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Soil report on Brickearth deposits associated with a palaeolith (hand axe) on the Taplow Terrace at Sipsons Lane, Middlesex

R I Macphail   May 1986

Summary

A micromorphological investigation of the junction between decalcified and undecalcified Brickearth was carried out at Sipsons Lane because a palaeolith had been located at this level. A very complicated history of emplacement, erosion and a second period of deposition were identified together with cold and temperate weathering phases. The hand axe was possibly dropped after late Wolstonian or early Ipswichian erosion of the primary deposit, which agrees well with the Wolstonian (35,000-100,000 yrs BP) typology of the palaeolith. The study contains seven plates.

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During the mainly Iron Age and Roman excavations at Sipsons Lane (Director, John Mills) by the Outer London Unit, machine stripping of the underlying "Brickearth" ahead of gravel extraction found a palaeolith. This palaeolith apparently lay at the junction of the decalcified/undecalcified "Brickearth". A thin section sample was taken across this boundary to ascertain if there was any significance to the position of the axe at this level.

The samples were investigated by soil micromorphology (Bullock, et al 1985), grain size, organic carbon and calcium carbonate analyses (Avery and Bascomb, 1974). Approximately 1 metre of strong brown (7.5YR4/6) clay loam "decalfied Brickearth" (layer 2) separated the level under scrutiny and the Roman surface and modern soils. The underlying brown (7.5YR4/6) clay loam "undecalcified Brickearth" (layer 1) was distinguished by obvious calcium carbonate efflorescence. It had been noted that the palaeolith was apparently more weathered on its upper face, approximating with this boundary. 4-5 cms beneath this junction the "undecalcified Brickearth" gave way to 10 cms of yellowish red (5YR4/6) (palaeo-argillic? - Avery 1980) sandy Brickearth and gravels (Plate 1), which overlie sands and gravels of the Taplow Terrace.

It was not intended to reconstruct the Quaternary history of the site, but some reconstruction of the environment of the site was necessary in order to try and explain the presence of the hand axe at this level. A possible reconstruction of the sedimentary and pedological events at this site are summarised in Table 1, which is based on the analytical data (Table 2) and Micromorphological Description and Interpretation.

Table 1. Depositional and Pedological Events and Sipsons Lane

A. Probable fluvial sedimentation of mineral material derived from i) the Chalk ii) Cold Phase soils (Plates 2-3) and iii) already relic rubified soils (nodules) to form Layer 1. (Late Interglacial-Late Temperate cool/cold - ??Hoxnian??).

B. Probable burial (forming hypothetical layer 1 "1") of layer 1 by calcareous deposit. (Late Temperate/glacial cold phase - ??Wolstonian??).

C. Calcium carbonate impregnation and infills (Plates 4-5) into layer 1 from overlying layer 1 "1". (?late-glacial cool phase (interstadial?) - Wolstonian).

D. Erosion of layer 1"1", exposing layer 1 (?late-glacial cool/cold phase - Wolstonian).

E. Hand axe dropped?

F. Probable solifluction/soliflual deposition of layer 2 with material derived from i) Cold Phase soils (similar to 1) ii) ferruginous soil nodules (similar to 2), but little from the Chalk. The handaxe may also have been transported in at this time. (?late-glacial cold phase - Wolstonian into Ipswichian ?).

G. Argillic brown soil formation through layers 1 and 2. (Interglacial-temperate phase - ?Ipswichian?).

H. Cracking of soil and deposition of coarse mineral infills (Plates 6-7). (?Late Interglacial - post temperate cool phase - ?Ipswichian?).

I. Emplacement of rest of overlying Drift (Glacial-Late Glacial-Devensian).

J. Soil formation (Present Interglacial-Flandrian).

The chronological sequence, which is based on Mitchell, et al (1973) would thus suggest a late Wolstonian, early Ipswichian date for the palaeolith. As this hand axe, according to typology is probably Wolstonian and of 35,000-100,000 years old (John Mills, pers comm), this assessment seems reasonable. The interpretation is of course purely speculative in the sense that the deposits on the Taplow Terrace at this site were only examined in detail from this one thin section. In addition the author has very little experience of Quaternary studies.

Acknowledgements. The thin section was made by Aberdeen University, the grain size analysis was carried out by Mike Allen, calcium carbonate data was provided by Stephen Carter, and the photomicrographs were taken through Chris Murphy at the Soil Survey of England and Wales, Rothamsted, who are all gratefully acknowledged.

