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Ancient Monuments Laboratory
Report 73/92

SOIL REPORT ON DITCHFILL 92375 AT NORWICH CASTLE MALL

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Summary

Two thin sections from an early medieval ditchfill at Norwich Castle Mall were examined. Their analysis suggests that the ditchfill developed through muddy silting and the inclusion of probable locally windblown charred waste. The fill was also contaminated by sewage sludge, possibly from human waste disposal and during the fill's later history of on-site herbivore trampling, the last bringing in coarser mineral material. A timescale of a few years rather than weeks or months, for the development of the fill, is appropriate.

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R I Macphail, BSc., MSc, PhD. 1992

Introduction

In October 1990 the site of the Norwich Castle Mall Project (then under the direction of Jez Reeves) was under excavation by the Norfolk Archaeological Unit (current site project manager, Liz Shepherd). During the excavation it was found that the site was characterised by a number of ditches which seemed to pre-date the main medieval castle earthworks. One ditch feature which itself was cut by an early medieval defensive ditch, contained a dark soil fill ("dark silt" 92375). This layer was examined from a large monolith sample (143G) and photographs of the section. A field interpretation was made, which suggested that the deposit related to the fill of a wide ditch and had probably been open for a number of years rather than weeks or months and was therefore of some significance to the constructional history of the site (letter dated 17-10-90). The letter also stated that little more detail could be gleaned from the monolith sample without recourse to soil micromorphological analysis. Ms Reeves agreed to the project financially supporting two thin sections from the monolith to be manufactured.

Methods and samples

Two undisturbed soil thin section samples were taken from the 50 cm long monolith. These were samples A, 6-14 cm to examine the upper chalky dump (92373) and the upper part of the dark silt (92375), and B, 18-26 cm to investigate the basal chalky dump (92346) and the lower part of the dark silt (92375). Samples were air dried, impregnated in crystic resin and then manufactured into thin sections at Stirling University (Murphy

1986). These were described according to Bullock et al. (1985), and interpreted useing the guidelines of Courty et al. (1989).

Results

A full soil micromorphological description is included as an appendix, whereas a basic description and the interpretation of the main features is given here.

Description: The basal chalk dump (92346) contains many fragments of layered fine clay. This material could be relic of decalcified soils associated with the natural chalk deposits. Before fine silt deposition became dominant, a charcoal-rich layer some 0.5 cm thick, was first deposited. It contains wood ash, probable fragments of human coprolites (particularly ultra violet light fluorescent), bone and probable cereal processing debris. It is also interesting to note that part of the chalky sediment beneath, has been very strongly phosphatised (UV fluorescent)(Plates 1, 2 and 3).

The dark silt (Plates 4 and 5) is generally a massive and very dense calcareous silt, very rich in fine charred organic matter. Phytoliths are also present, and occasional diatoms occur. Possible poorly defined earthworm burrows are associated with iron and manganese replaced amorphous organic matter, which has had a partially decalcifying effect.

Nearer the top, the deposit becomes far more heterogeneous. Firstly, the deposit becomes far richer in coarse mineral material, eg., fine and medium sands, chalk and flint fragments, bone and what are assumed to be poorly preserved Arionid (slug) granules (Plates 6 and 7). The sediment is also heterogeneeous because calcareous silty deposits with contrasting charred and amorphous organic contents, are commonly juxtaposed. Textural features (infills, intercalations and crusts) also occur. As below, the sediment is very compact, but where there are coarse pores (vughs), these are associated with iron and manganese replaced amorphous organic staining and partially and totally decalcified sediment. Some matrix material and some fine pores also have pale yellowish brown amorphous organic matter fills and stains. Clear earthworm mixing from above (92373) is apparent, and so are occasional roots. The last have formed fine channels and these can contain very small excrements of soil mesofauna.

