Landscape Evolution in the Middle Thames Valley
Heathrow Terminal 5 Excavations Volume 2

Soil Micromorphology

(Section 19)

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SECTION 19

SOIL MICROMORPHOLOGY, CHEMISTRY, MAGNETIC SUSCEPTIBILITY AND PARTICLE SIZE ANALYSES

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Summary

Twenty-seven thin sections and thirty-one bulk samples from Terminal 5 were investigated through soil micromorphology and bulk analyses (chemistry, grain size and magnetic susceptibility). Ten thin sections were reviewed from Perry Oaks. Data are presented in six tables (Tables 1-3 bulk data; Tables 4-6 soil micromorphology); results are also supported by 62 figures (thin sections scans and photomicrographs). The natural soils are leached fine loamy gleyed soils developed in fine drift over sands and gravels ('control' profile study). There is clear evidence in all the Stanwell Cursus ditch fills investigated, of combined Early Neolithic soil disturbance and vegetation clearance by fire (*cf.* burned tree-throws), probably immediately ahead of Cursus ditch and bank construction (a likely parallel is Drayton Cursus, Oxfordshire.) Evidence includes burned disturbed soil with embedded charcoal, burned stones and the presence of an overabundance textural pedofeatures rich in fine charcoal – the last a supposed result of clay mobilisation by potassium (K) released from weathered ash. Although post-depositional gleying and leaching affects on soil iron in the ditch fills has resulted in this burning being essentially unrecorded by magnetic susceptibility, some phosphate concentration appears probable when compared to background levels. Neolithic opening up of the environment that probably ensued is indicated by proxy evidence of grassland soils managed by fire and associated herded stock, the effects of the latter being recorded both by textural pedofeatures of trampling origin and associated enhanced phosphate concentrations. This developing open landscape trend continues into the Bronze Age when mixed farming appears evident. Fine charcoal in the ditch fill sediments is indicative of landscapes managed by fire; burning of stubble and crop processing waste, for example, also probably being contributory activities. Evidence (soil micromorphology and phosphate) of stock is ubiquitous, and found not only in trackway deposits but also in most ditch fills. Arable (leached, and gleyed)

soils appear to have been rich in fine charcoal, but poorly organic. There is some evidence (residual household waste – examples of pot and burned flint) of probable low levels of manuring in ditch fills; track way deposits in addition to reflecting animal passage, may also exhibit an enhanced magnetic susceptibility resulting from trafficking (and/or spillage). Examples of Medieval waterhole deposits show stronger phosphate enhancement compared to the prehistoric soils, but the origin of this phosphate is unknown, however, as no thin sections were studied.

Introduction

Archaeological excavations were carried out at the sites of Perry Oaks (1998-99) and Terminal 5 (2002-2005) by Framework Archaeology (Archaeology, 2005; Lewis, 2005; Lewis and Welsh, 2004). Several visits were made by Macphail to the site, but all samples were collected by Framework Archaeology staff (e.g., Carl Champness and Simon Dobinson); some samples came via Oxford Archaeology North (Elizabeth Huckerby). Thirty-two monoliths were assessed in the first instance (Macphail, 2004). Additional monoliths were assessed during 2005-6. Discussions with Lisa Brown, John Lewis and Ken Welsh of Framework Archaeology, and Rebecca Nicholson of Oxford Archaeology, led to the selection of some 23 monoliths/monolith series for a post-excavation soil study from across the site. Further selection led to the analysis of 27 thin sections and 31 bulk samples. In order to address the most important archaeological questions of the site (Lewis and Welsh, 2004; Lewis *et al*., 2005) that could be tackled though this microstratigraphic approach (see below), samples from the Neolithic and Bronze Age were prioritised. Samples were also selected on the basis of providing a wide feature and geographical spread. In relationship to the latter, a further 10 thin sections (samples collected by Helen Lewis, Cambridge University)(Lewis, undated) from Perry Oaks, were reviewed.

The full microstratigraphic analysis of the Terminal 5 samples, using soil micromorphology and the bulk analysis of chemistry, magnetic susceptibility and particle size followed the successful application of similar methodologies carried out on soil landscapes cleared and managed by Neolithic and Bronze Age populations; for example, at Eton Rowing Lake and Drayton Cursus (Oxfordshire), and Raunds (Northamptonshire)(Barclay *et al*., 2003; Goldberg and Macphail, 2006; Healy and Harding, Forthcoming; Macphail, 1990, Forthcoming; Macphail and Linderholm, 2004).

Samples and Methods

Terminal 5 bulk samples and thin section and are listed in Tables 1 and 4, respectively (the thin sections from Perry Oaks that were reviewed are recorded in Table 6.) Terminal 5 monoliths were first subsampled for bulk analyses, then cut up using a motor saw into suitable lengths (8 or 15 cm) for thin section processing.

Chemistry, magnetic susceptibility (Table 1 and 2) and particle size (Table 3)

Analysis was undertaken on 31 bulk samples of soils and sediments in the hope of gaining additional insight into their character, origin and mode of development. The samples were taken to complement thin sections investigated by Dr Richard Macphail.

The bulk samples were analysed for phosphate (see reviews by Bethel and Máté, 1989; Crowther, 1997; Heron, 2001) and magnetic susceptibility (Clark, 1996; Scollar *et al.*, 1990), both of which are widely used in the investigation of archaeological contexts; and for loss-on-ignition (LOI), which provides an estimate of the organic matter concentration. Analysis was undertaken on the fine earth fraction (i.e. <2 mm) of the samples.

Phosphate-P_i (inorganic phosphate) and phosphate-P_o (organic phosphate) were determined using a two-stage adaptation of the procedure developed by Dick and Tabatabai (1977) for measuring phosphate-P (total phosphate) in which the phosphate concentration of a sample is measured first without oxidation of organic matter, using HCl as the extractant (P_i); and then on the residue following alkaline oxidation with NaOBr (P_o). These were summed to give total phosphate (phosphate-P), and the ratios phosphate-P_i:P and phosphate-P_o:P (expressed as percentages) were calculated. For six of the samples the phosphate-P_o concentrations were too low for accurate measurement, and in these cases conventional determinations of phosphate-P were made.

In addition to χ (low frequency mass-specific magnetic susceptibility), determinations were made of χ_{max} (maximum potential magnetic susceptibility) by subjecting a sample to optimum conditions for susceptibility enhancement in the laboratory. χ_{conv} (fractional conversion), which is expressed as a percentage, is a measure of the extent to which the potential susceptibility has been achieved in the original sample, viz: (χ/ χ_{max}) x 100.0 (Tite, 1972; Scollar *et al.*, 1990). In many respects this is a better indicator of magnetic susceptibility enhancement than raw χ data, particularly in cases where soils have widely differing χ_{max} values (Crowther and Barker, 1995; Crowther, 2003). A Bartington MS1 meter was used for magnetic susceptibility measurements. χ_{max} was achieved by heating samples at 650°C in reducing, followed by oxidising conditions. The method used broadly follows that of Tite and Mullins (1971), except that household flour was mixed with the soils and lids placed on the crucibles to create the reducing environment (after Graham and Scollar, 1976; Crowther and Barker, 1995). LOI (loss-on-ignition) was determined by ignition at 375°C for 16 hours (Ball, 1964). Carbonate content was estimated from the observed reaction when acid was added during the phosphate extraction. Particle size analysis was also undertaken on seven of the samples using the pipette method on <2.00 mm mineral (peroxide-treated) soil (Avery and Bascomb, 1974).

Soil micromorphology

Undisturbed monolith subsamples were impregnated with a crystic resin mixture, cured and cut up into 75 mm long blocks (Goldberg and Macphail, 2006; Murphy, 1986). Blocks were sent to Quality Thin Sections, Tucson, Arizona for thin section manufacture (Figs 1-2, 7-8). Thin sections were analysed 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 4 and 5), 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). Soil microfabric types

(MFTs) were identified during the review of the Perry Oaks thin sections in order to allow specific comparisons with the Terminal 5 soils (see Table 6).

Results

Bulk analyses

The bulk analytical data are presented in Tables 1-3. It should be noted that many of the samples appeared to be gleyed, with varying degrees of Fe mottling (see below).

Organic matter content

Despite the fact that many of the samples appear to have been subject to gleying (and presumably waterlogging), the majority of the samples are largely minerogenic, with LOI values of <4.00%. Only two samples (thin sections M20A and M20B – highlighted in Table 1), both from the sequence of fills in the MBA ditch, have notably higher organic matter concentrations (10.4 and 8.73%, respectively). These results confirm the more humic (possibly peaty) character of these fills as noted in field descriptions, and presumably reflect a poorly drained environment in which the rate of minerogenic sedimentation was relatively slow. The fact that the LOI of the basal fill of the ditch (thin section M21) is low compared with the overlying fills suggests that the initial sedimentation was quite rapid.

Particle size

The seven samples analysed display quite marked variability in texture (Table 3). The buried soil and underlying natural brickearth subsoil (thin sections M24 and M25) are relatively fine textured, with high proportions of silt and clay. By far the coarsest textured sample was from the basal fill of the MBA ditch (thin section M21), which contains 65.9% sand, the vast majority of which is coarse or medium sand. This may be indicative a primary fill derived largely from initial instability of the ditch sides and/or a time when the ditch had higher energy flows – i.e. with predominantly coarse sediments being deposited. The overlying sediment (thin section M20B) has a much finer texture, with a particularly high proportion of silt (46.6%).

Phosphate concentrations

The phosphate-P data display considerable variability (0.092-3.39 mg g^{-1}). Interestingly, the two lowest phosphate-P concentrations (both 0.092 mg g^{-1}) were recorded in the samples from the natural 'control' profile through a buried soil and natural brickearth subsoil (thin sections M24 and M25). A high proportion of the samples (14/31) have very low phosphate-P concentrations of <0.500 mg g^{-1}, and 24/31 have <1.00 mg g^{-1}, which is somewhat surprising in view of the quite high proportions of clay present in many of the samples. It seems reasonable to assume that samples with concentrations of ≥1.00 mg g^{-1} indicate likely enrichment, and that values ≥2.00 mg g^{-1} are strongly enriched (highlighted in Table 1). Of these, the two MBA trackway ditch fills (thin sections M22 and M23) stand out as both showing signs of enrichment. Perhaps not unsurprisingly (Medieval waterhole) samples 569023 (2.24 mg g^{-1}) and 569024 (3.39 mg g^{-1}) may be characterised as being strongly enriched and very strongly enriched, respectively, compared to the prehistoric samples.

The proportions of organic phosphate are very variable (P_o:P range, 12.0-61.5%) and are on the whole rather higher than are often found in archaeological contexts, for which values typically range from 5.0-25.0%. Not surprisingly, very high ratios (61.5 and 59.8%, respectively) were recorded in the two very humic MBA ditch fills (thin sections M20A and M20B). However, ratios >25.0% are present in a number of samples with LOI concentrations of <3.0%. This is somewhat surprising, and is presumed to reflect a combination of the preservation of some organic phosphates under waterlogged conditions and the generally low levels of inorganic phosphate in these gleyed, and presumably quite heavily leached, soils.

Magnetic susceptibility

Gleyed soils are often problematic in terms of magnetic susceptibility because of the mobilisation, leaching and local redeposition of Fe minerals. As is typical of gleyed soils, the χ values are generally very low (maximum, 28.2 x 10^{-8} SI) and χ_{max} is extremely variable (range, 94-3920 x 10^{-8} SI). In the majority of cases χ_{conv} is <2.00 x 10^{-8} SI, and only two samples (thin sections M17A and M13 – highlighted in Table 1) have χ_{conv} values in the 5.00-9.99, which is generally taken as being indicative of enhancement, though not strong enhancement. However, in view of the low χ_{max}

values recorded for these two samples (235 and 205 x 10^{-8} SI, respectively), even this evidence needs to be regarded with some degree of caution.

Carbonate content (estimate)

Only three of the samples, all from the MBA ditch and overlying sediment sequence, contain carbonate, with the highest proportion being in the middle sample (thin section M20B). The thin section analysis revealed the nature and origin of these carbonates, as natural tufa formations (see below).

Soil micromorphology

Soil micromorphology descriptions, SMT (soil microfabric types), MFT (microfacies types), counted characteristics and inclusions, thin section and context-specific associated bulk data are presented in Tables 4-5. 32 contexts were analysed from 27 thin sections. Data from the review of the Perry Oaks thin sections are given in Table 6. Specific features are illustrated in Figs 1-62.

General characteristics such as void space and stoniness (i.e. flints) were counted, alongside specific inclusions of interest (charcoal, plant fragments, burned clay, burned flint, bone and pottery) and 'pedofeatures' (iron [Fe], iron and manganese [Fe-Mn], depletion, burrows, rooting, carbonate [$CaCO_3$], and textural pedofeature types [intercalations, papules and yellow clay infills and coatings], as defined by detailed descriptions. Some sixteen characteristics were therefore counted, as well as other numerous characteristics being described.

As already noted above, waterlogging has had a probable effect on the bulk measurements, especially magnetic susceptibility; this waterlogging (gleying) is also recorded by 'depletion' (leaching), and 'secondary Fe' and 'secondary Fe-Mn' pedofeatures, i.e., soil mottling (Bouma *et al*., 1990; Crowther, 2003)(Goldberg and Macphail, 2006, Table 3.4d). Leaching produced bleached stone rims, for example. The authors encountered similar post-depositional effects at Stanstead Airport (Macphail and Crowther, 2005). No chemical or soil micromorphological evidence of recent sewage sludge contamination was found. The only example of 'contamination' of the prehistoric deposits with medieval/post-mediaeval was a small fragment of clinker present within an earthworm burrow in sample 27220, context 702008 (M20A). One beneficial effect of general waterlogging and leaching at Terminal has been the lack of earthworm mixing from above in the studied samples; context 702008 being a tufa/carbonate-rich exception.

Discussion

Post-depositional effects

Any interpretation of the soil micromorphology and bulk analyses of soils and deposits at Terminal 5 require the consideration of post-depositional effects (Courty *et al*., 1989). Waterlogging (gleying) and associated leaching have produced soil micromorphological features such as bleached stone rims (Macphail *et al*., 1987; Romans and Robertson, 1983) and likely iron-depleted microfabrics which contrast strongly with iron, and iron and manganese impregnated soil. Such transformations of iron have undoubtedly affected the magnetic susceptibility of many contexts (Crowther, 2003). This post-depositional process was also a factor in the interpretation of feature fills at Stanstead airport (Macphail and Crowther, 2005).

One concern during the study of the Terminal 5 soils was the possible impact of recent land use, e.g., sewage works. Neither soil micromorphological nor chemical evidence of contamination was noted in the studied samples.

Natural soils M24 and M25 (Area 58)

The site mainly occurs on a cover of gleyic argillic brown earths (Waterstock soil association) developed on river terrace drift (deep fine and coarse loamy deposits) – the Langley Silt Complex (‘brickearth’) over the gravels of the Taplow terrace; with lower ground and palaeochannels being associated with pelo-alluvial gley soils (Fladbury soil association) composed of stoneless clayey fine silty to fine loamy deposits that are related to the floodplain of the River Colne (Jarvis *et al*., 1983; Lewis and Welsh, 2004). The site is therefore variously subject to ground water and flooding.

All Terminal 5 contexts (including Perry Oaks) are feature fills (e.g., ditches) and no prehistoric buried soils *sensu stricto*, could be investigated as analogue samples to aid our understanding of the feature-fill deposits. The best and only example of an *in situ* soil profile occurred in Area 58, and although this soil was supposed to have been only protected from post-mediaeval times onwards, it still provided the only potential 'control' profile and example of the gleyic argillic brown earths (Waterstock soil association) developed on river terrace drift.

Two samples (M24 and M25 – sample 23012; Figs 1 and 2) examined upper subsoil Eb/lower subsoil Ebg/Bg horizons down to a truncated soil depth of *c*. 0.50 m. The soil contains little organic matter (1.49-1.50% LOI), very little phosphate (both 0.092 mg g^{-1}) and has a very low magnetic susceptibility (0.46-49% χ_{conv}) that reflects gleying and secondary iron impregnation (1401-1714 x 10^{-8} SI χ_{max}). (χ_{max} is a proxy measurement of the amount of iron present, the more iron the higher the χ_{max} after sample ignition.) Soil micromorphology (M25) reveals a lowermost homogeneous moderately flinty clay loam, with shrink and swell features, rare dusty void coatings, and strong iron depletion and iron, and iron and manganese mottling; and only minor burrowing (Figs 3-4). Above, (M24) a homogeneous, moderately gleyed (bleached stone rims; Fig 5), essentially stone free fine sandy silt loam, with many dusty clay void coatings and humic(?) clay infills is present, with trace amounts of very fine charcoal (Fig 6). Essentially, the 'control' 'gleyic argillic brown earth' (as mapped by the Soil Survey of England and Wales; Jarvis *et al*., 1983) is composed of a moderately disturbed Ebg upper subsoil horizon (base of an undated plough layer?) over a gleyed clayey lower subsoil (Ebg/Bg) horizon formed from terrace sands and gravels and clay. It can be argued that argillic features are probably of an anthropogenic origin (clearance, tree-throw, plough disturbance; (Macphail, 1986, 1987), and the original early-mid Holocene/'Neolithic' soils were therefore simply gleyic brown earths.

Neolithic contexts

Neolithic soils from feature fills, including the Stanwell Cursus, were studied from five Terminal 5 areas, and two locations at Perry Oaks; 16 contexts in all. The findings at Area 15 are detailed and discussed first, in order to attempt an explanation of site formation processes associated with the 'pre-Neolithic' landscape, Neolithic activities and associated Cursus and Cursus ditch construction, and ditch infilling, from one specific locality.

Area 15 Eastern Cursus Ditch Intervention 559495 (Sample 18235: M1, M2, M3 and M4; Figs 7-8) (Contexts 559503, 559504, 559496 and 559505)

559503 is heterogeneous and contains very coarse gravels (Fig 7) and patches of sand that include fine charred organic matter. Fine charcoal-rich clay soil is dominated by textural pedofeatures that are indicative of disturbed soil, is also present (M1). This basal ditchfill is also characterised by major inwash of pale (iron-depleted) yellowish brown clay sometimes as layers infilling between disturbed soil fills.

Upwards in M1, 559504 is very similar, but there are also patches of mixed sands (from upper sands and gravels), orange brown clay fragments (Figs 8-9), occasionally with embedded charcoal. The last is possibly relict rubefied (reddened/burned) disturbed subsoil (see Figs 24-29).

In M2, 559504 is more strongly characterised by fine charcoal-rich clays. Both coarse and fine charcoal is abundant, alongside rare rubefied (burned) mineral grains (Figs 10-15). (As much of the coarse mineral material is leached flint and quartz, few grains show rubefication). Fine charcoal is present both in intercalations and in clay void coatings (very abundant textural pedofeatures) and there are common patches and mixed intercalations of reddened and 'black' clay, the last with iron and manganese staining and included fine charcoal (Fig 15-20). Also present are fragments of clayey textural pedofeatures (technical term is 'papule') of very charcoal-rich reddish yellow clay (Figs 21-23).

In M3, 559504 continues to be a mixture of rubefied clay soil, black (iron and manganese stained) once-humic 'soil' infill material (see Figs 18-20), rare charcoal, frequent flints and (now partially iron-depleted) in an overall textural pedofeature-dominated soil. Context 559496 is similar to 559504, but rubefied soil dominates and possible topsoil fragments are also present. Disturbed soil also includes a fragment of calcareous soil/tufa.

Both contexts 559504 and 559496 include examples of rubefied soil containing embedded charcoal and features of disturbance formed prior to burning (Figs 24-29).

The bulk analyses indicate that the clay-textured soils of the natural soil profile (Table 3, samples 632118 and M25)(see above) may be reflected in the clay textures of the fills of the Cursus Ditch (sample layers 559496 and 559504), above the dominantly mixed sands and gravels of the lowermost secondary fill (layer 559503). Equally, the extremely low amounts of organic matter (0.662% LOI), phosphate (0.072 mg g^{-1}) and magnetic susceptibility (0.04% χ_{conv}) measured in 559503 can be compared to those in the overlying finer fills (2.76-3.23% LOI; 0.546-0.576 mg g^{-1} phosphate-P; 0.28-1.40% χ_{conv}). This may be the result of inputs of organic matter and possible ashed/burned organic matter (see below), although hydromorphism is clearly affecting the deposits throughout (see above), as recorded by these very low $\%\chi_{conv}$ figures, although soil micromorphology (rubefied mineral grains, textural pedofeatures and soil clasts) indicates burned soil material is present. Gleying effects and associated loss and secondary deposition of iron (producing example of χ_{max} of 2330 10^{-8} SI) thus appear to have effectively depleted any magnetic susceptibility signal of burning here (Crowther, 2003).

Summary: These analyses can be employed to suggest a basic interpretation of the secondary fill sequence (*Eastern Cursus* Ditch Intervention 559495;Sample 18235)

- 559503 is a lowermost ‘coarse’ fill of sands and gravels (from coarse and coarse loamy substrate), clay fragments (from clay subsoil), intercalated and void infilling pale yellowish (iron-depleted) clay (possibly of alluvial origin infilling the new-cut ditch), with occasional fine charcoal present within the sands (background evidence of clearance?)(Figs 7, 9-10).
- 559504/559496 are finer (clayey), more humic and more phosphate-rich fills of both: 1) pale iron-depleted soil material, and 2) reddish, reddish orange (rubefied) and reddish and black (Fe-Mn) fine soil, and textural pedofeature material containing abundant fine charcoal and intercalated with coarse charcoal – presumably ‘silting’ from the central Cursus Bank and local soils. This has produced a mixture of soil infills, some of which have become obviously leached, while there is also relict rubefied soil that has its probable origins in the *in situ* burning of the woodland cover; see end of this Neolithic section [*Clearance*] for full discussion)(Figs 8, 11-29).
- 559505 – a more coarse, heterogeneous and stony fill similar to below (559504/559496), but probably representing higher energy slumping of the Cursus Bank.

Other Cursus Ditch fill sites will be dealt with in less detail.

Area 16 Western Cursus Ditch 18463 (Sample 18461; M7-8)

In M7, 588307 is a heterogeneous fill that is similar to M1 (559503), with mixed clay and sands, but with more iron-depleted soil overall and notable amounts of included iron-replaced amorphous organic matter being present. There is also possibly rubefied clay present, but masking by secondary iron staining makes this difficult to establish. There are also very abundant intercalations and upwards void coatings form a closed vugh porosity. In M8 (588306) a similar mixed microfabric is present, which is characterised by textural pedofeatures and relict (partially iron-replaced) amorphous organic matter. In addition, earthworms seemed to have been active.

Bulk analysis shows a relatively high χ_{conv} (3.04%) in 588305 (no thin section) compared to 588306 (0.20%) possibly reflecting the presence of more burned soil/less waterlogging effects here. Both layers also contain levels of organic matter (3.54-3.88%) which are consistent with the presence of relict amorphous organic matter (now mostly iron-replaced). Amounts of phosphate are noteworthy both, with layer 588306 (M7) showing clear enrichment (1.59 mg g^{-1}).

