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SOIL REPORT ON BEESTON CASTLE, CHESHIRE

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(Contribution by A J Walker of the Isotope Measurements Laboratory, Harwell and K Whittaker for soil pollen data.)

Excavations at Beeston Castle funded by English Heritage (Properties in Care) were carried out (under the direction of P Hough) throughout the 1980s. An upper site within the Outer Ward and the area of the Gateway contained important prehistoric archaeological remains (Neolithic, Bronze Age and Iron Age) and these were subjects of a number of soil reports (Macphail, 1980, 3235; 1981, 3565; 1983, 4101; 1984, 4441). The present report aims to summarise these earlier findings and combine them with more recent (1985-87) studies of the soils and sediments at the site for a fuller environmental assessment.

Beeston Castle was built in the 13th century on Beeston Crag, on the edge of the Peckforton Hills, overlooking the Cheshire Plain. The medieval fortress, however, was superimposed upon a major Iron Age hillfort, which itself post-dates a Bronze Age metallurgical site and fort and Neolithic defences (Ellis, pers. comm.).

Methods Environmental studies at Beeston have been limited by a combination of erosion within the Outer Ward and lack of soil stability along the steep slopes of the Gateway. Hence, although truncated soils, colluvial and occupation sediments readily occur, well sealed in situ buried soils are rare. Of the latter, one was examined in 1980, and another (formed in a Late Bronze Age rampart) is the subject of this present study. In addition, sediments at the site were not generally suitable for fossil pollen studies, both because of instability and because of their highly oxidised nature and induced high pH around the Gateway. The sediments are naturally acid, but medieval use of mortar has superimposed alkaline conditions upon them. It was therefore encouraging to find a series of ditch fills sealed by a soil dump (section 0473) some distance from the Gateway, which contained good quantities of pollen. This sequence has been investigated by K Whittaker, and two levels have been dated by carbon 14 assays. Soils have been analysed (Avery and Bascomb, 1974), described (Hodgson, 1974) and classified (Avery, 1980). In particular, the profile described in 1985, east of the Gateway was further studied by thin section analysis of the Ah/occupation and the Bs/Bs(t) layers (Bullock et al., 1985; Courty et al., in press, 1989).

This report comprises:

a) the detailed results of the present soil investigation of the section just east of the Gateway, sampled in 1985,

b) a discussion of the C^{14} dates and the soil pollen from section (0473), and

c) a general discussion of the soils and local environment of the site as a whole.

a) Results

The deposits described (see Profile Description) from the Outer Gateway are clearly comparable to those reported upon previously from this area (Macphail, 1984, AMLR 4441), comprising in situ occupation layers intermixed with colluvial sand. At this part of the site, where slopes are so steep (10-28°), the stability of sediments has been effected by ditch cutting or stone revetting and the use of log frames for rampart construction. These activities have occurred at different dates. At the section examined in 1985 similar Iron Age deposits buried what appeared to be an in situ soil (Plate 1), but it is now interpreted as part of a Late Bronze Age rampart overlying natural sands (Ellis, pers. com.).

The buried soil profile displayed a patchy humic Ah horizon (layer 0872) intermixed with charcoal laminae and reddened soil layers. These overlaid what appeared to be a moderately leached Ea horizon above weakly illuvial Bhs, Bs and Bs(t) horizons typical of a podzol. Podzols have already been described from Beeston Castle, both buried by ramparts at the Outer Gateway and from within the Outer Ward (Macphail, 1980, AMLR 3235; 1981, AMLR 3565). Physical and chemical analyses (Table 1) also suggest that the profile is essentially podzolic in character, in that a humic Bhs is present. Very clay-poor fine loamy sands in the upper soil (rampart) also give way to fine sandy loam subsoils of the in situ profile.

Soil micromorphology indicated that the Ah horizon could be divided into two major components: natural and anthropogenic. The natural elements are bleached (leached) sand grains and amorphous organic matter infills and coatings, normal for Ah horizons. Frequently, however, this material has been affected by human activity and contamination. Instead of displaying an open structure of quartz grains, areas are characterised by more fine material which has become moderately compacted and shows some signs of slaking, in the form of acid attacked dusty clay coatings (Plates 2, 3), themselves anomalous in a leached sandy soil. The dusty clay coatings probably relate to trampling and slaking of colluvial material affecting the top of the rampart on this slope. Occupation has mixed fine charcoal with phytoliths (from grass/cereals) and unweathered calcite ash crystals also occur rarely - the latter also unusual under natural acid podzol conditions. Further unexpected features are rare amorphous infills (probably containing phosphorus) that are common in occupation sediments and result from organic wastes (Courty et al., in press, 1989). Thus the microfabric produced is a complex result of natural soil processes and anthropogenic activity. The continued presence of the clay and ash particularly, suggest that the occupation fabrics are likely to be the result of Iron Age activities on the site (prior to rampart construction), because they appear to post-date the podzolisation of the Late Bronze Age rampart.

There was also evidence that strongly burned mineral material was present, probably locally derived (see below) fine soil being used, and fragmented layers are frequent in this horizon. The burned layer is dense, cemented, generally poorly birefringent with bright orange colours under oblique incident light (Plates 4, 5, 6). Close inspection shows a fine fabric containing black inclusions (Plate 7) which have been interpreted elsewhere as pure carbon (Courty et al in press 1989) produced by high temperature fires where wood/charcoal have been fully combusted and there has been some fusion of the fuel's mineral residue with the hearth. The presence of melted and bubbled quartz also indicates the employment of fires of a higher temperature than necessary far purely domestic needs. One suggestion is that they are redeposited fragments of hearth, scraped up for (LBA) rampart construction, and possibly relate to the earlier Late Bronze Age metallurgy, because fragments of metalwork also occur in this layer (Ellis, pers. comm.).

Near the base of the profile, within the Bs(t) horizon, a rather mixed subsoil was found. Firstly, about 70% of the soil is made up of a weakly cemented illuvial sesquioxidic polymorphic (podzolic) fabric (Plates 8, 9). Some thin clay coatings are also present. Both these fabrics probably relate to rampart construction in the Late Bronze Age and subsequent podzolisation. The earliest soil material, however, comprises sand grains with compact coarse coatings, the individuals being only very poorly rounded. These grains are not in their original place, but are relic of earlier, very locally occurring periglacial fragipan soils (link capping or silt droplet fabric, Romans and Robertson, 1974) that have broken up whilst moving downslope under gravity through minor slumping/soil creep. There is therefore an apparent diffuse junction between the in situ relic soil subsoil, as noted in the field (Bs(t) horizon), and the overlying podzolic sands of the rampart.

