Appendix 3: Environment and economy

Pollen from Freemasons Road Underpass
by Denise Druce (Fig. 4.3, A3.1)

Introduction

The site at Freemasons Road Underpass revealed a buried Neolithic to Bronze Age weathered land surface with flint artefacts plus a number of cut features sealed by peat. Radiocarbon dates retrieved from the top and bottom of the peat indicate accumulation commenced at 2230-2030 cal BC (SUERC-24600: 3745±35 BP) during the early Bronze Age. The top of the peat, which provided a date of 1050-840 cal BC (SUERC-24604: 2800±35 BP) during the late Bronze Age, was sealed by a layer of bluish grey clay alluvium probably deposited as a result of a rise in relative sea-level. The features associated with the deposits appear to be situated on the periphery of settlement; an early to middle Bronze Age structure forming a double row of substantial timber piles may have provided access across an area of wetland.

A number of monoliths taken from T23 and Area A, during the Phase II and Phase III works at Freemasons Road Underpass, were assessed for their pollen potential (A. Haggart in Gifford and Partners 2001a; 2003b). The Phase II pollen assessment looked at the potential of all the various sediment units present in the sequence, the Phase III assessment concentrated on the organic deposits associated with the piled structure, including its interface with the overlying minerogenic deposits. The assessment demonstrated that pollen was well preserved through peat and upper alluvial deposits but less well preserved in the other deposits investigated, particularly the basal deposits. This preliminary study showed an environment of lime and hazel woodland giving way to alder carr and saltmarsh conditions probably related to a period of sea-level rise in the Thames estuary during the later Holocene (related to Devoy's Thames III (1979) or Model Stage 4 and 5 of Bates and Whittaker 2004). In addition, the assessment showed indications of the known decline in lime woodland in the area, which has been associated with Bronze Age anthropogenic activity, and also indicated possible arable activity in the vicinity.

Further pollen work on the Freemasons Road Underpass deposits was recommended to provide a detailed record of landscape change in the area associated with both regional environmental parameters, such as fluctuations in relative sea-level, and with more local, perhaps anthropogenically driven, landscape changes at the dryland/wetland interface. The results may also be compared with other recent pollen studies from the Thames Valley, such as those from excavations carried out in advance of the Channel Tunnel Rail Link (Andrews *et al.* 2011; Bates and Stafford forthcoming; Wenban-Smith *et al.* forthcoming). Five monoliths taken through a section from the sump area just outside Area A revealed a similar sediment sequence to that observed in T23. Three overlapping monoliths, samples 111, 112 and 113, were chosen for full palynological investigations (Fig. 4.3).

Methodology

Detailed lithological descriptions and sub-sampling of the monoliths used in this study were carried out by the author. Each monolith was cleaned and described in the laboratory. Eighteen sub-samples were taken in total, and of these, six came from the upper part of the organic silty sand (layer 5), two came from the highly organic silty sand (layer 4), nine came from the peat deposit (layer 2), and one came from the uppermost minerogenic deposit (layer 1). The two lowest sub-samples, taken at -0.83m and -0.93m OD respectively from the silty sand deposit layer 5, contained very few pollen grains and are therefore not included in the results. The remaining 16 sub-samples provided the data for the pollen diagram (Figure A3.1), where the depths are expressed as metres (m) OD and the data as percentages of the total land pollen and spore sum (sumP). Aquatic taxa and other palynomorphs and charcoal particles are presented as percentages of sumP + sum of the category to which they belong. Calculations and diagrams were made using the programs TILIA and TILIA-GRAPH in TGView (Grimm 1990). The pollen diagram was divided into five pollen assemblage zones (PAZ), and these were placed by visual examination of the pollen curves.

Sub-samples of a standard size (1ml in volume) were prepared for pollen analysis using the standard technique of heating with hydrochloric acid, sodium or potassium hydroxide, sieving, hot hydrofluoric acid, and Erdtman's acetolysis to remove carbonates, humic acids, large particles, silicates, and cellulose, respectively. The samples were then stained with safranin, dehydrated with tertiary butyl alcohol and mounted in 2000 centistoke silicone oil (Method B of Berglund and Ralska-Jasiewiczowa (1986)). Tablets containing a known number of *Lycopodium* spores were added to the known volume of sediment at the beginning of the preparation so that pollen and spore concentrations could be calculated (Stockmarr 1971). Pollen was counted from equally spaced traverses across whole slides at a magnification of x400 (x1000 for critical examinations) until a minimum sum of 500 terrestrial pollen and spores was reached, if possible. Identifications were aided by a pollen key (Moore *et al.* 1991) and a small modern reference collection held by OA North. Cereal-type grains were defined using the criteria of Andersen (1979). Indeterminate grains were recorded using groups based on those of Birks (1973) as an indication of the state of pollen preservation. Charcoal particles >5 microns were also recorded following the procedures of Peglar (1993). Other identifiable inclusions on the pollen slides (including: fungal and algae spores, remains of dinoflagellate cysts, foraminifera) were also registered. Plant nomenclature follows Stace (1997).

Pollen results: the 'sump sequence'

PAZ1: -0.75 to -0.68m OD (layer 5, organic silty sand)

Arboreal pollen is relatively well represented at the very base of this zone with values of *c* 75% total land pollen and spores (referred to hereafter as TLP). *Alnus glutinosa* (alder) and *Corylus avellana* (hazel) maintain consistent levels during this zone, both with values of around 20 to 25% TLP. *Tilia cordata* (lime) has a similar value of 25% at the base of this zone, but subsequently declines to about 15% TLP, which is reflected in the summary pollen curve. *Quercus* (oak), *Pinus sylvestris* (Scots pine), cf. *Taxus baccata* (yew) and *Ulmus* (elm) are also represented in low numbers. Poaceae (grass) pollen is initially poorly represented but increases to 20% TLP in the middle of the zone. *Cerealia*-type (cereal-type) pollen is also recorded at the very base of this zone, however, the similarity of cereal pollen with some wild grasses, such as *Glyceria* (sweet-grasses), means that the evidence for cereal cultivation at this time is uncertain. The diversity of the herbaceous assemblage is relatively low and includes *Taraxacum*-type (dandelion-type) and *Plantago*-undiff. (plantain), which both have values of *c* 5% to 7% TLP. Other herbaceous taxa include *Aster*-type (daisy-type), *Plantago lanceolata* (ribwort plantain) and *Rubiaceae* (bedstraw). Low values of Cyperaceae (sedge), Caryophyllaceae (pink family), *Potentilla*-type (cinquefoils), and *Ranunculus*-type (buttercups) are recorded in the top of the zone. Undifferentiated *Pteropsida* (fern) spore values peak to values of *c* 15% in the middle of this zone, and *Pteridium aquilinum* (bracken) spores increase to about 10% TLP at the top of this zone. Some pollen grains from aquatics, such as *Lemna* (duckweed) and *Potamogeton* (pondweed) are present, but in very low numbers.

PAZ2: -0.68 to -0.60m OD (layer 4, highly organic silty sand)

Arboreal pollen values increase in this zone, attaining values of about 80% TLP, and this increase is most marked in values of *Tilia*. The rise in arboreal pollen is accompanied by a decrease in herbaceous pollen to less than about 10% TLP. Poaceae show a marked decline in this zone, attaining values of less than 5% TLP compared to a peak of around 20% TLP in the preceding zone. *Plantago*-undiff increases slightly at the top of this zone.

PAZ3: -0.60 to -0.48m OD (layer 2, humified peat)

After the peak in arboreal pollen to about 80% TLP in Zone 2 values very gradually decrease to around 60% TLP during this zone. *Alnus* and *Corylus* values remains relatively constant at about 20 to 30% TLP and 10 to 15% TLP respectively, *Tilia* values, however, decrease from about 20% to 10% TLP at the top of the zone. Additional arboreal pollen grains include low numbers of *Hedera helix* (ivy), *Rosaceae* undiff. (rose family) and *Salix* (willow). The suite of herbaceous pollen remains relatively restricted and numbers decrease during this zone, attaining values of no more than *c* 5% TLP. In contrast, however, *Pteropsida* spores increase dramatically from about 10% TLP to about 40% TLP. *Potamogeton* values increase slightly in the middle of this zone.

PAZ4: -0.48 to -0.38m OD (layer 2, humified peat)

Alnus pollen values increase to about 40% TLP at the base of this zone but then decrease to *c* 10/15% TLP in the upper half. *Corylus* and *Tilia* both decrease in value, and *Tilia*, especially, continues to show the most marked decline reaching values of less than 5% at the top of the zone. As in the preceding zone, *Quercus* pollen values fluctuate slightly but still represents no more than *c* 5% TLP at its highest value. The suite of other arboreal pollen taxa remains largely unchanged and at low values. *Fraxinus*, however, is no longer present, but occasional grains of *Fagus sylvatica* (beech) are recorded in the bottom half of this zone. The diversity of herbaceous pollen increases substantially and both Poaceae and Cyperaceae show marked increases from less than 5% TLP in the previous zone, to values of about 20% TLP in this zone; herbaceous pollen representing roughly 50% to 60% TLP at this time. *Aster*-type, *Taraxacum*-type, and *Ranunculus*-type pollen values increase very slightly, while *Plantago lanceolata* pollen increases to about 10% TLP and *Plantago major/media* (great/hoary plantain) pollen also becomes better represented. Other herbs appear for the first time in the record, many of them restricted to this zone only. They include cf. *Alchemilla* (lady's-mantle), *Apium*-type (marshworts), *Artemisia* (mugworts), *Cirsium/Carduus* (thistles), *Thalictrum* (meadow-rue), *Centaurium* (centauries), *Fallopia convolvulus* (black-bindweed), *Filipendula* (meadowsweet), *Caltha palustris* (marsh marigold), *Rhinanthus*-type (yellow-rattle), *Rumex acetosa*-type (sorrel), and *Urtica* (nettle). *Cerealia*-type pollen is recorded once more, this time accompanied by occasional grains of

Avena/Triticum-type (oat/wheat) and *Hordeum*-type (barley-type) pollen. *Pteropsida* spores show a marked decline in this zone, decreasing to values of less than 10% TLP. *Pteridium*, however, increases from less than 5% TLP to about 10% TLP in the top half of this zone. Aquatic pollen increases slightly and both *Typha angustifolia/Sparganium* (lesser bulrush/bur-reeds) and *Typha latifolia* (bulrush) are recorded for the first time; the former reaching values of around 10% TLP plus aquatics. The occurrence of non-pollen palynomorphs such as green algae and fungal spores also increases in this zone.

PAZ5: -0.38 to -0.13m OD (layer 2, humified peat and layer 1, blue-grey clay)

Arboreal pollen values decrease further to about 10% TLP in this zone and *Tilia* disappears from the record altogether. Both *Alnus* and *Corylus*, however, increase slightly at the very top of this zone. The herbaceous component remains relatively uniform, representing around 30% TLP. However, herb diversity is much reduced compared to the preceding zone. Poaceae and Cyperaceae pollen continue to dominate the herbaceous assemblage, at values of 10% TLP and 15% TLP respectively. Occasional grains of *Cerealia*-type, *Hordeum*-type, and *Cannabis/Humulus* (hemp/hop) are recorded in the middle of this zone. The number of *Pteropsida* spores increases dramatically reaching values of approximately 50% TLP. The number of aquatic pollen grains decreases in this zone, as do the number and diversity of algae and fungal spores.

Interpretation and discussion

The pollen data in the earliest zone (PAZ1), which stratigraphically relates to the late Neolithic/early Bronze Age weathered sand (layer 005), indicates a local environment of damp alder carr and sedge, with lime, hazel and oak woodland growing on the drier slopes or interfluves. Areas of disturbed or lightly grazed ground are indicated by the presence of dandelion and plantain. There is evidence of possible cereal cultivation with the presence of one or two cereal-type pollen grains at –0.75m OD. However some wetland and marine grasses such as floating sea-grass (*Glyceria fluitans*) and sea barley (*Hordeum marinum*) produce very similar pollen grains. The decrease in arboreal pollen and corresponding increase in grass pollen suggests possible clearance; although lime woodland appears to be most affected as both alder and hazel appear to show very little change (possibly evidence for a first lime decline?).

A mid Holocene decline in lime pollen has been recorded in many diagrams from southern England and is thought to be caused by anthropogenic activity (Turner 1962). Normally associated with late Neolithic/Bronze Age activity, which saw the more-or-less complete removal of lime from the Thames valley landscape (Devoy 1979; Sidell and Wilkinson 2004; Wilkinson *et al.* 2000) there is increasing evidence for earlier, temporary, periods of decline (Huckerby, Peglar and Verrill in Bates and Stafford forthcoming). However it is unclear whether these episodes were anthropogenically driven or caused by rising water levels (or both?). The marked but temporary decline in lime during PAZ1 at this site, occurred some time before 2230-2030 cal BC (see date of base of peat PAZ3 below), and commensurate with its decline is a spread in ferns, bracken and grassland. It is quite possible that its early decline here was as a result of increased clearance or grazing pressure on drier ground.

The second zone (PAZ2) corresponds with the development of the organic silty sand (layer 004). The pollen data indicates a recovery in the lime (and hazel) woodland on drier ground and a corresponding decline in areas of grassland and bracken. The locally growing alder carr shows very little change at this point, subsequently any local disturbance caused by nearby activity is not yet apparent.

The pollen data within the third zone (PAZ3, peat layer 002) indicates a period of relative stability with a slight increase in oak to the detriment of hazel at the start, but a very steady decline in woodland generally. As with the decline in woodland at the base of the diagram, lime (and this time oak) appears to be the most affected and ferns take advantage of the lighter conditions on the woodland floor. A slight increase in pondweed suggests increased wetness, plus increased waterlogging is also indicated by the onset of peat development. A radiocarbon date at -0.60m OD at the base of the peat (see Appendix 1.1) produced an early Bronze Age date of 2280-2240 (7.5%) and 2230-2030 (87.9%) cal BC (SUERC-24600: 3745±35 BP).

PAZ4 (peat layer 002) shows the period of most change and records a decline in the local alder and hazel woodland alongside a significant decline in lime woodland on the surrounding slopes. The decline in woodland is accompanied by a decline in ferns and a slight increase in bracken, which may indicate increased grazing (Behre 1986). There is also evidence for nearby cereal cultivation. Damp species-rich sedge/grassland developed immediately at the site and freshwater pools and streams are prevalent with green algae, aquatics, and bulrushes. This increase in wet conditions may be as a result in a rise in the water table associated with Devoy's Thames III (1979) period of estuary expansion, although there is very little evidence of encroaching salt-marsh conditions at the site at this time. A radiocarbon date at -0.48m OD at the base of this zone (see Appendix 1.1) produced an early Bronze Age date of 1880-1660 cal BC (SUERC-24503: 3435±30 BP). This corresponds extremely well with the piled timber structure (Str. 32) and the linear 'enclosure' gully (Gp.199) in the northern coffer dam. Open conditions are maintained during PAZ5 (peat layer 002 and silty clay layer 001), however, a slight regeneration in alder and hazel is indicated at the very top of the diagram; lime, however, has more-or-less disappeared from the record altogether. A local sedge-dominated, relatively species poor environment has developed at the site, and ferns have spread on the adjoining slopes. This encroachment of ferns may indicate a period of possible abandonment at the site. A radiocarbon date at -0.32m OD towards the top of the peat produced a late Bronze Age date of 1050-840 (95.4%) cal BC (SUERC-24604: 2800±35 BP). Although the stratigraphy shows a shift from peat to clay, apart from a slight rise in goosefoot pollen, which includes species that grow on saltmarshes, there is very little in the pollen assemblage to suggest a major increase in saline conditions as yet, although the sedimentary changes seen here are likely to be related to shifts in the morphology of the river during a period of estuary expansion (Devoy 1979).

Conclusion

The pollen and dating evidence shows that peat development at the pollen site took place during the late Neolithic, probably as a result of increased waterlogging due to estuary expansion. Although there is evidence for an earlier, temporary clearance episode (a first lime decline), the most marked change in the pollen record, linked to a significant decline in woodland (a second lime decline) and the development of grassland and pasture, with evidence of cereal cultivation, is almost synchronous with the date of the Bronze Age piled structure and possible enclosure (see PAZ4 above). At the same time, the pollen evidence indicates the development of reedswamp with freshwater pools and streams immediately at the site, which would support the view that the wooden piled structure was a possible bridge, platform or jetty.

The pollen evidence from Freemasons Road Underpass is consistent with the other pollen sites from the A13 roadscheme and with other London sites such as those from Bramcote Green (Thomas and Rackham 1996; Sidell and Wilkinson 2004), Silvertown (Wilkinson *et al*. 2000; Sidell and Wilkinson 2004) and STDR4 in the Ebbsfleet Valley (Druce, Peglar and Huckerby in Wenban-Smith *et al*. forthcoming). All of which show a Neolithic and early Bronze Age landscape of mixed deciduous woodland dominated by lime with an understorey

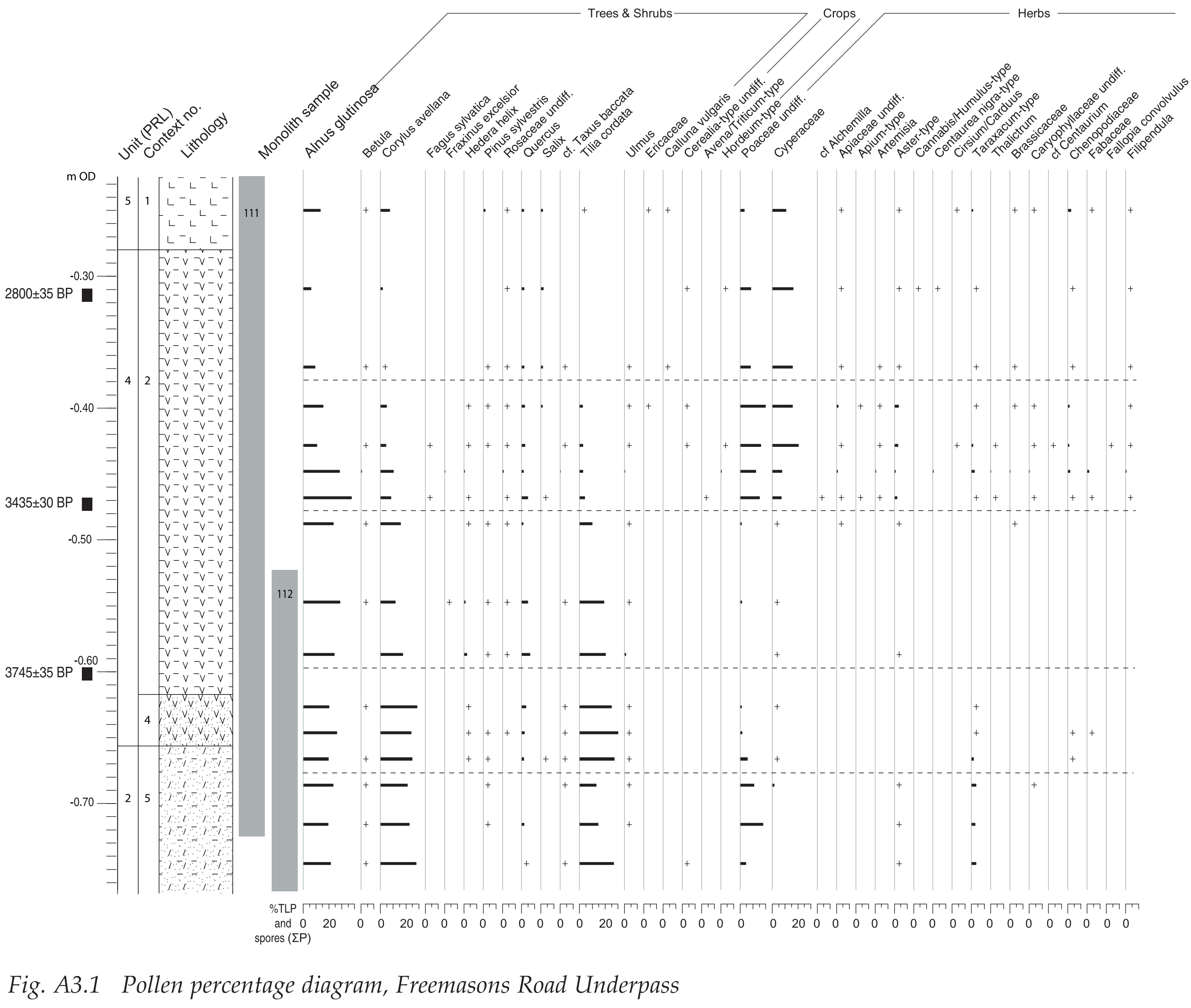


Fig. A3.1 Pollen percentage diagram, Freemasons Road Underpass of ferns growing on drier ground, and alder carr growing in wetter locations. The Movers Lane diagrams also show at least two periods of lime decline, which is commensurate with increasing evidence of grassland, pasture and cereal cultivation. Like the evidence from Freemasons Road, the (final) lime decline at Movers Lane and other London sites, sees an almost complete removal of lime from the landscape. This coincides with a marked increase in Bronze Age occupation and associated construction. Underlying and, no doubt, influencing this activity is a period of estuary expansion and increased waterlogging.

Pollen and diatoms from Woolwich Manor Way
by Andrew Haggart (Figs 5.3, A3.2-3.10)

Introduction

Two sequences were submitted for detailed analysis of pollen and diatoms from Woolwich Manor Way. The first derived from a deep sequence of alluvial and peat deposits sampled in TP1 during the evaluation stage at the far western extreme of the site (Fig. 5.3). This sequence was initially assessed in 2001 (Haggart in Gifford and Partners 2001b) and was sampled by four monoliths (M1-M4) covering 3.5m of the stratigraphy between -4.23 and -0.73m OD, but with a gap in the coverage of 0.35m between -2.48 and -2.13m OD. The second sequence derived from the detailed excavation of Area 2 focusing on the peat deposits associated with trackway 2/14 (Fig. 5.3). This sequence was assessed in 2003 (Haggart in Gifford and Partners 2003a) and sampled by two monoliths (M2A and M2B) totalling 0.94m in length between -1.32 to -0.38m OD. Particle size analysis was also conducted on some of the samples from both sequences, along with geochemical analysis on the trackway sequence to aid in the interpretation of the assemblages.

Methodology

The pollen samples were prepared using standard extraction techniques. A known number of exotic *Lycopodium* spores in tablet form were added to 1cm^3 of fresh sediment allowing pollen concentration

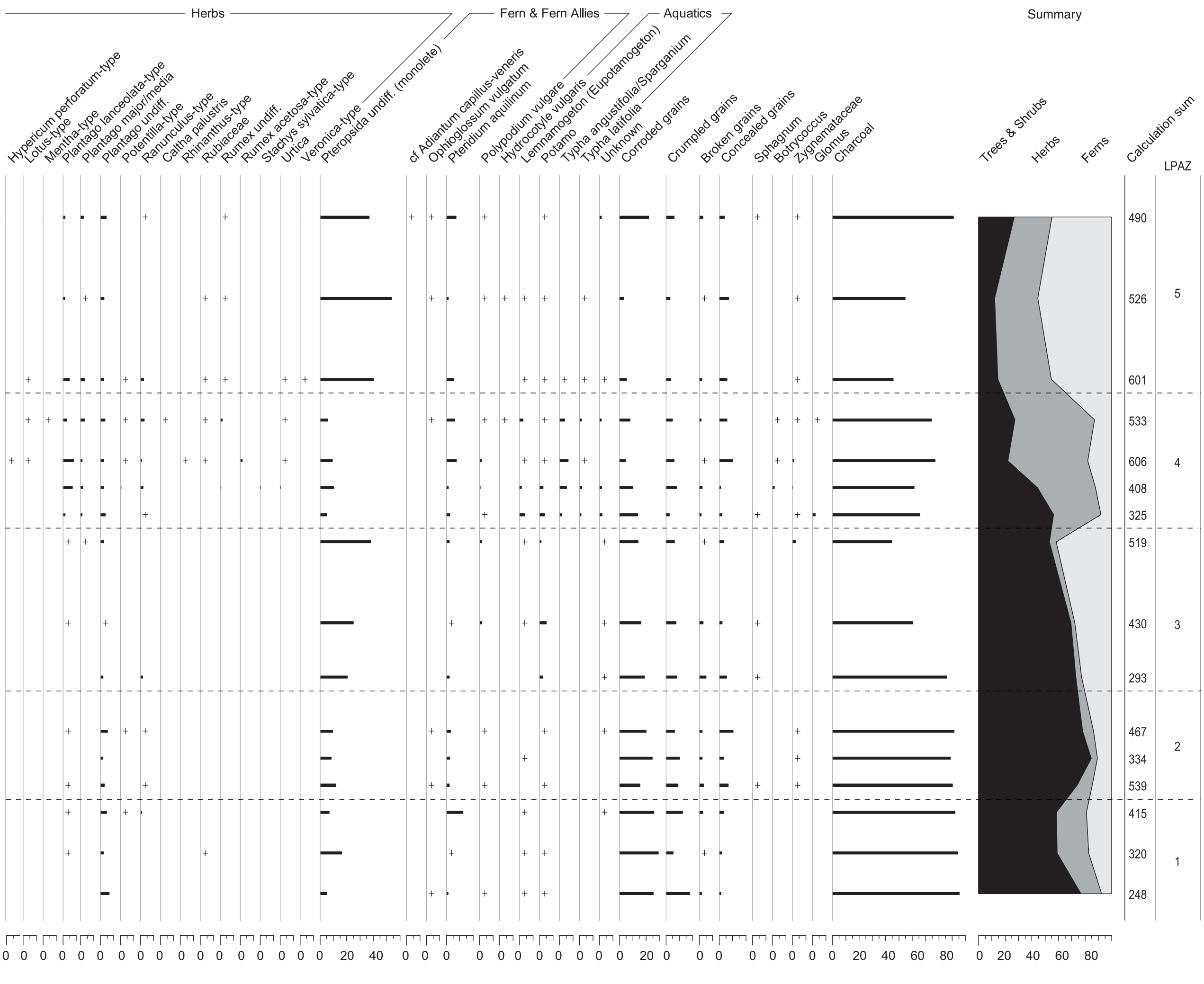


Fig. A3.1 Pollen percentage diagram, Freemasons Road Underpass (continued) values to be derived (Stockmarr 1971). The samples were then deflocculated overnight in a sonic bath using calgon and passed through sieves of 180μm and 10μm. The larger sieve is designed to remove coarser plant debris and the smaller sieve allows fine silt and clay-sized particles to pass through but retains the pollen-sized fraction. The samples were then mixed with a non-toxic heavy liquid, sodium polytungstate, made up to a specific gravity of 2.0. At this specific gravity, the organic component, including pollen, floats and the majority of the mineral component sinks, enabling physical separation. This procedure reduces degradation of pollen grains during extraction from mineral sediments and represents a significant and safer advance on the former use of Hydrofluoric acid to digest the mineral fraction. Following separation, the samples were subjected to standard acetolysis procedures to remove cellulose, (Erdtman 1960) then stained with safranine and mounted on slides using glycerine jelly. The slides were scanned at 400x magnification until a total of 400 total land pollen grains (TLP) were reached. In the Trench 2 profile at 2 levels (0.45m and 0.55m) 100 and 241grains were counted, bringing the average down to 348 ±116. In the TP1 profile at three levels; 3.55m, 4.75m and 5.15m were below the 400 target reducing the average to 356 ± 89. All pollen and other significant content including microscopic charcoal fragments were recorded. Pollen identifications were made using Moore, Webb and Collinson (1991), Reille (1992) and the reference type slide collection at the University of Greenwich. Nomenclature follows Bennett (1994), Bennett, Whittington and Edwards (1994) and Stace (1991). The preservation of each determinable grain counted was also recorded under the categories amorphous, corroded, broken, folded or well preserved whilst indeterminable grains were also categorised using the first four categories above to which a fifth, concealed, was added.

For the diatom analysis hydrogen peroxide (30%) was added to the samples to remove organic material. The samples were allowed to stand and the reaction took place at room temperature. After several days, when the effervescence had stopped and the samples had settled, the supernatant liquid was decanted and replaced with distilled water. A random sample was transferred using a disposable pipette to a coverslip covered in distilled water and allowed to settle and dry. The coverslip was then fixed on a microscope slide using Naphrax diatom mountant. Slides were scanned at x 1000 magnification. The lowest number of diatoms counted was 144 at 3.05m and the highest 458 at 2.85m, overall averaging 300 ± 100 per slide. Identifications were made with reference to Cleve-Euler (1951-55), Hartley (1996) Hendey (1964), Hustedt (1930-61), Krammer and Lange-Bertalot (1986) and van der Werff and Huls (1957-64). Use was also made of the following electronic resources: ADIAC (1998-2001), the ANSP Algae Image Database and Kelly *et al.* (2005). Nomenclature follows Williams *et al.* (1988) and the University College London (UCL) Amphora checklist.

Particle size analysis was undertaken by laser diffraction on a Malvern Mastersizer 2000 in wet dispersion mode, the organic material having previously been removed by digestion in 30% concentrated hydrogen peroxide. Samples for geochemical analysis were oven-dried overnight then crushed to a powder in a ball mill. They were then transferred to glass tubes and dried overnight at 105^{o}C. For the major and trace elements a lithium metaborate fusion process was used prior to ICPMS and ICPOES analysis.

Test pit 1

The stratigraphy comprised a basal sandy flint gravel with well rounded flint clasts between 5.60m and 5.35m. Overlying this was a dark greyish-brown silty clay with carbonate patches which gives way to a 40mm thick layer of clayey silt at 5.08m. Above the clayey silt was a more organic, very dark grey clay-silt with visible plant fragments which is in turn succeeded by 2m thick very dark brown silty peat at 4.80m. This peat bed is variable in nature ranging from true peat to silty peat. In places there are abundant wood fragments and occasional pockets of dark greyish-brown organic silt. Between 4.50m and 4.40m in the base of monolith 2 there was an extremely dry and cemented peat suggesting a period of desiccation and compaction.

The peat layer has been AMS dated in three places (see Appendix 1.2); towards the base between 4.68m and 4.78m (4580-4350 cal BC; Beta-152740: 5630±60 BP) in the middle between 3.94m and 4.04m (3350-2890 cal BC ; Beta-147956: 4410±70 BP) and towards the top of the layer between 3.06m and 3.16m (1750-1490 cal BC; Beta-149754: 3330±60 BP). Above the peat, at 2.80m, was a dark greyish-brown silt to clay-silt, more organic toward the base, which in turn was overlain by a yellow-brown oxidised clay-silt. Above 1.00m is modern made ground.

Particle size

Twelve samples were analysed for particle size by laser granulometry between 2.90m and 1.85m within the upper part of the main peat bed and the overlying silty clay (Fig. A3.2). There was little difference between samples, most were categorized as poorly sorted fine and medium silts with clay content varying between 9% and 16%. The lowermost sample within the upper part of the main peat bed at 2.9m (-1.88m OD) does contain a small proportion of sand, which is hard to explain. The radiocarbon date in the upper part of the main peat bed suggests this happened after 1750-1490 cal BC. Evidence from Trench 2 at higher altitudes (-0.96m OD) suggests there was incorporation of sand, perhaps from trackway traffic or local soil erosion at this time. It is possible therefore that some reworked sand was transported to lower altitudes and incorporated into the peat at TP1

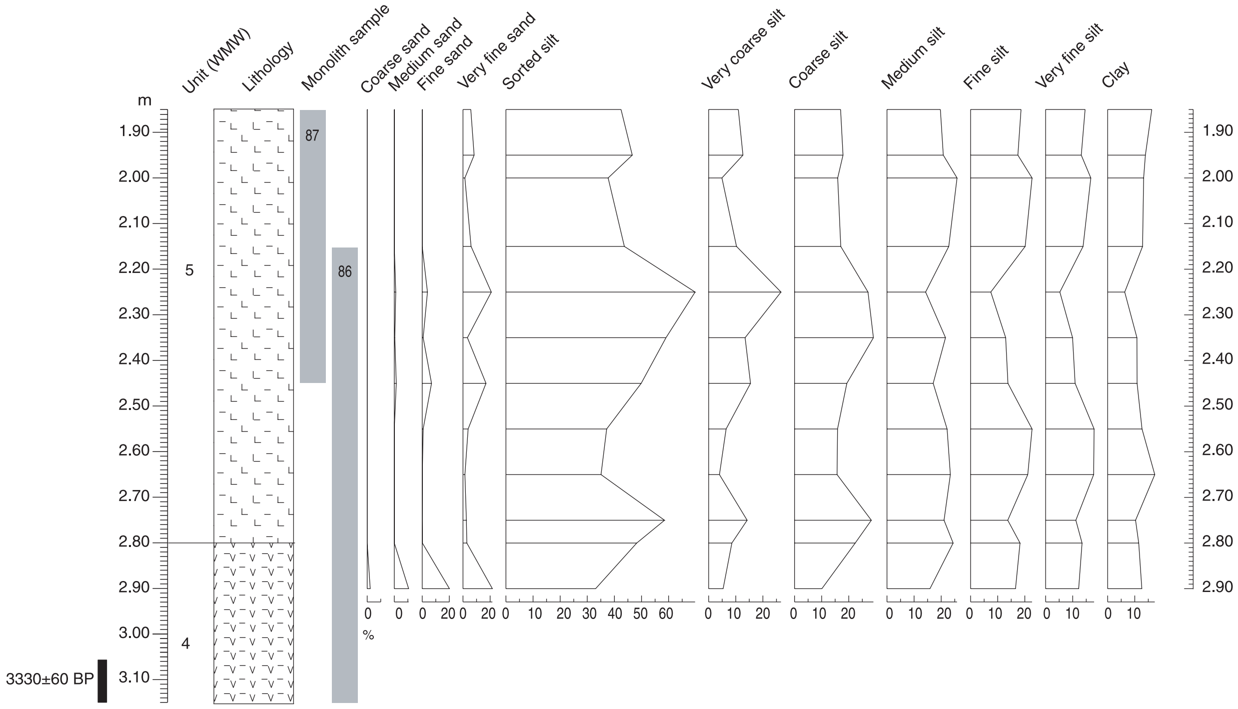


Fig. A3.2 Particle size distribution curves by size classes, TP1, Woolwich Manor Way

Because particles below about 10μm in equivalent spherical diameter (fine silts and clays) flocculate and aggregate at the freshwater/saltwater boundary in estuaries and modern particle size methods such as laser granulometry measure a particle's disaggregated size, what is actually measured may not be meaningful to reconstructing the depositional environment (McCave *et al.* 1995a).

These authors considered the 10μm limit to be much more meaningful in terms of sedimentary processes than the traditional 2μm boundary between clay and silt or even the 63μm boundary between silt and sand. It led them to define the 'sortable silt' mean, which is the average size of the 10–63μm fraction. They suggested that this is the size fraction that varies in response to hydrodynamic processes at the sea bed and from which relative changes in current speed can be inferred. They used this proxy successfully to map palaeocurrent fields in the North Atlantic (McCave *et al.* 1995b).

Figure A3.2 also contains the average 'sorted silt' curve, the average of the 10-63μm fraction for each sample. There appear to be two main peaks in the 'sorted silt' curve equating to 2.75m and 2.25m, the latter of which is accompanied by a rise in the very fine and fine sand category, which might relate to slightly higher energy in the depositional environment.

Diatoms

Fourteen levels were prepared for diatom analysis between 3.05m within the upper layers of the main peat bed to 1.85m within the upper silty clay. Preservation was variable and in six of the levels it was not possible to obtain a meaningful count. The remaining eight levels are shown in Figure A3.3. On the diagram the diatoms are grouped from left to right according to their ecological codes of Hustedt (1953) as compiled by Denys (1991/2). On the left are fully marine polyhalobous diatoms which give way to this brackish mesohalobous forms and then to largely freshwater oligohalobous types.

The diagram (A3.3) is divided into two diatom assemblage zones, above and below the diatom-barren zone between 2.85m and 2.35m. The boundary has been arbitrarily placed halfway between at 2.60m.

WMWTP1 A 3.05m–2.60m (-2.03 to -1.58m OD)
The diagram is dominated by the brackish form *Cyclotella striata* with an average of 46% total diatoms (TD). The largely freshwater *Pinnularia* genus occurs in frequencies between 8-11% and there are declines in the marine forms *Plagiogramma van-heurckii* and *Rhaphoneis amphiceros*. Total numbers of taxa are low, at about 35 per level.

WMWTP1 B 2.60m- 1.85m (-1.58m to -0.83m OD)
Cyclotella striata again dominates with an average of 31% but there are many more taxa present, ranging from 46 to 70 and averaging 53. Prominent polyhalobous forms include *Opephora marina* and *Rhaphoneis amphiceros* whilst oligohalobous diatoms include *Cocconeis disculus* and *C placentula* and *Gyrosigma acuminatum*.

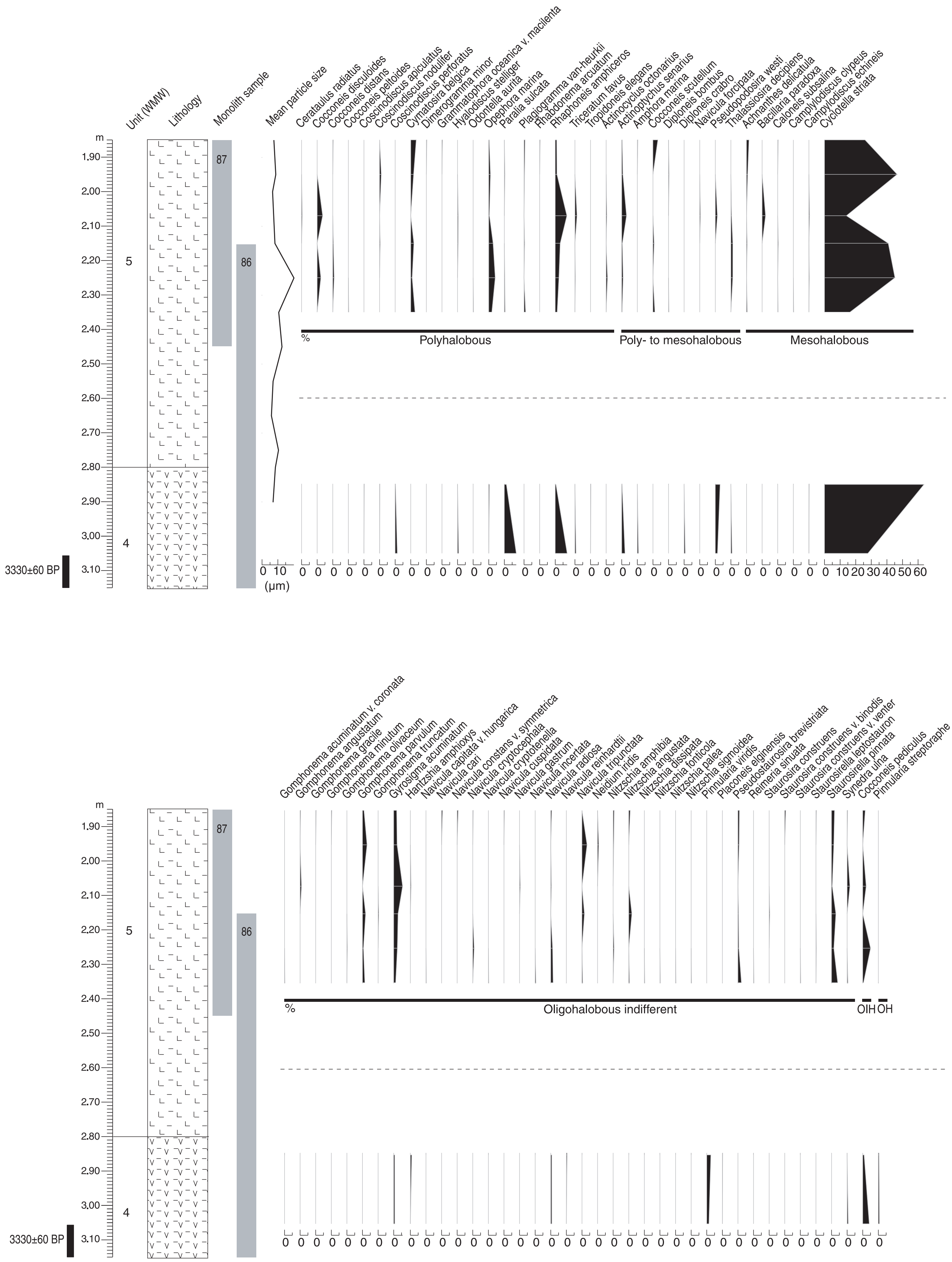


Fig. A3.3 Diatom diagram from TP1, Woolwich Manor Way

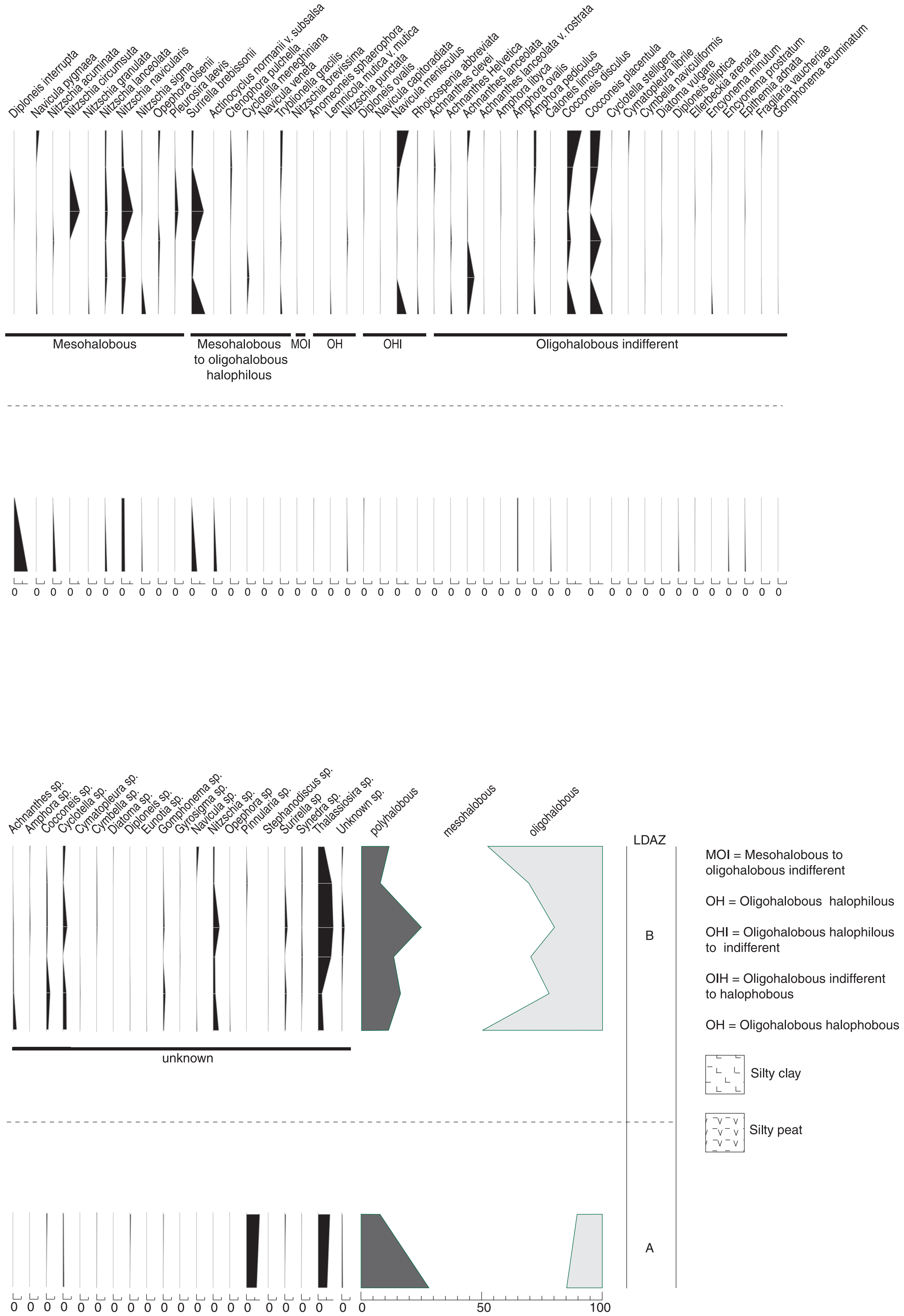


Fig. A3.3 Diatom diagram from TP1, Woolwich Manor Way (continued)

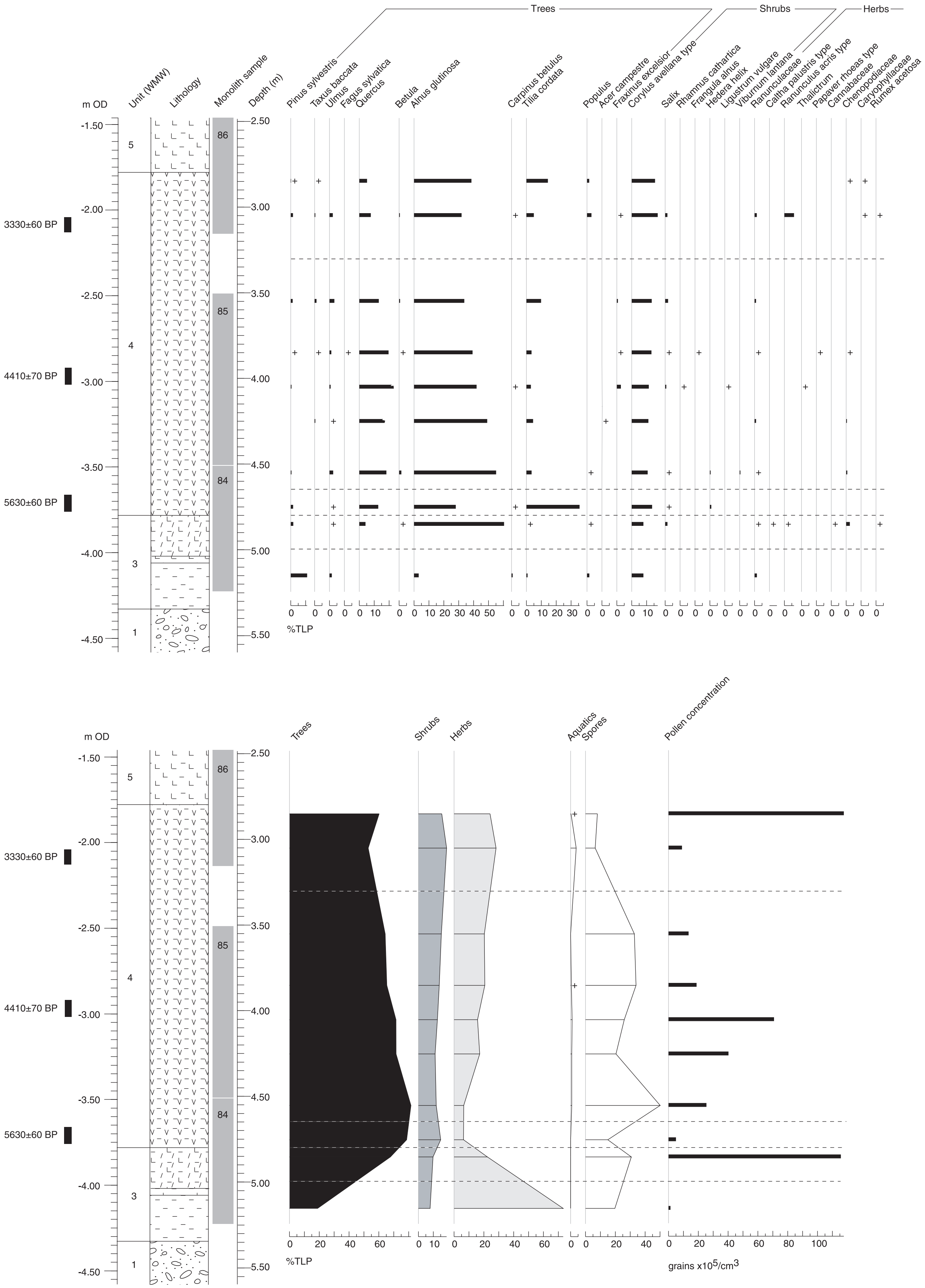
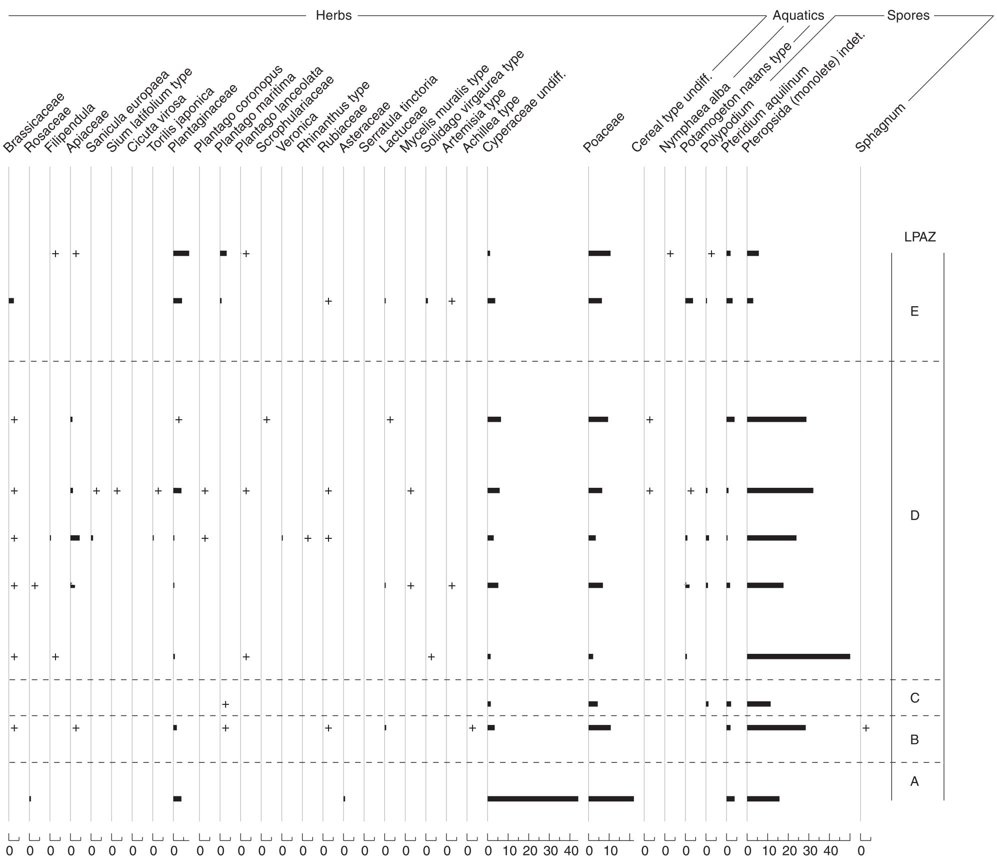


Fig. A3.4 Pollen percentage diagram, TP1, Woolwich Manor Way



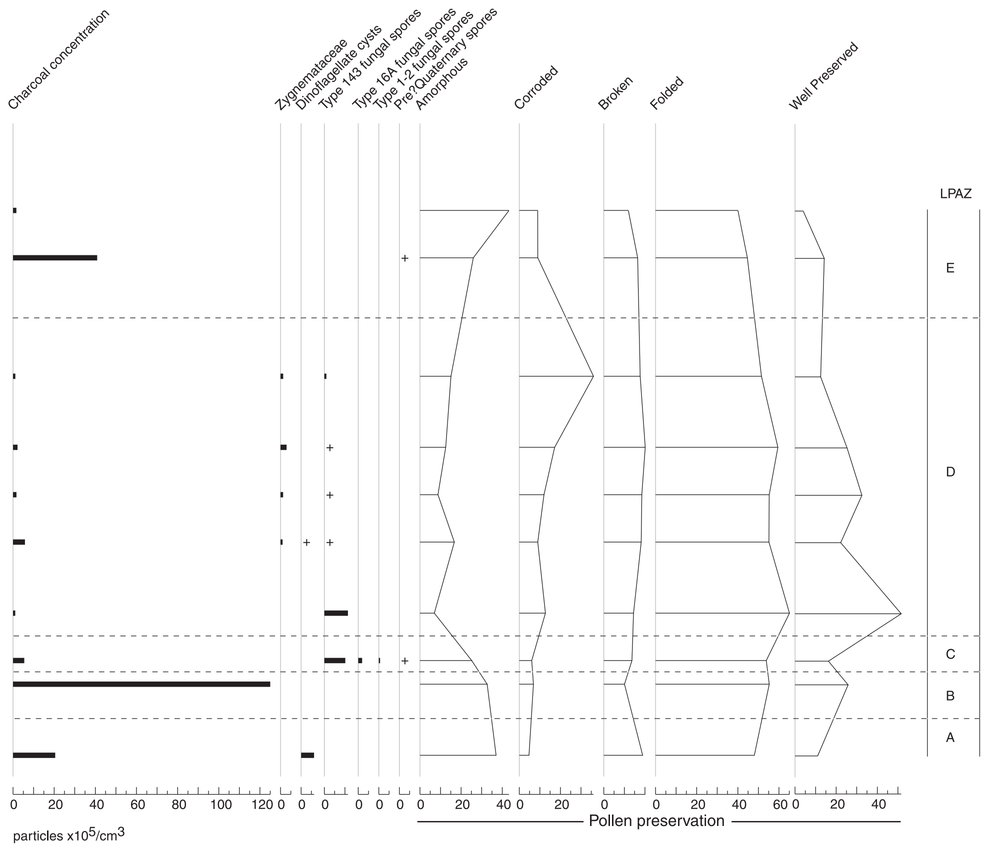


Fig. A3.4 Pollen percentage diagram, TP1, Woolwich Manor Way (continued)

The most abundant diatom in the lowermost count at 3.05m is *Cyclotella striata*, an estuarine planktonic form, common in tidal channels (Vos and de Wolf 1988) and often abundant in the spring plankton (Hendey, 1964). The presence of *Diploneis interrupta* at 8% suggests the presence of saltmarsh nearby. *D. interrupta* is a brackish aerophile whose life habit is epipelic, living freely on the substrate. It inhabits the upper part of saltmarshes at or just below the Mean High Water Spring Tide level (Innes *et al.* 1996; Vos and de Wolf 1998). This would be in accord with the rise in Plantaginaceae including *P. maritima* in the upper part of the pollen diagram. *Cyclotella striata* then rises to 64% TD at 2.85m suggesting an increase in saline conditions.