The fill here differs from that at 18235 in Area 15, by having less obvious burned soil evidence of the original clearance soils, and having a much more ‘wet’, slurry-like ditch infill (dominant iron-depleted soil, textural pedofeatures and associated closed vughs), which needs to be explained. The presence of amorphous organic matter, phosphate enrichment, slurry-like features and presence of earthworms may be proxy indicators of the past presence of stock, their trampling and input of dung.

Summary: These analyses can be employed to suggest a basic interpretation of the secondary fill sequence (*Area 16 Western Cursus Ditch 588324; Sample 18461 and 18463)*

- Contexts 588307/588306 are secondary ditch fill deposits that include some burned soil (presumable relict of Early Neolithic clearance), but which is dominated by iron-depleted soil slurries (textural pedofeatures from animal trampling?), amorphous organic matter and phosphate (from herbivore faecal inputs) that possibly date to the Middle Neolithic identified at the site (M7 and M8)(see end of this Neolithic section [*Herding*] for full discussion)

Area 49 Early(?) Neolithic Pit 587028 (sample 18078 (context 587031)(M12)

This pit was discovered only only after removal of the cursus by machine, so the pre-cursus date is likely but unproven. : In M12, 587031 is a biologically homogenized (under some wet conditions) weakly humic occupation soil (Ah2) and Eb horizon material from ‘argillic’ brown gley soil (formed in fine sandy silt loam river terrace drift; see above M24 and 25) that contains much fine charcoal. It also includes burned humic topsoil (Ah1; Fig 30), which is possibly reflected by a magnetic susceptibility of 4.95% χ_{conv}.

Summary:

- Context 587031 is as pit fill of loamy soil from a likely grassland landscape that was possibly grazing land managed by fire; the fill resembles some of the Bronze Age soils (see end of this Neolithic section [*Herding*] for full discussion)

Area 49 Recut of the Neolithic Cursus ditch 526189 Neolithic or Early Bronze Age (sample 18063)(M15)

Thin section M15 samples the junction between very gravelly fill 526193 and slightly less stony 526194, and is characterised by a heterogeneous mixture of clays with iron-replaced organic matter, possible rubefied clay, and clayey fills that contain high amounts of fine charcoal and blackened organic matter. There is also inwash of iron-depleted clays forming roughly layered textural pedofeatures. Bulk analyses show very low LOI, phosphate-P and magnetic susceptibility.

Summary:

- 526193/526194 is a gravely fill that becomes more clay rich because of the inwash of possible alluvial clay soils that includes relict humus and in some cases high amounts of fine charcoal (disturbed Neolithic alluvial soils affected by a recent? history of clearance by fire)(see end of this Neolithic section [*Clearance*] for full discussion); the formation of such a mixed and muddy deposit may also originate from human ?(low phosphate-P) trampling associated with ditch maintenance?

Area 49 - Middle-Late Bronze Age Enclosure ditch 512005 (sample 17096)(xM26)

Bulk analysis of context 514006 within sample 17096 showed a low LOI, and very low phosphate-P and magnetic signal, implying infilling with subsoil material and gleying and secondary iron impregnation being an important characteristic (high χ_{max}).

Area 58 – C2 Cursus ditch 650091 (sample 24019, intervention 650053)(M5)

Layer 650052 is essentially a silt-dominated fine fill probably eroded from upper subsoil Eb horizons and some included small subsoil (Bw) clay fragments (see 'local soils' above). There is only occasional very fine charcoal present. The pedofeatures indicate that it is a ditch fill slurry which was partially burrowed by mesofauna when still wet and forming this muddy fill. This context was therefore not permanently waterlogged.

Grain size confirms the silty clay nature of the fill, with the low LOI and very low phosphate-P consistent with infilling by subsoil material.

Summary:

- 650052 is a silty clay fill derived from the local subsoil, and shows only a very weak anthropogenic signal.

Area 58 – C2 Cursus ditch 636048 (sample 24016)(xM27)

Bulk analysis of context 648034 is noteworthy because of its enriched phosphate-P content (1.55 mg g^{-1}). The exact origin of this phosphate is unknown as no thin section was made, but one possibility is that it was influenced by stock (see Area 16 Western Cursus Ditch sample 18463; M7 and M8).

Summary:

- 648034 is enriched in phosphate, which suggests it is a Cursus ditch fill influenced herded stock.

Area 58 – C2 Cursus ditch 650065 (sample 24020, xM29A and xM29B)

Contexts 650038 and 650039 are weakly humic, have moderately low phosphate-P contents and very low magnetic susceptibility, with χ_{max} indicating gleying. This data set resembles those of the Cursus ditch fill at Area 15 Eastern Cursus Ditch Intervention 559495, which records clearance (see above).

Area 99 – Neolithic pit complex (sample 18361/18362)(M16)

555945 and 555943 are strongly compact fills of 'leached' Eb horizon silty fine sandy loam soils that contain flints, and which are characterised by very abundant textural pedofeatures, minor burrowing and small amounts of fine charcoal. 555945 contains a once-humic soil clast. The fills resemble the Neolithic pit fill at Area 49 (sample 18078; context 587031; M12)

Bulk analyses show no strong signals of anthropogenic impact.

Summary:

- 555945 and 555943 are (human/animal?) trampled likely pit fills from eroded upper subsoils, but which may possibly come from an area of managed grazing (but which is better expressed at Pit 18078 in Area 49).

Perry Oaks Neolithic thin section review

Perry Oaks Western Cursus ditch fills (WPR 1067, 1066A and 1066B)(Figs 31-32)

149008-7 (samples WPR 1067 and WPR 1066A)(Fig 31) is a moderately heterogeneous fill with disturbed fine charcoal rich soils mixed with iron and manganese stained crumbs of topsoil/earthworm burrows (Figs 33-35). The fill also contains very finely mixed dusty charcoal-rich soil and coarse void infills of clay and fine charcoal (Figs 36-40). Later features of iron and iron and manganese staining, with fine rooting and iron depletion features are post-depositional effects, including gleying.

149007 (sample WPR 1066B)(Fig 32) is similar but becomes less heterogeneous upwards, and is characterised by abundant textural pedofeatures that can be up to 500 µm thick. The fine soil is also becoming more humic and contains more fine charcoal generally.

Summary:

- 147008 and lower 149007 are heterogeneous fills of soil that has its probable origins in the *in situ* burning of the woodland cover (see end of this Neolithic section [*Clearance*] for full discussion) and cursus bank and ditch construction.

- Upper 149007 is more homogeneous and likely results from later (later Neolithic/possible Bronze Age) soil infills that are more the possible result of grazing land managed by burning.

Perry Oaks Northern End of Eastern Cursus ditch Western Cursus ditch fills (WPR 1029)

154022 is a heterogeneous mixture of dark and iron mottled once-humic and moderately finely charcoal-rich 'topsoil' (H and Ah1 horizons) and less charcoal-rich Ah2/upper Eb horizon soil, forming a slaked and disturbed ditch infill. Strong iron impregnation of humic soil components and total ferruginisation of amorphous organic matter are secondary features. In addition, later fine rooting led to leaching (gleying) down root holes.

Summary:

- 154022 appeared to be the upper fill of cursus ditch, but in fact is probably a middle fill, since much has been truncated. A date of around 3,300 BC is likely (J. Lewis, pers. comm.). 154022 contains soil components possibly suggesting infilling with soils that had been disturbed (textural pedofeature evidence) by human activities that had already led to the incorporation of fine charcoal into the soil.

Perry Oaks Neolithic ditch section 632001; fill context 132004 (WPR 1030)

132004 is an fill of very fine charcoal-rich almost 'stoneless' soil characterised by inclusions of fragmented, once-humic topsoil. The fill was also affected by soil inwash and compaction (abundant textural pedofeatures), and burrow mixing of humic and iron-stained fine soil.

Summary:

- 132004 is an almost 'stonefree' ditchfill that probably results from slow silting of ditch associated with managed grazing land(??), but with stock trampling along the ditch.

The Neolithic: the 'pre-Neolithic' landscape, Neolithic activities (clearance) and associated Cursus bank and ditch construction, ditch infilling, and ensuing (later) herding (?)

A pattern of land use can be traced from Perry Oaks in the north to Terminal 5 Areas 49 and 58 in the south.

The 'pre-Neolithic' landscape

There is little soil data on the pre-Neolithic soils other than that these were gleyic brown earths, with iron-depleted clay loam upper subsoils and clay subsoils. As no fragments of old woodland Moder and/or Mor humus horizons (Goldberg and Macphail, 2006, table 3.2) were encountered it is impossible to attempt to identify the presence of *completely* undisturbed woodland soils prior to Neolithic impact and Cursus construction. An example of such an undisturbed Mor humus formed under oak woodland was encountered below a LBA/EIA bank at Hengistbury Head (Barton, 1992; Macphail, 1992a; Scaife, 1992). At Terminal 5, however, no buried soils were available for study, and at comparable sites (e.g., Drayton Cursus and Raunds) where soils were disturbed by clearance no fragments of Mor humus were found either (Macphail, 1990, Forthcoming; Macphail and Linderholm, 2004). Humic soil fragments (Ah1 and Ah2 horizon soil) from the mineral topsoil (of managed grassland?) are, however, were found in 'later' Neolithic ditch fills and pits (see below).

Neolithic clearance

There is evidence of clearance of woodland by the use of fire from along the length of the Stanwell Cursus (Perry Oaks to Area 49). In the Terminal 5 thin sections, reddened (rubefied) mineral grains, rubefied soil fragments with embedded charcoal ('baked clay'), and textural pedofeatures formed from reddish clay and intercalated coarse and fine charcoal, all testify to disturbed soils and burning (Figs 11-28). This interpretation is based upon burned soil experiments (Courty, 1984; Courty *et al*., 1989; Wattez, 1992) the investigation of tree-throw soils where there is baked clay and associated charcoal, and where *in situ* burning of pulled down/fallen trees is believed to be the best explanation of the archaeology, soils and charcoal (Barclay *et al*., 2003; Healy and Harding, Forthcoming; Goldberg and Macphail, 2006, fig 9.8; Macphail, 1990, Forthcoming). Challinor (this volume) found only *Quercus* charcoal present in tree throw 611069 which cuts the Cursus ditch, and an abundance of *Fraxinus* charcoal within the Stanwell Cursus western ditch (512071). Both may be evidence of tree clearance. Although individual fragments of baked clay, and burned clay concentrated in tree-throw features may retain a high magnetic susceptibility (Macphail and Goldberg, 1990) effects on soils from this burning is unfortunately essentially unrecorded in the Cursus ditch fills at Terminal 5, probably because of dilution by unburned soil and the marked effects of gleying on soils that were essentially already poor in iron. At Terminal 5, no tree-throw features were studied and as again no buried soils were found, no pattern to soil burning can be elucidated.

It is interesting to note that micromorphological features indicative of clearance fires are also found in Cursus ditch fills at Perry Oaks (Figs 36-40). These are textural pedofeatures that include abundant fine charred organic matter/charcoal. (A buried soil example of textural pedofeature evidence of clearance can also be cited from Neolithic Maiden Castle; Goldberg and Macphail, 2006, fig 9.9.Macphail, 1991). The exact origins of 1) burned clay with embedded charcoal (‘baked clay’), and 2) textural pedofeatures that include fine charcoal, differ.

1: fragments of burned (rubefied) clay soil that are characterised by (textural pedofeature) intercalations and associated closed vugh/void clay coatings which are also rubefied, originate from disturbed soil (e.g., from tree-throw or other woodland clearance activities) that has become baked by the *in situ* burning of a tree(s), for example (Courty *et al*., 1989; Macphail, 1992b; Macphail and Goldberg, 1990; Macphail and Linderholm, 2004)(Figs 24-28).

2: textural pedofeatures rich in fine charcoal, however, result from the wash of disturbed soil that has enhanced dispersion because of the presence of potassium (K) weathered from ash – hence the association of these pedofeatures and fine charcoal (e.g., Figs 21-23, 36-40). The role of potassium from weathered ash where there is an association of charcoal and an overabundance of clay translocation was noted in Neolithic pits in France and Germany (Courty and Fedoroff, 1982; Slager and Van der Wetering, 1977); a probably similar association was noted recently in an Early Neolithic pit at Peterborough, Cambridgeshire (Macphail and Crowther, 2006b). It can also be noted that the Cursus bank-buried soil at Drayton Cursus, Oxfordshire contained burned stones, soil, charcoal, and textural pedofeatures (clay wash) similarly rich in fine charcoal. Again, this phenomenon was attributed to the weathering of ash associated with tree-throws/pulled down trees that had been burned *in situ* (Barclay *et al*., 2003; Macphail, 1990)(new photomicrographs in Terminal 5 soil archive). Amounts of phosphate-P, although low (e.g., Area 15, 557504 and 553496: 0.546-0.0.576 mg g^{-1}) are still higher than at the base of these fills (559503: 0.072 mg g^{-1}) and in the 'control' profile samples (both 0.092 mg g^{-1}), and one contributor to this weak concentration could be weathered ash.

Along the line of the Stanwell Cursus therefore, there are apparent soil records of soils being burned ('baked clay') and soil wash probably encouraged by the presence of ash (charcoal-rich textural pedofeatures) from burned woodland/scrub. Certainly fragments (papules) of the last are present in Cursus ditch fills, but there are also features indicative of charcoal-rich clay wash into the ditch itself, implying some Cursus ditch (and bank) construction almost immediately after clearance by fire, given the rapid weathering of ash in western temperate regions (generally days rather than weeks) and enhanced earthworm burrowing once toxic-levels of potassium have been reduced by this weathering; these textural pedofeatures of clearance by fire origin have not been biologically worked (Courty *et al*., 1989, e.g., fig 7.2). Construction of Neolithic monuments over recently cleared sites was reported from Britany, France, with an extremely rare example of ash being found in the buried acid granite soil at (Er Grah) indicating how rapid construction followed burning/a fire (Gebhardt, 1993).

Cursus ditch and bank construction

The characteristics of the basal secondary fills of the Cursus ditches shows the disturbance of both the river terrace sands and gravels, and overlying natural clay-rich (Bg) subsoils (Figs 1-4, 7, 9-10). The fills, however, also contain very much material (e.g., Figs 17, 22) from the silt-rich clay loam upper (Ebg) subsoils (2, 5-6). Fill material indicative of soils being affected clearance by burning was dealt with above, but other fill material was encountered that might also result from clearance fires. This is black and red, iron and manganese stained clay that contains much fine charcoal (Figs 18-20). The exact origin of this material is unknown, but could be from either 1) once-humic alluvial clays that were formed during periods of clearance when the local environment was characterised by air and water borne charcoal (cf. Mesolithic Three Ways Wharf, Middlesex; Lewis *et al*., 1992) or 2) local ditch fill clays/ditch flooding, again influenced by clearance fires. The latter suggestion, however, seems least likely because the basal ditch fills can also include intercalated pale yellow clays, which infills some voids; but these clays do not contain any charcoal (e.g., Area 15, layers 559303-557504).

The fills overall suggest that the digging of Cursus ditches and the construction of the putative Cursus bank from the upcast led to secondary ditch fills that essentially commenced with 'fine' silting of this upcast soil that included much soil material indicative of a burned landscape (see above)(e.g., contexts 557504-553496) before becoming more coarse (e.g., context 550905) presumably through slumping of the bank. Conditions in the ditches were wet and gleyed and sometimes slurry-like deposits are present. Some mixing may imply trampling, and where amounts of phosphate are low, this may be from examples of human traffic/maintenance (Area 49, ditch 526197).Other trampling is examined next:

Herding(?)

A number of characteristics may provide proxy indications of a developing Neolithic grazed landscape associated with the herding of managed stock. In Area 16, the secondary ditch fill (588307/588306) of the Cursus (18463) includes some burned soil (presumable relict of Early Neolithic clearance; see above), but which is in fact dominated by iron-depleted soil slurries (textural pedofeatures), amorphous organic matter (3.54-3.88% LOI) and phosphate (up to 1.59 mg g^{-1} phosphate-P). It can be suggested that these characteristics originate from trampling by stock and their associated faecal inputs; burrowing by mesofauna recorded here is also typical of dung-enriched soils. Experiments in animal trampling and analogue studies of herding areas have recognised the development of textural pedofeatures (Beckman and Smith, 1974; Schofield and Hall, 1985; Valentin, 1983) and the inferred association of soil phosphate concentrations and stock is well known (Craddock *et al*., 1985; Crowther, 1996; Proudfoot, 1976). Trampling by humans is not normally accompanied by the deposition of organic matter and phosphate (Macphail *et al*., 2004; Rentzel and Narten, 2000) whereas stock areas and droveways at archaeological sites have all these characteristics (see reviews in (Macphail, 2000, Forthcoming; Macphail *et al*., 1999). Examples of likely animal activity were recently analysed from later prehistoric Stanstead, Essex (Macphail and Crowther, 2005) and soil micromorphological evidence of 'puddling' in Neolithic fields at Aubechies, Belgium, was interpreted as the result of cattle trampling (Mikkelsen and Langohr, 1996); here phosphate concentrations were also identified. At Terminal 5's Area 58 Cursus ditch fill 648034 is enriched in phosphate-P (1.55 mg g^{-1}), which may also be a further chemical indication of Neolithic stock activity.

At Early Neolithic Raunds stock management led to the opening up of the riverine (Nene) landscape and the development of grassland soils, as indicated by both soil and other environmental (macro-botanical, insects, pollen) data (Healy and Harding, Forthcoming; Macphail, 2003a). The Terminal 5 Neolithic pitfall in Area 49 (587031) is a biologically homogenized weakly humic occupation soil (Ah2) and Eb horizon material from argillic brown soil that contains much fine charcoal. Here, and in Area 99 (contexts 555945 and 555943) probable Moder topsoils (Goldberg and Macphail, 2006, table 3.2) of grasslands managed by fire are present; an included burned humic topsoil fragment (Ah1; Fig 30), however, which contributes to a magnetic susceptibility of 4.95% χ_{conv}, probably resulted from local occupation (fireplaces; cf. Easton Down buried soil and Peterborough pit fill; (Macphail and Crowther, 2006b; Whittle *et al*., 1993)). Similar 'humic' and fine charcoal-rich topsoil material has been eroded into the Cursus ditch at Perry Oaks (context 146007). Grasslands managed by fire for grazing, are not uncommon for the Neolithic of western Europe (Gebhardt, 1993; Macphail and Linderholm, 2004). Whether there is a purposeful link between open landscapes (developed through grazing) with monument construction at Neolithic Heathrow (Lewis, 2005), is unknown. Parallels may be present at Drayton Cursus and at Raunds (Barclay *et al*., 2003; Healy and Harding, Forthcoming; Windell *et al*., 1990).

Bronze Age contexts

Twelve contexts from nine areas were investigated.

Area 23 EBA round barrow ditch (sample 22551)(M6)

Sample 22551 is a sand-dominated fill with silt and coarse sand and gravel patches, with sedimentary laminations, some of which have been picked out by impregnative iron. Clay clasts from 'subsoil' and very rare likely fragments of alluvial(?) clay are present. Very little charcoal and fine and coarse burned mineral grains are present.

Summary:

- 22551 sampled a barrow ditchfill affected by inwash from the site's parent material gravels, sands and subsoil clay; inwash possibly affected by local alluvial activity (being situated on low ground on the western edge of the site). There is little evidence of anthropogenic activity.

Area 26 MBA trackway (sample 17161)(M22)

530085 is a mainly iron-stained fine loamy soil, with included soil fragments major textural feature formation (Figs 44-45) co-eval with burrowing that continued under gleying conditions. Only rare charcoal and traces of burned flint are present, but phosphate-P is enriched P (1.97 mg g^{-1}).

Summary:

- 530085 is a muddy trackway deposit with evidence of anthropogenic activity (animal trampling and phosphate enrichment) and trafficking.

Area 34 MBA trackway ditch (sample 18199)(M23)

Sample 18199 shows the presence of textural pedofeature-dominated fine sandy silt loam with very few flints, rare burned flints and charcoal; phosphate-P enrichment is recorded (1.50 mg g-1).

Summary:

- 18199 sampled muddy trackway ditch deposit formed by animal passage as evidenced by soil infills, co-eval biological activity and phosphate-P enrichment.

Area 58 EBA/MBA enclosure ditch 635036 (sample 24024)(M11)

635037 is a ditch fill of leached silt and fine sandy Eb horizon material, with partially biologically worked inclusions of fine fragments of burned(?) clay, Fe-Mn stained topsoil fragments and subsoil clay. It is characterised by very abundant very dusty and dark intercalations associated with 250 µm thick extremely dusty void coatings; some infills earlier burrows. A burned flint flake is also present (Figs 41-43). The soil also has a moderate phosphate-P concentration of 1.33 mg g^{-1}.

Summary:

- 635036 is an enclosure ditch fill strongly characterised by relict Neolithic(?) disturbed clearance soils, eroded Eb horizon and weakly humic soils with moderately weak anthropogenic signal of charcoal, burned flint, phosphate-stained (?) textural pedofeatures associated with earlier burrowing, and enhanced phosphate content – overall possibly indicating the influence of stock on the fill.

Area 58 D shaped enclosure 639085 (sample 25006)(M9)

671001 is moderately well homogenised (by biological working and trampling – very abundant textural pedofeatures) leached moderately fine charcoal-rich soil that contains a rare example of a (burned flint tempered) pottery fragment (Figs 46-48). The fill has a weakly enhanced magnetic susceptibility (4.26% χ_{conv}).

Summary:

- 671001 is probably an infill of weakly humic soil (managed by fire) that also includes rare anthropogenic material.

Area 58 MiddleIron Age gully (sample 24055)(M17A and M17B)

658155 is very similar to 658156 below, but contains more charcoal and eroded subsoil clay; and a small bone-rich, possible animal scat is present (Fig 52). This layer is characterised by 0.960 mg g^{-1} phosphate-P and, 9.23% χ_{conv}.

658156 is a complex mixture of humic and poorly humic fine sandy silt loam soil, with numerous inclusions of humic clay papules and iron-stained loam fragments rich in textural pedofeatures (Fig. 51); most organic matter has been iron and manganese-replaced. Charcoal and burned mineral grains are also present within this textural pedofeature-rich fill.

Summary:

- 658156 and 658155 are heterogeneous, probable trampled, fills that include soil fragments of local (managed and burned grazing/arable?) topsoil and upper subsoils, with inclusions of humic papules and clasts rich in textural pedofeatures that may also infer the close presence of a droveway heavily used by stock (see Figs 44-45; M22). The increased presence of charcoal and bone scat in 658155 may indicate a greater input of occupation material as also reflected in a moderate phosphate concentration and magnetic susceptibility enhancement.

Twin Rivers E/MBA trackway ditch 630082 (sample 26042)(M13)

658013 is an extremely homogeneous deposit of very well sorted silts and clays, with textural pedofeatures that include pans of clay rich in fine organic matter and charcoal. An enhanced magnetic susceptibility was measured (7.85% χ_{conv}).