The other part of the soil is more similar to the Ah horizon. It is a darker brown colour (Plates 10, 11) because of the high amounts of fine charcoal present, which together with phytoliths show that this fabric is anthropopogenic in contrast to the rest of the Bs(t) horizon. Some deep disturbance has therefore occurred, but may only relate to mixing during rampart construction or be associated with the juxtaposed Neolithic (?) pits (Ellis, pers. comm.).

b) C^{14} dating and the soil pollen sequence at Section 0473

i) Dating: In 1983 a c. 3 metre deep ditch section (0473) was found to be sealed by some 80cm of overburden. Two buried soils were found to have formed in the ditch fills; one in the major fill (2b Ah horizon, etc.) and one right at the top of the fill (b Ah horizon etc.)(Macphail, 1983, 4101; Appendix 3). The acid nature of the fill suggested that soil pollen, that had not been found elsewhere in sealed contexts, could be present, and this turned out to be the case. Any pollen sequence, however, would have to be dated. At the time the ditch was believed, but not proven to be prehistoric, so large bulk samples of the b Ah and 2b Ah horizons were taken in the belief that they would contain enough organic matter for C^{14} dating (0.82% and 1.26% organic carbon, respectively). Dating was carried out by the Isotope Measurements Laboratory, Harwell.

On archaeological terms (Ellis, pers. comm.) the ditch is regarded as prehistoric because of its relationship to other features and because it contained an unstratified fragment of Late Bronze Age/Early Iron Age pottery. The sand infill (b B(s)) that buries the stabilised fill (2b Ah horizon etc.) is regarded as slumped material from the Late Bronze Age rampart, whereas the overburden is considered to be Medieval or post Medieval spoil from a juxtaposed quarry.

The C^{14} dates for the ditch section are: 2b Ah, 2510 ± 90 years bp, 560bc (HAR-8102) for the stabilised humic horizon formed on the major fill; and b Ah, 1230 ± 90 years bp, ad 720 (HAR-8101), for the humic A horizon formed in the top part of the ditch fill sealed by overburden. Such soil dates, however, unlike charcoal dates for instance, have to be carefully interpreted. Normally C^{14} dates for buried surface soil A horizons have to take into account residual organic matter that was already ancient when the soil was buried (Jenkinson and Rayner, 1977; Guillet, 1982; Macphail, 1987, p360), because otherwise buried soils would be incorrectly dated as being much older than the actual date of burial. For example, a modern A horizon will record a predicted radiocarbon age of 1240 years (Jenkinson and Rayner, 1977) and similar figures have been subtracted from C^{14} dates recorded for mid-Flandrian and later prehistoric buried soils (quoted in Macphail, 1987, p360).

The above correction factor cannot be immediately applied to the C^{14} dates at section 0473, because the theoretical radiocarbon age of topsoils relates to soils formed in situ over many thousands of years. At Beeston, the two humic horizons have formed as post ditch fill soils, and the time-length of soil formation for each, has to be argued. In the case of the b Ah horizon right at the top of the ditchfill, field analysis showed it to be a moderately deeply formed mature topsoil over a weakly developed B(s) horizon. It therefore seems to have had plenty of time to have formed residual organic matter, and so the radiocarbon age of 1230 ± 90 years may suggest that it was quite recently buried (even though some fine charcoal was present), or that the date is unreliable. In contrast, the lower buried humic horizon (2b Ah) appeared as a more narrow and more humic band that was less like a slowly developed topsoil than a moderately rapid accumulation of organic matter in fine material concentrating in the damp bottom of the remaining ditch. The radiocarbon date here of 2510 ± 90 years bp, which again includes fine charcoal, can more satisfactorily be considered as a "peat" date rather than a soil date. When calibrated (1 sigma (68% range) 800-415 cal-BC; 2 sigma (95% range) 885-400 cal-BC (Haddon-Reece, pers. comm.)) a Late Bronze Age/Early Iron Age date is indicated, which is comparable to the pottery evidence, and in line with the possible (rapid?) burial of the 2b Ah horizon by sands from the Late Bronze Age rampart (Ellis, pers. comm.). The ditch is therefore accepted to be Late Bronze Age.

ii) Soil Pollen: The pollen sequence of 31 levels was carried out by K Whittaker (unpublished report, Appendix 4) under the supervision of N Balaam (CEU), and a pollen diagram of four zones was produced. A summary, relating to the interpretation and dating of the ditch is presented.

In pollen zone 1 both the primary mineral fill (2b B) and the humic band (2b Ah) contain high arboreal pollen ratios (AP), primarily consisting of Quercus (oak) and Corylus (hazel). Other woodland elements are present, including Ilex (holly), Betula (birch), Alnus (alder) and Tilia (lime). The non-arboreal pollen (NAP) component consists primarily of Graminae (grasses) and Pteridium (bracken). Cereal pollen and weed species associated with agriculture are also present. The data suggests that the Late Bronze Age ditch was cut in a wooded environment, although open areas for agriculture were probably contemporary with the occupation of the site.

Pollen zone 2 occurs in sands probably eroded from the Late Bronze Age rampart, and so problems of differential preservation and residuality have to be considered. All that may be said from the pollen is that the environment probably became increasingly more open. This may be reflected locally because palaeomagnetic and pollen data from the nearby Peckforton Mere does pick out a primary peak of erosion related to intensified agriculture possibly during late prehistory ("Romano-British"; Oldfield, et al., 1985, p38-40) although there has been no absolute dating.

The more recent history of the crag as represented by soil pollen in the mature soil profile right at the top of the ditch fill (pollen zone 3), indicates that the area became re-wooded first with Betula and Quercus, then by Alnus and Corylus. The modern soil pollen (pollen zone 4) reflects the open nature of the present vegetation.

Discussion

Beeston Crag is composed of coarse Permo-Triassic sediments, such as the Keuper Sandstone, Keuper Sandstone Conglomerate and Bunter Upper Mottled Sandstone. These freely-draining deposits have given rise to humo-ferric podzols of the Delamere Soil Series (Furness, 1978) and typical brown sands, within the Bridgnorth Soil Association (Ragg et al, 1983). The development of these soils is now examined.

Firstly, periglacial deposits have been suspected on the site including probable solifluction gravels at the Outer Gateway, and microfabric analysis (Plates 8, 9) has confirmed that soils developed under a periglacial environment were present. During the Flandrian, primary soil formation appears to have been brown sand (Avery, 1980) development in the sandstone parent material as it continued to weather. It is evident that the brown sand soil progressively acidified, developing into a podzol (by the Iron Age - see later). Although Whittaker's (unpub.) soil pollen data is not tightly dated, it can be inferred that the soils at Beeston Castle developed under a mixed oak woodland, one that was still extant into the Late Bronze Age. The analysis of the soil developed in the Late Bronze Age rampart clearly indicates a podzol had formed before Iron Age burial. The Iron Age ramparts elsewhere also bury podzols (Macphail, 1980, 3235), but it is probable that podzolisation at Beeston Castle had developed in the first place under a mixed oak woodland cover. This is not that unusual, the chemical mechanisms for this being well understood (Davies, 1970; Mokma and Buurman, 1982), and other examples of acid parent materials developing a podzol soil cover under oak woodland (without full forest clearance and the impact of a heathland vegetation) are well documented, for example, by the Iron Age at Caesars Camp, Keston, Kent (Cornwall, 1958; Dimbleby, 1962).

