A SUBMERGED FOREST WITH EVIDENCE OF EARLY NEOLITHIC BURNING ACTIVITY AND THE TILBURY ALLUVIAL SEQUENCE AT CANNING TOWN, EAST LONDON

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SUMMARY

Archaeological evaluation of a small redevelopment site in Canning Town revealed a deep, well-stratified Holocene alluvial sequence (the Tilbury Formation) to 5.8m depth (-4.75m OD) over Devensian fluvial sands and gravels. A thin peat (the lower peat) at c.*5.5–5.75m depth (-4.45 to -4.7m OD) contained tree trunks, some with roots attached. The layer was sampled and assessed for plant macrofossils, wood and molluscs and was radiocarbon dated to the early Neolithic (3940–3700 cal* BC*), probably relating to the Tilbury III regression. Floodplain alder carr and surrounding mixed deciduous woodland were inundated in the Early Neolithic by Thames flood waters during marine transgression and have been preserved* in situ *as a submerged forest. Human activity in the local forest is indicated by the presence of wood charcoal and scorched snails but no archaeological features or artefacts were found.*

The thick overlying sediment sequence contained two further main bodies of peat dating to the end of the Early Neolithic (3350–3030 cal BC*) and Middle Bronze Age (1400–1130 cal* BC*), correlating broadly with other Tilbury sequences in London and with a shallower peat sequence at Silvertown, where a Neolithic trackway was identified. The pollen indicates the continuation of dense and relatively undisturbed forest for the Neolithic to Middle Bronze Age wetland edge landscape. Although long-term settlement of the area would not have been feasible due to the fluctuation and instability of these wetlands, it is likely that the area offered opportunities for economic activities such as fishing and fowling.*

Excellent preservation by waterlogging in this deep sequence has been demonstrated and archaeological evidence in the form of organic remains, eg trackways and fishtraps, may be discovered in the area in the future.

THE SITE

The study area, centred on NGR 539876 180859, comprises a small (0.1ha) plot of land proposed for redevelopment within an area of commercial properties and warehouses in the London Borough of Newham. It is located on low-lying land <0.5km north-east of the confluence of the River Lea (Bow Creek) with the River Thames and is adjacent to the Royal Victoria Docks (Fig 1). The geology of the area is mapped as alluvium over river gravels and the Eocene London Clay Formation (British Geological Survey 1998 sheet 257).

No archaeology has previously been recorded for the site, but a number of Neolithic to Bronze Age sites and deposits have been excavated at other floodplain locations within the Borough, notably timber trackways at Beckton, Bramcote Green and Silvertown (Meddens 1996; Thomas &