Summary:

- 658013 is characterised by off-trackway silting/wash containing finely sorted soil and finely fragmented organic matter (dung residues?); an enhanced magnetic susceptibility indicates that burned mineral material is also present .

Twin Rivers E/MBA horseshoe enclosure ditch 636112 (sample 24053)(M14)

660077 is a very heterogeneous infill of Eb horizon silty and sandy soils with small amounts of charcoal, very abundant clayey intercalations, very pale dusty clay pans and void coatings, and fragments of 'trackway' deposits (i.e., soil fragments rich in textural pedofeatures) and burned argillic clay subsoil (possibly relict of [Neolithic] clearances?); moderate phosphate-P concentration (0.567 mg g^{-1}) is present.

Summary:

- 660077 possibly results from eroded arable soils and local and some *in situ* animal activity/stock management, a suggestion that is not inconsistent with the micromorphology and phosphate.

Twin Rivers EBA barrow ditch (Section 58010)(samples 22549 and 22550)(M18 and M19)

584011 is a moderately heterogeneous mix of silt and sands characterised by very abundant textural pedofeatures, with inclusions of relict rubefied (burned) subsoil clay (clearance soils?), and fine charcoal (M18). There are also abundant burrows that have introduced clay and much amorphous organic matter (now Fe and Fe-Mn replaced) from above. Lower down (M19) a similar deposit is present that includes a charred peat fragment, as well as charcoal and very abundant textural pedofeatures (Figs 49-50). The upper part of 584011 (M18) is also characterised by a 2.70% LOI, 0.606 mg g^{-1} phosphate-P, compared to 2.14% LOI, 0.246 mg g^{-1} phosphate-P below (M19).

Summary:

- 584011 is a barrow ditch fill of mainly sands and silt (from subsoil Eb horizon and parent material) and possible relict Neolithic (?) burned clay, and a fragment of local(?) burned peat(?) is found towards the base of the fill. The abundance of textural pedofeatures throughout, and burrow mixing of (now Fe-Mn replaced) amorphous organic matter (dung residues?) in the upper part of this context are indicative of (animal?) trampling; a suggestion possibly not inconsistent with the bulk data. Down-profile there is less mixing of organic (dung?) residues as also indicated by the chemistry.

LFA05 MBA Ditch 725001 overlain by 702010 and 702010 (monolith sample 27220) (M20A, M20B and M21)

725001 (uppermost context 702008) is an organic and charcoal-rich fine silty deposit, partially homogenized by earthworms which have mixed in calcitic tufa material. The microfabric was later affected by iron staining. One more recent(?) burrow brought in a fragment of clinker. The deposit is humic (10.4% LOI) with a moderate estimated carbonate content.

725001 (middle, context 702010) is a heterogeneous, partially biologically homogenized sequence, which records moderately fine charcoal-rich clay deposition followed and disrupted and impregnated by tufa formation (e.g.'s of biogenic 'growth' patterns present); mollusc shell fragments and shells are also present (Figs 53-56). There was also co-eval burrowing by earthworms (biogenic calcite granules), and sometimes the deposits were re-wetted and slaked. Later, the sediment was influenced by fine rooting and iron staining, along with continued burrowing. The deposit is a humic (8.73% LOI) clay loam with a high estimated carbonate content.

725001 (lowermost, ditch fill context 725003) is a biologically mixed finely rooted basal gravel, which includes burned stones. It contains patches of highly humic and charcoal-rich silty clay, which were deposited before 'invasion' by tufa (biogenic calcium carbonate). Overall the deposit is a weakly humic (3.50% LOI) sandy loam with a low estimated carbonate content.

Summary:

- Intervention 725001 includes ditch fill context 725003 and overlying deposits containing inputs of highly humic clay and associated fine charcoal, and calcareous (biogenic) tufa formation, indicating (despite the presence of earthworm activity) probable long periods of standing water/waterlogging. Initial infilling of the ditch included relict burned stones (of unknown date) and peaty clay deposition – the fine charcoal content of which probably records a landscape cleared/managed by fire (and/or alternatively fine residues from crop processing waste, etc.). Tufa formation likely relates to calcareous ground water upwelling, which the ditch tapped at this location. The 0-15 cm/35-43 cm thin section samples record a period during which fine charcoal-rich peaty clay and periodic tufa formation took place in an environment managed by fire. The generally calcareous environment encouraged earthworm burrowing, although post-depositional decalcification and iron impregnation commenced probably once the calcareous 'spring' became inactive.

Perry Oaks Bronze Age thin section review

Perry Oaks BA field system ditch Section 648002; context 148014 (thin sections WPR 1083A, 1083B and 1085)

148014 (upper; WPR 1083A) is similar to below, but with slightly more fine charcoal and humic matter. Soil mixing and fragmentation as evidenced by 'papules' and textural pedofeatures; pan-like fills and coatings sometimes dark brownish with iron staining, which possibly imply inputs of animal slurry (trampling stock?).

148014 (middle; WPR 1083B) fill is dominated by generally iron-depleted ditch fill soil, probably from eroded Eb horizon soil (see Figs 5-6, 59). This deposit also includes coarse flints which have been affected by gleying and moderately acid conditions. Within the soil matrix there are iron and iron and manganese impregnated soil clasts with high amounts of fine amorphous and charred organic matter, which may be slightly burned topsoil fragments. The ditchfill is characterised by textural pedofeatures indicative of physical disturbance. Co-eval post-depositional features are burrow mixing and inwash of fine charcoal-rich humic soil, some associated with some iron staining, sometimes forming pans (Figs 60-62).

148014 (lowermost; WPR 1085) is composed mainly of eroded poorly humic iron-depleted Eb horizon soil, with small patches of eroded humic and fine charcoal-rich managed topsoil, including a burned example (Figs 57-59). There is evidence of *in situ* burrowing by mesofauna and rooting before slaking and possible trampling by stock (and resulting formation of textural pedofeatures).

Summary:

- 148014 is formed by an infilling mainly of leached Eb horizon soil with generally low amounts of organic matter and charcoal (as in the 'control profile' M24-M25; 23012), but upwards contains increasing amounts of soil containing fine charcoal, while there are always inclusions of humic topsoil fragments, some of which are burned. The fill therefore may reflect local erosion of arable soils, although textural pedofeature formation and burrowing in the fill itself indicate the likely trampling of the wet ditch fill by stock at times.

The Bronze Age: an open arable and grazed landscape(?)

The character of ditch fills changed from those in Early Neolithic, both later on in the Neolithic and in the Bronze Age. The Early Neolithic Cursus ditch fills were heterogeneous and recorded freshly disturbed and burned soil, which was the apparent result of clearance along the line of the Cursus. Later(?) in the Neolithic the fills generally became more homogeneous with microfabrics indicative of silting of fine loamy (Eb and Ah horizon) soils consistent with grassland landscapes employed for herding and managed by fire; trampling features and phosphate data support this conjecture. The Bronze Age soils found in ditches and trackways are similar, in that they are mainly composed of poorly humic soil derived from eroded Eb horizons with inclusion of more humic topsoil Ah1 and Ah2 horizon soil.

Bronze Age barrow, enclosure and track side ditches and trackway deposits themselves were examined. The chief inference from the soil study is that a landscape used for mixed farming, is in evidence. One complication to the study of ditch fills is the ever-present evidence of trampling (textural pedofeatures, soil fragments) along these ditches, which although sometimes may be of human origin (e.g., for maintenance), is more often probably by stock (dung residues, enhanced phosphate, dark stained clay coatings, associated burrowing). It can therefore be assumed that herded animals may not have been absolutely 'confined' within enclosures, which may be of significance when hedging/fencing practices are modelled for Terminal 5 (see Carruthers this volume). Equally, the role of ditches may simply be for demarcation and/or drainage. The discussion follows the order of: barrows, trackway features, and field and enclosure ditches.

Barrows

Two Early Bronze Age barrow ditches were studied (Figs 49-50). In Area 23 (sample 22551) the fill was little influenced by anthropogenic activity, apart from soil material relict(?) of Neolithic(?) clearance. In contrast, in the Twin Rivers Area (samples 22549 and 22550) although again relict (Neolithic?) clearance soil was found, a major influence on the fills was apparently the likely presence of stock (Figs 49-50). At Stanstead, there was also both evidence of a barrow ditchfill infilling under wet conditions and also some possible evidence of activity by stock (Macphail and Crowther, 2005).

Trackway deposits and track side ditch fills

The Middle Bronze Age trackways in Area 26 (sample 17161) and Area 34 (sample 18199) have abundant textural pedofeatures (muddy clay and silty pans)(Figs 44-45), included fine organic matter, contemporary burrowing and enriched amounts of phosphate; charcoal and burn flints are also rarely present. These features are typical of trackway deposits that are formed by animal passage and rural trafficking (*cf*: Iron Age 'road' ruts in Swedish Scania, late prehistoric/R-B cobbled trackway at Baldock, Hertfordshire; inner rampart stock concentrations at Balksbury Camp, Hampshire; Ellis and Rawlings, 2001; Macphail, 2003b; Macphail and Crowther, 2006a; Macphail *et al*., 2001). Similar features have been recorded in LIA and Romano-British trackways at Stanstead, Essex, where gleying is also a major feature of the site; the deposits are less phosphate rich compared to those at Terminal 5 (Macphail and Crowther, 2005). The Early/Middle Bronze Age track side ditch in the Two Rivers Area (sample 26042) was infilled with fine deposits resulting from trackside silting/wash. The presence of finely sorted soil, finely fragmented organic matter (dung residues?) and an overall enhanced magnetic susceptibility (indicating that burned mineral material is present), suggest that occupation material has been trafficked across the site. Only sparse evidence of manuring of arable fields has been obtained from field and enclosure ditch fills (see below). Nevertheless manuring may well have taken place that involved the transport of dung and household waste (that included burned soil, burned flint, pot, charcoal as strongly residual material; Macphail *et al*., 1990; Mikkelsen *et al*., 2006; Wilkinson, 1990). The transport of this material can lead to spillage (including that of dung) and thus account for high magnetic susceptibility readings for some trackway deposits.

Field and enclosure ditches

In Area LF05 a MBA ditch (undated but cut by an MBA ditch; Ken Welsh, pers comm.) records waterlogged conditions that led to both infilling with peaty clay and calcareous tufa formation (Figs 53-56). Whatever the date of this infilling, the high amounts of fine charcoal present in the peaty clays indicates a landscape affected by burning. This supports the model of a developing grassland pasture/arable landscape managed by fire. It also may reflect the burning of stubble in arable fields (resulting in ditch silty loam infills rich in fine charcoal) and/or the general burning of crop processing waste.

Enclosure ditches, gully fills and field ditches have fills that are not inconsistent with grazing and arable land uses. For example, fills that include fine charcoal-rich soils from eroded poorly humic A/Eb horizons may well have their origins as arable soils (French, 2003; Gebhardt, 1990, 1992; Lewis, 1998; Macphail, 1992b; Macphail *et al*., 1990), and as noted above the rare inclusion of domestic waste such as pot and burned flint in ditch sediments may imply manuring of local soils (Macphail, 1998)(Figs 41-43, 46-48) in Areas 58 (24024 and 25006). At the last location, magnetic susceptibility is also enhanced. A phosphate concentration at 24024 is however associated with *in situ* formed textural pedofeatures, which obviously are not of plough origin, and more likely result from herded animals using the ditch. Equally, in the Twin Rivers Area enclosure ditch deposits can be interpreted as resulting from erosion of arable soils but with stock activity also affecting the fill (24042). At Perry Oaks (148014) the fill therefore may also reflect local erosion of arable soils, although textural pedofeature formation and burrowing in the fill itself indicate the likely trampling of the wet ditch fill by stock at times (Figs 57-62). In contrast, at Perry Oaks, ditch 632001, context 132004 appears to have developed through slow silting of local grassland soils managed by fire, with concomitant trampling of the ditch by this grazed stock. The soils involved could well resemble the grazed Bronze Age soils studied from Raunds, Northamptonshire (Healy and Harding, Forthcoming; Macphail, Forthcoming). Lastly, the fill of gully 24055 in Area 58 contains not only evidence of being trampled, but also includes soil fragments of local (managed and burned grazing/arable?) topsoil and upper subsoils. There are, in addition, inclusions of humic (clay soil) papules and clasts rich in textural pedofeatures that may also infer the close presence of a droveway heavily used by stock (??). The increased presence of charcoal and bone scat in 858155 may indicate a greater input of occupation material as also reflected in a moderate phosphate concentration and magnetic susceptibility enhancement; i.e., possibly occupation activity was intensifying locally.

At Bronze Age Perry Oaks and Terminal 5, mixed arable and grazing were carried out, and it is quite clear that stock were not excluded from arable areas. Whether this was purely accidental, or some kind of fallow-manuring was being practiced is unknowable when only ditch fills are available for study. Nevertheless, resistant residues such as pot and burned flint may imply manuring, while trackway evidence indicates such materials were transported.

Unlike the Bronze Age landscape at Raunds, where grazing along the River Nene continued to be the chief land use, at Heathrow, the feature fills and track way deposits indicate that an integrated mixed farming land use seems to have been developed.

Medieval

The only medieval samples studied came from waterholes in Area 49 (contexts 569023 and569024 from waterhole 569022) and these display marked phosphate enrichment compared to the prehistoric contexts examined. It is unknown whether this results from their concentrated use by stock, or the dumping of midden waste, for example.

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Terminal 5: soil micromorphology, chemistry, magnetic susceptibility and particle size analyses (Macphail and Crowther, 2006); Tables 1-6

Table 1: Chemical (excluding phosphate fractionation) and magnetic susceptibility data

Area	Feature (date)	Thin section	Context	LOI$^{\$}$ (%)	CO_3 (est, %)§	Phosphate-P† (mg g^{-1})	χ (10^{-8} SI)	χ_{max} (10^{-8} SI)	χ_{conv}¶ (%)
15	E cursus ditch fill (EN)	M4	559496	2.76	0	0.546	6.6	2330	0.28
15	E cursus ditch fill (EN)	M3	559504	3.23	0	0.576	6.1	436	1.40
15	E cursus ditch fill (EN)	M1	559503	0.662	0	0.072	0.1	278	0.04
16	W cursus ditch fill (EN)		588305	3.88	0	0.971	20.2	664	3.04
16	N end of W cursus ditch fill (EN)	M7	588306	3.54	0	**1.59***	8.0	3920	0.20
49	Pit fill (EN)	M12	587031	2.82	0	0.254	5.3	107	4.95
49	Ditch fill (N)	M15	526194	2.62	0	0.133	3.6	263	1.37
58	Enclosure? (N)	M11	635037	2.00	0	**1.33***	8.4	598	1.40
58	C2 cursus ditch fill (N)	M5	650052	2.54	0	0.336	6.8	1400	0.49
23	Roundbarrow ditch fill (EBA)	M6	584080	1.20	0	0.310	4.2	1820	0.23
58	Inner D enclosure (MBA)	M9	671001	1.52	0	0.579	4.0	94	4.26
58	Gully fill (MIA)	M17A	658155	1.94	0	0.960	21.7	235	**9.23***
99	Pit complex (MN)	M16	555945	1.67	0	0.378	4.1	383	1.07
99	Pit complex (MN)	M16	555943	1.14	0	0.236	4.0	225	1.78
TRiv	Outer D trackway ditch fill (E/MBA)	M13	658018	1.85	0	0.279	16.1	205	**7.85***
T Riv	Horseshoe enclosure (E/MBA)	M14	660077	1.88	0	0.567	4.8	278	1.73
TRiv	Round barrow ditch fill (EBA)	M18	584011	2.70	0	0.606	7.6	1280	0.59
TRiv	Round barrow ditch fill (EBA)	M19	584011	2.14	0	0.246	5.4	1370	0.39
LFA	Sediment over ditch	**M20A**	702008	**10.4**	**Mod**	0.753	19.3	1040	1.86
LFA	Sediment over ditch	**M20B**	702010	**8.73**	**High**	0.582	7.9	792	1.00
LFA	Ditch fill – basal fill (MBA)	M21	725003	3.50	**Low**	0.184	2.2	346	0.64
58	Buried soil	M24	632118	1.48	0	0.092	6.4	1400	0.46
58	Natural (brickearth) subsoil	M25	n/a	1.50	0	0.092	8.4	1710	0.49
58	Cursus ditch 2 fill (N)	M27	648034	1.80	0	**1.55***	6.7	1240	0.54
58	Cursus ditch 2 fill (N)	M29A	650038	2.49	0	0.467	7.7	2310	0.33

Area	Feature (date)	Thin section	Context	LOI[$] (%)	CO_3 (est, %)[§]	Phosphate-P[†] ($mg\ g^{-1}$)	χ (10^{-8} SI)	χ_{max} (10^{-8} SI)	χ_{conv}[¶] (%)
58	Cursus ditch 2 fill (N)	M29B	650039	2.69	0	0.506	9.3	3620	0.26
49	Enclosure ditch fill (M/LBA)	M26	514006	2.56	0	0.173	5.2	1050	0.50
34	Trackway ditch fill (MBA)	M23	828213	2.08	0	**1.50***	7.4	484	1.53
26	Trackway ditch fill (MBA)	M22	530085	2.62	0	**1.97***	28.2	2490	1.13
49	Waterhole (Med)	M30	569023	2.98	0	**2.24****	17.6	1620	1.09
49	Waterhole (Med)	M31	569024	3.42	0	**3.39*****	13.8	1400	0.99

$ **LOI:** Figures highlighted are relatively high values

§ **Estimated carbonate:** Samples highlighted contain carbonate

† **Phosphate-P:** Figures highlighted in bold show signs of phosphate-P enrichment: * = enriched (1.00-1.99 $mg\ g^{-1}$), ** = strongly enriched (2.00-2.99 $mg\ g^{-1}$), *** = very strongly enriched (3.00-3.99 $mg\ g^{-1}$) – phosphate fractionation data are presented in Table 2

¶ χ**:** Figures highlighted in bold show signs of magnetic susceptibility enhancement (χ_{conv} = 5.00-9.99%), though none of the samples shows strong signs of enhancement ($\chi_{conv} \geq 10.0\%$)

Table 2: Phosphate fractionation data

Area	Feature (date)	Thin section	Sample	Phosphate-P_i (mg g^{-1})	Phosphate-P_o (mg g^{-1})	Phosphate-P (mg g^{-1})	Phosphate-P_i:P (%)	Phosphate-P_o:P (%)
15	E cursus ditch fill (EN)	M4	559496	0.295	0.251	0.546	54.0	46.0
15	E cursus ditch fill (EN)	M3	559504	0.400	0.176	0.576	69.4	30.6
15	E cursus ditch fill (EN)	M1	559303	n.d.	n.d.	0.072	n.d.	n.d.
16	W cursus ditch fill (EN)	?	588305	0.628	0.343	0.971	64.7	35.3
16	N end of W cursus ditch fill (EN)	M7	588306	1.096	0.491	1.59	69.1	30.9
49	Pit fill (EN)	M12	587031	0.142	0.112	0.254	55.9	44.1
49	Ditch fill (N)	M15	526194	n.d.	n.d.	0.133	n.d.	n.d.
58	Enclosure? (N)	M11	635037	1.136	0.189	1.33	85.7	14.3
58	C2 cursus ditch fill (N)	M5	650052	0.183	0.153	0.336	54.5	45.5
23	Roundbarrow ditch fill (EBA)	M6	584080	0.137	0.173	0.310	44.2	55.8
58	Inner D enclosure (MBA)	M9	671001	0.467	0.112	0.579	80.7	19.3
58	Gully fill (MIA)	M17A	658155	0.813	0.147	0.960	84.7	15.3
99	Pit complex (MN)	M16	555945	0.259	0.119	0.378	68.5	31.5
99	Pit complex (MN)	M16	555943	0.151	0.085	0.236	64.0	36.0
TRiv	Outer D trackway ditch fill (E/MBA)	M13	658018	0.195	0.084	0.279	69.9	30.1
TRiv	Horseshoe enclosure (E/MBA)	M14	660077	0.430	0.137	0.567	75.8	24.2
TRiv	Round barrow ditch fill (EBA)	M18	584011	0.446	0.160	0.606	73.6	26.4
TRiv	Round barrow ditch fill (EBA)	M19	584011	0.099	0.147	0.246	40.2	59.8
LFA	Sediment over ditch	M20A	725008	0.290	0.463	0.753	38.5	61.5
LFA	Sediment over ditch	M20B	702010	0.234	0.348	0.582	40.2	59.8
LFA	Ditch fill – basal fill (MBA)	M21	725003	n.d.	n.d.	0.184	n.d.	n.d.
58	Buried soil	M24	632118	n.d.	n.d.	0.092	n.d.	n.d.
58	Natural (brickearth) subsoil	M25	n/a	n.d.	n.d.	0.092	n.d.	n.d.
58	Cursus ditch 2 fill (N)	M27	648034	1.301	0.249	1.55	83.9	16.1
58	Cursus ditch 2 fill (N)	M29A	650038	0.267	0.200	0.467	57.2	42.8
58	Cursus ditch 2 fill (N)	M29B	650039	0.265	0.241	0.506	52.4	47.6
49	Enclosure ditch fill (M/LBA)	M26	514006	n.d.	n.d.	0.173	n.d.	n.d.
34	Trackway ditch fill (MBA)	M23	828213	1.298	0.200	1.50	86.6	13.4
26	Trackway ditch fill (MBA)	M22	530085	1.583	0.389	1.97	80.3	19.7

Area	Feature (date)	Thin section	Sample	Phosphate-P_i (mg g^{-1})	Phosphate-P_o (mg g^{-1})	Phosphate-P (mg g^{-1})	Phosphate-P_i:P (%)	Phosphate-P_o:P (%)
49	Waterhole (Med)	M30	569023	1.856	0.381	2.24	83.0	17.0
49	Waterhole (Med)	M31	569024	2.985	0.407	3.39	88.0	12.0

n.d. = not determined (where phosphate-P <2.00 mg g^{-1})

Table 3: Particle size analysis

Area	Feature (date)	Thin section	Sample	Coarse sand 600µm-2mm (%)	Medium sand 200-600 µm (%)	Fine sand 60-200 µm (%)	Silt 2-60 µm (%)	Clay <2 µm (%)	Texture class
15	E cursus ditch fill (EN)	M4	559496	6.8	24.6	10.0	23.3	35.3	C
15	E cursus ditch fill (EN)	M3	559504	4.2	20.6	8.9	24.9	41.5	C
58	C2 cursus ditch fill (N)	M5	650052	2.4	7.2	7.6	47.8	35.1	ZyC
LFA	Sediment over ditch	M20B	702010	4.2	14.6	9.6	46.6	25.0	CL
LFA	Ditch fill – basal fill (MBA)	M21	725003	27.0	32.6	6.4	17.5	16.6	SyL
58	Buried soil	M24	632118	2.2	11.0	16.4	37.8	32.6	CL
58	Natural (brickearth) subsoil	M25	n/a	3.0	8.7	10.9	39.7	37.7	C

