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SOIL REPORT ON THE CAIRN AND FIELD SYSTEM AT CHYSAUSTER, PENZANCE, CORNWALL.

R I Macphail BSc MSc PhD

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Summary

The soils associated with the cairn and field system at Chysauster, Cornwall were studied by field, physical and chemical laboratory techniques, and by the investigation of 18 large thin sections. Late Devension periglacial soil formation in granitic head (including probable patches of loess) was differentiated from Flandrian pedogenesis. The acid brown soils developed by the Bronze Age which were cleared and probably cultivated at this time were succeeded by a podzol cover which has been present from Iron Age to contemporary times. This is both the first example of the brown soil progenitor of the present day podzol cover on the granite and clearest evidence of Bronze Age cultivation so far. The sites comprising lynchets and succeeding walls and colluvial banks occur on a deeply eroded landscape. Podzolisation was apparently coeval with continuous cultivation which produced these features. Possibly lyncheting was "encouraged" to offset erosion, whereas there is some evidence later for animal stocking. The report is supported by 75 colour plates.

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SOIL REPORT ON THE CAIRN AND FIELD SYSTEM AT CHYSAUSTER, PENZANCE, CORNWALL

R I Macphail (with contributions by M J Allen and S Ross) 1987

1.A Introduction

During March 1984 the cairn and prehistoric field system to the north-east of the Guardianship Iron Age village at Chysauster (near Penzance, Cornwall) was excavated by the Central Excavation Unit (director George Smith) after damage by land improvement for agriculture. The cairn has been dated to the Bronze Age by C14 assays (yrs bc) on charcoal (satellite burials - 1730 ± 80 Harwell, 1840 ± 120 Harwell, 1380 ± 80 Oxford; Central burial - 1480 ± 80 Oxford; Old Land Surface 1700 ± 80 Harwell), whereas the field systems (one C14 date of 2650+160bc Harwell at 224 unfortunately appearing to be residual) are believed to have been extant through the Iron Age/Romano-British to the Medieval period (George Smith, pers. comm.). The soil investigation carried out by the author with the aid of Dr Sheila Ross, Geography Department, Bristol University, and Mike Allen, Geography Department, Southampton University, was coordinated with a valley peat pollen (see Fig. 1) and buried soil pollen study by Dr Rob Scaife, Institute of Archaeology, through Nick Balaam, environmentalist for the CEU.

1.B Methods and Samples Studied

The soils were described (Hodgson, 1974, Avery, 1980) and selectively analysed (Avery and Bascomb, 1974) for grain size, pH, calcium carbonate, loss on ignition, organic carbon and nitrogen, pyrophosphate extractable carbon, iron and alluminium; dithionite extractable iron; potassium, calcium, magnesium, sodium, hydrogen and total cation exchange capacity. Grain size, pH and organic carbon analyses were carried out at the Institute, whereas the other analyses were made by Dr Peter Loveland, Soil Survey of England and Wales (Sites 527, 403 and 117) and Dr Sheila Ross, Bristol University (Sites 405 and 224). Detailed 100 gm. samples were tested for magnetic susceptibility enhancement (Tite and Mullins, 1971; Clark 1983) by Mike Allen at University College, Lampeter, and gaps in the sample sequence were filled by the assay of 10gm samples at the Institute. Overlap showed good comparison between the two sample sizes. The above investigation was correlated with the study (Bullock *et al* 1985; Courty *et al* in preparation) of 18 large thin sections, either made by Aberdeen University (Dr Fitzpatrick) or prepared at the Institut National Agronomique, Grignon, France (courtesy of Dr M A Courty). Photomicrographs were made at the Soil Survey of England and Wales, Rothamsted Exp Station (courtesy of Chris Murphy).

37 soil samples (within lab Nos. 40-80) from Chysauster came under scrutiny. These are:-

From 527 (Cairn), Fig 2, Plates 1-2; Nos 40-47; thin sections A, B, C, D, E and F of Profile 1, Plates 3-30.

From 403, Fig 3, Plate 31; Nos 48-58; thin sections G and H of Profile 2, Plates 32-40.

From 117, Fig 4, Plate 41; Nos 59-64; thin sections L, I, J and K of Profile 3, Plates 42-54.

From 224, Fig 5, Plate 55; Nos 75-80; thin sections O, P and Q of Profile 4, Plates 56-65.

From 405, Fig 6, Plate 66; Nos 68-73; thin sections R and S, Plates 67-74.

2. Results

These are presented as follows:-

Grain Size (Table 1), Chemistry; Analytical Data (a) - organic matter, iron, aluminium and MS (Table 2) and (b) Nutrients (Table 3). In Appendix 1 the sites are located and described in Figs 1-6 and Profiles 1-6 where field horizon notations are given. The micromorphology (description and interpretation of individual slides and profiles) of 18 thin sections A-S is given in Appendix 2. The field and micromorphological description is supported by 75 colour plates in Appendix 3. The text is further aided by summary Tables 4 and 5.

2.A Present day soils

Fig 1 shows the major distribution of typical brown podzolic soils (Moretonhamstead Association) on the valley side and bottom, and ironpan stagnopodzols (Hexworthy Association) on the granite plateau at Chysauster, mapped by the Soil Survey of England and Wales (Findlay, et al 1983). As described in later sections of this chapter, the ironpan stagnopodzols are mainly developed in shallow eroded soils or in colluvium overlying eroded subsoils approximating to the Trink (527), Hexworthy (412) and Moorgate (403, 405, 117) Series (Staines, 1979a). It is probable that the typical brown podzolic soils downslope are predominantly colluvial in origin. Fig 1 also locates Dr Scaife's peat site, the Iron Age village and the Bronze Age cairn (527) and the walls, banks and lynchets (405, 224, 403, 117 and 412) of the field system investigated.

2.B Late Devensian soil development (all profiles)

It was only by understanding the character of this early soil formation, that prehistoric pedogenic trends and amounts of erosion and colluviation could be assessed.

The granite weathers into generally clay poor (c.10%) sandy silt loams or sandy loams (Table 1) containing mainly feldspar and quartz, with frequent biotite and few hornblende (see Micromorphogical Descriptions, Appendix 2, A-S). However, a possible palaeoargillic (Avery 1980) fabric was identified in dumped subsoil at 405 (Thin Section R). This is suggested by the "cracked" reddish limpid clay infills (Plates 73, 74) which are unlike any of the textural features described later. Such reddening of soils has long been held as one indicator of pre-Devensian weathering (Kemp, 1985) and in this case appears to have been accompanied by possible haematic ferruginisation.

In addition to weathered granite, there is some evidence to indicate that late Devensian loess contributed as a parent material in the area of Chysauster. This suggestion comes from 527 (Cairn), the least eroded of the buried soils. Firstly, patches of yellowish red clay loam were found throughout this generally sandy silt loam profile (Profile 1). In thin section (Fig 2; C and F) these produced much finer fabrics (Plates 15-18) compared with the surrounding soil, and where this clay loam was involved in bulk grain size analysis, amounts of clay were doubled, whereas quantities of silt were also probably enhanced (Table 1, Sa. 43, 44). Within the upper soil (bBhs horizon, thin section C) patches of loess can be related to how soils formed in the Holocene up to the Bronze Age, and thus is dealt with later (Section 2C). Recent studies by Catt and Staines (1984) have identified widespread loess in Cornwall and on the Scilly Isles. They suggest that this loess differs in character to loess found in East Devon and the rest of southern England, and was probably blown from glacial outwash deposits in the southern part of the Irish Sea basin. The loess here at Chysauster was probably more widespread, but is believed to have suffered from both Late Devensian gelifluction, and from Flandrian erosion and colluviation (see 2C etc) as suggested by Catt and Staines (1984) for the County as a whole. In this context it is worth noting that at Carn Brae, on the "Falmouth" granite (as opposed to the Penzance granite),top soils buried as early as the Neolithic were still strongly loessial in character (Macphail, in preparation).

The relative dating of the subsoil microfabrics (ie fragipan horizons x) is based on micromorphology. Soils dissaggregated by tundra conditions on well drained convex slopes, as at Chysauster, are effected by freeze/thaw processes which produce a number of diagnostic features (Fitzpatrick 1956, Romans and Robertson, 1974; Romans et al, 1980; Van Vliet-Lanoe, 1982), namely link cappings, silt and clay pans ("silt droplets") and silt and clay granules. At Chysauster very strongly formed examples of the above are present in all subsoils examined, but the pans are broken - the granules themselves being the result of the breaking up of caps and pans and the rotating of the resulting fragments (Plates 20-25). These are interpreted as the result of annual freeze/thaw conditions during the early part of Zone II forming strong pans under a cold, dry continental environment (details of mechanism in Macphail's report on Hengistbury Head, in preparation), and their disruption by renewed sub-arctic conditions and periglacial activity in Zone III (Romans and Robertson, 1974; Romans et al 1980; Romans, pers. comm.). Superimposed upon this, and thus more recent, is a generally massive fabric (Plates 49, 50) throughout all the subsoils, sometimes displaying weakly formed continuous silt and clay pans (Plates 39, 40). These are believed to have developed during the early part of Zone IV when conditions were more humid because of continued maritime influences from Zone III (Romans, et al 1982). In short (Table 4) strong pans were formed in Zone II, and these were disrupted in Zone III during which time dissaggregated soils were transported downslope by solifluction, and early Zone IV annual freezing and thawing produced a superimposed weakly formed pan fabric in overlying deposits.

This weathered head subsoil under discussion - sometimes termed "growan" (Waters, 1971) - is very poor in fine material and becomes increasingly stoney with depth (Table 1; Sa. 45, 46, 47, 57, 64). It is also little chemically weathered and low in sesquioxides - the iron content probably linked to low MS (Tables 2 and 3 Sa. 45, 46, 47). Exceptions occur elsewhere because subsoils are affected by hydromorphism or by podzolic illuviation relating to later erosion bringing subsoils closer to the soil surface (Sa. 57, 64). Subsoil material, as defined in this section, was effected by Flandrian pedogenesis and became involved in man induced erosion and colluviation.

2.C Flandrian soil development (527)

As will be shown in Sections 2.D and 2.E, most of the evidence of early pedogenesis has been lost by erosion of heavily altered by later Flandrian podzolisation. In fact, even at 527, beneath the cairn the chemistry of the buried soil has been strongly influenced by podzolic leaching and illuviation.

The exact nature of the Bronze Age soil at 527 is detailed later (2.D), therefore suffice it to say that apparently by this time the soil had all the characteristics of a developing acid brown soil (Cambisol - Soil Survey Staff, 1975; Aurosseau, 1983) formed in weathered granitic head, except for the patches of loess where in contrast an argillic (Avery, 1980) fabric (as a response to the forest cover) was evident when these occurred nearer the soil surface (C). The latter patch of loessial soil situated in the lower Bhs horizon could have once been part of a more extensive "near surface" worm worked (Plate 19) horizon developed in the Flandrian, that through some mechanism became disrupted into fragments, now included in this mainly sandy granitic soil. Evidence for disturbance is in the form of dusty clay infills, indicative of within-soil mass movement - the infills themselves being right way up and thus resulting from this soil disruption (Plates 15-18). Such features have been discussed elsewhere (Macphail, AMLR,4897 1986) and have been ascribed to tree throw or forest clearance disturbance, in which broken soil fragments are easily slaked and produce these textural pedofeatures (Courty et al, in preparation).

In brief (see interpretation of thin section C and 527 as a whole), it seems reasonable to suggest that by the mid Flandrian at 527, a patchy Late Devensian loessial cover weathered into an acidified argillic loamy soil (as at the Neolithic soil at Carn Brae; Macphail in preparation) over a subsoil of only partially pedogenically affected and biologically worked relic granitic head.

Natural tree throw or clearance (two late Neolithic arrowheads were found in the buried soil-Smith pers Comm.) disrupted the soil, causing fragments of the overlying loessial argillic soil to become enclosed within the sandy granitic soil. However, the absence of this loessial soil at the present day buried surface (A, B) possibly suggests erosion of is loamy cover (if it was present) sometime prior to Bronze Age cairn construction, or that most patches had become homogenised by Late Devensian solifluction and Flandrian pedogenesis.

2.D <u>The Bronze Age soil</u> (527)

a) <u>Woodland enviroment, clearance, cultivation and cremations</u>. The soil at 527 (Plates 1, 2; Profile 1; Fig 2) was an acidifying brown soil (Tables 1, 2 and 3), where earthworms were still present (Plates 11, 12) but decreasing in numbers, when burial took place. Earthworm passage features penetrate as far as the bB(g) x 3 horizon (c.65cms depth), whereas the bEa horizon (see 2.Db) and upper Bh horizon were moderately well worked. Similar continuing earthworm activity was reported through micromorphology from beneath a rather later (1550-1650bc) Bronze Age barrow (at c. 240m) on the west facing side of the Colliford Downs, Bodmin Moor (Maltby and Caseldine, 1982). Here on a granitic parent material a brown podzol, with a brown soil ancestry, as confirmed by microfabric analysis and by sodium dithionite and potassium pyrophosate extractable iron assays was present under a contemporary vegetation of relatively open grassland (trees in the valley, Casseldine, 1980). Across the St Neot river valley similarly dated barrows bury full podzols (Maltby and Caseldine, 1982).

At Chysauster, examination of the bEa horizon (Thin Section A) under Ultra Violet and Blue Light (at the INA, Grignon) showed it to contain common pollen, especially Polypodium with few Corylus, probably derived from a woodland environment (see Scaife). Burial by the cairn did not completely seal the Bronze Age soil from later podzolisation (see Ee) and so the 527 soil cannot be compared chemically to the Colliford profile. However, through the micromorphological study it can be suggested that the lower altitude of the Chysauster soil at c.195m and southern aspect its continued open woodland vegetation and earlier date (c. 1700-1800bc), in contrast to the Colliford buried soils, may account for the continued brown soil status, although the declining earthworm population does show acidification was underway.

This latter deterioration of the soil was probably accelerated by forest/woodland clearance and the use of the site for cultivation. A distinct cultivated layer of some 3cm remains beneath kerbstone 524 (Plate 2,3 and 4), in which all earthworm channels have been destroyed, whereas just below, a bow shape mineral infill includes probable wood charcoal-possibly relating to the clearance phase, brought down by earthworm activity. The cultivated layer has been completely homogenised and is characterised by vughy pores coated by dusty clay set in a matrix containing a fragment of earlier coatings. The high concentration of phytoliths and "graminae" type charcoal (Plate 5) in the groundmass could suggest "stubble" burning, whereas the concentration of dusty clay coatings in the surface few cms on this low (4°) slope site (ie erosion unlikely to be rapid) could possibly indicate hoe cultivation, rather than deeper arding (Romans and Robertson, 1983b; Macphail et al 1987). Tillage by physically breaking up the topsoil, made it very vulnerable to slaking by rainfall, hence the creation of apedal surface crust or pan, similar to that noted at Strathallan mound, Perthshire (Romans and Robertson, in Barclay 1983; thin sections also viewed by the author). The washing-out of clay from the surface horizons by the impact of the cultivation would most certainly have acted as a trigger accelerating leaching, acidification and podzolisation of this profile-had it not been buried. In fact, incomplete sealing by the cairn did allow the bEa to be preferentially leached (Table 2, Sa41). This trigger mechanism could have acted elsewhere at Chysuaster in the Bronze Age, as earthworms which could offset leaching by soil mixing, were already infrequent and shown to be discouraged by the effects of tillage.

In short, the cairn at Chysauster has preserved not only the sole example of the (so far mainly theoretical -see c) brown soil progenitor of the present day pozolic cover on the granite of the West Country, but also provides the first pedological evidence of a Bronze Age cultivated soil here.

b) Effects of cairn construction. When the large stones were laid to build the cairn these had a dramatic impact on the soil. At Profile 1 (Plate 1, Fig 2) stone 524 had the effect of denting the soil, and soil water gathered round its base. This led to localised hydromorphism (gleying), as occurs at many monuments (Macphail, 1986a; Allen and Macphail 1987), affected this layer (Plate 2), which with the combined effects of acid leaching, strongly suppressed MS (Table 2, Sa. 41) to a level very much lower than probably existed in the Bronze Age.

c) Post-burial podzolisation. The soil was not well-sealed by the cairn, on which through time an acid vegetation grew progressively podzolising the underlying soil. As a result the chemistry of Profile 1 clearly shows a leached but organic modern Ah horizon (Tables 2 and 3, Sa. 40) developed between the stones, whereas the buried and cultivated mineral "topsoil" of the buried soil (bEa) is even more strongly depleted of cations (Sa. 41). Podzolic acidity is confirmed by low pH and high C/N. In contrast, the illuvial or spodic horizons (Sa. 43, 44) are evidently enriched in humus and sesquioxides, associated with which are high cation values. MS has been apparently strongly enhanced by podzolisation at this level in the soil.

In thin section, the fabric and coatings within the bEa horizon are obviously leached (Plates 3-5), but much of the unslaked lower part of the horizon retains its acid brown soil structure, except for areas penetrated by acidophyle (probable Oribatid; Babel, 1975; Bullock et al 1985) fauna (Plates 6-7). The Bw (Cambic) horizon of the Bronze Age acid brown soil has had its general structure cemented by podzolic (organic matter and sesquioxides) illuviation (Plates 11-12) - as similarly recorded for example from upland soils in Scotland when comparable upland brown soils became podzolised (Romans and Robertson, 1975), although in the Bh horizon itself a typical polymorphic (de Coninck, 1980) fabric has developed.

Thus, as Table 4 shows, the Bronze Age profile was an acid brown soil onto which the physical and chemical effects of burial and progressive podzolisation are superimposed. Local pollen studies (see Scaife) should help "date" the onset of podzolisation in general at Chysauster, which, as next described, was extant during periods of later prehistoric cultivation, erosion, colluviation and wall building.

2.E The Iron Age and later (403, 117, 412, 405, 224)

Little dating material was obtained from the excavation of the field system, but while minor features may date to the Bronze Age or Medieval periods, most are believed to be of Iron Age Romano-British origin (Smith, pers. comm.) and relate to the Iron Age village at Chysauster (Fig 1). The sites will thus be dealt with on an upper slope and plateau (403, 117, 412) and lower slope (405, 224) basis.

a) Upper slope (403, 117, 412). Field study of 412 showed that the prehistoric hut on this low slope (4^o) site, buried an ironpan podzol formed in an eroded subsoil developed in granitic head. Although "sealing" was not perfect it is probable that podzolisation, which post-dated deep erosion, commenced before hut construction.

Downslope, on the upper parts of the steeper (7^{o}) slope, erosion - as recorded at 412 - produced colluvial sequences at 403 and 117. However, even at these two sites the relic granitic head subsoil had been exposed by erosion losing at least 50-60cms of soil as calculated from the present buried profile at 527; and later were buried by half a metre of colluvial (lynchet) episodes (Profiles 1, 2, 3; Figs 2, 3, 4; Thin Sections A-K). If the excavated area (see Smith) 200/400 metres was equally affected some 40,000 cubic metres of soil could have been transported, some contributing to the colluvial valley soils downslope in away more commony recognised in the South-East of England (Bell 1983) than in the South-West

At 403 (Profile 2; Fig 3; Plate 1) relic granitic head subsoil - containing undisturbed Zone IV weak silt and clay pans (Plates 39, 40) - because it had been brought close to the surface by erosion had been effected by minor biological activity and sesquioxidic illuviation (H). Both factors possibly account for moderately enhanced MS at this level (Table 2, Sa. 57). Above, an acid topsoil formed at the 3bAh horizon, and this was in turn buried by colluvial and further surface horizon formation (Table 5a). The colluvium comprised eroded 4bB x 2 horizon fabrics into which surface (at the top of bBs lower - G) vegetation rooted (Plates 37-38). A thin "surface" horizon (2bAH) was also marked by a burning and slaking episode (Plates 34-36) possibly relating to agriculture (Macphail, AMLR 4897, 1986; Macphail, et al 1987) - producing a soil crust or pan containing charred "grass like" (stubble?) organic matter (Courty et al in preparation). Continued colluviation of 4bB x 2 type material (Plates 32, 33) continued. A phase of podzolisation then occurred in the sandy loam (Table 1) colluvium leaching the bEa horizon (Tables 2 and 3, Sa. 50) and weathering and enriching in sesquioxides (Sa. 51) this generally poorly (chemically) weathered material (Sa. 52). MS is anomalously low in the upper bBs horizon, although much iron is present. However, possibly agricultural practices, including the recorded burning event may have moderately enhanced MS within this subsoil colluvium, even while iron levels are generally low. Post-burial colluviation continued, again in which podzolisation has been active (Table 2, Sa. 48, 49)

In the case of 117 (Profile 3; Fig 4; Plate 41) the fine sandy loam (Table 1, Sa. 64) subsoil (K, Plates 49, 50) is similarly eroded and buried by subsequent colluvial sandy loam sequences (Table 5b). Here however, the erosional/colluvial phases clearly coincided with podzolisation in the area and both fragments of relic subsoil and podzolic B horizon material are included (J; Plates 46, 47, 48). Thus, both truncated relic soils and "more recently" developed podzols were being eroded, probably by cultivation practices, of which there is direct evidence. In the bEa/Bh horizon the presence of fine and coarse charcoal and very dusty clay coatings and infills (I; Plates 42-45) all indicate on site agriculture (Macphail, et al in press). In addition, the sesquioxidic nature of the coatings and infills, which clearly does not relate to subsequent podzolic illuviation, demonstrates that tillage and podzolisation were coeval at Chysauster. Obviously, podzolisation continued on the site producing typical distribution of C, Fe and Al (Table 2, Sa. 60, 61, 62), although it should be noted that the cation data (Table 3) indicates that the colluvial parent material may have been already leached because much of it came from a podzolised source. The latter can be illustrated from the "modern" soil section (Fig 4) where well developed Bh and Bhs horizon microfabrics have formed in colluvium that is strongly degraded (L; Plates 51-54; Table 1, Sa. 65). At 117 MS levels remain moderate, but appear slightly enhanced by colluviation and illuviation, whereas acid leaching has had the effect of dramatically reducing enhancement (Table 2, Sa. 60, 61, 62, see also Sa. 40, 41).

In summary, it is apparent that the upslope position of 117 was mainly affected by colluviation from eroding podzols, whereas 403 received soil dominantly derived from already truncated relic granitic subsoils. Further, at 117 cultivation was contemporaneous with podzolisation, showing that even while cultivation was being practised podzolisation continued as the dominant soil process. Similar coincidence of these has been reported from multi-period soils at West Heslerton, Yorkshire (Macphail, AMLR 3706, 1982; Fisher and Macphail, 1985).

b) Lower slope (405, 224). These two sites occur on the same slope unit (Fig 1) approximately 50 metres apart laterally. Again the original soils seen to have been deeply eroded into the relic subsoil. At 405 (Profile 5, Fig 6, Plate 66) this horizon (46 B(hsg) x) is only weakly affected by podzolic illuviation, but more strongly displays the traits of hydromorphism (gleying) - (possibly relic - see later) mottling and ferruginous cementation (Tables 2 and 3, Sa. 73) accounting for its enhanced MS. Cation analysis show it is also little leached. The overlying 3b Ea horizon comprises in situ podzolised degraded colluvium (Sa. 70), but significantly this material is richer in cations (Table 3) than the colluvial layers described from 403 and 117 upslope. Clearly it has come from a weathered, but not strongly leached source.

The micromorphology of the 3b Ea horizon shows it to be a moderately depleted soil, with evidence of slaking (dusty clay coatings) and burning of "grass" (stubble?) materials (fine flaky charred organic matter and phytoliths) being probable cultivation (Table 5c) indicators (S; Plates 72-74). Thin section analysis also shows that this horizon has been contaminated by sesquioxidic illuviation and acidophyle fauna from the overlying soil sequence in the bank. This has probably rather enhanced amounts of measured organic matter, iron, and (with burning) MS (Sa. 70).

During stone wall and bank construction which buried this soil, a variety of soil materials were dumped (2b Bs (h)). These comprised (R) fragments of Bh horizon fabric, probably cultivated Ea horizon material (Plates 67-69) and pieces of relic subsoil (Plates 70-71). Details of the latter, probably from the 4b B(hsg) x horizon, have already been discussed (2.B). In fact the red (? palaeoargillic) weathered clay may well be contributory to the enhanced MS (Table 2, Sa. 71) in this layer, whereas in the overlying lynchet/bank, markedly higher MS probably relates to the effects of erosion of "cultivated" topsoils and possibly in situ burning, rather than to the quantity of crystalline iron present (Sa. 68, 69). With such a high MS, the inclusion of charred organic matter may be just as contributary as podzolisation to the high levels of loss on ignition, organic carbon and C/N (Allen and Macphail, 1987).

At 224 (Profile 4; Fig 5; Plate 55) the eroded and now deeply buried relic subsoil (Table 5d) became strongly mixed by human activity with later soil formation. Probable cultivation (Q) mixed the relic subsoil fabric with charcoal and large quantities of Ah horizon material (Plates 64-65; Table 1, Sa. 80), the latter probably formed "in situ" as surface podzolisation effected a thin layer of weathered colluvium (see 405, 3bEa). In fact the horizon, as bulk analysed, is very humic and ferruginous reflecting its heterogenous character and post-depositional podzolic illuviation (Tables 2 and 3, Sa. 80). The thick leached colluvium (3bEa) which succeeds it is a sandy loam (Sa. 79) with all the features, including MS, of a depleted horizon, although cation measurement again suggests that source material for 224 was never completely degraded.

The data (P; Sa. 78) for the next colluvial episode (2bB(sg)) all confirm that it is a weathered sediment that underwent further podzolic leaching, but is now weakly cemented by post-burial sesquioxidic illuviation from overlying layers. In fact, the 2bEa2 horizon above, has many of the same traits as the 2bB(sg) horizon, ie physically and chemically, and the inclusion of much fine charred organic material characteristic of anthropic/cultivation colluviums. There are however some differences. For example, the horizons below 2bEa2 all feature acidophyle faunal excrements typical of podzols, whereas the 2bEa2 horizon has in addition a phase of earthworm activity (O; Plates 62-63). There was also evidence, in the form of dusty (depleted) clay coatings, of on site cultivation. Lastly here (and also in 2bB(sg)), crumpled (transported) "bright rings" (See 117 Sa. I) or probable spore cases of vesicular arbuscular mycorhizae occur (Romans, pers. comm.). From their presence at Chysauster and the work of Romans and Robertson (1983a) who investigated their occurrence in modern and ancient soils, a number of interpretations can be suggested. Firstly, because the spore cases are aged and fully birefringent, that these layers at 224 (Plates 60-61) are over 900 years old. Secondly, the spore cases, because of their association with animal grazing, may possibly relate to local (small spore size therefore sheep?) herding. Thus, continued agricultural colluviation possibly occurred alongside a (sheep?) grazing landuse. In addition, the 2bEa2 horizon itself contains evidence for on site tillage. Perhaps all these factors including continued manuring effects may have been sufficient to allow earthworms to invade, as reflected in the lower C/N (Sa. 77) in an essentially podzolising environment. Possibly similar effects of Iron Age in-field (stocking) brown soil maintenance in comparison to outfield (grazing) podzolisation can be cited from Strageath, Perthshire (Romans and Robertson, 1983b).

As an aside, it is worth noting that in the colluvial samples of 77, 78 and 79 very low MS is recorded, even while all the data suggests that these are cultivation colluviums influenced by burning as indicated by large quantities of charred organic materials. As these soils are depleted of iron by podzolic leaching however, MS may be strongly depressed as a result.

In the bAh/Ea horizon near the top of the sequence, the colluviation of very depleted (Table 1, Sa. 76) soils (M; Plates 58-59) and the formation of humic Ah horizon within it (Plates 56-57) can be noted. Podzolisation and its effects, as in the overlying Ah2 horizon (Sa. 75) continued, although probably more intensive anthropic influences perhaps including on site burning, have enhanced MS levels (Tables 2 and 3).

e) Podzolisation and landuse. Even whilst dating is not satisfactory at Chysauster it can be supposed that forest and woodland clearances and cultivation initiated in the Bronze Age (as detailed in 2Da) rapidly led to the deterioration of acid brown soils to podzols by the Iron Age.

The mechanisms for this common occurrence in upland cool and wet regions of England have been dealt with by Dimbleby (1962). Similar effects were recorded locally at Shaugh Moor on Dartmoor (Keeley and Macphail, 1982), whereas the propensity of soils generally to acidity more rapidly because they are on acid parent materials at altitude (Ball, 1975), and in the Iron Age particularly because they were effected by the cooler and wetter climates of the Sub-Atlantic, (Keeley, 1982; Macphail, 1986 , 1987) is also well documented.

For the South-West, a number of reviews on the podzolisation of the upland granite have been made recently (Staines, 1979; Caseldine, 1980; Caseldine and Maguire, 1981; Maltby, in Bell, 1984). The brown soil ancestry of the present day podzol cover on the granite has been accepted on theoretical grounds (Clayden and Manley, 1964), and this was supported by the findings from Colliford Down (Maltby and Caseldine, 1982). In theory this brown soil had developed under an oak forest, and again this was confirmed by Staines (1979b), Brisbane and Clews (1979) and Smith etal (1981) (see Scaife). At Chysauster there is clear evidence of this pre-podzol, acid brown soil, with patches of argillic brown earth ("forest soil") fabric testifying to its having a forest cover. There is similar micropedological support for this "forest soil" ancestry at Carn Brae (c. 200m

OD) from a Neolithic palaeosol (Macphail, in prep.). Equally, both these latter two sites have evidence of clearance and cultivation. At Chysauster cultivation took place in a woodland clearing (see Scaife) - a situation comparable to that at the presumed Bronze Age site of Cholwichtown, Lee Moor, Devon at c. 272m OD (Simmons, in Eogen, 1966) and also possibly at Stannon Down (c. 330m OD) (Mercer and Dimbleby, 1978). The actual mechanisms for the podzolisation of an earlier brown soil through the replacement of forest/woodland by grasses and heather are well known for soils above 250m OD (Dimbleby, 1962; Ball, 1975; Staines, 1979b; Keeley and Macphail, 1982; Keeley, 1982; Maltby in Bell; 1984 Macphail 1986), but Caseldine (1980) suggests that clearance alone was not the trigger at Colliford Down (c 240m OD), because clearance had already occured. Rather rapid soil deterioration took place at the time of occupation prior to barrow construction. In the Chysauster area, this trigger could well have been cultivation in the Bronze Age (see 2Da).

The effects of physiographic position, aspect and altitude on podzolisation through time have been modelled by Maltby (in Bell, 1984, p 101), the concensus being - without detailing all the sites involved - that most granitic upland soils were podzolised by the Iron Age (Staines, 1979b; Caseldine and Maguire, 1981). Staines (1979b) also suggests that upland settlements concentrated on the 7° slopes to avoid low slope wet ground, which in part may account for the location of Chysauster village (Fig 1) - the valley floor was certainly bogey, whereas just downslope it is too steep (10°). The plateau areas (above 200m) can be assumed to have been used for grazing, podzolisation by the Bronze Age not affecting this (Keeley and Macphail, 1982; Caseldine 1980; Caseldine and Maguire, 1981; Balaam etal 1982), as the field system only extends to this altitude. The actual pattern of landuse and its effects has been detailed earlier (2E) but its relationship to podzolisation is summarised below.

At all the sites there is evidence of cultivation practises such as probable stubble burning (Plates 34-36), and tillage effects causing soils to slake at the same time as profiles were being influenced by podzolisation in the marginal upland environment. For example, both leached topsoils and sesquioxidic rich subsoils were ploughed (Plates 42-45, 72-74). At 224, there is also evidence of animal grazing locally, which may have produced an isolated instance of soil amelioration. Alternatively, animals may have been only pounded within the field system as an infield practice, whereas they normally were grazed above 200m OD on the moorland.

3. Summary and Conclusions

A Site History

a) Late Devensian loess deposition on granitic head.

b) Phases of Late Devensian freeze/thaw soil development (fragipans).

c) Early Flandrian pedogenesis; acid brown soils on granitic head, argillic soils in the loamier patches of loess.

d) Later Flandrian primary forest clearance(?); some erosion of patchy loessial soil cover? (in Bronze Age?).

e) Only rather shallow acid brown and patchy argillic brown soil development in mixed loessial granitic head by Bronze Age; diminishing earthworm population as soil continues to acidify.

f) Secondary(?) clearance, phases of hoe(?) cultivation and stubble(?) burning, further discouraging earthworms and accelerating acidification; in Bronze Age, triggering podzolisation; a dominant effect by the Iron Age.

g) Undated (Bronze Age-Iron Age) erosion through presumed cultivation strips off soil cover exposing relic granitic subsoils.

h) Probable Iron Age agricultural expansion onto more marginal land (plateau); possible measures taken to halt erosion led to lynchet formation as cultivation continued to cause podzols and exposed relic subsoils to erode. Strengthening of lynchets by stone wall/bank building created fields in which probable animal herding accompanied cultivation and the continued development of upslope colluvium; generally uninterrupted podzolisation.

B. Methods

a) Micromorphology was very successful in distinguishing the history and origins of parent materials and colluvial sediments, especially where heterogeneous deposits occurred. Landuse, including on site cultivation, and soil processes were clearly observed.

b) Chemistry substantially aided the corroboration of subsoil illuviation and cementation. It also helped understand the weathered nature of the various parent materials and colluviums.

c) Magnetic susceptibility was obviously enhanced by podzolic illuviation and ferruginous concentrations, whereas it was much depressed by acid leaching. Relic fragipan subsoils often also showed very low MS when uncontaminated by later pedogenic processes. Off and on-site "burning" with cultivation caused little enhancement of leached horizons, whereas illuvial layers were perhaps only marginally effected. Actual intense burning on site, as some form of "occupation", was best identified through MS.

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Fig. 1.

