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SOIL REPORT ON DRAYTON CURSUS, NEAR ABINGDON, OXFORDSHIRE.

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Summary

Eight thin sections were used to study the soil micomorphology of prehistoric soils associated with probable tree throw pits and the contemporary Neolithic cursus bank at Drayton, Oxfordshire. Roman and later Thames alluvium was also investigated. Some areas of the early Holocene argillic brown earth soil cover were found to be turbated, probably by tree throw that was either the result of a major storm or caused by the toppling of dead trees killed by Neolithic people. Some fallen dead trees could have been burned in situ and before the construction of the cursus bank much charcoal became included in surface horizons. A rise in water table caused iron impregnation of the soil, whereas later alluviation produced iron depleted fabrics and a cover of pelo-calcareous gley soils, as chalklands upstream were eroded. The report contains one table, thirty colour plates, and supportive archaeological, dating and charcoal data (appendix 2).

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R I Macphail, PhD, MSc, BSc. 1990

1. Introduction

During 1986-1988 the area of the Neolithic cursus in the upper Thames valley at Drayton, Oxfordshire, was excavated (director, George Lambrick) by the Oxford Archaeological Unit. Environmental studies of the Neolithic, Iron Age, Roman, Saxon and Medieval sediments was coordinated by Mark Robinson (University Museum, Oxford). Interest in the palaeoenvironment and archaeology of the upper Thames valley has continued since the late 1970's (Robinson 1981) and this present study is a continuation of this research. The major excavated area (approximately 60-80 metres by 50 metres) at Drayton, whilst revealing the prehistoric land surface associated with the ditch and bank of the cursus, also found tens of subsoil features tentatively recorded as tree-throw holes (Appendix 2, fig. 1). Many of these subsoil features were excavated in detail, alongside the excavation of a number of Neolithic/Beaker period pits, sections through the cursus and other features, such as areas of ard ploughmarks and spreads of charcoal and burned flint. Two previous radiocarbon dates on animal bones from Drayton Cursus had indicated early construction of the cursus in the Neolithic (Lambrick, pers. comm.). A second series of radiocarbon dates from a range of charcoal remains (eg. root wood) are now available from the cursus ditch and from soil contexts sealed by the cursus bank, including one from a probable tree-hollow context, and from other probable tree-hollow features (Appendix 2, radiocarbon dates, fig. 2). Archaeomagnetic dating (by Dr Tony Clark) of the cursus ditch infill and overlying alluvium was also carried out (Appendix 2, figs. 3, 4, 5). In addition to the analysis of artefacts found in pits and charcoal spreads and probable tree-hollows, charcoal analyses were also carried out. The last was done specifically to see what comparisons could be made between the charcoal contents of "anthropogenic" features and the probable tree-throw features.

The subsoil features examined by Lambrick and Robinson are roughly circular in plan and have heterogeneous semi-circular infills when viewed in section (Appendix 2, figs. 1, 2, 6), and these field attributes suggested to them that the features were probably tree-throw holes. In addition the charcoal analyses outlined above showed that the probable tree-throw hollows generally only contained charcoal from one or two tree species, whereas the charcoal spreads and pits could contain charcoal from up to five or six species (Appendix 2, Figs. 8, 9). These findings indicated that these subsoil features could be best interpreted as tree-throw holes and permitted Lambrick to model what may have happened to the soil during and after tree-throw for one particular probable tree-throw hollow (Appendix 2, fig. 7). The absolute dating and artefact assemblages from the site now indicate that the cursus was constructed around 4730 +/- 30 BP, and that a number of the tree throw hollows could date to just before this construction (eg. 4940 +/- 80 BP [OxA 2075], Appendix 2, radiocarbon dates), whereas other probable tree throw holes date to a later period of Late Neolithic and Beaker activity (4220 +/- 80 BP [OxA 2076], 3880 +/- 80 BP [OxA 2078]. The field, archaeological, dating and charcoal data, suggest to Lambrick and Robinson, that a) trees at Drayton Cursus were toppled and burned in situ as a clearance activity, and b) that there were two major episodes of this, an early one associated with construction of the cursus, and a later one in Late Neolithic/Beaker times.

The analysis of soils from the site, especially through soil micromorphology, was requested to characterise better a) the alluvium and b) the nature of the soil beneath the cursus bank associated with a probable tree-throw feature, and the character of soils in probable tree-throw hollows.

2. Methods

Four areas were studied (fig. 1). These are i) a probable tree-throw pit (TTP 760)(thin sections A, B, C, D; Appendix 2, fig. 6), ii) the Neolithic soil (405) associated with probable tree-throw upcast occuring beneath the cursus bank (410: thin section E; sampled by Robinson and Lambrick, Appendix 2, fig. 4), iii) a possible tree-throw hollow sealed by late Iron Age and later sediments (Hollow 516/130)(thin section F) and iv) a typical profile through the late prehistoric to medieval alluvium (Appendix 2, figs. 3, 4, 5; cf. drawing 685)(thin sections G and H), .

These eight (A-H) undisturbed samples were taken (fig. 1), impregnated with crystic resin (Murphy 1986) and manufactured into large (5x6-9 cm.) thin sections (Guilloré 1985). The thin sections were described after Bullock, et al. (1985) and interpreted with the aid of Courty, et al. (1989). Complementary bulk samples were taken alongside the soil micromorphological samples for, grain size, organic carbon, calcium carbonate (Avery and Bascomb 1974) and magnetic susceptibilty (MS; Tite and Mullins 1971; Longworth and Tite 1977) analyses.

3. Results

Analytical data is presented in table 1. Micromorphological descriptions and preliminary interpretations (first appraisals) are given in appendix 1, alongside the colour plates.

4. Interpretation

a) Present-day soils. Typical argillic brown earths (Sutton 1 Association) have been mapped on the river terrace gravels, whereas on the river alluvium pelo-calcareous alluvial gley soils (Thames Association) are recorded (Jarvis,et al.,1985). The related affects of alluviation and hydromorphism (gleying; Bouma et al. 1990) have caused both iron depletion (leaching) and iron and manganese cementation of the underlying soils and sediments (i.e. mottling). This has resulted in the microfabric evidence losing definition, either because is is leached-out or because it is obscured by iron and manganese impregnation. In addition, biological activity has reworked the underlying pre-alluvial soils and sediments to some degree. For example, vegetation on the site, possibly hay meadows since the late Saxon/Medieval periods (Robinson, pers. comm.), has produced evident rooting patterns (plate 1), that may penetrate as far as the prehistoric levels (see plates 25, 26). This has also permitted later silts and clays to wash into the earlier stratigraphies. Both these processes of gleying and biological disturbance have created difficulties for the interpretation of the palaeo-microfabrics (appendix 1).

b) Tree-throw pit 760. At this site of a probable tree-throw hollow revealed in a quarry section (alluvial cover mainly stripped off; plate 3; fig. 1; Appendix 2, fig. 6), an asymetrical fill of turbated fine soil (the only material that could be sampled for thin sections), coarse sands and gravels, occurred in undisturbed bedded late Pleistocene/early Holocene alluvial coarse sands and gravels. This soil hollow was sealed by Roman ploughsoil/alluvium (Lambrick, Robinson, pers. comm.). Even the fine soil that was sampled comprises a heterogeneous mixture (plates 4, 5) of gravels and sandy clay loams which can be either calcareous (table 1, sample 6) or non-calcareous (sample 7). Even in the last, fragments of oolitic limestone material can be present (thin section A). The micromorphology shows that the lowest samples (A, B, C), although gleyed, are almost unaffected by post-depositinal biological homogenisation or rooting (compare thin section D) and that they have have a fabric of "broken" soil (Bt horizon material) fragments separated by dusty clay and impure clay infills (Bullock,et al. 1985). This anomalous subsoil microfabric indicates soil disruption (Macphail 1986, 1987), whereas in the field the asymetrical infill pattern of the turbated soil and sediments in the hollow, in contrast with the surrounding bedded alluvial gravels, may be compared with modern subsoil features caused by tree-throw (Lutz and Griswold 1939; Denny and Goodlett 1956; Kooi 1974, cited in Newell 1980). Lambrick (Appendix 2, fig. 7) has modelled the possibility that the field evidence of this hollow and many of the others at Drayton Cursus, may suggest that these hollows and the associated rotation and upthrow of the soil and poorly decalcified sediments was caused by tree-throw. Elswhere, the subsoil of recently deforested profile shows a comparably heterogeneous microfabric (Courty et al. 1989: 286-90). There is therefore both macro- and micro-evidence of soil and sediment mixing and turbation at TTP 760, that may can be accounted for by tree-throw.

Further analysis of the soil showed the presence of charcoal, and that iron-stained flints and ferruginous oolite were apparently over-reddened (plate 6), possibly as the result being burned (Courty 1984), especially as such red gravels are not natural in the sediments (Lambrick and Robinson, pers. comm.). As discussed in the introduction, field evidence and charcoal analyses suggest to Lambrick and Robinson that some fallen trees may have been burned in situ at Drayton Cursus. Here at TTP 760 a probable tree-throw hollow with disrupted soil microfabrics, contains wood charcoal and possibly burned gravels, and these could be further indicators of tree throw, and the possibility that the fallen tree was burned in situ.

Thin section D is at the boundary between the probable tree-throw soil and the overlying Roman ploughsoil/alluvium (Lambrick, pers. comm.). Some of the underlying prehistoric (tree-throw) soil material is apparently preserved in the base of the supposed Roman ploughsoil, but markedly differs from the soils in thin sections A, B and C, by being much more strongly reworked (shrink and swell and biological activity, including obvious rooting). The soil surrounding the "new" porosity became strongly depleted of iron (plates 7, 8), whereas other areas were apparently already impregnated with iron and manganese. These hydromorphic features (Bouma et al. 1990: 267-70) possibly relate to an earlier rise in water table (producing impregnated soil), but before actual flooding (?) occurred (causing depleted soil) (Robinson and Lambrick 1984). The exact nature of the effects caused by Roman alluviation/ploughing, because of the associated hydromorphic and biological transformations imposed on the soil, cannot be readily determined. There may be a hiatus between the Roman alluviation and the prehistoric groundsurface. Possibly, the Thames or even cultivation eroded the more biologically worked topsoil just prior to alluviation. At all events, inundation and later plant colonisation led to renewed biological working of the buried soil, that because of water saturation of root channels (flood water meeting groundwater) caused depletion (pelosols, cf. Duchaufour 1982: 363; Bouma et al. 1990: fig. 4d) of earlier iron and manganese impregnated soil.

c) The Neolithic soil (405) and cursus bank (410). If the archaeological interpretation (Appendix 2, fig. 4) of these two layers is correct then layer 405 should represent the in situ Neolithic fine soil that occurs associated with a probable tree-throw hollow, whereas layer 410 is slightly later soil material which became deposited during cursus bank construction. Locally, the surface horizons of the buried soils were rich in charcoal.

Microfabric (thin section E) analysis of layer 405 shows that it comprises a decalcified clay (table 1, sample 5; although calcareous brown earths have been reported from the site, Limbrey and Robinson 1988: 138) made up of soil fragments associated with papules (fragments of oriented clay coatings). The soil fragments are irregular in shape and size, and void spaces between them are infilled by microlaminated dusty and impure clay (i.e. containing silt) (plates 9, 10, 11, 12). The infills themselves feature perforation by occasional fine ferruginised (root) channels. This rooting is believed to be penecontemporaneous with the infills because the latter are unaffected by depleted soil or strongly ferruginised silty clay inwash that stems from later alluvial events on the site (see plates 20, 21; section 4e), or occur in layer 410 above. Generally the buried soil (405) is moderately low in organic matter, except for some charcoal, but the thin section contains several coarse fragments of fibrous, probably woody, root fragments (Dr Jonathon Hather, Institute of Archaeology, pers. comm.), that have been pseudomorphically replaced by mineral material that is moderately birefringent and non-fluorescent (plates 13, 14). The mineral replacement material could be calcium carbonate absorbed by tree roots from subsoil (calcareous gravels) carbonate-rich water, but which has become partially decalcified when mixed into the upper decalcified fine soil.

The relic soil which includes fragments of oriented clay suggest that the mid-Flandrian/Neolithic clay (table 1, sample 5) soil developed on the late Pleistocene alluvium was an argillic brown earth (Avery 1981; Fedoroff 1982), but because of its present heterogeneous microfabric it was buried as a disturbed profile. In fact, the cursus bank has not buried a biologically worked topsoil, but a disturbed and fragmented soil mainly made up of subsoil horizon material. It is peculiar in that the soil has little porosity, fissures between soil fragments having been infilled by silt and clay. Such a microfabric type, as interpreted earlier (section b), has been associated with field features probably resulting from tree-throw (Macphail 1986, 1987; Macphail and Goldberg 1990). This soil layer 405 was also associated with a field feature interpreted as a tree-throw hollow (fig. 4; Lambrick and Robinson, pers. comm.). An alternative interpretation that this mixed soil horizon relates to tillage was rejected because, cultivation tends to more strongly break-up (increasing the porosity) and homogenise the surface soil, whether it is accompanied by the development of textural features or biological ones or not (Macphail et al. 1990). Further, this 4 cm thick layer of soil at the top of the buried Neolithic profile resembles the buried Neolithic soil that occurs just above the chalk (20-28 cm depth) at Maiden Castle, Dorset, by its dense microfabric of soil fragments and textural infills (Macphail AMLR 36/89). Here, as at Drayton, infills are perforated by ferruginised fine roots. At Maiden Castle these microfeatures were thought to relate first to disruption of the soil profile by woodland clearance, and second to revegetation of the soil. The comparable microfabric at Drayton that occurs beneath the cursus bank, may then be the result of soil mixing through tree-throw, and the fine rooting may have been the result of short lived revegetation on this shallow soil before being sealed by cursus bank construction. The mineralised woody root fragments, in contrast, that occur in layer 405 may be pieces of deep roots that are relic of the presumed fallen tree (see Lambrick's model, Appendix 2, fig. 7). Lastly, the possibility that layer 405 is truncated subsoil, has also to be considered, but there is no positive evidence for this conjecture.

Layer 410, the base of the overlying cursus bank, although characterised by many textural features (typical of dumps), differs from layer 405, by being more homogeneous and containing much more fine charcoal, with occasional coarse fragments being present (plates 15, 16). It has a boundary with layer 405 marked by a thin gravel layer sometimes associated with clean silt (i.e. of parent material origin). The porosity at this junction is infilled by a discontinuous, thin (several mm) layer made up of a series of laminae. These comprise layers (50-250 um) of silty clay with fine charcoal and pure clay (now ferruginised) of some 20 um in thickness, and these are capped by charcoal-rich bands of soil (plates 17, 18, 19). Thus layer 405 seems to be first buried by thin laminae of parent material silt and gravel, followed by inwashed silt, clay and charcoal, and these occur under a charcoal-rich layer of soil resembling material from layer 405, but which is far more homogenised and slaked.

Certainly, layer 405, the Neolithic groundsurface, was buried by an inwashed mixture of parent material and charcoal, and this seems to have been followed by subsoil material containing fine and coarse charcoal. Perhaps this charcoal rich-soil had been homogenised by trampling. Further, this charcoal-rich soil deposit, because it had developed a compact microfabric characterised by such textural features as intercalations, probably was dumped in a wet and slaked state.

In summary, the following sequence of events may be suggested as some possible ways to account for the field and micro-features at contexts 405/410.

i) Toppling of a tree and disturbance of the Flandrian soil (see Section 4b).

ii) (A very short ? period of [herbaceous?] revegetation)

iii) Burning of the tree _in situ_. This allowed coarse and fine charcoal to be trampled into adjacent surface areas of the mainly subsoil upcast. It is possible that burning of the tree over the soil at 405 produced ash and that the weathering of this ash released potassium accelerating the mobilisation of clay (Slager and van der Wetering,1977; Courty and Fedoroff,1982; Courty, _et al._,1989), which with silt and charcoal became washed down from the burned tree and its attached soil/parent material (eg on the root plate) onto the soil surface.

iv) Burial by cursus bank (with probably trampled charcoal-rich subsoil material taken from the top of the cursus ditch site being dumped first).

v) Deep post depositional rooting and inwash of clay during later alluviation.

d) Hollow 516/130. Like the buried Neolithic soil of 405 the soil (thin section F) infilling this hollow is a decalcified clay (table 1, sample 4). It also seems to have a turbated microfabric containing coarse and fine charcoal (plates 22, 23, 24) and thus resembles the probable tree-throw soils of TTP 760 and the buried Neolithic soil. Long exposure of the soil at 516/130 has permitted biological reworking by roots which have in turn been ferruginised, whereas other biological channels have strongly depleted boundaries. Perhaps there have been two phases of hydromorphism. A primary phase of iron and manganese impregnation (ground water gley; fluctuating water table according to pluvial input) was probably followed by a second phase, when flooding allowed standing water (which created anaerobic conditions) to deplete channel margins (pelosols) (Duchaufour,1982, p 340 et seq; Bouma et al. 1990).

e) Section through alluvium (Appendix 2, figs. 3, 4, 5; drawing 685). The sediments studied date from approximately the Neolithic to the Saxon/Medieval periods and become increasingly organic and in the last instance strongly calcareous (table 1, samples 1, 2, 3). Like the Neolithic soil they are clays, but differ texturally by having more silt but less sand. The prehistoric soil (thin section G) has been strongly reworked by shrink and swell and by biological agencies. Again, the ferruginised fabric has been increasingly (towards the surface) affected by hydromorphic iron depletion (plates 25, 26). The latter probably relates to actual flooding and the eventual deposition of the overlying calcareous and shelly (plates 27, 28) alluvium. The alluvium is micritic and is made up of very abundant fine fossil fragments that are probably relic of the chalk, pieces of which are also present. Also included in the sediment, are rounded (transported) decalcified silty clay soil clasts (plates 29, 30). These may originally have been part of the decalcified soil cover that was eroded with the chalk itself. Similar soil fragments occur in colluvium on chalk (Macphail and Scaife 1988) in Sussex (Macphail et al. in press). The chalky alluvium itself has also undergone some decalcification (weathering porosity and blackish poorly birefringent marl microfabric), whereas voids have sometimes been infilled by secondary calcite.