Table 4: Terminal 5: soil micromorphology; samples and counts

Sample No.	Relative Depth (m)	Context (layer)	Period	MFT	SMT	Voids	Flints	Charcoal	Phytoliths	Plant fragments	Burned flint (pot)
M17A 24055	0.6-0.14 m	658155	MIA	H3	3c	20-30%	fff	aa	a	a	a*
M17B 24055	0.14-0.22 m	658156	MIA	H3	3c	20-30%	fff	a	a	a*	a*
M22 17161	0.46-0.57 m	530085	MBA	H1	3b	30%	ff	a	a*		
M23 18199	0.13-0.23 m	828213	MBA	H1	3a	25%	f	a	a*		a
M20A 27220	0.0-0.075 m	702008		K3	9b	35%	f	aa		aaaa	
M20B 27220	0.075-0.15 m	702010		K2	9a (8~5)	40%	f	a		aa	
M21 27220	0.35-0.43 m	725003	MBA	K1	5a, 9a	25%	ffff	aa		aaaa	a-2
M18 22550	0.28-0.38 m	584011	EBA Twin Rivers	J2	3c/4 (4a)	20%	*	aa			a*
M19 22549	0.33-0.42 m	584011	EBA Twin Rivers	J2	3c/4 (4a)	20%	*	aa			a*
M13 26042	0.37-0.45 m	658013	E/MBA Twin Rivers	H4	3c	20%		a*	a	(aaaaa)	
M14 24053	0.01-0.09 m	660077	E/MBA Twin Rivers	H3	3c	25%	f	aa			
M9 25006	0.26-0.34 m	671001	E/MBA Area 58	H2	3d	30%	ff	a*			(a-1)
M6 22551	0.29-0.37 m	584080	EBA Area 23	J1	3c (4, 3a)	10%	*	a*			a
M11	0.09-0.17 m	635037	E/MBA	D2	3b (6a and	25%	f	a*			a-1

Sample No.	Relative Depth (m)	Context (layer)	Period	MFT	SMT	Voids	Flints	Charcoal	Phytoliths	Plant fragments	Burned flint (pot)
24024					3a)						
M16 18361/ 18362	0.6-0.14 m	555945 555943	M. Neo Area 99	I2	3b	15 and 20%	fff	a*			
M5 650091	0.22-0.30 m	650052	Neo	I1	3a and 3b	30%	ff	a*			
M10 18016	0.40-0.48 m	574056	Neo Area 49	E	5, 6a (7b)	30%	ff	a*			a-1
M15 526197	0.29-0.37 m	526194 526193	Neo. Area 49	D	5(6a)	35%	ffff	a*	a*		
M12 18078	0.29-0.37 m	587031	E. Neo Area 49	G	7a (7b, 7c)	20%	*	a		a	
M7 18463	0.05-0.13 m	588306	E. Neo Area 16	E-F	5 and 6a	25%	f	a*			
M8 18463	0.19-0.27 m	588307	E. Neo Area 16	E	4 and 5	25%	ff	a*			a-1?
M4 18235	0.04-0.08 m	559505	E. Neo Area 15	F	6a and 6c	25%	fff	a			
M4 18235	0.08-0.12 m	559496	E. Neo Area 15	F	6a and 6c	25%	ff	a*			
M3 18235	0.245-0.300 m	559496	E. Neo Area 15	F	6a (6c)	30%		a			
M3 18235	0.300-0.325 m	559504	E. Neo Area 15	F	6a, 6c(6b)	30%	ff	a			
M2 18235	0.35-0.41 m	559504	E. Neo Area 15	D-E	6 /6a/6b/6c (4 and 5)	35%	ff	aa-aaaa			a*
M1 18235	0.43-0.46 m	559504	E. Neo Area 15	E (D)	4, 5 and 6	40%	f	aa			
M1 18235	0.46-0.51 m	559503	E. Neo Area 15	E	4 and 5	40%	ff	aa	a*		

Sample No.	Relative Depth (m)	Context (layer)	Period	MFT	SMT	Voids	Flints	Charcoal	Phytoliths	Plant fragments	Burned flint (pot)
M24 23012	0.23-0.32 m	632118	Buried soil	C2	SMT 3b	25%	*	(a*)			
M25 23012	0.40-0.48 m	Natural	Buried soil	C1	SMT 3a	15-20% (40%)	fff		a*		

Table 4 continued:

	Relative	2ndary	2ndary								
Sample No.	**Depth**	**Fe**	**Fe-Mn**	**Depletion**	**Burrows**	**Root traces**	**Burned clay**	**2nd $CaCO_3$ (bone)**	**Textural (inter-calations etc)**	**Papules with charcoal (humic papules)**	**Yellow Textural**
M17A 24055	0.6-0.14 m		a		aaa			(a*)	aaaaa	aa	
M17B 24055	0.14-0.22 m		a		aaa				aaaaa	aaaa	
M22 17161	0.46-0.57 m					a					
M23 18199	0.13-0.23 m	aaaaa		aaa	(aaa)				aaaaa		
M20A 27220	0.0-0.075 m	aaa			aaaaa	aa		aa			
M20B 27220	0.075-0.15 m	aaaa		aa	aaaaa	aa		aaaaa	aaa	(aa)	
M21 27220	0.35-0.43 m			aaa	aaaa	a		aaaaa			
M18 22550	0.28-0.38 m	aaaa	a	aa	aaaa		aa		aaaaa		
M19 22549	0.33-0.42 m	aaaa	a	aa	aaaa		aa		aaaaa		
M13 26042	0.37-0.45 m			aa		a*			aaaaa		

Sample No.	Relative Depth (m)	Context (layer)	Period	MFT	SMT	Voids	Flints	Charcoal	Phytoliths	Plant fragments	Burned flint (pot)
M14 24053	0.01-0.09 m	aaa	aa	aa?			aaa		aaaaa		
M9 25006	0.26-0.34 m			aaa	aa				aaaaa		
M6 22551	0.29-0.37 m	aaaaa							aaa		
M11 24024	0.09-0.17 m	aa	aa		aaa		aa?		aaaaa		
M16	0.6-0.14 m		aa	aa	aa				aaaa-aaaaa		
M5 650091	0.22-0.30 m	aaaa	a	aa	aaa				aaaaa		
M10 18016	0.40-0.48 m	aaaaa		aa	(aaa)		aa		aaaaa		
M15 18063	0.29-0.37 m	aaa		aaaa		a*	a(?)		aaaaa	a*	a
M12 18078	0.29-0.37 m				aaaaa	a			aa		
M7 18463	0.05-0.13 m	aa	aa	aaaaa	aaaa		aaa		aaaaa		
M8 18463	0.19-0.27 m	aaaa	aa	aaaa		(a?)	aa?		aaaaa		
M4 18235	0.04-0.08 m	aaa		aaaa			aaaa		aaaaa		
M4 18235	0.08-0.12 m	aaa		aaaa			aaaa		aaaaa		
M3 18235	0.245-0.300 m	aaaa		aaaa			aaaa	(a)	aaaaa		
M3 18235	0.300-0.325 m	aaaa	aa	aaaa		a	aaa		aaaaa		
M2 18235	0.35-0.41 m	a		aa			aaa	a-1	aaaaa	a	aa

Sample No.	Relative Depth (m)	Context (layer)	Period	MFT	SMT	Voids	Flints	Charcoal	Phytoliths	Plant fragments	Burned flint (pot)
M1 18235	0.43-0.46 m			aa			aa		aaaaa		aaa
M1 18235	0.46-0.51 m	a		aa					aaaaa		aaaa
M24 23012	0.23-0.32 m	aaaaa		aaaa	aaa				aaa		
M25 23012	0.40-48 m	aaaaa	aaaa	aaaaa	aa				a		

NB:
* - very few 0-5%, f - few 5-15%, ff - frequent 15-30%, fff - common 30-50%, ffff - dominant 50-70%, fffff - very dominant >70%
a - rare <2% (a*1%; a-1, single occurrence), aa - occasional 2-5%, aaa - many 5-10%, aaaa - abundant 10-20%,
aaaaa - very abundant >20%

Table 5: Terminal 5: soil micromorphology; description and preliminary interpretation

Microfacies type (MFT)/Soil microfabric type (SMT)	**Sample No.**	**Depth (relative depth)** **Soil Micromorphology (SM)** **Bulk data (BD)**	**Preliminary Interpretation and Comments**
MFT H3/SMT 3c	**M17A** 24055	0.6-0.14 m SM: Heterogeneous; *Microstructure*: as below; *Coarse Mineral*: as below; flint >26 mm; *Coarse Organic and Anthropogenic Inclusions*: occasional charcoal (max 2.5 mm); rare examples of bone fragments (x 10, max 3 mm) – leached; frequent inclusion of 2-3 mm size clayey SMT 3a, also possibly humic SMT 5? with very fine charcoal; *Fine Fabric*: as below; *Pedofeatures*: as below, with extremely dusty void and planar void infills; *Fabric*: many broad 2-4 mm) burrows. BD (858155): 1.94% LOI, 0.960 mg g^{-1} *phosphate-P,* 21.7 *x* 10^{-8} SI χ, 235 x 10^{-8} *SI* χ_{max}, 9.23% χ_{conv}	Area 58 Middle Iron Age gully. Intervention 658155 As below with more charcoal and eroded subsoil clay, and possible animal scat present. *Gully fill showing trampling and slurry-like inputs of tracked- in soils from along a nearby? droveway.* *Weak p very strong burning signal present*
MFT H3/SMT 3c	**M17B** 24055	0.14-0.22 m SM: Heterogeneous; *Microstructure*: massive with weak planar voids; 25-30% voids, very fine to medium (0.5-3 mm) curved planar voids/simple packing voids; *Coarse Mineral*: as MFT H1, with common flints (>25 mm) and soil clasts – see below; *Coarse Organic and Anthropogenic Inclusions*: rare fine charcoal (max 1 mm); abundant 1-3 mm size humic clay papules – type 3c1 (some inclusion of silt and charcoal; generally only rare very fine charcoal, but possible spores and pollen present) – edges and parts sometimes Fe-Mn stained; many 1-3 mm size fine sandy silt loam soil clasts (type 3c2), with included coarse and many very fine charcoal, with reddish clay void coatings and infills (similar to textural pedofeature intercalatory complexes in MFT H1; examples of 3 mm size rubefied gravel; occasional fine patches of amorphous organic matter (dung residues?); *Fine Fabric*: as SMT 3c, with patchy high and low OM (amorphous organic matter – humic and dung fragments?) and very fine charcoal concentrations; occasional phytoliths present; *Pedofeatures*: *Textural*: very abundant microlaminated darkish brown to black clay to finely dusty void coatings, infills and	Area 58 Middle Iron Age Age gully. Intervention 658156 Complex mix of humic and poorly humic fine sandy silt loam soil, with numerous inclusions of humic clay papules and iron-stained loam fragments rich in textural pedofeatures, and charcoal; burned grains also present with a textural pedofeature-rich fill. *A probable much trampled mixture of local (managed and burned arable/grazing?) topsoil and upper subsoil, with inclusions of humic papules and clasts rich in textural pedofeatures that infer the close presence of a droveway heavily used by stock (cf M22).*

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		associated intercalations *Amorphous*: occasional weak iron impregnation of humic soil inclusions and OM fragments; rare Fe-Mn impregnation of included soil clasts (type 3c1 and 2); *Fabric*: many broad 2-4 mm) burrows..	
MFT H1/SMT 3b	**M22** (17161)	0.46-0.57 m SM: Mainly homogeneous; *Microstructure*: massive with developing coarse prismatic and crack microstructure; 30% voids, very fine to fine (0.5-1.0 mm) moderately well accommodated planar voids, with fine vughs; *Coarse Mineral*: C:F, 70:30, poorly sorted coarse silt, very fine to medium sand-size quartz, with frequent sand to small stone-size (max. 15 mm) subangular flints; *Coarse Organic and Anthropogenic Inclusions*: rare traces burned flint; rare charcoal (max 2.5mm); rare relict fine (450 µm) roots traces now totally ferruginised; *Fine Fabric*: as SMT 3b; *Pedofeatures*: *Textural*: very abundant infills and clay coatings up to 1 mm thick (fine dusty brownish, moderately well oriented), infills up to 2 mm wide with matrix intercalations – burrow in fills; some multilaminated, some possibly humic stained; both iron stained and leached varieties; last phase appears to be iron depleted; *Depletion*: abundant probable moderate to strong Fe depletion; *Amorphous*: very abundant dark ochreous brown and strong reddish impregnative iron nodules and hypocoatings; some picking out relict fine roots and divisions between soil and burrows; *Fabric*: many broad (2 mm) burrows, picked out by iron and depletion features. BD (xM22): 2.62% LOI, 1.97 mg g^{-1} *phosphate-P,* 28.2 *x* 10^{-8} SI χ, 2490 x 10^{-8} *SI* χ_{max}, 1.13% χ_{conv}	Area 26 Middle Bronze Age trackway A mainly iron-stained soil, with major textural feature formation co-eval with burrowing that continues under gleying conditions; deposit also shows relict/iron replaced fine roots. Only rare charcoal and trace of burned flint present. (Enriched P) *Muddy trackway deposit with evidence of anthropogenic activity (animal trampling and phosphate enrichment); with co-eval burrowing and a post-depositional history of rooting and waterlogging.*
MFT H1/SMT 1b	**M23** (18199)	0.13-0.23 m SM: Homogeneous; *Microstructure*: massive with developing coarse prismatic and crack microstructure; 25% voids, very fine to fine (0.5-1.0 mm) moderately well accommodated planar voids, with fine vughs; *Coarse Mineral*: C:F, 70:30, poorly sorted coarse silt, very fine to medium sand-size quartz, with few sand to small stone-size (max. 7 mm) subangular flints; *Coarse Organic and Anthropogenic*	Area 34, Middle Bronze Age trackway A textural pedofeature-dominated fine sandy silt loam with very few flints; rare burned flints and charcoal are anthropogenic indicators; coarse infills of washed

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		Inclusions: rare burned flint; rare charcoal (100 µm); *Fine Fabric*: as SMT 3b; *Pedofeatures*: *Textural*: very abundant infills and clay coatings up to 1 mm thick (fine dusty brownish, moderately well oriented), infills up to 2 mm wide with matrix intercalations; some multilaminated, some possibly humic stained; both iron stained and leached varieties; *Depletion*: abundant probable moderate Fe depletion; *Amorphous*: very abundant pale to dark ochreous brown and reddish impregnative iron nodules and hypocoatings; *Fabric*: possible many broad (2 mm) burrows, picked out by iron. BD (xM23): 2.08% LOI, 1.50 mg g^{-1} *phosphate-P,* 7.4 *x* 10^{-8} SI χ, 484 x 10^{-8} *SI* χ_{max}, 1.54% χ_{conv}	soil and clay are probably indicative of muddy animal passage.(Enriched P) *Muddy trackway deposit with weak signal of anthropogenic activity.*
MFT K3/SMT 9b	**M20A** (27220)	0.0-0.075 m SM: Moderately homogeneous; *Microstructure*: subangular blocky crumb and burrow microstructure; *Coarse Mineral*: moderately well sorted dominant silt size quartz; few flints (7 mm); very few fragments of tufa; *Coarse Organic and Anthropogenic*: abundant organic matter fragments (tissues and organs) – dung traces?; rare traces of roots (max 2.5 mm) and earthworm granules; rare charcoal and spores and fungal material; example of clinker present (2 mm); *Fine Fabric*: SMT 9b: speckled and dotted brown to reddish brown (PPL), moderately low and high interference colours (close porphyric, crystallitic and speckled b-fabric, XPL), speckled brown (OIL); very abundant amorphous organic matter and staining, many to abundant fine charcoal; *Pedofeatures*: *Textural*: many intercalations; *Amorphous*: many Fe hypocoatings and impregnations; *Fabric*: very abundant partial homogenization and broad burrowing; last phase of very broad (4 mm) burrowing – brought in clinker. BD (702008): 10.4% LOI, 0.753 mg g^{-1} *phosphate-P,* 19.3 *x* 10^{-8} SI χ, 1040 x 10^{-8} *SI* χ_{max}, 1.86% χ_{conv}; moderate estimated CO_3.	(LFA05) Layer of sediment overlyingMBA ditch 725001 Organic and charcoal-rich fine silty ditchfill, partially homogenized by earthworms which have mixed in calcitic tufa material; later burrow brought in a fragment of clinker. Late iron staining. Continuing silty and humic and charcoal-rich silty infill related to continuing management of the landscape by fire.
MFT K2/SMT 9a (8~5)	**M20B** (27220)	0.075-0.15 m SM: Heterogeneous; *Microstructure*: massive and subangular blocky; 40% voids, coarse (up to 8 mm) complex packing voids, poorly	(LFA05) Layer of sediment overlying MBA ditch 725001 Heterogeneous, partially

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		accommodated planar voids and chambers and channels; *Coarse Mineral*: C:F, 20:80 (SMT 8 (~SMT 5??) – fine silt) and 50:50 (SMT 9; very poorly sorted silt, medium sands and shell fragments and shells, few flints – max 10+ mm), *Coarse Organic and Anthropogenic*: many fine (2-300 µm) root remains (ferruginised) and organic matter fragments; very abundant shells and shell fragments (max 5 mm), rare earthworm granules and slug plates; rare traces of charcoal (300 µm); *Fine Fabric*: dominant at base (very few upwards) SMT 8 (as SMT 5); dominant SMT 9a: cloudy grey (with variants – iron staining and mixed SMT 5)(PPL), moderately high to high interference colours (open to close porphyric, crystallitic b-fabric, XPL), grey (OIL); trace amounts of organic matter, with mixed/burrowed patches with much amorphous OM; *Pedofeatures*: *Textural*: very abundant (at base) of finely laminated 'sedimentary' clays with very fine charcoal, and upwards more silty clays with calcitic impregnations as intercalated infills; *Depletion*: occasional depletion of calcium carbonate associated with ferruginised areas and root traces; *Crystalline*: very abundant tufa formation (e.g.'s of biogenic 'growth' patterns) and impregnation of matrix; *Amorphous*: very abundant ferruginisation of relict organic matter and root traces; *Fabric*: very abundant biological homogenization and broad (2 mm) burrowing. BD (702010): 8.73% LOI, 0.582 mg g^{-1} *phosphate-P,* 7.9 *x* 10^{-8} SI χ, 792 x 10^{-8} *SI* χ_{max}, 1.00% χ_{conv}; high estimated CO_3; 28.4% sand, 46.6% silt, 25.9% clay: texture class- Clay Loam.	biologically homogenized sequence of moderately fine charcoal-rich clay deposition, followed by and 'disrupted' by tufa formation and co-eval burrowing (by earthworms – granules), sometimes deposits were re-wetted and slaked. Later – fine rooting and iron staining, along with continued burrowing. *MBA (?) ditch – lower fill of alluvial clay enriched in fine charcoal (as Cursus ditch M1-M2?), earlier than tufa formation and earthworm mixing (later/recent contamination?).*
MFT K1/SMT 5a, 9a	**M21** (27220)	0.35-0.43 m SM: Heterogeneous; *Microstructure*: massive with fissure, 25%, poorly accommodated curved fine planar voids, with fine vughs and channels; *Coarse Mineral*: C:F, 70:30, very poorly sorted silt to very coarse sand-size quartz and flint, with dominant rounded stones of flint (max. 25 mm); *Coarse Organic and Anthropogenic Inclusions*: occasional charcoal (max 1.5 mm) and abundant fine amorphous and tissue fragments, charred fragments; rare shell; rare fine root traces; 2	(LFA05) Middle Bronze Age ditch 725001 (lowermost) Biologically mixed finely rooted basal gravels (included burned stones), highly humic and charcoal-rich silty clays, which were invaded by tufa. *Basal ditch fill reflecting original*

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		rubefied gravel; rare examples of earthworm granules; *Fine Fabric*: SMT 5a (as SMT 5): dotted dark reddish brown (PPL), moderately low interference colours (close porphyric, speckled and weakly grano-striate b-fabric, XPL), dotted brown (OIL); humic stained with abundant amorphous and tissue fragments, abundant fine charred OM (humic and bioworked variant of SMT 5); frequent SMT 9 (bioworked mixed tufa and SMT 5); *Pedofeatures*: *Depletion*: many partial decalcification of tufa infills; *Crystalline*: very abundant micritic void infills and layers of tufa; *Fabric*: abundant broad (2-3 mm) burrows; *Excrements*: abundant broad organo-mineral, some mammilated excrements. BD (725003): 3.50% LOI, 0.184 mg g^{-1} *phosphate-P,* 2.2 *x* 10^{-8} SI χ, 346 x 10^{-8} *SI* χ_{max}, 0.64% χ_{conv}; low estimated CO_3; 66.0% sand, 17.5% silt, 16.6% clay: texture class- coarse and medium Sandy Loam.	*clearance by fire (burned stones and charcoal) and initial moderately organic 'silting' (see above); 'peat' formation in fire-managed landscape?*
MFT J2/SMT 4/3c (6a)	**M18** (22549)	0.28-0.38 m SM: Moderately homogeneous with burrowing; *Microstructure*: massive, ompact; 20% voids, fine open and closed vughs, chambers and fissures; *Coarse Mineral*: C:F, 80:20, moderately sorted coarse silt and fine and medium sand size quartz, mica; very few flints (max 6 mm); *Coarse Organic and Anthropogenic Inclusions*: rare charcoal (<1 mm), traces of spores and fungal bodies (e.g. fine 'bright ring') and rubefied grains; many possible (iron-, and iron and manganese replaced) amorphous organic matter (dung residues?) as 2 mm size patches and probable burrow fills (also textural pedofeature associated); *Fine Fabric*: SMT 4/3c, with few 2-4 mm size SMT 6a fragments (rubefied subsoil clay); *Pedofeatures*: *Textural*: very abundant intercalations and associated finely dusty yellowish to reddish clay infills, 1 mm thick pans lining burrows; *Depletion*: many probable iron depleted areas; *Amorphous*: very abundant iron (and rare manganese) impregnation, especially of relict amorphous OM (burrows?); *Fabric*: abundant broad (2+ mm) burrows.	Early Bronze Age barrow ditch Twin Rivers 584081, context 584011 Moderately heterogeneous mix of silt and sands, with inclusions of relict rubefied (burned) subsoil clay, fine charcoal, and abundant burrows introducing clay and much amorphous organic matter, now Fe, and Fe-Mn replaced (dung residues?) *Ditch infill of mainly sands and silt (Eb horizon and parent material) and relict Neolithic (?) burned clay, with marked burrow mixed dung? Residues and very abundant textural pedofeatures indicative of (animal?) trampling.*