CHYSAUSTER, CORNWALL

valley-side profile

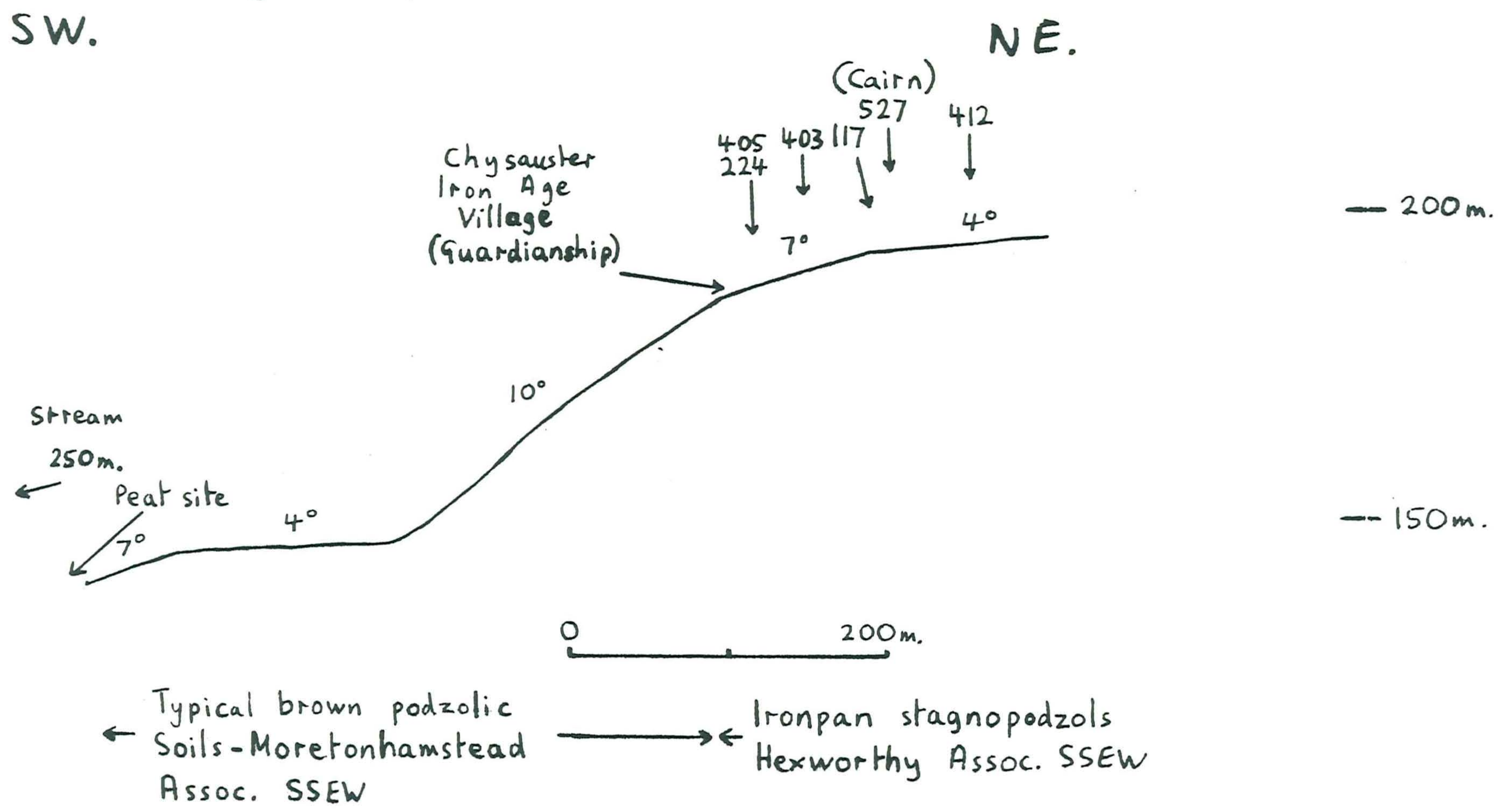


Fig 2

CHYSAUSTER: Thin Section (A), Bulk (41) Samples

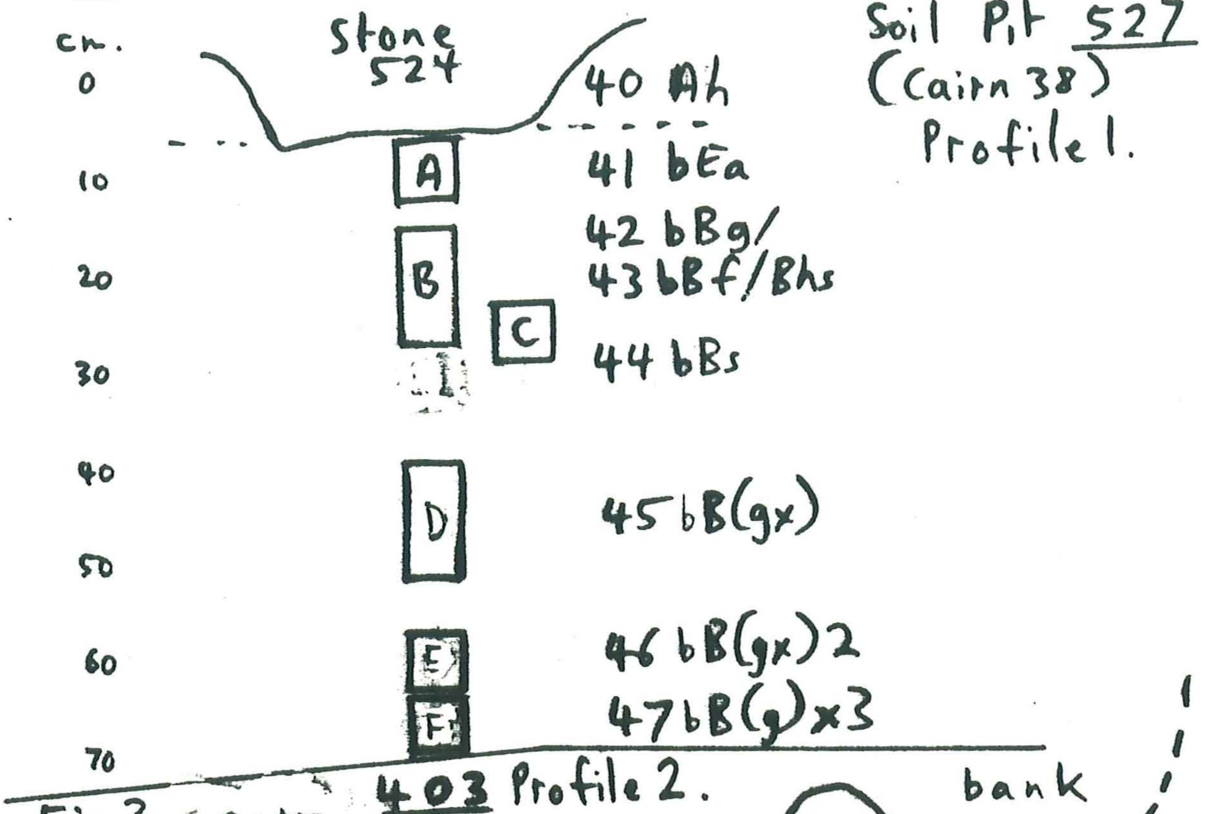


Fig. 3

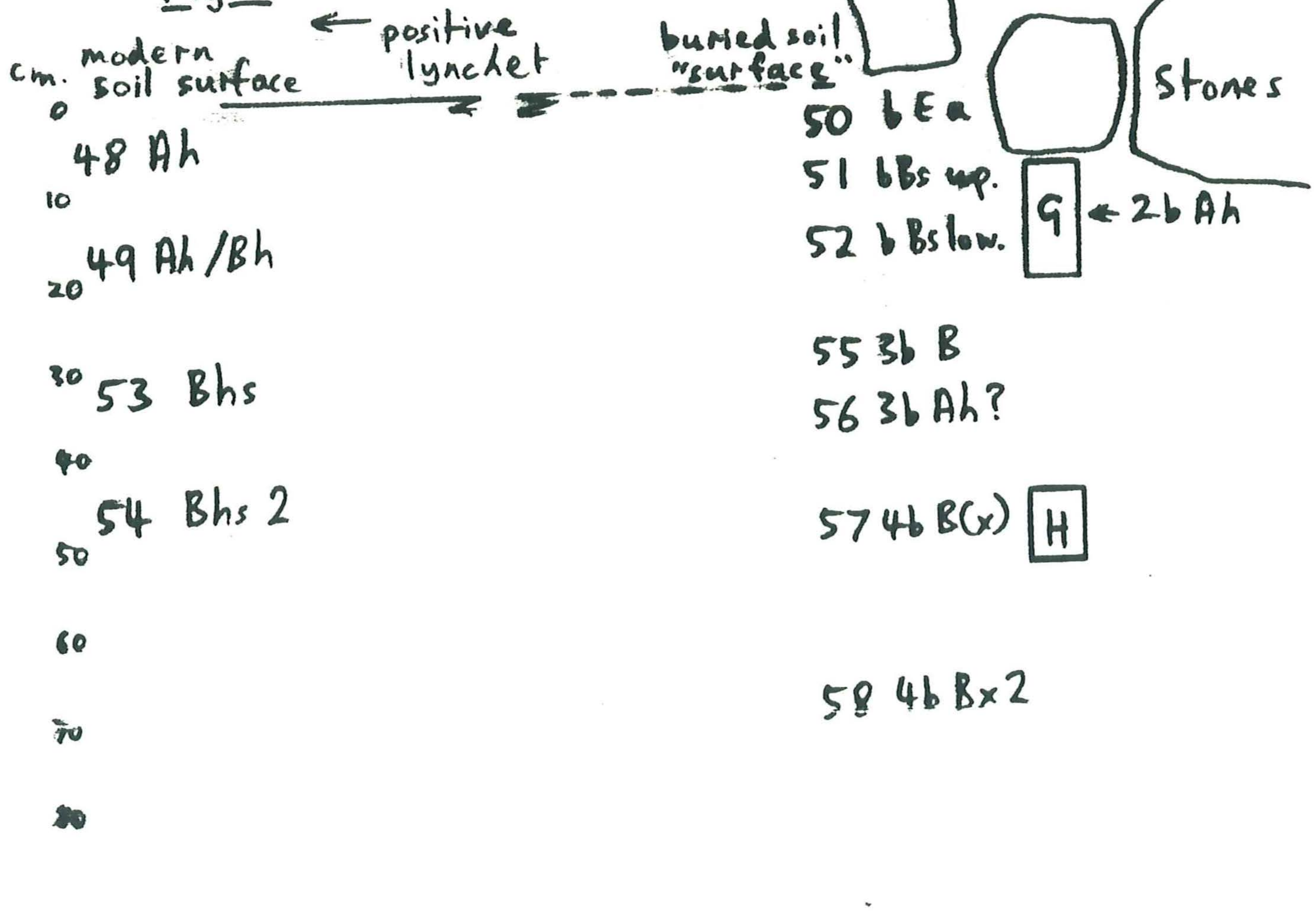


Fig.4 117 Profile 3

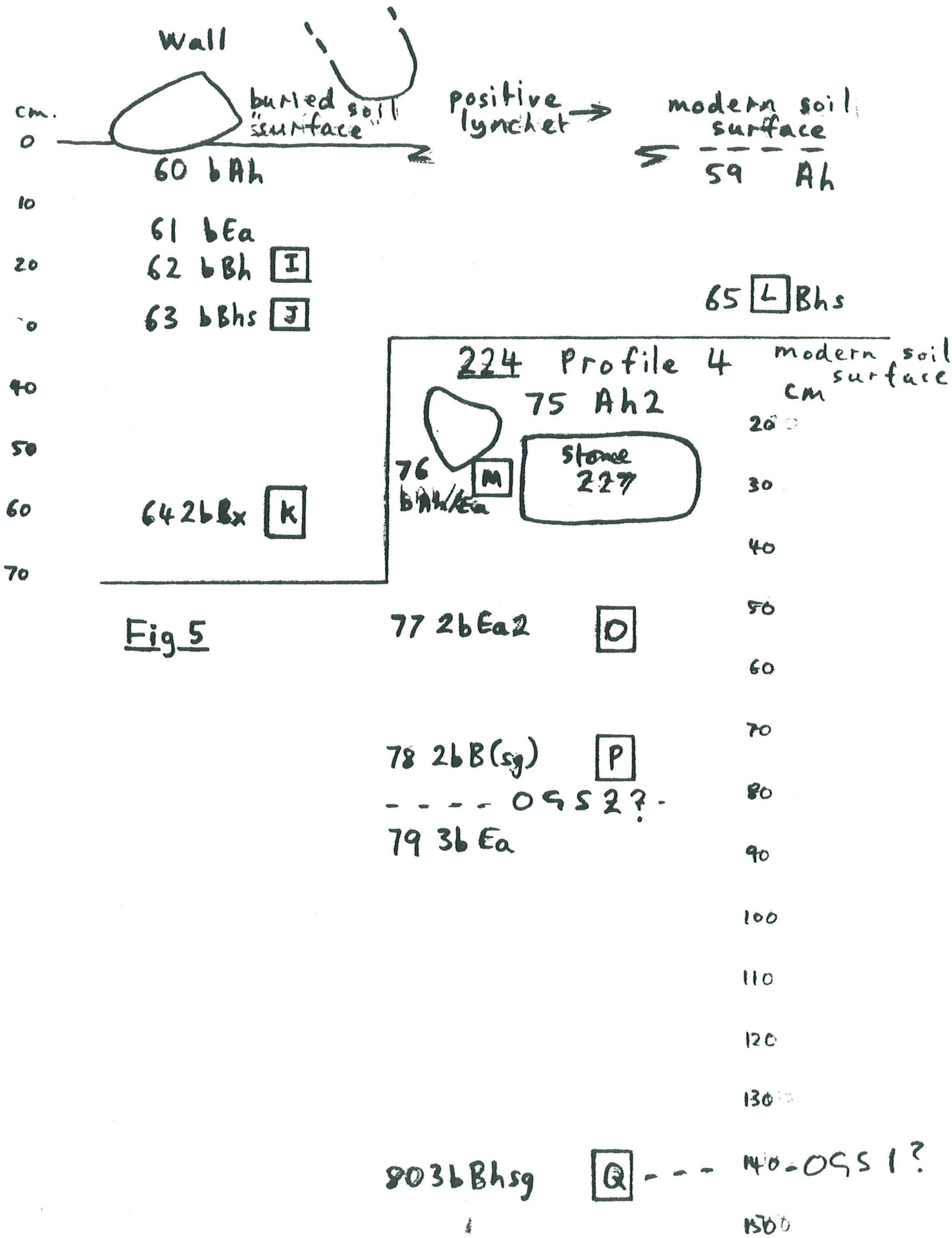


Fig 5

Fig 6

405 Profile 5

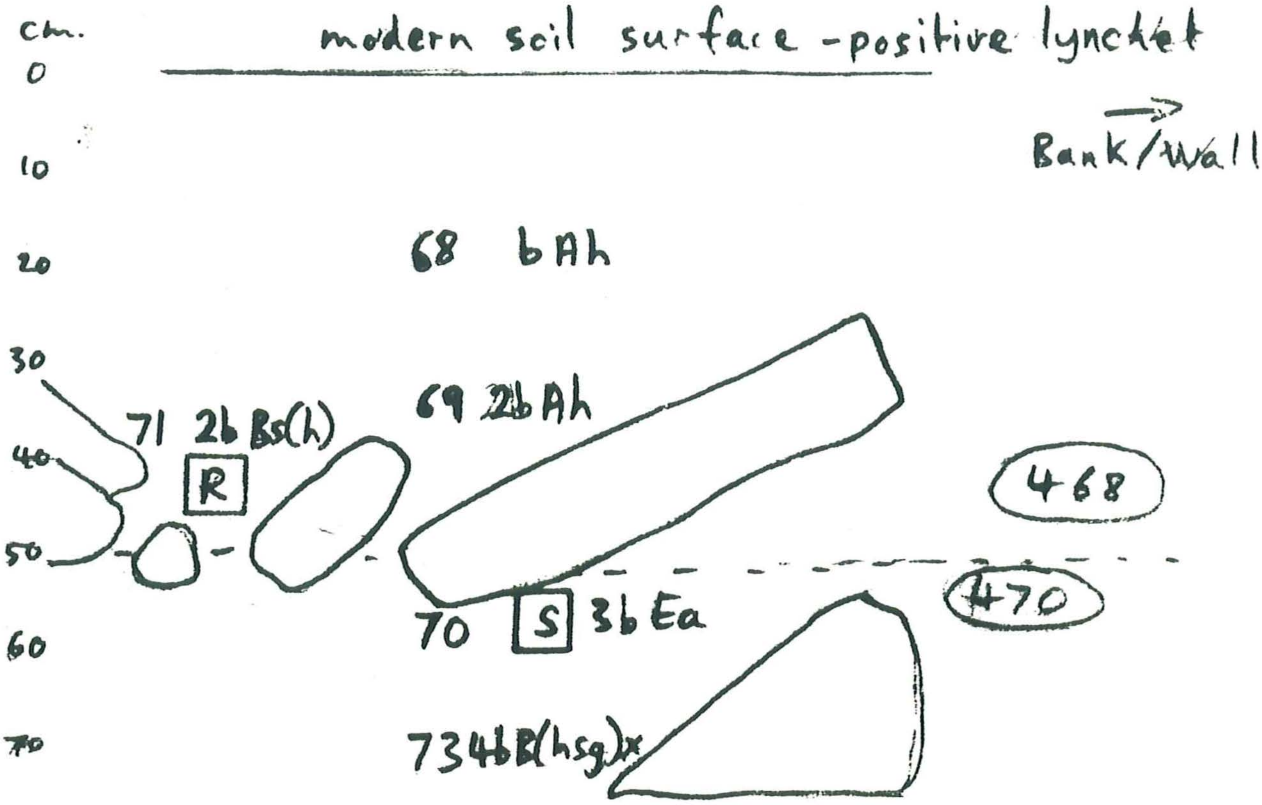


TABLE 1 CHYSAUSTER - GRAINSIZE

Site No		Clay	FZ	MZ	CZ	Silt	VFS	FS	MS	CS	VCS	Sand	(Gravel Pebbles)
CAIRN 527													Texture
Ah	40	11	5	10	29	44	12	7	11	10	6	46	(13) (6) SZL
bBf/Bhs	43	20	10	17	17	44	10	5	6	5	8	34	(16) (6) CL
bBs	44	19	14	13	15	42	14	6	5	5	7	37	(17) (12) CL
bB(gx)	45	10	13	23	20	56	11	6	5	5	6	34	(14) (19) SZL
bB(gx)	46	10	10	19	20	49	10	6	7	7	12	42	(21) (23) SZL
bB(g)x3	47	10	10	18	15	43	12	7	7	8	12	46	(18) (25) SZL
403													
Ah	48	10	12	7	10	29	29	8	12	7	5	61	SL
bEA	50	7	8	13	11	32	5	9	28	12	6	60	S
bBs(upper)	51	10	7	10	16	33	13	8	11	10	15	57	SL
3bB	55	10	7	11	24	42	21	6	7	8	6	48	SZL
4bB(x)	57	5	7	6	24	37	24	7	11	10	4	56	SL
Modern Bhs	53	10	5	11	15	31	38	5	7	6	3	59	SL
117													
bEA	61	7	7	12	12a	31	20	9	17	11	6	63	SL
bBh	62	10	8	9	18	35	12	9	13	12	9	55	SL
21	64	4	9	13	14	36	30	7	9	8	6	60	FSL
Modern Bh	65	5	6	11	16	33	16	9	14	13	10	62	SL
222 (terrace)													
Ah2	75	10	7	13	20	40	16	10	16	6	3	51	SL
Ah/Ea	76	1	18	8	16	42	23	12	10	7	5	57	FSL
2bEa2	77	10	6	9	17	32	18	13	16	6	5	58	SL
2bB(sg)	78	7	6	15	20	41	17	10	17	5	3	52	SL
3bEa	79	9	3	10	28	41	16	9	16	6	3	50	SL
3bBhsg	80	7	7	10	16	33	22	11	14	10	4	61	FSL

TABLE 2 Chemistry; Analytical Data (a); Organic Matter, Iron Aluminium and magnetic susceptibility (10-8Si Kg)

No Horizon	pH	Loss on Ignition	Org C.	Pyro C.	Ext Fe.	Al.	Dith. Ext Fe	N	C/N	Mag Sus.	Thin Section
527											
Modern soil											
40. Ah	4.5	-	3.9	1.0	0.08	0.10	0.14	0.10	39	4.3	
Buried soil											
41. bEa	-	-	1.9	0.3	0.08	0.14	0.03	0.04	47	3.68	A
42 bBg	-	-	-	-	-	-	-	-	-	-	A
43.bBf/Bhs	4.6	-	2.5	0.8	1.61	0.44	0.08	-	-	27.72	B/C
44.bBs	4.7	-	-	0.8	1.83	0.57	0.78	-	-	13.34	B/C
54. bB(gx)	4.8	-		-	0.6	0.77	0.42	-	-	-	D
46. bB(gx)2	4.9	-	-	-	-	-	-	-	-	6.3	E
47. bB(g)x3	4.9	-	-	-	-	-	-	-	-	6.3	F
403											
Modern soil											
4[illegible] Ah	4.3	-	6.6								
49. Ah/Bh	-	-	5.3								
53. Bhs	3.9	-	-								
54. Bhs2	-	-	-								
Buried soil											
50. bEa	4.5	-	2.6	1.3	0.20	0.13	0.04	0.21	12	-	
51. B(s) upper	4.7	-	-	1.0	1.51	0.38	0.51	-	-	6.4	G
52. B(s) lower	-	-	-	1.0	1.09	0.35	0.62	-	-	14.3	G

TABLE 2 Chemistry; Analytical Data (a); Organic Matter, Iron Aluminium and magnetic susceptibility (10-8Si Kg)

No Horizon 403 cont:-	pH	Loss on Ignition	Org C.	Pyro Ext C.	Fe.	Al.	Dith. Ext Fe	N	C/N	Mag Sus.	Thin Section
55. 3bB	4.6	-	-	0.8	0.53	0.25	0.80	-	-	12.3	
56. 3bAh?	-	-	-	-	-	-	-				
57. 4bB(x)	4.8	-	-	-	-	-	-	-	-	10.08	H
58. 4bBx2	-	-	-								
117											
Modern soil											
59. Ah	-	-	5.6								
65. Bhs	4.4	-									L
Buried soil											
60. bAH	-	-	6.0	0.7	0.07	0.12	0.02	0.19	32	4.7	
61. bEa	4.5	-	2.9	0.7	0.11	0.17	0.04	0.05	58	2.6	L
62. bBh	4.2	-	-	2.0	1.26	0.45	0.39	-	-	14.0	I
63. bBhs	-	-	-	-	-	-	-	-	-	10.8	J
64 2bBx	4.7	-	-	0.2	0.06	0.14	0.48	-	-	10.8	K
405											
Modern soil											
68. bAh	-	9.02	6.42	-	0.59	-	1.12	0.19	34	153.9	
69. 2bAh	-	7.87	5.72	-	0.65	-	1.09	0.18	32	73.1	
Buried dumped soil											
71. 2bBs(h)	-	6.60	4.21	-	0.26	-	0.66	0.15	27	32.4	R
Buried soil											
70. 3bEa	-	3.14	1.77	-	0.34	-	0.57	0.08	23	11.8	S

TABLE 2 Chemistry; Analytical Data (a); Organic Matter, Iron Aluminium and magnetic susceptibility (10-8Si Kg)

No Horizon 405 cont:-	pH	Loss on Ignition	Org C.	Pyro C.	Ext Fe.	Al.	Dith. Ext Fe	N	C/N	Mag Sus.	Thin Section
73. 4bB(hsg)x	-	4.75	1.83	-	0.63	-	1.24	0.09	19	18.3	
224											
Terrace soil											
75. Ah2	-	9.59	6.33	-	0.57	-	0.87	0.19	34	69.6	
76. bAh/Ea	-	6.39	4.34	-	0.58	-	0.73	0.16	26	31.5	M
77. 2bEa2	-	3.27	1.56	-	0.20	-	0.29	0.09	16	5.1	O
78. 2bB(sg)	-	6.61	4.68	-	0.50	-	0.66	-	-	5.1	P
Buried soil?											
79. 3bEa	-	3.62	2.19	-	0.20	-	0.38	0.09	25	6.1	
Buried soil											
80. 3bBhsg	-	8.20	4.11	-	0.61	-	1.27	0.11a	36	9.3	Q

NB. Data expressed as % ; Mag Sus in 10^{-8} Si Kg.

Sites 527, 403 and 117 (Dr Peter Loveland, Soil Survey of England and Wales)

Sites 405 ad 224 (Dr Sheila Ross, Bristol University).

TABLE 3 Chemistry; Analytical Data (b); Nutrients

No Horizon	% CaCo3	K*	Ca*	Mg*	Na*	H*	%	CEC*	Thin Section
527									
Modern soil									
40. Ah	-	.15	.21	.34	.16	1.4	37	2.3	
Buried soil									
41. bEa	-	.04	.01	.05	.07	.5	25	0.7	A
43. bBf/Bhs	-	.11	.17	.21	.18	.4	79	2.0	B/C
44. bBs	-	.11	.08	.14	.16	1.8	20	2.3	B/C
45. bB(gx)	-	.05	0.0	.05	.10	.9	19	1.1	D
403									
Buried soil									
50. bEa	-	.09	0.01	.06	.13	2.6	10	2.9	
51. bB(s) upper	-	.13	1.90	.40	.17	5.1	33	7.6	G
52. bB(s) lower	-	.06	0.0	.15	.15	2.6	12	3.0	G
55. 3bB	-	.06	0.0	.11	.11	1.7	15	2.0	
117									
Buried soil									
60. bAh	-	.10	0.01	.09	.15	2.3	12	2.6	
61. bEa	-	0.08	0.0	0.05	0.14	1.6	15	1.9	I
62. bBh	-	.14	0.02	.13	.32	8.2	6	8.8	I
64. 2bBx	-	.02	0.01	.02	.10	1.7	8	1.9	K
								CEC (less H^+)	
405									
Modern soil									
68. bAh	1.84	.21	.18	.22	.10			.71	
69. 2bAh	1.63	.15	.18	.23	.10			.66	

TABLE 3 Chemistry; Analytical Data (b); Nutrients

No Horizon	% $CaCo_3$	K*	Ca*	Mg*	Na*	H*	CEC*	Thin Section
405 cont:-								
Buried dumped soil								
71. 2bBs(h)	1.48	.08	.17	.19	.08		.52	R
Buried soil								
70. 3bEa	1.38	.12	.17	.17	.05		.51	S
73. 4bB(hsg)(x)	1.63	.08	.17	.18	.07		.50	
224								
Terrace soil								
75. Ah2a	1.43	.32	.17	.25	.20		.94	
76. bAh/Ea	1.68	.16	.17	.26	.10		.69	M
7[illegible]. 2bEa2	1.37	.18	.17	.14	.05		.54	O
78. 2bB(sg)	2.09	.09	.17	.27	.07		.60	P
Buried soil?								
79. 3bEa	1.03	.11	.17	.25	.05		.58	
Buried soil								
80. 3bBhsg	0.66	.38	.17	.17	.04		.76	Q

NG. *CEC me.e/100gm

Sites 527, 403 and 117 (Dr Peter Loveland, Soil Survey of England and Wales)

Sites 405 an 224 (Dr Sheila Ross, Bristol University).

Table 4 Suggested summary of environmental events at 527, the Cairn (soil evidence)

LATE DEVENSIAN				EARLY FLANDRIAN
"Continental Influence"		"Maritime Influence"		
Loess deposition	Early Zone II Freeze/thaw "Strong silt pans"	Zone III Periglacial disruption of Zone II features "Granules"	Early Zone IV Freeze/thaw "Weak silt pans"	? Argillic soil formation in patchy loess over relic periglacial granitic soils.

LATE FLANDRIAN			
? BRONZE AGE ?		BRONZE AGE	
? Primary clearance, erosion of loessial soil? Woodland regeneration	Moderately acid brown soil development in mainly weathered granitic soils.	Weak eathworm activity in acidifying brown soil. ?Secondary clearance, Cultivation; stubble burning? Burial by curbstones; cremations (coarse wood charcoal). Burial by cairn.	Hydromorphism in top few cm of buried soil; progressive podzolisation of buried soil through Cairn.

Table 5 Suggested environmental summaries based on 403, 117, 405 and 224 (soil evidence)

Horizon	Nature of deposit	Contemporary impact on site: Soil	Contemporary impact on site: Human	Post-burial effects	Interpretation
a) Site 403					
bEa	Dominantly relic subsoil colluvium	Podzol (leaching)	-	Illuvial contamination	Agricultural erosion of exposed relic subsoils in podzolising environment.
b Bs upper	"	(Illuviation)		"	"
2bAh	Localised ploughwash	Acid brown soil (rooting)	Burning and slaking	"	On site cultivation.
bBs lower	Dominantly relic subsoil colluvium	"	-	Weak illuvial contamination	Agricultural erosion of exposed relic subsoils in podzolising environment.
3bB	"	Acid brown soil	-	"	"
3bAh	Exposed relic subsoil	Podzol (leaching)	-	-	Erosion and podzolisation.
4bBx	"	(Illuviation and biological working)	Erosion	-	Relic Late Devensian soil effected by podzolisation
4bBx2	"	"	-	-	Weakly effected.

Table 5 cont'd

b) 117					
bAh	Strongly depleted colluvium	Podzol (leaching)	-	Weak illuvial contamination	Agricultural erosion of leached soils in podzolising environment.
bEa	" " with relic sub-soil fragments	(leaching)	Burning and slaking	-	On-site cultivation; and agricultural erosion of leached soils and exposed relic subsoils.
bBh	" "	(illuv-iation)	"	-	"
bBhs	" "	"	-	-	Agricultural erosion of leached soils and exposed relic subsoils.
2bBx	Exposed relic subsoil	Weak illuviation	-	-	Relic Late Devensian soil eroded and weakly effected by podzolisation.
c) 405					
bAh	Weathered colluvium	Podzol (leaching)	Cultivation ? burning	-	Agricultural erosion of podzols; probable on site "occupation" in podzolising environment.
2bAh	Weathered colluvium	"	"	-	"
2bBsh	Mixed dump of Ea, Bh and relic subsoil	-	Bank construc-tion, "local" burning and slaking	Illuviation	Near site cultivation.

Table 5 cont'd

3bEa	Depleted colluvium	(leaching)	Burning and slaking	Weak illuvial contamination	On site cultivation in podzolising environment.
4bB(hsg)x	Exposed relic subsoil	(Weak illuviation)	-	-	Relic Late Devensian soil eroded and weakly podzolised.
d) 224					
bAh	Weathered colluvium	Podzol (humic Ah and leaching)	Intense ? burning	-	Agricultural erosion of podzols in podzolising environment.
bAh/Ea	" "	"	-	Weak illuvial contamination.	"
2bEa2	" "	" with phase of soil amelior-ation (earthworms)	Burning and slaking	"	" on-site cultivation, local ?sheep herding.
2bB(sg)	" "	(leaching)	-	Illuvial contamination	Agricultural erosion of podzols in podsolising environment local ?sheep herding.
3bEa	" "	(leaching)	-	Minor illuvial contamination	Agricultural erosion of podzols.
3bBhsg	" " with relic "subsoil"	Humic Ah, leaching	Mixing	Illuvial contamination	Agricultural erosion of relic subsoil, podzolic colluviation and possible podzolising environment; 224 construction.

APPENDIX 1

SOIL PROFILE DESCRIPTION

Profile 1 (527) Plate 1 (528, Plate 2).

Cairn 38 (Bronze Age), East Soil Pit (527) under stone 524.

Soil type Ironpan stagnopodzol; Hexworthy Assoc.

(Findlay *et al* 1983), Trink Series (Staines, 1979).

Parent Material Granitic Head.

Altitude c.195m OD (see archaeol. report).

Slope 4° South (main valley); 6° West (tributary valley) - see Figs 1, 2 Site: receiving and shedding.

Vegetation Bracken.

Horizon, depth cms.

Ah (modern) 0-9	Black (5YR 2.5/1) weak sandy silt loam (Table 1); coarse blocky; few stones; very humose; abundant fine and medium roots running from cairn through cracks into the buried soil (strictly Ea downwards); clear, irregular boundary.
bEa 9-14	Reddish brown (5YR 4/3) very weak sandy silt loam; structureless; few stones; some humus staining in patches; few fine charcoal; sharp, irregular boundary.
bBg/Bf/Bhs 14-19	Discontinuous reddish brown (5YR 5/3) Bg of the overlying thin (0.6cm) black (5yr 2.5/1) Bf, merging into and mottling dark reddish brown (5YR 3/4) strong clay loam (Bhs); massive; few stones; broken, clear boundary.

bBsh 19-28	Dark reddish brown (5YR 3/3), with yellowish red (5YR 4/6) patches with old roots (see micro. C) strong to moderately firm, with depth, clay loam; massive; few stones, some large; rare coatings visible; gradual, wavy boundary.
bBs 28-33	Reddish brown (5YR 4/4) moderately weak sandy silt loam; weak coarse prisms; common stones; common coatings; clear, smooth boundary.
bB(gx) 33-48(51)	Brown (7.5YR 4/4) moderately weak sandy silt loam with narrow (4-5cms) patches of dark brown (7.5YR 3/2) "loam"; common fine stones; common coatings; clear, smooth boundary.
bB(gx)2 48(51)-62	Brown (7.5YR 4/4) very weak sandy silt loam; weak prisms; abundant fine stones; common coatings; clear, smooth boundary.
bB(g)x3 (bBsl) 62-71+	Strong brown (7.5YR 5/6) firm but brittle sandy silt loam; poor platy; abundant fine stones; coatings present; with narrow dark brown (7.5 YR 3/2) bands (see micromorphology).

Profile 2 (403) Plate 31

Bank 456, Section 53 Machine Trench 403

As Profile 1. approximates to Moor Gate, Series (Staines, 1979). Wall (Bank) and lynchet

Altitude c.190m OD. Slope 3°-4° S.W on positive linchet, negative lynhet 8°-6° S.W.

Site receiving and shedding. Vegetation Coarse grass.

Horizon, depth cms

c.71cm. of overburden (positive lynchet and bank).

bAh/Ea 0-(3)8	Dark grey to dark reddish grey (5YR 4/1-4/2) moderately weak sand (Table 1); few stones; poorly humose; relic root traces; clear, irregular boundary.
bBs(2bAh) (3)8-14(20)	Strong brown (7.5YR 4/6) becoming dark greyish brown (10YR 4/2) with depth, moderately weak sandy loam; moderately developed medium prisms; weakly humose; few stones; common medium relic root channels; discontinuous 1cm thick reddish brown (2bAh) - see micromorphology; relic earthworm channels; clear, irregular boundary.
3bB 14(20)-37	Brown (7.5YR 4/4) moderately weak sandy silt loam; poorly developed medium to coarse prisms; root free; rare coatings; sharp, smooth boundary.
3bAh?	Discontinuous very dark grey (10YRs 3/1) weak sandy loam; humose; common fine roots; relic earthworm channels; clear, smooth boundary.
4bB(x) 37(38)-54	Dark yellowish brown (10YR 4/4) moderately weak sandy loam; poor medium prisms; commmon stones; few fine roots; rare coatings; humic very dark grey (10YR 3/1) earthworm burrows; clear, wavy boundary.
4bBx2 54 +	Dark yellowish brown (10YR 4/4) weak sand; coarse prisms; abundant stones; common coatings.

Profile 3 (117) Plate 41.

Wall 123, Section 1, Trench 117 (c.100m upslope of 403).

As Profile 1 aproximates to Moor Gate Series (Staines 1979). Wall and lynchet.

Altitude c.198m OD. Slope 3° S.W. Site receiving and shedding.

Vegetation *Mollinia* grass and bracken.

Horizon, depth cm

C.50cm of overburden of wall and soil, thinning to 20cm of colluvium (modern Ah) often with sand lenses.

bAh 0-4	Black (5YR 2.5/1) moderately weak sandy loam (Table 1); medium subangular blocky; few stones; humose, common fine roots and medium bracken rhyzomes; clear, wavy boundary.
bEa 4-19	Grey (5YR 5/1) and reddish brown (5YR 4/3) moderately weak sandy loam; structureless; few stones; moderately humose; few fine roots; clear, smooth boundary.
bBh 19-24	Dark reddish brown (5YR 3/2) moderately weak to firm sandy loam; massive; many stones; humose; rare fine roots; clear, smooth boundary.
bBhs 24-49(70)	Reddish brown (5YR 5/8) with minor Bf (0.5cm) around pinkish grey (7.5YR 6/2) Bg pocket; weak massive sandy loam; few stones; humose in patches; rare fine roots; sharp, irregular boundary.
2bBx 49(70)-72	Brown (7.5YR 4/4) weakly cemented massive fine sandy loam; common stones; poorly humose; root-free; common fine coatings.
2bB/Cx 72+	Granitic Head.

Profile 4 (224) Plate 55

Trench 224, Section 17 (c. 50m downslope of 403).

As Profile 1 approximates to Moor Gate Series (Staines, 1979). Bank/?terrace?.

Altitude c.187m OD. Slope (in area) 4° S.W.

Vegetation coarse grass. Site receiving and shedding

Horizon, depth cm.

LF 4-0	Grass turf, abundant roots, bleached sand grains.
Ah 0-4	Very dark grey (5YR 3/1) moderately weak sandy loam (Table 1); medium to coarse subangular blocky; very few stones; humose; abundant fine roots; clear, smooth boundary.
Ah2 4-20	Dark brown (5YR 3/2) moderately weak sandy loam; coarse subangular blocky; very few stones; moderately to humose; common fine roots; gradual, smooth boundary.
bAh/Ea 20-46	Dark reddish brown (5YR 2.5/2) - more greyish when dry - becoming dark brown (7.5YR 3/2) with depth, weak fine sandy loam; coarse subangular blocky; abundant large stones; humose; few fine roots; rare charcoal; perhaps associated with stone line; gradual, smooth boundary.
2bEa2 46-67	Brown (7.5YR 4/2) very weak, structureless sandy loam; few large stones; poorly humose; few fine roots and root traces; rare charcoal; gradual, smooth boundary.

2bB(sg) Dark yellowish brown (10YR 3/4) weakly massive sandy loam; common large stones; humose?; root free; gradual, smooth boundary.

"Old Ground Surface"

3bEa Brown (7.5YR 4/2) moderately weak structureless sandy loam; abundant stones; weakly humose; root traces; clear, irregular boundary.

3bBhsg
106-(135) Strong brown (75YR 5/6) and dark reddish brown (5YR 3/4) firm to very firm fine sandy loam; massive; abundant stones; humose patches; root traces; few coatings; clear, irregular boundary.

3bBsgx Dark yellowish brown (10YR 4/6) with common sharp strong mottles; firm loamy sand; massive; cemented; common coatings.

Profile 5 (405) Plate 66.

Trench 405, Section 37

As Profile 1 approximates to Moor Gate Series (Staines, 1979). Slope 4 S.W. upslope, 6 S.W on negatie lynchet. Site receiving and shedding.

Vegetation Coarse grass, bracken.

Horizon, depth cms

L
1-0 Leaves, medium to coarse bracken, rhyzomes, bulbs etc.

Ah/Ea
0-0.5 Very dark grey (5YR 3/1) humic bleached sand; sharp, smooth boundary.

Ah2
0.5-12 Very dark grey (5YR 3/1) moderately weak sandy loam; moderately well developed medium to coarse blocky; humose; abundant fine roots, common medium to coarse bracken rhyzomes; gradual, smooth boundary.

bAh 12-30	Very dark grey (5YR 3/1) moderately weak sandy loam; coarse subangular blocky; few stones; very to moderately humose; common bracken and fine roots; gradual, smooth boundary.
2bAh 30-44(55)	Discontinuous very dark greyish brown (5YR 3/2) moderately weak sandy loam; coarse subangular blocky; few stones; moderately humose; comon bracken and fine roots; areas of Bs material; irregular, broken boundary.
2bBs(h) 46-59	Broken dark reddish brown (5YR 3/4) moderately firm massive sandy loam; abundant stones; poorly humose; rare fine roots; gradual, irregular boundary.

?Old Land Surface?

3bEa 44-70	Broken dark brown (7.5YR 3/2) (brown 7.5YR 4/2 when dry) moderately weak to modereately firm loamy sand; structureless; abundant stones; poorly humose; abundant fine root traces; clear, smooth and irregular boundary.
4bB(hsg)x 59-80+	Yellowish red (5YR 4/6) with very dark grey (5YR 3/1) zones and red (2.5YR 4/6) and reddish grey (5YR 5/2) mottles; very firm sandy loam; cemented; massive; common stones; fine root traces; clear, irregular into granite head.

Profile 6 (412) Plate 75

Trench 412, Wall 41, Hut Circle 497

As Profile 1 approximates to Hexworthy Series (Staines, 1979) 30m east of Cairn. Altitude c.198m OD. Slope 4^{o} N.W. into small valley. Site receiving and shedding. Vegetation Coarse grass and bracken.

Horizon, depth cms

LF 3-0	Turf top.
Ah 0-25	Black (5YR 2.5/1) very weak sandy dump of common stones; coarse blocky; very humose; abundant fine roots; gradual, wavy boundary.
? Old Ground	Suface
bEahg 25-28(36)	Very dark grey (5YR 3/1) and reddish brown (5YR 4/3) weak structureless loamy sand; few stones; humose; few fine roots; sharp or clear, irregular boundary.
bBf 28(36)- 28(36).5	Dusky red (5YR 3/2) and black (2.5YR 2.5/0) moderately strong; root mat; cemented; sharp, irregular boundary.
bBsg 28(36)-39	Broken brown (7.5YR 5/2) with common fine faint mottles; weak loamy sand; massive; few stones; poorly humose; coatings present; gradual, wavy boundary.
bBs(x) 39-51	Dark reddish brown (5YR 3/4) firm loamy sand; massive to relic prismatic; few stones; coatings present; gradual, wavy boundary.
bBx(g)2 51-69	Brown (7.5YR 4/4) moderately weak loamy sand; coarse prisms; common stones; few faint mottles; coatings present; gradual, wavy boundary.
bBx(g)3 69-86+	Brown (7.5YR 5/4-4/4) moderately firm loamy sand; massive with platy?; cemented; abundant stones; common coatings; iron pans present.

APPENDIX 2

Micromorphology at Chysauster - Descriptions and Interpretatons

Sample A Cairn 527, beneath stone 524, bEa horizon 9-14cms (Plates 3-7)

Structure: poorly developed medium to (with increasing depth) subangular blocky, partially accomodated within dense massive subangular blocky microstructure with minor vughy. Porosity: 15-20%, very low porosity in places; very dominant very fine to fine vughs, generally rough edge; some smooth with textural coatings; few short fine channel, frequent coarse "artefactual" cracks for structure.

Mineral: Coarse: Fine limit 10um. C:F 85: 15. Common small stone size to sand size granite fragments - comprising dominant plagioclase? feldspar, common quartz, frequent biotite and few hornblende. Plagioclase feldspar displaying alteration probably to kaolinite - dirty brown amorphous areas. Dominant medium to very coarse sand-size granite rock fragment, quartz; few fine micas, hornblende - dominantly angular. Very dominant silt and very fine sand size sub-rounded to subangular quartz and feldspar. Many phytoliths present in top.

Fine: In upper soil. Very dominant dirty grey to pale brownish (PPL) brownish (organic) PL, bright brownish (OIL); moderately poor birefringence. Very pale brown (OIL); very poor birefringence.

Organic: Coarse, no fresh roots, occasional fine size charred/charcoal fragments; "blackened" and brown lignified roots; many very fine and silt size charred/charcoal, possibly more in top 4 cms.

Fine: many fine plant fragments, mainly charred or as charcoal - possibly much grass type. In top 2-3 cms very fine brown amorphous organic matter intimately mixed with fine mineral fabric - but generally low amounts, probably pollen of *Corylus* and *Polypodium* seen under U.V. light. In lower half of slide biologically (faunal tubules, passage features etc) worked "pellety" brownish, amorphous organic matter and mineral fabric frequently worked into paler mineral soil. Organic matter seems poorly humified.

Groundmass: close porphyric; low birefringent b-fabric, speckled; dense silt size, coarse mineral fabric.

Pedofeatures

Excrements: In lower slide many mineral bow-like mineral excremental infillings of biopores; eg. 1.2mm across 2.5mm long; loose continuous, contains a micro-concentration of charred organic matter - possibly from upper soil - probably earthworm. Rare thin rounded organo-mineral excrements. In areas of organic fine fabric abundant moderately thin, brownish. *Oribatid*? excrements - both porous and dense. Relic earthworm, recent *Oribatid*.

Textural: Occasional unoriented silt and clay mineral capping. (Relic freeze/thaw feature). In top 3-4cms many poorly birefringent, dirty brown, very dusty void coatings - commonly crescent; somewhat opaque - acid attack? Coatings continue through slide - becoming far less frequent with depth also although still brown, are less blackened and less dirty looking and rather more birefringent - therefore less affected by "acid attack". In top most voids have coatings. In addition some translocated material has been worked into the fine fabric as "papules". In lower part of slide coatings of essentially the same translocated material ie, clay and many fine silt size micro-contrasted particles. These apparently post date both course faunal mixing and inclusion of organic fabric. Top part of soil apparently physically disrupted and slaked.

Depletion: Common depletion of particularly iron from much of upper part of slide, especialy from plasma and some coating edges. Lower part of slide less affected.

Amorphous: Common amorphous iron associated with weathering granite. Few diffuse edge impregnative nodules, dominantly associated with textural coatings (and porosity) in upper part of slide; less frequent down profile: ferro-mangniferous in character.

Fabric: Few coarse faunal passage features in lower slide (see excrements). Top of slide dense fabric and vughs and coatings - slaked? Homogenised?

Interpretation: bEa horizon investigated lays beneath a very large orthostat which has sunk (1-2cms)into the ground. The sample is not particularly well-sealed and the actual surface horizon is possibly missing, ie the top few (c.1-3)cms.

The thin section can be divided up into two main parts. An upper 2-3cms and lower 3cms. The upper part is more dense, more depleted (also with amorphous nodular material), is less obviously organic although containing much fine charcoal and few phytoliths, and has a vughy porosity with commonly degraded (leached) very dusty clay coatings. (Plates 3-5). This upper horizon is interpreted as a surface soil zone slaked by water after being disrupted by one or two phases of cultivation - the shallow depth effected suggesting hoeing. The soil contains much burned organic matter and a concentration of phytoliths probably as a result of the cultivation, whereas wood charcoal from the cremations apparently only occurs within the kerbstone, thus post-dating this arable activity (Smith, pers comm.)

The lower part has been primarily affected by inwash of very dusty clay from above. It has also been rather less affected by leaching and gleying. It features much more faunal activity, and the mixing of only moderately humified organic matter (rather acid) with the mineral, moderately leached, soil. The organic fabrics have recent excrements (Plates 6-7) - possibly of Oribitid mites - whereas the soil seems worked by much larger fauna - probably earthworms (see Plates 11-12). The large faunal burrow infills contain the moderately acid humus and burned/charred wood and other organic matter. The dusty coatings post date all this. Acid leaching with gleying, in part post date all the fabric and are probably of post burial date. The fabric may have been somewhat leached prior to the cremations, and building of the Cairn.
One scenario could be:

1) General acidifying (acid brown soil) soil, under forest/woodland (presence of tree fern (Polypodium) pollen); earthworm population still present, but probably not abundant as passage features clear, rather than a total excremental fabric.

2) Probable secondary clearance (see C) and use of clearing for more than one phase of cultivation (hoeing ?). Arable cultivation practices produced dusty clay coatings and topsoil rich in phytoliths (indicating a Graminae/cereal? vegetation) and fine charred organic matter. This activity probably accelerated a decline in earthworms although a few still remained to work charcoal (from clearance ?) from the surface into the the soil.

3) Emplacement of curbstones for cairn (followed by central cremations); stone No 524 "physically" protected the upper soil level, but did cause a local change in the water table, affecting the uppermost buried soil horizons.

4) The cairn produced imperfect sealing conditions, and the topsoil (slaked) especially suffered from hydromorphism (gleying) and acid leaching from the acid moorland vegetation which eventually developed on the cairn; and penetration by Oribatid and other acidophyle fauna to contaminate this horizon and other parts of the upper soil.

Sample B

Cairn 527 bBhfs 17-30 cms (Plates 8-14)

Structure moderately well developed medium subangular blocky with fine blocky; common fine crumb in coarse faunal channels. Blocky/crumb microstructure. Porosity 30% generally; worked areas 45%; dense areas 15%. Very dominant very coarse to fine moderately rough edged channels; few fine smooth walled channels and vughs intrapedal.

Mineral C/F : 60:40. Few medium (1.5-2cm) and very fine (.5cm) stones of granite fragments. As above (bEa) weathering plagioclase feldspars, fewer micas and quartz. Frequent coarse, medium and fine size angular quartz and granite fragments. Dominant silt and very fine sand size quarts, feldspar and mica. Fine a) Common pale brown (PPL), pale orange (RL), moderately low birefringence; b) Common as (a) but very pale orange (RL). Both speckled. c) Very few - included in (a) and (b) very fine areas, pale yellowish brown (PPL), dull pale orange (RL), high birefringent, limpid - textural inclusion. Fine fabric generally "finely lumpy" "micro-pellety"?

Organic: Coarse: rare lignified, and somtimes ferruginised plant fragments; rare charcoal. Fine: generally rare, occasional amorphous organic matter in mineral "excrements". Absence of fine charcoal.

Groundmass: Close porphyric; speckled birefringent fabric generally.

Pedofeatures: Excrements very abundant mineral excrements infilling coarse channels - producing open fine crumb structure; many coarse occasional moderately thin, coarse passage features; more recent excrements. Textural: rare thin dusty clay void coatings in upper part of slide. Occasional relic silt and clay mineral cappings - not oriented in soil. Also occasional fine fabric inclusion (c) - yellowish, high birefringence, often finely laminated, limpid or dusty clay - interpreted as relic - as part of silt and clay capping sand laminae which have been subsequently broken up.

Amorphous: occasional clear ferruginous impregnation of organic matter. Very thin (50um) iron staining of some granite rock fragments. Very abundant sesquioxidic impregnation of fine fabric; and some excrements.

Fabric: See above. Also some integraton of coarse silty coatings into fabric. Often fine soil without coarse material around channels - no textural birefringence obvious though to suggest inwash - possibly some old faunal working.

Interpretation: Predominantly upper podzolic brown soil fabric, (Plates 8-10), once with quite high biological activity by earthworms (Plates 11-12) which was probably already declining at time of occupation now replaced by acidophyle fauna. Some sesquioxidic impregnation and possible incipient "pellety" formation, with even fine fabric having a "lumpy fabric". A previous cryogenic fabric of clay and silt pans and cappings has been thoroughly worked into the fabric (Plates 13-14), as relic laminated clay inclusions, and stone capping. Some iron has moved as evidence of minor hydromorphism - lining some mineral grains. Some relic features weathered and reworked, but many only rotated, which is rather surprising at this shallow depth (see Sample C).

Sample C

527 Bhs (below Bh) 28-34.5cm. (Plates 15-19).

Structure: coarse subangular blocky, with fine subangular blocky, massive microstructure within coarse structures.

Porosity: 10% within coarse structures, very dominant fine smooth walled channels; 20% in area of fine blocky, dominant fine channels and interconnected vughs, moderately smooth walled.

Mineral: C:F 50-50/40:60 Coarse - as above, but most coarse grains are not coated (ie well biologically worked), whereas those which are coated, have a silty coating in contrast to the finer character of the matrix. Fine pale to dark orange brown, frequent speckles (PPL), pale orange (RL), medium birefringence.

Organic Matter: Coarse: very few charcoal and plant fragments - some included plant fragments ferruginised. Fine generally rare; many in places of darker fabric. Some amorphous organic impregnation? Groundmass; porphyric, speckled with weak grano-striate birefringence fabric.

Pedofeatures: Excrements had history of intensive biological working; common mixing-in of relic coatings and other features; subsequently occasional loose mineral excremental infills - probably earthworm working, quite extensive. Relic fine blocky are quite spongey, possible ex-near surface excremental fabric.

Textural: rare fine, moderately limpid clay coatings relic and unoriented in loose matrix. Occasional, but many in some parts of the slide very dusty (fine matrix), thin (10-20um thick) coatings and infills, and related intercalations; and occasional - abundant - in places, fine soil infills (40um thick) between silty soil matrix. Suggesting primary soil disruption followed by clay translocation. Amorphous where darker fabric, possibly more organic part, rather abundant amorphous sesquioxidic impregnation, especially of relic "surface" fabric. (Subsoil, less organic fabric, which underwent most slaking, least impregnated).

Fabric: Very abundant mixing of soil materials; old excremental A, and relic B(t), whereas other areas have dense intercalated, within-soil mass-movement fabric; all juxtaposed to the more coarse "granitic" soil.