6. Discussion

Tree throw holows as natural phenomena and as the result of clearance

Subsoil hollows, when associated with archaeology, have been interpreted in a variety of ways, for example, as Mesolithic dwelling pits. That they are natural Holocene soil disturbance features such as may be caused by tree-throw has been suggested by many workers, including Newell (1980). He reports cases where the hollow is free of artefacts, whereas the surrounding soil contains plenty, suggesting that the hollow is natural rather than an anthropogenic feature. Also other hollows may contain artefacts only on one side of the feature, where they have fallen into one restricted heap during decomposition of the root mass. Other hollows show a mixture of artefacts from various periods, because two pedologically separate culture layers become unstratified by soil upcast and by the way they fall into the tree throw hollow on root mass decomposition. In a probable tree-throw hollow at Irthlingborough, in the Nene valley, Northamptonshire, the presence of burned flint, some being conjoinable, (so far only poorly dated typologically to the late Mesolithic and early Neolithic periods) may suggest the use by humans of such hollows, although as yet their relationship with early prehistoric sherds and pits at approximately the same palaeo-groundsurface level has yet to be exactly ascertained (Halpin pers. comm.). After noting Newell's (1980) observations, cited above, this will not be straight forward. Also at Irthlingborough, probable tree-throw hollows repeatedly had fills containing coarse wood charcoal and associated coarse to very large fragments of what are believed to be red baked soil. These have very high magnetic susceptibility (eg. 894 Si units) and thus are unlikely to be soil reddened by hydromorphic processes (eg. 22-44 Si units; Macphail and Goldberg 1990). Micromorphological analyses of the red soil fragments showed them to be poorly birefringent, which can be a result of being burned (Courty 1984; Courty et al. 1989: 107-109), and to contain soil from a variety of horizons with infills of void spaces by dusty clay (Macphail and Goldberg 1990), very similar to the heterogeneous microfabrics reported from probable tree-throw and clearance features (Macphail 1986, 1987). Although further studies are to be carried out on material from Irthlingborough, the combination of field and micromorphological data, including the association of red soil fragments with strongly enhanced magnetic susceptibilities, and commonly large fragments of charcoal (often of oak wood, Robinson, pers. comm.) suggest that one likely way to account for these phenomena is to infer that fallen trees were burned in situ (Macphail and Goldberg 1990; Robinson, pers. comm.). No probable burned soil was observed at Drayton, however, although there is the possibility of some magnetic susceptibility enhancement (table 1, samples 5, 7). Possible fire reddened stones (plate 6; Robinson pers. comm.), and the many wood charcoal present, however, do suggest that fallen trees in the Thames Valley at Drayton could also possibly have been burned in situ as well, especially as the charcoal present is dominantly of only one or two tree species (Appendix 2, figs. 8, 9). The question of whether such large areas (Appendix 2, fig. 1; Lambrick and Robinson, pers. com.) of probable tree toppling at Drayton Cursus relates to purely human endeavour, or to infrequent massive storm damage is a moot one. The radiocarbon dates (Appendix 2), however, do indicate that toppling and burning of trees did occur at two main times, one just before cursus construction and the other during Late Neolithic and Beaker times, which may infer these were acts of deliberate clearance. In this context, the dating of charcoal from Irthlingborough will provide interesting comparable data.

Other tree-hollow sites can be cited. For example, the many probable tree-throw hollows with similarly oriented infills (in plan) found at Balksbury Camp, Hampshire on the Chalk, were devoid of human artefacts and date approximately (molluscs) to the "Atlantic " period (Macphail AMLR 4621; Macphail and Goldberg 1990; Donaldson in press). It is possible that trees were windthrown (Lutz and Griswold 1939; Denny and Goodlett 1956) by a westerly gale(s). Certainly, the microfabric of one of the probable tree-throw infills indicates, because it is so highly biologically (Limbrey 1975: 288-290) homogenised, that the hollow stayed open for a long time, untill possibly Iron Age/Roman agricultural colluvium infilled it totally. At Drayton and Irthlingborough the microfabric of the infills has often remained in its original disturbed state (preserved by baking at Irthlingborough), suggesting that human activity did not allow the probable tree-throw hollows to infill slowly and naturally. At Drayton it was cursus bank construction that sealed disturbed soil associated with probable tree-throw hollows (Appendix 2, fig. 4). Here there is also some indication of minor revegetation of the site prior to building of the cursus bank, whereas the bank itself contains large amounts of charcoal that could presumably result from the burning of the in situ dead tree trunk. As it is well known that it is very difficult to burn a fresh broadleaved tree, the suggestion by Lambrick and Robinson (pers. comm.) that trees were killed by ring barking, and toppled when dead, would allow them to be quickly burned after falling. The probable minor revegetation of the site but without time for any strong biological homogenisation of the soil (plates 9, 10, 11, 12), before burial by subsoil gravel and deposition of inwashed clays and charcoal (fallen from the root plate of the burned tree? ; plates 17, 18, 19), may possibly indicate rather rapid burning of fallen tree, and thus again infer that toppling was deliberate.

Hydromorphism and alluviation

A rise in water table seems to have caused initial gleying (iron and manganese impregnation) on the site, but later flooding and associated alluviation resulted in iron depleted soil fabrics. This finding is consistent with other upper Thames valley sites (Limbrey and Robinson 1988). Groundwater may have risen approximately during the Iron age, whereas alluvial flooding was mainly a Saxon period phenomenon (Lambrick and Robinson 1984). Certainly, intensification of upstream arable land use was probably responsible for the erosion of highly calcareous chalk soils, suggesting that their decalcified soil cover had mainly been lost (plates 29, 30).

6. Conclusions

a) Early Holocene argillic brown soil formation in decalcified sandy clay loam deposits overlying coarse late Pleistocene sands and gravels.

b) Probably two phases of largescale tree-throw, caused either by the killing of trees (eg by ring barking) and their toppling by Neolithic peoples, or by an infrequent storm damage event. In either case, trees were probably rather rapidly burned in situ for clearance purposes, firstly ahead of cursus bank construction, which included the use of soil containing much charcoal, and secondly in association with Late Neolithic and Beaker activity.

c) In later prehistory (Iron Age?), a rise in ground water caused the soils to become ground water gleys, but it was not untill Roman and Saxon times that actual flooding and alluviation commenced to produce the current cover of pelo-calcareous alluvial gley soils.

7. Aknowledgements

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Fig 1 Location of Samples

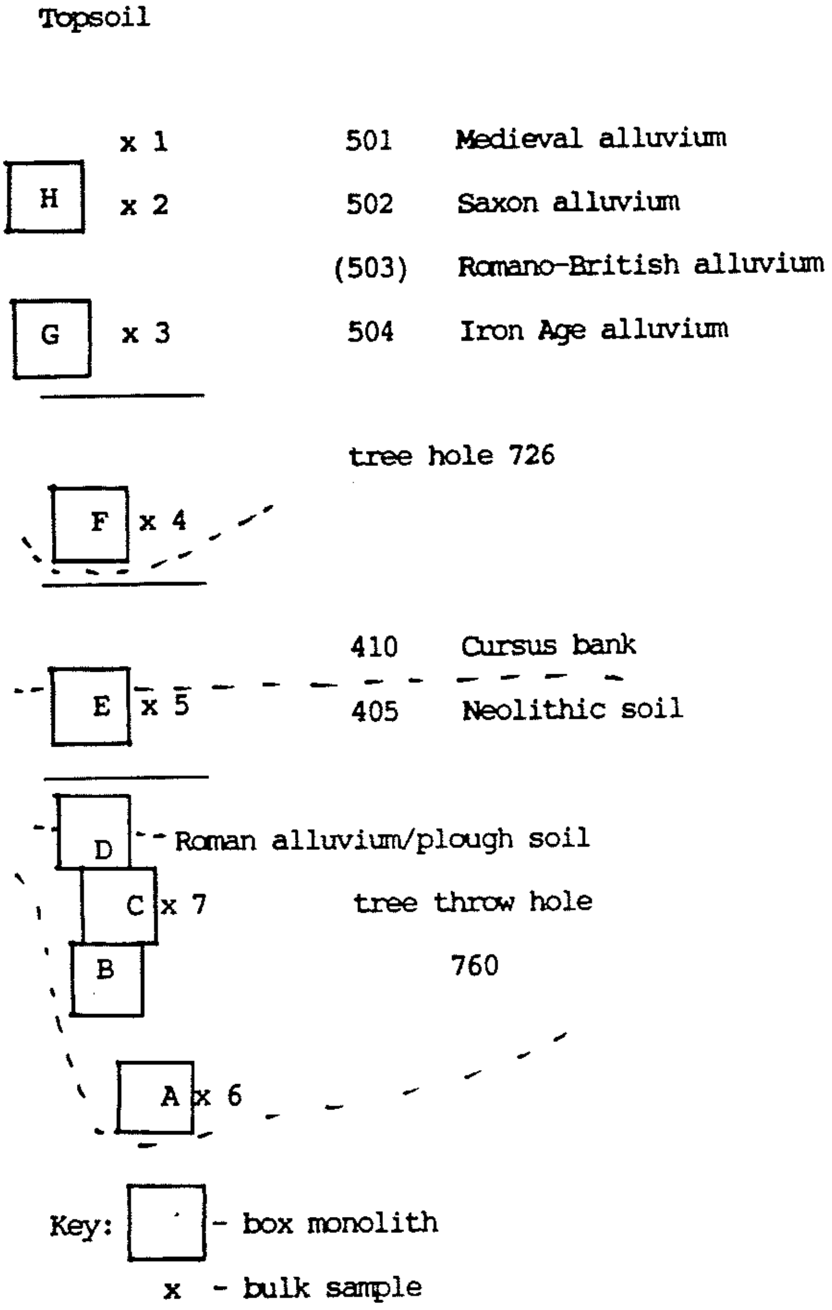


Table 1: Drayton Cursus; Analytical Data

Sample No	%Org. C	% Calcium carbonate	Magnetic susceptibility (Si units 10-8 Si/kg)	Thin section
1. 501	2.7	36.1	13	H
2. 501/502	2.1	0.2	13	H, G
3. 504	0.9	0.2	23	G
4. 726	1.0	0.5	13	F
5. 405	1.0	0.2	86	E
6. (TTP 760) TTP1	0.5	20.5	18	A
7. TTP2	0.7	0.5	105	C

Sample No	clay	FZ	MZ	CZ	Silt	VFS	FS	MS	CS	VCS	Sand	Texture	Thin Section
1. 501	44	10	16	12	38	8	3	4	1	<1	16	Clay	H
2. 501/502	65	8	15	6	29	2	1	2	<1	<1	6	Clay*	H, G
3. 540	40	7	17	12	36	6	5	7	3	3	24	Clay	G
4. 726	40	6	14	14	34	11	8	6	<1	<1	26	Clay	F
5. 405	47	3	7	8	18	3	9	13	8	2	35	Clay	E
6. (TTP 760) TTP1	29	1	8	8	17	5	15	17	10	7	54	Sandy Clay Loam	A
7. TTP2	28	6	5	10	21	4	11	20	10	6	51	Sandy Clay Loam	B

NB * sedimentation problems

Apppendix 1

Drayton Cursus: Soil Micromorphological Description and Preliminary Interpretation

Tree-Throw Pit (TTP) 760

A: 65-72 cm

Structure: poor coarse prisms. Porosity: 35%; inter-ped: very dominant coarse open walled coarse channels and cracks. Intra-ped; fine closed vughs and fine channels (the latter probably inherited; the former as the result of tree-throw). Mineral: C:F, 60:40, Coarse dominant small stone size (eg 0.3-1.5 cm) ferruginous nodules, red iron stained flint, flint, sandstone, quartzite, ferruginous oolite, tufa etc., many red (under OIL); dominant very coarse, coarse, medium, fine (very poorly sorted) sand size quartz. Fine a) very dominant very dark reddish brown (PPL), very low birefringence, bright orange (OIL); b) very few pale brown, speckled (PPL), moderatel low birefringence; pale orange (OIL); frequent, dark brown, blackish (PPL), extremely low birefringence, black (OIL) (a, relic subsoil; b, inwashed alluvium; c, relic Ah/topsoil). Organic Coarse: very few coarse roots; few charcoal incorporated into fine matrix. Fine in (c) very abundant amorphous (mainly iron and manganese replaced). Groundmass a) porphyric, speckled and granostriate b-fabric; b) textural pedofeature; c) porphyric, speckled b-fabric. Pedofeatures Textural very few impure coatings, fine fabric (b). Within peds, abundant intercalations and dusty clay infills between fine and coarse ped fragments. Also closed vugh coatings. Amorphous very abundant ferrugisation and many iron and manganese impregnation of relic Ah fabric. Fabric very abundant mixing of relic Ah and subsoil. Possibly red nodules and red soi. Fragments included within main matrix possibly burned. Later inwash of fragments (as well as coatings) of alluvium.

Interpretation: Strong turbation and mixing of Ah and probable Bt soil material. Possible burning of stones and soil (with wood charcoal).

Mixing also accompanied by inwash. Ferruginous nodules and iron stained flint can be very red under OIL, suggesting that they were burned.

B: 28-36 cm

Structure: poor coarse prisms. Porosity: 30-40%, dominant coarse open, rough walled channels and cracks; intra-ped, few fine channels and closed vughs, few medium channels perforating peds. Mineral: As A. Organic Coarse occasional medium roots (partially ferruginised); occasional charcoal. Fine occasional amorphous organic matter in subsoil fabric; abundant amorphous organic matter in relic Ah soil; fine charcoal and manganese replaced organic matter soil occasionally. Groundmass as A. Pedofeatures Textural (as A). Crystalline rare microsparitic calcite replacement of roots (near olitic rock fragment). Amorphous (as A) Occasional cryptocrystalline/haematitic ? coatings and organic matter replacement. Rare very red fine soil - burned? sedimentary? Fabric (as A).

Interpretation (as A)

C: 19-26 cm.

As A and B; with many ferruginised roots and occasional infills of microsparitic calcite post dating them.

D: 0-6 (pre-Roman soil, Roman ploughsoil/alluvium at top)

Structure moderate coarse and fine prisms. Porosity 35%. Common coarse cracks; frequent medium unaccomodated cracks. Common (through peds) medium channels and vughs (also closed vughs), moderately smooth walled, more open upwards. Mineral (alluvium above has washed in as depleted silty clay). C:F, 50:50 Coarse frequent large quartzitic pebbles, flints and nodules. Dominant very coarse, coarse and medium sand-size quartz; few silt. Fine: dark brown, cloudy (PPL), poorly birefringent, bright orange (OIL). Organic Coarse rare coarse charcoal; occasional roots. Fine many amorphous fragments. Groundmass dense porphyric, speckled and poro- and grano-striate b-fabric. Pedofeatures Textural abundant intercalations, infillings and very dusty clay coatings in closed vughs. Possible many dusty clay coatings in recent depleted porosity system, associated with root traces. Amorphous very abundant ferruginisation of groundmass. Occasional iron or iron and manganese impregnation of relic (disturbed soil) roots. Occasional impregnation of recent roots. Abundant manganese impregnation throughout. Fabric very abundant poorly homogenised mixture of soil materials.

Interpretation Although the junction of the disturbed prehistoric soil and the base of the Roman alluvium was sampled, the overall fabric is still rather similar to the tree-throw soil mixtures described earlier but more reworked, presumably by Roman ploughing. The major features of note are rooting contemporary with the alluvium, the deposition of which brought about hydromorphic depletion along the root channels. In turn, iron has moved into the compacted peds (later shrinking and swelling) to form impregnated soil fabrics. Strong manganese impregnation is apparent, but unrelated to depletion.

E: 0-6.5 cm (contexts 410 - the Cursus bank, and 405 - the Neolithic soil).

Structure: massive to very poorly developed blocky. Porosity: 25%; frequent poorly accomodated fissures, few fine channels; dominant within-ped fine channels and closed medium and fine vughs. Mineral C:F, 50:50. Coarse frequent stones and gravel. Dominant very coarse, coarse, medium sand-size quartz, flint (some red) etc. Fine dark brown to dark reddish brown, cloudy (PPL), poorly birefringent, bright orange to dull brown (OIL); many inclusions. Organic Coarse in soil; coarse roots (mineral replaced), in bank, rare to occasional charcoal. Fine many in buried soil; in upcast abundant amorphous fragments, many charred. Phytoliths rare. Groundmass close porphyric, speckled and weakly poro- and grano-striate b-fabric. Pedofeatures Textural very abundant channel infillings of strongly ferruginised clay (from overlying alluvium). Very abundant intercalations, infillings and dusty clay coatings (on closed vughs) within soil peds; and laminated dusty clay between peds in 405. Layered silt and clay over gravel layer at junction 405/410. Also rare papules of earlier Holocene Bt or earlier palaeo-argillic. Depletion abundant very strong iron depletion especially around channels. Amorphous very abundant ferruginisation - with less manganese impregnation - especially of clay infills from alluvium. Possible relic iron/clay fragments in fine fabric. Fine roots impregnated. Crystalline mineral pseudomorphic replacement of coarse woody (Dr Jonathon Hather, Institute of Archaeology, pers. com.) roots, low birefringent, non-UV fluorescent crystalline material, possibly depleted calcium carbonate. Fabric Strong fabric mixture of disturbed soil and alluvial clay brought in by rooting.

Interpretation 405 and 410 are very similar, except that 405 is more strongly heterogeneous, whereas 410 is more homogenous and contains more features of slaking, and far more fine charcoal. Layer 405 has a typical disrupted soil fabric (from a probably argillic brown earth, although no depleted soil (Eb) was noted). Dusty clay infills have been perforated by fine roots - some revegetation. The junction between layers 405 and 410 is marked by gravel and clean (sedimentary) silt and layers of fine charcoal.

Layer 405 is acting as the buried Neolithic soil surface but as it remains an unreworked mainly disturbed subsoil mixture, it may have been truncated. The charcoal which it contains may be relic of earlier fires, and not necessarily be related to burning of the tree which was possibly burned after tree-throw. The coarse mineralised roots, however, that are present as fragments are probably relic of the fallen tree. The fine roots that perforate post soil turbation infills, probably relate to post tree-throw revegetation (by herbaceous plants?). No biologically reworked topsoil was noted in the thin section, but layer 410 could represent exposed soil like 405 that had charcoal worked into it. This soil was then dug up, presumably at the site of the cursus ditch, and then dumped. The layer of gravel and clays and charcoal, could perhaps have been washed of the root mat at the base of the (burned?) fallen tree. There is no positive evidence that the soil, that appears to have been disturbed by tree-throw was left very long exposed to subaerial pedogenesis, although some minor revegetation did occur. If the tree was ring-barked, and left to die before being toppled over by humans (as suggested by Lambrick and Robinson), it would have fallen as dead wood, and then could been burned soon after.