As the ditch at section 0473 is apparently Late Bronze Age, it shows that the hillfort was probably first occupied in a mixed oak woodland environment with local clearance. There is also pollen evidence for possible on-site cultivation of cereals and for patches of waste ground.

Podzolisation continued into the Iron Age - with for instance a weakly developed podzol forming in Late Bronze Age rampart material, contrasting with the more strongly formed podzols that had developed in situ until buried by Iron Age ramparts. Bleached sand (topsoil) had been in fact used at this time to build ramparts. In the area of the Outer Gateway animal/human disturbance and possibly also cultivation upslope in the Outer Ward brought down a succession of soil materials of colluvial character. These are generally well sorted acid (Ea horizon origin) sands, with dumped layers occurring in the area of the prehistoric approachway where they have been mixed with charcoal, and also banked up against the insides of the ramparts. Their variety was described in 1984 (Macphail, AMLR 4441).

Soil micromorphology indicates that high temperature hearth material (Plates 4, 5, 6, 7), possibly relating to local Late Bronze Age metallurgy were dumped during rampart construction. In addition, micromorphology characterises the podzolic development in the rampart (Plates 8, 9), and that occupation activities, probably just prior to Iron Age burial, mixed fine charcoal, phytoliths and calcite ash into an otherwise typical acid Ah horizon. Surface slaking, possibly relating to trampling, produced clay coatings (Plates 2, 3), which are again only poorly preserved because of the acid soil environment.

Soil pollen (by K Whittaker) suggests that the site became increasingly open in late prehistory, but abandonment of the area after Iron Age occupation led to the crag becoming increasingly rewooded. This is also inferred for the area as a whole from the sedimentary record at Peckforton mere (Oldfield, et al., 1985, p38-40), and Beeston Crag was probably wooded when fortified in the 1220's AD.

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Beeston Castle: Table 1

Grain Size and Organic Carbon

Sample	% Org. C	Clay	FZ.	MZ.	CZ.	Silt	VFS.	FS.	MS.	CS.	VCS.	Sand	Texture.
Ah/occup.	0.7	2	6	3	8	17	21	30	25	3	2	81	FLS
Ea	-	5	3	7	13	23	20	22	26	2	2	72	FLS
Bhs	0.6	4	11	7	15	33	20	24	13	2	1	60	FSL
Bs	0.2	5	3	7	13	23	20	30	17	1	1	69	FSL
Bs(t)	0.2	8	6	6	11	23	24	23	19	2	1	69	FSL

Appendix 1

Micromorphological Description Beeston Castle

Ah/occupation: (37-46cms)

Structure: Massive, with medium subangular blocky, coarse lamina, generally massive microstructure. Porosity: 20-30% (variable) very dominantly complex packing pores. Mineral: Coarse: Fine (limit at 20um). C:F 80:20. Coarse: Very dominant very fine, fine and medium sand-size, sub-angular to sub-rounded quartz; very few feldspar, frequent very coarse pottery fragments in top part. Fine: a) common very pale brown, highly speckled (PPL), pale orange (RL), non-birefringent - in top; b) frequent i) darkish brown with ii) greyish brown (PPL), highly speckled; red (RL), both poorly birefringent; c) dominant (in lower part) greyish brown, highly speckled (PPL), brownish (RL), non-birefringent. (a: a mixture of colluviated bleached sand and anthropogenic debris - e.g. fine "burned clay" etc. b: possible hearth area c: Ah fabric with strongly mixed anthropic materials such as charcoal). Organic Matter Coarse: very abundant fine to coarse charcoal and charred organic fragments. Fine abundant amorphous organic matter and charred material - with "washed in look" (see features). Rare yellowish brown organo-phosphatic areas (residue from wood ash?). Frequent phytoliths. Groundmass a) Coated to porphyric, undifferentiated b-fabric; b) dense porphyric, grano-striate b-fabric. c) Coated and linked, undifferentiated b-fabric.

Pedofeatures Textural (in a) rare thin very dusty clay coatings on mineral grains, and porosity - very dark brownish and very poorly birefringent, (trampling-floor?) with fine charcoal. Possible washing in of bleached quartz sands) has been colluviated from local podzols.

Bs/Bst: (71-86cms)

Structure massive, massive microstructure.

Porosity 25%; very dominant fine to medium, sometimes open walled, generally rough walled vughs. Few medium, rough walled, channels.

Mineral Two fabrics - 60% a) natural Bs/Bst and 40% b) mixed anthropogenic materials. coarse: Fine a) 80:20 b) 70:30 - 75:25 (with depth).

Coarse - as in the Ah, but includes small stone size siltstone (with relic periglacial coating) and ferruginous mudstone fragments. Fine a) pale brownish, moderately speckled (PPL), orange (RL), and non-birefringent - this is the sesquioxidic Bs fabric b) darkish brown, heavily speckled (PPL); brownish orange (RL), very weakly birefringent (include anthropic fines-clay from burning of wood, ash etc.).

Organic matter a) occasional coarse to fine charcoal fragments b) occasional charcoal. Fine a) many fine charcoal, many fragments of amorphous organic matter - some material ferruginised b) abundant fine organic matter and charcoal. Frequent phytoliths.

Groundmass a) enaulic (coatings and infills), undifferentiated b-fabric b) both porphyric and enaulic, weakly crystallitic and speckled b-fabric.

Pedofeatures Textural in a) many relic rounded grains coated grains-coarse dusty clay (relic of periglacial fabrics - transported (colluvially) and rounded downslope) - also on stones. Rare very thin clay coatings on mineral grains.

Depletion in b) many sand grains with bleached history - derived from Ah or Ea horizons Amorphous in a) fine fabric comprises weakly developed polymorphic sesquioxidic fabric (Podzolic Bs).

Interpretation Although this horizon was 30-40cms deep, below an assumed Ah ground surface, the soil - which contains relic periglacial features, - is contaminated quite strongly by "occupation soils". The latter are similar to those soils present at Ah/occupation. (The buried soil sequence was subsequently found to be soil formation in a L.B.A. rampart, with probable Iron Age occupation influencing the uppermost layers. The deeper subsoil zone could have been mixed during rampart construction or this relic subsoil could have been influenced by earlier (Neolithic?) pit fills. Ellis (pers. comm.).

