Ancient Monuments Laboratory
Report 50/1999

TREE-RING ANALYSIS OF A CEDAR (*CEDRUS LIBANI*) FROM THE GROUNDS OF CHISWICK HOUSE, BURLINGTON LANE, LONDON

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Summary

A cedar tree in the grounds of Chiswick House fell down unexpectedly in April 1999. The tree was one of an avenue thought to have been planted before AD 1742 on the basis of written histories and early illustrations of the site. Tree-ring analysis showed that 239 rings existed from pith to bark at a height approximately 4m above ground level. From a single sample it was not possible to prove whether there were any missing or false rings, but the results are compatible with the tree having been planted a few years before AD 1742.

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Introduction

Chiswick House (NGR TQ209776) is the former London home of the 3rd Earl of Burlington who was responsible for laying out the landscape gardens in the style in which they are largely kept today. The site is currently cared for by English Heritage. A survey of the grounds (Travers Morgan Planning 1983) quotes from a description of the grounds written in AD 1742 which discusses the creation of an avenue of trees and sculpture, and reproduces a painting of the same year showing an avenue of trees thought to be those of a formal 'exedra' at the rear of the house. It is known that cedars were planted in the grounds in the 1720s, but there was some suggestion that these trees may have been transplanted from a seventeenth-century garden.

A large cedar of Lebanon tree (*Cedrus libani*), thought to be one of those discussed above, fell to the ground on the 27th April 1999. The English Heritage inspector, Juliet West, requested that the rings from this tree be analysed to see if it could be established whether the tree started life in the early eighteenth-century or was perhaps older.

Methodology

The site was visited in May 1999, when the fallen tree was inspected and a cross-section was removed from approximately 4m above ground level. The section was removed to the laboratory and 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 cross-section had its tree-ring sequence 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 an Atari desktop computer. The software used in measuring and subsequent analysis was written by Ian Tyers (pers comm 1992).

The ring sequence was plotted on translucent semi-log graph paper to allow visual comparisons to be made between it and similar sequences from other cedar sequences (Cutler *et al* 1993; Bridge *et al* 1996) on a light table. Statistical comparisons were made using Student's *t*-test (Baillie and Pilcher 1973; Munro 1984). Those *t*-values in excess of 3.5 are taken to be indicative of acceptable matching positions provided that they are supported by satisfactory visual matches, and give consistent matching positions. The plot (Fig 1) was prepared using program TSAP (Rinn 1996).

Results

The tree-ring sequence (Table 1; Fig 1) measured from pith to bark contained a total of 239 rings. The series was compared to a ring-width sequences from cedars felled at the Royal Botanic Gardens, Kew in the storm of 1987 (Cutler *et al* 1993; Bridge *et al* 1996) but no crossmatching was found. The average ring-width was 2.60mm, but a clear decline in increment is shown over most of the series.
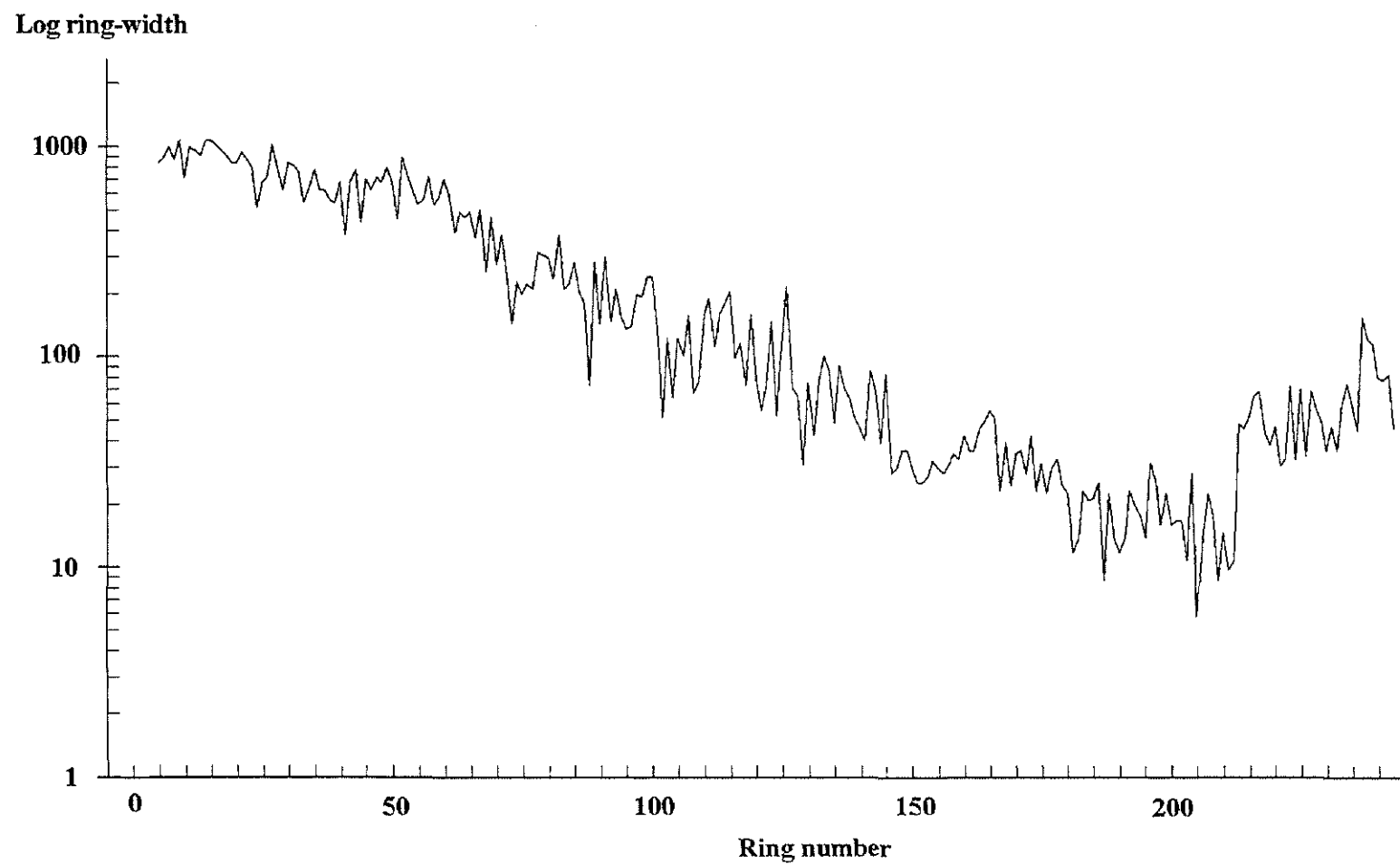
Figure 1: Plot of the ring-width series of the cedar section from Chiswick House grounds