Interpretation: This generally loamy Bhs material was noticed as brown patches within the more sandy buried soil. The loam is probably of a loessial origin (see 2A), occuring as patches worked into the granitic head or as a localised cover loam. The presence of it here, has to be interpreted. It contains evidence of once having a very minor B(t) subsoil fabric relating to a forest vegetation, and a nearer surface (biologically worked; Plate 19) fabric; all of which have been disrupted causing within-soil mass movement (Plates 15-18) - the coatings and infills of which are properly oriented - and few later clay coatings perhaps originating from the cultivation phase. The presence of fragments of this material would support this conjecture. The more common sandy granitic soil is less liable to clay translocation, and only shows very little evidence of disturbance in general. The overlying and juxtaposed Bh horizon contains far more relic periglacial features, included coated stones and coarse grains in comparison to this Bhs horizon (although coated grains do occur as inclusions), which suggests that material here has been more weathered and biologically worked. It is therefore possible that the site had some sort of patchy loessial cover, common on the granite in Cornwall (see 2A) and that a weakly formed argillic soil developed in it. However, something caused the mixing of fragments of it into the mainly sandy "soliflucted" soil - the disruption causing some mixing with the surrounding sandy soil, and internal mass-movement. The rest of the loessial cover seems to have been lost by minor erosion or very discontinuous because little is visible in the present buried Ea or Bh horizons above (see Samples A and B).

Sample D

Cairn 527

B(gx) 40-52cms (Plates 20-21).

Structure: weakly developed coarse prism or massive; mainly massive microstructure. Porosity Upper c.6cms 15-20% lower 7cms 5-10%. In upper; very dominant very coarse moderately rough edge channels, common fine intrapedal vughs. Coarse porosity of faunal origin. In lower; very dominant fine vughs.

Mineral C:F In upper 80:20. Coarse: few small stone size granite fragments, few fine sand size angular quartz, feldspar, granite fragments. Very dominant silt and very fine sand size (as coarser) with mica. Few nodules and rounded soil fragments. In lower C:F 85-15.

Fine moderatley low birefringence, very speckled pale brown (PPL), orange (RL) throughout. Variations in fine; see textural.

Organic: Coarse: few organic fragments, both amorphous root fragments and charcoal mainly confined to faunal channel fills and re-worked soil. Fine occasional to many amorphous material in faunal fabric especially in upper slide. Generally occasional organic matter. Groundmass: very dense porphyric, very speckled birefringent fabric.

Pedofeatures: Excrements: In upper part; common coarse passage features and loose mineral excrement channel infills. 30% of upper zone have obvious faunal worked character, commonly along old root channels. Textural: many silt and clay stone and sand capping; about half are right way up. Others are unoriented stones with all around rounded "capping" and "pendant" material. Occasional little disturbed band silt and clay fragments throughout. Whole soil fabric very dense, massive, like minor ageing of silt pan fabric, becoming compacted. Amorphous whole fabric moderately ferruginous.

Interpretation: This subsoil horizon is mainly characterised by silt pan and coating formation through periglacial freezing and thawing. The fabric is generally compacted and massive with very little porosity. It is a relic fragipan. The silt pan formation is generally weak - ie no strong pans, - although cappings are quite well developed. Whether the date for this formation is Zone II or Zone IV will have to be discussed. Much of the upper part of the slide and some lower parts have been biologically turbated (Plates 20-21), in part by earthworms.

Sample E

Cairn 527 B(gx)2, 58-63cms (Plates 22-25).

Structure: Massive, massive microstructure with compact grain and aggregate structure, relic platy. Porosity 25% dominant complex packing voids; frequent fine vughs and channels - moderately smooth walls.

Mineral: C:F 90:10 Coarse: Common large to small, subrounded, stone-size granite. Commonly coarse sandy angular-subangular granite fragments, quartz and feldspar - with few mica, hornblende. Dominant silt size quartz and feldspar. Fine: Coatings and granules etc dirty dark brown, very speckled (PPL), orange (RL) moderately low birefringence. Fine material absent from some areas.

Organic: occasional fine amorphous organic matter - (not present in rare coarse (silty) fabric). Groundmass: common single grain fine sand/silt (monic), no fine fabric. Dominant dense porphyric, speckled birefringent fabric.

Pedofeatures: Excrements rare biological penetration.

Textural: Textural features dominate fabric. Common well developed silt and clay cappings - poorly formed pendants only; cappings sometimes include earlier finer phase. Common granules, rounded and semi-orientated across slide (broken silt pans) associated with poorly continuous silt pans - moderately well formed. These capped "stones", granules and pan elements separated by common "clean" silt size material, eg quartz. Some pans, caps etc have dusty clay and finely dusty clay void coatings and total infills associated with them, semi-continuous birefringence. Depletion the clean silt infills are free of iron. Amorphous weak ferruginous staining of all fine fabric. Fabric generally disturbed fabric. Mineral cappings appear in situ but link cappings or silt pans have been broken up into rounded granules separated by clean silt. As evidence of biological activity is scarce at this level, the probable agency is periglacial.

Interpretation: In this rather deep subsoil horizon little biological activity is evident. The fabric is dominated by periglacial (freeze/thaw) textural features - silt and clay mineral caps, and silt and clay granules. The latter derive from disruption of a previously developed silt pan or link capping (Plates 22-25). The large mineral grains with their silt caps however seem little rotated. Possibly two phases of activity can be recognised. The fabric differs very much from the strongly developed continuous silt pans identified in a subsoil at Hengistbury Head, Dorset, which was dated to Zone III/II (Macphail, 1985).

Sample F

Cairn 527 bB(g)x3 63-68cms (Plates 26-30)

Structure: Massive, a) generally massive microstructure, with b) platy in top 1cm (63-64cm), and c) subangular blocky in bottom 2-3cms.

Porosity: Platy part: 30% dominant poorly formed planes between platy separations, - generally moderately rough edged; also has general vughy porosity associated with these planes. Massive area: 10-15%; dominant fine channels, moderately rough edge; common vughs. Subangular blocky: 30%; dominant fine and very fine moderately smoooth edge channels; common complex packing porosity for fine subangular blocky elements. Mineral: Similar C:F 80:20 in areas (a) and (b). Composition coarse and fine as in B(x) above. Area (c) C:F 40:60. Coarse: moderately sorted; very dominant silt-size quartz and plagioclase with frequent moderately weathered mica. Grains are subangular to angular. Frequent sand-size material, very few very coarse sand and stone-size material. Fine brown, lightly speckled (PPL); pale brownish orange (OIL); moderately low birefringence. Also contains very few fine fragments of bright reddish brown (PPL); orange (OIL); very low birefringence. In both, "clay" fabric undifferientiated b-fabric, but included very fine mica produce minor birefringence - "form birefringence".

Organic: Coarse: rare organic fragments and possible charcoal; occasional fungal bodies throughout. Fine occasional in (a) and (b) soils. In (c) rare. Groundmass (a) and (b) as in Bt; (c) open porphyric, form birefringence, plasma isotropic, with birefringence micas etc.

Pedofeatures: Excrements: Cambic B? Textural: In (c) many biological channels and excremental fabric 62-63cm very dominant silt droplet, link capping fabric, semi-continuous (ie little broken-up) moderately strongly formed, generally narrow (100um) on top of platy structures of coarser silt droplet material. Associated linked mineral caps. Minor granular separation also. In massive, 63-64(65)cm compacted poorly formed platy/silt droplet - no separation; dominates fabric. Amorphous: Minor probably sesquioxidic impregnation of (a) and (b); area (c) has general ferruginous character. Fabric: Soil contains two justaposed fabrics ie the coarse mineral periglacial fabric above and the silty clay fabric below.

Interpretation: Looks as though the periglacial deposit has buried (Plates 26-30) this brown silt and clay material (seen in field as dark bB' horizon patches within the lower subsoil periglacial horizons). However, the brown fabric is interpretated as Late Devesian granitic deposit, which has been affected by Flandrian groundwater. The latter brought in colloidal organic matter and iron, giving it this brown appearance. When the sample was air-dried this material shrunk considerably more than the local subsoil giving it an artificial structure. (I am grateful to John C C Romans for clarifying this confusing feature).

Overall interpretation of soil buried beneath Cairn at 527

This is the fullest soil sequence present at Chysauster. It contains weathered soliflucted/gelifluncted granitic deposits at depth forming a fragipan. As it is strongly developed, this is probably a Zone II fragipan which has been broken up by Zone III periglacial activity. The weaker but continuous fragipan at depth is probably of Zone IV orgin. There is also evidence from sample C that there may have been a patchy loessial surface soil cover which in part was incorporated into the soil, perhaps by tree-throw, whereas any surface material was eroded off or homogenised. The loessial fabric demonstrates brown argillic soil formation (compare Carn Brae, Macphail in preparation). As such horizons as the Bh and B(gx) horizons, which are within 50cms of the soil surface, are only moderately biologicaly reworked, it suggests that any erosion phase may have occurred quite late in pre-history.

There is pollen evidence (in situ pollen - see Scaife for soil pollen analysis) that (a presumably regenerated) woodland was present on an acidifying, but still worm-worked brown soil at the time the clearing was being cultivated. Large amounts of rather fine charcoal and phytoliths were worked into the surface soil possibly by hoe cultivation as the clay coatings are concentrated in the first few cms. Earthworms which were in low numbers because of soil acidity carried fine charcoal into the lower part of the Ea and into B(gx) horizon. The emplacement of the curbstone allowed physical preservation of the soil but encouraged hydromorphism around the stone's base. Through time an acid vegetation invaded the area and leachates moderately podzolised the soil, and acidophyle soil fauna penetrated through the loose cairn into the upper horizons of the buried soil.

403

Sample G bB(s); upper bB(s); upper 2bAh; 2bB(s) lower 9-22cms; 9-15cms; 15-16.75cms; 16.75cm (Plates 32-38).

Structure: Generally massive, with very weak coarse subangular blocky composed of fine subangular blocky; also relic granules. Dominant vughy and channel microstructure, with relic granular and platy microstructure. Porosity: 30% in upper strongly biologically worked upper part, to 15-20% in less well worked lower part. Dominant fine to medium rough edge vughs and channels; frequent complex packing voids in some loose areas. Mineral: C:F 70:30, 80:20 in lower part. Coarse as Ea/Bh, Bh/Bs of 117; micas etc less weathered. Fine a) very dominant palish dirty brown (rather more pale with depth), very speckled (PPL); brownish orange (OIL) - more pale with depth; generally low birefringence: b) few inclusions, rounded, of brown, lightly speckled and dotted (PPL); bright orange to orange-red (OIL); moderately low birefringence. Within (a) two types where biologically worked even lower birefringence. Also part of (a) granules and relic caps have moderate birefringence.

Organic: Coarse occasional in situ roots and root fragments in channels commonly ferruginised; rare fungal sclerotia, "black rings", and charcoal. Fine generally rare in a), but where biologically worked many fine fragments and amorphous material. In (b) abundant amorphous, possibly polymorphic organic matter.

Groundmass: a) porphyric, speckled b-fabric only not undifferentiated because contain fine mineral inclusions in predominantly organic fabric.

Pedofeatures: Excrements; abundant biological working and perforation of upper slide decreasing to many lower down. In root channels rare very thin Mite organic excrements; abundant moderately thin to thin porous, organo-mineral excrements - possibly Enchytraeids. Occasional broad and very broad burrows with porous organo-mineral excrements, minor discontinuous bow-like infills - probable earthworm. Textural: very abundant silt caps (fewer pendants) on mineral grains; some rotation; occasional very coarse (4mm) and smaller relic silt (and fine sand, and clay coatings included) granules. Very strongly perforated relic link capping fabric. Amorphous; very abundant sesquioxidic impregnation of fine fabric, especially fine mineral cappings, ferruginisation of roots. Impregnation rather greater in upper part, where fine fabric (b) is a polymorphic inclusion. Fabric: Zone of dark soil almost 1cm thick, extending over 1cm laterally. Upper part is dense, like a pan, the lower part has been biologically worked. It differs greatly from the rest of the slide. Fine fabric (c) brown to very dark brown, blackish, extremely speckled (PPL); brown to very dark brown blackish (OIL); low birefringence. Contains very abundant fine charcoal and charred organic matter. Top part of this zone comprises a very dense dark zone (100-150um thick), full of charcoal - it is extremely dusty. It is succeeded by a maximimum of 0.5cm dusty clay (with frequent silt) fine fabric.

Interpretation: The slide can be divided into two parts; as possibly related to a crack feature. A lower part comprised a colluvial "subsoil" relic weakly formed silt droplet (link capping) fabric - silt caps, granules etc all moderately to strongly perforated and worked by roots and fauna (Plates 37-38). This horizon blends in with similar soil material above (Plates 32-33), but is in part separated by an "Ah/Ap", charcoal rich layer (Plates 34-36), which is dense and resembles a "colluvial" ploughsoil pan - as indicated by large quantities of clay here. Burying this is a horizon, in character quite similar to the 2bB(s)2 horizon but in addition containing few fragments of soil - such as Bhs horizon material (fabric b) - from upslope to form a lynchet of some kind.

The whole soil has been biologically perforated, and affected by sesquioxidic impregnation as the soil podzolised.

Sample H

403 4bB(x) 45-53cm. (Plates 39-40).

Structure: massive; massive microstructure, with underlying weak granular, with channel/vughy. Porosity: 25% very domnant fine to medium rough edge channels and vughs.

Mineral: As 2bB(x) of 117; also very few (fragments) of type (b) fabric which is bright brown, coarse weakly dotted; dark brown (OIL); low birefringent; and comprises finely fragmented pseudosand "clay" pellets. Fragments about 1mm in size.

Organic: Coarse: rare roots; fungal sclerotia, other bodies. Fine: occasional fine fragments of amorphous organic matter.

Groundmass: As B(t) of 117; fabric (b), densely porphyric, speckled birefringent fabric.

Pedofeatures: Textural: At base of slide poorly developed broad (1mm thick) link cappings, little perforated by biological activity. Very abundant granules and broken more strongly formed link cappings/pans, rather narrow ($<$ 100um); also silt caps. Associated with the latter relic features are rare void very dusty clay and dusty clay infills - moderately birefringent with clear extinction patterns. Amorphous: abundant weak probable sesquioxidic impregnation especially finer textural features. Depletion: Possible depletion of iron from loose fabric around textural features. Excrements: Occasional thin dissagregating organo-mineral excrements in root channels.

Interpretation: In this subsoil horizon, weakly affected by podzolisation probably two phases of "silt droplet" formation can be recognised. The first phase of finely divided moderately well developed link cappings (pans) and mineral silt caps and pendants could date to Zone II (see Discussion). These were broken up during Zone III and silt granules formed. The weakly developed broad pans

(Plates 39-40) noted probably relate to Zone IV formation (see Discussion).

Overall interpretation at 403

Sample H at c.50cms represents the in situ fragipan subsoil relatively close to the palaeo-surface, even while much of the upper part of the soil (Sample G) is of colluvial origin. This indicates that mainly subsoil (Bx) elements were being colluviated downslope onto a soil already deeply eroded as far as this fragipan. Colluviation was accompanied by a burning and slaking phase to produce the 2bAh pan of fine charcoal. The colluvium above contains only few fragments of podzolic Bh/Bhs fabric, but this shows that polzolisation was well developed at Chysauster at this time. Prior to burial and increased colluvial accumulation into a positive lynchet, the soil was podzolised in situ.

117

Sample I bEa/Bh Bh upper. 17-22cm. (Plates 42-45).

Structure: massive, massive (very minor vughy) microstructure. Porosity: In upper part, some areas 20%, elsewhere generally 5-10%. Common fine rough edge channels fine rough edge vughs; some of both smooth-walled; few complex packing voids.

Mineral: C:F 75:25 Coarse: As usual very poorly sorted. Common small stone size to coarse sand size granite fragments; generally angular; common fine, sand size granite, quartz and plagioclase feldspar common very fine sand size and silt size (as described); few mica, but here generally quite weathered, splitting and browning. Fine upper area; darkish brown, speckled (PPL), palish brown (OIL), very low birefringence (included fine mineral). Generally; reddish brown, weakly dotted (PPL); bright brown (OIL), very low birefringence (by virtue of included fine material) - finest material is non-birefringent. At high magnification the upper fine material is much thinner.

Organic: Coarse: Occasional ferruginised roots; many fine charcoal fragments rare "bright rings" (see 2E). Fine dominating fine fabric; in upper part polymorphic amorphous organic matter dominates in lower part dominantly dense amorphous (underlying fabric character is polymorphic) organic matter. Few open polymorphic areas (top "Ea" part more open, a bit depleted of sesquioxides - probably more biologically active). Groundmass: in "Ea" open porphyric, speckled to undifferentiated b-fabric; in "Bh" ditto, but more dense porphyric.

Pedofeatures: Excrements polymorphic fabric in "Ea" generally excremental; coallescing excrements; also abundant loose channel infils of very thin possibly aged Oribatid Mite excrements; in Bh many channel fills as in Ea, also fresher clusters of ellipsoidal, reddish brown Oribatib Mite droppings present. Textural many relic silt caps on mineral grains (rotated). In Bh abundant very poorly birefringent (possible) fragments of coatings, infills and possible intercalations of dark reddish brown (PPL), blackish brown (OIL), very low birefringent, with diffuse to absent extinction zones. Coatings in approximate bands, broken up (material is not relic silt pan because fragments of this latter, in contrast are more pale, more birefringent, and more silty). The "clay" coatings although containing many silt size quartz and mica are comprised of "organic" particles, fine charcoal, the whole impregnated with amorphous sesquioxides. Coatings are apparently right way up, and some void infills contain more strongly birefringent bands. Looks like some slaking episodes of Bh material, with moderate breaking up of these features. Very dense fabric overall, "porosity" all infilled with these fine textural features, few open porosity with coatings. Depletion probable sesquioxide depletion of "Ea" part, producing rather less dark brown, thin fabric. Amorphous: Generally whole fine fabric impregnated with sesquioxidic material. In Ea this is weak; very strong impregnation of textural features; basic organo-sesquioxidic fabric of Bh. Fabric generally dense fabric in Bh part; some evidence of heterogeneity of more poorly impregnated material; also occasional fragments of less weathered "subsoil" with more birefringent groundmass.

Interpretation: The upper part of the slide ("Ea") is somewhat depleted although the fabric is still polymorphic. The main part is rather dense mineral and polymorphic Bh, but with evidence of slaking and mixing of soil materials (Plates 42-45). The situation is possibly part of a lynchet and may relate to cultivation mobilising soil material, soil movement downslope and overall mixing. A number of "subsoil" fragments appear "foreign". The general sesquioxidic staining and Bh character cultivation of a podzol soil.

Sample J

117 bBh/Bs 25-30cms (Plates 46-48).

Structure: moderately well developed medium subangular blocky, with fine subangular blocky interpeds; subangular blocky microstructure.

Porosity 25-30%; very dominant poorly accommodated cracks, generally fine around peds; frequent very fine channels within peds. Mineral: Rather low amounts of mineral compared with organic. C:F 30:70 (but fine is predominantly organo-). Coarse dominant silt size quartz, feldspar, with mica common fine, medium, coarse and very coarse mineral; few small stone size. Therefore moderately well sorted. Fine: Several types: a) dominant (strongly organic) reddish brown, weakly dotted (PPL), brown to dark brown (OIL), generally non birefringent except for fine inclusions. b) Few pale brown more speckled than dotted (PPL) (moderately organic), pale brownish orange (OIL), very low to moderately low birefringence. c) few darkish yellow, speckled (PPL) (mainly mineral), pale orange (OIL), moderate birefringence. In fine fabric (b) and (c) are soil fragments set in (a).

Organic: Coarse: occasional ferruginised roots; rare charcoal. Fine: very dominant polymorphic-fine fabric (a) - ditto (b) but less organic matter (/sesquioxides).

Groundmass: (a) open porphyric, undifferentiated (in the main part see "fabric") b-fabric. (b) open porphyric, speckled b-fabric. (c) dense porphyric, speckled b-fabric.

Pedofeatures: Excrements: abundant coallescing, ageing probable mite excrements; dominate fabric; many passage features. Textural: only relic silt cappings on mineral grains. Amorphous: strongly formed organo-sesquioxidic polymorphic fabric; to lesser extent in fabric (b); fabric (c) little affected. Fabric: Soil fabric contains frequent soil inclusions, both of less sesquioxidic Bh fabric (b) and subsoil B horizon material from silt droplet fabric (c). It is also worth noting that in addition to these small stone-size material the fine fabric (a) contains silt-size brown birefringent soil fragments, which may be rounded fine fabric fragments form silt droplet subsoils.

Interpretation: The fabric is that of a well developed Bh horizon, although it is unusual to have so much fine mineral (eg micas, rounded fine soil pellets) included. Also in this horizon are fragments of different - less well formed - Bh horizon material and also subsoil Bx silt droplet material. The soil is therefore a Bh but with a colluvial character (Plates 46-48). Probably as thesoil was forming soils from eroded levels upslope (by cultivation) were "washed" downslope. The process continued in the Ea/Bh above where cultivation mixing is clearly evident.

Sample K

117 2bBx 57-63cm (Plates 49-50).

Structure: Massive; massive microstructure (underlying very weak granular and platy). Porosity: 10-15% very dominant fine rough edge channels and associated vughs. Mineral: C:F 80:20. Coarse: as above, also as Bt of 527. Fine: pale brown, speckled (PPL); pale orange (OIL), low birefringence.

Organic: Coarse: rare root fragments. Fine occasional amorphous. Groundmass: dense porphyric, low birefringent speckled b-fabric.

Pedofeatures: Textural: very dominant dense fabric of relic weak granules have been broken up and almost homogenised; also compacted. Also many silt caps on mineral grains, but often poorly developed; also small void dusty clay infills. Amorphous general weak probable sesquioxidic impregnation. Fabric: compacted; fagipan like?, slaked?

Interpretation: In this subsoil horizon there is evidence of weak "silt droplet" formation eg silt and clay link cappings, but these have been strongly homogenised and compacted again by freeze/thaw to produce a very dense massive fabric, with relic weakly formed granules, and few areas of very dusty clay and dusty clay infills.

Sample L

117 Modern Bh/Bhs 20-25cms (Plates 51-54).

Structure: Upper Bh part (top 3-4cms) poorly developed fine subangular blocky, rather more massive in lower (Bhs) part; inter grain microaggregate (pellety) microstructure with loose subangular blocky. Porosity 30% in upper Bh, 20% in lower Bhs. In Bh common fine complex packing voids (around pellets etc); common fine and medium rough edge vughs; common fine rough edge channels - with aggreggates (blocks), of general faunal origin. In Bhs as Bh with few coarse cracks and vughs.

Mineral Bh C:F 40:60. Coarse: few stone-size (2-0.5cm) granite fragments, common medium sand size granite, quartz and plagioclase feldspar; few fine mica, hornblende; very dominant angular silt size quartz and feldspar. Fine pale brown to brown, faintly speckled

(PPL), brownish orange; extremely low birefringence - opaque. Bhs C:F 55:45. Coarse: as Bh, possibly more sand-size material. Fine darkish brown, speckled (PPL), brown (OIL), very low birefringence, - opaque.

Organic: Bh: Coarse; occasional brownish, pale yellow root fragments (in voids); rare charcoal. Fine very dominant pellety (excremental) amorphous organic matter; rare fine charcoal. Whole of fine fabric dominated by polymorphic organic matter, which is combined with fine silt size quartz and mica, giving a faint birefringent character. Bhs; Coarse; rare root fragments in situ also instances of non in situ ferruginised root; rare charcoal. Fine very dominant polymorphic organic matter (more accretionary, aged?, more coallesced than Bh above). Again fine fabric dominated by this material with included very fine mineral. Many fine charcoal. Groundmass: Bh: open porphyric, very low birefringent b-fabric, speckled. Bhs, close porphyric - as Bhs, but rather close to undifferentiated b-fabric.

Pedofeatures: Excrements: Bh very abundant moderately thin mainly organic, possibly Oribatid mite excrements, commonly coallescing. These dominate whole fabric but have mixed in mineral material. Also occasional moderately broad, possibly more mineral, possible Enchytraeid excrement. In Bhs more dense fabric perforated by many medium channels with loose moderately thin probable Oribatid mite excrements.

Amorphous: Polymorphic fabric is both essentially excremental and sesquioxidic. Possibly Bhs contains less organic matter, and more coarse mineral. The Bh is strongly organo-sesquioxidic, and has the "pellety" fabric typical of upland podzols (Clayden, 1970).

Fabric very abundant faunal passage features, channels etc especially in Bh. Mineral inclusions suggest colluvial origins to this mixed in material, eg it is moderately sorted in Bh. Also sharp edge nodules are included. Probably Bhs rather less colluvial.

Interpretation: The modern Bh/Bhs displays a well developed polymorphic organo-sesquioxidic fine fabric typical of podzols (Plates 51-54) - well worked by soil fauna. The Bh contains "fresher" organic matter and possibly developed in colluvial silts. Coarse inclusions of ferruginised root fragments and heavily iron stained rock fragments suggest mineral material is not in situ - rather podzol Bh horizon formed in weathered colluvium.

Overall interpretation of 117

The 2bBx horizon is again the in situ little biologically worked fragipan subsoil which is at a rather shallow depth to colluvial deposits above, suggesting the soil has been quite deeply eroded on this site. Both the bBhs and bEa/Bh are comprised of transported podzolic (Bh/Bhs) and subsoil (Bx) fragments in which podzolisation has occurred. Cultivation has affected the fine material producing textural pedofeatures of a podzolic character. Upslope colluvium represented by the modern Bhs horizon is quite fine, indicating weathering of the source material (ie not fragments), possibly as upper leached (Ah, Ea) horizons.

Sample M hAh/Ea 25-31cms (Plates 56-59).

Structure: poor coarse subangular blocky; with intergrain microaggregate microstructure. Porosity: 25-27.5cms, 45%; very dominant open walled fine to medium channels, and frequent complex packing voids. (27.5-31cms) 25-30% (becoming better structured); dominant open-walled vughy, with common rough walled to open walled fine to medium channels; few coarse channels. Mineral (top "Ah" part dominantly organic) C:F 40:60. Coarse very dominant fine size sand and coarse silt of quartz and feldspar, few weathered mica. Few very coarse sand size and stone-size granite fragments. Fine: (a) very dominant (pellety) very dark brown (PPL); dark brown (OIL); very poorly birefringent. (b) few (denser aggregate eg .4cm) very dark brown (PPL); dark brown (OIL); poorly birefringent. (Lower "Ea" part more dominantly mineral) C:F 60:40. Coarse as "Ah", more poorly sorted ie as above, with more frequent coarse sand and stone-size material. Fine brown, weakly dotted (PPL); palish brown (OIL) - less sesquioxide staining of this colluvial material; general low birefringence (higher than material in "Ah).

Organic: Coarse: occasional to many root fragments - often ferruginised; occasional fine charcoal throughout. Fine "Ah" part; very abundant polymorphic amorphous organic matter, with few fine fragments. (Polymorphic fabric apparently absorbed sesquioxides). "Ea" part abundant fine organic matter, frequent polymorphic; many charcoal/charred material (also sesquioxidic impregnation of OM).

Groundmass: "Ah" part; mainly enaulic, with minor gefuric, very low form b-fabric. "Ea" part gefuric to open porphyic, moderately low speckled b-fabric.

Pedofeatures: Excrements: very abundant very thin probable mite excrements, with many thin possible Enchytraeid excrements. In "Ea many to abundant excrements (as Ah). Depletion possible history of depletion in this slide - eg generally iron free mineral grains; thin fine mineral fabric. Amorphous probable abundant organo-sesquioxidic impregnation of fine fabric - especially Ah part. Fabric rather dense colluvial mineral fabric of "Ea" much biologically reworked with very porous Ah top. Few rounded soil pellets.

Interpretation: Colluvially buried, earlier colluvium (Plates 58-59) of depleted and sorted mineral material, biologically reworked (Plates 56-57) to form Ah/Ea, then later moderately impregnated by sesquoxides as podzolisation continues in upper soil.

Sample O

224 2bEa2 50-57cms. (Plates 60-63).

Structure: generally massive (minor cementation), previous rather structureless; perhaps minor channel microstructure.

Porosity: 20%; commmon fine moderately rough walled vughs and channels; frequent medium and coarse channels. Mineral C:F 50:50; Coarse; moderate sorting; dominant coarse silt, common fine sand; minerals as elsewhere - generally clean weathered grains. Fine moderately brown speckled becoming pale brown, speckled with depth (PPL); palish brown to very palish brown (OIL); moderately low birefringence to more birefringent (less stained with depth).

Organic Coarse many coarse charcoal rare "bright rings" fungal. Fine: In upper part: very abundant organic matter, charred organic matter with many charcoal; also occasional phytoliths. Lower part: same propertions but only about 10% (abundant) overall.

Groundmass: generally porphyric, low birefringent form b-fabric.

Pedofeatures Excrements: Occasional broad to very broad (probable earthworm) bow-like excremental infills especially in upper part. Occasional thin and very thin excrements also - again mainly in upper part. (Probably both Enchytraeids and mites working through). Possibly broad "lumbricadae" short-lived. Depletion: whole fabric, especially lower part appears generally depleted of some sesquioxides; also other fine mineral material. Textural: Occasional extremely thin (10um) very dusty clay low birefringent coatings, especially preserved in lower part. Fabric generally dense fabric where not reworked faunally; possibly colluvial/cultivation origin. Occasional rounded ferruginous soil.

Interpretation: Colluvial moderately well sorted soil containing transported ferruginous (podzolic) pedorelicts, and also "crumpled" fungal bright rings (see 2E Plates 60-61). Soil generally dense through probable cultivation colluvial origins, especially as thin dusty coatings present with marked presence of phytoliths and fine and coarse charcoal. Origins mainly from cultivated leached topsoil. It is worth noting that at one stage "cultivation" or other practises raised the fertility sufficiently for earthworms (Plates 62-63) to re-appear.

Sample P

224 2bB(sg) 72-79cms

Structure: generally massive (with areas of fine subangular blocky penetration); generally massive microstructure with minor channel/vughy. Porosity 15% intrapedally; 30-40% where biological worked. Intrapedally dominant fine and medium generally smooth wall vughs and channels; biologically worked areas dominantly vughy; few coarse very elongate channels throughout. Mineral C:F 80:20. Coarse moderately well sorted as bEa2 (as above). Fine dark brown, speckled (PPL) brown (OIL); very low birefringence (also soil fragments - see Q).

Organic: Frequent organic matter, c.5% measured chemically (Table Coarse occasional coarse *in situ* roots, often strongly ferruginised; occasional charcoal/charred organic matter of fine to medium size, also occasional very fine charred fragments. Many plant fragments, organs, cells, etc. Fine abundant, mainly amorphous fine material; rare charred, rare phytoliths. Weakly polymorphic.

Groundmass: porphyric, undifferentiated b-fabric to poorly speckled b-fabric.

Pedofeatures Excrements: frequent to common moderately thin ageing and coallescing probable *Oribatid* excrements throughout; some concentrated in relic faunal porosity.

Amorphous frequent ferruginous impregnation of root and other plant fragments. Apparent moderate sesquioxidic impregnation of organic fine fabric - polymorphic.

Interpretation: This strongly homogeneous horizon has been formed probably by the colluviation of moderately sorted material, developing in situ as a "depleted" (hence low clay/fine mineral material) Ah horizon. this Ah horizon with moderate biological activity (see Plates 56-57) developed a rather humic, polymorphic character. After later "colluvial" burial in this "terrace", biological activity mainly ceased and the fine fabric became impregnated by sesquioxidic illuviation from podzolic soils developed in the overburden. This also accounts for the ferruginisation of the root material.

Sample Q

224. 3bBhsg, 138-146cms (Plates 64-67)

Structure: Poorly accommodated subangular blocky "within massive". Subangular blocky, massive platy (compact grain) complex microstructure. Horizon is very heterogeneous. Porosity within massive 10-30%; generally 25-30%. Within massive dominant fine smooth channels and medium chambers. Biologically worked areas medium moderately rough channels and vughs. Common coarse planar voids.

Mineral: (heterogeneity) very dominantly a) "Bx fabric" b) frequent "relic pan Bx fabric", c) few "Ah fabric". D:F a) 85:15; b) 75:25 and c) 90:10 (very organic fine fabric). Coarse: Minerals are as previously described with fabric c) having mainly quartz and feldspar with weathered micas. a) and b) more diffuse suite of rock fragments etc. c) is also moderately well sorted, whereas a) b) are unsorted. Fine a) yellowish brown, speckled - brown speckled (PPL), pale orange, dark drown (OIL) to low moderate form birefringence. b) pale yellowish brown speckled with yellowish brown, speckled (PPL), pale orange (OIL), moderately low form birefringence. c) strong brown, a little speckled (PPL) bright brown (OIL), very low birefringence.

Organic: Generally very low in a) and b), high in c). Coarse a) and b) occasional fine fragments of charcoal in cemented pan material! Without doubt! c) rare bright rigns; many tissue fragments (blackened) occasional charcoal/charred materials, amorphous and cell fragments; Fine rare in a) and b). In c) very abundant, somewhat polymorphic amorphous organic matter.

Groundmass: a) dense porphyric, speckled b-fabric. b) dense porphyric, speckled to granostriate b-fabric. c) dense to open porphyric almost undifferentiated b-fabric - speckled b-fabric. Pedofeatrues: Excrements: not present in a) and b). c) few open channel infills of moderately thin excrements perforating fabrics a) and b). Dominant ageing and coallescing organo-excremental material making up weak polymorphic fabric of (c). Textural a) abundant general massive "linkcap" fabric with many relic granules and round mineral caps of mainly silt size material. b) Not totally differentiated from a) but with some more obvious link cap pans, and also occasional highly ferruginised (isotropic), thin clay coatings on voids and grains (see Sample R). Depletion: Many depleted (of iron and fine fabric) areas in a) and b); probably mineral grains in

c) have lost any ferruginous coatings when developing as an Ah.

Amorphous: Many ferruginous impregnations of parts of a) and b) into diffuse edge nodules; clay coatings strongly ferruginised; c) possible general sesquioxidic impregnation of amorphous organic fabric.

Fabric: Strong heterogeneity - mixing of Ah, B3 and earlier fabric.

Interpretation: This very heterogeneous (Plates 64-65) horizon near the base of the sequence investigated at the terrace contains deep subsoil fabrics - developed by late glacial and possibly earlier soil formation (see Sample R) - mixed with surface Ah horizon material. Interestingly the deep subsoil link capping B3 fabrics seem to include charcoal! The Ah material also includes charcoal and charred material. Again apparently deep erosion and mixing of Ah fabrics has occurred. It is unfortunate that deeper excavation was not carried out because this is not an in situ (except for the Ah fabric) subsoil.

Overall interpretation of 224

It is apparent that at the base of the very deep sequence at 224, the local soil has been deeply truncated as far as its Bx/Cx horizon, and that disturbed subsoil material was exposed and mixed with local Ah horizon material, which was possibly developing in situ.

The site apparently developed through continued dumping and colluviation - 2bB(sg) forming through Ah development in depleted colluvium. Podzolisation continued on the site and the colluvium thickened, and this horizon became somewhat cemented. Occasionally, however conditions changed sufficiently for earthworms to re-enter the soil as in the 2bEa2 horizon.

Colluviation and dumping (at least of stones) seems to have continued generally under a podzolising regime - originally depleted and colluvial horizons such as bAh/Ea again becoming somewhat impregnated by sesquioxides.

405

Sample R 2bBs(h), 38-43cms (Plates 67-74)

Structure: Massive; generally massive microstructure with vughy. Porosity 25%; dominant fine, moderately smooth walled channels; dominant fine to medium moderately smooth walled vughs: Very heterogeneous Mineral: General C:F 80:20. Three major fabrics a) Bh/Bs proper b) dense mineral dense silt droplet (deep subsoil horizon) and c) ferruginous fine and coarse laminated silt droplet. d) Ea fragments. Coarse very dominant coarse silt and very fine sand size quartz, feldspar, few weathered micas; frequent stone, very coarse, coarse, and medium sand size material. Fine a) dark brown, dotted (PPL); dark brownish (OIL); very low to low birefringence; polymorphic fabric. b) very pale brown to dark reddish brown, very speckled (PPL); very pale brown to dark reddish brown (OIL); moderately low birefringence to opaque. c) dark yellowish brown with paler laminae, very speckled (PPL); orange and very pale laminae (OIL); low birefringence. d) very pale brown, very speckled (PPL); very pale brown (OIL); very low birefringence (Ea fabric).

Organic: Rare coarse root fragments. Many charred/charcoal fragments associated with fine fabrics d (Ea) and a (Bh). Fine a) very abundant polymorphic (rather loose), occasional fine charcoal. b) occasional amorphous O.M. (care! many fine opaque minerals) c) occasional amorphous O.M. d) abundant amorphous and charred O.M. and charcoal fragments.

Groundmass: a) linked and coated grains (chitonic), speckled (form) birefringence fabric. b) dense - single spaced-porphyric, speckled b-fabric. c) dense porphyric, speckled b-fabric; d) dense porphyric (very thin fine fabric, form b-fabric).

Pedofeatures: Excrements a) very abundant porous both dissagregating and coallescing (see amorphous). Mainly very thin; few thin - mites and Enchytraeids. Also affecting c). Textural a) occasional thin extremely dusty, ferruginous, low birefringent clay void coatings (not often right way up). b) often associated with rotated grains with silt cappings, also clay infills (often ferruginised. c) very dominant "silt droplet"/link capping fabric. Very strongly formed. Fabric is generally right way up, approximately 400um across each laminae. However differ from other link capping fabrics because porosity between coarse laminae has been much infilled by (now cracked) reddish orange dusty and limpid clay - but not also a related textural feature. The dusty clay is probably derived from a similar fine fabric as the coarse laminae, but there are also fragments and infills of reddish orange limpid clay that is apparently so ferruginous it is opaque under X PL. Are these palaeo-argillic? Depletion fabric d) is strongly depleted of fine material and iron. It resembles Ea horizon material.

Amorphous: Very abundant sesquioxidic impregnation especially of areas of polymorphic a) producing small areas of cemented (orstein) fabric. b) many clear, dense nodular impregnation, especially fine fabric - such as silt caps. c) moderate ferruginous impregnation (hypo-coatings) of link capping features; also parts of weathered coarse mineral. Also very strong impregnation of fine infills (clay + dusty clay fabrics).

Fabric: Heterogeneous fabric - mixed materials. Deep subsoil, subsoil, illuvial and eluvial fabrics. Mainly "physically" mixed, although minor biological turbation.

Interpretation: A mixed soil (Plates 67-69), the whole affected by illuvial organic matter and sesquioxides, and showing a major Bh horizon character. It contains large (4 x 1.5cm) area of relic laminated silt droplet fabric (Plates 73-74), which in addition has a mixture of very ferruginous clay coatings and infills. The latter are "cracked" away from the void walls, and may include finer fragments of reddish limpid clay. They are unlike any of the clay coatings associated wth Zone II and IV link cappings. Effectively then these link cappings may have to be pre-Devensian with washed-in fragments of red palaeo-argillic (clay) fabric.

The soil also contains areas of dense silt droplet fabric (as seen commonly here) relating to probable Zone IV periglacial conditions. These have been mixed with depleted "Ea" fabric (Plates 70-72) containing much charred organic matter and charcoal typical of occupation at Chysauster (see Cairn 527). The dominant Bh/Bs fabric of polymorphic character seems to be taking over, but even in here there are fragments of possibly "relic" coatings relating to slaking of this kind of material through tillage - as noted at Sample I.

In total the soil shows both characteristics of truncation, transport and burial, all probably relating to dumping of mixed soil material-deep subsoil, cultivated Ea - onto the stone bank of 405. Latterly, the soil was, effected by podzolic illuviation and biological activity as this positive lynchet developed.

Sample S

405 3bEa. 51-58cms (beneath stone).

Structure: moderately well developed coarse subangular blocky; subangular blocky microstructure. Porosity 20% very dominant fine moderately smooth walled vughs. Poorly accommodated cracks (not included in porosity as sample "loose") between peds. Mineral C:F 85:15. Coarse: moderately poorly sorted. Dominant silt and very fine sand size quartz, feldspar, very few mica (weathering). Common fine, medium, coarse, very coarse sand size and small stone size mineral, eg granite fragments. Fine a) general; pale dirty brown, weakly dotted (PPL); very pale brown (OIL) very low birefringence. b) 51-56cms in parts; pale brown to brown, dotted (PPL); orange brown; very low to low birefringence. Area (b) is patchy but makes up at least 50% of slide.

Organic: many fragments of charcoal and charred material. Rare fragments of organic matter. Fine many fine charcoal in both fine fabrics. Type (a) contains many fine organic matter and rare phytoliths; type (b) contains very abundant organic matter. Type (b) is also rather excremental and pellety. Groundmass (a) dense porphyric, low form birefringence. (b) rather more open porphyric, form birefringence. Both have very thin, rather organic fine fabrics, type (b) may be fresher.

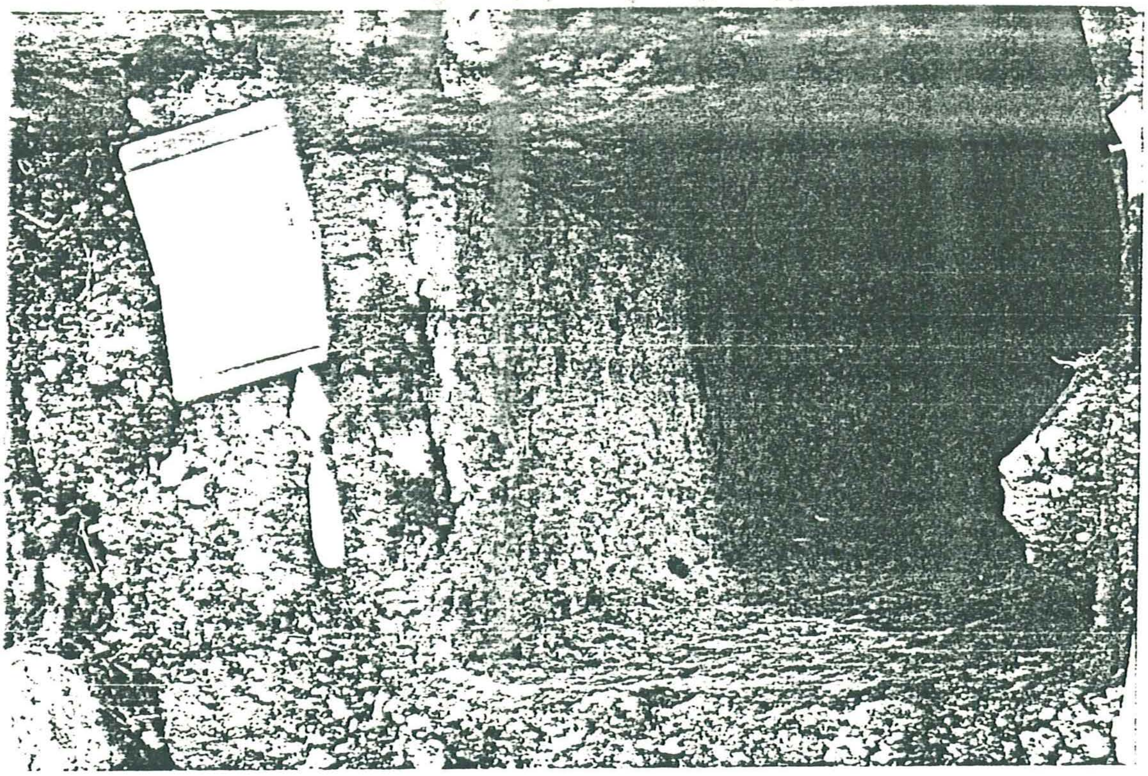
Pedofeatures Excrements: Very abundant very thin organo-mineral Oribatid mite excrements both in channels as very loose infills, and in general fabric of (b) - commonly both breaking down and coallescing. Excremental fabrics also associated with (a) but less coherent pellets.