Interpretation: The shallow ditch, which was seemingly cut in dumped chalky deposits, was first affected by refuse disposal of midden material, and this was partially water-sorted. Subsequently, the ditch became wet and slowly silted up with silt-size quartz and fine chalky colloids. Mixed with this are probable windblown waste from fires and local cereal processing. Often the ditch may have dried out into a mud which occasionally permitted biological activity to homogenise any sedimentary layering. Relic earthworm burrows have become foci for the downward movement of iron and manganese amorphous organic matter staining. The wet nature of the ditch, however, caused the sediment to continue to be slaked, forming a compact massive (non-structured) deposit, with few pores. It may be assumed that the ditch remained open and was generally undisturbed for a number of years, although silting could have been rapid.

The upper part of the ditchfill is heterogeneous, and as there are no evident signs of dumping, and the coarse mineral inclusions are far too large to be windblown, another mechanism to introduce this material must be sort. Some mixing is undoubtedly from earthworms, although again their burrows often show that they were active in mud, because of the way they are associated with textural features. Post-burial earthworm activity also disrupts textural features, such as crusts. These, the inclusion of coarse material and some of the organic staining, however, may be due to herbivore trampling (Beckman and Smith 1974; Courty et al. 1991). In addition, some of the pale yellow amorphous staining could also relate to a sewage input into the ditch. It is also a possibility, that the significant phosphatisation (eg. calcium phosphate), which occurs just beneath the dark silt, in the chalky deposits (calcareous regime), could also relate to the through-drainage of manure/sewage. Unfortunately, not enough is known concerning the formation of ultra violet light fluorescent (calcium?) phosphates from human sewage sludge. Cess pits usually produce thick amorphous pale yellowish brown coatings, and as noted above this kind of material is present.

Conclusions

A wet ditch allowed calcareous silts, rich in charred organic matter, to accumulate. Sedimentation was initiated by the dumping and partial water sorting of a thin midden deposit. Silting under wet conditions ensued over a number of years, during which time local anthropogenic activities supplied probably locally windblown fine charred organic matter. Some sewage sludge may also have been introduced into the ditch. There is also the possibility the upper part of the deposit was trampled by herbivores, further contaminating the sediment with liquid waste. The top of the deposit was earthworm worked at times even though the ditchfill was still sometimes wet.

Probable initial shallow burial of the dark silt also permited short-lived earthworm and rooting activity to penetrate the upper part of the fill.

References

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Appendix 1

NORWICH CASTLE MALL: SOIL MICROMORPHOLOGICAL DESCRIPTION OF DITCHFILL (CONTEXT 92375)(SAMPLE 143G)

Thin sections were taken from monolith sample that bracketed context 92375. The stratigraphy was as follows:

0-8 cm chalky material (92373)
8-24 cm dark silt (92375)
24-33 cm lower chalky material (92346)

The dark silt is some 16 cm thick.

Thin section B; 18-26 cm: upper part of chalky deposit (92346) and lower part of ditch silt (92375) (Plates 1-5)

Layer 92346: A dump of chalky material, with associated disturbed clay bands (dug from previous ditch?), medium sands, fine sandstone, burned clay, mollusc shell, burned humic topsoil/peat, probable human coprolite (ultra violet light fluorescent), bone and wood charcoal. Upwards, a chalky slurry had formed, and was affected by the dumping of probable ashed cereal remains - possibly blown-in. The calcitic sediment thus contains a few wood ash crystals and very abundant burned chaff-like fragments and phytoliths. Over this wood charcoal and cereal burned chaff deposit, more mineral deposition commenced (92375). This basal deposit was affected by inwash of chalky colloids and secondary calcium carbonate deposition (sparite), and a thin (1mm) one cm long layer of phosphatisation and phosphate infill (Plates 1, 2 and 3). A root was noted.

Layer 92375)
Structure: massive (Plates 4 and 5). Porosity: generally around 5%, except for 10% porosity concentrated along lines of fine channels and interconnected fine vughs, with associated few coarse chambers. Mineral: C:F, 20:80. Coarse: dominant silt and very fine and fine sand-size quartz. Moderately well sorted. Few fine chalk inclusions. Fine: pale greyish brown, heavily speckled (PPL), moderately high birefringence, brown, black speckled (OIL); with few rounded chalky soil fragments, that are more birefringent (and contain fewer charcoal). Organic: Coarse: many fine charcoal. Fine: very abundant fine charcoal, with very abundant amorphous organic matter; common phytoliths. Groundmass: close porphyric, crystallitic b-fabric. Pedofeatures: Textural: occasional intercalations of matrix material. Crystallitic: many sparitic calcite void infills. Amorphous: rare amorphous organic matter void coatings. Very abundant diffuse ferromanganese impregnation of organic matter, especially around coarser voids. Fabric: generally homogeneous.

