Location of Summer Pavilion, Swiss Cottage, Osborne House, Isle of Wight

Figure 3 Plans and sections of Summer Pavilion (after English Heritage 2003)

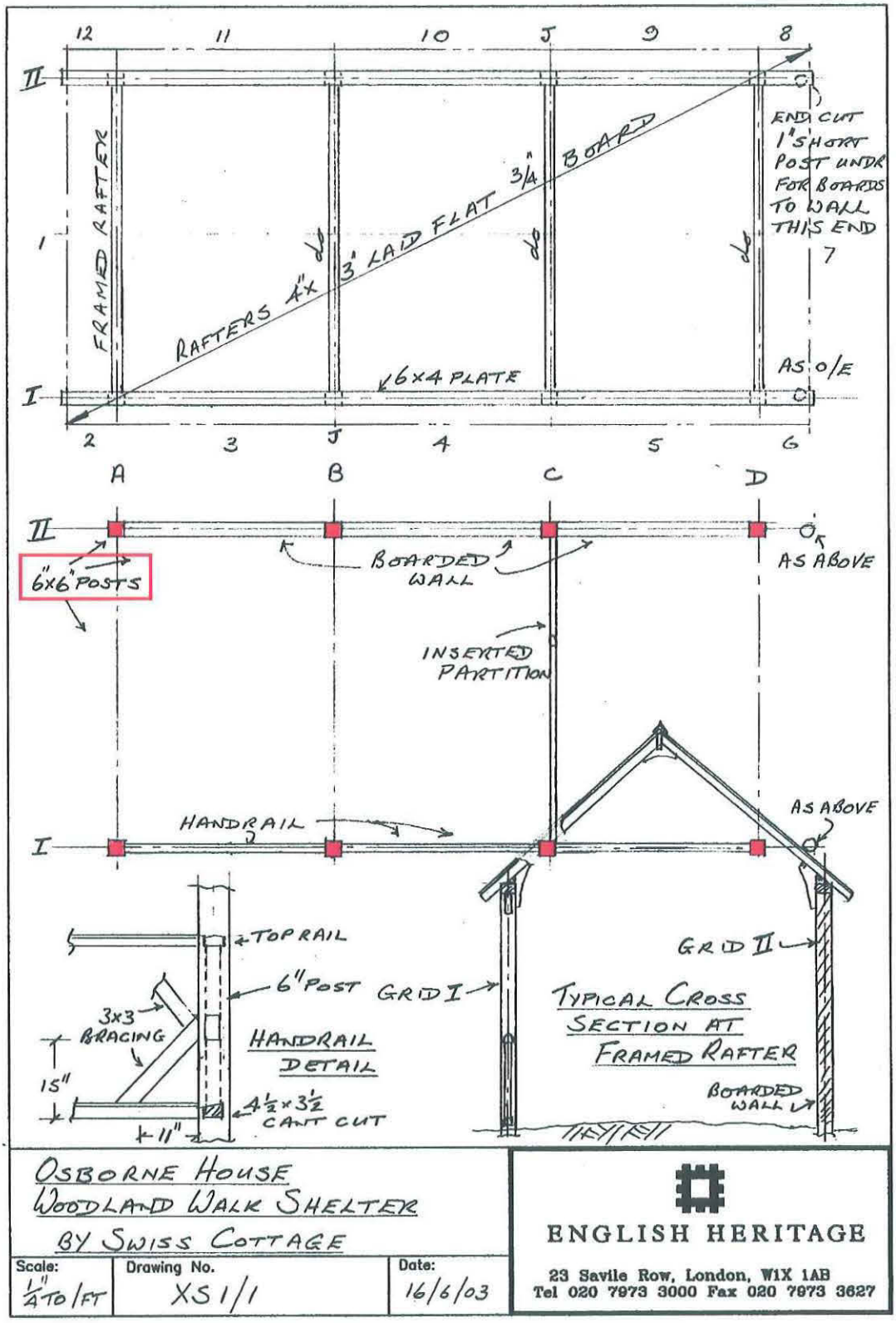

Figure 4 The north face of Summer Pavilion (English Heritage 2003)