F: 0-7.5 cm (tree hollow 516)

Structure: massive, with poorly developed coarse prisms. Porosity: 25% very dominant medium to coarse (root) channels and vughs; few medium and fine closed vughs. Mineral C:F 40:60. Coarse frequent small stones and gravel. Dominant fine, very fine and silt-size quartz. Fine: either pale brown, dark brown or dark reddish brown, cloudy (PPL), medium to non-birefringent, pale yellow to bright orange (OIL). Organic Coarse: occasional very coarse to fine wood charcoal. Very abundant to coarse ferruginised root margins. Fine many charred in pale fabric, many amorphous and tissue fragments. Groundmass close porphyric, grano-striate b-fabric to undifferentiated b-fabric. Pedofeatures Textural very abundant intercalations, infillings and dusty clay coatings. Very abundant impure (iron depleted) soil infills around roots channel perforations. Depletion very abundant moderate iron depletion of areas. Amorphous very abundant iron impregnation away from depleted areas; strong ferruginisation of most root traces. Fabric: very abundant mixing of original turbated soil and soil infillings around root channels.

Interpretation This probable tree hollow infill contains the usual charcoal fragments and turbated argillic soil, but is poor in gravel, and therefore may represent infiling of the upper more stone-free horizons of the Neolithic soil. Apart from contrasts caused by hydromorphic affects, the soil material shows some signs of being homogenised, and it may be that some original heterogeneity was lost through biological mixing, that could relate to the hollow remaining open longer than that of TTP 760. It has been strongly rooted subsequently, and this new porosity has through anaerobism (on flooding) caused iron depletion along the channel margins. Also iron depleted soil, probably from the alluvial layers above, has washed down these channels.

H (38-47 cm); G (75-84 cm) (Neolithic soil, upwards through Iron Age, Romano-British, Saxon and Medieval alluvium.

G: (79-84 cm - Neo soil: 75-79 cm - alluvium)

Structure: massive, with poorly developed coarse prisms. Porosity: 20%, frequent planar voids; dominant fine to medium channels, few fine closed vughs. Increase in channeling in top half of slide. Mineral C:F, 40-60. Moderately poorly sorted. Frequent gravel and small stone size ferruginous nodules and rock fragments. Dominant medium-size, with fine and silt-size quartz. Fine (in lower half of slide) dominant orange brown very dusty and cloudy (PPL), very poorly birefringent, pale yellow (OIL) (sesquioxidic rich and depleted soil respectively). In upper half of slide depleted soil becomes dominant. Organic Coarse many fine to coarse, commonly iron replaced roots; occasional charcoal. Fine occasional fragments of amorphous organic matter and tissues in lower part of slide, becoming many in upper half. Groundmass porphyric, undifferentiated to speckled and grano-striated b-fabric. Pedofeatures Textural occasional dusty clay void coatings and related intercalations in possible relic soil fabric (non-depleted). Many intercalations generally and thick clay inwash in channels. Depletion very abundant depletion in upper half of slide, where it is dominant; lower half of slide depletion still very abundant but less severe and more restricted to porosity margins. Amorphous very abundant ferruginisation of groundmass and roots, declining towards the top of the slide. Fabric rare possible clay clasts.

Interpretation. The soil appears to be a rather dense mixture of disturbed soil fragments (from tree-throw/clearance) that through wetting and drying, and biological activity such as rooting, became moderately homogenised. The upper part of the soil has been more severely influenced by hydromorphic depletion, relating to alluvial inundation. There is no real difference between the supposed Neolithic soil and the alluvial soil, except a slight increase in organic matter. The boundary between the two seems to have been blended by wetting and drying phenomena and biological activity (see thin section D). The depth of soil depletion that more strongly affects the upper (supposedly alluvial) part of the slide may only relate to degree of water saturation rather than realy demarcating the boundary between the Neolithic soil and the overlying alluvium.

H: (38-47 cm; late Saxon/Medieval)

Structure massive, with coarse prismatic on drying. Porosity 40%, dominant coarse to medium (sometimes strongly vertically oriented) channels (roots), few coarse open vughs. Mineral C:F, 10:90. Coarse dominant calcite and aragonite fragments of shell; bivalves and gastropods; very coarse to fine in size and often decalcified. Common medium and fine sand-size quartz; and chalk fragments. Fine a) dominant pale grey or very dirty grey cloudy (PPL), very high or low birefringence, grey or whitish (OIL) (marl and decalcifying marl, respectively). b) frequent yellowish brown (silt loam) (PPL), moderately low birefringent, dark orange (OIL) (as included soil clasts - gravel size and rounded). Organic Coarse rare root fragments. Fine occasional amorphous materail. Groundmass open porphyric, crystallitic (calcitic) b-fabric. Pedofeatures Depletion very abundant depletion of marl (decalcification - black areas). Crystalline rare calcium carbonate (sparitic) infills of voids. Whole fabric generally micritic. Amorphous very abundant ferruginous (reddish), and iron and manganese (blackish) staining of fine fabric as clear edge nodular growth - some possibly associated with the previous organic content of the associated with calcium carbonate depletion. Fabric calcareous shelly sediment contains brown soil clasts, and occasionally this clay has merged into the calcitic fabric - presumably through slaking.

Interpretation. The slide comprises of shelly calcareous alluvium that has been affected by rooting, and hydromorphism allied to minor and patchy decalcification. In addition to the calcareous sediment, which appears to have had a chalk source, fragments of silt loam are included. The lower part of the slide (2) may be rather more depleted of calcium carbonate and contain a higher proportion of clay clast material than the upper part of the slide. Also the clay and calcareous sediment seem to have been moderately mixed by biological perforation.

DRAYTON CURSUS

Radio Carbon dates

This series of 9 dates is from the site of one of two neolithic cursus monuments near Drayton, Abingdon Oxfordshire (NGR SU 490 945) excavated 1981-1986 (samples submitted in 1989 by G Lambrick and M Robinson). They were intended to address three problems.

1. The date of the cursus, indicated by 2 previous dates by Harwell to be surprisingly early.
2. The dating of tree-throw holes, containing charcoal and cultural material, which are thought likely to be associated with clearance.
3. The date of a possible circular sunken floored hut suspected of being Saxon in origin, but devoid of cultural material except a few bones.

The dates are grouped for the purpose of comments. The sample series numbers for the site and the context number references are given after the Laboratory reference number and sample type.

OxA - 2071	unid. slightly singed waterlogged bark	ABDC 7:	ABDR 81 F4 L7	4810 ± 70
OxA - 2072	*Corylus* nut fragments	ABDC 8:	ABDR 81 F4 L7	3630 ± 80
OxA - 2073	*Corylus* and *Fraxinus* charcoal and nut fragments	ABDC 9:	DRPG 86 412/B/1	4800 ± 100
OxA - 2074	Pomoideae charcoal	ABDC 10:	DRPG 86 405	4620 ± 80
OxA - 2075	*Quercus* charcoal including roots	ABDC 11:	DRPG 86 589	4940 ± 80
OxA - 2076	*Quercus* charcoal including roots	ABDC 12:	DRPG 86 517/A/5-7	4220 ± 80
OxA - 2077	*Equus* bones	ABDC 13:	DRPG 85 40/A/3	400 ± 70
OxA - 2078	*Quercus* charcoal including roots	ABDC 14:	DRPG 86 178/A/1	3880 ± 70

OxA - 2071 (ABDC 7), ABDR81 F4 L7 4810 ± 70 BP sample of slightly singed waterlogged bark from the base of the eastern cursus ditch.

OxA - 2073 (ABDC 9), DRPG86 412/B/1 4800 ± 100 BP sample of Corylus and Fraxinus charcoal plus Corylus nut fragments from tree throw pit sealed beneath the eastern cursus bank.

OxA - 2074 (ABDC 10), DRPG 405 4620 ± 80 BP Sample of charcoal, mostly pomoideae from the soil sealed beneath the eastern cursus bank.
Comment This group of dates provides a terminus post quem for the eastern cursus bank and a terminus ante quem for the eastern cursus ditch. The dates cluster sufficiently closely for them to be combined following the methods of Ward and Wilson (1978) to give a date of 4730 ± 47 BP for the construction of the cursus. This result is highly satisfactory, confirming the early date for the construction of the Drayton Cursus. Two conventional radiocarbon obtained on animal bones from the bottom of the eastern cursus ditch (HAR 6477, 4990 ± 100 BP; and HAR 6478, 4780 ± 100 BP) can also be combined with these dates to give a statistically acceptable date of 4786 ± 39 BP, although one of the Harwell samples unfortunately contained a small quantity of Equus bones which were perhaps reworked from the Late Glacial gravel of the site. The date obtained for OxA - 2073 suggested that tree clearance occurred just prior to the construction of the cursus.

OxA - 2075 (ABDC 11), DRPG86 589 4940 ± 80 BP Sample of Quercus charcoal including root wood from a tree-throw hole.

Comment. This date suggests that this tree pit could also have belonged to the clearance episode just prior to the construction of the cursus if allowance is made for the occurrence of old wood in the tree.

OxA - 2076 (ABDC 12), DRPG 86 517/A/5-7 4220 ± 80 BP Sample of Quercus charcoal including root wood from a tree-throw hole.

OxA - 2078 (ABDC 14), DRPG 86 178/A/1 3880 ± 70 BP Sample of Quercus charcoal including root wood from a tree-throw hole which contained Beaker sherds.

Comment. These two dates suggest that there was a further episode of clearance on the site. They correspond to artefactual evidence from man-made pits for Late Neolithic and Beaker activity.

OxA - 2072 (ABDC 8), ABDR 81 F4 L7 3630 ± 80 BP Sample of charred/singed Corylus nut fragments from near the bottom of the eastern cursus ditch.

Comment. This date suggests that the initial silting of the cursus ditch was relatively slow, which agrees with archaeomagnetic dating that alluvium in the upper part of the ditch was Iron Age.

OxA - 2077 (ABDC 13), DRPG 85 40/A/3 400 ± 70 BP Sample of

Equus bones from a circular hollow with post-holes, tentatively considered to be a possible Saxon sunken-floored hut of unusual form.

Comment. This date shows that the feature, which did not contain any artefacts, was post-Saxon.

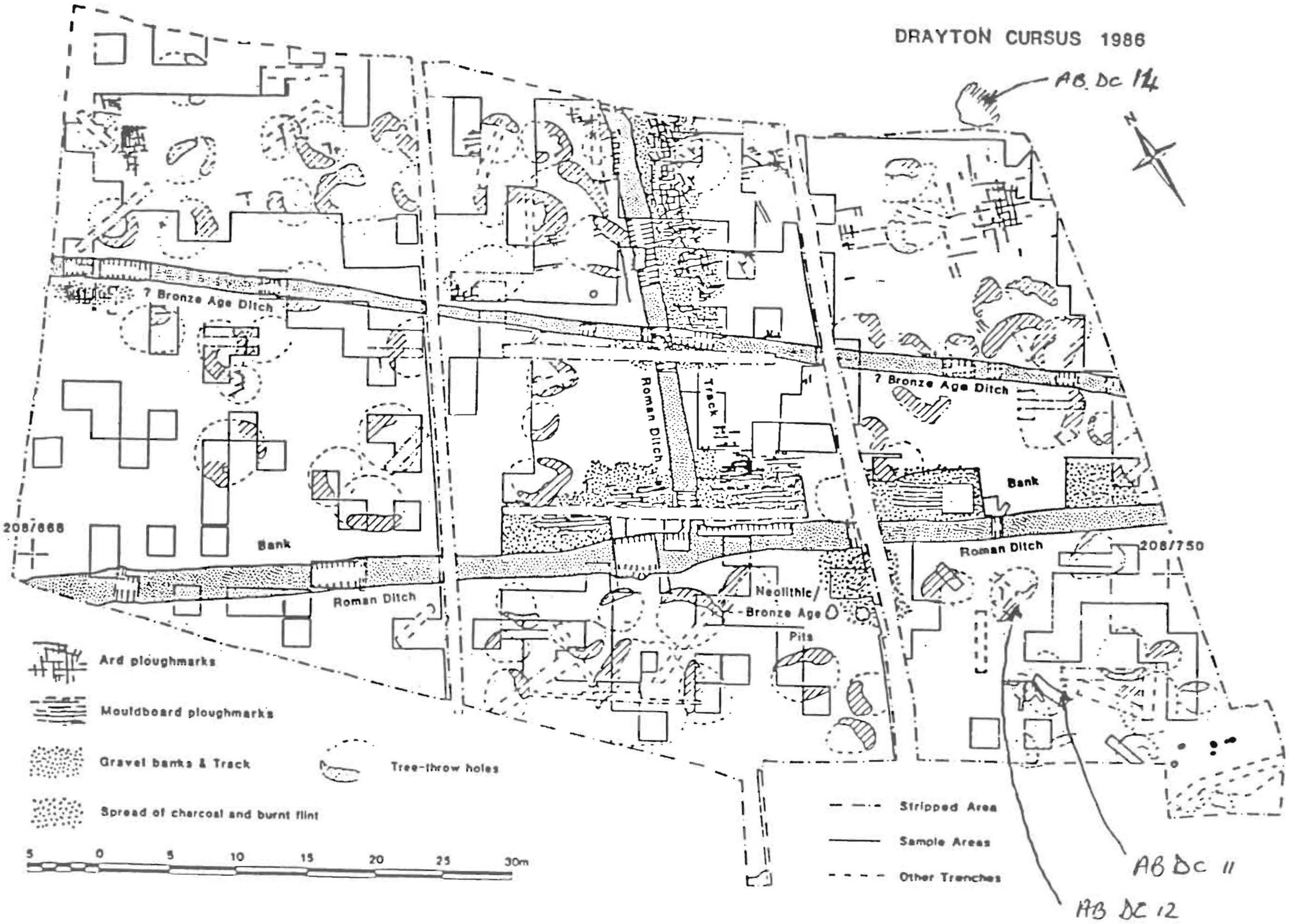

DRAYTON CURSUS 1986
AB Dc 14
N
? Bronze Age Ditch
Roman Ditch
Track
? Bronze Age Ditch
Bank
Bank
Roman Ditch
Roman Ditch
208/668
208/750
Neolithic/
Bronze Age
Pits
Ard ploughmarks
Mouldboard ploughmarks
Gravel banks & Track
Tree-throw holes
Spread of charcoal and burnt flint
Stripped Area
Sample Areas
Other Trenches
5
0
5
10
15
20
25
30m
AB Dc 11
AB DC 12

Fig. 1.

Fig. 2

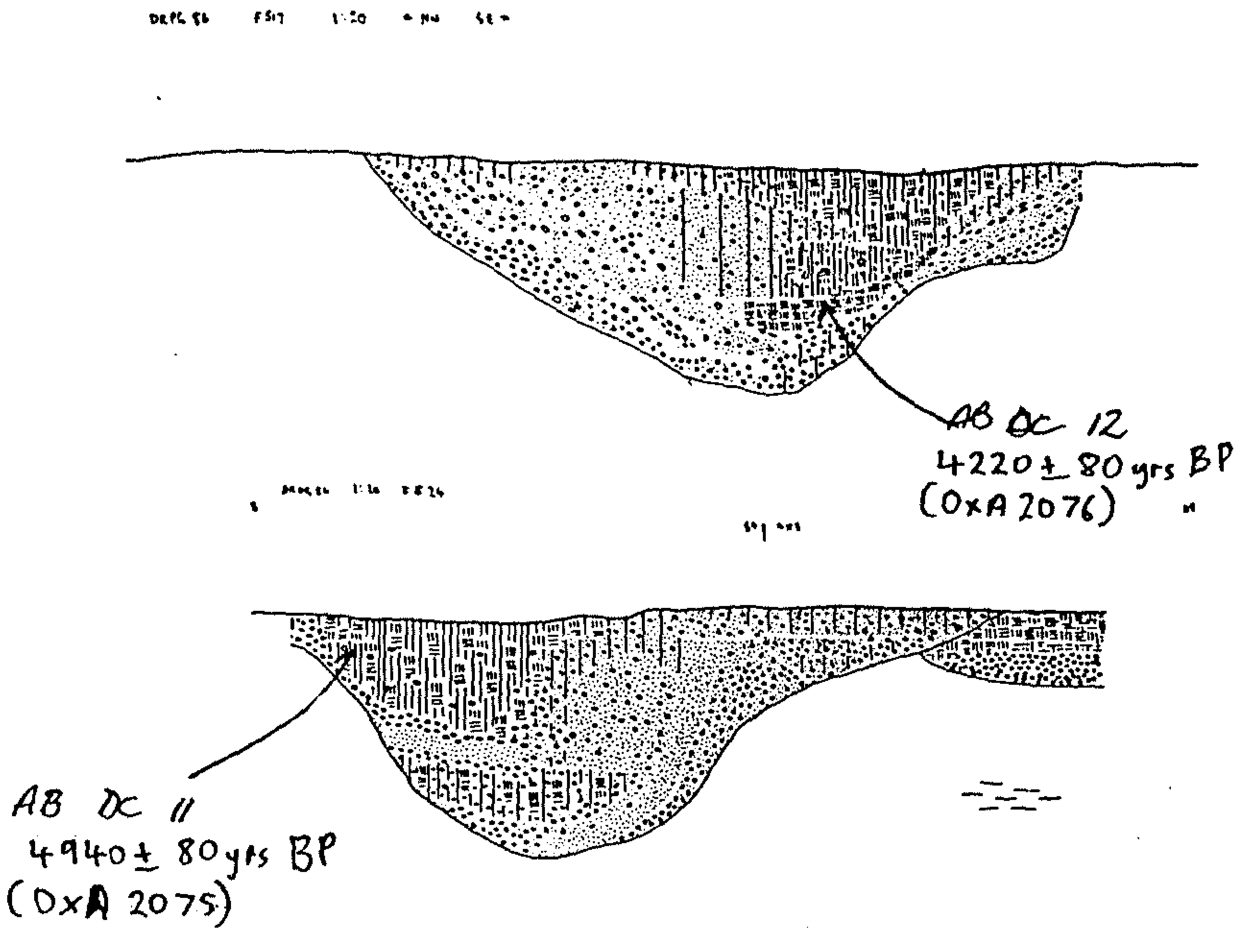
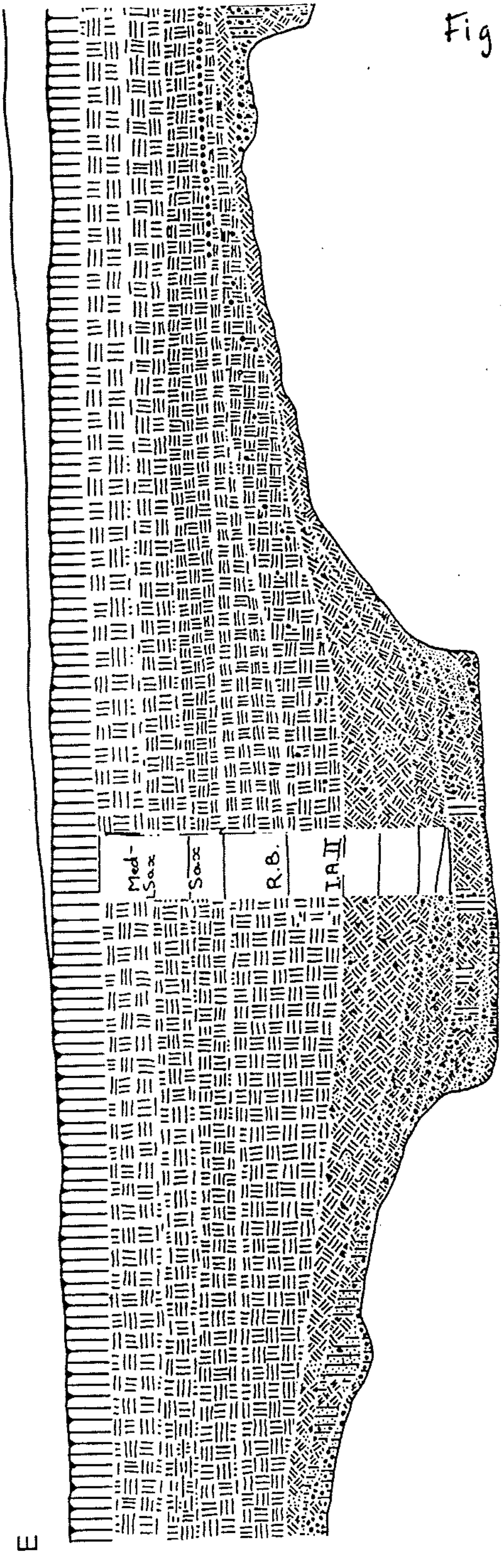

DRPL 86 F517 1:20 NW SE
AB Dc 12
4220 ± 80 yrs BP
(OxA 2076)
AB Dc 11
4940 ± 80 yrs BP
(OxA 2075)

Fig. 3.



