

Centre for Archaeology Report 20/2003

**Tree-ring Analysis of Two Trees from Witley Court,  
Worcestershire**

M C Bridge

© English Heritage 2003

ISSN 1473-9224

*The Centre for Archaeology Report Series incorporates the former Ancient Monuments Laboratory Report Series. Copies of Ancient Monuments Laboratory Reports will continue to be available from the Centre for Archaeology (see back cover for details).*

## **Tree-ring Analysis of Two Trees from Witley Court, Worcestershire**

M C Bridge

### **Summary**

Two trees from the historic gardens surrounding the ruins of Witley Court were examined. One was a *Thuja occidentalis*, the other an *Abies cephalonica*. Slices were taken about 1m above ground level from each recently-felled tree, and in addition, a slice from a large branch of the *Abies cephalonica* was supplied. A minimum age for each tree was determined on the basis of these sections, the *Thuja* being at least 120 years old, and the *Abies* at least 113 years old, assuming the rings are annual. The exact ages could not be determined because of the possibility of missing rings, and lack of knowledge of how quickly the trees would obtain 1m in height. It seems most likely that these two trees were planted early in the period of conversion of the house to a grand Italianate mansion in the AD 1870s and 1880s.

### **Keywords**

Dendrochronology  
Standing Building

### **Author's address**

M C Bridge: Institute of Archaeology, University College London, 31-34 Gordon Square, London.  
Telephone: . Email:

*Many CfA reports are interim reports which make available the results of specialist investigations in advance of full publication. They are not subject to external refereeing, and their conclusions may sometimes have to be modified in the light of archaeological information that was not available at the time of the investigation. Readers are therefore advised to consult the author before citing the report in any publication and to consult the final excavation report when available.*

*Opinions expressed in CfA reports are those of the author and are not necessarily those of English Heritage.*

## Introduction

Witley Court (NGR SO 769 649) is an early Jacobean manor house which was converted in the nineteenth century to a large Italianate mansion. This transformation was carried out by the 1<sup>st</sup> and 2<sup>nd</sup> Earls of Dudley in the AD 1870s and 1880s. The ruins of the house are surrounded by magnificent landscaped gardens by William Nesfield. The property is now in the care of English Heritage. As part of an ongoing tree-management plan, two trees in ill-health were recently felled, a *Thuja occidentalis* (Eastern White Cedar) and an *Abies cephalonica* (Greek Fir). Slices across the diameters of the trunks of each of these trees, plus a slice from a branch of the fir were retained by the head gardener (Richard Squires) in order that an age determination could be made to help understand the development of the garden landscape.

## Methodology

The trunk slices were taken about 1m above ground level by staff at Witley Court. In addition, a slice was taken from a large branch of the *Abies cephalonica*. They were prepared for measuring by sanding using an electric belt-sander with progressively finer grit papers down to 400 grit. Any further preparation necessary, eg where bands of narrow rings occurred, was done manually. The samples had their tree-ring sequences measured to an accuracy of 0.01 mm using a specially constructed system utilizing a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC. The software used in measuring and subsequent analysis was written by Ian Tyers (1999).

