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Archaeology on the A303 Stonehenge Improvement

Appendix 1: Soil

by Richard I. Macphail and John Crowther

Wessex Archaeology

Archaeology on the A303 Stonehenge Improvement

By Matt Leivers and Chris Moore

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Wessex Archaeology 2008

This volume is available from Wessex Archaeology
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Appendix 1: Soil

Richard I. Macphail and John Crowther

(Editorial note: this report was prepared before the analysis of the lithics from the site had been completed. Interpretative differences between this report and the main text are due to the finer dating that resulted from the lithic analysis)

Soil micromorphology, chemistry, particle size and magnetic susceptibility

Summary

Six thin sections and four bulk samples were analysed from two sites near Stonehenge. Remarkably, the investigated soil sequences record rare examples of a prehistoric decalcified soil cover, in a now generally rendzina-dominated landscape which reportedly has been extant since the Neolithic. At Site 54379 in the valley of the Avon, Early Neolithic phosphate-enriched animal trampled soils developed over river alluvium. Ensuing probable local cultivation (alongside likely continuing stock management) led to colluviation, and evidence of *in situ* ard-cultivation in the accreting soils is recorded. At site 48067, a bisequal soil profile had formed in reddish clay (of weathered chalk origin) and silt (loess), by the early Holocene. This soil was buried by a prehistoric humic colluvium of probable arable origin. These two soils give rare insights into an environment that is generally believed to have been an open pastoral rendzina landscape by the Neolithic, and where any cultivation impact has not been evident. These are also unique examples of *in situ* animal herding and cultivation, and demonstrate how any remaining post-glacial decalcified brown soils could have been eroded under human impact from Neolithic times onwards.

Introduction

Three soil monoliths from the A303 Stonehenge Improvement, Wiltshire were received from Wessex Archaeology. Monoliths 30 and 31 came from a 0.46 m thick soil sequence containing a Late Mesolithic/Early Neolithic flint scatter at Site 54379 (NW of Amesbury), which overlies alluvium and is sealed by some 0.70 m of later soil/colluvium. Monolith 15000 at Site 48067 (300 m south of Stonehenge) sampled the soil in a solution hollow in chalk, and up through the palaeosol into stony colluvium(?). This soil, which contains less well dated prehistoric flints, occurs below some 0.35 m of later soil/colluvium and topsoil.

Samples and methods

Monolith 15000 came from test pit 121 at Site 48067, some 300 m due south of Stonehenge, whereas monolith samples 30 and 31 were collected from Trench 3 at Site 54379 north-west of Amesbury. On receipt, monoliths 30, 31 and 15000 were evaluated, then subsampled for bulk analyses: context samples 15000/12103; 30/302, 30/303 and 31/304 (Tables 1–3). Sample 15000 was poorly stable, hence only one bulk sub-sample was taken. The monoliths were then sub-sampled for thin section analysis, with ~16 cm lengths being taken as follows (Tables 4–5):

15000 – 0.19–0.37 m depth, Contexts 'upper and lower' 12103 (2 thin sections: M15000A+B),
30 – 0.06–0.23 m depth, Contexts 302 and 'upper' 303 (2 thin sections M30A+B),
31 – 0.30–0.46 m depth, Contexts 'upper and lower' 304 (2 thin sections M31A+B).

Chemistry, grain size and magnetic susceptibility
Analysis was undertaken on the fine earth fraction (ie <2 mm) of the samples. Particle size was determined using the pipette method on <2 mm mineral (peroxide-treated) soil (Avery and

Bascomb, 1974). 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) in which the phosphate concentration of a sample is measured first without oxidation of organic matter (P_i), using 1N HCl as the extractant (after a slight excess of HCl had been added to remove the carbonate present); and then on the residue following alkaline oxidation with sodium hypobromite (P_o), using 1N H_2SO_4 as the extractant. LOI (loss-on-ignition) was determined by ignition at 375^{o}C for 16 hours (Ball, 1964) – previous experimental studies having shown that there is normally no significant breakdown of carbonate at this temperature; particle size was determined using the pipette method on <2.00 mm mineral (peroxide-treated) soil (Avery and Bascomb 1974); pH (1:2.5, water) was determined using a combination electrode; and carbonate content was estimated by observing the reaction when a few drops of 10% HCl are applied (Hodgson 1974).

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 data, particularly in cases where soils have widely differing χ_{max} values (Crowther and Barker 1995; Crowther 2003). χ_{conv} values of ≥ 5.00% are often taken as being indicative of some degree of susceptibility enhancement. A Bartington MS2 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).

Soil micromorphology
Three ~160 mm long samples were impregnated with a clear polyester resin-acetone mixture; samples were then topped up with resin, ahead of curing and slabbing for 75x50 mm size thin section manufacture by Spectrum Petrographics, Vancouver, Washington, USA (Goldberg and Macphail 2006; Murphy 1986). 14 thin section samples were selected from all the resin-impregnated material, the resin impregnated sawn blocks being used to select the best and most representative material. Thin sections (Figs 1–2) were analysed using a petrological microscope under plane polarised light (PPL), crossed polarised light (XPL), oblique incident light (OIL) and using fluorescent microscopy (blue light – BL), at magnifications ranging from x1 to x200/400. Thin sections were described, ascribed soil microfabric types (MFTs) and microfacies types (MFTs)(see Tables 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). Ancient soil formation on the Chalk and sometimes drift-covered chalklands of Wiltshire and other counties of southern England have come under much scrutiny in the past (Macphail 1993; 1999; see also reviews of soil studies by Cornwall, Evans, and re-examinations of Cornwall's thin sections; Macphail 1986; 1987; 1990), and more recently at Cranborne Chase, Dorset and more locally at Durrington Walls, Wiltshire (French and Lewis 2005; French *et al*. 2007; French pers. comm. 2008).

Results and Discussion

Local soils
Site 48067 (15000), south of Stonehenge, is located in a mapped area of the Icknield soil association (rendzinas) on chalk, but is a soil that is better described as a typical argillic brown earths (Charity 1 soil series) developed on flinty silty drift (Jarvis *et al*. 1983; 1984)(see below). In contrast, Site 54379 (30 and 31) is located in an area of mapped calcareous gley alluvial soils (Frome 1 soil association) in the valley of the River Avon on chalky and gravely river alluvium.

Chemistry, grain size and magnetic susceptibility

General characterisation of samples

The analytical results are presented in Tables 1–3. The contexts sampled are very slightly to slightly calcareous (estimated carbonate: 0.5–2.0%), alkaline (pH range: 7.5–8.3) and predominantly minerogenic (LOI range: 2.11–4.46%) clay loams (the latter based on the three samples from site 54379). There is little difference in particle size between the three samples and the sand fraction in each case is dominated by fine sands. The phosphate-P concentrations are not especially high, but do display quite marked variability (range: 0.529–1.55 mg^{-1}), which is likely to reflect a degree of enrichment in certain contexts. The proportion of inorganic phosphate (phosphate-P_i:P range: 58.3–74.2%) is somewhat lower than is often encountered in such minerogenic archaeological contexts, and this suggests that only somewhat limited enrichment of the inorganic fraction has taken place through mineralisation of organic phosphates. The samples display quite wide variability in χ (range: 11.1–63.4 x 10^{-8} SI) and χ_{conv} (range: 0.730–3.69%), though none of χ_{conv} values exceed 5%, which is often taken as being indicative of enhancement through heating/burning (Crowther, 2003).

Observations on individual samples

- **Site 54379 – Samples 302 and 303:** low organic matter content (maximum LOI: 2.27%); only very slightly calcareous; and no evidence of phosphate enrichment or magnetic susceptibility enhancement.
- **Site 54379 – Sample 304:** low organic matter content (LOI: 2.11%); higher carbonate concentration than any of the other samples (slightly calcareous, 2.0%), which may reflect a more calcareous parent material and/or the fact that the context has been less heavily de-calcified through leaching; no evidence of magnetic susceptibility enhancement; and likely evidence of phosphate enrichment (phosphate-P: 1.55 mg^{-1}). The results of the thin section analysis provide some insight into the source(s) of enrichment.
- **Site 48067 – Sample 12103:** notably higher organic matter content (LOI: 4.46%) which, in view of the low phosphate content, seems likely to be the result of natural organic accumulation/preservation (e.g. perhaps related to local waterlogging at time of formation and/or post-deposition); and notably higher magnetic susceptibility enhancement – though (as noted above) not sufficient to provide clear evidence of heating/burning.