DRPG 86 1:20 655

Fig. 4

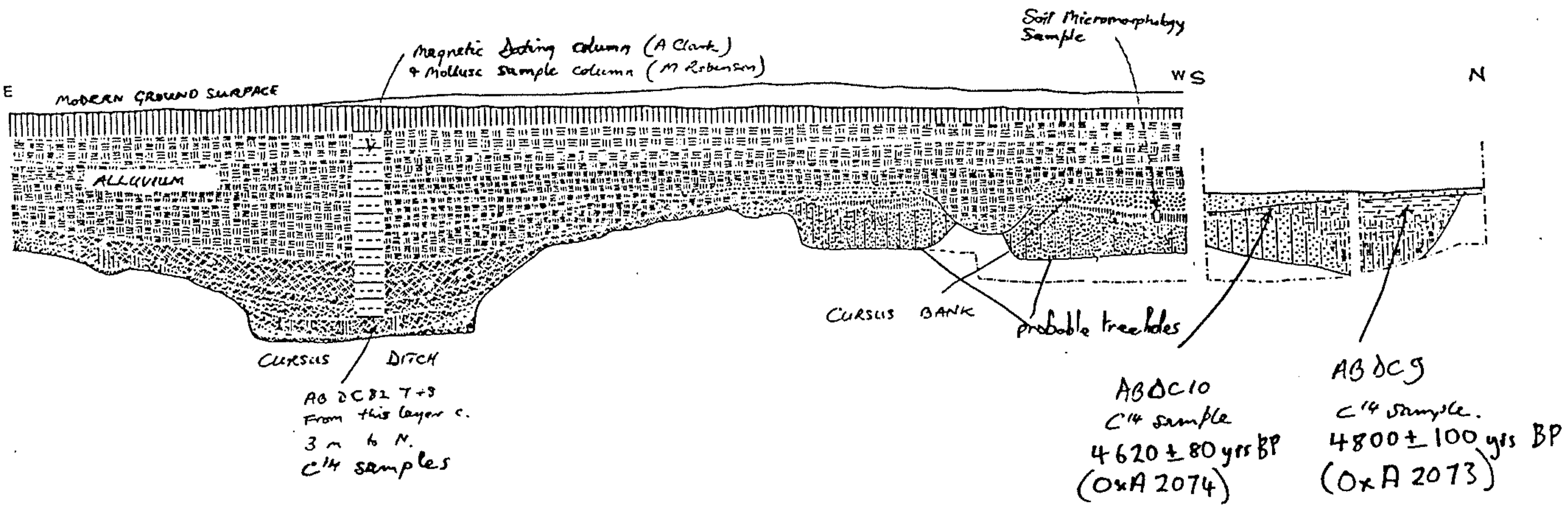

E
MODERN GROUND SURFACE
Magnetic Dating column (A Clark)
& Mollusc sample column (M Robinson)
Soil Micromorphology Sample
W S
N
ALLUVIUM
CURSUS DITCH
AB DC82 7+8
From this layer c.
3 m to N.
C^{14} samples
CURSUS BANK
probable treeholes
ABDC10
C^{14} sample
4620 ± 80 yrs BP
(OxA 2074)
AB DC9
C^{14} sample.
4800 ± 100 yrs BP
(OxA 2073)

Fig. 5

FIG. 1. The ditch during sampling

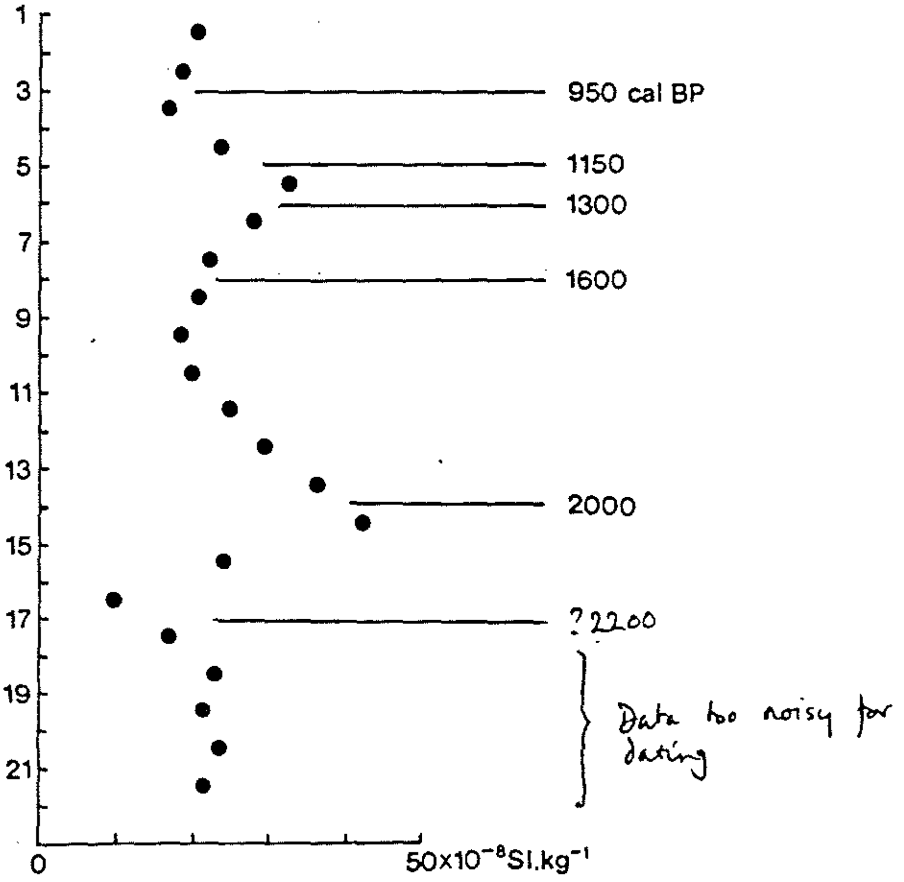


FIG. 2. Magnetic susceptibility plot. Running means of pairs of samples, the numbers of which are shown on the vertical scale

Drayton 1987 F 760 1:20

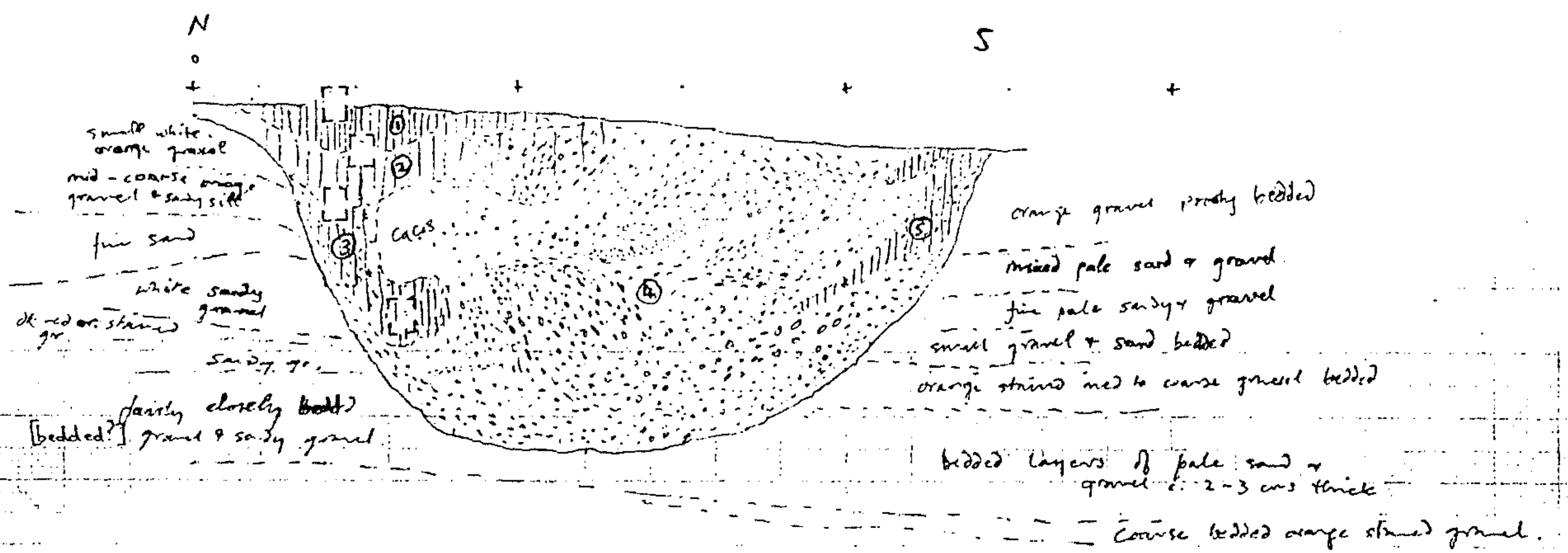


Fig. 6.

Location: 0.0 m on datum for section = 13.20 m N of N edge of Roman Ditch

① v. Dark grey brown de-calcified sandy silt c. 25% med to largish quartzite pebbles rd flecks

② orange to reddish brown fine loam decalcified with c. 10% pebbles

③ Brown loam much iron stained fine gravel (20-30%) at bottom grey brown, more clayey in general very mixed

④ disturbed v. variable sand & gravel with flecks of ~~sd~~ secondary calcium carbonate

⑤ yellowish to greyish mid brown fine loam to clay loam 20-30% gravel — iron stained pebbles

Fig. 7

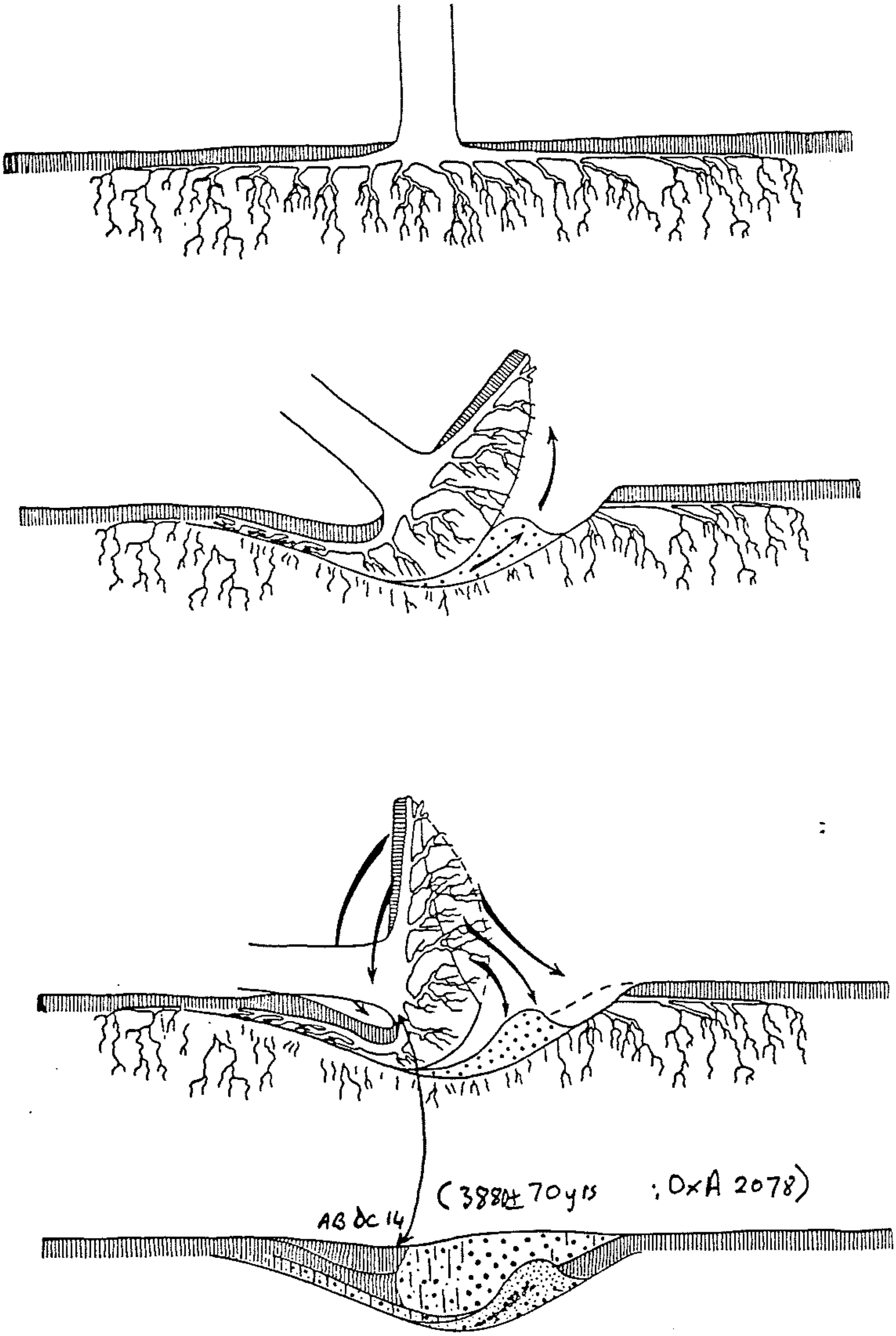
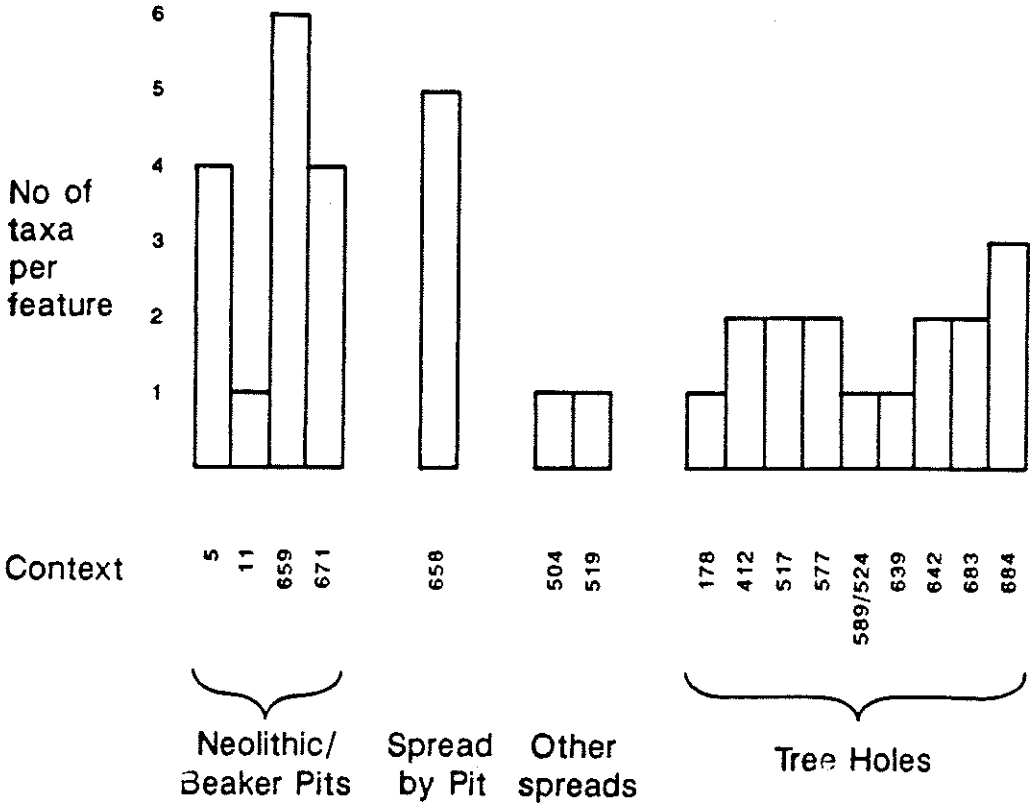


Fig. 8


No of taxa per feature
6
5
4
3
2
1
Context
5
11
659
671
658
504
519
178
412
517
577
589/524
639
642
683
684
Neolithic/ Beaker Pits
Spread by Pit
Other spreads
Tree Holes

