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SOIL REPORT ON THE LATE BRONZE AGE MIDDEN AT POTTERNE, NEAR DEVIZES, WILTSHIRE.

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Summary

The very extensive Late Bronze Age midden at Potterne was studied in detail through soil micromorphology at Cutting 12 (14 thin sections), with the aid of reference slides of a dog coprolite and ashed organic matter from the midden. Four slides were also studied from midden and "colluvial" midden from Cuttings 14 and 15. At Cutting 12 the soil had been deeply truncated prior to occupation and deposition of the midden, which mainly developed from the dumping of burned animal stable layers - phytoliths, ash, coprolitic material and included sand. Such an accumulation suggests that little of the stable clearings was used for field manuring. Weathering of the "Graminae" ash midden allowed mobilisation of calcium and phosphorus to produce calcium phosphate mineralisation of materials including seeds. The upper part of the midden which may contain more "hearth ash" was reworked agriculturally and in places local soil became mixed with midden material to produce colluviums which continued to be cultivated. The report is supported by 70 colour plates.

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SOIL REPORT ON THE LATE BRONZE AGE MIDDEN AT POTTERNE, NEAR DEVIZES, WILTSHIRE

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1. Introduction

During 1983, 1984, 1985 and 1986 the Late Bronze Age (archaeomagnetic date of 750 bc) midden at Potterne was excavated (Director, Chris Gingell) by The Trust for Wessex Archaeology (Unit Director, Andrew Lawson). This situation of midden deposits covering an area of perhaps 5 hectares (Gingell and Lawson, 1984, 1985) is apparently unique. Examples of similar, but much more restricted deposits, are only known (through micromorphology) to the author from Stoney Grange, The Fens (Romano-British; Charles French, pers. comm.), Brean Down, Somerset (Bronze Age; Macphail in prep.) and 28, Park St., Southwark (Late Roman; Macphail in prep.) where ash accumulations occur sometimes with bone and coprolites. The major problems to be solved at the Potterne midden were the identification of constituents and their origin, the mode of accumulation and nature of stratification as none could be found archaeologically even when employing 10cm. spits (Peter Donaldson, pers. comm.).

The essential heterogeneity of midden deposits as an example of occupation sediments clearly indicates that they have to be treated in the same way as other archaeological accumulations, and experience has shown that these can be best studied by soil micromorphology - standard geological and pedological techniques not being so useful (Macphail and Courty, 1985; Courty and Nornberg, 1985; Nornberg and Courty, 1985). In fact, because of the English climate and past land use, midden deposits of this kind have not often survived or been studied in this country and so the experience of French workers in semi-arid (pre-Harappan) sites in North-West India (Courty, pers. comm.) has been invaluable.

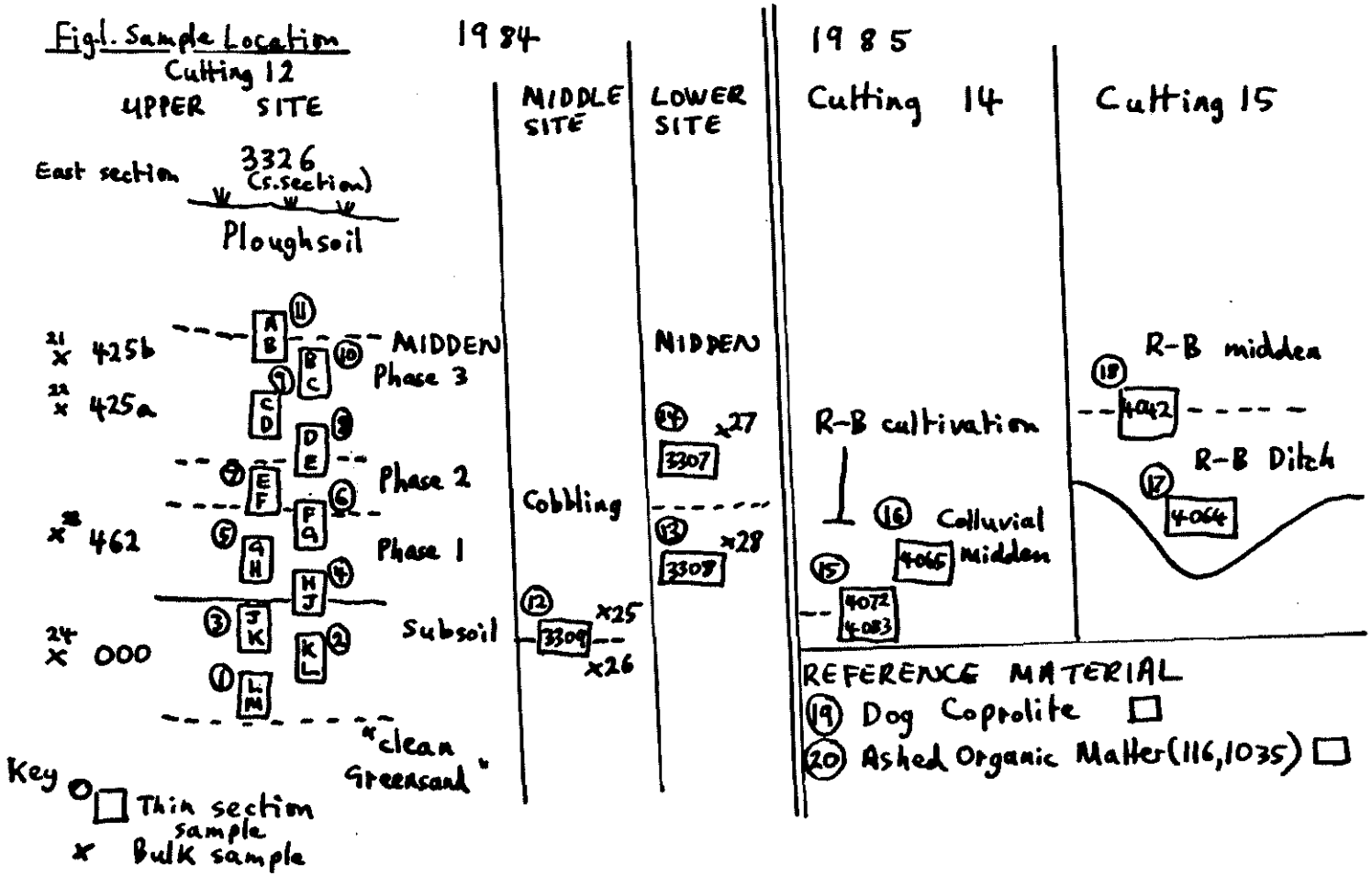
Fig1. Sample Location
Cutting 12
UPPER SITE
1984
MIDDLE SITE
LOWER SITE
1985
Cutting 14
Cutting 15
East section
3326
(Cr.section)
Ploughsoil
MIDDEN
Phase 3
Phase 2
Phase 1
Subsoil
"clean Greensand"
MIDDEN
Cobbling
R-B cultivation
Colluvial midden
R-B midden
R-B Ditch
4042
4064
4066
4072
4083
3307
3308
3309
Key
Thin section sample
Bulk sample
REFERENCE MATERIAL
19 Dog Coprolite
20 Ashed Organic Matter (116,1035)

2. Methods and Samples

As stated above, the main method applied to this site is soil micromorphology using the basic terminology of Bullock et al (1985) and employing the archaeological approach of Courty et al (in prep.). Bulk analyses for grain size, calcium carbonate, organic carbon and pH were also carried out, either by the author (see Acknowledgements) or by the Soil Survey of England and Wales, at Rothamsted Experimental Station (Avery and Bascomb, 1974). Samples, as schematically located in Figure 1, comprise;

from the 1984 excavation (cutting 12),

a) "upper site"

thin section samples (1-11; Plate 1) from the natural subsoil through to the top of the remaining midden, and bulk samples 21 and 22 (425b and 425a) from "phase 3" of the midden, 23 (462) from "phase 1" of the midden, and 24 (000) from the subsoil;

b) "middle site"

thin section sample (12) of the cobbled area, and bulk samples 25 (3309a) the overlying midden and 26 (3309b) cobbled surface,

c) "lower site"

thin section samples (13; 3308) of "phase 1" and (14; 3307) "phase 2" and respective bulk samples 27 (3307) and 28 (3308);

from the 1985 excavation,

d) "crest of the hill" (cutting 14)

thin sections (15; 4072/4083) from the occupation and overlying midden, and 16 (4065) from the midden and colluvial midden,

e) cutting 15

thin sections (17; 4064) of the Romano-British ditch fill, and (18; 4042) of the Romano-British colluvial midden, and

f) reference thin sections of dog coprolite (19; 212, 1132) and "ashed organic matter" (20; 116, 1035), and;

g) from 1983 excavations,

bulk samples only (28-41) from various contexts, which were taken before the author's involvement with the site, and therefore exact locations and relationship to the 1984, 1985 samples cannot be given.

This list shows that the main area of midden accumulation over the archaeological site (Plate 2), its close environs, reference midden constituents of ashed organic matter and dog coprolite, and later surrounding colluvial midden material were analysed in thin section to answer the questions posed in the Introduction, and other interpretive problems relating to bone, charred grain and mineralised seed preservation, for example.

3. Results and Discussion

The author's analysis of grain size and chemistry are presented in Tables 1 and 2 respectively, whereas the Soil Survey data is set out in Table 3. Soil micromorphological description and interpretation of the 20 slides is given in detail in Appendix 1, together with Plates 1 - 70.

3a Potterne Soils:- pre-site and primary occupation.

The site is in an area of Upper Greensand and Gault (Cretaceous), the main site being on a Greensand ridge. Soils developed on the Gault are mapped (Findlay et al 1983) as the Wickham III Association - Typical Stagnogley Soils whereas on the Greensand, Typical Argillic Brown Earths of the Ardington Association are present. The Greensand derives its name from the inclusion of frequent (thin sections 1, 2, 3) glauconite, a dark green iron rich mineral which locally eventually weathers to a brown plasma of ferruginous (goethite or lepidocrite) smectitic clay (Loveland, 1981; Loveland and Findlay, 1982). The soil micromorphological characteristics of argillic (ie Bt horizon) soil formation

in Upper Greensands have been reviewed by Loveland and Findlay (1982) (thin sections housed at the Soil Survey, Rothamsted, have also been scanned by the author). The micromorphology of Lower Greensand soils in Sussex (Scaife and Macphail, 1983; Macphail in Rudling, 1985) and Surrey (Macphail and Scaife, in press) have also been studied.

Examination of the subsoils at Potterne (Plates 1 and 2) found no Bt horizon (sensu stricto) relating to an argillic soil development phase. Such illuvial (Bt) horizons appear to have been eroded from the ridge-top part of the site, but nevertheless the presence of sesquioxidic nodules with associated clay clearly indicate that the pre-site soils were probably weakly formed Argillic Brown Earths - although the parent material is rather low in clay content (Table 1, Sa. 24, Table 3, Sa. 36). This is reflected in the pale, poorly birefringent character of the fine fabric in the fine sandy loam subsoil - the coarse fraction being dominated by very fine and fine (53%) sand (Plates, 3, 4, 5). Thus, the site occupied an area which had been eroded as far as the poorly weathered C horizon. The propensity of such sandy soils to erode in pre-history has been noted many times elsewhere (Scaife and Macphail, 1983; Macphail, in Drewett, 1985; in prep; Macphail, 1986; Macphail, 1987). However, it appears that possibly after erosion and during occupation some sub-aerial weathering and surface soil formation did take place, prior to burial by the midden accumulation, as illustrated by evidence of biological activity and development of soil structures (thin section 4).

The speculation that cultivation accelerated the deep erosion of the pre-occupation soil cover at the ridge top site is supported by the well-known theory (Wooldridge and Linton, 1933; Macphail, 1987) that such light soils would be first utilised for agriculture and therefore the first to erode.

Lastly, examination of the subsoil shows that contamination of the pure Greensand parent material by anthropogenic materials naturally increased towards the surface (thin sections 1, 2, 3) as occupation and midden material was worked by roots and fauna or was washed down into the soil via its porosity. Generally the contamination is in the form of dark fine charcoal rich coatings and infills or as inclusions of "midden materials" (Plates 6, 7) - eg calcitic ash (Table 2, Sa 24) - although in places there have been more subtle weathered combinations of clay from the Greensand, or new-formed clay from potassium and phosphate rich solutions derived from overlying dissolved ash layers (Plates 8, 9). The combination of chemicals from ash residues with local soil to form new fabrics has been described both from ash rich pit fills in Europe (Slager and van der Wetering, 1977; Courty and Fedøroff, 1982) and from English occupation deposits at Brean Down and Maiden Castle (Macphail, in prep.).

These subsoil indications of the overlying midden are noted here because in the case of other sites elsewhere when erosion has removed the archaeology, only these traces may suggest such intensive occupation. It is probable that at Potterne the moderately base rich nature (c.pH7) of the Upper Greensand has aided the preservation of calcitic materials (ash) whereas, for example at Beeston Castle, Cheshire (Macphail, in prep.) only rare traces of ash are present in the Iron Age soils because these were acid and of podozolic origin.

3b <u>The Midden "Phase 1"</u>

This part of the report draws upon the evidence from thin sections 4, 5, 6, 12, 13, 19 and 20. The junction (Plate 1, H/J) between the highly disturbed and contaminated occupation surface of the subsoil and the midden at Cutting 12 (Section 3326) commences with 2cm of discontinuous burned bone (probably associated with dog coprolite) and hearth layers; and 15-17cm of occasionally

layered "graminae" ash residues rich in phytoliths (plant opal), which also include coprolitic material, wood charcoal, charred plant remains, bone fragments, various burned and unburned daub and local fine quartz and glauconitic sand.

Constituents. These constituents which, although "dumped", have been only moderately disturbed in places during the process, are discussed with their origins next under the following sub-titles; i) dog coprolites; ii) hearth layers; iii) "Graminae" ash residues, and iv) daub and other mineral inclusions.

i) Dog coprolites Examination of reference dog coprolites from Potterne (thin section 19) and from Maiden Castle (Macphail, in prep.) allow some of the coprolitic material within the midden to be safely ascribed to this source. Dog coprolites are very dominantly made up of bone (plates, 10, 11, 12), which may sometimes, as found elsewhere (eg Maiden Lane, London; Clare de Rouffignac, pers. comm.), have been previously burned. The bone content also examined under Ultra Violet light shows bacterial attack probably associated with "digestion", with rather pure amorphous organic matter of these coprolites, relating to their carnivorous diet (Courty et al in prep.). The quantity of disarticulated and gnawed bone on site supports this theory at Potterne (Alison Locker, pers. comm.). However, independent palynological enquiries (Scaife, this vol.) show that dogs were also scavenging large quantities of cereal material at Potterne and within dog coprolites here amorphous organic is associated with phytoliths (Plate 13, 14, 15, 16) - also found in the pollen preparation - corroborating the omnivorous diet of the Potterne dogs. Careful examination of probable carnivore coprolites (ie often with associated bone) fragmented within the midden and the reference slide shows that mineral material became included within the coprolite. This material is not secondary because actual secondary mineral material washed in via porosity which can be easily distinguished, coats it.

Although, individual silt and fine sand grains may well have been ingested, it is believed, that areas of "midden" fabric including calcitic ash, are less likely, it is believed, to have been ingested, because of the effects of stomach acids for example; except perhaps as a lump of soil. Probably the original excrement was in a semi-liquid form and soaked into and enclosed midden material. By hardening into a calcium phosphate coprolite, the amorphous coprolitic organic matter and enclosed midden material were preserved, hence such good pollen counts in comparison with the surrounding midden deposits (Scaife, pers. comm.).

ii) Hearth Layers The stratifications which make up this sequence are typical, and fragmented versions may be found throughout the midden, some durable elements being found as transported fragments either downslope, or downprofile in the subsoil (see Plates 8, 9).

Ash layers, somewhat mixed with fine sand and silt, are yellowish brown in colour, and speckled with fine charred organic matter. The ash is comprised of calcite crystals which give it a typical high birefringence and generally grey colour under oblique incident light (Plates 17, 18). At high magnification, the crystals are mainly fine and somewhat dispersed and dissolved (decalcified), indicating with the presence of phytoliths and the flaky nature of the fine charred organic matter that probably a mainly "graminae" material was burned. Reference can be made here to "Graminae" ash, which comprises very fine poorly crystalline material (thin section 20; Plates 19, 20, 21). The preservation of phytoliths, which are susceptible to heat (lost at 5-600°C; Courty et al in prep.) suggests only low temperature fires at this level.

The presence of rather larger rhomboid shape calcite ash crystals and overlying wood charcoal, indicate however that probably deciduous wood was burned above. This dramatically raised the temperature (to above c.650°C; Courty et al in prep.) because the mineral residue here contains no phytoliths or ash. All has

been melted and what is left is a typical vesicular fabric of dark grey or black, non-birefringent siliceous material (Plates 22, 23, 24, 25, 26) - fine black dots probably being pure carbon. In addition, organic matter not burned at quite such high temperatures occur, and are yellowish, non-calcitic and therefore non-birefringent, but retain pseudomorphic plant shapes or "ghosts" - the yellowish colour possibly relating to phosphate the other major mineral constituent of organic matter after calcite.

These latter two materials (high temperature dark grey and lower temperature yellowish ashed organic matter) are much more strongly resistant, compared with ash for example, and are commonly found elsewhere as fragments and are easily picked out by Ultra Violet light as "whitish" bodies. It is also worth noting that this hearth sequence is moderately devoid of mixed in sands from the subsoil, a characteristic of the midden generally, and as no reddened (heated) soil (Courty, 1984) occurs under it then again this demonstrates that these layers are not in situ.

iii) "Graminae" ash residues The most important characteristic of this material is that it is not related to hearths, and is in no way associated with the origins of the fabrics just described. It is very important material, however, because it forms the basis of the midden at Potterne. In places this "graminae" ash residue can be seen in its original layering (thin section 5; Plates 27, 28, 29, 30, 31). For example, an 8mm thick section of the midden contains approximately 500um (microns) thick bands of alternating fine sand and ash (or ash residue), often with probable coprolitic amorphous organic matter; and very coarse (up to 4mm long) phytoliths.

Phytoliths, which may strengthen cell walls, infill cell cavities or occur as special cells in plants, are constructed of biogenic silica or opal, and occur most frequently in graminae (Smithson, 1958; Geiss, 1973). Generally, phytoliths

occur in soils as colourless silt-size (c.20-50um) individuals of high relief, but in some plant types (Inst. of Archaeol. ref. Coll.) very coarse spiny rods may be present, as here in the Potterne midden (see Plates 19, 20, 21). From their morphology it appears that these bands of phytoliths may originate mainly from cereal straw (as noted in ashed organic matter).

These layers when they occur in an undisturbed state, as here, are also characterised by fine horizontally oriented vesicular porosity; and these voids frequently display very dusty clay coatings. Such layering and related porosity and textural pedofeatures are recognised (Courty et al in prep.) as typical of "floors". In this case the abundance of phytoliths, the presence of amorphous organic matter patches which are interpreted as coprolitic, suggest that these are animal stable floors - with a large component comprising dung (Courty, 1985). The occurrence of coarse phytoliths in such deposits is indicative of cattle as other herbivores such as sheep and goats tend to produce fine phytoliths in their excrements. Thus, the coprolitic material here has nothing to do with the dog coprolites which were mainly deposited during the accretion of the midden, but rather seem to relate to cattle dunging in stable areas.

There is no doubt that these stable layers were burned in situ and the ash bands and textural pedofeatures testify to this. Low temperature burning destroyed all the organic matter (ie non-mineral organic carbon and nitrogen), leaving only the mineral residues of silica phytoliths and fine calcitic ash typical of graminae. No "fresh" plant remains occur - hence generally low organic carbon content. Only very fine charred or charcoal fragments may remain, and generally these are in very low numbers - hence the very pale colours of the resulting fabric (see Plates 27, 28, 29, 34, 35).

The presence of coprolitic material could be associated with liquid cess, penetrating the burned layers and causing slaking and resultant coatings features. Within these layers sand grains are somewhat enigmatic. Reasons for

the presence of the sand could be; a) through herbivore ingestion, b) soil blowing, or c) purposeful scattering of sand on dung or burned dung layers. The burning itself could be for a couple of reasons, either to cleanse the stable areas or to reduce the bulk of the dung. Certainly burning was a purposeful and regular practice, as only rare unburned graminae residues occur.

In summary, the main constituent of the midden can be interpreted as burned, probably mainly stable floor clearings/farmyard manure (burning considerably reducing the bulk) which comprised abundant phytoliths as the main component, ash, some sand grains and minor quantities of amorphous (coprolitic) organic matter. This material was strongly mixed up and disturbed during the transportation and dumping onto the midden, but essentially forms the main fabric of this deposit (see Plates 34, 35, 36, 37, 50, 51, 60, 61, 62). Once on the midden its bulk changed little except for in the uppermost part (see 3d). Therefore, even the small area of cutting 12 alone represents a significant amount of stable/farmyard manure which was reduced to its ash and phytolith component. If dung was dealt with in this way it indicates that the Late Bronze Age population were not manuring their fields, an interpretation similar to that for the development of farm mounds (AD50 - AD1600) in Norway as the result of curtailment of local cereal production when easy imports became available (Griffin, 1984).

iv) Daub and other mineral components Most of the mineral material stems from the Greensand either as individual grains of quartz or glauconite, or as coherent sandstone fragments. As noted in the pottery (Elaine Morris, pers. comm.) however, there are a number of "foreign" materials. These are present in rather small quantities as chalk/limestone fragments or as loam or clay soils, sometimes calcareous, used for daub. Some containing pseudomorphic porosity of plant tempering (Plates 32, 33) typical of daub were burned to various degrees (see Plates 42, 43). The rather infrequent occurrence of these materials clearly indicates that debris originating from building destruction or decay were, unlike bone, commonly deposited on the midden. Also present are what appear to be

poorly preserved biogenic calcite nodules of Arinonids (slugs), probably from the midden fauna.

Cobbled Area (3309) Approximately halfway down the gentle slope excavated by cutting 12, an area free of pre-midden occupation has been tentatively interpreted as a trackway. Locally, a surface at the base of the midden was cobbled. Cobbling, in the thin section (12) was noted to include coarse pottery and sandstone fragments, with fewer coarse burned daub, chalk, hearth and bone fragments. The fine matrix is pale brown and very poorly birefringent here, which appears to relate to the midden deposits or contaminated subsoil of this cobbled area being depleted of (ash) calcium carbonate (Table 2, Sa. 26). Presumably, during the occupation/early midden accumulation a cobbled area was created to make a permanent surface, and the exposure of the midden fabric here to rain led to the leaching-out of the ash residue (ie decalcification) and fine organic fraction, resulting in moderate compaction. The level above (3309) is very much a mixture of subsoil and midden material (Table 2, Sa. 25) indicating a colluvial soil/midden cover rather than a dump, in the first instance.

Downslope Area (3308) A single thin section (13) was examined approximately at the level of "Phase 1" from the lower site at cutting 12. It is dominated by a greyish brown fine fabric composed of very abundant phytoliths, many fine charred organic matter fragments, and a scattering of calcitic ash crystals (Plates 34, 35). Typically small bone fragments, wood charcoal and charred cellulose occur, alongside patches of amorphous organic matter, which when associated with bone are probably dog coprolite, whereas others are presumed to originate from herbivore dung (Plates 36, 37) as discussed earlier (3d iii). Again this pale phytolith rich fabric is the most common in the midden and results from the dumping and minor reworking of previously burned animal stable layers.

At 3308, there is minor mixing with a dark brown fabric (see Plates 48, 49) very much the same as the "graminae ash residue" fabric, except that it contains in addition very abundant fine charred organic matter. As this is more typical of "Phase 2" it is discussed in detail in the next part.

3c The Midden "Phase 2"

What marks "Phase 2" is the inclusion of fine (mainly wood) charcoal spreads within the midden. At thin section 7 (Plate 1, E/F) over 60% of the fabric is composed of very dark brown, fine charcoal rich material (Plates 38, 39) still with abundant phytoliths but calcitic ash seems less frequent, whereas clay (which is generally infrequent in the midden) is present. The latter gives the material a speckled birefringence in contrast to the crystallitic birefringence of the "graminae ash residue" fabric, which still makes up 40% of the slide.

The dark fabric is associated with spreads of coarse charcoal, vitrified ash (see 3b ii) and fragments of burned daub and hearth (Plates 40, 41, 42, 43). The latter (hearth), comprising sand, clay and (originally) plant temper have been strongly burned.

This level and the next (thin section 8; E/F) also show signs of increased weathering or exposure and post-depositional disturbance. The evidence for this conjecture relates to a) the decreasing quantity of calcitic ash, b) the minor development of probably neo-formed clay within the very dark brown fine charcoal fabric, c) the increasing number of textural features (slaking effects) and d) neo-formed phosphate fabrics. Of these (a) is an obvious weathering effect, although (b) is a bit more complicated in that it relates to the combination of liberated potassium from charcoal to combine with local silica, the resulting clay sometimes enhancing the birefringence of clay coatings.

Textural features (c) themselves are in part related to this formation of alkaline clay (Slager and van der Wetering, 1977; Courty and Federoff, 1982) and at least two major phases of translocation can be noted downprofile of this mobile material. In fact, coarse porosity as deep as the subsoil may be affected, whereas in the midden below, old biological channels may be infilled (Plates 44, 45). The features produced are coatings which may be extremely dusty and dark because of the very large quantities of included fine charcoal. More localised in "Phase 2" are intercalations or separations of the fine fabric from the sand because of slaking. In thin section 8 (D/E) the differentiation of pale "graminae ash residue" fabric and dark fine charcoal rich fabrics is often less sharp as there appears to have been greater homogenisation at this level.

Neo-formed phosphatic material (d) is not abundant (Plates 46, 47) and perhaps only relates to the sub-aerial decalcification of calcitic wood ash (related to charcoal spreads). When the ash is dissolved the only mineral left is phosphate which is moderately mobile and produces yellowish, non-birefringent infillings. Similar residues have been noted at a number of sites (Macphail, 1987; Courty et al in prep) including occupation levels at Brean Down.

The presence of charcoal spreads may be only fortuitous at this level, but the other evidence does suggest increased exposure of the midden surface. Downslope at 3307 (thin section 14) the major fabric is of a graminae ash midden but here again there are indications of mixing, reworking and decalcification. Dark charcoal rich midden material has also been introduced (Plates 48, 49). It may be that "Phase 2" marks the stage when waste from domestic fires begins to be dumped.

3d The Midden "Phase 3"

The boundary between phases 2 and 3 is rather diffuse and many of the features exhibiting themselves in thin section 8 (D/E) are to be found in thin section 9

(C/D), although homogenisation of the pale ash fabric and the dark charcoal rich fabric seems to be more apparent. In thin section 10 (B/C) animal stable floor residues appear to be greatly reduced and the midden here is much influenced by waste from domestic fires, and possibly by an "agricultural soil".

Firstly, the dominant component is pale brownish grey and is again mainly made up of phytoliths, but calcite ash is abundant (Table 2; Sa 21) - hence the enhanced birefringence (Plates 50, 51) and increased calcium carbonate content. This material is interpreted as low temperature ashed organic matter, as in the reference material (thin section 20; Plates 19, 20, 21), and is believed to originate from domestic hearths, rather than from stable clearings which are far less birefringent in character. Also the second major component at this level is the fine charcoal rich material which is poor in ash, but has more associated clay as described in 3b. The latter material is also involved in textural features.

There is the possibility that some of the dark fine charcoal rich fabric may not originate solely from hearths. Firstly because of the lack of normally associated ash. (Of course where there are obvious charcoal spreads resulting from dumping, there is no interpretive problem). In addition, the presence of clay may suggest a "soil" association brought about by cultivation - such fine charcoal rich and clay birefringent fabrics were associated with presumed "stubble" burning and "cultivation" slaking at Chysauster, Cornwall (Macphail, 1987b) - and in fact definite evidence for such associations occur later in Potterne's history (see 3e).

There are, therefore, indications of changing inputs to the midden and greater post-depositional effects upon it. In the last thin section (11; A/B) the most common fabric is very dark brown, and while fine charred organic matter is very abundant, numbers of phytoliths are greatly reduced. The graminae ash midden component here is very small and probably residual as the midden became

increasingly reworked in its upper part. Continued sub-aerial weathering and soil water movement have caused the fabric to compact (Plates 52, 53) in this upper part of the midden perhaps by c. 50%. The dark soil fabric at this level is more certainly the result of cultivation of the midden, phytoliths becoming physically destroyed and Greensand subsoil constituents weathering to produce a speckled birefringent fabric. Stubble burning produces fine flaky charred organic matter and often phytoliths are poorly preserved (Courty, pers. comm.) which apparently accounts for the nature of the dark brown fabric. There is, however, no doubt of the increasing influence of slaking and physical mixing of the midden in "phase 3", as demonstrated by such well-developed textural pedofeatures as complex intercalations where fine material has separated from the coarse (Plates 54, 55).

3e The Midden; reworking and post-depositional changes

This part mainly utilises the information from thin sections 15, 16, 17 and 18, although some reworking and post-depositional changes have already been noted from No. 11, for example.

Thin section 15, although located in the section drawing of cutting 14 to range from the occupation to the midden, cannot be compared to subsoil or midden samples already described. The material of thin section 15 differs mainly by containing more clay in the fine fabric than for instance experienced at 13 or 14. Phytoliths and a scatter of calcitic ash particles occur but it is the significant presence of clay that gives the sediment here a dark grey brown colour (Plates 56, 57) in contrast to the grey colours (see Plates 27, 28, 34, 35) of the ash midden proper, which are clay poor (Table 2, Sa. 21, 22, 23, 27, 28). The former suggests the mixing of midden material with a small amount of weathered soil - the clay component deriving from weathered glauconite. The clay

data in Table 3 thus seems to infer that many of these early samples were taken from contexts similar to those from cutting 14.

The weathered nature of these Greensand elements here result in more iron being present - hence brown colours, and minor hydromorphism (gleying). These two factors combined with the occurrence of mobile organo-phosphates from ash, bone and coprolites - (Courty et al in prep), which have already been reported from the midden, have led to a small amount of vivianite (eg $Fe_3 (PO_4)_2.8H_2O$) being formed (Plates 58, 59) throughout this slide.

In the upper part of the thin section (4083) there is much evidence of transported material, such as rounded fragments of ash bands (Plates 60, 61, 62), and the mixing-in of "foreign" material which may contain rather "fresh" reddish brown organic matter (Plates 63, 64). The latter anomalous fabric can be regarded as some form of incorporated "topsoil/ploughsoil". Other textural features (see Plates 54, 55) which become more evident in thin section 16 (4065) testify to the colluvial and probably agriculturally reworked nature of this area of the midden.

The changes noted here are more dramatically illustrated by the Romano-British sediments at Cutting 15. In both thin sections 17 (4064) and 18 (4042) agriculture has incorporated large amounts of soil into the sediments, leading to a rise in levels of clay producing a speckled birefringent fabric as a result, whereas ash and phytoliths are greatly reduced. The colluvial and reworked nature of these deposits is demonstrated by the very abundant textural pedofeatures in the form of all kinds of intercalations and complex coatings and infills (Plates 65, 66, 67, 68). These, for example, show a sequence of post depositional translocation initiated by the slaking of unstable ploughsoils (Jongerius, 1970; Macphail et al, in press) as the deposit accreted as a ploughwash colluvium.

It is interesting to note that in the Romano-British ditch fill (4064) neo-formed calcite - produced by the decalcification of the ash rich sediments locally, is itself coated by subsequent soil translocation (plates 69, 70) indicating a history of calcium carbonate movement and deposition, followed by continuing ploughing of the soils above. Apparently, the deposition of the colluvium was too rapid to permit earthworm working, as is more often the case in base rich hillwash deposits.

i) Mineralisation. The quantity of natural phosphate such as in ash, coprolites and bone can easily account for the amount of mineralisation that has occurred on site. The noting of bone mineralisation (Locker, pers. comm.) and the well preserved nature of much of the bone in thin section, clearly suggest that the predominant source of calcium phosphate is from the weathering of ash. Organo phosphatic infills, the occurrence of vivianite and neo-formed calcite testify to the movement of calcium and phosphate from the original midden constituents, which themselves show evidence of breakdown (eg decalcifying biogenic Arionid nodules; patchy occurrence of ash bodies). This certainly supports the view of Carruthers (1986) that the seeds and other constituents were mineralised within the midden, and not incorporated as already mineralised materials.

Conclusions

1. Human activity led to erosion of the Greensand ridge - Late Bronze Age occupation occurring on deeply truncated soils.

2. Occupation and midden accumulation contaminated the subsoil.

3. In places the midden commenced with clear dumps of ashed organic matter from hearths and burned layers from animal stable floors; dog coprolites and domestic

waste such as burned daub, bone and charcoal being additional elements in the midden.

4. The major component of the midden is a greyish brown "graminae ash residue" comprising phytoliths, calcitic ash, a few sand grains and probably herbivore coprolitic material. This suggests (in Cutting 12) that manure was burned and then dumped, rather than being used as a fertiliser.

5. Occasional spreads of charcoal and hearth fragments produced dark fabrics.

6. Towards the top of the midden where calcitic ash from hearths (rather than stable floors) becomes equally important with the dark charcoal rich fabrics, there is evidence that probable agricultural reworking, slaking and the addition of some local soil initiated a change in the midden material, which also suffered some compaction.

7. Where midden material has become agriculturally worked with local soil, quantities of clay have risen, whereas amounts of phytoliths and ash have diminished. Such dilution of the midden perhaps allowed the spread of fertile colluvial soils over areas of poorly drained Gault soils.

8. Other post-depositional changes include the movement of calcium carbonate and phosphate (both primarily as residues of ash) to form infills of calcite, "organo-phosphate complexes" and vivianite, so indicating the in situ mineralisation of other materials such as seeds within the midden.

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Analytical Data : Potterne

Table 1. Grain Size (Institute of Archaeology)

No.	Sample	Clay	FZ	MZ	CZ	Silt	VFS	FS	MS	CS	VCS	Sand	texture	Thin Section
Cutting 12														
Upper Site														
midden														
21	425b	16	12	11	10	33	18	26	4	1	1	50	FSL	cf. 10
22	425a	9	5	6	10	21	33	32	2	2	2	71	FSL	cf. 9
23	462	14	8	8	8	24	47	8	1	1	1	58	FSL	cf. 5
subsoil														
24	000	13	5	9	13	27	30	23	2	1	1	57	FSL	cf. 2
Middle Site														
midden														
25	3309a	11	10	8	9	27	22	33	2	2	2	61	FSL	12
cobbled level														
26	3309b	15	9	9	10	28	36	23	2	1	3	65	FSL	12
Bottom Site														
midden														
27	3307	14	10	15	15	40	20	20	2	1	3	46	FSZL	14
28	3308	13	10	12	12	34	29	19	2	1	1	52	FSL	13

Table 2. Chemistry (Institute of Archaeology)

No.	Sample	% Org. Carbon	% $CaCO_3$	Thin Section	
Cutting 12					
Upper Site					
midden					
21	425b	2.9	3.0	cf	10
22	425a	1.7	0.3	cf	5
23	462	2.2	0.7	cf	5
subsoil					
24	000	3.2	2.1	cf	2
Midden Site					
midden					
25	3309a	1.3	2.1		12
cobbled level					
26	3309b	1.0	1.5		12
midden					
27	3307	2.9	3.1		14
28	3308	2.6	1.6		13

Table 2. Chemistry (Institute of Archaeology)

No.	Sample	% Org. Carbon	% $CaCO_3$	Thin Section	
Cutting 12					
Upper Site					
midden					
21	425b	2.9	3.0	cf	10
22	425a	1.7	0.3	cf	5
23	462	2.2	0.7	cf	5
subsoil					
24	000	3.2	2.1	cf	2
Midden Site					
midden					
25	3309a	1.3	2.1		12
cobbled level					
26	3309b	1.0	1.5		12
midden					
27	3307	2.9	3.1		14
28	3308	2.6	1.6		13

Table 3. Grain Size and Chemistry (Soil Survey of England and Wales, Rothamsted)

No.	Sample	pH (Water)	pH ($CaCL_2$)	Org. Carbon	$CaCO_3$	Clay	Silt	(VFS)	FS	MS	CS
midden											
29	404	8.1	7.5	1.5	7.7	28	38	(13)	29	3	2
"marley clay"											
30	408	8.1	7.4	0.6	1.6	16	50	(19)	29	4	1
subsoil											
31	493	8.1	7.4	0.6	1.6	14	30	(39)	53	2	1
"brown soil/ midden?"											
32	407	7.9	7.3	1.5	8.1	24	42	(17)	30	3	1
"midden"											
33	124	8.0	7.4	1.7	7.3	28	36	(14)	31	2	3
"midden"											
34	134	8.0	7.4	1.7	4.8	28	36	(13)	28	3	5
"beneath hearth"											
35	444	8.1	7.5	1.0	4.7	19	33	(24)	44	2	3
"subsoil"											
36	000	7.2	7.5	0.5	1.0	14	32	(26)	34	8	12

No.	Sample	pH (Water)	pH ($CaCL_2$)	Org. Carbon	$CaCO_3$	Clay	Silt	(VFS)	FS	MS	CS
37	409	7.7	7.2	0.6	0.6	24	47	(20)	25	2	2
38	249	8.1	7.5	1.1	0.7	20	35	(21)	42	2	1
39	251	8.0	7.4	1.5	1.9	28	30	(20)	39	2	1
40	403	7.2	6.7	2.8	1.0	23	34	(17)	36	4	3
41	248	8.0	7.4	1.5	1.4	17	32	(27)	48	2	1

Appendix 1

Micromorphological Description. Potterne

Locations Fig 1, Plate 1.