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Analytical Data

Table 2. Sipsons Lane

Soil	pH	%OrgC	$CaCO_3$	Clay	F2	MZ	CZ	Silt	VFS	FS	MS	CS	VCS	Sand	texture
decalcified upper	8.0	0.21	0.1	24	9	22	18	49	23	4	1	1	0	28	CL
Undecalcified lower	8.0	0.10	6.0	28	10	24	3	37	22	6	4	2	1	35	CL

Sipsons Lane   Micromorphological Description

"Brickearth" (buried by c.100cms of Brickearth)

Layer 1. Decalcified: ?-3.5cms

Structure massive; massive with vughy microstructure and underlying compound grain microstructure.

Porosity 15%; dominant smooth medium vughs and frequent smooth fine to medium, generally short channels.

Mineral C:F limit 10um. C:F 75:25. Coarse dominant silt-size subangular quartz; frequent fine sand-size subrounded quartz; few small stone-size flint and weathered fine mica; frequent silt and fine sand-size opaques (mainly limonite with minor magnetite and pyrite); few weathered glauconite. It is worth noting that many of the sand grains embody rounded embedded grain argillans (Bullock and Murphy 1979) and like the few fine sand size relic or fossil rounded soil aggregates or granules (see Textural) are transported materials. As a whole the coarse mineral is well sorted. Fine dirty pale brown, very speckled (PPL), moderate birefringence; very pale to pale orange (OIL).

Organic Coarse rare ferruginised plant fragments (tissues) and amorphous material. Fine occasional fine organic matter in matrix.

Groundmass single spaced porphyric, grano-striate b-fabric.

Pedofeatures Textural many moderately thick (100um) micro-laminated fine dusty and very dusty highly birefringent clay coatings generally succeeded by less birefringent impure clay coatings (see Plates 4-7). Coarse (2mm) channels similarly largely infilled by similar fine dusty to very dusty and very dusty/impure clay with silt-size quartz. Much of underlying fabric affected by freeze/thaw with occasional silt and clay, and clean silt link capping, layering or crusts still evident.

Many embedded grains with rounded dusty clay or very dusty and impure clay occur, in addition to rounded granules (see Plates 2-3) of relic (fossil) link cappings. Depletion occasional link capping fabric silt bands are still moderately depleted of iron. Amorphous very abundant ferruginous presence in fossil fine material. Occasional medium diffuse impregnative ferro-manganiferous nodules. Fabric occasional medium passage feature; also much of the porosity could be fossil.

Layer 2. Undecalcified sharp boundary 3.5-7cms.

Structure as above; possible fossil prismatic; within massive channel microstructure.

Porosity 10% common fine smooth vughs; common very fine channels interconnecting medium to coarse moderately rough chambers.

Mineral C:F 65:35. Coarse similar to layer 1 above; only moderately sorted. More flint, few chalk, limestone, and calcium carbonate fossils present (Plates 4-5). More small stones and coarse sand-size material (4-5%) present. More (frequent) transported rounded soil aggregates or granules (see Textural) are present. Few embedded grain clay coatings, very few ferruginised soil aggregates.

Fine Mineral: dirty pale brown, very speckled (PPL), moderately high birefringence (XPL), pale orange with pale greyish orange (OIL) through calcitic impregnation.

Organic Coarse as layer 1, Fine occasional fine amorphous material commonly ferruginised.

Pedofeatures Textural many void dusty clay and impure clay coatings and infills (as layer 1) - infilled crack 2mm wide runs 4cms through slide (Plates 6 and 7). Many embedded coated grains and relic soil granules from probable link capping fabrics (Plates 2-3). Possible more granules than layer 2.

Crystalline very abundant general calcitic impregnation of fine fabric (Plates 4-5). Many chalky (textural) void infills including much silt-size quartz and rare organic matter. Both coatings and hypocoatings present. Rare coarse granular calcite growth in margins of coatings. (Calcareous coatings pre-date influx of dusty clay into porosity). Amorphous general weakly ferruginous stained fine material. Many diffuse medium to coarse ferro-manganiferrous impregnative nodules.

Fabric It is worth noting that some of the porosity post-dates the development of the calcitic fabric, but pre-dates the dusty and impure clay infills.

Interpretation The slide can be divided into two parts, a decalcified upper part and an undecalcified lower part. However this boundary does not relate to the depth of decalcification in this drift deposit as a whole from weathering, but the junction divides two distinct sedimentary bodies. These can be divided up into layer 1 - undecalcified - and layer 2 - decalcified.