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		D (584011): 2.70% LOI, 0.606 mg g^{-1} *phosphate-P,* 7.6 *x* 10^{-8} SI χ, 1280 x 10^{-8} *SI* χ_{max}, 0.59% χ_{conv}	
MFT J2/SMT 4/3c (6a)	**M19** (22550)	0.33-0.42 m SM: Moderately homogeneous with burrowing; *Microstructure*: as above; *Coarse Mineral*: as above with very few small (2 mm) flints; *Coarse Organic and Anthropogenic Inclusions*: as above, with occasional charcoal, most as <1 mm size fragments, but with a 3 mm size charred peat fragment; *Fine Fabric*: SMT 3c with very few 4a (burned clay); *Pedofeatures*: as above, with 1-2 mm thick 10mm+ extensive pans. BD (584011): 2.14% LOI, 0.246 mg g^{-1} *phosphate-P,* 5.4 *x* 10^{-8} SI χ, 1370 x 10^{-8} *SI* χ_{max}, 0.39% χ_{conv}	Early Bronze Age barrow ditch Twin Rivers 584081, context 584011 (monolith taken to the side of (22549) As above, with inclusion of charred peat fragment. *Weaker effects (?) of animal trampling of ditch infill and associated biological working.*
MFT J2/SMT 3c	**M13** (26042)	0.37-0.45 m SM: Very homogeneous; *Microstructure*: massive with minor crack and fine channel; 20% voids, curved fine planar and fine channel (<0.5 mm) (root) channels; *Coarse Mineral*: 50:50, very well sorted silt-size quartz and mica; *Coarse Organic and Anthropogenic Inclusions*: are traces of fine (ferruginised) roots; *Fine Fabric*: SMT 3c, with trace amounts of very fine charcoal; *Pedofeatures*: *Textural*: very abundant intercalations, associated microlaminated clay and suty clay void coatings and infills, and major clayey pans, containing very abundant finely fragmented amorphous organic matter and many fine charcoal (bands forming mm thick discontinuous laminae); phytoliths present. BD (658013): 1.85% LOI, 0.279 mg g^{-1} *phosphate-P,* 16.1 *x* 10^{-8} SI χ, 205 x 10^{-8} *SI* χ_{max}, 7.85% χ_{conv}	Early/Middle Bronze Age D-shaped trackway ditch 658013 Twin Rivers. Context 658013 Extremely homogeneous very well sorted silts and clays, with textural pedofeatures that include pans of clay rich in fine organic matter and charcoal. *Off-trackway silting/wash containing finely sorted soil and finely fragmented organic matter (dung residues?).* *X - burning*
MFT H3/SMT 3c	**M14** (24053)	0.01-0.09 m SM: heterogeneous; *Microstructure*: massive with poorly accommodated fine cracks; 25% voids, poorly accommodated medium planar voids and fine channels and vughs; *Coarse Mineral*: as MFT H, with few medium (10 mm) gravel size flints; frequent soil inclusions of 3-5 mm size SMT 6a (burned clay with rubefied textural pedofeatures, included charcoal and Mn features) and MFT	Middle Bronze Age horseshoe shaped enclosure ditch Twin Rivers fill 66077 within 66075 Very heterogeneous infill of Eb silty and sandy soils with small amounts of charcoal, and

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		H1 fragments with iron-stained textural pedofeatures; *Coarse Organic and Anthropogenic Inclusions*: occasional charcoal up to 3 mm in size (see soil inclusions); *Fine Fabric*: as SMT 3c; *Pedofeatures*: very abundant clayey intercalations, very pale dusty clay pans and void coatings; *Amorphous*: occasional iron staining and iron and manganese inpregnations. BD (660075): 1.88% LOI, 0.567 mg g^{-1} *phosphate-P,* 4.8 *x* 10^{-8} SI χ, 278 x 10^{-8} *SI* χ_{max}, 1.73% χ_{conv}	fragments of 'trackway' deposits (rich in textural pedofeatures) and burned argillic clay subsoil relict of Neolithic clearances (??) associated with Cursus soils. Trackway/animal trample soils associated with erosion of relict Neolithic Cursus (?) burned clearance soils.
MFT H2/SMT 3d	**M9** (25006)	0.26-0.34 m SM: Homogeneous; *Microstructure*: poor medium prismatic; 30% voids, poorly accommodated curved medium (2-3 mm) planar voids, with intrapedal fine (2-400 µm) vughs and closed vughs; *Coarse Mineral*: as MFT H, with frequent flint (20 mm max), some with bleached rims (0.5-1 mm); *Coarse Organic and Anthropogenic Inclusions*: rare charcoal (max 2 mm); possible pot fragment (2 mm), burned flint tempered; *Fine Fabric*: SMT 3d: strongly speckled darkish grey brown (PPL), very low interference colours (close porphyric, speckled and grano-striate b-fabric, XPL), grey to very pale grayish brown (OIL); moderately low humic staining with occasional fine charcoal and rare rubefied grains; *Pedofeatures*: *Textural*: very abundant intercalations and channels (3 mm) infills, and associated very dusty void infills and coatings to closed vughs; *Depletion*: probable moderately strong iron depletion; *Fabric*: occasional thin (<1 mm) burrows; other burrow traces? BD (671001): 1.52% LOI, 0.579 mg g^{-1} *phosphate-P,* 4.0 *x* 10^{-8} SI χ, 94 x 10^{-8} *SI* χ_{max}, 4.26% $\chi_{conv.}$	Early/Middle Bronze Age D-shaped enclosure Area 58 Context 671001 within 671002 Moderately well homogenized (by biological working and trampling?) leached moderately fine charcoal-rich soil from managed grazing/landuse; rare examples of pot fragment and burned flint present.(Generally leached soil but burned material reflected in moderate χ_{conv})
MFT J1/ SMT 3c (4)	**M6** (22551)	0.29-0.37 m SM: Mainly homogeneous; *Microstructure*: massive with 2 mm thick laminations in places; 10% voids, fine (<400 µm) vughs and channels; *Coarse Mineral*: often moderately well sorted coarse silt, fine and medium sandy (as below), with very few flints and sandstone (7 mm); patches of very poorly medium to very coarse	Early Bronze Age Area 23 channel fill 584080 Sand-dominated fill with silt and coarse sandy and gravel patches, and sedimentary laminations, now sometimes picked out by iron

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		ands and gravel (SMT 4); few sand size dark brownish iron stained clay clasts (SMT 3a); rare traces of yellow clay; *Coarse Organic and Anthropogenic Inclusions*: example of rubefied 7 mm size rounded ferruginous fine sandstone; *Fine Fabric*: SMT 3c: dusty yellowish brown (PPL), low interference colours (close porphyric, speckled and grano-striate b-fabric, XPL), grey to pale orange (OIL); thin humic staining, rare traces of fine charcoal and rubefied mineral grains; *Pedofeatures*: many dusty clay thin panning (sedimentary feature?) and void infill; *Amorphous*: very abundant moderate iron impregnation, picking out sedimentary laminations. BD (22551): 1.20% LOI, 0.310 mg g^{-1} *phosphate-P,* 4.2 *x* 10^{-8} SI χ, 1820 x 10^{-8} *SI* χ_{max}, 0.23% χ_{conv}	impregnations; includes clay clasts from 'subsoil' and very rare likely fragments of alluvial clay; very little charcoal, but rare fine and coarse burned grains are present. (Secondary iron reflected in high χ_{max}) *Muddy barrow ditchfill with inwash of parent material alluvial sands and clay clasts, along with clay fragments from subsoil; fine charcoal and relict burned mineral evidence of occupation.*
MFT D2/SMT 3b (3a, 6a)	**M11** (24024)	0.09-0.17 m SM: heterogeneous; *Microstructure*: massive with crack and channel microstructure; 25% voids, poorly accommodated medium planar voids and fine channels and vughs; *Coarse Mineral*: *Coarse Organic and Anthropogenic Inclusions*: rare traces of charcoal (200 µm); examples of angular burned (whitened) flint flake? (3 mm); frequent inclusions of fine clayey SMT 3a, possibly burned 6a, iron and manganese stained once-humic topsoil material; *Fine Fabric*: as SMT 3b, with occasional fine charcoal, traces of rubefied fine grains and thin humic staining and occasional amorphous organic matter; *Pedofeatures*: *Textural*: occasional fine dusty void infills and coatings; very abundant very dusty and dark intercalations associated with 250 µm thick extremely dusty void coatings, following burrowing in places; *Amorphous*: occasional iron and, iron and manganese impregnated soil inclusions; *Fabric*: many thin to broad (1-2 mm) burrows. BD (635037): 2.00% LOI, 1.33 mg g^{-1} *phosphate-P,* 8.4 *x* 10^{-8} SI χ, 598 x 10^{-8} *SI* χ_{max}, 1.40% χ_{conv}	Area 58, Early/Middle Bronze Age enclosure ditch near 'land grab' 635036, fill 635037 Ditch fill of leached silt and fine sandy Eb horizon material and partially biologically worked inclusions of fine fragments of burned? clay, Fe-Mn stained topsoil fragments and subsoil clay. (moderate Phosphate signal) *Enclosure ditch fill strongly characterised by relict Neolithic disturbed clearance soils, eroded Eb horizon and weakly humic soils with moderately weak anthropogenic signal of charcoal, burned flint, phosphate-stained textural pedofeatures – animals(?).*

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
MFT I2/SMT 3b	**M16** (18361/ 18362)	0.06-0.14 m SM: Homogeneous, becoming slightly darker and denser upwards (555945); *Microstructure*: massive with fine curved cracks, 20% voids, fine (300 µm) curved planar voids, channels and semi closed and closed vughs; 555945 – compact with 15% voids – closed vughs; *Coarse Mineral*: as MFT C2, with common flints (>35 mm max); *Coarse Organic and Anthropogenic Inclusions*: rare traces of charcoal (600 µm); example of 5 mm size once-humic now Fe-Mn impregnated 'topsoil' clast; *Fine Fabric*: as SMT 3b, rare trace of very fine charcoal and OM; 555945 – rare fine charcoal and amorphous OM; *Pedofeatures*: *Textural*: 555943 – abundant finely to very dusty void coatings and infills; some dark and up to 300 µm thick; 555945 – very abundant as below, associated with intercalations and thin pan like features, and collapsed burrows; *Depletion*: moderate probable iron depletion of material with some bleached stone rims; *Amorphous*: occasional clasts of soil showing iron and manganese impregnation and possible OM replacement; *Fabric*: occasional broad 3mm burrows, some with crescent shaped open fills. BD (555945): 1.67% LOI, 0.378 mg g^{-1} *phosphate-P,* 4.1 *x* 10^{-8} SI χ, 383 x 10^{-8} *SI* χ_{max}, 1.07% χ_{conv} BD (555943): 1.14% LOI, 0.236 mg g^{-1} *phosphate-P,* 4.0 *x* 10^{-8} SI χ, 225 x 10^{-8} *SI* χ_{max}, 1.78% χ_{conv}	Middle Neolithic pit complex Area 99 555945 Strongly compact 'leached' (Eb horizon) silt fine sand dominated (with flints) soil with very abundant textural pedofeatures, and small amounts of fine charcoal and a once-humic clast. *Animal/human trampling of, at times, a wet pit fill of mainly leached Eb horizon material.* 555943 *Fill of Eb horizon soil and associated small amounts of charcoal; disturbed wet-trampled fill.*
MFT I1/SMT 3a and 3b	**M5** (24019)	0.22-0.30 m SM: mainly homogeneous; *Microstructure*: massive with developing medium prisms, 25% voids, finme and medium poorly accommodated planar voids, with intrapedal fine fissures and closed vughs; *Coarse Mineral*: C:F, 60:40, moderately sorted with coarse silt (silt dominated), fine and medium sand-size quartz and flint;	Area 58, Neolithic Cursus ditch fill 650052, in 650091 Essentially silt-dominated fine fill from upper subsoil Eb horizons and some included small subsoil clay fragments; overall with only

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		frequent flint stones (17 mm max); *Coarse Organic and Anthropogenic Inclusions*: rare trace of fine (<0.5 mm) charcoal; *Fine Fabric*: dominant silty SMT 3b with very few 1-3 mm size fragments of clayey SMT 3a; *Pedofeatures*: *Textural*: very abundant intercalations affecting whole fill, with clayey pans and dark finely dusty multilaminated fills; *Depletion*: occasional weak iron depletion - very thin bleached rims; *Amorphous*: abundant weak iron impregnation; *Fabric*: many broad (1-2 mm) burrows and crescent infills – most later affected by textural pedofeatures. BD (650052): 2.54% LOI, 0.336 mg g^{-1} *phosphate-P,* 6.8 *x* 10^{-8} SI χ, 1400 x 10^{-8} *SI* χ_{max}, 0.49% χ_{conv}; 17.2% sand, 47.8% silt, 35.1% clay: texture class- Silty Clay.	occasional very fine charcoal present; slurry ditch fill was partially burrowed by mesofauna when still wet and forming as a muddy fill; not permanently waterlogged. *Muddy ditchfill formed from the erosion of local silt-dominated upper subsoil Eb horizons and few fragments of subsoil clayey B horizons (see M24 and M25)*
MFT D/SMT 5, 6a (7b)	**M10** (18016)	0.40-0.48 m (Modern contamination recorded as a very broad (10 mm) burrow containing humic soil, fine organic excrements, frequent coarse charcoal and clinker up to 5 mm in size) SM: heterogeneous, as MFT E, with frequent SMT 6a reddish (rubefied?) clay fragments up to 3 mm; rare examples of blackish SMT 7b; *Microstructure*: fine prismatic with coarse burrow and associated root channel; 30% voids, poorly accommodated planar voids, with fine intrapedal channels; *Coarse Mineral*: as below, with frequent flints (max 15 mm); *Coarse Organic and Anthropogenic Inclusions*: rare traces of charcoal, frequent rubefied clay (SMT 6a) and rare blackish SMT 7b (burned topsoil); *Fine Fabric*: as MFT D, SMT 5 and 6a; *Pedofeatures*: as MFT E, with very abundant iron hypocoatings.	Area 49, Neolithic ditch 574055 fill 574056 Very similar fill to Early Neolithic ditch fills; disturbed soil (included burned clay subsoil and humic topsoil – but not necessarily contemporaneous) as ditchfill slurry. (Later much iron staining and broad burrow contamination with Post-medieval? material.) *Muddy ditch infill with mixed and burned soil relict of earlier(?) clearance and possibly more contemporaneous burned topsoil.*
MFT D/SMT 5	**M15** (18063)	0.29-0.37 m SM: Heterogeneous; *Microstructure*: massive, with angular blocky; 35% voids, poorly accommodated coarse to fine (0.5-2 mm) planar voids, with intrapedal fine closed vughs/vesicles; *Coarse Mineral*: as MFT D, with dominant coarse flints (25 mm); *Coarse Organic and*	Neolithic Ditch, Area 49 526189, contexts 526194 526193 Junction between very gravelly

Microfacies type (MFT)/Soil microfabric type (SMT)	**Sample No.**	**Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)**	**Preliminary Interpretation and Comments**
		Anthropogenic Inclusions: trace amount of charcoal; trace s of very fine roots (0.5 mm); *Fine Fabric*: dominant SMT 5, with clayey fragments rich in iron-replaced amorphous organic matter; clayey fine fabrics also rich in very abundant fine charred and blackened organic matter; possible rubefied (now iron-stained) SMT 5; *Pedofeatures*: multiphased – very abundant type a) 1-2 mm complexes of very dusty brown matrix intercalations and associated very dusty infills and grain coatings, with fine closed vughs/vesicles; later rare type b) once humic (fine OM) now weakly iron-stained infills; later type c) rare pale yellowish brown, finely dusty with organic matter particles, very thick (1 mm) infills and coatings (whitish to blackish brown under OIL), with phytoliths; type c) forms pan-like features and layers; *Depletion*: probable occasional iron depletion around intra-pedal voids; *Amorphous*: occasional weak to strong iron impregnation. BD (526194): 2.62% LOI, 0.133 mg g^{-1} *phosphate-P,* 3.6 *x* 10^{-8} SI χ, 263 x 10^{-8} *SI* χ_{max}, 1.37% χ_{conv}	526193 and slightly less stony 526194, with heterogeneous mixture of clays with iron-replaced organic matter, possible rubefied clay, and clayey fills that contain high amounts of fine charcoal and blackened organic matter; also inwash of iron-depleted clays; forming roughly layered textural pedofeatures. Muddy ditchfill over gravels that includes fragmented and some burned alluvial clay soils; inwash of alluvial clays rich in fine charcoal because of major clearance by fire.
MFT G/SMT 7a (7b and 7c)	**M12** 18078	0.29-0.37 m SM: Almost totally homogeneous; *Microstructure*: massive, with fine planar voids, 20%, with fine (200-300 µm) channels; *Coarse Mineral*: C:F, moderately sorted coarse silt to medium sand-size quartz and flint with very few flint stones (2 mm); *Coarse Organic and Anthropogenic Inclusions*: rare fine charcoal (<0.5 mm); rare sand-size burned humic soil inclusions (SMT 7b); rare very fine (150-300 µm) *in situ* roots and root fragments – some partially ferruginised; rare small plant fragments; *Fine Fabric*: very dominant SMT 7a: dusty darkish brown (PPL), moderately low interference colours (close porphyric, speckled b-fabric, XPL), brown (OIL); humic stained with many very fine charcoal and amorphous OM fragments; very few SMT 7b: dotted and blackish (PPL), very low interference colours to isotic (close porphyric, undifferentiated, XPL), blackish (OIL); strongly humic, with organ fragments and sometimes abundant fine charcoal; very few patches of SMT 7c:	Area 49 Early Neolithic pit 587028 context 587031 Biologically homogenized (under some wet conditions) humic occupation soil (Ah2) including burned humic topsoil (Ah1) and Eb horizon material from argillic brown soil (formed in fine sandy silt loam river terrace drift)(Resembles BA soils from Perry Oaks?)(LOI and χ_{conv} reflect inputs of topsoil and burned topsoil) *Pitfill records local occupation soil (grazing land managed by fire?)*

Microfacies type (MFT)/Soil microfabric type (SMT)	**Sample No.**	**Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)**	**Preliminary Interpretation and Comments**
		coarse silt and sand, with C:F of 95:05; *Pedofeatures*: *Textural*: occasional examples of dusty void coatings and infills and intercalations, some brownish and multilaminated (300 µm thick) – which appear last; *Fabric*: almost totally burrowed and homogenized. BD (587031): 2.82% LOI, 0.254 mg g^{-1} *phosphate-P,* 5.3 *x* 10^{-8} SI χ, 107 x 10^{-8} *SI* χ_{max}, 4.95% χ_{conv}	
MFT E-F(~J2)/SMT 5 and 6a	**M7** (18463)	0.05-0.13 m SM: Moderately heterogeneous; *Microstructure*: massive and finely fissured; 25% voids, fine and very fine (300 µm) fissures; *Coarse Mineral*: as below with few flints (max. 7 mm); *Coarse Organic and Anthropogenic Inclusions*: rare trace of very fine (1 mm) charcoal; *Fine Fabric*: dominantly SMT 5, with frequent SMT reddish clay (ferruginised OM inclusions) and possible 6a; *Pedofeatures*: as below; *Fabric*: abundant broad burrows mixing–in reddish soil. BD (588305): 3.88% LOI, 0.971 mg g^{-1} *phosphate-P,* 20.2 *x* 10^{-8} SI χ, 664 *10-8 SI* χ_{max}, 3.04% χ_{conv} BD (588306): 3.54% LOI,1.59 mg g^{-1} *phosphate-P,* 8.0 *x* 10^{-8} SI χ, 3920 *10-8 SI* χ_{max}, 0.20% χ_{conv}	Area 16 Early Neolithic Western Cursus ditch 588306 *Ditch slurry of mixed iron depleted soil with included reddish clay fragments (burrowed in) with relict organic matter (dung residues?) and rubefied clay fragments (from clearance?) – stock activity?).*
MFT E/SMT 4 and 5	**M8** (18463)	0.19-0.27 m SM: Heterogeneous; *Microstructure*: prismatic breaking to angular blocky, 25% voids; medium planar voids and very fine (300 µm) fissures; *Coarse Mineral*: C:F, 50:50, very poorly sorted silt to medium and very coarse sand-size quartz and flint, with frequent stone-size (17 mm max) flint; example of 6 mm size ironpan fragment; *Coarse Organic and Anthropogenic Inclusions*: rare trace of very fine charcoal; *Fine Fabric*: common SMT 4, with common inclusions of SMT 5, with very abundant iron replaced amorphous organic matter, and occasional very fine charcoal; *Pedofeatures*: *Textural*: very abundant intercalations and upwards closed vugh coatings; *Depletion*: abundant probable iron depletion; *Amorphous*: very abundant moderate to strong iron impregnation and occasional iron and manganese impregnation.	Area 16 Early Neolithic Western Cursus ditch Intervention 588324 fill 588307 Heterogeneous – very similar to M1, with mixed clay and sands that include much iron replaced amorphous organic matter (possible rubefied clay, but masked by iron staining?) *Mixed fill of disturbed alluvial soils.*

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
MFT F/SMT 6a and 6b MFT F/SMT 6a and 6b	**M4** (18235)	0.04-0.08 m As below; with common flints (max. 20 mm); *Fine Fabric*: patches/inclusions of reddish SMT 6a include embedded charcoal; also rubefied are intercalations and associated fine closed vughs/vesicles. 0.08-0.12 m SM: Heterogeneous; *Microstructure*: massive with planar cracks, as below; *Coarse Mineral*: as below with common flints (max. 8 mm); *Coarse Organic and Anthropogenic Inclusions*: rare traces of charcoal; *Fine Fabric*: as below; *Pedofeatures*: as below	Area 15 Early Neolithic Eastern Cursus ditch Intervention 617042, context 550905 As below, with examples of rubefied soil containing embedded charcoal and features of disturbance formed prior to burning. *Fill contains burned treethrow soils/clearance features?* 559496 As below
MFT F/SMT 6a(6c) MFT F/6a, 6c(6b)	**M3** (18235)	0.245-0.300 m SM: Heterogeneous; *Microstructure*: fragmented medium prismatic; 30% voids, poorly accommodated medium to coarse (2+ mm) planar voids and fine intrapedal closed vughs/vesicles; *Coarse Mineral*: as below, but stone free; includes 7 mm calcareous soil fragment/tufa; *Coarse Organic and Anthropogenic Inclusions*: rare fine charcoal; *Fine Fabric*: dominant SMT 6a, with common 6c; *Pedofeatures*: as below, but without Fe-Mn impregnations/included once-humic soil. BD (559496): 2.76% LOI, 0.546 mg g^{-1} *phosphate-P,* 6.6 *x* 10^{-8} SI χ, 2328 *10-8 SI* χ_{max}, 0.28% χ_{conv}; 41.4% sand, 23.3% silt, 35.3% clay: texture class- Clay. 0.300-0.325 m SM: Heterogeneous; *Microstructure*: fragmented medium prismatic; 30% voids, poorly accommodated medium to coarse (2+ mm) planar voids and fine intrapedal closed vughs/vesicles; few medium (1 mm) vertical channels; *Coarse Mineral*: C:F, 60:40, as below with frequent flints (max 20mm); *Coarse Organic and Anthropogenic Inclusions*: rare fine (<0.5 mm) charcoal; occasional 2 mm size fragments of possible humic topsoil with plant traces and fine rooting patterns (now iron and manganese impregnated); *Fine Fabric*:	Area 15 Early Neolithic Eastern Cursus ditch; context 559496 As below, but rubefied soil dominates and possible topsoil fragments are present; also disturbance includes a fragment of calcareous soil/tufa. (LOI reflects possible topsoil, with secondary Fe producing the very high χ_{conv}) 559504 Mixture of rubefied clay soil, black (iron and manganese stained) once-humic topsoil fragments(?), rare charcoal, frequent flints and (now partially iron-depleted) textural pedofeature dominated soil. *Infill of disturbed soil (some burned from woodland*