The second diatom assemblage zone within the upper silty clay is again dominated by *Cyclotella striata*, while *Thalassiosira* sp. averages 6% throughout the zone. This form has been placed in the unknown category because they are hard to identify to species level using light microscopy (Belcher and Swale 1986). However the majority of species in this genus are found in the marine plankton (Round *et al.* 1990; Hendey 1964).

Overall the diatoms suggest deposition in a marine-brackish environment, probably a tidal muflat. However there may be subtle changes evident. *Cyclotella striata* frequencies are only 16% at 2.35m (Fig. A3.3) and oligohalobous diatoms such as *Navicula menisculus*, *Cocconeis disculus*, *C. placentula* and *Staurosirella pinnata* rise in prominence. While the first three have quite wide salinity tolerance, *S. pinnata* is a freshwater species often found attached to sand grains in freshwater lagoons, lakes, pools and ditches. The oligohalobous diatoms total 57% at this level possibly suggesting an increased freshwater influence.

Cyclotella striata frequencies rise to 45% at 2.25m and then fall to 14% at 2.07m. This time the decline in *C. striata* seems to be accompanied by a rise in marine planktonic forms such as *Rhaphoneis amphiceros*, *Triceratum favus* and *Actinoptychus senarius* suggesting an increased marine influence. The decline in mesohalobous forms *Nitzschia circumsuta*, *Nitzschia navicularis* and *Surirella brebissonii* from 2.07m seems to be mirrored by an increase in oligohalobous forms such as *Navicula menisculus*, *Cocconeis disculus* and *C. placentula*.

Pollen

Ten levels were counted for pollen between 5.15m and 2.85m (Fig. A3.4) and five local pollen assemblage zones have been described.

PAZA: 5.15m–5.00m (-4.13m to -3.98 m OD)
This zone comprises a single count within the dark greyish-brown silty clay that overlies the basal sandy gravel. The zone is dominated by Cyperaceae (44%) and Poaceae (22%) followed by undifferentiated monolete fern spores (16%) and *Pteridium*. *Pinus sylvestris* is the largest contributor to total tree pollen, but reaching only 11%.

PAZB: 5.00m–4.80m (-3.98m to -3.78m OD)
Again this zone comprises a single count at 4.85m within the very dark grey clay-silt unit which lies just below the main peat bed. *Alnus glutinosa* frequences rise to dominate at 60%TLP with subsidiary *Quercus* at 11%. Other notable features are the fall in Cyperaceae and Poaceae to 4% and 11% respectively. This level has the highest microscopic charcoal concentration and total pollen concentration also shows a peak at 115 x 10^3 grains / cm^3.

PAZC: *4.80m–4.65m (-3.78 to -3.63m OD)*
This zone consists of a single count at 4.75m within the basal layers of the main peat bed. It is unusual in that it has very high *Tilia* frequencies (36% TLP) which exceed those of *Alnus glutinosa* which falls to 28%. The zone is characterised by a very low pollen concentration of 5 x 10^3 grains/ cm^3. Fungal spores of type 16A and 143 are also present.

PAZD: 4.65m–3.30m (-3.63m to -2.28m OD)
This zone comprises five levels within the base and middle of the main peat bed. *Alnus glutinosa* pollen rises to 55% then falls to 34% through the zone. *Quercus* rises to a peak of 22% TLP at 4.05m then declines thereafter. *Tilia* frequencies are consistently low through the zone, averaging just 5%. Cyperaceae and Poaceae are also at uniformly low frequencies, averaging only 4% and 6% respectively. Cerealia-type pollen is present in low frequencies in the upper two levels in the zone at 3.85m and 3.55m.

PAZE: 3.30m–2.85m (-2.28 to -1.83m OD)
Quercus representation continues to fall to 5% by 2.85m. *Alnus glutinosa* and *Tilia* frequencies show a slight resurgence to 39% and 14% TLP. Also of note are the rises in Ranunculaceae, Brassicaceae and Plantagniaceae pollen and the aquatic *Potamogeton natans*-type towards the top of the main peat bed.

Cyperaceae and Poaceae dominate the first pollen zone, with total herb pollen reaching 73% and total tree pollen only reaching 19%. This might suggest a fairly open environment, however total pollen concentration is extremely low, the lowest of all levels counted, at 1.36 x 10^3 grains/cm^3 and the total pollen count at 127 TLP was also low. No diatoms were encountered either, presumably due to post-depositional dissolution, but the presence of dinoflagellate cysts in the dark greyish-brown silty clay may suggest marine conditions existed at or near the site. *Pinus sylvestris* is the dominant tree pollen type and is often over-represented in estuarine clays (Godwin 1975).

Alnus glutinosa dominates the second assemblage zone and the presence of *Salix* and *Corylus avellana*-type suggests alder car had become established at the site with secondary willow and hazel and perhaps oak at slightly higher elevations. Systematic scanning of diatom slides indicated rare occurrences of sponge spicule fragments and a single example of *Cyclotella striata*, a brackish diatom. This, together with the presence of Chenopodiaceae pollen hints at the proximity of intertidal conditions.

The third pollen assemblage zone is rather an anomaly, very high *Tilia* percentages in excess of 30% TLP is unusual. *Tilia* is insect-pollinated and despite high pollen production rates, its pollen percentages recorded in peat or lake deposits are often considered to underrepresent the actual proportion in the contemporary flora. However on the other hand it is highly recognisable and even in a damaged or fragmented condition it can be recorded. It also is very resistant to decay so tends to be preserved where conditions are in general unfavourable for the preservation of other pollen types. According to Godwin (1975) this tends to make *Tilia* pollen well-represented in mineral soils and in assemblages where the proportion of derived pollen is high. No diatoms were encountered during scanning but rare sponge spicule fragments were present.

Of note here is the presence of Type 16A and Type 143 fungal spores at this level. Van Geel *et al.* (1981) suggest the fungus producing the Type 16A ascospore seems to indicate dry mesotrophic conditions. Blackford *et al.* (2006) suggest it to be an indicator of heathland and dry woodland conditions. Type 143 has been attributed to *Diporotheca* sp. (van Geel *et al.* 1981) a mildly parasitic fungus, which favours eutrophic to mesotrophic conditions. Prager *et al.* (2006) have reported Type 143 as being abundant in dry leaf litter of alder carr.

Taken together these two fungal spore types might suggest the environment to be dry alder carr. Under these conditions oxidation could lead to the destruction of less resistant pollen and the over-representation of the more robust *Tilia* grains. A similar feature has been recorded in the lower layers of a comparable peat bed *c* 1.5km to the south east, at the University of East London Campus, borehole 108 (Haggart 2007) perhaps suggesting a more regional lowering of the watertable.

The main peat bed between 4.55m and 3.55m is dominated by *Alnus glutinosa*, *Quercus* and *Corylus avellana*-type with *Tilia* at low but constant frequencies. Cyperaceae and Poaceae are also in low numbers at the site is likely to have been dense alder carr with willow and hazel. Sporadic occurrences of *Taxus baccata* (yew), *Rhamnus cathartica* (buckthorn) and *Viburnum* sp., probably *V. lantana* (wayfaring tree) pollen occur in this fen peat, a finding mirroring that of Scaife (2000) who comments on the species richness of fen carr peats during the Neolithic and early to middle Bronze Age at the Union Street and Joan Street sites. Yew was apparently a major component of coastal woodland at this time, as shown by common macrofossil remains in the coastal woodland preserved on the foreshore at Erith (Seel 2000). Scaife (2000) suggests that this species- rich alder carr/coastal woodland may have no modern analogue.

Slides were prepared for diatoms at 4.25m and 3.85m but they were not countable. Rare valves of the marine form *Pseudostelligera westii* were noted at 4.25m. At 3.85m two brackish diatoms *Cyclotella striata* and *Diploneis didyma* were present along with the marine planktonic form *Actinoptychus senarius* and rare sponge spicule fragments.

Spores of Zygnemataceae rise to 3% TLP at 3.85m and then decline. These spores are derived from a type of green algae commonly found in stagnant, shallow (less than 0.5m) and mesotrophic fresh water (van Geel, 1976) suggesting a higher fresh watertable between 4.25m and 3.55m.

Quercus pollen continues to decline in the uppermost pollen zone to 5% by 2.85m, probably reflecting regional forest clearance. *Alnus glutinosa* and *Tilia* pollen frequencies rise slightly, but the main feature of the zone is a rise in Plantaginaceae including *P. maritima* and also an increase in *Potamogeton natans*-type suggesting a rising watertable probably triggered by encroaching marine conditions after 1760-1450 cal BC (Beta 147954: 3330 ± 60 BP).

Area 2

The stratigraphy comprises a basal mid-greyish brown fine to medium sand (Neolithic sands, context 25) overlain by a black sandy peat (25/28), the lower part of which has been dated to 2930-2700 cal BC (SUERC-25563: 4265±35 BP). The sandy peat is in turn succeeded by a very dark grey to black silty clayey peat with woody fragments (28). Above this lies a woody peat containing the late early Bronze Age – middle Bronze Age trackway. A hazel stake from the trackway has been dated to 1880-1520 cal BC (Beta-153984: 3390±60 BP) while a sample of alder roundwood gave an age of 1610-1430 cal BC (SUERC-24292: 3230±30 BP). Overlying the trackway is a layer of humified silty peat ranging in colour from black to very dark grey (1), the upper part of which has been dated to 2140-1910 cal BC (SUERC-25562: 3645±35 BP). This date appears anomalous since it is several centuries older, yet overlies the upper surface of the trackway peat by 0.15m. Two possibilites arise: either the trackway has subsided relative to the peat in which it is presently encased or the peat sample used for dating has been contaminated by older carbon. The silty peat is in turn overlain by a very dark grey silty clay (26). The uppermost deposit is an orange brown and grey mottled silty clay (26) with iron-staining along former root channels.

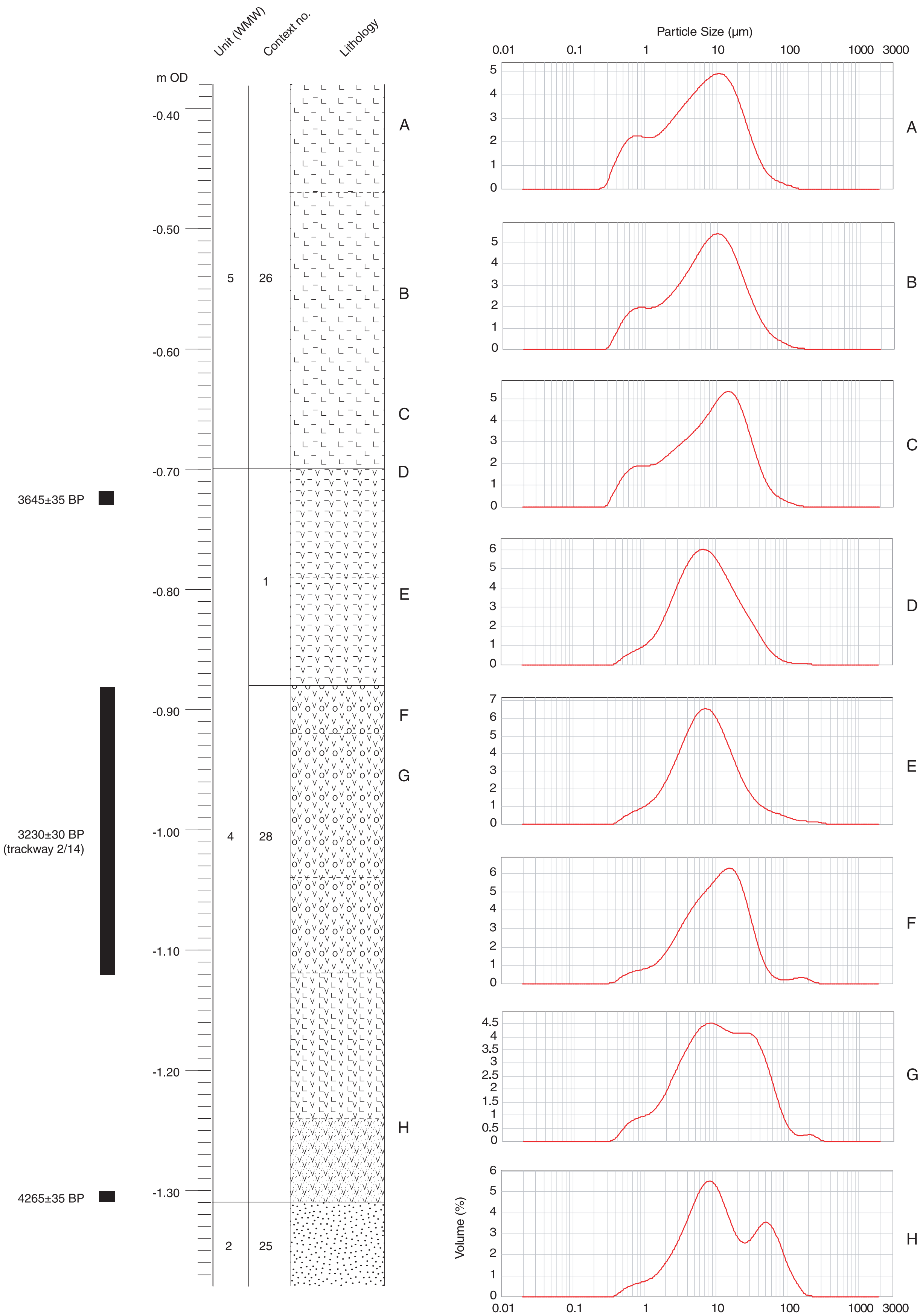


Fig. A3.5 Particle size distribution curves, Trench 2, Woolwich Manor Way

Particle size

Size is one of a number of properties of sediment particles that affects their entrainment, transport and deposition. As such particle size analysis can provide clues to sediment provenance, transport and deposition and can be used as a general measure of the energy present in depositional environments.

Taken as a whole, there is a fining-upwards sequence through the two monoliths. The lowermost sample from 0.87m within the lower black sandy peat is a bimodal, poorly sorted, sandy medium silt (Fig. A3.5) with peaks at 50μm (very coarse silt) and 8μm (fine silt) respectively. The bimodal distribution and sand content of 10.5% could suggest a degree of reworking of the basal Neolithic sands. The following sample at 0.58m is within the trackway wood peat. It again shows a bimodal distribution with peaks this time at 30μm and 8μm and a lower sand content of 5.6%, again perhaps suggesting inclusion of the sand by a different process from that by which the fine silt was deposited.

The fining-upward sequence within the mineral fraction continues through the trackway peat and overlying silty peat in samples at 0.53m, 0.43m and 0.33m. There are progressive peaks in coarse and medium silt, fine silt and very fine silt through these three samples and the mean grain size falls from 16 to 12μm. There is a marked change in the character of the particle size distribution in the upper samples, with a doubling of the clay fraction between 0.33m and 0.28m; Fig. A3.6). The percentage clay content of the three uppermost samples averages 20.5%.

Geochemistry

Eleven samples were taken for geochemical analysis. Figures A3.7-A3.9 show changes through the profile in major oxides, other major elements and trace elements. Most of the curves have a similar shape which probably reflects the changing concentration of silt and clay. The typical shape, as exemplified by the curve for Al_2O_3 in Fig. 3, is a rise to a small peak within the base of the woody trackway peat at 0.72m–0.74m and then a fall to a minimum at 0.57m–0.59m within the middle unit of the trackway peat. Thereafter there is a rise through the overlying silty peat and into the upper silts and clays.

Two notable exceptions, however, are silicon (Si) and zirconium (Zr) which show the reverse, with a peak in lowermost sandy peat and another in the middle unit of the trackway peat. The most common minerals of these elements, silica (quartz) and zircon are extremely resistant to weathering and concentrations tend to build up in soils.

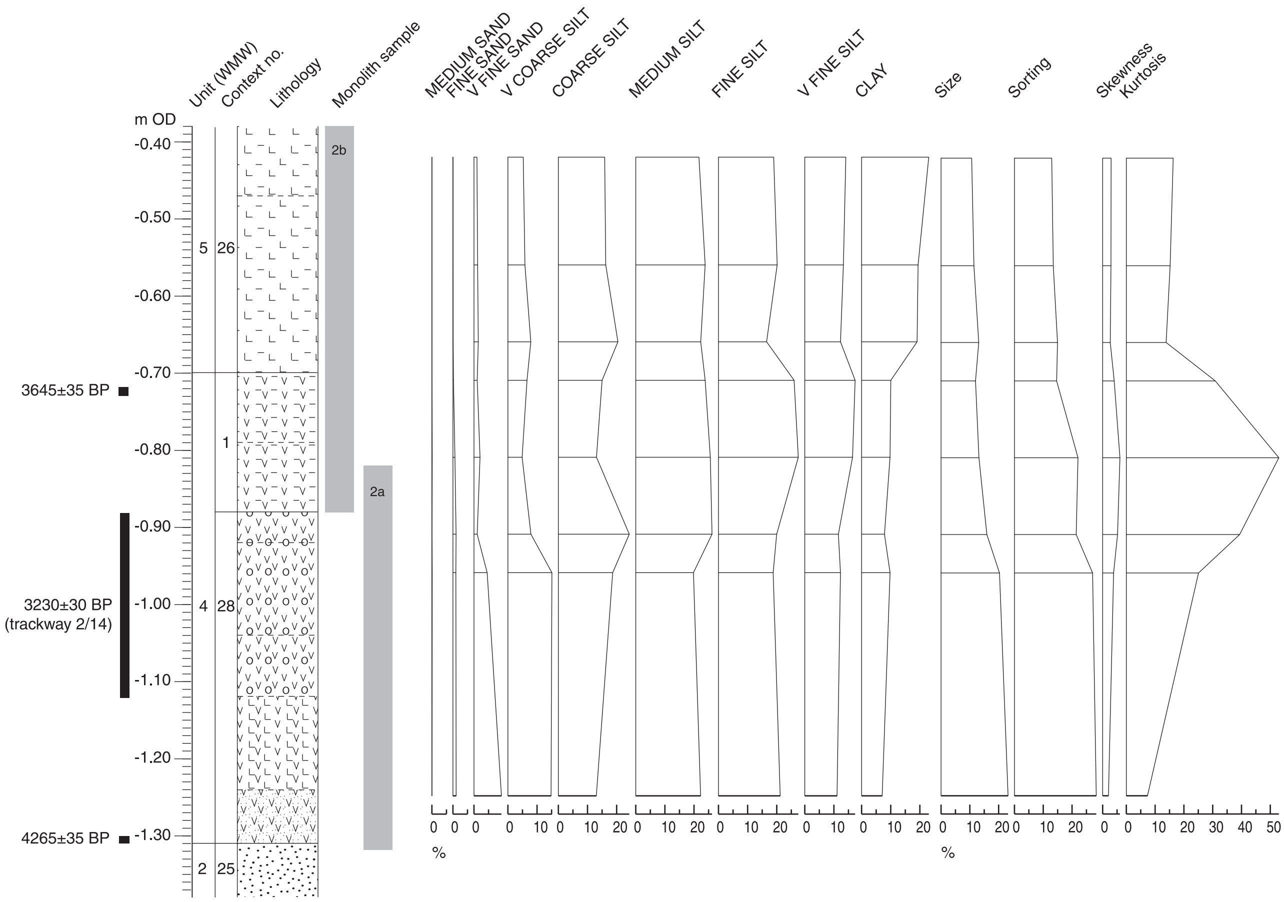


Fig. A3.6 Particle size distribution curves by size classes, Trench 2, Woolwich Manor Way

The lower peak in these curves could relate to partial reworking of the basal Neolithic sands and their incorporation within the lower sandy peat. The upper peak could reflect the inclusion of sand and soil into the woody trackway peat via trackway traffic and/or inwash, as also suggested by soil micromorphological analysis.

Another notable feature of the geochemical analysis is the fivefold increase in Pb concentrations in the upper three samples (Fig. A3.8) to an average of 21.3 ppm. A problem exists however in defining what 'natural' background levels of Pb are for this time and location. A core through pre-Industrial Medway mudflat sediments suggests 'natural' levels vary between 10–20 ppm (Cundy *et al.* 2005). A figure of 20 ppm for background levels has also been used in pollution studies of Essex and Medway saltmarshes (O'Reilly Wiese *et al.* 1995; Spencer 2002). This suggests the raised Pb levels may be slightly above background levels.

Levels for natural soils seem to be a bit lower with Emsley (2001) quoting a range between 0.7-11 ppm. A recent study of palaeosols underneath Bronze Age burial mounds in Denmark produced similar figures with natural Pb concentrations ranging from 3 to 11 ppm (Elberling *et al.* 2010). However, these authors also noted, in line with previous studies, that Pb concentrations tend to increase with decreasing particle size, owing to the affinity of metals to bind with clay particles. They found a significant relationship between the proportion of clay and Pb concentrations and produced a regression equation which enabled the estimation of natural background levels based on % clay content.

Using a similar approach but with a far smaller sample, if the levels below 0.35m are assumed to be 'natural', a regression of clay particle size against Pb concentration extrapolated to the 'elevated' values suggests they are higher than would be expected from the increase in clay concentration alone. This could be taken as an indication that the increase in lead levels may be partly due to prehistoric/historic industrial activity or modern contamination and partly due to increasing clay content.

Diatoms

Diatom preservation was extremely poor throughout the column; their scarcity and poor preservation state suggesting post-depositional dissolution of silica. Reinvestigation of the diatom slides after the assessment phase showed that the basal sample at 0.87m within the lower sandy peat contained several examples of a small marine *Thalassiosira* sp. all of which had an orange colouration, suggestive of iron staining. Fragments of sponge spicules and *Pinnularia*, a predominantly freshwater genus, were also present. The lower sandy peat appears to be a mixed deposit with two context numbers (28/25). It

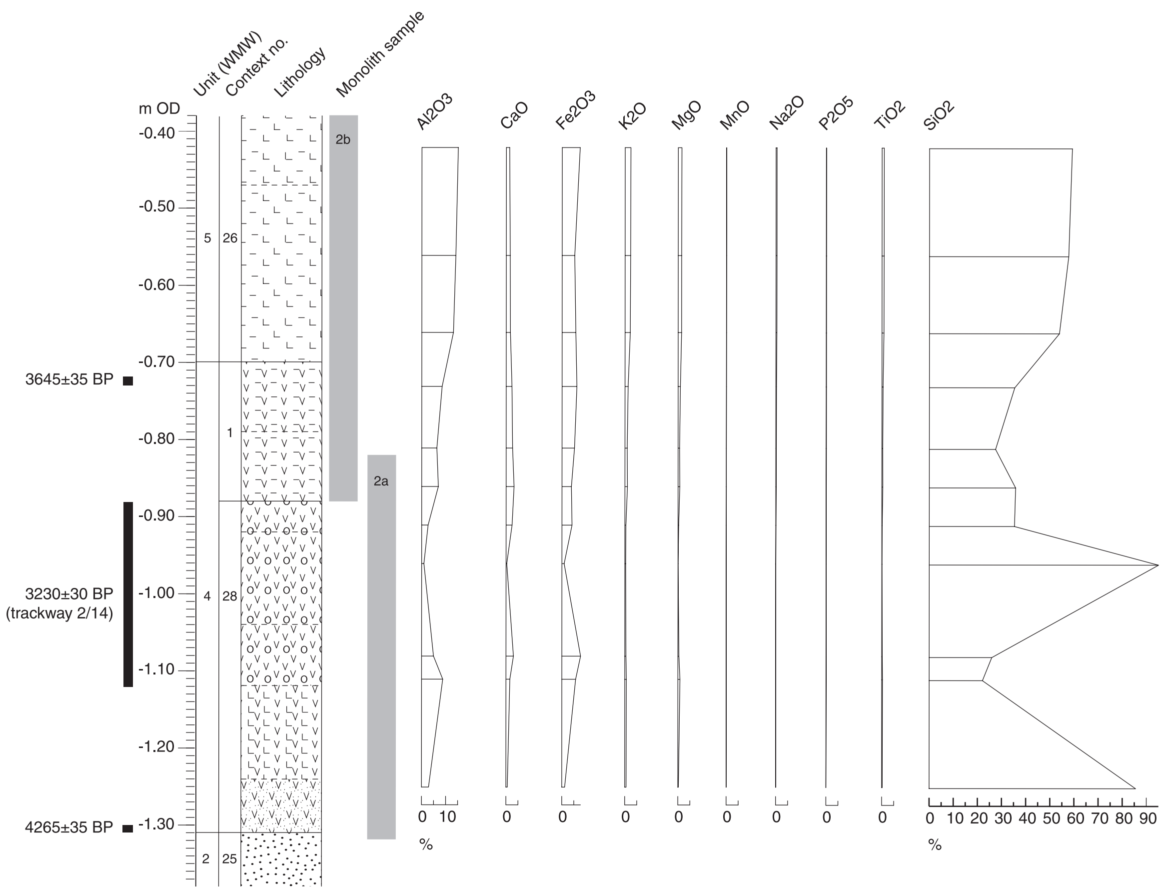


Fig. A3.7 Major oxides, Trench 2, Woolwich Manor Way

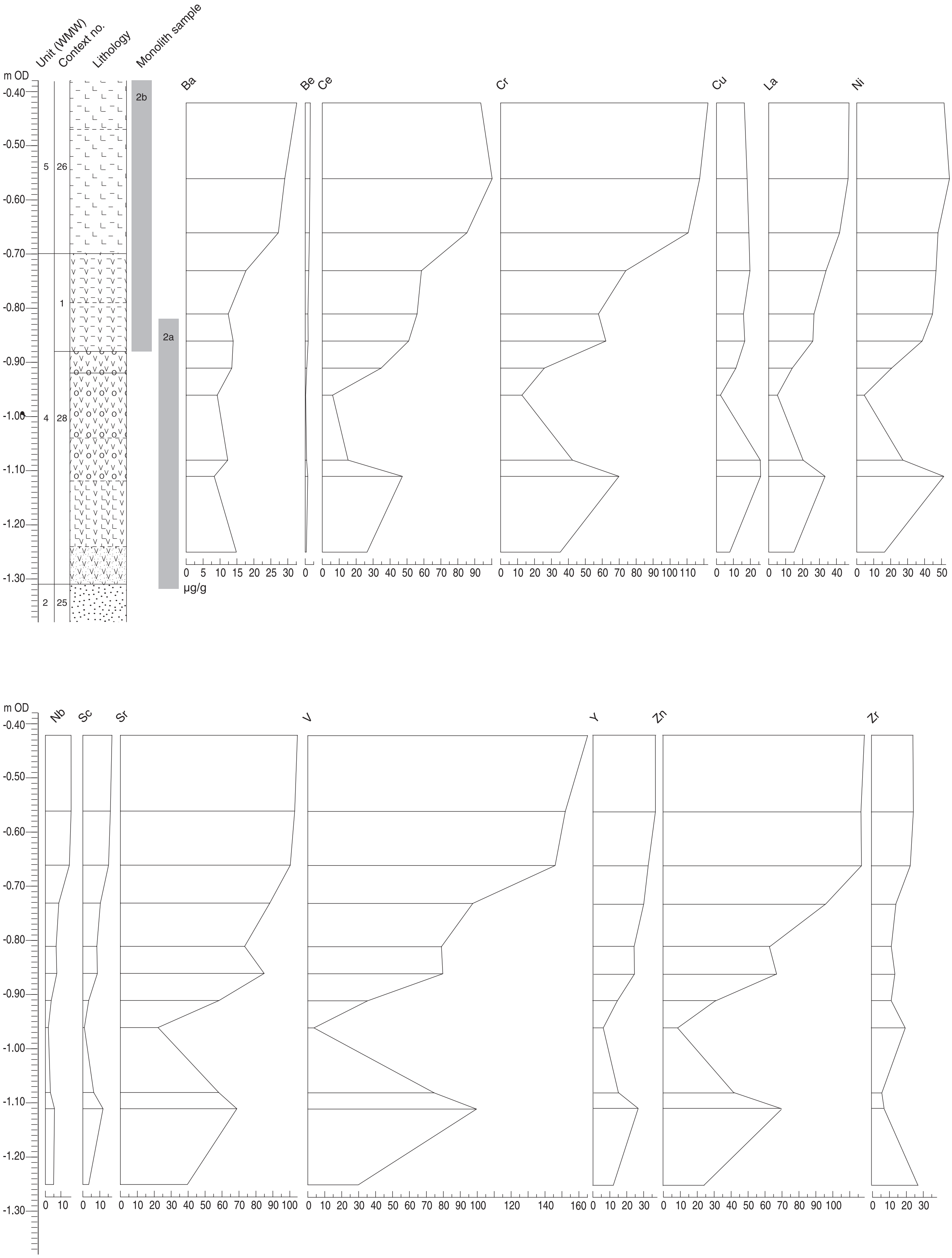


Fig. A3.8 Other major elements, Trench 2, Woolwich Manor Way

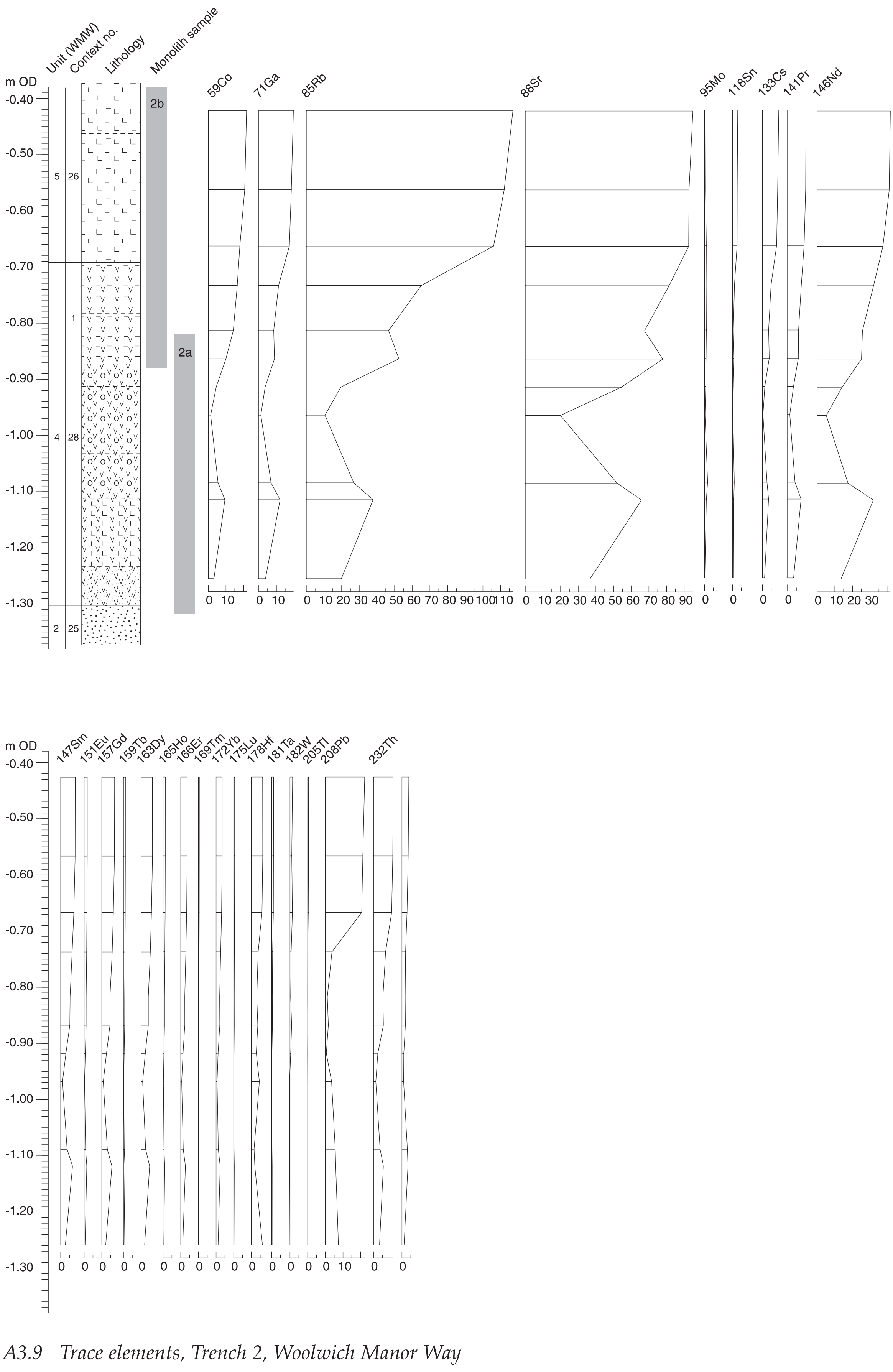


Fig. A3.9 Trace elements, Trench 2, Woolwich Manor Way seems likely therefore that the sand component of this sample (10.5%) may well have been derived from reworking of the underlying Neolithic sands.

At 0.45m within the silty peat above the trackway there were a few examples the brackish form *Cyclotella striata*. At 0.43m again there were a small number of *Cyclotella striata* and poorly preserved *Navicula navicularis* valves. Within the upper organic clay silt *Cyclotella striata* was again present, if badly preserved, with a well preserved example of the fully marine form *Triceratum favus* at 0.28m.

Pollen

The column can be divided into two pollen assemblage zones (Fig. A3.10):

> *WMWT2A 0.85m–0.44m (-0.47 to -0.06m OD)*
> This lower zone is dominated by *Alnus glutinosa* which reaches a peak of 58%TLP at 0.71m and averages 42% through the zone. Also prominent is *Quercus* which declines from 25% to 19% and *Corylus avellana*-type at 10%. *Tilia* also has low but consistent percentages of about 6%. Also of note is the rise in *Potamogeton natans*-type to about 5% at 0.45m. Throughout the zone, trees and shrubs dominate with 80% and 11%TLP respectively.
>
> *WMWT2B 0.44m–0.04m (-0.06m to 0.34m OD)*
> Compared to the lower zone, while still dominated by *Alnus glutinosa*, it is at a lower frequency of 31% TLP. Other trees such as *Quercus* and *Tilia* (most probably *T. cordata*; Godwin 1975) decline in importance as well. There are complementary rises in the frequencies of grasses and sedges, Chenopodiaceae, Plantaginaceae and *Pteridium*. Cerealia-type also has a continuous presence.

Interpretation

The basal Neolithic sands were not directly sampled but it is likely that the high medium and fine sand content in the lower sandy peat derives from a reworking of these sands. The oxidised *Thalassiosira* sp. and sponge spicule fragments may suggest the Neolithic sands originally had a marine origin and were then subjected to subaerial weathering and oxidation prior to waterlogging and peat formation.

This sequence of events may have a correlative at Purfleet where Wilkinson and Murphy (1995) describe an estuarine sediment containing poorly preserved marine diatoms which underwent a considerable period of subaerial weathering during which time a soil formed, stable woodland vegetation developed and a woodland molluscan fauna also became established. This may well record a fall in sea level during Devoy's (1979) Tilbury III regression. The subsequent rise in sea level during the following Thames III period triggered a rise in watertable that killed the trees yet preserved them. Tree roots at the base of the wood peat overlying the rubified soil at Purfleet are dated to 4503–4262 (68% confidence; Wilkinson and Murphy 1995) which is very similar to the date on the base of the sandy peat of 2930-2700 cal BC (SUERC-25563: 4265 ± 35 BP) in Trench 2.

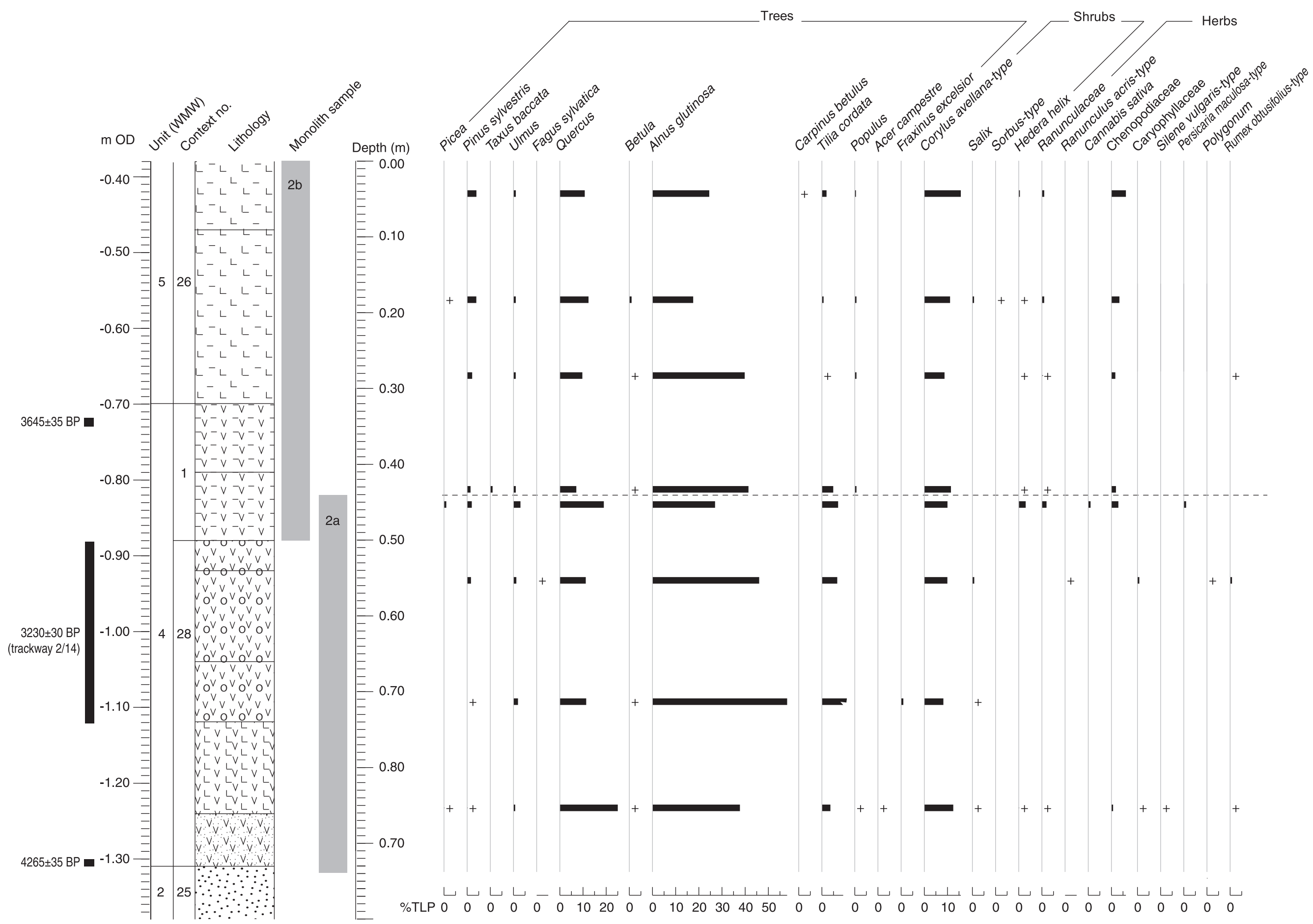
The presence of *Alnus glutinosa* in such high percentages suggests an alder carr formed at the site. *Quercus* and *Tilia* were probably components of drier woodland at slightly higher elevations. The rise in frequency of *Potamogeton natans*-type pollen and aquatic pollen in general to 0.45m suggests a rise in the fresh watertable. The trackway therefore seems to have been built in a largely wooded environment, an alder carr with hazel and willow under conditions of rising groundwater table.

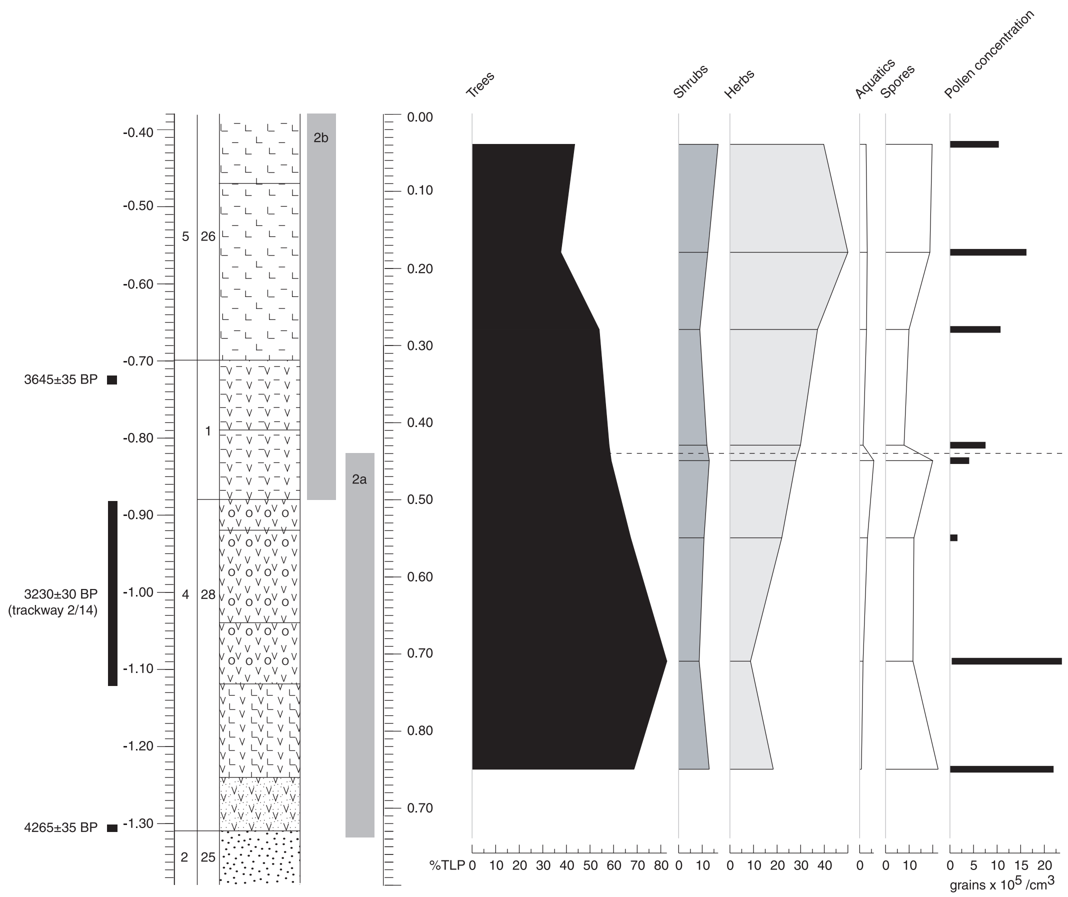
The fall in pollen concentration between 0.71m and 0.45m may also be informative. Pollen concentration is a function of the pollen rain, sedimentation rate and pollen preservation. If we assume the pollen rain from local, extralocal and regional sources did not vary by much during the formation of the trackway peat and there are no major changes in pollen preservation (Fig. A3.10) then it suggests there was an increase in peat sedimentation rate until ultimately the trackway was abandoned just prior to the arrival of marine conditions at the site.