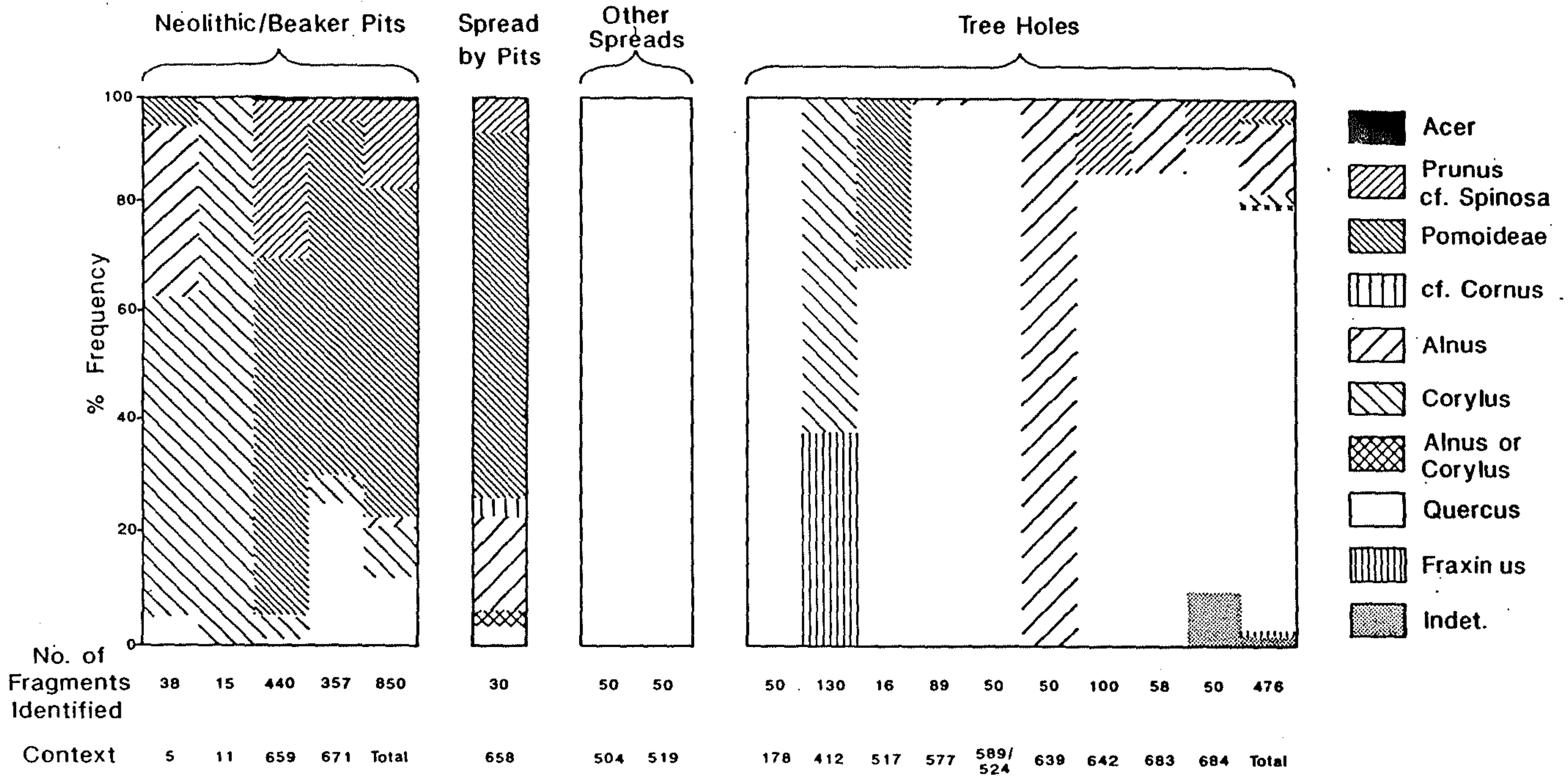

Neolithic/Beaker Pits
Spread by Pits
Other Spreads
Tree Holes
% Frequency
100
80
60
40
20
0
No. of Fragments Identified
38
15
440
357
850
30
50
50
50
130
16
89
50
50
100
58
50
476
Context
5
11
659
671
Total
658
504
519
178
412
517
577
589/524
639
642
683
684
Total
Acer
Prunus cf. Spinosa
Pomoideae
cf. Cornus
Alnus
Corylus
Alnus or Corylus
Quercus
Fraxin us
Indet.

Figure 9

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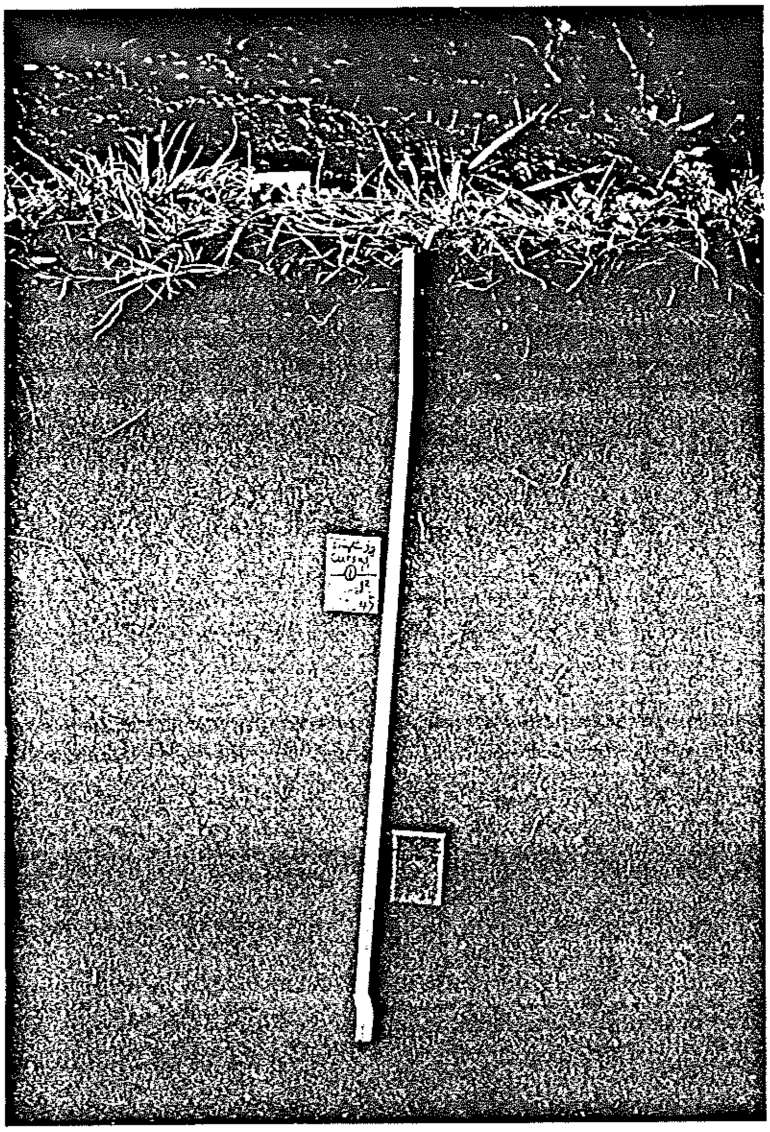

Plate 1. Field section of Thames alluvium at Drayton; lower sample - junction of Iron Age and Romano-British deposits; upper sample - junction of Romano-British and Saxon deposits.

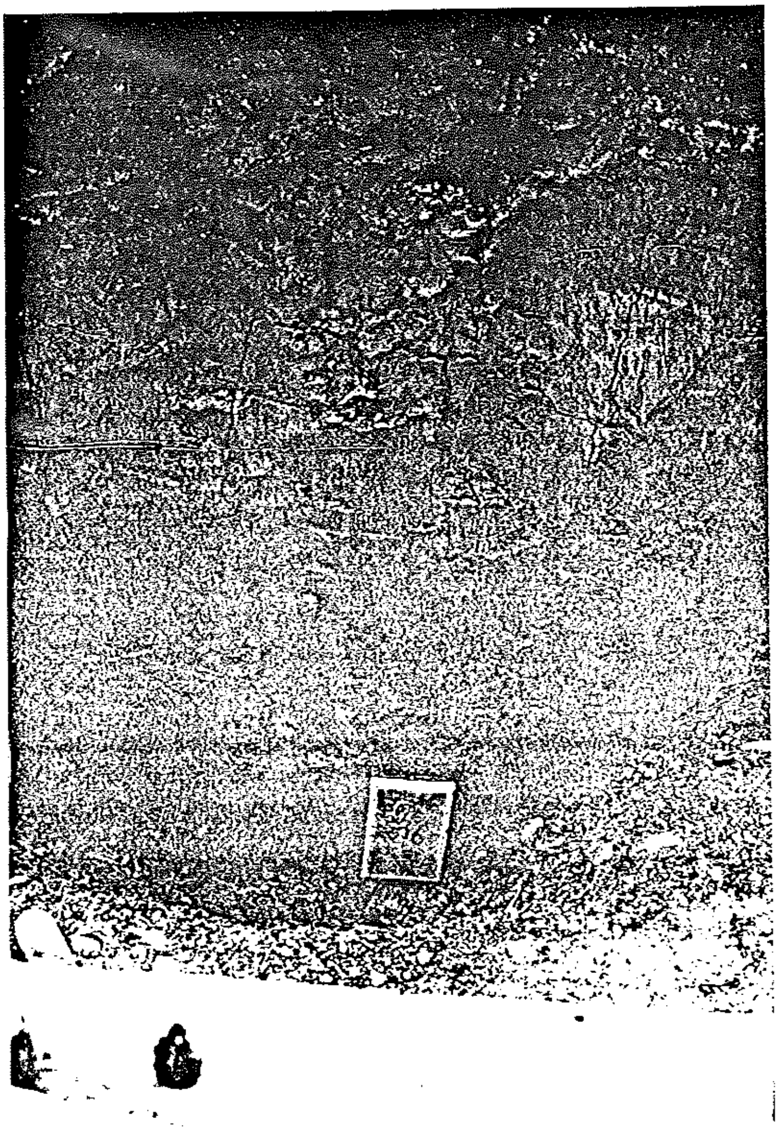

Plate 2. Field section of tree hollow 726, with a soil infill merging with the overlying post-prehistoric alluvium.

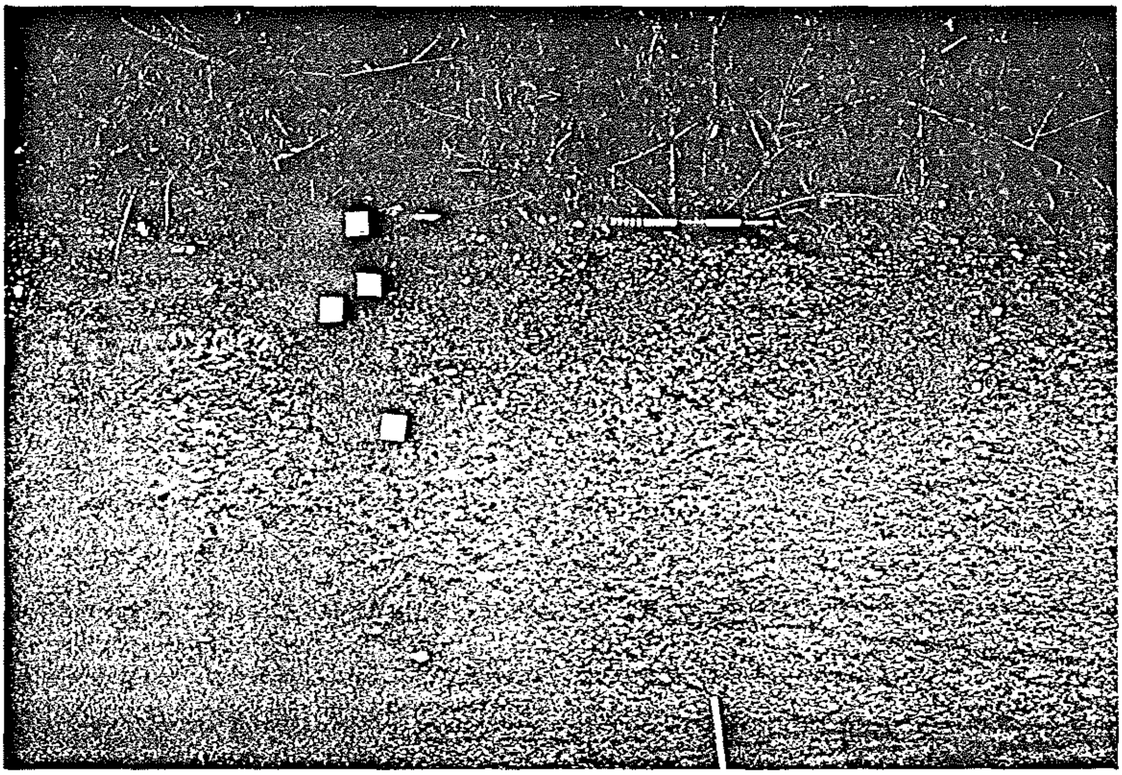

Plate 3. Field section of tree-throw pit 760, showing turbation of late Pleistocene coarse sediments, sampling of the fine soil infill and the thin overlying fine Roman alluvium.

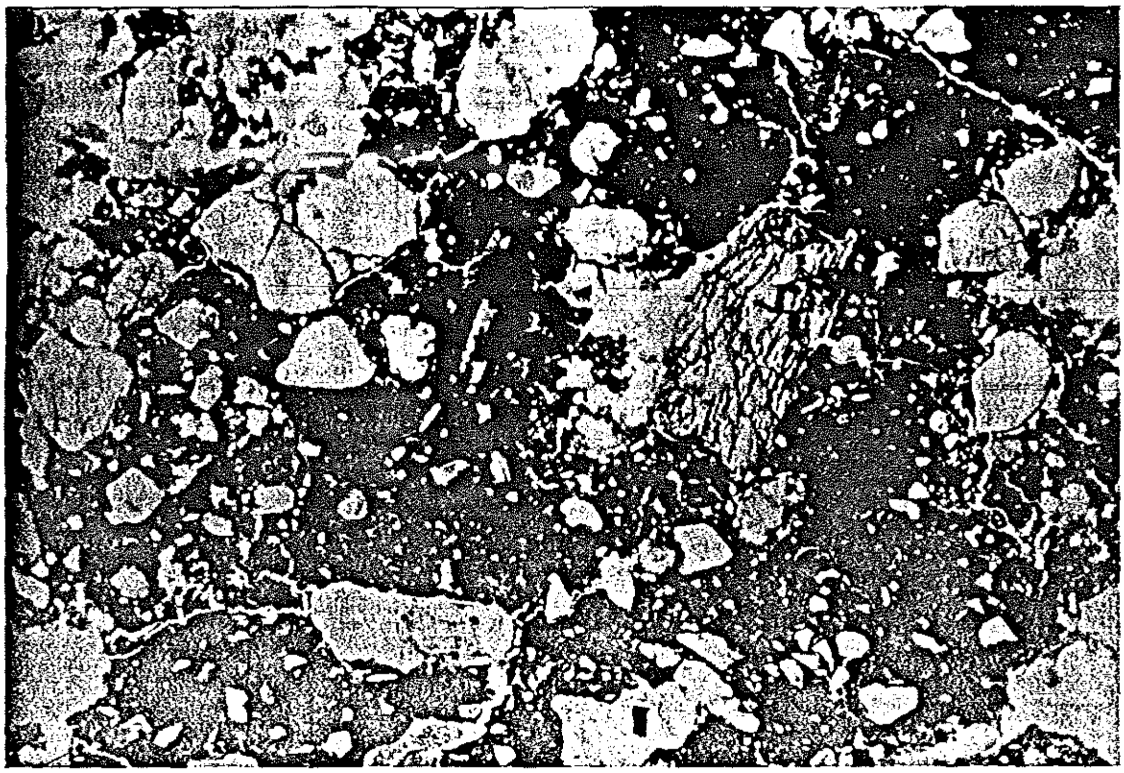

PLate 4. Photomicrograph: thin section A, base of infill of TTP 750; dark dense fine fabric is the result of impregnation by iron and manganese (hydromorphism), strongly masking soil heterogeneity. Plane polarised light (PPL), frame length is 5.36 mm.

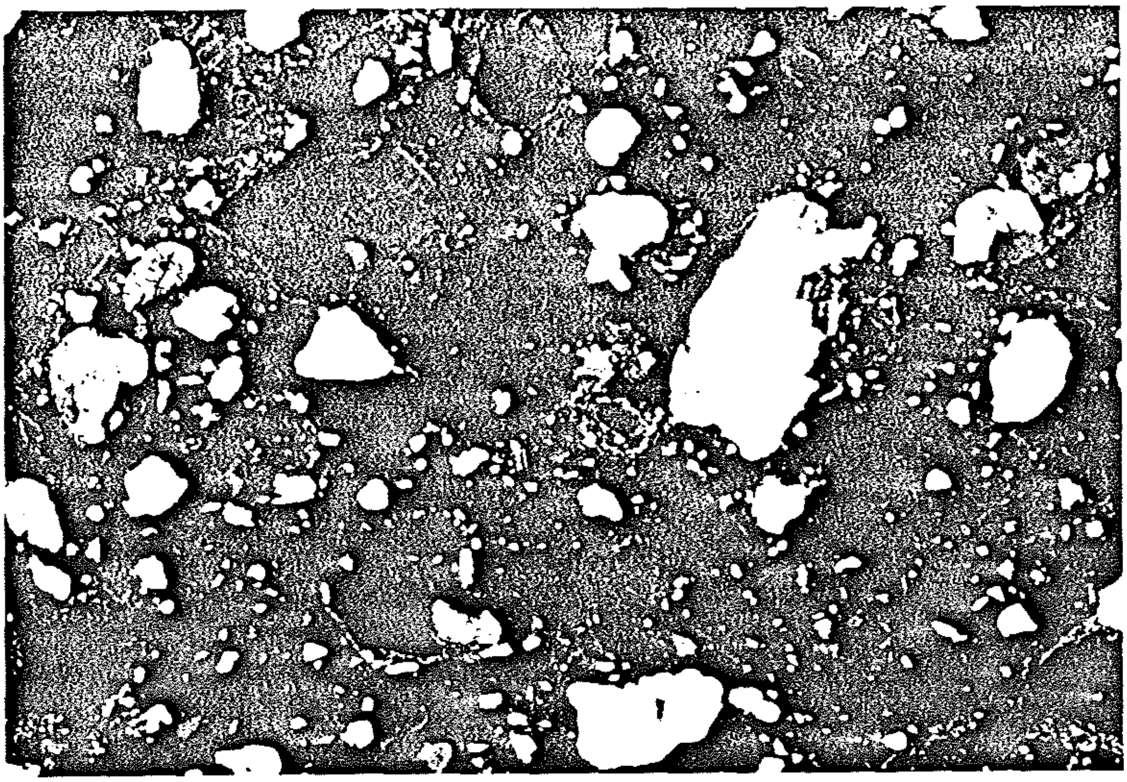

Plate 5. As plate 4, but crossed polarised light (XPL). Shrinking and swelling of clay may have led to some homogenisation of the fabric and the bright birefringent boundaries around coarse mineral grains. Alternatively these birefringent boundaries may be relic of soil slaking as the tree hollow infilled with disturbed soil - the birefringent void coatings (bottom right hand corner) supporting this interpretation.