Appendix 2

Beeston Castle 1985 (W. of NT of OG) Outer Gateway

Profile Description:

Depth cm, Horizon.

Below Medieval Terrace

(Iron Age rampart)

BC0853 0-3	Discontinuous reddish brown (5YR5/4) moderately firm fine sand.
BC0858/ BC0860 3-26	Reddish brown (5YR4/3) loose sand, containing many rocks; smooth, sharp (charcoal band) boundary becoming diffuse eastwards.
BC0864 26-37	Brown (7.5YR4/2) loose sand containing charcoal; clear, smooth boundary.

Buried soil and occupation

(Late Bronze Age rampart)

BC0872 (Ah) 37-46	Brown (7.5YR5/4) loose fine loamy sand (Table 1) with reddish brown (2.5YR4/4) bands in the upper part, dark brown (7.5YR3/2) humic patches (10%); common charcoal; gradual, uneven boundary.
BC0877 (Ea) 46-52	Brown (7.5YR5/4) loose fine loamy sand; charcoal present; clear, uneven boundary.

BC0873 (Bhs) 52-61	Brown (7.5YR4/2) weak moderately humic fine sandy loam; charcoal present; clear, uneven boundary.
BC0887 (Bs) 61-71(76)	Reddish brown (5YR5/3) weak fine sand loam; few coarse stones; charcoal present; gradual, irregular boundary.
BC0938 (Bs(t)) 71(76)-86	Yellowish red (5YR5/8) moderately weak fine sandy loam; charcoal present; clay coatings present; sharp, irregular boundary.
C	Sandstone bedrock, and large rocks.

Appendix 3

SOIL PROFILE DESCRIPTION: BEESTON CASTLE

Rampart and ditch section: 0473

(ie Rampart over a ditch fill)

Horizon, depth, cms (0-82:- dump for Rampart)

L,F 0-3	Abundant fine roots, very common coarse bracken roots; medium sand present; clear, wavy boundary.
Ah 3-11	Dark reddish brown (5YR3/2) loose medium sand; coarse blocky; moderately humose; abundant fine roots; many coarse bracken roots; common stones with small to medium angular sand stone; clear, irregular boundary.
B 11-51	Dark reddish grey (5YR4/2) loose medium, sand; poorly developed coase blocky; many fine and common coarse roots; extremely stoney, small stones to sandstone bounders; clear, irregular boundary.
B2 51-69	Dark reddish brown (5YR3/3) and yellowsh red (5YR5/6) moderately weak to loose sand; poorly developed coarse blocky few fine roots; extremely stoney (as above); clear, irregular boundary.
C 69-82	Reddish brown (5YR3/4) loose, structureless sand; few fine roots; stones as above; sharp, smooth boundary.
b Ah 82-108	Dark reddish brown (5YR3/2) moderately weak medium sand; moderately well developed coarse blocky; moderately humose; few fine roots; moderately stoney with medium to large stones; fine charcoal present; clear, wavy boundary.
b B(s) 108-117	Dark reddish brown (5YR3/4) moderately weak sand; poorly developed massive; few fine roots; abundant stones (as above); smooth, sharp boundary.

2b Ah	Very dark grey (5YR3/1) moderately weak
225-236	fine sandy loam; well developed coarse blocky; few fine roots; humose; few large stones; charcoal present; clear, smooth boundary.
2b B	Brown (7.5YR5/4) loose medium sand;
236-317	structureless; rare boulders; rate fine roots; manganese present; charcoal present; gradual, smooth boundary.
2b B2	Brown (7-5YR5/4) laminated sand and
317-372	Sandy loam; common manganese.

Appendix 4

A preliminary Report On The Pollen Diagram From Beeston Castle, Cheshire.

K M Whittaker

This is the initial report on the deposits revealed in section 0473 excavated by Mr P Hough in 1983. The stratigraphy encountered has been described by Dr R I Macphail (1983).

Samples for pollen analysis were collected by Dr Macphail in 1983 and were subsequently submitted to standard pollen concentration techniques (Moore and Webb, 1978) at the A.M.L. The more organic deposits were sampled at 4cms intervals, whilst the less organic deposits were sampled at 10cms intervals. A total pollen sum of 500 grains at each level (excluding Alnus and spores) was counted. The counts are expressed in the diagram as a percentage of total pollen excluding Alnus and spores, and Alnus and spores expressed as a percentage of total pollen.

The pollen diagram has been subdivided into four zones, from 1 at the bottom to 4 at the top of the present soil.

Zone 1: This consists of the 2b Ah and 2b B horizons which overlay the primary ditch fills. These deposits have been described by Macphail as "'silts' of a humose nature". These were found to contain high arboreal pollen ratios (AP), primarily consisting of Quercus (oak) and Corylus (hazel). Other woodland elements are present, including Ilex (holly), Betula (birch), Alnus (alder) and Tilia (lime). The non-arboreal pollen (NAP) component consists primarily of Gramineae (grasses) and Pteridium (bracken). Cereal pollen and weed species associated with agriculture are also present.

Zone 2: This zone was found to have high percentages of Gramineae which is associated with a sharp decline in the previous representation of woodland elements. Alongside the increase in Gramineae pollen there is a corresponding rise in the representation of other grassland taxa, e.g. Plantago lanceolata (ribwort plantain) and Taraxacum type (dandelion). Cereals are still represented, but not at their previous level. Pteridium is also well represented.

Zone 3: This zone consists of the b Ah and B B(s) horizons of a soil developed in the top of the ditch fill. This zone is characterised by the steady increase in the representation of the woodland taxa. Betula and Quercus reach a peak at the beginning of this zone, but it is Alnus and Corylus who eventually dominate this zone. The representation of Gramineae declines as there is a return to a more wooded habitat. Likewise the herbaceous taxa associated with the more open habitat decline. The decrease in Pteridium suggests that the re-established woodland is relatively closed.

Overlying the deposits of Zone 3 is a soil dump. This deposit does not posses any stratigraphic unity therefore the pollen preserved in it is of no value to the analysis.

Zone 4: This zone consist of the top of the modern soil and therefore represents the modern vegetation. High values for Gramineae and Pteridium reflect the open nature of the present vegetation. Woodland elements are displayed, with Quercus and Betula the main components. The occurence of Pinus (pine) pollen is a result of recent commercial forestry plantation. It is noticable that Ilex is no longer present as a component of the woodland, and that cereals are poorly represented at the site despite its cultivation on the plans at the foot of the crag on which Beeston Castle is sited.