1. L/M (Plates 3, 4, 5)

Structure massive, very minor weak angular blocky, massive microstructure. Porosity 10-15% in lower part of slide, increasing to 20% in upper part of slide. Dominant medium mainly loose walled, often vertical channels; coarse to very coarse loose walled vughs becoming common in upper part of slide. Mineral Coarse/Fine limit 10um. C/F 75:25; very well sorted; dominant fine quartz sand, with frequent glauconite (mainly brownish or greenish speckled weathered), rare feldspar, tourmaline; few opaques - commonly limonite, micas; rare ferruginous (clay) fine sandstone fragments. Grains generaly sub-angular to sub-rounded, glauconite mainly sub-rounded to rounded.

Fine very dominant pale grey, speckled (PPL), very poorly birefringent, very pale greenish orange (OIL) - resulting from weathered Greensand, producing rather "thin" fine fabric.

Organic Coarse rare charcoal and bone as washed-in inclusions. Fine rare amorphous organic matter and plant fragments in "greensand soil" fine fabric. 1) Included within dark soil fragments and 2) washed in dark matrix material (see Fabric). 1) Many to abundant charcoal some coarse, 2) very abundant very fine (< 10um) charcoal. Groundmass porphyric, embedded, speckled b-fabric.

Pedofeatures Excrements rare earthworm working.

Textural rare, thin (50um), blackish, very dusty (with charcoal), very poorly birefringent clay coatings in porosity; rare yellow non-birefringent "organic" coatings. Amorphous rare, clear fine ferruginous nodules. Fabric occasional (especially in upper part of slide) dirty yellow brown fine fabric areas - infills act as matrix - phytoliths, organic matter and odd calcite crystals - basically ash residue. Fragments of blackish soil in burrows/channels, containing frequent coarse and fine charcoal.

Interpretation This deep subsoil horizon has the predominant characteristics of the weathered Greensand parent material, and as such is probably part of the C horizon of the in situ soil. Porosity is predominantly from fine root penetration and minor later earthworms, mixing in "midden" type material. Very small amounts of clay with very much fine charcoal have been washed in from above, to a small extent.

2. K/L

Structure massive, with very weak fine sub-angular blocky (mixed-in fabric). Porosity 10-15% increasing to 20% in places. Common coarse to very coarse probable earthworm channels - empty or with very loose infills. Common fine to medium, both open walled to smooth walled vughs. Mineral C:F - fabric a) ie parent material - 75/25; fabric b) mixed-in material C/F, 60/40. Coarse as No. 1. L/.M, with rare burned daub, burned chalk, vitrified glassy "ash", and ash/phytolith residues; also papules of clay from "palaeosols" also present - some argillic source. Fine dominant a) very thin, pale grey, speckled (PPL), very low birefringent, very pale greenish yellow (OIL) - Greensand soil; b) frequent dark grey and yellowish brown heavily speckled (PPL), very weak and weak birefringence, pale yellow and pale orange (OIL) - contaminated or mixed soil from midden - often in aggregates. Where it is yellowish brown there seems to be some neo-formed clay related to this "ash" residue fabric.

Organic few coarse wood charcoal up to 5mm in size present in channels etc, rare burned and unburned bone. In a) many organic matter fragments, rare phytoliths. Organic matter makes up bulk of the fine fabric. In b) very abundant amorphous organic matter mix with clay; also many charcoal; this fabric also often associated with many phytoliths.

Groundmass a) open embedded (porphyric) to embedded, speckled b-fabric. b) embedded, speckled or weakly striated b-fabric.

Pedofeatures Textural rare thin (50-100um) very dusty poorly birefringent clay coatings (fine charcoal content), penetration of sandy fabric and infillings 50-150um - producing different fabric areas as type (b). Fabric material - ashy residue washed deeply into sandy matrix, some areas seem mixed in from above

have far lower amount of coarse material (fabric b). Washed down channels and "worm-worked". Amorphous occasional clear or sharp edge ferruginous fine or medium impregnations.

Interpretation Still predominantly Greensand subsoil, but much fine charcoal rich "ash" residue has been washed down porosity forming coatings, and infilling loose packing porosity of Greensand subsoil. Coarse charcoal and other anthropic materials have also come down earthworm channels etc. Generally fine fabric of Greensand very thin, but ash residue fine fabric appears to have more substance because of phytolith and fine charred organic matter. In places there may be a combination of ash residue with the parent material to possibly produce neo-formed clay giving a weakly birefringent brown fabric.

3. J/K (Plates 6, 7, 8, 9)

Structure weakly massive; vughy/channel microstructure. Porosity 25%, common medium to coarse smooth walled vughs; common medium to very coarse (4mm), sometimes elongate, moderately smooth walled channels (some earthworm burrows). Mineral C:F 50:50. Coarse as L/M, only few glauconite, often weathered brownish; very few sandstone fragments. Fine a) dominant (ash residue) dirty brownish grey, very speckled (PPL), generally very low birefringence, pale brown (OIL); b) very few (organic) brown (PPL), low birefringence, brown (OIL); c) frequent pale greyish brown, speckled (PPL) very low birefringence, very pale orange (OIL) (soil). Organic Coarse few wood charcoal, few bone fragments, often burned; very few brownish plant remains. Fine (in Fabrics) a) in ash residue, rare to occasional amorphous and charred organic matter, but abundant phytoliths. b) very abundant amorphous organic matter, many phytoliths. c) rare organic matter and occasional phytoliths. Coprolites frequent fragments from fine to coarse (3mm by 1m); various types, eg fine fabric, b) is possibly coprolitic of omnivore type (described later) whereas others could be coprolitic and have a few silt, a black outer margin and contain orange/brown amorphous organic matter that has been somewhat ferruginised. They have a somewhat birefringent character, as though some clay is involved. At high power they have a tubular like fabric; also in places possible pyrite framboids. Other anthropogenic components very few, black, vitrified ash; few yellowish brown, very low birefringent, orange/brown (OIL) vitrified ash residue, sometimes containing residual plant fragments.

Groundmass a) porphyric, very weak crystallitic b-fabric. b) porphyric, undifferentiated b-fabric. c) low fine fabric, porphyric, very weak crystallitic b-fabric.

Pedofeatures Excrements very few earthworm burrows; possibly reworked by Enchytraeidae because there are a few organo-mineral excrements of this type. Textural Very abundant very thin (50um) to less frequently thin (100-150um) (in upper part of slide) black, extremely dusty clay coatings, with very poor birefringence containing very abundant charcoal. Similarly very abundant intercalatory infills especially in upper part of slide. Amorphous abundant diffuse ferruginous impregnation, generally weak, of probable organic coprolitic fragments. Crystalline occasional calcite ash crystals occur in ash residue fabrics.

Interpretation Sandy "subsoil" here is becoming dominated by midden material. Even in the lower part of the slide most of the fine fabric is composed of dark ash residue, and most porosity have thin coatings of the same. Further up Greensand fabric is strongly mixed with midden fabric, although fragments of the former are still recognisible. In zones of high porosity extremely thick coatings and infills of dark ash residue occur from washing down from above. Anthropic inclusions occur throughout.

4. H/J (Plates 10, 11, 12, 17, 18, 23, 24, 25, 26, 32, 33)

Structure Weak sub-angular blocky especially in lower part, within weak massive, vughy microstructure. Porosity 25% dominant fine to medium, generally smooth walled vughs; common medium to very coarse (earthworm) channels, commonly open or rough walled. Mineral C:F - variable - Greensand subsoil areas 70:30, elsewhere 50:50. Coarse (as 3); anthropic inclusions (see below) frequent in top half, few in bottom half of slide.

Fine dominant a) as 3; frequent c) as 3. b) see Organic. Organic Coarse many wood charcoal throughout. Bone, often burned (slightly reddened) and partially digested (greyish and poorly "birefringent) occasional fragments in lower half, very abundant (including a very coarse (over 2cm long) fragment), horizontally layered often, in upper part - 1st phase of midden. Fine a) again only occasional to many organic matter and charcoal, whereas phytoliths, deformed and fractured (heating) may be very abundant. b) as 3. Coprolites Occasional fine to coarse sub-rounded fragments orange/brown (PPL), sometimes containing silt or fine sand, generally non birefringent, golden brown (OIL), with occasional phytoliths. Primarily of amorphous organic matter. Also present in midden above are coprolites featuring large (1.3cm) fragments of greyish, non-birefringent bone in a coprolite possibly 2.5 x 1.5cm in size. It also contains amorphous organic matter either staining bone boundaries or as specks within the coprolite fabric. The coprolite contains mineral inclusions of ash residues with phytoliths, daub, silts. Whether all this is included material from ingestion or from depositional mixing will be discussed later in 19 (reference slide of probable dog coprolite). It also appears that the coprolite may have been involved in a fire, as some of the bone is burned (but burned bone is known to be sometimes eaten by dogs). Anthropic. Anthropic inclusions and fabric increases from 25% in the subsoil to 70-80% in the midden. The contaminated subsoil is buried by a dump very rich in ash, vesicular vitrified ash residues, burned daub,

burned bone charcoal and plant remains including intact still organised phytoliths.

a) First, a burned bone layer.

b) Second an ash horizon, somewhat mixed with fine sand and silt. The layer is pale yellowish brown, speckled with fine charred organic matter (PPL). The calcite ash crystals give it a high birefringence. It is generally grey under OIL, although the included residual organic matter give it a brownish tinge. At high power many of the calcite crystals can be seen to be fragmented, dissolved, but a few whole ones are rhomboids of probable deciduous origin. In addition, frequent phytoliths and the flaky nature of the charred/charcoal suggests much of the ash also originates from a "grass/cereal" source. Fine fragments of burned chalk also occur. Good phytolith preservation suggests a low temperature fire.

c) Wood charcoal.

d) A rather pure greyish yellow ash band, mainly of deciduous wood origin, merging into a much more dominant decalcified ash residue band which is also greyish yellow, but totally non-birefringent, and yellowish grey in OIL. This band contains very little quartz sand of the parent material. The wood ash, probably because it is more calcitic, is preserved whereas the associated now decalcified ash residue is mainly "grass". The latter has been little reworked and whole intact sheets or layers of phytoliths occur.

e) Lastly, the ash residue is succeded by very dark grey, blackish (PPL), mainly non-birefringent, white (OIL) heavily burned bone.

Other anthropic inclusions within the mainly ash (wood) and ash ("grass") residue matrix are:-

calcareous soil; pale yellow brown soil, highly birefringent, very pale orange (OIL) - clay loam for daub and other manufacturing. Also pure chalky soil fragments.

burned "daub"; many very dark brown, blackish (PPL), clay loam with mainly silt size coarse material, generally non-birefringent except for "burned chalk" or "recrystallised" calcium carbonate from ash or local calcitic source. Also some fragments have clear coarse plant (tempering) pseudomorphic porosity. Under OIL they are brownish orange. They seem to have developed from a calcite rich soil - possibly the material noted above? (Not Greensand origin).

Groundmass lower part as 3. Matrix of upper, midden area, loosely porphyric; weak to strong crystallitic b-fabric.

Pedofeatures Excrements. Occasional earthworm burrow (note high K (potash) levels from ash can be toxic to worms in the first instance). Textural in lower part very abundant coatings and infills of dusty clay being washed through subsoil - character as in 3, often associated with amorphous organic matter, that is not necessarily coprolitic. In upper part, minor coatings in porosity of bones etc related to post depositional soil water movement. Fabric major difference between subsoil, with basic Greensand fabric - possibly near surface sub-angular blocky structures - and in character. Amorphous minor diffuse ferruginisation of some amorphous organic matter.

Interpretation The slide can be divided into 2 halves. The lower Greensand subsoil although containing much included (mixed and washed-in) coarse and fine material - eg coarse bone, charcoal, fine charcoal, amorphous organic matter it is primarily within a Greensand, parent material context, ie dominated by fine quartz sand and glauconite. There are also soil structures possibly suggesting that it is not a completely unworked deep subsoil horizon - however, there is no

sign of A horizon fabric. Mixing of parent material with anthropic material is predominant up to the junction with the midden dump. The latter includes probably dog coprolites, pieces of layered hearth deposits, burned bone, wood charcoal and calcitic ash, "grass" ash residues rich in phytoliths, calcareous soil fragments, and common burned daub. Some of the dumps are very pure, with very little Greensand mineral included, whereas elsewhere very mixed ash and Greensand mineral occur.

5. G/H (midden phase 1) (Plates 27, 28, 29, 30, 31)

Structure weakly massive, channel microstructure. Porosity variable, 15-30%; dominant medium to coarse, often smooth walled channels. Mineral C:F 35:65. Coarse As 4, with very few burned chalk, burned daub, unburned daub and mollusc shell. Fine very dominant dirty brownish grey, heavily speckled (PPL), medium birefringence, pale yellowish brown to brown (OIL), with dark organic staining - see Coprolites. Organic Coarse, many wood charcoal and "cereal" fragments - cellulose; occasional plant remains - some coarse (1,250um). Many, phytoliths, up to c. 4mm long of probable cereal origin, occasional bone. Fine abundant phytoliths, occasional charred organic matter fragments (also plant fragments may contain in situ phytoliths). Coprolites abundant fragments of dark reddish brown to very dark (PPL) non-birefringent, brownish black (OIL); mainly amorphous organic matter, with few plant fragments and common phytoliths. Where bone absent and plant fragments and phytoliths are common - probably more herbivorous than dog. Other anthropogenic components occasional vitrified ash residues, sometimes merging into fabrics containing phytoliths, or charcoal. Sometimes these may show some ferruginisation. Ash rare ash concentrations, often recrystalised in part. However, generally very abundant ash crystals throughout fine fabric; absent from occasional ash residues, but often abundant fine crystals even in textural pedofeatures. Floor layers A c.8mm thick fragment of layered "floor" material comprises; averaging 500um thick bands of alternating fine sand, and ash (or ash residue), coprolitic fragments and phytolith bands (large horizontal bedded phytoliths).

Also both coarse porosity and minor horizontal porosity have thick very dusty clay coatings (see 4) but all these which could be typical of slaking of a floor, are wrong-way-up (coatings at the top of the void rather than at the bottom), which indicates this material is not in situ but a dump of a multiple layered floor. First indications suggests they originate from a stable. Groundmass

porphyric, crystallitic b-fabric. Pedofeatures Textural very abundant very dusty coatings (as 4). However, it is worth noting that while many relate to contemporary channels (possibly 2 phases) within the midden, and are vertically oriented; many others appear wrong way up and suggest the coatings were developed prior to dumping (in stable ? floor layers). Amorphous occasional diffuse ferruginous impregnation. Fabric whole midden is comprised of mixed dumped materials; common rough banding of sands and ash, ash residue.

Interpretation In short, this part of the midden seems to comprise dumps of probable stable floor layers containing coprolitic material, ash, ash residues, relic organic matter and coarse phytoliths layered with fine sand. These probably stable layers were burned prior to dumping. In cases disturbance was minimal and delicate long phytoliths were preserved. It appears that "dung"? layers were burned then (wind? or purposely?) covered in sand, and every now and again the stables were cleared out and dumped onto the midden. Unlike 4, there is less hearth material here, although vitrified ash occurs.

6. F/G

Structure weak coarse sub-angular blocky, within massive; sub-angular blocky and minor channel microstructure. Porosity 20%, dominant coarse to very coarse, - some rough walled, channels (some earthworm), common fine channels. Mineral C:F 40:60. Coarse as 4, with frequent Greensand fragments up to 4cm in size; "calcite" tempered pot, burned daub, vitrified ash, ferruginous sandstone, "red" clay present; few chalk and burned chalk occur. Possible biogenic calcite also present. Fine As 5, but very pale brown to almost colourless under OIL (general lack of iron, and organic matter except for coprolitic material), Organic Coarse abundant wood and "cereal" charcoal; many phytoliths. Fine occasional charred organic matter fragments/charcoal, very abundant phytoliths (see next). Coprolites abundant (as in 5) mainly amorphous organic matter, with some phytoliths. Few others clearly associated with bone fragments. Other anthropogenic components as in 5, although no clear probable stable layers occurred. Generally the material is very mixed ash residue concentrations may relate to "floor" layers and are now mixed and unoriented, juxtaposed sand layers are mixed in. Also coprolitic amorphous organic matter forms organic nodule around sand. (Others similar to 5 although discrete layers not present, still evidence of mixing of previous layers of "stable" ash etc.) Groundmass (as 5). Pedofeatures Excrements rare fine mammilated (earthworm). Textural two types as described for 5; those relating to floors and layers within floors that once mixed may resemble intercalations, and a post-depositional phase in major porosity. Fabric mixing in of large Greensand fragments in top of slide, otherwise similar to 5, ie general homogenous mix.

Interpretation As 5, possibly with changes towards the top.

7. E/F (Plates 38, 39, 40, 41, 42, 43, 44, 45, 46, 47)

Structure rather massive with minor fine sub-angular blocky; channel and vughy microstructure. Porosity mainly 15-20%, but up to 40% where biologically worked. Dominant (mainly) fine to medium, with (fewer) very coarse moderately rough-walled channels; frequent fine to medium moderately smooth walled vughs. Mineral C:F. Main (a) (60%) 25:75 (dark areas) with b) other areas (as 6) 40:60 or less. Coarse as 4, but with few burned chalk and limestone; Greensand ferruginous stone fragments, pot; and a particular discontinuous "layer" of burned "daub" or hearth fragments (very dark brown to black (PPL)), low to non-birefringent, dark brown OIL; may have blackened or "charcoal fused" edges; have plant temper pseudomorphic porosity, sand and silt inclusions; fine organic matter included in fine matrix has been charred. Fine a) very dark brown, heavily speckled and dotted (PPL), poorly birefringent, not ash but clay, brown (OIL); b) pale greyish brown to dark brown speckled (PPL), low (but more than a)) birefringence; pale grey/yellowish brown (OIL). Organic Coarse: few bone, often sub-rounded; few charcoal, very few plant remains; rare coarse phytoliths. Fine a) very abundant organic matter and charcoal, only occasional phytoliths, b) occasional to many phytoliths ("ash residue fabric"). Lower half rare amorphous organic matter concentrations (coprolitic), but more (few) occur in top half. Also present in the top (associated with hearth debris?) are yellow to reddish brown non-birefringent, dark greenish yellow to reddish brown (OIL), a bit ferruginised organo-phosphatic residues - phytolith and charcoal ("grass/cereal") is associated. Probably these may relate to hearth deposits.

Coprolites fewer and smaller than in 5 or 6. Other anthropogenic features include the probability that a hearth was nearby because at various levels in the top half of the slide are discontinuous spreads of burned "daub"/hearth and charcoal.

Groundmass a) embedded, speckled b-fabric. b) as 5. Pedofeatures Textural In a) very abundant extremely dusty intercalations (ie all of fine fabric) or mixing of sandy zones and "charcoal" zone; associated are "channel" infills bringing type a) material with very abundant, thick (150um) coatings - extremely dusty clay and infills - eg down cracks, 2 phases; 1st phase moderately birefringent very dusty clay coatings (200-350um thick); 2nd phase poorly birefringent extremely dusty and common associated fine sand. Also two phases noted in charcoal porosity. Fabric very heterogeneous.

Interpretation Rather complicated. Typical pale midden fabrics from "grass" ash and "stable" floor and dung continue into this slide, but they become strongly mixed with a new much darker fabric. The latter is not so much an ash residue low in organic matter but rather is dominated by a fine fabric containing very abundant charred organic matter. Mixing seems to have been accompanied by slaking forming intercalations and coatings (many coatings in lower slides may possibly derive from this zone). This dark fabric also differs by being "more worked" - many fewer phytoliths, very coarse phytoliths are almost absent, calcitic ash is almost absent, coprolitic material is less and smaller and more clay seems to be involved in the fine fabric. At the same time the upper part of the slide contains evidence of a local hearth and "spreads" of burned soil and charcoal occur. Some of the high density charcoal could derive from this. In addition, fragmentary yellow organo-phosphatic features are present and could be associated with solutions from a hearth.

In short, physical mixing, after with slaking, has affected this part of the midden which has also changed in character, to being far more organic.

8. D/E

Structure massive, channel and vughy microstructure. Porosity variable 15 to 40%; dominant medium to coarse, mainly smooth walled vughs and channels; very coarse (up to 1cm wide) vertical earthwork burrow dominates the slide. Mineral C:F 30:70 to 50:50 - quite variable according to mix. Coarse as 6 with usual soil, burned daub, vitrified ash (hearth fragments), fewer cracked quartz than 7, Greensand stone fragments, mixed Grensand, etc. Fine very dominant pale to dark brown, heavily speckled (PPL) very low to low birefringence (minor clay involvement); pale to darkish brown (OIL). Organic Coarse occasional bone, many charcoal. Fine mainly areas of occasional to many charred organic matter with very abundant phytoliths, and fewer areas of very abundant charred organic matter and many phytoliths. Occasional yellow organo-phosphatic ash residues occur - (from hearths) - tends to be a bit ferruginised and has besides phytoliths, charred organic matter included. Coprolites Occasional fine coprolitic fragments and coprolitic "impregnation" of matrix. Mixing of mainly mineral "hearth deposits", eg vitrified silica/ash, and charcoal rich material. Large (1cm) patches of ash residue fabrics. Groundmass embedded, mainly speckled b-fabric - (too few calcite crystals for crystallitic).

Pedofeatures Excrements possible mamilated casts in very coarse earthworm channel. Textural occasional very dusty, moderately birefringent clay coatings rich in charred organic matter, within dark patches in midden (equivalent to most of 7) extremely dusty, low birefringent clay coatings and associated intercalations. Fabric dumps or spreads from hearth area although present are less common than in 7, more common is a mix of Greensand and "ash/grass residue".

Interpretation This horizon, although still heterogeneous, and includes few "intact" layers from a hearth situation, is more homogenous than 7. It is less

influenced by the very high quantities of fine charcoal present at the "hearth level" (7), and is mainly a grass ash residue zone. It has been both dumped and probably a bit reworked although coatings are not abundant and many fragments of charcoal are intact.

9. C/D Midden Phase 3

Structure massive, with sub-angular blocky; channel and vughy microstructure. Porosity common mainly smooth walled fine and medium vughs, and dominant mainly smooth walled medium and coarse channels. Mineral D:F 40:60. Coarse: as 6, with frequent vitrified ash residue especially, (as 8). Fine pale brown, speckled (PPL), low birefringent, pale yellowish brown to brown (OIL). Organic Coarse occasional bone, many charcoal, rare coarse phytoliths and plant fragments. Fine occasional plant fragments, many amorphous areas. Coprolites As 8. Groundmass embedded, speckled b-fabric, (rare ash crystals).

Pedofeatures excrements occasional probable earthworm burrows with loose infill; rare decalcifying biogenic calcite (Arionid?) as in 8. Textural Occasional extremely dusty, poorly birefringent clay coatings especially with dark areas and near coarse and within coarse channels. Possible extremely dusty intercalations of fine material (high charcoal - hearth origin?) or possible areas from the hearth layers. Fabric discrete mixing of ash residue from "stable floors"; very thin pale fabric; with very dark high charcoal content material from nearby hearth.

Interpretation As 8.

10. B/C phase 3 (Plates 50, 51)

Structure massive with medium sub-angular blocky; channel and vughy microstructure. Porosity 15-30%. (As 9). Mineral C:F 30:70. Coarse Very dominant fine sand size quartz; very few ditto size glauconite; very few burned(?) biogenic calcite (Arionid?) nodules, burned chalk (hearth ash fabric inclusions now make up very much of fine fabric, therefore, see fine fabric). Fine a) dominant pale brownish grey, heavily speckled (PPL), moderate birefringence, pale brownish grey (OIL) (hearth ash residue contains very abundant calcite ash - hence grey colour and birefringence). b) Common very dark brown, very speckled/dotted (PPL), low birefringence; very dark brown (OIL) (area of very high charcoal - as in 8, 9 - again from some hearth area but calcite ash absent. Two parts of the same hearth?) Organic occasional charcoal, bone; rare in situ root remains. Fine a) very abundant - almost 80%! mainly poorly preserved phytoliths (other 20% of groundmass is ash crystals), and many dark brown amorphous (patches) organic matter - (coprolitic). b) very abundant charred organic matter and general very fine organic matter; many phytoliths; many amorphous organic matter (coprolitic). Coprolites Dark brown and yellow amorphous, non-birefringent with mineral inclusions. Groundmass embedded - a) crystallitic b-fabric, b) speckled b-fabric.

Pedofeatures Excrements occasional possible mineral, mammilated casts. Textural occasional very dark brown, extremely dusty clay coatings, usually on major porosity; generally poorly birefringent and very rich in charcoal - probably from fabric (b). Fabric Even mix of fine fabric from hearth ash (a) and hearth? very fine charcoal (b).

Interpretation This slide differs from 10 below by lacking the "stable floor ash residue fabric". Instead it is mainly made up of two other fabrics. a) a phytolith and calcitic ash fabric (part of a hearth) and b) a dark fine charcoal rich fabric, probably also related to another level (?) in a hearth. Discrete areas of both have been well mixed, material of (b) slaking and washing down profile.

11. A/B (Plates 52, 53, 54, 55)

Structure massive, with very minor sub-angular blocky; channel and vughy microstructure. Porosity 15-20% (10% in b) (coarse infills - see fabric), common fine to coarse moderately smooth and smooth walled channels; common mainly fine and medium smooth walled vughs. Mineral variable a) 20:80 (pale area) 25:75 (dark area). Coarse As 10, very few weathered/probably burned chalk fragments, flint; very few anthropic inclusions (large pot fragment) eg ash hearth fabrics, etc, fewer than 10. Fine a) dominant very dark brown, very dotted (PPL); generally low birefringence; brown (OIL) - some clay in fine fabric very rare calcitic crystals; all masked by organic matter. b) common pale greyish brown lightly speckled (PPL); moderately birefringent; pale greyish brown (OIL) (very abundant calcite ash). Organic Coarse occasional charcoal, rare bone. Fine a) very abundant charred organic matter - rare to occasional phytoliths. b) occasional charred organic matter, very abundant phytoliths. Coprolites occasional discrete fragments of coprolitic material throughout. Also present are fragments of organo-phosphate (ash residue) nodules. Groundmass a) embedded, speckled to weakly crystallitic b-fabric, b) embedded, crystallitic b-fabric.

Pedofeatures In a) very abundant intercalations of fine (charcoal rich) fabric, often in places leaving clean sand after washing through - fine fabric is very mobile; often also forming micropans. Occasional extremely dusty clay coatings and infills similarly effect major porosity in (relic)(b) fabric. Fabric Two fabrics occur; a residual (b) midden fabric which is cracked and fragmented, and (a) a much more recent charcoal rich fabric juxtaposed by both biological and anthropogenic (cultivation?) mixing; such mixing produced coarse porosity down which soil slaked forming intercalations and crescent shaped micropans (as infills). These processes caused fragments of (b) to become rounded, similarly coprolitics and other anthropogenic materials have been rounded indicating transport.

Interpretation By this level in the midden, actual midden material is very compacted and residual and was broken up by biological and human activity - the latter producing very charcoal rich soils which have washed down into coarse porosity produced by this turbation. The dense midden material, which is mainly phytolith rich ash, could have been reworked itself previously to become so compacted.

12. Cobbled Area

1. Cobbled midden/subsoil 2.5cms. 2. Overlying midden colluvial subsoil 5.5cms. Structure massive, (1) massive microstructure; (2) channel and vughy microstructure. Porosity (1) 15% dominant fine to medium rough walled vughs; common fine, moderately smooth-walled channels. (2) 30-40%, very dominant rough walled medium and coarse to very coarse channels; frequent medium to coarse rough walled vughs. Mineral (1) C:F 60:40; Coarse very dominant sub-rounded and sub-angular fine sand size quartz, few glauconite: coarse inclusions are frequent pottery and sandstone fragments (part of cobbling), very few calcitic hearth fragments, burned chalk, daub (also coarse bone fragments have been included). Fine very pale brown, speckled (PPL), moderately low birefringence, very pale yellow (OIL) (very thin ash residue fine fabric with rare calcite grains). 2. Coarse (as 1) with few burned daub, hearth fragments, burned chalk, sandstone fragments pottery. Fine brownish grey (PPL), low to moderate birefringence, pale brownish yellow (more dense in places) fabric like (1) but more calcitic ash left - less depleted? Organic Coarse occasional charcoal, and generally rare bone fragments (apart from cobbling) throughout. Fine (1) rare organic matter, many phytoliths, and fragments (weathered, damaged) - coprolitic material generally rare (leached out?), but at base of this compressed upper zone ash rich, and probably organo-phosphatically rich areas occur with abundant amorphous organic matter - and probably represent "non-depleted cobbled zone". (2) variable, many to abundant organic matter fragments - some charred. Very abundant phytoliths also occur. Many organo-phosphatic (ash residue nodules) and yellow and brown amorphous organic matter in coprolitic inpregnations are present. Groundmass both embedded, crystallitic b-fabric.

Pedofeatures Textural rare dusty clay coatings, occasional dusty clay intercalations in (2) - (mixed layers?). Depletion the fine fabric of the upper part of (1) is depleted of calcite, amorphous organic matter, and possibly

phytoliths are less well preserved - probably through it was never as rich in charcoal as 2. There may be some coprolitic material, however, as part of an inclusion in the cobbled surface, which has been less affected by depletion.

Fabric many passage feature porosity.

Interpretation Over mixed midden and subsoil (1) the cobbled horizon comprises coarse inclusions and fine ash residue material, probably low in organic matter. This surface was probably somewhat depleted by rainwater although there is little evidence of puddling (textural features) to indicate it was well trampled. The overlying midden material (2) contains a high frequency of subsoil material of probably colluvial origin. It is richer in organic matter and ash than (1).

13. 3308 Phase 1. Midden (Plates 34, 35, 36, 37)

Structure massive, with minor sub-angular blocky; channel and vughy microstructure. Porosity variable 10-50%, averaging at 20%. Common medium to coarse moderately smooth walled channels; common medium to coarse moderately smooth walled vughs. Areas of dense fabric are characterised by a network of very fine horizontal channels, sometimes associated with vesicles (suggesting compaction and minor slaking of this deposit). Mineral C:F 50:50 generally with 30:70. Coarse As 5, only few inclusions. Fine a) very dominantly greyish brown, heavily speckled, pale greyish brown (OIL), moderate birefringence (weakly ashey); b) frequent darkish brown, very heavily speckled/dotted (PPL), moderate birefringence, greyish brown (OIL) (ashey with much fine charcoal). Organic occasional charcoal; rare bone; very rare in situ roots, clumps of phytoliths. Rare biogenic (Arionid?) calcite, sometimes not too badly "weathered". Fine a) many charred organic matter, very abundant phytoliths. b) very abundant charred organic matter, abundant to very abundant (some masking) phytoliths. Coprolites fragments of amorphous brown coprolitic material are many, spread around. Groundmass embedded, crystallitic b-fabric.

Pedofeatures Excrements many faunal perforations, rare mammilated earthworm; rare probable organo-mineral Enchytraeidae excrements. Textural occasional extremely dusty clay (earlier ones dusty within matrix) coatings, eg on top of faunal working (therefore later). Probable occasional intercalations or micro-panning in fabric b. Fabric common root/faunal passage features. In fabric (a) very abundant semi-lamina fabric (associated vesicles and coatings not so dusty as later ones).

Interpretation This material looks like the mixing of two midden deposits, after reworking by "colluvial" transportation. Fabric (a) after exposure and decalcification and minor slaking has compressed a bit, whereas fabric (b) has formed micropans. Coprolitic material has been well broken up by transportation. Once in place it was partially perforated by biological activity, then later affected by very dusty coatings from above.

14. 3307 Midden, phase 2 (Plates 48, 49)

Structure predominantly sub-angular blocky, minor massive; channel and vughy microstructure. Porosity 20-30%; dominant medium to coarse moderately smooth walled channels; frequent similar medium vughs. Mineral C:F generally 40:60. Coarse (as 13) again very few coarse inclusions - if present usually sub-rounded. Fine greyish brown (minor amorphous brown coprolitic staining), speckled; medium birefringence, pale yellowish grey. Organic Coarse many charcoal (rarely very big) and occasional bone (again small). Fine occasional organic matter and charcoal, very abundant phytoliths. Coprolites many amorphous organic matter coprolitic inpregnation of fabric. Groundmass Embedded, crystallitic b-fabric.

Pedofeatures Excrements many possible earthworm burrow with dense infills, and loose "spongey" fabric infills of organo-mineral material which, although darker than the surrounding soil, is less rich in organic matter (but higher in charcoal). Textural Occasional extremely dusty, very poorly birefringent 100-150um thick clay void coatings, especially of major porosity - channels etc. Last phase feature occasional intercalations of fine material in bands in pale fabric. Fabric general mixings of different "midden" fabrics of varying amounts of organic matter (probably coprolitic). Some very dense fabrics; many biological passage features.

Interpretation The slide is made up of grass ash midden material, and some mixed in coprolitic organic matter, but appears to have been somewhat reworked and mixed with minor amounts of more charcoal rich material. It is not a pure dump deposit. Some slaking and decalcification have caused some compaction. Probably this horizon was overlain by one containing more fine charcoal as at samples 1-11, and slaking and biological activity have brought some of this material downprofile.

15. 4072/4083 (Plates 56, 57, 58, 59, 60, 61, 62, 63, 64)

Structure weakly massive, with minor sub-angular blocky; channel and vughy microstructure. Porosity generally 30%, dense areas (10%) only 15%. Dominant fine to coarse moderately smooth walled channels - common similar vughs. Coarse faunal channels in 4083. Mineral C:F variable - generally 40:60. Coarse very dominant fine sand size sub-rounded and sub-angular quartz; very few same size, mainly weathered glauconite; few Greensand fragments (stone size to medium sand size), very few weathered Chalk fragments, rare associated Chalk fossils; very few calcareous brown soil fragments (see Anthropogenic materials); rare vivianite crystals. Fine various. a) Dominantly darkish grey brown, speckled (PPL), medium birefringence, pale greyish brown (OIL); b) few pale greyish brown (PPL), moderately high birefringence, mainly greyish (OIL). Organic Coarse occasional bone (sometimes ferruginised) occasional charcoal; unusual (in particular dark soil inclusions) very abundant reddish brown organ fragments and amorphous organic matter fragments; occasional charred parenchymatous tissue - cereal stem? Fine a) abundant charcoal; abundant amorphous organic fragments, abundant phytoliths. b) occasional charcoal, fewer organic matter; very abundant phytoliths. Frequent areas of abundant amorphous organic matter, sometimes associated with amorphous iron, and yellowish organo-phosphatic material; rare organo-phosphatic material (high ash area) associated with blue viviante crystal formation. Coprolites many amorphous brown inpregnation of fine fabric, and fragments with phytoliths, and enclosed fine mineral. Other anthropogenic features include occasional calcareous daub or "mortar-like" material comprising a mixture of Greensand material and brown calcareous, highly birefringent, and somewaht chalky (includes fossils) soil; also occasional ash residue "hearth" fragments, and rare charcoal rich dark soil containing many brown amorphous (unburned) plant fragments - possibly from a "ploughsoil" mixture - ie intrusive; and also rare rounded "transported" ash bands - again from part of hearth or

stable clearing? Also rare vitrified ash, rounded burned daub, and fragments of ash and mineral bands (as above).