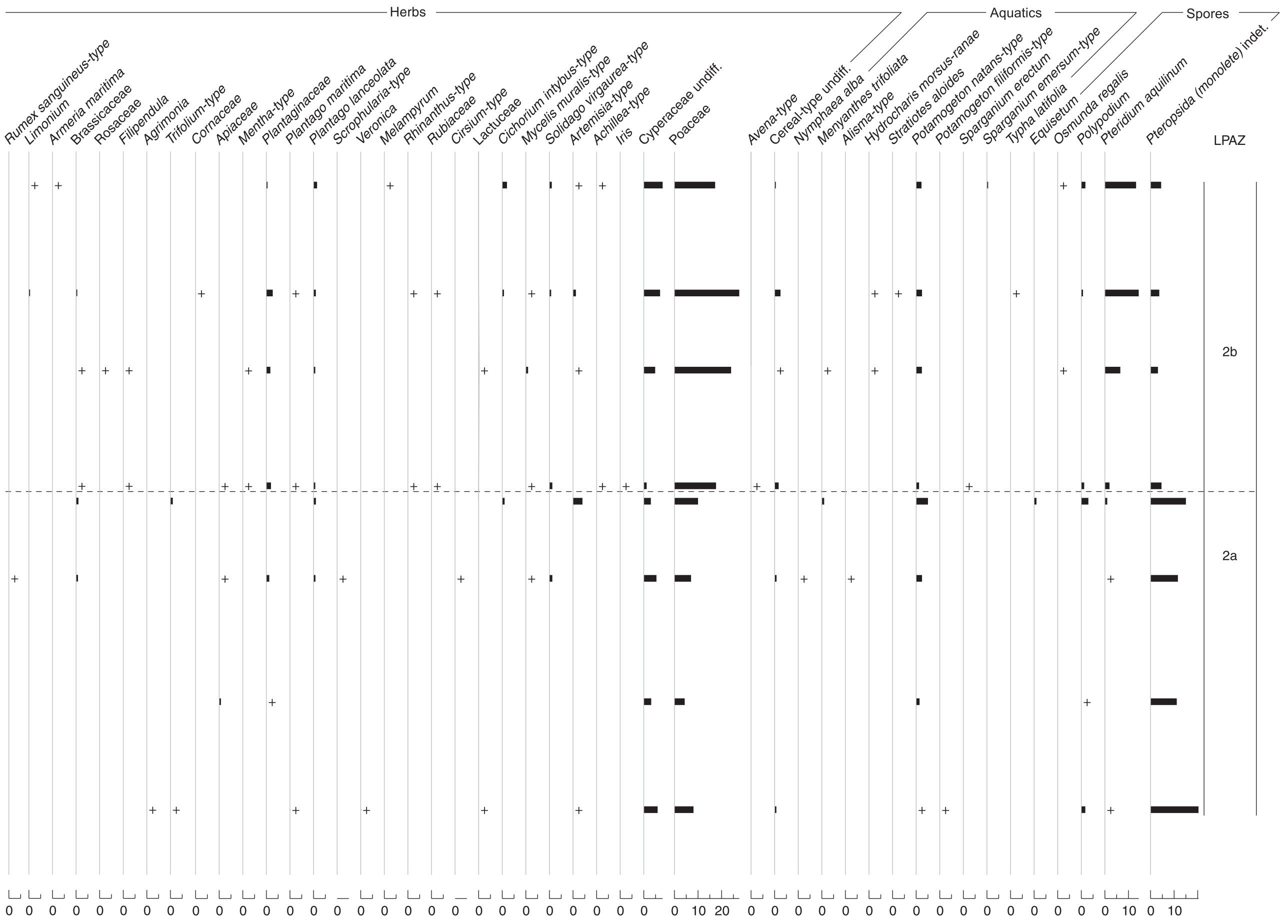
Marine conditions at or near the site are suggested by the organic-walled foraminifera, dinoflagellate cysts and the brackish water diatom *Cyclotella striata.* There is also a rise in the representation of Chenopodiaceae pollen. The Chenopodiaceae or goosefoot family is a large one with 7 genera and perhaps up to 32 species that are native or probably native to the British Isles (Stace 1991), so viewed alone its diagnostic value is limited. However some genera such as *Atriplex* (oraches), *Salicornia* (glassworts) and *Suaeda* (sea-blites) contain species that are often dominant members of saltmarsh communities.

Taken together with the rise in the clay fraction, the rise in Poaceae and presence of brackish diatoms, it is likely the transition from silty peat to upper silty clay represent a change from marginal marine, perhaps saltmarsh environments to less organic intertidal mudflats.

Cerealia-type pollen is present in all but two samples. Tweddle *et al.* (2005) have recently commented on the difficulty of separating Cerealia-type pollen from wild grasses and suggest that only *Secale cereale* (rye) pollen can generally be identified to species level, while pollen from the other cultivated genera *Avena* (oats), *Hordeum* (barley) and *Triticum* (wheat) cannot be confidently separated from some wild grass species, many of which are potentially present in the coastal zone (Behre 2007). A recent paper by Joly *et al.* (2007) suggests a limit of 47μm for grain diameter and 11μm for annulus diameter was best at discriminating between the two groups, putting a minimum of large grass pollen types into the Cerealia-type group and this approach has been adopted here. Using the keys of Andersen and Küster in Tweddle *et al.* (2005) and the grain sizes in Andrew (1984) one grain at 0.43m has provisionally


Trees
Shrubs
Herbs
m OD
Unit (WMW)
Context no.
Lithology
Monolith sample
Depth (m)
Picea
Pinus sylvestris
Taxus baccata
Ulmus
Fagus sylvatica
Quercus
Betula
Alnus glutinosa
Carpinus betulus
Tilia cordata
Populus
Acer campestre
Fraxinus excelsior
Corylus avellana-type
Salix
Sorbus-type
Hedera helix
Ranunculaceae
Ranunculus acris-type
Cannabis sativa
Chenopodiaceae
Caryophyllaceae
Silene vulgaris-type
Persicaria maculosa-type
Polygonum
Rumex obtusifolius-type
3645±35 BP
3230±30 BP
(trackway 2/14)
4265±35 BP
2b
2a
%TLP


Trees
Shrubs
Herbs
Aquatics
Spores
Pollen concentration
3645±35 BP
3230±30 BP
(trackway 2/14)
4265±35 BP
2b
2a
%TLP
grains x 10⁵ /cm³



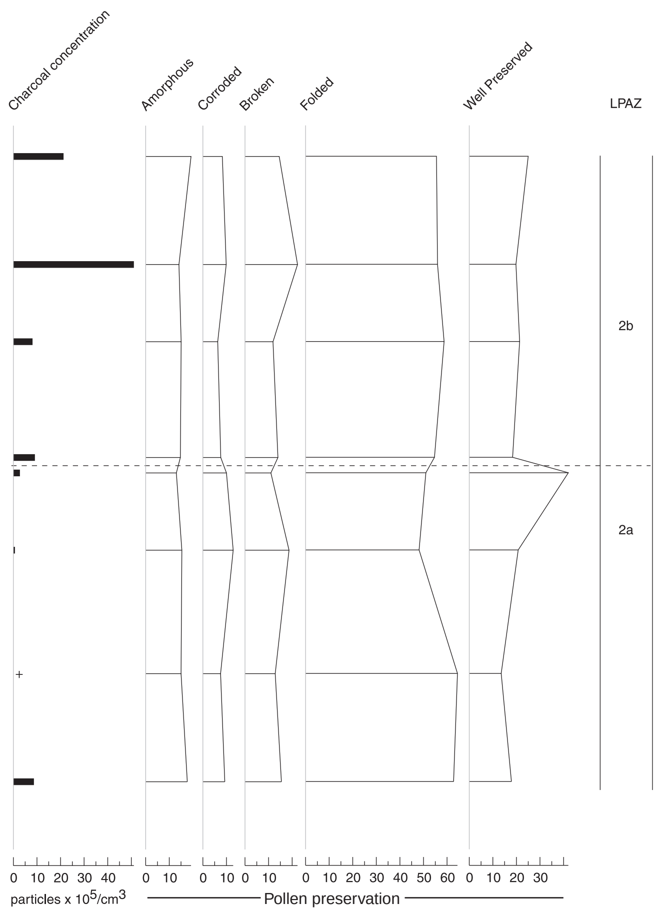


Fig. A3.10 (facing page and above) Pollen percentage diagram, Trench 2, Woolwich Manor Way been attributed to *Avena* type which includes *Triticum* spp. on the basis of its maximum diameter, annulus diameter and pore diameter.

Because cereal pollen is not widely dispersed it is likely that cereal cultivation took place in the vicinity of the site, perhaps on slightly higher and drier ground. However there is the proviso that samples from the silty peat above 0.50m and especially in the overlying silty clay will have a waterlain component.

The radiocarbon date on the upper contact of the silty peat of 2140-1910 cal BC (SUERC-25562: 3645±35) seems to be anomalous in that it is older than the trackway it overlies. The two possibilites mentioned earlier are that the trackway has subsided and now lies at an altitude below its original position, or that the sample has been contaminated by older carbon. Assuming the date should be about 3200 BP, it would take about 5% contamination by inert carbon to age the sample by 400 years (Lowe and Walker 1997). The high Pb concentrations in the upper three levels do suggest the sediment may be contaminated, however the high silt and clay proportions in the samples would preclude much downward leaching of contaminants

Pollen from Movers Lane *by Sylvia Peglar* (Figs 7.4-7.5, A3.11-3.13)

Introduction

After assessment of many monoliths from Movers Lane junction with the A13 (Scaife in Wessex Archaeology 2003) three sections were chosen for full pollen analysis: one from the Area 3 palaeochannel, one from the adjacent trackway and (Fig. 7.5) and one from an 'offsite' sequence (Fig. 7.4). It was hoped that the 'offsite sequence' (TP39) would provide a background vegetational and environmental history during the middle Holocene into which the sequences associated with the trackway and sand bar could be slotted.

Methodology

Standard volumes of the sediment samples were prepared for pollen analysis using a standard chemical procedure, using HCl, NaOH, sieving, HF, and Erdtman's acetolysis to remove carbonates, humic acids, particles >170 microns, silicates, and cellulose, respectively. The samples were then stained with safranin, dehydrated in tertiary butyl alcohol, and the residues mounted in 2000 cs silicone oil (method B of Berglund and Ralska-Jasiewiczowa (1986)). Tablets containing a known number of *Lycopodium* spores were added to the known volume of sediment at the beginning of the preparation so that pollen and spore concentrations could be calculated (Stockmarr 1971). Slides were examined at a magnification of 400x (1000x for critical examination) by equally-spaced traverses across at least two slides to reduce the possible effects of differential dispersal on the slides (Brooks and Thomas 1967). The aim was to achieve a count of 500 grains of land pollen and spores. Pollen identification, where necessary, was aided using the keys of Moore *et al.* (1991) and a small modern pollen reference collection. Andersen (1979) was followed for identification of cereal-type pollen. Indeterminable and unknown grains were recorded as an indication of the state of the pollen preservation. Other identifiable palynomorphs encountered on the slides were also recorded – vegetative remains, *Sphagnum* spores, fungal spores, dinoflagellate cysts, foraminifera, charcoal particles <170 microns, turbellarian eggs, pre-Quaternary spores, algal remains, et*c*, the inclusion of which can add to the interpretation of the pollen analytical results. Plant nomenclature follows Stace (1997).

The results are presented as pollen and spore diagrams with taxa expressed as percentages of the total land pollen and spore sum (sumP/calculation sum). Obligate aquatic taxa and other palynomorphs are presented as percentages of sumP + the sum of the category to which they belong. Calculations and diagrams were made using the programs TILIA and TILIA.GRAPH in TGView (Grimm 1990). Percentage values of <1% are represented as pluses. Taxa to the left of the 'calculation sum' are included in the calculation sum: those to the right are %s of the calculation sum + the sum of the group to which the taxon belongs.

Trackway 5268, Area 3

Monolith <40>, 0.75m long, was extracted from Trench A3, section 592, covering a series of silts, sands and peat. Ten subsamples were analysed (Fig. A3.11)

Organic sand and peaty sand (0.75–0.40m from top of monolith<40>)

The pollen assemblages from the four subsamples from these two basal sediment units are very similar. They are dominated by tree and shrub pollen (>80% total land pollen and spores (TLP)) most of which is alder *Alnus* (alder) but also with *Tilia* (lime), *Quercus* (oak) and *Corylus* (hazel), and odd grains of *Betula* (birch), *Fraxinus* (ash), *Pinus* (pine), *Taxus* (yew), and *Ulmus* (elm). Ferns (Pteropsida (monolete) undifferentiated (undiff.) are also present. There is very little herb pollen and no evidence of aquatic taxa apart from one grain of *Lemna* (duckweed) in the top sample. Pollen preservation is quite good but pollen concentrations are low. Charcoal particle values are very low.

Such assemblages suggest that these sediments were laid down in a reasonably fast-flowing channel as there are no aquatic taxa present and no small minerogenic particles. Regionally there was mixed deciduous woodland probably dominated by lime growing on the drier soils, with oak, hazel and an understorey of ferns, with alder growing on the wetter soils and along the river channel banks. The very small amounts of elm pollen suggest that these sediments were laid down post 'Elm Decline', a more or less synchronous event probably caused by an infection and dated to about 5000 years BP. It has been dated in the Thames estuary to just earlier than 4850 BP at Mar Dyke (Scaife 1988), 5010 BP at Silvertown (Wilkinson *et al.* 2000) some 5km WSW of Movers Lane, and 5040 BP at Rotherhithe (Sidell *et al.* 1995). Wood from 0.60–0.64m between the two basal subsamples in the basal organic sand has been radiocarbon dated to 2570-2330 cal BC (SUERC-25572: 3950±35 BP). The top of the peaty sand (0.40m) has been dated to 2130-1890 cal BC (SUERC-25571: 3625±35 BP). There is very little evidence for reedswamp or grasslands in the area at this time, and no evidence for human presence

Sandy peat (0.35–0.21m)

Two subsamples were analysed from this sediment. The pollen assemblage from the basal subsample is similar to those from the lower subsamples in the organic sand and peaty sand indicating that there was a lot of woodland, including wet alder carr within the area. However, Poaceae (grass) and Cyperaceae (sedge) pollen values are slightly raised and other herbs characteristic of reedswamp and grassland are present. The upper subsample shows a greater increase in grass and sedge pollen and biodiversity is greatly increased with many more herb taxa represented, herbs making up around 15% TLP. These include taxa which may be associated with grassland *Plantago lanceolata* (ribwort plantain), *Taraxacum*-type (dandelion-type), *Aster*-type (daisy-type) and *Ranunculus acris*-type (buttercup-type). There is a concomitant decrease in tree taxa during this period. There is also an increase in taxa charcteristic of reedswamp and marsh including sedges, grasses, *Alisma*-type (water plantain-type), iris and *Typha* species (bulrushes). Charcoal particle values are low in the basal subsample but very high in the upper subsample.

These assemblages suggest some increasing opening of the woodland around the site with increasing wetlands and grassland, perhaps being used for pasture. Lime values decrease particularly and this may be the 'lime decline' that is found in many diagrams from southern England, for example at 3630 BP at Bramcote Green, Bermondsey (Thomas and Rackham 1996) and is thought to have an anthropogenic cause, although the decline could also be due to rising water levels: lime being intolerant of wet soils. The presence of humans locally is evidenced by the dramatic rise in charcoal particles and the occurrence of cereal growth with the presence of several cereal grains within this unit, including (*Triticum* sp.) emmer/spelt and possibly *Hordeum*-type (barley). However, this latter type can also include pollen from wild grasses found in marine and reedswamp habitats (see Haggart, above).

Wood peat (0.21–0.15m)

This unit is associated with 7m long wattle/hurdle trackway 5268. Only one sample was analysed from this unit and the pollen assemblage obtained is very similar to that of the top subsample in the sandy peat below. There is thus evidence of increasing areas of wetlands and grasslands locally at the time of the trackway being constructed. The trackway has been dated to 1680-1490 cal BC (SUERC-24595: 3295±35 BP).

Clayey silt (0.15–0.00m)

Three subsamples were analysed from this upper unit. They are similar to the subsample from the wood peat below but with increasing herb percentages, particularly grasses, sedges and taxa characteristic of reedswamp and grasslands. There is also an increase in goosefoot family (Chenopodiaceae) pollen towards the top of the sequence. This could either indicate increased arable agriculture, representing weeds growing among cereal crops (which have increased values at the top of the sequence) within the area, or that saltmarsh was growing closer to the site. Charcoal values remain high. The very top subsample includes a few dinoflagellate cysts and foraminifera which are characteristic of brackish/saline conditions. However, it also includes pre-Quaternary grains and many spores of the soil fungus *Glomus*, which may suggest that these taxa have been reworked from earlier sediments.

Western palaeochannel, Area 3

Two monoliths <47> and <48> were taken through organic silty clay and silty clay units associated with a sand bar in Trench A3, Section 568. Monolith <47> went down into a gravelly sand correlated with the occupation deposit, but unfortunately pollen was not preserved in this sedimentary unit (Fig. A3.12).

Organic silty clay (1.14–0.87m from top of monolith <48>)

The basal two subsamples are from monolith <47> and the upper subsample from <48>. Tree and shrub pollen accounts for *c* 40-50% TLP in this unit. About half of this is alder with oak, hazel and a little lime and birch making up the rest. There is also about 40% herb pollen, mainly grass and sedge but with many other herbaceous taxa at small values. A few ferns are present and also a variety of obligate aquatic freshwater taxa including *Potamogeton* (pondweed), duckweed, basal hair cells of waterlily (Nymphaeaceae), and remains of the aquatic green algae *Botryococcus* and *Pediastrum*, together with telmatic species such as bulrushes and iris. Charcoal particle values are high throughout.

Such assemblages are characteristic of a variety of habitats around the site with open water, wetlands including alder carr and reedswamp, grassland with many herbs indicative of pasture and arable land with cereals being grown (emmer/spelt and possibly barley) indicating the presence of humans. This organic silty-clay overlies a gravelly sand which is correlated with an occupational layer. Unfortunately subsamples prepared from this unit

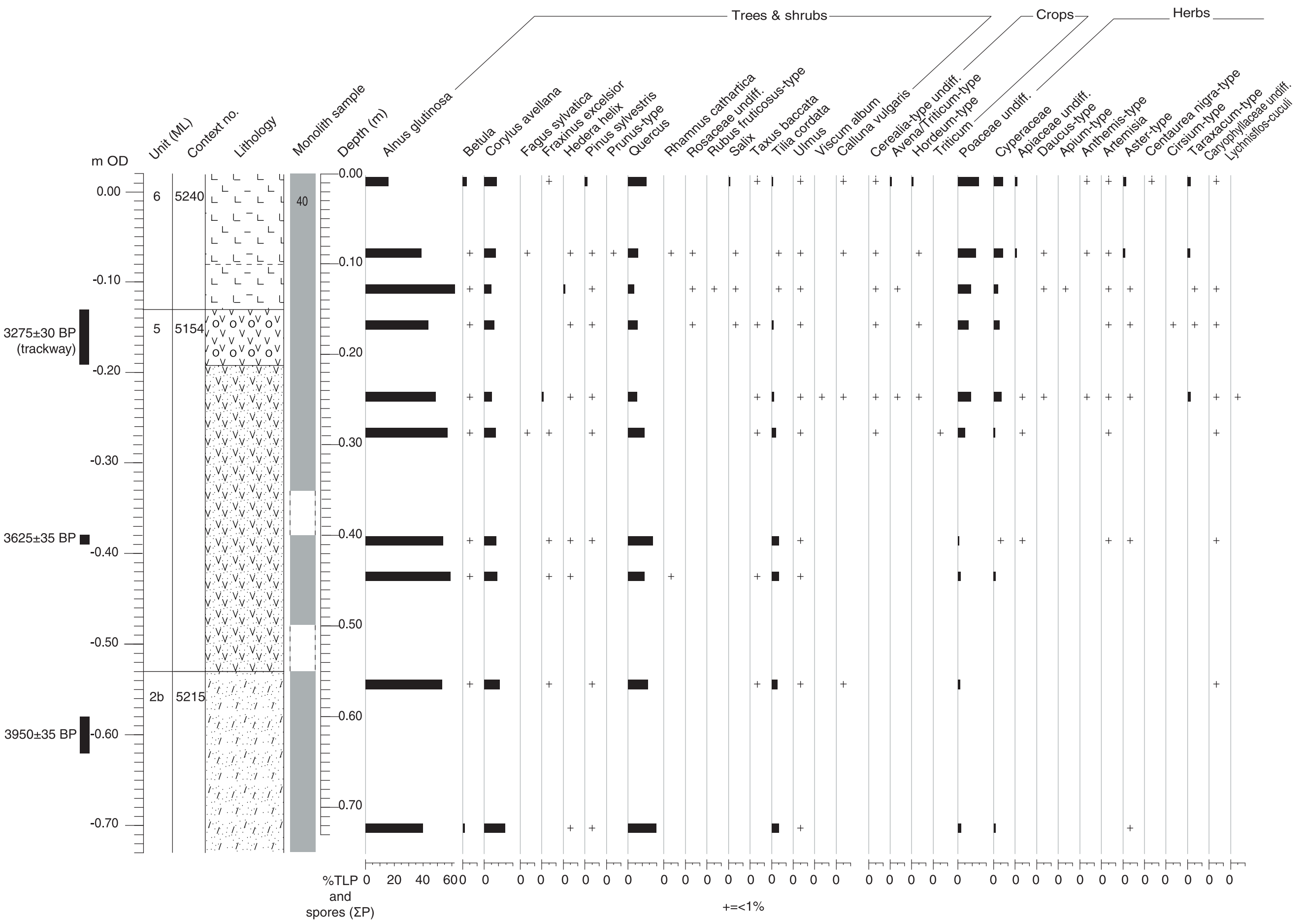


Fig. A3.11 Pollen percentage diagram, Trackway 5268, Area 3, Movers Lane

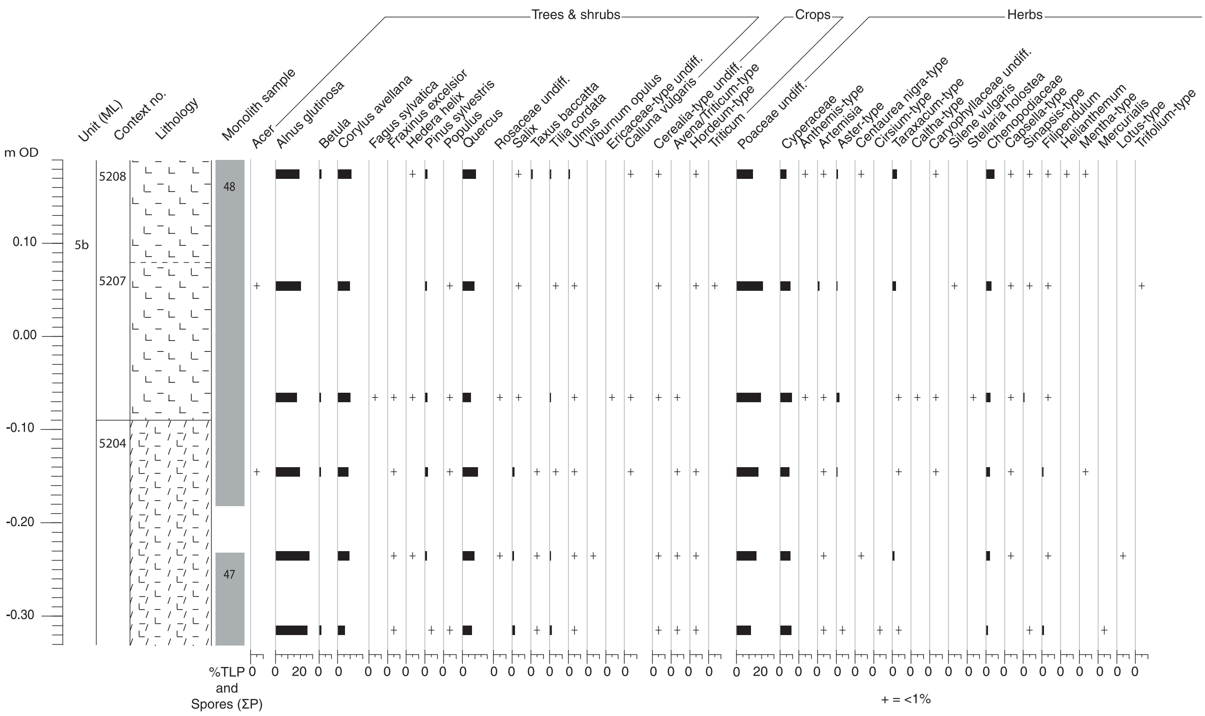


Fig. A3.12 Pollen percentage diagram, palaeochannel, Area 3, Movers Lane

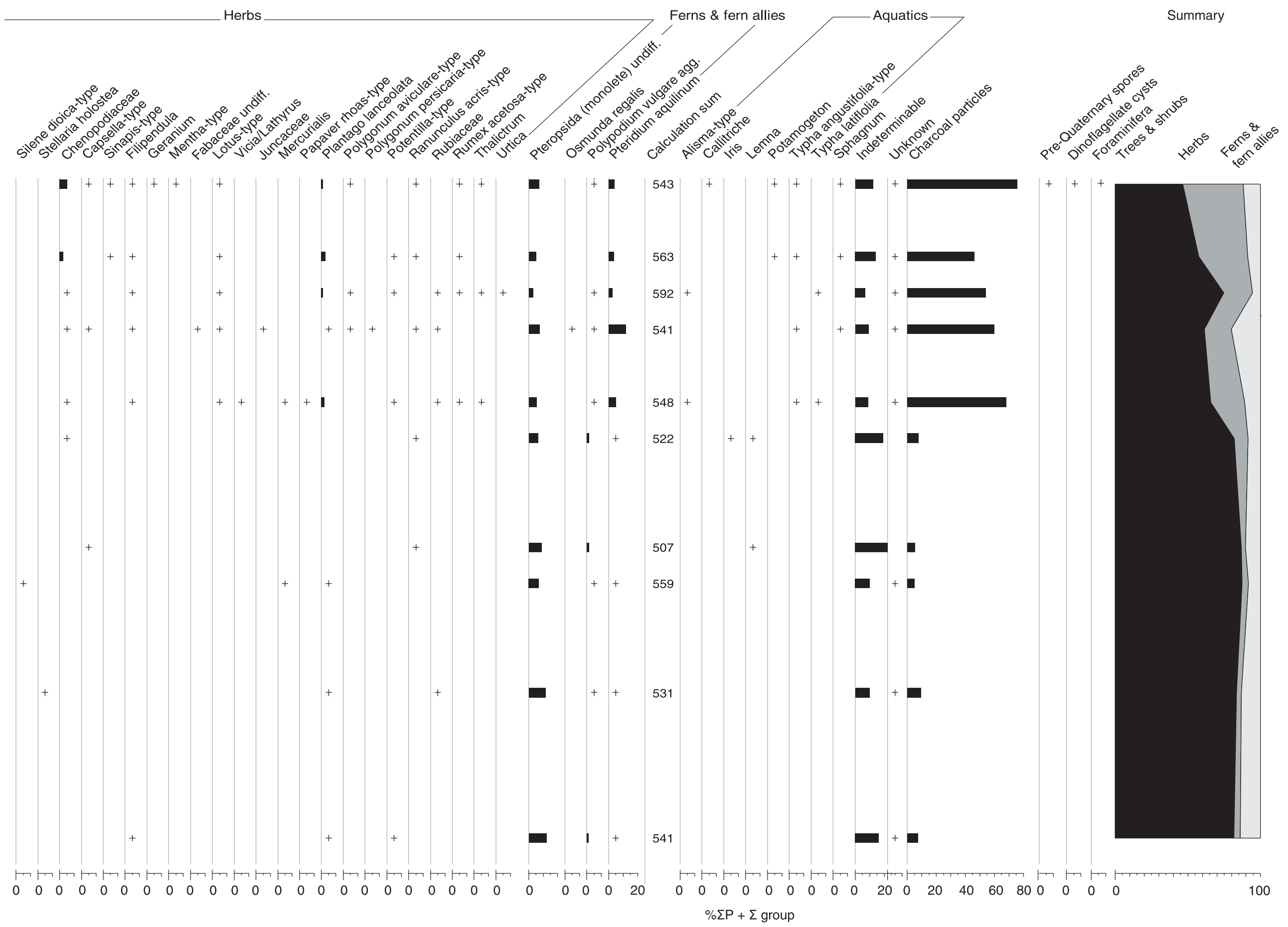


Fig. A3.11 Pollen percentage diagram, Trackway 5268, Area 3, Movers Lane (continued)

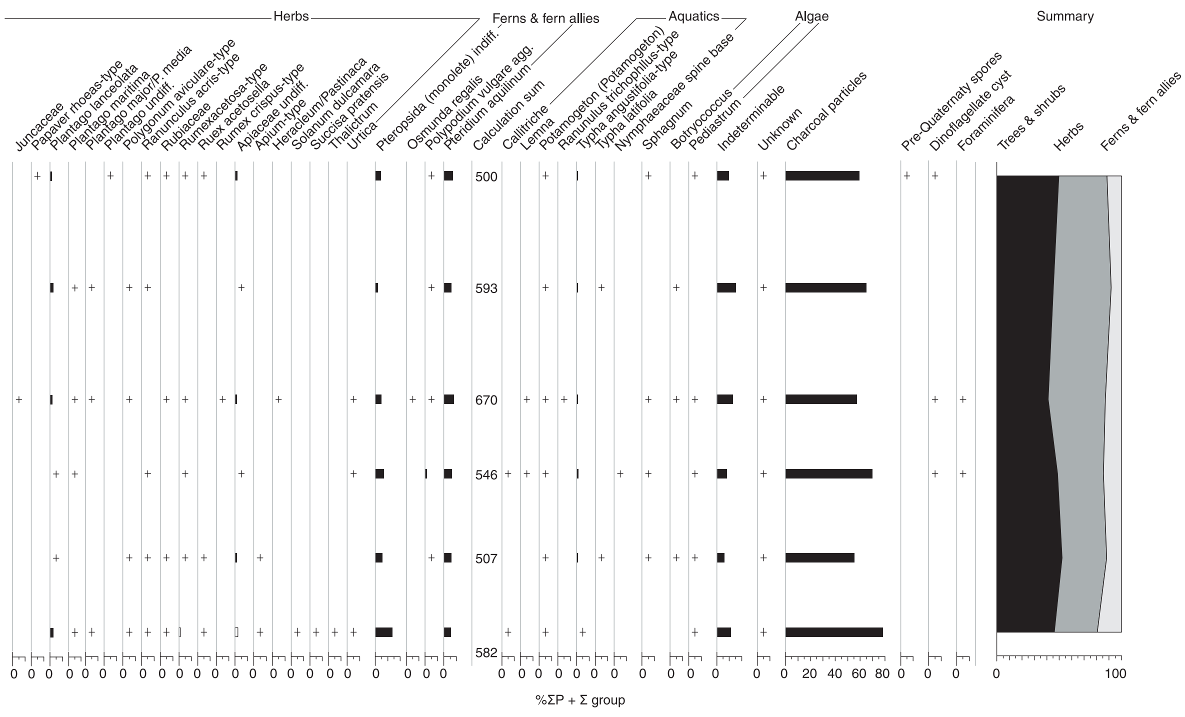


Fig. A3.12 Pollen percentage diagram, palaeochannel, Area 3, Movers Lane (continued) had extremely low concentrations of badly preserved pollen and could not be analysed. Regionally, deciduous woodland was still extant mainly of oak and hazel with an understorey of indeterminable ferns, *Pteridium aquilinum* (bracken) and *Polypodium vulgare* (polypody fern) which may also have grown on the oaks. Charcoal particle values are high throughout.

Silty clay (0.87–0.57m)

The assemblages from the three subsamples analysed from this unit (monolith <48>) are very similar to those of the unit below, but there is a gradual increase in grasses and other herbs as ferns and deciduous tree taxa slightly decrease. There is also a slight increase in goosefoot family and decrease in sedges towards the top of the monolith, possibly connected with saltmarsh encroaching towards the site. Spores of *Glomus*, pre-Quaternary spores, Dinoflagellate cysts and Foraminifera identified throughout the sequence suggest reworking of older sediments.

The very small values of elm and lime pollen suggest that the sequence postdates the 'elm' and 'lime' declines and would therefore here probably date from <3500 years BP (see below – TGWOO, Trench TP39), the early Bronze Age.

Test pit 39

This is regarded as an 'offsite sequence'. Two monoliths, <29> and <30>, cover the tripartite sequence of clays and silts, peats and clays and silts characteristic of the Thames estuary during the mid-Holocene (Devoy 1979) (Fig. A3.13).

Silty peat (3.95–3.60m)

Four subsamples have been analysed from this unit. Tree and shrub pollen dominate the pollen assemblages (60-80% TLP), particularly alder, averaging 40% TLP. However, other tree taxa are important – lime, oak and hazel all have values of 6-10% TLP. Ferns are also present at *c* 18% TLP and charcoal particles are quite high. The pollen in this sequence was not very well preserved with 18-20% TLP + indeterminable sum, and the assemblages may therefore be somewhat biased with grains that are easily identified even when poorly preserved being overcounted (for example grasses, alder and lime).

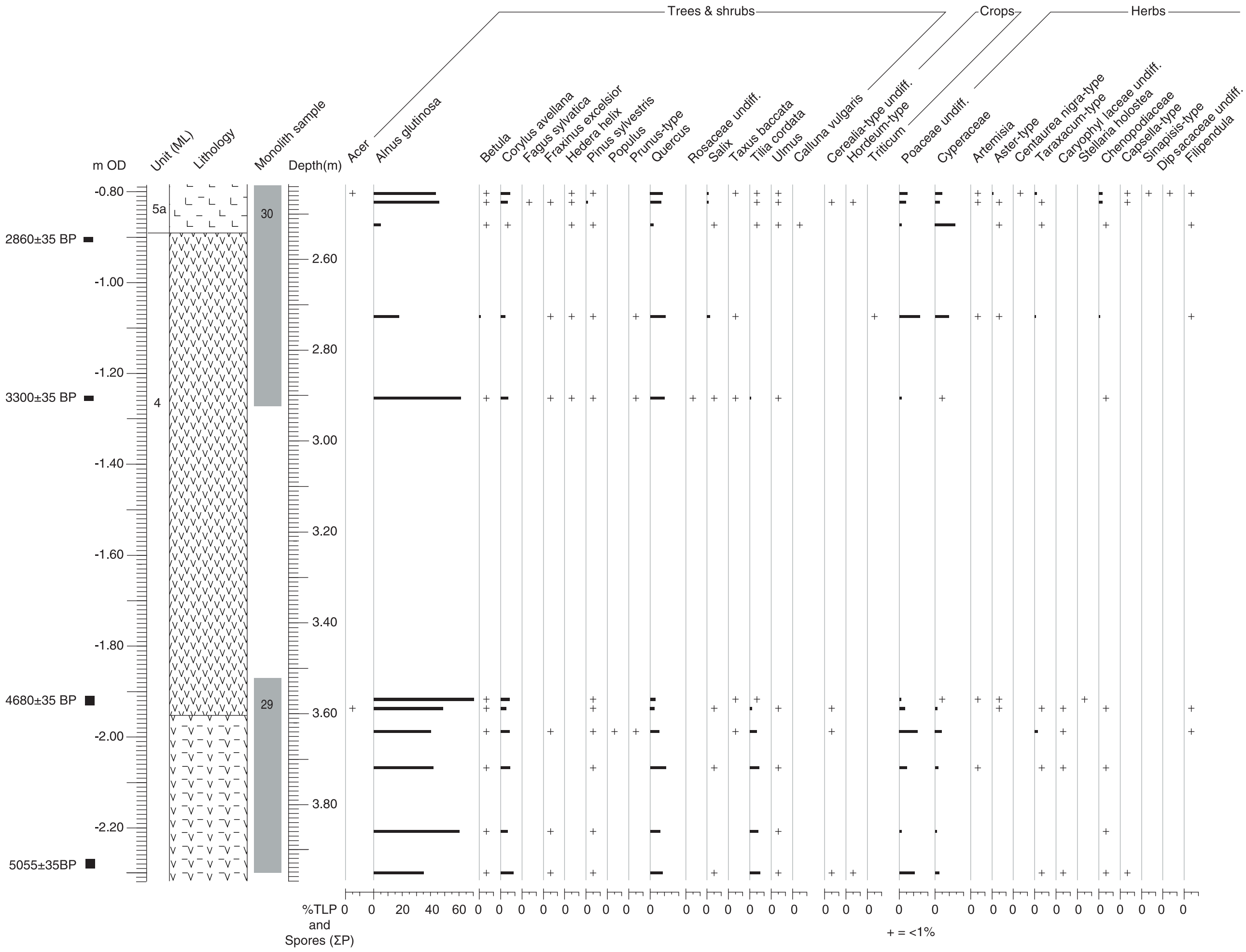


Fig. A3.13 Pollen percentage diagram, TP39, Movers Lane

The pollen assemblages suggest that woodland was prevalent over the landscape, with alder carr in wet places locally and along river banks, and deciduous woodland probably dominated by lime, with oak, hazel and ferns growing regionally on the drier ground. There is no evidence for the growth of freshwater aquatic taxa or of taxa associated with saline water but the growth of alder carr suggests the water around was fresh at the time these sediments were laid down. There were some open areas with grassland, possibly used for pasture, and possible cereal grains which would imply human presence. The base of this unit has been dated to 3960-3770 cal BC (SUERC-25568: 5055±35 BP) which would equate with the early Neolithic. There is very little elm in the assemblages suggesting that this unit is post 'elm decline' but pre 'lime decline' as there are quite high values of lime pollen. The top of the silty peat (humic acid fraction) has been dated to 3630-3360 cal BC (SUERC-25567: 4680±35 BP).

Peat (3.60–2.54m)

Unfortunately, only the very base and near the top of this unit were sampled (top of monolith <29> and most of monolith <30>). The two basal subsamples and the lower of the two upper subsamples provided pollen assemblages dominated by tree and shrub pollen (alder, oak and hazel but without lime: 85% TLP) with very few herbs and ferns and no aquatics. The junction of the silty peat and peat units therefore mark the 'lime decline' which probably has an anthropogenic cause, but could be due to an increased water level as lime cannot survive on wet ground. The increase in alder could be further evidence of a raised water level. However, it is possible that there may be a hiatus in the sedimentation. The thick alder carr may also be preventing other pollen reaching the site. A subsample (humic fraction) from within the peat at 0.48-0.49m has been dated to the early middle Bronze Age (1690-1510 cal BC (94.3%); SUERC-25570: 3330±35 BP). Although the 'lime decline' was affected by human communities and is therefore not a synchronous event, other sites in the Thames basin have provided dates. The uppermost subsample has increased herb pollen and fern spores and a concomitant decreased tree and shrub value, mainly due to a large drop in alder and increases in grasses and sedges.

The results from this unit thus suggest that alder carr was very prevalent locally at the time of peat

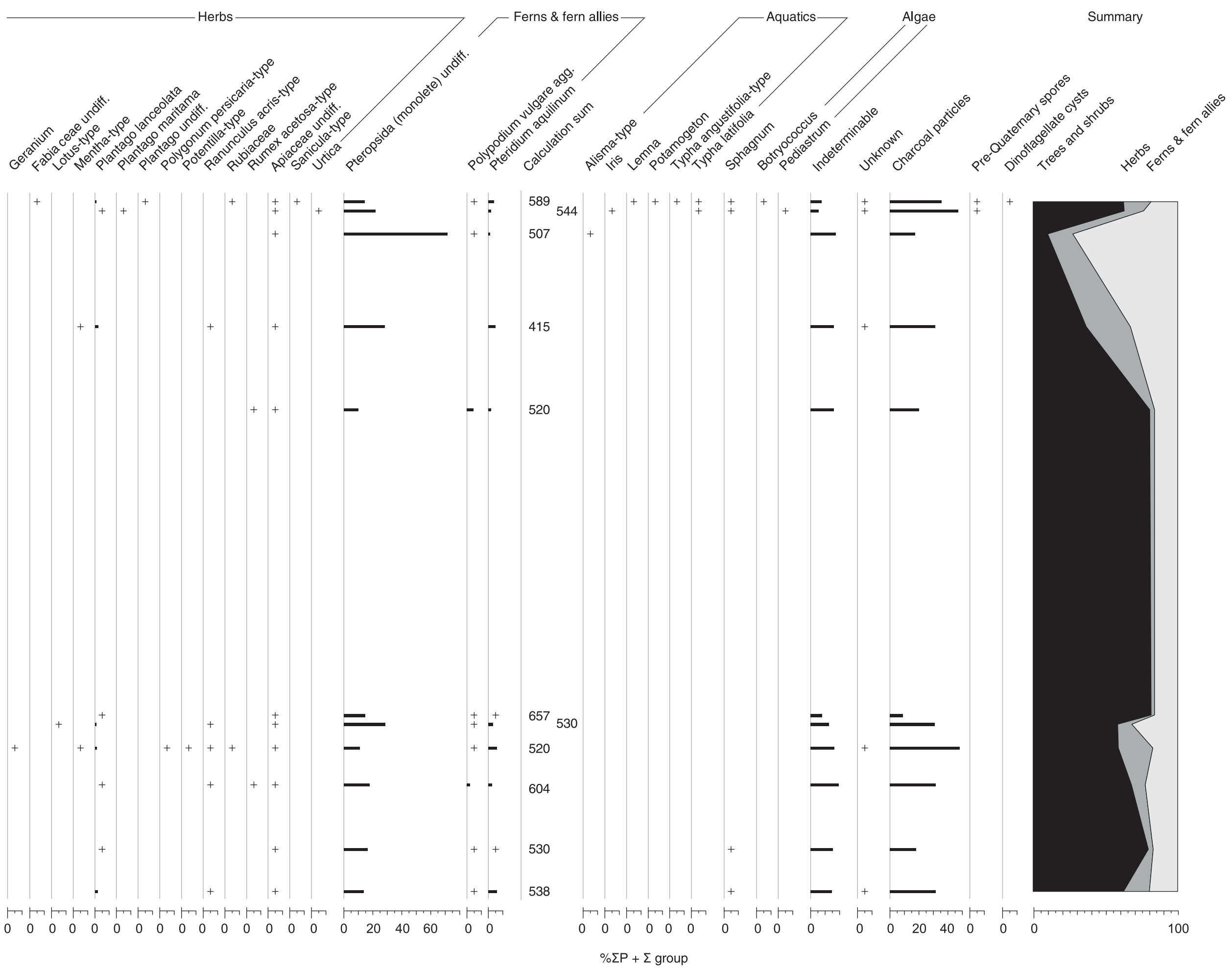


Fig. A3.13 Pollen percentage diagram, TP39, Movers Lane (continued) formation, and possibly only towards the top of the unit was there evidence for human presence, possibly with some pasturing. There is no evidence for cereal growth in the vicinity although, as above, the large cereal grains may have been filtered out by the dense alder woodland.

Silty clay (2.54–2.44m)

Three subsamples were analysed from this unit. The basal subsample had a very high fern value (>70% TLP) but this could be due to the inclusion of a whole or part fern sporangium in the preparation. Pollen assemblages are again similar to those from the peat, but many aquatic taxa and green algae suggest freshwater wetlands and reedswamps were found locally, possibly due to a rise in water level. In the top subsample a small rise in goosegrass family pollen may indicate that saltmarsh was growing closer to the site.

Interpretation and discussion

The pollen assemblages from the sediments associated with trackway 5268 (Fig. A3.11) show that at the base of the sequence the site was probably in a quite fast-flowing channel with wet ground and channel banks dominated by alder with deciduous woodland with lime, oak and hazel on the drier ground. There is no evidence for other than a freshwater environment at this time. After *c* 3625 radiocarbon years BP woodland taxa begin to diminish (particularly lime) with a corresponding increase in biodiversity and wetland and grassland taxa (grasses and sedges). This suggests that water levels were rising and towards the top of the sandy peat large values of charcoal particles and the presence of cereal pollen grains are evidence of local human presence. An overlying wood peat is associated with a trackway. Trackways have also been excavated at Bramcote Green, Bermondsey (Thomas and Rackham 1996) and correlated with a series of wet boggy areas within the Thames channel. It seems that a rising water level with an increase in wet habitats at our site is also the reason for the building of the trackway here. A few spores of *Sphagnum* (bog moss), not found lower in the sequence, may be further evidence of increasing wetness. Above the wood peat is a clayey-silt unit in which the pollen assemblages are similar to that from the wood peat but with increasing herb pollen indicating increasing open ground (reedswamps and grasslands, possibly being used for pasture) together with cereal production. At the top of the sequence there is possibly some evidence of brackish water influence with dinoflagellate cysts and foraminifera present. However, these may be indicative of reworked sediments, as pollen of telmatic taxa such as grow in reedswamps (bulrushes) and obligate aquatic taxa showing the presence of open freshwater *Potamogeton* (pondweed) and *Callitriche* (starwort) are present.

An underlying unit of gravelly sand was correlated with an occupational level in the sediments associated with a sand bar (Fig. A3.12) but unfortunately it was impossible to obtain pollen analyses from them. However, units of organic silty-clay and silty-clay above the gravelly sand provide evidence of local human presence throughout with high charcoal particle values and the local production of cereals. The landscape was quite open with grassland (possibly pasture) and with some wet habitats, reedswamps and open water. Throughout the sequence analysed there is little change but goosegrass (Chenopodiaceae*)* values are reasonably high and increase upwards. Also odd remains of dinoflagellate cysts and foraminifera are present, possibly evidence for saltmarsh gradually encroaching on the site.

The site at TGWOO trench TP39 (Fig. A3.13) was analysed as an 'offsite' sequence, hopefully to provide a background vegtetational history of the area into which the trackway and sand bar sequences could be slotted. It dates from the beginning of the Neolithic, just after the 'Elm Decline'. The pollen assemblages from the basal sedimentary unit (organic silt) indicate that the landscape was mainly wooded with lime, oak and hazel being the main constituent trees, with an understorey of ferns. However, there is some evidence for some opening of the woodland with herb taxa suggestive of pasture and some cereal grains present. This would suggest that humans were living close by at this time. At the top of the organic silt lime pollen values drop; the base of the peat above has been dated to 3630-3360 cal BC (SUERC-25567: 4680±35 BP). This may be the anthropogenically produced 'lime decline', caused by the trees being cleared as they were on the best soils, or pollarded for cattle fodder (Turner 1962). However, lime is intolerant of wet soils and it's decline here may be due to waterlogging correlated with a rise in sea level. In the upper part of the peat unit tree pollen values decrease further and herbs, particularly grasses and sedges increase. It is difficult to say whether this is due to further clearance by humans or rising water levels. At the top of the sequence there is possibly a small increase in taxa associated with saltmarsh and brackish water which may be indicative of saltmarsh approaching closer to the site.

Ostracods and foraminifera *by John Whittaker*

Introduction

Although no work was carried out on ostracods and foraminifera during the post-excavation analysis stage of the project, the assessment of samples provided a significant body of data that has aided in the characterisation of the environments of deposition associated with the sediments at each site, described in Part 2 of this volume (Whittaker in Gifford and Partners 2000; 2001a; 2001b; 2002; 2003a; 2003b; Wessex Archaeology 2003). For this reason the results of the various stages of assessment for both the evaluations and detailed excavations have been included in this Appendix. Preservation between and within assessed sequences along the route was quite variable, and the negative results from the Phase II investigations at Woolwich Manor Way and Movers Lane and the Phase III investigations at Woolwich Manor Way have therefore been omitted from this report.

Methodology

Each sample was placed in a ceramic bowl and thoroughly dried in a Hotbox (fan-assisted) oven. Boiling water was then poured over the dried sediment, with a little sodium carbonate added to deflocculate the clay fraction. In a few cases a very small amount of dilute hydrogen peroxide was introduced to speed up the breakdown, but always care was taken not to leave the sample in hydrogen peroxide for more than one hour (as long-term exposure is known to have destructive tendencies on the microfauna). Each sample was then washed through a 75μm sieve with hot water and decanted back into ceramic bowl, before final drying in the oven. The dried residues were then stored in small plastic bags before examination under a binocular microscope.