The kind of microfabric interpretation of relic and transported features, as present at Sipsons Lane, have been used previously to establish the history of emplacement and pedology of Plateau Drift soils elsewhere, eg in Oxfordshire (Bullock and Murphy, 1979). Using the pedofeatures present, and copying their hierarchical approach it is possible to suggest a history at Sipsons Lane and possibly indicate the context of the flint axe.

Layer 1 comprises a number of components which were transported to this site. Grain size analysis shows the deposit to be a clay loam but this is very much an average of all the components (Plates 2-7) so here textural analysis is useless to actually identify mode of deposition. In fact, it is better to consider the size range of the coarse constituents such as the medium and fine sand-size soil granules, embedded dusty clay grains and flints that are present, to suggest moderate energy alluvial deposition. Several sources of material can be distinguished:

a) The Chalk - this gives rise to chalk, limestone and "fossil" inclusions.

b) Freeze-thaw (cold phase cryogenic soils) - soil formation locally under cold conditions produces silt and clay link cappings, and mineral caps and pendants (or laminated fragipan) - the cryoturbation of which forms rounded "soil granules" and "embedded dusty to very dusty and impure clay grains" (Plates 1-5) from these layers (Bullock and Murphy, 1979; Romans and Robertson, 1974; Federoff and Goldberg, 1982) and these in fact can be wind transportd (Federoff, pers comm; Macphail 1985 Balksbury AMLR 4621).

c) Rubified horizons - soil formation at high mean temperatures (possibly Hoxnian rather than Ipswichian Interglacial as interpreted from Bullock and Murphy 1979) produce reddened, haematite-rich soil fabrics (ie palaeo-argillic - see underlying gravel - Plate 1) fragments of which occur as nodules.

The above named materials were deposited alongside silt and clay. It is also likely that layer 1 was thicker with an upper part containing possibly more calcareous materials, because during weathering of this sediment the hypothetical layer 1 "1" lost calcium carbonate downwards into layer 1 forming Crystalline calcitic pedofeatures (Plates 4-5). The calcitic material which was washed in, also included silt-size quartz suggesting possible major disturbance of the calcareous layer 1 "1". This probably occurred at a time when calcareous soil water was flushing through the whole deposit as has been identified in some Devensian late Glacial deposits (Macphail, et al in press).

The deposition of layer 2 was preceded by the erosion of layer 1 "1". Layer 2 is composed of similar elements as layer 1 ie silt and clay granules (see b), embedded dusty clay grains (see b), and ferruginous nodules (see d), but chalky material is mainly absent - hence low (0.1%) calcium carbonate content. The sources of material could well be similar to layer 1. However, the mode of deposition of layer 2 could be solifluction or soliflual rather than purely fluvial because of the freeze/thaw weak link-capping fabric which is present (Romans and Robertson, 1974).

The flint axe was apparently retrieved at the junction of layers 1 and 2, and hence may have been "dropped" after the erosion of layer 1 "1", or come from the base of the solifluctecd layer 2.

Soil formation followed the cold conditions of deposition developing a porosity pattern and an argillic (Bt) fabric. This also affected layer 1.

Layers 1 and 2 were then subjeced to coarse cracking, either relating to prismatic structure or ice-wedging activity. The latter is possible as the massive inwash of dusty clay and impure clay void coatings (Plates 6-7) is indicative of an onset of cold conditions (Federoff and Goldberg, 1982). This activity may relate to cold conditions and the emplacement of the present Drift overburden. The latter probably continued into the late Devensian and the upper part of the sequence has been affected by Holocene (Flandrian) soil formation.

Captions to the Plates

1. Sipsons Lane field section: above the yellowish red gravels there is the junction between the decalcified and undecalcified Brickearth at which the palaeolith was found.

2. Photomicrograph; layer 1, undecalcified; note rounded "granules" and "embedded dusty clay mineral grains" eroded from cryogenic soils. Plane Polarised Light. (PPL), frame length is 5.225mm.

3. As 2, Crossed Polarised Light (XPL).

4. Photomicrograph; layer 1, undecalcified; note few chalk fragments and greyish calcitic impregnation, with later dusty clay translocation (centre) into void space. PPL, frame length is 5.225mm.