Thin section A; 6-14 cm: upper part of dichfill (92375) into upper chalky deposit (92373) (Plates 6-7)

Layer 92375

Structure: massive. Porosity: 5-10%, with dominant smooth walled or polygonal shaped vughs, and few possible horizontal planar voids, and very few fine root channels. Mineral: as 92375 for the bottom half of the slide, whereas above; C:F, 40:60, Coarse: dominant fine to medium sands, with common silt; frequent partial decalcified probable biogenic calcite (Arionid granules (slugs)) (Plates 6 and 7). Fine: common dark brown, heavily speckled (PPL), moderately high birefringence, brown speckled (OIL); common greyish brown, moderately speckled (PPL), high birefringence, pale brown speckled (OIL). Organic: Coarse: many charcoal, and occasional small coprolites; diatoms present. Rare in situ root material. Fine: abundant fine charred material, amorphous fragments, especially in the darker fine fabric; phytoliths present. Patchy amorphous organic staining throughout. Groundmass: close porphyric, crystallitic b-fabric. Pedofeatures: Textural: many matrix coatings and infills, merging into intercalations. Also some crust-like deposits occur in a fragmented way towards the top of the unit Depletion: common partial decalcification of slug granules. Abundant partial decalcification around amorphous staining. Amorphous: very few pale yellow organic coatings (cess?). Abundant dark brown amorphous staining of some coarse voids and patchy impregnation of surrounding sediment, generally iron and manganese replaced (also probable cess? related). Fabric: lower part of slide is generally homogeneous, but upper half is heterogeneous, containing patches of coarse mineral, and mixed very charcoal-rich to moderately charcoal-rich and chalky soil. Excrements: few very fine round mineral excrements associated with root channels. Probable abundant earthworm channel mixing into the top of the unit.

Layer 92346: A chalky and anthropogenic soil dump which is comparable in its basic character to layer 92373, but is much more earthwom mixed with the fill 92375 beneath