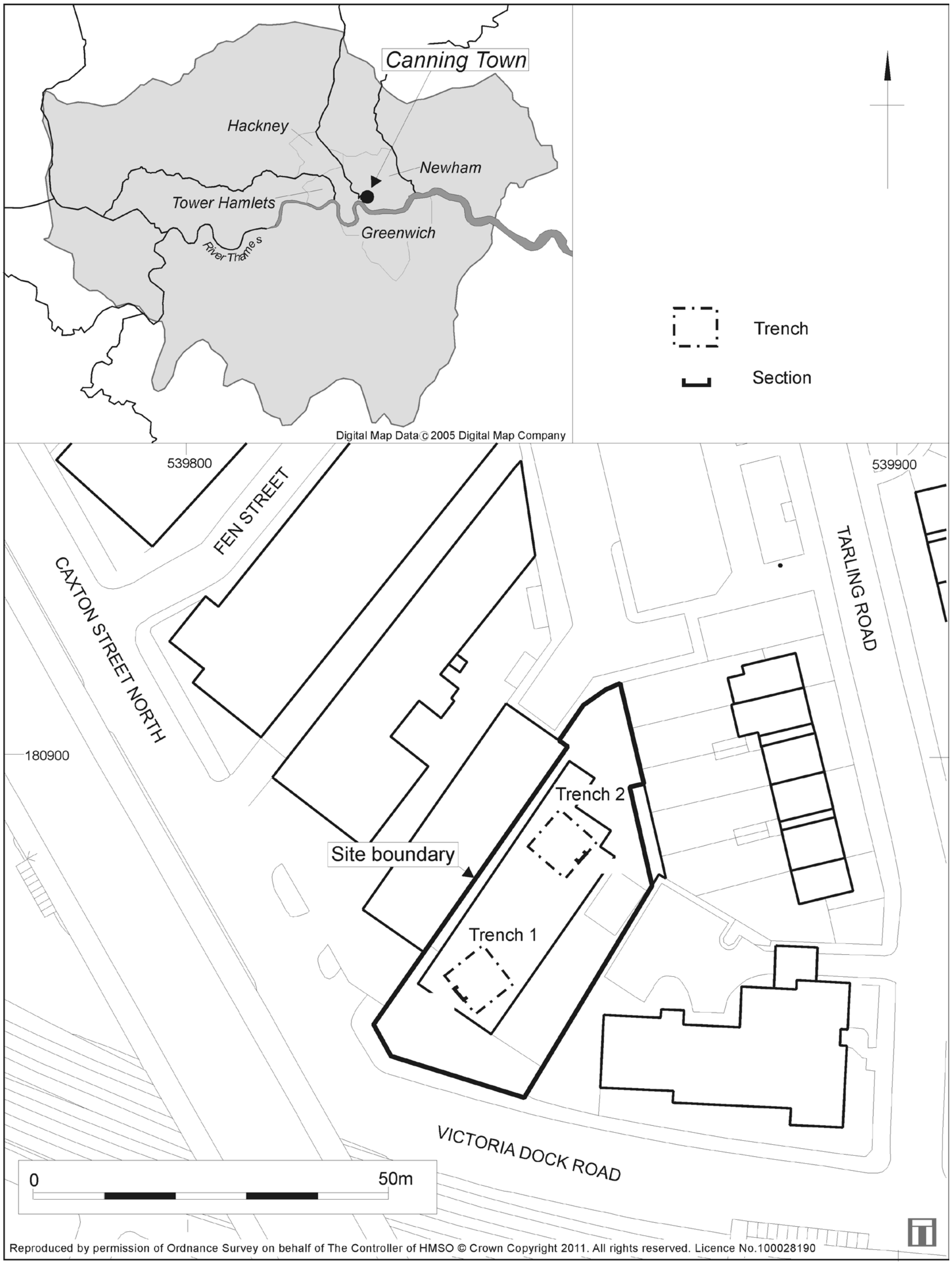

Fig 1. Site location and plan: 118 Victoria Dock Road, Canning Town

Rackham 1996; Crockett *et al* 2002). There is little evidence for later settlement, the area forming the wetlands, marsh, pasture and arable land of the Plaistow Levels, at least in the post-medieval period, as shown by the Chapman and André map for 1777 (Fig 2). Subsequently, the area was drained, reclaimed and developed as Canning Town in the 18th–19th centuries and grew in importance for industry and freight with the opening of Victoria Dock in 1855.

ARCHAEOLOGICAL INTERVENTIONS

Two 7m by 7m evaluation trenches were machine dug *c*.20m apart. The alluvial sedimentary sequence was exposed to 3.5m below ground (-2.4m OD) in the southern Trench 1 and to *c*.6m (+1.05m OD to *c*.-5m OD) in the northern Trench 2 (Fig 3). Geotechnical logs of two previous boreholes (Ashdown Investigations Ltd 2004) revealed the basal gravels and underlying London Clay at over 6m depth (Table 1). No archaeological evidence was recorded. A series of bulk samples and overlapping undisturbed sediment samples (monoliths) was taken from the upper, accessible, sequence of Trench 1 at 1.2–3.4m below ground (-0.1 m OD to –2.3m OD) and grab bulk samples were taken from the digger bucket for the deeper layers in Trench 2 (Fig 3).

THE BROAD SEDIMENTARY SEQUENCE

The waterlogged alluvial sequence was recorded in both trenches, although the basal sands and gravels were only reached in Trench 2. All layers were horizontal and generally continuous, allowing direct correlation of the sedimentary units. Detailed sediment descriptions (available in the archive) can be summarised as follows (see also Table 1): the London Clay is overlain by 1.75m of coarse fluvial sands and gravels of probable Late Devensian age (unit 8, *cf* The Shepperton Gravel, Bridgland 1994;

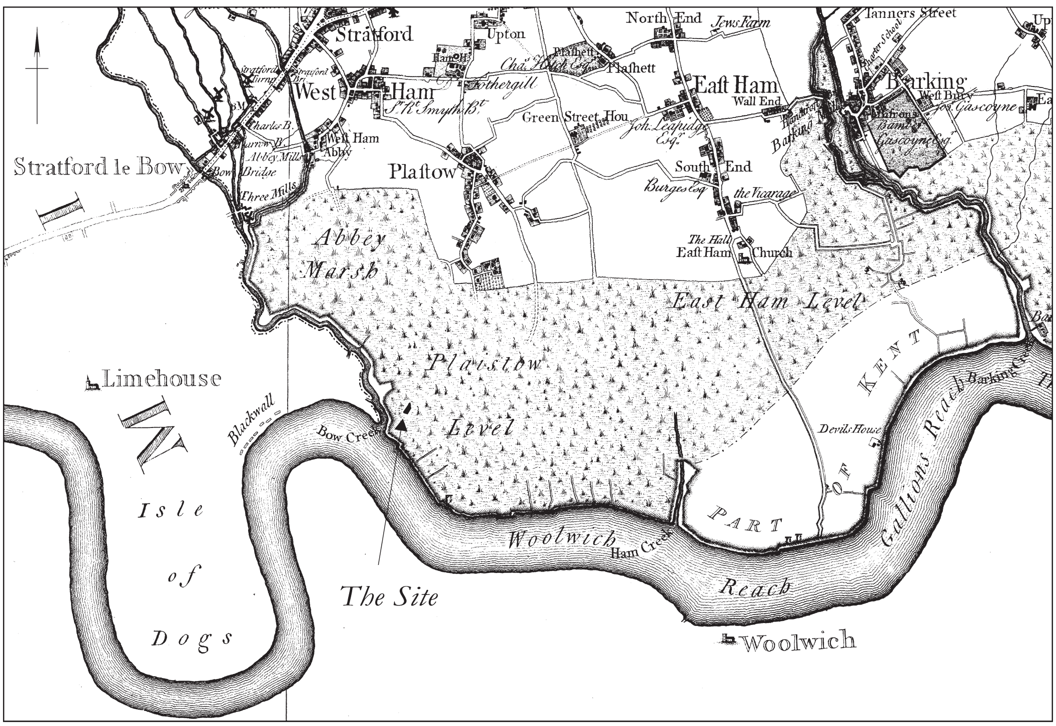

Fig 2. Extract from the Chapman and André Map of 1777 (Reproduced with kind permission of Phillimore & Co Ltd)