Groundmass porphyric calcitic b-fabric. Pedofeatures Textural many fine and coarse laminations, weakly intercalatory, possibly relic ash residue and mineral layers which have been mixed in this depost - minor secondary clay movement. Also fragment of ash bands feature abundant very dusty clay coatings - probably relating to previous slaking. Contemporary - occasional dusty clay, moderately birefringent clay void coatings, sometimes related to possible vesicular porosity relating to slaking during deposition of this sediment. Depletion some slaking may produce sand bands as fine material is washed out. Crystalline rare vivianite - see earlier. Fabric occasional coarse faunal passage features - probably earthworm - rounded channels, channels with crescent shaped 'loose side' infills. Many clearly rounded (transported) fragments. Very abundant discrete greater mixture of charcoal and ash bands. Clear mixing of fabrics (a) and (b) - variations in charcoal content.

Interpretation Basic midden material is present. Coprolitic material is generally abundant throughout and well mixed in. This, with the clear inclusion of very well rounded daub and ash fragments, clearly indicate a strong colluvial influence on this deposit. The upper part 4072 may differ by containing "local" dumped material that has been less homogenised.

Structure weakly massive, with minor sub-angular blocky; channel and vughy microstructure. Porosity 25-30%, dominant coarse to fine moderately smooth walled channels; frequent moderately smooth walled fine to medium vughs. Mineral Coarse As 15, including weathered biogenic calcite. Fine quite homogeneous, greyish brown to dark greyish brown, speckled (PPL), moderate birefringence, brownish grey (OIL). Organic Coarse many charcoal, rare bone fragments and plant fragments. Fine many to abundant amorphous and charred organic matter, very abundant phytoliths - often fragmented. Coprolites occasional "coprolitic fragments" finely divided in matrix. Anthropogenic features same as 15 but fewer, again some well rounded. Groundmass porphyric, weak calcitic b-fabric.

Pedofeatures Textural very abundant laminations of fine material, sometimes with crescent shape - old layers somewhat slaked or coarse void infills. Often these may be associated with thin (30um) very dusty clay coatings. Fabric occasional passage feature; generally soil is homogeneous.

Interpretation Similar to 15, but far more homogenised, but again much washing of fine material - slaking from colluvial/agricultural activity/hillwash or some relic from original layers.

17. 4064 R/B ditch fill (Plates 69, 70)

Structure weakly massive with possibly weak prismatic structure; vughy and channel microstructure. Porosity Coarse inter-aggregate/faunal channel, porosity 25% on its own. Intra-aggregate is 10-30%, but textural infiling (see later) has reduced porosity by sometimes 25%. Mineral C:F 55:45. Coarse very dominant fine sand size sub-rounded and sub-angular quartz; few ditto size brown to green glauconite. Few sandstone, burned daub, chalk hearth. Fine darkish brown, speckled and dotted (PPL), medium birefringence, pale brown, brownish grey (OIL). Organic Coarse rare charcoal, rare bone. Fine many charred, occasional amorphous organic matter; many phytoliths, "coprolitic" material is rare. Groundmass porphyric, speckled and granostriate b-fabric.

Pedofeatures Textural very abundant dusty clay coatings, moderate birefringence, contain fine charcoal, several linked phases, sorting to fine moderately high birefringent laminae; apparently associated with abundant intercalations and lamina bands, leaving pure sand areas. Often coatings c. 100um thick with late "finer" phase. Crystalline occasional poorly crystalline and equigranular xenotopic calcite void infills. These infills which can both pre- and post-date textural, can begin with sparite, followed by micro-sparite.

Interpretation This is very much a "colluvial" deposit, most inclusions are rounded by transportation; there is rather more clay and non-charred organic matter in the fine fabric than in the middle sensu stricto. The superabundance of textural pedofeatures suggests much slaking of the deposit and material above - an "agricultural" colluvium, with added effect of soil water concentrating in the ditch.

18. 4042 (Plates 65, 66, 67, 68)

Structure weak massive with possible prismatic channel and vughy microstructure. Porosity (10-20%) dominant fine to very coarse smooth walled channels, common fine to medium smooth walled vughs. Mineral As 17, coarse inclusions of few flint, sandstone, calcitic brown soil/chalky soil, ash residue "hearth" fragment. Fine darkish yellowish brown, brown, speckled (PPL), medium birefringence, pale brown, greyish brown (OIL), (clayey fabric not ashey). organic matter Coarse, rare charcoal, rare bone. Fine abundant charred, but in addition abundant amorphous organic matter; many to abundant phytoliths. Possible rare coprolitic fragments. Groundmass porphyric, speckled and granostriate b-fabric. Pedofeatures very abundant commonly interlaced intercalations, related laminae and very dusty clay coatings of "matrix" material; complex textural infills 1st; rare finely dusty clay, 2nd; many very dusty - coarse inclusions of charred organic matter and phytoliths; poorly birefringent; 3rd very abundant moderately birefringent dusty clay with frequent organic matter inclusions, and 4th, probably last phase of moderately high birefringent finely dusty clay. Whole infill 400um thick. Finely dusty "laminae" or phase infills suggest last phase of translocation of fine material. Crystalline rare poorly crystalline calcitic infills and matrix impregnation.

Interpretation This level, like 17, is colluvial, most ash has been decalcified and the b-fabric is now primarily related to clay, so that the material of the midden - ie mainly phytoliths - has been mixed with clay from the Gault soils(?) of the area. Again, slaking and various phases of inwash can be seen - according to the nature of material involved. The last, and later phases of finely dusty clay suggests sorting downprofile, or more settled conditions.

19. Dog Coprolite (W35, 212, 1132)

(3 slices) (Plates 13, 14, 15, 16)

Main constituent is pale yellow, very pale yellow (PPL), very porly birefringent, very dark grey (OIL), and black (PPL), general 1st order grey birefringence, white (OIL) bone. Black areas are considered "partially digested". Staining bone is occasional brownish amorphous organic matter. As in thin sections of the midden, porosity within bone contains very dusty clay coatings - moderately birefringent. Other materials (other than fragments of midden fabric included within non-solid coprolite) are occasional areas of, i) fine bone, few sand grains, and fine fabric of common poorly birefringent ash residue, and a mixture of very abundant finely fragmented amorphous organic matter, very abundant coarse and fine phytoliths; - areas of wood ash also seem to have been ingested or enclosed by semi-liquid coprolitic material. This material is of an original coprolitic nature - either ingested or enclosed, because it is coated by a phase of very dusty clay coatings - the same as effect the porosity within the bone. Possibly some ash was ingested because pseudomorphs are no longer birefringent - possibly dissolved by stomach acid. There is no doubt that the organic matter included is amorphous, and where seen elsewhere probably relates to coprolitic material. However, were dogs scavenging "stable" areas which already contained herbivore coprolites - and this is a secondary remain?

20. Ashed organic matter (116, 1035) (Plates 19, 20, 21, 22)

Major part is very dirty yellowish grey to black, with residual plant shapes; non birefringent - only perhaps very, very low brownish tinge - included silt and very fine sand are visible; bright whitish yellow under OIL. Relic cell structures visible. At high power occasional amorphous organic matter is present, and also rare phytoliths along relic structure lines. Most phytoliths have presumably been destroyed by high temperature. These contrast with totally non-birefringent ash residue areas which, in comparison, are grey (PPL) and grey (OIL), presumably because all organic material has gone, leaving only some sort of "silica" residue (from phytoliths) "decalcified ash". Within this thin section areas of more sandy, ash rich, midden material occur with included, abundant, often layered phytoliths. In the thin section, areas very rich in calcitic ash are juxtaposed with low ash areas. The low ash area has very coarse phytoliths, whereas the high ash area has mainly fragmented phytoliths - but this may not be significant. The ash in these areas include rare rhomboids (5um) of probable wood (rather than grass) origin. One area in the slide, exhibiting many intact and layered phytoliths from "grass"/"cereal" material, ash patches of very fine ash, which occurs as poorly crystalline rounded crystals 2-3um in size which produce dark grey areas at low power. The predominant ash is probably "grass" ash here. Very delicate areas of phytoliths are preserved, some closely resembling Triticum reference phytolith material.

List of Plates and Captions

Plate 1 Cutting 12, South Section; thin sections No. 1-11 (A/B - L/M); modern (Romano-British, and Medieval) ploughsoil at top; midden and occupation in centre; contaminated subsoil (Greensand) at base.

Plate 2 Cutting 12, south Section, terrace area; note post holes of Late Bronze age occupation and location of hearths, one giving an archaeomagnetic date of 750bc.
Photomicrographs.

Plate 3 cutting 12, thin section 1 (L/M); Greensand subsoil comprising mainly fine quartz sand with frequent greenish weathered glauconite (a C horizon) Plane Polarised Light (PPL), frame length is 3.32mm.

Plate 4 As 3, Crossed Polarised Light. Note well sorted quartz and glauconite.

Plate 5 As, Oblique Incident Light (OIL) which shows the overall weakly ferruginous nature of the Greensand parent material.

Plate 6 Cutting 12, thin section 3 (J/K); channel in Greensand subsoil thickly coated by inwash of highly mobile charcoal-rich clay and (at top) fragments of ashed organic matter from hearths (see Plates 23 and 24), as contamination from overlying midden. PPL, frame length is 3.32mm.

Plate 7 As 6, XPL. Note isotropic hearth fragment, and very poorly birefringent clay coatings.

Plate 8 As 6. Note inclusion of coarse wood charcoal fragment, and intercalations of fine soil, perhaps as a result of minor slaking of "fines" within Greensand subsoil by occupation activities. PPL, frame length is 3.32mm.

Plate 9 As 8, XPL. Note poorly birefrigent fine fabric, probably originating from the weathering of glauconite in the first instance in this "clay poor" parent material (Table 1, Sa.24).

Plate 10 Cutting 12, thin section 4 (H/J); junction of subsoil and midden. Midden commences with probable dog coprolite comprising mainly semi-digested bone with blackish staining, that probably relates to bacterial attack (large fragment at top of plate, with smaller fragment below), dark brown amorphous organic matter coating both the bone and the mineral (midden-like) inclusions. PPL, frame length is 3.32mm.

Plate 11 As 10, XPL. Note variations in birefringence in the bone related to "digestion", and the quartz grains as mineral inclusions.

Plate 12 Detail of Plate 10 Semi-digested bone and associated brown amorphous organic matter typical of dog coprolites. PPL, frame length is 0.33mm.

Plate 13 Thin section 19, reference dog coprolite from Potterne (W35, 212, 1132). Again blackened bone, amorphous organic matter both on the bone and included within the coprolite with mineral (midden-like) material. Note area of mineral inclusion is coated by later non-coprolitic material washed into the coprolite as a post-depositional effect. PPL, frame length is 3.32mm.

Plate 14 As 13, XPL. Mineral inclusions contain birefringent quartz grains and calcitic ash material.

Plate 15 Detail of Plate 13 - the included material. In addition to quartz and calcitic ash which has been ingested there is much amorphous organic matter, and the plant fragments and many phytoliths testify to the

intake of vegetable matter as part of the dog's omnivorous scavenging diet (see Scaife, this volume). PPl, frame length is 0.33mm.

Plate 16 As 15, XPL. Note calcitic (birefringent) nature of secondary inwash around original ingested material.

Plate 17 Cutting 12, thin section 4 (H/J), base of midden. Dump from hearth over bone of coprolite (see Plate 10); ash made up of fine calcite crystals with phytoliths and few charred organic matter (probably low temperature burned "graminae" ash), mixed with few sand grains; overlain by wood charcoal. PPL, frame length is 0.33mm.

Plate 18 As 17, XPL. Typical high birefringence of (disturbed) ash dump.

Plate 19 Thin section 20, reference ashed organic matter from Potterne (W35, 116, 1035). Fabric dominated by very coarse, probable cereal, phytoliths as residue of burned organic matter, mixed with burned (brown) soil and patches of ash. PPL, frame length is 3.33mm.

Plate 20 As 19, note non-birefringent nature of phytoliths, low birefringent burned soil, and highly birefringent calcitic ash.

Plate 21 Detail of 19, very coarse phytoliths still attached as structural "sheets". PPL, frame length is 0.33mm.

Plate 22 As 19; grey and yellow "graminae" ash residue from burning above 500-600°C (calcite "ash" lost); only mineral material of phosphate (yellowish) and carbon (black dots) staining siliceous (from phytoliths) material remains, with weakly pseudomorphic (of plants) fabric. PPL, frame length is 3.32mm.

Plate 23 Cutting 12, thin section 4 (H/J), base of midden. Dump from hearth (above plate 17). Over wood charcoal is a yellowish layer of ashed (burned) "graminae" material (see plate 22), merging into black, vesicular, siliceous "graminae" residue. Here the silica from phytoliths has melted (above 650°C) like a glass, probably under localised reducing conditions (Straker, pers. comm.). Black staining from pure carbon. PPL, frame length is 3.32mm.

Plate 24 As 23, XPL. Note totally non-birefringent nature of the residue.

Plate 25 As 23, OIL. Vitrified ash is typically white because all impurities have been burned off.

Plate 26 Detail of 23. Note relic phytoliths in yellowish residue, quite lost in the higher temperature vitrified (bubbled) blackish silica residue. PPL, frame length is 0.33mm.

Plate 27 Cutting 12, thin section 5 (G/H). Horizontal layers of coarse phytoliths (of "graminae"), fine calcite ash, sand grains and amorphous organic matter staining; these are believed to represent stable floor layers/dung (cattle?), burned in situ before being dumped onto the midden (here with minimal disturbance); here contaminated by later inwash of fine charcoal from above. PPl, frame length is 3.32mm.

Plate 28 As 27, XPL. Note banding.

Plate 29 As 27, OIL. Note very pale "graminae" ash and phytolith bands are typically free of much charcoal.

Plate 30 Detail of 27, showing very coarse phytolith, ash bands, sand grains and amorphous organic matter, with very dusty clay coatings (base of layers) in porosity from slaking of the deposits, probably related to the amorphous organic matter/coprolitic staining. PPL, frame length is 0.33mm.

Plate 31 As 30, XPL.

Plate 32 Cutting 12, thin section 4. Inclusions; rounded "daub" fragment with plant temper porosity, made out of "foreign" calcareous brown soil; ashey hearth fragments, phytoliths, charcoal and a few sand grains are also present. PPL, frame length is 3.32mm.

Plate 33 As 32, XPL. Note high birefringence of calcareous "daub".

Plate 34 Cutting 12, north end, lower midden (3308), thin section 13; grey brown fabric of "graminae" ash midden where minor amounts of clay and charred organic matter are present. Note physically mixed, heterogeneous nature of fine fabric and sands. PPL, frame length is 3.32mm.

Plate 35 As 34, XPL. Note weakly calcitic (ash crystal scatter) birefringence.

Plate 36 As 34; more general pale grey brown fabric of disturbed burned stable floor debris, mainly phytoliths and ash crystals with very little charred organic matter; the whole stained and effected by coprolitic amorphous organic matter. PPL, frame length B 3.32.

Plate 37 Detail of 37, showing very pale fabric impregnated by amorphous organic matter, with an almost absence of fine charred organic matter. PPL, frame length is 0.33mm.

Plate 38 Cutting 12, thin section 7 (E/F); juxtaposition of pale "graminae" ash midden material, with very dark brown "hearth" debris very rich in fine, probable wood, charcoal (the latter is also highly mobile - washing down channels into the subsoil), the latter fabric is also poor in phytoliths. PPL, frame length is 3.32mm.

Plate 39 As 38, XPL. Note higher birefringence (calcite ash) of pale "graminae" midden.

Plate 40 As 38; coarse wood charcoal spread from hearths. PPL, frame length is 3.32mm.

Plate 41 As 40, XPL.

Plate 42 As 40; heavily burned (reddened) "daub"/hearth clay associated with charcoal spreads. PPL, frame length is 3.32mm.

Plate 43 As 42, XPL showing loss of birefringence from burned clay.

Plate 44 As 38, showing "earlier" greyish "graminae" ash midden contaminated by charcoal rich soil material, both through physical mixing and by downwash PPL, frame length is 3.32mm.

Plate 45 As 44, XPL, showing more clay rich nature of the darker soil fabric.

Plate 46 As 38, showing area of midden infilled by probable phosphatic amorphous organic matter, "leached" from ash and redeposited here as evidence of weathering of the midden. PPL, frame length is 3.32mm.

Plate 47 As 46, XPL. Note non-birefringent nature of the infills.

Plate 48 Cutting 12, north end, thin section 14 (3307); midden phase 2, mixing of dark charcoal rich fine fabric with grey "graminae" ash midden (see Plate 38). PPL, frame length is 3.32mm.

Plate 49 As 48, XPL, again showing lower birefringence of charcoal rich fabric.

Plate 50 Cutting 12, thin section 10 (B/C), midden phase 3; pale greyish brown "graminae" ash midden fabric, rich in calcite ash and probably from low temperature hearth layers (rather than stable layers); contains very abundant poorly preserved phytoliths, suggesting reworking/disturbance before dumping, and strong staining by coprolitic amorphous organic matter. PPL, frame length is 3.32mm.

Plate 51 As 50, XPL. Note moderately high crystallitic b-fabric (from calcitic ash).

Plate 52 Cutting 12, thin section 11 (A/B); "compacted midden". PPL, frame length is 3.32mm.

Plate 53 As 52, XPL.

Plate 54 As 52; two fabrics; at the base as plate 52, with washed in bands (intercalations) of more organic, but less ashey fine soil. PPL, frame length is 3.32mm.

Plate 55 As 54, XPL. Note lower birefringence of dark fabric.

Plate 56 Cutting 14, thin section 15 (4072/4083); well developed intercalations of clay rich fine soil through probable ploughsoil mixing. PPL, frame length is 3.32mm.

Plate 57 As 56, XPL.

Plate 58 As 56; ash rich area, containing fine calcitic fabric, wood charcoal and in the centre neo-formed vivianite; the latter produced from locally mobilised phosphate (from ash) and iron (from Greensand) under localised anaerobic conditions. PPL, frame length is 0.33mm.

Plate 59 As 58, XPL.

Plate 60 As 58, part of the colluvial deposit; rounded (transported) fragment of an ash layer over an ash and sandy layer. Note fine included charcoal PPL, frame length is 3.32mm.

Plate 61 As 60, XPL. Note low birefringence of ash band.

Plate 62 Detail of ash band in Plate 60; only few calcite ash crystals are present; the bulk comprises fine charred organic matter and very abundant phytoliths. PPL, frame length is 0.16mm.

Plate 63 As 58; colluvial mixing of calcitic "graminae" ash midden (right) and ploughsoil rich in clay, charcoal and reddish plant fragments (normally absent from the midden). PPL, frame length is 3.32mm.

Plate 64 As 63, XPL.

Plate 65 Cutting 15, thin section 18 (4042); colluvial midden/Romano-British midden; moderately clayey fine soil, with little ash but common charcoal; note very well developed dusty clay channel infill from ploughsoil disruption and slaking of topsoil. PPL, frame length is 3.32mm.

Plate 66 As 65, XPL. Note birefringence clay-rich infill.

Plate 67 Detail of 65; fine fabric lacks fine calcite ash (hence low birefringence) through weathering; infill comprises some four phases of dusty and charcoal rich clay through ploughsoil slaking, the last fine clay phase resulting from slaking of soil as the profile thickens - only fine clay being translocated this deep. PPL, frame length is 0.33mm.

Plate 68 As 67, XPL.

Plate 69 Cutting 15, thin section 17 (4064), Romano-British ditch fill; clayey fine soil; void infill by neo-formed calcite (grey zone), followed by later clay translocation (from continued ploughing). PPL, frame length is 3.32mm.

Plate 70 As 69, XPL. Note high birefringence of calcite; derived from weathering of the calcite ash of the midden.

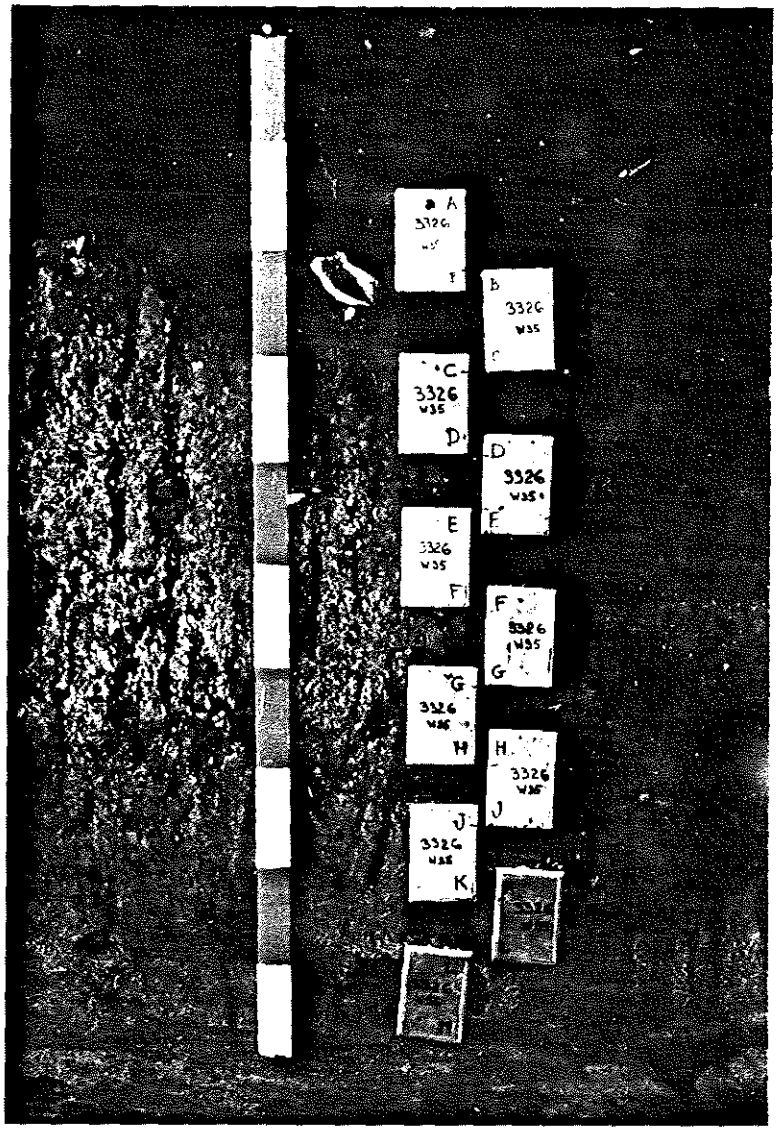


Plate 1 Cutting 12, South Section; thin sections No. 1-11 (A/B - L/M); modern (Romano-British, and Medieval) ploughsoil at top; midden and occupation in centre; contaminated subsoil (Greensand) at base.

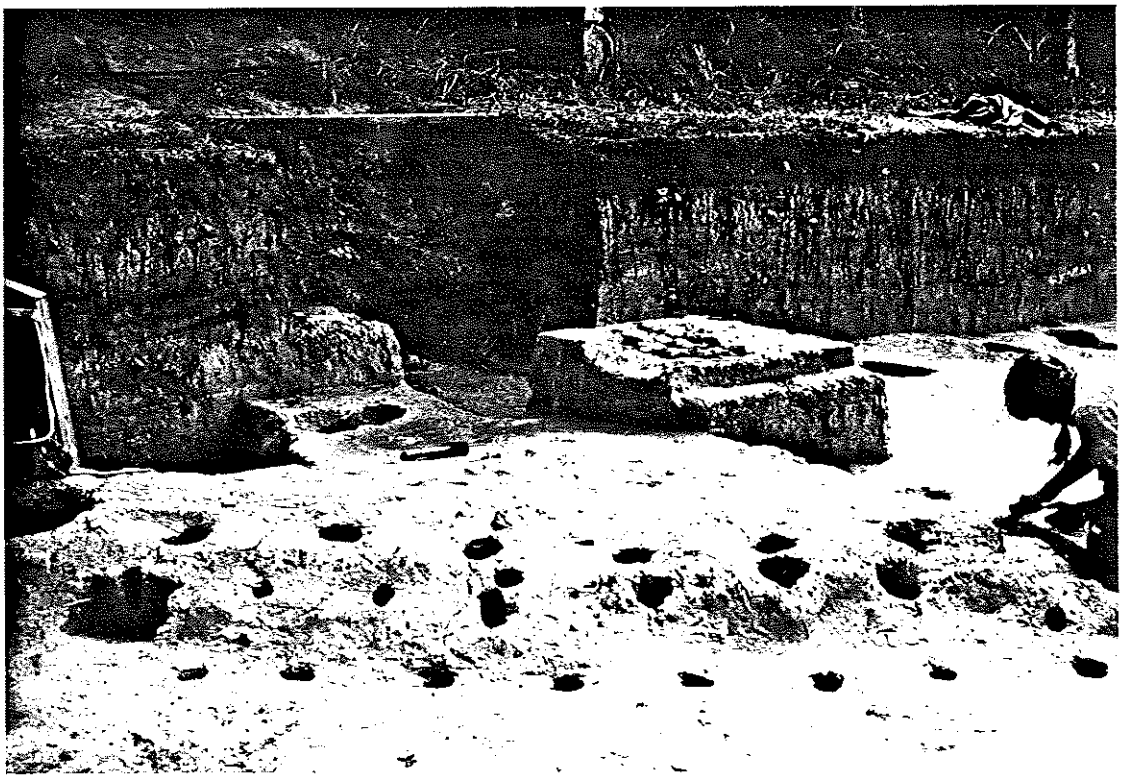
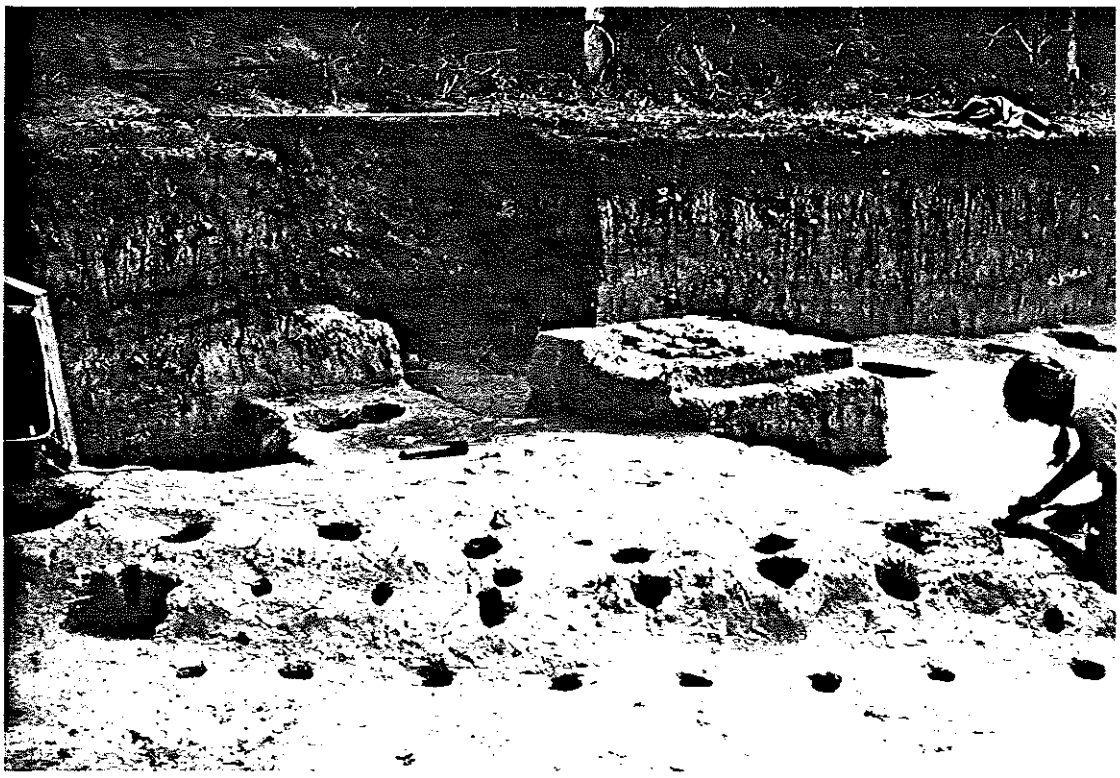


Plate 2 Cutting 12, south Section, terrace area; note post holes of Late Bronze age occupation and location of hearths, one giving an archaeomagnetic date of 750bc.

Photomicrographs.



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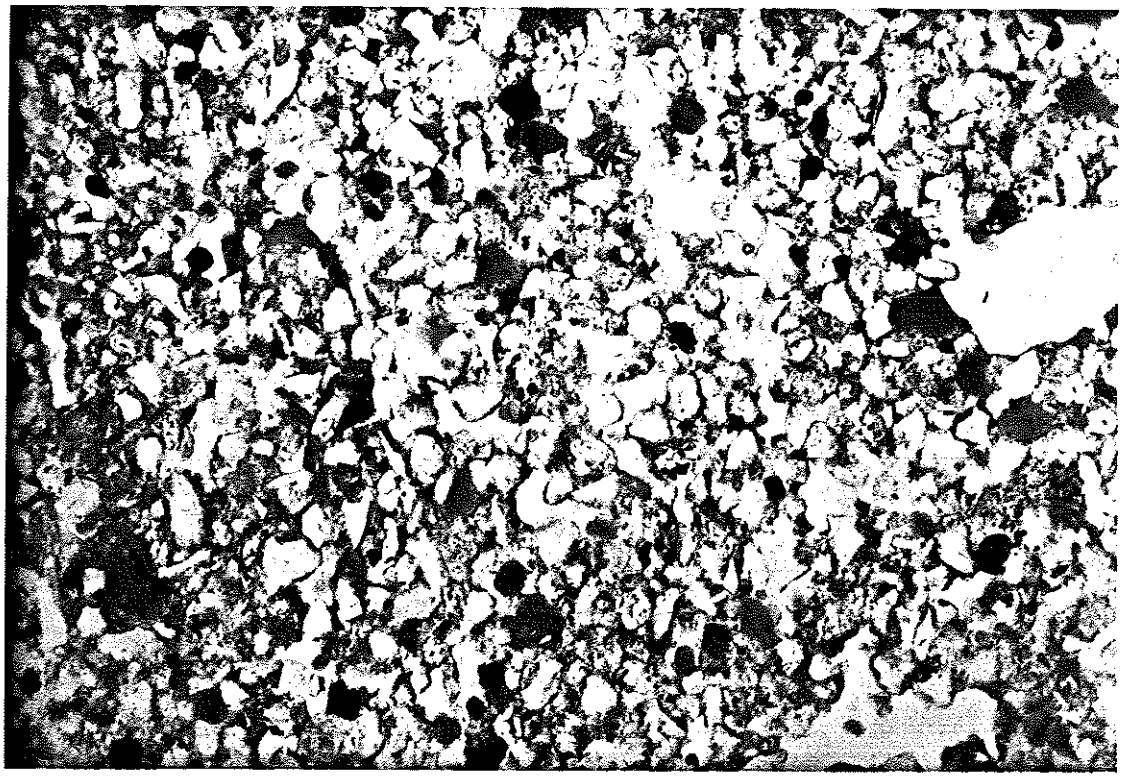


Plate 3 cutting 12, thin section 1 (L/M); Greensand subsoil comprising mainly fine quartz sand with frequent greenish weathered glauconite (a C horizon) Plane Polarised Light (PPL), frame length is 3.32mm.

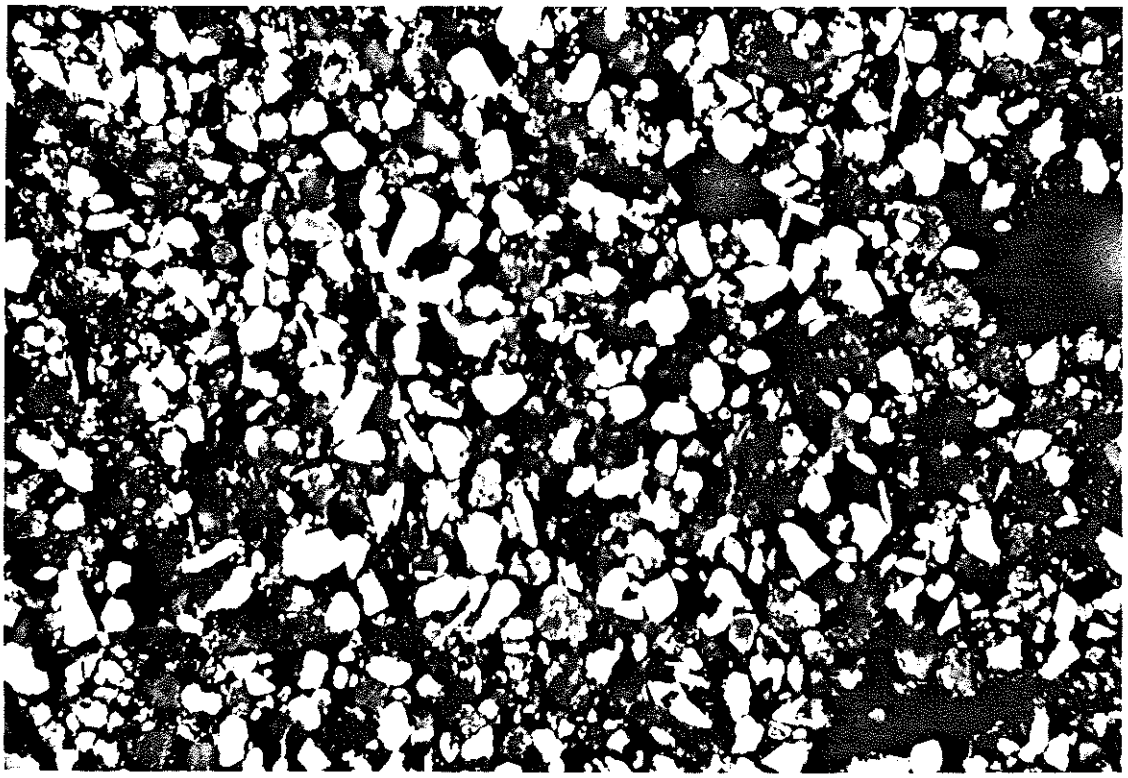


Plate 4 As 3, Crossed Polarised Light. Note well sorted quartz and glauconite.