Results and interpretation

Phase 1 evaluation (Canning Town, Woolwich Manor Way, Roding Bridge and Movers Lane)

Twenty four samples from 4 route sections were submitted for microfaunal analysis (Tables A3.1 and A3.2). The lower part of each section examined appears to have been entirely freshwater, even though the samples from a variety of habitats

Table A3.1 Samples examined for ostracods and foraminifera from the Phase I evaluations

Works phase	*Site*	*Trench*	*Sample*	*Depth bgl*	*m OD*	*Facies*	*Vol. (g)*	*Description*
I	CT	TP29	3	2.65	-0.45	CT5	56	(205) 2.5Y 4/2 dark greyish brown clay-silt with 10YR 3/6 dark yellowish brown mottles.
I	CT	TP29	4	2.9	-0.7	CT5	41	(204) 2.5Y 4/1 dark grey clay-silt. Occasional 10YR 3/6 dark yellowish brown mottles.
I	CT	TP29	8	4.33	-2.13	CT3	50	(201) 5YR 2.5/1 black well humified peat/silty peat
I	CT	TP29	8	4.45	-2.25	CT3	34	(201) Soft Gley 2 3/5/PB dark bluish grey clay silt
I	WMW	TP1	87/M1	1.85	-0.83	WMW5	38	Dense and firm 10YR 4/2 dark greyish-brown silt to clay-silt
I	WMW	TP1	87/M1	2.07	-1.05	WMW5	40	as above
I	WMW	TP1	86/M3	2.52	-1.5	WMW5	38	as above, becoming more organic
I	WMW	TP1	86/M3	2.85	-1.83	WMW4	46	10YR 2/2 very dark brown peat varying to silty peat. Peat is moderately well humified in places. In places abndant wood and plant remains Occ. Pockets of 10YR 4/2 dark greyish brown organic silt.
I	WMW	TP1	84/M1	4.95	-3.93	WMW3	46	10YR 3/1 very dark grey clay-silt. Occasional plant fragments.
I	WMW	TP1	84/M1	5.15	-4.13	WMW3	62	10YR 5/2 to 10YR 6/2 dark greyish-brown silty-clay with carbonate patches..
I	RB	Rdar1	na	3.32	0.44	RB5		Dense, brownish grey clay-silt. Massive and structure less. Occ. black mottling. Some Fe staining along old root channels.
I	RB	Rdar1	na	3.68	0.08	RB5		As above
I	RB	Rdar1	na	4.1	-0.34	RB5		Dark brown clay-silt, more organic and softer.
I	RB	Rdar1	na	4.9	-1.14	RB4		Dark grey sandy silt with organic material. Dense and very compact.
I	RB	Rdar1	na	5.13	-1.37	RB2		Grey brown sandy silt, becoming silty then gravelly sand with depth. Dense, massive and structureless.
I	RB	Rdar1	na	5.42	-1.66	RB2		as above
I`	ML	TP39	30	2.5	-0.85	ML5	38	Firm 10YR 4/2 dark greyish-brown silty clay.
I	ML	TP39	28	4.15	-2.5	ML3	33	10YR 3/2 very dark greyish brown silt, some sand and organic content.
I	ML	TP39	28	4.25	-2.6	ML3	48	as above
I	ML	TP39	28	4.37	-2.72	ML3	41	as above
I	ML	TP39	28	4.55	-2.9	ML3	47	as above
I	ML	TP39	?	5.15	-3.5	ML2	82	10YR 4/4 dark yellowish-brown medium well-sorted sand. Slight laminations, in places cross bedded. Occasional flint clasts.

Table A3.2 Ostracods and foraminifera assemblages from the Phase I evaluations

			Foraminifera			*Ostracods*								*Others*		
						Brackish			*Freshwater*							
Site	*Depth*	*Unit*	*Ammonia limnetes* (Todd and Bronnimann)	*Elphidium williamsoni* (Haynes)	*Haynesina germanica* (Ehrenberg)	*Cyprideis torosa* (Jones)	*Cytherura gibba* (Muller)	*Leptocythere porcellanea* (Brady)	*Candona neglecta* (Sars)	*Candona* sp.	*Cypria ophtalmica* (Jurine)	*Darwinula stevensoni* (Brady and Robertson)	*Limnocythere inopinata* (Baird)	Charophyte oospores	Fish bones	Molluscs
CT TP29	2.1	CT5			+		+									
	2.37	CT5	+	+	+					+						+
	2.65	CT3														+
	2.9	CT3														
	4.33	WMW5													+	+
	4.45	WMW5													+	+
WMW TP1	1.85	WMW5	+		+	+		+		+				+		
	2.07	WMW4	+	+	+	+	+	+++	++			+	+	+		+
	2.52	WMW3														
	2.85	WMW3				+										
	4.95	CT5				+										
	5.15	CT5														
RB Irar1	3.32	RB5				++	+			+						
	3.68	RB5														
	4.1	RB5														
	4.9	RB4														
	5.13	RB2														
	5.42	RB2														
ML TP39	2.5	ML5														
	4.15	ML3									+					
	4.25	ML3														
	4.37	ML3									+			+		
	4.55	ML3												+		
	5.15	ML2														

(sandy and calcareous substrates, and rich vegetation) were often barren. There is, however, sufficient evidence from the molluscs, fish remains and Cladocerans, especially at Canning Town (Fig. 3.3) to demonstrate a freshwater origin. Freshwater ostracods were only found at Movers Lane (Fig. 7.4), but it is likely that the very acid organic-rich deposits, in particular, would not only have been non-conducive to the subsequent preservation of calcareous valves but might also signify a generally unfavourable environment. At Movers Lane all that remains in several samples is the chitinous integument of valves of the ostracod (*Cypria ophtalmica*). This ostracod is significantly tolerant of waters high in organic pollution; often stagnant streams and pools. This, then, may give an indication of what the site might have been like throughout the sequence examined.

For the remainder of the samples, from Woolwich Manor Way (TP1, Fig 5.3), Canning Town (TP29, Fig 3.3) and Roding Bridge (Rdar 1, Fig 6.2), the latter part of each section is characterised by a change to brackish water conditions caused by tidal incursion, possibly associated with a small rise in sea-level. The section down to 2.07m bgl at Woolwich Manor Way, to 2.37m bgl at Canning Town and the top sample at Roding Bridge at 3.32m bgl, contain ostracods *Cyprideis torosa*, *Leptocythere porcellanea,* and/or *Cytherura gibba* (the former two in large numbers), all of which signify the development of muddy, protected brackish creeks. A salinity of between 5% and 10% may be suggested; in salinities lower than that *C torosa* valves are often noded and all the present material, both adult and juvenile, is smooth. That the vast majority of these brackish ostracods were found as carapaces (rather than discrete valves), which also suggests that the populations are *in situ* and not washed in by tidal surges from elsewhere. Some freshwater input into the creeks would still have occurred, as evidenced by some associated freshwater ostracods, but a species such as *Candona neglecta* (the only one commonly present) can itself tolerate low salinities. The interpretation of tidal access is reinforced at these localities by the occurrence of minute foraminifera, which if they were not living *in situ* in salinities close to their limits of tolerance (5%), would have been brought in suspension by the tide from estuarine localities further downstream.

Phase II evaluation (Prince Regent Lane)

Ten samples were submitted from assessment from the Phase II investigations at Prince Regent Lane (Table A3.3). All derive from a series of monoliths (monoliths 103/1, 103/2, 103/3 and 103/4; Fig. 4.3) retrieved from the alluvial sequence in T23 in the western part of the site (adjacent to the Phase III coffer dam excavations)

The slightly organic sand in the lower part of the section was barren of microfauna. There was some plant debris, seeds and oogonia of charophytes. If it is equivalent to the peats found elsewhere then it is presumably freshwater. Higher in the sequence there is a well marked brackish incursion associated with the onset of tidal influence. This becomes apparent in the sample from 1.02m bgl; the signal is very strong at 0.89m bgl, and was still present at 0.69m bgl. In the uppermost sample, at 0.44m bgl the signal is lost, possibly due to decalcification and/or pollution.

The well-known brackish ostracods *Cytherura gibba*, *Cyprideis torosa* and *Loxoconcha elliptica* all signify muddy, protected brackish creeks (Athersuch *et al.* 1989). Here, and unlike sites investigated during Phase I works (above), they are accompanied by a rich fauna of freshwater ostracods, especially *Sarscypridopsis aculeata* and *Heterocypris salina*, which often live together and have a preference for slightly brackish, small water bodies or coastal pools influenced by marine water; the other taxa represented can also tolerate slightly salty water (Meisch 2000). It is likely, therefore, at this location there were small coastal pools, as well as creeks, that were flooded at high tide by estuarine

Table A3.3 Samples examined for ostracods and foraminifera from Phase II Trench 23 at Prince Regent Lane

Works phase	*Site*	*Trench*	*Sample*	*Depth bgl*	*m OD*	*Facies*	*Vol.(g)*	*Description*
II	PRL	23	103/1	0.44	0.81	PRL5	27	(158) dark brownish grey silty clay
II	PRL	23	103/1	0.69	0.56	PRL5	18	(159) light brownish grey silty clay
II	PRL	23	103/1	0.89	0.36	PRL5		(160) mid greyish blue silty clay
II	PRL	23	103/2	1.02	0.23	PRL5		(161)1light brownish grey silty clay
II	PRL	23	103/3	1.13	0.12	PRL5		as above
II	PRL	23	103/3	1.33	-0.08	PRL5		as above
II	PRL	23	103/3	1.53	-0.28	PRL5		(162) mid grey silty clay
II	PRL	23	103/4	1.55	-0.3	PRL5		as above
II	PRL	23	103/4	1.75	-0.5	PRL2		(164) dark grey silty sand
II	PRL	23	103/4	1.95	-0.7	PRL2		(165) light yellow grey silty sand

Table A3.4 Ostracod assemblages from Phase II Trench 23 at Prince Regent Lane

		Ostracods										*Other*	
		Brackish			*Freshwater*								
Depth	*Facies*	*Cyprideis torosa* (Jones)	*Cytherura gibba* (Muller)	*Leptocythere porcellanea* (Brady)	*Candona neglecta* (Sars)	*Candona* sp.	*Cypria ophtalmica* (Jurine)	*Heterocypris salina* (Brady)	*Ilyocypris* cf. *bradyl* (Sars)	*Limnocythere inopinata* (Baird)	*Sarscypridopsis aculeata* (Costa)	Charophyte oospores	Molluscs
0.44	PRL5												
0.69	PRL5	+	+	+						+			+
0.89	PRL5	+	++		+++		+	++	+++	+++	+++		+
1.02	PRL5					+					+		
1.13	PRL5												
1.33	PRL5												
1.53	PRL5											+	
1.55	PRL5											+	
1.75	PRL2												
1.95	PRL2												

water during this later phase of Holocene Thames sedimentation.

Phase III excavation, Freemasons Road

Nine samples from four monoliths from the Phase III cofferdam excavations were submitted for assessment. The samples derived from the lower part of the upper alluvium (layer 1) as well as the fill of channel 22 (Section 17, Fig. 4.3). Additional samples were also examined from the basal sandy silts (layers 106 and 76). Ostracods were only preserved in the uppermost sample (0.10m) in monolith 115 (fill 009 of channel 22). These belonged to the *Candona* group of freshwater ostracods and in all cases only fragmentary remains were recovered. These remains were associated with a few earthworm granules. The sample from the upper alluvium (layer 1) in monolith 116 was totally barren. The basal sandy silt produced insect remains and ephippia (egg-cases) of freshwater cladocerans (water fleas) along with abundant fish remains including 3-spined stickleback and eel (S. Parfitt pers. comm.). Apart from the few fragmentary ostracod remains from monolith 115 no other calcareous remains were found in any of the samples. Scales, spines and bone of fish are made of hydroxyapatite (calcium phosphate, not calcite, P. Forey pers. comm.) and therefore the samples would appear to be strongly decalcified.

Phase III excavation, Movers Lane

Eighteen samples, nine each from Areas 2 and 3, were submitted for assessment from the Phase III Movers Lane excavations. These samples were selected from nine monoliths and covered a range of stratigraphic units through both palaeochannels and associated features.

Results from Area 2 were disappointing; no calcareous (or siliceous) microfossils were recorded. The only environmental indication from the main channel deposits came from the peat (layer 3012; monolith 66, 8cm) which contained charophyte oospores. However, the fact that even here the calcareous sheath was missing, leaving only the chitinous inner lining, probably means that this and all the other samples from this sequence are heavily decalcified and/or oxidised. Charophytes (stoneworts) can, however, live in both fresh and brackish-water. In ditch 1038, some ephippia (egg-cases) of cladocerans (water-fleas) were found (monolith 60, 36cm) indicating that this was probably a freshwater habitat.

In Area 3 non-marine ostracods and ephippia of cladocerans, in particular the small channel cut in peat (monolith 38, sample 18, Fig. 7.5) and throughout the basal sands (monolith 55, samples 15-13, Fig. 7.5) suggest that this part of the section was wholly freshwater. However, in the upper alluvium (monolith 51, samples 11 and 12, monolith 52, sample 10) creek-dwelling ostracods, and minute, marine foraminifera occur. The ostracods were clearly *in situ*, the foraminifera would have been brought in, in suspension with the tide. This, therefore and importantly, signals the onset of tidal conditions, perhaps associated with a rise in sea-level.

Insects *by David Smith* (Fig. A3.14)

Introduction

The insect faunas described here are from the series of open area excavations that occurred along the line of the A13 Thames Gateway improvements during Phase III of the archaeological programme. Material was selected for insect analysis based on two factors. Primarily, it was decided to concentrate on deposits associated with the main archaeological features at these sites, such as trackways and ditches. Secondly, samples were selected based on the degree of apparent preservation. At Prince Regent Lane (Freemasons Road) and Woolwich Manor Way this had been indirectly assessed during the assessment of plant macrofossils (Giorgi in Gifford and Partners 2001a; 2001b; 2002; 2003a; 2003b) and at Movers Lane samples were assessed specifically for insects (Robinson in Wessex Archaeology 2003). This was an extensive investigation and the samples analysed come from various periods as well as sites. These are listed in Table A3.5. It was hoped that an examination of the insect remains from these locations might provide information on the nature of the environment and land use surrounding the sites, and the nature of materials that may have been deposited into the features.

Methodology

The samples were initially processed at the Museum of London Archaeology Service. The samples were divided with part of the sample retained for further analysis and a second part being processed for plant macrofossils. Unfortunately, the retained 'whole earth' samples from Freemason Road and Woolwich Manor Way were not available for insect analysis when the present work programme commenced. The insect analysis described therefore took place on the plant macrofossil flots and residues. The former had been retained over a 250μm mesh sieve and the residues retained over a 1mm mesh sieve. Unfortunately, the use of a 1mm mesh when the residues were processed means that some insect fragments will not have been retained and will have been lost to analysis. However, the material from Movers Lane was processed by Wessex Archaeology where the complete samples had been sieved over a 300μm mesh during a previous assessment for insect analysis. The context details, archaeological description and the weights and volumes of the samples are presented in Table A3.5. During this study the various flot and heavy residues fractions were re-combined and then were processed using the standard method of paraffin

Table A3.5 Context details for the insect analysis

Site	*Site code*	*Period*	*Context no.*	*Context type*	*Sample no.*	*Vol. soilprocessed by flotation (L)*
Prince Regent Lane (Freemasons Road)	FRU01	MBA	146	Fill of ditch 132 (Area B)	143	19
	FRU01	EMBA	72	Posthole fill associated with EMBA double timber post alignment (Str. 32, Area A)	103	19
	FRU01	MLBA	125	Flood deposit (Area B)	133	10
	FRU01	MLBA	46	Peat layer	92	9
	FRU01	MLBA	47	Peat layer	99	9
	FRU01	LBA-EIA	37	Fill of ditch 38 (Area B)	52	19
Woolwich Manor Way	WMA02	EMBA	28	Peat layer under trackway 2/14 (Area 2)	1	2
	WMA02	EMBA	57	Peat layer under trackway 29 (Area 1)	23	20
	WMA02	MLBA	1	Peat layer overlying trackway 2/14 (Area 2)	8	9
	WMA02	MLBA	56	Peat layer overlying trackway 29 (Area 1)	22	20
Movers Lane	RIR01	MLBA	1049	Fill of ditch 1038 (Area 2)	6	6
	RIR01	EMBA	3011	Peat associated with trackway 3031 (Area 2)	69	6

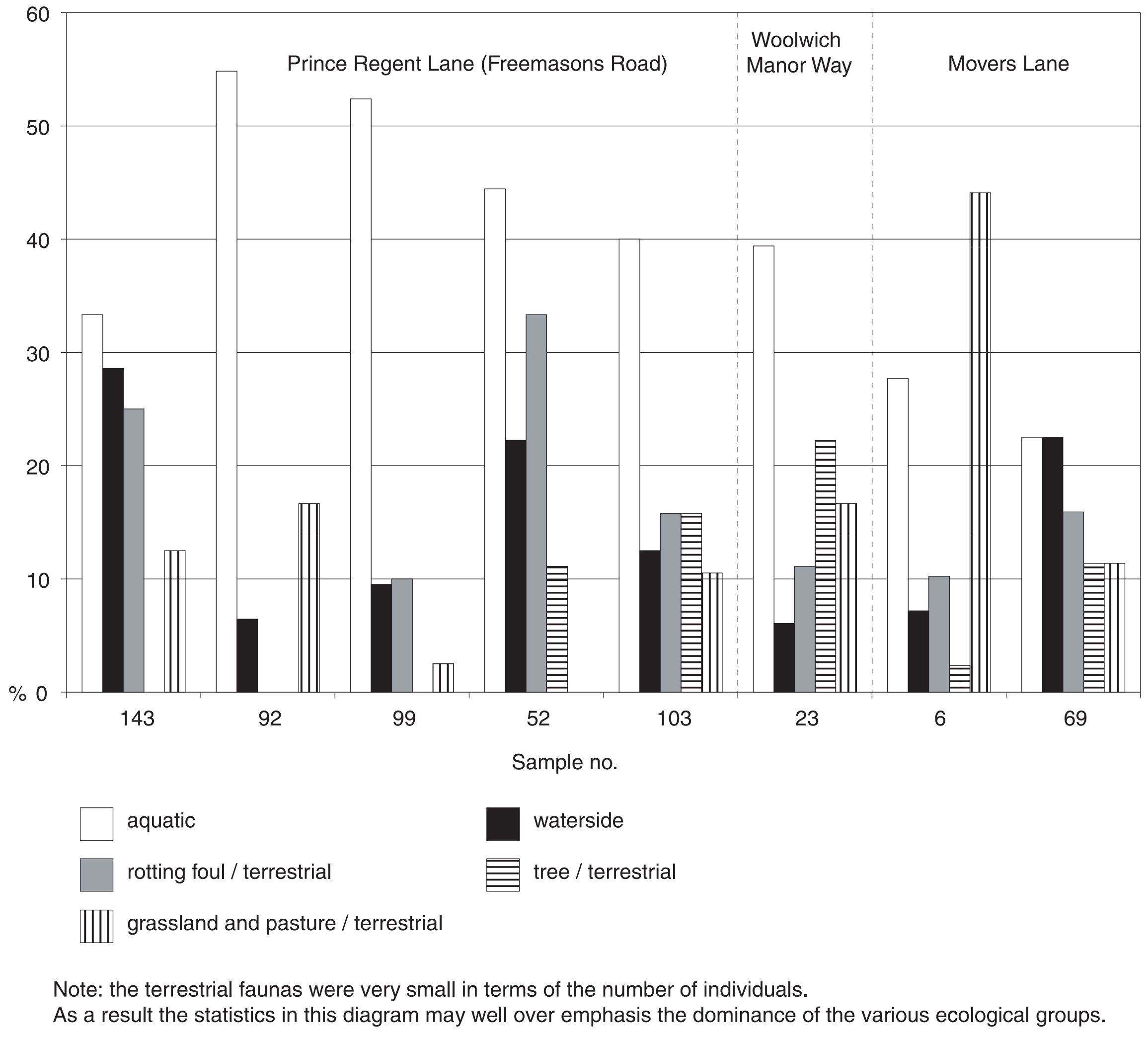


Fig. A3.14 The relative proportions of the ecological groups of Coleoptera recovered from the A13 sites

Table A3.6 The insect assemblages

Site code		*PRL (FRU)*						*WMW*			*ML*		
Sample number	*Ecological codes*	*143*	*103*	*133*	*92*	*99*	*52*	*1*	*23*	*8*	*6*	*69*	*Plant associations*
COLEOPTERA													
Carabidae													
Leistus ?ferrugineus (L.)		-	-	-	-	-	-	-	-	-	1	-	
Nebria brevicollis (F.)		-	-	-	-	-	-	-	-	-	1	-	
Dyschirius globosus (Hbst.)		-	1	-	-	2	-	-	-	-	1	1	
Bembidion? lampros (Hbst.)		-	-	-	-	-	-	-	-	-	1	-	
Bembidion doris (Panz.)		-	-	-	-	1	-	-	2	-	-	-	
B. guttula (F.)		-	-	-	-	-	-	-	-	-	1	-	
Bembidion spp.		-	1	-	1	-	1	-	-	-	-	-	
Patrobus sp.		-	-	-	-	-	-	-	-	1	-	-	
Pterostichus nigrita (Payk.)	ws	-	-	-	-	-	-	-	-	-	-	1	
Pterostichus minor (Gyll.)	ws	-	-	-	-	-	-	-	1	-	-	1	
Pterostichus spp.		-	-	-	-	-	-	-	-	-	3	-	
Calathus fuscipes (Goeze)		-	-	-	-	1	-	-	-	-	-	-	
Calathus melanocephalus (L.)		-	-	-	-	-	-	-	-	-	-	1	
Agonum sp.		-	-	-	-	-	-	-	1	-	1	-	
Platynus dorsalis (Pont.)			-	-	-	1	-	-	-	-	-	-	
Amara spp.		1	-	-	-	-	-	-	-	-	-	1	
Syntomus truncatellus (L.)		-	-	-	-	-	-	-	-	-	1	-	
Halididae													
Haliplus spp.	a	-	-	-	-	-	-	-	-	-	1	-	
Dytiscidae													
Hygrotus spp.	a	-	-	-	-	1	-	-	-	-	1	-	
Hydroporus spp.	a	-	-	-	-	1	-	-	-	-	1	1	
Colymbetes fuscus L.	a	-	1	-	1	1	1	-	-	-	-	-	
Notaris? clavicornis (Geer.	a	-	-	-	-	-	-	-	-	-	-	1	
Agabus bipustulatus (L.)	a	1	-	-	-	-	-	-	-	-	-	-	
Agabus spp	a	-	-	-	-	-	-	-	-	-	-	1	
Acilius spp.	a	-	-	-	-	1	-	-	-	-	-	-	
Gyrinidae													
Gyrinus spp.	a	-	-	-	-	-	-	-	-	-	1	-	
Hydraenidae													
Hydraena testacea Curt.	a	1	1	-	1	-	-	-	-	-	18	-	
Hydraena britteni Joy	a	-	-	-	-	-	-	-	-	-	-	1	
Hydraena spp.	a	-	-	-	-	-	1	-	-	-	9	4	
Ochthebius minimus (F.)	a	-	-	-	4	15	-	-	-	-	6	1	
Octhebius spp.	a	1	5	-	8	30	9	1	-	-	4	1	
Limnebius spp.	a	-	1	-	1	-	-	-	-	-	1	-	
Helophorus spp.		-	1	-	1	8	1	-	-	-	7	-	
Hydrophilidae													
Coelostoma orbiculare (F.)	a	-	4	-	-	1	-	-	-	1	-	3	
Cercyon ustulatus (Preyssl.)	a	-	-	-	-	-	-	-	1	-	-	-	
Cercyon tristis (Ill.)	a	-	-	-	-	-	-	-	-	-	1	-	
Cercyon sternalis Shp.	a	-	-	-	-	-	-	-	7	-	-	-	
Cercyon spp.		-	5	-	-	-	1	1	-	-	-	-	
Megasternum boletophagum (Marsh.)		2	-	-	-	-	-	-	-	-	1	1	
Cryptopleurum minutum (F.)		-	-	-	-	-	-	-	-	-	1		
Hydrobius fusipes (L.)	a	-	3	-	-	1	1	-	2	-	1	1	
Laccobius spp.	a	-	-	-	-	-	-	-	-	-	5	-	
Cymbiodyta marginella (F.)	a	-	-	-	-	-	-	-	-	-	-	1	
Chaetarthria seminulum (Hbst.)	a	-	-	-	-	-	-	-	-	-	-	2	
Histeridae													
Acritus nigricornis (Hoffm.)	df	-	1	-	-	-	-	-	-	-	-	-	
Hister spp.	df	1		-	-	-	-	-	-	-	-	-	
Abraeus globosus (Hoffman)		-		-	-	-	-	-	-	-	1	-	

Table A3.6 The insect assemblages (continued)

Site code		*PRL (FRU)*						*WMW*			*ML*		
Sample number	*Ecological codes*	*143*	*103*	*133*	*92*	*99*	*52*	*1*	*23*	*8*	*6*	*69*	*Plant associations*
Silphidae													
Silpha spp.		1	-	-	-	-	-	-	-	-	1	-	
Catopidae													
Catops spp.		-	-	-	-	-	-	-	-	-	1	-	
Orthoperidae													
Corylophus cassidoides (Marsh.)	ws	-	-	-	-	-	-	-	-	-	-	2	
Orthoperus spp.		-	-	-	1	1	-	1	1	-	7	7	
Ptiliidae													
Ptilidae Genus & spp. indet.		-	-	-	-	-	-	-	-	-	2	3	
Acrotrichis spp.			-	-	-	-	-	-	-	-	-	1	
Staphylinidae													
Micropeplus staphylinoides (Marsh.)		-	-	-	-	1	-	-	-	-	1	-	
Omalium spp.		-	-	-	-	-	-	-	-	-	1	-	
Olophrum spp.	ws	-	-	-	-	-	-	-	-	-	1	-	
Lesteva heeri Fauv.	ws	-	-	-	-	-	-	-	-	-	-	2	
Lesteva longelytrata (Goeze)	ws	-	-	-	-	-	-	-	-	2	-	-	
Lesteva spp.	ws	-	1	-	-	-	-	-	-	-	1	-	
Trogophloeus bilineatus (Steph.)	ws	-	-	-	-	-	1	-	-	-	-	-	
Trogophloeus spp.		-	-	-	-	1	-	-	-	-	-	1	
Aploderus caelatus (Grav.)		-	-	-	-	1	-	-	-	-	2	-	
Oxytelus rugosus (F.)	df	-	-	-	-	1	-	-	-	-	2	1	
Oxytelus sculpturatus Grav.	df	-	-	-	-	1	-	-	-	-	1	-	
Platystethus arenarius (Fourc.)	df	-	-	-	-	-	-	-	-	-	1	-	
Platystethus cornutus (Grav.)	ws	1	1	-	1	3	-	-	-	-	-	-	
Stenus spp.		1	-	-	4	5	-	-	1	2	2	-	
Stilicus orbiculatus (Payk.)		-	-	-	-	-	-	-	-	-	-	2	
Lathrobium spp.		-	1	-	-	-	-	1	2	-	1	2	
Xantholinus spp.		-	-	-	-	-	-	-	-	-	1	-	
Quedius spp.		-	-	-	-	-	1	-	-	-	-	-	
Philonthus spp.		-	1	-	-	4	-	-	-	-	1	2	
Tachinus spp.		-	-	-	-	-	-	-	-	-	1	-	
Aleocharinidae Genus & spp. Indet.		-	-	-	3	4	-	-	-	1	8	3	
Pselpahidae													
Euplectus spp.		-	-	-	-	-	1	-	-	-	-	-	
Rybaxis sp.		-	-	-	-	-	-	-	-	1	-	-	
Cantharidae													
Cantharis sp.		-	-	-	-	-	-	-	-	-	2	-	
Elateridae													
Agroties spp.	p	-	-	-	-	-	-	-	1	-	4	-	
Adelocera murina (L.)	p	1	-	-	-	-	-	-	-	-	1	1	
Actenicerus sjaelandicus (Müll)	p	-	-	-	-	-	-	-	-	-	1	-	
Athous? haemorrhoidalis (F.)	p	-	-	-	-	-	-	-	-	-	1	-	
Athous spp.	p	-	-	-	-	-	-	-	-	-	-	1	
Eucnemidae													
Melasis buprestoides (L.)	l	-	-	-	-	-	-	-	1	-	-	-	
Throscidae													
Throscus spp.	ws	-	-	-	-	-	-	-	1	-	-	-	
Helodidae													
Helodidae Gen. & spp. Indet.	a	-	1	-	-	-	-	-	2	-	3	-	
Dryopidae													
Dryops spp.	a	-	-	-	-	2	-	-	1	1	1	1	
Oulimnius spp.	a	1	-	-	1	-	-	-	-	-	-	-	
Elmis aenea (Müll.)	a	3	-	-	-	-	-	-	-	-	-	-	
Nitidulidae													
Brachypterus urticae (F.)	p	-	-	-	-	-	-	-	-	-	4	-	*Urtica dioica* L. (stinging nettle)

Table A3.6 The insect assemblages (continued)

Site code		*PRL (FRU)*						*WMW*			*ML*		
Sample number	*Ecological codes*	*143*	*103*	*133*	*92*	*99*	*52*	*1*	*23*	*8*	*6*	*69*	*Plant associations*
Cryptophagidae													
Cryptophagus spp.		-	-	-	-	1	-	-	-	-	-	-	
Lathridiidae													
Enicmus minutus (Group)		-	-	-	-	1	-	-	-	-	-	-	
Lithostygnus serripennis Broun		-	-	-	-	-	-	-	-	1	-	-	
Cartodere ruficollis (Marsh.)		-	-	-	-	-	-	-	-	3	-	-	
Corticaria/ corticarina spp.		-	-	-	-	-	-	-	1	-	1	-	
Colydiidae													
Cerylon histeroides (F.)	l	-	-	-	-	-	-	-	1	-	-	-	
Cerylon sp.	l	-	-	-	-	-	-	-	-	-	-	1	
Endomychidae													
Mycetaea hirta (Marsh.)		-	-	-	-	-	-	-	-	1	-	-	
Coccinellidae		-											
Chilocorus bipustulatus (L.)			-	-	-	-	-	-	-	-	1	-	Heather (*Calluna* and *Erica* spp.)
Asphidiphoridae													
Aspidiphorus orbiculatus (Gyll.)	l	-	-	-	-	-	-	-	-	-	1	-	
Anobiidae													
Grynobius planus (F.)	l	-	-	-	-	-	-	-	1	-	-	-	
Anobium punctatum (Geer)	l	-	1	-	-	-	-	-	-	-	1	1	
Hadrobregmus denticollis (Crtz)	l	-	-	-	-	-	-	-	-	-	-	1	
Scarabaeidae													
Onthophagus spp.	df	-	1	-	-	-	1	-	-	-	1	-	
Oxyomus silvestris (Scop.)		-	1	-	-	1	-	-	-	-	-	-	
Aphodius sphacelatus (Panz.) or *A. prodromus* (Brahm)	df	-	-	-	-	1	1	-	-	-	7	-	
Aphodius fimentarius (L.)	df	-	-	-	-	1	1	-	-	-	-	-	
Aphodius fasciatus (Ol.) / *A. putridus* Herbst	df	-	-	-	-	-	-	-	-	-	1	-	
Aphodius spp.	df	1	1	-	-	-	-	1	2	-	-	6	
Melolontha melolontha (L.)	p	-	-	-	-	-	-	-	-	-	1	-	
Phyllopertha horticola (L.)	p	-	-	-	-	-	-	-	-	-	5	1	
Chyrsomelidae													
Donacia marginata Hopp	ws	-	-	-	-	1	1	-	-	-	2	1	*Sparganium ramosum* (Erect burr-reed)
Donacia simplex F.	ws	1	-	-	-	-	1	-	-	-	-	-	Range of water reeds and rushes
Donacia spp.	ws	-	-	1	-	-	-	-	-	-	-	-	
Plateumaris sericea (L.)	ws	1	1	-	-	-	1	-	-	-	1	1	Usually on *Carex* spp. (sedges)
Prasocuris phellandri (L.)	ws	-	-	1	-	-	-	-	-	-	-	1	On aquatic Apiacae (Umbellifers)
Agelastica alni (L.)	l	-	-	-	-	-	-	-	-	-	-	-	*Alnus* spp. (Alder spp.)
Phyllotreta spp.		-	-	-	-	2	-	-	-	-	1	1	
Chaetocnema concinna (Marsh.)		-	-	-	-	-	-	-	-	-	1	1	
Scolytidae													
Kissophagus hederae (Schmitt)	l	-	1	-	-	-	-	-	-	-	-	-	*Hedera helix* (L.) (Ivy)
Cuculionidae													
Apion craccae (L.)	p	-		-	-	-	-	-	-	-	1	-	*Vicia* species (various vetches)
Apion spp.	p	-	1	-	1	-	-	-	1	-	6	2	
Phyllobius sp.	p	-	-	-	-	-	-	-	-	-	3	-	
Barypeithes spp.		-	-	-	-	-	-	-	1	-	-	-	
Sitona hispidulus (F.)	p	-	-	-	-	-	-	-	-	-	2	-	*Trifolium* species (Clover)
Sitona spp.	p	-	-	-	-	-	-	-	1	-	-	-	
Bagous spp.	a	-	-	-	1	2	-	-	-	-	1	-	

Table A3.6 The insect assemblages (continued)

Site code		*PRL (FRU)*						*WMW*			*ML*		
Sample number	*Ecological codes*	*143*	*103*	*133*	*92*	*99*	*52*	*1*	*23*	*8*	*6*	*69*	*Plant associations*
Tanysphyrus lemnae (Payk.)	ws	1	1	-	1	5		-	-	-	8	6	*Lemna* spp. (Duckweed)
Notaris acridulus (L.)	ws	-	-	-	-	1	1	-	-	-	-	2	Often on *Glyceria maxima* (Hartm.) Holmb. (reed sweet-grass) and other *Glyceria* species (sweet-grasses)
Notaris spp.	ws	1	-	-	-	-	-	-	-	-	1	-	
Thyrogenes spp.	ws	-	1	-	-	-	-	-	-	-	-	1	
Curclio spp.	l		1	-	-	-	-	-	-	-	-	1	
Leiosoma deflexum (Panz.)	ws	1	-	-	-	-	-	-	-	-	-	-	*Caltha palustris* L. (Marsh marigold)
Alophus triguttatus (F.)	p	-	-	1	-	-	-	-	-	-	18	-	
Limnobaris spp.	ws	-	-	-	-	-	1	-	-	-	-	-	Juncaceae and Cyperaceae (rushes)
Ceutorhynchus contratus (Marsh.)	p	-	-	-	-	-	-	-	-	-	3	-	Associated with Resedaceae and Papaveraceae (migonettes and poppies)
Ceutorhynchus eryisimi (F.)	p	-	-	-	-	-	-	-	-	-	1	-	On *Capsella bursa-pastoris* (L.) Medik. (Shepard's purse)
Ceutorhynchus pollinarius Forst.	p	-	-	-	1	-	-	-	-	-	-	-	*Urtica dioica* L. (stinging nettle)
Ceutorhynchus spp.	p	-	-	-	-	-	-	-	-	-	2	-	
Gymnetron spp.	p	-	1	-	-	1	-	-	-	-	3	-	*Plantago lanceolata* L. (plantain)
Rhynchaenus quercus (L.)	l	-	-	-	-	-	-	-	-	-	1	-	*Quercus* spp. (Oak)
Rhynchaenus sp.	l	-	-	-	-	-	1	-	1	-	-	1	

flotation as outlined in Kenward *et al.* (1980). Insect remains were sorted and identified under a low-power binocular microscope at a magnification between x15 to x45. Where achievable the insect remains were identified to species level by direct comparison to specimens in the Gorham and Girling insect collections housed in the Institute of Archaeology and Antiquity, University of Birmingham.

Results

The majority of the insect remains present are beetles (Coleoptera), with very few individuals of true bugs (Hemiptera) and flies (Diptera) present. A list of Coleoptera recovered is presented in Table A3.6. The nomenclature for Coleoptera (beetles) follows that of Lucht (1987). Column 14 in Table A3.6 lists the host plants for the phytophage species of beetle that were recovered and are predominantly derived from Koch (1989; 1992). The plant taxonomy follows that of Stace (1997).

In order to aid interpretation, where possible, taxa have been assigned to ecological groupings. The Coleoptera follow a simplified version of the scheme suggested by Robinson (1981; 1983). The affiliation of each beetle species to a particular ecological grouping is coded in the second column of Table 2. The meaning of each ecological code is explained in the key at the base of Table A3.6. The occurrence of each of the ecological groupings is expressed as a percentage in Table A3.7 and in Figure A3.14. The pasture/grassland, dung and woodland/ timber beetle species are calculated as percentages of the number of terrestrial species, as opposed to the whole fauna.

Prince Regent Lane (Freemasons Road)

Posthole 73 (Str. 32, Area A): A moderately sized insect fauna came from the fill of post hole 73 (sample 103) associated with the double post alignment (Str. 32, Fig 4.7). The insect fauna is dominated by taxa associated with slow flowing or standing water such as *Colymbetes fuscus, Hydraena testacea, Ochthebius* spp., *Limnebius* and *Coelostoma orbiculare* (Nilsson and Holmen 1995; Hansen 1986). There is evidence for stands of sedges and areas of duckweed locally. The former is suggested by the

Table A3.7 The relative proportions of the ecological groups of Coleoptera recovered from the A13 sites

	Prince Regent Lane (Freemasons Road)						*Woolwich Manor Way*			*Movers Lane*	
	143	*103*	*133*	*92*	*99*	*52*	*1*	*23*	*8*	*6*	*69*
total number of individuals	21	40	3	31	105	27	5	33	11	195	80
total number of species	18	27	3	16	35	19	5	22	9	76	47
% aquatic	33.3	40.0	0.0	54.8	52.4	44.4	20.0	39.4	18.2	27.7	22.5
% waterside	28.6	12.5	66.7	6.5	9.5	22.2	0.0	6.1	18.2	7.2	22.5
% rotting foul / terrestrial	25.0	0.0	0.0	10.0	33.3	15.8	25.0	11.1	0.0	10.2	15.9
% tree / terrestrial	0.0	0.0	0.0	0.0	11.1	15.8	0.0	22.2	0.0	2.4	11.4
% grassland and pasture / terrestrial	12.5	100.0	16.7	2.5	0.0	10.5	0.0	16.7	0.0	44.1	11.4

presence of *Plateumaris sericea* and *Thyrogenes* spp. and the later by *Tanysphyrus lemnae* (Koch 1992). Given that this is interpreted as a post hole the insect fauna clearly suggest that the feature was probably flooded at some point.

There is also a suggestion as to the nature of the surrounding vegetation and landscape. The 'bark beetle' *Kissophagus hederae* is normally associated with ivy (*Hedera helix*) in woodland. The 'nut beetle' *Curclio* is also an indicator for woodland, as can be the 'woodworm' *Anobium punctatum* which, in addition to its role as destroyer of furniture and structural timbers in settlement, is also often associated with dry deadwood in forests and woodlands. Once again, due to the small size of the fauna recovered, care should be taken with the interpretation of these taxa.

Ditch 132, Area B: A small fauna came from middle Bronze Age ditch 132 (sample 143, Figs. 4.7 and 4.11). The fauna is dominated by beetles associated with slow flowing or stagnant water (Table A3.7 and Fig. A3.14). Typical of this environment are the predatory 'diving beetle' *Agabus bipustulatus* and the small hydreanid *Octhebius* (Nilsson and Holmen 1995; Hansen 1986). Similar conditions are also suggested by a number of the phytophages (plant feeding) taxa recovered. The presence of waterside vegetation is clearly indicated by *Donacia simplex* and *Plateumaris sericea* which are associated with *Sparganium ramonsum* (branched bur-reed) and other waterside vegetation, such as *Phragmites* (reeds) and *Carex* (sedges) (Koch 1992). The presence of still water is also suggested by *Tanysphyrus lemnae* which feeds on *Lemna* spp.(duckweed) and by *Liosoma deflexum* which is associated with *Caltha palustris* (marsh marigold) (Koch 1992).

There are also indications that the ditch may have contained areas of sands and gravels, or that water from a fast moving area of river periodically flooded into the ditch. Elmid species such as *Oulimnius* spp. and *Elmis aenea* are normally associated with flowing water crossing over sands and gravels (Holland 1972).

There are hints that some of the landscape around this feature may have been relatively open. The 'click beetle' *Adelocera murina* is commonly associated with grassy ground and woodland edges. A single *Aphodius* 'dung beetle' was also recovered. However, these aspects of the fauna should not be over interpreted and, in the case of this feature, the plant macrofossils and pollen analysis may give a far better indication of the nature of the surrounding vegetation.

Flood deposit 125 Area B and peat layers 46 and 47 Area A : Three insect faunas come from the 'sandy' layer 125 (sample 133, Fig. 4.13) and peat development (samples 92 and 99) above the early Bronze Age 'bridge' (Str. 32). Once again the vast majority of the insect remains recovered are associated with slow flowing water (Table A3.7 and Fig. A3.14). Again, this is indicated by a range of water beetles recovered such as *Hygrotus* spp. *Hydroporus* spp., *Colymbetes fuscus, Acilius, Hydraena testacea, Ochthebius minimus* and *Coelostoma orbiculare* (Nilsson and Holmen 1995; Hansen 1986). Similar conditions are also suggested by the dryopid *Dryops* spp. and the weevils *Bagous* spp. and *Tanysphyrus lemnae*, the latter species is associated with duckweed (Koch 1992). There also indicators for stands of reed sweet grass, bur-reeds and aquatic hogweeds (Apiacae). This is suggested by the recovery of *Notaris acridulus*, *Donacia marginata* and *Prasocuris phellandrii* which feed on these plants (Koch 1992).

There is limited evidence from the insects that the area around the structure may have been relatively open or that disturbed ground was present. This is suggested by the recovery of *Ceutorhynchus pollinarius* which is associated with *Urtica dioica* (stinging nettle), *Gymnetron* spp. which is associated with plantain *Plantago lanceolata* (plantain), and a single individual of an *Aphodius* 'dung beetle'. However, again, without supporting information from the pollen and plant macrofossils this aspect of the fauna should not be over emphasised.

Ditch 38, Area A: Sample 52 came from ditch 38 (Fig. 4.15). The small insect fauna recovered contains several individuals of the set of water beetles, described above, which are typical of slow flowing water. There is also evidence that a mixed stand of waterside vegetation consisting of *Carex* (sedges), *Sparganium* spp. (bur-reeds) and *Glyceria maxima* (reed sweet grass) grew in the ditch. This is indicated by the 'reed beetle' *Donacia* spp. and the weevil *Notaris acridulus* (Koch 1992). Again, there is evidence for open ground since a number of individuals of *Onthophagus* and *Apion* 'dung beetles' were recovered. A single individual of the 'leaf minor' *Rhynchaenus* spp. was also recovered suggesting there was some tree cover in the area. Once again these aspects of the fauna should not be over emphasised, especially if there is no corroborating evidence from the plant macro fossils and pollen analyses.

Woolwich Manor Way

Only one of the four samples submitted from Woolwich Manor Way produced an interpretable insect fauna. This was from peat context 57 (sample 23) below the trackways in Area 1 (Fig. 5.3). This moderate sized fauna is dominated by species such as *Ochthebius* spp., *Cercyon sternalis*, *Laccobius* spp. and *Dryops* spp. which are all associated with slow flowing or stagnant waters (Hansen 1986).

A few individuals of a number of species associated with deadwood are present. *Melasis buprestoides* is normally associated with dry deadwood of *Quercus* spp. (oak) or *Fagus* spp.(beech) and is today relatively uncommon (Red Data Book notable B) (Hyman and Parsons 1992). However, it is a species that is regularly encountered in prehistoric trackway and wood peat sites in a variety of locations throughout the British Isles (Buckland and Buckland 2006). *Cerylon histeroides* is a small predator which hunts scolytid 'bark beetles' in the deadwood of a range of trees and *Grynobius planus* is a 'woodworm' associated with deadwood and dry timber from a range of hardwood trees. Though these species may indicate the presence of woodland in the area they may also have lived and bred in the timbers of the trackway itself. A single wing case of an *Aphodius* 'dung beetle' was also recovered.

The remaining three samples from Woolwich Manor were either too small to be interpretable or, in the case of sample 22, produced no insect fauna at all. Sample 8 also contained an individual of the lathridiid *Lithostygnus serripennis*. This species is a recent importation from New Zealand with its first record in Britain being in the 1920s (Buckland and Buckland 2006). This, unfortunately, suggests that this sample may have become contaminated during sampling or storage.

Movers Lane

Sample 69 from the peat associated with trackway 3031 (Figs. 7.8 and 7.9) produced a relatively large fauna. The majority of the fauna is again made up of a range of beetles associated with slow flowing water conditions. There are also indications that stands of waterside vegetation existed in the area of the trackway. This is indicated by the recovery of *Donacia marginata* which is associated with *Sparganium* spp. (bur-reed) and the 'reed beetles' *Donacia simplex* and *Plateumaris sericea* which are both associated with a range of sedges, rushes and water reeds.

There were also a few individuals of *Aphodius* 'dung beetles' recovered along with a single individual of the 'garden chafer' *Phyllopertha horticola* suggesting that grassland or meadow was present in the area. There are, again, a number of species which are associated with deadwood such as *Cerylon* spp., the 'woodworms' *Anobium punctatum* and *Hadrobregmus denticollis* and the *Curculio* 'nut weevil'. This may indicate that woodland is present in the local environment and/or that these species were associated with the decaying trackway.

Sample 6 from Movers Lane came from the fill of late Bronze Age ditch 1038 (Fig. 7.9). Once again the insect fauna is dominated by a range of water beetles that are associated with slow flowing or standing water. Typical for these conditions are *Haliplus* spp., *Hygrotus* spp., *Hydroporus* spp., *Hydraena testacea*, *Ochthebius minimus*, *Limnebius* spp. *Cercyon tristis*, *Laccobius* spp. and *Dryops* spp. (Nilsson and Holmen 1995; Hansen 1986). Also present was a single individual of a 'whirligig' *Gyrinus* spp. This beetle is normally associated with still and open water. The small weevil *Tanysphyrus lemnae* was also recovered and is associated with duckweeds.

There are also indications that some of the landscape surrounding the ditch consisted of grassland or pasture. This is suggested by the two 'chafers' recovered, *Melolontha melolontha* and *Phyllopertha horticola*, which both feed as larvae on the roots of grass in open dry pasture (Jessop 1986). *Onthophagus* and *Aphodius* 'dung beetles' again indicate that cattle or other herbivores may have been present in the area. The two 'click beetles' *Adelocera murina* and *Actenicerus sjaelandicus* are often associated with damp grassy areas, disturbed ground and agricultural land (Koch 1989). Disturbed ground is also indicated by the presence of the nitiduliid *Brachypterus urticae* which feeds on stinging nettle (*Urtica dioica)*. Similarly, the small 'ladybird' *Chilocorus bipustulatus* is normally associated with heather (*Calluna* spp. or *Erica* spp.).

There is a slight hint that some woodland or trees were present in the area. This is suggested by the 'woodworm' *Anobium punctatum* and the small mould beetle *Aspidiphorus orbiculatus,* both of which are commonly associated with a range of deadwood in a variety of trees. Similarly the 'leaf minor' *Rhynchaenus quercus* is associated with oak trees (*Quercus* spp.).

Discussion

Unfortunately, the individual insect faunas recovered from a range of deposits along the route of the A13 Thames Gateway are often fairly small sized and therefore they should not be interpreted in isolation, but should be used to support pollen and plant macrofossil analyses. It is evident that the majority of the features contained still waters, often associated with a range of waterside vegetation, or, in the case of the trackways, crossed this type of environment.

One major difficulty with these faunas and their archaeological circumstance is the degree to which they can be used reliably to reconstruct woodland surrounding the site. Taken at face value the faunas could suggest that the Bronze Age trackways in particular were located within woodland. However, many of the species recovered could be associated not with woodland but with the rotting timbers of the trackways themselves. Certainly, species such as *Anobium punctatum*, *Hadrobregmus denticollis*, *Melasis buprestoides* and *Cerylon* have occasionally been recovered from trackways and timber structures in the archaeological record before (Buckland and Buckland 2006; Girling 1980; Smith *et al.* 2000). It has been suggested previously that the presence of these or similar species at trackway sites probably indicates that the structures remained exposed on the mire or bog surface for some time. However, this does not seem to have been the case with a number of other trackways, such as those in the Somerset Levels, at Bronze Age Goldcliff, Gwent (Smith *et al.* 2000), and the Bronze Age trackways in London at Bramcote Green (Thomas and Rackham 1996) and Dagenham Hays (Smith 1996), where no wood boring insects were recovered and where it appears therefore that the structures were quickly inundated.