Soil micromorphology

Description and count data are presented in Tables 3–5. These are supported by Figs 1–16, and archive photomicrographs

Site 48067

12103 lower (M15000B) is composed of a mixture of slightly flinty mainly reddish argillic (clayey) subsoil Bt/Ct/*ß* horizon soil and brownish slightly humic silt loam (Eb, Eb&Bw) horizon soil (Figs 3–6). The argillic soil includes clay-embedded coarse flint, abundant (phase 1) reddish finely dusty clayey textural pedofeatures – intercalations, coatings and infills. The silt loam is also characterised by (phase 2) brown very dusty textural pedofeatures. It was also noted that much of the later porosity is affected by a third series of very dusty clay coatings and infills that contain very fine micro-contrasted particles (including charcoal; Fig. 6). Two example of coarse burned flint and rare traces of charcoal occur. Papule fragments of earlier-formed textural pedofeatures and rounded iron and manganese nodules are present, and there has also been overall fine iron and manganese impregnation of the soil.

This microfabric can be described as essentially a decalcified argillic brown earth that had formed in moderately flinty loess in a solution hollow in chalk (cf. Charity 1 soil series). Reddish *ß*clay was formed by the dissolution of chalk (Catt 1979; 1986; Duchaufour 1982, 148, 152), and this, with associated argillic Bt/Ct soil of the soil's lower sequum, had become strongly mixed with silt loam (upper sequum). The presence of papules (fragmented clayey textural pedofeatures) and rounded iron-manganese nodules indicate both soil disturbance and colluviation (periglacial activity and slope movement; more recent tree-throw? Catt 1979; 1986; Macphail and Goldberg 1990; Mücher 1974). Such reddish argillic soils have been observed on chalk at Cranborne Chase (French *et al*. 2007; Lewis pers. comm.) as well as at Ashcombe Bottom, East Sussex, where both lower sequum reddish clay and upper sequum silt loam loess occur (Macphail 1992; 197–205, figs 18.3–6); these are not considered to be palaeoargillic soils because the reddish clay (cf. *terra fusca*; Duchaufour 1982) probably did not form before the Devensian (Avery 1990, 109). At Site 40867 the rare traces of charcoal and a third phase of textural pedofeatures (very dusty clay containing very fine charcoal) indicate ensuing human impact, including colluvial burial of the Late glacial–Early Holocene soil. The presence of burned (prehistoric) flint may be accidental mixing from slightly higher levels, but reinforces the view that anthropogenic activity is likely associated with this phase of colluviation.

12103 upper (M15000A) is moderately stony silt loam, which becomes more humic upwards from SMT 1b to SMT 1c; there has also been probable earthworm mixing of the two microfabrics. Inclusions of burned (calcined) flint and the increase in amount of humic soil (hence the relatively high 4.46% LOI), which contains very fine charcoal, is possibly consistent with 3.69% χ_{conv}. The lower part of thin section includes traces of reddish argillic soil with silt loam-dominated soil, and associated relict intercalations. Upwards, the humic soil also shows very dusty intercalations and void infills that resemble those found as phase 3 textural pedofeatures in 12103 lower (M15000B; Figs 7–8).

Upper Context 12103 is apparently composed of a humic (mid-?) Holocene palaeosol topsoil buried below gravel layer 12102. It contains examples of burned flint and fine charcoal, with relict textural pedofeature evidence of having a disturbed colluvial origin. There are no indications suggesting that this humic colluvial soil horizon formed because clearance caused soil erosion (ie, there are no coarse soil clasts from different horizons or coarse charcoal/burned soil/enhanced magnetic susceptibility; Macphail 1992; Mücher 1974), but rather that this a result of accreting well-sorted hillwash likely produced by arable land use (cf. Farres *et al.* 1992). Clearly, loessic silty soils are susceptible to prehistoric (Allen 1992; Macphail 1992; Weir *et al*. 1971) and modern (Evans 1992) erosion. It seems logical that continuing agricultural impact led to the deposition of overlying gravel Context 12122. Upper Context 12123 thus resembles humic cultivation colluviums that are more characteristic of dry valley fills outside of Wessex (Allen 1992; 1994; Bell 1983, 1992), such as found in Sussex and Kent, one example being later prehistoric colluvium at White Horse Stone, Kent (Macphail and Crowther 2004).

It has been suggested that the dearth of colluvium, especially non-calcareous colluvium, in the Wessex region is paralleled by a lack of a well-developed brown soil cover by the Neolithic, when rendzina soils dominated an open and pastoral landscape (Allen 1992; French and Lewis 2005; French *et al*. 2007). Unpublished studies by C. French at nearby Durrington Walls, reinforce this view (French pers. comm., February 2008). The significance of Site 48067 in this debate will be discussed below, after the integrated results from Site 54379 are described.

Site 54379

304 (top of alluvium; M31B and lower half of M31A) is a poorly sorted, once moderately compact, clay loam containing coarse silt, very fine to coarse sand (Table 3) and flint gravel and flakes. It contains an example of very coarse charcoal (>13 mm) and much probable totally Fe-Mn mineralised amorphous organic matter. The mineralogy is dominated by quartz and mica, a marked occurrence of weathered glauconite sand, and example of sand-size chalk. The last, with the occurrence of rare calcite grains has led to an alkaline pH and a relatively high carbonate content, although no calcareous fine fabrics are present. In fact, the microfabric is non-calcareous and dominated by textural pedofeatures (dusty brown to very dark reddish dusty brown coatings and infills, some showing sub-horizontal orientation and others as vertical concentrations associated with infilled burrows; Figs 9–12). The soil has also been affected by major textural (form of elutriation) and iron depletion, with some strong leaching along major (current) voids; there has also been concomitant major iron and iron and manganese impregnation, the last associated with coarse patches of probable amorphous organic matter.

These are poorly sorted local silts and alluvial sands, which include weathered glauconite (see Fig. 13) and chalk that are presumably more abundant in the underlying calcareous gley alluvial soils (River Avon); Greensand geology occurs upstream in the Vale of Pewsey and is a probable source of the glauconite. Soil accretion, mixing and a predominant amount of textural pedofeature formation is believed to be the result of animal trampling. For example, detailed studies of Neolithic and Bronze Age barrow-buried soils at Raunds (Nene valley, Northamptonshire) demonstrated the probable association between similar dark reddish textural pedofeatures (which from a series of microprobe investigations and bulk analyses were shown to be P-enriched) and stock concentrations (Courty *et al*. 1994; Macphail 2003a; forthcoming). There was also corroborative evidence of stock concentrations at these sites from insect (dung beetles), macrobotanical, faunal and pollen studies (Healy and Harding forthcoming). Similar concentrations of dark coloured textural pedofeatures were noted in an Iron Age trackway in Scania, along with enhanced phosphate concentrations (Macphail 2003b), and associated microprobe investigations have also been applied to trackways at Stansted, Essex and Terminal 5, Middlesex, and a supposed river crossing point at Bad Homburg, Germany (Macphail and Crowther 2003; 2006; 2008). Typically, stock trampling is associated with high concentrations of textural pedofeatures, and can produce soil poaching features, compaction and surface crusts (Beckman and Smith 1974; Patto *et al*. 1974; Schofield and Hall 1985; Valentin 1983). Pene-contemporaneous burrowing by small meso-fauna, including possible fauna such as dung beetles, appears to be evident at Site 54379, with the now totally iron and manganese-replaced supposed amorphous organic matter being concentrated in these burrows along with textural pedofeature evidence of contemporary soil inwash. Context 304 also shows phosphate-P enrichment (Table 1); there are no micro-inclusions of bone, relict ash or cess to indicate a middening source for this phosphate. This suggested animal trample-induced soil accretion also caused inclusion of a coarse piece of charcoal and Late Mesolithic–Early Neolithic flint artefacts. Intermittent site wetness/fluctuating water tables led to iron mottling and organic matter replacement by iron and manganese. Lastly, it can be noted that the very abundant iron and manganese features are much less evident in overlying Contexts 303 and 302.