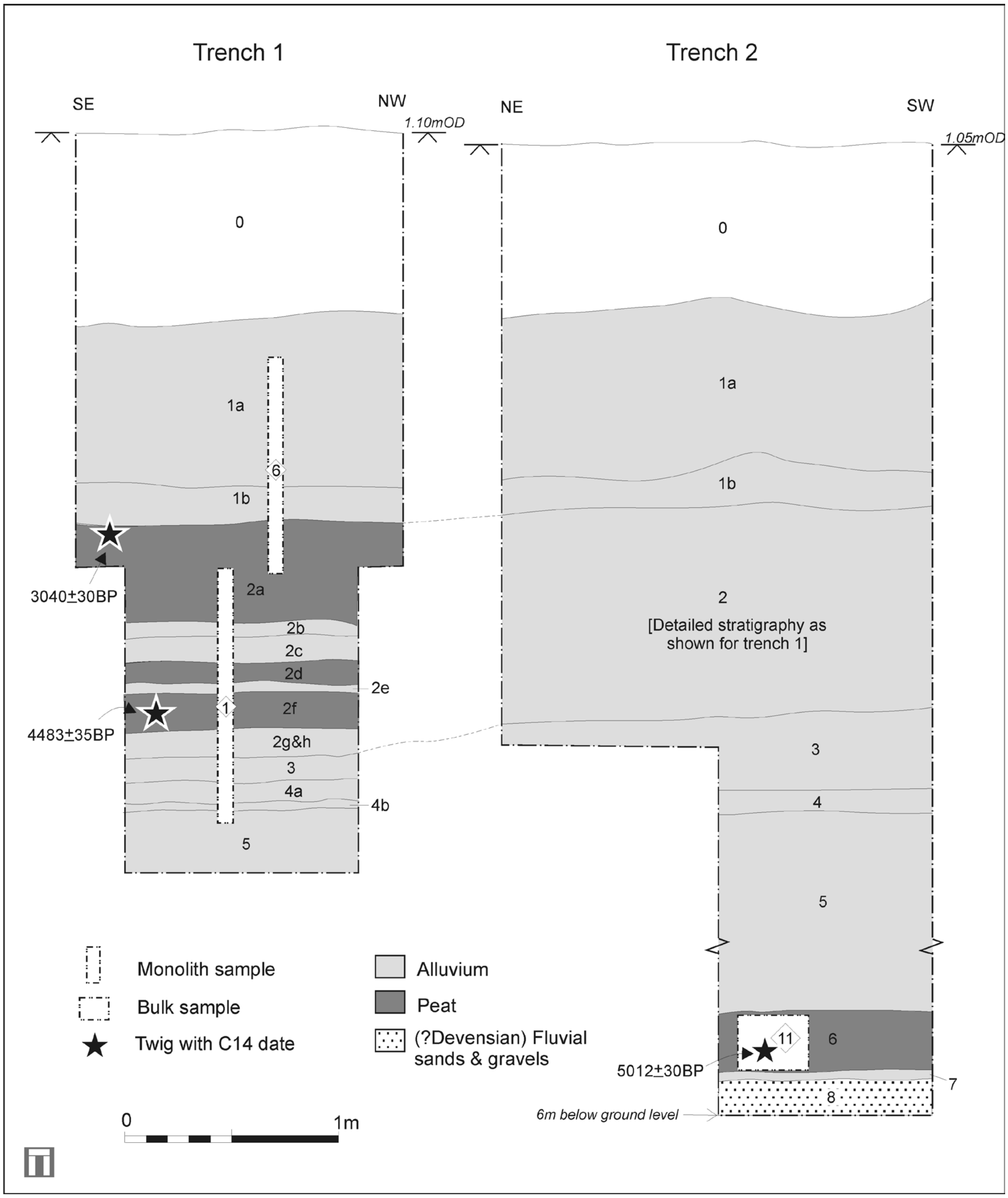

Fig 3. Section drawing Trenches 1 and 2

Gibbard 1994; Sidell *et al* 2000). A thick (5.8m) Holocene sequence of low-energy alluvium and peat layers occurs over the gravels from +1.1 to -4.75m OD and equates to the Tilbury Formation (Gibbard 1994; Haggart 1995), below. Of particular note is the lower peat (unit 6), which was observed to have whole tree trunks, some with roots, lying on and in its upper surface at 5.5m (-4.45m OD); the layer has therefore been termed the submerged forest.

THE TILBURY SEQUENCE

The Holocene alluvial sequence including the submerged forest is divisible into seven distinct sedimentary units as shown in Table 1 (p. 6) and summarised as:

Unit	Depth m	m OD	Summary sediment type
0	0-0.9	+1.1 to +0.2	Made ground and demolition rubble
1	0.9-1.84	+0.2 to -0.74	Oxidised overbank silty clay alluvium
2	1.84-2.85	-0.74 to -1.745	Complex of peats and alluvium
3	2.85-3.09	-1.745 to -1.99	Clay silt alluvium
4	3.09-3.17	-1.99 to -2.07	Clay silt alluvium with organic/peat laminations
5	3.17- c.5.5	-2.07 to -4.45	Clay silt alluvium
6	c.5.5-5.75	-4.45 to -4.7	Woody peat, (the lower peat) the submerged forest
7	c.5.75-5.8	-4.7 to -4.75	Sandy silt alluvium

A 0.25m-thick horizontal and laterally continuous layer of finely divided calcareous sandy silty fen carr peat with remains of trees (unit 6, the lower peat) occurred at *c.*5.5–5.75m depth (-4.45 to -4.7m OD). During and after inundation of this submerged forest (lower peat unit 6), thick layers of fine-grained alluvium were laid down (units 5 and 3). These showed faint horizontal banding (with no clear flood couplets that would indicate tidal conditions) and were interrupted by fine organic in-wash and thin peaty laminations (units 4a and b). Together these units indicate marginal wetland conditions and that the site was peripheral to the main Thames channel(s), but subject to inundation during high water levels.

The overlying substantial bodies of peat within the complex of unit 2 (units 2a, d, f) were formed under wet, but terrestrial conditions, as indicated by the quantity and type of plant inclusions (notably wood) and rooting within it. The gradual increase in organic matter in the alluvium prior to formation of *in-situ* peat indicates that its formation followed a gradual shift in channel position or lowering of energy due to lowered water levels during regression. Fluvial influences remained in close proximity to the site, hence it was subject to sporadic flooding or raised water table, as indicated by the layers of increased minerogenic content that interrupted peat accumulation (units 2e and c). This was a relatively stable wetland environment that would have afforded human access to the area during its accumulation.