Plate 6. Thin section A: coarse red stones possibly reddened by burning. Oblique incident light (OIL), frame length is 5.36 mm.

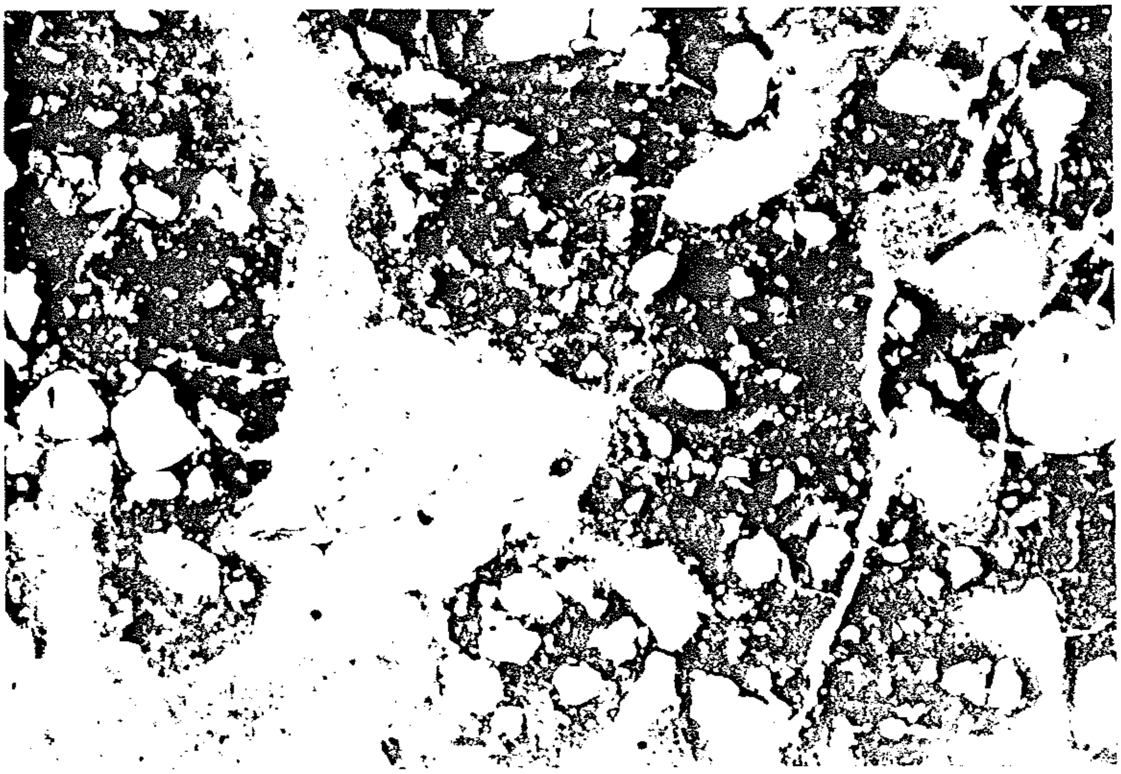

Plate 7. Thin section at top of infill of TTP 750 and near boundary with Roman alluvium; the porosity, namely the vertical fissure and the vughs, caused by plant growth, probably held stagnant standing water. Under such hydromorphic conditions the soil surrounding the porosity has become strongly depleted of iron. PPL, frame length is 5.36 mm.

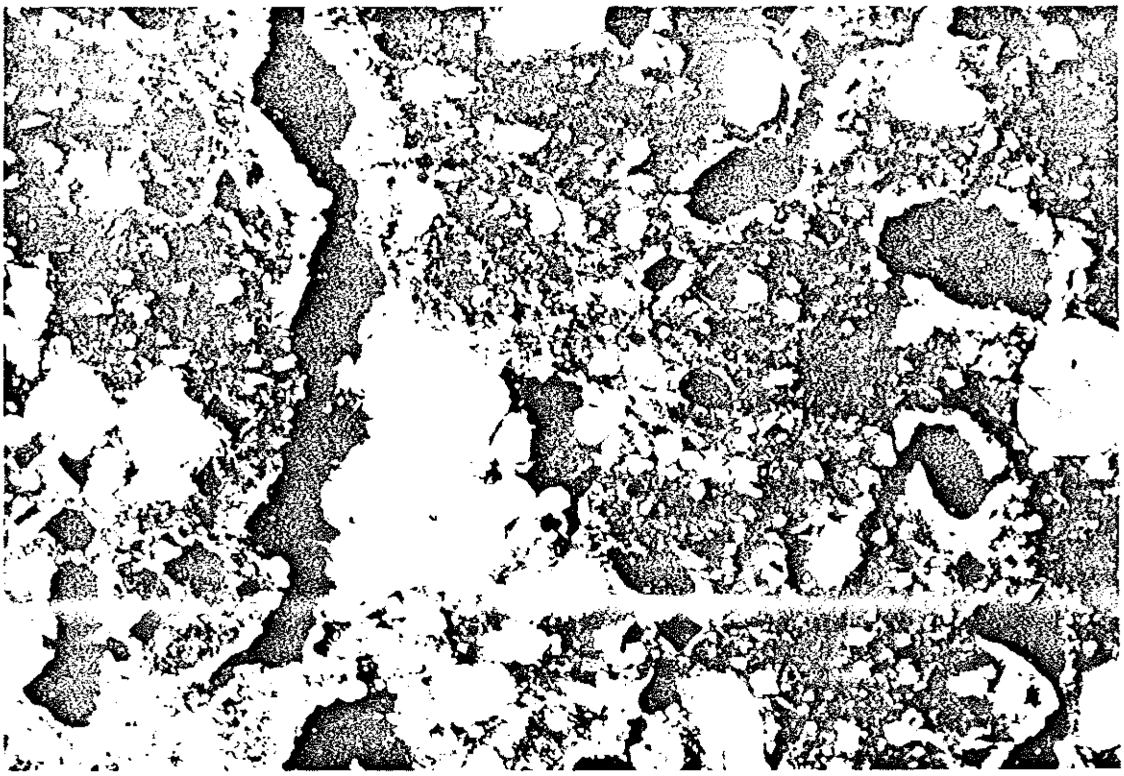

Plate 8. As plate 7, but XPL; note birefringence of leached clay, and the relic coated void (centre) unaffected by gleying

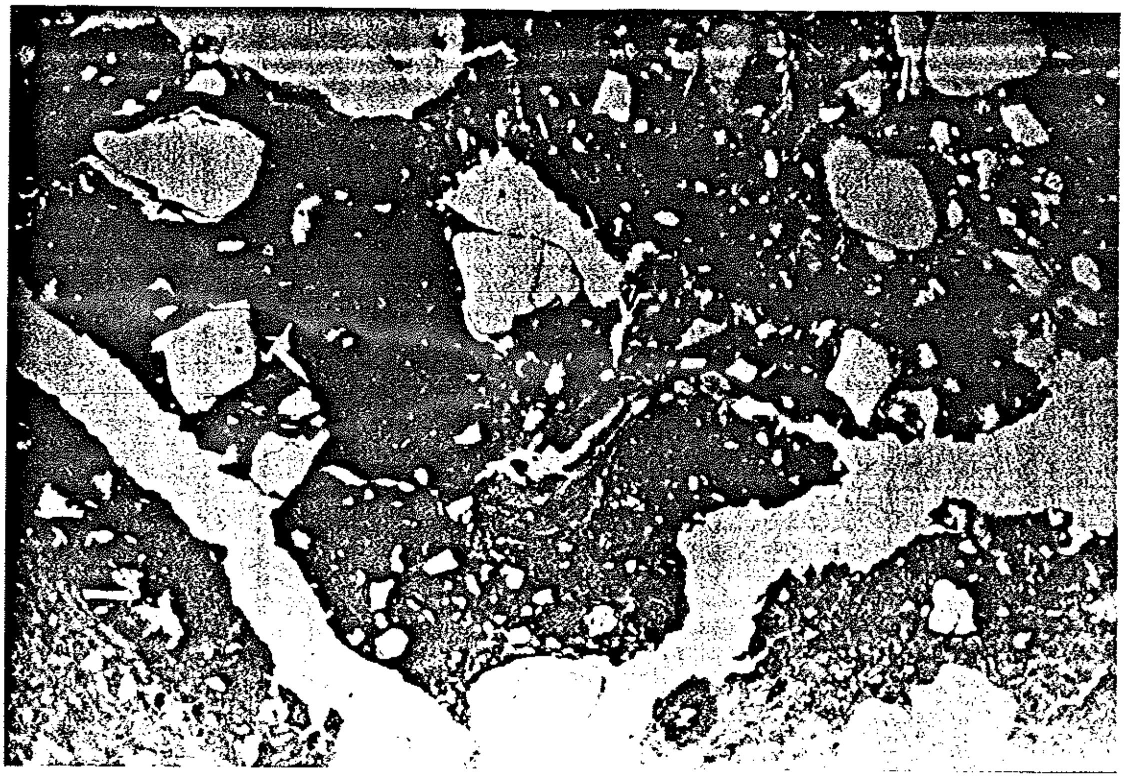

Plate 9. Thin section E: layer 405, the Neolithic soil buried by the cursus bank; the soil, again strongly impregnated with iron and manganese, comprises many soil fragments separated by fissures that have become infilled by silt and clay, all as the result of tree-throw turbation. PPL, frame length is 3.35 mm.

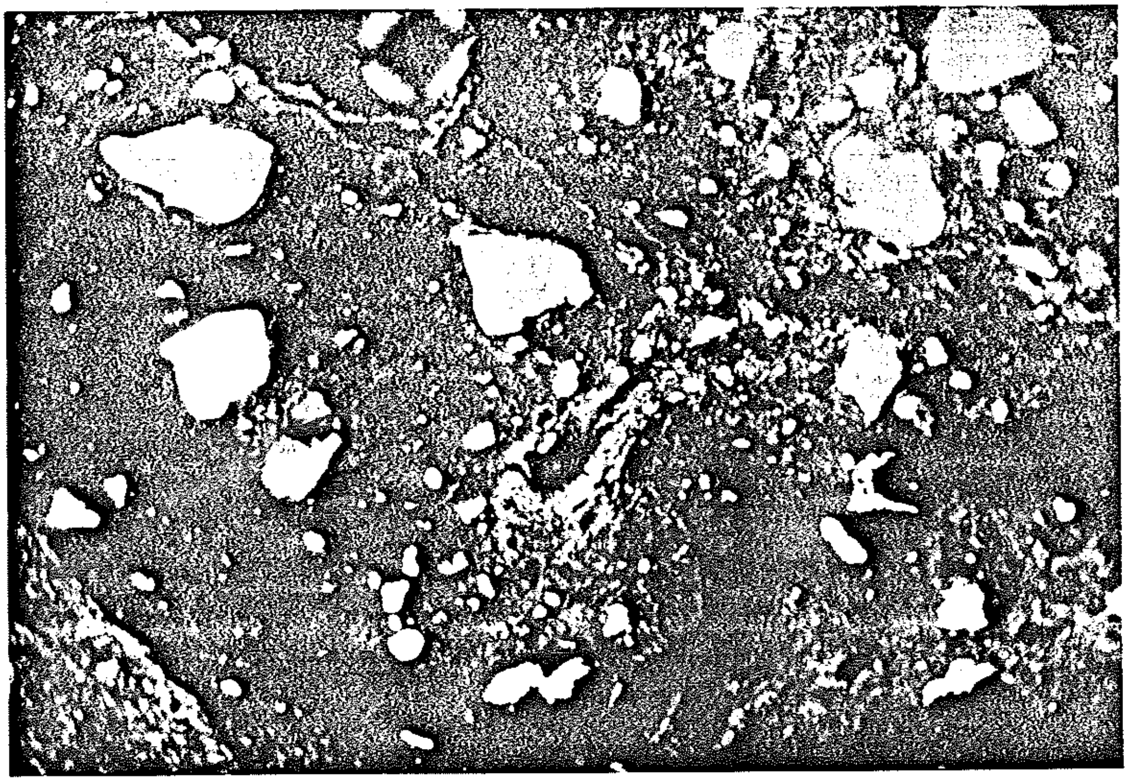

Plate 10. As plate 9, but XPL; note birefringent infill in centre and the iron stained secondary void within this, that may be the result of post-turbation rooting.

Plate 11. Detail of plate 9; note the dusty clay nature of the infill. PPL, frame length is 0.33 mm.

Plate 12. As plate 11, but XPL; note iron stained nature of secondary void.

Plate 13. Thin section E (layer 405); possible fibrous woody root fragments relic of the tree thrown on this site. Original organic cells pseudomorphically replaced by mineral material - possibly calcium carbonate, now acid etched. PPL, frame length is 5.36 mm.

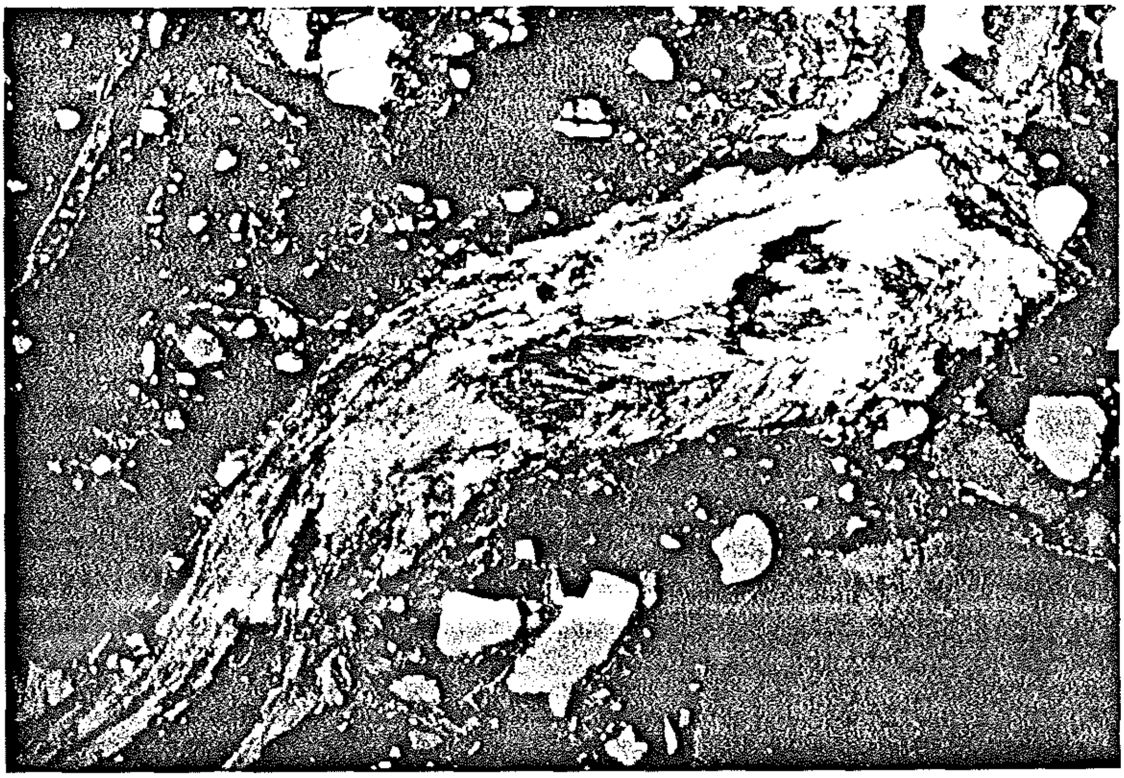

Plate 14. As plate 13, but XPL.

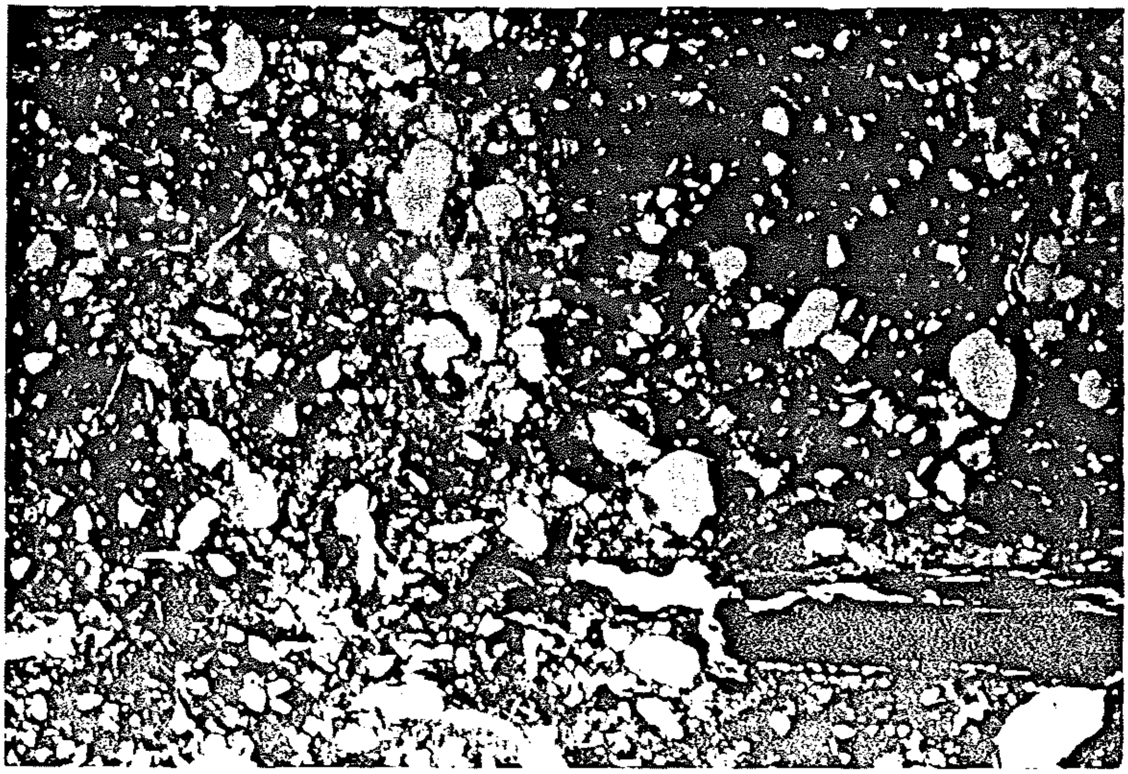

Plate 15. Thin section E, layer 410 the cursus bank: this soil is more homogenous than layer 405, and contains coarse and fine charcoal (bottom right). It has also been affected by secondary hydromorphic depletion. PPL, frame length is 3.35 mm.