The Vegetational History

The earliest record presented depicits a stable mixed oak woodland in Zone 1. This woodland was likely to consist of oak as the primary component of the canopy, with a understorey of holly and hazel. Birch was likely to be found at the margins of the woodland. Within this woodland habitat the herbaceous aspect of the pollen record suggest the presence of two other habitat types.

a) Waste ground. Taxa present which suggest waste ground include Chenopodiaceae (Goosefoot family), and Polygonum aviculare type (Knotgrass). The type of habitat suitable for these taxa would probably be provided within the vicinity of the enclosure.

b) Cultivated areas. Areas of cultivation are indicated by the presence of Plantago lanceolata and Anthemis type pollen. Furthermore the presence of Cereal type pollen grains suggest that cultivation took place close to the site as Cereal pollen does not travel far.

Therefore during Zone 1 the picture given is of local clearance within a mixed oak woodland.

The next major phase in the vegetation history of the site occurs during the time the ditch is filling. This is associated with a sharp decrease in the arboreal aspect of the pollen diagram and a corresponding increase in the presence of taxa indicative of open grassland. Gramineae is the main component at this stage but also other herbaceous taxa are found to reach peaks in their representation, including Taraxacum type (dandelion), Plantago lanceolata, Thalitricum type (meadow rue), and Ranunculus type (buttercup). These taxa are often associated with pastoral situations and it is interesting to note that whilst Cereal pollen is still represented it is less so than under the previous habitat. It may be therefore that this period of major clearance (a feature found over large parts of the country during the Iron Age) is associated with an increase in the pastoral element in the economy of the contemporary human populations.

This phase of relatively open habitat was followed by the re-establishment of a wooded habitat. The pollen record in Zone 3 suggests that initially oak and birch re-establish themselves at the site to be quickly followed by a major rise in the representation of Alnus (alder). Alnus is a taxa often associated with wet environments and this could reflect the deteriorating falling into disuse.

Addendum

It must be stressed that the above is only a preliminary report. Further thought must be given to the processes which have formed this deposit as these will have a direct bearing on the interpretation. Also reference to other work will help refine the interpretation and a carbon 14 date is awaited which may affect the final interpretation.

Plate 1. Field Photograph, Beeston Castle. Section No .

Plate 2. Photomicrograph: Ah/occupation horizon; top to left, clay coatings on quartz grains from surface slaking (trampling), clay coatings are rather dull brown because of acid environment; to right fine fabric of mainly amorphous organic matter with fine charcoal. Plane Polarised Light (PPL), Frame length is 3.35 mm.

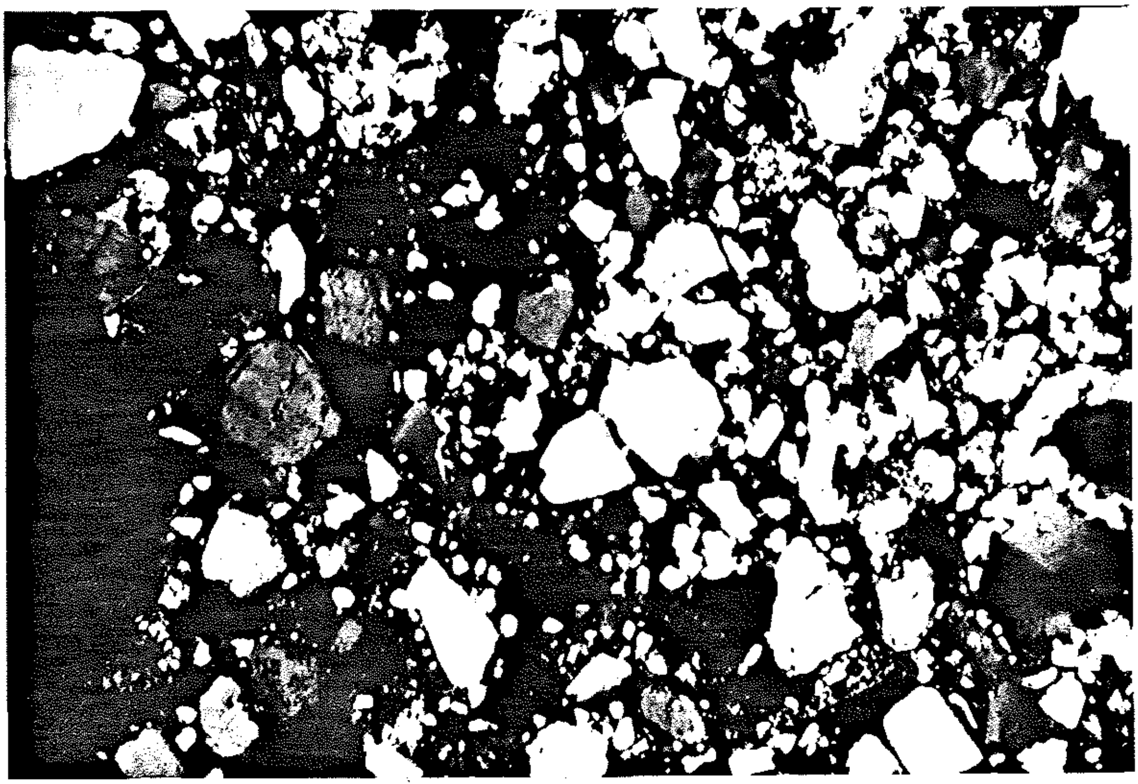

Plate 3: As Plate 2. Crossed Polarised Light (XPL); note poor birefringence of "acid" clay coatings, and lack of birefringent fine fabric genereally from this leached horizon.