Another factor in all of the samples from the sites examined is that small numbers of 'dung beetles' and 'chafers' are routinely recovered. This may suggest that some of the landscape near to the archaeological features was cleared of woodland or used as pasture. However, given the small size of the faunas recovered it is very difficult to suggest the extent of this clearance. Pollen and plant macrofossils may provide a better indictor for this aspect of the landscape. Notably, the dates for these sites do match some of the early dates suggested for woodland clearance in the area (Sidell *et al.* 2000; Sidell *et al.* 2002; Thomas and Rackham 1996; Wilkinson *et al.* 2000). One common assumption that is often made when dung beetles are recovered from trackways is that this indicates that cattle may have been driven across the structure. This interpretation of the insect remains is some thing of a fallacy. Dung beetles have a very strong flight potential and are a very routine part of the 'background fauna' found on most archaeological sites (Kenward 1975; 1978). As a result low numbers of them are to be expected on almost any archaeological site and do not necessarily indicate that grazing was very local or that animals were directly involved with the use of any structures on site. High numbers of dung beetles are required before suggesting the presence of cattle with any confidence. Moreover one cannot rule out wild herbivores such as deer.

Locally a number of other insect faunas of similar dates have been recovered; several from trackways. The faunas from Bronze Age Bramcote Green (Thomas and Rackham 1996), Dagenham Hays (Smith 1996), Beckton (Elias *et al.* 2009) and Belloit Street, Greenwich (Elias *et al.* 2009) were similar to those recovered from the A13 sites. All indicated the presence of still waters, reed beds and a potentially cleared landscape. One exception to this is the fauna from the Neolithic trackway and wood peats from Atlas Wharf (Smith 1999). In this case it is clear that the trackway crossed a major channel of the Thames where fast flowing water predominated and that a dense stand of alder carr and woods surrounded the site.

However, despite the methodological issues with these assemblages, these faunas from the A13 Thames Gateway do generally appear to match the general sequence for the development and change of insect faunas in this part of the Thames Valley (Elias *et al.* 2009; Smith in press).

Charred and waterlogged plant remains *by Ruth Pelling*

Introduction

The excavations along the route of the A13 Thames Gateway Road Scheme have revealed a landscape wide sequence of sediment deposition including mid-Holocene peat formation. Throughout the programme of excavation samples were taken for the extraction of the biological remains in order to trace vertical and lateral patterns in the vegetation and hydrological conditions along the edges of this section of the Thames floodplain. Useful sequences of plant remains have been recovered from Prince Regent Lane, Woolwich Manor Way and Movers Lane, largely relating to the end of the Neolithic and the Bronze Age period of peat formation. The greatest value of the deposits lies in their potential to provide a landscape wide understanding of the sedimentary development and in their comparison with other published sites both locally, and those further up and down river.

Methodology

Systematic sampling across vertical and lateral sequences was undertaken at various locations along the length of the road scheme. The strategy was designed to enable sampling of a wide area and range of deposit types. For each site samples were processed by floatation or wet sieving with the flots collected on a 0.25mm mesh and residues on a 1mm mesh. Flots were kept wet while residues were dried before being sorted for artefacts. Following an initial assessment of the flots (Giorgi in Gifford and Partners 2001a; 2001b; 2002; 2003a; 2003b, Allen and Stevens in Wessex Archaeology 2003) a total of 32 were selected for more detailed study of waterlogged material: 18 from Prince Regent Lane, Freemasons Road Underpass (FRU01), 6 from Woolwich Manor Way (TGW00/WMW00 and WMA02) and 8 samples from Movers Lane (RIR01). Flots selected for more detail examination were first washed through a stack of sieves with water. Each fraction (down to 0.25mm) was scanned under a x10 – x40 stereo-binocular microscope. Species present were identified and item frequency was estimated. Precise counts were not given. While this method limits the potential for quantitative analysis it does enable a greater number of samples to be examined in sufficient detail to characterise the deposits. Nomenclature follows Stace (1997) and species are presented in ecological groups. Item frequency follows a five point scale as follows: 1 = 1-5 items; 2 = 6-25; 3 = 25-100; 4 = 100-500; 5 = >500 or exceptionally abundant. The presence of non-plant remains is also noted. The results are discussed by site and reference is made to the assessment results. As samples were largely related to chronological sequences through flood-plain peats and alluvium rather than distinct archaeological features, the charred and waterlogged plant remains are discussed together in order to explore the temporal and spatial data. Each site is discussed in turn, while an overview section traces the evolution of the wider landscape bringing in both the comparisons between the three sites and data from contemporary sites elsewhere in this section of the Lower Thames Valley.

A number of samples were shown to contain charred plant remains. Following assessment of the material a small number were examined in more detail at analysis level. A total of three samples are discussed from Prince Regent Lane/Freemasons Road Underpass and six samples from Woolwich Manor Way. Charred plant remains (retained in the 0.5mm and larger sieves) were extracted under a binocular microscope at x10 to x40 magnification following standard methods. Identifications were based on well established morphological criteria and by comparison with modern reference material held at Wessex Archaeology. Material is quantified on the basis of grain, seed, chaff item and so on and nomenclature of wild species follows Stace (1997). The results are given in a separate table (Tables A3.8-15).

Prince Regent Lane (Freemasons Road)

A total of 29 samples were taken from 18 deposits during the excavation at Freemasons Road Underpass; these came from a range of features including multiple samples from the peat deposits. Archaeological features sampled included fills of ditches, a channel, a pit and post-hole. Sample volumes range from 10 to 90L, although most were 20 to 30L. The deposits are discussed by period and summarised below. The samples can be characterised by the major plant groups represented, most notably the seeds and catkins of alder, although other species including bur-reed (*Sparganium erectum*) are characteristic of some sample or deposit groups.

The early to middle Bronze Age features

Sample 165 was taken from gully 199 (fill 198) associated with the early Bronze Age 'enclosure' in Area B (Fig. 4.7). Assessment by Giorgi (in Gifford and Partners 2003b) demonstrated that few biological remains were present other than a few seeds and fruit of mainly aquatic species such as *Lemna* spp. (duckweed), *Chara* spp. (stoneworts), *Alisma* spp.(water plantain) as well as wood and charcoal flecks.

Two samples examined from the fill of ditch 132 in Area B (fill 146, sample 143, Figs 4.7 and 4.11) and posthole 73 associated with the 'bridge' (Str. 32) in Area A (fill 73, sample 103, Fig 4.7) produced very similar assemblages. Both assemblages were characterised by frequent wood fragments, seeds and cones of alder (*Alnus glutinosa*) and fruit of branched bur-reed (*Sparganium erectum*) suggesting a dominant vegetation of alder fen-carr. Aquatic species included crowfoots (*Ranunculus* subgen *Batrachium*), water plantain (*Alisma plantago-aquatica*), water-pepper (*Persicaria hydropiper*) and occasional seeds of duckweed (*Lemna* sp.) as well as oogonia of stonewort (*Chara* sp.) and the larval cases of caddisfly (order Trichoptera). These last three items are particularly indicative of standing water, presumably within the features.

Bankside vegetation which might have included species growing within the shallow muddy water of ditch fill 146 include branched bur-reed (*Sparganium erectum*), club-rushes (*Schoenoplectus* sp.), water dropwort (*Oenanthe aquatica),* fool's water-cress (*Apium nodiflorum*), gypsywort (*Lycopus europeaus*) and water mint (*Menthe aquatica*). Wet or damp grassland is indicated by meadow species including possible meadow rue (*Thalicturum flavum*) and ragged robin (*Lychnis flos-cuculi*) present in the post hole fill (sample 103), while *Juncus articulatus* gp.(rushes) and *Carex* spp. (sedges) and some of the buttercups may have derived from similar habitats.

In addition to the fruits and catkins of alder, seeds of elder (*Sambucus nigra*) and bramble (*Rubus* spp.) were present, which can today be seen in alder carr, but is also a common indicator for shrubby disturbed ground. Disturbed habitats and nitrogen rich soil are also suggested by the presence of fat hen (*Chenopodium album*) as well as stinging nettle (*Urtica dioica*), black nightshade (*Solanum nigrum*), hairy buttercup (*Ranunculus sardous*) and docks (*Rumex* sp.). Other seeds included those of *Viola odorata/hirta (*sweet or hairy violet). Sweet violet (*V. odorata*) is characteristic of shaded and wooded conditions while hairy violet (*V. hirta*) is found within calcareous pastures and open scrub. Either would be possible in this context. Possible food debris is suggested by nutshell fragments of *Corylus avellana* (hazel) from the post hole.

Middle to late Bronze Age flood deposit 125

Two samples (samples 133 and 153) were examined from flood deposit 125 in Area B (Fig. 4.13). The samples produced broadly similar assemblages characterised by wood, alder seeds and catkins, and fruits of branched bur-reed. A similar range of wetland species included crowfoots, water-plantain, pondweeds, duckweeds and stoneworts suggesting shallow, mineral rich water, with caddisfly larval cases suggesting open bodies of still water. In addition seeds of celery-leaved buttercup (*Ranunculus sceleratus*) were present. The wet, marshy grassland type vegetation is represented again by water-pepper, water-dropwort, fool's water-cress, gypsywort, water mint and branched bur-reed with blinks (*Montia fontana* subsp. *chondrosperma*), soft rush (*Juncus effusus* type) and wood-rush (*Luzula* sp.) also present. This last species suggests shady conditions, as may seeds of violets (*Viola odorata/hirta* type). Disturbed and drier habitats are suggested by the presence of elder together with docks, thistles (*Carduus/Cirsium* sp.), brambles, fat hen and stinging nettles.

Middle to late Bronze Age peats

Samples were taken from three locations, all representing sequences through the same middle to late Bronze Age deposit within a roughly 10x10m area. Deposit 32 was located to the east separated from contexts 46 and 47 by a channel truncating the peat. Layer 46 was situated in the south-west and 47 in the north-west. A total of six samples were taken from layers 46 and 47. The assessment demonstrated that the botanical composition of the samples was broadly similar, suggesting homogeneity through the deposit. Detailed scanning was therefore limited to one sample from each layer (samples 92 and 99). Four samples were examined from layer 32.

The deposits are characterised by a significant decline in alder (represented by a single cone bract in layer 46) and *Sparganium erectum*, but an increase in seeds of duckweed (*Lemna* sp), water plantain (*Alisma plantago-aquatica*) and possible crowfoots (*Ranunculus* subg *Batrachium*). The number of seeds and species diversity was also more limited than in the earlier deposits. Degraded wood fragments and a range of mostly aquatic species were present in all the samples, with occasional fragments of charcoal and insects. There is similarly a decline in dry ground vegetation compared to the previous phases: occasional seeds of bramble, elder and violets were the only species represented. The number of seeds of aquatic species, particularly duckweed as well as crowfoots and stoneworts, was significantly increased from previous phases while bank side/marshland vegetation was well represented: common spikerush (*Eleocharis palustris*), water mint and dropwort, marsh pennywort (*Hydrocotyle vulgaris*), spikerush (*Eleocharis* spp.) sedges and rushes were identified. Caddisfly larval cases were noted in one of the samples (Sample 54). Samples examined at assessment were also noted to contain pondweeds (*Potamogeton*), an aquatic plant of slow moving water. Generally these deposits suggest increasingly wet conditions and flooding of the marsh associated with the reduction of the alder carr and the formation of the peat deposits.

A background of drier ground continues to be suggested by seeds of elder, bramble and stinging nettle, although the range and number of ruderal species is decreased from previous phases. The residues produced occasional fragments of bone and burnt flint suggesting human activity on the drier ground.

Late Bronze Age to early Iron Age alluvium and occupation layers

The following samples produced similar results to those described above. Material was limited in layer 31 (Fig 4.15) to occasional wood and charcoal fragments, seeds of *Juncus* sp. (rushes), *Lemna* sp. (duckweed), elder and bramble as well as charred seeds of bramble, ryegrass/fescue type grass seeds (*Lolium/Fescue* sp.) and basal culms/rhizomatous roots. These charred remains suggest some human activity in the area.

A series of samples were taken from the fill of ditch 28 (Figs. 4.3 and 4.15), from a clayey peaty fill context 27 (samples 15, 16 and 50) and the basal peaty silt, fill 33 (samples 44 and 55). The samples from fill 27 produced a slightly more diverse flora. Unsurprisingly seeds of aquatic species and marshland/bankside vegetation dominated, with large numbers of seeds of duckweed, crowfoot, stoneworts and water-plantain/arrowheads (*Alisma* sp./*Plantago-aquatica*/*Sagittaria* sp.) as well as sedges and rushes. Shrubby species indicative of disturbed habitats such as bramble and elder were fairly numerous while seeds of *Fumaria* sp. (fumitory) are also indicative of disturbed or cultivated soils. Wood and charcoal tended to be very fragmentary. The ditch deposits produced a range of aquatics and

A3.8 Samples selected for macroscopic plant remains analysis from Prince Regent Lane (Freemasons Road)

Sample	*Context*	*Context type*	*Period*	*Sample volume (l..)*
11	18	Fill of natural hollow 19	LBA-EIA	14.5
15	27	Fill of ditch 28	LBA-EIA	19
16	27	Fill of ditch 28	LBA-EIA	19
17	32	Layer (peat)	M-LBA	19
39	31	Layer (peat)	LBA-EIA	19
44	33	Fill of ditch 28	LBA-EIA	19
50	27	Fill of ditch 28	LBA-EIA	19
52	37	Fill of ditch 38/42	LBA-EIA	19
54	32	Layer (peat)	M-LBA	not rec.
55	33	Fill of ditch 28	LBA-EIA	19
81	32	Layer (peat)	M-LBA	19
92	46	Layer (peat)	M-LBA	9
93	32	Layer (peat)	M-LBA	9
99	47	Layer (peat)	M-LBA	9
133	125	Layer (flood deposit)	M-LBA	10
153	125	Layer (flood deposit)	M-LBA	10
103	72	Fill of posthole 73	EBA-MBA	19
143	146	Fill of posthole 146	MBA	19

Table A3.9 Waterlogged plant remains from Prince Regent Road (Freemasons Road)

	Sample	*143*	*103*	*133*	*153*	*17*	*54*	*81*	*93*	*92*	*99*
	Context	*146*	*72*	*125*	*125*	*32*	*32*	*32*	*32*	*46*	*47*
	Feature type	*ditch*	*ph*	*layer*	*layer*	*peat*	*peat*	*peat*	*peat*	*peat*	*peat*
	Period	*MBA*	*EMBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*
	Sample Vol (L.)	*19*	*19*	*10*	*10*	*19*	*?*	*19*	*9*	*9*	*9*
Aquatic/semi-aquatic species											
Ranunculus sceleratus L.	Celery-leaved buttercup	-	-	-	1	-	-	-	-	-	-
Ranunculus Subgenus *Batrachium*	Crowfoot	3	4	2	3	3	5	2	2	5	2
Alisma plantago-aquatica L.	Water-plantain	2	1	-	1	2	5	-	-	2	1
Alisma plantago-aquatica L./ Sagittaria sp.	Water-plantain/Arrowheads	-	-	1	1	-	-	1	-	-	-
Hydrocotyle vulgaris L.	Marsh pennywort	-	-	-	-	-	-	-	-	-	1
Potamogeton sp.	Pondweeds	-	1	1	1	-	-	-	-	-	-
Lemna sp.	Duckweeds	1	1	2	-	4	1	3	4	3	5
Chara sp.	Stoneworts	1	1	1	-	-	1	-	1	1	1
Wet grass/meadow, marshland											
cf. *Thalictrum flavum* L.	Common meadow rue	-	1	-	-	-	-	-	-	-	-
Montia fontana subsp. *chondrosperma* (Fenzl) Walters	Blinks	-	-	-	1	-	-	-	-	-	-
Lychnis flos-cuculi L.	Ragged-robin	-	1	-	-	-	-	-	-	-	-
Persicaria hydropiper/mitis	Water-pepper	-	1	-	1	-	-	-	-	-	-
Oenanthe aquatica (L.) Poiret in Lam.	Fine-leaved water-dropwort	1	2	1	1	2	1	-	-	1	-
Apium nodiflorum L.	Fool's water-cress	1	-	-	-	-	-	-	-	-	-
Lycopus europaeus L.	Gypsywort	1	-	-	1	-	-	-	-	-	-
Mentha aquatica L.	Water mint	1	-	1	1	-	-	1	-	1	1
Juncus articulatus gp.	Jointed rush	1	-	-	-	2	1	2	-	-	-
Juncus bulbosus type	Bulbous rush	-	-	-	-	-	-	-	-	-	-
Juncus effusus type	Soft-rush	-	-	1	2	-	1	-	-	-	-
Juncus sp.	Rushes	-	-	-	-	-	1	1	-	-	3
Luzula sp.	Wood-rush	-	-	-	1	-	-	-	-	-	-
Carex flat (< 2.5mm)		1	1	-	-	-	-	-	-	-	-
Carex trig		1	-	1	2	-	-	-	-	1	-
Eleocharis spp.	Common spike-rush	-	2	1	1	2	2	1	-	1	1
cf. *Schoenoplectus lacustris* (L.) Palla	Common club-rush	2	-	1	1	-	-	-	-	-	-
Sparganium erectum L.	Branched bur-reed	4	2	2	3	-	-	-	-	-	-
Cultivated ground/Waste places/Dry grassland											
Ranunculus sardous L.	Hairy buttercup	-	1	-	-	-	-	-	-	-	-
Urtica dioica L.	Stinging nettle	1	1	2	1	-	1	-	1	-	-
Chenopodium album L.	Fat-hen	1	-	1	1	-	-	-	-	-	-
Rumex acetosella group	Sheep's sorrel	-	-	-	1	-	-	-	-	-	-

Table A3.9 Waterlogged plant remains from Prince Regent Road (Freemasons Road) (continued)

	Sample	*143*	*103*	*133*	*153*	*17*	*54*	*81*	*93*	*92*	*99*
	Context	*146*	*72*	*125*	*125*	*32*	*32*	*32*	*32*	*46*	*47*
	Feature type	*ditch*	*ph*	*layer*	*layer*	*peat*	*peat*	*peat*	*peat*	*peat*	*peat*
	Period	*MBA*	*EMBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*	*M-LBA*
	Sample Vol (L.)	*19*	*19*	*10*	*10*	*19*	*?*	*19*	*9*	*9*	*9*
Rumex sp.	Docks	-	1	1	-	-	-	-	-	-	-
Solanum nigrum L.	Black nightshade	1	1	-	-	-	-	-	-	-	-
Sambucus nigra L.	Elder	1	2	3	3	-	1	1	-	-	1
Carduus/Cirsium sp.	Thistles	1	-	-	1	-	-	-	-	-	-
Shady places/woods/hedgerows											
Corylus avellana L.	Hazelnut shell fragment	-	1	-	-	-	-	-	-	-	-
Viola ordorata/hirta L.	Sweet violet	1	-	1	1	-	1	-	-	1	-
Trees											
Alnus glutinosa (L.) Gaertner	Alder cones (female)	2	2	1	3	-	-	-	-	1	-
Alnus glutinosa (L.) Gaertner	Aldet bracts	-	-	-	-	-	-	-	-	-	-
Alnus glutinosa (L.) Gaertner	Alder, seeds	2	1	1	1	-	-	-	-	-	-
Catholic/Not specified											
Ranunculus acris/bulbosus/repens		-	2	-	1	-	-	-	-	-	-
Atriplex sp.		-	-	-	1	-	-	-	-	-	-
Rubus section 2 Glandulosus Wimm. & Grab	Brambles	3	2	3	3	-	1	-	1	1	2
Rosaceae thorns		1	1	-	-	-	-	-	-	-	-
Aphanes arvensis L.	Parsley-piert	-	-	1	-	-	-	-	-	-	-
Small angular Asteraceae		-	1	-	-	-	-	-	-	-	-
Others											
charcoal		-	1	-	-	-	1	1	-	1	1
moss		-	-	-	-	-	-	-	-	-	-
Caddis fly larval cases		1	1	1	1	-	1	-	-	-	-
fungal spores		-	-	-	-	-	-	-	-	-	3
wood fragments		1	1	4	4	-	2	-	2	4	-
degraded wood		-	-	-	-	-	-	3	-	-	3

Table A3.10 Charred plant remains from Prince Regent Lane (Freemasons Road)

	Sample	*26*	*31*	*39*
	Context	*31*	*31*	*31*
	Feature	*Layer (peat)*	*Layer (peat)*	*Layer (peat)*
	Period	*LBA-EIA*	*LBA-EIA*	*LBA-EIA*
	Sample vol (L.)	*not rec*	*not rec.*	*19*
Cerealia indet	Indeterminate grain	1	1	-
Cerealia indet	Culm node -	-	1	
Rubus section 2 Glandulosus Wimm. & Grab	Bramble/Blackberry etc	-	1	1
Lolium/*Festuca* sp.	Rye-Grass/Fescue -	1	1	

marshland seeds with fragmented and degraded wood including twigs, round wood and bark. Aquatic species include duckweeds, and crowfoots, while the bankside/marshland species included spikerush, rushes and sedges. Drier ground species include stinking nettle, fool's parsley (*Aethusa cynapium*), fat hen, bramble, violet and bugles (*Ajuga* sp.). Occasional seeds and cones of alder were present in the basal deposits of ditch 28.

The single sample from hollow 19 (fill 18) produced a flot containing fragmented wood and silt with a fairly restricted range of marshland and aquatic species. No dry ground plants were identified in the sample. The aquatic species include duckweeds, stoneworts and water-plantain/arrowheads, while gypsywort (*Lycopus europaeus*) and rushes represent marshland or bankside vegetation.

The sample from channel 22 (fill 9, sample 5, Figs 4.3 and 4.15) was not analysed in detail but was assessed by J. Giorgi (Gifford and Partners 2003b). Very limited botanical remains were present beyond small fragments of wood and charcoal and a small number of seeds of while plants including a charred fragment of brome grass (*Bromus* sp.) seed.

Discussion

The deposits from Freemasons Road demonstrate most clearly a presence of alder-carr in the earlier phases which decreases in relation to an increase in wet conditions and rising basal water levels over time. In the earlier phases there is evidence for dry ground and disturbance in the vicinity of the site. There is evidence for standing water (suggested by the caddisfly larval cases as well as the aquatic plants) in part relating to cut features, such as the ditch sampled (feature 146), but also potentially to pools within the alder carr and grassy marshland or possibly cut-off channels. Much of area may simply have been marshy supporting alder trees and plants of disturbed habitats. Some evidence of wet grassland is indicated in the post hole fill associated with the 'bridge' (Str. 32) in Area A (sample 103). This phase also produced possible food debris in the form of hazelnut shell. Throughout these early phases there is evidence for disturbance by humans or livestock in the form of nitrogen loving ruderal species.

The period of later peat formation appears to be characterised by a decrease in drier land species as well as the alder and possibly increased evidence for standing water. This suggests that conditions became too wet for the alder, possibly in association with some clearance and the construction of trackways. Seeds of duckweed in particular become abundant in this phase, although evidence for wet marshland conditions is prevalent. Despite the evidence for disturbed conditions economic species are not positively identified, although both hazelnut and the brambles may have been utilized for food. Occurrences of occasional charred seeds through some of the deposits are indicative of some level of human activity in the area, although they cannot be associated directly with specific activities or activity areas.

Woolwich Manor Way

Samples were taken from Woolwich Manor Way during the Phase II and Phase III investigations. From the Phase II works 18 bulk samples were taken from peats and clay silts. From the Phase III works 8 samples were associated with the trackway, of which 7 were from peat deposits and one from the fill of a ditch/channel. Following assessment of the samples by Giorgi (in Gifford and Partners, 2001b; 2003a) two from Phase II (T15) and four from the Phase III excavations were selected for more detailed analysis.

Four samples were analysed from T15: two from peat layer 2007 (samples 24 and 20) and two for charred plant remains from the underlying weathered sand/palaeosol (samples 21 and 25). This weathered surface produced an early Neolithic artefact spread. Samples from the Phase III works included samples from the peat deposits (context 28) around the Beaker pot in Area 2 (sample 1), and three samples from peat deposits associated with trackway 2 in Area 2 (context 1, sample 8) and trackway 29 in Area 1 (contexts 57, sample 23 and 57, sample 22).

Trench 15 (Phase II works)

Two sequences of four samples were examined from the eastern and western extents of this trench through a series of sandy peat deposits: layers 2008 (palaeosol), 2007, 2006 and 2005 (bottom to top, Fig. 5.3). The assessment demonstrated that the upper most layer (deposit 2005) contained relatively little botanical material other than fragmented wood, charcoal, mosses and a few seeds of sedges and spikerush. The next layer (2006) produced slightly more material including fragmented wood, mosses and seeds of wet and disturbed ground such as sedges and buttercups. The lower two deposits (2008 and 2007) were much more informative and provide a useful insight into the earliest phase of peat formation in the area. They are discussed in chronological order, with the earliest deposit (2008) first.

Layer 2008: Neolithic deposit of emmer wheat (Phase II works) (Plate 28)

The basal deposit of this sequence, layer 2008, consisted of a sandy palaeosol and produced evidence for human activity in the form of a Neolithic artefact scatter. Two samples were taken: sample 21 from the eastern part of the trench and sample 25 from the western end of the trench. Waterlogged preservation was limited in this deposit, consisting of occasional fragments of wood and occasional seeds of buttercup in sample 25. In contrast this deposit did produce abundant evidence in the form of charred plant remains, which were clearly focused in the western extent of the trench being most abundant in sample 25, with flecks of charcoal and occasional grain only turning up in sample 21 from the eastern area.

The charred deposit consists of a large assemblage of charred emmer wheat (*Triticum dicoccum*) and associated spikelet forks and glumes, as well as occasional weeds and hazelnut shell. Preservation of the material was exceptionally good for a deposit of this antiquity. An initial radiometric date on charred grain and charcoal grain from 2008 during the assessment stage provided a date of 3950-3350 cal BC (Beta-153983: 4850 ±100 BP). A second AMS date on a grain of emmer wheat obtained during the analysis produced a date of 3770-3630 cal BC (SUERC-24597: 4890±35 BP)

In total 470 grains were counted. The identification of hulled wheat grains to species is notoriously difficult given the morphological variation possible. Of the 470 grains, only 77 were identified as emmer wheat with any degree of certainty, however, and the majority were identified as *Triticum dicoccum/monococcum/spelta* (hulled wheat) or wheat. A small number of grains showed characteristics of einkorn (*Triticum monococcum*), showing characteristics of having come from single seeded spikelets with a convex ventral surface, high dorsal ridge and laterally narrowed grains. It was not possible to identify the grain as einkorn with any certainty however and they may simply derive from single seeded emmer wheat. The chaff, consisting of spikelet forks and glume bases, provides a much more reliable method of identification. Out of 213 glume bases (where one spikelet fork is composed of two glume bases), some 57 were positively identified as emmer wheat. No chaff was identified as einkorn. The remaining chaff consisted of glume bases or spikelets which were too damaged or eroded to enable identification. The limited weed flora includes typical ruderal species, mostly spring germinating, which tend to be found associated with early prehistoric cereal remains such as fat hen (*Chenopodium album*), black bindweed (*Fallopia convolvulus*), small seeded medick/trefoil/clover type (*Medicago/Trifolium/Lotus* sp.) and grasses. Given the likelihood that the chaff is going to be underrepresented in the deposit (Boardman and Jones 1990), this deposit is interpreted as a deposit of burnt emmer wheat spikelets and associated weed flora.

Peat layer 2007 (Phase II works)

Two samples were examined from sandy peat layer 2007 (samples 20 and 24) overlying deposit 2008. Waterlogged preservation was much better indicating increased wetness resulting in the accumulation of peat. Both samples produced good sized flots containing wood and moss and a large number of seeds and cones of alder (*Alnus glutinosa*). The wetland component included rushes, bulbous buttercup (*Juncus bulbosus* type), sedges (*Carex* sp.), celery-leaved crowfoot (*Ranunculus sceleratus*), blinks (*Montia fontana* subsp. *chondrosperma*), gypsywort (*Lycopus europaeus*), possible marsh stichwort (*Stellaria* cf. *palustris*) and red shank (*Persicaria maculosa*). This range of species is more characteristic of wet grassy ground rather than open water. Species of waste/disturbed habitat were also present, particularly seeds of common or stinging nettle and bramble (*Rubus* section 2 *Glandulosus*) but also buttercup, fat hen, chickweed, *Aphanes arvensis* (parsley-piert), docks and a single seed of dandelion (*Taraxacum* sp.). Species of *Viola* may have been growing in shadier areas, while some scrub or at least the utilization of wild resources is suggested by a fragment of hazelnut shell. A single seed of yew (*Taxus* sp) was also noted in this sample. Occasional charred grain included possible emmer wheat, conceivably part of the same assemblage picked up in the underlying assemblage from context 2008.

Peat deposits beneath the Bronze Age trackways (Phase III works)

Sample 1 was taken from peat deposits (layer 28) beneath the levels associated with the Beaker pottery and trackway 2/14 in Area 2 (Fig. 5.3). The small flot produced mostly degraded wood and silt and a small flora consisting of wetland plants. Alder was not represented in the samples examined, although limited evidence for alder was recovered from a sample from the same deposit examined at assessment (sample 7, Giorgi in Gifford and Partners 2003a). Identified seeds or fruit included brambles (*Rubus* section 2 *Glandulosus*), water dropwort (*Oenanthe aquatica*), gypsywort (*Lycopus europaeus*), crowfoots (*Ranunculus* subgen *Batra-*

chium) and spikerush (*Eleocharis* spp.). Occasional moss was also noted.

Two samples were taken from the peat below trackway 29 in Area 1 (Fig. 5.3). The lowermost sample (sample 15 peat layer 59) had produced a much richer assemblage. Plant remains noted in the assessment report (Giorgi in Gifford and Partners 2003a) included large quantities of wood and a diverse range of seeds of wetlands plants such as sedges, crowfoots, water dropwort, water pepper/mite, disturbed ground species including chickweeds, black nightshade, goosefoots and brambles, and fragments of hazelnut. The assemblage appears to be comparable to the deposit from the sand/peat interface in trench 15 (layer 2007). The overlying peat (layer 57) produced a limited flora, largely a reflection of the small sample size (1L). The assessment data was generated from a larger flot (20L) and is therefore also referred to. The flots both at assessment and analysis level were found to consist largely of fragmented wood. At analysis level a single seed of yew was the only plant taxa noted, along with fungal spores and the eggs of the water flea. The assessment data recorded by Giorgi (in Gifford and Partners 2003a) included occasional seeds of bramble, water dropwort, and spikerush, as well as a small amount of moss and beetle fragments.

Peat deposits above the Bronze Age trackways (Phase III works)

Both the samples examined were taken from peat deposits overlying the Bronze Age trackways (trackways 2 and 29, Fig. 5.3) in Areas 1 and 2 and are interpreted as being broadly contemporary.

A far richer deposit than layer 56 in Area 1 (sample 22) was recovered from peat layer 1 in Area 2 (sample 8), in part due to a larger sample size (9L), but possibly reflecting the nature of the peat and preservation in Area 2. The deposit was dominated by fragments of wood and evidence for alder (cones and bracts), some of which presumably derives from the trackway itself. A range of fruits and seeds of wet ground species were noted particularly those of water pepper/mite (*Persicaria hydropiper/mitis*), but also *Rumex conglomeratus* (clustered dock), gypsywort, spikerush, branched bur-reed (*Sparganium erectum*) and water plantain (*Alisma plantago-aquatica*). Seeds of meadow buttercup (*Ranunculus acris*) and rushes including soft rush type (*Juncus effusus* type) suggest damp grassland type vegetation. Species of disturbed ground were also present including nettle (*Urtica dioica*) and bramble. Rare seeds of yew (*Taxus baccata*) were again present suggesting it to have been a persistent part of the vegetation in the area of Woolwich Manor Way for a prolonged period.

A much more restricted flora and smaller flot was recovered from the peat deposits in Area 1 (peat layer 56), which is in part likely to be due to the small sample size, although a larger sample was examined at assessment level and produced a similarly limited flora (Giorgi in Gifford and Partners 2003a). The plant remains noted at analysis level were limited to fragmented wood and seeds of nettle. At assessment a slightly greater range of seeds were identified including spike-rush, sedges and brambles. It is possible that conditions in this part of the site were less conducive to good waterlogged preservation of botanical remains. The underlying deposit (layer 57) was similarly limited, while the deposit below that (layer 59) was much richer (see above). Possibly this part of the site was slightly drier.

Vegetation Development at Woolwich Manor Way

The samples from Woolwich Manor Way are particularly useful in that they include samples from Neolithic deposits pre-dating the Bronze Age peat as well as the earliest Bronze Age peat formation. An exceptional deposit was the find of emmer grain and chaff on the sand (layer 2008. T15), beneath the sandy peat sequence which provides evidence for human activity in the area. The differential preservation of grain and chaff is such that chaff tends to be under-represented in archaeological assemblages. This deposit has therefore been interpreted as unprocessed emmer wheat spikelet forks (in which grain and glume bases would appear in equal numbers in a living crop) with associated weeds.

The significance of cereals in the diet of Neolithic people, particularly in relation to the importance of collected woodland resources, is still a topic of debate (Moffett *et al.* 1989; Robinson 2000; Jones 2000; Jones and Rowley-Conwy 2007). Such deposits, while rare, do demonstrate that cereal deposits were probably more widespread than the archaeology tends to suggest, but that for some reason they only survive in good numbers occasionally. This might be as a result of a combination of the scale of Neolithic agricultural production and processing methods, and the subsequent erosion of archaeological features.

The unusual aspect of the Woolwich Manor Way deposit is that it appears to derive from charred spikelets. The majority of Neolithic cereal remains in Britain to date derive from occasional grain, often poorly preserved. There are an increasing number of deposits of spikelets of emmer wheat however, in addition to the exceptional deposits at Balbridie, Grampian region (Fairweather and Ralston 1993) and Lismore Fields (Jones and Rowley-Conwy 2007). A substantial deposit of several thousand emmer spikelets was recovered from a small pit at Westwood Cross, Isle of Thanet, which produced an early Neolithic date of 3800-3650 cal BC (NZA-26510: 4951±35 BP) (Stevens nd). A slightly later date 3650-3100 cal BC (OxA-2299: 4675±70 BP) was recovered from an assemblage of possible emmer spikelets from The Stumble, Essex (Wilkinson and Murphy 1995, 58). A deposit of emmer spikelets and naked barley grain has also recently been dated from a pit at Poundbury, Dorset (Pelling nd.) producing a date of 3766-3637 cal BC (NZA-31070:

Table A3.11 Samples selected for analysis from Woolwich Manor Way

Area/Trench	*Sample*	*Context*	*Feature type*	*Period*	*Sample volume (L.)*
T15	21	2008	Sandy Peat layer	EN	15
T15	25	2008	Sandy Peat layer	EN	20
T15	24	2007	Sandy Peat layer	EBA	20
T15	20	2007	Sandy Peat layer	EBA	20
Area 2	1	28	Peat around beaker, below trackway 2	EBA	2
Area 2	8	1	Peat above trackway 2	MBA	9
Area 1	22	56	Peat above trackway 29	MBA	1
Area 1	23	57	Peat below trackway 29	EBA	1

Table A3.12 Waterlogged plant remains from Woolwich Manor Way

	Trench/Area	*15*	*15*	*A2*	*A1*	*A2*	*A1*
	Sample	*24*	*20*	*1*	*22*	*8*	*23*
	Context	*2007*	*2007*	*28*	*56*	*1*	*57*
	Feature/layer	*Peat*	*Peat*	*Peat*	*Peat*	*Peat*	*Peat*
	Period	*EBA*	*EBA*	*EBA*	*MBA*	*MBA*	*EBA*
	Sample Vol (L.)	*20*	*20*	*2*	*1*	*9*	*1*
Alisma plantago-aquatica L.	Water-plantain	-	-	-	-	1	-
Alnus glutinosa (L.) Gaertner	Alder cones (female)	3	2	-	-	-	-
Alnus glutinosa (L.) Gaertner	Aldet bracts	-	-	-	-	3	-
Alnus glutinosa (L.) Gaertner	Alder, seeds	4	2	-	-	-	-
Aphanes arvensis L.	Parsley-piert	3	-	-	-	-	-
Atriplex sp.	Orache	-	1	-	-	-	-
Carex trig	Sedges	2	4	-	-	-	-
Chenopodium album L.	Fat-hen	1	-	-	-	1	-
Chenopodium polyspermum L.	Many-seeded goosefoot	-	-	-	-	1	-
Corylus avellana L.	Hazel nut shell fragment	-	1	-	-	-	-
Eleocharis palustris (L.) Roem.& Schult	Common spike-rush	-	-	-	-	1	-
Euphorbia sp.	Spurge	-	1	-	-	-	-
Juncus bulbosus L.	Bulbous rush	2	-	-	-	-	-
Juncus effusus L.	Soft-rush	-	-	-	-	1	-
Juncus sp.	Rushes	-	-	-	-	3	-
Lycopus europaeus L.	Gypsywort	2	-	1	-	1	-
Oenanthe aquatica (L.) Poiret in Lam.	Fine-leaved water-dropwort	-	-	1	-	-	-
Persicaria hydropiper L.	Water-pepper	-	-	-	-	3	-
Persicaria maculosa Gray	Red shank	-	1	-	-	-	-
Potentilla sp.	Cinquefoils	-	1	-	-	-	-
Ranunculus acris L.	Meadow buttercup	-	-	-	-	1	-
Ranunculus acris/bulbosus/repens	Buttercup	2	3	1	-	-	-
Ranunculus bulbosus L.	Bulbous buttercup	3	2	-	-	-	-
Ranunculus Subgenus *Batrachium*	Crowfoots	-	-	1	-	-	-
Rubus sect. 2 *Glanulosus*	Brambles	1	3	-	-	1	-
Rumex cf. *conglomeratus* Murray	Clustered dock	-	-	-	-	1	-
Rumex sp.	Docks	1	1	-	-	1	-
Sparganium erectum L.	Branched bur-reed	-	-	-	-	1	-
Stellaria media (l) Vill	Common chickweed	1	1	-	-	-	-
Stellaria cf. *palustris* L.	Marsh stichwort	3	-	-	-	-	-
Taraxacum sp.	Dandelion	-	1	-	-	-	-
cf. *Taxus* sp.	Yew	-	2	-	-	-	-
Urtica dioica L.	Stinging nettle	4	-	-	1	1	-
Viola ordorata/hirta L.	Sweet violet	1	1	-	-	-	-
Indet large seed coat		-	-	-	-	-	1
Wood fragments		-	-	-	4	3	-
Coleoptera frags		1	-	-	-	1	-
Fungal spores		-	-	-	-	-	2
Degraded wood and silt		-	-	2	3	-	-
Daphnia (waterflea) egg)		-	-	-	-	-	1
moss		2	-	-	-	-	-

4902±40 BP), again early Neolithic so comparable to the Westwood Cross material.

That chaff is rarely recovered from Neolithic assemblages (Robinson 2000) has lead to discussions about storage methods and the suggestion that in the Neolithic crops were perhaps stored as fully dehusked grain (Stevens 2007) in contrast to the later prehistoric period when storage pits are well known. The presence of dated spikelets in pits does raise the question of how crops were stored in the Neolithic and may demonstrate that the absence of chaff on many sites is simply a product of preservation bias. The Woolwich Manor Way deposit is unusual in that it has been recovered from a sand layer, sealed beneath the peat. It is unclear why or how such a deposit would have survived in a context of this type, unless it was originally situated within a subsequently eroded pit.

The weed flora associated with the emmer wheat is limited, consisting of fat hen (*Chenopodium album*), black bindweed (*Fallopia convolvulus*), possible goosegrass (*Galium* sp.), medick/trefoil type (*Medicago/Trifolium/Lotus* sp.) and grass seeds. Seeds of bindweed, cleavers and vetches were recovered at Westwood Cross (Stevens nd), while the Stumble produced goosegrass and vetch (Murphy 1989) and Poundbury produced bindweed and grass (Pelling unpubl). There appears to be a dominance of twinning species which would have been favoured by uprooting. Conditions clearly became wetter towards the end of the Neolithic, as suggested by the formation of peat. The local vegetation at the

Table A3.13 Charred plant remains in samples from Woolwich Manor Way

	Trench No.	*15*	*15*	*15*
	Sample	*24*	*25*	*21*
	Context	*2007*	*2008*	*2008*
	Feature	*Peat*	*Peat*	*Palaeosol*
	Period	*EBA*	*EN*	*EN*
	Sample Vol (L.)	*20*	*20*	*15*
Cereal Grain				
Triticum dicoccum L.	Emmer wheat grain	-	48	-
Triticum cf. *dicoccum* L.	cf. Emmer wheat grain	1	29	-
Triticum cf. *dicoccum/monococcum*	single grained emmer/einkorn	-	12	
Triticum spelta L.	Spelt wheat grain	-	-	-
Triticum cf. *spelta* L.	cf. Spelt wheat grain	-	-	-
Triticum dicoccum/spelta	Emmer/Spelt wheat grain	-	84	1
Triticum sp.	Wheat grain	1	181	-
Hordeum vulgare sl.	Barley grain	-	-	-
Cerealia indet	Indeterminate grain	2	116	1
Cereal Chaff				
Triticum dicoccum L.	Emmer wheat spikelet fork	-	23	-
Triticum dicoccum L.	Emmer wheat glume base	-	11	-
Triticum spelta L.	Spelt wheat spikelet fork	-	-	-
Triticum spelta L.	Spelt wheat glume base	-	-	-
Triticum dicoccum/spelta	Emmer/Spelt wheat spikelet	-	37	-
Triticum dicoccum/spelta	Emmer/Spelt wheat glume base	-	25	-
Triticum sp.	Wheat rachis segment	-	1	-
Cerealia indet	Culm node	-	-	-
Wild Species				
Corylus avellana L.	Hazelnut shell fragments	-	3	-
Chenopodium album L.	Fat hen	-	4	-
Atriplex sp.	Orache	-	-	-
Chenopodiaceae		-	1	-
Galium aparine L.	Goosegrass	-	-	-
cf. *Galium* sp.		-	1	-
Fallopia convoluvulus (L.) Á. Löve	Black bindweed	-	1	-
Rubus section 2 Glandulosus Wimm. & Grab	Bramble/Blackberry etc	-	-	-
Medicago/Trifolium/Lotus sp.	Medick/Trefoil/Clover etc	-	1	-
Rubus sp.	Bramble/Raspberry etc	-	-	-
Lolium/Festuca sp.		-	-	-
Poaceae	Grass, small seed (<2mm)	-	1	-
Poaceae	Grass, medium sized seed		1	-
Indet leaf bud		-	1	-
Indet seed		-	3	-

Neolithic/Bronze Age transition appears to be characterised by alder carr, as it is at Prince Regent Lane (above) and Movers Lane (below). Wet, mineral-rich open sediments are suggested by herbaceous vegetation, such as sedges, rushes, dropworts, gypsyworts and stoneworts (noted in the assessment of some samples not examined at analysis) which are likely to have been accompanied by alder woodland. The presence of crowfoots, water plantain and the presence of water flea eggs (*Cladoceran ephippia*), suggest some standing bodies of water, although the evidence for this may be less than at Prince Regent Lane and Movers Lane. A background of drier ground ruderal vegetation is also suggested. Also, in contrast to the other sites, evidence of yew was found through the peat deposits at Woolwich Manor Way, both in terms of the fruit or seeds and wood remains. A piece of yew wood from context 1523, sample 68 (wood sample 2, trench 9) submitted for dating gave a radiocarbon date of 2850-2270 (91.5%) and 2260-2200 cal BC (3.9%) (Beta-152739: 3930±60 BP).

The presence of yew is suggestive of drier woodland in the vicinity, although the paucity of the fruit suggests that the trees stood some distance away from the area of the trenches. Both yew and alder wood were identified from the trackway structures (Barnett, Appendix 3, Goodburn this volume).

There appears to be reduction in the presence of alder in the peat deposits associated with the trackways, with the exception of the deposit above trackway 2/14 (peat deposit 1) and an increase in evidence for wet conditions.

Several floodplain sites within Greater London have revealed timber belonging to *Taxus baccata*, such as Wennington Marsh (Sidell 1996), Dagenham (Divers 1994) and Beckton (Meddens and Sidell 1995; Scaife 1997). At Wennington, *T. baccata* macrofossils suggested a local densely covered mixed forest (over 20 tree trunks were recovered from within a trench approximately 20m x 20m), yet the pollen content was low. Sidell (1996) has suggested that *T. baccata* was an important woodland taxon, and that the low pollen representation was due to taphonomic factors. Alternatively, if the woodland was as dense as that suggested by the excavation, and the local conditions (peat) were sufficiently acidic, flowering could have been decreased / inhibited, contributing to the apparently low pollen concentrations. *T. baccata* is also frequently found within lowland wetland coastal and estuarine peat in Belgium, Germany and The Netherlands (Deforce and Bastiaens 2004). Across Europe there is a recognised shift in *T. baccata* from lowland wetlands to upland dryland during the Holocene, which may be attributed to a change in ecological preference.

Movers Lane

A total of 29 bulk samples and 9 samples for waterlogged plant remains were taken during the Phase III excavations at the site. Following assessment of the sample by Stevens (in Wessex Archaeology 2003) seven samples were selected for closer examination of the waterlogged plant remains (an 8th sample had deteriorated too significantly in storage to be viable for further work). Charred plant remains other than charcoal were limited to the occasional grain in one sample and occasional charred weed seeds and hazelnut shell fragments. Two samples were examined at analysis level although the remains add little to the assessment data.

The samples had suffered some deterioration in storage in the period between assessment and analysis despite storage in IMS in sealed jars. This is seen particularly in the decreased range of species noted in some samples during analysis compared to the assessment (Stevens in Wessex Archaeology 2003). In particular one sample (sample 70 from the peat adjacent to the trackway) had suffered extreme growth of mould rendering it unusable. Generally the range of species remains fairly constant across the site. However, there are some differences between the Movers Lane samples and those from Prince Regent Lane (Freemasons Road).

A series of 29 bulk samples were also taken for charred plant remains. The samples were processed by standard bulk flotation and the flots collected onto 0.5mm mesh sieves with the residues collected on 1mm mesh. The volume of deposit processed for each sample ranged from 5 to 30 litres. An assessment of the flots demonstrated the presence of small quantities of charred seeds throughout the sequence, although in most cases this consisted of one or two charred weed seeds. A fragment of hazelnut shell (*Corylus avellana*) was present in cremation feature 1207. A cereal grain of indeterminate species was noted in pit 1221. These deposits therefore suggest a background presence of activity related to food processing and procurement but produced insufficient material to provide any useful interpretation of the deposits. Charcoal was abundant in a small number of samples and is discussed elsewhere (Barnett, Appendix 3).

Area 2 terrace

Two samples were examined from late Bronze Age ditch 1038 (Fig. 7.8) including sample 6 from the basal fills (context 1049). While the lower fill produced a more diverse flora, both deposits where characterised by an abundance of seeds of stinging nettle (*Urtica dioica*) and bramble/blackberry type (*Rubus* section 2 *Glandulosus*), as well as thorns of Rosaceae type which are likely to have derived from the same species. Seeds of elder (*Sambucus nigra*) were also present in the upper fill (1042, sample 4) and possible dogwood (cf. *Cornus sanguinea*) in the lower fill (1049 sample 6), further suggesting scrubby vegetation. Also present were quantities of wood and the seeds and cones of alder (*Alnus glutinosa*).

Herbaceous species of disturbed habitats were common in the deposits including docks of unknown species (*Rumex* sp.), common toadflax (*Linaria vulgaris*), thistles (*Carduus*/*Cirsium* sp.), willowherb (*Epilobium* sp.), and, most common of all, stinging nettle. Smaller numbers of seeds of ruderal species included fat hen (*Chenopodium album*), chickweed (*Stellaria media*), plantain (*Plantago major*), parsley-piert (*Aphanes arvensis*), cinquefoils (*Potentilla* sp.), hawkweed ox-tongue (*Picris hieracioides*), smooth sow-thistle (*Sonchus oleraceus*) and dead nettle (*Lamium* sp.). Seeds of greater stichwort (*Stellaria holostea*) and a single seed of three-nerved sandwort (*Moehringia trinervia*) in 1042 (sample 4) suggest shady conditions, again possibly indicative of scrubby vegetation. The high numbers of seeds of some of the ruderal species, particularly nettle, would suggest that plants were growing alongside the ditch, their seeds falling into the wet deposits.