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		common SMT 6a, with common 6c and very few 6b; *Pedofeatures*: *Textural*: very abundant intercalations and associated infills and formation of closed vughs; *Depletion*: abundant probable iron depletion of matrix and as void hypocoatings; bleached stone rims; *Amorphous*: very abundant moderately weak iron impregnation; occasional patches of iron and manganese impregnation. BD (559504): 33.7% sand, 24.9% silt, 41.5% clay: texture class-Clay.	*clearance?); collapse soil features formed in wet ditch?* *(More loamy soils involved here compared to the more clayey alluvial soils noted below)*
MFT D/6 /6a/6b (4 and 5)	**M2** (18235)	0.35-0.51 m SM: Heterogeneous; *Microstructure*: as below, 35% voids; as below, coarse (4 mm) planar voids; *Coarse Mineral*: C:F, various as below, common stone size sandstone and flints – up to 300 µm thick bleached rims; *Coarse Organic and Anthropogenic Inclusions*: generally rare to occasional with patches (SMT 6) of abundant charcoal (3 mm); rare traces of rubefied sand grains; *Fine Fabric*: SMT 6a (associated with coarse charcoal and some rubefied mineral grains): speckled and dotted yellowish to reddish brown (PPL), moderately low interference colours (intercalatory composition with embedded grains - grano-striate appearance, XPL,), weakly golden yellow (OIL): weakly humic, occasional amorphous fine organic matter; abundant fine charred OM; rare rubefied (burned?) particles; very few examples of 2 mm to sand-size fragments of SMT 6b: blackish, very dark reddish brown, dotted (PPL), very low interference colours-isotic (very open porphyric, weakly mosaic-speckled b-fabric, XPL), orange to reddish, and blackish examples (OIL); examples of fine organic matter-rich and fine charcoal; frequent SMT 6c: as SMT 6a, but pale (unburned, iron-depleted?); *Pedofeatures*: *Textural*: very abundant intercalations, with associated closed vughs/vesicles, grain and void coatings (SMT 6a); occasional type c (yellow clay); rare papules (type d) – some 2.5 mm size – poorly laminated fine charcoal rich dark yellow and reddish yellow clay; *Crystalline*: rare example of sparitic calcite void infills; *Depletion*: many likely iron depleted zones and fine hypocoatings to	Area 15 Early Neolithic Eastern Cursus ditch; Intervention 617042 context 559504 Heterogeneous with fine charcoal-rich clays, common patches and mixed intercalations of reddened and blackened clay, rubefied grains, and abundant charcoal, with very abundant textural pedofeatures, and fragments (papules) of very charcoal-rich reddish yellow clay; later iron depletion and yellow clay inwash. (Iron depletion effect on magnetic susceptibility; LOI reflects humic clay etc) *Infill dominated by the mixture of alluvial clay soil and burned alluvial clay soils/alluvium – burning also evidenced by charcoal concentrations and burned mineral grains – all relict of woodland clearance by fire, and associated clay movement encouraged by the release of*

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		voids; *Fabric*: very abundant fabric mixing. BD (559504): 3.23% LOI, 0.576 mg g^{-1} *phosphate-P,* 6.1 *x* 10^{-8} SI χ, 436 *10-8 SI* χ_{max}, 1.40% χ_{conv}	*potash (K) from ash.*
MFT D/SMT 4, 5 and 6 MFT E/SMT 4 and 5	**M1** (18235)	0.43-0.46 m SM: Heterogeneous as below with MFT D; *Microstructure*: as below; *Coarse Mineral*: as below; *Coarse Organic and Anthropogenic Inclusions*: occasional charcoal (max. 1 mm); few coarse (10 mm) patches of MFT D – which includes charcoal; *Fine Fabric*: common SMT 5, frequent SMT 4; frequent SMT 6: orange to reddish brown (PPL), low to moderate interference colours (very open porphyric, speckled and strial b-fabric, XPL), orange brown (OIL); heterogeneous clay with many fine charcoal, and possible relict organic matter(?); *Pedofeatures*: as below, *Depletion*: probable occasional iron depletion around intra-pedal voids; *Fabric*: abundant mixed SMT 4 and 6. 0.46-0.51 m (irregular boundary) SM: Heterogeneous; *Microstructure*: fine prismatic, 40% voids, moderately well accommodated medium (2 mm) and fine planar voids, with fine channels and vughs (and fine vesicles); *Coarse Mineral*: heterogeneous with C:F 85:15 (SMT 4) and 30:80 (SMT 5), very poorly sorted with frequent large stone-size (>45 mm) flints, patches of poorly sorted coarse silt, fine to very coarse sand-size quartz and flint; very few mica; *Coarse Organic and Anthropogenic Inclusions*: occasional charcoal (max. 1 mm); occasional yellow clay fragments (cf textural pedofeature type c); *Fine Fabric*: SMT 4: very dusty very pale brown (PPL), very low interference colours (close porphyric, speckled b-fabric, XPL), grey (OIL), very thin humic staining, occasional very fine charred and blackened organic matter; SMT 5: speckled and dotted brown (PPL), moderate interference colours (open porphyric, speckled and grano-striate b-fabric, XPL), moderately humic(?), many to abundant fine amorphous organic matter, spores and charcoal; *Pedofeatures*: *Textural*: multiphased – very abundant type a) 1-2 mm complexes of very dusty brown matrix	Area 15 Early Neolithic Eastern Cursus ditch; basal sands and gravels 559504 Very similar to below but also patches of mixed sands (from upper sands and gravels) and orange brown clay and embedded charcoal (possible 'burned' subsoils). *Ditch infill of locally disturbed (woodland clearance?) alluvial sands and clays; continuing alluvial inwash* 559503 Very coarse gravels, patches of sands (containing fine charred OM), with fine charcoal-rich clays dominated by textural pedofeatures (disturbed soil), with major inwash of pale yellowish brown clay sometimes as layers infilling between disturbed soil. *Mixture of basal sands and gravels – although fine charcoal is present – and disturbed and collapsed clayey brown soil rich in fine charcoal (disturbed alluvial Holocene soils?), with base of ditch also being infilled by*

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM) Bulk data (BD)	Preliminary Interpretation and Comments
		intercalations and associated very dusty infills and grain coatings, with fine closed vughs/vesicles; later rare type b) once humic (fine OM) now weakly iron-stained infills; later type c) abundant pale yellowish brown, finely dusty with organic matter particles, very thick (1 mm) infills and coatings (whitish to blackish brown under OIL), with phytoliths; type c) forms pan-like features and layers; *Depletion*: probable occasional iron depletion around intra-pedal voids; *Amorphous*: rare weak iron impregnation. BD (M559503): 0.662% LOI, 0.072 mg g^{-1} *phosphate-P,* 0.1 *x* 10^{-8} SI χ, 278 *10-8 SI* χ_{max}, 0.04% χ_{conv}	*contemporary alluvium(?)/alluvium in the ditch.*
MFT C2/SMT 3b	**M24** (23012)	230-320 mm SM: Homogeneous; *Microstructure*: fine and medium prismatic, 25% voids, dominant fine to medium (1-2 mm) well accommodated planar voids, with frequent very fine (100 µm) vughs and channels; *Coarse Mineral*: C:F, 70:30, poorly sorted coarse silt, very fine to medium sand-size quartz, with very few sand to small stone-size (max. 2.5 mm) rounded to subangular flints (with bleached 100-500 µm rims); *Coarse Organic and Anthropogenic Inclusions*: *Fine Fabric*: dominant SMT 3b: finely speckled yellowish brown (PPL), moderately low interference colours (close porphyric, speckled and grano-striate b-fabric, XPL), yellow (OIL); rare relict humic and amorphous organic matter; trace of fine charcoal; common SMT 3a; *Pedofeatures*: *Textural*: many thin (120 µm) pale finely dusty to impure clay void coatings, and multilaminated clay to dusty clay infills (pale brown humic?) – some up to 600 µm thick; *Depletion*: abundant probable moderate Fe depletion; *Amorphous*: very abundant pale yellow to ochreous brown impregnative iron nodules; *Fabric*: many thin and broad (1-2 mm) burrow fills. BD (632118): 1.48% LOI, 0.092 mg g^{-1} *phosphate-P,* 6.4 *x* 10^{-8} SI χ, 1400 *10-8 SI* χ_{max}, 0.46% χ_{conv}; 29.6% sand, 37.8% silt, 32.6% clay: texture class- Clay Loam.	Area 58 – 'buried soil' 632118 Homogeneous, moderately gleyed, essentially stone free fine sandy silt loam, with many dusty clay void coatings and humic(?) clay infills; trace amounts of very fine charcoal. (Very low LOI and high χ_{max} confirm subsoil gleyed/iron mottled character.) *Disturbed lower clay loam subsoil (Ebg) horizon (very base of a plough layer?)*
MFT C1/SMT 3a	**M25** (23012)	400-480 mm SM: Homogeneous; *Microstructure*: medium prismatic, 40% voids,	Area 58 – 'buried soil' natural subsoil

Microfacies type (MFT)/Soil microfabric type (SMT)	**Sample No.**	**Depth (relative depth)** **Soil Micromorphology (SM)** **Bulk data (BD)**	**Preliminary Interpretation and Comments**
		very fine (200 µm) to very coarse (5 mm) well to poorly accommodated planar voids (cracks and fissures); compact intra-ped 15-20% voids, very fine (150 µm) channels and fissures; *Coarse Mineral*: Coarse:Fine (limit at 10 µm), C:F 30:70, very poorly sorted with common small stone-size (10 mm) rounded to angular flint and impure chert (some with thin [60 µm] weak bleached margins) and common coarse silt, very fine and medium sand-size angular to sub-rounded quartz, very few mica; *Coarse Organic and Anthropogenic Inclusions*: *Fine Fabric*: SMT 3a: fine speckled pale yellowish grey to pale yellowish brown (PPL), low to medium interference colours (open porphyric, speckled and grano-striate b-fabric, XPL), very pale yellowish grey to yellow (OIL); rare traces of relict fine amorphous organic matter; *Pedofeatures*: *Textural*: rare very thin (30-50 µm) to medium (150 µm) dusty clay void coatings and impure clay void coatings; rare example of pale brown (weakly humic?) intercalated void infill (1 mm 'ped'?); *Depletion*: very abundant probable Fe depletion; *Amorphous*: very abundant pale yellow to ochreous brown impregnative iron nodules, with abundant, commonly associated impregnative and void iron and manganese hypocoatings; *Fabric*: occasional weak relict slickensides; occasional broad (2 mm) burrow fills. BD (25): 1.50% LOI, 0.092 mg g^{-1} *phosphate-P,* 8.4 *x* 10^{-8} SI χ, 1710 *10-8 SI* χ_{max}, 0.49% χ_{conv}; 22.6% sand, 39.7% silt, 37.7% clay: texture class- Clay.	A homogeneous moderately flinty clay loam, with shrink and swell, rare dusty void coatings, and strong iron depletion and iron, and iron and manganese mottling; minor burrowing. (Very low LOI and high χ_{max} confirm subsoil gleyed/iron mottled character.) *Gleyed clayey subsoil (Ebg/Bg) horizon formed from terrace sands and gravels and clay.*

Table 6: Perry Oaks (WPR98) and Northern Taxiway (GIA) sites at Heathrow Terminal 5: review of soil micromorphology

Monolith **Sample/Context/Section**	**Thin section No.**	**Soil Micromorphology (SM) – features of note**	**Preliminary Interpretation and Comments**
WPR 1083 Context 148014 Section 648002	WPR 1083A	Similarly moderately flint-rich as below with dominant SMT 1b (as SMT 1a, but finely speckled and dotted, weakly humic stained with occasional to many very fine charred and amorphous organic matter); occasional sand size clasts of papules – fragments of textural pedofeatures silty clay loam, with fine charcoal included; patches of 2-3 mm size soil dark yellowish brown with fine charcoal – weakly iron stained; very abundant textural pedofeatures 100-200 µm thick, some dark brownish and weakly iron stained, some pan like and associated with horizontal fissures; iron-stained sand grains with 60-90 µm bleached rim; rare 1 mm root traces (one example with iron stained matrix/hypocoatings); rare trace of yellowish amorphous fills (phosphate?).	BA field system ditch – upper Similar to below, but with slightly more fine charcoal and humic matter (more arable in character); soil mixing and fragmentation as evidenced by 'papules' and textural pedofeatures; pan-like fills and coatings sometimes dark brownish with iron staining, possibly implying inputs of animal slurry (trampling stock?). *Ditchfill type MFT B3 – arable(?) erosion of mainly ploughed/arable upper subsoil argillic brown earth soil, with further possibility of* in situ *stock trampling*
ditto	WPR 1083B	Moderately flint rich with coarse (max. 20 mm) flints (some showing 1 mm thick bleached margins); massive poorly sorted fine sandy silt loam with vertical fine cracks and weak prismatic structure; very dominant soil is SMT 1a (very finely speckled, dotted very pale brownish grey [PPL], low interference colours [close porphyric, speckled and granostriate b-fabric, XPL), grey [OIL]; very thin humic staining, trace amounts of fine charcoal); trace amount of coarse (max 1 mm) charcoal; few 5 mm size soil inclusions (SMT 2: speckled and dotted dark yellowish brown [PPL], very low interference colours [close porphyric, speckled and weak granostriate b-fabric, XPL], bright orange [OIL]; probable humic staining with abundant amorphous and fine charred organic	BA field system ditch – lower part(?) of upper Fill dominated by SMT 1a, general iron-depleted ditch fill soil, probably from eroded Eb horizon soil; overall this soil and included coarse flints have been affected by gleying and moderately acid conditions; included within soil matrix a few soil fragments (SMT 2) iron and iron and manganese impregnated soil clasts with high amounts of fine amorphous and charred organic matter – these may have been slightly burned topsoil fragments; wet conditions of ditchfill led to formation of textural pedofeatures indicative of

Monolith **Sample/Context/Section**	**Thin section No.**	**Soil Micromorphology (SM) – features of note**	**Preliminary Interpretation and Comments**
		matter; weak to strong Fe impregnation/hypocoatings and Fe-Mn impregnation); very abundant textural pedofeatures throughout: 60-200 µm thick void coatings and associated intercalations; frequent burrow infills/wash with dark brownish (PPL) soil; associated with very fine dusty, sometimes microlaminated (200 µm) dusty clay infills infilling 1 mm size areas; some infills also associated with thin 150 µm thick pan-like Fe impregnations; rare fine root traces.	physical disturbance. Post-depositional features are burrow mixing and inwash of fine charcoal-rich humic soil, associated with some iron staining. *Ditchfill type MFT B2 – arable(?) erosion of mainly upper subsoil argillic brown earth soil, and few iron stained (possibly weakly burned) topsoil material rich in fine charred organic matter.*
WPR 1085 Context 148014 Section 648002	WPR 1085	Massive, vughy and burrowed, with few coarse (17 mm) rounded flint gravel with 0.75 mm thick bleached rims; very dominant SMT 1a, with occasional moderately weakly iron stained mottles in lower half of thin section; rare trace of charcoal (<1 mm), example of burned humic soil (1 mm) in patch of fine charcoal-rich SMT 2; very abundant textural pedofeatures, coating and infilling voids as 1 mm thick intercalations and matrix infills, with microlaminated finely dusty humic void infills 150 µm thick,	Lowermost? Bronze Age field system ditch Mainly eroded poorly humic iron-depleted Eb horizon soil, with small patches of eroded humic and fine charcoal-rich managed topsoil – with burned example; *in situ* burrowing and rooting before slaking and possible trampling by stock. *Ditchfill type MFT B1 – primary erosion fill of Eb horizon and some managed (by fire) topsoil – rich in fine charcoal and including burned topsoil fragment.*
WPR 1030 Context 132004 Section 632001	WPR 1030	Massive fine sandy silt loam with very few fine gravel (flint – max. 4 mm); fine soil matrix is similar to SMT 1b, with common SMT 1e (as SMT 1d, with less strongly ferruginised amorphous organic matter); compact with weak horizontal fissuring as (MFT B2 – BA 1083A), with rare traces of clay papules, rare fine charcoal (<500 µm), very abundant textural pedofeatures including silty pans and iron (humus) stained fine	Early Bronze Age ditch Infill of very fine charcoal-rich almost 'stoneless' soil – ditch silting; with inclusions of fragmented once-humic topsoil and wash and compaction and burrow mixing of humic and iron-stained fine soil. *Ditchfill Type MFT B3 – silting of ditch associated with managed grazing*

Monolith **Sample/Context/Section**	**Thin section No.**	**Soil Micromorphology (SM) – features of note**	**Preliminary Interpretation and Comments**
		soil and amorphous organic matter – also associated with burrows.	*land(??) with stock trampling of ditch?*
WPR 1029 Context 154022 Section 653004	WPR 1029	Moderately flint-rich with few to frequent coarse flint – some with 150 µm thick bleached rims; massive, compact with subhorizontal coarse (4 mm) root channels/fissures; poorly sorted clay loam with frequent coarse silt and fine sand rare trace of secondary carbonate – sparitic void infill; occasional fragments of iron-rich clay with few quartz sand and a grano-striate b-fabric, and traces of charcoal; common SMT 1c: extremely dusty with speckles greyish brown (PPL), moderately low interference colours (close and open porphyric, speckled and grano-striate b-fabric, XPL), grey (OIL); occasional very fine amorphous (blackened), and charred organic matter; phytoliths present; frequent to common patches of SMT 1d: dark reddish brown to black (PPL), isotic to very low interference colours (close porphyric, undifferentiated grano-striate b-fabric), yellowish orange (OIL); very abundant relict amorphous organic matter (ferruginised with goethite?) and many fine charred/charcoal; very abundant textural pedofeatures including 150-400 µm thick infills and broad intercalations linking with embedded grain features (200 µm thick) around flints for example; abundant amorphous (goethite) iron infills of voids/replacement of amorphous organic matter (wet conditions) – also fungal material; examples of iron-depleted clay coatings to fine (600 µm) voids as post depositional event.	Neolithic: Northern End of Eastern Cursus (Stanwell) ditch. Heterogeneous mixture of dark and iron mottled once-humic and moderately finely charcoal-rich 'topsoil' (H and Ah1 horizons) and less charcoal-rich Ah2/upper Eb horizon soil as a slaked disturbed ditch infill (MFT A); strong iron impregnation of humic soil components – total ferruginisation of amorphous organic matter; also later fine rooting secondary gleying effects down root holes (as ditches got waterlogged). Soil components suggest cursus constructed in area of humic (non-arable [woodland, scrub, pasture] pollen data?) humic soils (H and Ah horizons), but where human activities had already led to the incorporation of fine charcoal into the soil. Dumped mixed soil material (bank?) already affected by slaking before ending up in the ditch, where secondary ferruginisation took place; possibly ditchfill became revegetated at times. (analogues of Neolithic disturbed Maiden Castle drift soils and Drayton Cursus basal ditchfill soils. *Ditchfill MFT A1 – heterogeneous woodland clearance soils (but not totally virgin forest?) – slaked*

Monolith **Sample/Context/Section**	**Thin section No.**	**Soil Micromorphology (SM) – features of note**	**Preliminary Interpretation and Comments**
			disturbed topsoils as ditchfill.
WPR 1066A Context 149007 Section 649002	WPR 1066A	As below, with few iron and manganese impregnated relict humic soil crumbs. Common broad burrow mixing/ intercalatory fill of very charcoal-rich humic soil (cf. SMT 1b); little iron impregnation and less heterogeneous compared to below; abundant textural pedofeatures, up to 500 µm thick, but showing iron depletion/effect of gleying.	Neolithic Western Cursus ditch The upper part of the Neolithic context is less heterogeneous and more earthworm worked, with large areas of soil of similar character to Bronze Age soils (generally more humic and fine charcoal-rich - managed topsoil). *MFT A-B – mixed fill boundary between Neolithic fill and Bronze Age managed soil fills?*
WPR 1066B Context 149007 Section 649002	WPR 1066B	Massive with frequent coarse (17 mm) size flints; similar to below with few iron and manganese once-humic crumbs, a heterogeneous character, from earthworm mixing; patches of moderately charcoal-rich soil and clayey textural pedofeature-rich areas, which are more charcoal rich, with fine charcoal intercalated in clayey fills; charcoal fragmentation – 1 mm and finer of rare charcoal – most as very fine and dusty charcoal. In addition to secondary iron; rare examples of micritic to microsparitic void coatings and void hypocoatings/impregnations of $CaCO_3$.	Neolithic Western Cursus ditch Very similar to below, with earthworm coarsely mixing fine charcoal-rich soil from disturbed A and upper Eb soil horizons; clay mobilised by potash along with fine charcoal. Inwash of bank and buried (woodland-cleared? soils) *MFT A2 – ditchfill of soils produced by clearance by fire – very dusty charcoal, neoformed (by potash) clay infills with much fine charcoal; earthworm soil crumbs.*
WPR 1067 Context 149008 Section 649002	WPR 1067	Massive fine sandy silt loam with few flints (15 mm max); moderately heterogeneous with common SMT 1c and frequent coarse (5-15 mm) iron and manganese impregnated soil fragments (SMT 1e: similar to SMT 1d, but with fine vughy and channel porosity; black (PPL and OIL) iron and manganese stained crumb-like once-humic soil; very abundant textural pedofeatures, as 1029, many with included fine charcoal; one example a 1mm thick clay and fine charcoal void infill;	Neolithic Western Cursus ditch Moderately heterogeneous fill with disturbed fine charcoal rich soils mixed with iron and manganese stained crumbs of topsoil; fill contains very finely mixed dusty charcoal-rich soil; also coarse void infills of clay and fine charcoal. Later features of iron and iron and manganese staining, with fine rooting and iron depletion features

Monolith **Sample/Context/Section**	**Thin section No.**	**Soil Micromorphology (SM) – features of note**	**Preliminary Interpretation and Comments**
		example of 2 mm size soil clast of mixed iron stained clayey and dusty and fine charcoal rich soil. Inclusions of clay papules are probably relict of Pleistocene drift cover soils.	(gleying evidence of waterlogging). Fill records burning (clearance) and the likely neoformation of clay through potash (ash) weathering; local activities also finely fragmented the charcoal, and this lowermost fill also received humic topsoil (earthworm) crumbs and fine subangular blocky structures (Ah1 and Ah2 soil horizons); mixed with upper Eb horizon soil. *MFT A2 – ditchfill of soils produced by clearance by fire – very dusty charcoal, neoformed (by potash) clay infills with much fine charcoal; earthworm soil crumbs.*

Terminal 5: Soil Micromorphology; Figures 1-30
(Macphail and Crowther, 2006)

Fig. 1: Scan of M24, upper subsoil fine sandy silt loam Ebg horizon of 'control' buried soil (Area 58). Frame width is ~50 mm.