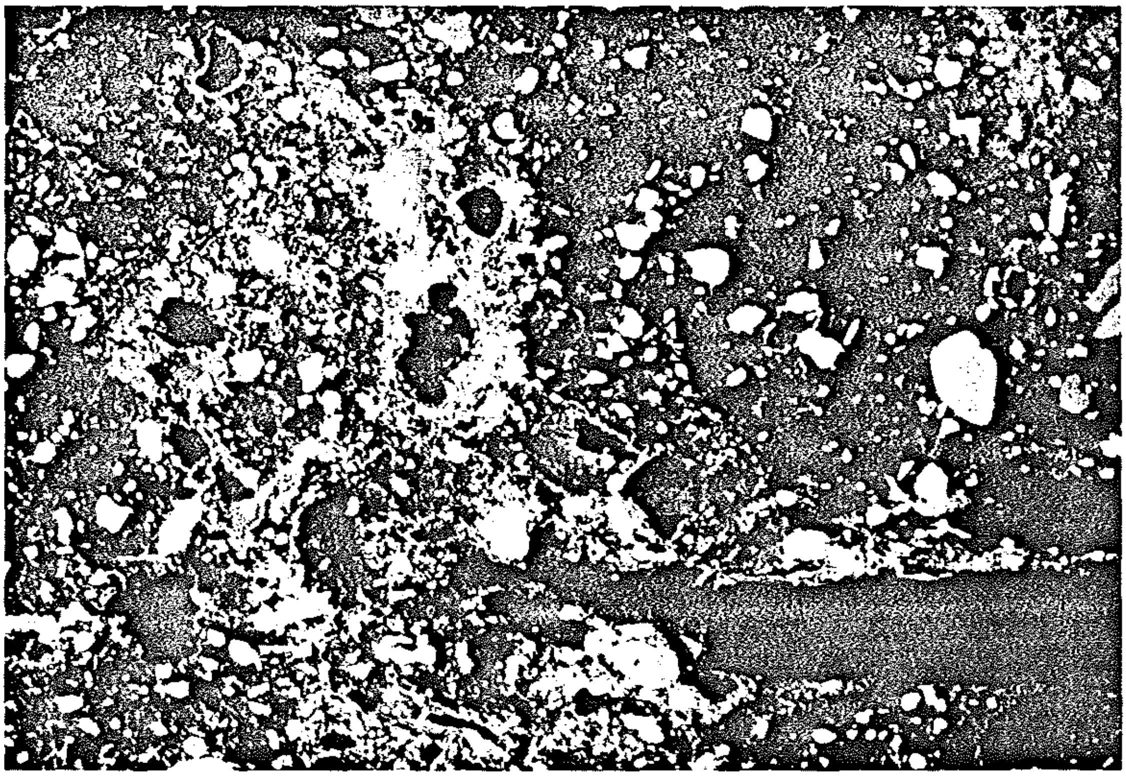

Plate 16. As plate 15, but XPL.

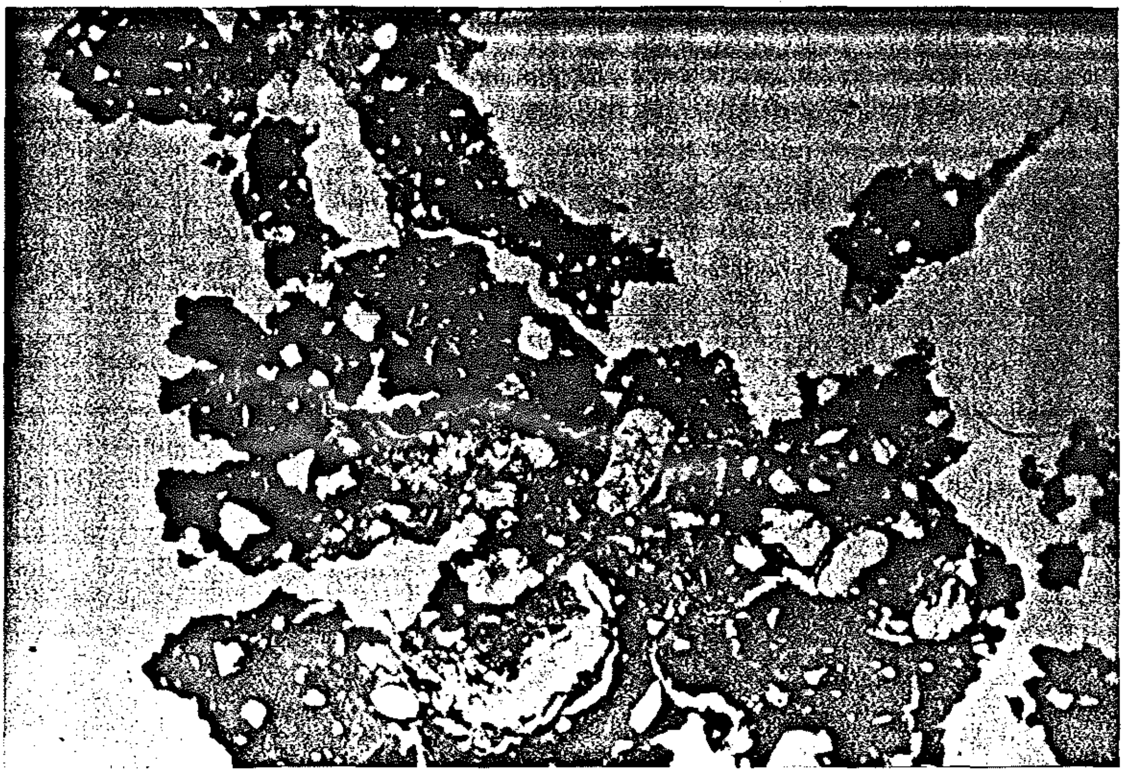

Plate 17. Thin section E, junction of of Neolithic soil and cursus bank: some of the coarse porosity is infilled by layers of silt and clay sometimes rich in fine charcoal. This is washed in material, either from dumped "occupation" soil, or possibly from material washing off the in situ burned tree. PPL, frame length is 3.35 mm.

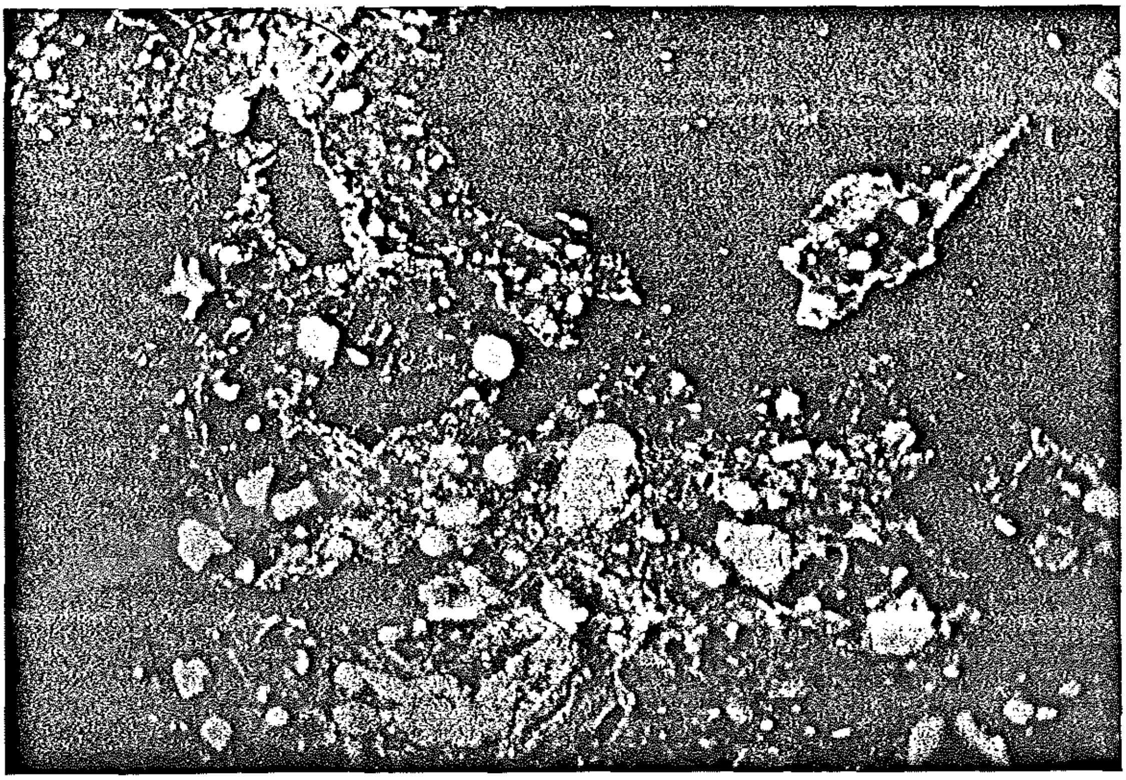

Plate 18. As plate 17, but XPL, clearly showing layered clay at the bottom.

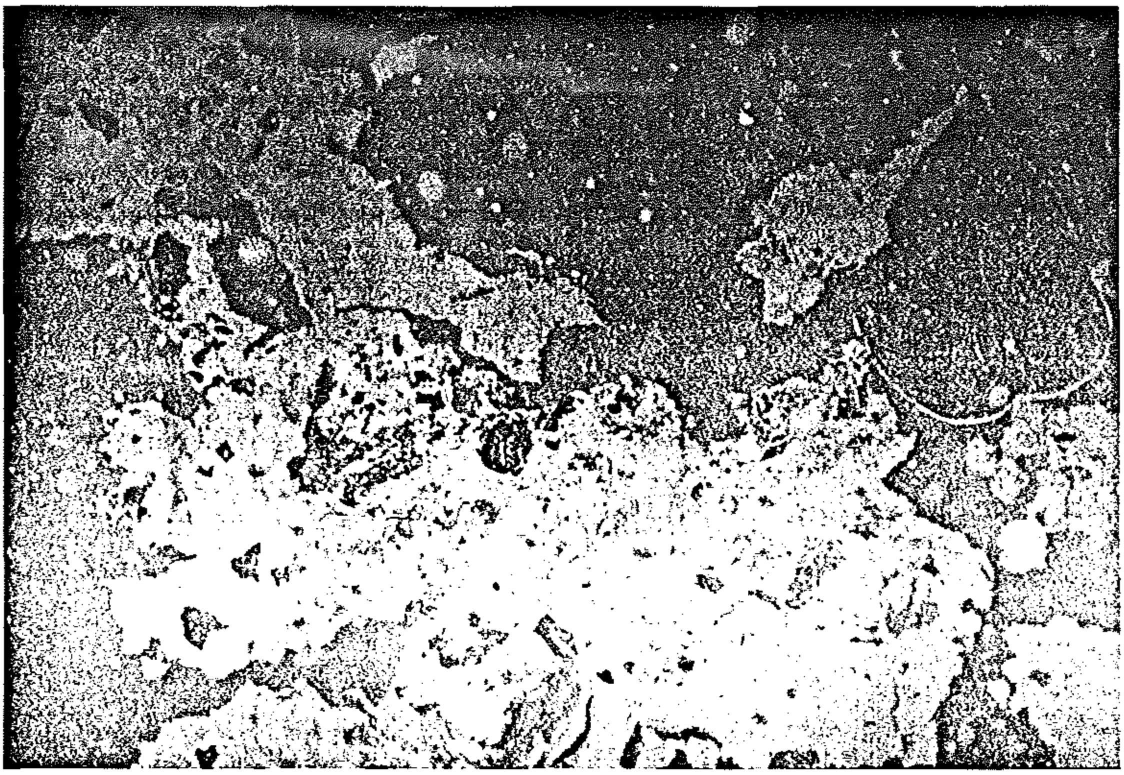

Plate 19. As plate 17, but OIL; note fine charcoal layer.

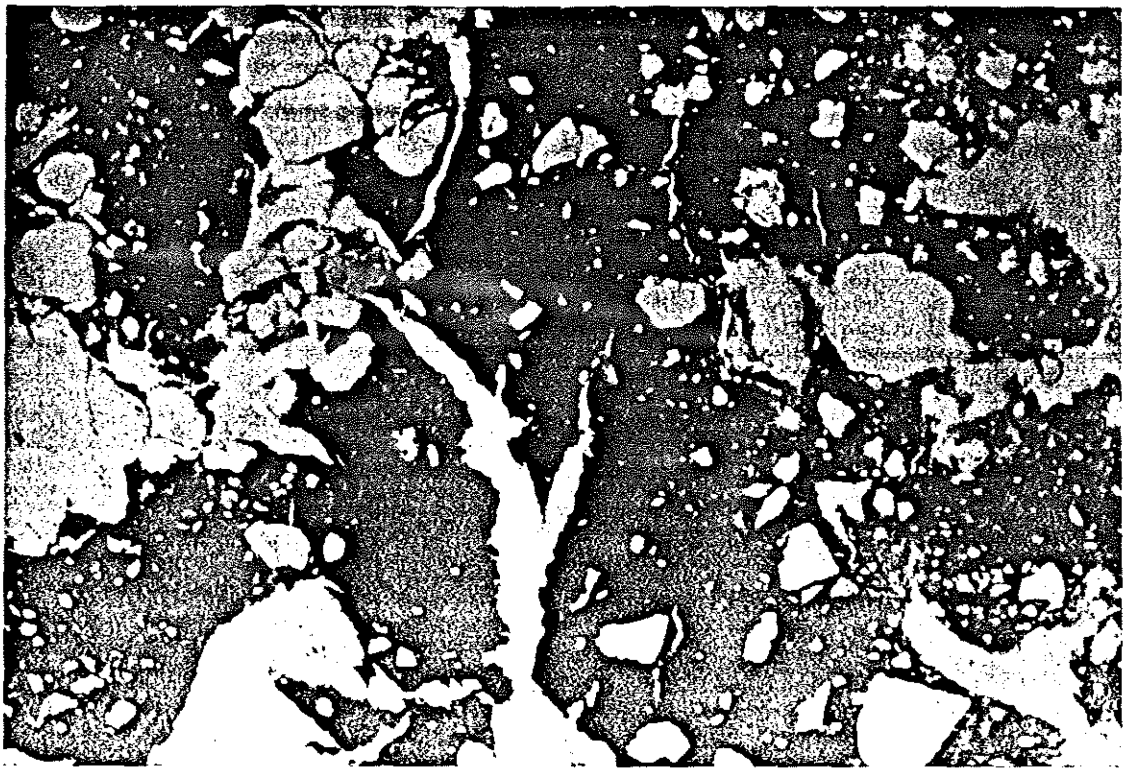

Plate 20. Thin section E: cutting right through layers 405 and 410 are coarse vertical fissures completely infilled by heavily iron and manganese stained clay, probably resulting from root perforation and alluvial clay inwash dating to post-prehistoric alluviation. PPL, frame length is 5.36 mm.

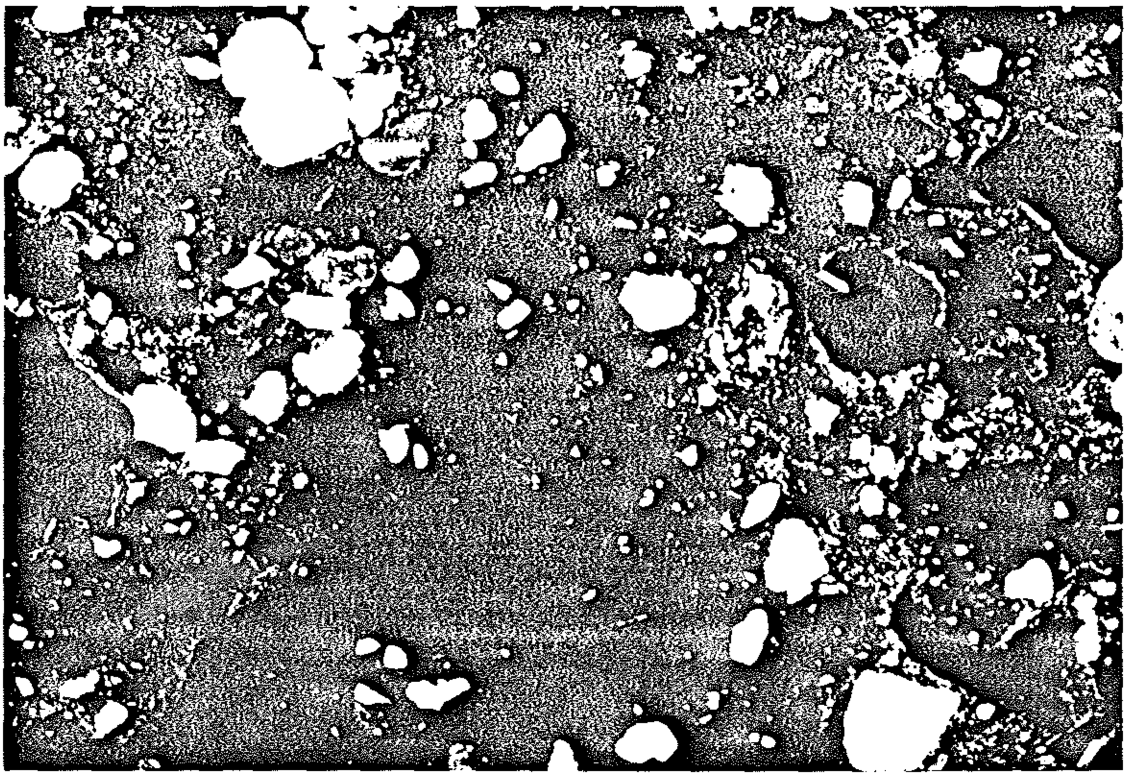

Plate 21. As plate 20, but XPL; note isotic nature of heavily stained clay.