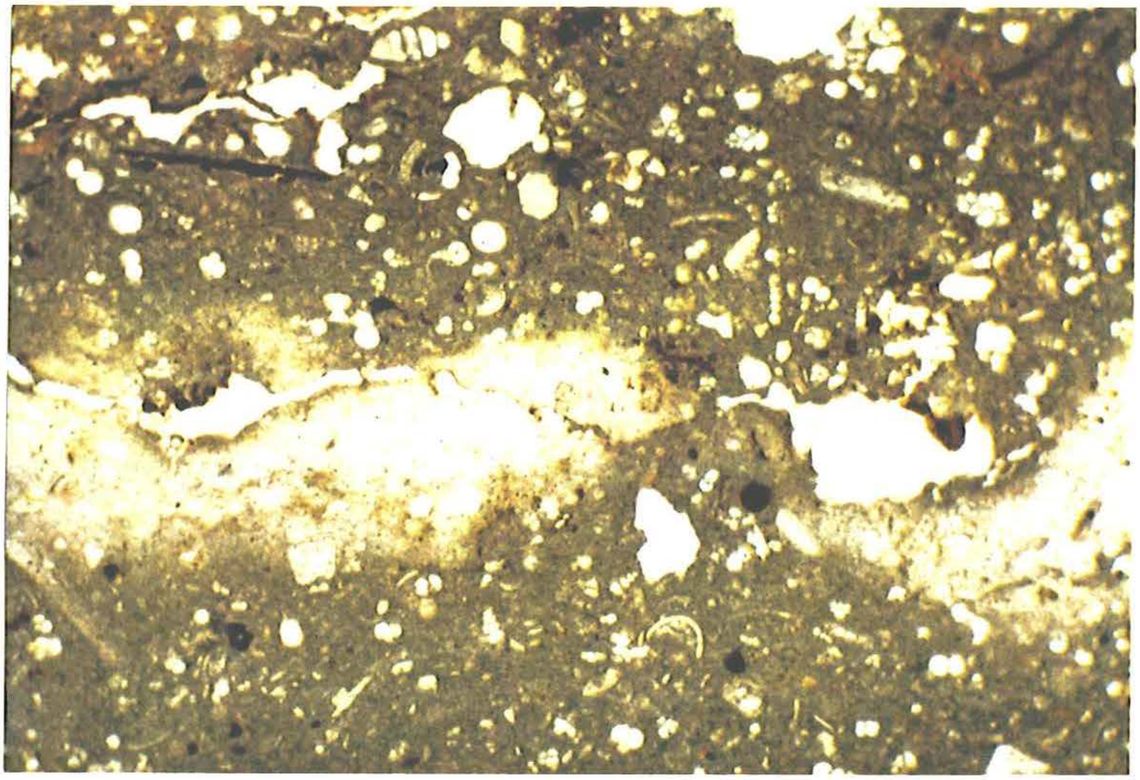

Plate 1: Photomicrograph of chalk dumped deposits just beneath the charcoal-rich midden layer that occurs at the base of the ditch silts. The chalky sediment is weakly stained with iron and manganese, and seemingly leached by phosphatisation. Plane polarised light (PPL); frame length is 3.3 mm.

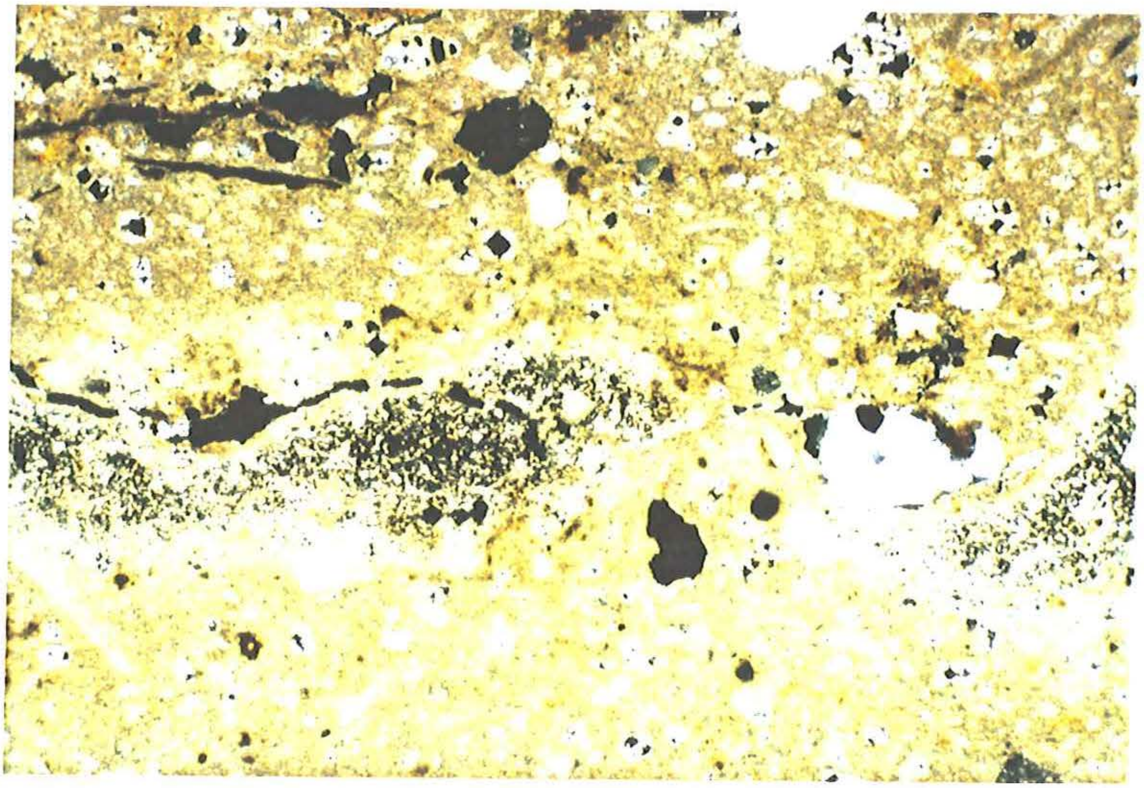

Plate 2: As plate 1, but under crossed polarised light (XPL). Note high birefringence of chalky material, but non-birefringent nature of probable phosphatised zone.