Textural: occasional relic silt caps on rotated coarse grains. Rare (probably more before biological re-working) very thin (c.40-50um), extremely dusty clay void coatings, containing silt size particles including organic matter and charcoal. Coatings possibly "leached" and are poorly birefringent. Depletion: General depletion of type (a) fine fabric - very low in plasma and sesquioxides. Amorphous possibly moderate impregnation by sesquioxides of pellety type (b) fabric. Fabric: Very abundant faunal reworking of pale depleted fabric, which can be very dense, and vughy as though slaked.

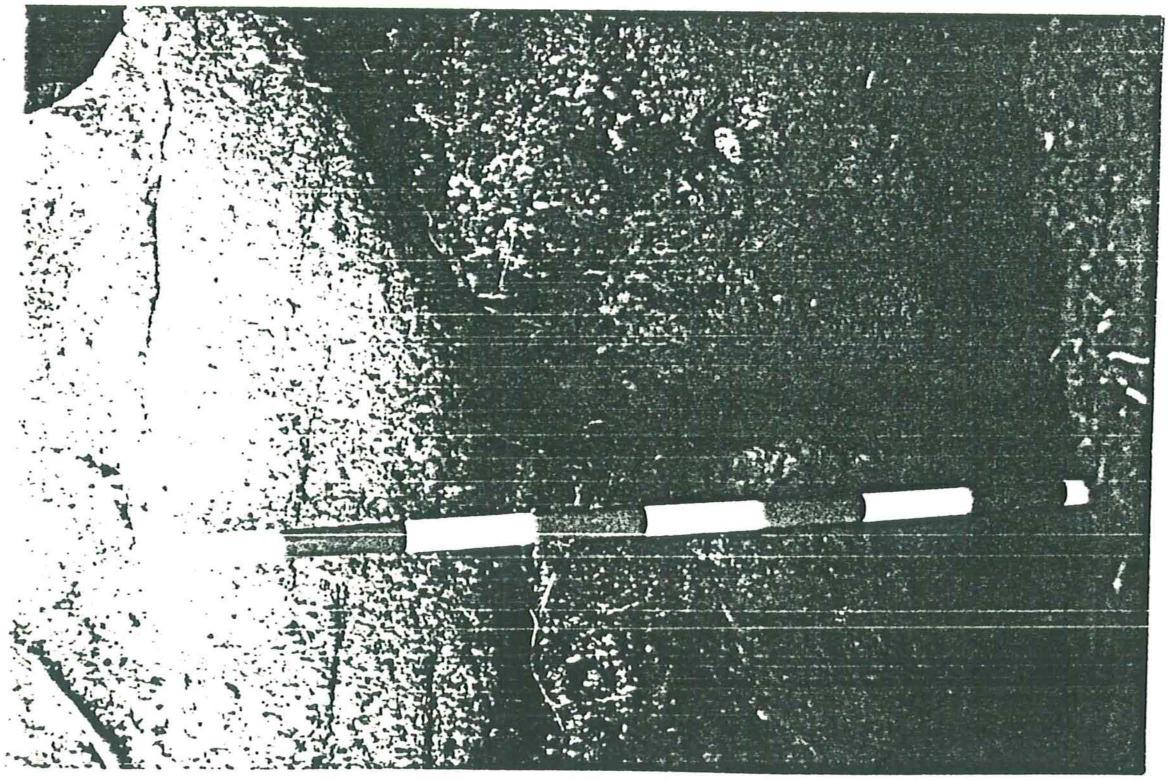
Interpretation: Two main fabric types are present. The pellety (excremental) one (b) is probably related to biological activity together with some sesquioxides coming in from the overlying Ah colluvial horizons and, ferruginous bank material. Type (a) fabric relates to an Ah/Ea horizon which was affected by cultivation - causing slaking and the dense fabric, and minor clay coatings. The latter are few because there is little clay to move. Also the large amounts of very fine and fine charcoal relate to this cultivation (see Plates 70-71). Phytoliths were also present.

Overall interpretation of 405

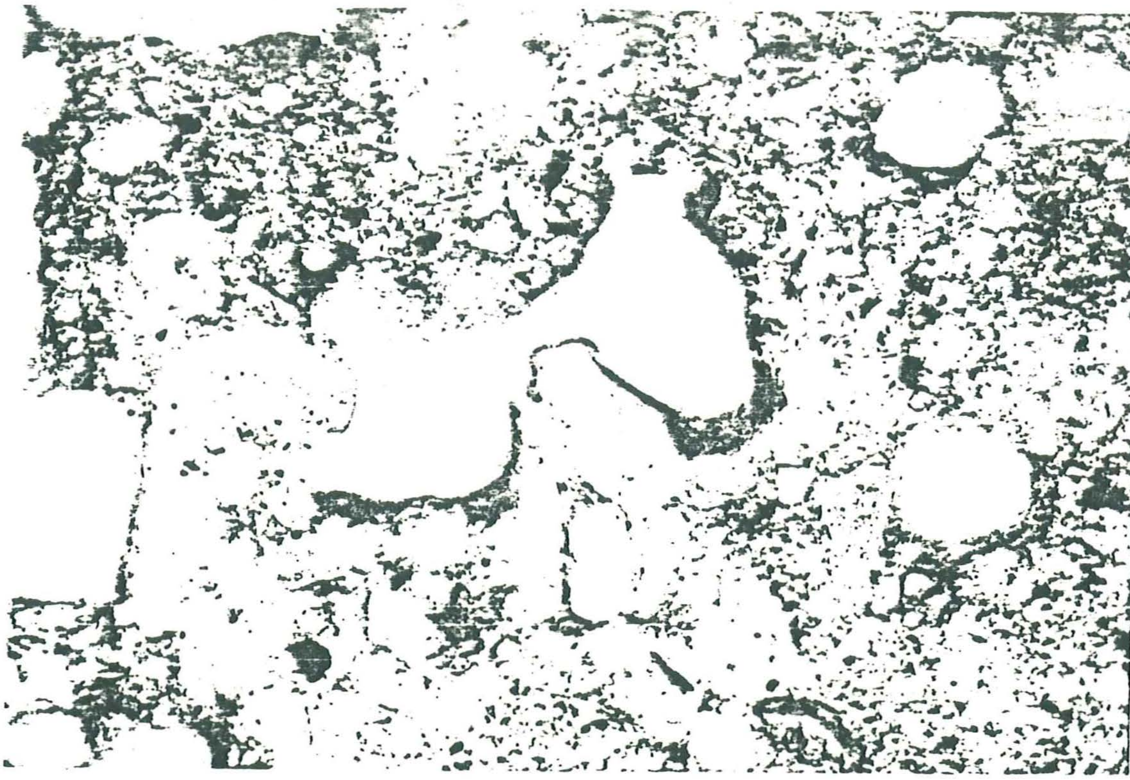
Part of the bank and positive lynchet included dumped deep subsoils (Bx/Cx) and cultivated depleted (Ea) horizons. Subsequently, they have been affected by continued Ah/Bh horizon formation as the positive lynchet developed. The buried soil itself is apparently a depleted horizon which has been affected by cultivation, and latterly by biological and illuvial contamination from above.



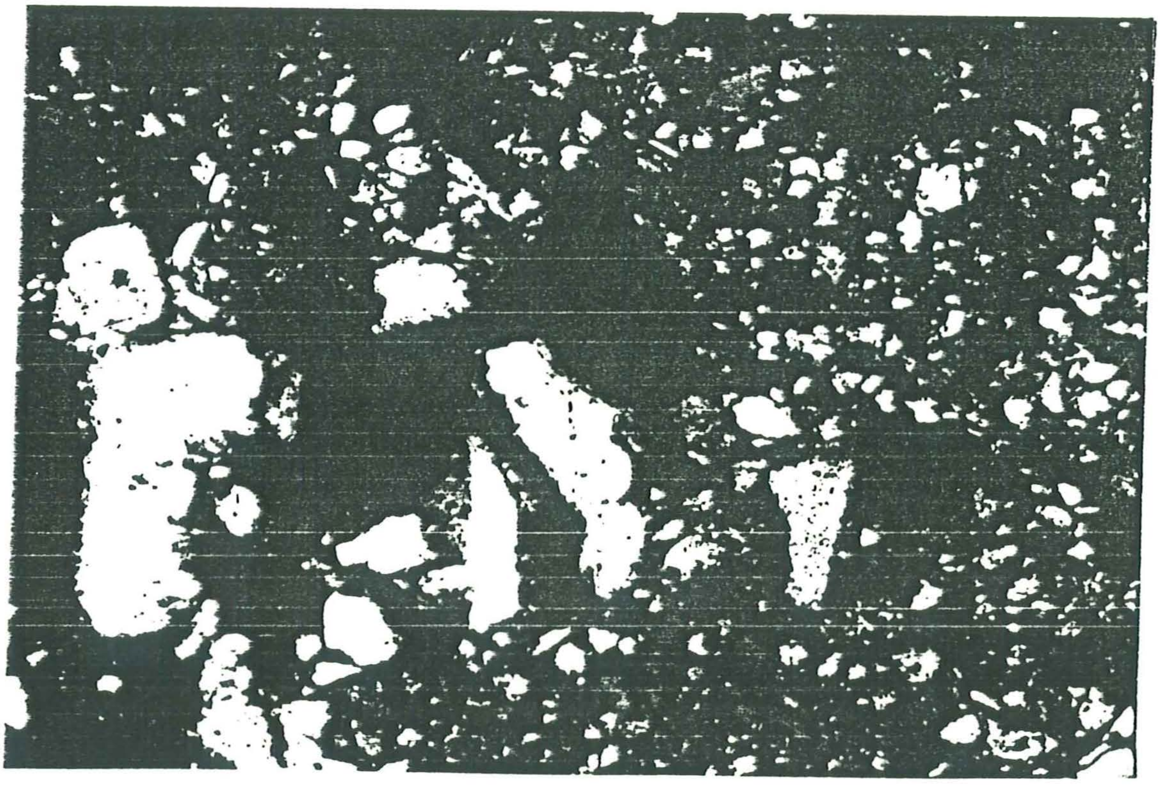
1. Within the Bronze Age cairn; soil pit 528. Note leached humic surface, thin iron pan, ochreous illuvial horizon and yellowish-brown relic periglacial subsoil.



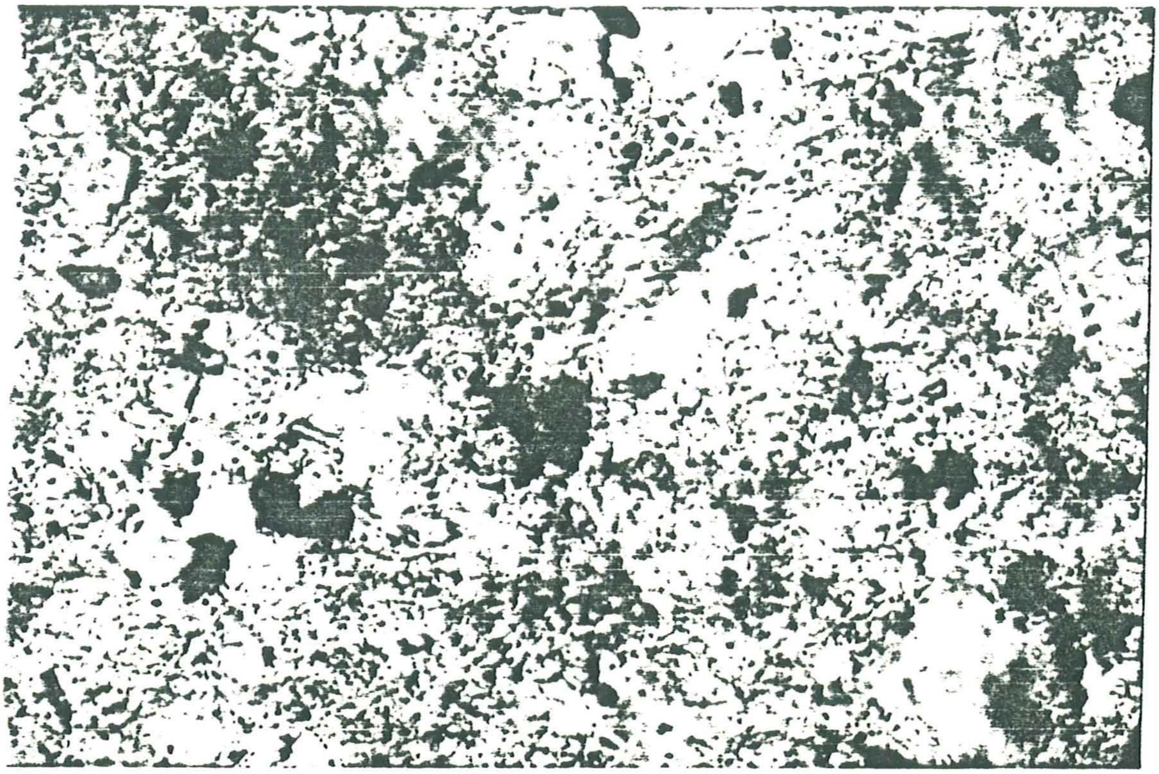
2. Edge of Bronze Age cairn; soil pit 527. Note modern rooted humic Ah horizon. Soil improperly sealed by curbstone. Square cuts of pollen and micromorphological samples - see Fig 2.



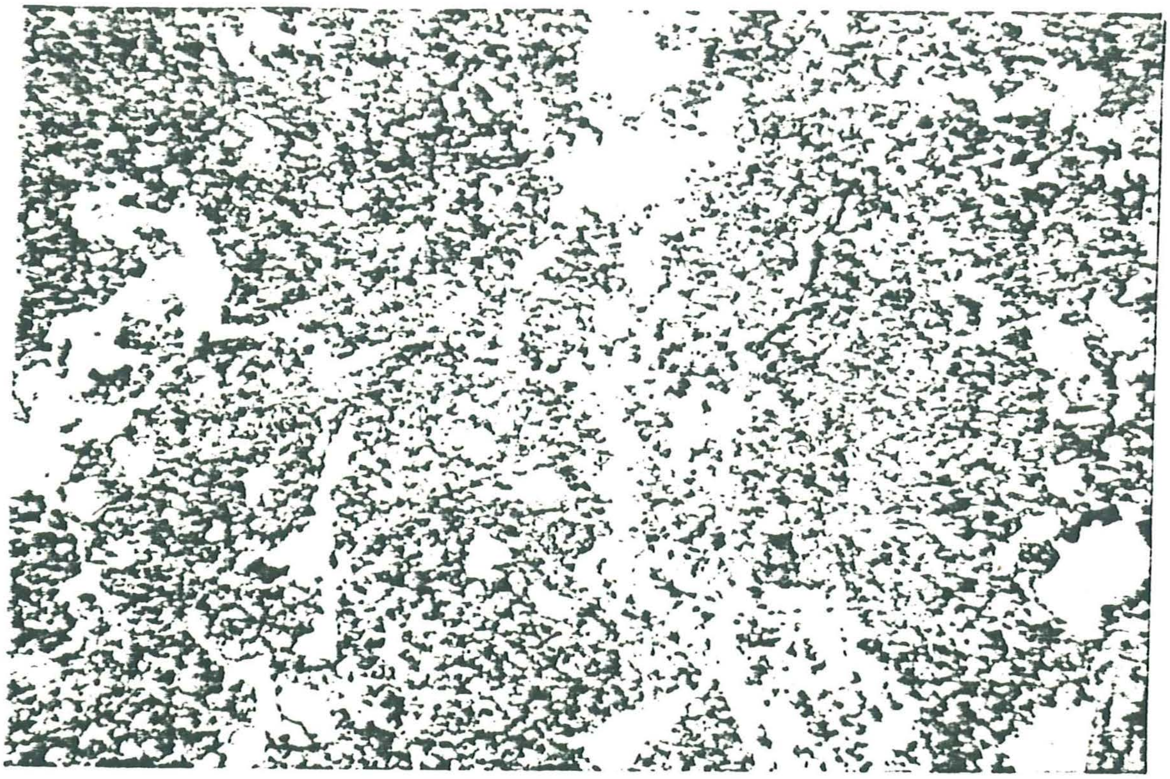
3. Photomicrograph: 527; bEa; upper slaked part; leached dusty clay porosity coatings mobilised within fine charcoal-rich soil, which also exhibits post-burial depletion. Plane Polarised Light (PPL), frame length is 1.348 mm.



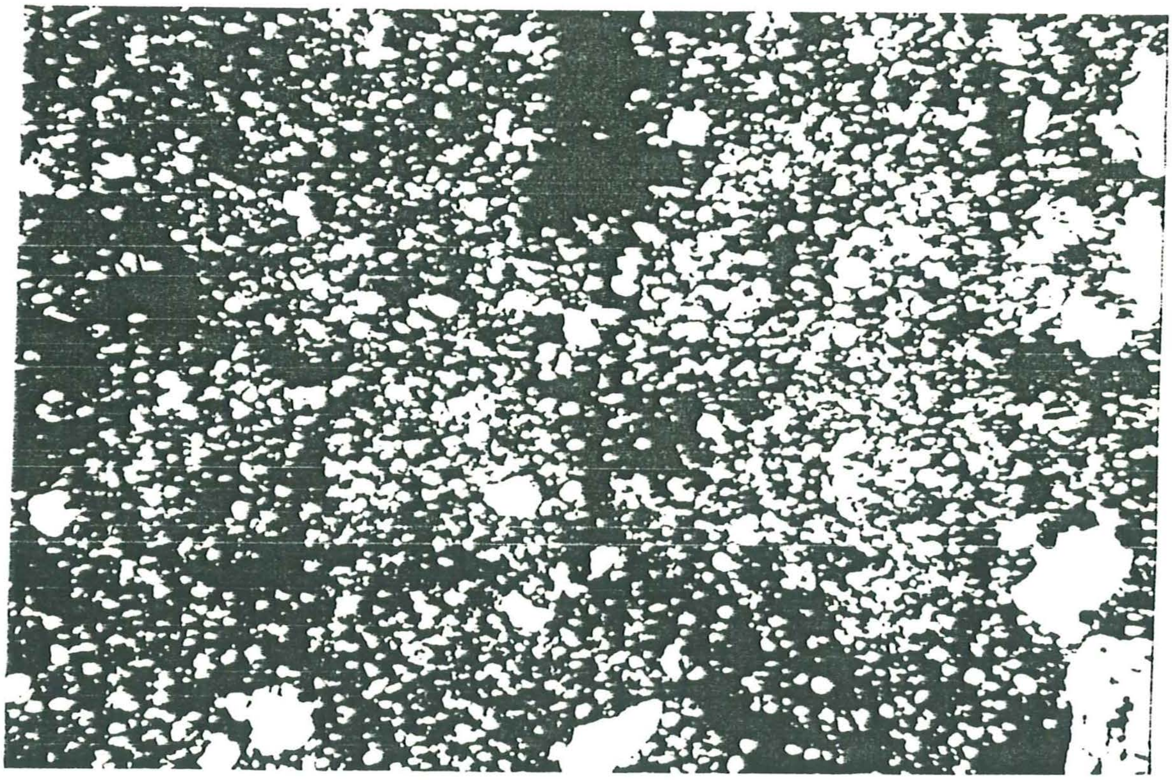
4. As 3; Crossed Polarised Light (XPL); note poorly birefringent dusty clay coatings depleted by acid leaching.



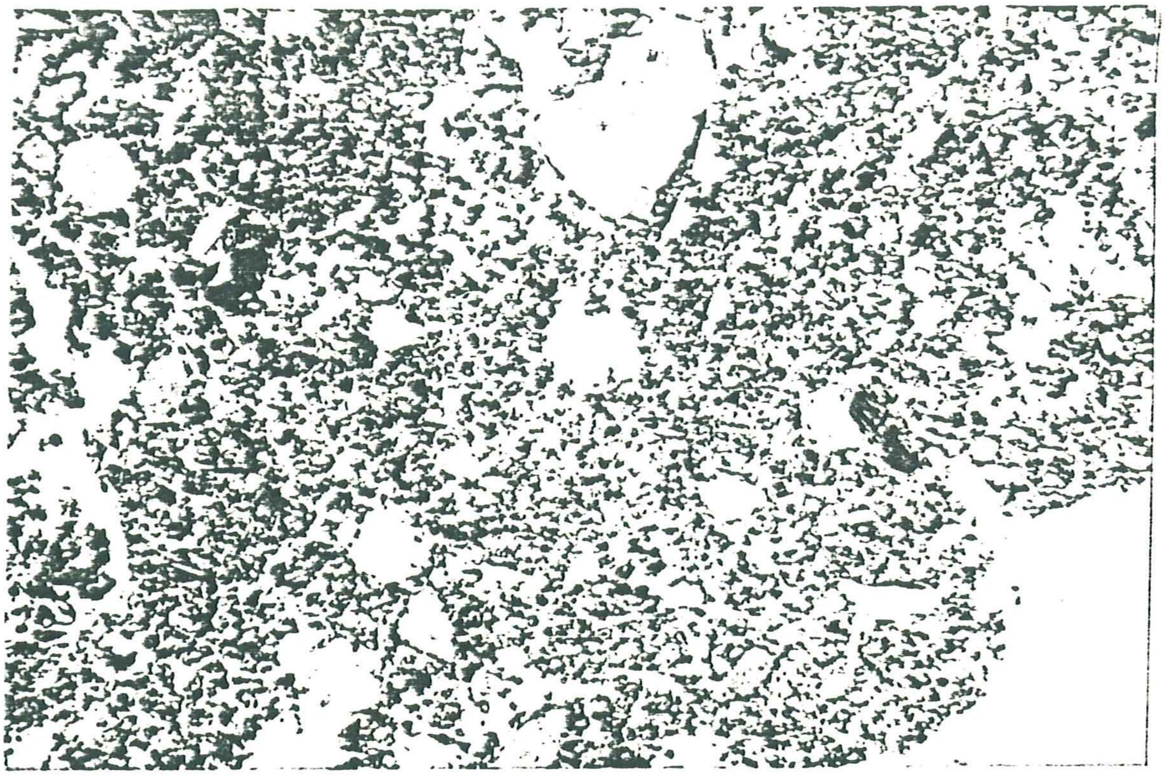
5. As 3; detail of depleted "thin" fine fabric particularly rich in fine charred organic matter and phytoliths. PPL, frame length is 340 mm.



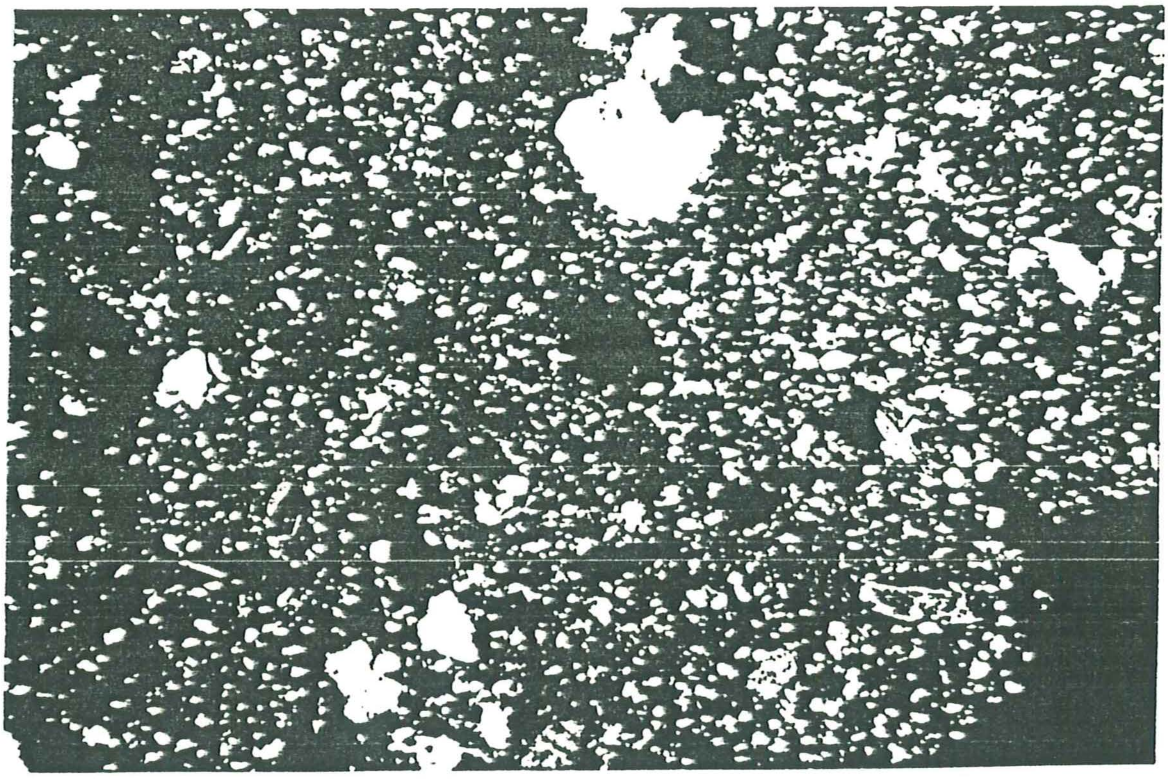
6. 527, bEa, lower unslaked part; relic worm-worked upper Bronze Age acid brown soil, now contaminated by post-burial pedogenic effects (gleying and podzolisation) and perforated by acidophyle fauna; note fine organic excrements in central channel. PPL, frame length is 5.225 mm.



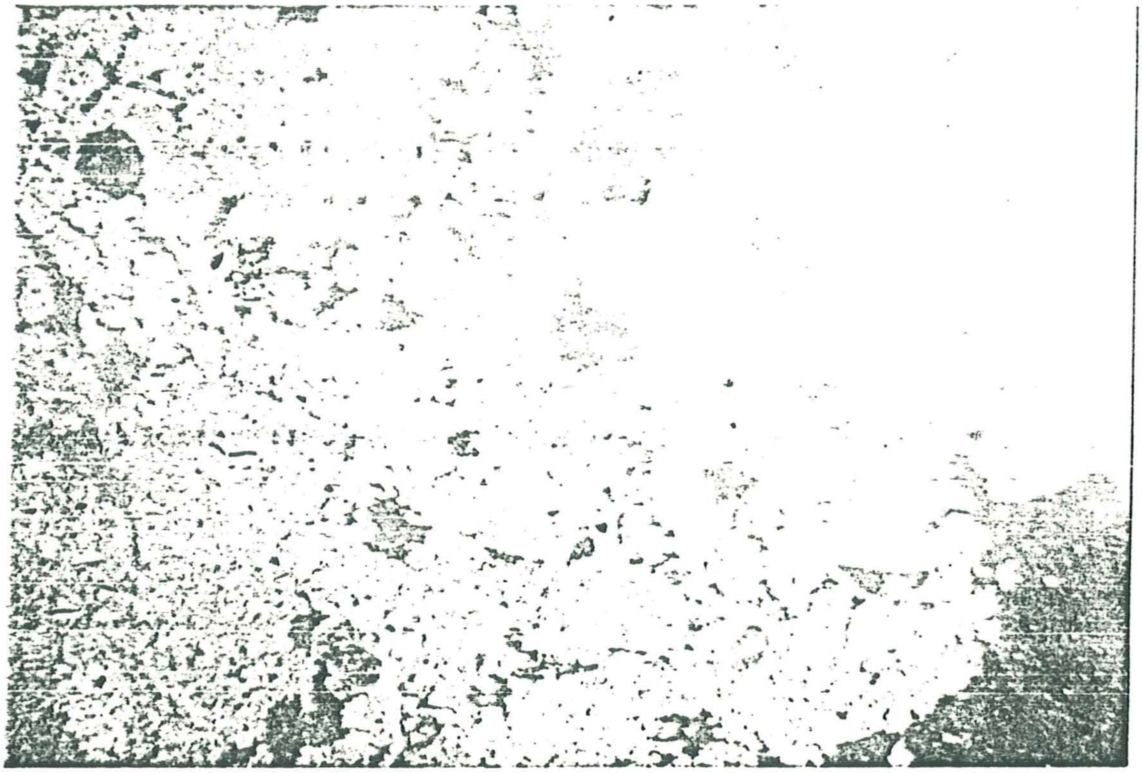
7. As 6, XPL. Note weak birefringence of fine fabric.



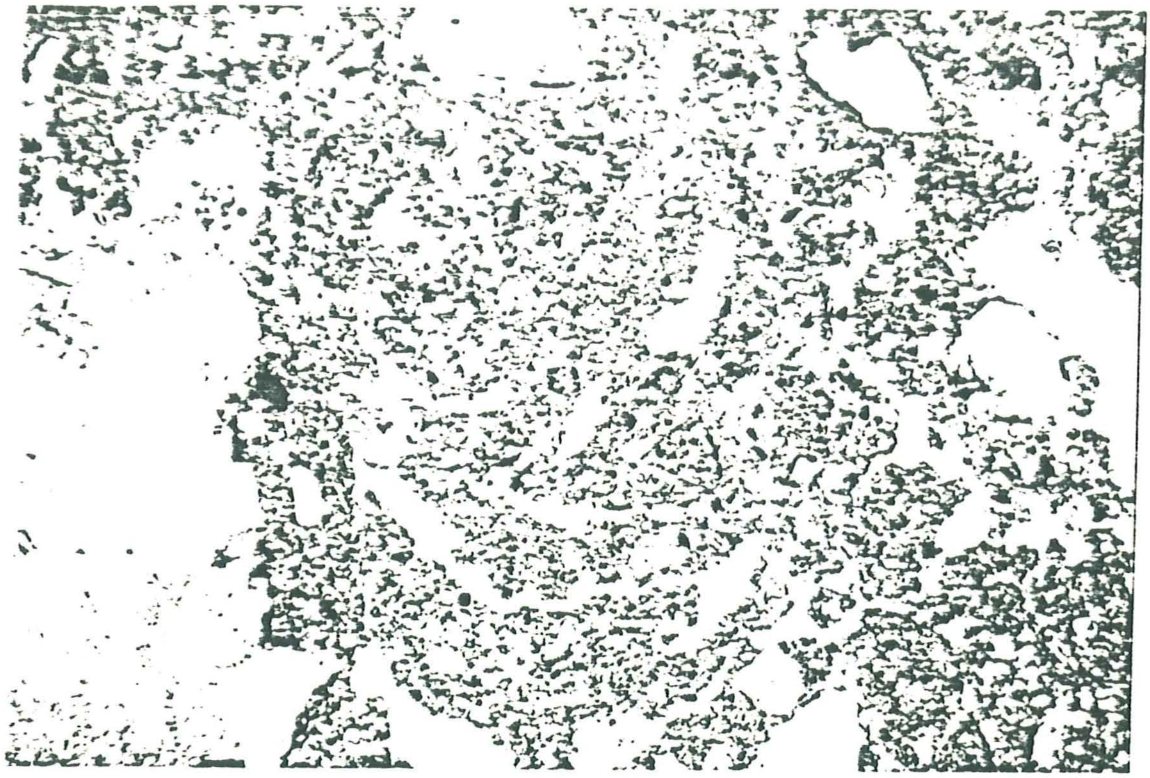
8. 527, bBhs. Typical polymorphic ("pellety") spodic fabric of podzolic B illuvially enriched in organic matter and sesquioxides. PPL, frame length is 5.225 mm.



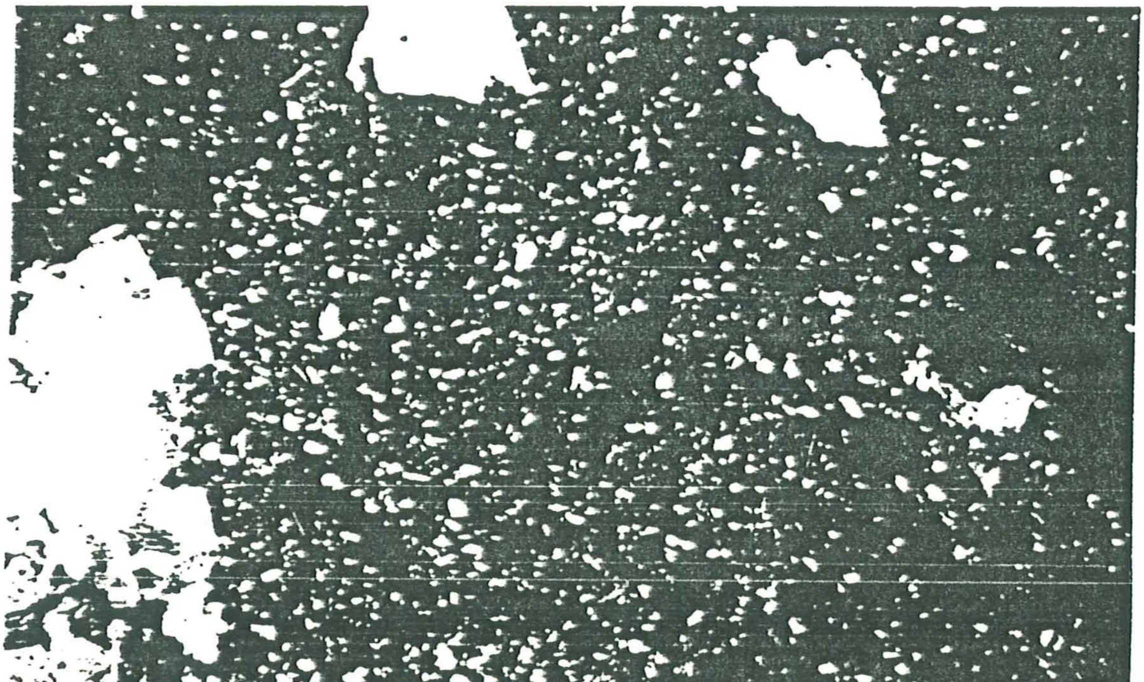
9. As 8, XPL.



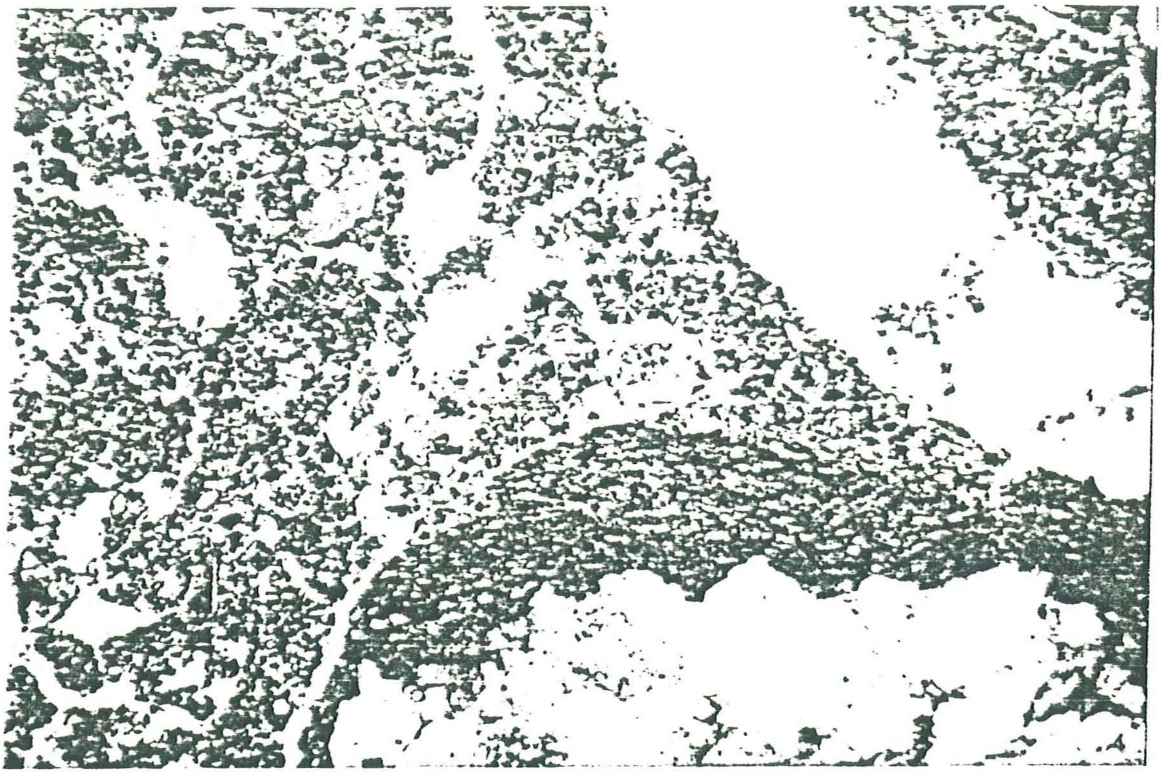
10. As 8, Oblique Incident Light (OIL); note better developed and ochreous polymorphic fabric developed "up-profile" (to left).



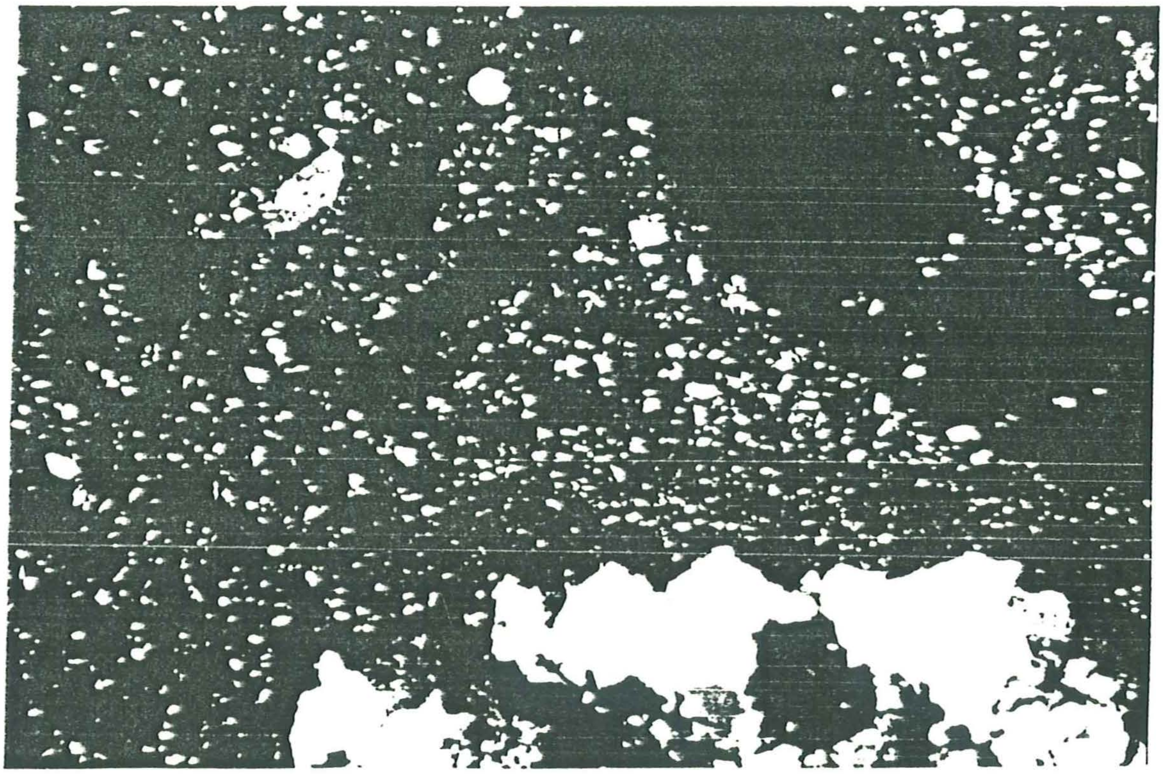
11. 527, bBhs; crescent shape banded moderately loose mineral infills of earthworm burrow, now cemented by post-burial illuviation.



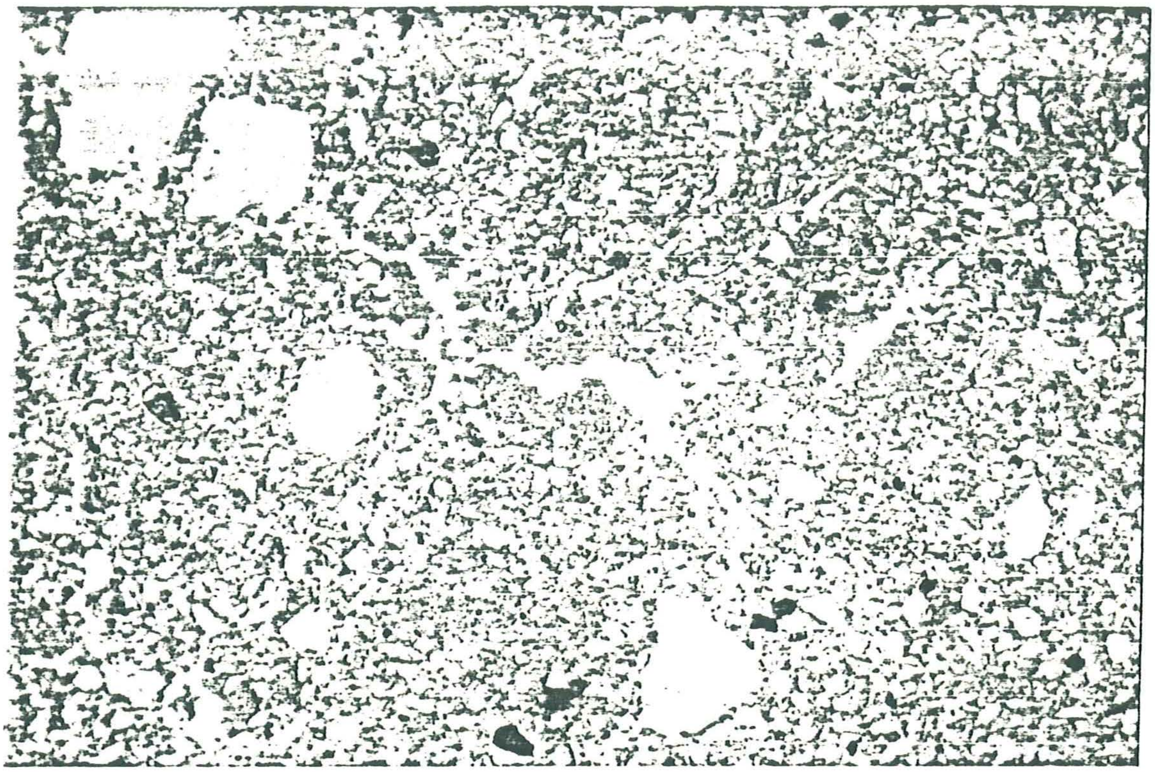
12. As 11, XPL; note granite rock fragment (plagioclase feldspae, mica and hornblende) to left; relic excremental infilling appears to have resisted some of the masking illuvial humus and sesquioxides effecting the surrounding soil, and as a result is still weakly birefringent.