5. As 4, XPL.

6. Photomicrograph; layer 1, undecalcified; note general argillic fabric, and very coarse crack running from layer 2, undecalcified above, infilled with dusty and impure clay. PPL, frame length is 5.225mm.

7. As 6, XPL.

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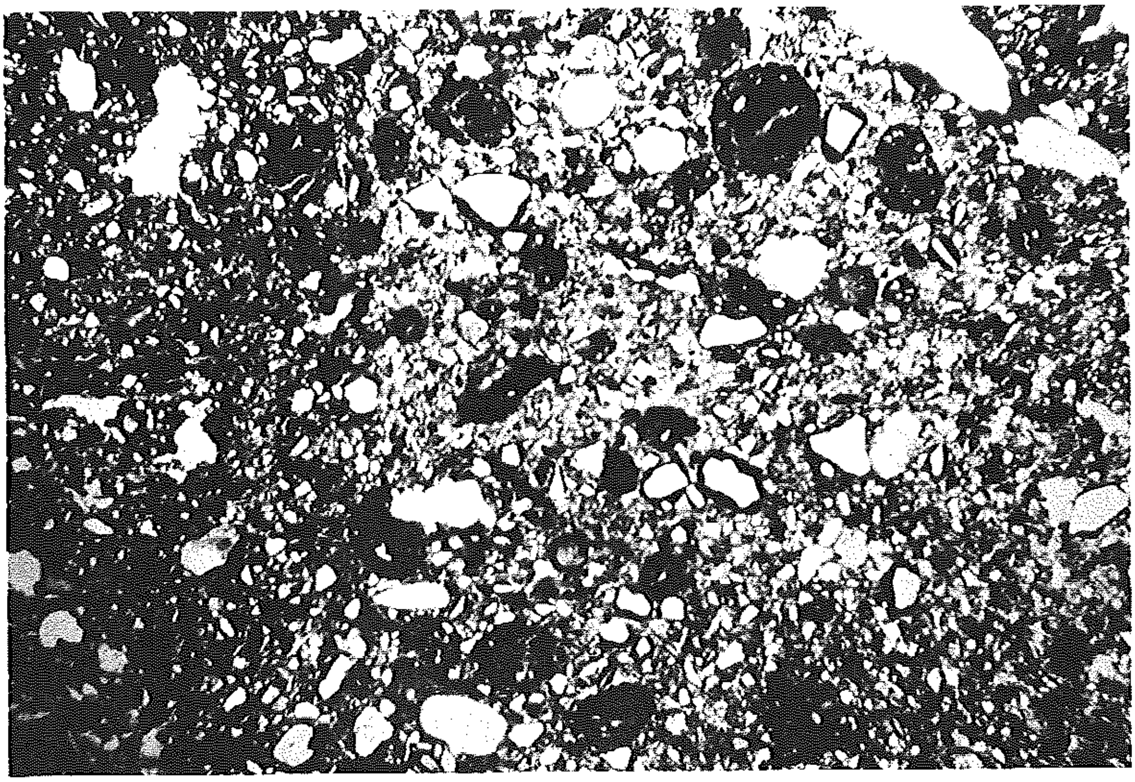