A horizontal twig from the peat at 2.75m depth (unit 2f) was AMS radiocarbon dated to 3350–3030 cal BC (4483±35 BP, NZA-22533) and another from the uppermost peat layer at 1.88m (unit 2a) to 1400–1130 cal BC (3040±30 BP, NZA-22395) (Table 2). This indicates that the peats of unit 2 are typical of Thames edge peats elsewhere in the vicinity (*eg* Scaife 2000a; 2000b; Sidell *et al* 2000) in encompassing the (late) Early Neolithic (3350–3030 cal BC) to the Middle Bronze Age (1400–1130 cal BC). In date they broadly equate to the Tilbury III and Tilbury IV regressions/peat formation described for the Thames catchment (Devoy 1979; 1980; Gibbard 1994; Haggart 1995). However, the dates show that the major phase of alluviation, represented by greater than 2.5m of inorganic sediment (units 3 and 5), occurred relatively rapidly, between two phases of Early Neolithic peat formation. The lower peat/submerged forest of unit 6, described in detail below, is dated to 3940–3700 cal BC, (5012±30BP, NZA-22396) and is also seemingly comparable with Tilbury III, with a further brief stabilisation between the two alluvial units shown by a lesser, thin (though possibly truncated) peat band (unit 4b). This alluvial phase apparently does not correlate with a named Thames transgression and indicates that, on a local scale, the scheme may be overly simplistic (*cf* Sidell *et al* 2000).

A clear and, in some locations, sharp boundary of the uppermost peat, unit 2a, to the massive body of fine-grained alluvium of unit 1 indicates a relatively rapid rise in water level in the later history of the site. This was either due to a shift in channel position or to a rise in energy and base level resulting from sea level rise/marine transgression (Devoy 1979). The wetlands once more became inundated and subject to overbank sedimentation. The chronology of this upper portion of the sequence is unclear but alluviation post-dating peat formation

Table 1. Summary of sedimentary sequence, pollen and radiocarbon dating samples

Depth below ground m	m OD	Radiocarbon results	Summary sediment type	Unit
0-0.9	+1.1 to +0.2		Disturbed and dumped sandy loam and rubble: **Made ground and demolition rubble**	0
0.9-1.62	+0.2 to –0.52		Massive grey iron-stained silty clay: **Oxidised overbank alluvium**	1a
1.62-1.84	-0.52 to -0.74		Massive grey gleyed silty clay: **Overbank alluvium**	1b
1.84-2.34	-0.74 to –1.745	Twig at 1.88m: 3040±30BP 1400-1130 cal BC	Black compact well-humified peat with common roots and herbaceous stems: **Humified edge/fen peat**	2a
2.34-2.39			Black humic silt: **Organic alluvium**	2b
2.39-2.47			Dark grey-brown slightly organic silt loam: **Alluvium**	2c
2.47-2.57			Highly humified compact peat, common wood and twig to base, increasingly minerogenic to top: **Humified edge/fen peat**	2d
2.57-2.60			Dark grey clay silt: **Discontinuous lens of alluvium**	2e
2.60-2.76		Twig at 2.75m; 4483±35 BP 3350-3030 cal BC	Black silty fibrous peat, well-preserved wood and twigs: **Humified edge/fen peat**	2f
2.76-2.85			Organic clay silt and peaty silt loam, occasional wood fragments: **Organic alluvium**	2g+2h
2.85-3.09	-1.745 to -1.99		Dark grey clay silt, faint sedimentary banding, common wood: **Alluvium**	3
3.09-3.16	-1.99 to -2.06		Dark olive-brown clay silt, horizontal black laminations: **Minerogenic alluvium with organic in-wash**	4a
3.16-3.17	-2.06 to -2.07		Black fibrous silty peat: **Fine peat band**	4b
3.17-(Tr1 3.4+, Tr2 *c.*5.5m)	-2.07 to –4.45		Gleyed clay silt, fine banding clay and silty clay (but no flood couplets observed), wood and twig: **Alluvium**	5
*c.*5.5-5.75	-4.45 to -4.7	Twig at c. 5.75m: 5012±30 BP 3940-3700 cal BC	Finely divided calcareous sandy silt peat, exceptionally well-preserved waterlogged plant macrofossils wood and molluscs. Whole tree trunks observed on and in surface of layer: **The submerged forest**	6
*c.*5.75-5.8	-4.7 to -4.75		Pale grey sandy silt: **Alluvium**	7
*c.*5.8-6.0	-4.75 to -4.95		Pale grey calcareous silt with 85% coarse sand and fine angular gravel, occasional sub-rounded clasts up to 4cm, abundant molluscs: **Fluvial sand and gravel**	8
Below 6m from previous geotechnical logs (Ashdown Site Investigation Ltd) Borehole 2 (equivalent to Tr1)				
6.0-7.5	*c.*-4.95 to -6.45		Medium dense black sandy (fine to coarse) gravel of flint with cobbles of flint: **Fluvial sands and gravels**	8
7.5-20.0	*c.*-6.45 to -18.95		Firm to stiff grey clay with a trace of fine to medium gravel of flint, becoming very stiff/ hard below 10.0m: **London Clay Formation**	-

Table 2. Radiocarbon determinations

All results have been calibrated with the atmospheric data presented by Stuiver *et al* (1998) and performed on OxCal ver 3.9 (Bronk Ramsey 1995; 2001) and are expressed at the 95% confidence level with the end points rounded outwards to 10 years following the form recommended by Mook (1986).