Aquatic species in the upper deposit were limited to occasional seeds of water crowfoot (*Ranunculus* subgen *Batrachium*), duckweed (*Lemna* sp.), rushes (*Juncus* sp.) and possible meadowsweet (*Filipendula ulmaria*). The lower fill (context 1049) produced a more substantial list of species associated with wetter habitats including species suggesting standing water such as pondweed (*Potamogeton* sp.) and duckweed (*Lemna* sp.). More abundant in context 1049, however, were species typical of nutrient rich wet, muddy, marshy or fen conditions, either present within the ditch or around it: celery-leave buttercup (*Ranunculus sceleratus*), crowfoots (*Ranunculus* subgen *Batrachium*), water dock (*Rumex hydrolapathum*), possible clustered dock (*Rumex* cf. *conglomeratus*), gypsywort (*Lycopus europaeus*), water mint (*Mentha aquatica*), fool's watercress (*Apium nodiflorum*), branched bur-reed (*Sparganium erectum*) and one seed of possible yellow iris (cf. *Iris pseudacorus*). This range of species might be growing within the muddy base of the ditch, which may have supported some open water. Caddisfly larval cases further suggest there was some open water in the ditch. There is also slight evidence for damp meadow type grassland including seeds of meadow rue (*Thalictrum flavum*) and ragged robbin (*Lychnis flos-cuculi*). Sedges and rushes further suggest wet or marshy conditions.

The assemblages from the ditch are generally characteristic of scrubby and disturbed habitats that are likely to have been present in the area around the ditch, with evidence for wetter conditions, including standing water within the ditch, as well as marshy grassland type conditions in the vicinity. It is difficult to establish quite how wet the surrounding area was at the time, and it is possible that the very wet conditions only prevailed within the ditch itself.

Area 2, floodplain/palaeochannel area

Three samples were examined from this area including one associated with the root system 3012, and two from peat adjacent to the Bronze Age trackway 3031 (Fig. 7.8). A third sample from the trackway peat had been examined at assessment level but was too badly infested with fungal growth to allow closer examination. Species of wet, marshy conditions dominate although evidence for open water is not strong. Evidence for alder is minimal in these deposits while the scrubby vegetation seen in the Area 2 ditch fills is largely absent, although a background of ruderal vegetation is present.

The sample from the root system was characterised by degraded wood, peat and silt. A fairly restricted flora was represented with small numbers of seeds and only limited evidence for alder. Occasional seeds of cinquefoils (*Potentilla* sp.) and fat hen (*Chenopodium album*) suggest some drier ground. Seeds of thistles (*Carduus/Cirsium* sp.) were also present, although these may derive from bankside species such as marsh thistle (*Cirsium palustre*). Seeds of fine leaved water-dropwort (*Oenanthe aquatica*) indicate quite wet conditions, possibly watery. The remaining species, including water-pepper (*Persicaria hydropiper*), fool's water-cress (*Apium nodiflorum*), branched bur-reed (*Sparganium erectum*), crowfoot (*Ranunculus* subgen *Batrachium*) and red shank (*Persicaria maculosa*), are typical of shallow, nutrient rich water or wet bankside conditions. A small number of fungal sclerotia, including possible charred examples, were also present.

Three samples were taken from the peat associated with the Bronze Age trackway 3031 (context 3011). The lowest sample (sample 70, 30-50cm) had dried out and become mouldy during storage and was consequently not examined further. The assessment demonstrated it to be the poorest of the three samples, consisting of badly degraded peat and wood fragments. Identifiable seeds were limited to a single example of water crowfoot (*Ranunculus* subg. *Batrachium*).

The two samples from the top 30cm of the peat (samples 68 and 69, 0-15cm and 15-30cm) were much more productive. Both samples were characterised by wood fragments as well as degraded peat and silt, with the greater concentration of better preserved wood, including roundwood and twiggy material, in the middle sample (15-30cm). This deposit also produced a slightly more diverse flora, although both samples were seed rich. Species of wet, marshy fen type conditions dominated such as water-dropwort (*Oenanthe aquatica*), fool's water-cress (*Apium nodiflorum*), gypsywort (*Lycopus europaeus*), watermint (*Mentha aquatica*), common spike-rush (*Eleocharis palustris*), branched bur-reed (*Sparganium erectum*), crowfoots (*Ranunculus* subgen B*atrachium*), water-starworts ((*Callitriche* sp.) not recorded in the earlier deposits at the site), water-plantain (*Alisma plantago-aquatica*), red-shank (*Persicaria maculosa*), as well as sedges and rushes. A limited number of seeds of meadowsweet (*Filipendula ulmaria*) were present in the upper deposit (sample 68), typical of wet meadows and common along the edge of alder carr woodland where cover is limited. A small number of seeds of duckweeds (*Lemna* sp.) may point to some open bodies of water, as do the caddisfly larval cases, present in both samples. The wet ground species as

Table A3.14 Samples selected for analysis from Movers Lane for waterlogged plant remains

Area	*Sample*	*Context*	*Feature*	*Feature type*	*Period*	*Sample volume (L.)*
A2	4	1042	1038	Ditch (base)	LBA	1
A2	6	1049	1038	Ditch (base)	LBA	6
A2	29	3004	3012	Root/platform	LBA	1
A2	68	3011	3031	Peat through trackway (0-15cm)	BA	6
A2	69	3011	3031	Peat through trackway (15-30)	BA	6
A2	70	3011	3031	Peat through trackway (30-50cm)	BA	6
A3	34	5147	5159	Gully	BA	30
A3	49	5131	5263	Peat layer	BA	6

Table A3.15 Waterlogged plant remains from Movers Lane

	Area	*A2*	*A2*	*A2*	*A2*	*A2*	*A3*	*A3*
	Context	*1042*	*1049*	*3004*	*3011*	*3011*	*5147*	*5131*
	Feature	*1038*	*1038*	*3012*	*3031*	*3031*	*5159*	*5263*
	Sample	*4*	*6*	*29*	*68 -top*	*69 -mid*	*34*	*49*
	Feature type	*ditch (b)*	*ditch (b)*	*Root system*	*peat*	*peat*	*gully*	*peat*
	Period	*LBA*	*LBA*	*LBA*	*BA*	*BA*	*BA*	*BA*
	Sample Vol (L.)	*1*	*6*	*1*	*6*	*6*	*30*	*6*
Aquatic/semi-aquatic species								
Ranunculus sceleratus L.	Celery-leaved buttercup	-	4	-	-	-	-	-
Ranunculus Subgenus *Batrachium*	Crowfoot	1	4	2	4	3	-	2
Callitriche sp.	Water-starworts	-	-	-	1	1	1	3
Alisma plantago-aquatica L.	Water-plantain	-	-	-	2	1	-	4
Alisma plantago-aquatica L./*Sagittaria* sp.	Water-plantain/ Arrowheads	-	-	-	-	-	-	-
Hydrocotyle vulgaris L.	Marsh pennywort	-	-	-	-	-	-	-
Potamogeton sp.	Pondweeds	-	2	-	-	-	-	-
Lemna sp.	Duckweeds	1	3	-	-	1	-	1
Wet grass/meadow, marshland								
Ranunculus acris L.	Meadow buttercup	-	1	-	-	-	-	-
cf. *Thalictrum flavum* L.	Common meadow rue	-	1	-	-	-	-	-
Lychnis flos-cuculi L.	Ragged-robin	-	1	-	-	-	-	-
Persicaria maculosa Gray	Red shank	-	-	1	-	1	-	-
Persicaria hydropiper/mitis	Water-pepper	-	-	1	-	-	1	3
Rumex hydrolapathum Hudson	Water dock	-	2	-	-	-	-	1
Rumex cf. *conglomeratus* Murray	Clustered dock	-	3	-	-	-	-	-
Oenanthe aquatica (L.) Poiret in Lam.	Fine-leaved waterdropwort	-	-	1	1	2	1	2
Apium nodiflorum L.	Fool's watercress	-	1	1	-	1	-	-
Lycopus europaeus L.	Gypsywort	-	3	-	1	1	1	-
Mentha aquatica L.	Water mint	-	2	-	2	1	-	1
Filipendula ulmaria (L.) Maxim	Meadowsweet	-	-	-	1	-	-	-
cf. *Filipendula ulmaria* (L.) Maxim	Meadowsweet	1	-	-	-	-	-	-
Bidens cernua L.	Nodding bur-marigold	-	-	-	-	-	-	1
Juncus articulatus gp.	Jointed rush	-	-	-	-	1	-	-
Juncus effusus type	Soft-rush	-	1	-	-	-	-	5
Juncus sp.	Rushes	-	1	-	1	-	-	-
Luzula sp.	Wood-rush	1	-	-	-	-	-	-
Carex flat (< 2.5mm)		-	1	-	3	1	1	2
Carex trig		-	-	1	3	2	-	3
Eleocharis spp.	Common spike-rush	-	-		1	1	-	3
Sparganium erectum L.	Branched bur-reed	-	2	1	2	2	-	3
cf. *Iris pseudacorus* L.	Yellow iris	-	1	-	-	-	-	-
Cultivated ground/Waste places/Dry grassland								
Ranunculus bulbosus L.	Bulbous buttercup	-	1	-	-	-		

Table A3.15 Waterlogged plant remains from Movers Lane (continued)

	Area	*A2*	*A2*	*A2*	*A2*	*A2*	*A3*	*A3*
	Context	*1042*	*1049*	*3004*	*3011*	*3011*	*5147*	*5131*
	Feature	*1038*	*1038*	*3012*	*3031*	*3031*	*5159*	*5263*
	Sample	*4*	*6*	*29*	*68 -top*	*69 -mid*	*34*	*49*
	Feature type	*ditch (b)*	*ditch (b)*	*Root system*	*peat*	*peat*	*gully*	*peat*
	Period	*LBA*	*LBA*	*LBA*	*BA*	*BA*	*BA*	*BA*
	Sample Vol (L.)	*1*	*6*	*1*	*6*	*6*	*30*	*6*
Urtica dioica L.	Stinging nettle	5	5	-	2	-		2
Chenopodium album L.	Fat-hen	-	1	1	3	1	1	2
Chenopodium sp.		-	1	-	-	-		
Stellaria media (l) Vill	Common chickweed	-	1	-	-	-		1
Stellaria sp.	Chickweed/Stitchworts	-	-	-	-	1		
Polygonum aviculare L.	Knotgrass	-	-	-	1	-		1
Rumex acetosella group	Sheep's sorrel	-	-	-	-	-		1
Rumex sp.	Docks	-	4	-	-	-		2
Solanum nigrum L.	Black nightshade	-	-	-	1	-		
Lamium sp.	Dead-nettle	-	1	-	-	-		
Linaria vulgaris Mill.	Common toadflax	-	2	-	-	-		
Sambucus nigra L.	Elder	1	-	-	-	-		
Carduus/Cirsium sp.	Thistles	1	3	1	1	-		
Picris hieracoides L.	Hawkweed oxtongue	-	1	-	-	-		
Sonchus asper (L.) Hill	Prickly sow-thistle	-	-	-	-	-	1	
Sonchus oleraceus L.	Smooth sow-thistle		1					
Shady places/woods/hedgerows								
cf. *Cornus sanguinea* L.	Dogwood, fruit	1						
Moehringa trinervia (L.) Clairv.	Three-nerved sandwort	1						
Stellaria holostea L.	Greater stichwort		1					
Viola ordorata/hirta L.	Sweet violet					1		1
Trees								
Alnus glutinosa (L.) Gaertner	Alder cones (female)	2	1			1	1	2
Alnus glutinosa (L.) Gaertner	Aldet bracts		1					
Alnus glutinosa (L.) Gaertner	Alder, seeds	2	3	1		1	3	4
Catholic/Not specified								
Ranunculus acris/bulbosus/repens			1			1		2
Ranunculus parviflorus L.	Small-flowered buttercup							
Atriplex glabriuscula Edmondston	Babington's-orache					1		
Atriplex sp.		1	1		4			
Stellaria cf. *pallida* L.	Lesser chickweed							2
Rubus section 2 Glandulosus Wimm. & Grab	Brambles	3	4		1	2	2	3
Potentilla sp.	Cinquefoils	1	1	1	1	1		1
Rosaceae thorns		2	5					
Aphanes arvensis L.	Parsley-piert	1						
Vicia/Lathyrus sp.	Vetches/Vetchlings/Tares							2
Epilobium sp.	Willowherbs		3					
Appiaceae	indet. medium seed	1						
Plantago major L.	Greater plantain		1					
Scruphularaceae	Figwort family		1					
Poaceae mid (2mm-4mm)	grass							1
Poaceae small (<2mm)	grass		1					
Others								
Indet leaf fragments								1
caddisfly larval cases			2		1	1		1
Coleoptera frags		2	1	1	1			2
Fungal spores		1		1		1	1	3
mites								4
wood fragments		4			2	5		
degraded wood and silt			1	3	2			

a whole suggest wet, marshy grassy conditions possibly with occasional open bodies of water, pools and puddles.

The drier ground species were relatively limited, but indicate a background of scrubby vegetation including brambles and ruderal vegetation. Some evidence for alder (seeds and cones) is present in the middle layer (sample 29). In addition there were a range of species of ruderal and disturbed habitats such as fat hen (*Chenopodium album*), stinging nettles (*Urtica dioica*), orache (*Atriplex* sp.), knotgrass (*Polygonum aviculare*), cinquefoils (*Potentilla* sp.), chickweed/stitchworts (*Stellaria* sp.), black nightshade (*Solanum nigrum*) and thistles (*Carduus/Cirsium* sp.). The viola species (*Viola odorata/hirta*) include species of shady conditions which may occur under the scrubby vegetation.

Area 3

Two samples were examined from Area 3: sample 34 from the Bronze Age peat in gully 5159 (context 5147, Fig 7.11) and sample 49 from the main peat layer 5263 (context 5131).

A limited flora was recovered from the fill of gully 5159 (context 5147) cut through the peat. Most dominant in the flot were seeds and cones of alder and seeds of bramble. A small number of ruderal species of disturbed ground, such as fat hen and prickly sow-thistle were present as were a restricted range of species of wet, muddy or marshy ground such as water-pepper (*Persicaria hydropiper*), water-dropwort (*Oenanthe aquatica*), water mint (*Mentha aquatica*), water-starworts (*Callitriche* sp.) and sedges.

The deposit from the main peat layer produced a rich deposit with large numbers of seeds of many of the taxa. Most abundant were seeds of rushes (*Juncus* sp.), particularly soft rush (*Juncus effusus* gp.), as well as alder seeds and cones and seeds of water-plantain (*Alisma plantago-aquatica*). The assemblage produced strong evidence for marshy wetland conditions such as water-pepper (*Persicaria hydropiper*), water dock (*Rumex hydrolapathum*), water-dropwort (*Oenanthe aquatica*), branched bur-reed (*Sparganium erectum*), duckweeds, sedges and rushes. Occasional seeds of nodding bur-marigold (*Bidens cernua*) were also noted, again a plant of wet ground adjacent to ponds and ditches or marshy fields. Larval cases of caddisfly are indicative of open water.

A range of dry land species was also present, again typical of disturbed, ruderal habitats such as fat hen, chickweed (*Stellaria media)*, knotgrass, docks, prickly sow-thistle. A small number of vetches/vetchlings/tares (*Vicia/Lathyrus* sp.) and grasses were present, possibly indicating the presence of grassland.

Discussion

The waterlogged sequences from Movers Lane share many characteristics with the other sites, particularly the deposits from Prince Regent Lane Underpass, suggesting a certain degree of continuity along the extent of the floodplain/gravel terrace margins.

The vegetation suggested by samples from both Area 2 and 3 associated with the onset of peat formation, is characterised by scrubby vegetation, particularly stinging nettle and brambles, with alder carr. The alder woodland appears to have supported an understory of sedges and rushes, with some drier ground shady species such as violets. The wet ground species tend to be more indicative of nutrient rich wet, marshy conditions rather than open bodies of water, with evidence for hay meadow type species such as meadow rue, ragged robin and meadowsweet. The cut features appear to have supported open water as indicated by caddis fly larval cases and higher numbers of aquatic, open water plant species.

The substantial number of ruderal plants associated with disturbed and nitrogen rich soils such as stinging nettle, as well as the limited evidence for charred plant remains, provide evidence for a background of human disturbance, or at least grazing. However there is limited direct botanical evidence for human activity and it is likely that much of this disturbance was on the drier ground of the gravels not directly represented in the excavated area. Evidence for brambles including thorns was abundant in some deposits, particularly ditch 1038, suggesting possible encroachment of drier scrub land onto the edges of the floodplain.

Samples associated with platform and trackway were less productive, but indicate a similar range of wet marshy ground and a background of drier, disturbed habitats, but possibly with less evidence for damp, meadow type grassland and a decline in alder in area 2. Towards the top of the peat deposits above the trackway conditions appear slightly wetter, with a decline in ruderal species, although it is difficult to measure this. This increase in wet conditions and associated decline in alder appears to follow a similar pattern seen at Prince Regent Lane and Woolwich Manor Lane.

Landscape overview

At all three sites a similar pattern of vegetation and hydrological evolution appears to be represented. The sequence broadly follows that seen elsewhere along the Lower Thames. Most of the samples examined fall within a relatively narrow time frame from the late Neolithic to the late Bronze Age.

The earliest deposits represented are the early Neolithic deposits on the sandy silt at Woolwich Manor Way, sealed by overlying peat formation. Evidence for human activity here is derived from the deposit of emmer wheat spikelets. Conditions at this point on the higher ground were presumably relatively dry and there is little evidence for the vegetation prior to the development of the overlying peat.

At all three sites the earliest waterlogged deposits are associated with a vegetation of alder-carr with a fringe vegetation of reeds and rushes, and wet ground species typical of muddy mineral rich deposits. Within the London region alder carr is generally dated to the Early Neolithic to the Middle Bronze Age (Barnett *et al.* 2010; Crockett *et al.* 2002), as it is further up river at Runnymede (Greig 1991) and in the lower Colne Valley at Slough (Wessex Archaeology 2006). At Rainham, there is evidence for clearance and increased agriculture, at the same time as the local environment became wetter, changing from an alder carr to reed swamp (Scaife 1991). This is also the case at Wilsons Wharf (Tyers 1988) and Erith (Sidell *et al.* 1997), where the environment appears to have been opened up and increases in fen taxa occur, along with appearances of cereal pollen and ruderals. It is difficult to establish how dense the woodland is likely to have been from the current deposits, although the deposits from all three sites suggest a background of disturbed and relatively open vegetation.

Some of the cut features and channels clearly supported open bodies of relatively mineral rich water. The presence of yew in Bronze Age deposits at Woolwich Manor Way is of interest. It is a characteristic of a number of sites in London where both the seeds and timber have been identified, for example at Wennington (Sidell 1996), Dagenham (Divers 1994) and Beckton (Meddens and Sidell 1995). The construction of the Bronze Age trackways is clearly associated with increasingly wet conditions and to enable movement across the wetland zone. The wetter conditions with rising basal water levels along the Thames corridor may have resulted in a reduction in alder and a change to reed/sedge fen vegetation prior to the later brackish water conditions. This reduction in alder is dated to the middle to late Bronze Age across London (Merriman 1992, 263; Scaife 2000; 2002; Allen *et al.* 2005, cf. Greig 1991) and appears to be associated with increasing activity within these periods (Meddens 1996), as is presumably seen here. The pattern at all three sites investigated as part of the A13 Thames Gateway Road Scheme fills the well-established sequence of alder carr replaced by a wetter more open landscape during the course of the Bronze Age.

Waterlogged wood: species and age *by Catherine Barnett*

Introduction

A number of key contexts were chosen for waterlogged wood analysis during post-excavation assessment of samples from three sites along the route of the A13: Prince Regent Lane (Freemasons Road), Woolwich Manor Way and Movers Lane. The samples are of worked wood from contexts of Bronze Age date and predominantly derive from the wooden trackway structures. The wood species identifications are presented here and briefly discussed, but this report should be viewed in tandem with the information regarding the wood technology provided by D. Goodburn in this volume.

Methodology

Identification of all waterlogged wood samples recovered was attempted. In the case of samples containing multiple fragments, a minimum of 10 pieces was undertaken. A fine slice was taken from each wood fragment along three planes (transverse section (TS), radial longitudinal section (RL) and tangential longitudinal section (TL)) using a razor blade. The pieces were mounted in water on a glass microscope slide, and examined under bi-focal transmitted light microscopy at magnifications of x50, x100 and x400 using a Kyowa ME-LUX2 microscope. Identification was undertaken according to the anatomical characteristics described by Schweingruber (1990) and Butterfield and Meylan (1980). Identification was to the highest taxonomic level possible, usually that of genus and nomenclature is according to Stace (1997). The results are shown in Table A3.16

Results

As recorded in Table A3.16, a number of fragments had either desiccated or undergone lignitic degradation and so were beyond safe identification. However, a good proportion of the assemblage has been analysed successfully. Young roundwood of alder (*Alnus glutinosa*) clearly dominates the worked wood. However, where samples of bundles of coppiced wood and rod ends were collected, a surprisingly large range of deciduous and evergreen taxa was identified, including willow/poplar (*Salix/Populus* sp, the two being anatomically indistinguishable), holly (*Ilex aquifolium*), hazel (*Corylus avellana*), yew (*Taxus baccata*), oak (*Quercus* sp.) elm (*Ulmus* sp.) and ash (*Fraxinus excelsior*). Larger stakes and logs tend again to be of alder but on occasion were of ash and elm. Since the worked wood derives from chronologically similar structures, they are discussed together below.

Discussion

There are no clear discernible differences in the choices of wood made for the earliest (later early Bronze Age) and latest (late Bronze Age) wooden structures in the three excavated areas, with alder continuing in dominance but with the continued presence of a range of other tree and shrub types. Assuming the woods were all sourced locally, it can be suggested that two habitats were exploited. The dominance of alder and importance of willow/poplar points to the use and management of wetland alder carr, and the use of slightly drier marginal mixed open woodland is indicated by the presence of oak, hazel, holly, elm and ash. While management of stands is clearly shown by the

Table A3.16 Waterlogged wood identifications

Site Code	*Context no*	*Sample/ SF no.*	*Context type*	*Grp*	*Period*	*Comments (all are medium roundwood 1.5-3.5cm unless stated)*	*Identification*
WMA02	5	-	Log in trackway 14 (cleft)	14	EMBA	large timber	*Alnus glutinosa*
WMA02	6	-	Cleft timber with cut ends in trackway 14	14	EMBA		Desiccated unidentified
WMA02	9	-	Roundwood in trackway 14	14	EMBA		*Fraxinus excelsior*
WMA02	10	-	Timber with 'wedge' type cut end in trackway 14	14	EMBA		*Ulmus* sp.
WMA02	12	-	Cleft half log or trimmed plank in trackway 14 (reused)	14	EMBA	Large stake, slow grown/ narrow rings	*Fraxinus excelsior*
WMA02	13	-	Cut rod possibly of coppice origin in trackway 14	14	EMBA		*Alnus glutinosa*
WMA02	15	-	Tangentially cleft timber in trackway 14	14	EMBA		*Fraxinus excelsior*
WMA02	16	-	Log with lopped branch in trackway 14	14	EMBA		*Alnus glutinosa*
WMA02	18	-	Rod with wedge type cut end in trackway 14	14	EMBA		*Alnus glutinosa*
WMA02	21	ss 3	Roundwood in trackway 14	14	EMBA	rod samples	*Alnus glutinosa* 3 rods, 5 poles; *Salix/ Populus* sp. 1 rod; *Ulmus* sp.1 pole; *Fraxinus excelsior* 1 pole; *Ilex aquifolium* 1 pole
WMA02	21	ss 5	Roundwood in trackway 14	14	EMBA	10 pieces	*Fraxinus excelsior* 5; *Corylus avellana* 1; *Ulmus* sp. 1; *Alnus glutinosa* 1; *Salix/ Populus* sp. 2
WMA02	63	ss 21	Roundwood under large timbers in trackway 61	61	MLBA	numerous small fragments (25% identified)	*Ulmus* sp. 1 large rwd; *Salix/ Populus* sp. 1 large rwd; *Alnus glutinosa* 5; *Salix/ Populus* sp. 3; *Fraxinus excelsior* 1; degraded unid 1
WMA02	20	-	Branch from naturally fallen tree in trackway 29	29	EMBA		*Alnus glutinosa*
WMA02	30	-	Rod with wedge point in trackway	29	EMBA		*Alnus glutinosa*
WMA02	31	-	Rod with pencil point in trackway	29	EMBA		Desiccated unidentified
WMA02	33	-	Stake in trackway 29	29	EMBA		*Alnus glutinosa*
WMA02	36	-	Rod end in trackway 29 with wedge type cut end.	29	EMBA		*Salix/ Populus* sp.
WMA02	51	-	Decayed yew stem In trackway 29	29	EMBA		*Taxus baccata*
WMA02	49	ss 10	Roundwood in trackway 50	50	EBA	numerous small fragments	All desiccated and degraded unidentified
WMA02	49	ss 11	Roundwood in trackway 50	50	EBA	small fragments	Modern root 1; *Alnus glutinosa* 1; cf *Alnus glutinosa* 1; *Quercus* sp.; *Fraxinus excelsior* 2; *Ulmus* sp. 1
WMA02	62	ss 19	Roundwood beneath large timbers in trackway 29	29	EMBA	2 bags of small fragments (*c*.20% identified)	*Alnus glutinosa* 2 large timbers; cf. *Alnus glutinosa* 1; *Fraxinus excelsior* 1; *Taxus baccata* 1; cf. *Salix/ Populus* sp. 8; *Ulmus* sp. 2; desiccated unid large rwd 2
WMA02	41	-	Log in trackway 61	61	MLBA	large timber	*Ulmus* sp.
WMA02	42	-	Stake not in situ associated with trackway 61	61	MLBA		*Alnus glutinosa*
WMA02	40	-	Stake in situ. may be associated with curved line of stakes to NE of 61	-	MLBA	Large stake 80mm diameter	*Alnus glutinosa*

Table A3.16 Waterlogged wood identifications (continued)

Site Code	*Context no*	*Sample/ SF no.*	*Context type*	*Grp*	*Period*	*Comments (all are medium roundwood 1.5-3.5cm unless stated)*	*Identification*
WMA02	54	-	Stake *in situ*, may be associated with irregular stake line round 61	-	MLBA	Large stake 80mm diameter	*Fraxinus excelsior*
WMA02	64	-	?Stake	-	EMBA or M-LBA		*Alnus glutinosa*
WMA02	65	-	Cut branch possibly small stake. Poss. associated with trackway 29	-	EMBA	Small rod	*Taxus baccata*
RIR01	1047	-	Fill of ditch 1039	1038	LBA	small pieces	5 Unidentified
RIR01	3009	ss 53	Peat deposit below trackway 3031	-	EMBA	numerous small pieces	*Alnus glutinosa* 1 Rest degraded unid
RIR01	3013	-	Bundle of coppiced wood to one side of trackway 3013	-	EMBA	2 bags of small pieces (25% identified)	*Alnus glutinosa* 5; cf. *Alnus glutinosa* 2; *Salix/ Populus* sp. 1; cf. *Salix/ Populus* sp. 2; *Quercus* sp. 1; unid 3
RIR01	3027	ss 42	Trackway 3031-coppiced bundles	3031	EMBA	several small pieces	Degraded cf. *Salix/ Populus* sp. 3; rest degraded unid
RIR01	5142	ss 16	Sandbank within western channel with artefact scatter	-	LBA	1 bag small pieces (33% identified)	*Salix/ Populus* sp. 1; *Alnus glutinosa* 6; *Alnus glutinosa* 4yr twig<1cm; degraded unid 2
RIR01	5247	ss 36	Stake built structure near trackway 5268 (Area 3)	-	EMBA		*Alnus glutinosa* 2
RIR01	5108	-	Trackway 5268 (Area 3)	5268	EMBA	2 bags small pieces (25% identified)	*Alnus glutinosa* 14 rwd, 1 4yr twig; *Fraxinus excelsior* 1; *Salix/ Populus* sp. 5 rwd, 1 twig; cf. *Salix/ Populus* sp. 6; degraded unid 2
FRU01	27	-	Upper fill of ditch 28	42	post LBA		*Fraxinus excelsior* 2 larger rwd
FRU01	46	sf 67	Sandy silty peat	35	MLBA		*Taxus baccata*
FRU01	48	ss 95	Spread of wood	35	MLBA		Desiccated cf. *Alnus/ Corylus*
FRU01	49	ss 114	Spread of wood 49	31	EMBA		*Taxus baccata* 1 branching twigwood; *Alnus glutinosa* 2 rwd; 8 degraded mature and rwd fragments
FRU01	64	-	Possible timber post	29	EMBA	Large log 110mm diameter	*Fraxinus excelsior*
FRU01	65	-	Plank	33	EMBA		*Alnus glutinosa*
FRU01	85	-	Worked wood part of spread 49	31	EMBA		cf. *Alnus/ Corylus*
FRU01	86	-	Worked wood part of spread 49	31	EMBA		*Taxus baccata*
FRU01	90	-	Worked wood part of spread 49	31	EMBA		*Fraxinus excelsior*
FRU01	91	-	Worked wood part of spread 49	31	EMBA		Desiccated unidentified
FRU01	93	-	Worked wood part of spread 49	31	EMBA		*Alnus glutinosa*
FRU01	94	-	Stake, associated with piled structure	32	EMBA		*Alnus glutinosa*
FRU01	174	-	Part of wood spread 164	22	MBA		cf. *Alnus/ Corylus*
FRU01	175	-	Part of wood spread 164	22	MBA		Unidentified
FRU01	176	-	Part of wood spread 164	22	MBA		*Alnus glutinosa*
FRU01	177	-	Part of wood spread 164	22	MBA		*Alnus glutinosa*
FRU01	185a	-	Post	21d	MBA		*Alnus glutinosa*
FRU01	185b	-	Post	21d	MBA		Unidentified
FRU01	212	-	Posthole 213	21d	MBA		*Alnus glutinosa*
FRU01	335	-	Stake	21a	MBA		*Alnus glutinosa*
FRU01	345	-	Stake	21e	MBA	stake?	*Alnus glutinosa*

presence of coppiced pieces (see Goodburn, this volume), the range of taxa utilised may also suggest some casual exploitation. The selection and use of wood types is considered further in the charcoal report (Barnett, this volume).

The use of alder, hazel and willow for structural components of Neolithic and Bronze Age wetland trackways is commonly reported in the UK, for example in the Somerset Levels where for instance the Sweet Track was constructed of alder and hazel pegs and rails, with oak, lime (*Tilia* sp.) and ash planks (Coles and Coles 1986); the Tinney's trackways were of alder, hazel and willow brushwood with oak planks (Coles and Orme 1980) and the Meare Heath track was of birch (*Betula* sp.) and alder brushwood with oak stakes (Coles 1980). The use of larger tree types such as ash and oak for planks and large stakes is reported, although often, where present, oak is a more dominant type among the larger stakes and logs than indicated here.

Somewhat more unusual is the use of yew (WMA02 contexts 62 and 65) and holly (WMA02 context 21) within trackways, the former also found within worked wood spreads (FRU01 contexts 49 and 86) and potentially unworked samples at FRU01, these suggesting the yew was growing in/immediately adjacent to the wetland there. Yew has indeed previously been documented in wetland margins in the region for the Bronze Age, eg at Wennington Marsh (Sidell 1996) and at Erith (Sidell *et al.* 2000), where it was an important component within the submerged forest along with oak, alder and ash. The environment associated with Bronze Age trackways in Beckton was dominantly alder carr (Scaife 1991 in Rackham and Sidell 2000) and oak with alder at Bramcote Green (Thomas and Rackham 1996). The Bronze Age flora at West Heath showed an increase in holly within the existing mix of oak, lime and hazel, which tallies well with its appearance here (Rackham and Sidell 2000).

Charcoal *by Catherine Barnett*

Introduction

A number of contexts were chosen by Oxford Archaeology for wood charcoal analysis during post-excavation assessment of samples from three sites along the route of the A13: Prince Regent Lane (FRU01), Woolwich Manor Way (TGW00) and Movers Lane (RIR01). These contexts range in date from the early Neolithic to the late Bronze Age/

Table A3.17 Charcoal assemblages

Site Code	Area	Sample no	Cxt no	Context type	Grp	Phase
TGW00	T15	21	2008	Palaeosol with artefact scatter formed on surface of sand sealed by peat.		ENEO
RIR01	3	18	5083	Possible burnt mound: black sandy silt clay with abundant burnt flint inclusions by palaeochannel	5264	MLBA
RIR01	3	10	5085	Fill of pit 5084 assoc with burnt flint deposit 5264		MLBA
RIR01	3	20	5154	Peat at edge of western channel. (Late) EBA-MBA trackway sits on its surface	5263	BA
RIR01	3	34	5147	Fill of gully 5159 with burnt daub and charcoal, overlies stake structure	5161	EMBA
RIR01	2B	-	3004	Peat containing burnt flint, wood chips, LBA pot, over drowned root system adapted using brushwood and used as a possible LBA platform adj to trackway		MLBA
FRU01		101	49	Artefact rich organic deposit accumulated around and associated with piled structure (double row oak piles, poss bridge)		EMBA
FRU01	A	82	34	Sandy silt alluvium over the peat that caps the piles		LBA-EIA
FRU01	A	39	31	Dark grey brown, clayey peaty silt at top of piled structure sequence		LBA-EIA

early Iron Age and include layers associated with a Bronze Age piled structure and a possible burnt mound. The results of this charcoal analysis should be viewed in tandem with the waterlogged wood analysis (Barnett above; Chapter 10 above).

Methodology

Up to 100 fragments per sample >2mm were prepared for identification according to the standard methodology of Leney and Casteel (1975; see also Gale and Cutler 2000). Each was fractured with a razor blade so that three planes could be seen: transverse section (TS), radial longitudinal section (RL) and tangential longitudinal section (TL). The pieces were mounted using modelling clay on a glass microscope slide, blown to remove charcoal dust and examined under bi-focal epi-illuminated microscopy at magnifications of x50, x100 and x400 using a Kyowa ME-LUX2 microscope. Identification was undertaken according to the anatomical characteristics described by Schweingruber (1990) and Butterfield and Meylan (1980). Identification was to the highest taxonomic level possible, usually that of genus, and nomenclature is according to Stace (1997).

As shown in Table A3.17, a minimum of 13 tree and shrub types were identified for the contexts as a whole, most being common deciduous types.

Woolwich Manor Way

Early Neolithic

The early Neolithic assemblage from the palaeosol (layer 2008, Fig. 5.3) included hazel, pomaceous fruit wood (Pomoideae), cherry-type (*Prunus* sp., a group containing e.g. wild cherry and blackthorn) and also contained the only charred representation of elm (*Ulmus* sp.). The small but mixed sample is likely to represent domestic hearth fuel.

Movers Lane

Bronze Age-early Iron Age

Alder (*Alnus glutinosa*) proved to be the dominant taxon, forming a large proportion of most of the early, middle and late Bronze Age samples, a phenomenon also found with the worked wood assemblage (Barnett, Appendix 3, above). Interestingly, although alder was found to dominate most

Comments	*Alnus glutinosa*	cf. *Alnus glutinosa*	*Betula pendula/ pubescens*	*Corylus avellana*	*Frangula alnus*	*Fraxinus excelsior*	*Hedera helix*	*Pomoideae*	*Prunus* sp.	*Quercus* sp.	*Salix/ Populus* sp.	*Sambucus nigra*	*Tilia* sp.	*Ulmus* sp.	*Unidentified*	Total no. fragments
Small sample of small fresh fragments	-	-	-	1	-	-	-	9	1	-	-	-	-	5	-	16
Large fragmentary sample,some friable *c.* 10% Identified	11	-	-	79	-	-	-	-	-	2	2	2	-	-	4	100
Medium fragmentary sample, most v miner-alised, some vitrified	-	-	-	47	-	-	-	1	1	-	1				9	50
	44	-	-	8	-	1	-	-	-	-	-	-	-	-	4	57
Large sample of fragment-ary and mineralised pieces. *c.* 15% Identified	46	-	4	44	-	3	-	-	-	3	-	-	-	-	-	100
A few large fresh pieces	5	-	-	-	-	-	3 (twig)	-	-	-	-	-	-	-	3	11
Medium-large fresh fragments	20	-	-	2	-	1	-	2	-	23	-	-	6	-	5	59
Sample of v. large pieces incl roundwood 40mm diameter	-	-	50	-	-	-	-	-	-	-	-	-	-	-	-	50
Medium-large fragments, several vitrified. 50% Identified	26 + 2 twig	2	5	-	3 + 1 cf 3yr twig	-	-	1	-	-	-	-	-	-	5 + 5 twig	50

of the later prehistoric charcoal samples, it was not found in the early Neolithic assemblage from the palaeosol at Woolwich Manor Way (layer 2008, T15). Since only a single small charcoal assemblage of this date was available, it is unclear whether this is a true reflection of availability or selection, but a rise in alder carr and widespread fen conditions might be expected in the early Bronze Age of the Thames Basin and is reflected in the pollen assemblages from the late Mesolithic to early Neolithic period at both Movers Lane and Woolwich Manor Way (Haggart, above).

Hazel (*Corylus avellana*) is also important in a number of the assemblages of all ages, and forms *c* 80-95% of the pieces from the possible channel-side middle-late Bronze Age burnt mound and associated pit (RIR01, contexts 5083 and 5085, Figs 7.14 and 7.15). Small numbers of fragments of pomaceous fruit wood, oak (*Quercus* sp.), willow/poplar (*Salix/Populus* sp., the two being anatomically indistinguishable), elder (*Sambucus nigra*), cherry-type and alder were also found in these contexts. This mix of wood types, a minimum of seven taxa, is likely to reflect local gathering of fuel wood but with stands of (potentially managed) hazel particularly targeted. The importance of hazel in the wood charcoal is not reflected in the waterlogged wood assemblages from the same and same-age contexts, suggesting that there was deliberate selection of hazel for fuel and a preference for alder to use in structures likely to be periodically submerged. Alder wood is indeed known for its durability under water (Edlin 1949, 23; Gale and Cutler 2000, 34) and would have made an economic and long-lasting choice for trackway construction.

The charcoal assemblage from the surface of the peat in Area 3 of RIR01, context 5263, has been suggested to be contemporary with the construction and use of the Bronze Age trackway that rests on it. Alder forms 88% of the assemblage, with lesser amounts of hazel and a single fragment of ash (*Fraxinus excelsior*). This compares well with the selection of alder wood shown by analysis of the Area 3 trackways, where alder dominates but is accompanied by small numbers of ash and also willow/poplar pieces.

Middle-late Bronze Age context 3004 is a complex one, comprising a peat over and surrounding the root system of a large tree which is thought to have been adapted and used as a platform with the addition of bundles of brushwood. The peat contained wood chips, pottery and burnt flint. The small charcoal assemblage proved to be of alder with three narrow pieces of ivy (*Hedera helix*). The relationship to the peat and to the possible platform is unclear; it might be from the burning of offcuts and debris from the bundles of coppiced wood or represent an unrelated dump of spent fuel. However, it is suggested the ivy would not have been deliberately chosen for fuel but was attached to the alder wood collected.

The early-middle Bronze Age gully fill, context 5147 is again heavily dominated by alder and hazel but contains small quantities of birch (*Betula pendula/ pubescens*), ash and oak. The fill, which overlay structure 5161, contained charcoal and burnt daub. However, the mix of taxa in the charcoal assemblage shows this is unlikely to originate from structural wood; instead it is likely to represent domestic fuel use.

Prince Regent Lane (Freemasons Road)

Early Bronze Age-early Iron Age piled structure sequence

A sample was analysed from (late) early Bronze Age context 49, an organic deposit that had collected around and was believed associated with the piled oak 'bridge' structure (Str. 32). The charcoal assemblage differs somewhat in composition from a sample of similar age at Mover's Lane (context 5147). Alder, hazel and ash are again present, though it is oak that dominates with alder. Ash, pomaceous fruit wood and six pieces of lime/linden (*Tilia* sp.) were also recovered, the latter the only representation of the taxon in this analysis.

A sample from context 34, from alluvium capping the oak piles contained large fresh charcoal fragments including pieces of large roundwood of 40mm diameter. All proved to be of hazel and it is possible these pieces derive from a bundle of coppiced hazel wood related to the structure that was either discarded and burnt or used for fuel, perhaps during construction.

Much of the charcoal from the peaty silt context 31 at the top of the piled structure sequence was vitrified, indicating a high temperature of burn, likely in excess of >800°C (Prior and Alvin 1983). Alder, birch, and pomaceous fruit wood are represented, along with the first appearance of alder buckthorn (*Frangula alnus*). Several pieces of twig wood were found, including alder and alder buckthorn and it may be the assemblage derives from *in situ* burning of vegetation to clear the site or a temporary hearth utilising material immediately to hand.

Discussion

Overall, a moderate range of woody types were selected and used across the three sites. The concentration on alder and hazel is likely to reflect both their local availability and, from the Bronze Age, their increased productivity due to coppicing. As suggested from the results of the waterlogged wood analysis (Barnett, Apppendix 3, above) both the use and management of wetland alder carr in the immediate area and the use of slightly drier mixed open woodland beyond the floodplain edges is indicated by the types identified. The results are somewhat site specific but compare well in broad terms to the findings at Springhead and Northfleet (Barnett 2011) There, alder (and sometimes Pomoideae) dominated the charcoal assemblages of the early and middle to late Bronze Age boiling pits, burnt mounds, pits and hearths and was accompanied by hazel, oak, birch, cherry-type (including bird cherry) in differing quantities. Lime and willow/poplar were rare but field maple (*Acer campestre*), dogwood (*Cornus sylvatica*) and beech (*Fagus sylvatica*) were also found, unlike the A13 sites, suggesting drier, possibly chalky areas beyond the wetland margins were also exploited for wood at those sites.

Animal bone *by Lena Strid and Rebecca Nicholson*

Introduction

This report encompasses animal bones from the adjacent sites Prince Regent Lane (PGL00, Phase II) and Freemasons Road Underpass (FRU01). A small number of bones were recovered from the nearby Bronze Age site at Movers Lane (RIR01) and are discussed briefly at the end of this report. The animal bone assemblage from the Prince Regent Lane and Freemasons Road Underpass comprises 462 refitted fragments from securely dated contexts. The assemblage was recovered from contexts dated from the later part of the early Bronze Age (1690-1520 ^{14}C yr BC) to the late Bronze Age (referred to here as M-LBA) and contexts dating from the late Bronze Age to the Iron Age (LBA-IA). The bones were recovered both through hand collection during excavation and from wet sieved bulk samples, but almost 77% of the recorded bones were hand-retrieved. A full record of the assemblage, documented in a *Microsoft Access* database, can be found with the site archive.

Methodology

Initial assessment of the assemblages was carried out in 2000 and 2003 (Liddle in Gifford and Partners 2000; 2003b; Mepham in Wessex Archaeology 2003). The bones were identified at Oxford Archaeology using a comparative skeletal reference collection, in addition to standard osteological identification manuals. All the animal remains were counted and weighed, and where possible identified to species, element, side and zone. For zoning, Serjeantson (1996) was used, with the addition of mandible zones by Worley (forthcoming 2011). Sheep and goat were identified to species where possible, using Boessneck *et al.* (1964) and Prummel and Frisch (1986); they were otherwise classified as 'sheep/goat'. Ribs and vertebrae, with the exception of atlas and axis, were classified by size: 'large mammal' representing cattle, horse and deer; 'medium mammal' representing sheep/goat, pig and large dog; and 'small mammal' representing small dog, cat and hare. The minimum number of individuals (MNI) was calculated on the most frequently occurring bone for each species, using Serjeantson's zoning guide (Serjeantson 1996) and taking into account left and right sides.

The condition of the bone was graded on a 6-point system (0-5). Grade 0 equating to very well preserved bone, and grade 5 indicating that the bone had suffered such structural and attritional damage as to make it unrecognisable (Table A3.18).

The age-at-death of the animals was based on evidence from tooth eruption, tooth wear and epiphyseal fusion, using Habermehl (1975) for fusion and tooth eruption, and Grant (1982), Halstead (1985), Payne (1973) and O'Connor (1988) for tooth wear of cattle, sheep/goat and pig. Sex estimation was carried out on morphological traits on cattle pelves, goat horn cores and pig mandibular canine teeth, using data from Boessneck *et al.* (1964), Schmid (1972) and Vretemark (1997).

Measurements were taken according to von den Driesch (1976), using digital callipers with an accuracy of 0.01mm. Large bones were measured using an osteometric board, with an accuracy of 1 mm. These measurements will be available as part of the site archive.

Bone condition

The majority of the bone from the site was in good to fair condition (Table A3.19). The bones from the (late) early and middle-late Bronze Age were slightly less well preserved, which is to be expected given their older age. A total of 4% of the M-LBA and 4.7% of the LBA-IA animal bone fragments had been gnawed. Rodent gnawing was only recorded on one fragment (from a M-LBA context) whereas the other gnaw marks came from from canids or other carnivores. No bones were burnt.

Table A3.18 Bone preservation grading categories

Grade 0	Excellent preservation. Entire bone surface complete.
Grade 1	Good preservation. Almost all bone surface complete. No cracks in bone.
Grade 2	Fair preservation.
Grade 3	Poor preservation. Most bone surface destroyed.
Grade 4	Very poor preservation. No surface structure remaining.
Grade 5	Extremely poor preservation. Unlikely to be able to identify element.

Table A3.19 Preservation level for contexts from the Freemasons Road assemblage.

	N	*0*	*1*	*2*	*3*	*4*	*5*
M-LBA	376	0.8%	35.3%	45.1%	16.2%	2.7%	
LBA-IA	86		58.1%	33.7%	8.1%		

The (late) early and middle to late Bronze Age assemblage

The assemblage from the earlier part of the second millennium BC consisted of 376 bones, of which 177 (47.3%) were identified to taxon (Table A3.20). The domestic mammals included cattle (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra hircus*), sheep or goat (*Ovis aries* or *Capra hircus*) and dog (*Canis familiaris*). The wild fauna included bank vole (*Clethrionomys glareolus*), field vole (*Microtus agrestis*) and frog (*Rana* sp.). One rabbit metatarsal was recovered from layer 47. Since rabbits are burrowing animals, thought to have been introduced by the Normans (Yalden 1999, 158-61) this bone must be considered intrusive and is therefore not considered further.

Domestic species

Cattle dominate the assemblage by number of identified fragments (NISP). Using the calculated Minimum Number of Individuals (MNI) cattle remains the most common species, although they are less dominant compared to sheep/goat and pig. Unfortunately the total number of bones from these three animals is below the recommended cut-off point for intra-species frequency analysis (*cf* Hambleton 1999, 39-40) and so further interpretation of the intra-species frequency would be imprudent. In general, cattle and sheep/goat are the most common taxa in Bronze Age animal bone assemblages in Britain (Serjeantson 2007, 87). Variation in the ratios of cattle:caprines between sites could be dependent on environmental factors; for instance, wetland pastures suit cattle far better than sheep. However, not all selection factors are environmentally determined: as Serjeantson argues (*ibid.*), activities such as feasting and trading secondary products such as wool and dairy products may be at least partly responsible for patterning in faunal assemblages.

Table A3.20 Middle to late Bronze Age bone assemblage from Freemasons Road

	Cattle	*Sheep/goat*	*Sheep*	*Goat*	*Pig*	*Dog*	*Bank vole*	*Field vole*	*Rodent*	*Frog*	*Micro-fauna*	*Small mammal*	*Medium mammal*	*Large mammal*	*Indeterminate*
Horn core	2			4											
Skull	4				1	2								5	
Mandible	18	7			2	4									
Loose teeth	11	9					1	1	6						
Atlas	1					2									
Axis		1													
Vertebra													4	6	
Rib													2	13	
Scapula	6	1			1									1	
Humerus	7	3			1	1				2				1	
Radius	9	6				2							1		
Ulna	3					2									
Carpal bones												1			
Metacarpal	10	3													
Pelvis	3	1											1		
Femur	6	3			1										
Tibia	7	6		1	1										
Fibula						1									
Calcaneus	2														
Astragalus	2														
Metatarsal	8	2													
Phalanx 1	4	1			1										
Phalanx 2		1			1										
Sesamoid														1	
Long bone											5		8	12	
Indeterminate														13	107
TOTAL (NISP)	103	43	2	5	9	14	1	1	6	2	16	1	16	61	107
MNI	6	4			1	2	1	1							
Weight (g)	9190	534	59	126	179	275	0	0	0	0	0	0	65	993	405

Table A3.21 Middle to late Bronze Age: mandibular wear stages (MWS) and calculated age at death for cattle (Halstead 1985), sheep/goat (Payne 1973) and pig (O'Connor 1988).

Species	*dp4*	*P4*	*M1*	*M*	*M3*	*MWS*	*Estimated age*
Cattle	j		e	C		12	8-18 months
	g		b			10	8-18 months
	k		g	C-E		N/A	8-18 months
			g	b		20	18-30 months
			j	f	b	32	30-36 months
				g	f	38	Young Adult
			j	g	f	N/A	Young Adult
				j	g	41-42	Adult
					g	37-49	Adult
Sheep/goat	k		f	E		14	6-12 months
			g	g	d	33	2-3 years
			h	g	e	35	3-4 years
				g	g	36-41	4-6 years
Pig		A	e	c	V	19-21	Subadult

While not all skeletal elements are represented in the small assemblage, bones from meat-rich body parts as well as meat-poor body parts were present. This would suggest that domesticates were butchered on or close to the site.