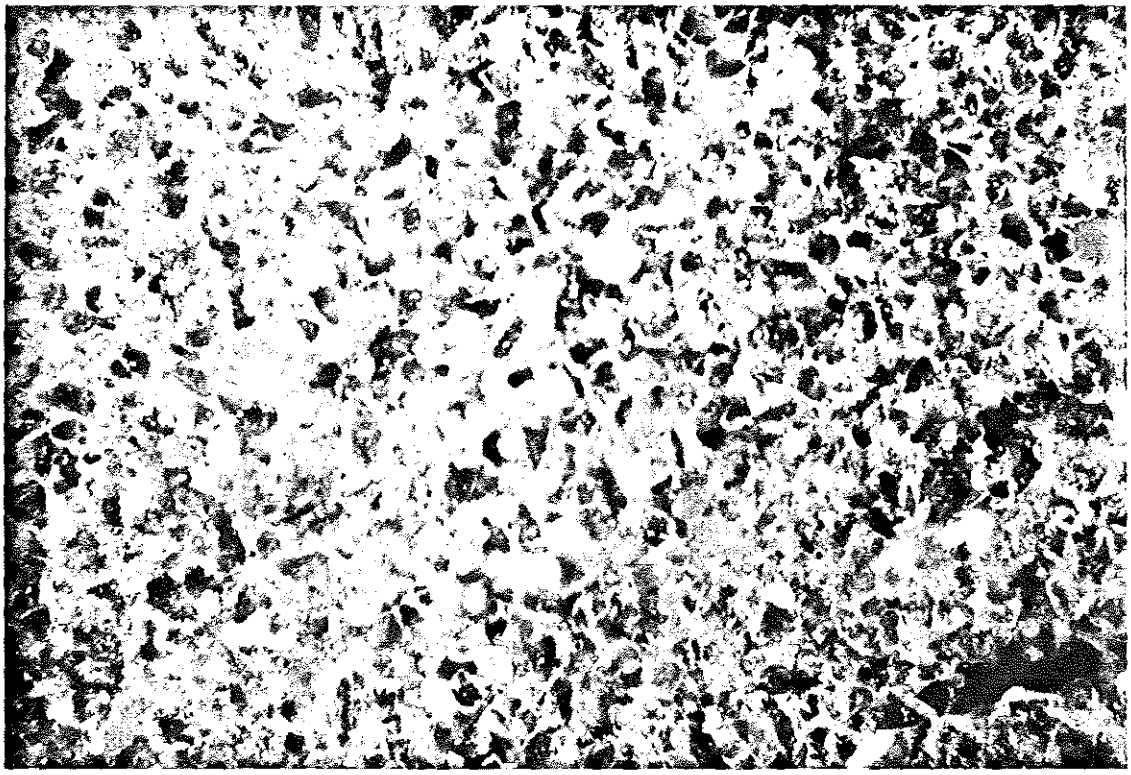


Plate 5 As, Oblique Incident Light (OIL) which shows the overall weakly ferruginous nature of the Greensand parent material.

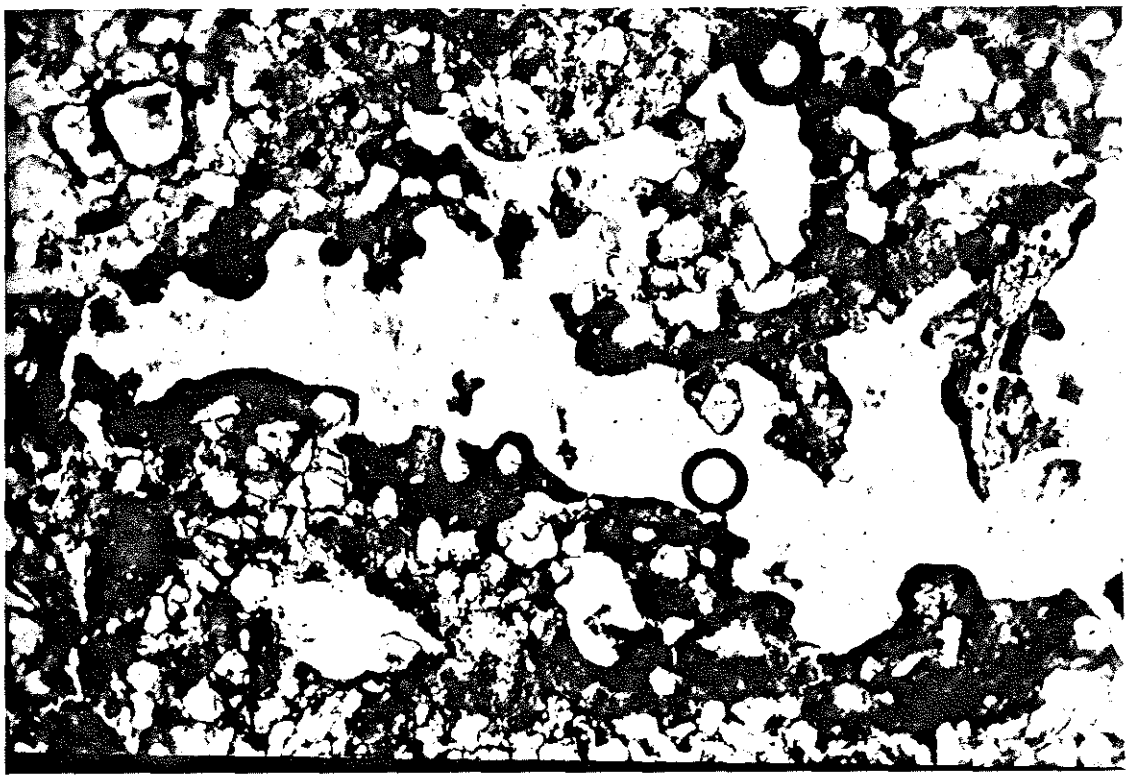


Plate 6 Cutting 12, thin section 3 (J/K); channel in Greensand subsoil thickly coated by inwash of highly mobile charcoal-rich clay and (at top) fragments of ashed organic matter from hearths (see Plates 23 and 24), as contamination from overlying midden. PPL, frame length is 3.32mm.

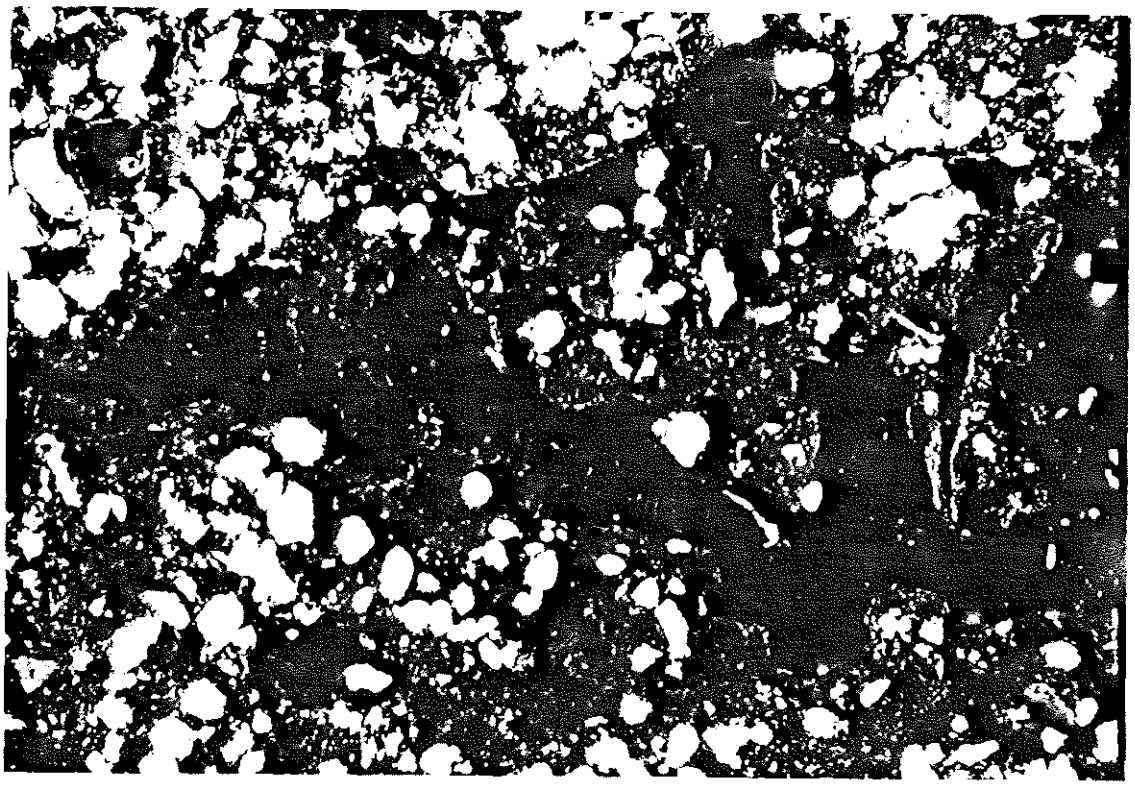


Plate 7 As 6, XPL. Note isotropic hearth fragment, and very poorly birefringent clay coatings.

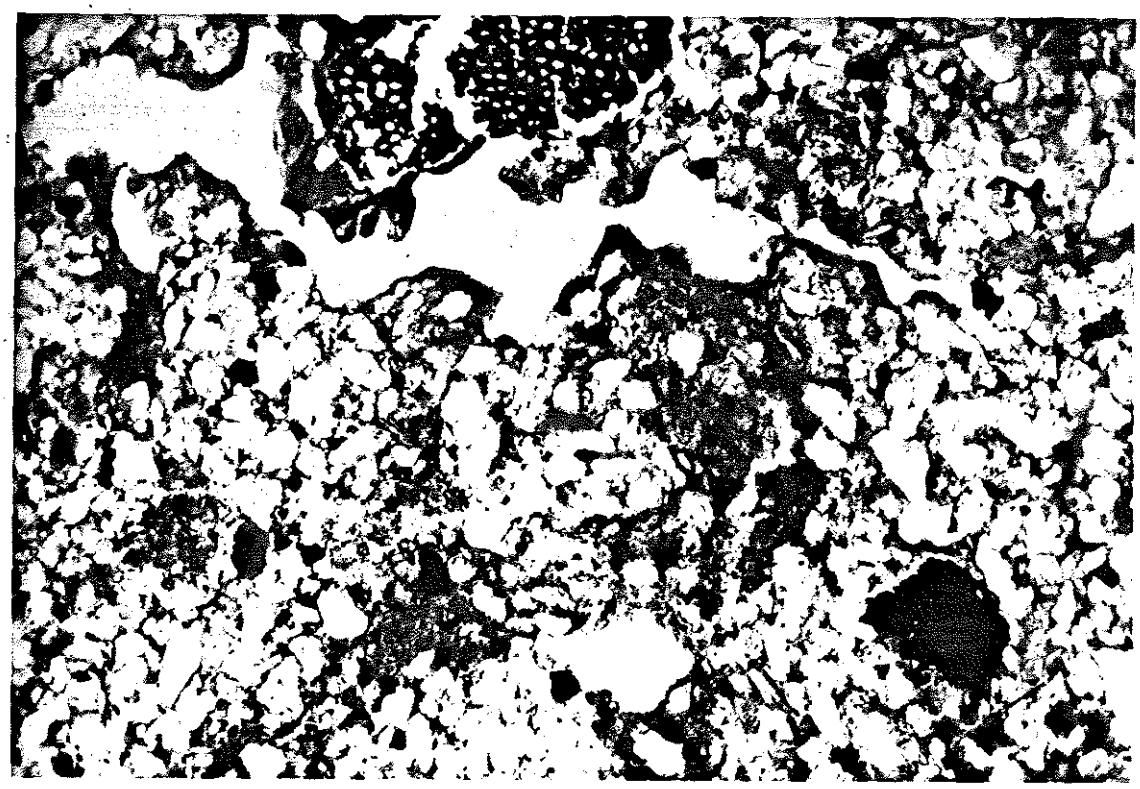


Plate 8 As 6. Note inclusion of coarse wood charcoal fragment, and intercalations of fine soil, perhaps as a result of minor slaking of "fines" within Greensand subsoil by occupation activities. PPL, frame length is 3.32mm.

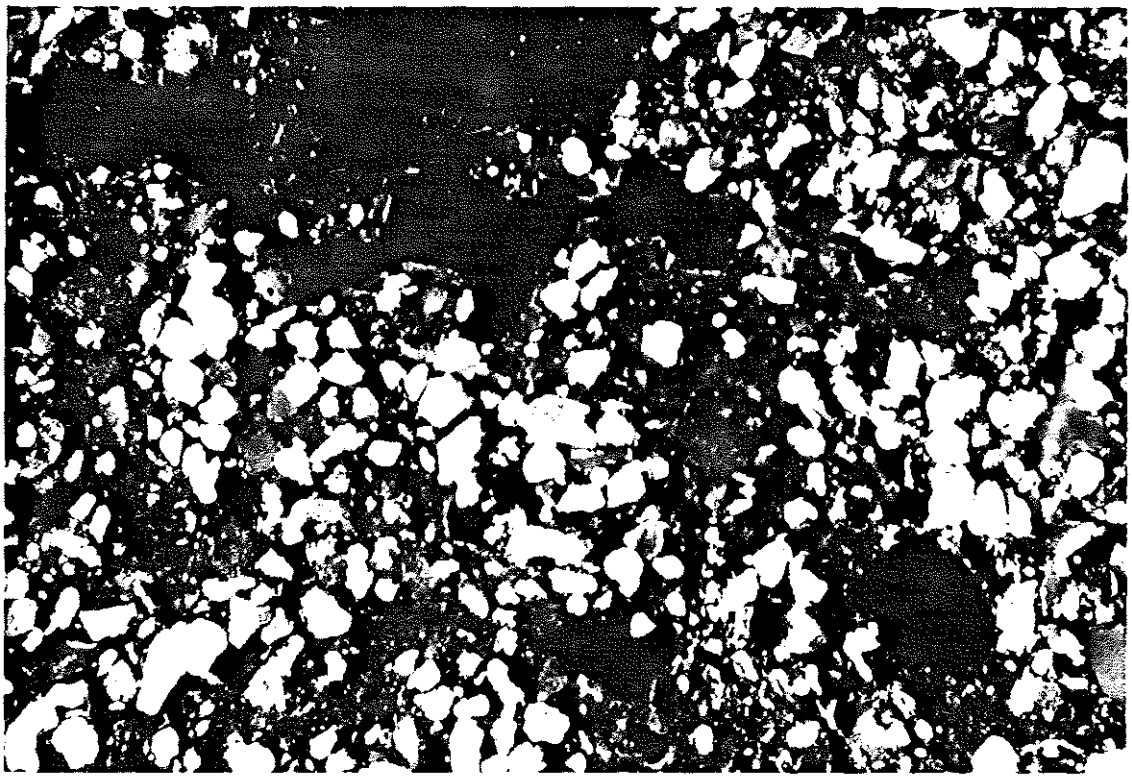


Plate 9 As 8, XPL. Note poorly birefri-gent fine fabric, probably originating from the weathering of glauconite in the first instance in this "clay poor" parent material (Table 1, Sa.24).

Plate 10 Cutting 12, thin section 4 (H/J); junction of subsoil and midden. Midden commences with probable dog coprolite comprising mainly semi-digested bone with blackish staining, that probably relates to bacterial attack (large fragment at top of plate, with smaller fragment below), dark brown amorphous organic matter coating both the bone and the mineral (midden-like) inclusions. PPL, frame length is 3.32mm.

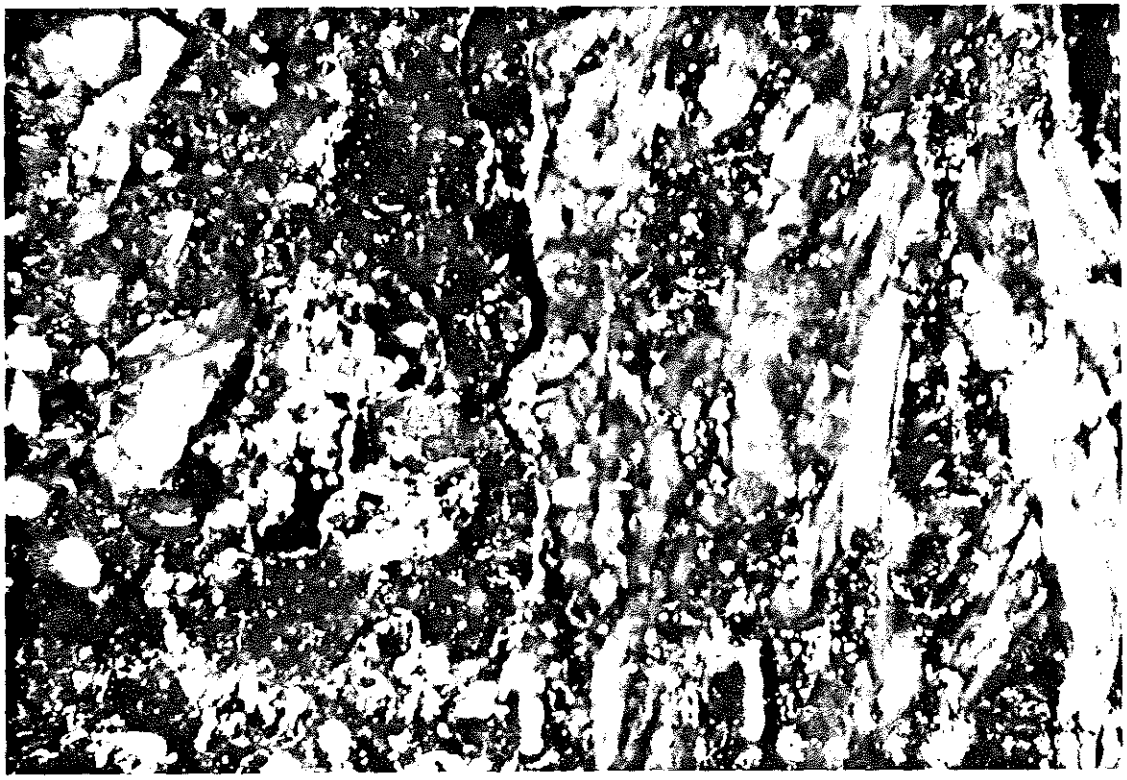


Plate 11 As 10, XPL. Note variations in birefringence in the bone related to "digestion", and the quartz grains as mineral inclusions.

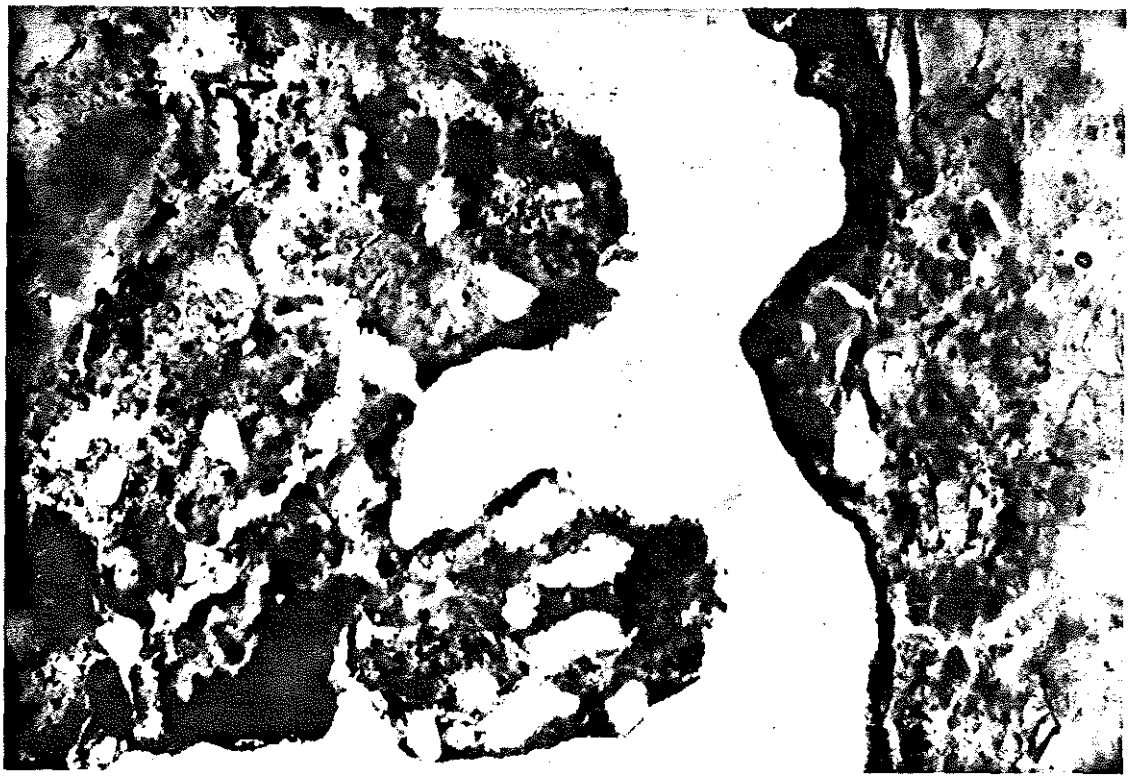


Plate 12 Detail of Plate 10 Semi-digested bone and associated brown amorphous organic matter typical of dog coprolites. PPL, frame length is 0.33mm.

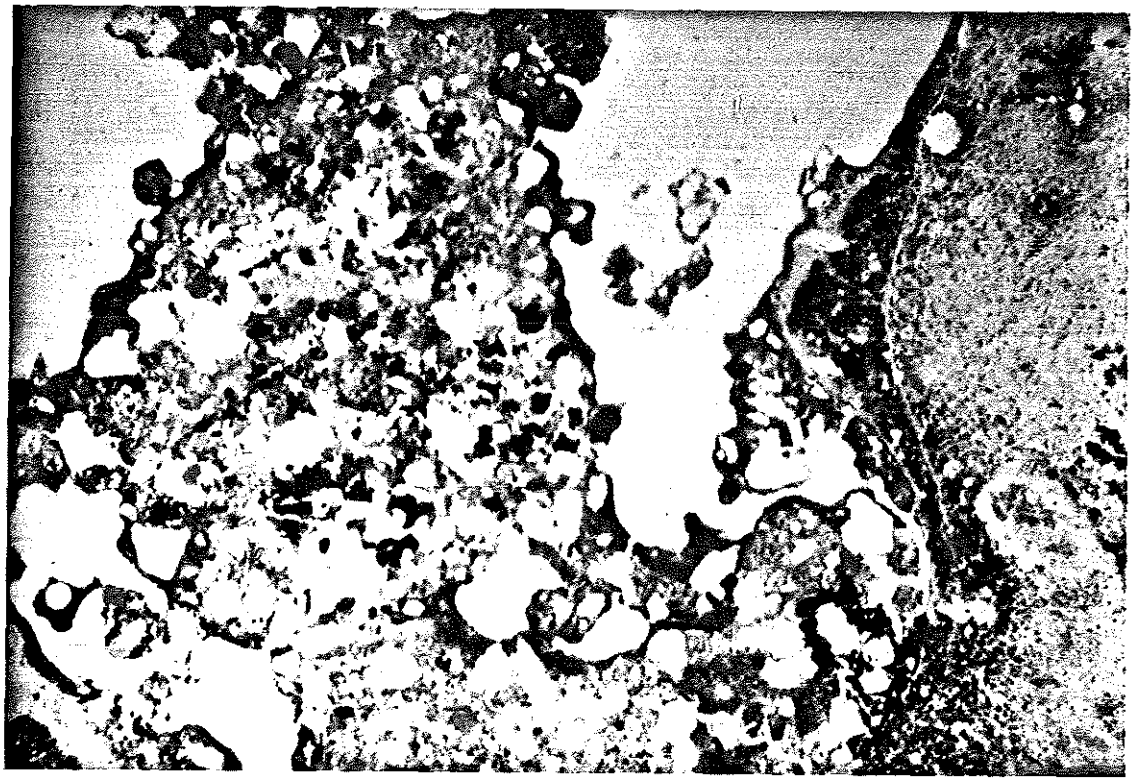


Plate 13 Thin section 19, reference dog coprolite from Potterne (W35, 212, 1132). Again blackened bone, amorphous organic matter both on the bone and included within the coprolite with mineral (midden-like) material. Note area of mineral inclusion is coated by later non-coprolitic material washed into the coprolite as a post-depositional effect. PPL, frame length is 3.32mm.

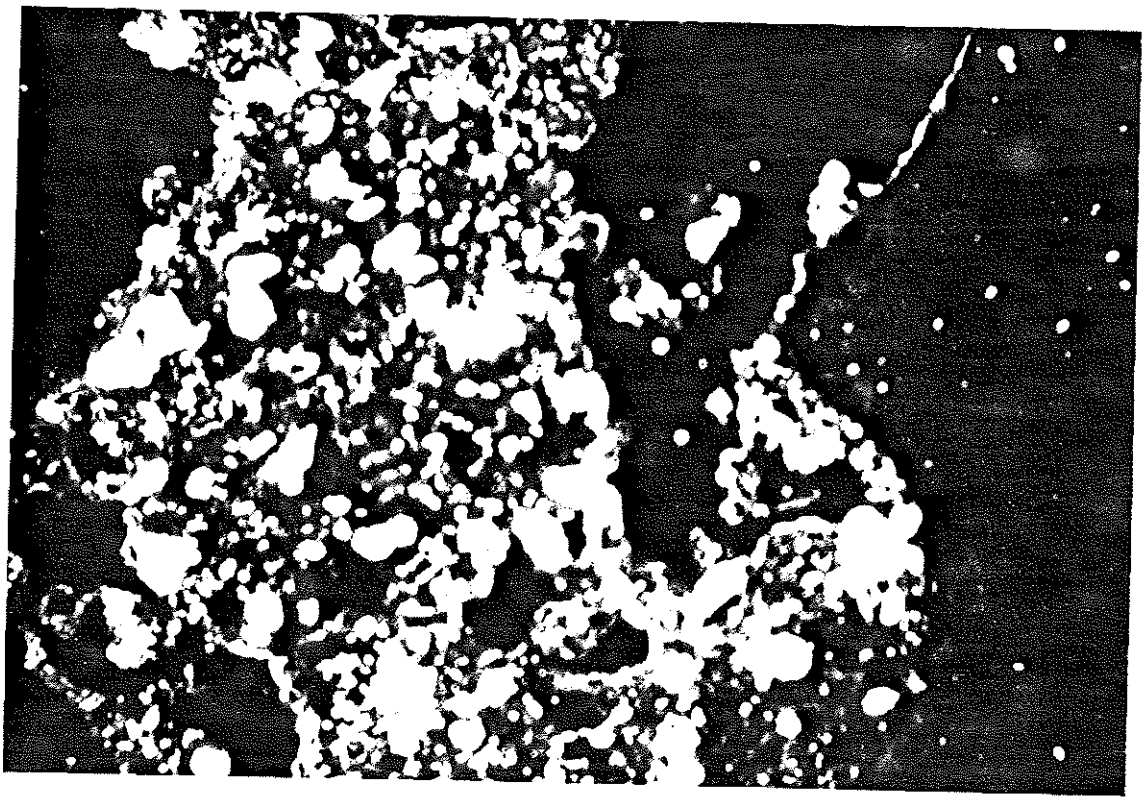


Plate 14 As 13, XPL. Mineral inclusions contain birefringent quartz grains and calcitic ash material.

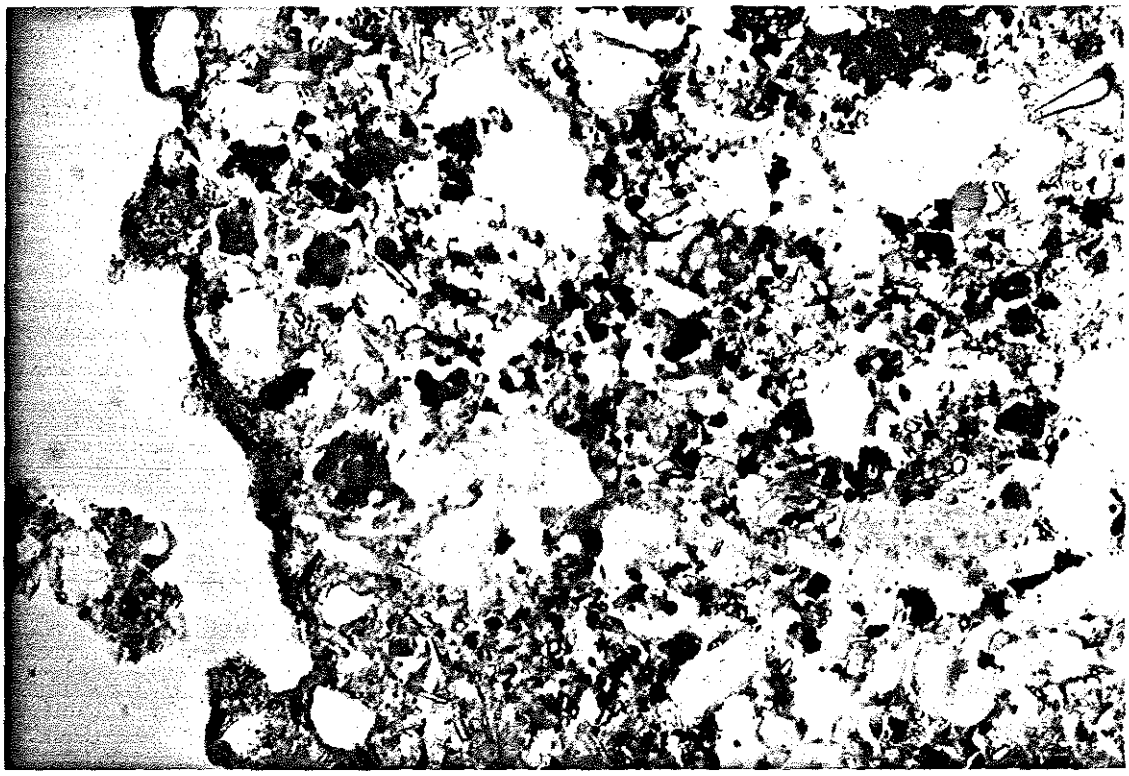


Plate 15 Detail of Plate 13 - the included material. In addition to quartz and calcitic ash which has been ingested there is much amorphous organic matter, and the plant fragments and many phytoliths testify to the intake of vegetable matter as part of the dog's omnivorous scavenging diet (see Scaife, this volume). PPl, frame length is 0.33mm.

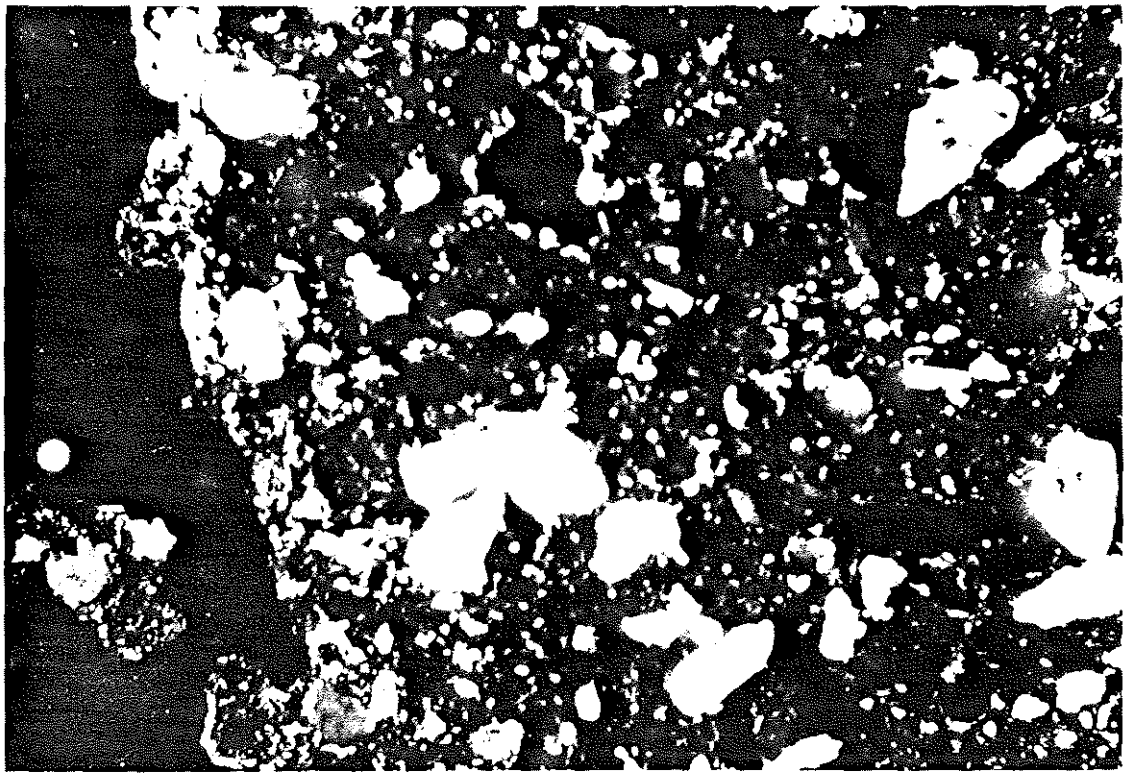


Plate 16 As 15, XPL. Note calcitic (birefringent) nature of secondary inwash around original incested material.

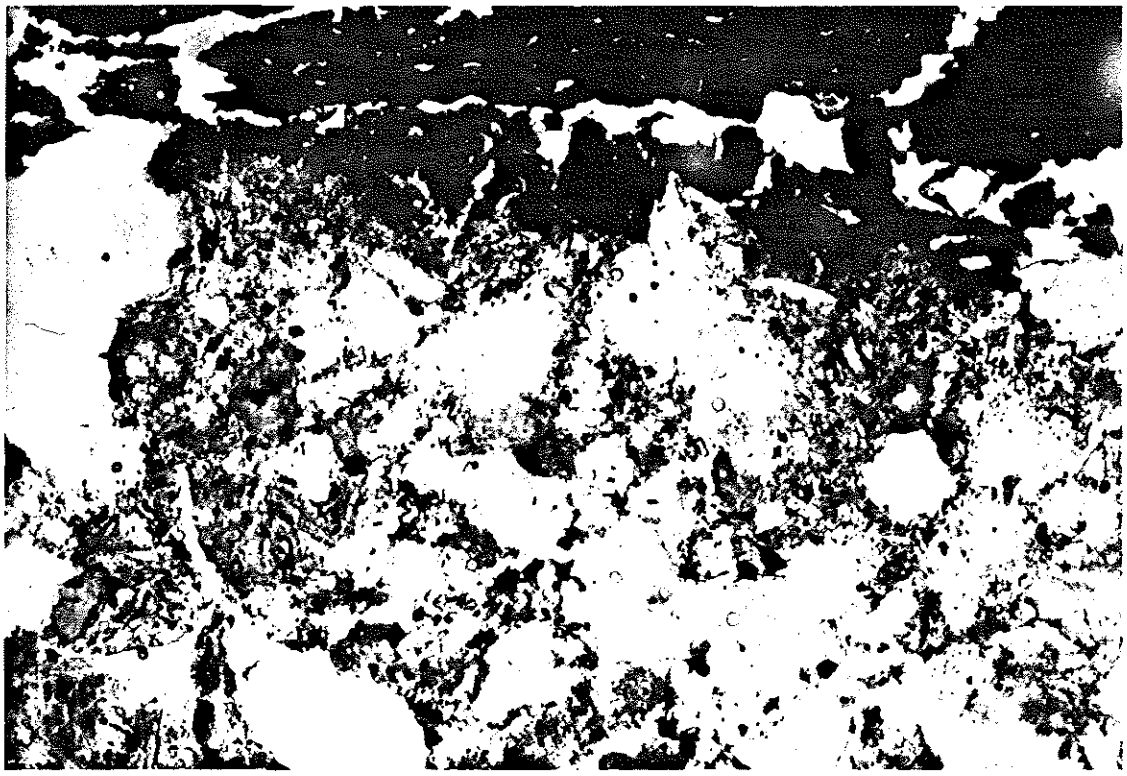


Plate 17 Cutting 12, thin section 4 (H/J), base of midden. Dump from hearth over bone of coprolite (see Plate 10); ash made up of fine calcite crystals with phytoliths and few charred organic matter (probably low temperature burned "graminae" ash), mixed with few sand grains; overlain by wood charcoal. PPL, frame length is 0.33mm.