303 The base of 303 (upper M31A) is marked by a concentration of flint (flakes), and although the soil microfabric is quite similar to that of 304, it contains less charcoal and much less iron and manganese replaced amorphous organic matter.

Continuing soil accretion is evident, but although animal trampling (Fig. 13) is probably a component factor (trampled flint-rich 'surface'? see Fig. 1), the reduction in organic matter (ie, as Fe-Mn replaced amorphous OM) and phosphate input (Tables 1–2) may suggest colluviation induced through erosion has become a more dominant process. Colluviation seems to have also produced this putative flint concentration, and may possibly be linked to a changing land use (cultivation?; see below).

303 upper (lower half of M30B) is a moderately poorly sorted clay loam with very coarse iron-stained flint (including one rubefied by burning) and rare traces of charcoal. It is characterised by fewer textural pedofeatures, and these are mainly dirty brown in colour with few examples of dark reddish stained ones. There is also an example of an amorphous yellow, likely iron-phosphate infill.

Upper 303 seems to record continued soil accretion, but which appears to be more strongly associated with the colluvial inputs rather than being animal-trampled soil (cultivation?, see below). Nevertheless, there seems to be continuing likely additional inputs from animal trampling and associated secondary phosphate deposition.

302 (upper M30B and M30A) is similarly composed of a moderately poorly sorted clay loam (Table 3) with very few flint, including burned examples. Its fine fabric differs from that in 303 by containing a slightly increased amount of very fine charcoal. It is a compact soil and apparently shows examples of horizontal and sub-horizontal small to large (max 23 mm long) shear planes, and sometimes these are associated with dusty clay concentrations (Figs 2, 14–15). There are also generally very abundant textural pedofeatures of a dusty brown type, some infilling pene-contemporaneous burrowed soil. There are only few dark reddish blackish textural pedofeatures, and these only where Fe-Mn stained (once organic?) soil is present. There are also traces of fine ferruginised roots.

Context 302, like much of 303, can be tentatively described as a ploughsoil colluvium that is mainly composed of poorly humic subsoil clay loam soil, but which contains some fine charcoal and burned flint. The shear planes and overall concentration of textural pedofeatures (Fig. 16) may imply *in situ* ard ploughing, as described in Beaker colluvium beneath ard marks in similar soils at Ashcombe Bottom (Allen 1994; Macphail 1992), and as produced experimentally by ard ploughing (Lewis 1998). The association of textural pedofeatures and ancient tillage of poorly stable (eroded) subsoils and colluvium formed from eroded subsoils is well documented; experimental cultivation effects on loess soils in the Hambacher Forst, Germany and the classic loess-drift on Chalk-type Neolithic cultivation site of Kilham, Yorkshire, also need to be considered (Dimbleby and Evans 1974; Gebhardt 1990; 1992; Kwaad and Mücher 1977; 1979; Macphail 1998; Macphail *et al*. 1990; Romans and Robertson 1975; 1983)(Cornwall's Kilham thin section is also reviewed in Macphail 1986). It can be suggested that the presence of Fe-Mn stained soil and associated darkish textural pedofeatures may indicate the occasional presence of stock; but as herded animals or as serendipitous deposits from traction animals, is a moot point.

Overview

There are models of land-use for the topographic variations present in the chalklands of southern England (Barker 1985, fig 74; Whittle 1997), and a variety of soil types have been investigated from Neolithic and Beaker sites, which include valley silty gleys (Silbury Hill), rendzinas, and calcareous brown earths, and occupation sites (Belle Tout, Easton Down, Maiden Castle, Windmill Hill; eg, Evans 1972; Macphail and Linderholm 2004; Cranborne Chase and Durrington Walls; French and Lewis 2005; French *et al*. 2007; French pers. comm. 2008). At the two A303 Stonehenge sites, there are unusual examples of non-calcareous soil accumulations in a landscape that is generally rendzina-dominated (Icknield soil association; Jarvis *et al*. 1983), and one that is thought to have produced very little colluvium (Allen 1992), presumably because it only had a thin decalcified drift cover. The rendzinas of the region have a silt content that is believed to have a loessic origin (Catt 1978). This is also an area where a stable, rendzina-dominated pastoral landscape was often formed by the Neolithic, as based upon numerous soil studies in the area (see above; French pers. comm.). These two A303 prehistoric locations, including the Late Mesolithic/Early Neolithic site, thus provide some unique insights into the use, and impact upon, decalcified brown soils prior to the almost universal development of shallow calcareous rendzinas and brown calcareous soils. Moreover, these two decalcified brown soils have effectively recorded ancient land use.

Catt (1978; 1979; 1986) has suggested that much of the loess cover of southern England had been eroded into valleys by the early Holocene, and clearly Neolithic Silbury Hill buries a valley gley formed in loessic silt (review of Ian Cornwall's thin section in Macphail 1986, and unpublished report to Cardiff University). South of Stonehenge, Site 48067 records both the presence and character of the bisequel (clayey *ß*/Bt and silty Eb&Bw) late glacial/early Holocene argillic brown earth, with the overlying prehistoric humic hillwash apparently recording the erosion of this decalcified soil cover. Traces of such loessic brown soils occur as decalcified turf fragments in ditch fills at Neolithic Millbarrow, Wiltshire (Macphail 1994), while Neolithic clearance and cultivation(?)-induced erosion of loess was reported at Pegwell Bay, Kent. Unfortunately, the assumed cultivation and associated hillwash at site 48067 can only be broadly dated to prehistory (Barnett and Norcott, pers. comm.).

At site 54379, however, soil accumulation which can be dated from the flint scatter to the Late Mesolithic/Early Neolithic seems to be associated with a primary land-use of stock management and their passage effects at this location, presumably associated with grazing and drinking along the valley of the Avon. This is both consistent with models of Neolithic valley land use on chalklands (Barker 1985, fig. 74; Whittle 1997) and on floodplains in general (cf. Neolithic Raunds, Northamptonshire; Macphail and Linderholm 2004). Ensuing local (upslope) cultivation is presumed to have triggered additional colluviation that deposited flints, and which produced a colluvial soil that was ard-ploughed *in situ*. The 302, 303, and 304 sequence thus records: stock concentrations (304), presumed cultivation-induced colluviation (303) and *in situ* cultivation of this accreting colluvium (302), with the likely continuing presence of stock throughout (303 and 302). It has been suggested that after clearance of the Mesolithic woodland, soils of this chalkland region were primarily stable rendzinas used for pastoralism (French and Lewis 2005), and there are plenty of other buried soil records to support this view (Evans 1972; Macphail 1987; Macphail and Linderholm 2004). Nevertheless, some Neolithic cultivation of 'upland' chalk soils was inferred at Easton Down, Wiltshire (Macphail 1993), and here near Amesbury, there are clear indications that cultivation was taking place in the Early Neolithic which was causing active erosion of a locally present decalcified brown soil cover in the Avon valley.

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Acknowledgements

The authors wish to thank Dr Charles French (Cambridge University) for access to his unpublished material on Durrington Walls, and his views on the Neolithic soil cover of the region. Cathie Barnett and Dave Norcott (Wessex Archaeology) for site information; thin sections were manufactured by Spectrum Petrographics, Vancouver, Washington State, USA.