Judging by the state of epiphyseal fusion, most cattle, sheep/goat and pigs were sub-adult or adult at the time of death. The absence of neonatal remains is likely to be due to taphonomic loss, as bones from neonatal animals are very fragile. A wide range of slaughter ages for cattle and sheep/goat was indicated by the dental evidence (Table A3.21), although the majority of cattle appear to have been slaughtered as sub-adults. Only one pig mandible, from a sub-adult individual, could be aged.

A measurable cattle metacarpal was found to be very large when compared to metacarpals from contemporary British sites published in the ABMAP database (University of Southampton 2003: http://archaeologydataservice.ac.uk/archives/view/abmap), although the number of measureable bones was extremely low (see Table A3.22). The metacarpal was much smaller than those from aurochsen cows, indicating that it belonged to a domestic animal, probably either a bull or an ox.

The dog remains consist of one semiarticulated skeleton and one disarticulated fibula in flood deposit (125); one atlas, skull and two articulating mandible halves in spread (49), discussed further below; and three disarticulated bones in overlying peat deposits (32, 101, 105). These included a butchered atlas, discussed further below. Since the flood deposit (125) was formed later than the spread (49), the dog remains are unlikely to be contemporary. Although the mandible from (125) was incomplete, length and width measurements on the P4 tooth (11.8 and 6.4mm respectively) and M1 (23.8 and 9.4mm: measurements after von den Driesch 1976 and Phillips *et al.*. 2009) suggest that the mandibular teeth were of similar size and shape to those from of a modern deerhound (data published in Phillips *et al.*. 2009) although the partial and fragmented nature of the skull and limb bones meant that estimation of withers height and skull shape could not be made. Data summarised by Harcourt (1974) suggests that dogs in the Bronze Age stood 0.43-0.62m at the withers, but without other measureable bones the height and general body shape of the dog from deposit (125) can not be established. Although the dog would probably fall at the upper end of Harcourt's range it is very unlikely to have been as large as a modern deerhound (this breed stands at 0.7m–0.8m at the withers). It is plausible that the atlas, skull and mandibles in (49) were articulated at the time of deposition, but later disarticulated. Although not all teeth were present, measurements on the mandibular P4 and visual comparison with the mandible from flood deposit (125) indicated a dog of similar or slightly larger size. The fragment of fibula shaft from the same context was also large and hence could have belonged to a wolf rather than a dog, although since the fibula is very fragmented this can not be verified. From visual inspection alone, the bone would appear to have come from a bigger animal than the other dog bones from this context.

Wild species

The only wild fauna in the assemblage were rodents, amphibians and fish. The presence of bank vole, field vole and frog is consistent with a local environment comprising a mixture of open fields and woodlands, interspersed with streams or wetlands (Bjärvall and Ullström 1995). A fin spine from a three-spined stickleback (*Gasterosteus aculeatus*) from post hole (72) was recorded by J. Liddle during assessment. These fish can be found both in freshwater streams and rivers and in estuarine and coastal waters.

Butchery

Butchery marks were recorded on bones from cattle, sheep/goat, goat and dog. Most of these were cut marks deriving from disarticulation and marrow extraction. Chop marks on the basal part of one cattle (32) and one goat horn core (49) suggest utilisation of horn for horn working. The dog atlas from (105) had transverse chop marks on the ventral side on the neural arch, indicating an attempt at decapitation, but the absence of the corresponding skull means that full decapitation can not be confirmed. It is conceivable that the dog's head may have been used for ritual purposes, but it is also possible that removal of the head was undertaken during butchery of the animal for food. Dog bones with butchery marks have been found on some Iron Age sites, suggesting that in this later period dogs were occasionally exploited for their meat (Maltby 1996, 23-24). Eating of dogs may have been practiced in the Bronze Age as well, for dietary, ritual or medicinal purposes (*cf*. Pasda 2004, 44-45) and it is possible that the skins were used for clothing, though skinning evidence is absent here.

Pathology

A sheep/goat mandible displayed slight bone absorption at the forth premolar/first molar, indicating an infection of the gums. Gum infection is fairly common in livestock populations, and, if severe, can cause mastication difficulties and weight loss (Baker and Brothwell 1980, 153-154).

A note on the bone from spread 49

The bones retrieved from layer 49, an organic deposit that had collected around the piled oak 'bridge' structure (Str. 32), comprised 24 speciable fragments from cattle, sheep/goat, goat, pig, dog and frog (*Rana* sp.). A cattle mandible from this layer was dated to 1690-1520 cal BC (94.0%) (SUERC-27345: 3340±30 BP). With the exception of the two dog mandible fragments discussed above, no bones were articulated. However, the presence of a dog atlas, skull and two articulating mandible halves suggests that these may have been part of a single head, the bones becoming disarticulated by water movements and peat formation.

At the Norfolk Bronze Age sites of Flag Fen and the Power Station Post Alignment site, deposits of articulated and semi-articulated skeletons of dogs and disarticulated human remains suggest ritual depositions, possibly related to funerary rites (Halstead *et al.* 2001, 348-350). This is less likely to have occurred at Prince Regent Lane/Freemasons Road Underpass, as the bones from layer (49) are relatively few in number and no specific body parts are over represented. The presence of gnaw marks suggest that some bones were accessible to dogs or other carnivores. Butchery marks on cattle and sheep/goat bones indicate food waste, although whether from ordinary meals or from more ritualised feasting can not be established from such scant evidence.

Late Bronze Age to Iron Age assemblage

The late Bronze Age to Iron Age assemblage comprised only 86 bones, 35 (47.7%) of which were identifiable to taxon (Table A3.23). Cattle, sheep/goat, goat and pig were represented. No firm identification of sheep was made, but since goats are generally rare on Iron Age sites in comparison to sheep (Maltby 1981, 159-160) it is likely that some or many of the bones are from sheep.

Domestic species

The greatest number of fragments (NISP) was from cattle (Table A3.22), but when calculating the Minimum Number of Individuals (MNI) cattle, sheep/goat and pig were similarly represented. Due to their larger size, cattle were likely to have been the main meat provider of the three species and the extremely low number of identified bones renders any comparison of taxon abundance meaningless.

The assemblage contains very few ageable bones and mandibles and it would be folly to try to establish a slaughter age pattern for this assemblage. Nevertheless, the surface structure of the bones indicates all animals were sub-adult or adult at the time of death. However, the absence of neonatal and juvenile bones is likely to reflect taphonomic loss, as the mortality rate of newborn and juvenile livestock would have been high even if none were deliberately slaughtered (Vretemark

Table A3.22 Cattle metacarpal measurements (Bd = Greatest distal breadth) from Freemasons Road and contemporary sites from the ABMAP database.

Site	*Phase*	*Mean*	*Min*	*Max*
A13 Thames Gateway	M-LBA	59.9		
Crab Farm, Shapwick (Dorset)	EBA	50.4	48.0	52.7
A303, Stonehenge (Wiltshire)	MBA	61.1		
Middle Farm, Dorchester Bypass (Dorset)	LBA	50.8	50.1	51.5

Table A3.23 Late Bronze Age to Iron Age bone assemblage from Freemasons Road

	Cattle	*Sheep/goat*	*Goat*	*Pig*	*Amphibian*	*Micro-fauna*	*Medium mammal*	*Large mammal*	*Indeterminate*
Horn core	3		1						
Skull								6	
Mandible	2	2		1					
Loose teeth	2	2							
Vertebra							2	7	
Rib								5	
Humerus	1	1		2					
Radius	1	1							
Ulna	1							1	
Carpal bones	2								
Metacarpal	2								
Femur	1	1							
Tibia	2	1							
Metatarsal	2	1							
Phalanx 1	1								
Phalanx 2	1								
Long bone					3	2		3	
Indeterminate									23
TOTAL (NISP)	21	9	1	3	3	2	2	22	23
MNI	2	2		2					
Weight (g)	1744	133	33	116	0	0	11	352	52

1997, 82-83, 88, 95).

A single sheep/goat distal tibia was measured; at a greatest length of 22.3mm this animal is within the size range of caprines from contemporary British sites listed in the the ABMAP database (http://archaeologydataservice.acuk/archives/view/abmap).

Wild species

Fragments of unidentified amphibians, fish and microfauna were again the only non-domestic remains in the assemblage. Hunted animals are normally very rare from British Iron Age sites (Hambleton 1999, 14) and it seems clear that in general game was of minimal dietary significance. The fish bones, identifed by J. Liddle during the assessment from a sample taken from ditch context 41, comprised two fin spines from three-spined stickleback (*Gasterosteus aculeatus*). As above, this fish can be found in both freshwater and saltwater.

Butchery

Butchery marks were found on six bones from cattle, sheep/goat, goat and pig, as well as one unidentified large and one medium mammal. These comprised filleting and disarticulation, as well as marrow extraction. Portioning of the carcass was identified from one paramedially split vertebra from a medium-sized mammal and from one transversly split vertebra from a large mammal. A goat horn core had several chop marks at its base, suggesting utilisation of the horn sheath.

Discussion

Animal husbandry

The two phases of the settlement both yielded very small bone assemblages, which renders intra-site and inter-site comparisons difficult, due to issues of representativity (*cf* Hambleton 1999, 39-40). Indeed, a chronological comparison between the two phases from A13 Thames Gateway is not possible, due to the extremely small number of bones identified to species in the Late Bronze Age/Iron Age assemblage. Nevertheless, the predominance of domestic taxa, mainly cattle, sheep/goat and pig is typical for contemporary sites (Yalden 1999, 100-102).

A comparison of four larger Bronze Age bone assemblages from southern England (Table A3.24) (Bates 2008; Legge 1992; Powell and Clark 2006; Serjeantson 1996) suggests that different animal husbandry strategies were adopted in different areas. Sheep/goat typically comprise around 40% of the three major domesticates by NISP, but at Stansted caprines consitute over 50% of the speciated bone. While the slightly higher relative proportion of sheep/goat bones at Stansted has not been specifically discussed in the report (Bates 2008) and is perhaps surprising given the poorly draining nature of the soils around the sites, it is possible that at Stansted sheep/goat secondary products were particularly important. The comparatively large proportion of pig bones at Runnymead and Whitecross Farm may relate to local environments preferentially suited to pig keeping, or unfavourble to ruminants. Alternatively, it is possible that at these sites there was a specialised focus on pig rearing for feasting (although this suggestion is not one favoured by Done (1991, 342-3)). Pigs are very fecund and fast-growing, making them the best of the three taxa for this purpose (Powell and Clark 2006, 110; Serjeantson 2007, 88). Cattle remains frequently dominate the animal bone assemblages of Bronze Age sites in the middle Thames region (Knight and Grimm 2010) while at Grimes Graves, in Norfolk, a predominance of cattle in the Bronze Age in conjunction with a large number of slaughtered calves was interpreted as evidence of a focused dairy economy (Legge 1992).

Although at Prince Regent Lane/Freemasons Road cattle dominated the assemblage, it should be remembered that here the number of identified bones was small and calves were absent, although possibly under-represented due to poor survival and retrieval. Cattle could have provided meat, dairy products and traction, while sheep/goat may have been utilised for meat, dairy products, wool and possibly dung: sheep dung is better than cattle or pig manure for the fertilisation of fields (Serjeantson 2007, 83). Pigs were raised for meat, and consequently slaughtered at or before reaching their full growth. Due to their larger size, cattle would have been the main meat providers.

Ritual or secular?

Bones associated with ritual or ceremonial deposits have not been identified with certainty in the assemblage, although chop marks on a dog atlas from peat deposit 105 representing a decapitation attempt, suggests the possibility of 'ritual' use. However, since no other dog bone could be securely associated with the atlas, the question remains open. Likewise, while it is tempting to see what was almost certainly a disarticulated dog's head in the organic deposit around the piled oak 'bridge' structure (Str. 32) as an example of ritual deposition, the deposit also included bones from domestic ungulates, with no clear over-representation of any skeletal elements (for example, skulls).

Table A3.24 Percentages of cattle, sheep/goat and pig from Freemasons Road and from four other Bronze Age assemblages in Britain

Site	No.	Cattle	Sheep/goat	Pig
A13 Freemasons Road	164	62.8%	31.7%	5.5%
Grimes Graves	5094	52.5%	42.4%	5.1%
Runnymede	1531	28.3%	41.5%	30.1%
Stanstead	792	38.4%	50.8%	10.9%
Whitecross Farm, Wallingford	481	22.0%	42.4%	35.6%

A note on the animal bone from Movers Lane

The Movers Lane assemblage comprised 36 bones, of which 11 were speciable. The assemblage was dominated by cattle bones (n:8). Sheep/goat (n:2) and horse (n:1) were the only other animals present. Judging by epiphyseal fusion and bone surface structure all animals were adult or sub-adults when they died. One sheep/goat femur had been sawn through mid-shaft. The edge is smooth, which suggests wear. The distal end would have functioned as a handle. Unfortunately the poor bone surface condition made it impossible to see any wear polishing on the shaft. The femur may have been used to make decorative circular impressions in leather or bark.

Human Bone from Movers Lane *by Jacqueline McKinley*

A small amount of human bone was recovered from Movers Lane and was assessed in 2003. No further work was undertaken.

Cremated human bone was recovered from two contexts (both upper spits) within cut 1207, weighing a total of 189g. The bone is that of an adult ?male; it is well burnt, and quite comminuted: fragments are small and relatively abraded.

In addition, five fragments of redeposited, disarticulated human bone were recovered; all were fragments of long bone shafts and came from sandbank artefact scatter 5142, alluvial deposit 3005 and hurdle trackway 5268.

Micromorphology and bulk analyses *by Richard Macphail and John Crowther* (Fig. A3.15)

Summary

A variety of landscapes and features (palaeosols, occupation soils, burnt mounds, trackways, developing wetland) were studied employing nine thin sections and eleven bulk samples from Movers Lane and Woolwich Manor Way. The Neolithic occupation palaeosol at Woolwich Manor Way formed either by trampling or by cultivation, or through a combination of both processes.

The local Bronze Age landscape had an inferred argillic brown earth soil cover, and fragments of this soil type were found alongside and within a possible terrestrial trackway soil fragment in wooden trackway sediments at Woolwich Manor Way. Evidence of this soil cover was also recorded in palaeosols and at the burnt mound at Movers Lane. Muddy puddles and infills associated with sediment formation, developed along a trackway at Movers Lane; one puddle may speculatively have originated as an animal(?) print. At Movers Lane, occupation soils and the burnt mound were affected by trampling, and by sediment accretion from both occupation disturbance and contemporary alluviation. At the top of the burnt mound occupation deposits are intercalated upwards within the alluvium, as muddy spreads. Across both sites, ensuing peats were affected by both humification and biological working in places (fluctuating water tables), and alternating and migrating stream flow led to sands (stream flow?) and humic silt (backswamp?) deposition, as local peats were weathered and eroded. These interpretations, however, must remain speculative as sample coverage of the different landscapes and features was small. The report is supported by 3 tables and 27 photos; a CD-Rom with supporting data including 122 digital scans and photomicrographs can be found in the site archive.

Introduction

A series of monoliths from Movers Lane and Woolwich Manor Way were received from Liz Stafford (Oxford Archaeology) in order to analyse the sediment micromorphology and bulk character of prehistoric palaeosols, burnt mounds and trackways onto developing Thames wetland. In addition, the character of the sites and human activities in relationship to rising base levels and marine inundation were investigated.

Methodology

The monoliths were subsampled for nine thin sections and eleven bulk sample analyses (LOI, phosphate-P and grain size; Tables A3.25 and A3.26)

Woolwich Manor Way Monolith 2 was discussed with Andrew Haggart at the Chatham Campus of Greenwich University, from where it was collected after it had been subsampled for diatoms and multi-element analysis.

Bulk analyses

Analysis was undertaken on the fine earth fraction (ie < 2mm) of the samples. LOI (loss-on-ignition) was determined by ignition at 375°C for 16 hours (Ball 1964), previous experimental studies having shown that there is normally no significant breakdown of carbonate at this temperature. Phosphate-P (total phosphate) was measured following oxidation with NaOBr using 1N H_2SO_4 as the extractant (Dick and Tabatabai 1977), with a slight excess of H_2SO_4 being added initially to neutralise any remaining carbonate. Particle size was determined using the pipette method on < 2mm mineral (peroxide-treated) soil (Avery and Bascomb 1974).

Soil micromorphology

The nine thin section subsamples from monolith series 2, 4, 40, 44 and 47 were impregnated with a clear polyester resin-acetone mixture; samples were then topped up with resin, ahead of curing and slabbing for 75x50 mm-size thin section manufacture by Spectrum Petrographics, Vancouver, Washington, USA (Goldberg and Macphail 2006; Murphy 1986) (Fig A3.15, 1-6). The

Table A3.25 Bulk analytical data

Mono	*Context*	*Description*	*LOIa (%)*	*Phosphate-Pb (mg g 1)*	*Coarse sand > 600 μm(%)*	*Medium sand 200-600 μm(%)*	*Fine sand 60-200 μm(%)*	*Silt 2-60 μm(%)*	*Clay <2 μm(%)*	*Texture class*
Woolwich Manor Way										
4	2007	Basal peat	9.74*	0.165						
4	2008(u)	Stained sand	1.05	0.059	2.6	47.1	40.0	8.1	2.2	Sand
4	2008(l)	Stained sand	0.618	0.048						
2A	28	Wood peat (trackway)	46.5**	0.415						
Movers Lane										
47	5204	Basal alluvium	4.84	0.251	3.4	42.3	29.6	12.8	11.9	Sandy loam
47	5142	Occupation sands	0.690	0.135*						
44	5121	Stained clays	3.15	0.308	0.8	4.8	5.6	40.0	48.8	Clay
44	5083	Burned mound	4.91	0.588*	3.3	18.9	16.8	42.3	18.6	Sandy silt loam
40	5154(u)	Wood peat (trackway)	27.8**	0.249						
40	5154(l)	Sandy peat upper	29.7**	0.379						
40	5154/52	Peaty sand	17.0**	0.322						

Table A3.26 Soil micromorphology : samples

Thin	*Relative*	*Context*	*Sediment*	*MFT*	*SMT*	*Voids*	*Eb clasts*	*Bt clasts*	*Trampled clasts*	*'wetland' clay clasts*	*Stones*
Woolwich Manor Way (WMW) Trench 2 Sample 2 - trackway											
M2A	620-630 mm	28	Wood Peat - trackway	A1	1a1	65%	a-2	a-1	a-1		f
M2A	630-650(665) mm	28	Wood Peat - trackway	B1	1a1	50%	a-5				
M2A	650(665)-700 mm	28	Wood Peat - trackway	C1	1a1	60%					
Woolwich Manor Way (WMW) Trench 15 Sample 4 - palaeosol											
M4A	320-360 mm	2007	Basal peat	B1	1b	55%					
M4A	360-395 mm	2008	Stained sand	D2	2b	35%	a-1				*
M4B	395-470 mm	2008	Stained sand	D1	2a(3a)	30%					*
		2013	Natural sand								
Movers Lane (Western Area 3)(R1R01) Sample 40 - trackway											
M40A	150-230 mm	5154	wood peat - trackway	B2	1a1, 1a2, 1a3	35-70%					*
M40B	230-310 mm	5154	sandy peat upper	B2	1a1, 1a2	45-65%					*
Movers Lane (Western Area 3)(R1R01) Sample 44 - burned mound											
		5122	Laminated clay								
M44A	230-270 mm	5121	stained clays	E1	4a, 4a2(2c etc)	15%				aaa	
M44A	270-310 mm	5083 upper	burned mound	D4	2c, 2b, 4a	20%				aa	f
M44B	340-420 mm	5083 lower	burned mound	D3	2a, 2b, 2c	25%				a*	fffff
		5117	natural gravels								
Movers Lane (Western Area 3)(R1R01) Sample 47 - palaeosol											
M47A	30-110 mm	5204	Basal alluvium with charcoal	E3	4d, 2a	40%					
M47B	110-145 mm	5205	Basal alluvium with charcoal	E2	4b, 4c, 2a	35%					
M47B	145-185 mm	5142	Occup. Sands	D5	4b, 4c, 5a	40%		a-1(large)		a	fff
M47C	185-260mm	5195	Sands/gravels								

nine thin sections included an extra thin section funded by Macphail to try and extend context coverage. Thin sections were further polished with 1,000 grit papers and analysed using a petrological microscope under plane polarised light (PPL), crossed polarised light (XPL), oblique incident light (OIL) and using fluorescent microscopy (blue light – BL), at magnifications ranging from x1 to x200/400. Thin sections were described, ascribed soil microfabric types (MFTs) and microfacies types (MFTs)(see Tables A3.26 and A3.15), and counted according to established methods (Bullock *et al.* 1985; Courty 2001; Courty *et al.* 1989; Goldberg and Macphail 2006; Macphail and Cruise 2001; Stoops 2003). In addition, the quantitative microchemistry of materials within trackway sample M2A were analysed employing SEM-EDAX (Energy Dispersive X-ray Analysis), see Fig. A3.15, 27.

Results

Bulk analyses

The analytical results are presented in Table A3.25. Here, a broad overview is presented of the individual properties analysed. Key features relating to individual samples are highlighted in Table A3.25.

Organic matter (estimated by loss-on-ignition)

The samples exhibit quite wide variability in LOI (range, 0.618–46.5%). The highest values (≥ 9.74%) were recorded in the samples described as including peat, though in several cases the LOI does not appear to match the actual description, for example context 2007 is described as 'basal peat', but with a LOI of only 9.74% clearly contains a high proportion of sand; and the 'wood peat' of context 5154(u) has a slightly lower LOI (27.8%) than the underlying 'sandy peat upper' (29.7%). The remaining samples are largely minerogenic (ie LOI < 5.00%). Of these, the samples from contexts 5204 (basal alluvium) and 5083 (burnt mound), with LOI values of 4.84 and 4.91%, respectively, are notably more organic rich than the others. In the case of the former, significant amounts of charcoal were present, and this will have contributed to the higher LOI.

Total phosphate (phosphate-P)

The phosphate-P concentrations recorded are relatively low (range, 0.048–0.588mg g^{-1}). As might be anticipated, the lowest values were recorded in the three more sandy samples, sands having a low phosphate-retention capacity. Interestingly, context 5142 (occupation sands) has a much higher phosphate-P concentration (0.135 mg g^{-1}) than contexts 2008(u) and 2008(l) (stained sand) (0.059–0.048mg g^{-1}, respectively). Assuming that all three samples have a similar particle-size distribution, then this may indicate some degree of phosphate enrichment in the occupation sands. Otherwise, only context 5083 (burnt mound) stands out as showing likely signs of enrichment (phosphate-P, 0.588mg g^{-1}).

Particle size

The results are consistent with the field descriptions of the various contexts. In each case the sand fraction largely comprises medium and fine sands (cf. coarse sands), which presumably reflects the character of the alluvial parent materials at these sites.

Overall, the results have demonstrated that there is considerable variability in all three properties analysed. They have enabled better characterisation of the various peaty samples, identified two contexts that show possible signs of phosphate enrichment, and provided detailed insight into the particle-size distribution of selected samples.

Soil micromorphology

Results are presented in Tables A3.26 and A3.15, and illustrated in Fig A3.15, 1-27; results are also supported by a CD-ROM photomicrographic archive (includes EDAX data, and 122 thin section digital scans and photomicrographs). Fourteen sub-units were identified in the 9 thin sections, and 25 characteristics were described and counted.

Woolwich Manor Way, Bronze Age trackway 2/14, Area 2 (sample 2, Fig.5.3)

Context 28; Wood Peat – trackway (M2)

This is layered (sub-units) with different microfacies at 650 (665)-70mm, 630-650 (665)mm and 620-630mm depth (A3.15, 2).

> *650(665)-700mm*: This sub-unit (3) is a partially humified peat and coarse wood-dominated layer, which contains frequent scattered medium sand. Examples of fine burnt flint and coarse wood charcoal were recorded, alongside many ferruginised patches of peat.
> This part of context 28 is a peat/wood peat affected by fluctuating water tables, hence peat humification and iron impregnation. Anthropogenic signals include the presence of coarse charcoal and burnt flint, which probably result from overlying trackway traffic and background human activities.
>
> *630-650(665)mm*: This sub-unit (2) is a medium sand-dominated sediment with small amounts of clast type 1 (Ea horizon soil) and many fine to medium size wood and humified peat fragments. Rare traces of charcoal and rubefied grains are present. *In situ* woody roots, many ferruginised plant remains and relict roots occur. Relict patches of intercalated peat and

sand are visible, and this sub-unit has a marked wavy and irregular lower boundary.

It is a mainly minerogenic medium sandy 'alluvium' containing peat and wood fragments, with *in situ* woody roots and trace amounts of charcoal and rubefied grains. Wavy boundary and peat-sand intercalations could imply trampling of this layer.

620-630mm: This uppermost sediment (sub-unit 1) is composed of fine wood and partially humified peat fragments, and contains a scatter of medium sand and few small gravel-size flint and rounded soil (Eb and Bt) and layered humic clay loam clasts (Fig. A3.15, 7-10). This layered clay loam has peat, clay, flint and burnt flint inclusions and a striated b-fabric, and contains rare traces of charcoal. *In situ* woody and monocotyledonous roots are present, alongside minor iron staining (SEM-EDAX investigations found that 'ferruginisation' produced concentrations of 8.10-13.5% Fe [*n*=4], and one clayey example had also been enriched in phosphate [0.88% P]. Overall, 46.5% LOI and 0.415 mg g^{-1} phosphate-P was recorded. It is a moderately sorted fluvial waterlogged sediment dominantly containing fine partially humified peat and wood fragments, with small flint and presumably local soil clasts. These soil clasts – and an example of humic stained layered clay loam, which contains peat and burnt flint fragments and is probably eroded from a muddy trackway (cf. prehistoric trackway sediments at Stanstead Airport studied through microprobe; Macphail and Crowther, 2005; 2008) – indicate redeposition of trampled and finely fragmented material.

As far as can be judged from this one thin section and bulk sample, it can be suggested that the Bronze Age trackway occupied a fen carr environment where peat formation alternated with alluvial sand deposition; this is also consistent with a geochemical log recording peaks of SiO_2 (Andrew Haggart, Greenwich University, pers comm). The trackway and its use is also recorded by the inclusion of soil clasts (Eb and Bt horizon) and 'wetland' clay clasts within the sediments, presumably eroded from local terrestrial soils and wetland, and deposited within in sub-units 1 and 2. In addition, charcoal, burnt flint and a layered fragment of 'trackway' sediment are also present. The peat itself is organic (46.5% LOI), but no remarkable phosphate concentrations (relating to animal traffic?) were recorded (0.415 mg g^{-1} phosphate-P). Inundated sites where waterlogged leaching is common often poorly preserve phosphate concentrations (Thirly *et al.* 2006); an example of phosphate (0.88% P) being fixed with secondary iron was however recorded by SEM/EDAX in the possible terrestrial trackway clast.

Woolwich Manor Way, early Neolithic to early Bronze Age palaeosol, T15 (sample 4, Fig. 5.3)

2008 Stained sand (M4B)

This is a moderately sorted compact coarse silt, fine and medium sand (see Table A3.25), with much fine charcoal and occasional fine burnt flint and quartzite. The fine fabric is weakly humic and contains much very fine charcoal, which thinly coats mineral grains and voids (Fig. A3.15, 11-13); more pure clay void coatings occur rarely. Fine and coarse woody root channels are present, with one channel also being infilled with peaty coarse silt. Weak ferruginisation is recorded throughout.

It is a homogenised occupation soil containing fragmented charcoal and fine burnt flint and quartzite from local burnt mound(s); trampling could have compacted and homogenized this soil as well as producing ubiquitous thin dusty coatings. It is also conceivable that these characteristics could also stem from context 2008 being a ploughsoil (Bronze Age ploughsoils of similar character are recorded from the fens and under Thames alluvium at Bermondsey, London (French 2003; Macphail *et al.* 1990; Merriman 1992; Sidell *et al.* 2000). A rise in the water table led to weak ferruginisation, while overlying wood peat formation is associated with woody rooting.

2008 Stained sand (M4A lower)

The top of the buried soil has a similar character to that in found in M4B below, but in addition, a fine humic pellety fine fabric becomes more common. Fine non-woody roots are partially preserved by ferruginisation. Woody roots become more common. An example of greyish clay void coatings is recorded.

This uppermost 30mm of buried soil records pedogenesis under increasingly moist (and natural topsoil) conditions, with the roots of the extant non-woody vegetation being partially preserved by ferruginisation (perhaps during an intermittent waterlogging stage). Trace evidence of possible marine(?) clay inwash (greyish clay void coatings) appears to have succeeded wood peat formation.

2007 Basal peat (M4A upper)

This partially once-layered, fine and medium sand contains very abundant humified organic matter (humified peat) as organic excrements within thin burrows (Fig. A3.15, 14). Abundant woody roots are present.

Occupation site and palaeosol burial by alluvial sand and wood peat formation is recorded. This sediment probably originally formed as a laminated and intercalated sand and peat, but was affected by a period (or periods) of fluctuating water tables leading to peat ripening and associated burrowing and organic excrement-replacement of the original peat sediment (Avery 1990, 323-325; Bal 1982; Dinç, *et al.* 1976).

The fine and medium sandy palaeosol (2008) and overlying moderately humic (9.74% LOI; Table A3.25) sandy peat (2007) at Trench 15, Woolwich Manor Way studied in thin sections M4A and M4B is a formed of a mature occupation soil and bioworked and humified sandy peat. The 'stained' sand appears to have been trampled, producing well-sorted and finely fragmented charcoal, and thin dusty void and grain coatings that include fine charcoal. Other clay deposition is also recorded, and at least one phase could relate to inundation. No humic topsoil, as such, is present. It can be suggested that this was eroded during phases of alluvial sand and peat formation. The site was affected by fluctuating water tables, allowing soil mesofauna to work the humified peat.

Movers Lane, Bronze Age trackway 5268, western Area 3 (sample 40, Fig. 7.5)

5154 sandy peat upper (M40B)

This is a broadly layered wood peat, with wood fragments and woody roots, and a scattered fine and medium sand component (Fig. A3.15, 1 and 4). Rare fine and very fine charcoal, a burnt flint fragment (Fig. A3.15, 15) and charred humic soil fragment occur. Layers of silty peat sediment occur also as a 5-10mm thick, 15mm-wide, undulating and curved infill (Fig. A3.15, 4, 16-17). The upper sandy peat and peaty sand are humic (29.7% and 17.0% LOI, respectively), but no obvious phosphate-P enrichment is recognised. Broad burrowing, thin organic excrements, and later, abundant gypsum crystal formation, are also recorded.

A sandy wood peat formed that included periodic inwash of fine detrital peat and medium and coarse silt. This silty peat forms incomplete layers and an example of an undulating fine fill. The latter appears to be anomalous and could *possibly* be part of an animal(?) print. One fill includes a charred very coarse sand-size humic sandy topsoil fragment. Rare charcoal occurs throughout the sediment sequence, and one small fragment of burnt flint also testifies to an anthropogenic input. As the detrital peat includes humified peat, it is impossible to recognise if finely fragmented dung is present. The sediments were occasionally burrowed and worked by mesofauna. This level of bioactivity and minor iron-staining records generally continuous waterlogged conditions, with occasional drying out. Gypsum formation probably reflects changed environmental conditions after marine inundation.

5154 wood peat – trackway (M40A)

This is a broadly layered monocotyledonous and wood peat, over humic silt containing detrital fine organic matter. Small amounts of sand and one example of flint gravel, rare fine charcoal and an example of sand-size burnt flint occur. Some infills and one clast are very rich in very fine charcoal. Monocotyledonous roots and peaty material show strong humification and sometimes strong iron impregnation, compared to (later) woody roots. Minor burrowing, with organic excrements, and abundant gypsum formation is visible. The peaty layer is notably organic with 27.8% LOI.

Layers of detrital organic matter-rich silts and mainly monocotyledonous peat show moderately strong humification and iron impregnation (fluctuating water table). Later(?) woody rooting (wood peat formation) occurred as conditions became permanently waterlogged. Trackway use and fluctuating water tables led to inwash of very fine charcoal-rich silts, along with rare additions of sand, burnt flint and charcoal. Later marine inundation of the site likely resulted in gypsum formation.

Movers Lane, Bronze Age burnt mound 5264, western Area 3 (sample 44, Fig. 7.15)

5083 Burnt mound (M44B1, M44B2)

This a heterogeneous very poorly sorted stony soil deposit with both leached loamy sands (Fig. A3.15, 2, 6 and 18), and humic and fine charcoal rich sandy loam. Upwards, increasing amounts of reddish brown sandy loam-silty clay loam soil, containing fine charcoal, is present, mainly as broad burrow infills (Fig. A3.15, 19). The deposit is very charcoal and burnt flint/chert-rich, and trace amounts of fine burnt bone were found (Fig. A3.15, 20). Very abundant dusty clay intercalations occur alongside thick matrix void coatings; reddish clay infills are also present. Many broad burrows are visible, and moderate iron-staining is recorded. Overall weak phosphate enrichment (0.588mg g^{-1} phosphate-P), a sandy silt loam texture and a 4.91% LOI was measured (Table A3.25).

This is a markedly heterogeneous stony, burnt flint and charcoal-rich burnt mound deposit, formed of once-humic and loamy fine charcoal-rich occupation soils which had developed upwards from leached upper subsoil sands. Traces of fine burnt bone occur as evidence of probable food preparation. The abundance of textural pedofeatures (intercalations and matrix infills) and coarse heterogeneity indicate mixing by trampling of an often muddy substrate; minor likely burrow mixing by earthworms also took place. These mesofauna also mixed rubefied clayey soil from overlying mound deposits. Although these burrows may also possibly be associated with alluvial clay washing through as a record of inundation history, it is additionally considered that the site was likely being affected by ongoing episodic clayey alluviation during the occupation itself. This may have helped thicken the silty clay loam mound above the naturally *in situ* subsoil sands and the natural gravels (context 5117).

Upper 5083 – burnt mound (M44A)

This part of context 5083 is similar to that found in

M44B, below, but is much less stony with smaller burnt flint and less coarse charcoal. Reddish soil as strongly rubefied and finely fissured clay loam and as iron-stained once-humic(?) clayey soil also occur more commonly than below. It is present as clasts and as burrow fills, with some of the latter associated with impure clay void coatings. Intercalations are equally abundant in this very heterogeneous deposit.

Continuing use (trampling) of the site, but with continuing and possibly increasing frequency of clayey alluviation, led to clayey soil accretion over the stony burnt mound itself. Indeed, alluvial clay itself seems to have got burnt/used for hearth construction, and this burnt soil was mixed by trampling and burrowed down-profile. Alluviation may also have led to truncation and reworking of these occupation soils/upper burnt mound; grey alluvium has also been burrowed down-profile. It seems likely that continuing human disturbance occurred, hence the unclear boundary with the overlying stained alluvium (Context 5121).

5121 Stained clays (M44A)

This context is composed of mixed sandy silt loam alluvial soil and clayey alluvial clasts and infills. Some small charcoal and burnt flint and much soil from the underlying burnt mound, including rubefied clay and blackened burnt topsoil, are also present. Muddy pans and infills – some 1-2mm thick – occur, alongside brownish clay infills (Fig. A3.15, 2, 5, 21-22). Iron staining and iron hydroxide infills/plant pseudomorphs occur. This layer records 3.15% LOI, and has a 40.0% silt and 48.8% clay content (Table A3.25)

5121 can be characterised as a muddy slurry of eroded mound material (including burnt soil, charcoal and small burnt flint) and locally trampled(?) silty clay alluvium. Textural pans formed and the deposit as a whole was also earthworm-burrowed at times. Fragments of pure alluvial clayey sediment also occur as sedimentary clasts, while clayey inwash from the overlying alluvial clay is also recorded. The exact origins of this context are not clear, but inundation, erosion and disturbance could have been occurring as the site became wetter and more frequently influenced by clayey alluviation.

Movers Lane, palaeochannel deposit 5142, western Area 3 (sample 47, Fig. 7.5)

5142 Occupation sands (M47B)

These are heterogeneous and, upwards poorly layered, mainly leached medium to very coarse sands and gravels. They contain traces of an argillic clay matrix. The upper layered part includes coarse argillic soil (fine sandy silt loam with clay void and grain clay coatings) clast. There are also poorly bedded sands; one layer is for example relatively rich in medium sand size limonite (weakly-developed gravity separation). Rare traces of burnt flint occur (3.5mm). Many part-humified and iron-stained woody roots (4-8mm) are present. Humic (alluvial) clay contains humified plant fragments, diatoms and phytoliths, while sometimes fine charcoal occurs in relict root channels. In addition, silty clay occurs. One example of void clay coatings formed in this clay was observed. Sands are very poorly humic (0.690% LOI) but may show weak phosphate-P enrichment (0.135 mg g^{-1}).

This context is composed of truncated, disturbed natural sands and gravels which had originally developed an argillic brown sand soil. The last is now evidenced by relict fine matrix material and by a locally eroded coarse (10mm) clast of fine sandy silt loam argillic Bt horizon soil. Occupation led to the inclusion of rare traces of burnt flint, and weakly enriched phosphate-P content (see 5204 below). Woody rooting during fen carr development (and continued occupation) led to inwash of humic clay containing phytoliths, diatoms and sometimes fine charcoal.

5204 Basal alluvium with charcoal (M47B)

These are formed by heterogeneous, intercalated and broadly bedded medium and fine sands and humic silty clay (Fig. A3.15, 23). The homogenised grain size of these two components averages out as a sandy loam (Table A3.25). The sediments contain detrital plant fragments, charcoal (possible charred bark), and include an example of burnt bone (2.5mm), and a 2mm-size burnt sandy soil clast and rare fine burnt flint were also recorded. (The bone fragment seems have attracted fungal activity.)

This basal alluvium is characterised by both low energy humic silty clay and higher energy sands. Included charcoal, burnt bone, burnt flint and a burnt soil example, all testify to the erosion of burnt mounds/occupation soils locally.

5204 Basal alluvium with charcoal (M47A)

The alluvium continues upwards as intercalated and broadly bedded humic clayey silts and clean medium sands. Rare fine charcoal but very abundant very fine to coarse detrital blackened and humified woody plant fragments (up to 6mm) occur – and some are horizontally oriented; phytoliths and diatoms also occur (Fig. A3.15, 25). This humic content, along with clasts of humified peat, have produced 4.84% LOI and 0.251mg g^{-1} phosphate-P content. Fine woody roots seem to be post-dated by monocotyledonous plant roots; the latter are often iron impregnated and associated with iron hypocoatings when penetrating fine sediments. Coarse (1.5mm) prismatic gypsum formation has affected the sediments (Fig. A3.15, 26).

These sediments record alternating deposition of sands and humic silts, with small amounts of charcoal, although abundant humifed (blackened) woody plant material may have appeared charcoal-like in the field. The sediments may be recording rapidly migrating(?) stream flow (sands) and overbank flooding (humic silts), with fen carr wood peat being eroded during this process. Only background human activity (rare charcoal) seems to have been recorded. Changing environmental conditions – marine inundation(?) – led to a monocotyledonous vegetation becoming dominant, and secondary iron and gypsum formation took place.

Discussion

Local soils: modern and ancient soil cover

The A13 route currently runs through urban areas where soils are unmapped. It is possible, however, to extrapolate from the soil cover mapped east of the road route, to suggest that the mid-Holocene soils were typical argillic brown earths (Huckersbrook soil association) or argillic gley soils (Hurst soil association) formed in coarse and fine loamy river terrace drift, which also included gravel (Jarvis *et al.* 1983; 1984). Currently, the margins of the River Thames have a pelo-alluvial gley soil cover formed in marine alluvium (Wallasea 1 soil association); further north of the Thames, tributaries of the Thames are characterised by pelo-alluvial gley soils formed in river alluvium (Fladbury 1 soil association). At Movers Lane and Woolwich Manor Way, the samples studied were selected from sediments that underlie these pelo-alluvial gley soils formed in alluvium. The effects of marine inundation, which can be marked (Boorman *et al.* 2002; Macphail 1994; Macphail 2009; Macphail *et al.* 2010), were apparently only recorded by secondary gypsum formation, for example at Movers Lane (Fig. A3.15, 26) (Kooistra 1978). Waterlogging of the sites due to rising base levels, peat formation and freshwater alluviation, even prior to marine inundation, undoubtedly caused iron depletion and secondary ferruginisation, while loss of phosphate is also likely if in an unstable form; bone fragments may remain but their phosphate content may be reduced (Crowther 2000; Huisman 2009; Macphail *et al.* 2010; Thirly *et al.* 2006).

Thin section sub-sampling of the monoliths allowed the uppermost soil horizons of the Mid-Late Holocene soils to be examined and characterised. At Movers Lane, leached and iron-depleted sandy and gravelly subsoils of the argillic brown earths are recorded below the burnt mound (sample 44; Fig. A3.15, 2, 6 and 18), while the layered and mixed upper 'palaeosol' in sample 47 included a large (10mm) clast of fine sandy silt loam argillic Bt horizon soil. In addition, at Woolwich Manor Way rounded clasts of iron and clay-depleted soil found in trackway deposits are consistent with being fragments of Eb horizon soil that have been eroded from the argillic brown earth cover; a rounded fragment of eroded Bt soil was also recorded in sample 2 (Fig A3.15, 7-8). Argillic brown earth soils have the following horizons: topsoil Ah, upper subsoil Eb and subsoil Bt. The local presence of these soils and river drift deposits of coarse silts, fine and medium sands is also recorded in the overlying alluvial sediments which contain these grain sizes (Table A3.15; Fig. A3.15, 16-17, 21-22 and 23-24).

Occupation soils and burnt mound

Occupation soils were studied from both Movers Lane and Woolwich Manor Way. At Woolwich Manor Way the early Neolithic to early Bronze Age palaeosol ('stained sand'), is a sand that shows no phosphate enrichment (Table A3.25), but which contains much fine anthropogenic material (burnt flint and charcoal). As discussed earlier, this homogenisation and the presence of dusty clay void coatings (Fig. A3.15, 11-12) can be ascribed to human trampling or cultivation, or both processes (cf. Bronze Age Phoenix Wharf, Bermondsey (Macphail *et al.* 1990; Merriman 1992; Sidell 2003; Sidell *et al.* 2000) (cf. 'equifinality', Goldberg and Macphail 2006, 356). Without a wider sample these speculations cannot be taken further.

At Movers Lane, it can be noted that both the Bronze Age palaeosol (sample 47) and the burnt mound (sample 44) show signs of being both truncated and thickened – the last probably by both trampling and alluviation. Minor phosphate-enrichment was noted in these two occupation deposits (Table A3.25), and traces of burnt bone were recognised in the burnt mound for example, in addition to ubiquitous burnt flint and charcoal (Fig. A3.15, 2, 6 and 19-20). It can be noted that the burnt mound (sample 44) contains coarse charcoal compared to the 'stained sands' at Woolwich Manor Way (sample 4). Microstratigraphic analysis of the burnt mound revealed the movement of red clays down profile, as both wash and burrow-infills. A 'burnt' surface, however, is absent, and has been lost by trampling or alluvial erosion. These red clays (Fig. A3.15, 5 and 19-20) are the likely result of K in ash mobilising rubefied clay, as found in some burnt tree-throw holes and pits (Courty and Fedoroff 1982; Goldberg and Macphail 2006; Slager and Van der Wetering 1977). In addition to trampling, the mound is thickened by clayey alluvium, which is also intercalated with partially trampled spreads of occupation soils (eg. burnt topsoil fragments) in the overlying muddy 'stained clays'. It can also be noted that the burnt mound deposits at Ebbsfleet, Kent were affected by colluviation (Macphail and Crowther forthcoming).

The 'occupation sands' of the palaeosol in sample 47 are truncated and the uppermost deposits included an eroded fragment of Bt horizon material, while overlying sands display a small concentration of sand-size limonite as an example of weak gravity separation (cf. placer deposits). Clearly, this 'old ground surface' was being fluvially worked as water tables rose and flooding took place.

Bronze Age trackway deposits

Trackway deposits were investigated from both sites. Unlike trackways studied elsewhere, such as the Stanstead and Terminal 5 sites at London Heathrow (Framework Archaeology 2006; 2010; Macphail 2003; Macphail and Crowther 2005; Macphail and Crowther 2006; Macphail and Crowther 2008; Macphail and Crowther 2009; Macphail and Cruise 1997-2003), these trackways are constructed of roundwood etc, with one at Woolwich Manor Way (Area 2) being some 1.20m wide and 0.30m thick. In thin section these are obviously rich in woody material, and include peaty sediments; a maximum 46.5% LOI was measured in sample 2. No bulk phosphate enrichment was found in contrast to many terrestrial trackway deposits. Sediments associated with the trackway at Woolwich Manor Way, however, include anomalous amounts of eroded soil clasts (see above) in sandy layers which imply traffic from 'dryland' onto wetland where eroded/ trampled soil was locally reworked (Fig. A3.15. 7-8). Moreover, there appears to be one possible example of iron-stained, and in places phosphate-enriched, terrestrial trackway sediment, which includes peat fragments, charcoal and burnt flint (Fig. A3.15, 9-10 and 27). Terrestrial material was therefore apparently 'tracked-in' along the trackway – probably by people, as the structure is only narrow – and locally reworked by stream flow (Fig. A3.15, 3). Undulating sediment boundaries may also imply trampling effects.

At Movers Lane (sample 40), again sediments within and below the trackway record rare inclusions of anthropogenic materials (examples of burnt flint and charred topsoil (Fig. A3.15, 15-17)). A possible humic silt-infilled animal(?) print was noted (Fig. A3.15, 4 and 16-17), possibly recording muddy conditions, and slowly infilling puddles, along the trackway. At Iron Age Goldcliff, Gwent probable cattle prints along a episodically inundated droveway in the salt marshes, had slowly infilled with impure clayey sediments (Macphail and Cruise 2000). At Movers Lane and Woolwich Manor Way there are too few samples (only 3 thin sections in all) to say more about the use and environment associated with these trackways.

Alluvium

It seems quite clear that the Bronze Age land surfaces were affected not only by flooding and sedimentation, but also by erosion, sometimes all happening whilst the sites were still being utilised (Fig. A3.15, 5-6 and 21-22). Coarse (sandy), fine (silty) and very fine (clayey at Movers Lane burnt mound) sedimentation are all recorded (Table A3.25), alongside wood peat formation for example. Fluctuating water tables are also evidenced by humification (ripening) of peat and its transformation into organic excrements by small invertebrate mesofauna (Dinç *et al.* 1976). Bedded humic silts and non-humic sands occur (Fig. A3.15, 23-25), with the humic silts containing high amounts of detrital humified wood peat and other peat fragments. The exact processes are unknown, but may have included alternating (and migrating) stream flow(?) (sands) and backswamp(?) sedimentation (humic silts) which also testify to weathering and erosion of local peat.

Conclusions

A variety of landscapes and features (palaeosols, occupation soils, burnt mounds, trackways, developing wetland) were studied employing 9 thin sections and 11 bulk samples from Movers Lane and Woolwich Manor Way. The local landscape had an inferred argillic brown earth soil cover, and fragments of this soil type were found in Bronze Age trackway sediments at Woolwich Manor Way; a possible terrestrial trackway soil fragment was also recognised. Evidence of the argillic soil cover was also recorded in palaeosols and at the burnt mound at Movers Lane. Muddy puddles and infills associated with sediment formation, developed along a trackway at Movers Lane; one 'puddle' may speculatively have originated as an animal(?) print.

The early Neolithic to early Bronze Age occupation palaeosol at Woolwich Manor Way formed either by trampling or by cultivation, or possibly through a combination of both processes. At Movers Lane, occupation soils and the burnt mound were affected by trampling and by sediment accretion from both occupation disturbance and contemporary alluviation. At the top of the burnt mound occupation deposits are intercalated upwards within the alluvium, as muddy spreads. Across both sites, ensuing peats were affected by both humification and biological working in places (fluctuating water tables), and alternating and migrating stream flow led to sands (stream flow?) and humic silt (backswamp?) deposition, as local peats were weathered and eroded. These interpretations, however, must remain speculative as sample coverage of the different landscapes and features was small.