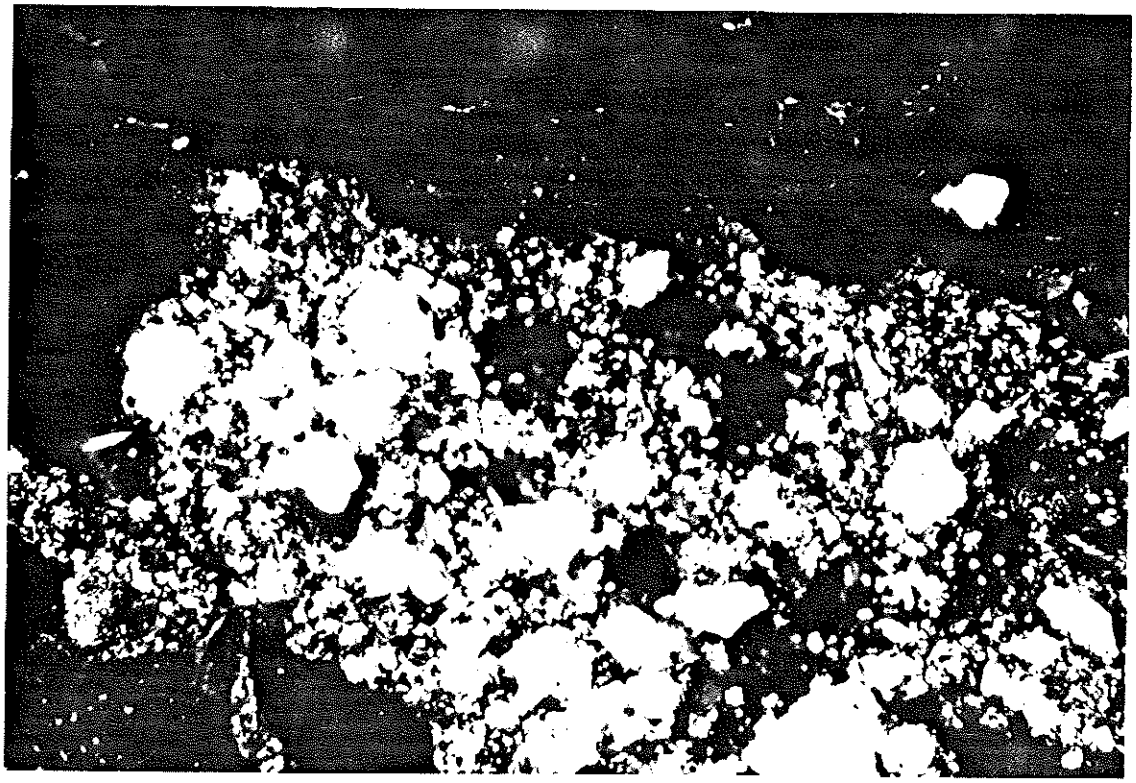
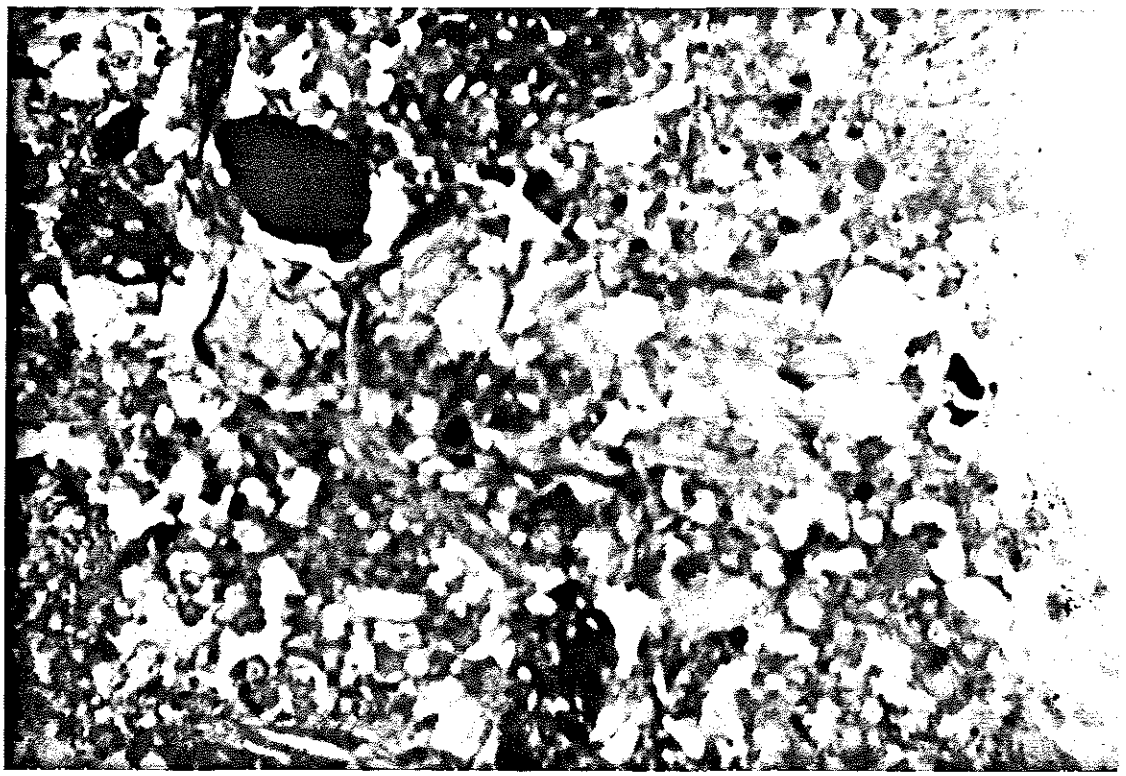


Plate 18 As 17, XPL. Typical high birefringence of (disturbed) ash dump.



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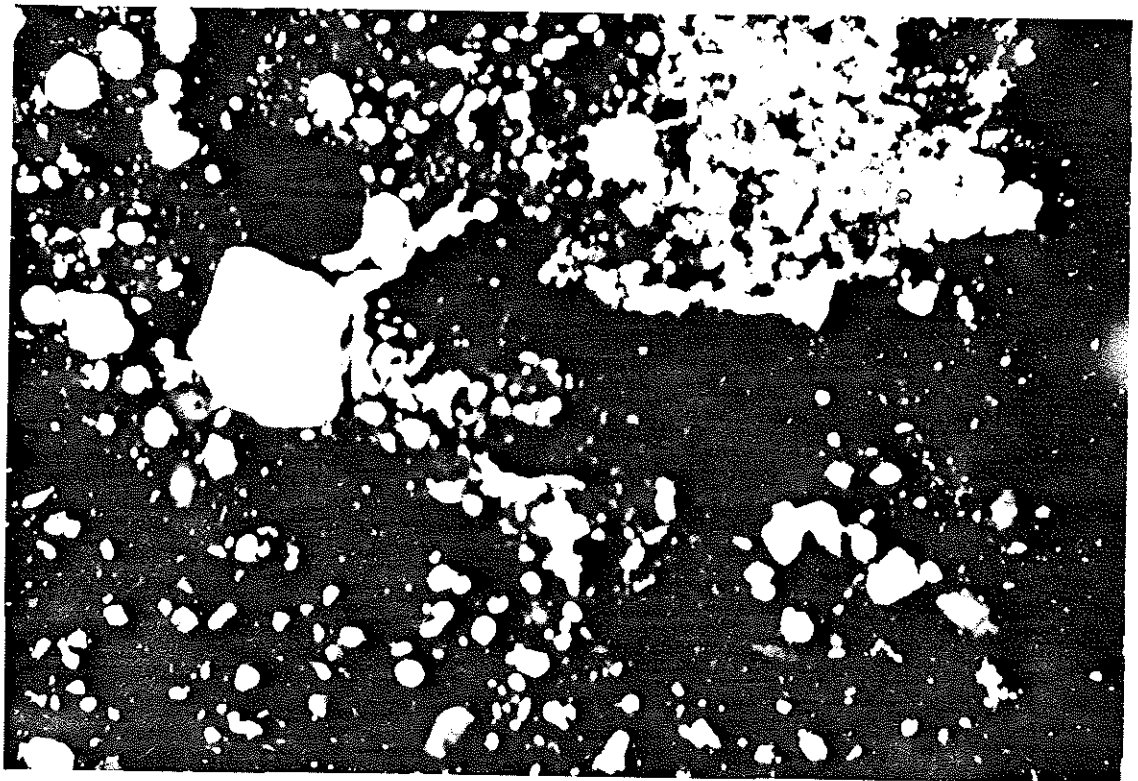

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Plate 21 Detail of 19, very coarse phytoliths still attached as structural "sheets". PPL, frame length is 0.33mm.

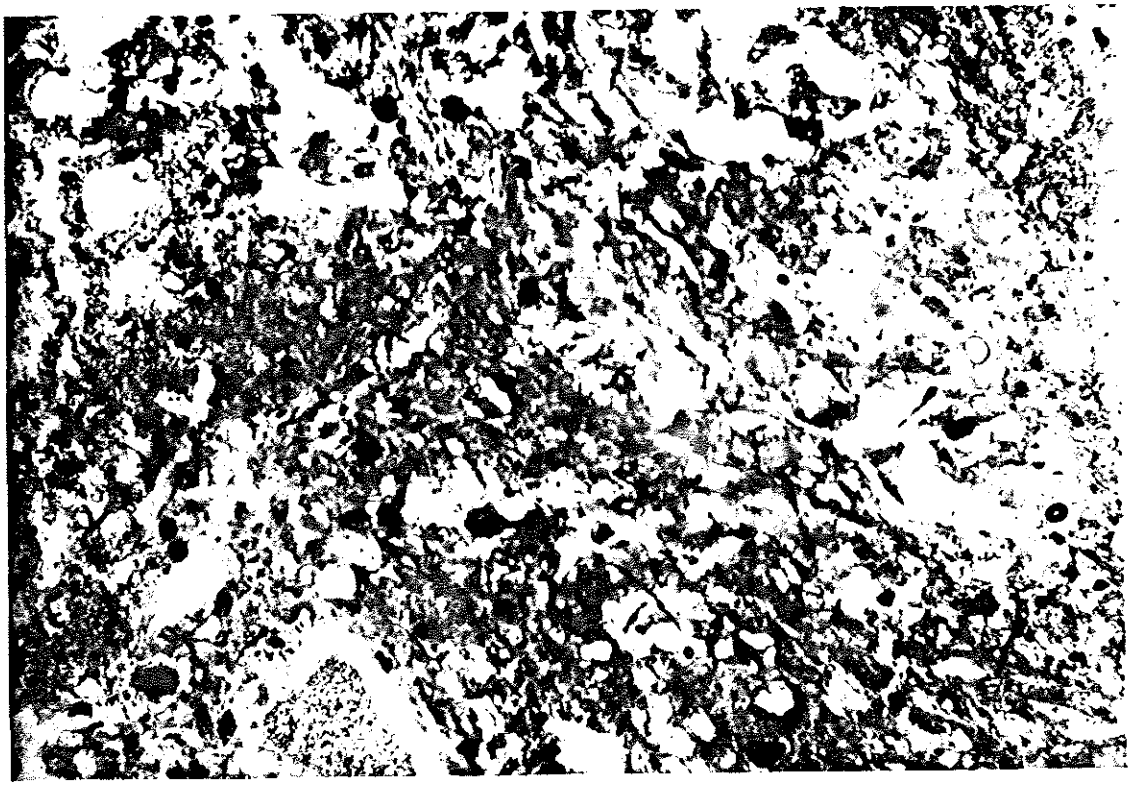
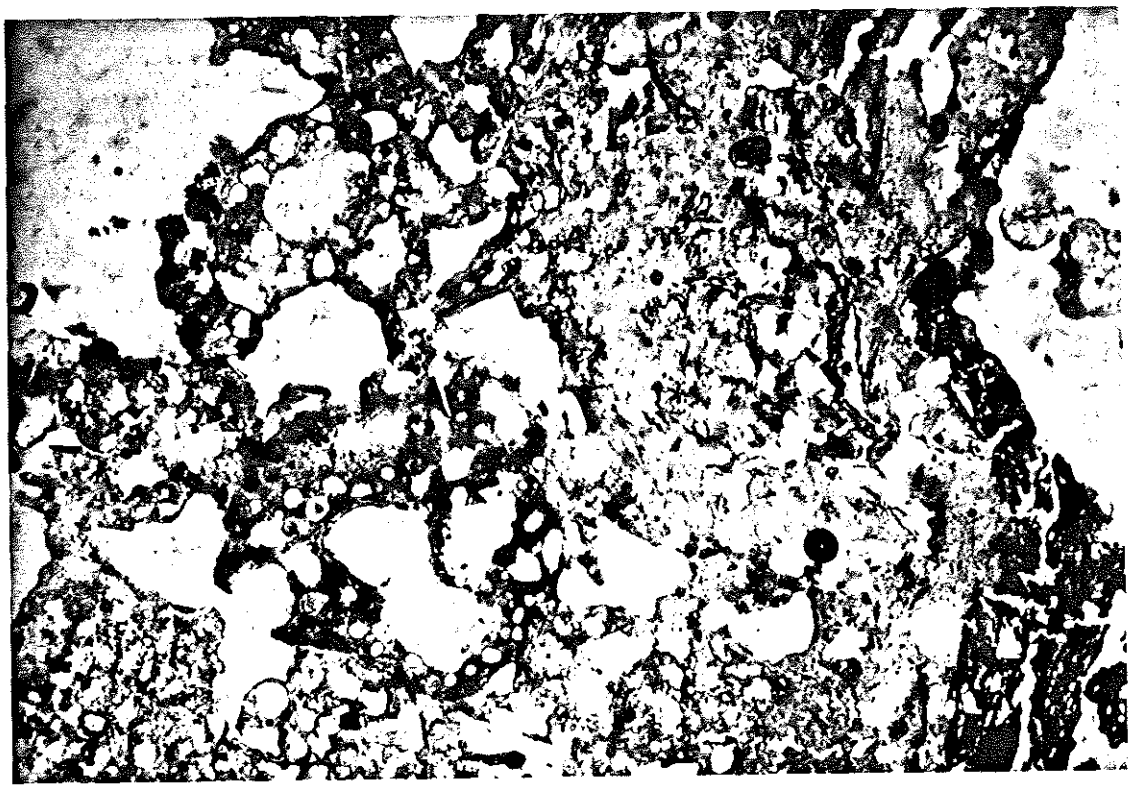


Plate 22 As 19; grey and yellow "graminae" ash residue from burning above 500-600°C (calcite "ash" lost); only mineral material of phosphate (yellowish) and carbon (black dots) staining siliceous (from phytoliths) material remains, with weakly pseudomorphic (of plants) fabric. PPL, frame length is 3.32mm.



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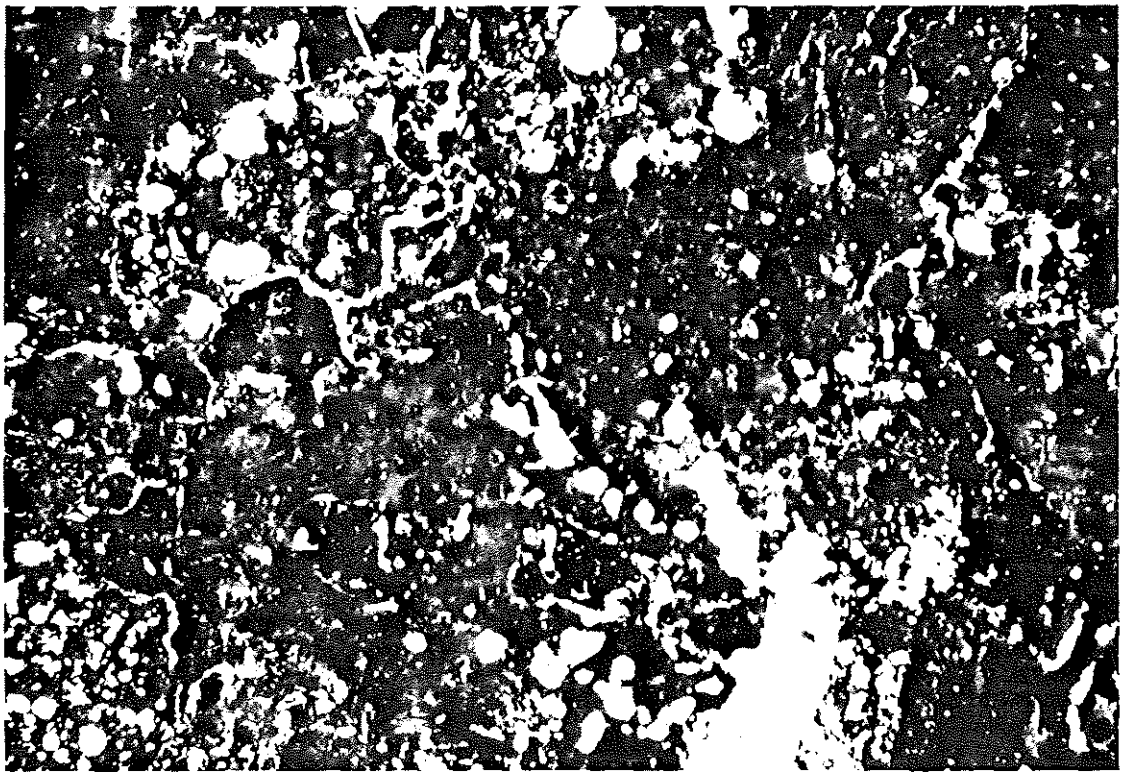


Plate 24 As 23, XPL. Note totally non-birefringent nature of the residue.

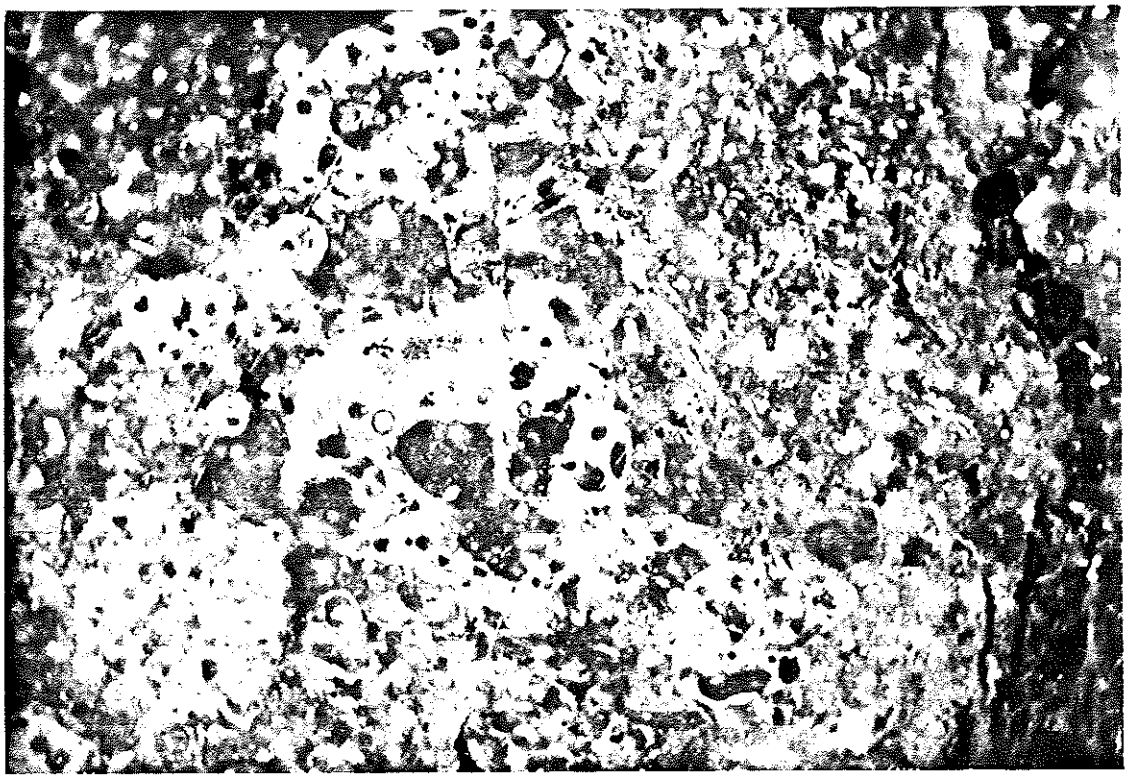


Plate 25 As 23, OIL. Vitrified ash is typically white because all impurities have been burned off.

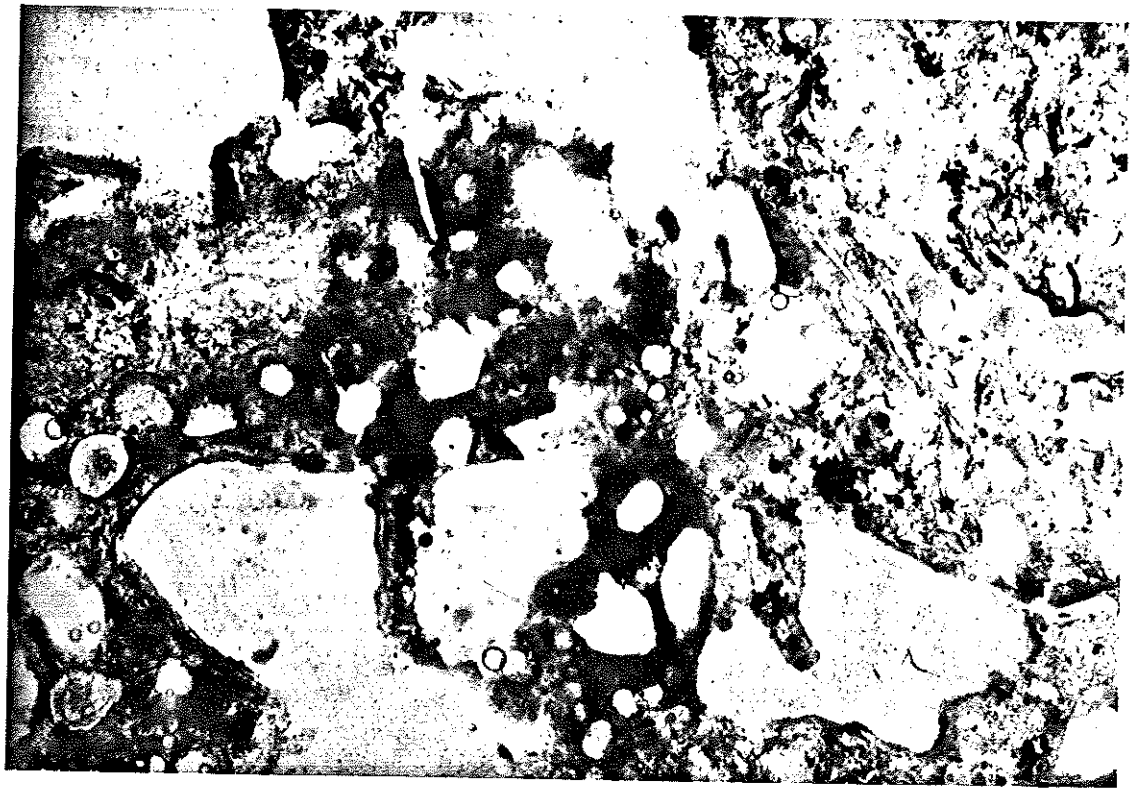


Plate 26 Detail of 23. Note relic phytoliths in yellowish residue, quite lost in the higher temperature vitrified (bubbled) blackish silica residue. PPL, frame length is 0.33mm.

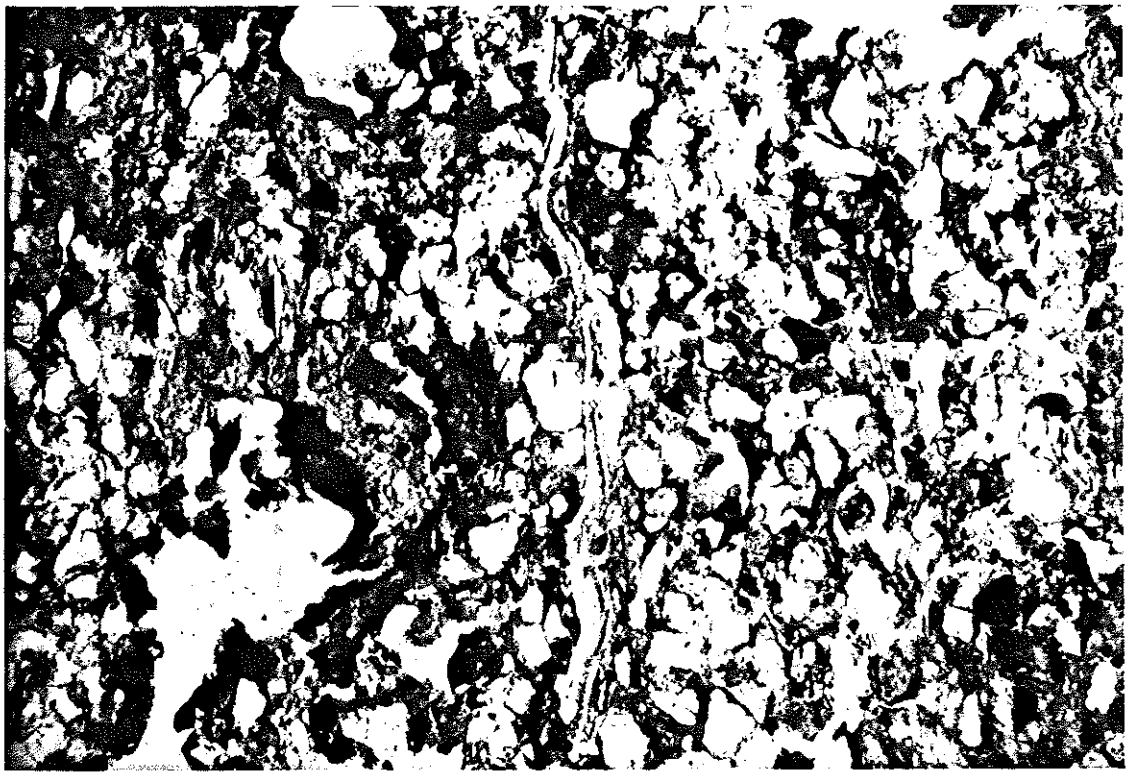


Plate 27 Cutting 12, thin section 5 (G/H). Horizontal layers of coarse phytoliths (of "graminae"), fine calcite ash, sand grains and amorphous organic matter staining; these are believed to represent stable floor layers/dung (cattle?), burned <u>in situ</u> before being dumped onto the midden (here with minimal disturbance); here contaminated by later inwash of fine charcoal from above. PPl, frame length is 3.32mm.

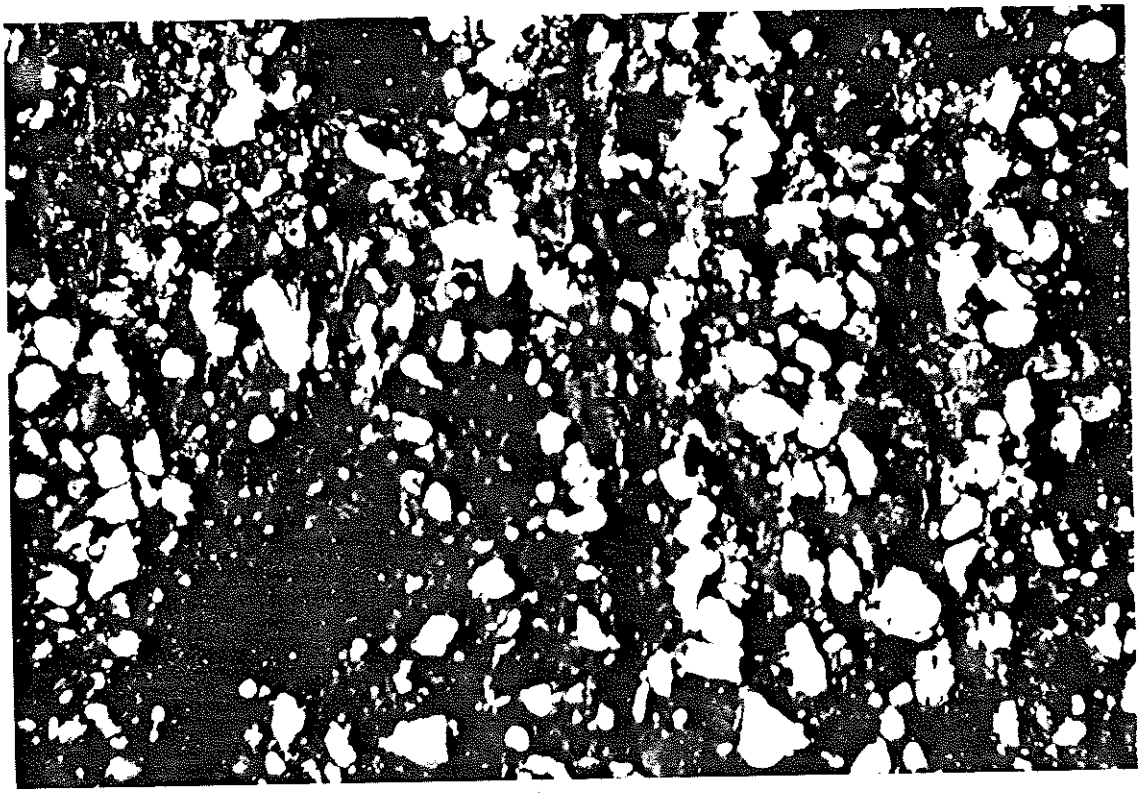


Plate 28 As 27, XPL. Note banding.

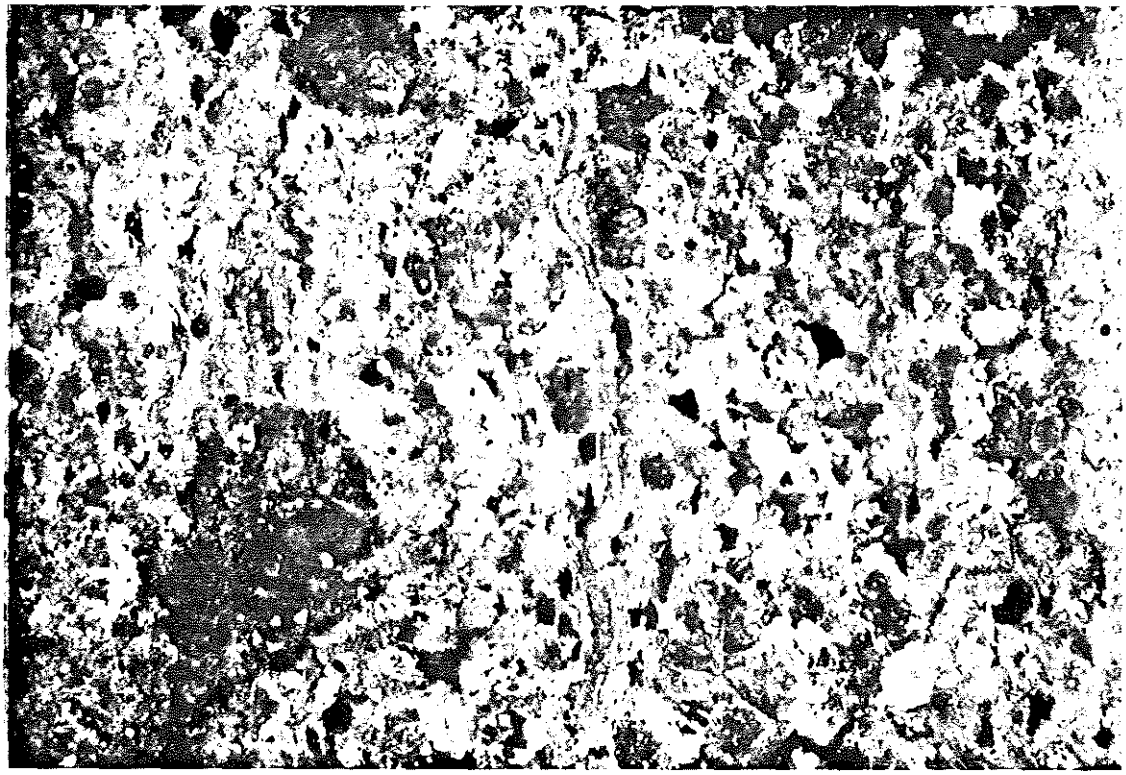
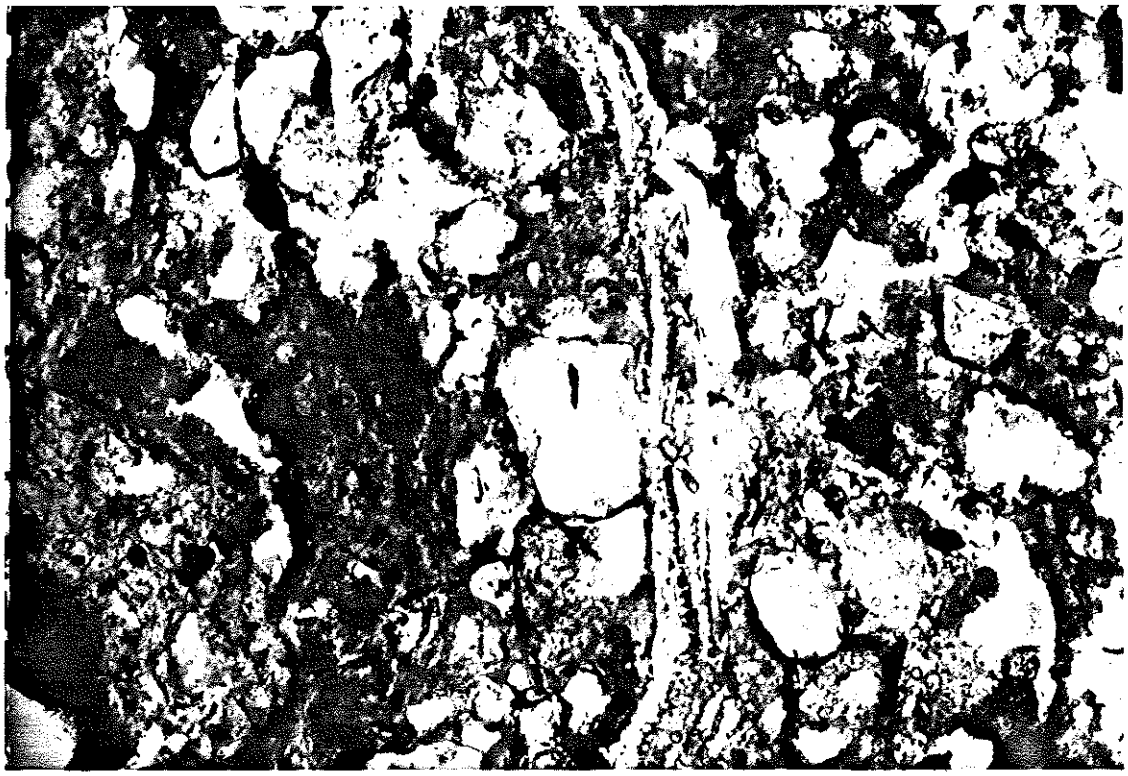


Plate 29 As 27, OIL. Note very pale "graminae" ash and phytolith bands are typically free of much charcoal.



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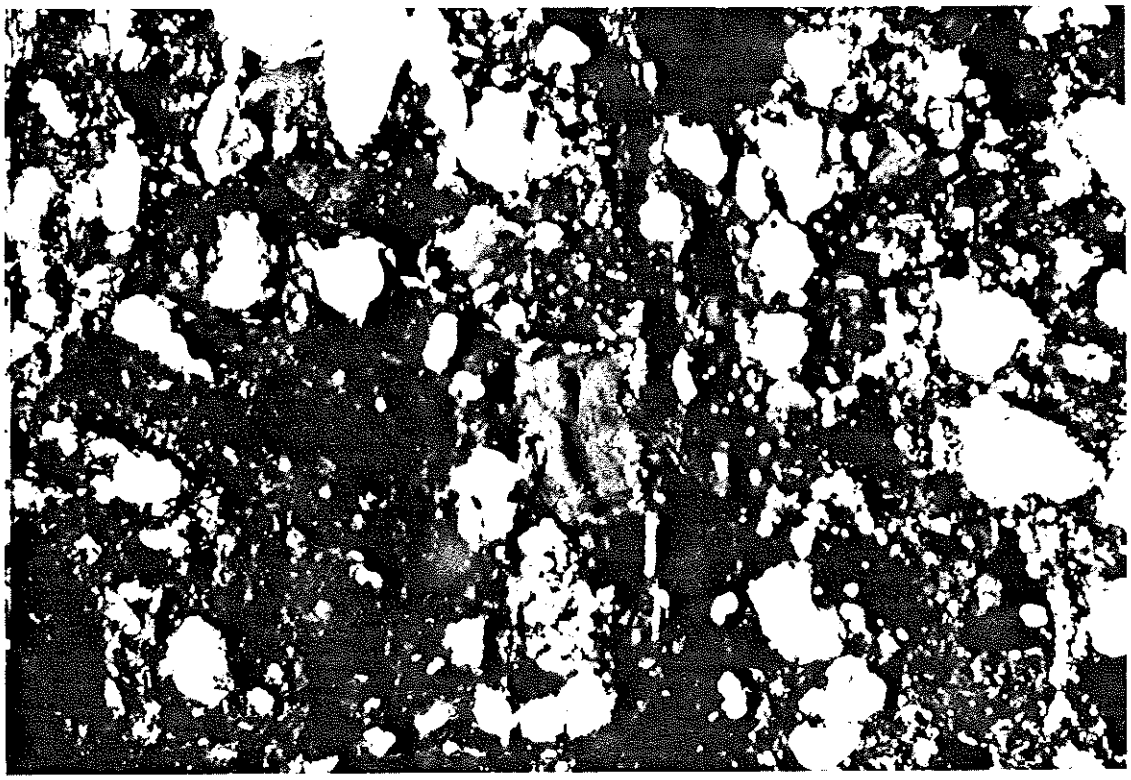

Plate 31 As 30, XPL.