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

Sample	*LOI*[a] *(%)*	*pH*[b] *(1:2.5, water)*	*Carbonate*[b] *(estimate) (%)*	*Phosphate-P*[c] *(mg g^{-1})*	*χ*[d] *(10^{-8} SI)*	*χ_{max}* *(10^{-8} SI)*	*χ_{conv}*[d] *(%)*
Site 54379							
302	2.19	7.6	0.5	0.825	15.6	1090	1.43
303	2.27	7.7	0.5	0.958	15.5	1650	0.939
304	2.11	8.3*	2.0*	1.55*	11.1	1520	0.730
Site 48067							
12103	4.46*	7.5	0.5	0.529	63.4	1720	3.69

[a] **LOI:** * indicates notably higher LOI than the remaining samples
[b] **pH and carbonate:** * indicates notably higher pH and carbonate content
[c] **Phosphate-P:** * indicates likely phosphate-P enrichment
[d] **χ and χ_{conv}:** None of the samples shows clear signs of magnetic susceptibility enhancement

Table 2. Phosphate fractionation data

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 (%)*
Site 54379					
302	0.481	0.344	0.825	58.3	41.7
303	0.591	0.367	0.958	61.7	38.3
304	1.15	0.399	1.55	74.2	25.8
Site 48067					
12103	0.312	0.217	0.529	59.0	41.0

Table 3. Particle size analysis of samples from Site 54379

Sample	*Coarse sand 600 µm–2.0 mm (%)*	*Medium sand 200–600 µm (%)*	*Fine sand 60–200 µm (%)*	*Silt 2–60 µm (%)*	*Clay <2 µm(%)*	*Texture class*
302	1.7	11.3	19.1	47.1	20.8	Clay loam
303	1.3	8.5	15.1	47.2	27.9	Clay loam
304	1.1	11.0	18.6	42.5	26.8	Clay loam

Table 4: A303 Stonehenge; Samples and micromorphological counts

Thin section	*Depth (cm)*	*Context Bulk*	*MFT*	*SMT*	*Voids*	*Flint*	*Burned flint*	*Charcoal*	*Reddish textural*	*Brownish textural*	*Textural papules*	*Dark reddish textural*
Sample		sample										
Site 48067												
M15000A	19–27	x12103	B	1b, 1c (1a)	25%	ff	a*	a*	a*	aaa	a*	
M15000B	29–37		A	1a, 1b(1c)	20%	f	a-2	a*	aaaa	aa	a	
Site 54379												
M30A	6–23	x303	C3	2b	25%(35%)	*	a-1	a*		aaa		aaaa
M30B	6–23	x302	C4	2c	20%(35%)	*	a*	a*		aaaaa		aa
M31A	30–33	(x303)	C2	2a	20%(35%)	f		a*				aaaaa
M31A	33–38	x304	C1	2a	20%(30%)	f*		a*				aaaaa
M31B	38–46	(x304)	C1	2a	20%(30%)	f		a				aaaaa

Thin section Sample	*Context Bulk sample*	*Fe-Mn Rounded nodules*	*Fe-Mn impreg. nodules*	*Fe impreg. nodules*	*Fe-P? infill*	*Depletion*	*Broad burrows*	*Broad excrements*
Site 48067								
M15000A	x12103	a	aaa				aaa	aaa
M15000B		a	aaaa				aa	a
Site 54379								
M30A	x303		aaa	aaaa	a-1		aaaa	aa
M30B	x302		aa	aaaa			aaaa	aaa
M31A	(x303)		aa	aaaaa		a	aaa	
M31A	x304		aaaaa	aaaaa		aa	aaa	
M31B	(x304)		aaaaa	aaaaa		aaaa	aaa	

* = very few 0–5%, f = few 5–15%, ff = frequent 15–30%, fff = common 30–50%, ffff = dominant 50–70%,
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: A303, Stonehenge: Soil Micromorphology (Descriptions and preliminary interpretations)

Microfacies type (MFT)/Soil microfabric type (SMT)	*Sample No.*	*Depth (relative depth)* *Soil Micromorphology (SM)* *Bulk analysis (BD)*	*Preliminary Interpretation and Comments*
			Site 48067
MFT B/SMT 1b, 1c (1a)	M15000A	19–27 cm SM: Heterogeneous (dominant SMT 1c, frequent SMT 1c); *Microstructure*: 25% voids, as below; with few chambers; *Coarse Mineral*: as below, with frequent coarse flint (max 22mm); traces of papules and very few Fe-Mn nodules; *Coarse Organic and Anthropogenic*: two example of fine whitened (burned) flint with traces of burning on more coarse flint; rare traces of fine charcoal and ferruginised fragments of amorphous organic matter; traces of very fine roots; *Fine Fabric*: as below, with SMT 1c becoming very dominant upwards; traces of SMT 1a in SMT 1b; *Pedofeatures*: *Textural*: occasional dusty intercalations, especially in SMT 1b-dominated lower soil; occasional very dusty intercalations and void infills (200–300 µm) in SMT 1c-dominated soil (as phase 3, below); trace amounts of papules; *Amorphous*: many fine Fe-Mn impregnative nodules; *Fabric*: many very broad (2–3 mm) burrows; *Excrements*: many broad (1–2 mm) organo-mineral excrements in burrows. BD (12103): 4.46% LOI, pH 7.5, 0.529 mg g^{-1} phosphate-P, 63.4 x 10^{-8} SI χ, 1720 x 10^{-8} SI χ_{max}, 3.69% χ_{conv}	12103 upper Moderately stony silt loam, which becomes more humic upwards from SMT 1b to SMT 1c (probable earthworm mixing of the two microfabrics); inclusions of burned flint and increase in amount of humic soil – with very fine charcoal (hence relatively high 4.46%LOI; possibly consistent with 3.69% χ_{conv}); lower part of slide includes traces of reddish palaeo-argillic soil with silt loam-dominated soil, and relict intercalations; upwards humic dominated soil also shows very dusty intercalations and void infills (as found as phase 3 textural pedofeatures in 12103 lower). *Humic Holocene palaeosol topsoil (below gravel layer12102) containing examples of burned flint and fine charcoal, with relict textural pedofeature evidence of a disturbed colluvial origin – but as hillwash from agriculture rather than simply clearance (lack of coarse mixed soil components); continuing agriculture led to deposition of overlying gravel?*
MFT A/SMT 1a, 1b (1c)	M15000B	29–37 cm SM: Heterogeneous (common SMT 1a and 1b, very few SMT 1c)(example of calcitic fine soil); *Microstructure*: (now fragmented) fine to medium prismatic, (was?) 20%, very fine (<0.5 mm) moderately well accommodated planar voids and channels, and vughs, with very broad (5 mm) chambers; *Coarse Mineral*: C:F (limit at 10 µm), SMT 1a 60:40, SMT 1b 80:20, SMT 1c 60:40; moderately well sorted fine soil of coarse silt–very fine sand-size quartz with very few medium sand (with flint, feldspar and mica), with few coarse (max 13mm) angular flints (some flake fragments?), very few sand-size iron nodules (embedding silt); rare fine (200–300 µm) papules (eroded clayey textural pedofeatures); in SMT 1a examples of coarse flint embedded in argillic/clayey soil; *Coarse Organic and Anthropogenic*: trace of fine (200–400 µm) charcoal; example of 11 size whitened/burned flint; rare traces of fungal material; *Fine Fabric*: SMT 1a (argillic 'Bt' and *ß* horizon): reddish (PPL), moderate interference colours (close porphyric, speckled and grano-striate b-fabric, XPL), orange brown (OIL), occasional Fe-Mn replaced fine amorphous organic matter; SMT 1b (silty 'Eb'): speckled and occasionally dotted brown (PPL), low interference colours (close porphyric, speckled b-fabric, XPL), pale orange (OIL);	12103 lower Mixture of slightly flinty mainly reddish argillic (clayey) subsoil Bt/Ct/*ß* horizon soil (which includes clay embedded coarse flint, abundant reddish finely dusty clayey textural pedofeatures – intercalations, coatings and infills) and brownish slightly humic silt loam (Eb, Eb&Bw horizon soil) which is also characterized by brown very dusty textural pedofeatures; much of the later porosity is affected by a third series of very dusty coatings and infills that contain very fine micro-contrasted particles (including charcoal); two example of coarse burned flint and rare traces of charcoal occur; papule fragments of earlier-formed textural pedofeatures and rounded iron and manganese nodules are present; there has also been overall fine iron and manganese impregnation of the soil.(fragments of 1c and chalky soil present from sample mixing) *Decalcified argillic brown earth (formed in moderately flinty loess in a chalk solution hollow) with evidence of disturbance and colluviation; strong physical mixing of argillic Bt/Ct/ß lower subsoil (lower sequum) and silt*