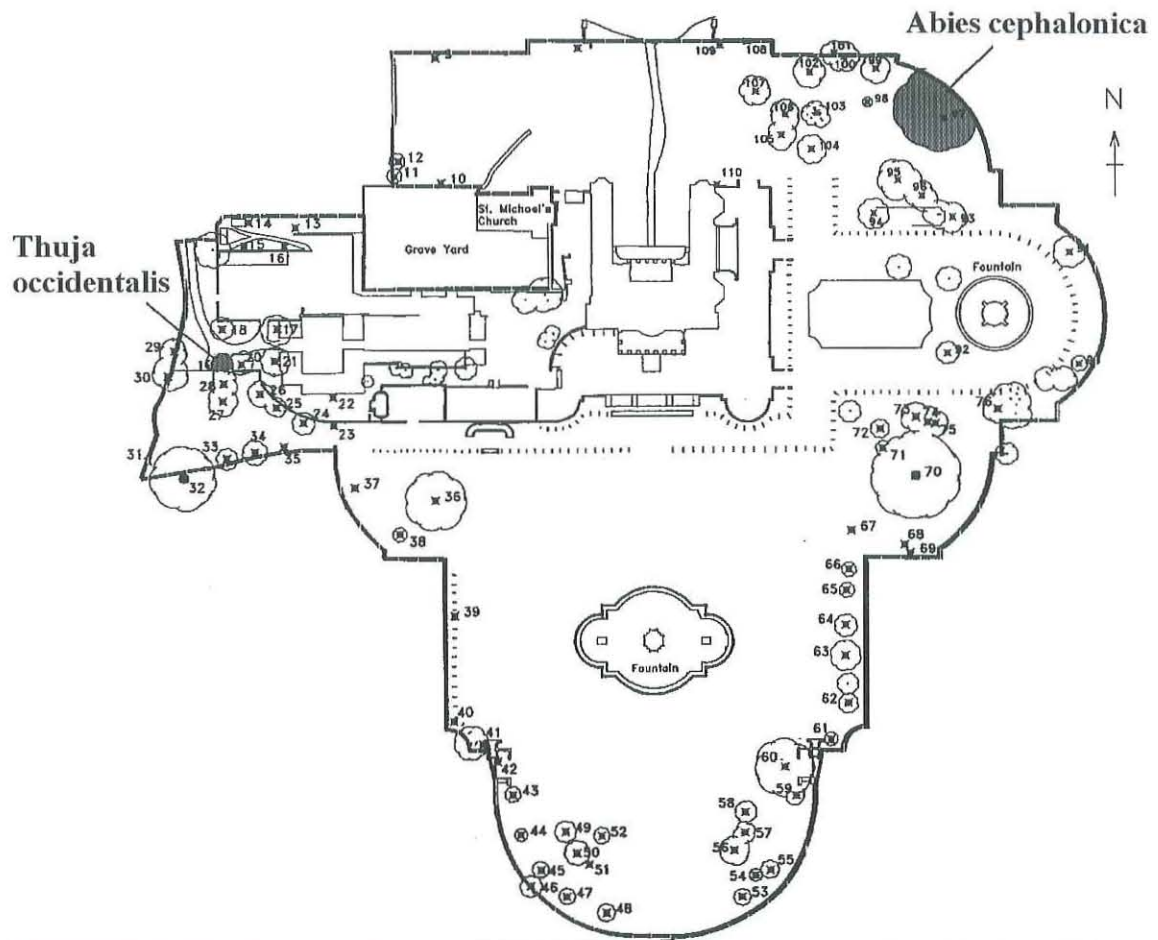
Ring sequences were plotted to allow visual comparisons to be made between sequences on a light table. This activity also acts as a measure of quality control in identifying any errors in the measurements when the samples crossmatch. Statistical comparisons were made using Student's *t*-test (Baillie and Pilcher 1973; Munro 1984). The *t*-values quoted below were derived from the original CROS program (Baillie and Pilcher 1973). Those *t*-values in excess of 3.5 are taken to be indicative of acceptable matching positions in oak, provided that they are supported by satisfactory visual matches, and give consistent matching positions. The appropriate *t*-values for acceptable matching in the species investigated here are not known.

## Results

The growing positions of the trees within the Witley Court landscape are illustrated in Figure 1. Both trees showed a good deal of 'wedging' of the rings, as illustrated in Figures 2 and 3.

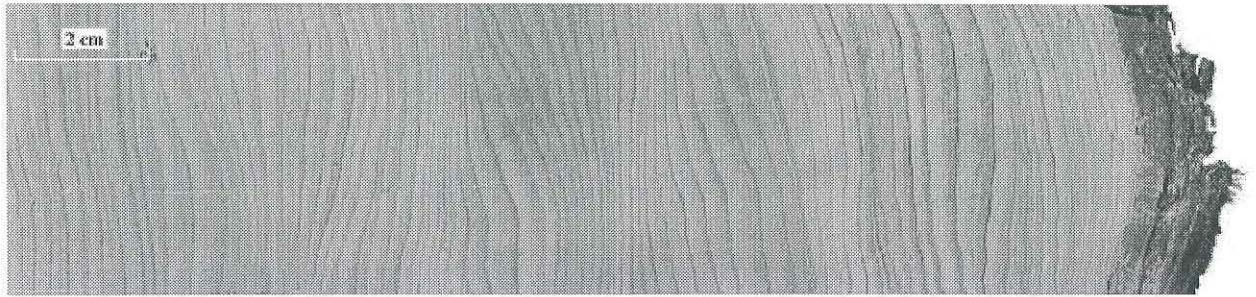
The *Thuja occidentalis* trunk section had 119 complete rings from the pith, with the addition of a partial ring before the bark. This gives a minimum age of 120 years. Ring 95 contained two bands of different density within the annual ring. Average ring width was 2.73mm

