Tree-ring spot dates & wood identifications of archaeological samples: Hunts Hill Farm, Upminster, London

Site code: UP-HH89

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Hunts Hill Farm, Upminster, London (sitecode UP-HH89)

12 samples from timbers excavated at Hunts Hill Farm, Upminster, London (sitecode UP-HH89, NGR *c*. TQ 5651 8302) were submitted for dendrochronological assessment and analysis, a further 7 samples were submitted for wood identification. All 12 of the dendrochronological samples were suitable for analysis, and 9 of these were successfully dated; comprising 7 Roman, & 2 early medieval timbers derived from 2 different features on the site. The 7 identification samples were a mix of native species.

Methodology

Each dendrochronological sample was supplied as a complete cross section, it is assumed in the absence of other information that these were obtained from the optimum location for sapwood and bark survival from the timber. The identification samples were supplied as sub-samples of timbers.

Each dendrochronological sample was assessed for the wood type, the number of rings it contained, and whether the sequence of ring widths could be reliably resolved. For dendrochronological analysis samples need to be either oak (*Quercus* spp.), or another of the dendrochronologically viable timbers types, 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. The supplied samples were oak. Standard dendrochronological analysis methods (see e.g. English Heritage 1998) were then applied to each suitable sample. The sequence of ring widths in each sample 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 sequence of ring widths were then plotted onto semi-log graph paper to enable visual comparisons to be made between sequences. 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, if any of these were satisfactory, new composite sequences were constructed from the synchronised sequences.

The *t*-values reported below were derived from 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.

Tables 4 & 6 lists examples of the matches for composite series from this site against reference series. These tables are intended to show that there is independent corroboration for the dates given to the various dated samples in this report, this individual and composite series match many other reference series.

This initial analysis dates the rings present in the datable samples. The correct interpretation of those dates relies upon the character of the final rings in the samples. If a 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 that may be missing. This *tpq* may be many decades prior to the real felling date. Where some of the 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. If bark-edge survives then a *felling date* can be directly utilised from the date of the last surviving ring. The sapwood estimates applied here to the English sourced oak are a minimum of 10 and maximum of 46 annual rings, where these figures indicate the 95% confidence limits of the range. For both groups these interpreted dates do not necessarily indicate the date of the structure from which the samples were derived. There may be unrecognised re-used timbers or timbers which are later repairs to structures on this site.

The wood type of the identification samples was determined by taking thin sections of each timber in three planes (radial, transverse and tangential sections). The microscopic comparison of these sections with permanent reference slides and reference keys such as Schweingruber (1978) enabled identifications to be made for the material. The identifications are given in Table 2.

Results

The submitted dendrochronological material comprised 12 oak samples. The details of the separate samples are provided in Table 1. The 7 identification samples (Table 2) comprise a mixture of native species.

All of the dendrochronological material contained measurable sequences. These samples were measured successfully yielding 12 individual series of between 45 years and 167 years length (Table 1). This diverse group of samples comprised 2 well groups, 525, of probable Roman date, and 2709, of probable Saxo-Norman date. Initial comparison between the material identified 2 groups of timbers which were found to cross-match each other (Tables 3 & 5). In each case these groups produce internally consistent groups of samples, and reflect the phase/grouping information supplied with them (illustrated Figures 1 & 2). Each of these composite groups was mathematically converted to a single composite sequence at their synchronised positions and these, and the residual individual series were compared with Roman, medieval and later tree-ring data from London, England and Europe. Consistent dating positions were identified for the 2 composite series (Tables 4 & 6). The 2 composite series comprised 7 local oak timbers from the Roman period, and 2 local oaks from the earlier medieval period. No reliable and consistent dating information was obtained for the 3 remaining unmatched individual oak series.

Discussion

The material had spent some years between excavation and analysis. The different samples were in a mixture of dried, and rather soft conditions, requiring different technical skills to recover the tree-ring sequences. If the samples originally retained sapwood it is likely to have disintegrated.

9 of the dendrochronological samples were from well 525, and 3 were from well 2709. This summary discussion below uses these phase/groups.

Well 525. The analysis identified 7 datable samples from the 9 supplied (Figure 1). None have sapwood, although one seems fairly convincingly to end at the heartwood/sapwood boundary ring. The latest extant heartwood rings are at AD89 from sample 540, and AD80 from sample 533. A combined interpretation for the timbers suggests a date for this feature of between AD99 & AD126. Sample pair 540 & 571, and also sample pair 589 & 591 were each derived from a single tree, these may indicate each was a broken single plank, or that they were originally 2 planks each derived from the same tree. The nearly contiguous sequences obtained from 539 and 533 might indicate these 2 excavated planks were originally a single wider (~330mm) plank, subsequently split lengthwise, although their relative positions within the feature may disprove this suggestion.

Well 2709. The analysis identified 2 datable samples from the 3 supplied (Figure 2). None have sapwood. All 3 are rather unusual cross-sections, for example 2900 is a tangential section rather than the radial section it appears to be and 2924 tapers outward, rather than inward. These timbers are discoloured around the edges and all appear quite eroded and compressed. I would suggest it is possible that these timbers may be the surviving inner parts of originally rather larger timbers. As a result it is quite possible that the dating obtained could be significantly earlier than the true construction date of the feature. A combined interpretation suggests a date for this feature of after AD933.

Acknowledgements

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Figure 1. Bar diagram showing the dating positions of the 7 dated Roman tree-ring sequences for oak samples from Hunts Hill Farm, site UP-HH89 feature 525. KEY; Heartwood (white bars).