Fig. 2: Scan of M25, subsoil clayey and flint-rich gleyed Ebg/Bg horizon of 'control' buried soil (Area 58). Frame width is ~50 mm.

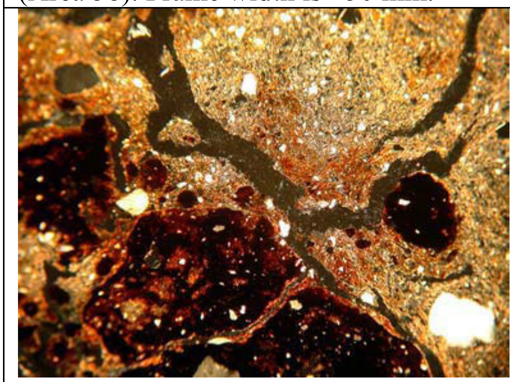


Fig. 3: Photomicrograph of M25; iron-depleted areas, iron, and iron and manganese impregnated clayey nodules. Crossed polarised light (PPL), frame width is ~4 mm.

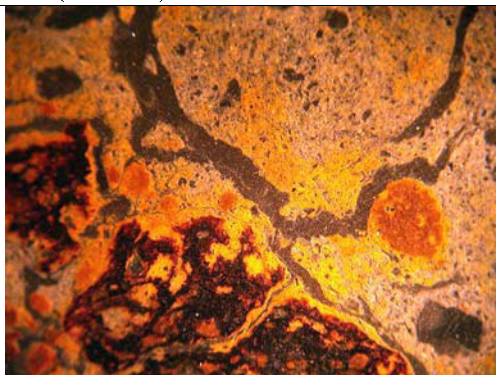


Fig. 4: As Fig 3, under oblique incident light (OIL), showing pale iron-depleted soil, orange and yellow iron-stained areas and blackish iron and manganese impregnated soil.

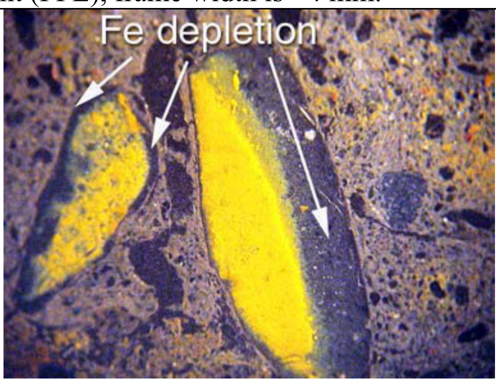


Fig. 5: Photomicrograph of M24; OIL picture showing iron-depleted flints (bleached stone rims). Frame width is ~4 mm.

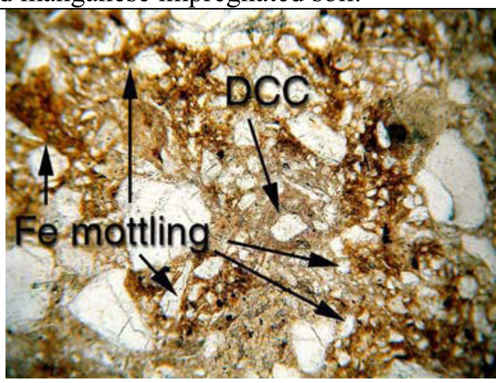
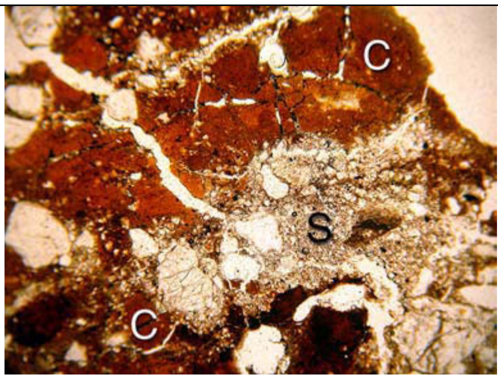
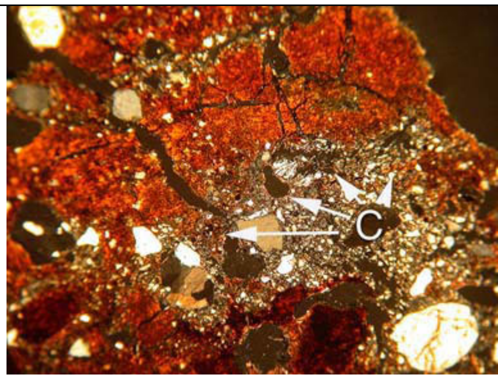
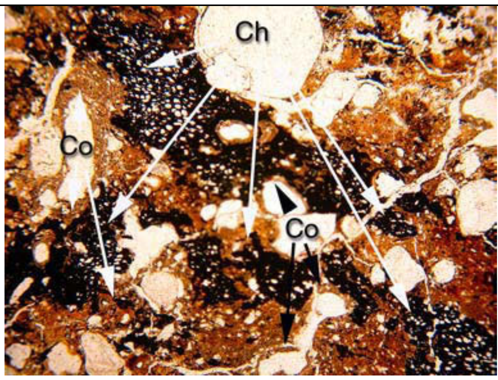
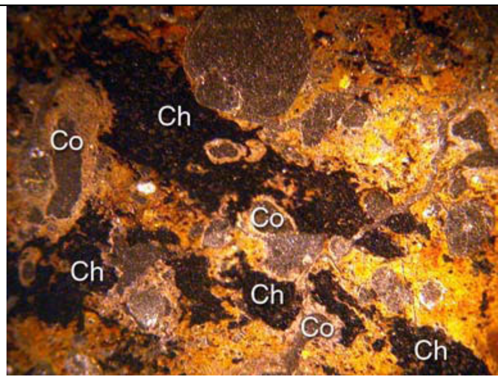
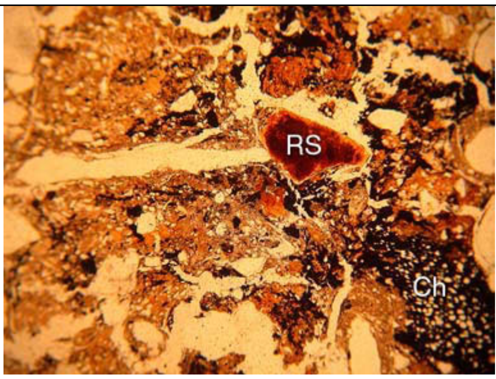
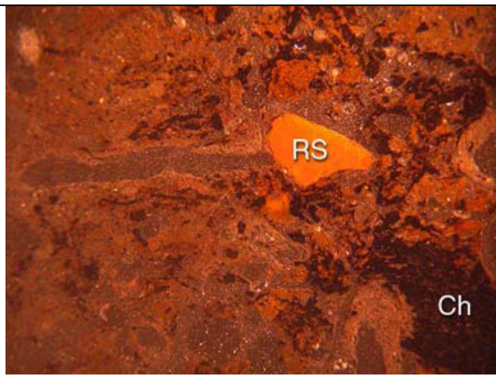
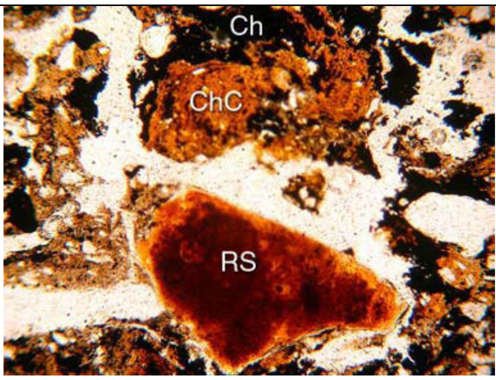
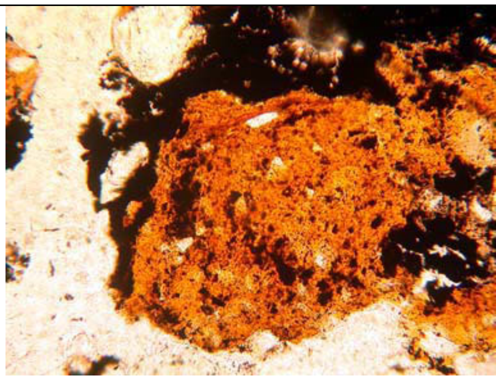
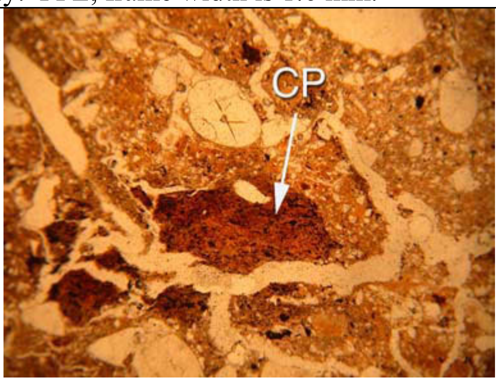
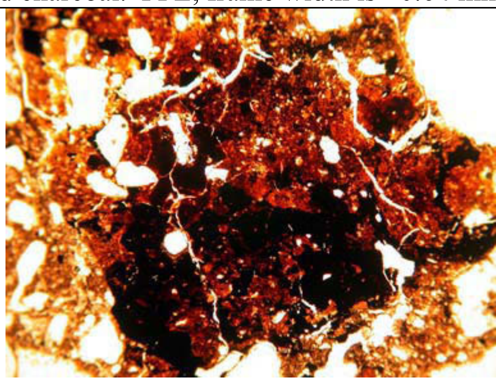


Fig. 6: Detail of microfabric of M24, showing pale Eb soil, iron mottling and dusty clay void coatings (DCC), indicative of small scale soil

	disturbance. Plane polarized light (PPL), frame width is ~1.6 mm.
 Fig. 7: Scan of M1 (Area 15, base of Cursus ditch fill; contexts 559303 and 559304); flint (F) gravel base, and mixed sands and clay fills (see Figs 9-10), with occasional charcoal. Width is ~50 mm.	 Fig. 8: Scan of M2 (Area 15, lower Cursus ditch fill; context 559304); both flints with bleached (B) margins and fine rubefied grains (see Figs 13-15; occasional to abundant charcoal. Width is ~50 mm.
 Fig. 9: Photomicrograph of M1 (559304), mixed basal fill of sands (S) – containing fine charcoal (earlier human activities?) – and clay (C). PPL, frame width is ~4 mm.	 Fig. 10: As Fig 10, XPL; mixed subsoil materials with coatings (C) and intercalations from disturbance; probably from a) the digging of the Cursus ditch, b) dumping to form the bank, and c) now as slumped soil at the bottom of the ditch.
 Fig. 11: Photomicrograph of M2 (559304),	 Fig. 12: As Fig 7, XPL; mixture of charcoal

Area 15 Cursus ditch fill; a dense mixture of charcoal (Ch) and reddish clay intercalations and void coatings (Co). PPL, frame width is ~4 mm.	and rubefied clay may be indicative of a ditch fill formed from inwash of soils relict of clearance by fire (local burning of trees).
 Fig. 13: M2, showing rubefied clayey soils containing wood charcoal (Ch) and rubefied (reddened) stones (RS). PPL, frame width is ~4 mm.	 Fig. 14: As Fig 8, OIL, showing rubefied stone (RS) and intercalated charcoal (Ch) and clay; possible inwash from local burned trees and disturbed soil.
 Fig. 15: Detail of Fig 9; rubefied stone, charcoal and orange coloured charcoal-rich clay. PPL, frame width is 1.6 mm.	 Fig. 16: Detail of Fig 15, showing charcoal and clayey infill rich in fine charred organic matter and charcoal. PPL, frame width is ~0.64 mm.
 Fig. 17: Photomicrograph of M2 (559304), Area 15 Cursus ditch fill; included charcoal-rich clayey papule (CP); a fragment of a textural pedofeature eroded into the ditch. PPL, frame width is ~1.6 mm.	 Fig. 18: Photomicrograph of M2 (559304), Area 15 Cursus ditch fill; iron and manganese stained 'black' clay that contains included fine charcoal. PPL, frame width is ~4 mm.

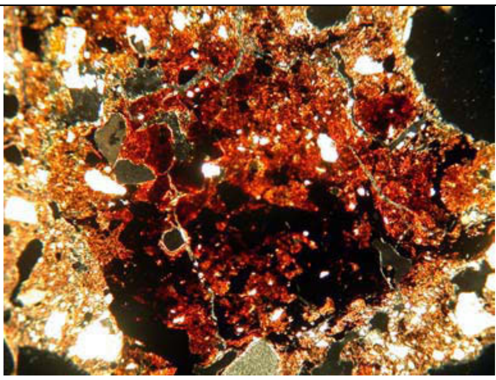


Fig. 19: As Fig 18, under XPL; note poorly birefringent Fe-Mn stained clay.

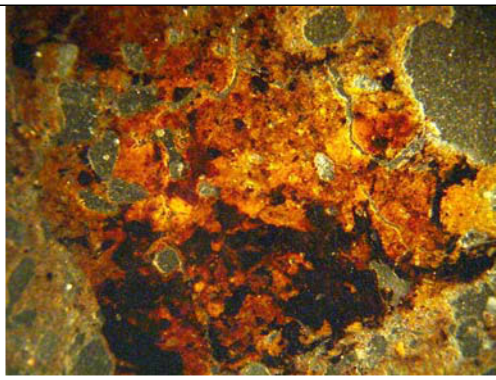


Fig. 20: As Fig. 18, OIL; note black Fe-Mn stained clay (sometimes replacing once-humic material) and iron-depleted surrounding soil material in this 'leached' ditchfill.

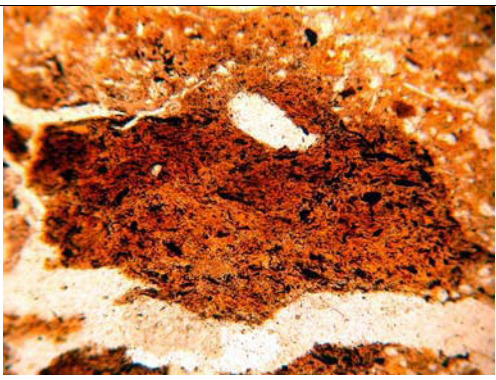


Fig. 21: Detail of Fig 17: note reddish clay and abundant fine charcoal content (rubefied clay and charcoal, preferentially mobilised by the weathering of ash and release of potassium (K). PPL, frame width is ~0.64 mm.

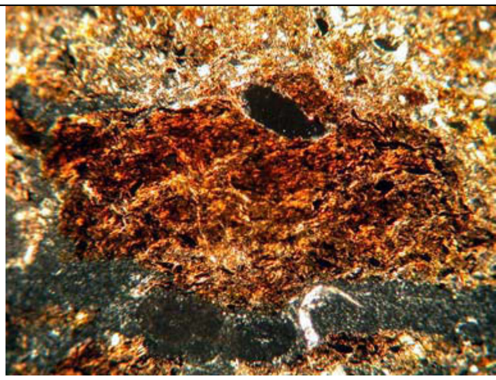


Fig. 22: As Fig 18, XPL; note birefringent pattern of papule.

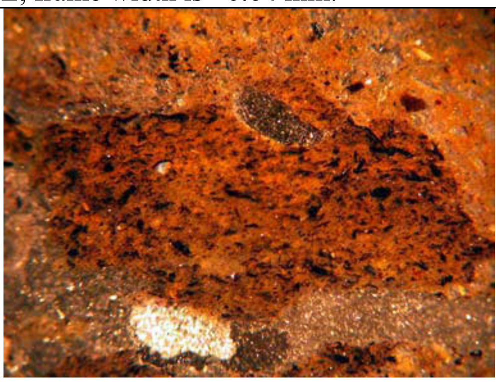


Fig. 23: As Fig 18, OIL; note reddish colours relict of burning(?).

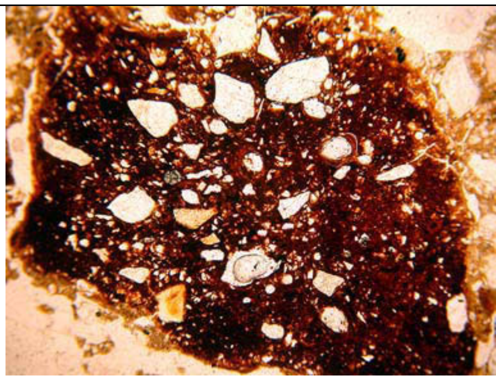


Fig. 24: Photomicrograph of M4 (559496), Area 15 Cursus ditch fill; dark red (rubefied) soil clast within iron-depleted (leached) ditch fill. PPL, frame width is ~4mm.

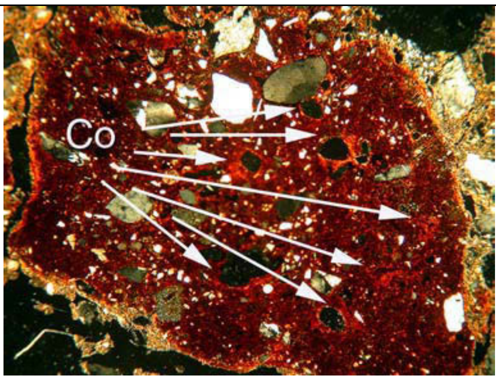


Fig. 25: As Fig 24, XPL, showing poorly birefringent (low interference colours) of rubefied soil fragment and textural pedofeatures of very abundant intercalations and associated void clay coatings (Co) – typical of disturbed soil that was then burned.

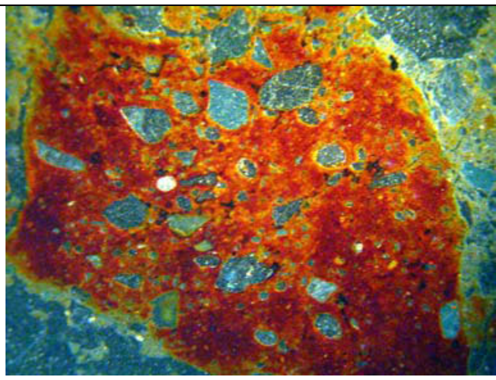


Fig. 26: As Fig. 25, OIL, showing red rubefied soil and yellow iron-depleted surrounding ditch fill soil; note textural pedofeatures are essentially still rubefied (little leached), except for some void and clast edges, indicating leaching is a post-depositional phenomenon.

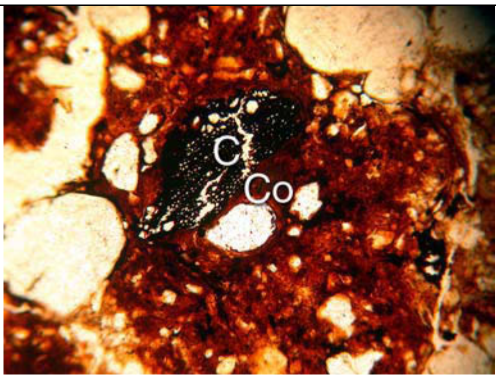


Fig. 27: M4; another rubefied soil clast, with an embedded charcoal (C) fragment and rubefied clay coatings (Co); a burned disturbed soil containing charcoal. PPL, frame width is ~1.6 mm.

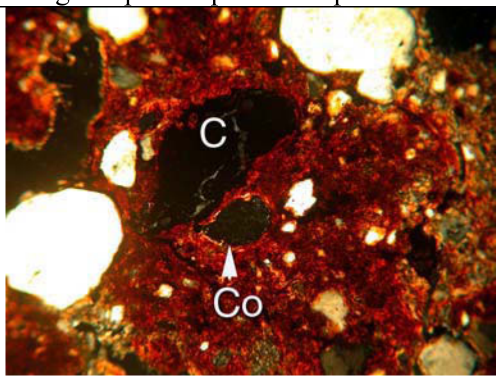


Fig. 28: As Fig 27, XPL, showing embedded charcoal (C) and intercalations (textural pedofeatures and associated thick clay void coatings (Co).

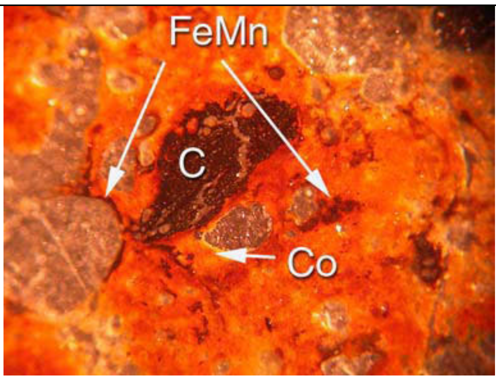


Fig. 29: As Fig 27, OIL, showing black tissues of charcoal fragment, a very thin yellow coloured (iron-depleted) edge to a mainly red void clay coating (Co) and further post-depositional blackish iron and manganese staining.

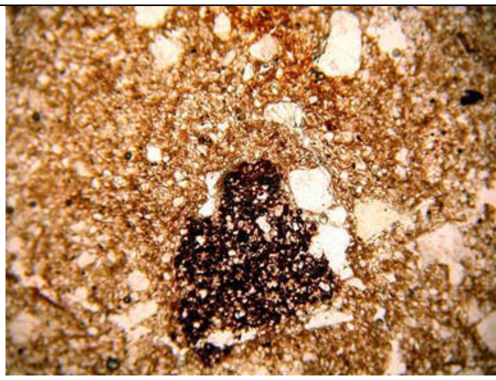


Fig. 30: Photomicrograph of M12 (587031), Area 49 Neolithic pit fill; generally moderately humic soil with included fragment of burned (blackened) humic topsoil. PPL, frame width is ~4 mm.

Terminal 5: Soil Micromorphology; Figures 31-62
(Macphail and Crowther, 2006)

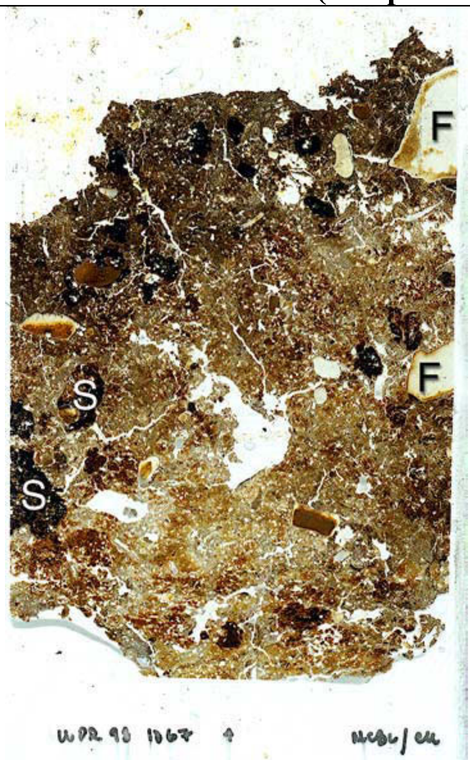


Fig. 31: Scan of Perry Oaks thin section WPR 1067 (Western Cursus ditch fill; 149008); fine loamy soil mixed with coarse flints (F), iron stained (once-humic crumb-like?) soil fragments and likely earthworm burrows (S)(see Figs 33-34); fine charcoal and clay inwash (see Figs 35-40) . Frame width is ~65 mm.