The *Abies cephalonica* trunk had 113 rings from pith to bark (average ring width 5.13mm), giving a minimum age of 113 years. The branch section yielded a sequence of 48 years from the pith, with an additional 58-60 rings present on the sample. These could not be measured because of rot in the wood preventing a good surface being obtained, and the narrow rings being difficult to distinguish. The two series did crossmatch however, with the branch section corresponding to years 26 – 63 on the trunk section ( $t = 4.4$ , 48 years overlap; Fig 4). The ring width data for these samples are given in Table 1.

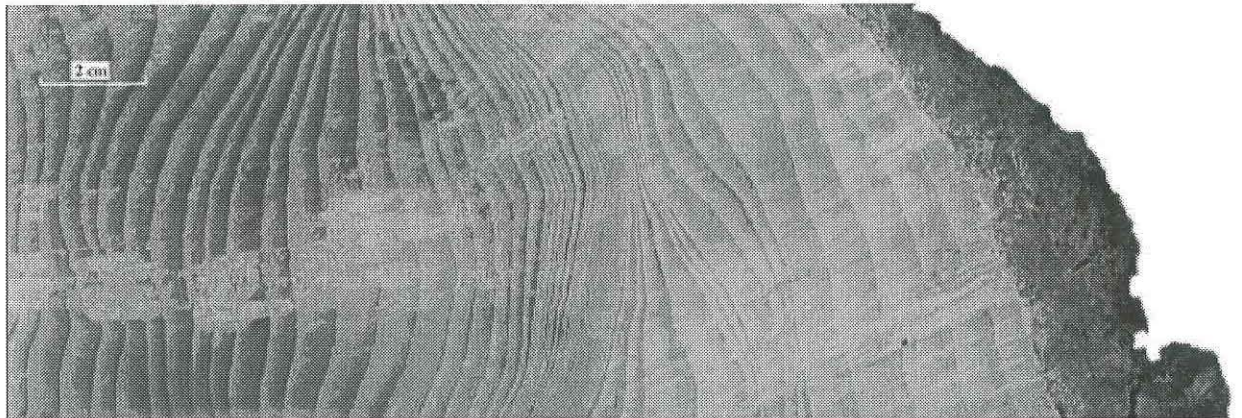


**Figure 1:** Plan of Witley Court showing the position of the trees from which samples were supplied (adapted from an English Heritage drawing by G Shand)

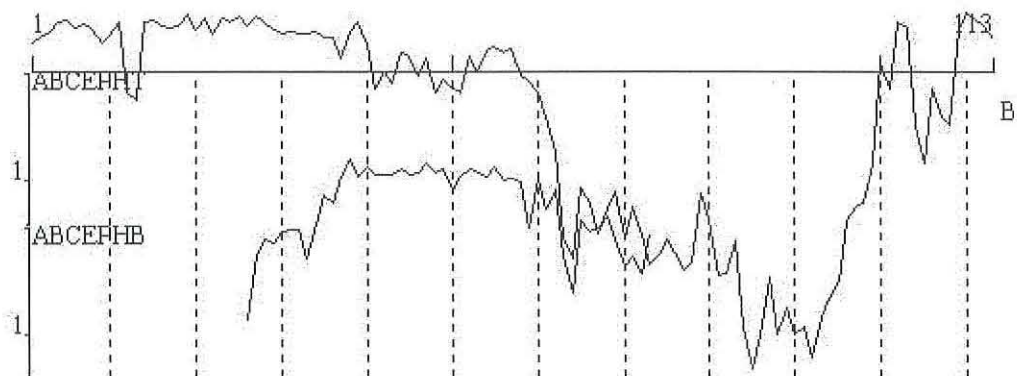




**Figure 2:** Scan of the outer rings of the *Thuja occidentalis* trunk, showing the 'wedging' of a number of rings



**Figure 3:** Scan of the outer rings of the *Abies cephalonica* trunk, showing the 'wedging' of a number of rings



**Figure 4:** Plots of the ring width sequences of the trunk (ABCEPHHT) and branch (ABCEPHB) of the *Abies cephalonica*, showing the best matching position and degree of variation in ring width. The vertical scale is a logarithmic scale of ring width in mm