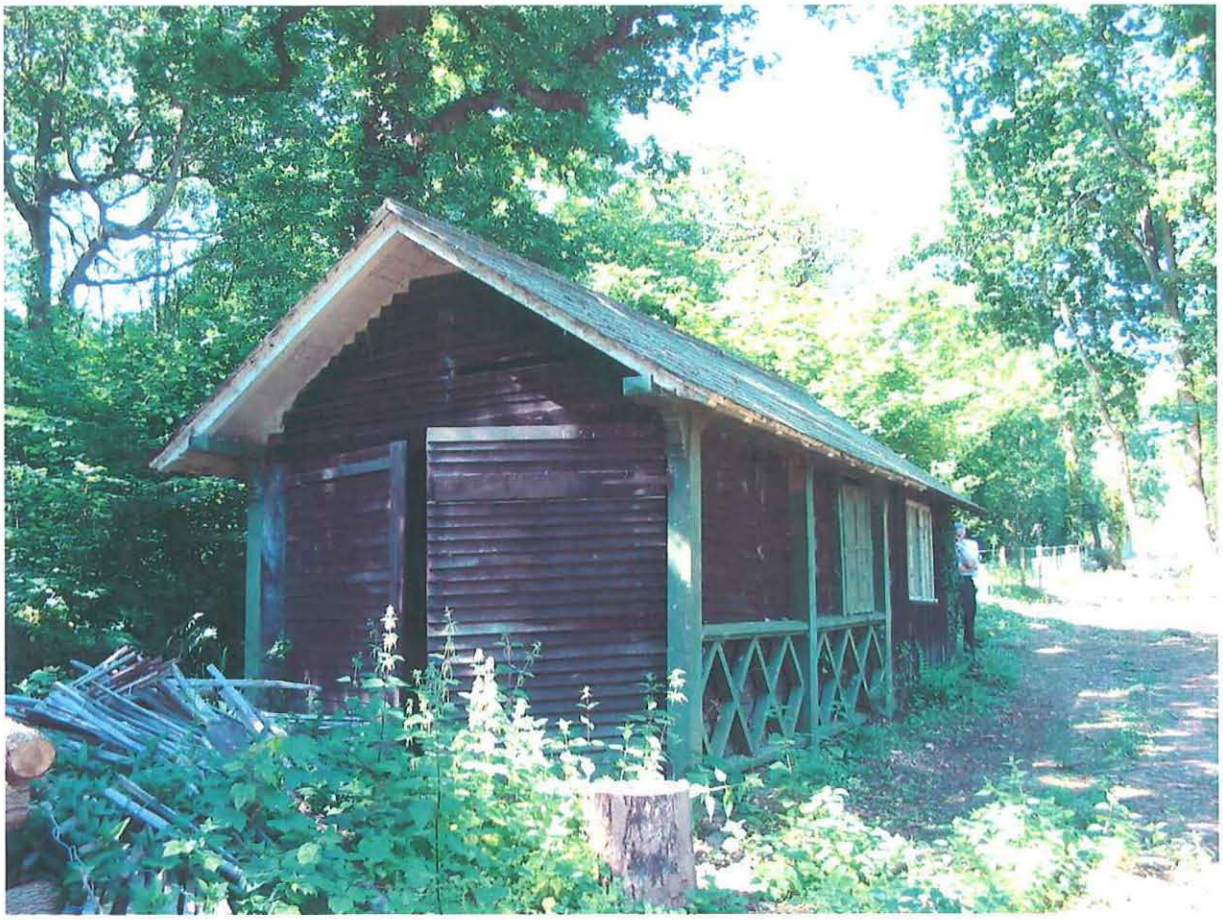

Figure 5 Bar diagram showing the relative positions of the two matching sequences included in the Summer Pavilion site master sequence **OSBNH-SP**

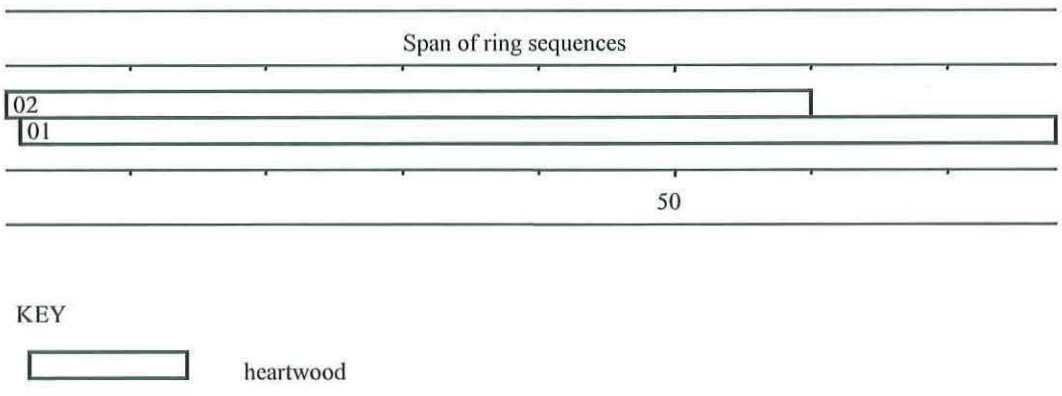

Figure 6 Diagram showing the similarity between the ring sequences derived from samples 01 and 02

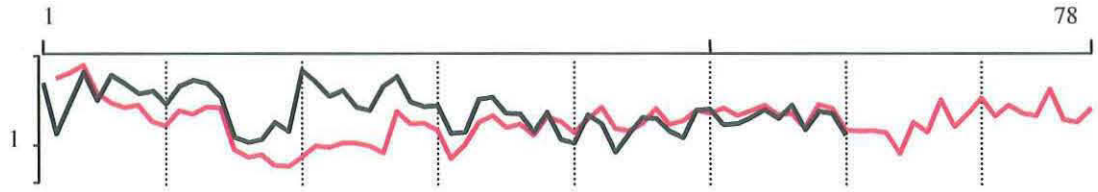

Table 1 Details of the samples from Summer Pavilion, Swiss Cottage, Osborne House, Isle of Wight

Sample number	Number of rings	Sapwood rings	Average Ring Width (mm)	Cross-section type	Cross-section dimensions (mm)
01	77	-	1.60	halved	150 x 75
02	60	-	1.95	whole	160 x 155

Number of rings - total number of measured rings including both heartwood and sapwood;
Sapwood rings – number of measured sapwood rings only

Table 2 Matrix showing the *t*-value obtained between the two matching sequences included in the Summer Pavilion site master sequence **OSBNH-SP**

	02
01	6.18

Table 3 Ring width data from the undated site master chronology **OSBNH-SP**

Ring widths (units of 0.01mm)

300	224	283	385	235	276	243	225	205	173
234	243	246	213	104	93	98	109	98	226
201	166	183	149	142	185	257	180	172	165
100	113	186	200	155	159	122	171	130	113
164	169	110	124	153	175	135	133	184	181
167	157	172	193	165	187	133	192	182	124
127	128	124	86	149	125	222	138	174	227
165	201	174	167	267	155	149	191		