Context	Material	Result no.	δC^{13} ‰	Result BP	Cal date BC
top unit 2	twig at 1.85m	NZA-22395	-28.51	3040±30	1400-1130
bot. unit 2	twig at 2.75m	NZA-22533	-25.81	4483±35	3350-3030
unit 6	alder twig at 5.50-.75m	NZA-22396	-29.73	5012±30	3940-3700

elsewhere in the area has been described as forming from 750–400 cal BC (Wilkinson *et al* 2000); deposition of this alluvium may well have been rapid. The upper oxidised alluvium (unit 1a) was heavily gleyed. Any soil profile that may once have developed on its surface has been lost with recent made ground and disturbance at the top of the sequence.

To summarise, the sediments indicate fluctuation between stable semi-terrestrial conditions as represented by the three main peat layers (and lesser thin peats and organic laminations) and periods of fine overbank alluvial sedimentation with raised water levels. The latter are believed to relate to wider eustatic changes (marine transgressions) in the Thames Estuary; however local variation in alluviation also occurred.

THE SUBMERGED FOREST AND HUMAN ACTIVITY

Detailed environmental assessment was undertaken on the bulk grab sample from the lower peat (unit 6). A 1 litre sub-sample was processed for waterlogged remains by laboratory flotation, with flots retained on a 0.25mm mesh and residues on a 0.5mm mesh. 1500g was also processed using standard methods (Evans 1972) for land snails and the remaining 4 litres artefact-sieved though a 4mm and a 2mm mesh for larger plant macrofossils, molluscs, animal bone and wood charcoal in order to consider the environment at time of deposition.

Detailed assessment of the plant remains showed preservation by waterlogging to be exceptional. Whole shells and fragments of hazelnut (*Corylus avellana*) and numerous cones, catkins and fruits of alder (*Alnus glutinosa*) were recovered. Other taxa were relatively rare but included bramble (*Rubus* sp.) and elder (*Sambucus nigra*). Alder apparently dominated the local vegetation but with mature hazel trees/shrubs growing in close proximity. There were no indicators of more open or even partially shaded riverside or wet environments such as seeds of sedges, rushes, nettles *etc*. The indication is then of a dense alder-hazel woodland growing around and on the floodplain. Identification of well-preserved mature wood, twigwood and bark indicates ash (*Fraxinus excelsior*) and oak (*Quercus* sp.) were also present locally and confirms the importance of hazel and alder.

Analysis of molluscs from this same layer provides complementary environmental information. The 4 litre sub-sample contained both land and aquatic shells. A total of 239 molluscs were recovered (*c*.60 molluscs per kilogram). The context was well-sealed and contained no intrusive molluscs (*eg Cecilioides acicula*), and so provides a very rare Early Neolithic assemblage for Greater London. 75% of the assemblage is terrestrial, but 25% are aquatic fresh- and brackish-water species. Analysis of species diversity indices was undertaken on the autochthonous terrestrial elements. The terrestrial assemblage (Table 3) is largely shade-loving (*cf* Evans 1984) (84%), *Discus rotundatus* and *Aegopinella nitidula* predominating, with a number of intermediate species but with no open country species. The taxa represented, and the diversity indices created, indicate the presence of well-established but locally variable, shady vegetation, with humic detritus. The presence of the rare species *Zonitides nitidus* indicates the existence of emergent vegetation at the edge of the river, with decaying *Carex* and *Phragmites* leaf-litter and drift wood or wood in muddy ground (Kerney 1999, 148). This interpretation accords well with the interpretation of alder carr from the plant remains (below).

In contrast, the aquatic assemblage is

Table 3.
Mollusc data from unit 6, basal sandy peat

(Note numbers in [ ] indicate burnt shells)

Context	sandy peat
Unit	6
Sample	11
Depth	Spot
Wt (g)	1500g
LAND	
Succinea/ Oxyloma sp	6
Cochlicopa spp.	13 [6]
Acanthinula aculeata (Müller)	1
Discus rotundatus (Müller)	76 [30]
Vitrea crystallina (Müller)	3
Nesovitrea hammonis (Ström)	1
Aegopinella pura (Alder)	3
Aegopinella nitidula (Draparnaud)	50 [19]
Oxychilus cellarius (Müller)	4 [2]
Zonitoides nitidus (Müller)	4 [3]
Limacidae	10
Cochlodina laminata (Montagu)	2 [1]
Clausilia bidentata (Ström)	2 [1]
Trichia hispida (Linnaeus)	1
Cepaea spp.	3 [2]
FRESH- /BRACKISH-WATER	
Valvata cristata (Müller)	8 [2]
Bithynia tentaculata (Linnaeus) opercula	152 [1]
Bithynia tentaculata (Linnaeus)	14 [2]
Lymnaea truncatula (Müller)	22 [3]
Bathyomphalus contortus (Linnaeus)	7 [1]
Pisidium nitidum (Jeyns) valves	4
Pisidium spp. valves	14
Terrestrial Taxa	15
Terrestrial TOTAL	**179**
Freshwater Taxa	5
Freshwater TOTAL	**60**
Shannon Index	1.75
Brillouin Index	1.63
Shannon Index – Brillouin Index	0.12
Delta 2	0.73

allochthonous — found in a place remote from the site of formation — (as indicated by the high and disproportionate numbers of *Bithynia tentaculata* opercula), and represents the local water body, the shells having been deposited by flood waters near the river's edge. The assemblage is dominated by *B. tentaculata, Valvata cristata* and *Lymaea truncatula* and suggests large bodies of slow-moving, well-oxygenated hard water, muddy-bottomed with dense aquatic plants, fringed by marshy grassland and mud. The presence of clean running water but thick weedy vegetation is suggested by the occurrence of *Bathyomphalus contortus* and *Pisidium nitidum.*

Overall the molluscs indicate woodland giving way to marshy woodland and reeds adjacent to a large slow-moving body of clean water with muddy, and possibly well-vegetated, bottom or edges.