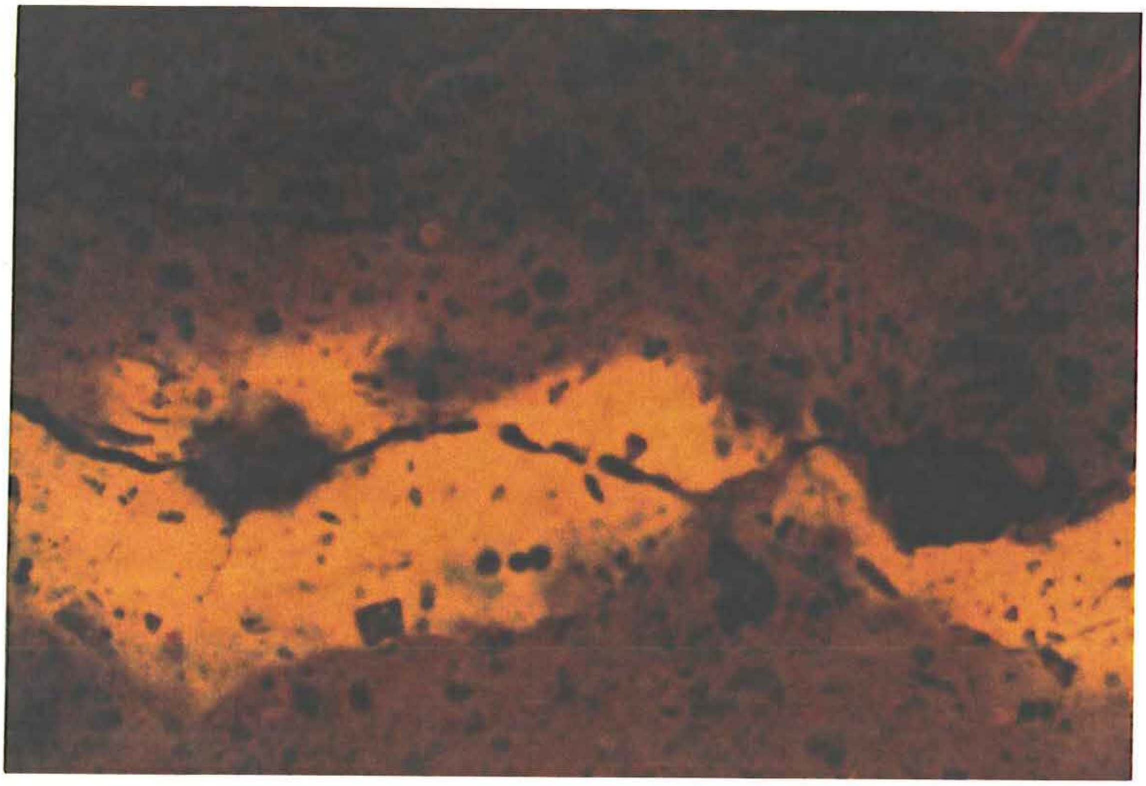

Plate 3: As plate 1, but illuminated by ultra violet light. Note highly fluorescent probable phosphatised zone, which may result from an input of human cess and/or sewage sludge associated with herbivore trampling activity.