Table A3.27 Soil micromorphology : descriptions

Microfacies type (MFT)/ Soil microfabric type (SMT)	*Sample No.*	*Depth (relative depth) Soil Micromorphology (SM)*	*Preliminary Interpretation and Comments*
Woolwich Manor Way (WMW) Trench 2 Sample 2 - trackway			
MFT A1/SMT 1a1	M2A	620-700mm SM: Moderate homogeneous layers; *Microstructure*: massive, layered: 620-630mm: 65% voids, simple packing voids; *Coarse Mineral:* C:F (limit at 10μm), 100:0, poorly sorted fine and medium sand-size quartz, with few small (1-2.5mm) flint and rounded soil-sediment aggregates (type 1: pale moderately sorted coarse silt and fine-medium sand [eroded natural river terrace soil/weathered Eb horizon]; type 2: brown micaceous silt and sandy loam, with grano-striate b-fabric and humic-staining [eroded subsoil Bt horizon); type 3: brown humic-stained clay with embedded amorphous peat fragments, clay soil clasts, small flint and burned flint, with layered, striated b-fabric (trampled trackway fragment); *Coarse Organic and Anthropogenic:* dominant fine (2-3mm) wood and humified peat fragments (see SMT 1a), with rare fine (1mm) monocotyledonous roots and many medium to coarse (10mm) woody roots; rare charcoal; *Pedofeatures: Amorphous:* occasional ferruginisation of organic material. SEM-EDAX: 'Ferruginisation' produced 8.10-13.5% Fe concentrations (n=4), and one example of 0.88% P.	Context 28; Wood Peat – trackway Layered with, 620-630mm: sediment of fine wood and partially humified peat fragments, with scatter of medium sand and few small gravel-size flint and rounded soil (Ea and Bt) and layered humic clay loam clasts. Layered clay loam has peat, clay, flint and burned flint inclusions and striated b-fabric; rare trace of charcoal. *In situ* woody and monocotyledonous roots are present, alongside minor iron staining. (46.5% LOI and 0.415mg g^{-1} phosphate-P was recorded) *Moderately sorted fluvial waterlogged sediment dominantly containing fine partially humified peat and wood fragments, with small flint and local soil clasts. These soil clasts and an example of humic stained layered clay loam, containing peat and burned flint fragments – which is probably eroded from a muddy trackway – indicate redeposition of trampled and finely fragmented material.*
MFT B1/SMT 1a		630-650 (665) mm: 50% voids, simple packing voids, vughs and coarse channels; *Coarse Mineral:* C:F, 95:05, moderately sorted medium and coarse sand-size rounded quartz; rare Clast type 1; trace amounts of micas; *Coarse Organic and Anthropogenic:* frequent to common fine to medium (2-5mm) wood and partially humified peat fragments, with many medium to coarse (10mm) woody roots; rare trace of charcoal and rubefied grains; *Fine Fabric:* SMT 1a1: reddish brown (PPL), generally isotropic or with very low interference colours (relict cellulose)(XPL), black to blackish brown (OIL); very dominant amorphous organic matter with tissue and organ remains; *Pedofeatures: Amorphous:* many ferruginisation of organic material; *Fabric:* relict patches of intercalated peat and sand. Wavy and irregular boundary.	Medium sand dominated sediment with small amounts of clast type 1 (Eb horizon soil) and many fine to medium size wood and humified peat fragments; rare trace of charcoal and rubefied grains. In situ woody roots; many ferruginised plant remains and relict roots. Relict patches of intercalated peat and sand, and marked wavy and irregular boundary. *Mainly minerogenic medium sandy alluvium containing peat and wood fragments, with in situ woody roots and trace amounts of charcoal and rubefied grains. Wavy boundary and peat-sand intercalations could imply trampling.*
MFT C1/SMT 1a		650(665)-700mm: 70% voids, mainly coarse simple packing voids and fissures; *Coarse Mineral:* C:F, 100:0, well sorted frequent medium sand; *Coarse Organic and Anthropogenic:* very dominant coarse	Partially humified peat and coarse wood dominated layer, with frequent scatter of medium sand; examples of fine burned flint and coarse wood charcoal;

		wood (25mm), woody roots (10mm) and humified peat (SMT 1a); rare charcoal (4mm) and example of burned flint (2mm); *Fine Fabric:* as SMT 1a1; *Pedofeatures: Amorphous:* many moderate iron impregnation of organic matter.	many ferruginised patches of peat. *Peat/wood peat affected by fluctuating water tables, hence peat humification and iron impregnation; anthropogenic signals include presence of coarse charcoal and burned flint – affects of traffic from above.*

Woolwich Manor Way (WMW) Trench 15 Sample 4 - palaeosol

MFT /SMT 1b	M4A upper	320-360mm SM: Homogeneous; *Microstructure:* massive with very poor layering; 55% voids, simple and complex packing voids, medium to coarse (4mm) root channels; *Coarse Mineral:* C:F, SMT 1b, well sorted fine and medium sand-size quartz; *Coarse Organic and Anthropogenic:* abundant woody root traces; Fine Fabric: SMT 1b: dark reddish brown (PPL), isotropic (mainly interaggregate with coated grain, undifferentiated b-fabric, XPL), very dark reddish to black brown (OIL); very abundant humified amorphous organic matter; *Pedofeatures: Amorphous:* weak trace of ferruginisation; *Fabric:* very abundant thin (250 μm) burrows; *Excrements:* very abundant very thin to thin organic excrements. Sharp, horizontal boundary.	2007 Basal peat Poorly once-layered fine and medium sands and very abundant humified organic matter (humified peat) as organic excrements within thin burrows; abundant woody roots. *Site/palaeosol burial by alluvial sand and wood peat formation. This formed probably laminated and intercalated sand and peat, but this was affected by period or periods of fluctuating watertables leading peat ripening and associated burrowing and excrement-replacement of peat.*
MFT D2/SMT 2b	M4A lower	360-395mm SM: Generally homogeneous, thin mixing of SMT 1c in topmost few mm; *Microstructure:* massive; 35% voids, fine vughs and closed vughs, with common medium to coarse (7mm) extant root channels; *Coarse Mineral:* C:F, as SMT 2a; *Coarse Organic and Anthropogenic:* many medium to coarse (1-7mm) woody(?) root traces, with rare traces of non-woody fine roots (Fe stained) 1-2mm wide; occasional fine charcoal (max 4mm); occasional fine burned mineral, including weakly calcined flint and quartzite (fine to coarse sand-size, angular); rare trace examples of sand size aggregate mixed type 1/2 (upper Bt/lower Ea); enigmatic greenish clayey material (weathered glauconite/inwashed base-rich clay??); *Fine Fabric:* SMT 2b: dusty and speckled dark brown becoming reddish upwards in places (PPL), mainly isotropic (mainly intergrain aggregate/pellety, undifferentiated b-fabric, XPL), darkish orange brown (OIL); thin humic staining, with many amorphous and charred very fine organic matter *Pedofeatures: Textural:* rare trace of 100 μm thick pale grey finely dusty clay void coatings/infills (same channels as non-woody roots); *Amorphous:* abundant moderate Fe-impregnation of earlier roots and charcoal.	2008 Stained sand This top of the buried soil has a similar character to that in M4B below, but in addition, fine humic pellety fine fabric becomes more common; fine non-woody roots are partially preserved by ferruginisation. Woody roots become more common. An example of greyish clay coatings is recorded. *This uppermost 30mm records soil formation under increasingly moist conditions, with the roots of the extant non-woody vegetation being partially preserved by ferruginisation (during intermittent waterlogging stage). Trace evidence of possible marine clay inwash – succeeding wood peat formation.*

MFT D1/SMT 2a(3a)	M4B	395-470mm SM: Generally homogeneous, with very dominant SMT 2a and very few 3a; *Microstructure:* massive, with poorly formed fine prisms; 30% voids, fine, sometimes closed vughs, with fine vertical fissures, and with very fine to coarse (1-7mm) extant root channels; *Coarse Mineral:* C:F, SMT 2a: 75:25, moderately poorly sorted coarse silt, fine and medium sand-size quartz (and feldspar), with very few weathered glauconite and mica; very few fine flint gravel present; SMT 3a: C:F 50:50, well sorted coarse silt; *Coarse Organic and Anthropogenic:* occasional very fine to coarse (1-7mm) woody(?) root traces; many fine charcoal (max 2mm); occasional fine burned mineral, including weakly calcined quartzite and flint (fine to coarse sand-size, angular); *Fine Fabric:* SMT 2a: dusty and speckled dark brown (PPL), very low interference colours (intergrain aggregate and coated grain, speckled b-fabric, XPL), darkish orange brown (OIL); thin humic staining, with many amorphous and charred very fine organic matter; SMT 3a: blackish brown (PPL), very low interference colours or isotropic (porphyric, speckled or undifferentiated b-fabric, XPL), dark reddish brown (OIL); very abundant amorphous and sometimes strongly humified organic matter and rare fine charred; *Pedofeatures: Textural:* abundant very thin (25μm) dusty clay, often partially iron-stained grain and void coatings, sometimes containing very fine charcoal; example of 1mm thick fine channel fill of coarse humic silt (SMT 3a); *Amorphous:* abundant weak iron staining and replacement of clay coatings and amorphous infills, rare staining weathered glauconite.	2008 Stained sand Moderately sorted compact coarse silt, fine and medium sand (see Table A3.25), with many fine charcoal and occasional fine burned flint and quartzite. The fine fabric is weakly humic and contains much very fine charcoal, and thinly coats mineral grains and voids. Fine and coarse woody root channels are present, with one channel also being infilled with peaty coarse silt. Weak ferruginisation is recorded throughout. *This is a trampled occupation soil containing fragmented charcoal and fine burned flint and quartzite (from local burned mound(s); trampling compacted and homogenized this soil as well as producing ubiquitous thin dusty coatings. It is possible that K from ash may have accelerated the formation of these textural pedofeatures. Water table rise led to weak ferruginisation while overlying wood peat formation is associated with woody rooting.*
			2013 Natural sand

Movers Lane (Western Area 3) (R1R01) Sample 40 - trackway

MFT B2/SMT 1a1, 1a2, 1a3	M40A	150-230mm SM: Broadly layered with SMT 1a1 (150-190mm) and 1a2 (190-230mm); 5mm patch of of SMT 1a3; *Microstructure:* finely laminated and broadly layered; 55% voids, SMT 1a1: 70% voids, subhorizontal fissures, open vughs and simple and complex packing voids; SMT 1a2: 35% voids, open vughs associated with plant inclusions; *Coarse Mineral:* C:F, as below; very few (example of) gravel-size flint (7mm); *Coarse Organic and Anthropogenic:* rare trace of fine charcoal; example of mediun sand-size burned flint; example of fine charcoal-rich fragmented clasts(s)/infill (5mm) SMT 1a3; abundant (strongly iron impregnated) monocot roots (5mm) and very abundant monocot plant material fragments (tissues and organs; peat); very abundant humified monocot	5154 wood peat – trackway Broadly layered monocotyledonous and wood peat over humic silt containing detrital fine organic matter; small amounts of sand and one example of flint gravel; rare fine charcoal and an example of sand-size burned flint occur. Some infills/example of clast are very rich in very fine charcoal. Monocotyledonous roots and peaty material show strong humification and sometimes strong iron impregnation, compared to (later) woody roots. Minor burrowing, with organic excrements, and abundant gypsum formation. Peaty layer is notably organic with 27.8% LOI.

		and woody(?) OM; many non-iron impregnated (later??) woody roots (7mm) in silty SMT 1a2 layer; *Fine Fabric:* SMT 1a3: very dotted greyish brown (PPL), low interference colours (very open porphyric, speckled (micaceous/fine silty) b-fabric, XPL), grey with black and reddish brown inclusions (OIL): very abundant amorphous OM and plant tissues with abundant fine charcoal; *Pedofeatures: Textural:* occasional humic silt inwash, forming pans(?) or within decaying plant roots(?)(contains rare or very abundant very fine charcoal); Crystalline: abundant small gypsum crystal formation, including typical prisms; *Amorphous:* many amorphous iron staining of plant material; *Fabric:* occasional very broad (2-3mm) vertical burrows; *Excrements*: many very thin (100μm) organic excrements.	*Layers of detrital organic matter-rich silts and mainly monocotyledonous peat show moderately strong humification and iron impregnation (fluctuating water table). Later(?) woody rooting (wood peat formation) occurred as conditions became permanently waterlogged. Trackway use and fluctuating water tables led to inwash of very fine charcoal-rich silts, along with rare additions of sand, burned flint and charcoal. Marine inundation of the site resulted in gypsum formation.*
MFT B2/SMT 1a1 and 1a2	M40B	230-310mm SM: Broadly layered with SMT 1a1 and 1a2; *Microstructure:* massive, broadly layered (15mm) and laminated (10mm); 45-65% voids, medium and coarse root channels; *Coarse Mineral:* C:F, SMT 1a1 – 40/60:60/40 – moderately sorted coarse silt to fine and medium sand, with very few subrounded flint (3mm); SMT 1a2 – 55:45, well sorted medium and coarse silt and very fine sand; *Coarse Organic and Anthropogenic:* rare fine charcoal (max 2.5mm); very abundant wood and woody roots (11mm), lignified bark material; occasional non-woody plant fragments (monocots?); examples of burned flint shard (2mm) and 1mm-size blackened (burned) humic sandy soil; very abundant humified organic matter present – but impossible to identify dung traces – natural humified peaty material present; *Fine Fabric:* SMT 1a2: finely dotted brown and reddish brown (PPL), low interference colours (close porphyric, speckled b-fabric (fine silt ['silasepic'] and fine cellulose plant cells), XPL), orange brown (OIL); humic with very abundant amorphous OM and fine tissue fragments; phytoliths and diatoms present; rare very fine charred OM; *Pedofeatures: Textural:* occasional examples of 5-10mm thick curved and undulating peaty silt infills – 15mm wide (animal trample? and infill??); *Crystalline:* very abundant small gypsum crystal formation, including typical prisms; *Amorphous:* rare amorphous iron staining of plant material; *Fabric:* occasional very broad (2-3mm) vertical burrows; *Excrements:* many very thin (100μm) organic excrements.	5154 Sandy peat upper Broadly layered wood peat, with wood fragments and woody roots, and a scattered fine and medium sand component. Rare fine and very fine charcoal, a burned flint fragment and charred humic soil fragment occur. Layers of silty peat sediment occur also as 5-10mm thick 15mm-wide undulating and curved infill. Upper sandy peat and peaty sand are humic (29.7% and 17.0-% LOI, respectively); but no obvious phosphate-P enrichment is recognised. Broad burrowing, thin organic excrements, and later, abundant gypsum crystal formation, are recorded. *A sandy wood peat formed that included periodic inwash of fine detrital peat and medium and coarse silt. This silty peat forms incomplete layers and an example of an undulating fine fill, which could possibly be part of an animal print. One fill includes a charred very coarse sand-size humic sandy topsoil fragment. Rare charcoal occur throughout the sediment sequence, and one small fragment of burned flint also testifies to an anthropogenic input. As the detrital peat includes humified peat, it is impossible to recognise if finely fragmented dung is present. The sediments were occasionally burrowed and worked by mesofauna. This bioactivity and minor iron-staining records generally continuous waterlogged conditions, with occasional drying out. Gypsum formation probably reflects changed environmental after marine inundation.*

Movers Lane (Western Area 3)(R1R01) Sample 44 - burned mound

MFT E1/SMT 4a/4a2, with 2a, 2c, 2d and 2e MFT D4/SMT 2a, 2c with 2d and 4a	M44A	230-270mm SM: Heterogeneous, becoming more homogeneous up-profile (dominant 4a [and more brownish 4a2], with clasts of 2a, 2c, 2d and 2e (as 2d blackened/burned with fine charcoal); *Microstructure:* 15% voids (fine fissures), but with 2-3mm size planar voids separating medium prisms (25% voids); *Coarse Mineral:* C:F, SMT 4a-4a2: 45:55, becoming 20:80 up-profile; well sorted coarse silt with few fine and medium sand; alluvial clay clasts and mound soil clasts also incorporated; *Coarse Organic and Anthropogenic:* rare fine (<1mm) charcoal and burned flint; Fine Fabric: SMT 4a2: speckled pale to darkish brown (PPL), moderately high interference colours (open porphyric, speckled and grano-striate b-fabric (mica present), XPL), orange grey to pale orange (OIL); very weak humic staining and rare relict ferruginised OM, trace of fine charcoal; *Pedofeatures: Textural:* very abundant textural intercalations, with 1-2mm thick silty clay pans and infills marking approximate boundary between 5083 and 5121, and many 2-300μm thick moderately oriented brownish clay (alluvial) infills; *Amorpho*us: many Fe broad impregnations and occasional amorphous ferruginisation of plant material and void infills; *Fabric:* very abundant mixing of different soil material and alluvium – possibly muddy slurry of mound and alluvial soil and alluvial clay components; *Fabric:* many broad burrows. Diffuse, mixed unclear boundary	(5122 Laminated clay) 5121 Stained clays Mixed sandy silt loam alluvial soil and clayey alluvial clasts and infills, with some small charcoal and burned flint and much soil from the burned mound, including rubefied clay and blackened burned topsoil. Muddy pans and infills – some 1-2 mm thick – occur, alongside brownish clay infills. Iron staining and iron hydroxide infills/plant pseudomorphs occur. (3.15% LOI, 40.0% silt and 48.8% clay recorded) *Muddy slurry of eroded mound material (including burned soil, charcoal and small burned flint), local mobilised silty clay alluvium, forming pans and also being earthworm-burrowed at times. Fragments of pure alluvial clayey sediment also occur as clasts. Clayey inwash from the overlying alluvial clay. The exact origins of this context are not clear, but inundation, erosion and disturbance could have been occurring as the site became wetter and more often influenced by clayey alluviation.*
		270-310mm SM: Very heterogeneous (common 2a, 2c, and frequent 2d, very few 4a); *Microstructure:* massive becoming fine and medium prismatic upwards (5204-5142 boundary); 20% voids, mainly very fine and fine fissures, vertical fissures (100-300μm wide); *Coarse Mineral:* C:F, 65:35, poorly sorted coarse silt, fine and medium sand (quartz and quartzite), with few chert (4mm) and quartzite (8mm) gravel; *Coarse Organic and Anthropogenic:* many fine burned flint (4-5mm), occasional coarse (5mm) charcoal; abundant burned soil (SMT 2c or 2d) – as clasts (2-3mm) or burrow fills (5mm); rounded clayey (alluvium) clasts, and burrow infills; *Fine Fabric:* SMT 2c: as SMT 2c, but finely fissured, dark reddish orange brown (PPL), low interference colours (close porphyric, speckled and grano-striate b-fabric, XPL, mica present), orange to reddish orange (OIL); patches of abundant fine charred organic matter (burned subsoil B clay); SMT 4a: rare wide (1500μm) finely speckled greyish	Upper (5083) burned mound As below in M44B, but much less stony with smaller burned flint and less coarse charcoal. Reddish soil as strongly rubefied and finely fissured clay loam and as iron-stained once-humic(?) clayey soil occur more commonly than below, as clasts and as burrow fills – some associated with impure clay void coatings. Intercalations are equally abundant in this very heterogeneous deposit. *Continuing use (trampling) of the site, but with continuing clayey alluviation, leading to clayey soil accretion over the stony burned mound itself. Alluvial clay seems to have got burned/used for hearth construction, and this burned soil was mixed by trampling and burrowed down-profile. Alluviation may also have led to truncation*

		brown, impure clay broad burrow infills with rare silt and sand and fine charcoal (open porphyric, speckled and mosaic b-fabric, XPL), grey (OIL), weak humic staining, rare fine amorphous organic and charcoal; *Pedofeatures: Textural:* rare intercalations and embedded grains associated with burned red clay (daub/hearth?); very abundant dusty clay intercalations throughout; rare reddish clay void coatings/infills up to 500μm thick – poorly oriented and partially iron-stained – containing relict fine OM and rare charcoal – phytoliths present; these can occur in burrows infilled with reddish clayey soil (with fine rubefied inclusions); *Amorphous:* many ferruginisation of possibly once-humic soil and also associated ferri-hydrite(?) amorphous iron as void infills; *Fabric:* many broad burrows.	*and reworking of the occupation soils/upper burned mound, and grey alluvium has also been burrowed down-profile. Continuing disturbance occurred, hence the unclear boundary with the overlying stained alluvium (Context 5121).*
MFT D3/SMT 2a, 2b, 2c	M44B	340-420mm SM: Very heterogeneous (common SMT 2a, with frequent 2b and 2c – mainly in burrows); *Microstructure:* fine to medium prisms and subangular blocky; 25% voids, moderately accommodated medium planar voids, open and closed vughs; *Coarse Mineral:* C:F, 70:30, very poorly sorted coarse silt, fine and medium sand-size quartz (with mica, feldspar and very few glauconite), with very coarse sand and stone size angular and rounded flint (19 mm); *Coarse Organic and Anthropogenic:* abundant coarse charred wood and charcoal (max 15mm), many burned flint (calcined, cracked, traces of rubefication; max 20mm); traces examples (x3) of sand-size burned bone; example of clayey clast (mica-rich wetland clay?); occasional burned soil (upwards); *Fine Fabric:* SMT 2a – as M4B; SMT 2b – as 2a but, greyish and speckled brown (PPL), grey (OIL); very thin humic coatings and rare to occasional amorphous organic matter and rare fine charcoal (uppermost Ea/Eb horizon); SMT 2c: speckled brown/reddish brown with red inclusions (PPL), moderately low interference colours (close porphyric, speckled b-fabric, XPL), brown and orange brown (OIL); occasional to many fine charcoal (red material is red clay papules) – sometimes very dark and isotropic because of ferruginisation (burned red soil); *Pedofeatures: Textural:* occasional (in uppermost part) thin 50-75 μm reddish clay coatings, some dusty with fine charcoal; generally poorly birefringent (translocated burned clay?); abundant very dusty textural intercalations and pseudo-layering, and embedded grains (form of grano-striate b-fabric) – associated with matrix void coatings up to 500μm thick;	5083 Burned mound Heterogeneous very poorly sorted stony soil deposit with leached loamy sands, humic and fine charcoal rich sandy loam, and upwards increasing amounts of reddish brown sandy loam-silty clay loam soil, containing fine charcoal and present mainly as broad burrow infills. Deposit is very charcoal and burned flint/chert-rich, with trace amounts of fine burned bone present. Very abundant dusty clay intercalations occur alongside thick matrix void coatings; reddish clay infills are also present. Many broad burrows are present, and moderate iron-staining is recorded. (Weak phosphate enrichment 0.588mg g-1, a sandy silt loam texture and a 4.91% LOI was measured; Table A3.25) *This is a markedly heterogeneous stony, burned flint and charcoal-rich burned mound deposit, developed upwards from leached upper subsoil sands and once-humic and more loamy fine charcoal occupation soils. Traces of fine burned bone occur as evidence of probable food preparation. The abundance of textural pedofeatures (intercalations and matrix infills) and coarse heterogeneity indicate mixing by trampling of an often muddy substrate; minor likely burrow mixing by earthworms also took place. These also mixed rubefied clayey soil from overlying mound deposits/possibly also associated with alluvial clay washing through(?). During occupation, the site was*

		Amorphous: many weak to moderate ferruginous impregnations; *Fabric:* many broad (2mm) burrows in upper part.	*likely being affected by clayey alluviation, helping to thicken the silty clay loam mound above upper subsoil sands and the natural gravels (context 5117).*

Movers Lane (Western Area 3)(RIR01) Sample 47 - palaeosol

MFT D6/SMT 4d and 2a	M47A	30-110mm SM: Heterogeneous, intercalated and broadly bedded humic clayey silts (SMT 4d) and medium sands (2a); *Microstructure:* bedded and fine laminated; 40% voids, fissures, open vughs and channels, simple packing voids; *Coarse Mineral:* as M48B; C:F, SMT 4d, 60/80:40/20; moderately well sorted coarse silt and fine sand; *Coarse Organic and Anthropogenic:* rare fine charcoal (1-2mm); occasional fine woody and monocot roots (1-2mm); very abundant detrital humified plant fragments (6mm) and rare coarse clasts of amorphous peat (3mm); Fine Fabric: SMT 4d: speckled and finely dotted dark brownish (PPL), moderately low interference colours (open or close porphyric [according to silt/fine sand content], speckled b-fabric, XPL), pale brown with rare reddish flecks [detrital iron-impregnated OM?] and blackish inclusions (OIL); humic with very abundant fine and medium-size amorphous OM and tissue fragments; fine charcoal, diatoms and phytoliths present; *Pedofeatures: Crystalline:* occasional coarse (1.5mm) gypsum prisms; Amorphous: occasional strongly Fe impregnated fine fabric – associated with non-woody post-woody rooting; *Fabric:* possible rare thin burrows.	5204 Basal alluvium with charcoal Intercalated and broadly bedded humic clayey silts and clean medium sands (overall mean grain size=fine and medium sandy loam). Rare fine charcoal but very abundant very fine to coarse detrital blackened and humified woody plant fragments (up to 6mm) occur – some horizontally oriented – along with clasts of humified peat, producing 4.84% LOI and 0.251mg g-1 phosphate-P. Fine woody roots seem to be post-dated by monocotyledonous plant roots; the latter are often iron impregnated and associated with iron hypocoatings when penetrating fine sediments. Coarse (1.5mm) prismatic gypsum formation has affected the sediments. *These sediments record alternating deposition of sands and humic silts, with small amounts of charcoal, although abundant humifed (blackened) woody plant material may have appeared charcoal-like in the field. The sediments may be recording rapidly migrating(?) stream flow (sands) and overbank flooding (humic silts), with fen carr wood peat being eroded during this process. Changing environmental conditions – marine inundation(?) – led to a monocotyledonous vegetation becoming dominant, and secondary iron and gypsum formation took place.*
MFT E2/SMT 4b, 4c, 2a	M47B	110-145mm SM: Heterogeneous, intercalated and broadly bedded humic clayey silts (SMT 4b and 4c) and medium sands (2a); *Microstructure:* massive, broadly bedded; 35% voids, horizontal fissures and simple packing voids; *Coarse Mineral:* C:F, 100:0 (sands), 25:75 (silty clay); well sorted layers of fine and medium sand, clayey silts and poorly sorted layers with coarse inclusions; *Coarse Organic and Anthropogenic:* rare woody root traces (4mm); abundant wood charcoal (charred bark?)(1-2mm); examples of 2.5mm-size burned bone (associated	5204 Basal alluvium with charcoal Heterogeneous, intercalated and broadly bedded medium and fine sands and humic silty clay (mixed average grain size=sandy loam), with detrital plant fragments, charcoal (possible charred bark), and including example of burned bone (2.5mm) and 2mm-size burned sandy soil, with rare fine calcined burned flint. *Basal alluvium includes both low energy humic silty clay and higher energy sands,*

fungal material?) and 2mm-size burned (rubefied) sandy soil (see 5083); rare fine calcined burned flint; *Fine Fabric:* as below; *Pedofeatures: Amorphous:* occasional iron-impregnated woody material.

and included charcoal, burned bone burned flint and burned soil examples, evidencing erosion of burned mounds/occupation soils locally.

MFT D5/SMT 5a, 4b and 4c

145-185mm

SM: Heterogeneous (sands and gravels with frequent SMT 5a [argillic fine sandy silt loam soil – as coarse 9mm clast and matrix material] and common SMT SMT 4b and 4c – alluvium); *Microstructure:* massive, channel, poorly layered/laminated (3-6mm thick – includes moderately limonite-rich sand lens); 40% voids, simple packing voids, open vughs and broad channels (4-8mm); *Coarse Mineral:* C:F, 95:05 (sands), 60:40 (argillic loam); very poorly sorted mainly medium, coarse and very coarse sand, with common gravel (13mm); quartz, flint, chert, feldspar, limonite; flint showing both depletion and iron-staining features; *Coarse Organic and Anthropogenic:* rare trace of weakly burned (calcined) flint (max 3.5mm); many 4-8mm woody root traces; *Fine Fabric:* SMT 4b (alluvial clay): yellow brown to dark brown with very dark brown/blackish inclusions (PPL), moderately low to moderate birefringence (open porphyric, speckled and grano-striate b-fabric, XPL), grey with reddish brown and blackish inclusions (OIL); very humic clay (with silt), very abundant blackened and browned tissue fragments and amorphous organic matter; occasional diatoms and phytoliths; rare trace of charcoal; SMT 4c (as 4b – with many very fine charcoal); SMT 5a (argillic fine soil): pale yellowish brown (PPL), moderately low interference colours (close porphyric, speckled and grano-striate b-fabric, XPL), pale yellowish orange (OIL); trace of humic staining in fine voids (relict root channels?); *Pedofeatures: Textural:* abundant thin (25-100μm) well oriented very finely dusty, void and grain clay coatings in 'argillic' SMT 5a clast and within sandy matrix; rare example of thin (50 μm) brownish clay void infilling in SMT 4b 'fill'; *Depletion:* examples of iron depletion from iron-stained flint; *Amorphous:* abundant thin iron grain coatings, fine fabric impregnation, clast hypocoatings and partial ferruginisation of organic inclusions; *Excrements:* possible rare traces of relict iron-replaced very thin excrements in channels.

5142 Occupation sands

Heterogeneous and upwards, poorly layered mainly leached medium to very coarse sands and gravels, with traces of argillic matrix; upper layered part includes coarse argillic (fine sandy silt loam with clay void and grain clay coatings), and poorly bedded sand – one for example relatively rich in medium sand size limonite. Rare traces of calcined burned flint occur (3.5mm). Many part-humified and iron-stained woody roots (4-8mm) occur; humic (alluvial) clay containing humified plant fragments, diatoms and phytoliths, and sometimes fine charcoal occur in relict root channels; silty clay clasts also occur. One example of void clay coatings formed in this clay was observed. Sands are very poorly humic (0.690% LOI) but may show weak phosphate-P enrichment (0.135 mg g-1). *Truncated, disturbed natural sands and gravels which had developed an argillic brown sand soil – now evidenced by relict fine matrix material and as a locally eroded coarse (10mm) clast of fine sandy silt loam argillic Bt horizon soil. Occupation led to the inclusion of rare traces of burned flint, and weakly enriched phosphate-P content (see above). Woody rooting during fen carr development (and continued occupation) led to inwash of humic clay containing phytoliths, diatoms and sometimes fine charcoal.*

Soil Microphotographs and scans (Fig 3.15)

1. Scan of impregnated block 40A=B (Trackway at Movers Lane) that produced thin sections M40A (through peat [P] and humic silt [HS] and M40B (sandy peat [SP]). Block is *c*140mm long
2. Scan of impregnated block 44A+B (Movers Lane; that gave thin sections M44A (laminated clays [LC] and M44B (burnt mound [BM] with calcined flints) at Movers Lane. Block is *c*180mm long.
3. Scan of M2A (Trackway Context 28, Woolwich Manor Way), composed of 1: layer of fragmented wood peat, flint and sediment clasts, 2: sands and soil clasts, 3: wood peat. Frame height is *c* 75mm.
4. Scan of M40B (Trackway Context 5154, Movers Lane)(see 1); broadly layered peat and humic silts containing very abundant fine detrital organic matter. One silty infill may possibly record a small cloven hoof print (Arrow; see 16-17). Frame height is *c* 75mm.
5. Scan of M44A (Context 5121, Movers Lane) (see 2); 'stained clays' composed of alluvium, a muddy slurry of burnt mound material and upper burnt mound containing rubefied clay. Frame height is *c* 75mm
6. Scan of M44B (Context 5083, Movers Lane) (see 2); burnt mound develops upwards from subsoil sands, as fine charcoal-rich loam characterised by coarse flints, burnt flint (BF) and charcoal (Ch). Rubefied burnt soil has been burrowed into the mound from the 'upper mound' (see 5). Frame height is *c* 75mm.
7. Photomicrograph of M2A (WMW, Context 28) showing rounded soil clast of likely upper subsoil Eb in uppermost part of M2A (sub-unit 1 in 3, above). Plane polarised light (PPL), frame width is *c* 4.62mm.
8. As 7 (above), under crossed polarised light (XPL), showing coarse silt and fine and medium sand content of Eb soil clast.
9. Photomicrograph of M2A (WMW, Context 28) showing rounded soil clast of probable 'trackway' soil in uppermost part of M2A (sub-unit 1 in 3, above). Note included burnt peat fragments, flint (BF) and secondary iron impregnation (Fe). PPL, frame width is *c* 4.62mm.
10. As 9, above, under oblique incident light (OIL), illustrating blackish peat fragments, calcined burnt flint and iron staining in voids and around margin of the clast
11. Photomicrograph of M4B (WMW, Context 2008); coarse silt, fine and medium sand with many fine charcoal and examples of burnt mineral grains; dusty grain and void clay coatings occur – see arrow for marked example in 12-13. PPL, frame width is *c* 2.38mm.
12. detail of 11 (see arrow); dark dusty, grain and void coatings. PPL, frame width is *c* 0.90mm.
13. As 12, under OIL. Note reddish burnt mineral grain and fine charcoal in dusty clay coating.
14. Photomicrograph of M4A (WMW, Context 2007); humified and bioworked sandy peat, characterised by thin organic excrements and wood fragments. PPL, frame width is *c* 2.38mm.
15. Photomicrograph of M40B (ML, Context 5154); burnt flint fragment (arrow) and peat. OIL, frame width is *c* 4.62mm.
16. Photomicrograph of M40B (ML, Context 5154); humic silts (HS) in possible 'hoof print' over sand (S) beds (see 1 and 4 above); note – included fragments of peat and charred (blackened) humic sandy topsoil fragment (arrow). PPL, frame width is *c* 4.62mm.
17. As 15, above., under OIL. Note horizontally oriented detrital peat fragments in the humic silts (HS) that may be infilling a 'hoof print', and charred (blackened) topsoil clast (arrow).
18. Photomicrograph of M44B (ML,Context 5083)(see 2 and 6); lower mound with iron-stained flint gravel and sandy soil with little included fine anthropogenic material. PPL, frame width is *c* 4.62mm.
19. As 18, but higher up in burnt mound showing marked heterogeneity and included charcoal (Ch), burnt flint (BF) and inwashed red clay – rubefied and mobilised by burning. PPL, frame width is *c* 4.62mm.
20. As Fig 19, showing rare trace of orange burnt bone (BB); charcoal (Ch) and red clay (RC) as inwash and in burrows, also occur. PPL, frame width is about 4.62mm.
21. Photomicrograph of M44A (ML, Context 5121) (see 2 and 5, above); trampled muddy layers containing red clay (RC), blackened burnt soil (BS), alluvial muddy pans (A) and further mixed (M) layers upwards. PPL, frame height is *c* 4.62mm.
22. As 21. Note red clays (RC), blackend burnt soil (BS), pale alluvial muds (A) and further mixed (M) layers making up these 'stained clays'.
23. Photomicrograph of M47B (ML, Context 5204); broadly bedded humic silty clay and sands. PPL, frame height is *c* 4.62mm.
24. As 23, coarse burnt bone fragment in sandy beds. PPL, frame width is *c* 4.62mm.
25. Photomicrograph of M47A (ML, Context 5204); detail of humic clayey silts, containing phytoliths and diatoms (arrow); PPL, frame width is 0.47mm.
26. As 25; secondary prismatic gypsum crystals, probably recordingeffects of marine inundation of the site.PPL, frame width is *c* 4.62mm.
27. Example of SEM-EDAX analysis on clast within M2 (Woolwich Manor Way, Trench 2, trackway) – see 9-10 above.

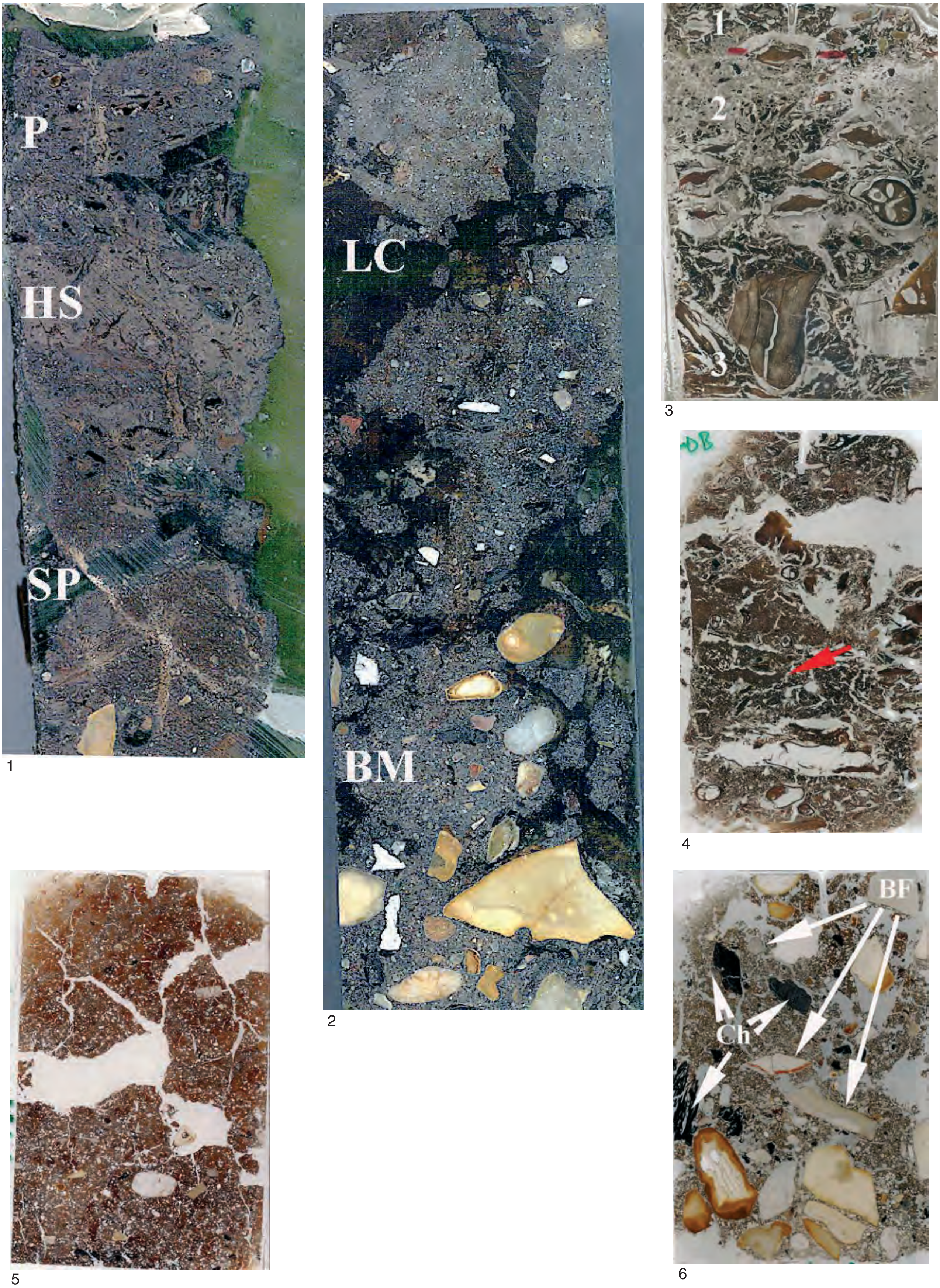


Fig. A3.15 Soil microphotographs and scans

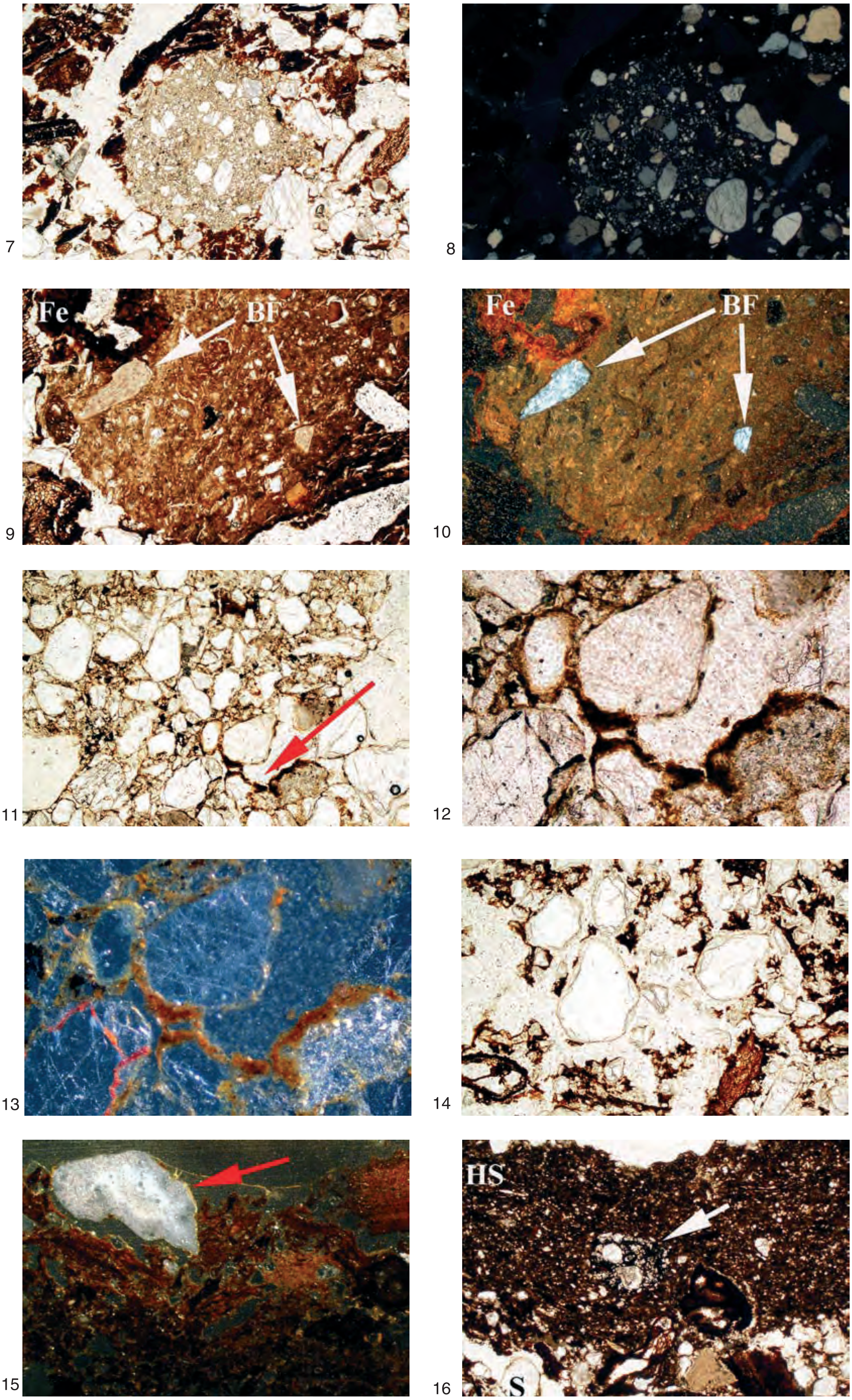


Fig. A3.15 Soil microphotographs and scans

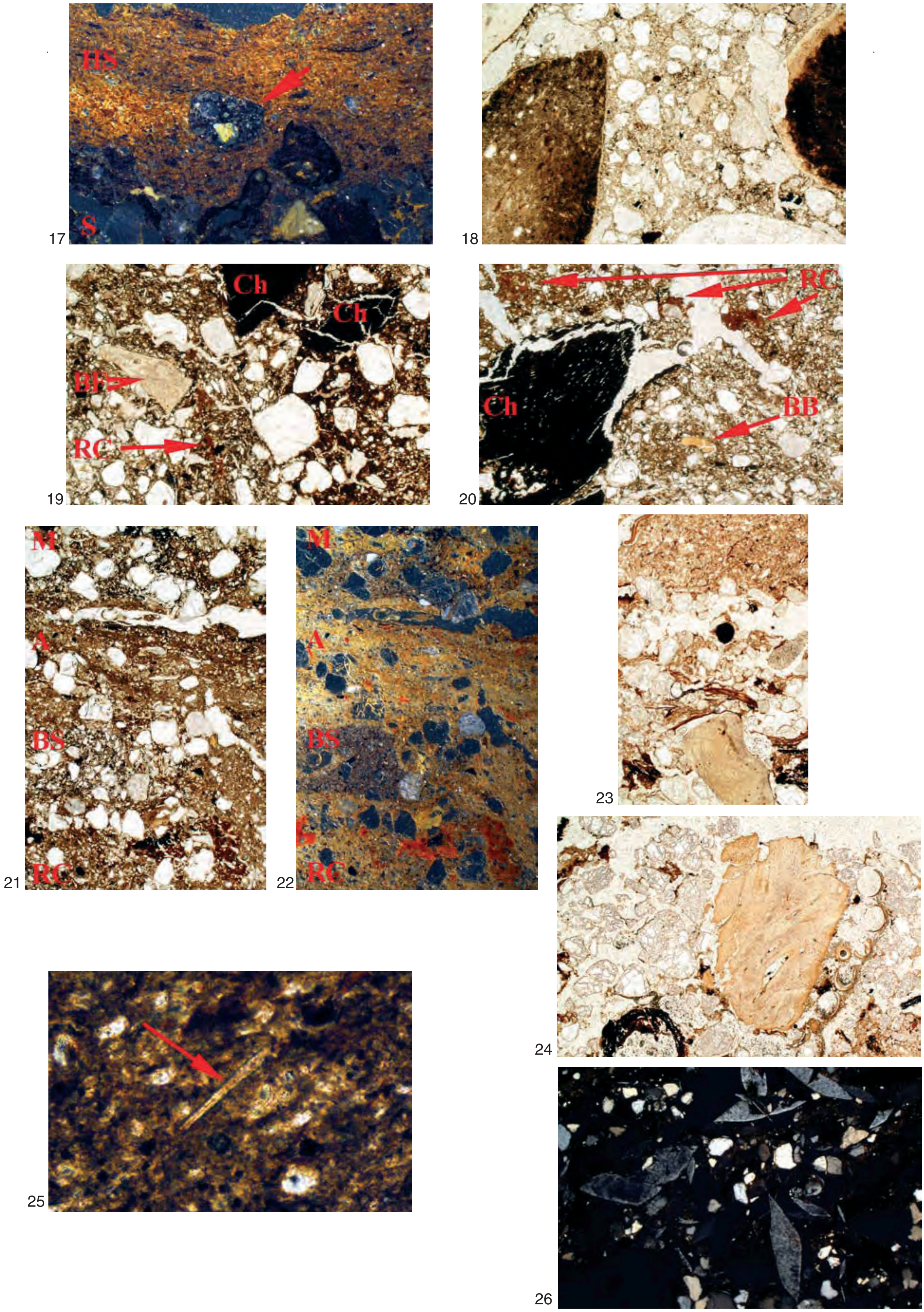
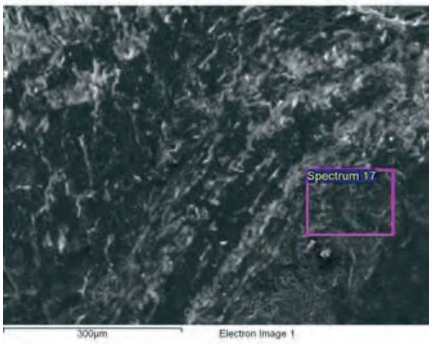
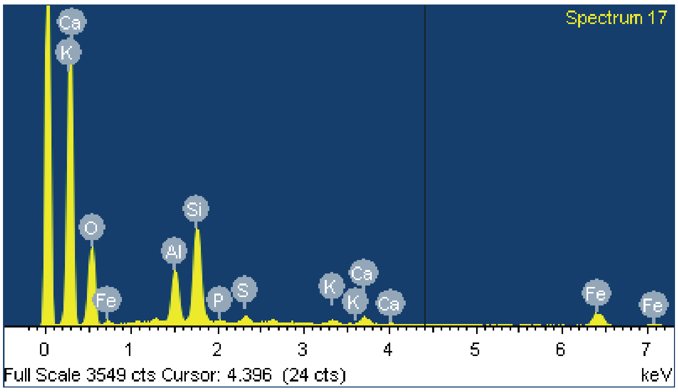


Fig. A3.15   Soil microphotographs and scans





No peaks omitted

Processing option : All elements analyzed (Normalised)
Number of iterations = 3

Standard :
O SiO2 1-Jun-1999 12:00 AM
Al Al2O3 1-Jun-1999 12:00 AM
Si SiO2 1-Jun-1999 12:00 AM
P GaP 1-Jun-1999 12:00 AM
S FeS2 1-Jun-1999 12:00 AM
K MAD-10 Feldspar 1-Jun-1999 12:00 AM
Ca Wollastonite 1-Jun-1999 12:00 AM
Fe Fe 1-Jun-1999 12:00 AM

Element	Weight%	Atomic%
O K	49.87	66.82
Al K	10.52	8.36
Si K	21.79	16.63
P K	0.88	0.61
S K	1.81	1.21
K K	1.10	0.61
Ca K	2.47	1.32
Fe K	11.57	4.44
Totals	100.00	

Fig. A3.15 Soil microphotographs and scans