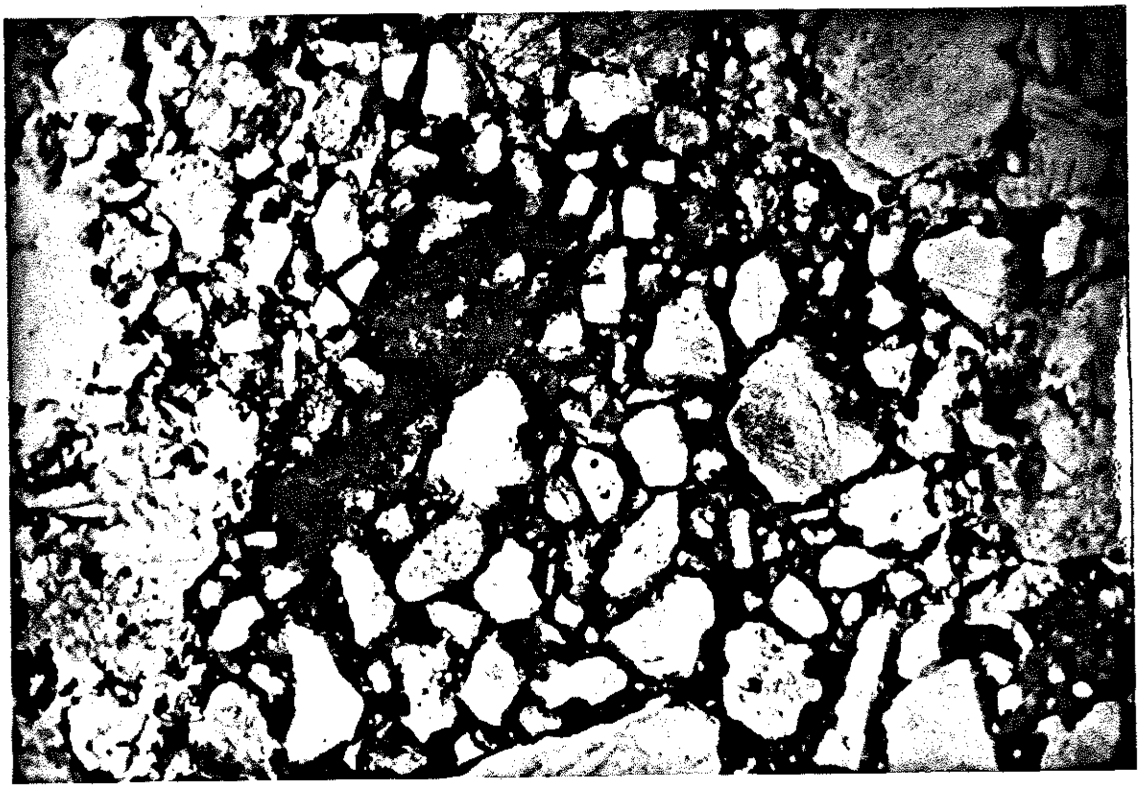

Plate 4. Ah/occupation horizon; high temperature hearth fabric; quartz sand grains set in a matrix of finely dotted siliceous cement. Plane Polarised Light (PPL). Frame length is 3.35 mm.

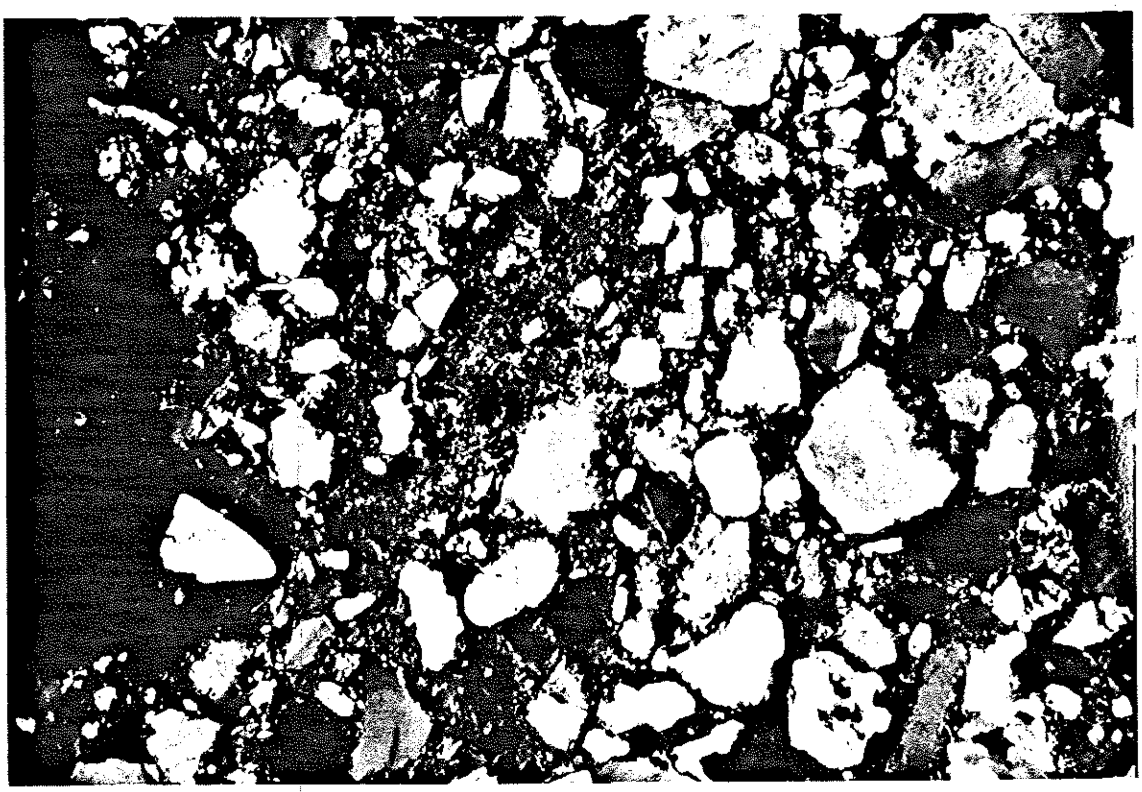

Plate 5. As Plate 4. XPL. Note general lack of reddish birefringent clay fabric found in low temperature heated soil, instead there is a finely speckled birefringent fabric.