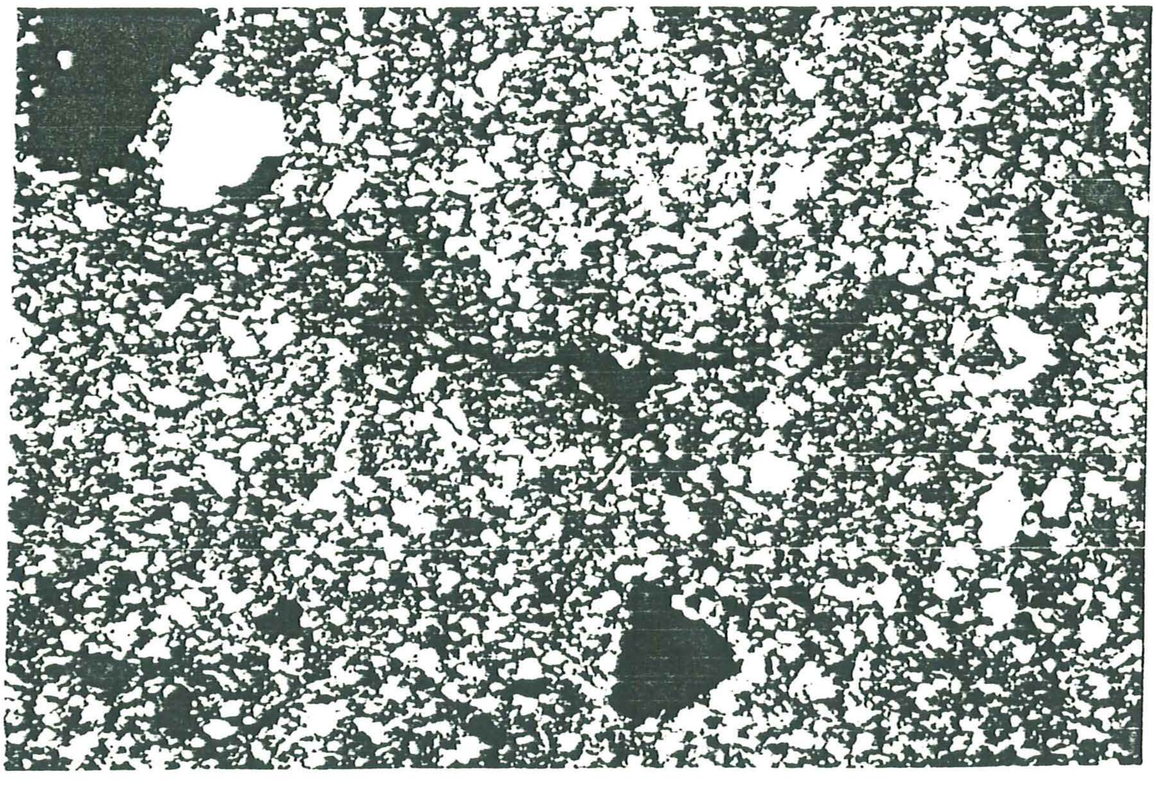
13. 527, bBhs; relic silt and clay-coated coarse mineral grain (capping) dating to periglacial soil (fragipan) formation in Late Devensian, which has become rounded by Flandrian biological mixing of the soil. Main silty fabric of the soil relates to this phenomenon. PPL, frame length is 5.225 mm.



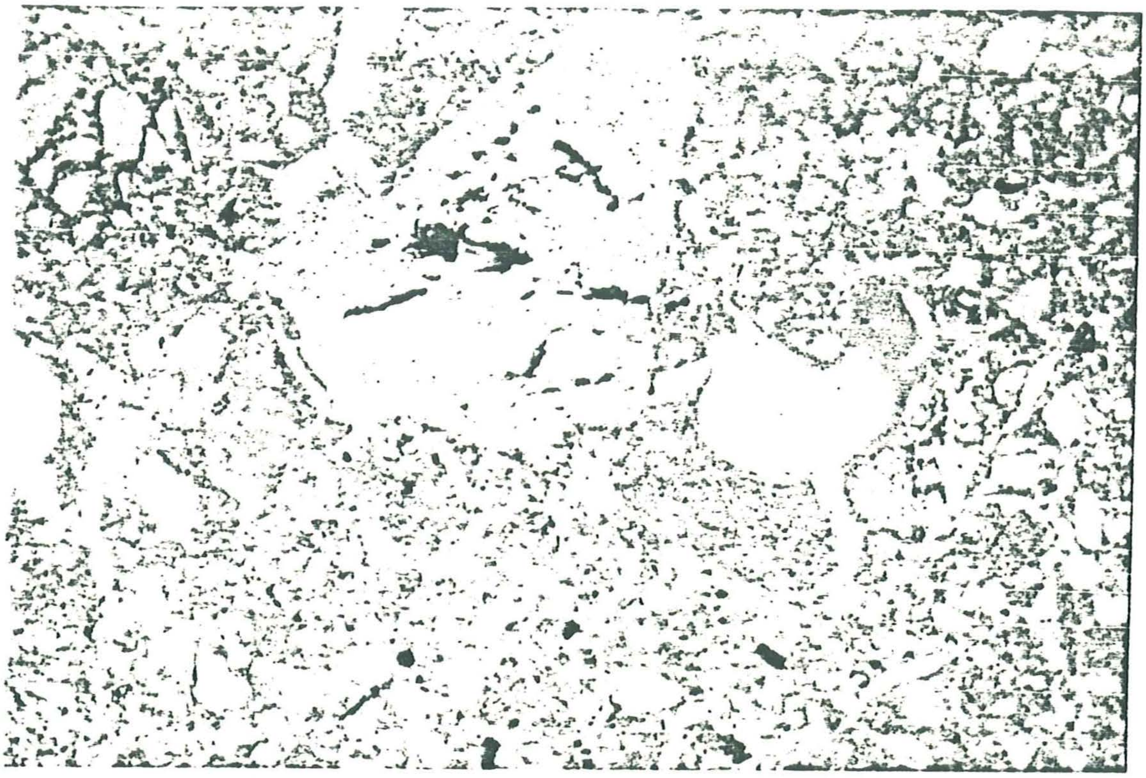
14. As 13, XPL. Note rounded birefringent relic silt and clay coating.



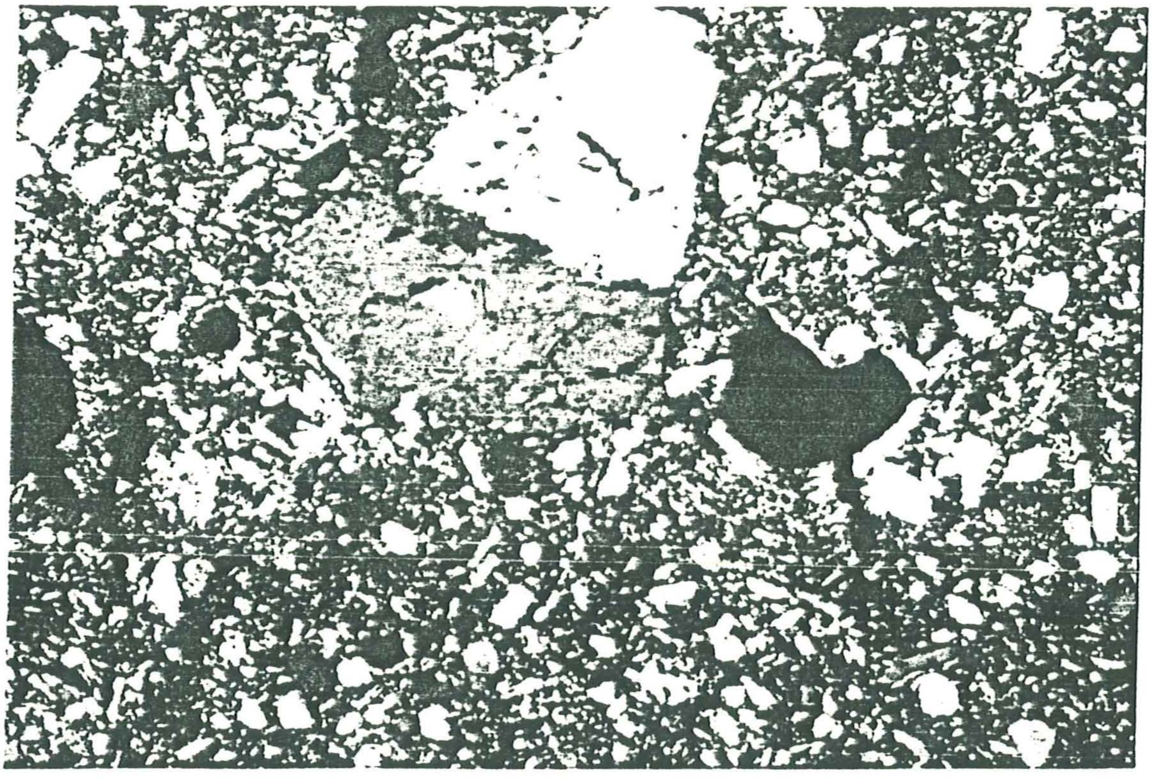
15. 527, lower bBhs; fragment of mixed-in loessic argillic brown soil; note large amount of fine mineral material (e.g. clay) compared with bEa, bBhs etc; note particularly horizontal channel infilled by fine material. PPL frame length is 3.35 mm.



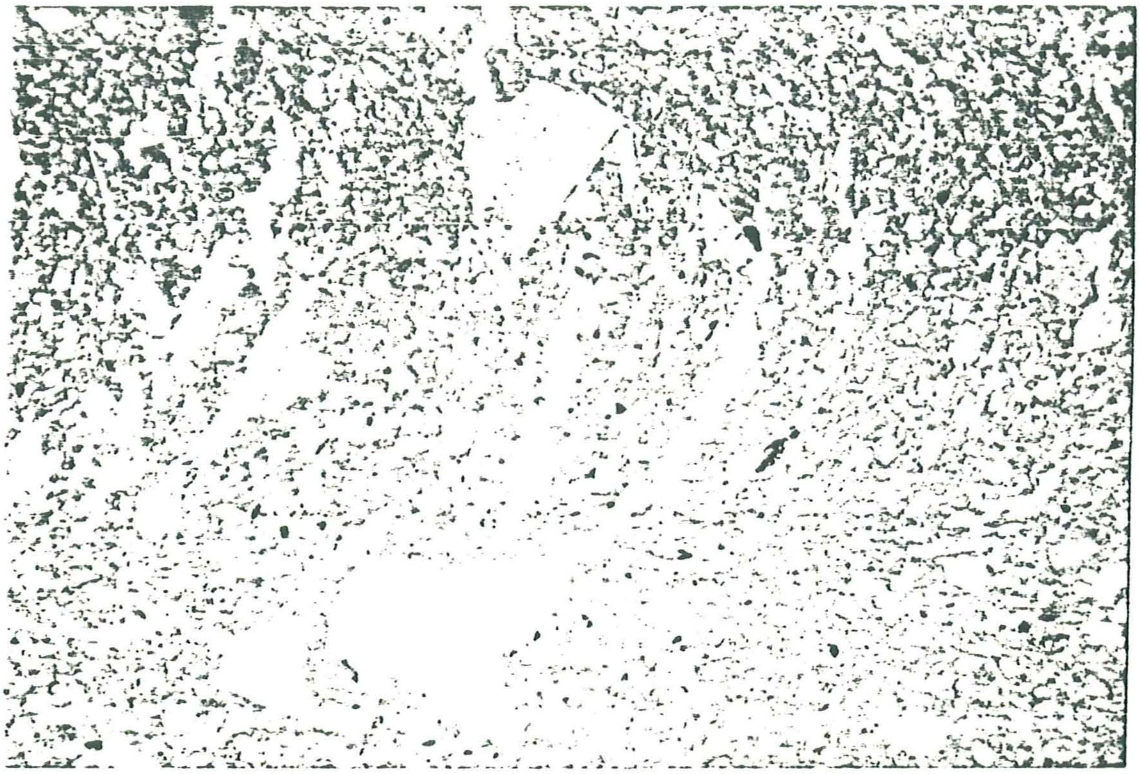
16. As 15, XPL. Note overall moderately high birefringence of this clay-rich fabric (also silty) which is also affected by illuviation.



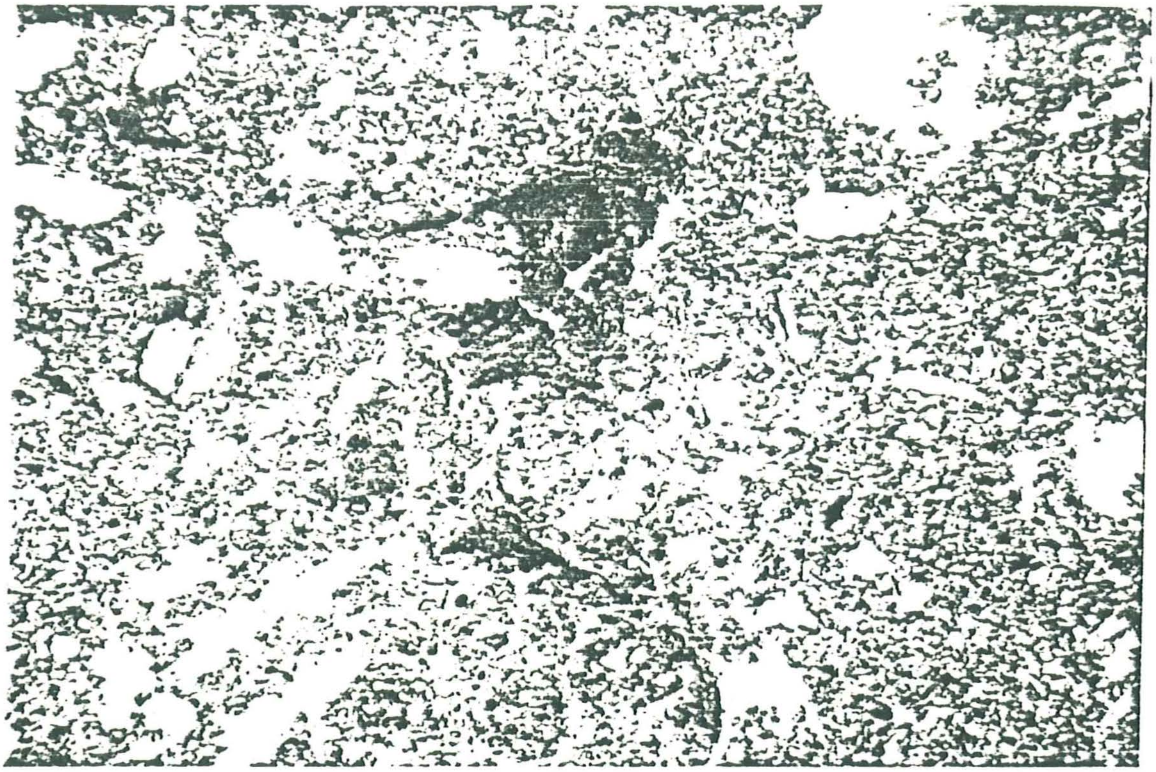
17. As 15; detail showing birefringent dusty clay porosity coatings; and infills (only evident in these loessic argillic soil fragments) as evidence of within-soil mass movement and slaking, as a result of soil disturbance. PPL, frame length is 0.332 um.



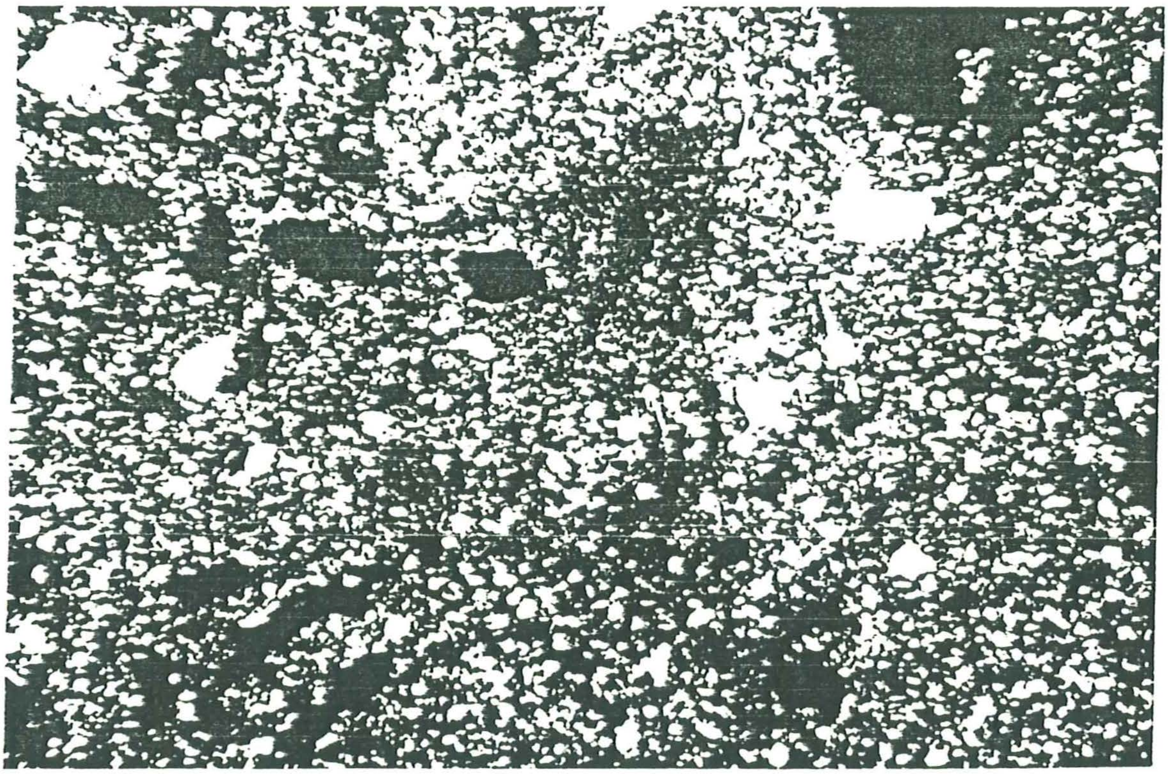
18. As 17, XPL.



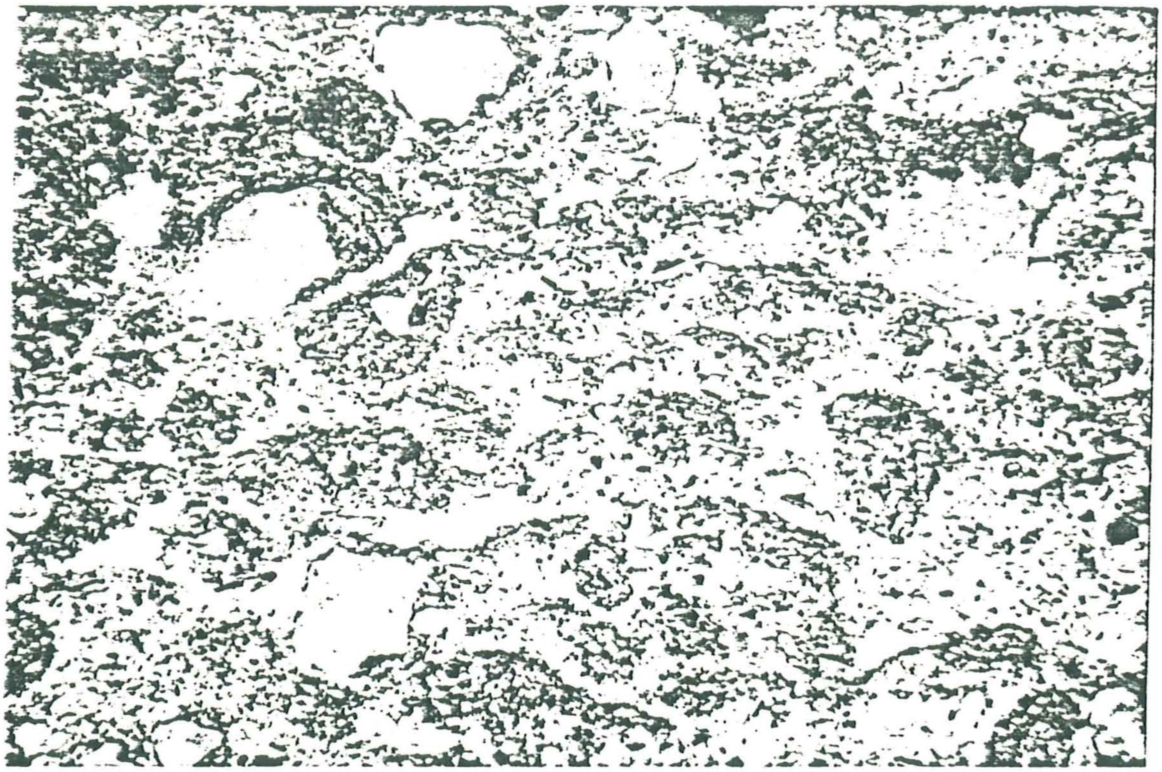
19. As 15, crescent-shaped loose mineral excremental earthworm infills in loessic argillic soil fragment. PPL, frame length is 3.35 mm.



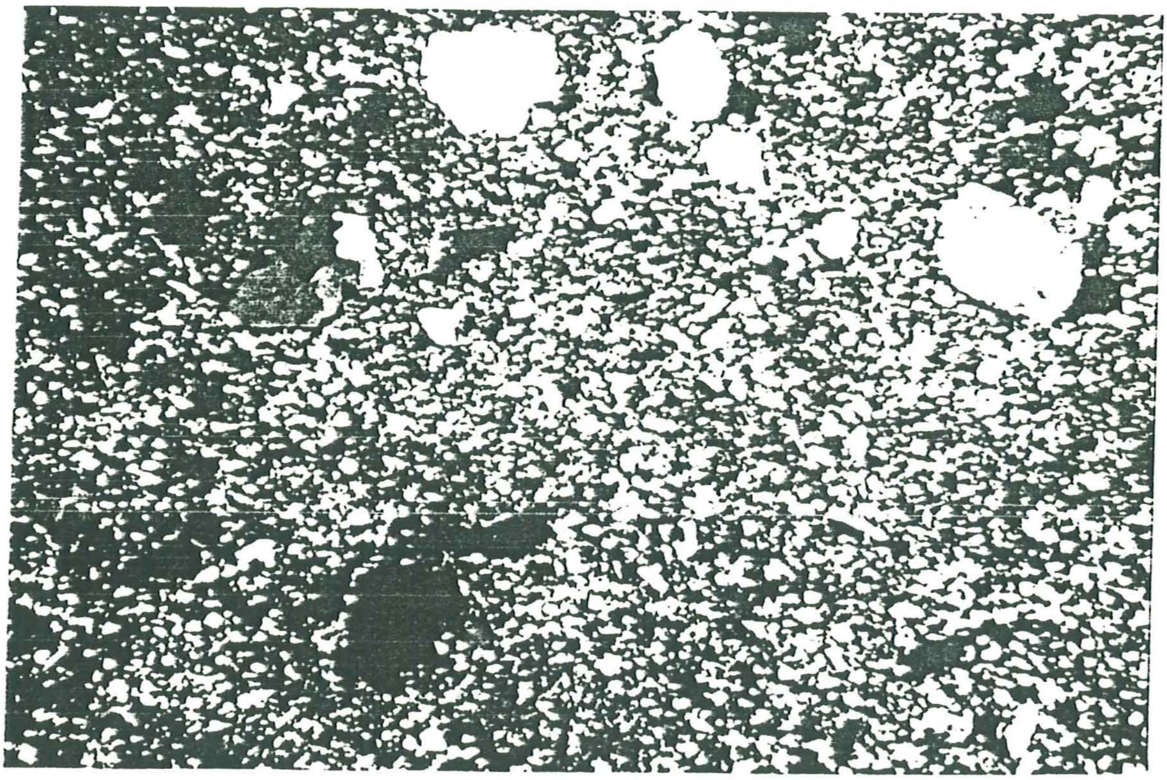
20. 527; bB (gx); moderately biologically worked relic subsoil with coarse fragments of relic periglacial (Late Devensian) silt and clay pans (fragipan horizon). PPL, frame length is 5.225 mm.



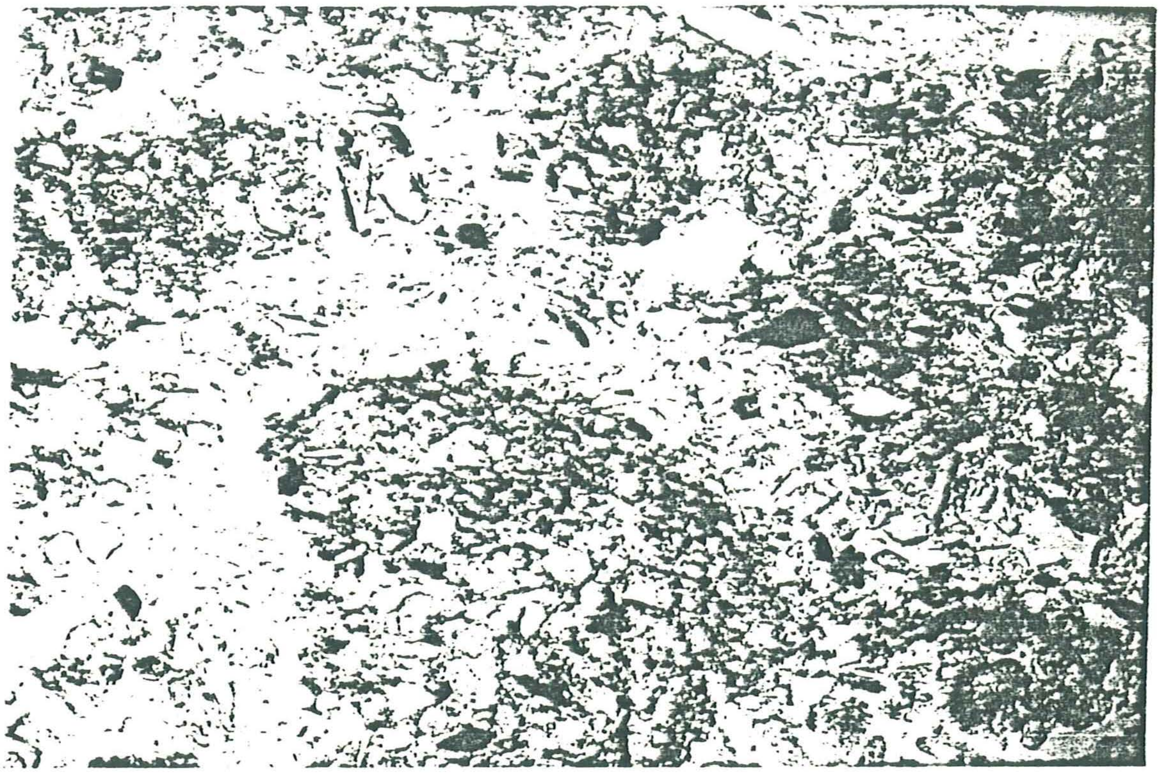
21. As 20, XPL; birefringent pan fragments.



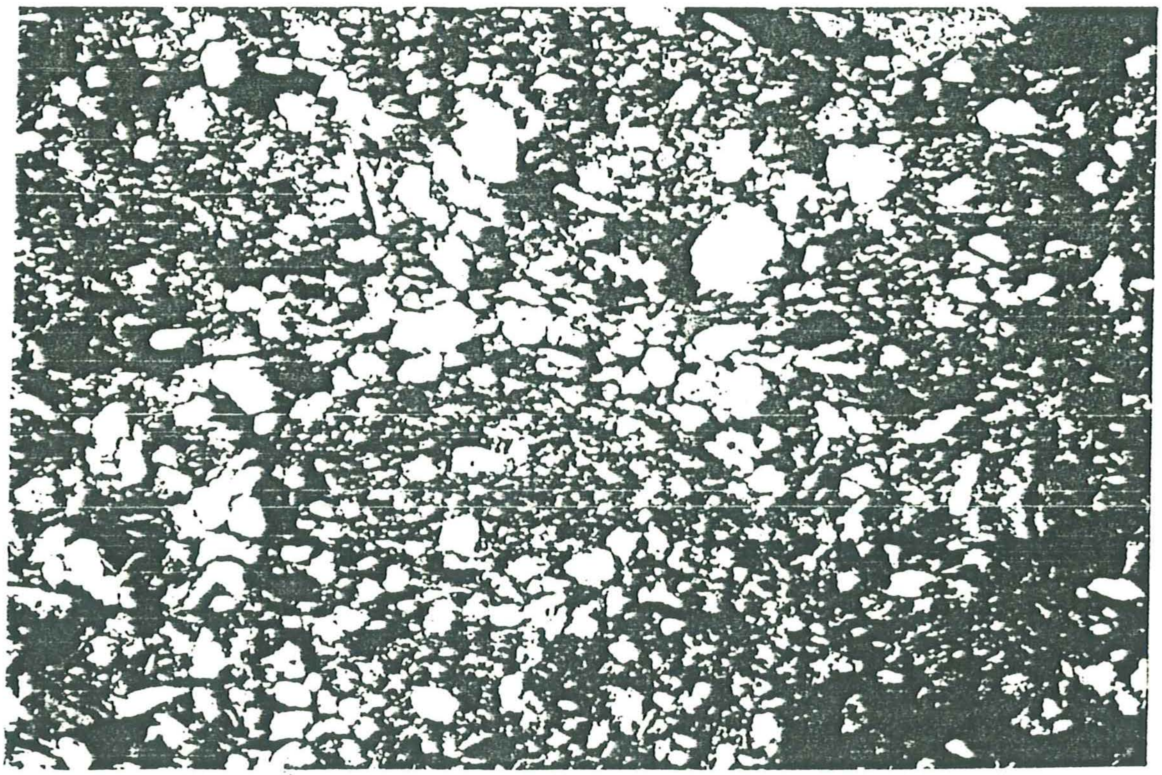
22. 527; bB(gx)2; discontinuous Late Devensian silt and clay pans ("silt droplets"). These strongly formed pans (probably Zone II) were probably broken up into fragments and rounded into granules by Zone III reworking. PPL, frame length is 5.225 mm.



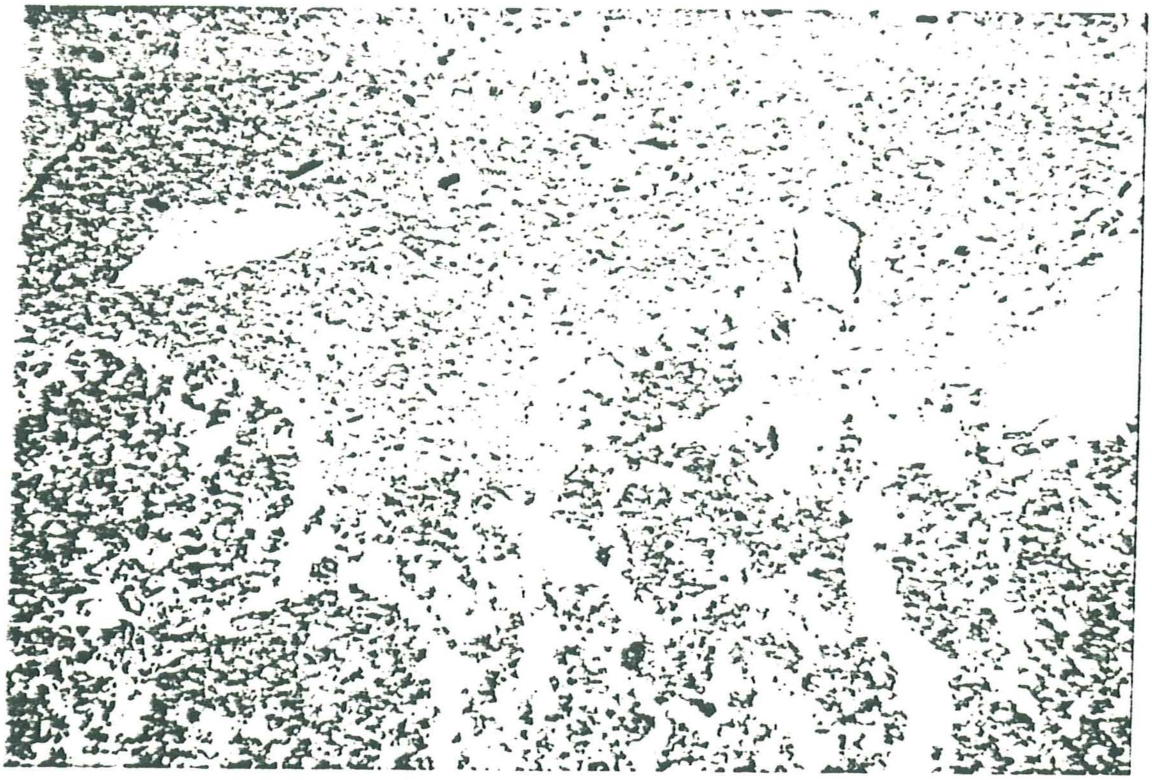
23. As 22, XPL; "clean silt" bands (washed clean of fines by "silt droplet" process) show up clearly around browner birefringent pan fragments and granules.



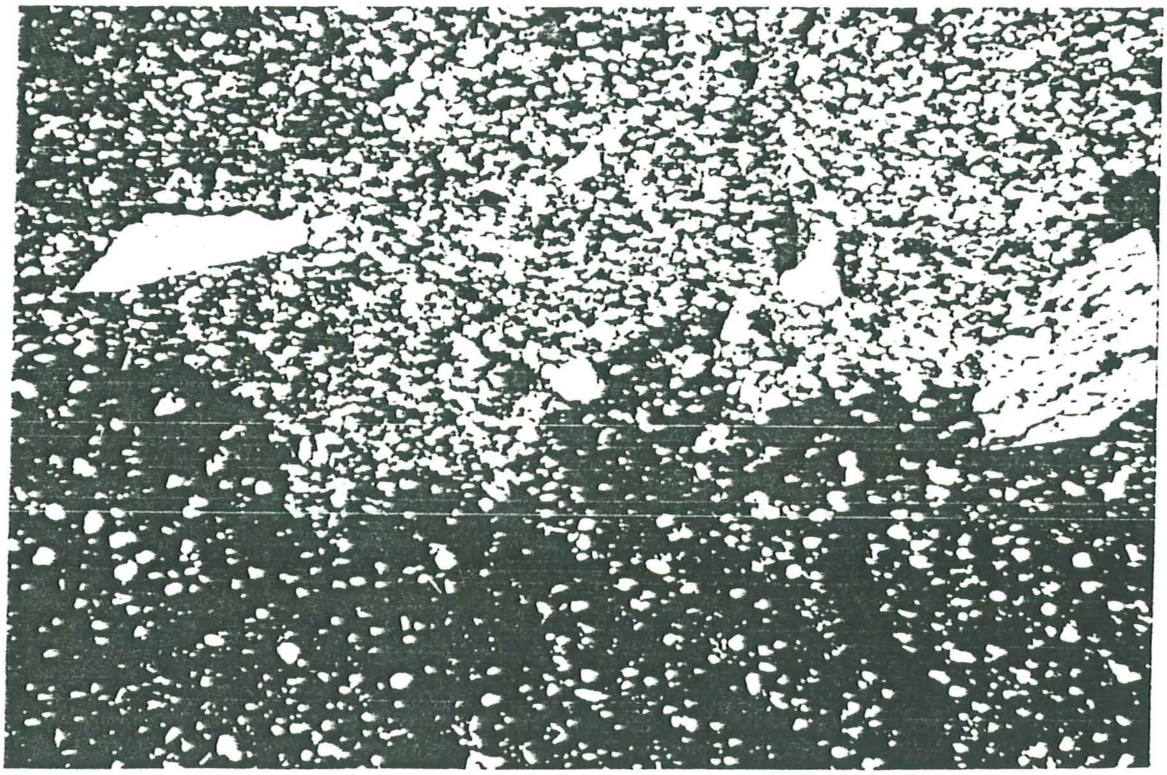
24. As 23, detail of silt and clay granule and surrounding clean, washed silt. PPL, frame length is 1.348 mm.



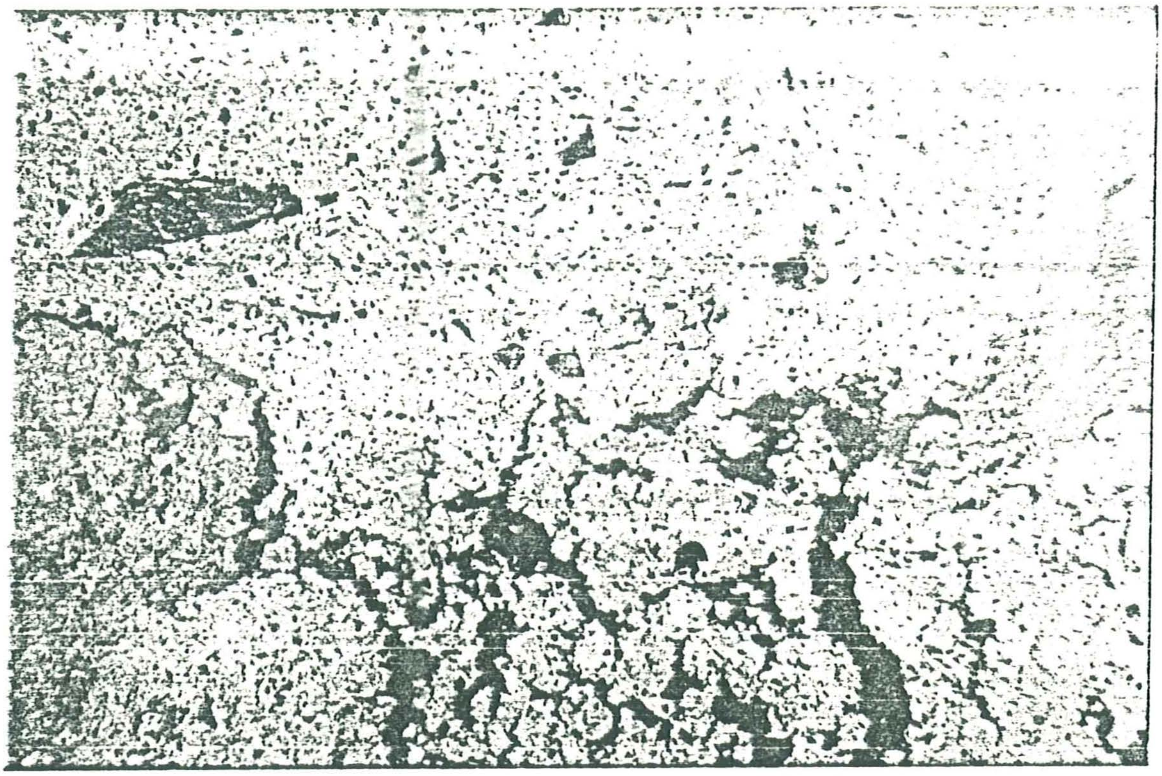
25. As 24, XPL.



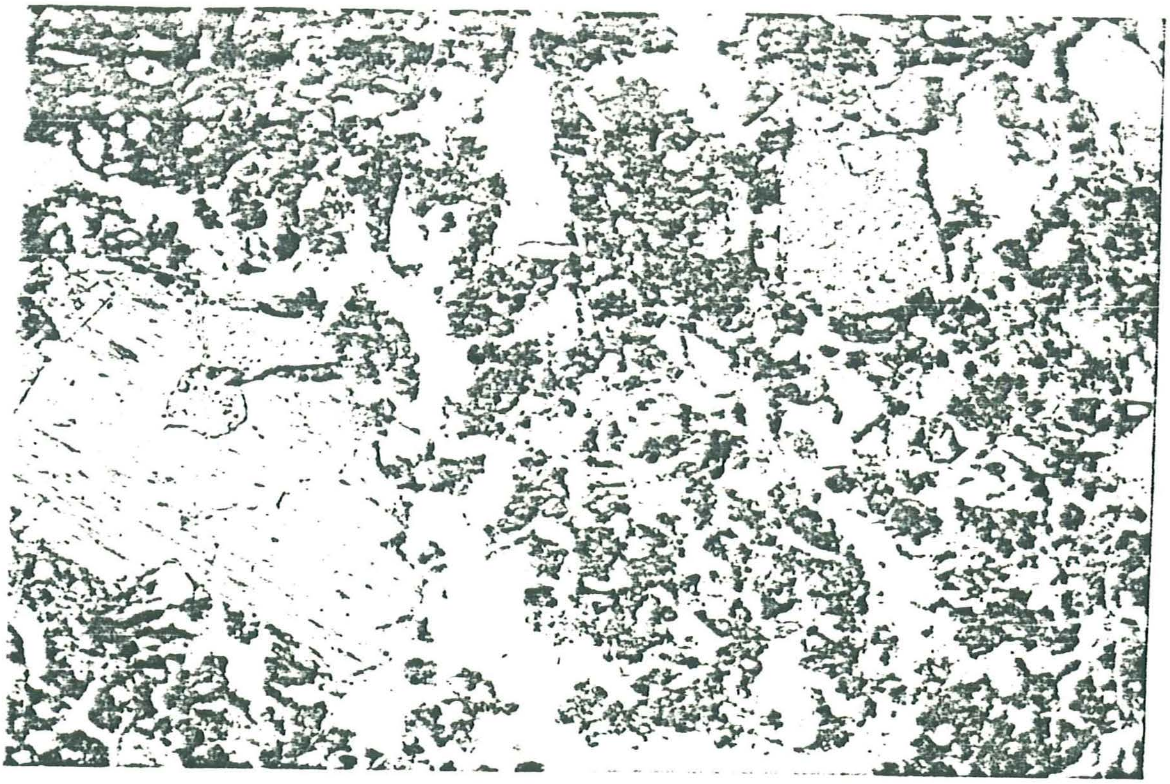
26. 527, bB(g)x3. Clean, massive, silty fabric typical of periglacial soil (fragipan), probably soliflucted over more clay-rich, ferruginous, brown soil possibly developed in temperate Zone II (Alleröd) in Late Devensian loess. Brown soil has a biolically worked and structural Al/Bw (cambic) character. PPL, frame length is 5.225 mm.



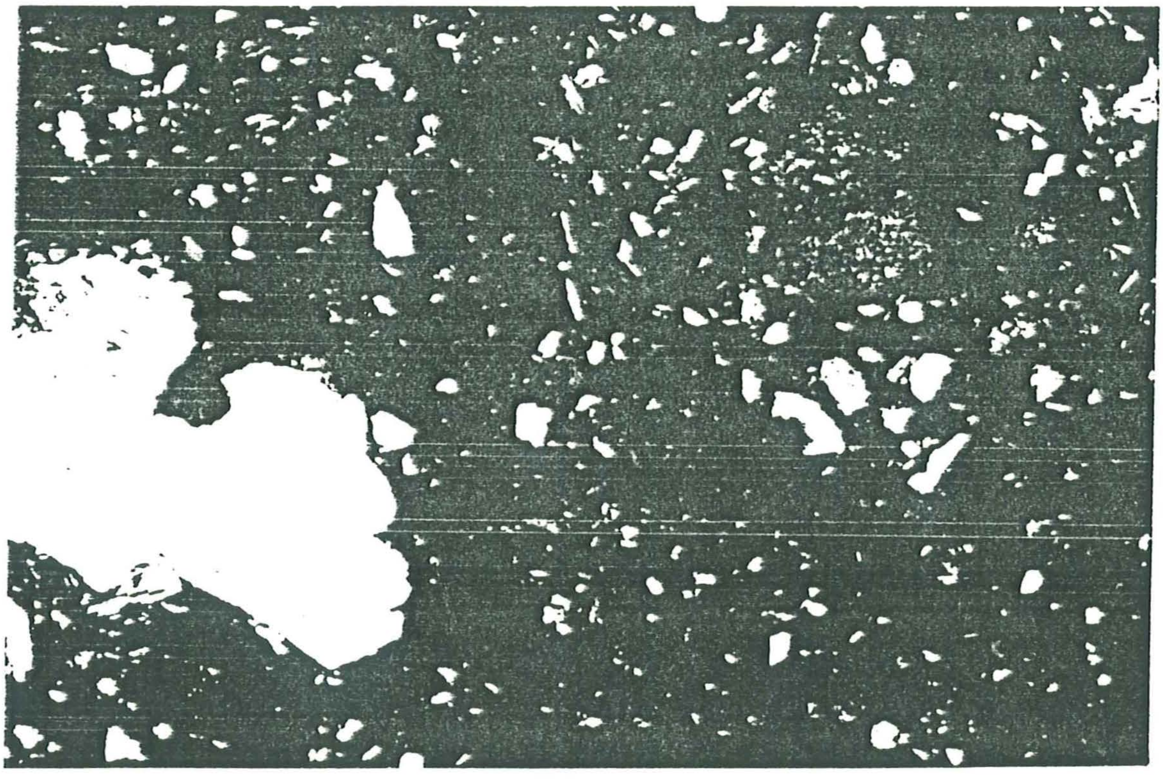
27. As 26, XPL. Silt-rich periglacial soil contrasts strongly with underlying clay-rich loessial brown soil.