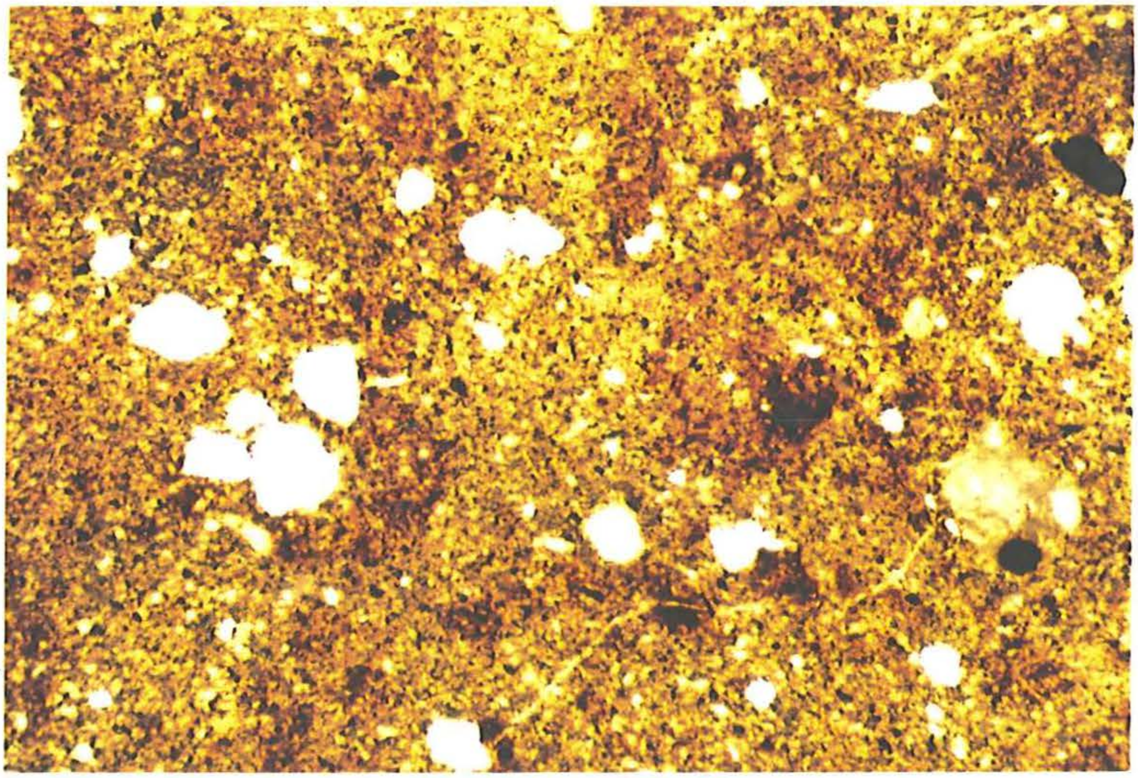

Plate 4: Lower ditch silts. Note dense massive silts containing few sand grains, but high amounts of very fine charcoal, amorphous organic matter and iron and manganese staining. Previously open earthworm burrows have collapsed under wet slaking conditions. PPL, frame length is 5.5 mm.