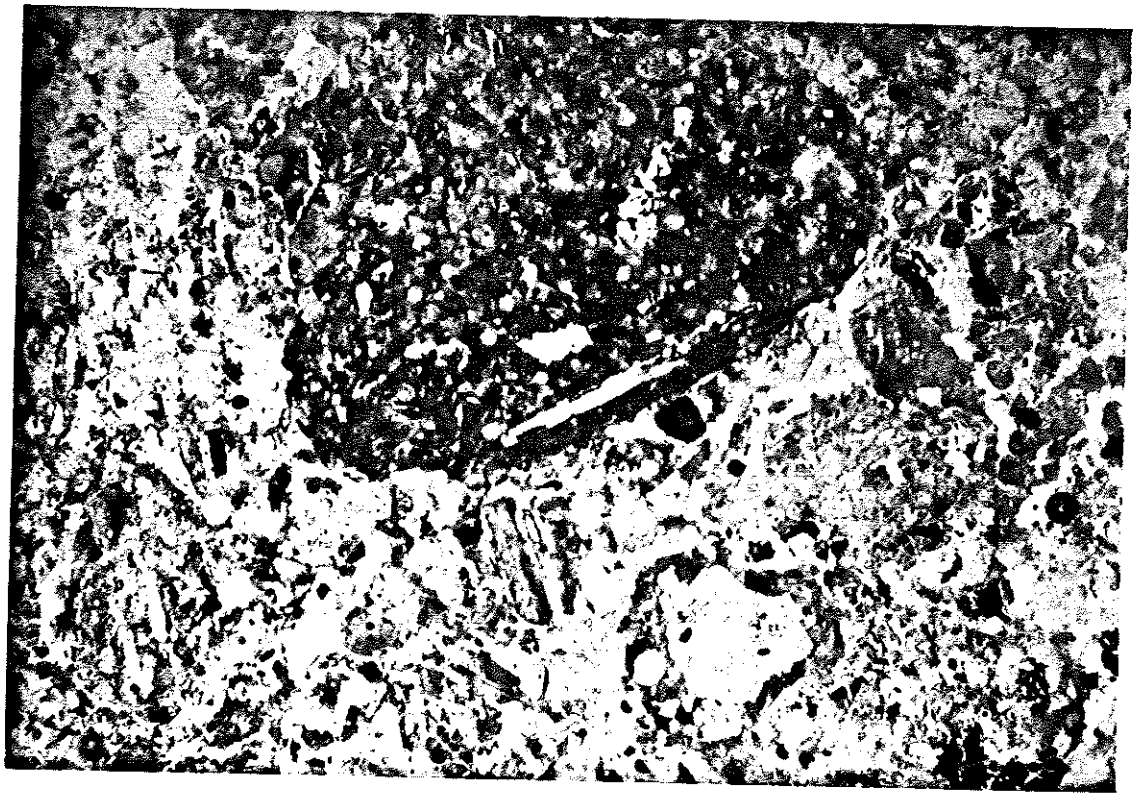

Plate 32 Cutting 12, thin section 4. Inclusions; rounded "daub" fragment with plant temper porosity, made out of "foreign" calcareous brown soil; ashey hearth fragments, phytoliths, charcoal and a few sand grains are also present. PPL, frame length is 3.32mm.

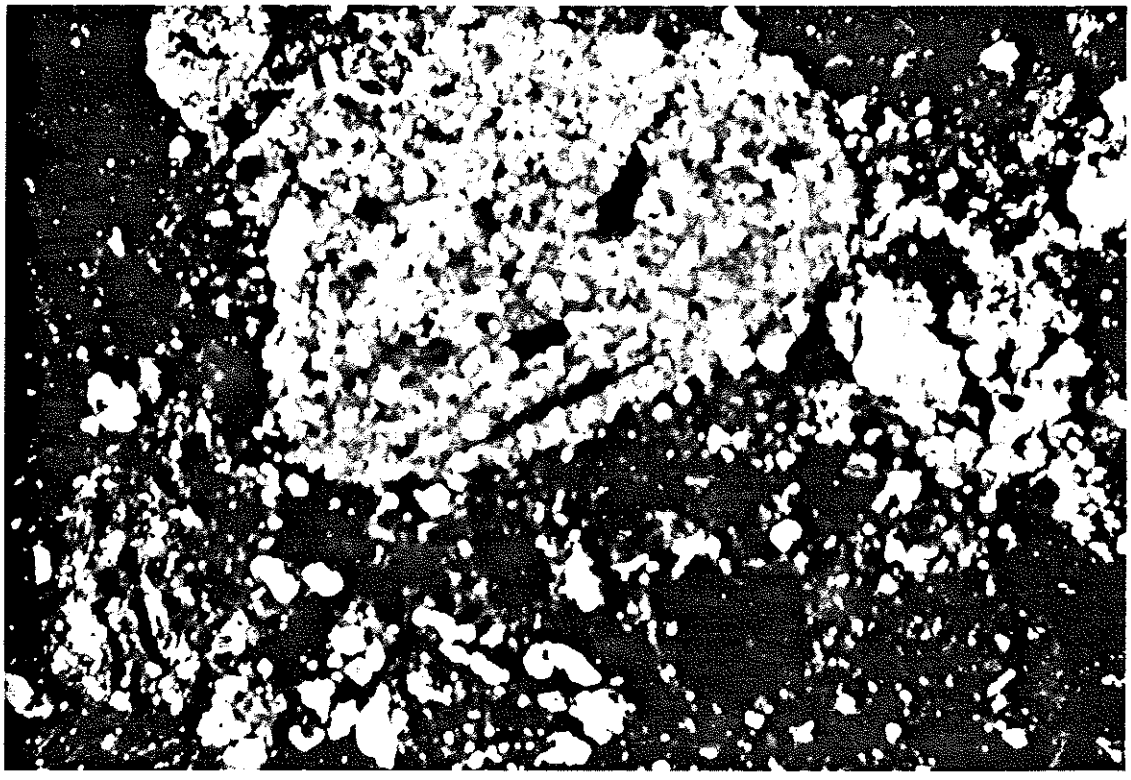

Plate 33 As 32, XPL. Note high birefringence of calcareous "daub".

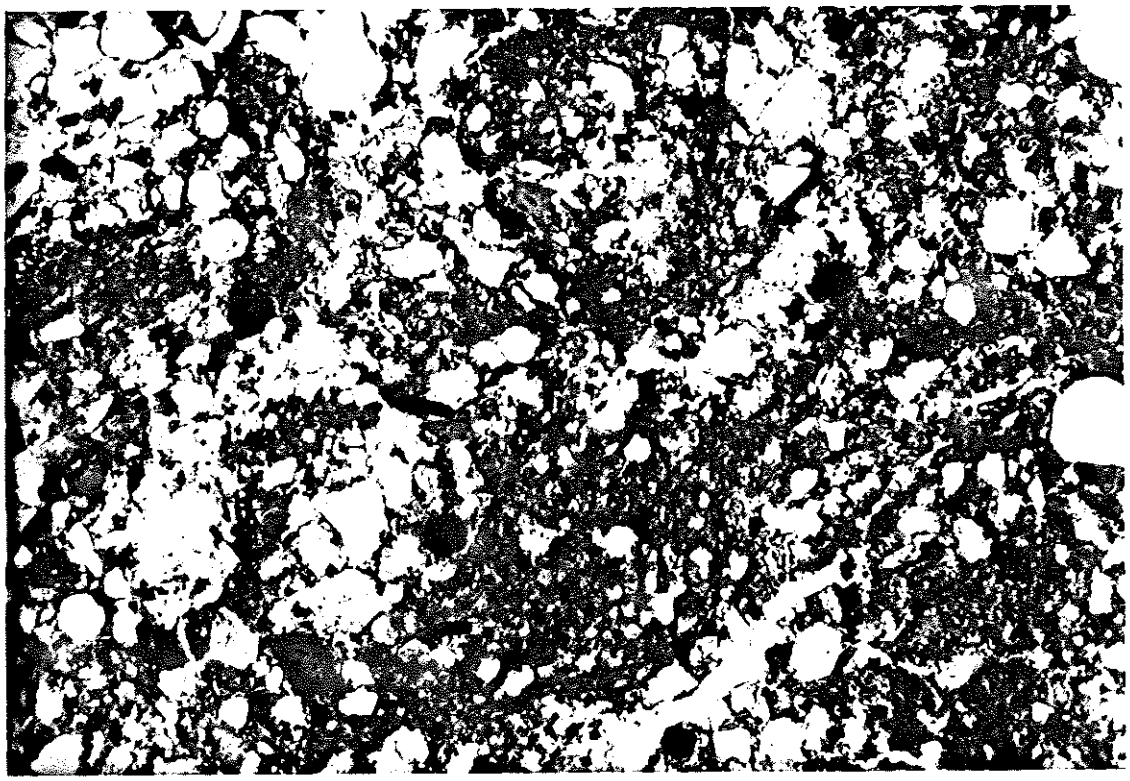

Plate 34 Cutting 12, north end, lower midden (3308), thin section 13; grey brown fabric of "graminae" ash midden where minor amounts of clay and charred organic matter are present. Note physically mixed, heterogeneous nature of fine fabric and sands. PPL, frame length is 3.32mm.

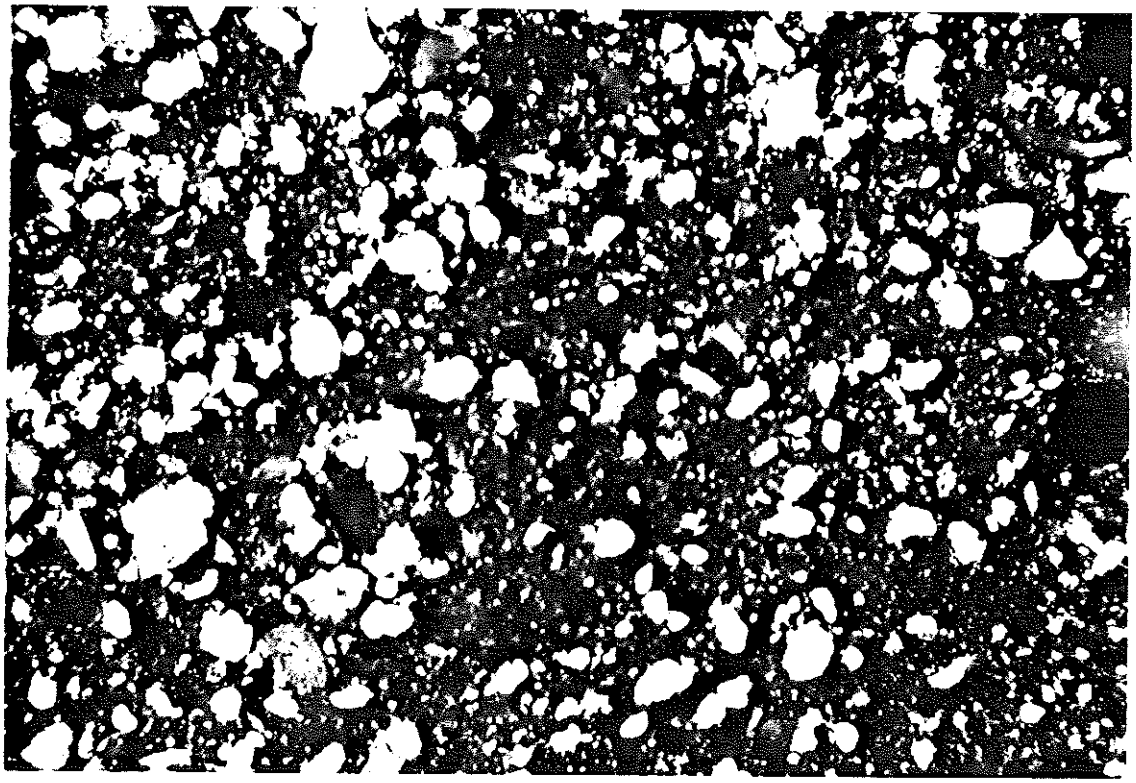

Plate 35 As 34, XPL. Note weakly calcitic (ash crystal scatter) birefringence.

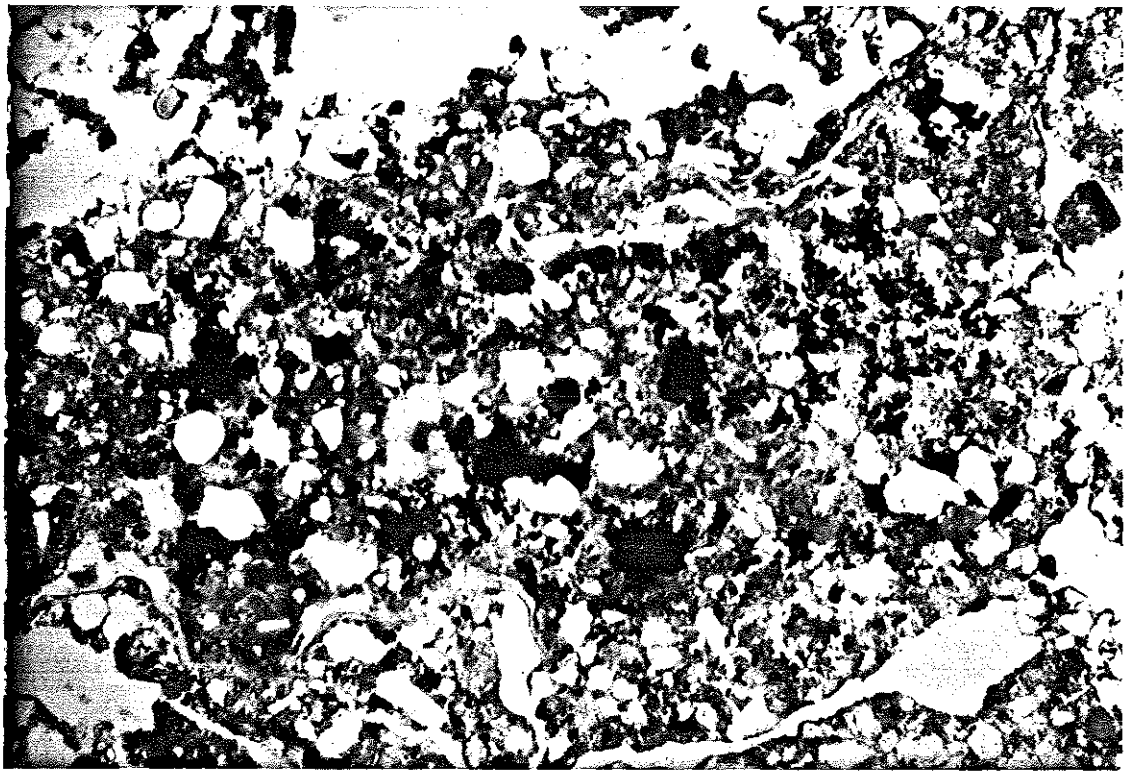

Plate 36 As 34; more general pale grey brown fabric of disturbed burned stable floor debris, mainly phytoliths and ash crystals with very little charred organic matter; the whole stained and effected by coprolitic amorphous organic matter. PPL, frame length B 3.32.

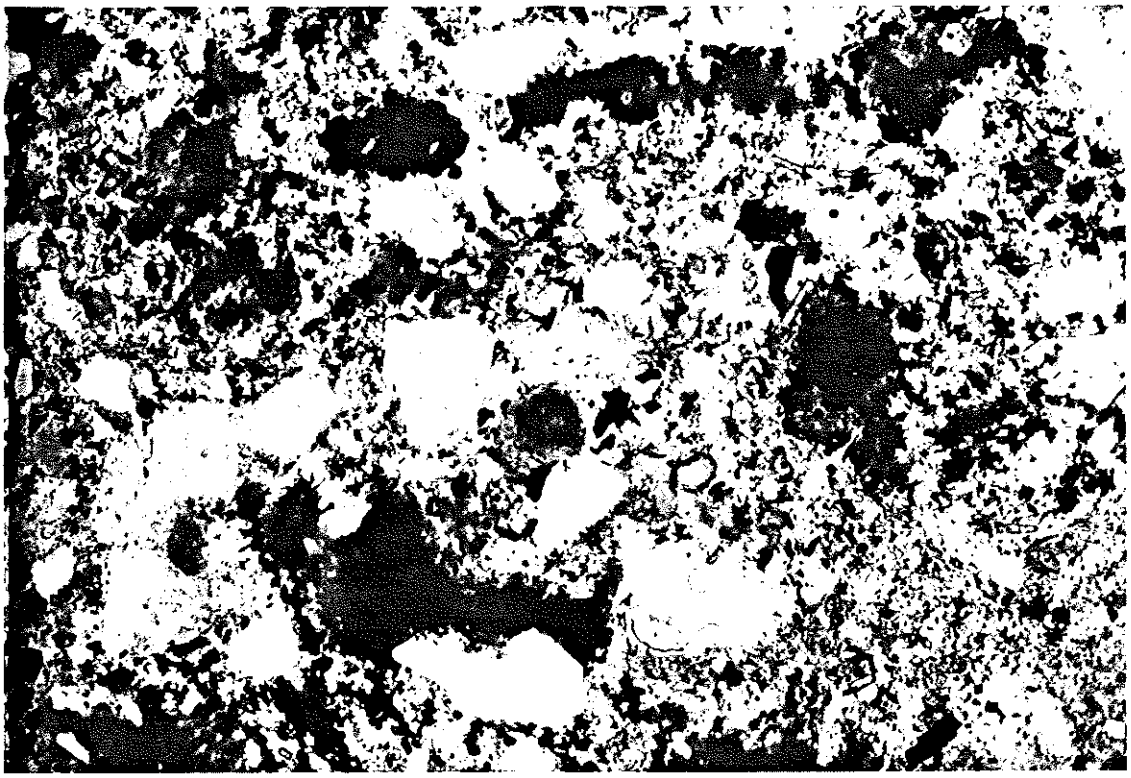

Plate 37 Detail of 37, showing very pale fabric impregnated by amorphous organic matter, with an almost absence of fine charred organic matter. PPL, frame length is 0.33mm.

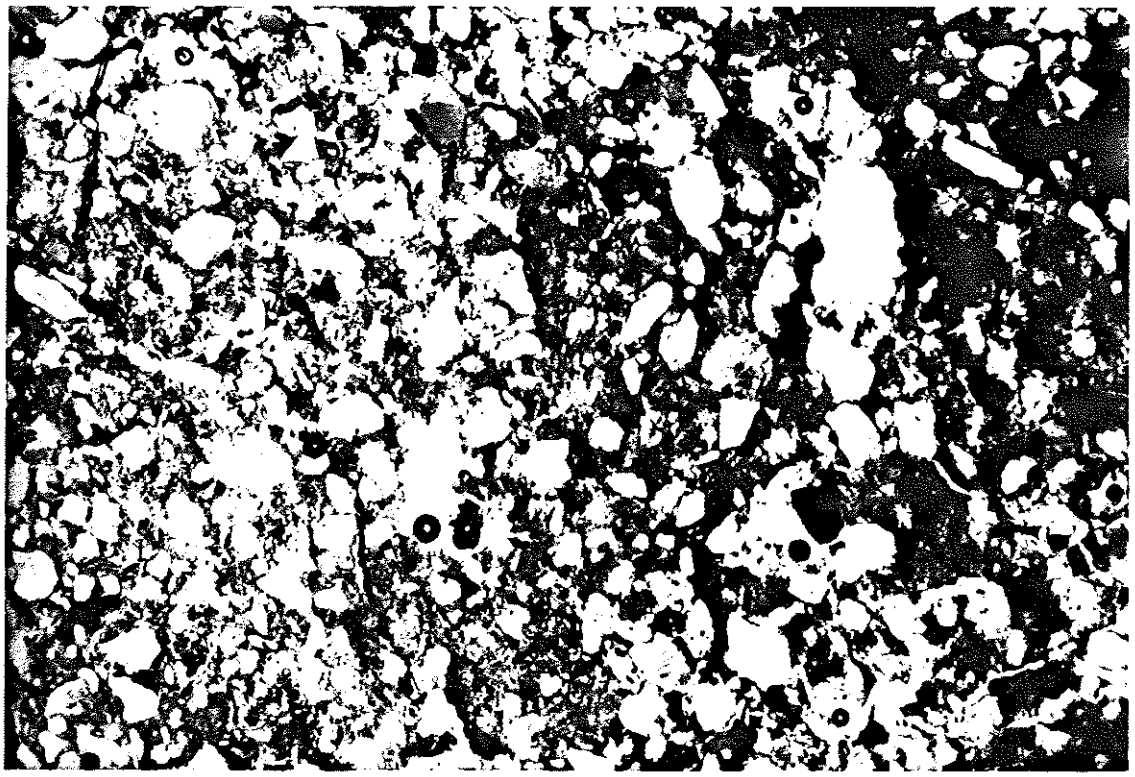

Plate 38 Cutting 12, thin section 7 (E/F); juxtaposition of pale "graminae" ash midden material, with very dark brown "hearth" debris very rich in fine, probable wood, charcoal (the latter is also highly mobile - washing down channels into the subsoil), the latter fabric is also poor in phytoliths. PPL, frame length is 3.32mm.

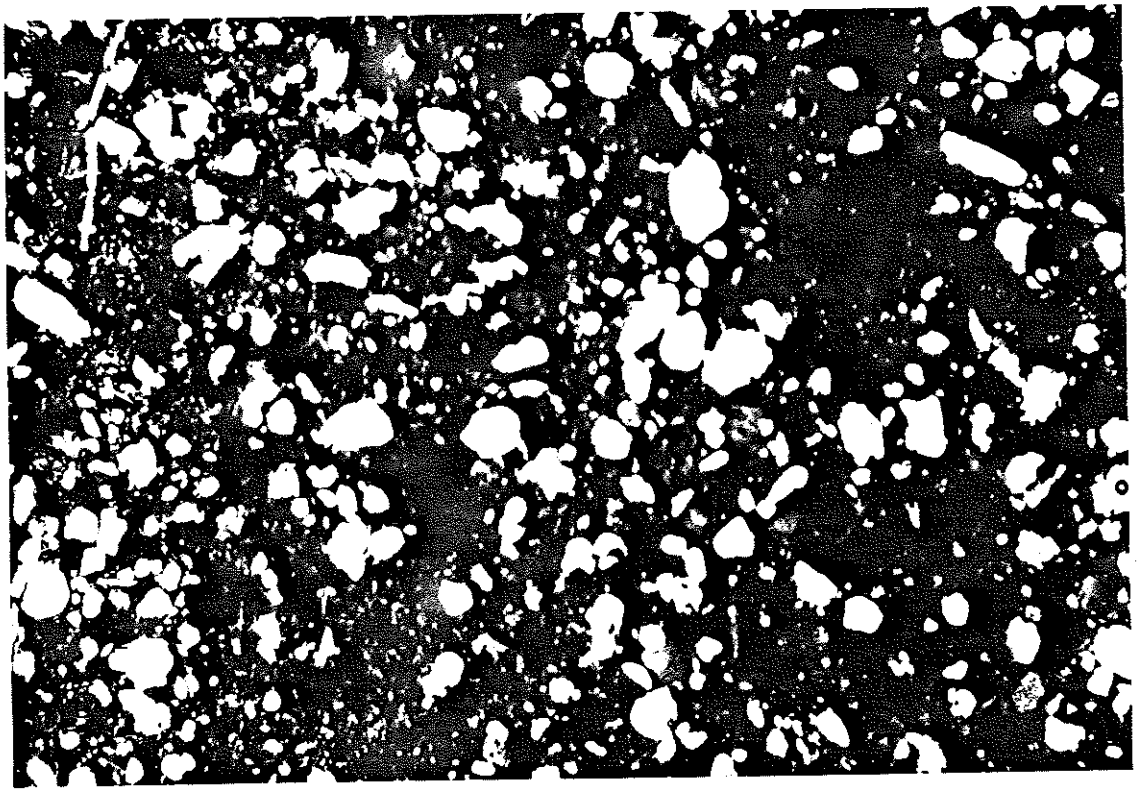

Plate 39 As 38, XPL. Note higher birefringence (calcite ash) of pale "graminae" midden.

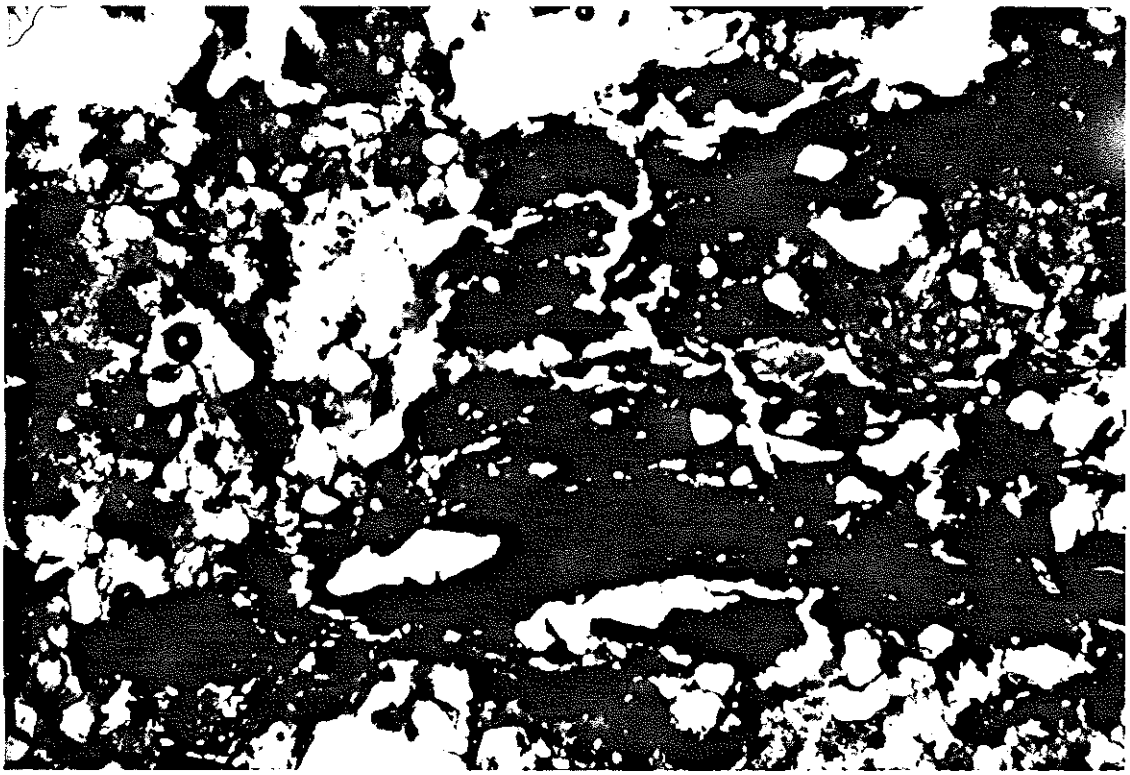

Plate 40 As 38; coarse wood charcoal spread from hearths. PPL, frame length is 3.32mm.

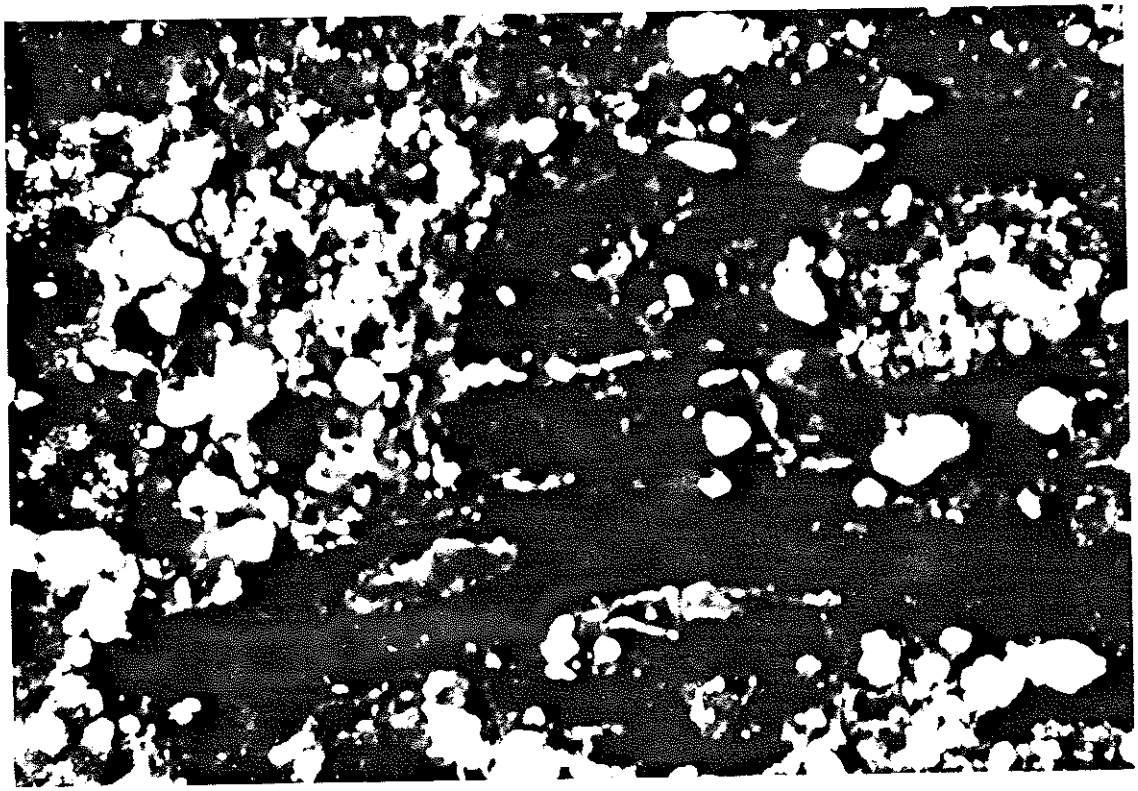

Plate 41 As 40, XPL.

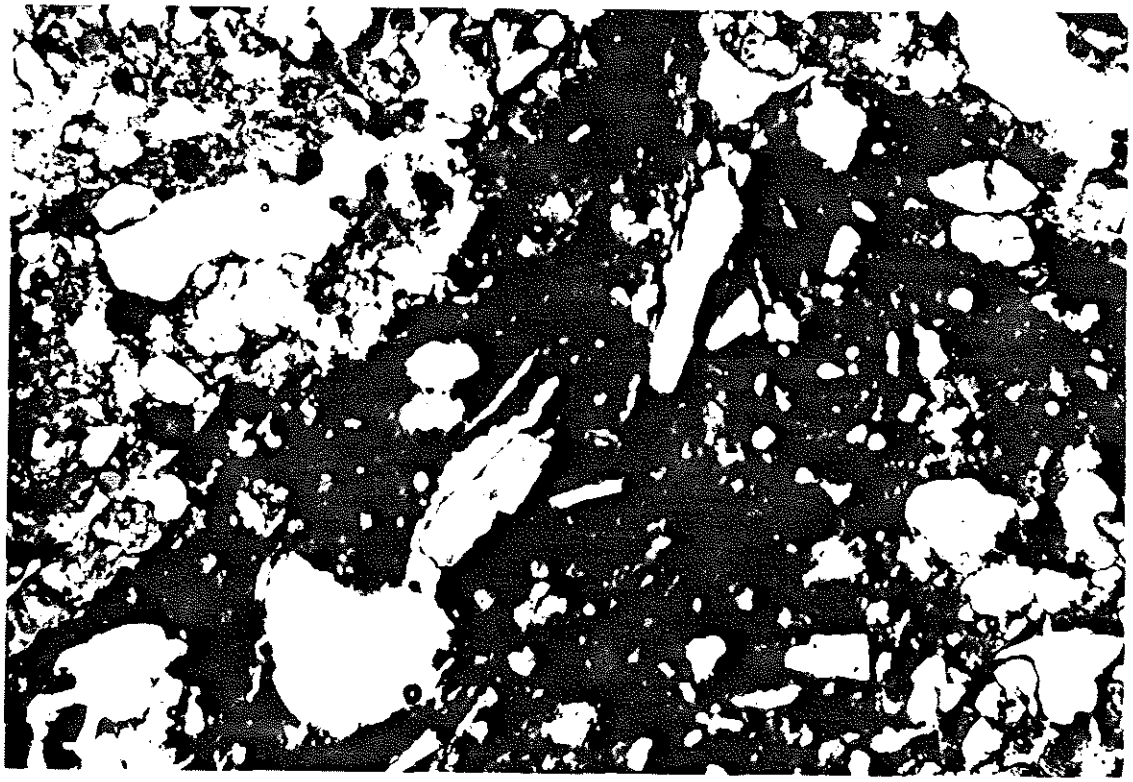

Plate 42 As 40; heavily burned (reddened) "daub"/hearth clay associated with charcoal spreads. PPL, frame length is 3.32mm.

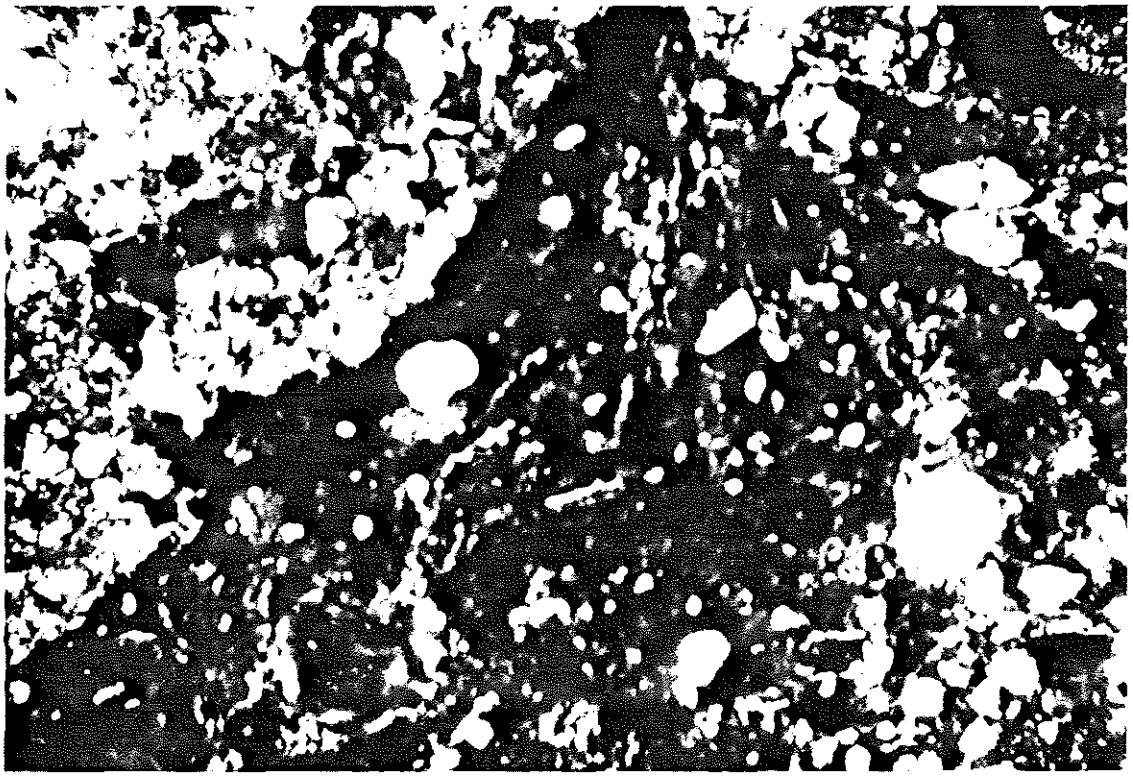

Plate 43 As 42, XPL showing loss of birefringence from burned clay.

