Tree-ring spot dates from archaeological samples:

Crossrail Pudding Mill Lane (sitecode XSK10)

5 samples from timbers excavated from the Crossrail Pudding Mill Lane excavations (sitecode XSK10, NGR *c*. TQ 3770 8345) were submitted for dendrochronological assessment and analysis. None of these timbers were successfully dated.

Methodology

The timbers were supplied as cross-sections. They were assessed for the wood type, the number of rings they contained, and whether their sequences of ring widths could be reliably resolved. For dendrochronological analysis samples usually need to be oak (*Quercus* spp.), to contain 50 or more annual rings, and the sequence needs to be free of aberrant anatomical features such as those caused by physical damage to the tree whilst it was still alive. Standard dendrochronological analysis methods (see e.g. English Heritage 1998) were applied to both samples. The sequence of ring widths in these samples were revealed by preparing a surface equivalent to the original horizontal plane of the parent tree with a variety of bladed tools. The width of each successive annual growth ring was revealed by this preparation method. The complete sequence of the annual growth rings in the suitable samples were then measured to an accuracy of 0.01mm using a micro-computer based travelling stage. The sequences of ring widths were then plotted onto semi-log graph paper to enable visual comparisons to be made between the sequences and reference data. In addition cross-correlation algorithms (e.g. Baillie & Pilcher 1973) were employed to search for positions where the ring sequences were highly correlated. Highly correlated positions were checked using the graphs and where these were satisfactory, these locations were used to identify the calendar dates of the measured series.

Computer searches for cross-matching use the original CROS algorithm (Baillie & 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 needs to have been obtained from a range of independent sequences, and that these positions were supported by satisfactory visual matching.

The tree-ring analysis initially dates the rings present in the timber. The interpretation of these dates relies upon the nature of the final rings in the sequence. Oak timber contains 2 types of wood, heartwood and sapwood, the latter is on the outside of the tree and thus contains the most recent growth rings, this material is softer and is not always preserved under archaeological conditions. If the sample ends in the heartwood of the original tree, a *terminus post quem (tpq)* date 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 actual date that a tree was felled, particularly where poor preservation or other loss of outer heartwood has occurred. Where some of the outer sapwood or the heartwood/sapwood boundary survives on the sample, a date range for the felling of a tree can be calculated by using the maximum and minimum number of sapwood rings likely to have been present. For this material the sapwood estimates used are a minimum of 10 and maximum of 46 annual rings, where these figures indicate the 95% confidence limits of the range.

Results

The submitted material comprised 5 oak (*Quercus* spp.) dendrochronological samples. 3 of these contained measurable tree-ring sequences, and were measured successfully (Table 1). Sequences from these did not cross-match each other, nor with Roman or post-Roman tree-ring data from London, elsewhere in England, or elsewhere in northern Europe.

Acknowledgements

References

Baillie, M G L & Pilcher, J R, 1973 A simple crossdating program for tree-ring research, *Tree Ring Bulletin*, **33**, 7-14

English Heritage, 1998 *Dendrochronology: guidelines on producing and interpreting dendrochronological dates*, English Heritage

Table 1. Details of the oak (*Quercus* spp.) samples from Crossrail Pudding Mill Lane (XSK10). +B complete to bark surface

Context	Rings	Sap rings	Date of measured sequence	Interpreted result
33	53	22+B	undated	-
63	~45	-	not analysed	-
101	53	21+B	undated	-
105	55	22+B	undated	-
111	~25	-	not analysed	-