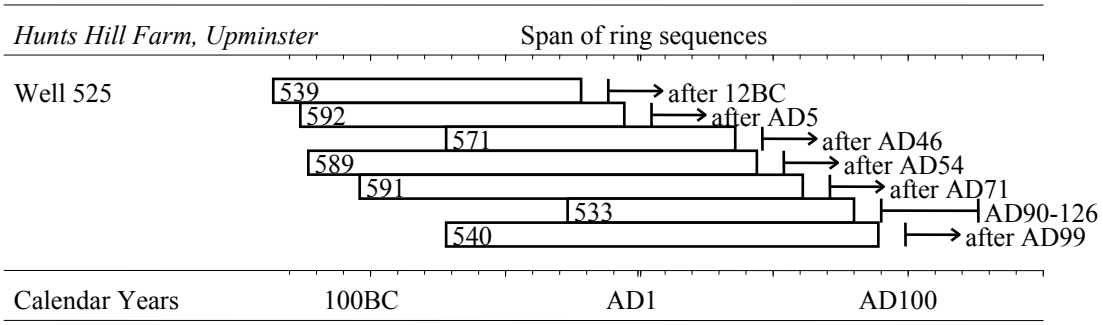

Figure 2. Bar diagram showing the dating positions of the 2 dated early medieval tree-ring sequences for oak samples from Hunts Hill Farm, site UP-HH89 feature 2709. KEY; Heartwood (white bars).

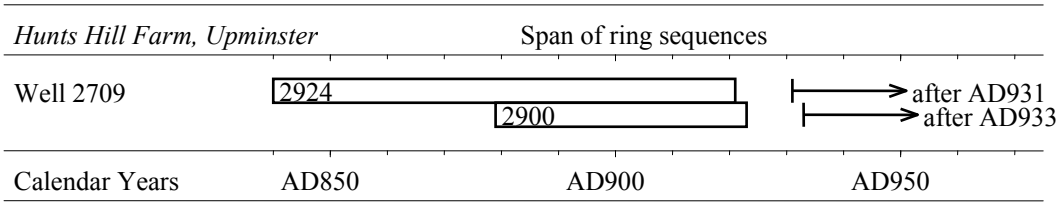

Table 1. Details of the 12 oak (*Quercus* spp.) dendrochronological samples from Hunts Hill Farm, site UP-HH89.

Sample	Size (mm)	Rings	Sap	Date of measured sequence	Interpreted result
533	175 x 25	107	H/S	27BC-AD80	AD90-126
539	155 x 20	115	-	136BC-22BC	after 12BC
540	260 x 25	161	-	72BC-AD89	after AD99
559	95 x 25	59	-	undated	-
571	265 x 25	108	-	72BC-AD36	after AD46
589	170 x 35	167	-	123BC-AD44	after AD54
591	190 x 45	165	-	104BC-AD61	after AD71
592	160 x 55	121	-	126BC-6BC	after AD5
597	65 x 15	55	-	undated	-
2900	110 x 40	45	-	AD879-AD923	after AD933
2923	60 x 30	69	-	undated	-
2924	70 x 30	82	-	AD840-AD921	after AD931

KEY H/S indicates the last ring is the heartwood/sapwood boundary.

Table 2. Details of the 7 identification samples from Hunts Hill Farm, site UP-HH89.

Context	wood type
527	Quercus (larger bit), Salicaceae (smaller bit)
547	Quercus
556	Salicaceae
650	*cf*. Prunus
5685	Fraxinus
5695	Ulmus
7010	Betula

KEY
Betula; *Betula* spp., birch, one of 2 species
Fraxinus; *Fraxinus excelsior*, ash
Prunus; *Prunus* spp., one of cherry, blackthorn type fruit trees
Quercus; *Quercus* spp., oak, one of 2 species
Salicaceae; willow *Salix* and/or poplar *Populus* indeterminate
Ulmus; *Ulmus* spp., elm, one of several species

cf. Comparable to

Table 3. The *t* values (Baillie & Pilcher 1973) between 7 Roman dated series from Hunts Hill Farm, site UP-HH89 feature 525. – *t* values less than 3.0, \ no or short overlap. These timbers were combined for use in Table 4.

	539	**540**	**571**	**589**	**591**	**592**
533	\	3.67	4.77	5.76	5.11	3.71
539		4.50	3.78	4.25	-	-
540			23.63	4.02	3.85	-
571				3.87	4.33	3.64
589					15.29	3.68
591						3.20

Table 4. Showing example *t* values (Baillie & Pilcher 1973) between the UPHH-525 composite sequence and local oak reference data.

	UPHH-525 136BC-AD89
1 Poultry ONE94 (Tyers 2000)	10.67
Drapers Gardens DGT06 (Tyers 2008b)	10.64
Guildhall Yard GYE92 (Tyers 2008a)	10.37
Guildhall Yard GAG87 (Tyers 2008a)	10.31
Fleet Valley VAL88 (Tyers & Hibberd 1993)	9.99
154-6 Upper Thames St SUF94 (Tyers & Boswijk 2001)	9.62

Table 5. The *t* values (Baillie & Pilcher 1973) between 2 dated series from Hunts Hill Farm, site UP-HH89 feature 2709. This material was combined for use in Table 6.

	2924
2900	3.84

Table 6. Showing example *t* values (Baillie & Pilcher 1973) between the UPHH-2709 composite sequence and local oak reference data.

	UPHH-2709 AD840-AD923
Fleet Valley VAL88/PWB88 T89 (Tyers & Hibberd 1993)	6.43
Bull Wharf UPT90 (Tyers 1994)	5.71
Seal House SH74 (Morgan 1978)	5.11
Thames Exchange TEX88 (Nayling 1991)	4.79
Vintry VHA89 (Hibberd 1992)	4.71
Bull Wharf BUF90 (Tyers & Boswijk 1997)	4.67