28. As 26, OIL. The silty soil is "clean" (depleted) whereas the brown soil is ferruginous.

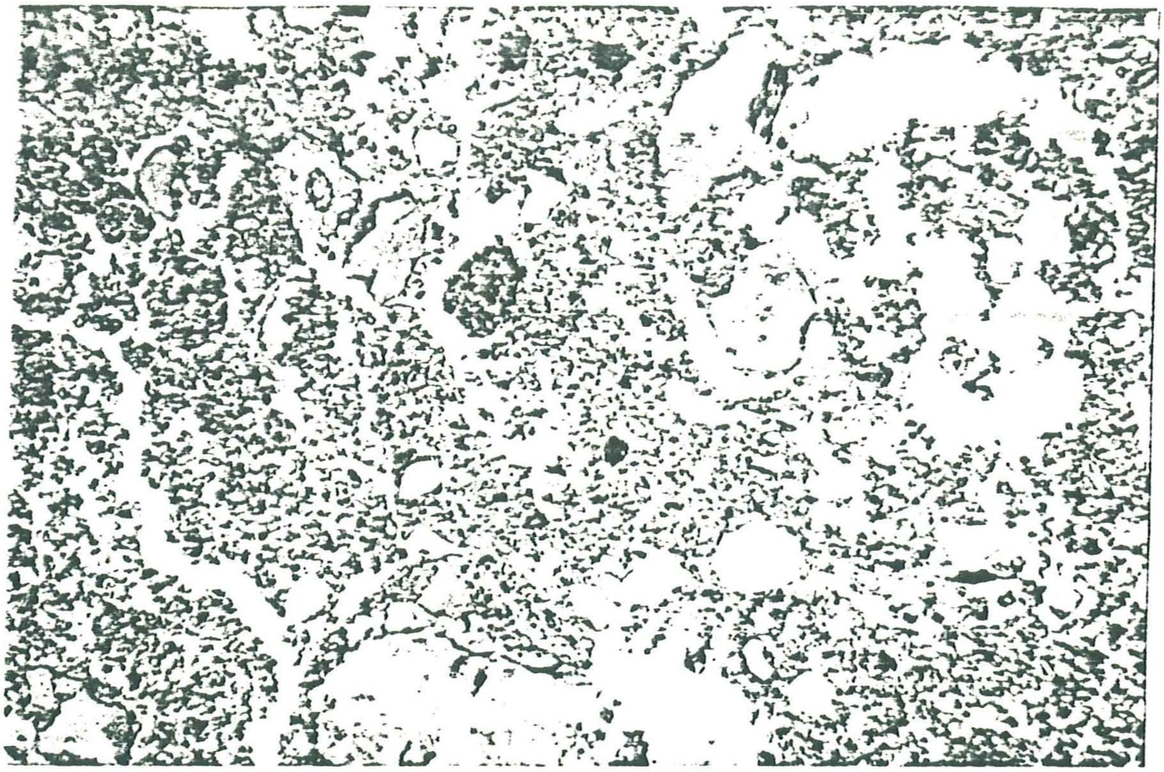


29. As 26; detail of biologically worked ferruginous clay loessial soil - of Alleröd (Zone II) age? PPL, length of frame is 1.348 mm.

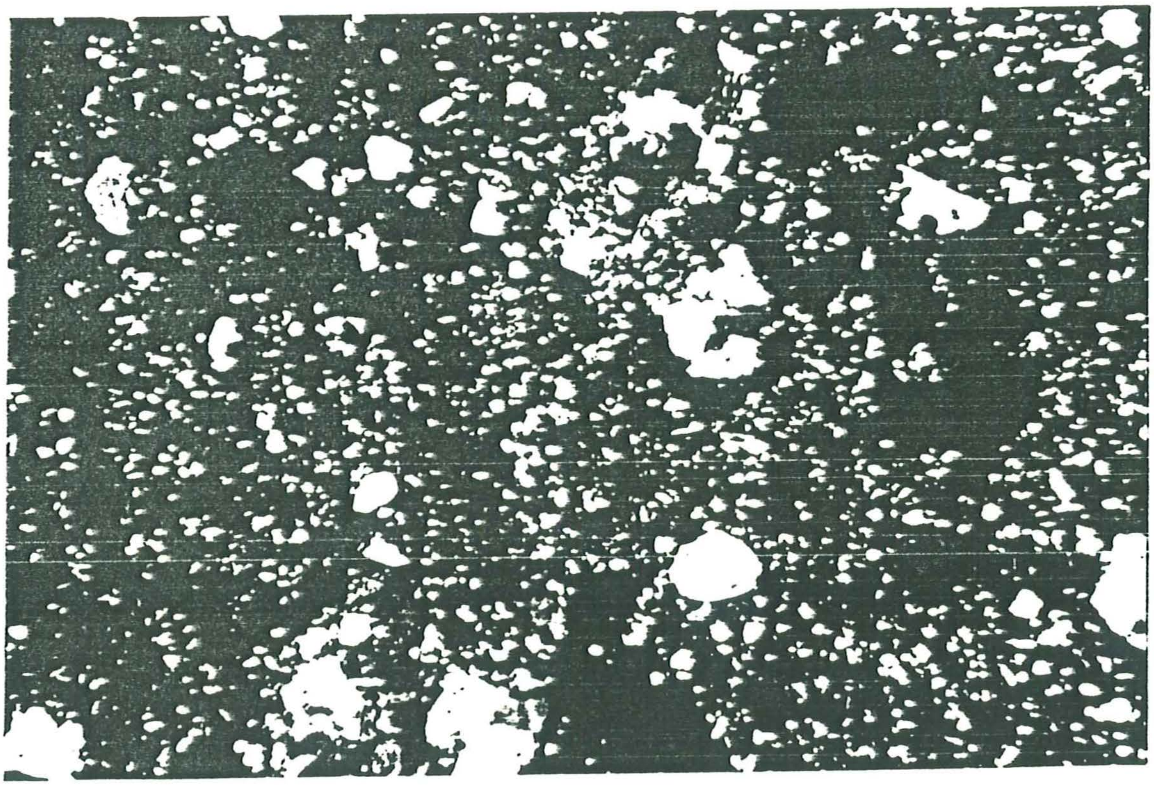


30. As 29, XPL. Note low birefringence of biologically worked fine fabric; and mica fragment.

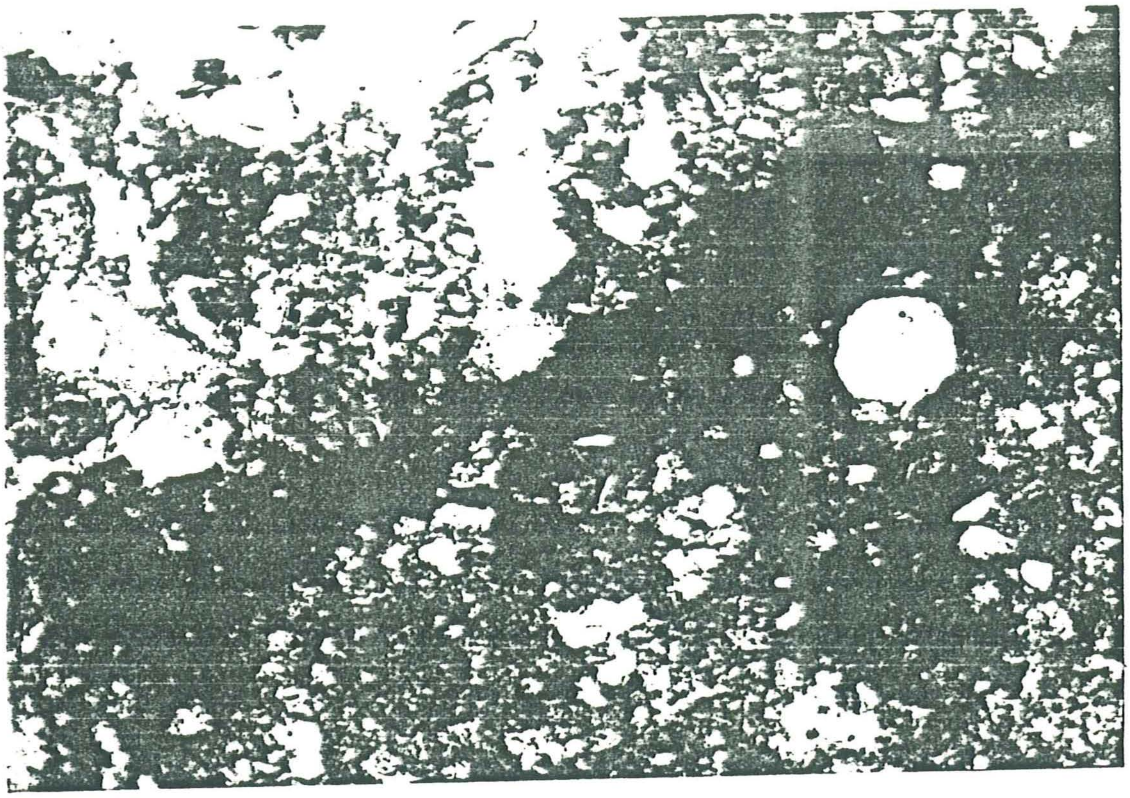
31. 403; field photograph (see Fig 3); stone wall and colluvial bank (dark grey) occur on dark brownish lynchet deposits, overlying deeply eroded stony yellowish relic granitic periglacial subsoils.



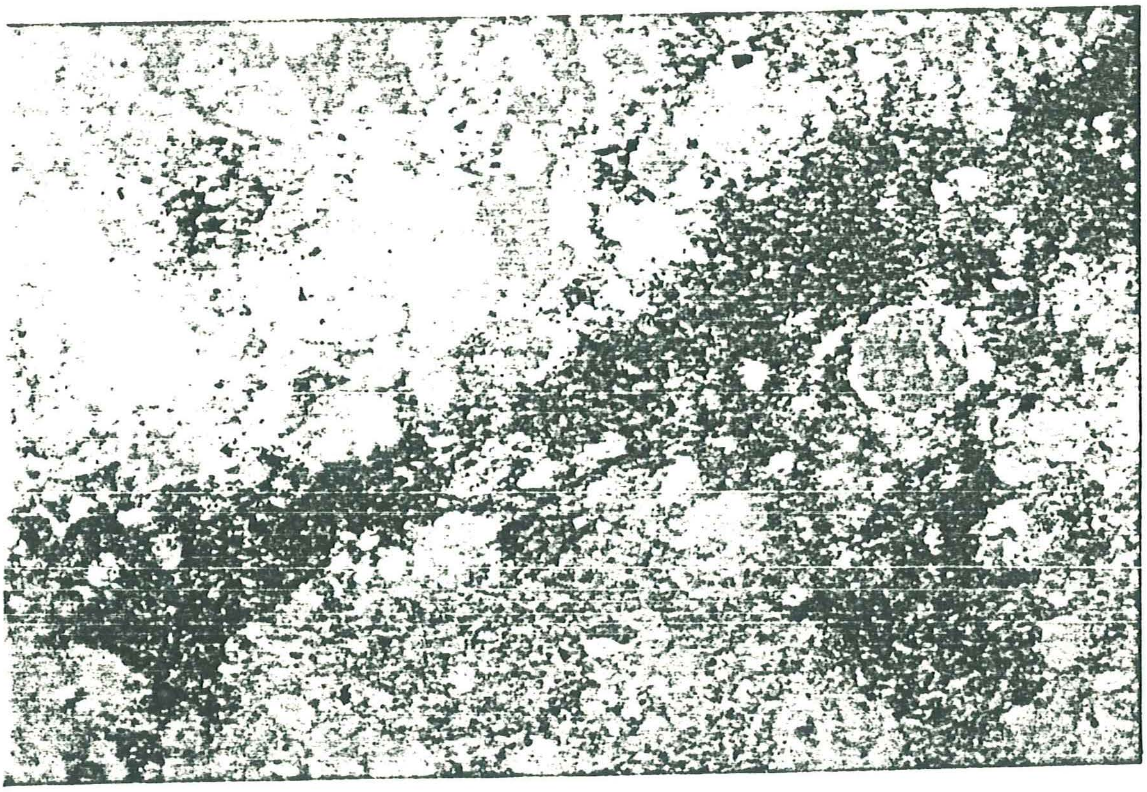
32. 403; bBs (upper); lynchet formed of moderately weathered colluvium derived from relic granitic periglacial subsoil; note fragments of granules etc; soil moderately biologically worked and cemented by sesquioxides. PPL, length of frame is 5.225 mm.



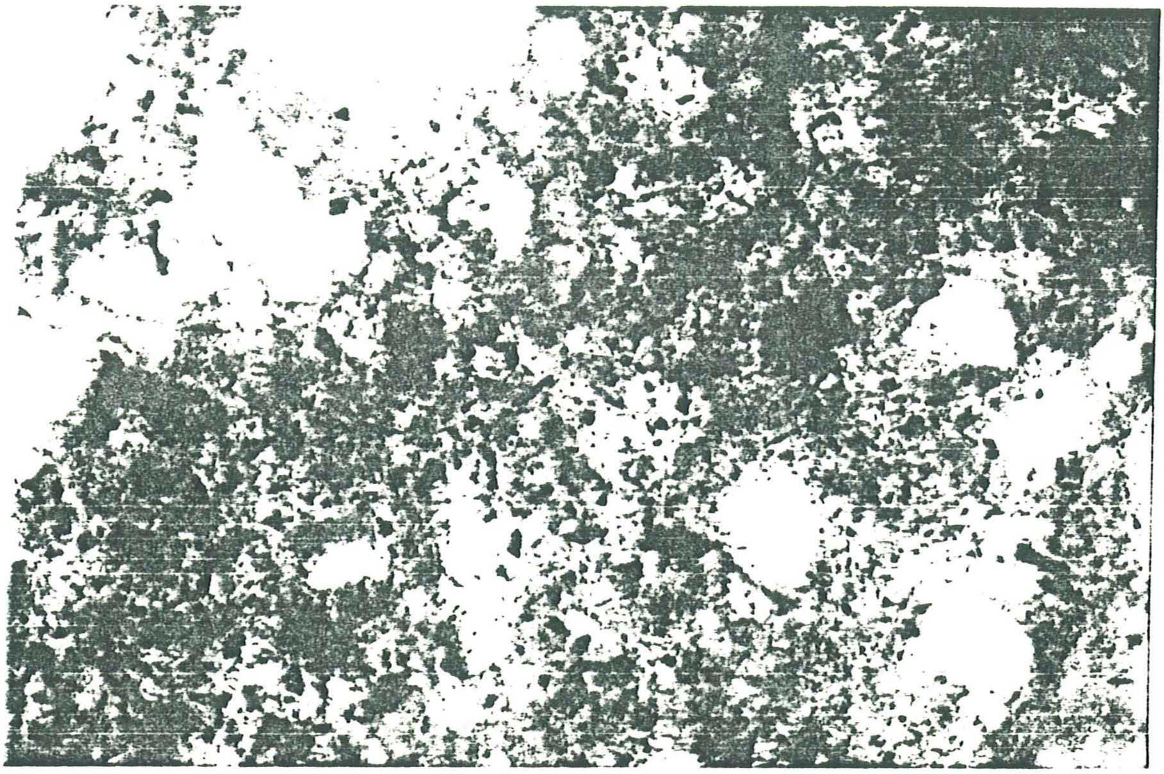
33. As 32, XPL; birefringent granules.



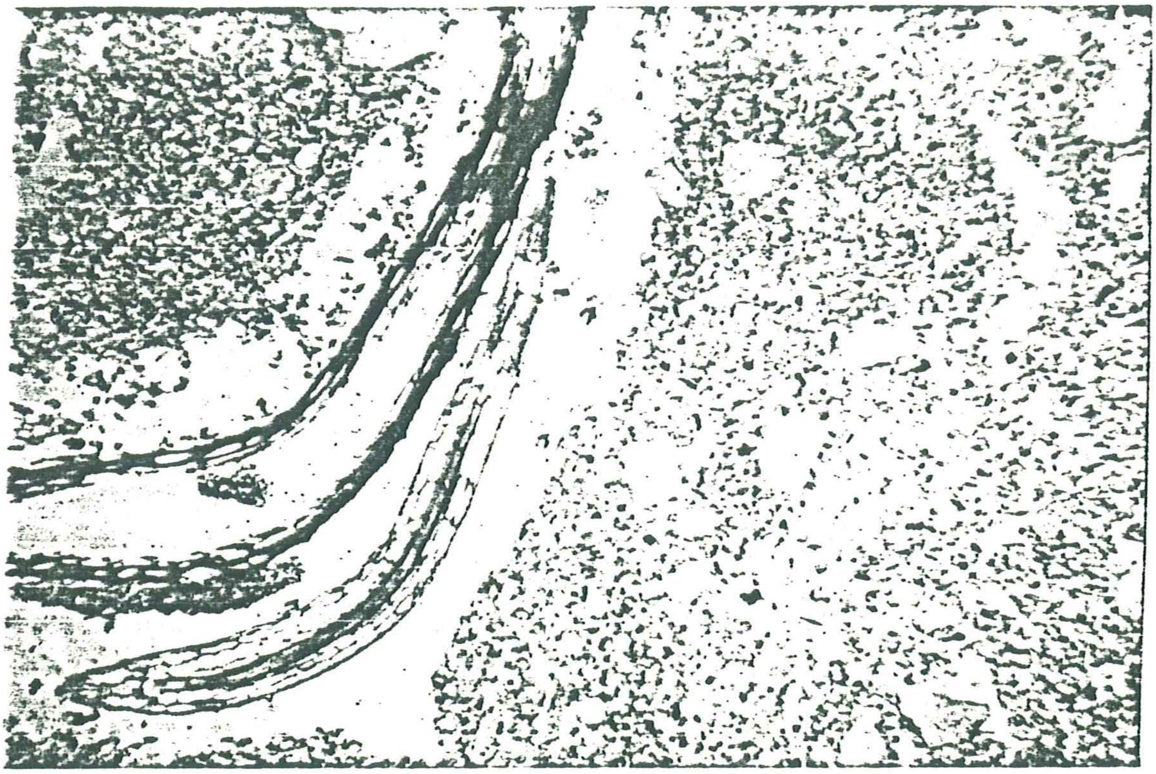
34. 403; 2bAh (within bBs); layer of slaked soil containing very abundant charred organic fragments, forming a pan-like feature. PPL, length of frame is 1.348 mm.



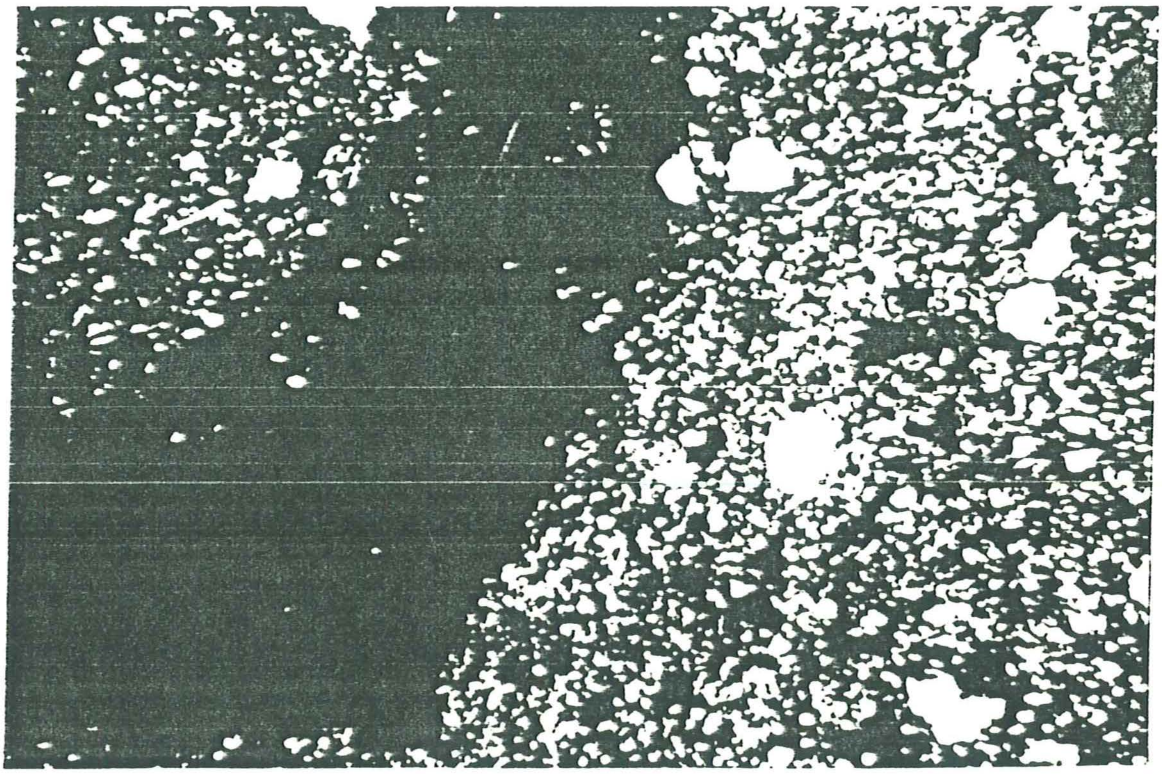
35. As 34, OIL; black charcoal fragments and reddened charred organic matter and soil, through burning.



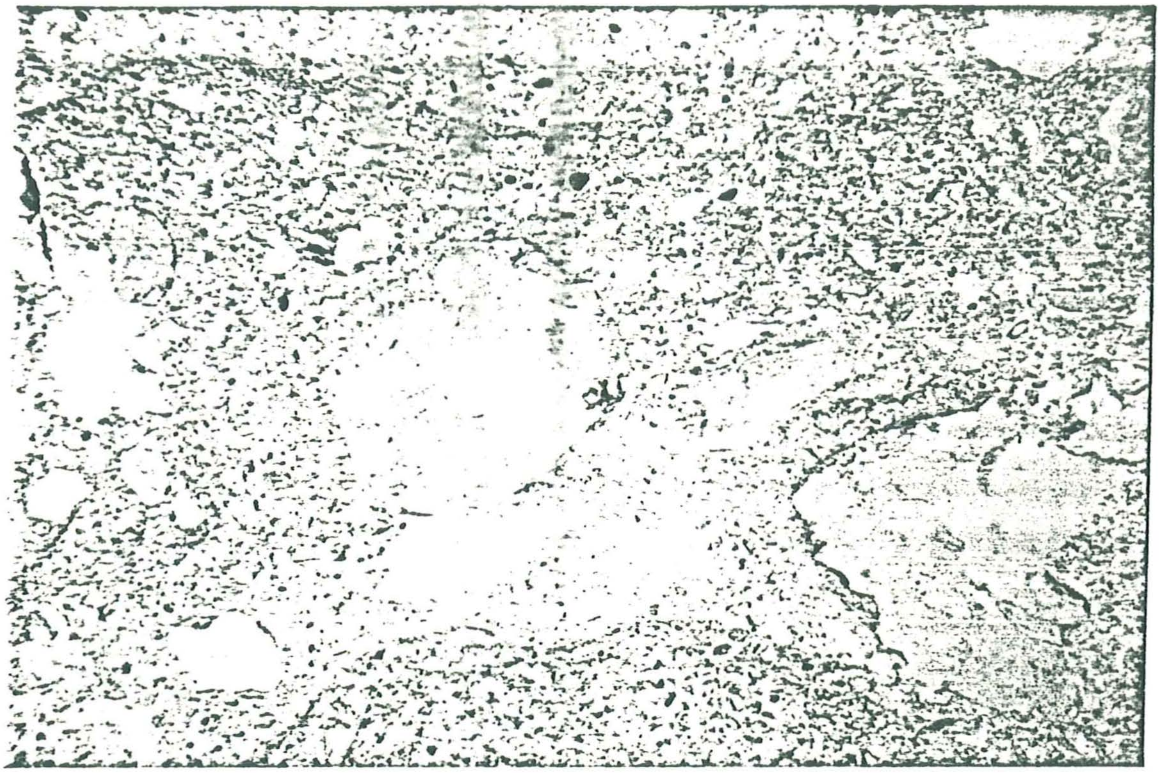
36. As 34, detail; showing concentration of flaky charred organic matter in this fine soil pan, here interpreted as resulting from "stubble" burning and soil slaking resulting from cultivation. PPL, length of frame is 340 um.



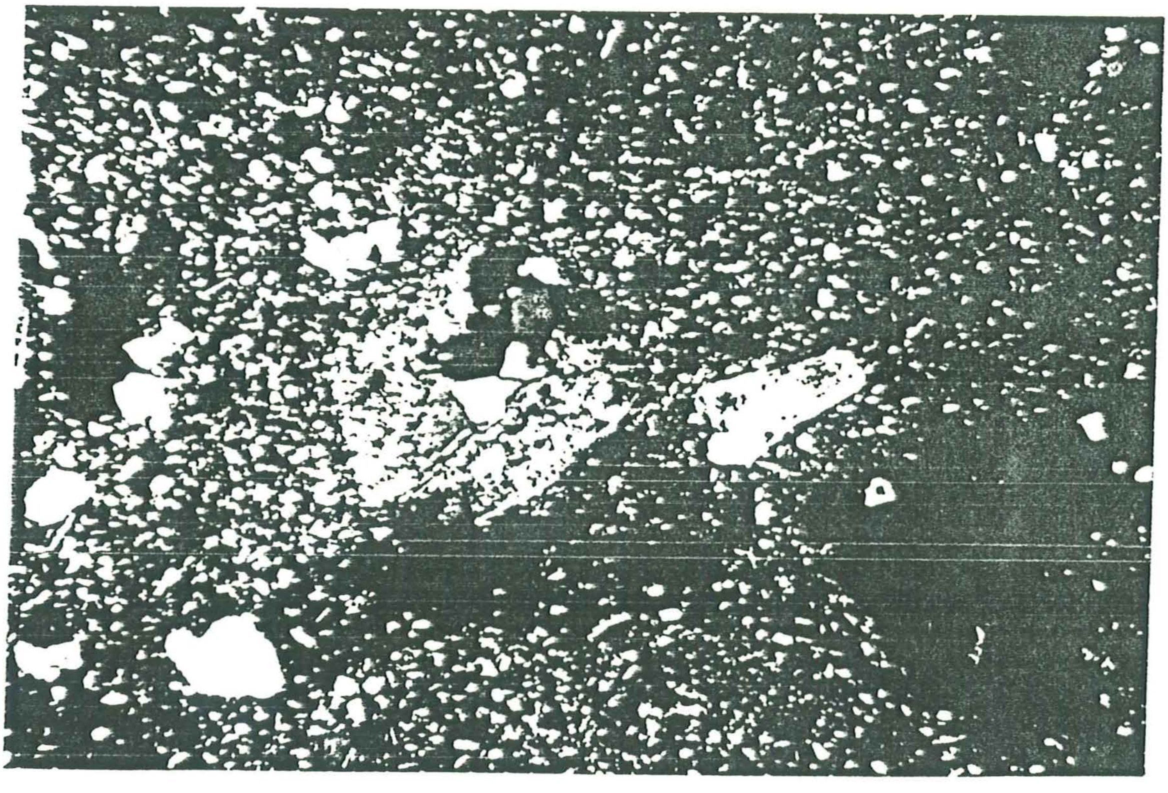
37. 403; bBs (lower); weathered granitic subsoil colluvium in which occur heavily ferruginised roots, presumably to the surface at 2bAh. PPL, length of frame is 5.225 mm.



38. As 37, XPL. Root ferruginised by illuvial iron.

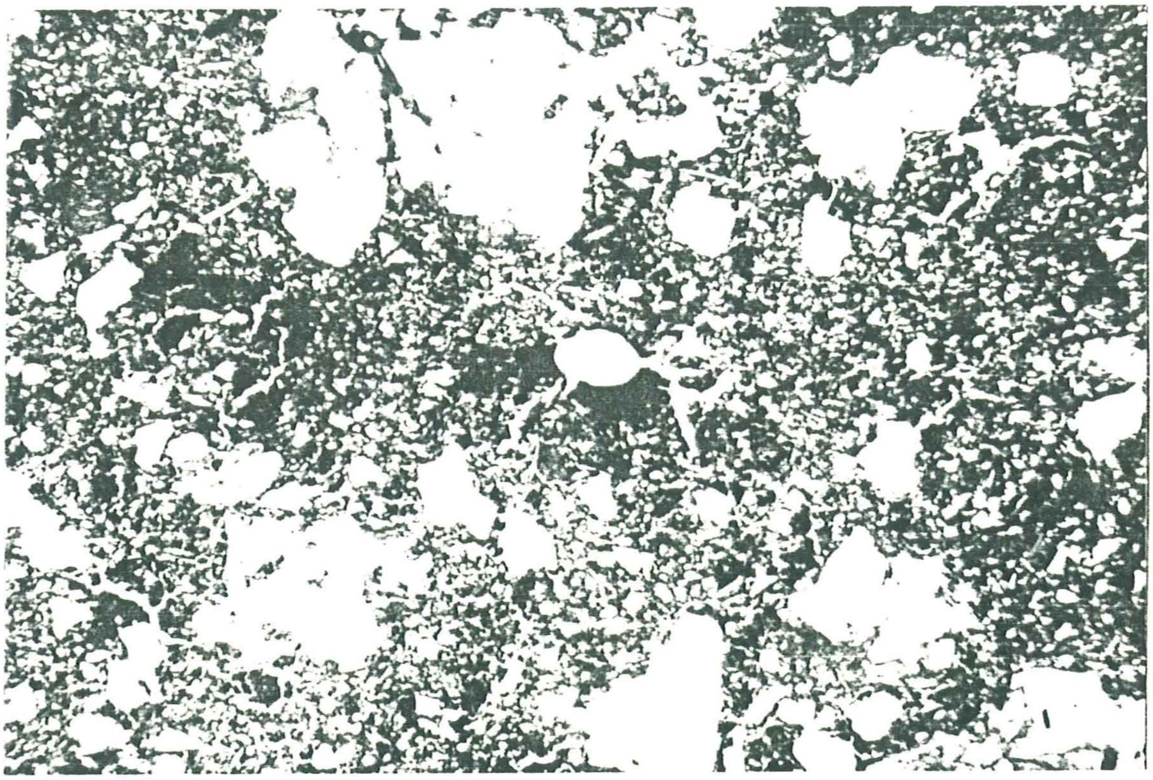


39. 403; 4bB(x); in situ relic granitic Late Devensian periglacial subsoil displaying weakly developed, but continuous, silt and clay pans (silt droplets) - probably date to Zone IV.

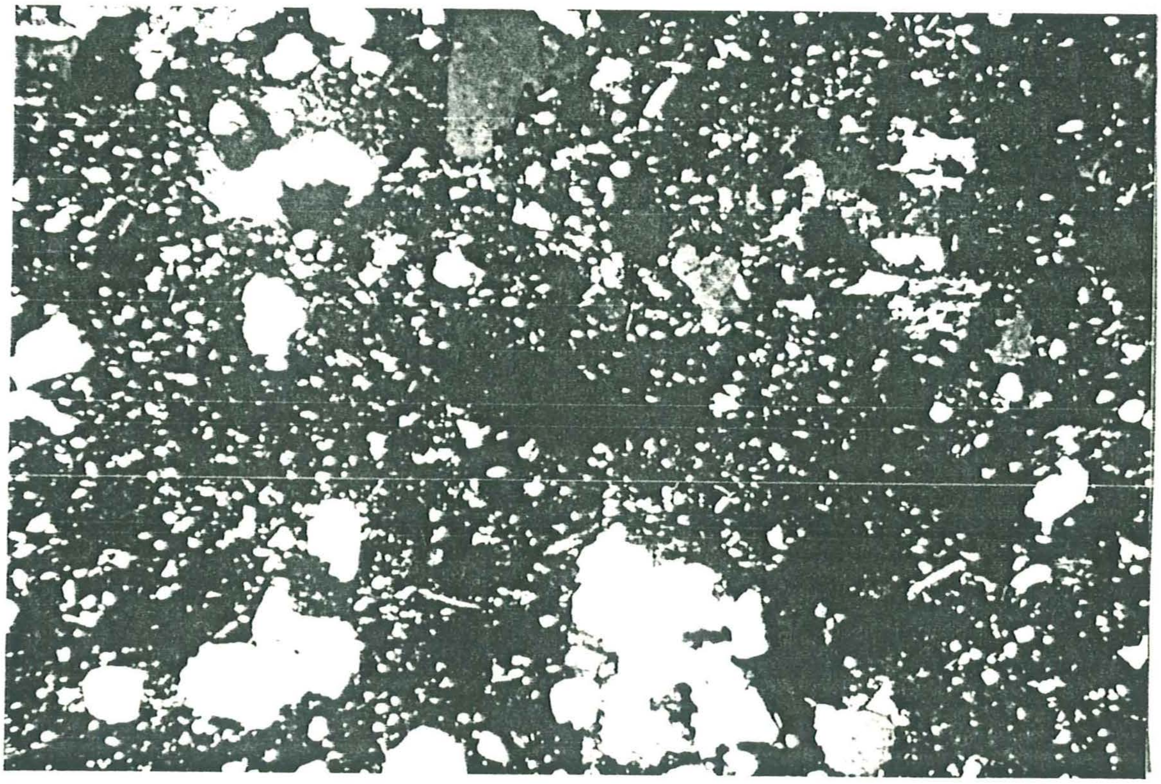


40. As 39; XPL; weakly formed silt and clay pan.

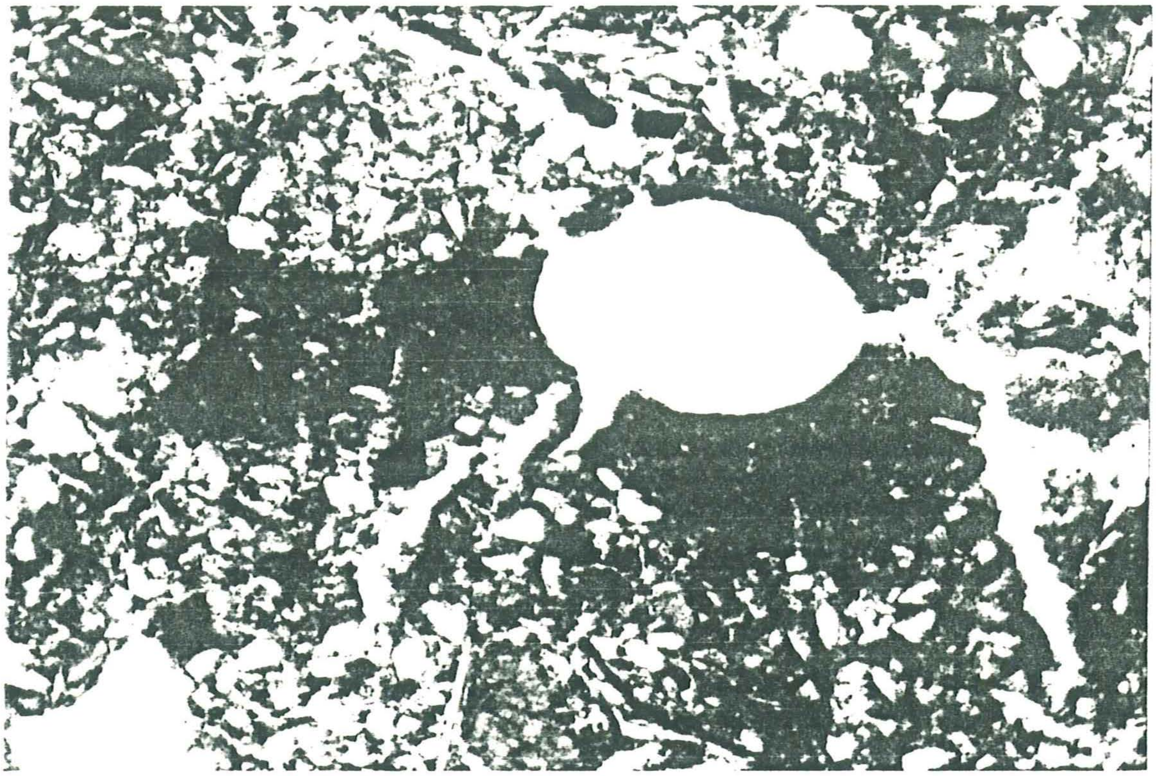
41. Field photograph, 117 (Fig 4). Wall and bank over buried podzol formed in a lynchet over exposed relic granitic periglacial subsoil.



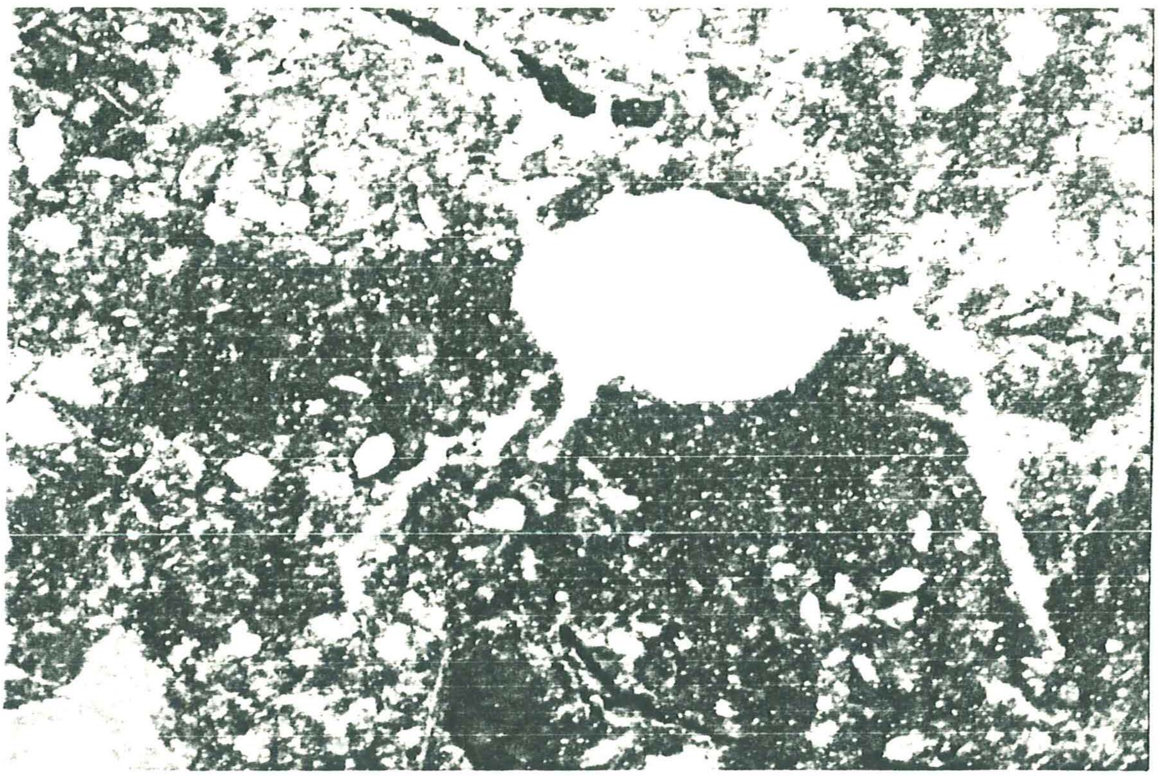
42. 117; bEa/Bh, lower part; illuvial podzolic horizon formed in granitic parent material (colluvium) containing dark reddish brown fragments of dense very dusty clay void coatings, infills and pans, presumed to have developed from slaking of the soil during cultivation; at the same time as these fine features were becoming cemented by podzolic illuviation; and lastly broken up by further tillage. PPL, frame length is 5.225 mm.



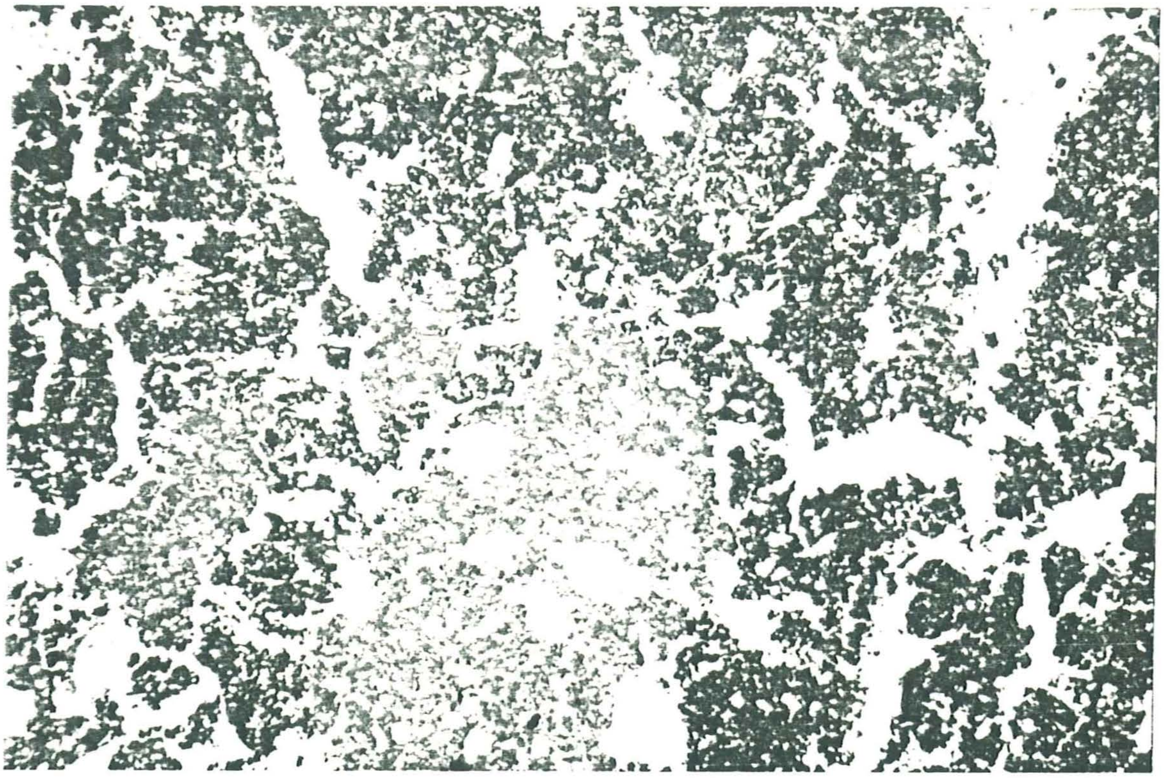
43. As 42, XPL; fine soil infills are very poorly birefringent because of



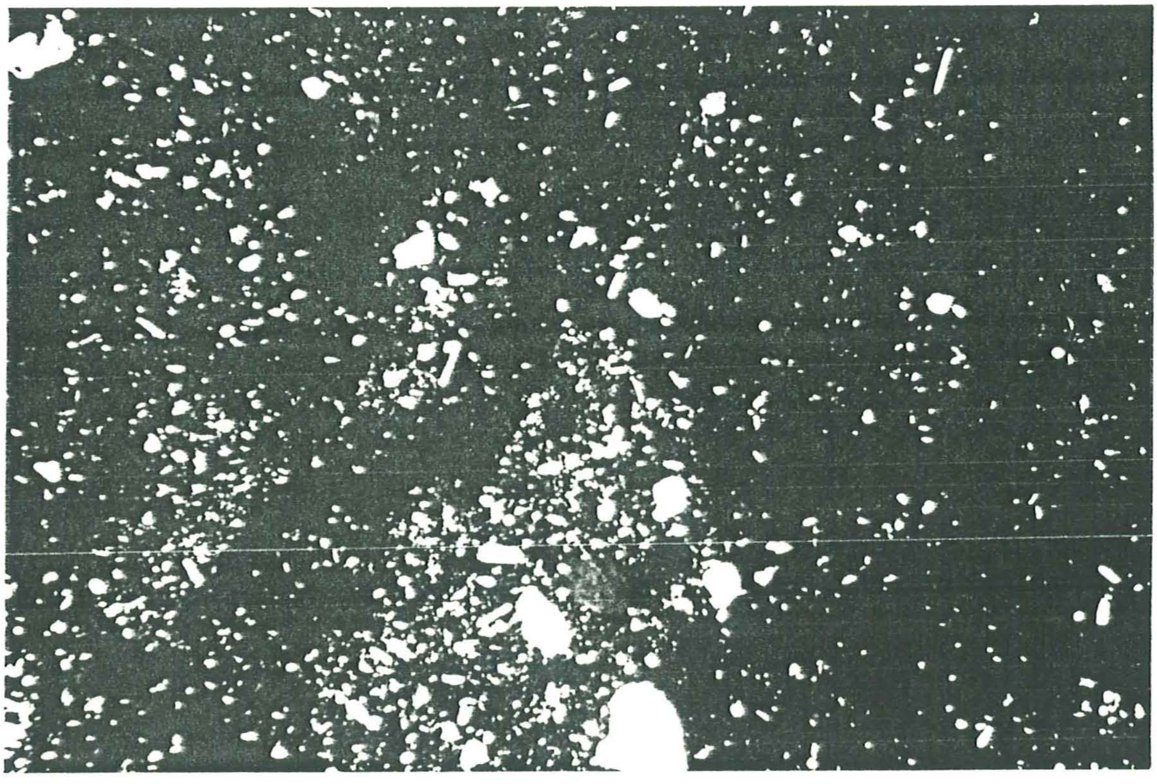
44. As 42, detail of infill of fine micro-contrasted particles, including fine charcoal and fine spodic fragments. PPL, length of frame is 1.348 mm.