Interpretation and Discussion

As only one tree was available, and the series obtained did not crossmatch to any data held from other sites, it is not possible to be completely certain that each ring corresponds to a calendar year. It is possible that some years may not be represented in the series (missing rings), or indeed that there is more than one ring formed in some years (false rings). Evidence from a large range of trees, including cedars, from the Royal Botanic Gardens, Kew (Cutler *et al* 1993; Bridge *et al* 1996) suggests that the rings are likely to be annual in nature. If one accepts that the rings are annual, the sample taken at approximately 4m above ground level is 239 years old. Some allowance needs to be made for the growth of the tree to 4m tall in order to age the tree itself. The growth is quite vigorous in the innermost rings (Fig 1) and it unlikely to have taken more than a few decades to reach this height. If the tree was indeed transplanted, this may have affected the growth rate until the tree became properly established in its new environment, but there is no evidence of this in the cross-section obtained.

Many conifers show the growth decline illustrated by the first two hundred years growth of this sample (Fritts 1976), but the rapid increase in the outermost 30 - 40 rings is of interest. This increased growth rate may result from localised changes in the tree's immediate environment, or may reflect wider-scale changes such as cleaner air following the introduction of the Clean Air Acts, increased carbon dioxide concentrations in the atmosphere, or increased summer warmth. The ring-width series appears to be quite 'sensitive' (*sensu* Fritts 1976) although if the rings are assumed to be annual (the last ring being formed in AD 1998) none of the particularly wide or narrow rings appear to correspond with well known weather variations during the period of growth.

This study supports the notion that the trees in the avenue of which this was a part were planted by AD 1742, but shows no evidence that they had been transplanted from an earlier garden. Samples from nearer ground level might help resolve this question more fully.

Acknowledgements

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Table 1: Ring-widths from the cedar radius from Chiswick House grounds

				ring widths (0.01mm)					
845	911	999	881	1099	725	1009	977	919	1103
1089	1044	988	930	848	859	955	886	808	528
692	724	1040	814	628	845	841	762	560	649
778	635	642	564	557	694	389	686	780	441
705	640	719	690	803	681	462	895	756	638
534	568	734	533	578	702	601	402	503	465
496	378	511	256	467	284	387	251	147	234
205	228	212	324	313	305	240	394	216	226
290	208	182	75	290	146	308	150	213	157
137	144	201	197	247	246	139	52	125	65
124	102	159	69	78	163	190	114	162	181
207	100	118	74	163	81	56	75	150	54
127	217	73	66	31	76	43	78	102	88
49	92	72	64	52	45	41	87	71	40
85	29	30	37	37	30	26	26	27	33
30	29	31	36	34	43	37	37	47	51
57	52	24	40	25	36	37	29	43	24
32	23	30	34	25	23	12	14	24	21
22	26	9	23	14	12	14	24	20	18
14	32	26	16	23	16	17	17	11	29
6	14	23	18	9	15	10	11	49	47
54	66	70	44	39	48	31	34	74	34
72	35	71	58	51	37	48	37	61	77
60	46	158	123	119	82	80	85	47	