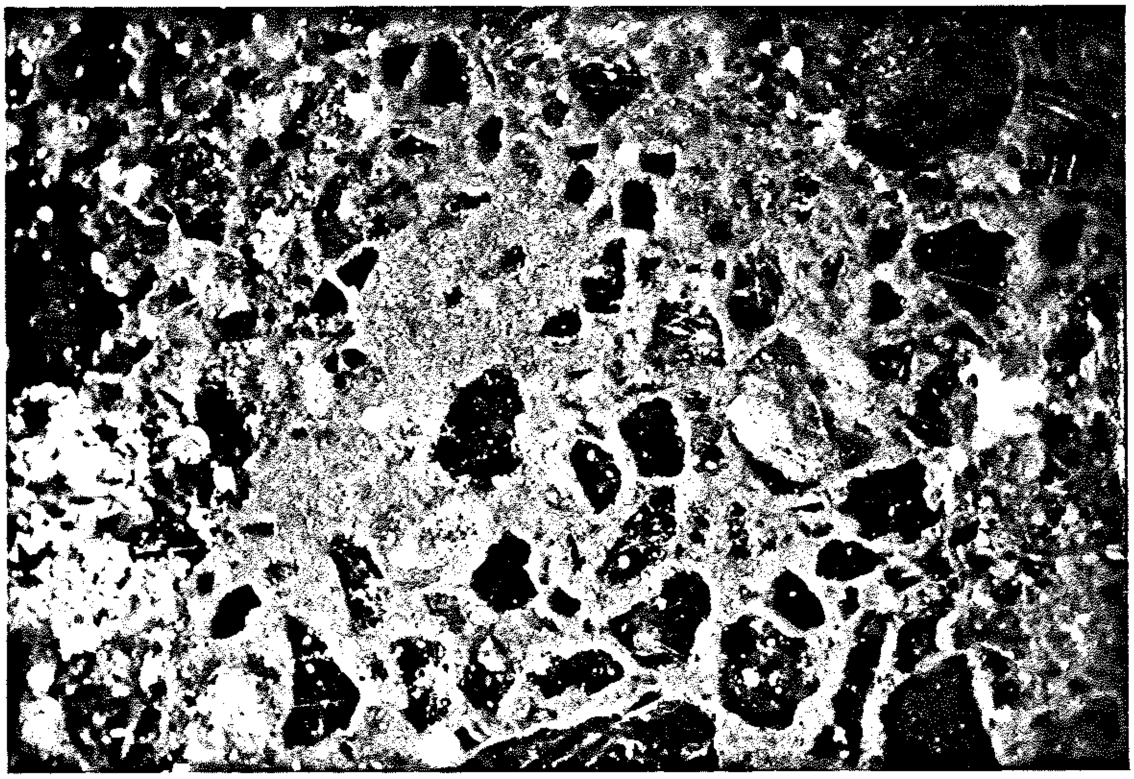

Plate 6. As Plate 4. Oblique Incident Light (OIL). Note bright orange of contained oxidised sesquioxides.

Plate 7. As Plate 4. Detail of hearth matrix showing probable mineral carbon (from fuel) set in silica as a result of high temperature fusion. PPL. Frame length is 0.332 mm.

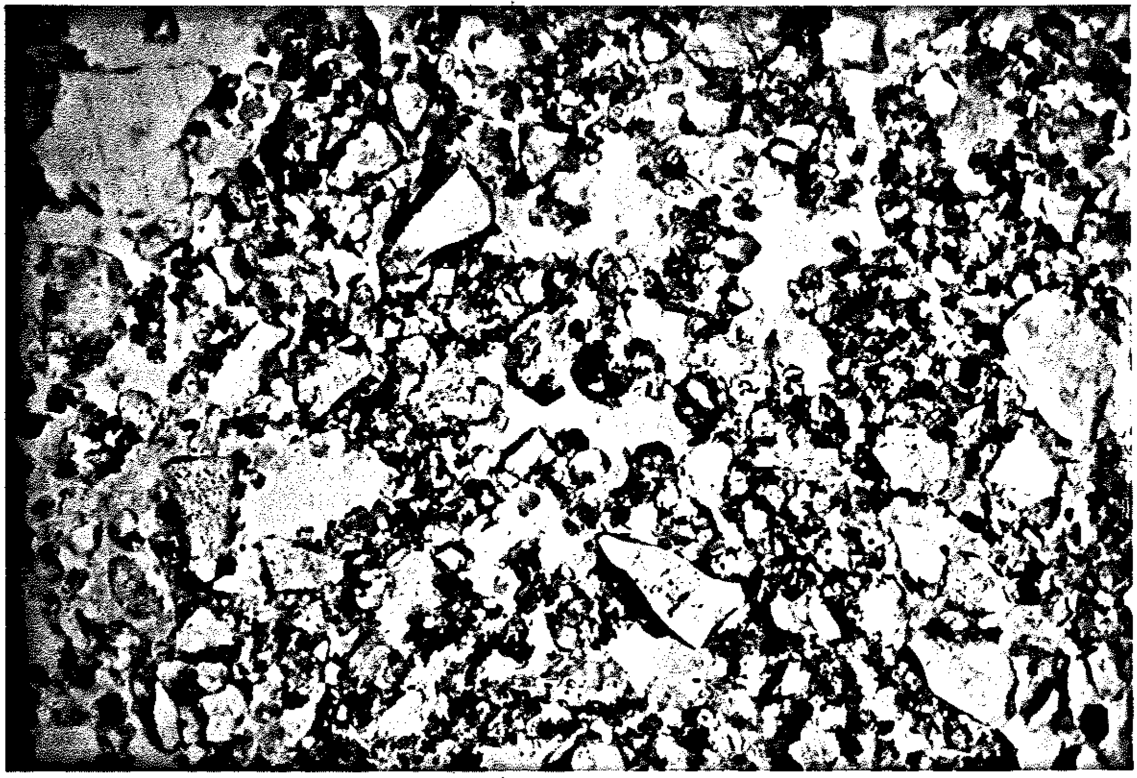

Plate 8. Bs(t) horizon: two fabrics are present here; a) the relic fragipan fabric as represented by sand grains which still retain impure silt and clay coatings; b) a loosely cemented weakly polymorphic sesquioxidic cement typical of the lower subsoil of a podzol. PPL. Frame length is 3.35 mm.

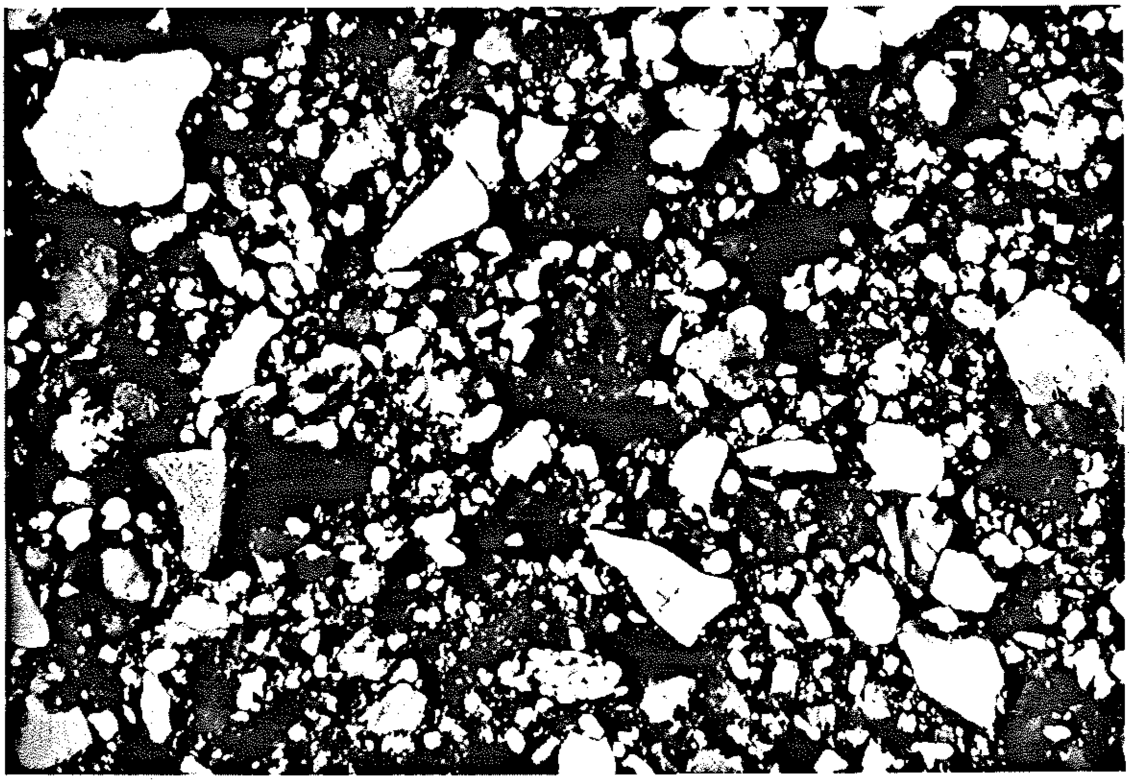

Plate 9. As Plate 8: XPL; poorly sorted relic coatings from periglacial link capping fabric are poorly birefringent, as is the podzolic fine fabric, in part the result of masking sesquioxides.