		poorly humic, rare traces of amorphous organic matter and fine charcoal; SMT 1c (humic 'topsoil'): occasionally dotted darkish brown (PPL), very low interference colours (close porphyric, speckled b-fabric, XPL), brown (OIL); moderately humic, many blackened and partially Fe-Mn replaced amorphous organic matter and organs; rare traces of charred OM; *Pedofeatures*: *Textural*: rare fine (200–300 µm) papules (eroded clayey textural pedofeatures); 1. very abundant reddish clayey intercalations (SMT 1a) with associated 200 µm thick finely dusty, moderately well oriented clay void infills and dark reddish 50 µm thick void coatings – and occasional fine vesicles/closed vughs; 2. occasional intercalations and associated coatings and infills (SMT 1b material mainly); 3. later very dusty, poorly oriented dark brownish clay infills and void coatings (25–100–200 µm), including very fine blackened organic matter and fine charcoal, most associated with channels and vughs that post-date reddish features; abundant fine (50–200) impregnative Fe-Mn nodules; rare rounded sand-size iron nodules; *Fabric*: occasional very broad (5 mm) burrows; *Excrements*: rare broad (1–2 mm) organo-mineral excrements in burrows.	*loam (upper sequum). This produced very abundant textural pedofeatures and was likely caused by periglacial activity that also produced papules and rounded Fe-Mn nodules as evidence of slope movement; the rare traces of charcoal and third phase of textural pedofeatures (very dusty clay containing very fine charcoal) indicates ensuing human impact; the presence of burned flint may be accidental mixing from slightly higher levels.*
			Site 54379
MFT C3/SMT 2b	M30A	6–14 cm SM: Homogeneous; *Microstructure*: massive with channel and developing coarse prismatic; in-ped compact with 25% fine channels and vughs/closed vughs, 35% coarse (5mm) poorly accommodated planar voids; *Coarse Mineral*: C:F 70:40, poorly sorted coarse silt to medium sand-size quartz, with coarse sand and very few iron-stained flint (max 13mm); mica and weathered glauconite present; *Coarse Organic and Anthropogenic*: coarse rubefied flint (13 mm); rare trace of charcoal (max 1mm); *Fine Fabric*: SMT 2b: finely dusty and occasionally dotted pale to dark yellowish brown (PPL), low interference colours (close porphyric, speckled b-fabric, XPL), pale dullish orange (OIL); thin humic staining with (ferruginised) rare amorphous organic matter fragments, rare trace of fine charcoal; *Pedofeatures*: *Textural*: abundant dusty intercalations with associated dark and dusty brown void coatings, occasionally microlaminated very dark reddish brown/blackish; *Amorphous*: example of fine (200 µm) yellowish amorphous (Fe-P?) void infill; abundant ferruginous moderately weak staining and many Fe-Mn fine impregnations; *Fabric*: abundant broad (2–4mm) burrows, with increasing amounts of fabric intercalations upwards; *Excrements*: occasional broad (2–4 mm) organo-mineral excrements. BD (303): 2.27% LOI, pH 7.7, 0.958 mg g^{-1} phosphate-P, 15.5 x 10^{-8} SI χ, 1650 x 10^{-8} SI χ_{max}, 0.939% χ_{conv}; clay loam	302 Moderately poorly sorted clay loam with very coarse iron stained flint (including one rubefied by burning) and rare traces of charcoal, with somewhat fewer textural pedofeatures than below, mainly dirty brown with examples of dark reddish stained ones; iron and fine iron and manganese staining throughout; example of likely Fe-P infill. *Colluvial accretion associated with silty clay subsoil erosion –and continuing cultivation?, with likely additional inputs from animal trampling and associated secondary phosphate deposition.*

MFT C3/SMT 2c	M30B	15–23 cm SM: Homogeneous; *Microstructure*: massive with channel and developing coarse prismatic; in-ped compact with 20% fine channels and vughs/closed vughs, 35% coarse (14mm) chambers with poorly accommodated vertical fine (1mm) planar voids; few 1 mm long and one 23 mm long sub-horizontal shear planes (some associated with finely dusty clay infills); *Coarse Mineral*: C:F 75:25, as M30B upper; very few coarse (max 6mm) angular flint – including an iron-stained example; *Coarse Organic and Anthropogenic*: rare fine burned(?) flint (5mm example); trace amounts of charcoal and ferruginised root traces; occasional fine patches of ferruginised and Fe-Mn replaced amorphous organic matter; *Fine Fabric*: SMT 2c, as SMT 2b, with rare very fine charcoal; *Pedofeatures*: *Textural*: very abundant brownish dusty intercalations and void infills, with finely dotted 'matrix' infills of burrows (300 µm thick); rare examples of dusty clay associated with shear planes; occasional dark reddish to black microlaminated examples associated with Fe-Mn stained (once humic?) patches and burrows; *Amorphous*: abundant ferruginous moderately weak staining and occasional Fe-Mn fine impregnations; *Fabric*: abundant broad (2–4mm) burrows, with examples of fabric intercalations upwards, some also with matrix infills; *Excrements*: many broad (2–4 mm) organo-mineral excrements. BD (302): 2.19% LOI, pH 7.6, 0.825 mg g^{-1} phosphate-P, 15.6 x 10^{-8} SI χ, 1090 x 10^{-8} SI χ_{max}, 1.43% χ_{conv}; clay loam	303 (upper) Moderately poorly sorted clay loam with very few flint, but including burned examples, with very fine charcoal in matrix; compact soil apparently affected by horizontal and sub-horizontal small to large (max 23mm) shear planes, sometimes with associated dusty clay concentrations; very abundant textural pedofeatures of dusty brown type (some infilling pene-contemporaneous burrowed soil, and fewer dark reddish blackish only where Fe-Mn stained soil is present (once organic?); traces of fine ferruginised roots. *Ploughsoil colluvium mainly composed of poorly humic subsoil clay loam, but containing some fine charcoal and burned flint; shear planes and overall concentration of textural pedofeatures may imply in situ ard ploughing; Fe-Mn stained soil and associated darkish textural pedofeatures may suggest occasional trampling by stock.*
MFT C2/2a MFT C1/2a	M31A	30–33 cm SM: Homogeneous; *Microstructure*: massive with channel, 30% voids, fine channels and closed vughs and chamber (pre-chamber – 20% voids); *Coarse Mineral*: as 304 (basal flint concentration); *Coarse Organic and Anthropogenic*: occasional coarse flint (including flakes?); trace amounts of fine charcoal; occasional possible relict patches of amorphous organic matter (30–30.5 mm) – now Fe-Mn replaced; *Fine Fabric*: as below; *Pedofeatures*: *Textural*: as below, with very dirty and some blackish void infills (isotropic, golden under OIL); *Depletion*: rare traces of void depletion hypocoatings; *Fabric*: as below. Boundary/base of 303 marked by concentration of semi-horizontally oriented 8 flints (including flakes?) up to 8mm in size. 33–38 cm SM: as M31B, below, with 35% voids and coarse chambers (7mm), and very few flints.	Base of 303 Quite similar to 304, but base marked by concentration of flint (flakes), but with less charcoal and much less iron and manganese replaced amorphous organic matter. *Continued accretion, but although animal trampling(flint concentration/'surface'?) is probably a component factor, the reduction in organic matter (ie as Fe-Mn replaced amorphous OM) and phosphate input may suggest colluviation and human disturbance may have become more dominant (cultivation?).* 304 *Animal trampled accumulations.*