Perhaps most significant is that 73 shells, a remarkable 41% of the assemblage, are burnt. This includes both terrestrial and aquatic taxa (Table 3), from which we can suggest that local burning was occurring and that these shells were on and at the land surface, and not incorporated within the peat (*cf* Canti & Linford 2000).

A number of small bones recovered from the lower peat, unit 6, were identified as a jaw and two loose teeth of a shrew (*Sorcidae*), a tooth of a mouse, post-cranial elements of rodents, one fish bone, and an epiphysis of a small mammal (probably not a domesticate).

It is noteworthy that a small, but significant, wood charcoal assemblage was recovered, with 20 fragments >2mm. Those 4mm in size were identified in assessment as three fragments of mature ash (*Fraxinus excelsior*), one of mature elm (*Ulmus* sp.), and three fragments of juvenile wood *cf.* alder buckthorn (*Frangula alnus*); the latter, however, probably derived from one fragment. Although the charcoal assemblage is small, its very presence indicates burning in the local area contemporary with peat formation, as well as the presence of mature mixed deciduous woodland. This interpretation assumes no fluvial reworking and in-wash to that peat layer, supported by the clean and fresh condition of the charcoal, which indicates that it had not been subject to fluvial or other transport. In combination with the large proportion of scorched molluscs, this suggests *in situ* burning. Given the evidence presented that this was an environment of wetlands and dense deciduous woodland, a natural cause for fire is improbable, instead an anthropogenic origin is suggested (see below). The taxa represented are consistent with the waterlogged wood assemblage and seemingly represent local material.

An alder (*Alnus glutinosa*) twig from the discrete grab sample of the lower peat, unit 6, at 5.50–5.75m depth was AMS radiocarbon dated to 3940–3700 cal BC (5012±30 BP, NZA-22396) (Table 2), giving the forest and human activity within it an Early Neolithic date. Overall, the environmental evidence is of a heavily forested landscape contemporary with peat formation and, more significantly, there is (albeit limited) evidence for anthropogenic clearance by burning, somewhat rare for this period.

THE LANDSCAPE AFTER INUNDATION OF THE FOREST

At the end of its life, the forest represented by the lower peat, unit 6, became increasingly flooded, waterlogged conditions causing trees (even wet-loving alder) to die and fall *in situ*, as indicated by the whole tree trunks, some with roots lying in and on the peat surface. It is likely that the flooding event relates to marine transgression, forcing a rise in base water levels in the area (*cf* Devoy 1979; 1980; Sidell *et al* 2000; Sidell *et al* 2002).

Pollen and diatom assessment was carried out on eight 10mm samples taken from the monoliths through the main bodies of alluvium and peat horizons subsequently laid down (units 2–5), (Fig 4). No pollen work could be undertaken on the submerged forest (the latter having necessarily been grab sampled). Badly degraded diatoms were present in only one sample, that from the minerogenic alluvium of unit 5 at 3.32m depth, and no conclusions could be drawn on water conditions and their saline/brackish/freshwater status.

Pollen was processed using standard techniques (Moore & Webb 1978; Moore *et al* 1992). Because this was an assessment level study, a pollen sum of only 200 grains of dry land taxa was counted per level, in addition all extant spores and pollen of marsh taxa, fern spores and miscellaneous pre-Quaternary palynomorphs were counted. Absolute pollen numbers were calculated using added exotics to known volumes of sample (Stockmarr 1971). Percentage values were calculated as Sum = % total dry land pollen (tdlp), marsh/aquatic = % tdlp + sum of marsh/aquatics (including *Alnus* and *Salix*), spores = % tdlp + sum of spores and Misc. = % tdlp + sum of misc. taxa and the results plotted using Tilia and Tilia Graph (Fig 4).

Absolute numbers of pollen were generally low and insufficient variation occurred through the profile to warrant zonation. However, the pollen spectra confirm a heavily wooded landscape continued in the wider

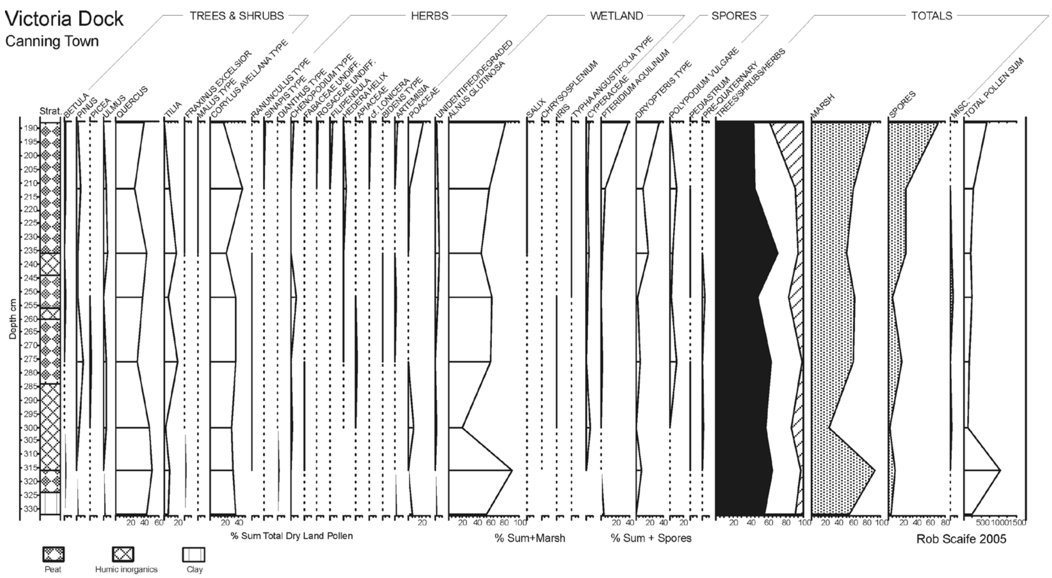

Fig 4. Percentage pollen diagram

area after submersion of the forest edge represented in unit 6. Alder (*Alnus glutiosa*) was important in the immediate vicinity (with the highest values in the lowest samples at -2.07 to -2.22m OD) forming alder carr, with willow (*Salix*), reed mace, bur reed (*Typha/Sparganium*) and sedges (Cyperaceae) also occurring on the wet floodplain. Occasional algal cysts of *Pediastrum* probably indicate occasional over-bank flooding from areas of slow-flowing or standing water.