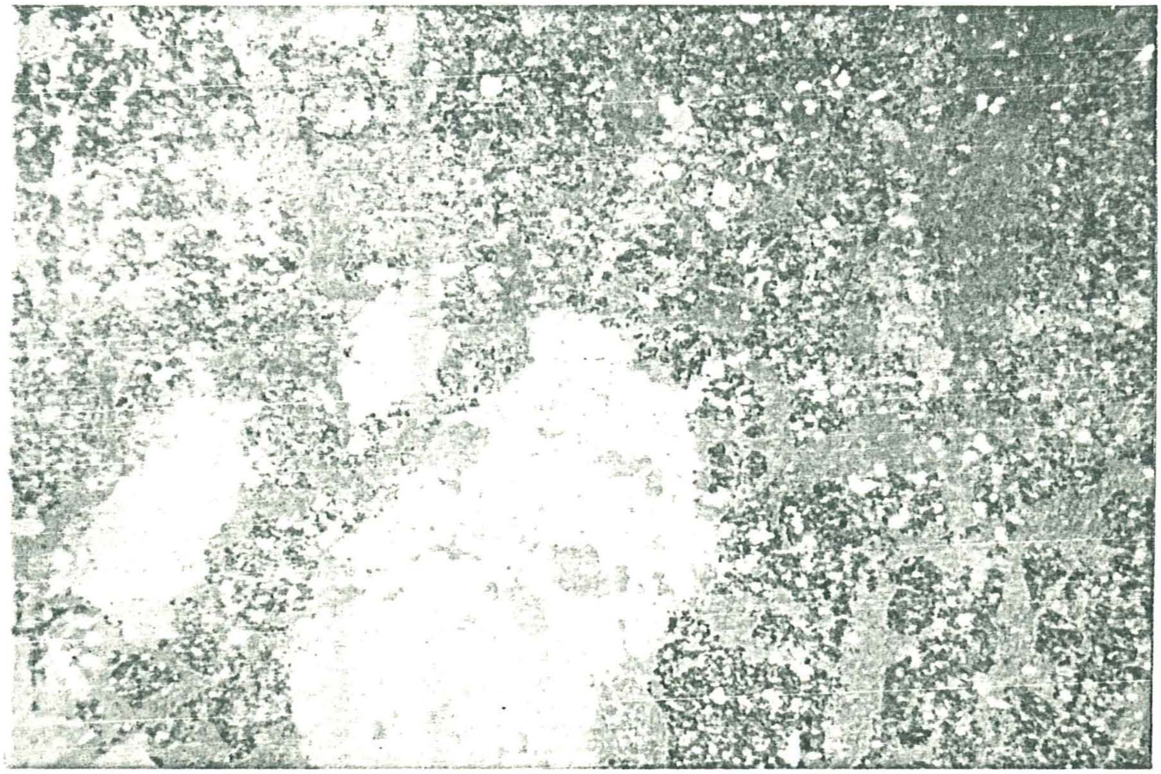
45. As 43, OIL.



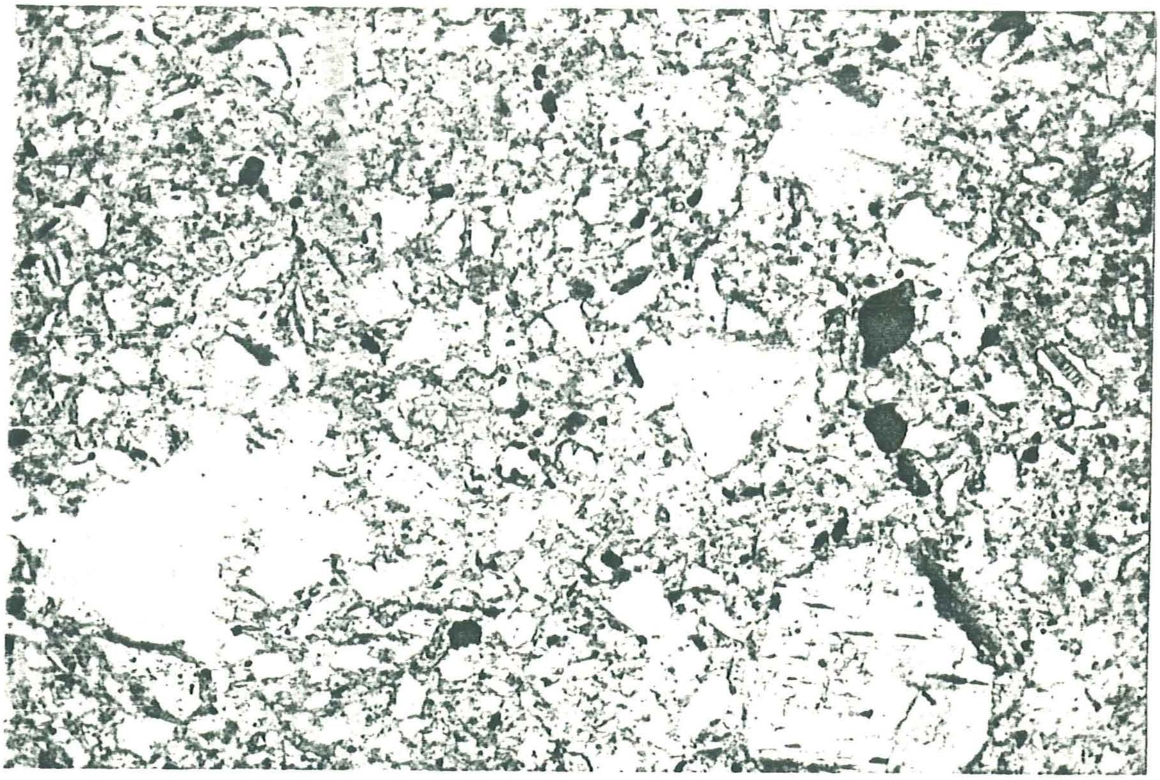
46. 117; bBhs; colluvial podzolic B horizon comprising typical dark brown polymorphic amorphous organic matter, and yellowish brown, often rounded, fragments of relic granitic subsoil. PPL, length of frame is 5.225 mm.



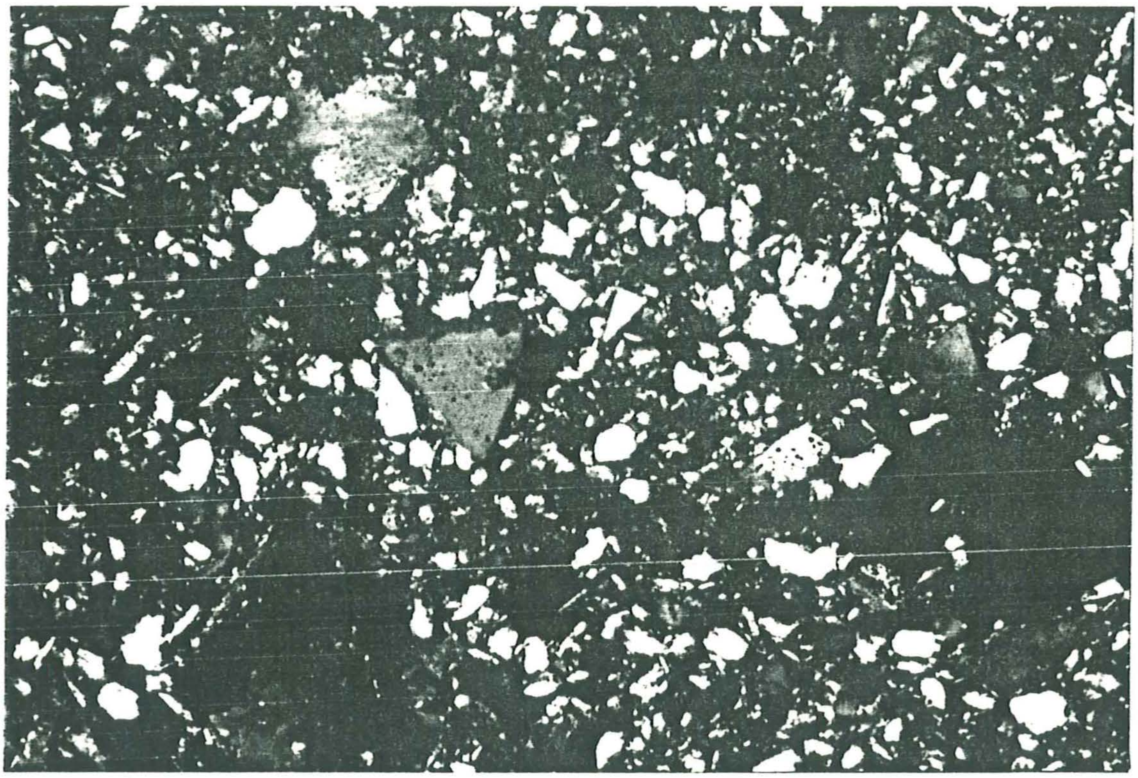
47. As 46, XPL. Note non-birefringent Bhs fabric, but birefringent (contains clay) relic subsoil fragments.



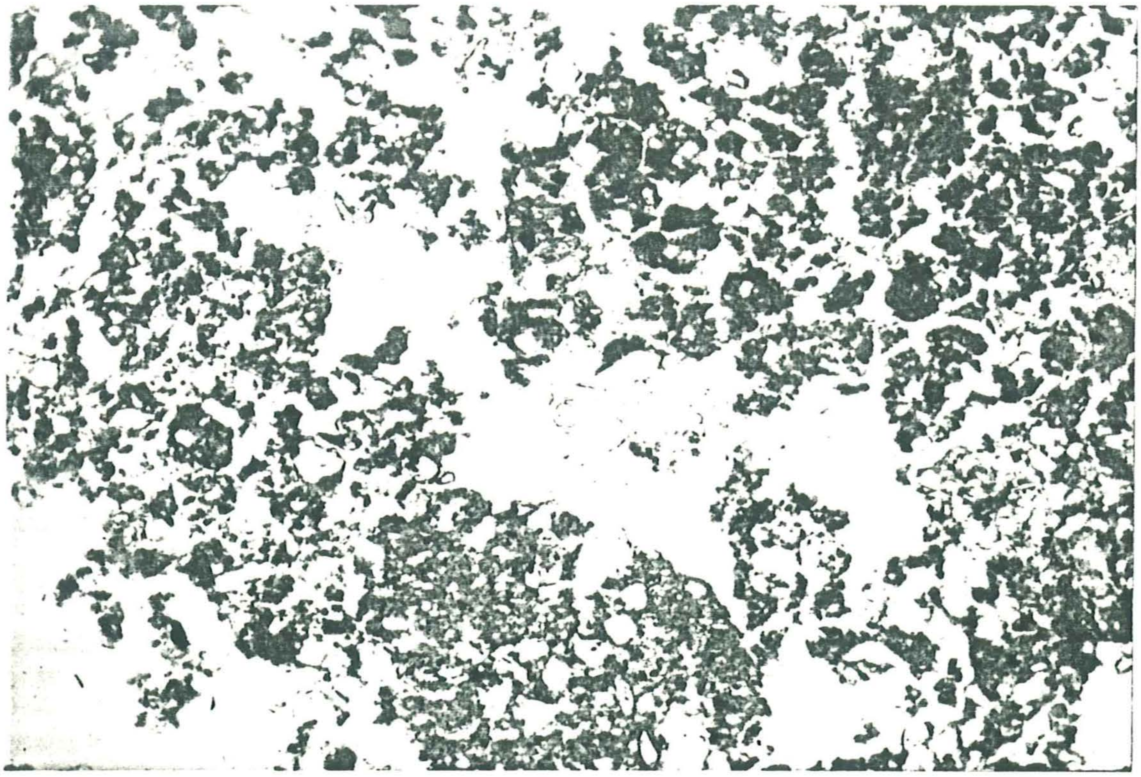
48. As 46, OIL; humic and sesquioxidic Bhs contrasts strongly with non-podzolic subsoil fragments.



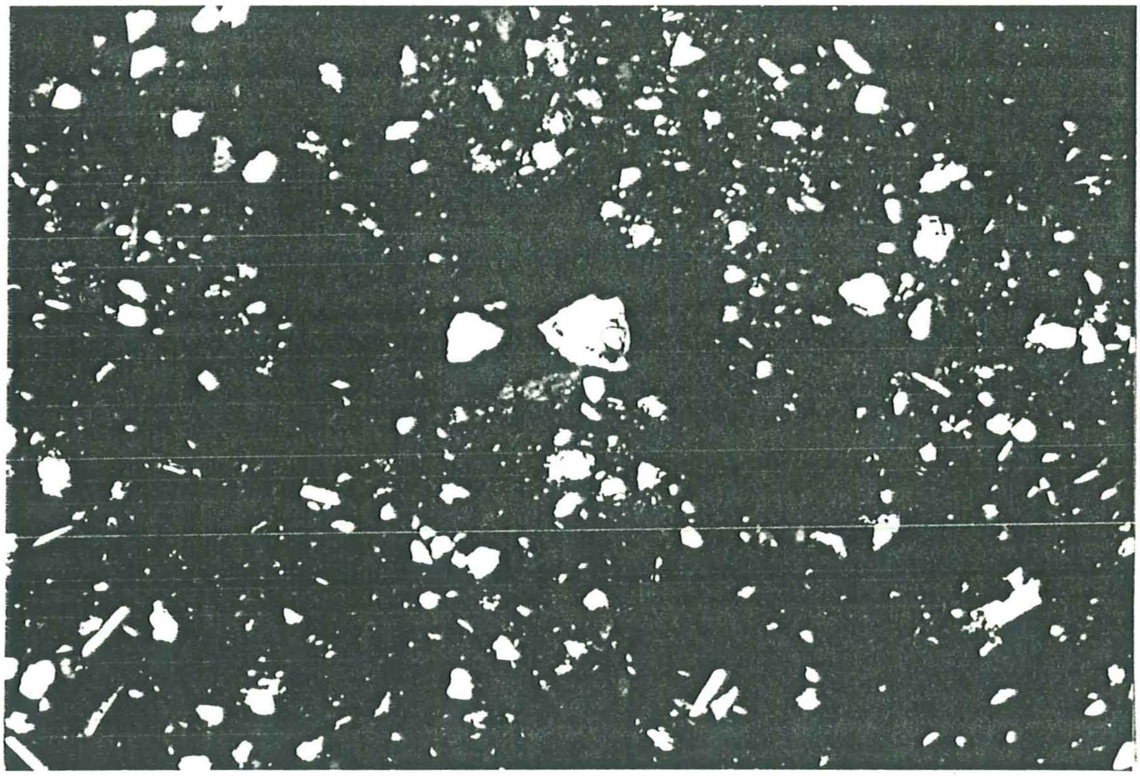
49. 117; 2bBx; dense, massive in situ relic periglacial granitic subsoil, with angular fragments, with thin "dirty" fine fabric. PPL, length of frame is 1.348 mm.



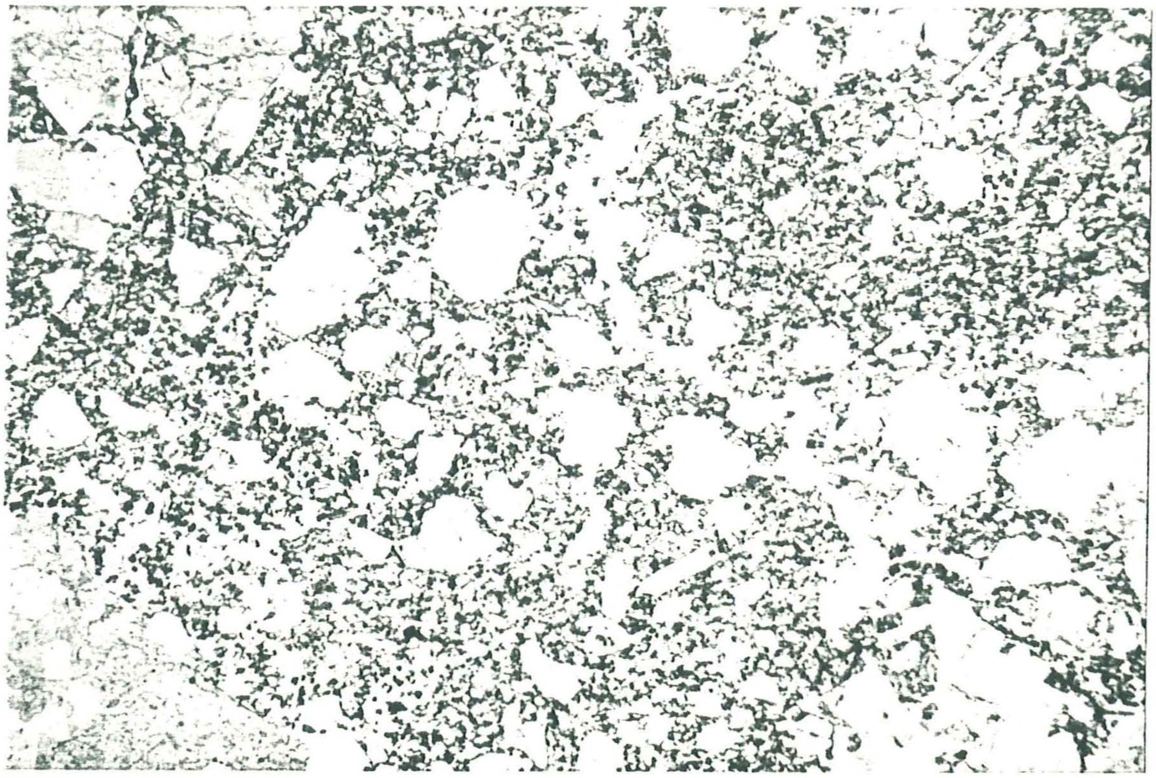
50. As 49, XPL.



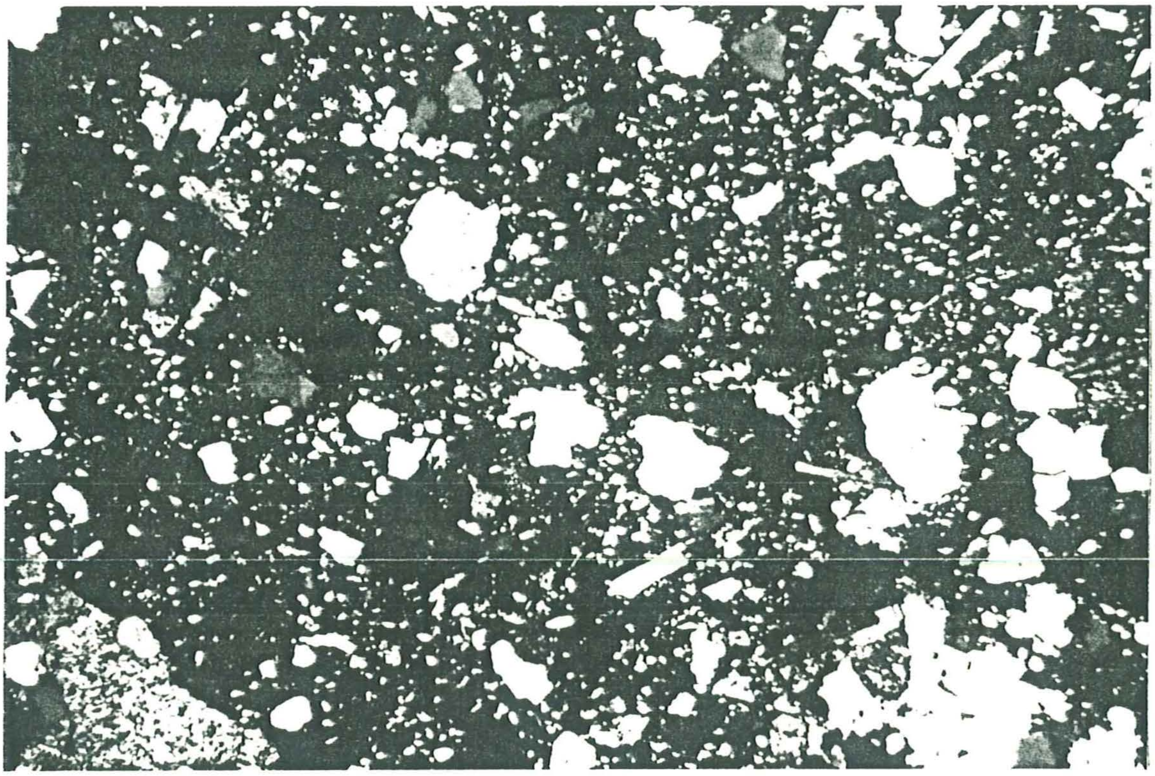
51. 117; modern Bhs (upper part) in upslope colluvial deposits; the polymorphic spodic fabric is intimately mixed with fine mineral material, i.e. derived from the weathered granitic parent material; also included are fragments of transported Bhs horizon material (bottom). PPL, length of frame is 5.225 mm.



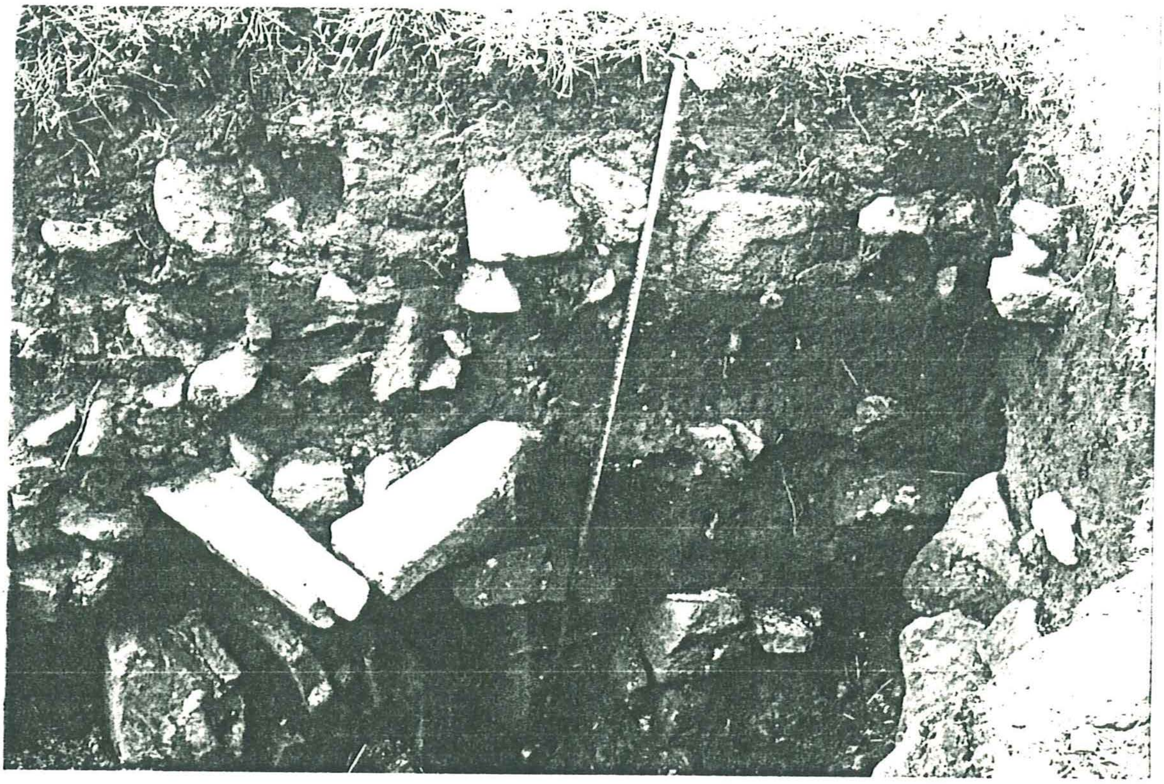
52. As 51, XPL (reversed); some clayey fabric still present.



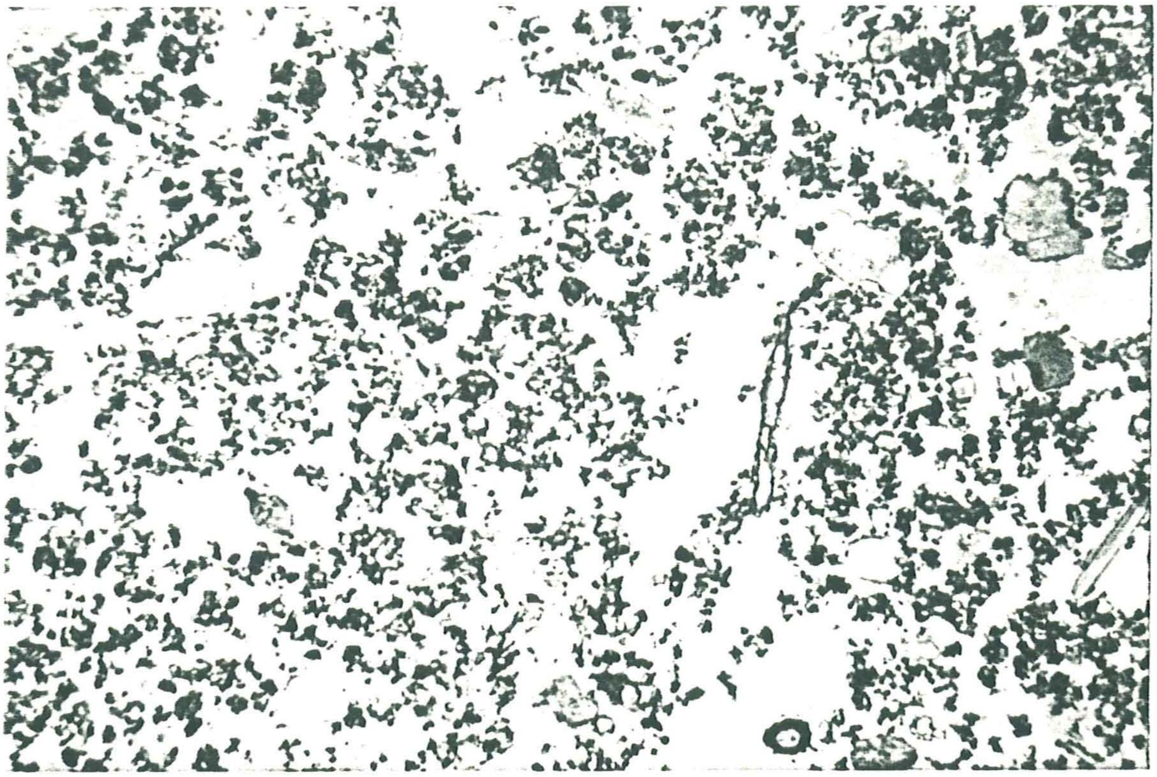
53. As 51, modern Bhs (lower part); here dense weathered colluvium has been cemented by podzolic illuviation, and is less polymorphic in character. PPL, length of frame is 5.225 mm.



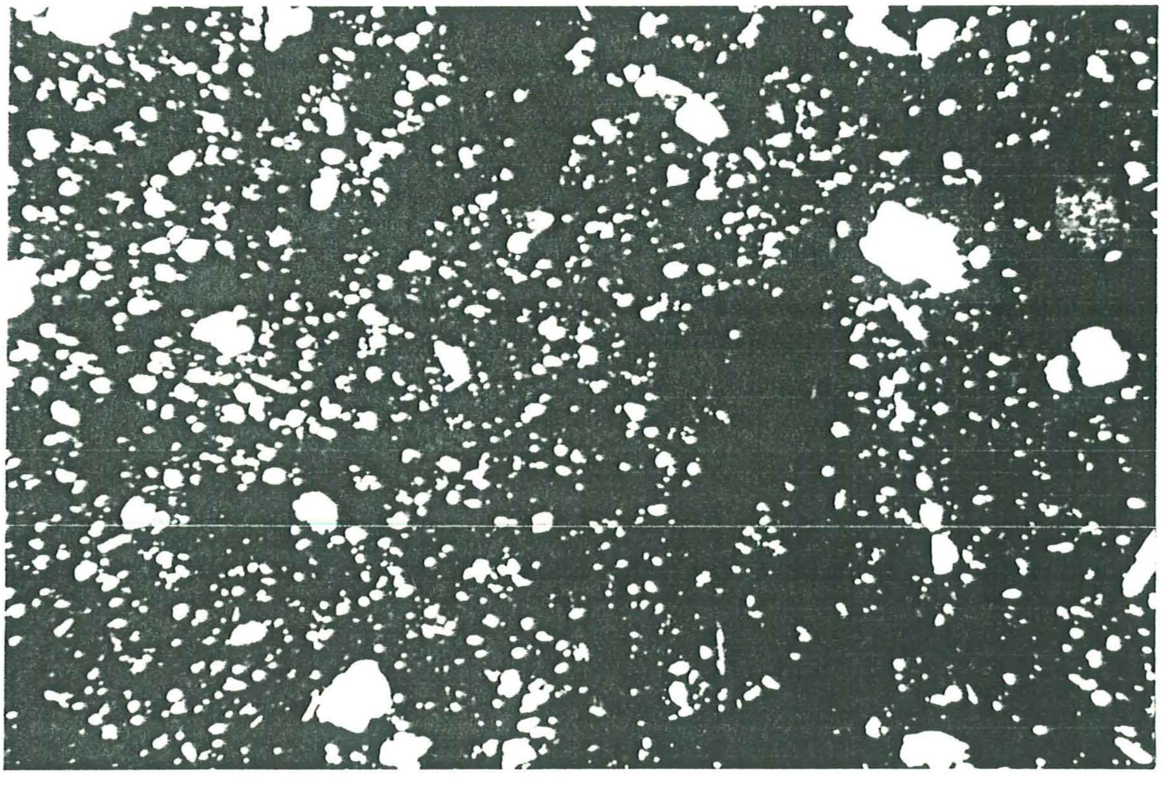
54. As 53, XPL. Note lack of birefringent clay fraction in this (originally) strongly leached colluvium.



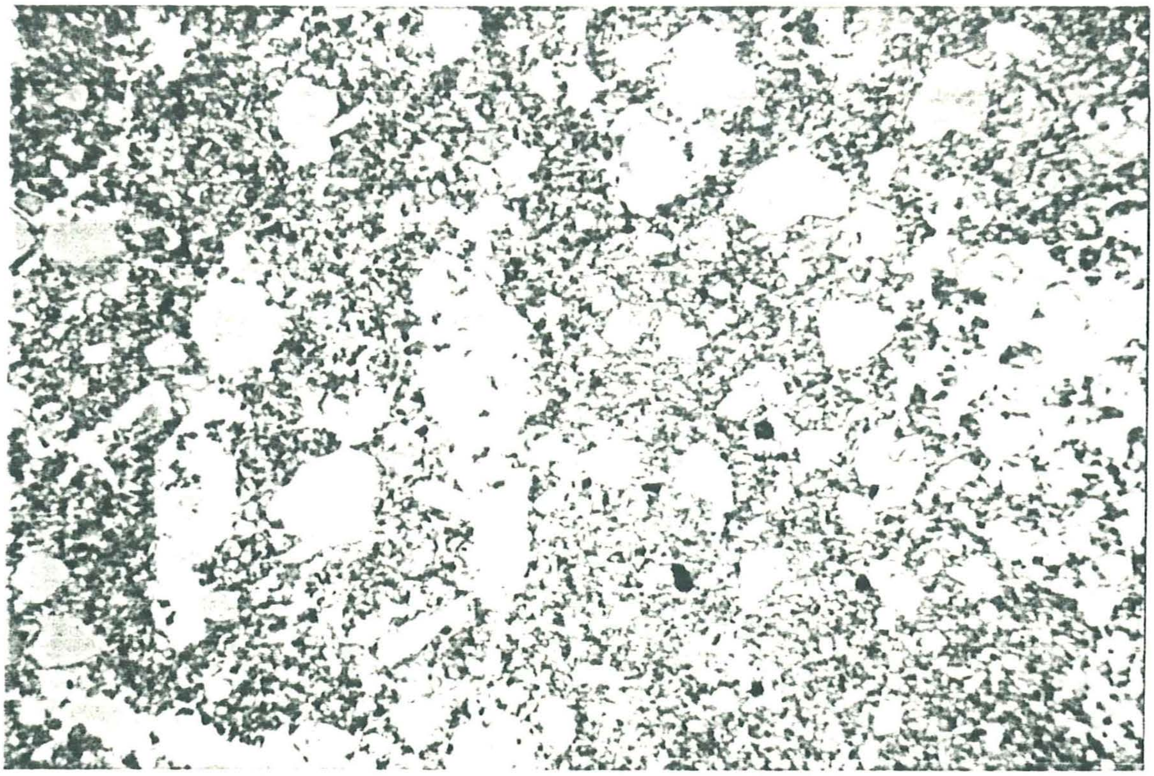
55. Field photograph, 224 (Fig 5); terrace/bank of successive "colluvial" layers and stone deposition; with dark greyish modern Ah horizon, whereas lower horizons have been effected by post-burial illuvation; base of tape in mixed horizon of disturbed subsoil.



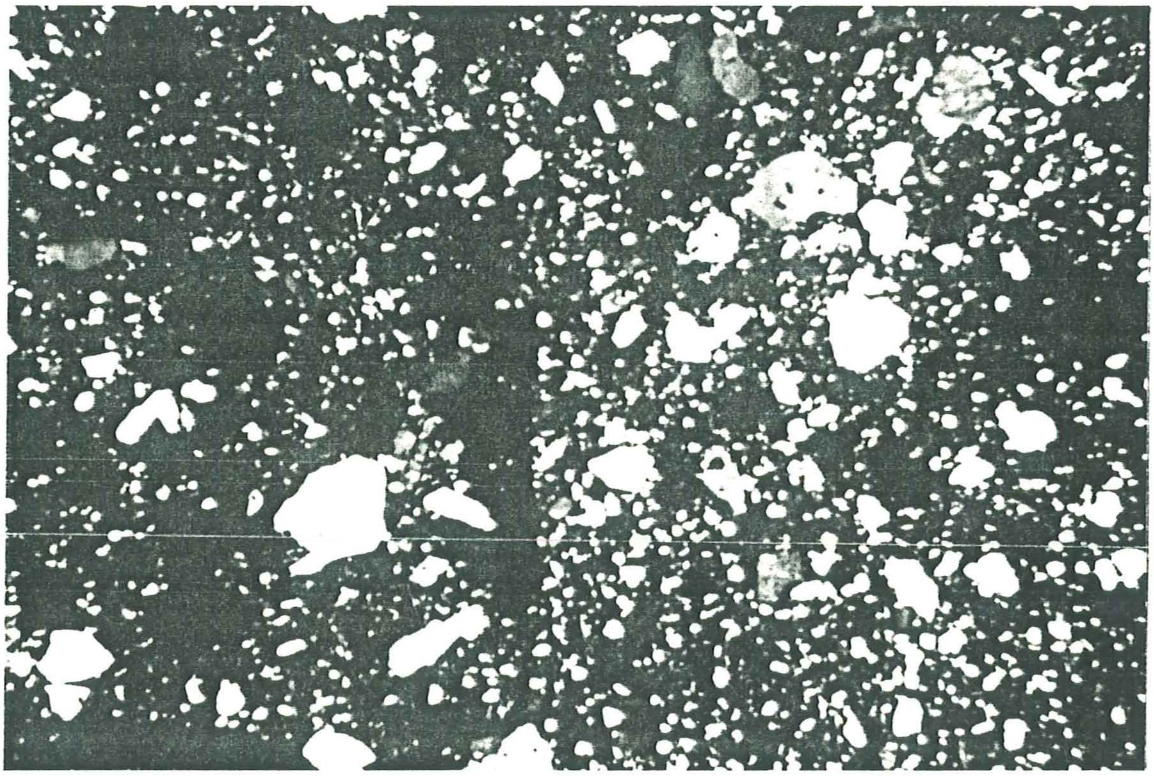
56. 224; bAh/Ea; standstill phase has allowed development of open, biologically (acidophyle fauna) worked Ah horizon, featuring abundant fine organic excrements. PPL, length of frame is 5.225 mm.



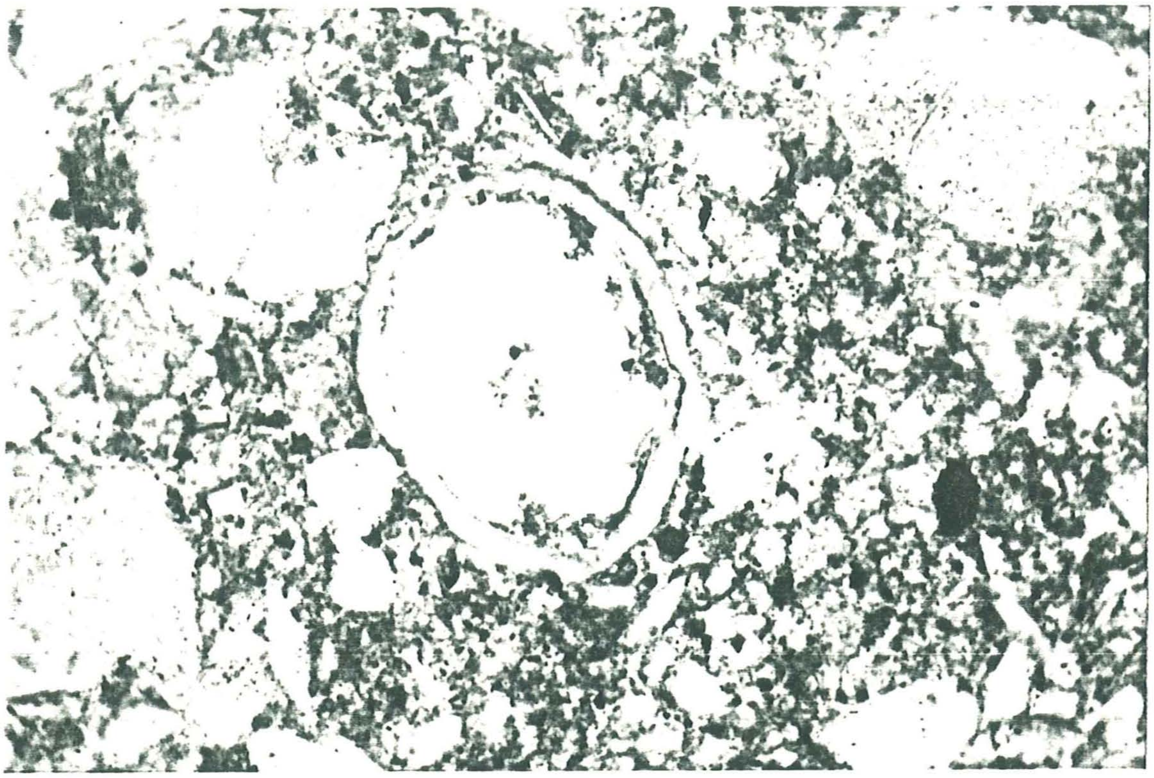
57. As 56. XPL; low birefringent fine fabric shows it is an organic and



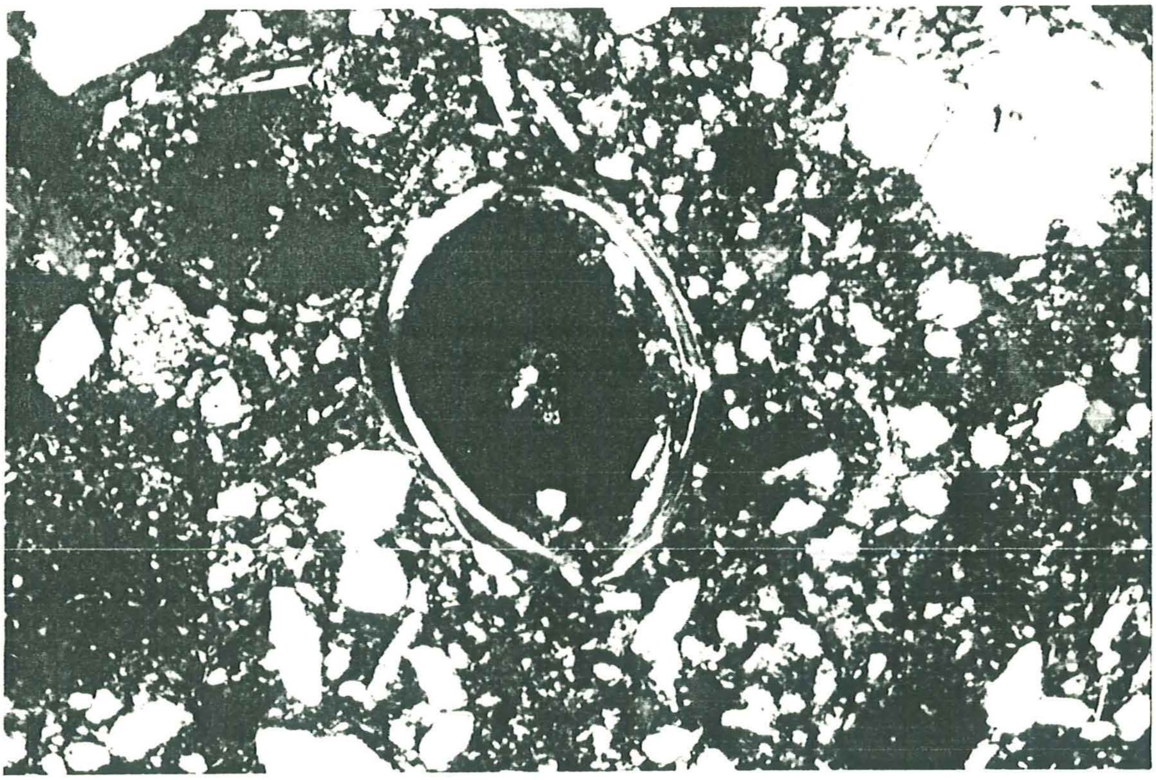
58. As 56, bAh/Ea lower part; dense depleted colluvium - parent material to humic biologically worked upper Ah part. PPL, length of frame is 5.225 mm.