MFT C1/SMT 2a	M31B	38–46 cm SM: Homogeneous; *Microstructure*: massive with channel, 35% voids, fine (0.5–1.0mm) channels and closed vughs and coarse (max 8mm) chambers – originally more compact (20% voids); *Coarse Mineral*: C:F 80:20, poorly sorted fine to coarse silt, very fine sand to coarse sand-size quartz (sand-size weathered glauconite; mica, sand size chalk; example of fine fragment of calcite), with few coarse angular flint (max 10mm); *Coarse Organic and Anthropogenic*: many coarse angular flint flakes(?), rare charcoal including very coarse (13mm) fragment (shows organic staining from uncharred parts); abundant patches of now-Fe-Mn replaced amorphous organic matter (also showing staining into matrix); *Fine Fabric*: SMT 2a: darkish, very dusty brown (PPL), low interference colours (close porphyric, speckled b-fabric, XPL), areas of greyish orange, yellowish orange and reddish orange (OIL); trace of humic staining, rare fragments of amorphous organic matter and charcoal – abundant patches of Fe-Mn replaced amorphous organic matter? in broad burrows; *Pedofeatures*: *Textural*: very abundant finely dusty to dusty brown to dark reddish brown void and grain coatings, with microlaminated infills (400 µm; example up to 1.0mm; also fragments) sometimes showing sub-horizontal concentrations – with some depleted zones in between (muddy poaching effect); some vertical multiple sequences occur in 1–2 mm wide burrows; rare thin (50 µm) fine silty coatings; *Depletion*: abundant iron and clay depleted zones throughout; occasional depletion void hypocoatings; *Amorphous*: very abundant iron and abundant iron and manganese (OM staining?) impregnative nodules; *Fabric*: many 1–2 mm broad to very broad (5mm) burrows, some associated with Fe-Mn replaced amorphous OM. BD (304): 2.11% LOI, pH 8.3, 1.55 mg g^{-1} phosphate-P, 11.1 x 10^{-8} SI χ, 1520 x 10^{-8} SI χ_{max}, 0.730% χ_{conv}; clay loam; 2.0% estimated carbonate	304 Top of alluvium Poorly sorted, once moderately compact, clay loam containing silt, coarse silt, very fine to coarse sand and flint gravel and flakes, with example of very coarse charcoal (>13mm) and much probable totally Fe-Mn mineralized amorphous organic matter; minerals dominated by quartz and mica, but with few weathered glauconite sand, and example of sand-size chalk (hence relatively high carbonate and pH); microfabric dominated by dusty brown to dark reddish dusty brown coatings and infills showing sub-horizontal orientation and vertical concentrations associated with infilled burrows; major textural and iron depletion – leaching of some void edges, and major iron and iron and manganese impregnation. *Poorly sorted local silts and alluvial sands, including glauconite and chalk, that have been mixed and become accreted through animal trampling producing high concentrations of textural pedofeatures and co-eval burrowing; organic inputs(often down burrows) now totally Fe-Mn replaced, but evident phosphate-P enrichment; accretion caused inclusion of coarse charcoal and Late Mesolithic-Early Neolithic flint artifacts; deposit subsequently affected by fluctuating water tables and iron mottling and organic matter replacement. General down-profile accumulation of phosphate-P.*

Sediment descriptions

Table T1_1. Sediment descriptions and sub-samples from WA 48067

Feature TP121
Descriptions incorporating detailed field notes with those from monolith 15000, one of adjacent pair of monoliths taken through argillic brown earth, located in test pit 121.
0 cm = ground level, bracketed depths are from top of monolith 15000
[1 is used to denote when top of monolith taken as 0 cm]

Depth[1] (m)	*Pollen samples taken*	*Other*	*Context (and excavators description)*	*Full sediment description*	*Interpretation*
0–0.24			12100 Ploughsoil	Dark silty loam/clay stone-free Ap horizon (rare v. small chalk pieces), common fine fleshy roots, smooth sharp boundary.	Modern ploughsoil
0.24–0.38			12101 Colluvium (with worked flint)	10YR 3/3 dark brown silt loam, medium weak blocky structure, 0.5% v fine macropores, rare medium flint <30mm, clear to sharp wavy boundary. Worked flints noted in field	Colluvium / colluvial B horizon
0.38–0.52 (0.04–0.19)			12102 High energy flinty colluvial deposit	Little fine material present but what there is suggests similar to above in colour & texture. Abundant flints – large (occasional), medium (abundant), small (common) flints – most 20–40mm but up to 300mm recorded in field. Seem to all have white patination. Sharp (?erosional) boundary. NB has (mostly non-diagnostic) worked flint on and to some extent within layer.	Gravel fan material - relatively high energy colluvial event(s)
0.52–0.67 (0.19–0.34)	**0.22–0.23** 0.26–0.27 **0.30–0.31**		12103 Basal horizons of palaeo argillic brown earth	10YR 4/4 dark yellowish brown silt loam, c.1–2% fine macropores, also rootlet/arthropod burrows. Well developed medium ?blocky or prismatic structure. Friable. Clayier to base. Clear boundary.	Basal horizons of palaeo-argillic brown earth (B)
0.67–0.70 (0.34–0.47)	0.34–0.35 **0.38–0.39** 0.42–0.43 **0.46–0.47**	Micromorphology sample	12103 Ditto	7.5YR 4/6 strong brown silty clay, 1–2% fine macropores, occasional small flints c.10mm, med to coarse blocky structure (although crumbly in monolith and difficult to ascertain reliably). Sharp to abrupt boundary.	Textural B horizon of palaeo-argillic brown earth (Bt)
0.70+ (0.47–0.50)			'natural'	Well solution-featured coarse periglacial solifluction material with many narrow steep-sided solution features filled with the Bt. Comprises buff chalk silty marl with abundant very small chalk pieces over weathered chalk comprising cemented, angular medium chalk pieces.	Periglacial chalk

Table T1_2. Sediment sequence in Test Pit 1 (WA 52086 Transect 2)

Depth[1] (m)	*Context*	*Description*
0–0.10		Dark greyish brown (10YR 4/2) silt loam with rare fine chalk/flint fragments and rare medium flint gravel. [Topsoil]
0.10–0.21	100	Brown to dark brown (10YR 4/3–3/3) stonefree silty humic loam with coarse crumb to fine/medium blocky structure, with few fine fleshy roots, clear boundary. [Base of soil profile]
0.21–0.55	101	Light brownish grey to light yellowish brown (2.5YR 6/2 – 6/3) calcareous stonefree (but rare very small calcareous flecks) silt to silty clay becoming lighter in colour and denser in matrix with depth. Common fine clear yellowish red (5YR 5/6)mottles predominantly in the lower portion (from c. 0.4m), clear boundary. [Calcareous overbank alluvium]
0.65–0.72	102	Zone of mottling within light yellowish brown (2.5YR 6/2) to pale yellow (2.5Y 7/3) calcareous silt marl. Many medium clear mottles of dark greyish brown (7.5YF), possibly representing a bA/B horizon. [Calcareous overbank alluvium with ?some soil ripening]
0.72–0.81		As above but a finer silt matrix with weak blocky – prismatic structure. [Calcareous overbank alluvium with ?some soil ripening]
0.81–0.95	103	Pale yellow (5Y 7/3) calcareous marl. [Calcareous overbank alluvium]
0.95+	104	Gravel, abundant medium subangular and angular flint gravel. [Valley gravel]

[1]depth below ground level; see sections for OD heights

Table T1_3. Sediment sequence in Test Pit 2 (WA 52086 Transect 2)

Depth[1] (m)	*Context*	*Description*
0–0.20		Topsoil mid brown silty clay
0.20–0.27	201	Dark greyish brown (10YR 4/2) humic silt with medium moderate crumb structure. Base 'B' horizon of alluvial gley soil. [Base of topsoil]
0.27–0.47	202	Brown (10YR 5/3) stone-free silty clay loam with weak blocky structure, 0.1% fine macropores, very rare very fine chalk pieces, clear boundary. [Humic calcareous overbank alluvium with soil ripening]
0.47–0.92	203	Light grey (2.5YR 7/2) massive calaceaous marl with very rare medium rounded chalk pieces, sharp boundary. [Calcareous fine grained alluvium]
0.92–1.15	204	Dark greyish brown to very dark greyish brown (10YR 4/2–3/2) silty clay with moderate to strong medium prismatic structure, fine distinct red (2.5YR 4/6) mottles. [Buried alluvial soil]
1.15–1.20+	205	Mottled light fey brown silty clay with common to many medium flint gravel. [Valley gravel]

[1]depth below ground level; see sections for OD heights

A303, Stonehenge: soil micromorphology; Figures 1-16

Fig. 1: Scan of M31A, showing flint-rich (arrows) junction between Contexts 303 and 304. With is ~50mm.