Vegetation of drier habitats was dominated by oak (*Quercus*) to *c*.50%, lime (*Tilia cf. cordata*) to 18% and hazel (*Corylus avellana* type) to 40% tdlp, with birch (*Betula*), pine (*Pinus*), elm (*Ulmus*) and ash (*Fraxinus excelsior*) in lesser numbers. These probably represent the (then) adjacent dry land but may also have been important on the heavier soils of the lower valley sides, and drier areas of the floodplain carr, as demonstrated from other sites in London (Greig 1982; 1992; Scaife 2000a; 2000b; 2002; Sidell *et al* 2000). The number and diversity of herbs, which included grasses (Poaceae) and goosefoots and oraches (Chenopodiaceae), were low, indicating few open areas. There were no clear indications of human activity or clearance in the form of *Plantago lanceolata*, cereal pollen or other taxa associated with activity and disturbance.

Overall, the pollen data suggest a continuance of the alder carr floodplain habitat with surrounding lime, oak and hazel woodland on adjacent drier ground. Small values of elm suggest occasional presence and a post Neolithic elm decline age for the peats of unit 2; *ie* post *c*.5500–5000 BP (4350–3750 cal BC), as confirmed by the radiocarbon results (Table 2).

DISCUSSION

Early Neolithic activity and the submerged forest

A submerged forest of early Neolithic (3940–3700 cal BC), Tilbury III (Devoy 1979; 1980; Haggart 1995) age, has been recorded, comprising both alder carr and more mixed deciduous woodland, with hazel, ash, oak, elm, alder buckthorn, elder, and bramble. The forest is associated with a 0.25m-thick peat layer at -4.45 to -4.7m OD (lower peat, unit 6). Although a range of deciduous types occurred in the forest at this site, no coniferous species have been identified, which contrasts with the extensive submerged forest at Erith, 8 miles (*c*.13km) to the east, with its Neolithic to Bronze Age remains. The forest at Erith is still under investigation, but it seemingly comprised substantial numbers of yew in addition to oak, alder and ash, and appears to have been inundated later, in the Middle to Late Bronze Age (Haughey 1999, 18; Seel 2000, 33–9), while at Victoria Dock Road the forest was lost to rising waters in the Early Neolithic. It is suggested, however, that the closer proximity to major water bodies and resulting higher water levels at the Victoria Dock Road site were responsible for the species composition differing to that at Erith rather than any time factor.

Of particular significance in light of the lack of artefactual evidence is that local human activity can be proposed for the Neolithic period on the basis of fresh wood charcoal and scorched snails from the lower peat, unit 6. This occurred in a relatively undisturbed and moderately wooded floodplain during a period of relative stabilisation represented by peat formation. This fire is argued to have been caused by anthropogenic burning activity, given the damp nature of the environment at that time, most likely representing deliberate burning, perhaps associated with minor/patch clearance.

While accidental spread of hearth fire is always a possible explanation for the presence of charcoal, the wetland and/or dense temperate deciduous woodland nature of this and indeed other comparable sites belie this. Indeed, strategy and skill is required to burn particularly mature trees in such environments (*cf* Williams 2003; Moore 2000, 131; Lewis 1982, 49; 1985, 77). Possible explanations for somewhat transient burning practices vary but may include the encouragement of browse for grazing herbivores so concentrating them to increase hunting success (Simmons 2001, 51; Bell & Walker 1992, 154); the encouragement of favoured plant species (Zvelebil 1994, 35; Johnson 1992, 5); the creation of corridors through the landscape to increase mobility (Boyd 1999, 11); and access to natural resources.

Over 100 Late Mesolithic sites with environmental evidence for burning have been proposed in Britain by Simmons (1979; 1996), mainly in the North Yorkshire Moors, with convincing examples also for other upland sites such as Dartmoor (Gearey *et al* 2000; Simmons 1996; Caseldine & Hatton 1993, 1996). However, such behaviour also appears to have occurred in lowland wetland contexts in early prehistory (*cf* Moore 2000, 126), with micro and macro charcoal associated with changes in the local pollen spectra at even Early Mesolithic riverine and lakeside sites, such as Star Carr in the Vale of Pickering (Day 1996; Dark 1998, 149–52), Thatcham Reedbed in the Kennet Valley (Barnett 2009), and the fen edge site of Peacock's Farm, Cambridgeshire (Smith *et al* 1989).

Lowland sites with burning in a generally wooded environment of Late Mesolithic and Early Neolithic date include the Severn Estuary sites of Goldcliff and Redwick (Bell *et al* 2000, 330, 337; Bell 2000, 75) and Westward Ho! (Balaam *et al* 1987), the continuing sequence at the fen edge Peacock's Farm site (Smith *et al* 1989), and the riverine site of Buxton, Derbyshire (Wiltshire & Edwards 1993). Published upland Late Mesolithic sites are certainly more numerous than Early Mesolithic and it is suggested that an increase in population and a tradition of such manipulation of the environment might have increased this type of activity over the transition into the Neolithic. That disturbed marginal wetland Neolithic sites are less frequently described or investigated may however be due to a concentration on the more widespread impact of man on the dry land prior to and with the advent of farming in Europe (see for instance Allen & Gardiner 2009; Berglund & Larsson 1991). Notably, as here, pollen studies undertaken at the inter-tidal estuarine site of The Stumble, Essex, showed little Early Neolithic impact on the woodland, despite the find of a large assemblage of collected plant materials at the site (Wilkinson & Murphy 1995). Clearly specific use of the wetlands continued to occur in the Early Neolithic and, as demonstrated here for Victoria Dock Road, small scale burning also continued to occur in otherwise relatively undisturbed and unsettled areas.