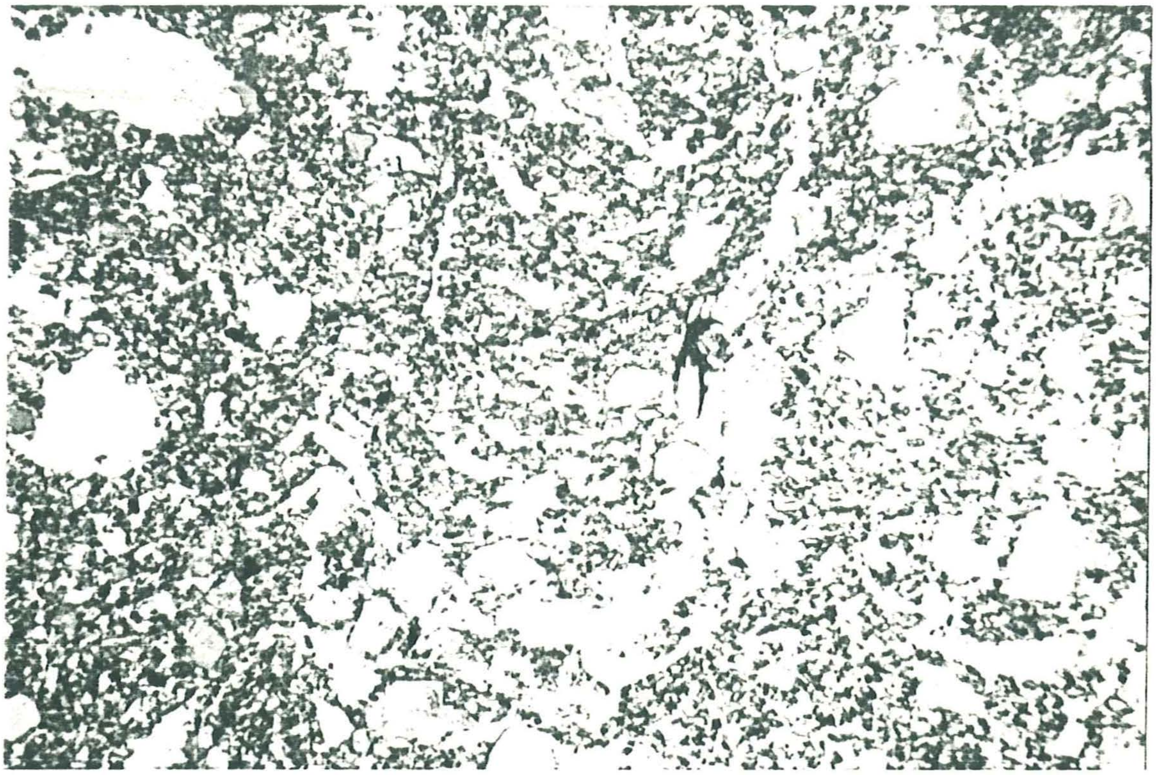
59. As 58, XPL.



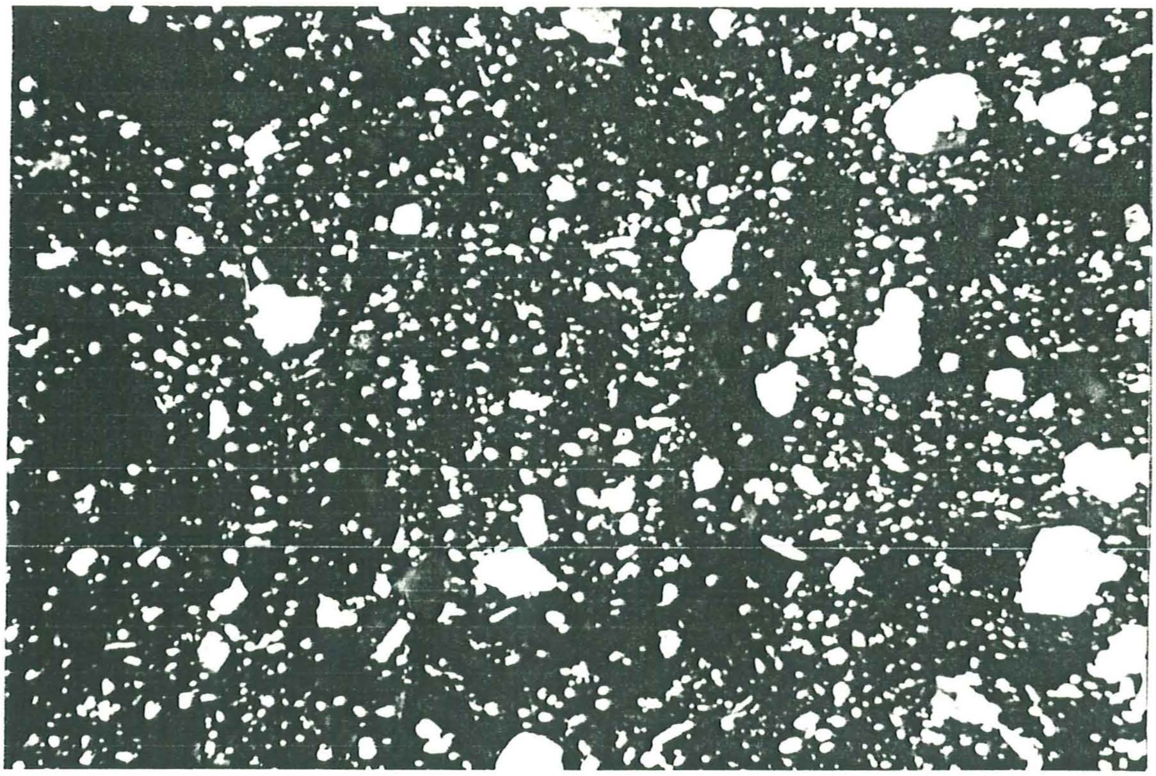
60. 224, 2bEa2; probable spore case of vesicular arbuscular mycorrhizae set in depleted colluvial deposit; averaging in size around 110-120 um. Their small size may indicate that they are associated with sheep grazing; their morphology indicates some transportation when still flexible. PPL, length of frame is 0.332 mm.



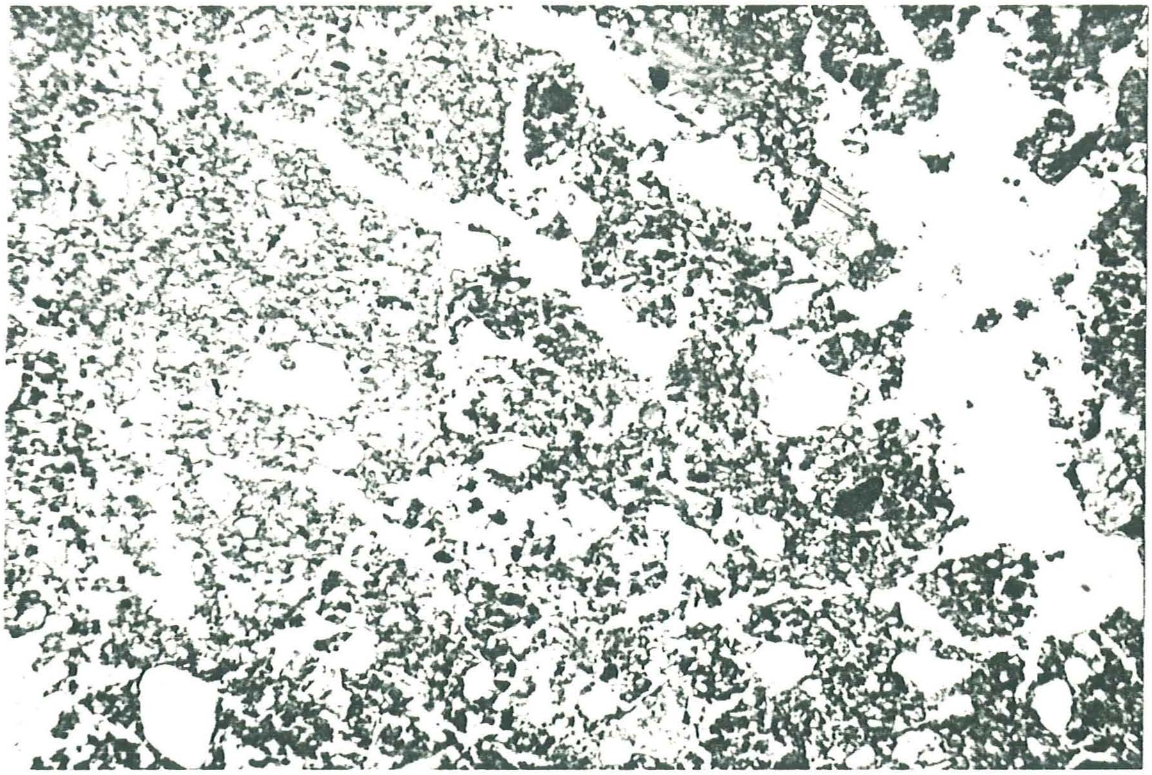
61. As 60, XPL; birefringent character seems to indicate that they are older than 900 years.



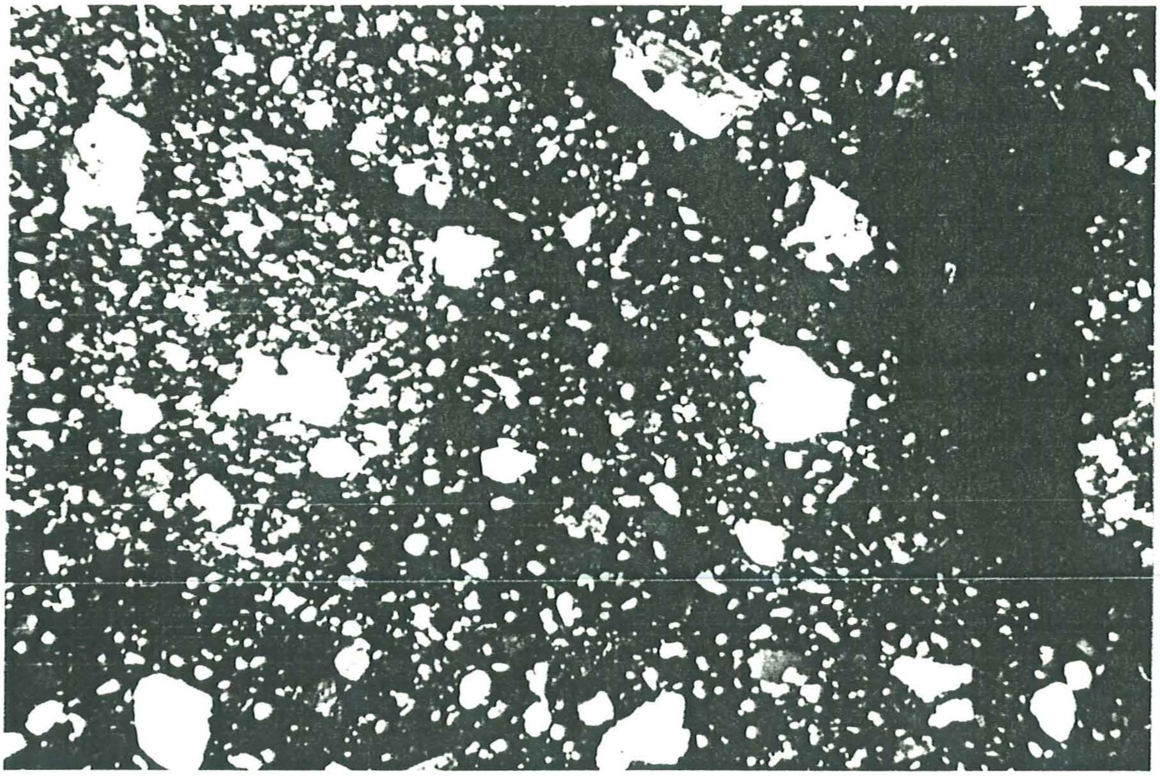
62. As 61, 2bEa2; depleted colluvial soil has evidence of being reworked by earthworms which produced these loose crescent-shaped channel infillings of mineral excrements; these may be associated with short-lived soil amelioration between phases of podzolisation dominating on this site. PPL, frame length is 5.225 mm.



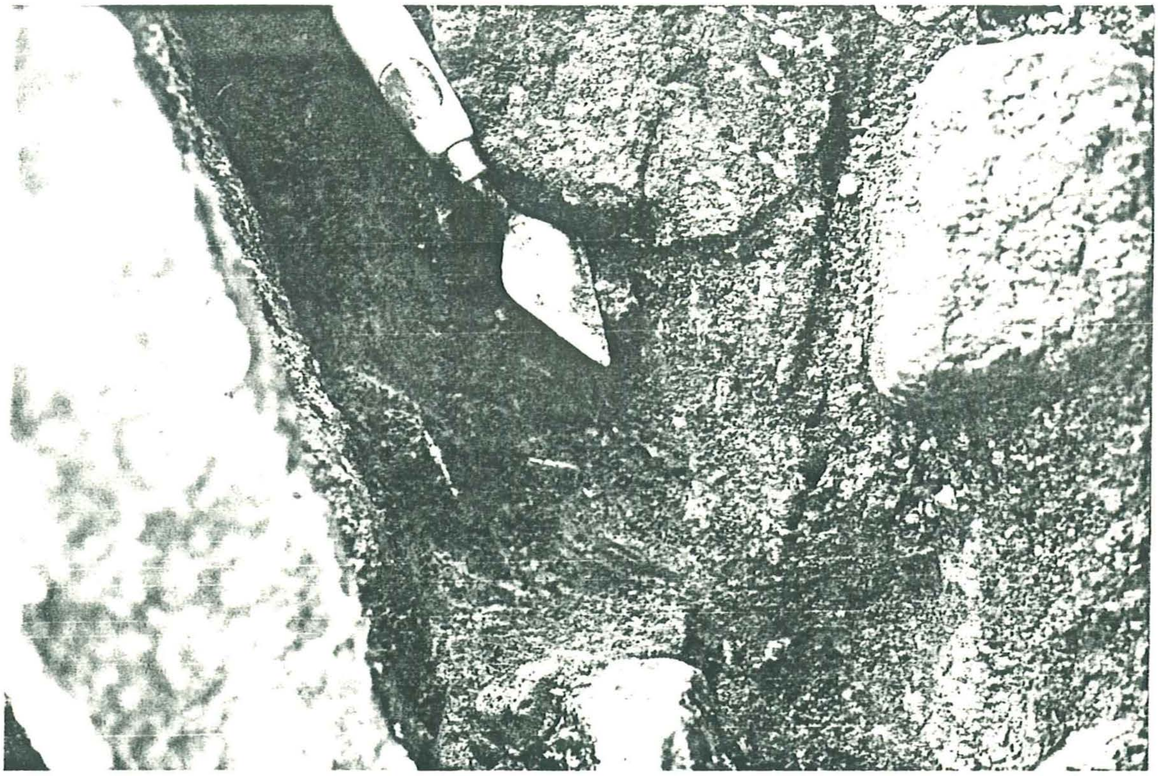
63. As 62, XPL; mineral material is similarly depleted as below and above.



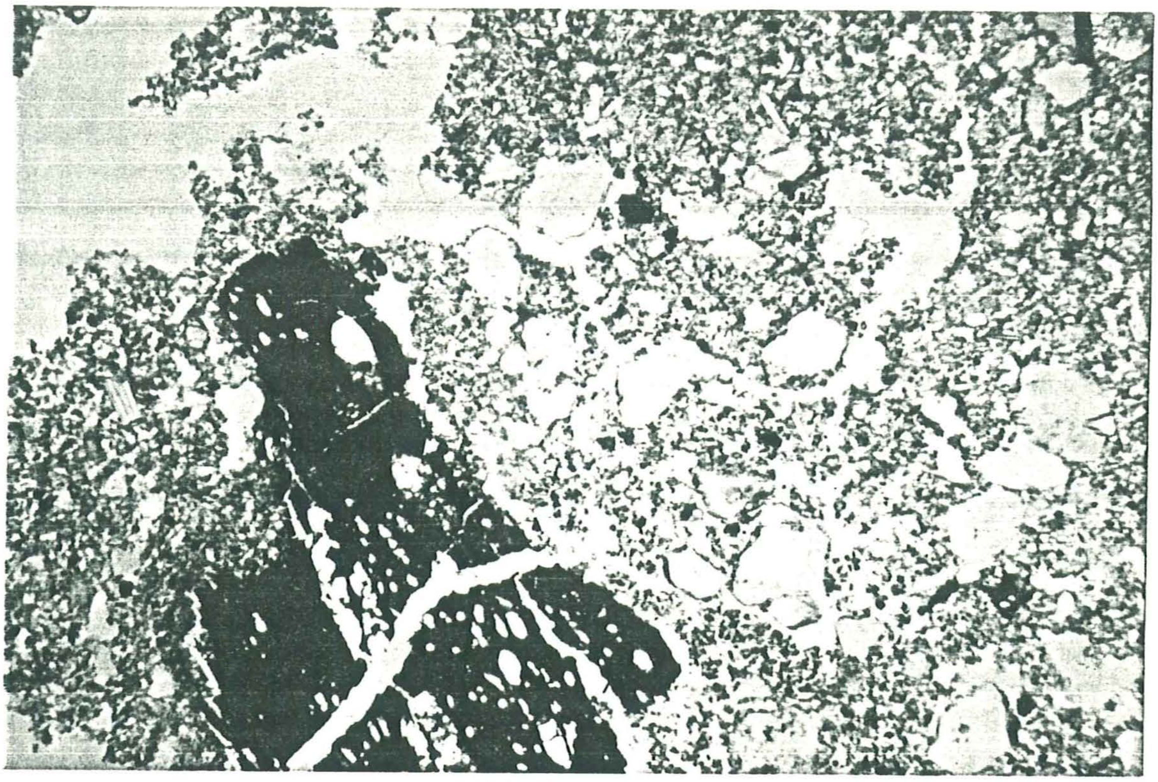
64. 224; 2bB(sg); colluvial deposit containing whole fragments of relic subsoil within a once depleted matrix that has been converted to a Bs horizon by podzolic illuviation from above. PPL, frame length is 5.225 mm.



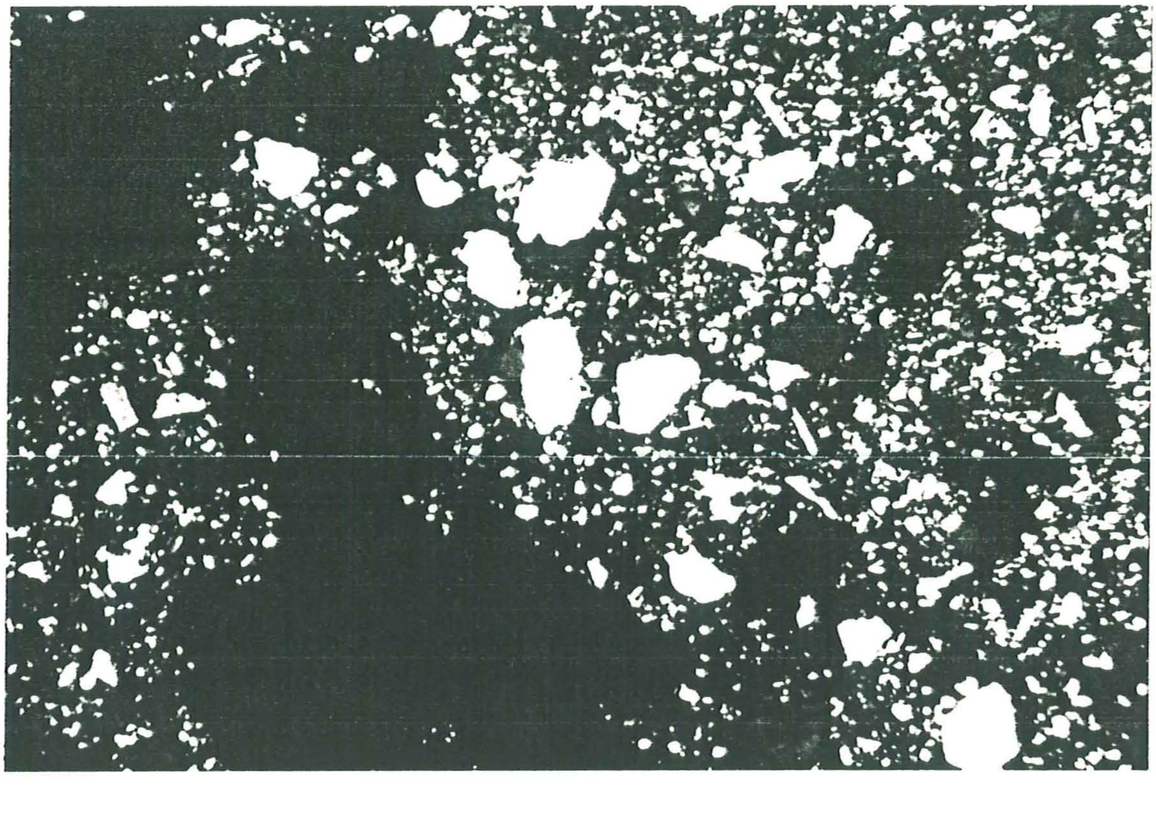
65. As 64, XPL. Note contrasting birefringence.



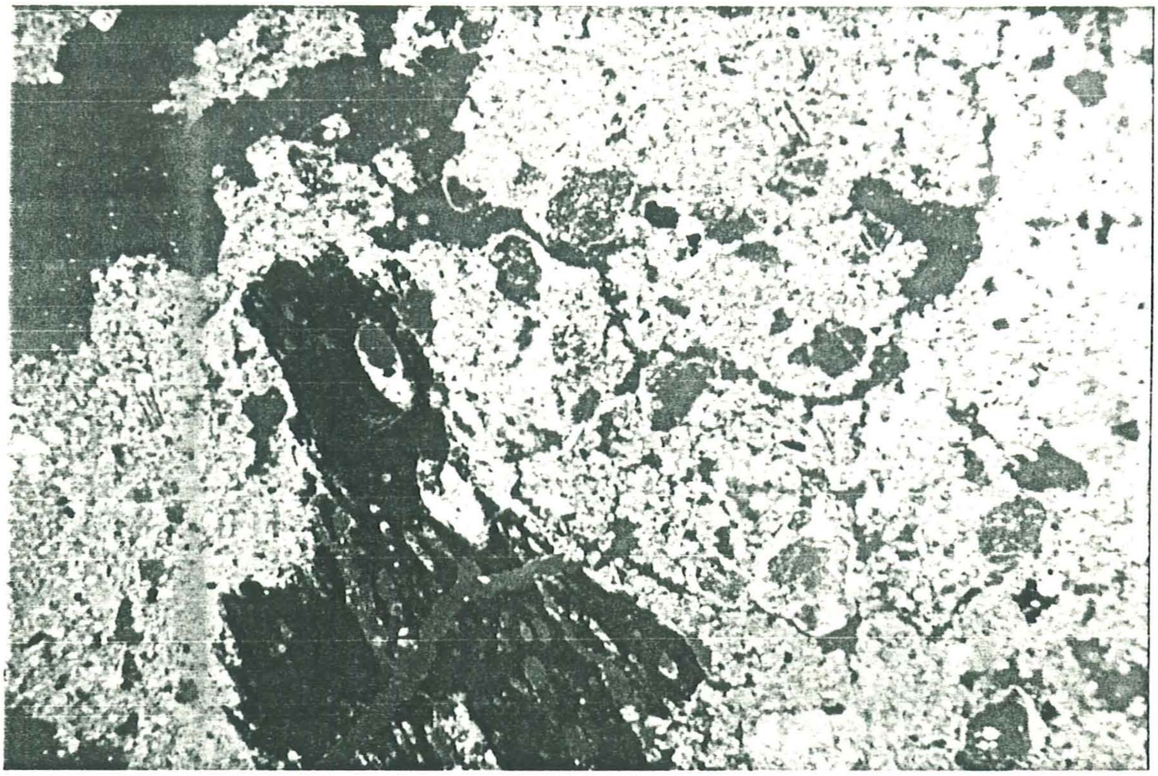
66. Field photograph; detail of 3bEa horizon beneath stone of bank 405 (Fig 6).



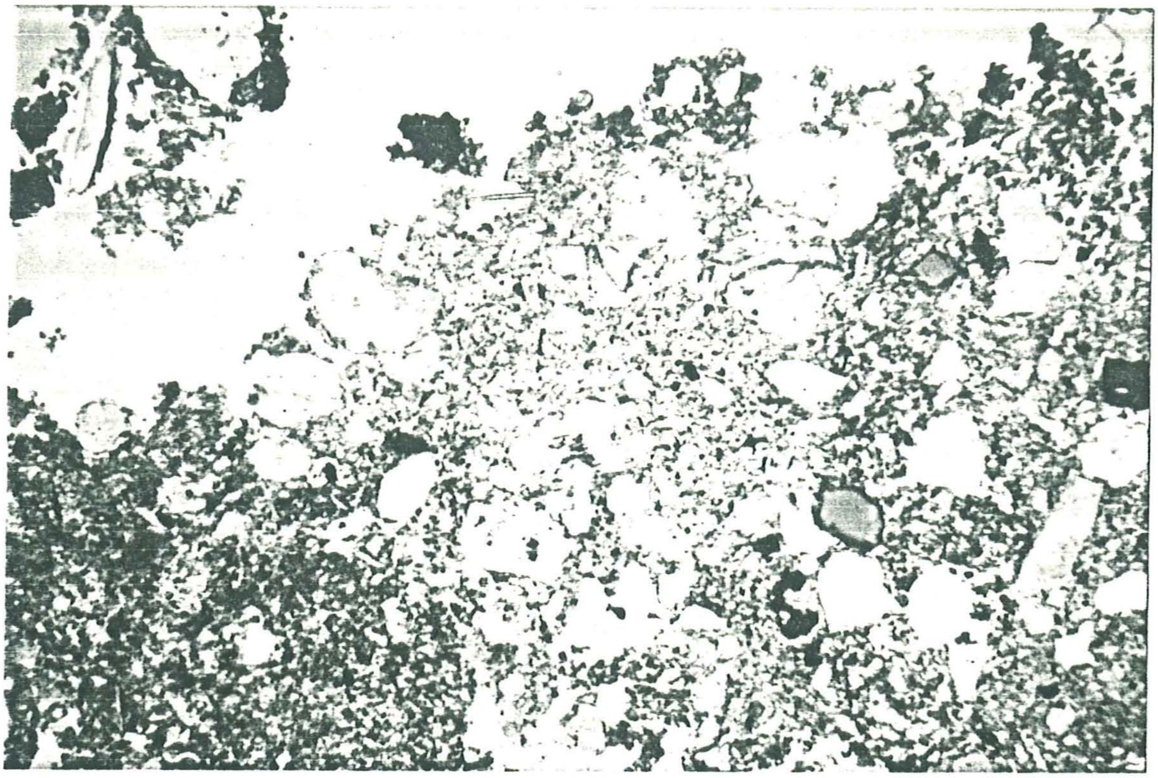
67. 405; 3bEa; moderately dense, depleted colluvial soil, containing coarse charcoal which has become further leached in situ before burial, and minor post-burial illuvial contamination. PPL, length of frame is 5.225 mm.



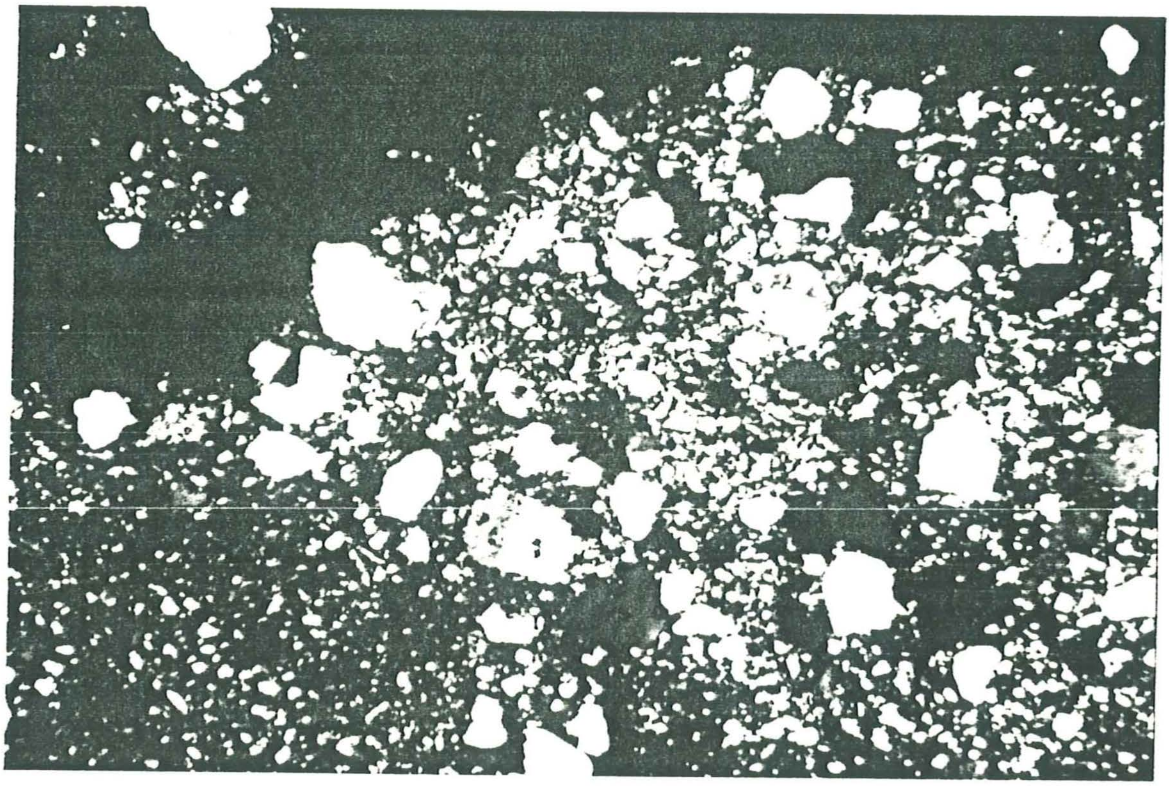
68. As 67, XPL.



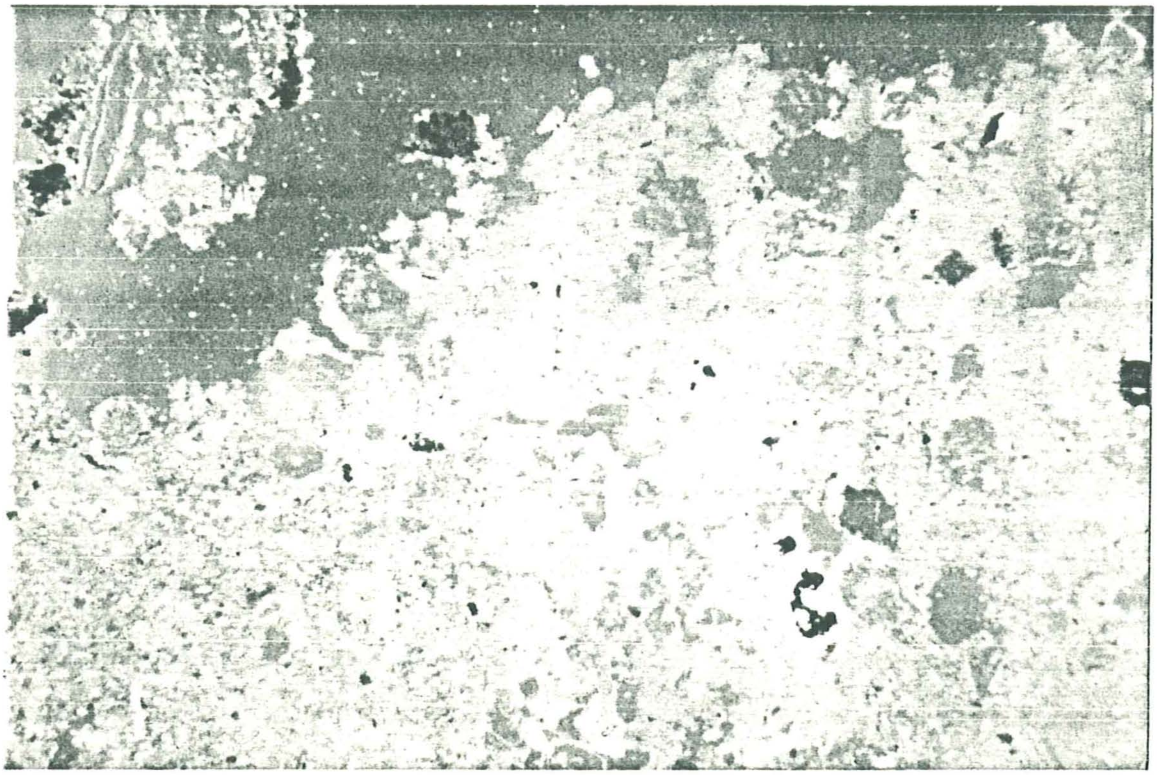
69. As 67, OIL; general depleted character and charcoal inclusions shown up by reflected light.



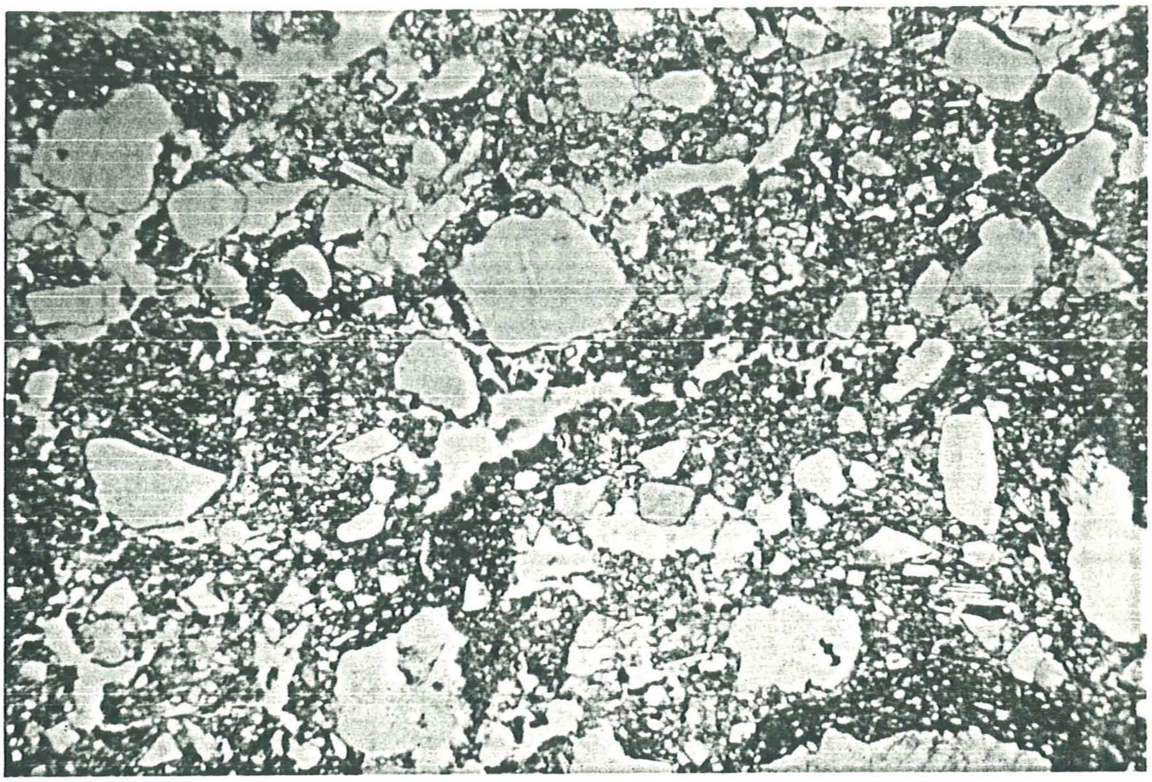
70. 405; 2bBs(h); within this dumped deposit occur areas of ferruginous Bhs horizon material, and much paler areas of very depleted Ea horizon material; the latter is rich in fine charred organic matter and phytoliths, indicating possible cultivation associations. PPL, length of frame is 5.225 mm.



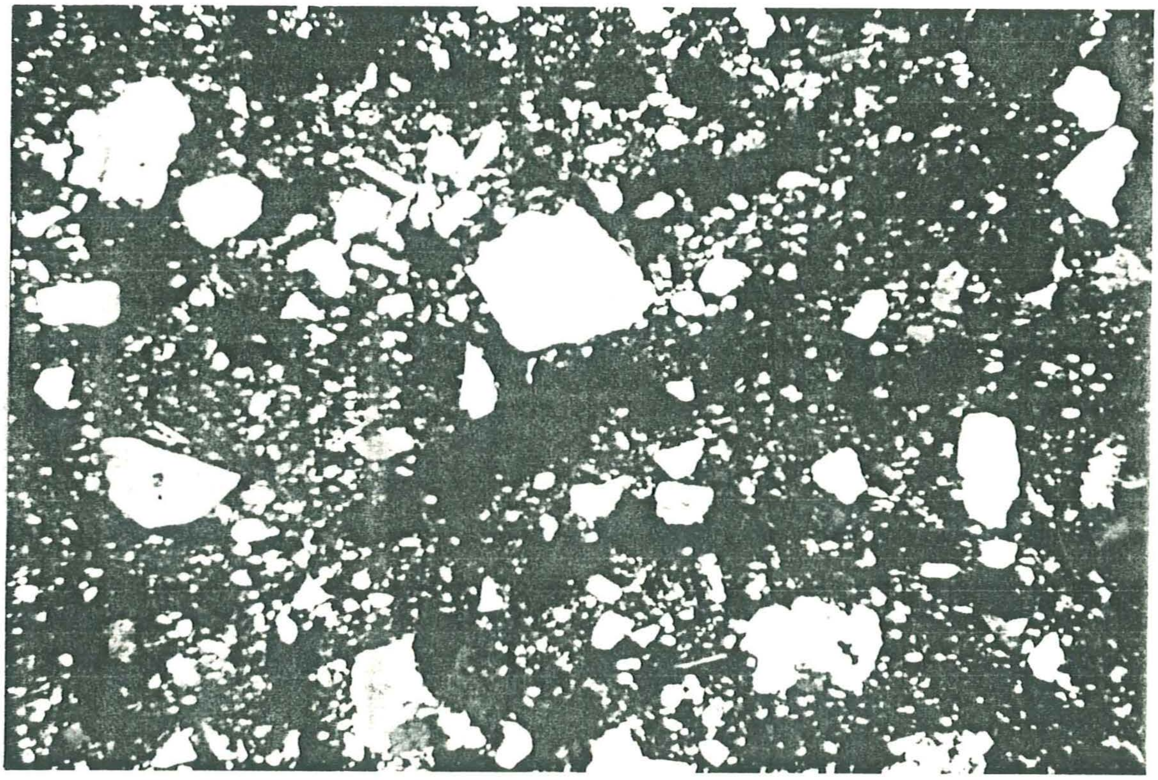
71. As 70, XPL; leached Ea area is far more mineral in character compared



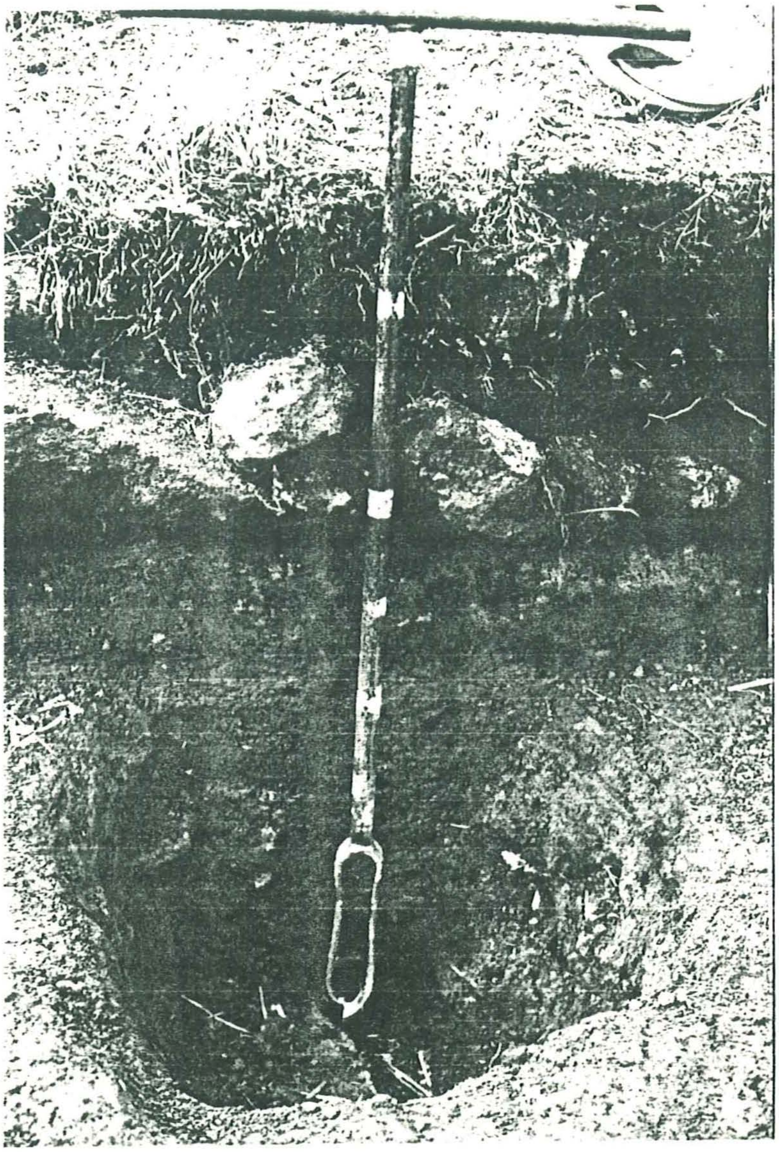
72. As 70, OIL; note charcoal, and pale leached areas.



73. 405; 2bBs(h); within this dumped deposit also occur fragments of the relic granitic subsoil; notably the fragipan here could be pre-Devensian on the basis that fine clay void coatings (not present elsewhere) are heavily ferruginised and cracked, possibly suggesting they are palaeo-argillic.



74. As 73, XPL; note non-birefringent clay coatings.



75. Field photograph; 412; hut with leached peaty modern soil over moderately well-sealed bEa and Bs overlying yellowish brown relic granitic subsoil.