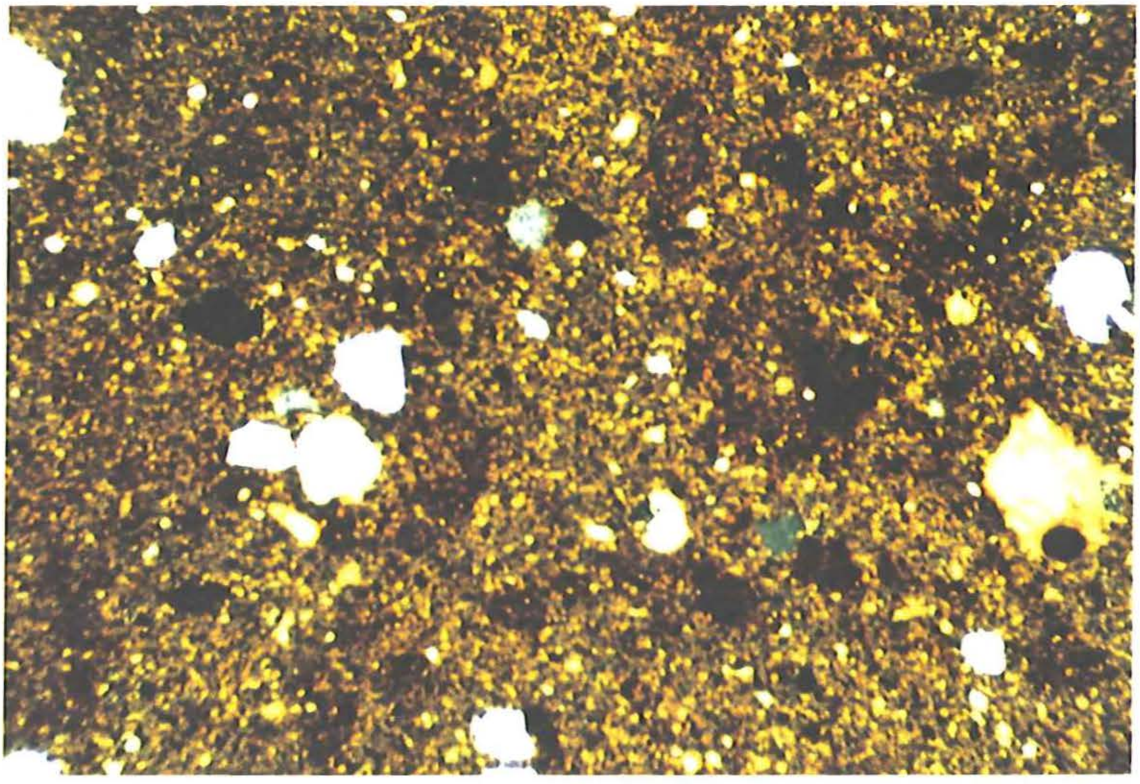

Plate 5: As plate 4, but XPL. Note, the organic content has obscured the birefringence of this moderately calcareous deposit.