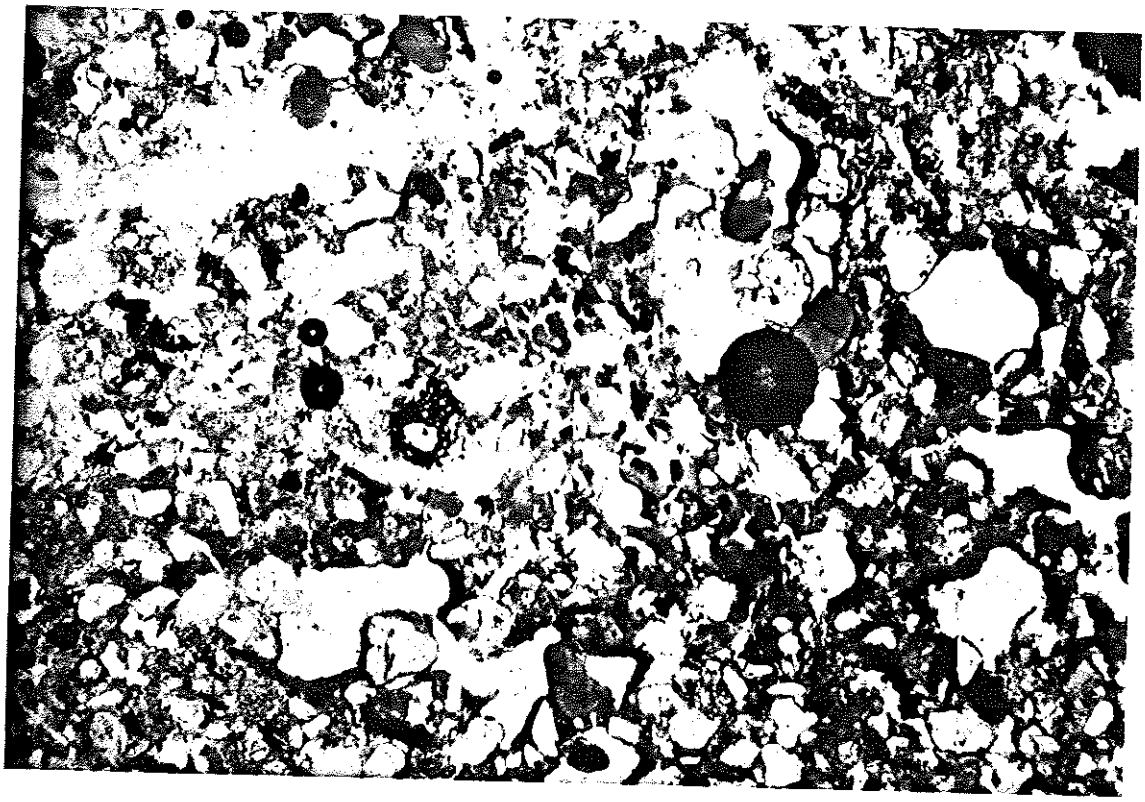

Plate 46 As 38, showing area of midden infilled by probable phosphatic amorphous organic matter, "leached" from ash and redeposited here as evidence of weathering of the midden. PPL, frame length is 3.32mm.

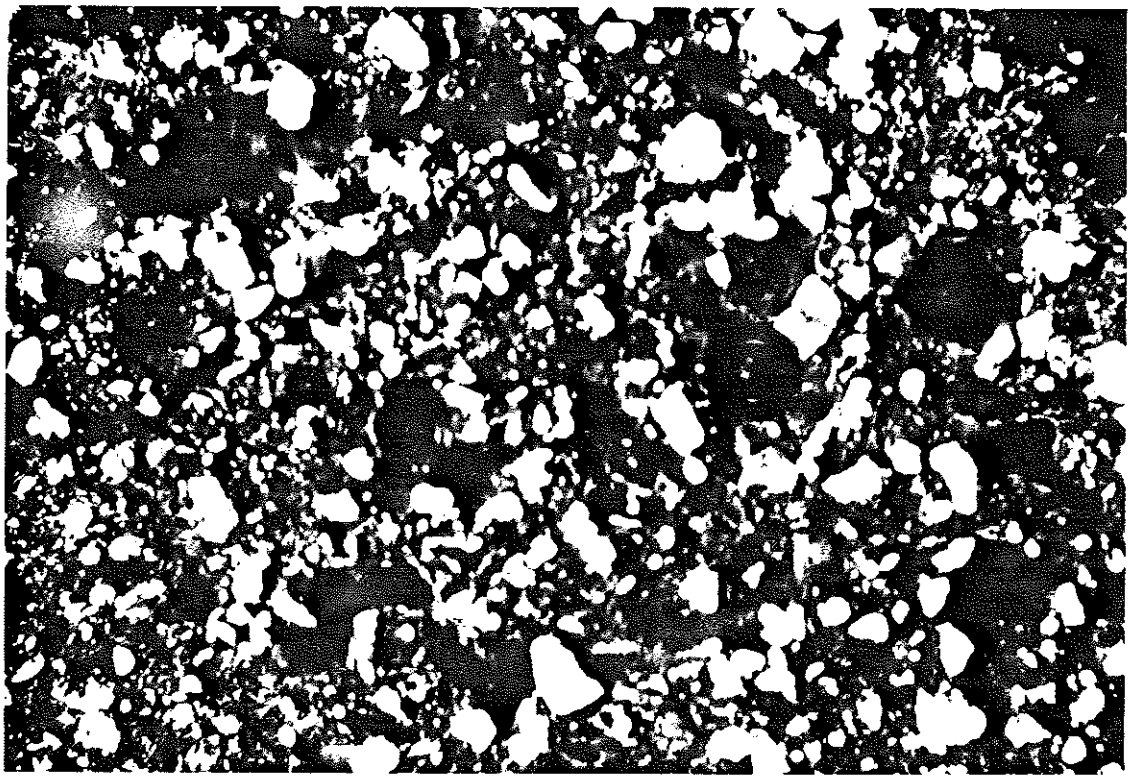

Plate 47 As 46, XPL. Note non-birefringent nature of the infills.

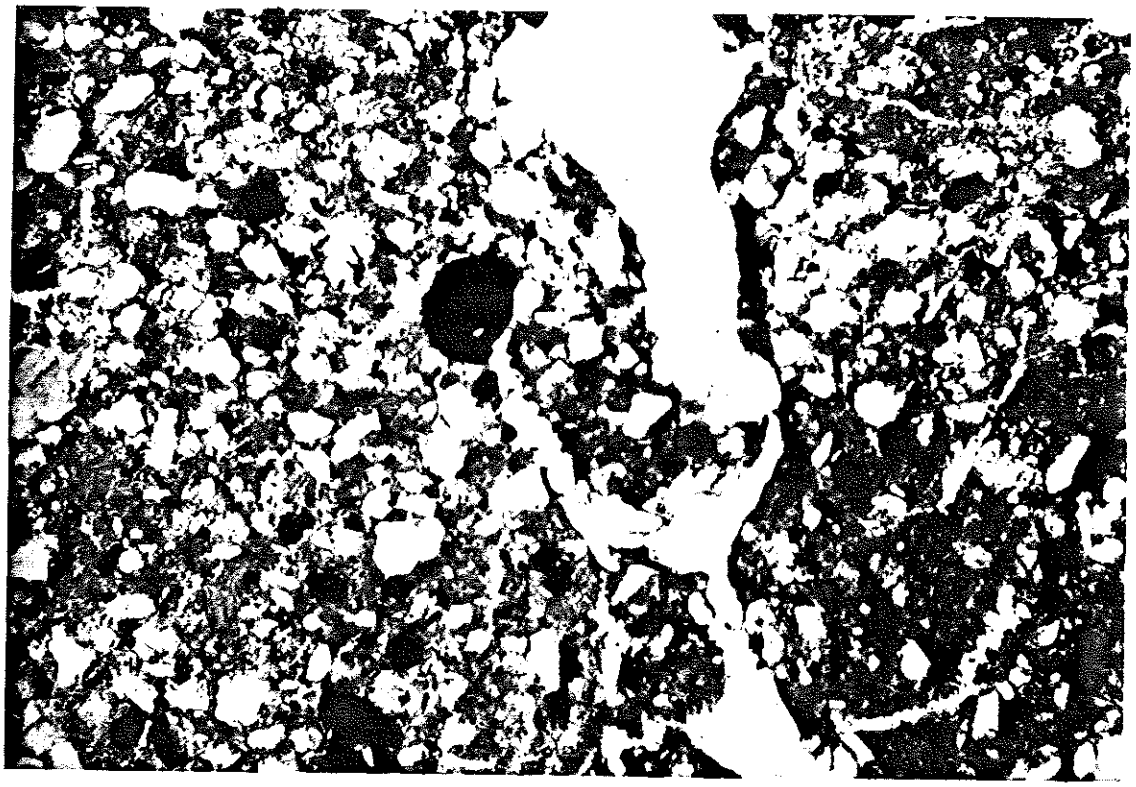

Plate 48 Cutting 12, north end, thin section 14 (3307); midden phase 2, mixing of dark charcoal rich fine fabric with grey "graminae" ash midden (see Plate 38). PPL, frame length is 3.32mm.

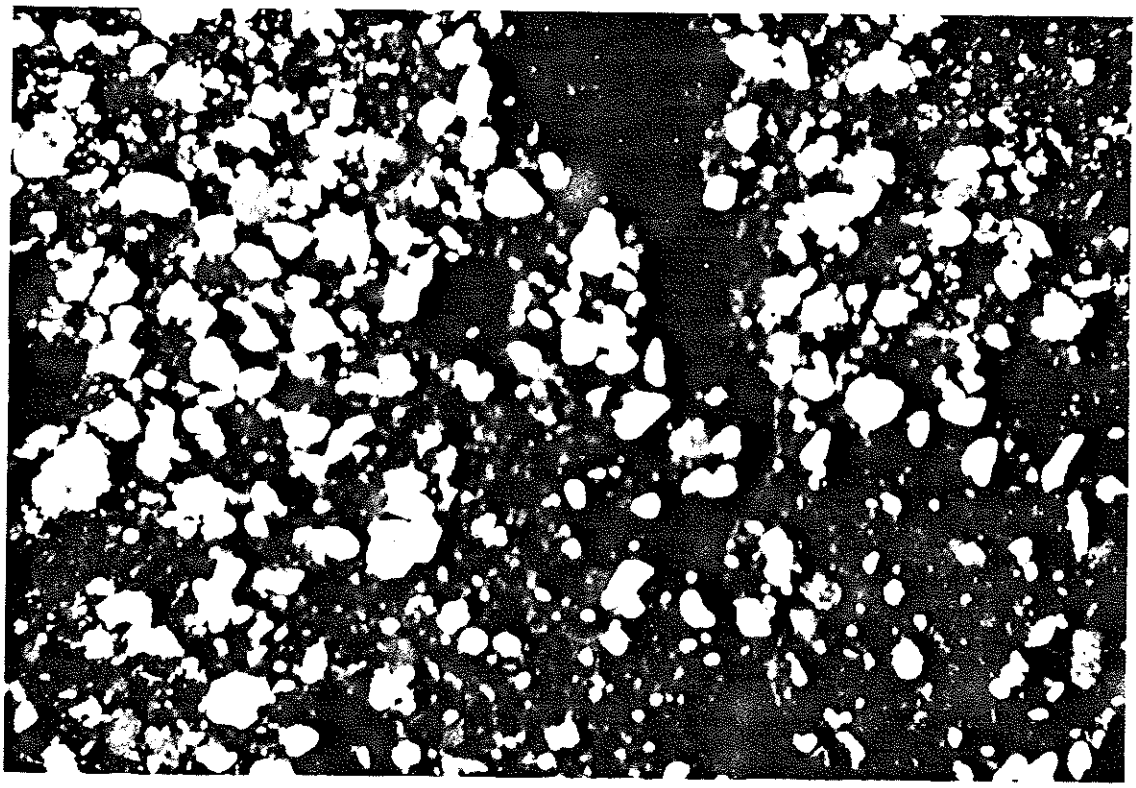

Plate 49 As 48, XPL, again showing lower birefringence of charcoal rich fabric.

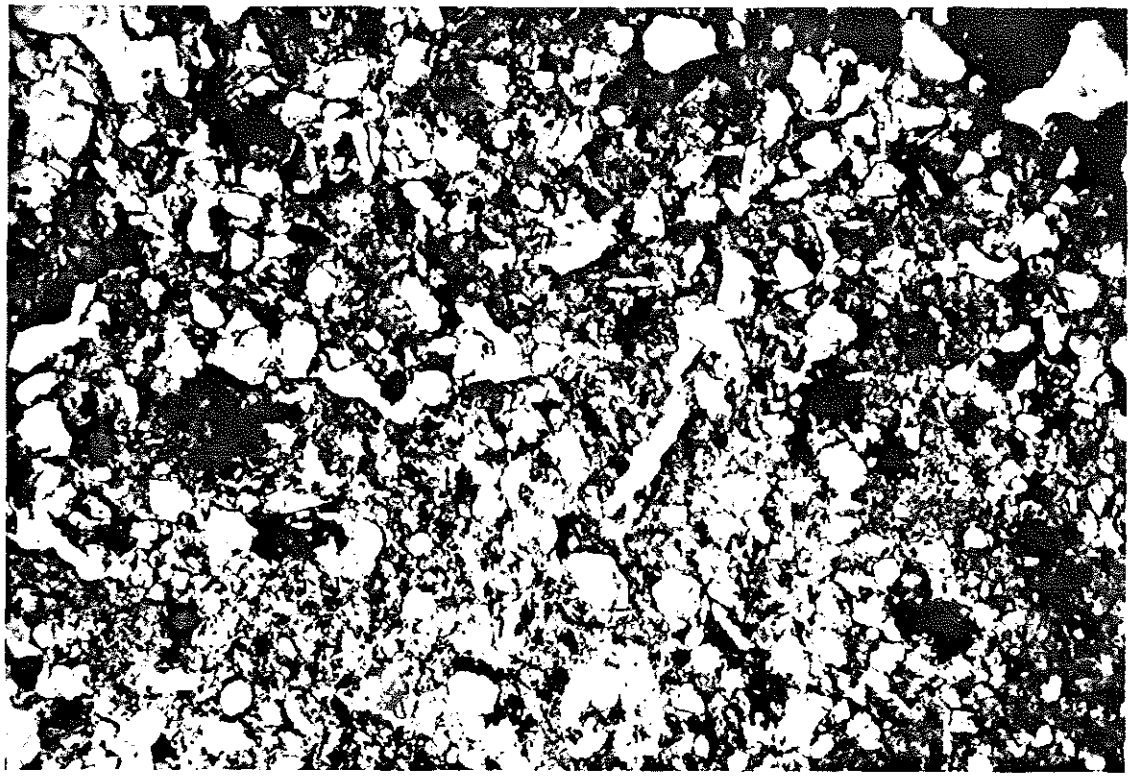

Plate 50 Cutting 12, thin section 10 (B/C), midden phase 3; pale greyish brown "graminae" ash midden fabric, rich in calcite ash and probably from low temperature hearth layers (rather than stable layers); contains very abundant poorly preserved phytoliths, suggesting reworking/disturbance before dumping, and strong staining by coprolitic amorphous organic matter. PPL, frame length is 3.32mm.

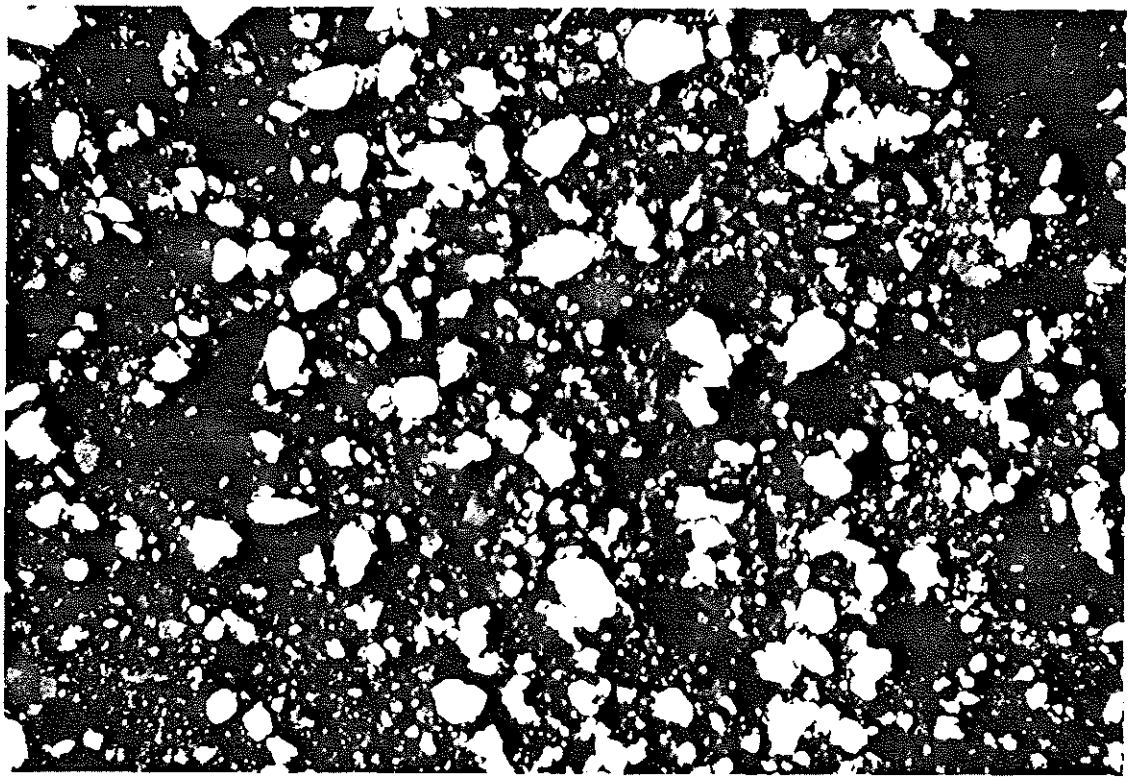

Plate 51 As 50, XPL. Note moderately high crystallitic b-fabric (from calcitic ash).

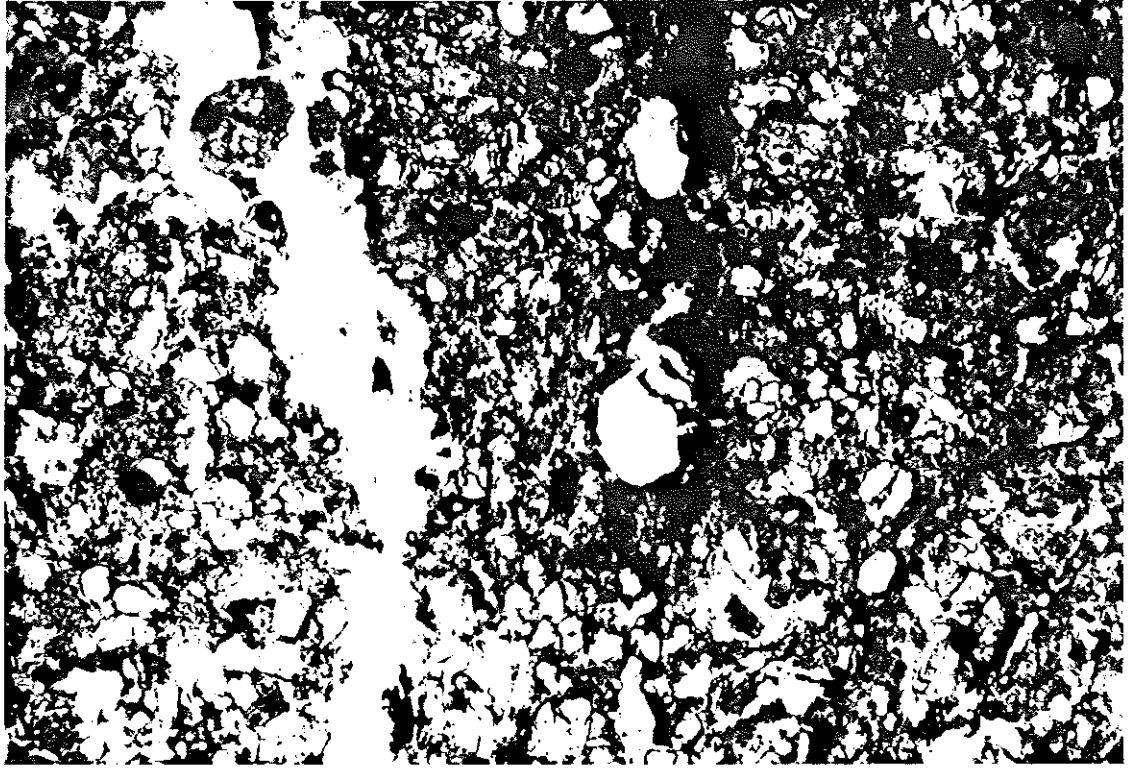

Plate 52 Cutting 12, thin section 11 (A/B); "compacted midden". PPL, frame length is 3.32mm.

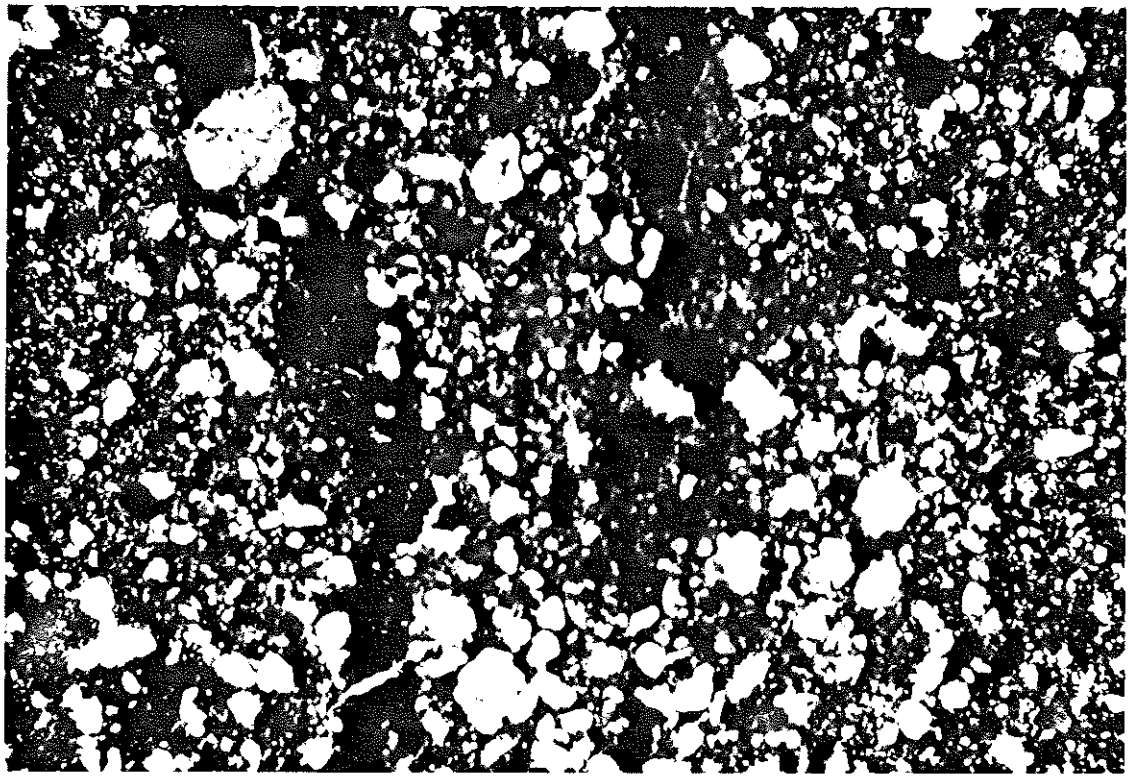

Plate 53 As 52, XPL.

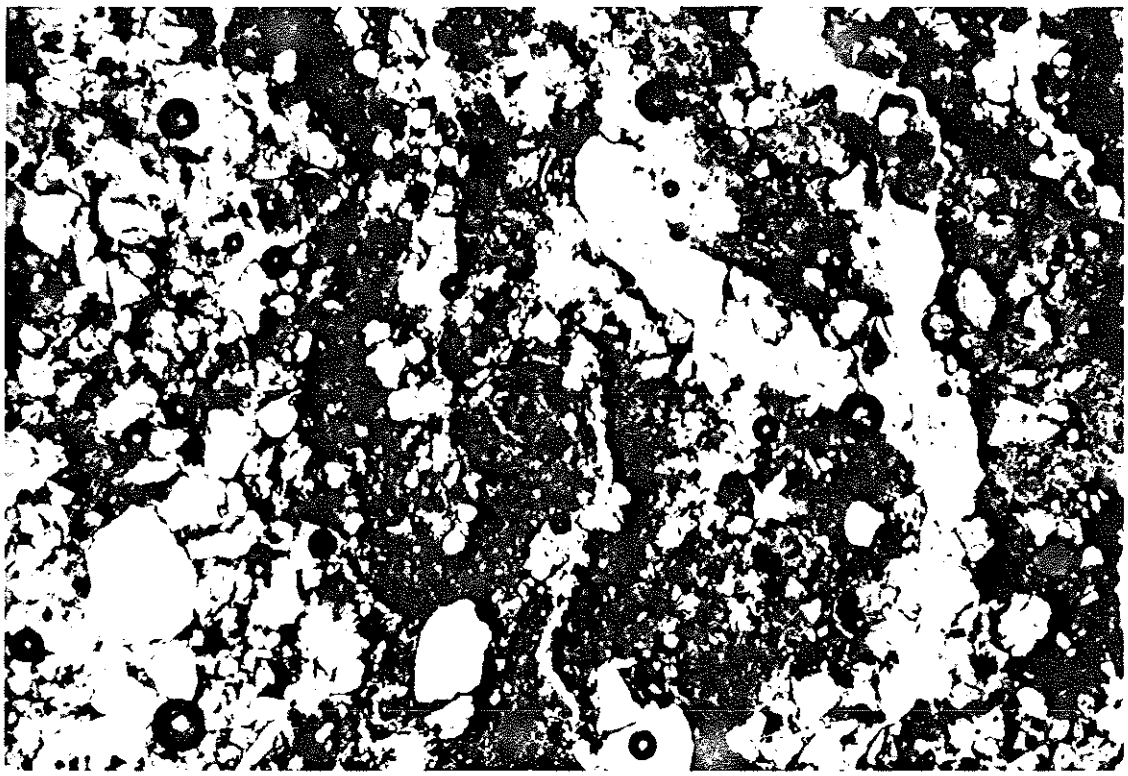

Plate 54 As 52; two fabrics; at the base as plate 52, with washed in bands (intercalations) of more organic, but less ashey fine soil. PPL, frame length is 3.32mm.

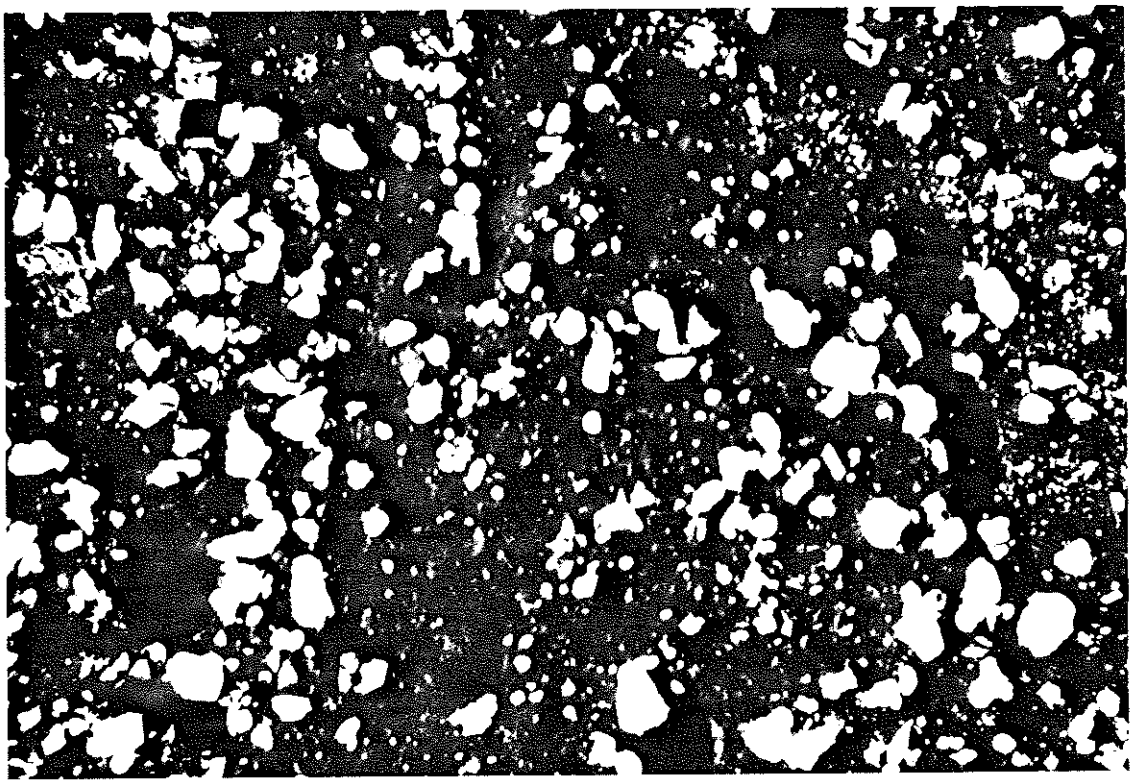

Plate 55 As 54, XPL. Note lower birefringence of dark fabric.

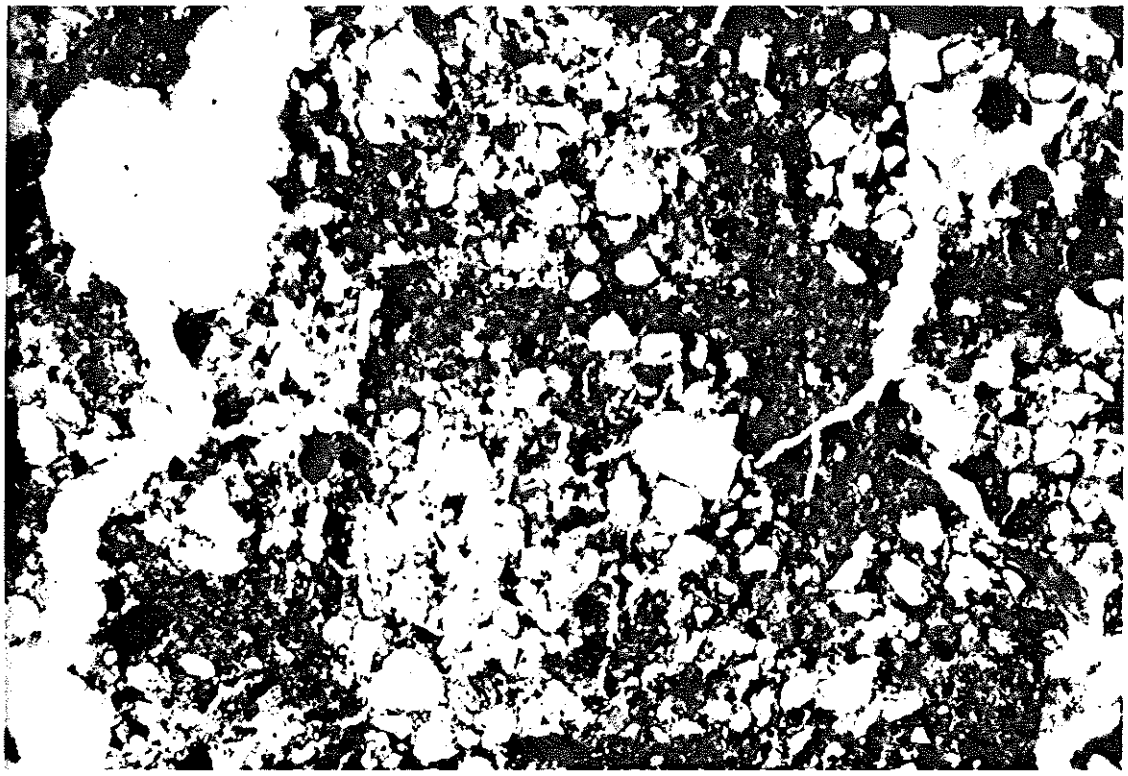

Plate 56 Cutting 14, thin section 15 (4072/4083); well developed intercalations of clay rich fine soil through probable ploughsoil mixing. PPL, frame length is 3.32mm.

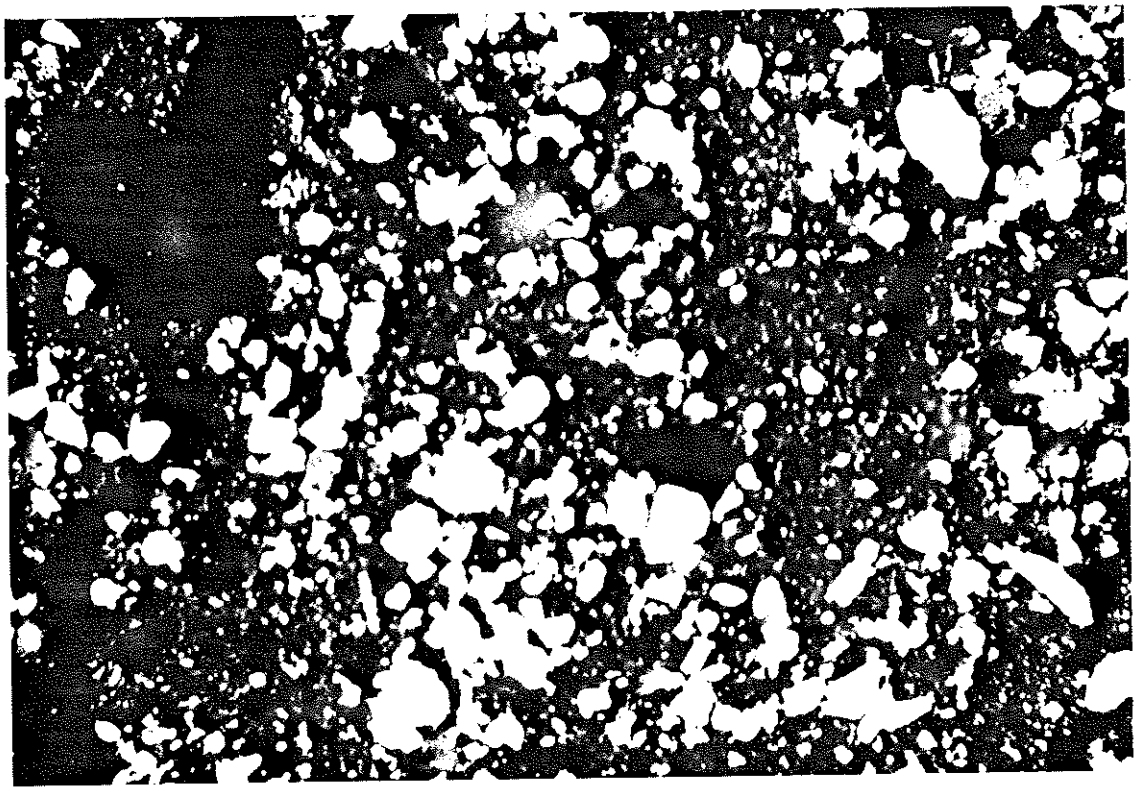

Plate 57 As 56, XPL.