Plate 22. Thin section F: base of tree hole 726; typical hydromorphic mixture of iron stained and iron depleted soil, that still contains come relic features of turbation (dusty clay infills, bottom right) and possible tree burning (charcoal fragment, right centre). PPL, frame length is 5.36 mm.

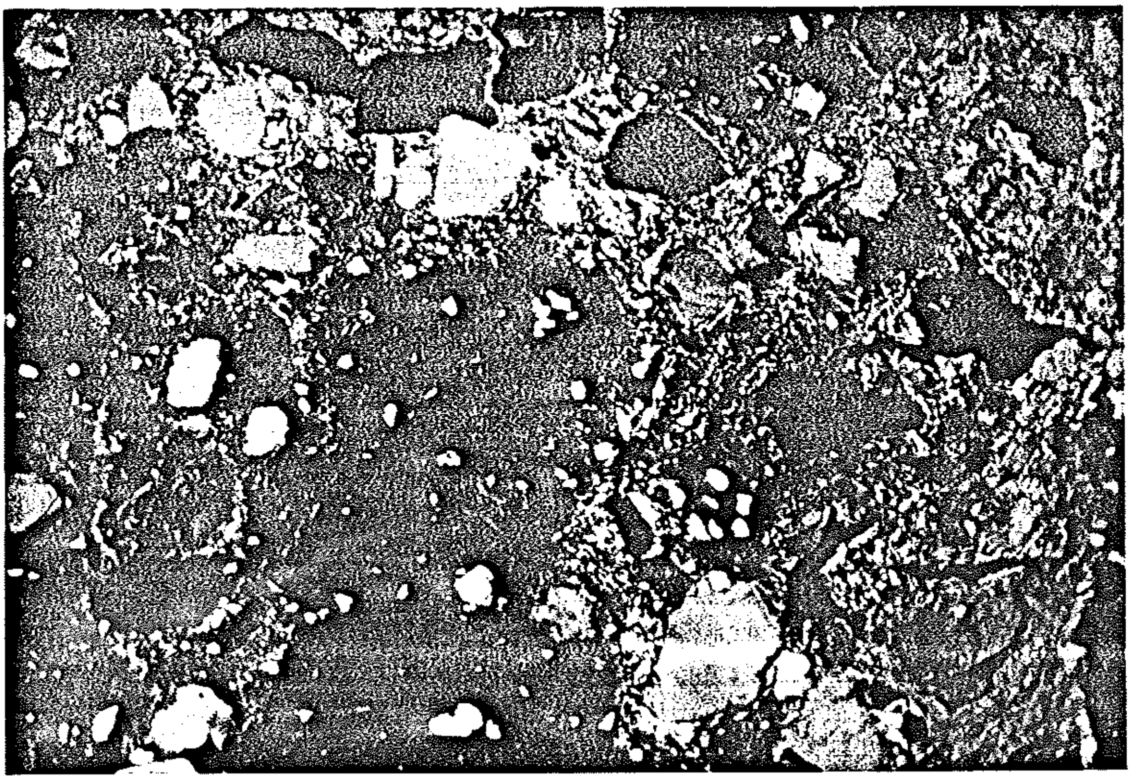

Plate 23. As plate 22, but XPL; clay infills on right only partially depleted of iron.

Plate 24. Thin section F: black charcoal, iron stained areas (orange and reddish areas) and depleted zones (very pale yellow areas) at the base of this tree-throw pit which has been affected by gleying, show up in this OIL view. Frame length is 5.36 mm.

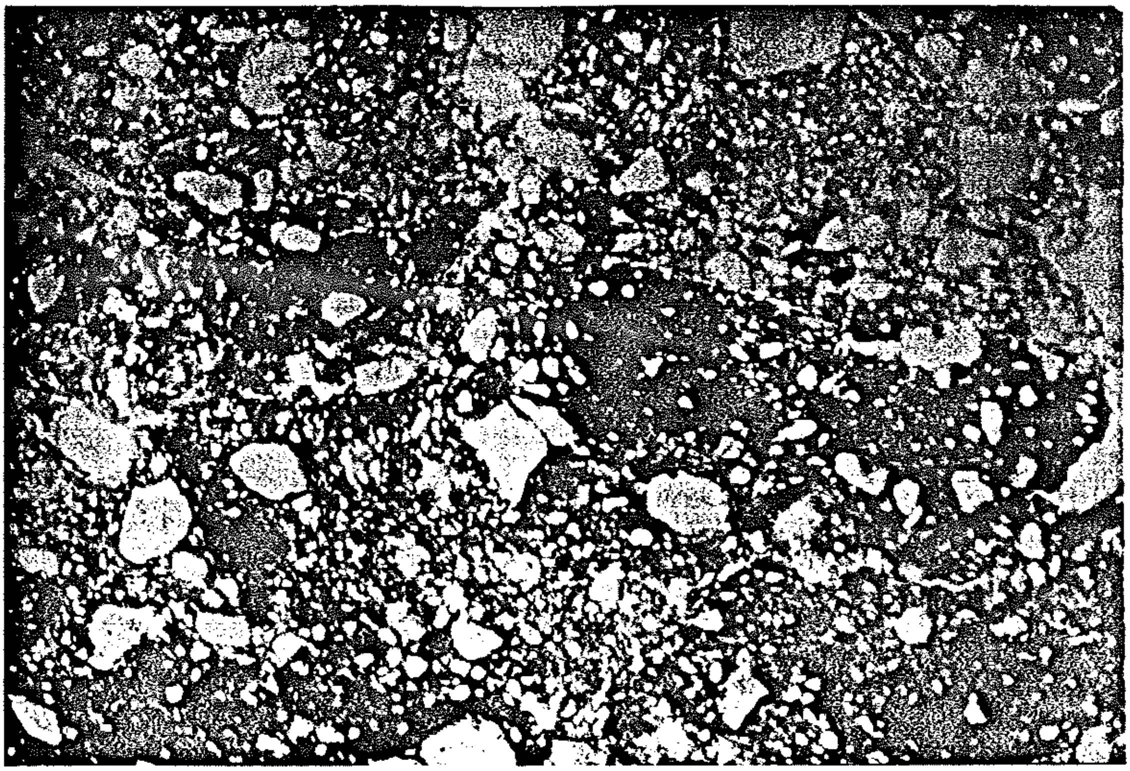

Plate 25. Thin section G: late prehistoric soil, which has been strongly homogenised, then later depleted by hydromorphism during later alluviation. PPL, frame length is 5.36 mm.

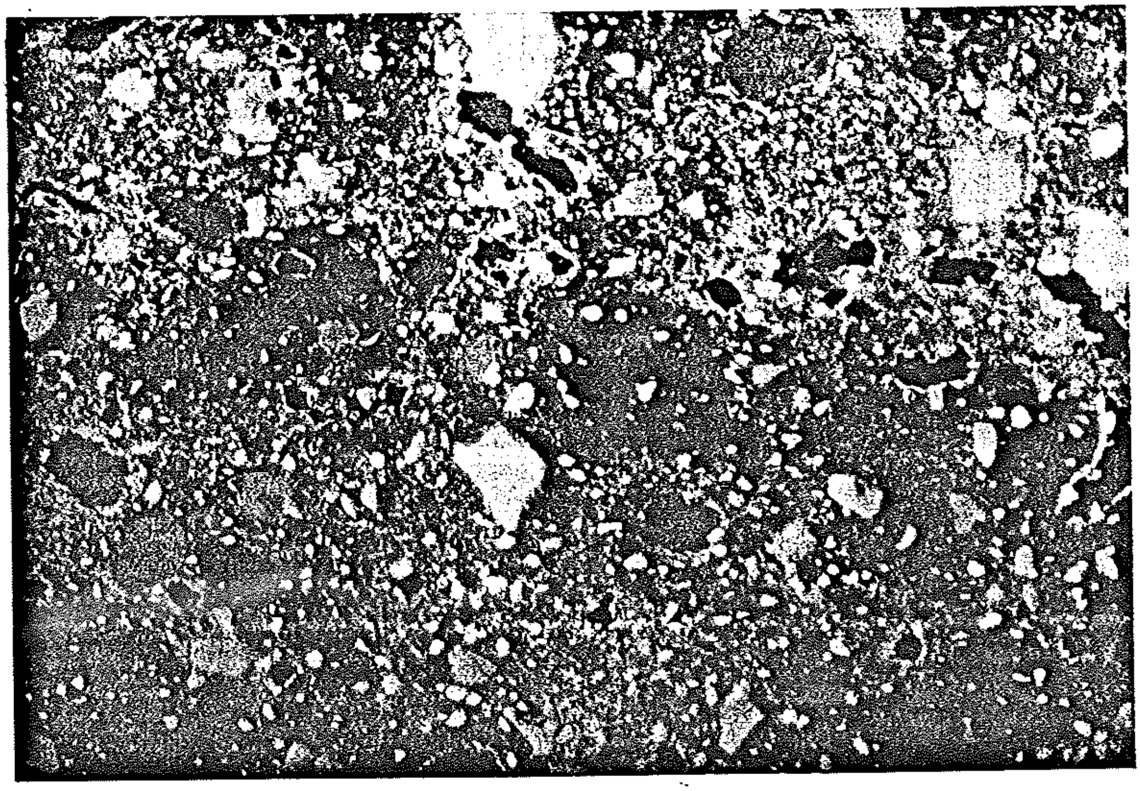

Plate 26. As plate 25, but XPL.

Plate 27. Thin section H: calcareous shelly alluvium of the Saxon period which is in contrast to the prehistoric decalcified soils. This alluvium, which contains chalk clasts suggests erosion of chalklands. PPL, frame length is 5.36 mm.

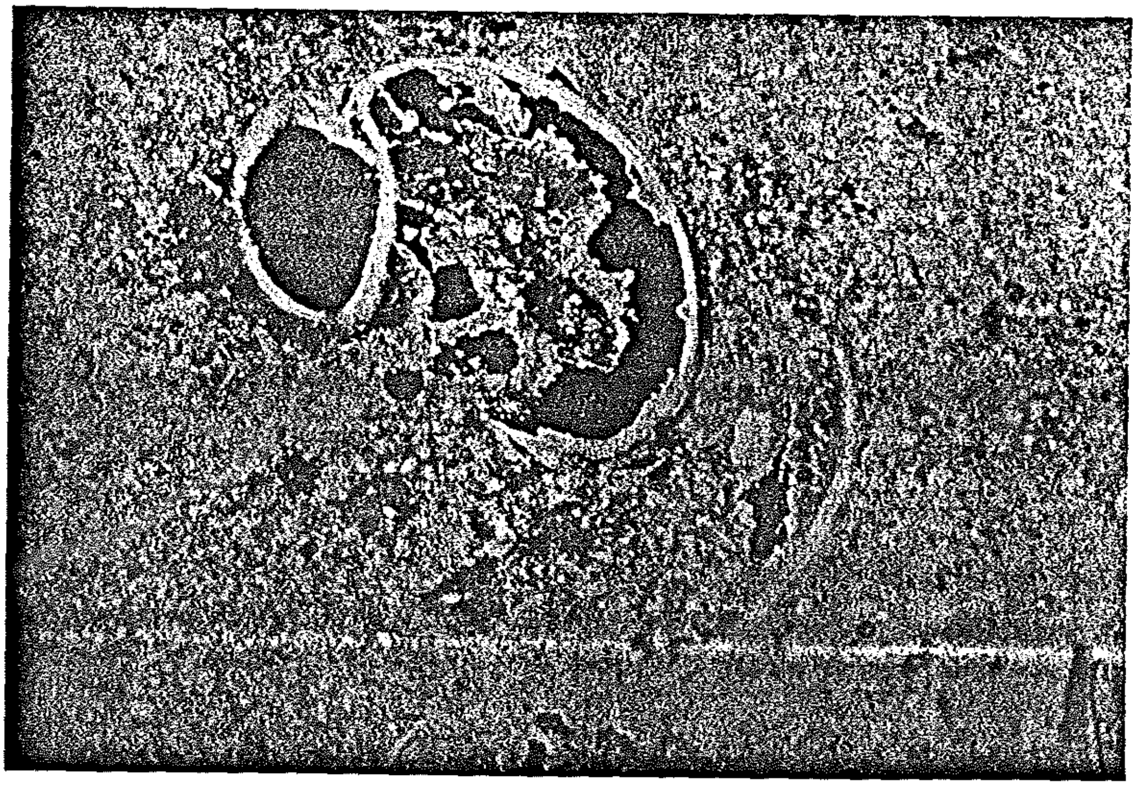

Plate 28. As plate 27, but XPL; note highly birefringent nature of the micritic alluvium and calcite shell.

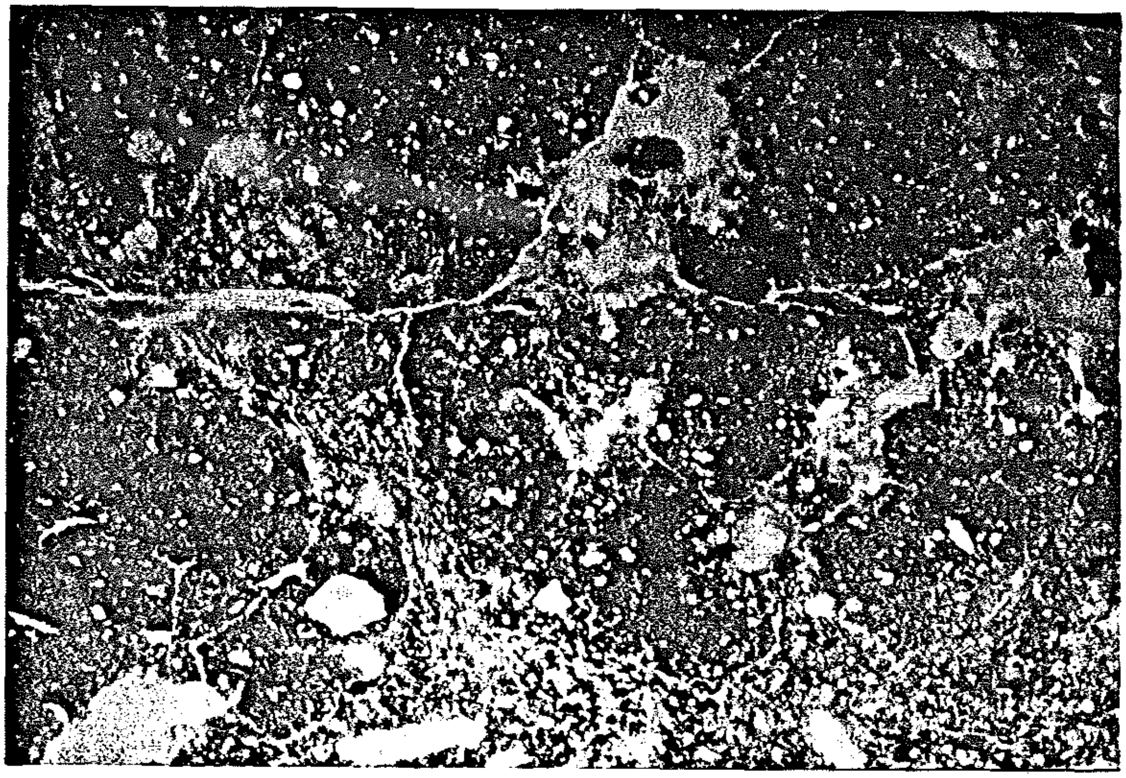

Plate 29. Thin section H: within the calcareous alluvium are clasts of decalcified loamy soil, which may indicate erosion of the decalcified soil cover of the chalk. PPL, frame length is 5.36 mm.

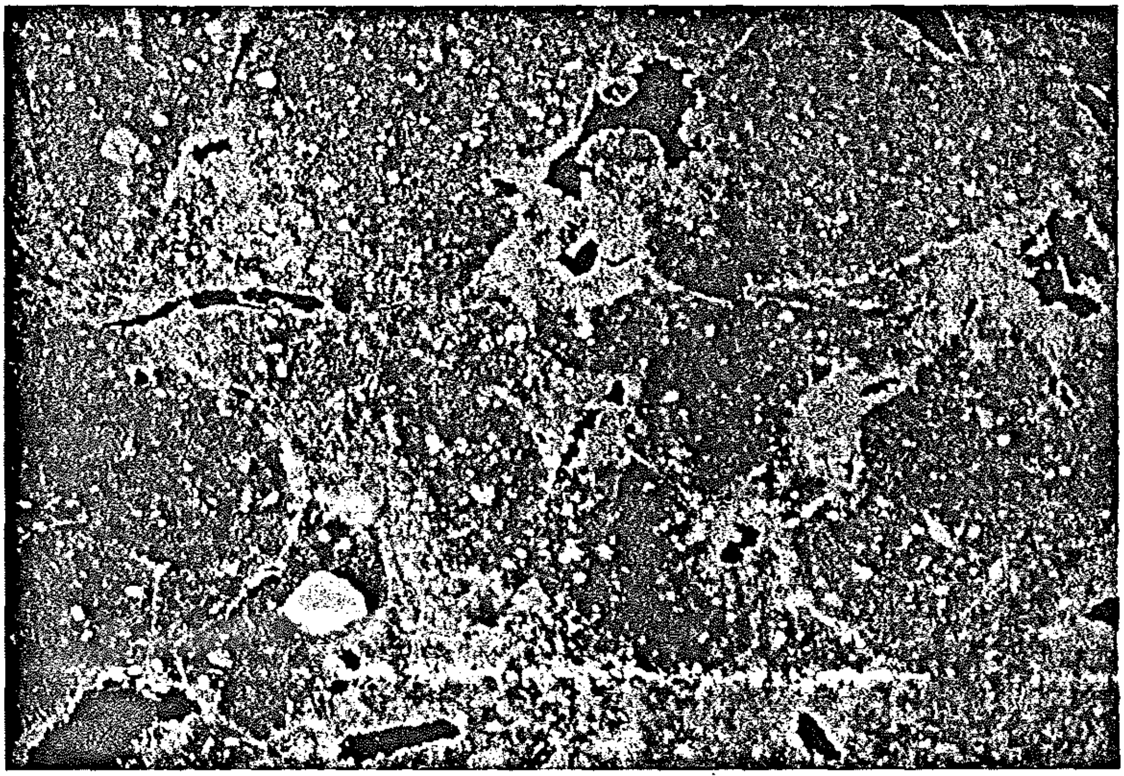

Plate 30. As plate 29, but XPL.