## Interpretation

The 'wedging', or rapid narrowing of the rings in part of the circumference, means that rings may be partially missing around the trunk, and it is impossible to establish the exact age of the trees without being able to compare the ring width series with a number of others from the site. The cause of this 'wedging' is unknown, and neither is it known whether this is normal growth behaviour in this species, though it has been seen in other species. It is encouraging however that the two series from the *Abies*, one from the trunk and one from the branch (Fig 4) do crossmatch. This suggests that the oldest ring in the branch was formed 26 years after the oldest ring in the trunk section. Without having the precise locations of each slice within the tree little more can be said, although it seems reasonable that a large branch is being formed when the tree is of about this level of maturity.

In order to interpret more accurately the age of the trees, one would have to first establish that there were no missing rings in the sections supplied. This could be done by reference to several other samples of trees which had grown on the site during the same period. In addition, one would need to allow for the time taken for the trees to grow to 1m above ground level, although looking at the vigour of the early growth rings in both samples, this is unlikely to have taken more than a few years in each case. Also it is likely that the trees were planted when already several years old, in which case the maximum age would be a slight over-estimate of the planting date.

The minimum ages of the trees (120 and 113 years) do suggest that they were early examples of trees planted during the period of conversion of the house in the AD 1870s and 1880s.

The two density bands in ring 95 of the *Thuja* probably represent some trauma during this growth period. Both species show very variable year-to-year ring width.

## Acknowledgements

Samples were taken by the Head Gardener, Richard Squires. This work was commissioned by English Heritage, and I would like to thank Alex Bayliss and Peter Marshall for their work in support of my activities. Alex Bayliss and Cathy Groves (University of Sheffield) also made helpful comments on an earlier draft of this report.

## References

- Baillie, M G L, and Pilcher, J R, 1973 A simple cross-dating program for tree-ring research, *Tree Ring Bulletin*, **33**, 7-14
- Munro, M A R, 1984 An improved algorithm for crossdating tree-ring series, *Tree Ring Bulletin*, **44**, 17-27
- Tyers, I, 1999 *Dendro for Windows Program Guide 2nd edn*, ARCUS Rep, **500**

**Table 1: Ring width data for the sections measured**

<b>ring widths (0.01mm)</b>									
<b><i>Thuja occidentalis</i></b>									
621	371	431	796	722	582	532	552	477	235
455	335	161	251	218	247	265	194	320	329
307	500	365	191	256	414	481	324	408	270
138	327	388	333	392	180	251	115	263	225
162	299	322	351	271	324	365	140	136	282
407	272	200	286	450	462	436	357	276	174
179	195	90	225	278	179	139	145	105	92
76	53	86	114	137	196	403	382	235	319
216	91	116	225	289	136	106	112	133	136
196	379	413	353	195	375	313	261	246	250
47	151	209	306	310	500	458	260	112	51
113	218	285	133	100	162	246	170	284	
<b><i>Abies cephalonica trunk</i></b>									
749	819	909	1048	1080	958	1014	918	751	850
1024	359	328	1025	1081	977	948	975	1171	921
1104	885	1103	1026	1127	991	1143	1033	915	870
897	865	870	911	822	833	604	899	1035	735
387	493	421	665	624	472	601	362	443	390
362	616	492	673	713	662	701	469	430	368
254	151	42	31	87	70	45	65	83	42
67	43	28	33	41	34	26	29	81	56
24	25	40	11	6	10	23	10	15	10
11	7	13	17	22	55	66	71	129	577
390	1041	961	222	129	390	254	227	952	1212
1071	972	811							
<b><i>Abies cephalonica branch</i></b>									
124	328	409	391	461	469	467	305	510	780
713	1058	1332	1039	1189	1087	1090	1090	1183	1063
1117	1285	1117	1161	869	1042	1170	1109	1042	1197
999	1026	972	492	1018	644	869	315	188	539
460	485	580	406	276	318	250	452		