Early Neolithic exploitation of riverside resources

This environmental evidence is important as it provides a rare snapshot of an Early Neolithic environment in the Thames estuary (*cf* Sidell *et al* 2000; Sidell *et al* 2002) and, more importantly, provides the opportunity to consider the implications for, and of, human communities. The sampled site was located in damp woodland, subject to occasional flooding and not far from the more open, reedy (*Carex* and *Phragmites*) river's edge. The presence of drier, possibly denser, woodland of oak and elm further away is also indicated. It is, however, necessary to consider more precisely the nature of the immediate floodplain woodland. The presence of hazel and elder indicates that there were at least openings in the forest canopy. Subcanopy flora such as brambles might have provided dense ground cover under such conditions, making access difficult. The lack of thistles and buttercups in the waterlogged material and the lack of open country snail species (Table 3) also support this interpretation, but a mosaic of conditions is possible.

The presence of charcoal and of burnt shells in the assemblages is strongly suggestive of fires and human activity. This is unlikely to represent residence but does indicate activity in, and potentially travel through, a wooded floodplain. This habitat would have offered a myriad of food resources, such as nuts and fruits, game and fowl. It was also an area of drier, more stable land, away from the wet and muddy river's edge, and so could have acted as a route between the higher ground and the water's edge, with the possibility of river crossings by boat beyond. This environment contrasts with that described for over half a millennium later at Silvertown *c.*1km to the south-west (Crockett *et al* 2002), which was considerably more open and supported marsh or open carr woodland.

Certainly it appears, at this site, that the forest bordering and colonising the floodplain was, though relatively undisturbed in terms of settlement and agriculture, used for its rich wild resources. This information adds to an existing body of data which may ultimately provide an opportunity to examine the location and activities of earlier Neolithic groups within the Thames estuary, which as yet we can only describe as 'mobile communities' (*sensu* Sidell *et al* 2002, 22–3).

The changing landscape after inundation of the forest

The substantial alluvial sequence overlying the submerged forest is also of Early Neolithic date, with (late) Early Neolithic peat at its top. This alluvial phase does not correlate well with any of the named Thames transgressive phases within the usual dates for the Tilbury III regression (Devoy 1979, 1980; Gibbard 1994; Haggart 1995); either local hydrological variation or a previously unrecorded transgression is indicated (see also Sidell *et al* 2000). Subsequent fluctuation between fine alluviation and temporary stability, represented by layers of fen peat, have been recorded, up to and possibly beyond the Middle Bronze Age, with layers believed to be comparable with the Thames III and Thames IV events (Devoy 1979, 1980; Gibbard 1994; Long 1995).

It is suggested that the peats of unit 2 (3350–3030 cal BC and 1400–1130 cal BC respectively) can be correlated with that seen in the similar, but shallower, Neolithic–Bronze Age peat sequence at Silvertown (Crockett *et al* 2002; Wilkinson *et al* 2000), and compared on a broader chronological level to peats seen across London at sites such as Joan Street and Union Street (Sidell *et al* 2000; Sidell *et al* 2002). Human activity in the area for the periods represented has been demonstrated elsewhere, with continued activity at Silvertown (Crockett *et al* 2002), and the presence of Neolithic and Bronze Age artefacts recorded for a buried soil at the Royal Docks Community School, Prince Regent Lane (Wessex Archaeology 1996). Bronze Age timber trackways have been recorded on the floodplain in the Beckton area (Meddens & Sidell 1995; Wessex Archaeology 1992). Indications of Bronze Age activity and impact on the landscape have also been noted in local pollen and sediment studies at Long Lane (Allen *et al* 2005), Horselydown (Ridgeway 2002), Lafone Street (Bates & Minkin 1999), and Bryan Road (Sidell *et al* 1995).

The relative lack of human activity suggested by the pollen spectrum here through the Neolithic and into the Early Bronze Age, with a continuation of dense, undisturbed forest, is in contrast to these other sites. It has not been established, from the palaeoenvironmental data presented, whether the site was directly affected by tides. However, the longer-term fluctuation in water level with each regression and transgression represented in the sedimentary sequence would have had a profound effect on the local landscape and on the people within it. Given the substantial alluviation observed, it may be that the area was, or was perceived to be, of greater instability and more prone to inundation or flooding than those other sites noted and thus deliberately avoided. Certainly, the wetlands here were probably unsuited to occupation, but they would have offered opportunities for a variety of, perhaps less archaeologically visible, economic activities, such as fishing and fowling, watering of livestock and access to water for local populations, throughout the Holocene.

While a number of deeply stratified alluvial floodplain sequences have now been established for the London area, submerged forests outside the present intertidal zone are uncommon and of particular research interest (*cf* Williams & Brown 1999; Nixon *et al* 2002). The results presented here are therefore noteworthy. Since other such wetland edge sites in London have revealed the creation of trackways and the setting of fishtraps in prehistory and given the high potential for preservation of any such organic remains by waterlogging at depth at Canning Town, any deep excavation in the area in the future may yet reveal archaeological remains that add to our understanding of the Neolithic activity in this part of the Thames floodplain, despite the lack of artefacts identified in this small-scale evaluation.

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