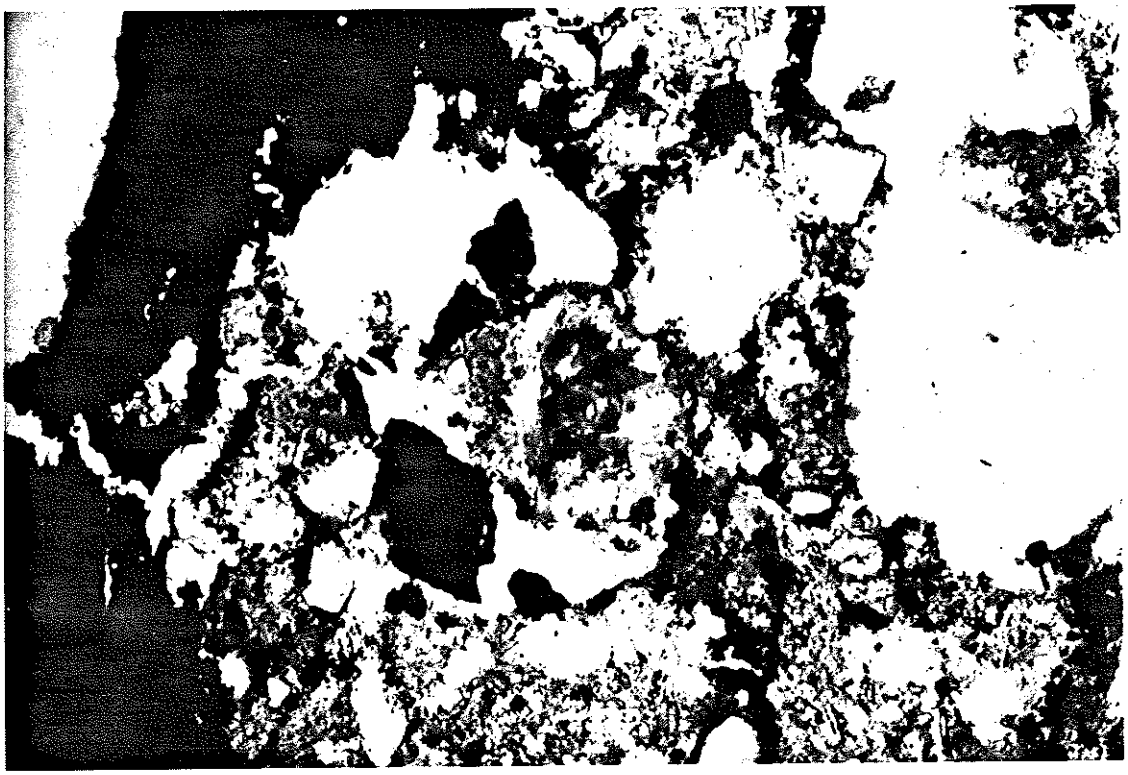

Plate 58 As 56; ash rich area, containing fine calcitic fabric, wood charcoal and in the centre neo-formed vivianite; the latter produced from locally mobilised phosphate (from ash) and iron (from Greensand) under localised anaerobic conditions. PPL, frame length is 0.33mm.

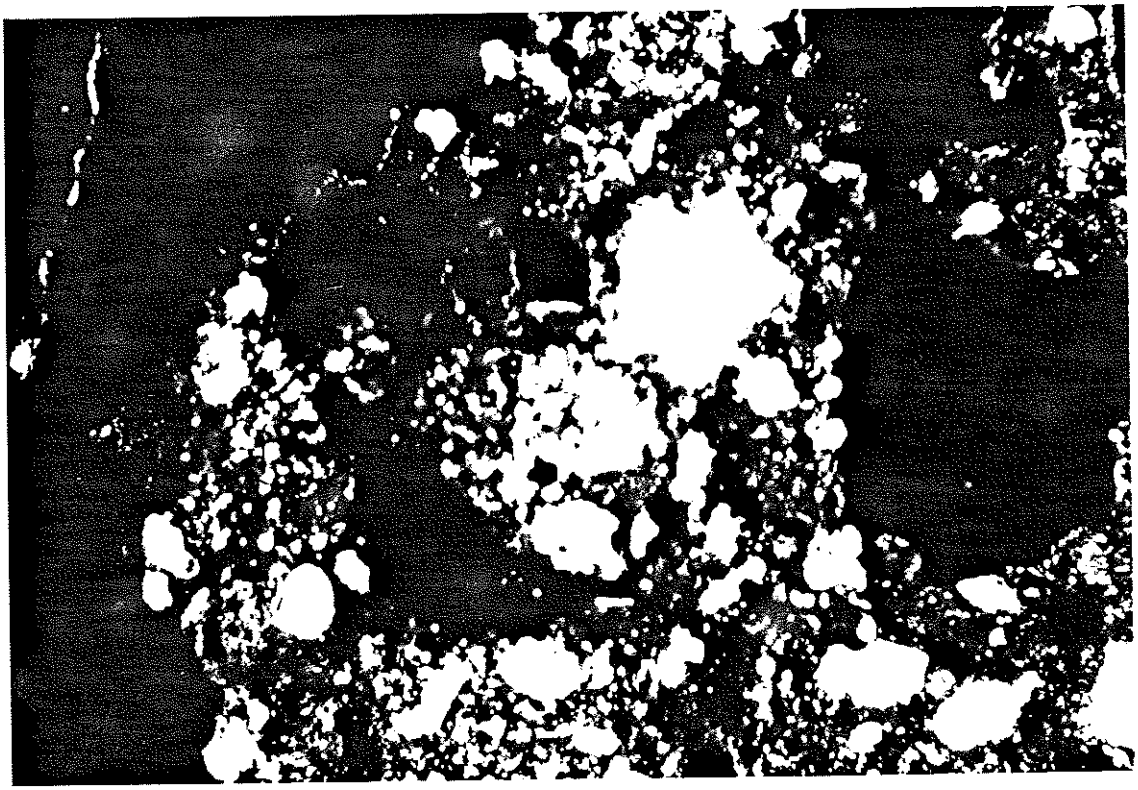

Plate 59 As 58, XPL.

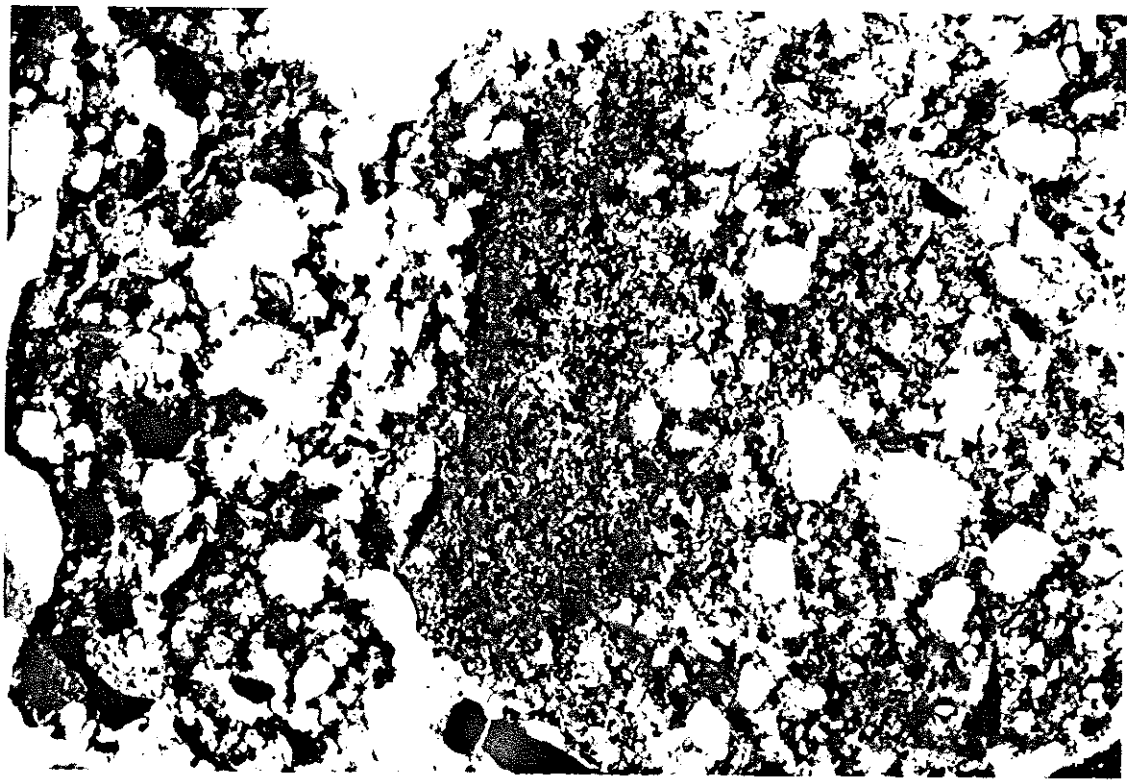

Plate 60 As 58, part of the colluvial deposit; rounded (transported) fragment of an ash layer over an ash and sandy layer. Note fine included charcoal PPL, frame length is 3.32mm.

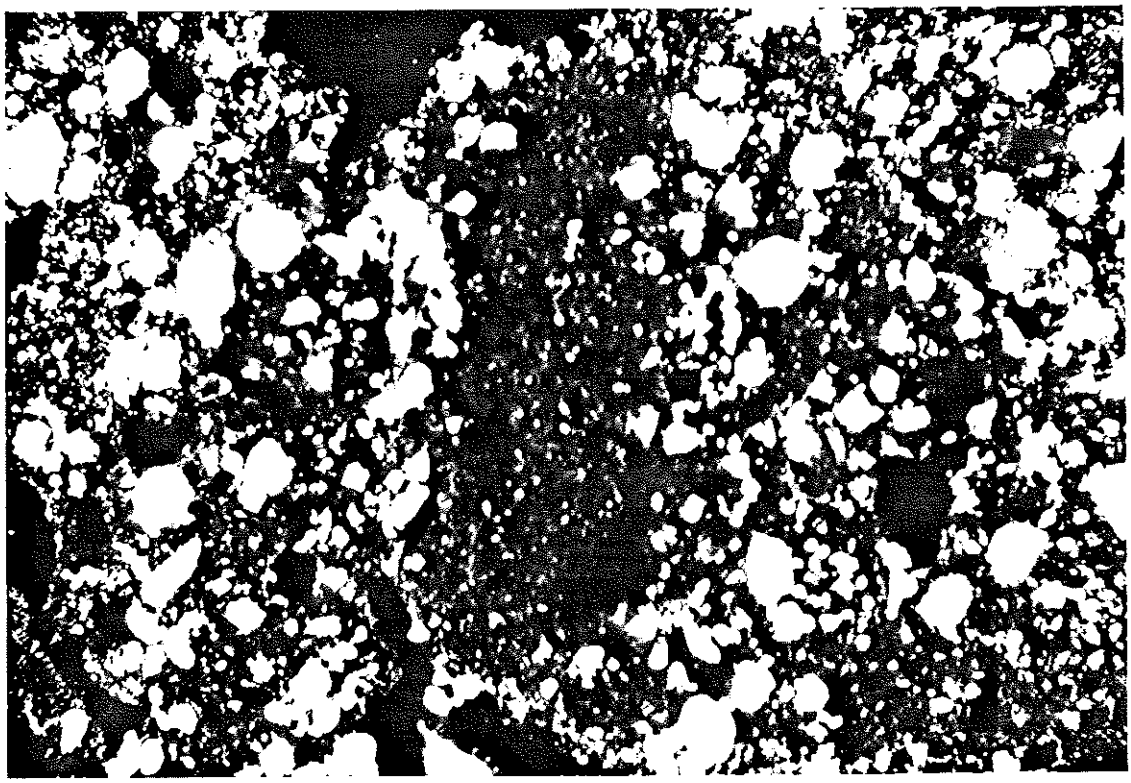

Plate 61 As 60, XPL. Note low birefringence of ash band.

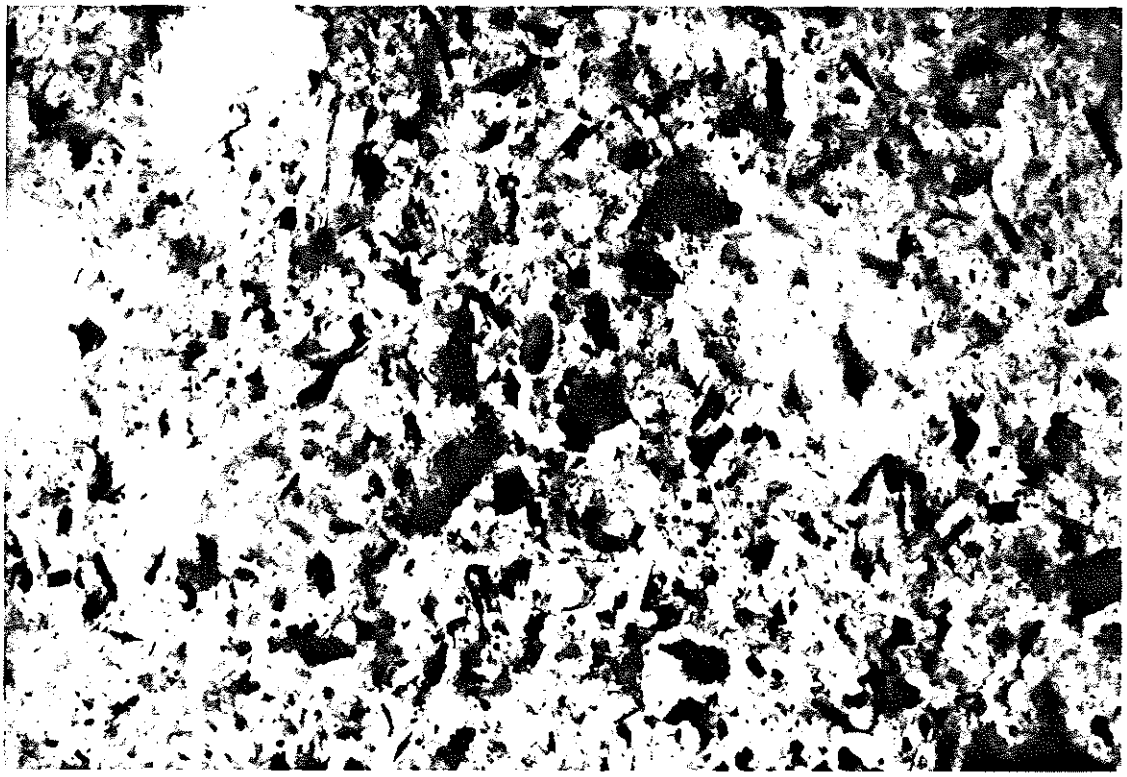

Plate 62 Detail of ash band in Plate 60; only few calcite ash crystals are present; the bulk comprises fine charred organic matter and very abundant phytoliths. PPL, frame length is 0.16mm.

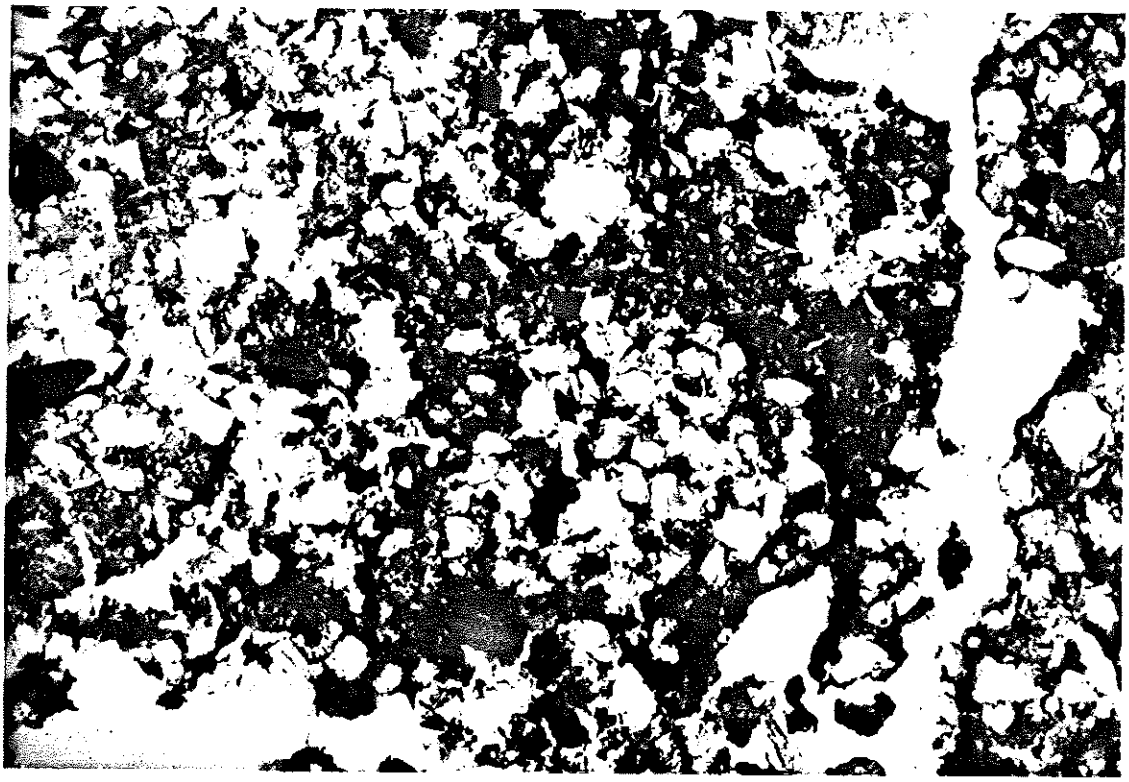

Plate 63 As 58; colluvial mixing of calcitic "graminae" ash midden (right) and ploughsoil rich in clay, charcoal and reddish plant fragments (normally absent from the midden). PPL, frame length is 3.32mm.

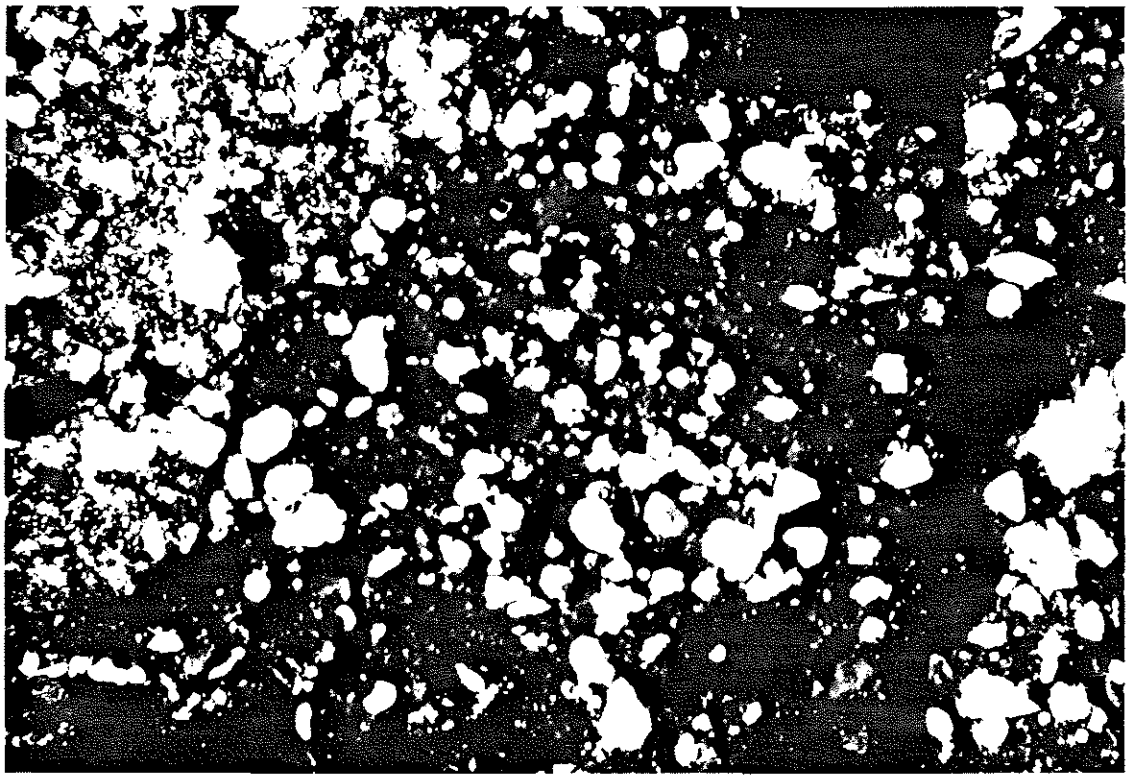

Plate 64 As 63, XPL.

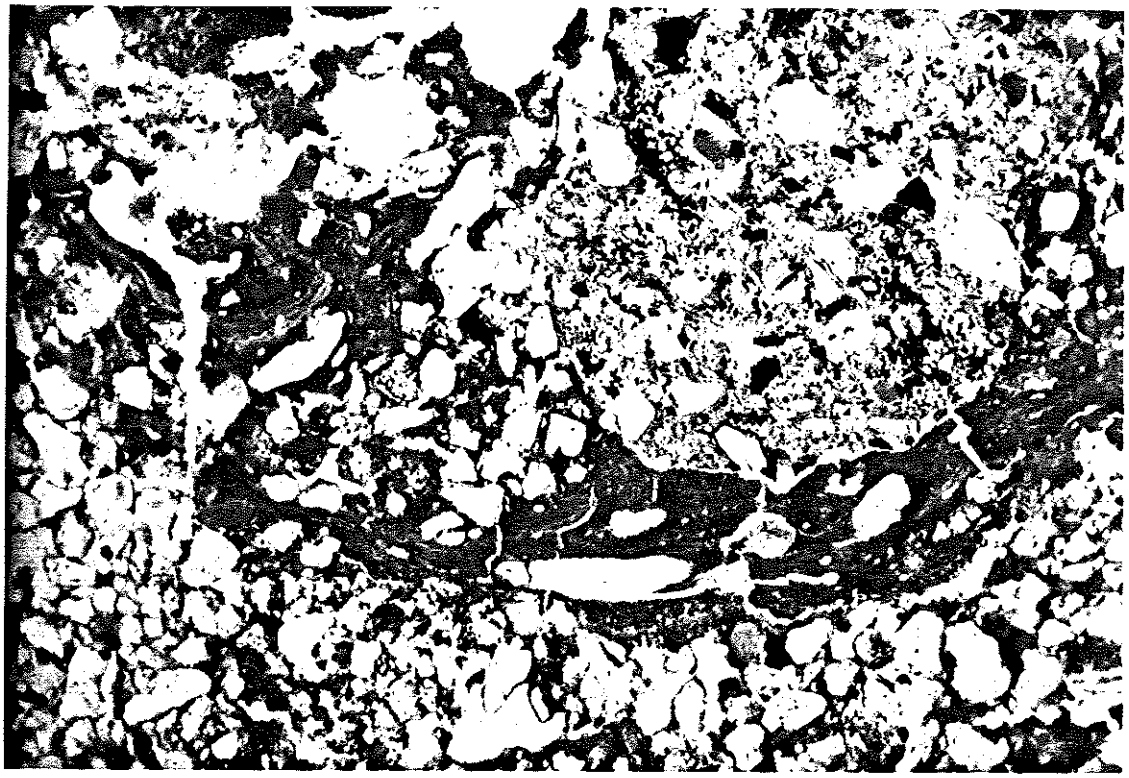

Plate 65 Cutting 15, thin section 18 (4042); colluvial midden/Romano-British midden; moderately clayey fine soil, with little ash but common charcoal; note very well developed dusty clay channel infill from ploughsoil disruption and slaking of topsoil. PPL, frame length is 3.32mm.

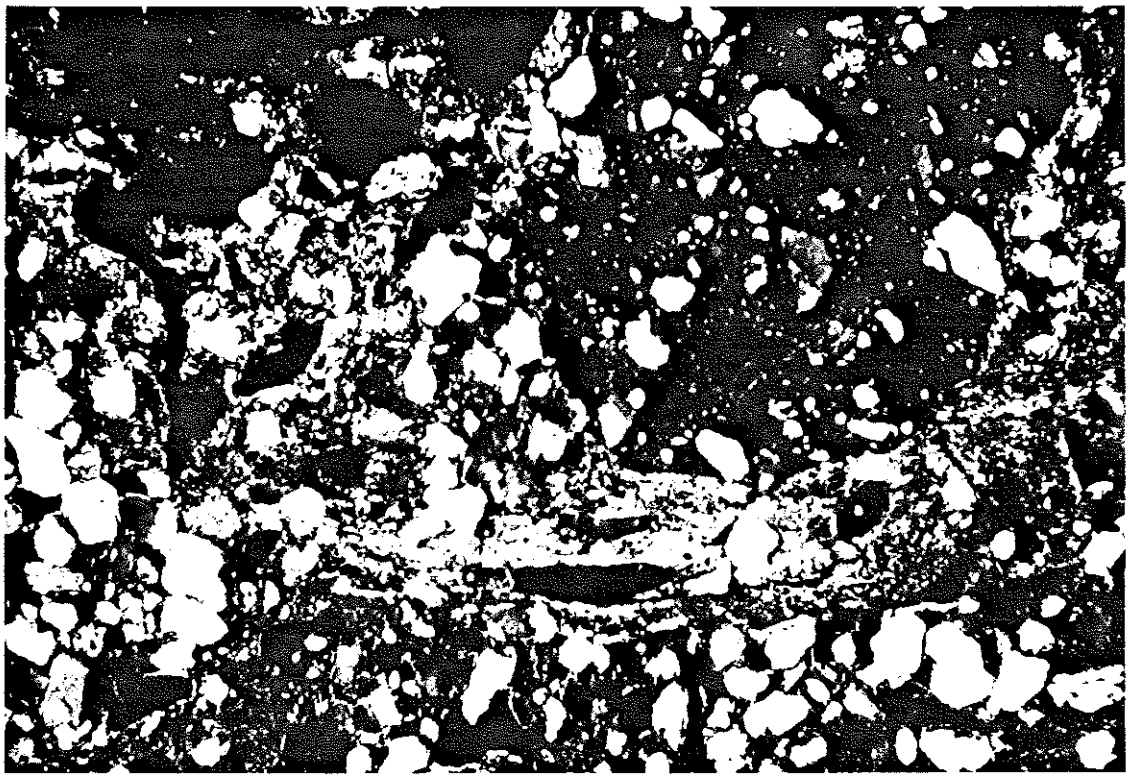

Plate 66 As 65, XPL. Note birefringence clay-rich infill.

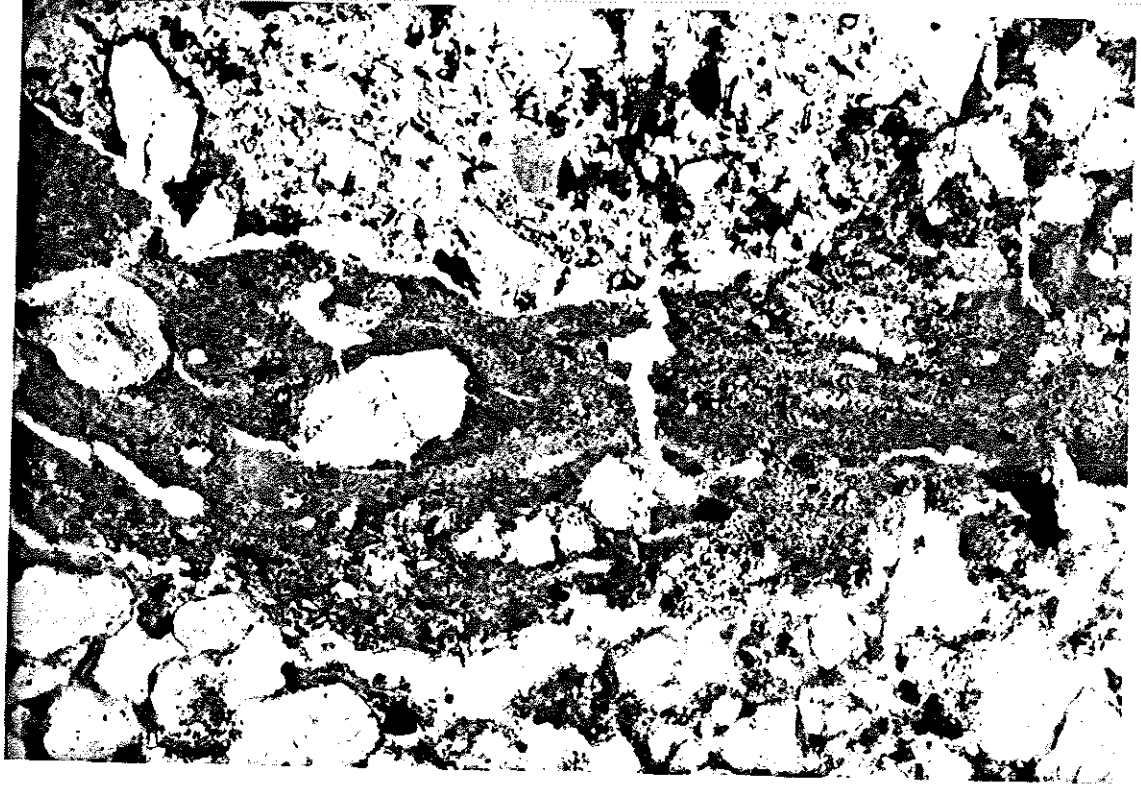

Plate 67 Detail of 65; fine fabric lacks fine calcite ash (hence low birefringence) through weathering; infill comprises some four phases of dusty and charcoal rich clay through ploughsoil slaking, the last fine clay phase resulting from slaking of soil as the profile thickens - only fine clay being translocated this deep. PPL, frame length is 0.33mm.

Plate 68 As 67, XPL.

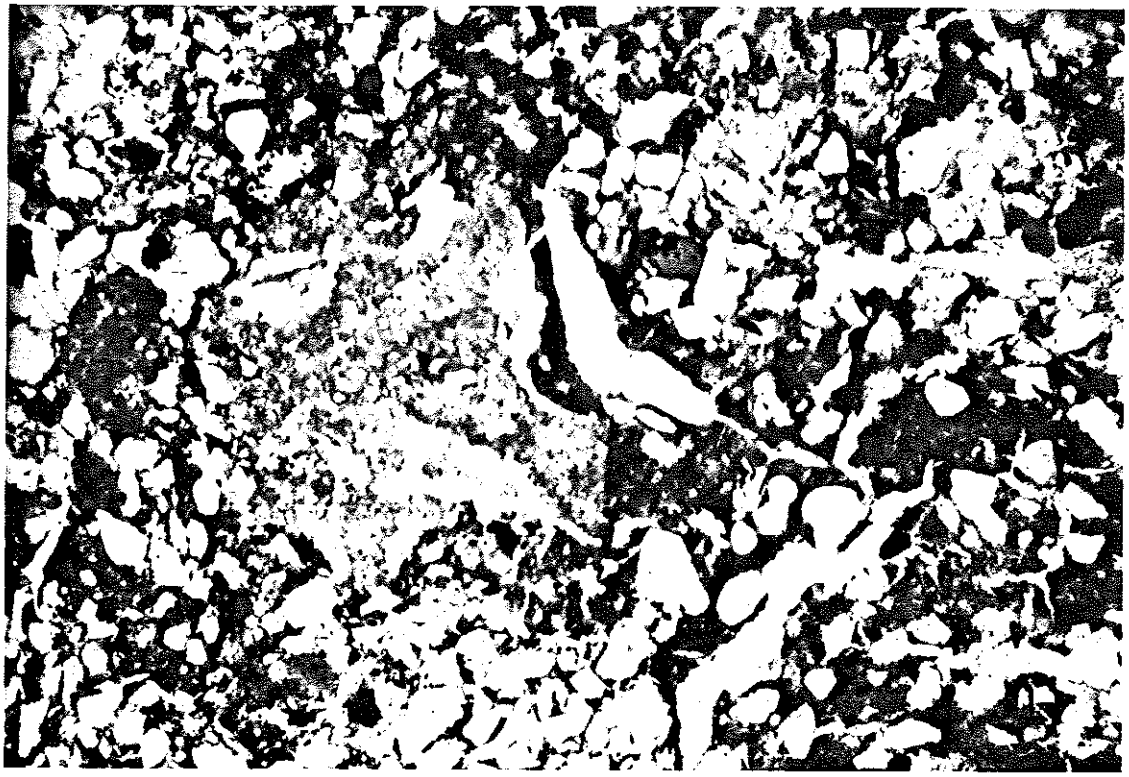

Plate 69 Cutting 15, thin section 17 (4064), Romano-British ditch fill; clayey fine soil; void infill by neo-formed calcite (grey zone), followed by later clay translocation (from continued ploughing). PPL, frame length is 3.32mm.

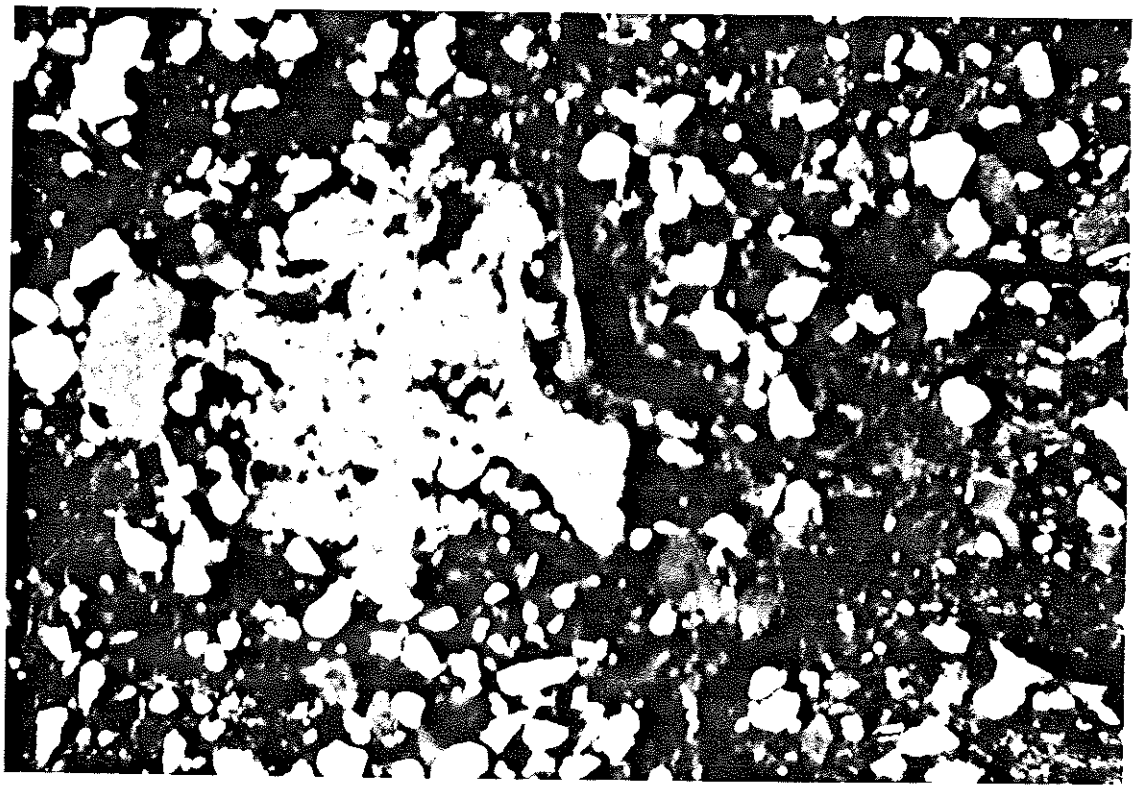

Plate 70 As 69, XPL. Note high birefringence of calcite; derived from weathering of the calcite ash of the midden.