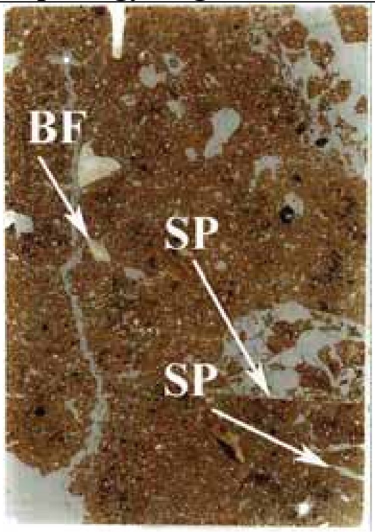


Fig. 2: Scan of M30B; flints and burned flint (BF) in compact soil featuring suggested shear planes (SP). Width is ~50mm.

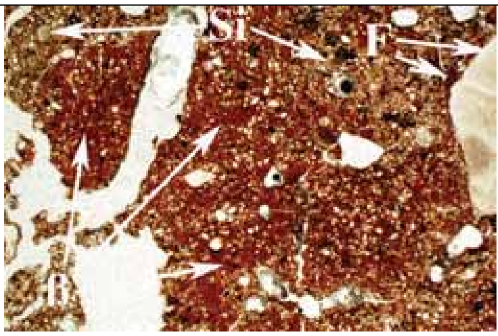


Fig. 3: Photomicrograph of M15000B; with reddish argillic *β*clay from weathered chalk (*β*) and associated textural pedofeatures, burned flint and embedding clay (F), mixed with loessic silt (Si). Plane polarized light (PPL), frame width is ~4.62mm.

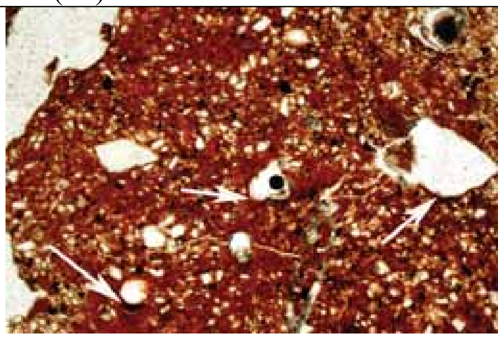


Fig. 4: Detail of Fig 3, with void clay and finely dusty clay coatings and infills. Frame width is ~2.38mm.

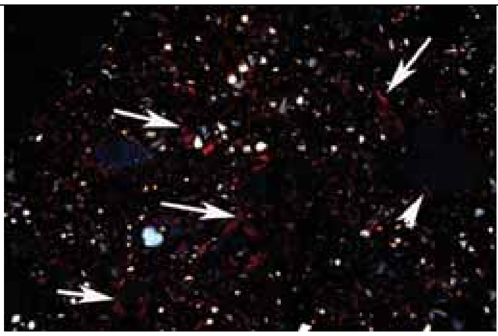


Fig. 5: As Fig 4, under crossed polarised light (XPL); coatings, infills and intercalations (arrows) developed through physical disturbance.

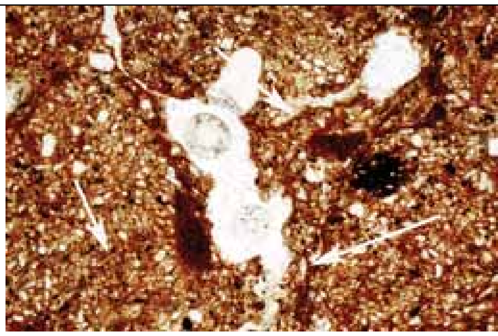


Fig. 6: Photomicrograph of M15000B, silty soil showing mainly very dusty intercalations, void coatings and infills (phase 3). PPL, frame width is ~2.38mm.

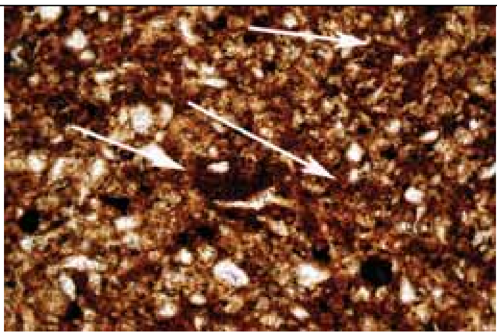


Fig. 7: Photomicrograph of M15000A; detail of humic fine fabric and extremely dusty and poorly birefringent intercalations and voids infills (arrows). Frame width is ~0.90mm.

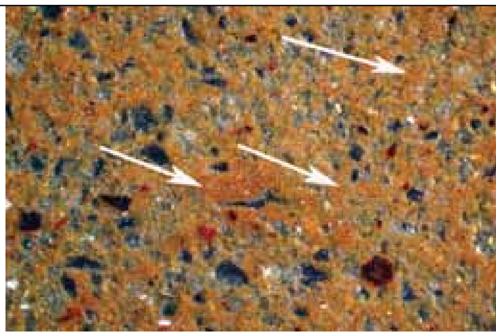


Fig. 8: As Fig 8, under oblique incident light (OIL), showing concentrations of fine soil.

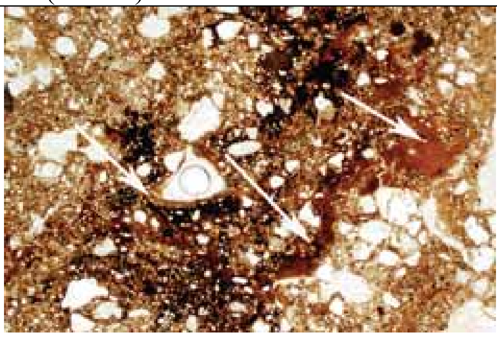


Fig. 9: Photomicrograph of M31B; concentration of reddish textural pedofeatures (arrows) and iron and manganese stained soil. PPL, frame width is ~4.62mm.

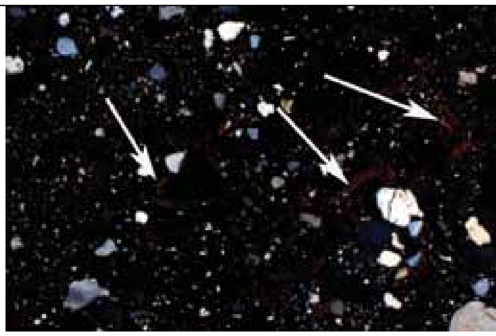


Fig. 10: As Fig 9, under XPL.

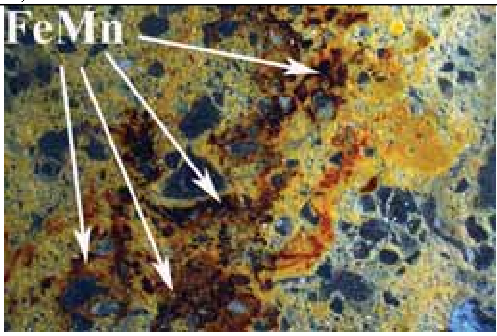


Fig. 11: As Fig 9, under OIL; note blackish Fe-Mn impregnations, likely associated with the mineralization of amorphous organic-rich soil.