Fig. 32: Scan of Perry Oaks thin section WPR 1066B (Western Cursus ditch fill; 149007); coarse flints and much fine charcoal and clay. Frame width is ~65 mm.

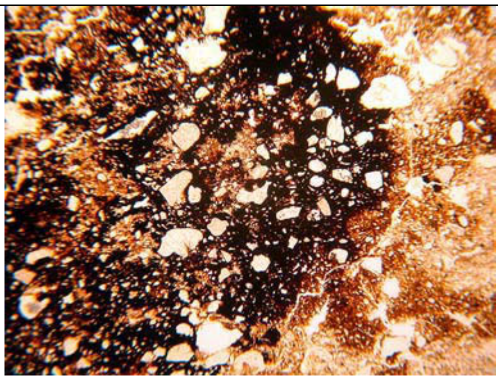


Fig. 33: Photomicrograph of WPR 1067 showing iron/iron and manganese impregnated once-humic(?) earthworm burrow fill. PPL, frame width is ~4mm.

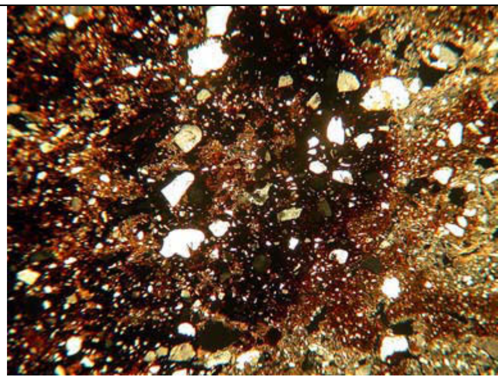
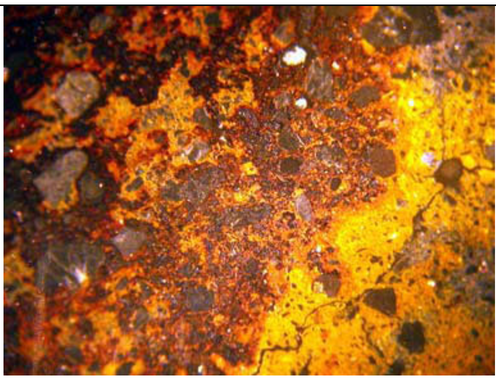
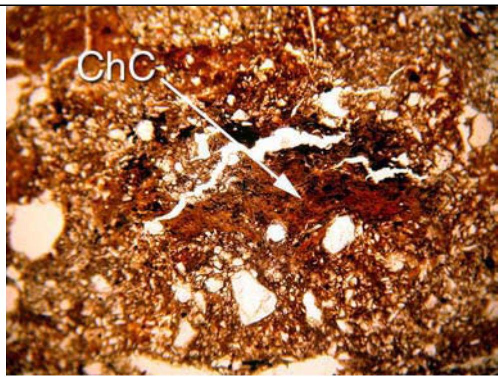
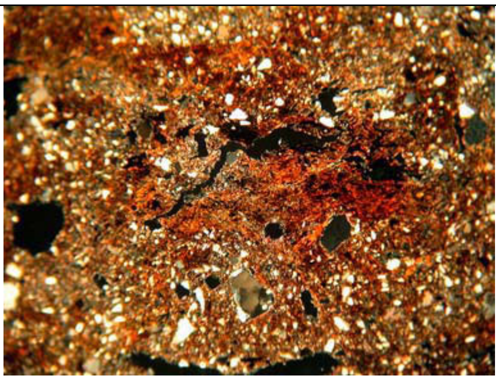
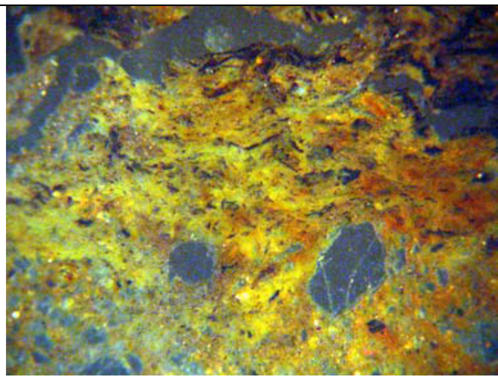
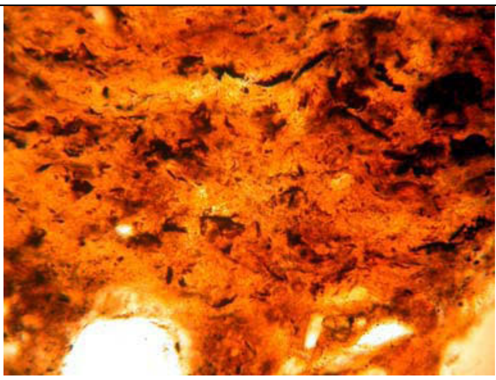
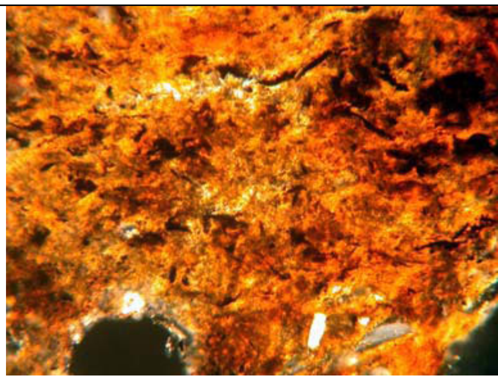


Fig. 34: as Fig 33, XPL, showing isotic character of iron impregnated soil.

 Fig. 35: as Fig 33, OIL, showing reddish brown iron/blackish iron and manganese impregnated soil, and moderately leached 'yellow' soil.	 Fig. 36: Photomicrograph of WPR 1067; intercalations and infills of charcoal-rich clay (ChC)(see Figs 21-23). PPL, frame width is ~4mm.
 Fig. 37: As Fig 36, XPL; note clayey intercalations.	 Fig. 38: detail of Fig 36, OIL. Note included fine charcoal. Frame width is ~ 1.6 mm.
 Fig. 39: Detail of Fig 37, showing concentration of fine charred organic matter and charcoal in clayey intercalation/papule. PPL, frame width is 0.64 mm.	 Fig. 40: As Fig 37, XPL.

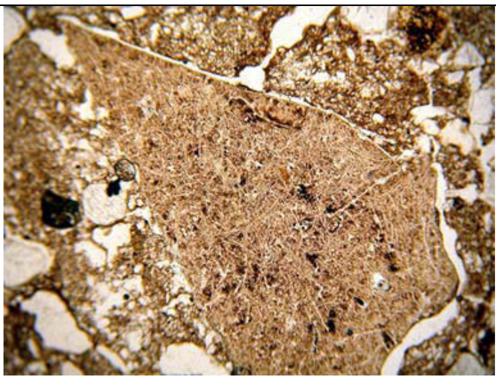


Fig. 41: Photomicrograph of M11 (EBA/MBA enclosure ditch (context 635056); burned flint within slaked weakly humic soil. PPL, frame width is ~4 mm.

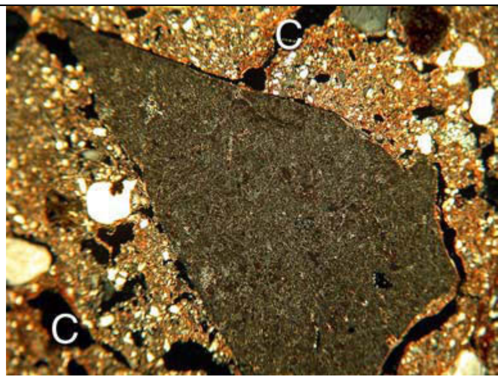


Fig. 42: As Fig 41, XPL, showing textural pedofeatures – dusty clay void coatings (C) associated with soil slaking.

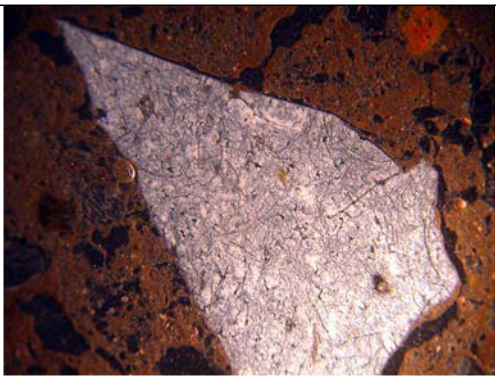


Fig. 43: As Fig 41, OIL – whitened burned and fire-cracked flint.

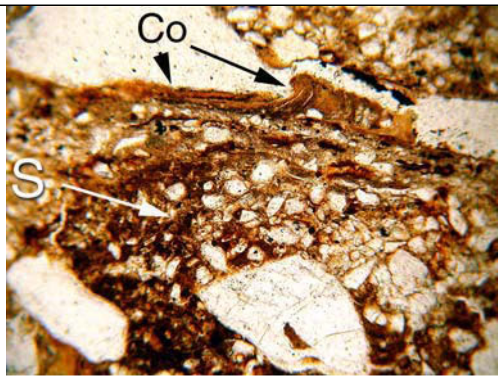


Fig. 44: Photomicrograph of M22 (Area 26 MBA trackway; context 530025); detail of included soil clast (S) and laminated humic(?), phosphate-rich(?) void clay coatings (Co); resulting from animal traffic. PPL frame width is ~1.6 mm.

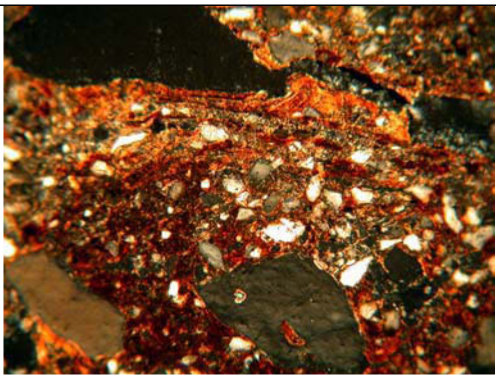


Fig. 45: As Fig 44, XPL.

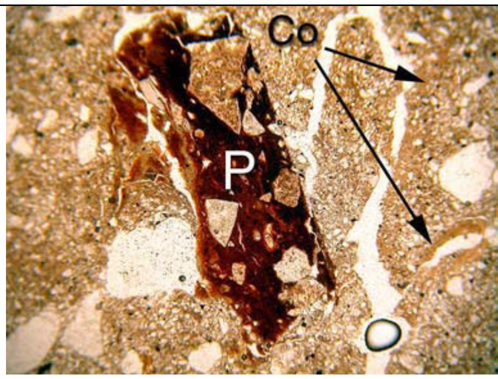


Fig. 46: Photomicrograph of M9 (Area 58, D shaped enclosure 639085); pot fragment (P) in slaked soil (intercalations and void coatings [Co]). PPL, frame width is ~4 mm.

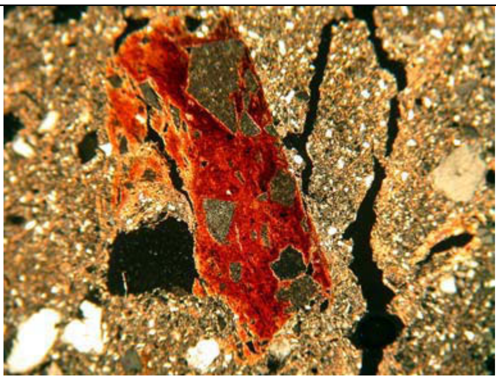


Fig. 47: As Fig 46, XPL; note flint temper.

Fig. 48: As Fig 46, OIL; note burned flint as temper.

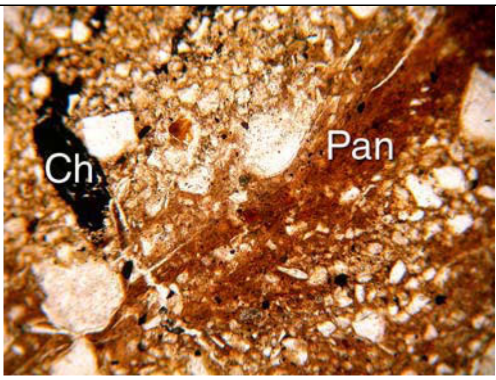


Fig. 49: Photomicrograph of M19 (Twin Rivers EBA barrow ditch fill section 58010); heterogeneous fill that includes charcoal (Ch) and textural pedofeatues such as this sloping dusty clay pan (Pan). PPL, frame width is ~1.6 mm.

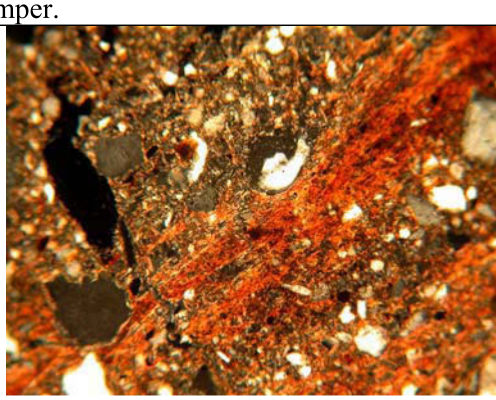


Fig. 50: As Fig 49, XPL; textural pedofeatures are indicative of (animal?) trampling of this fill.

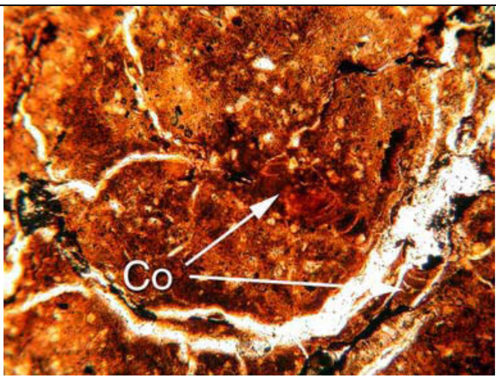


Fig. 51: Photomicrograph of M17B (Area 58 M/LBA gully; context 858155); detail of ‘humic’ clay fragment and associated clay coatings/void infills (Co). PPL, frame width is ~1.6mm.

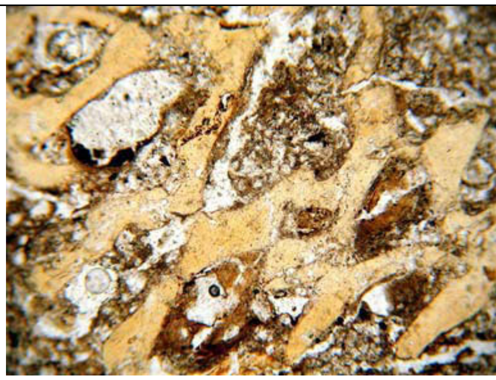


Fig. 52: Photomicrograph of M17A (Area 58 M/LBA gully; context 858155); bone concentration/possible animal scat. PPL, frame width is ~1.6 mm.

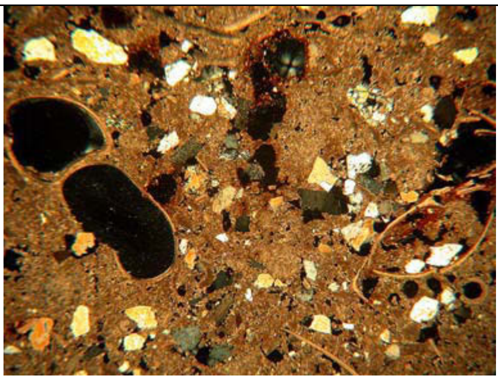


Fig. 53: Photomicrograph of M20B (LFA05 MBA ditch; context 725001); mixed calcareous (originally tufa) deposit containing mollusk shells and shell fragments. XPL, frame width is ~6 mm.

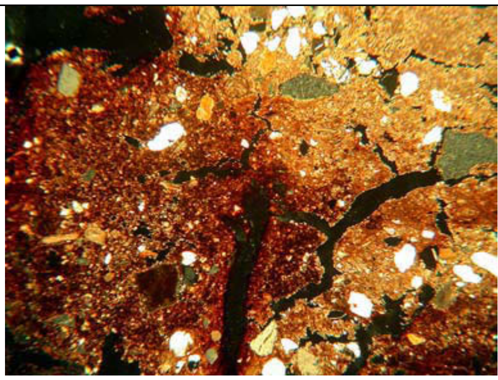


Fig. 54: Photomicrograph of M20B; calcareous fill of tufa origin, with post-depositional iron impregnation and decalcification. XPL, frame width is ~4 mm.

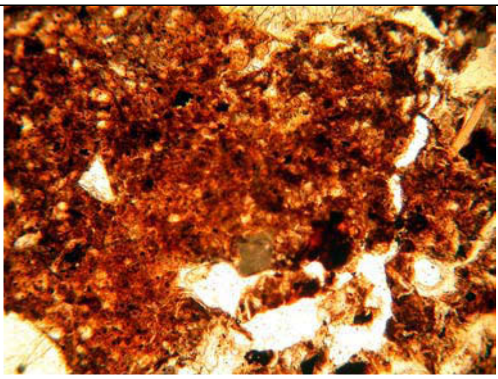


Fig. 55: Photomicrograph of M20B; detail of humic clay containing fine charcoal and charred organic matter (resulting from a landscape managed by fire). PPL, frame width is ~1.6 mm.

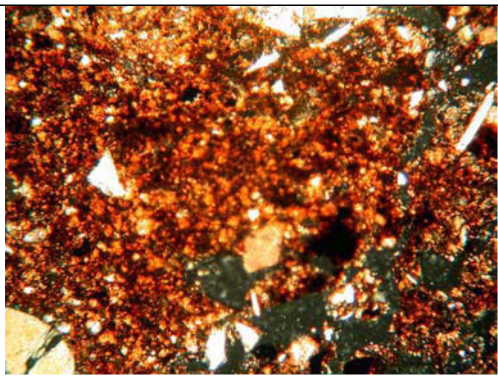


Fig. 56: As Fig 55, XPL, showing partial impregnation of micritic calcite (from tufa formation).

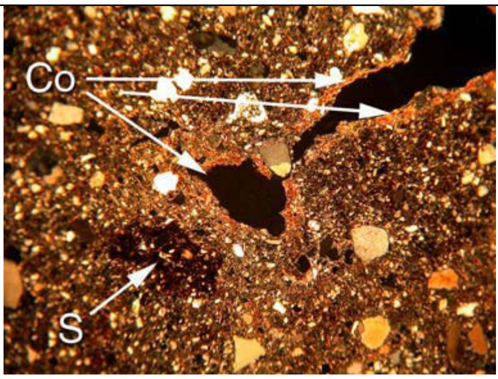


Fig. 57: Photomicrograph of WPR 1085 (Perry Oaks BA field system ditch; lower part of context 148014); mixed soil fill that includes humic soil fragments (S) and textural pedofeatures (intercalations and void coating – Co) indicative of *in situ* trampling. XPL, frame width is ~4mm.

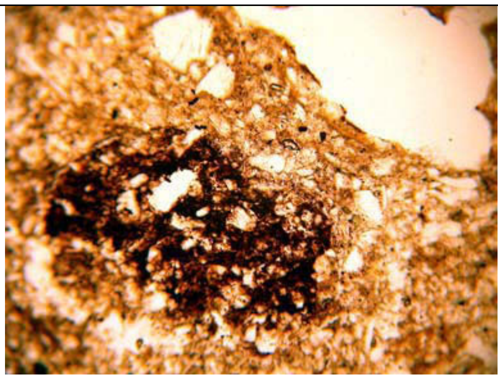
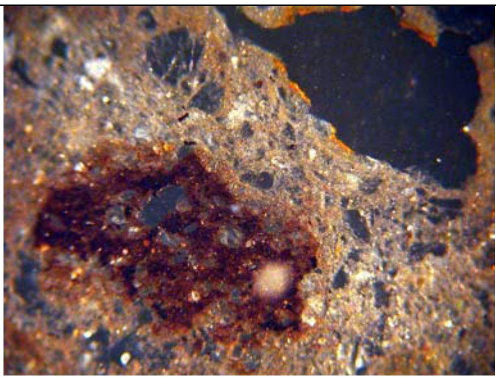
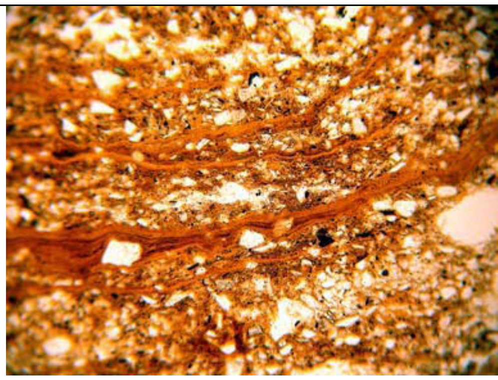
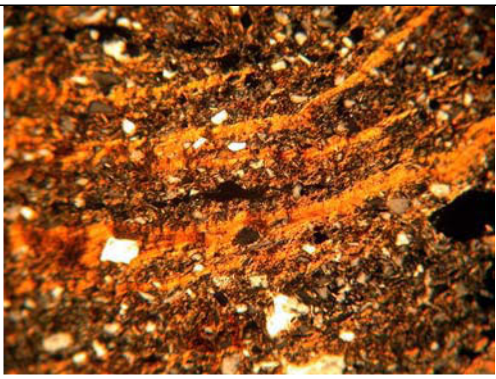
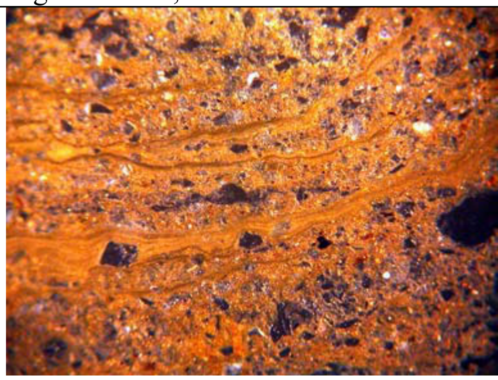


Fig. 58: Detail of Fig 57 showing burned humic topsoil fragment and background soils rich in fine charcoal (of arable soil origin?). PPL, frame width is ~1.6 mm.

 Fig. 59: As Fig 58, OIL; note blackened burned topsoil and included rubefied mineral grains, and pale background soil of Eb horizon origin.	 Fig. 60: Photomicrograph of WPR 1083B (Perry Oaks BA field system ditch; context 148014); detail of laminated textural pedofeatures, pans of alternating laminated clays and silt loams; fine charcoal is present throughout. PPL, frame width is ~1.6 mm.
 Fig. 61: As Fig 60, XPL; pan formation is indicative of *in situ* trampling of a wet ditch fill.	 Fig. 62: As Fig 60, OIL.

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