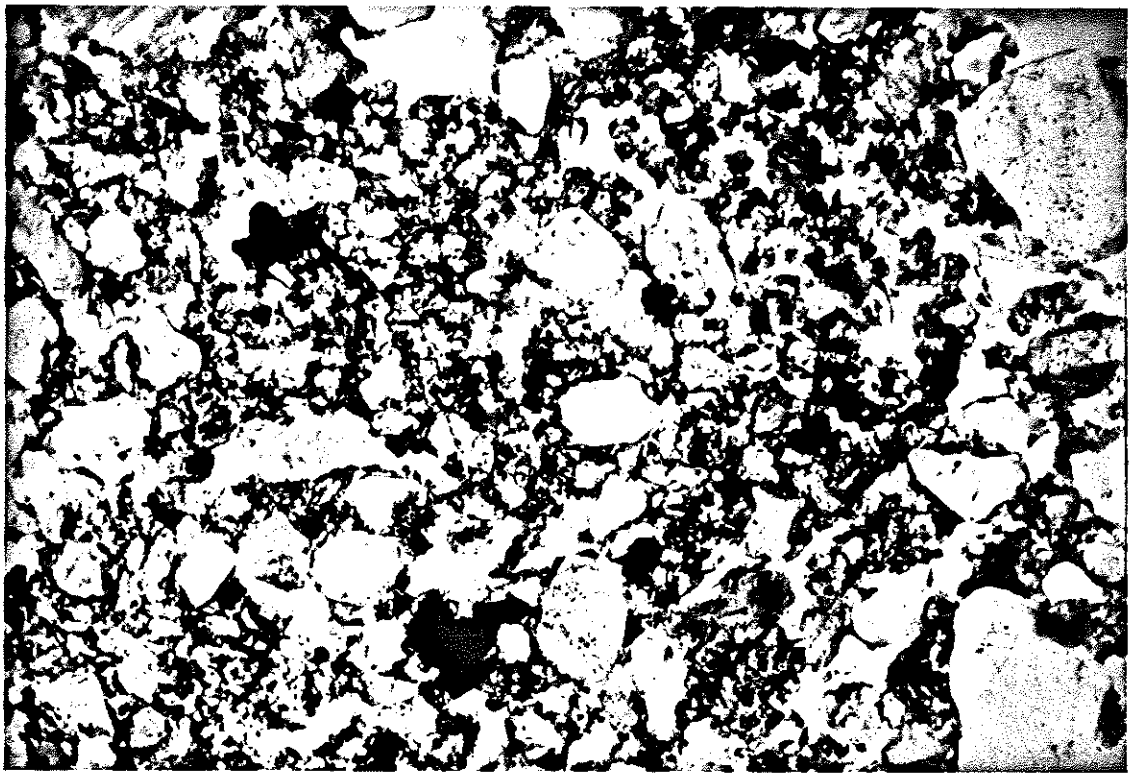

Plate 10. Bs(t) horizon: an area of contamination by occupation soil characterised by fine charred organic matter and charcoal fragments. PPL. Frame length is 3.35 mm.

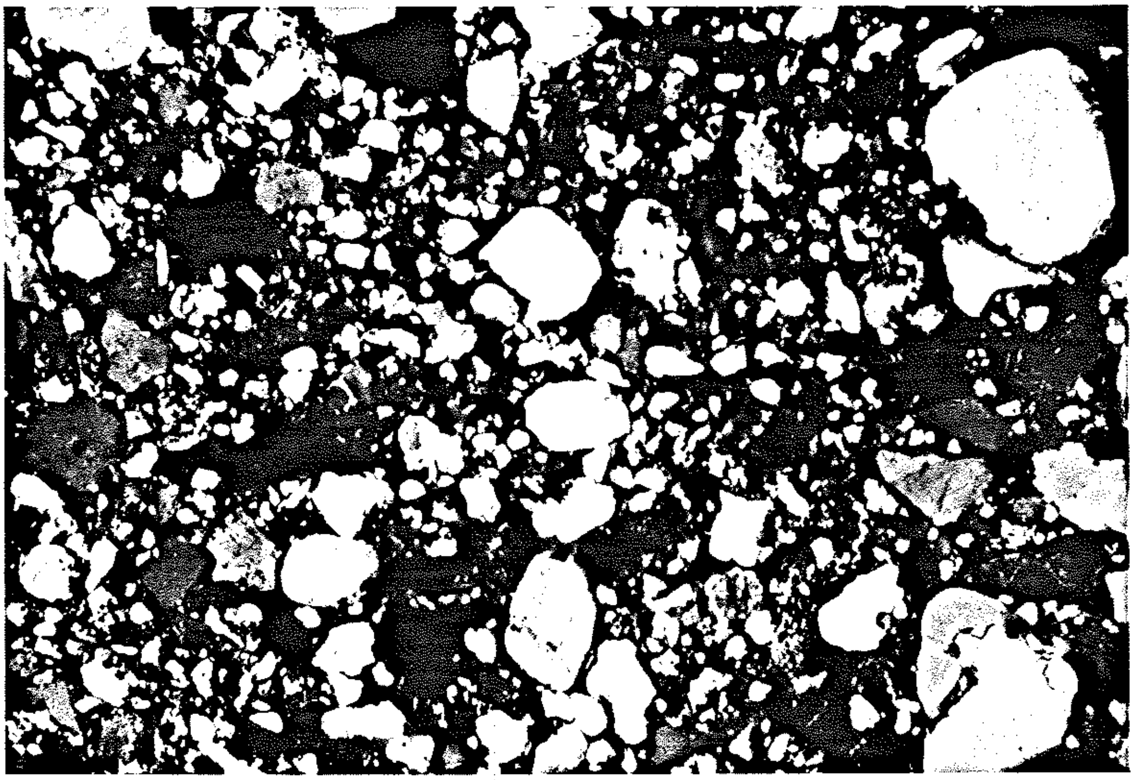

Plate 11. As Plate 10: XPL; this mixed of leached Ah Horizon and fine soil has slightly poorer birefringent fabric than the <u>in situ</u> Bs(t) horizon material.