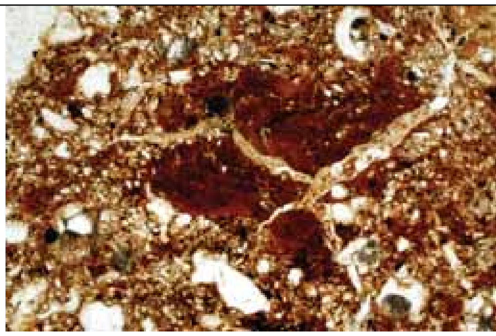


Fig. 12: M31B; slightly fragmented reddish clay infills. PPL, Frame width is ~2.38mm.

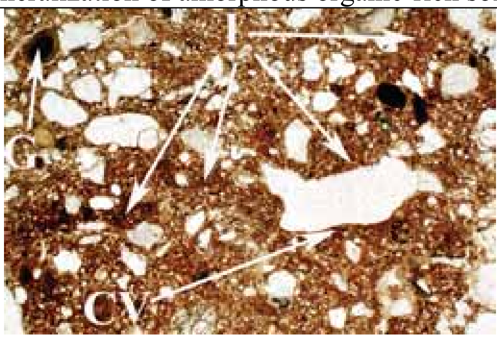


Fig. 13: Photomicrograph of M31A (lower); closed vugh (CV) and associated intercalations of slaked and collapsed soil; note weathered glauconite (G)

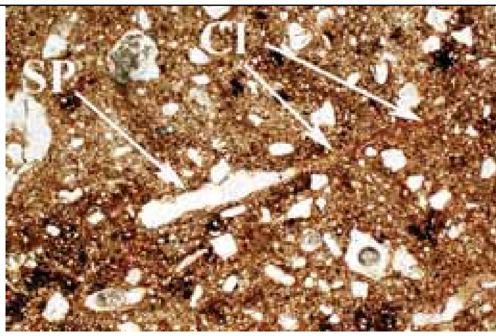
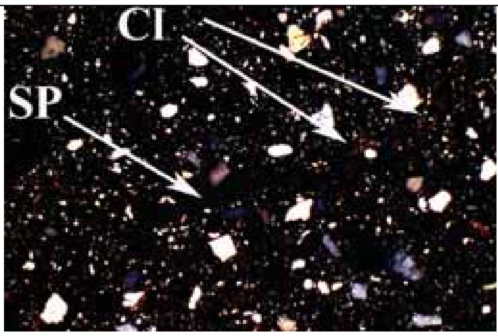
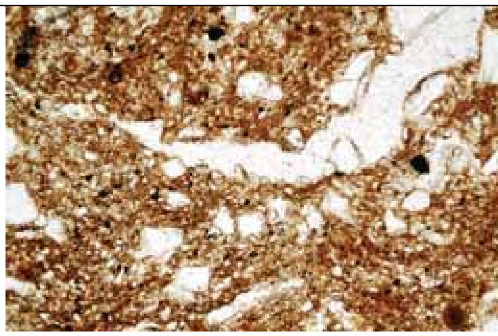


Fig. 14: Photomicrograph of M30A; example of small suggested shear plane (SP) and associated clay inwash along this void (Cl). PPL, frame width is ~4.62mm.

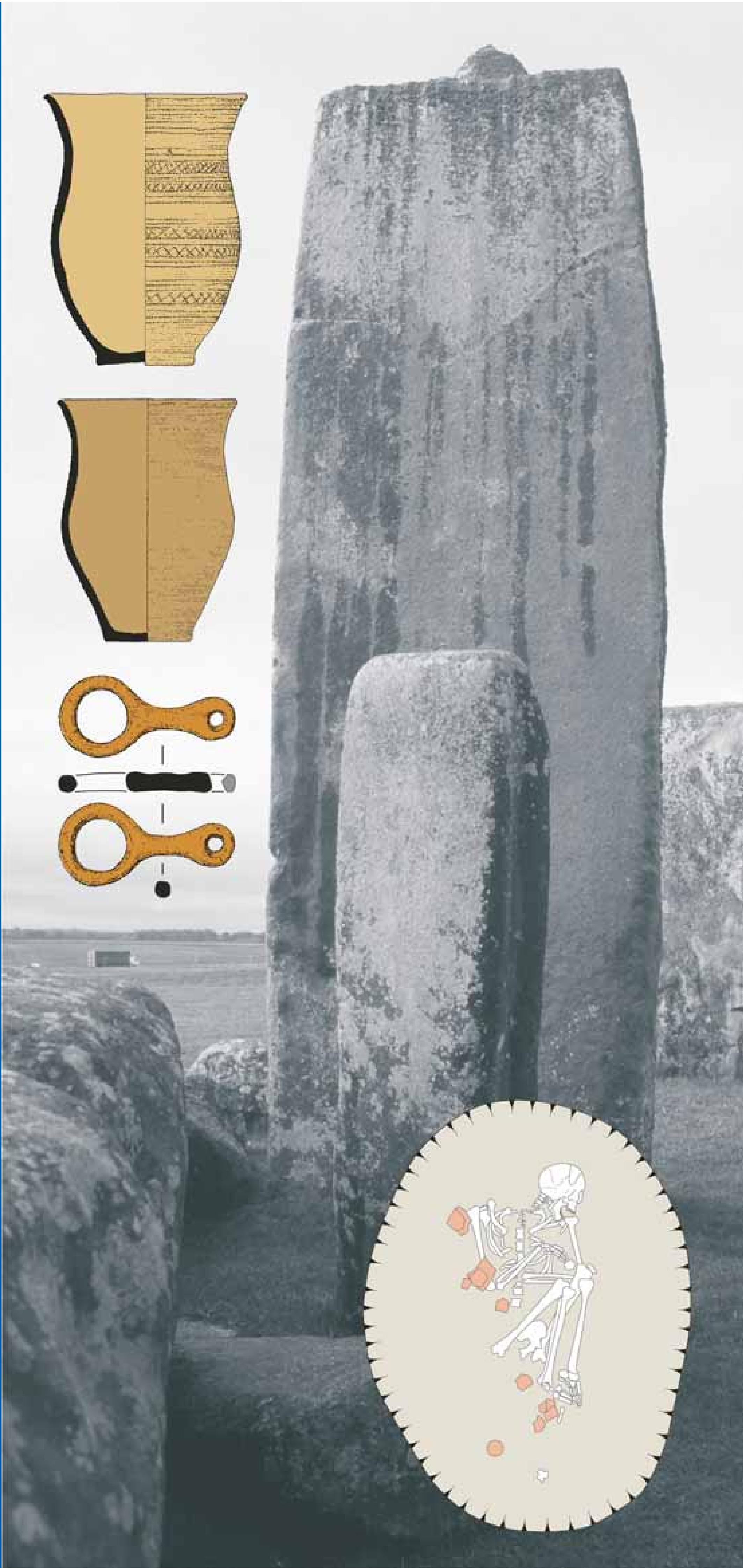
 Fig. 15: As Fig 14, under XPL, showing shear plane open void (SP) and oriented clay (Cl) along its partially infilled length.	 Fig. 16: As Fig 14; burrowed fill and oriented very dusty clay laminae, intercalations and coatings; these show very poor but visibly orientated clay. PPL, frame width is ~4.62mm.

This volume reports on the archaeological works undertaken between 1998 and 2003 as part of the A303 Stonehenge Improvement highway scheme promoted by the Highways Agency.

The A303 trunk road and the A344 which pass Stonehenge are widely agreed to have a detrimental effect on its setting and on other archaeological features within the World Heritage Site. Around Stonehenge there is noise and visual intrusion from traffic and also air pollution. Each year nearly one million people visit the World Heritage Site and surroundings, using visitor facilities intended to cater for a much smaller number.

Many plans that might improve this situation have been examined, involving partnership working across many organisations. Common to all these has been the aim of removing traffic from the area of Stonehenge and at the same time addressing highways issues with regard to road capacity and safety.

This volume sets out the objectives of the extensive programme of archaeological work that was undertaken to inform the planning of the highway scheme, the methods used, the results obtained, and to explain something of the significance of works which provided a 12 km transect across the WHS and beyond: the first of its kind ever undertaken.



ISBN 978-1-874350-48-4

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