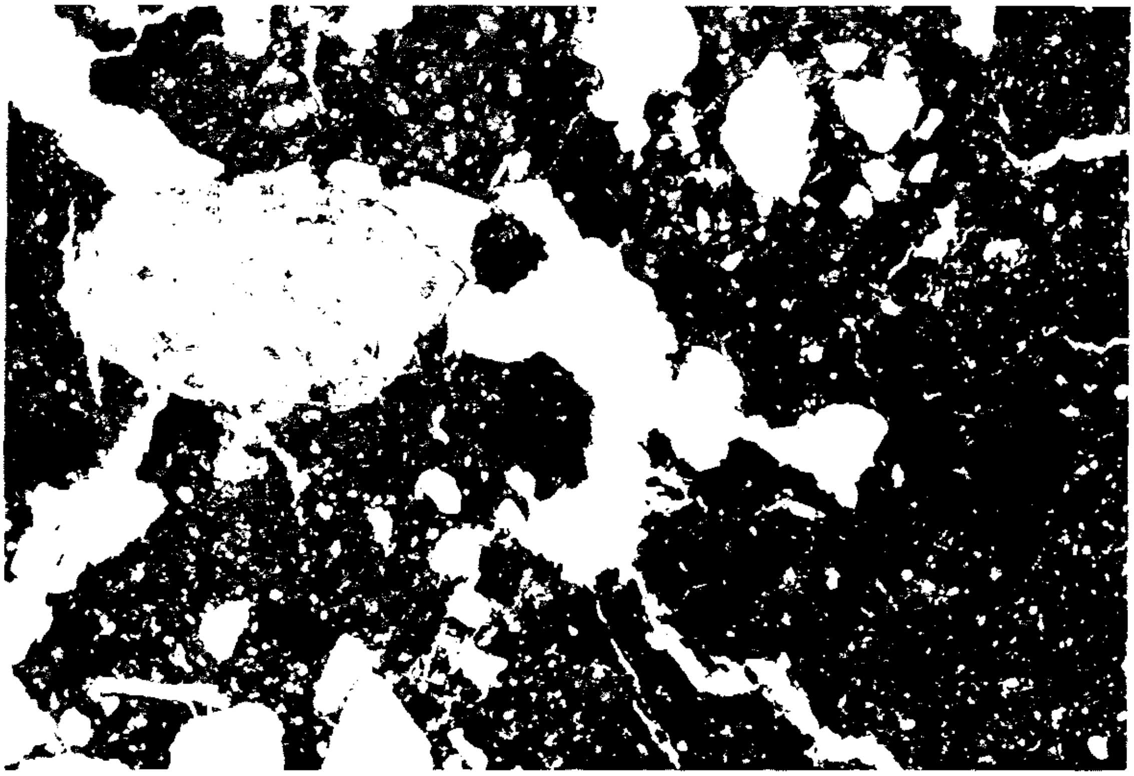

Plate 6: In the upper part of the ditchfill, physical mixing is accompanied by the inclusion of coarse mineral material such as this Arionid (slug) granule, and dark organic (now iron and manganese impregnated) staining. These effects, with the formation of crusts, may relate to herbivore trampling here. PPL, frame length is 5.5 mm.

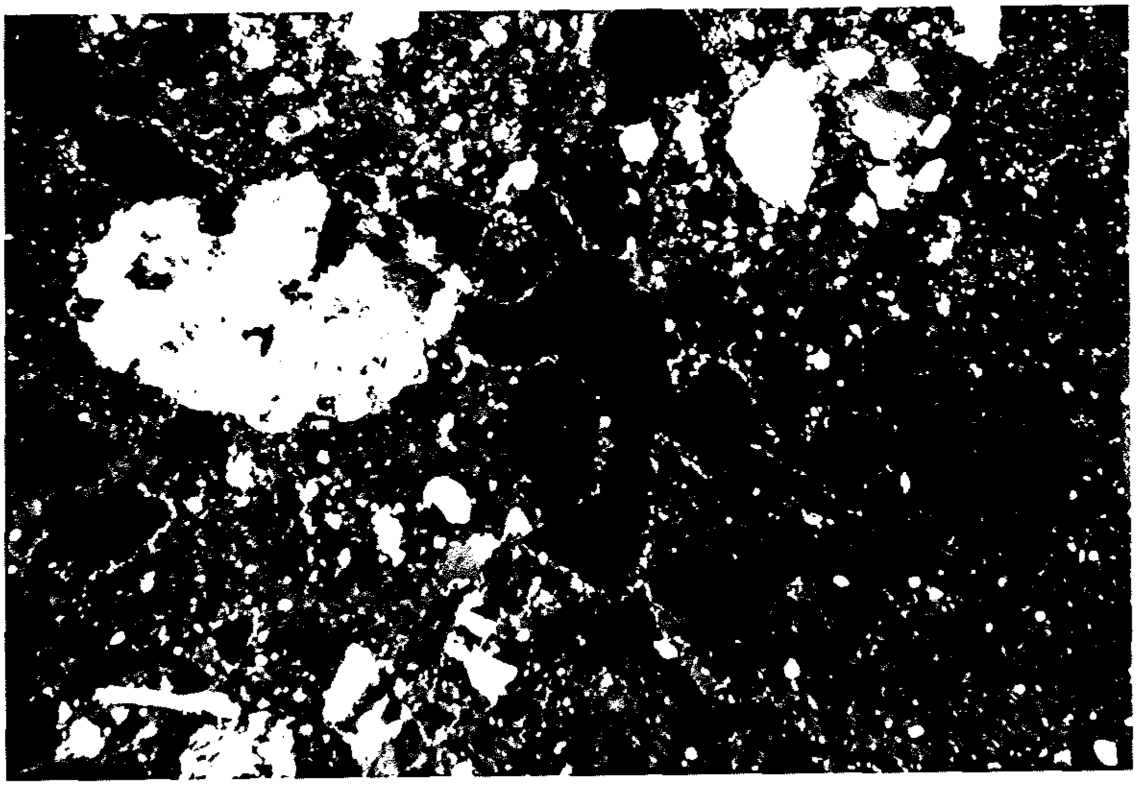

Plate 7: As plate 6, but XPL, showing lower birefringence and partially decalcified nature of the upper silts and the included Arionid granule.

colour plates in library.