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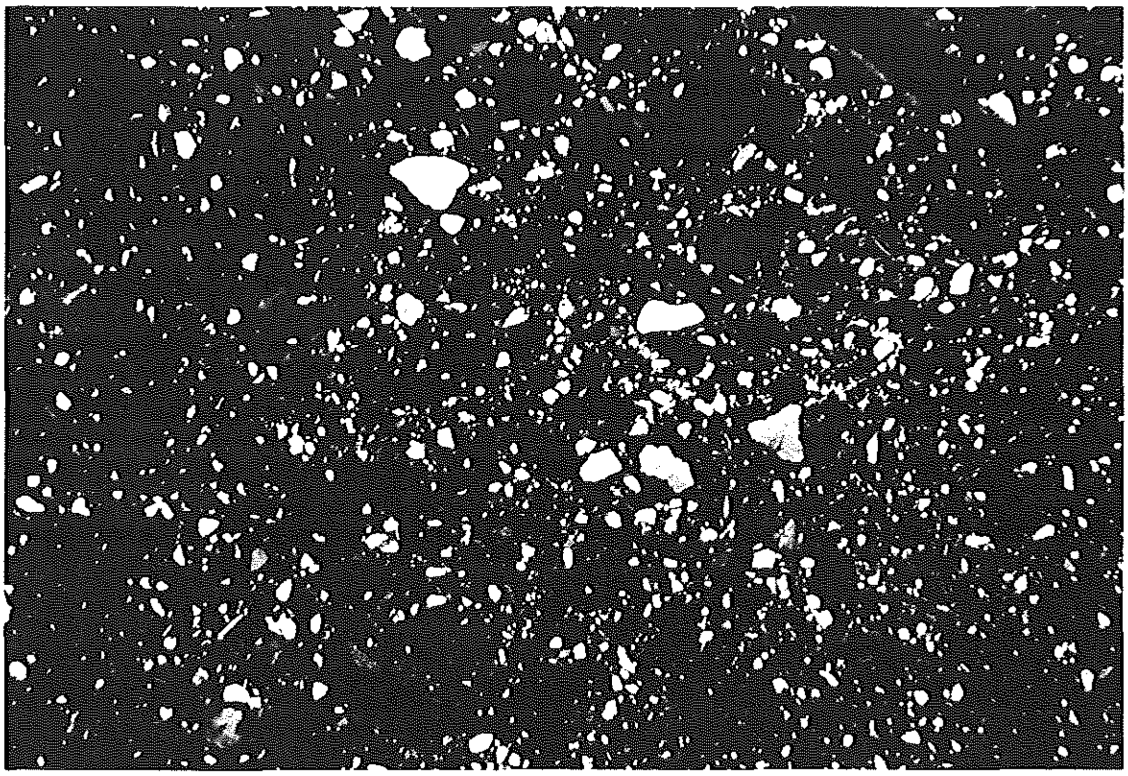

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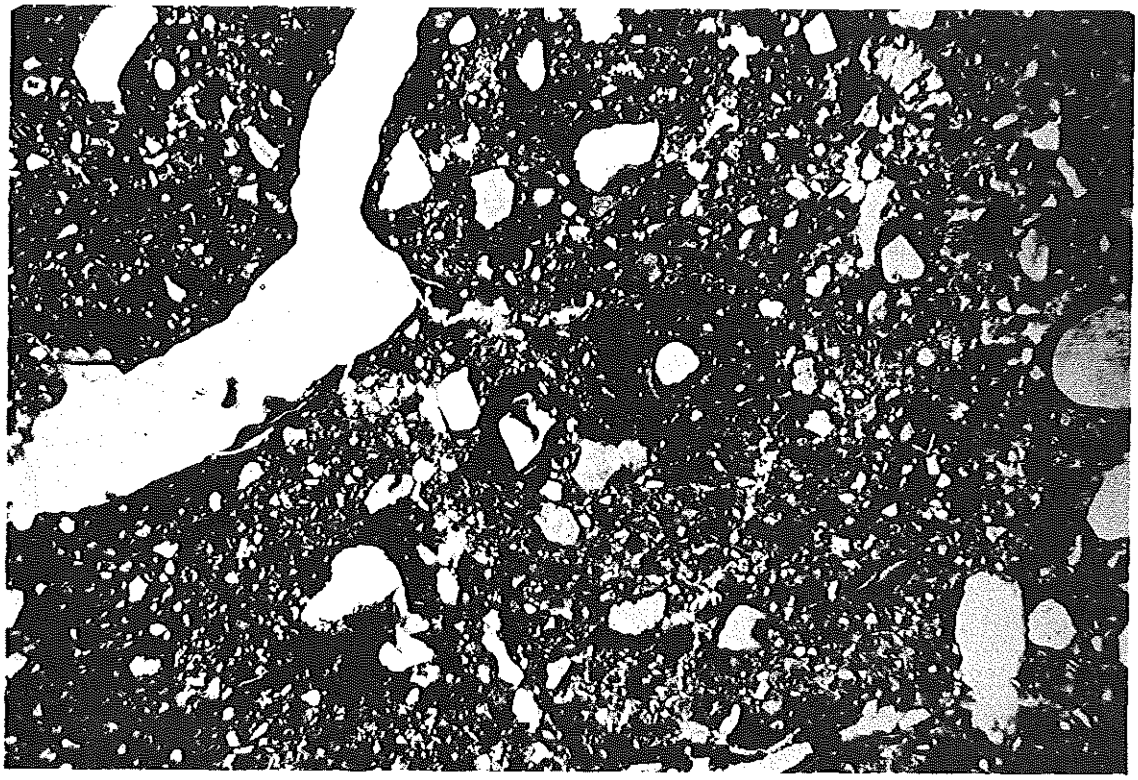

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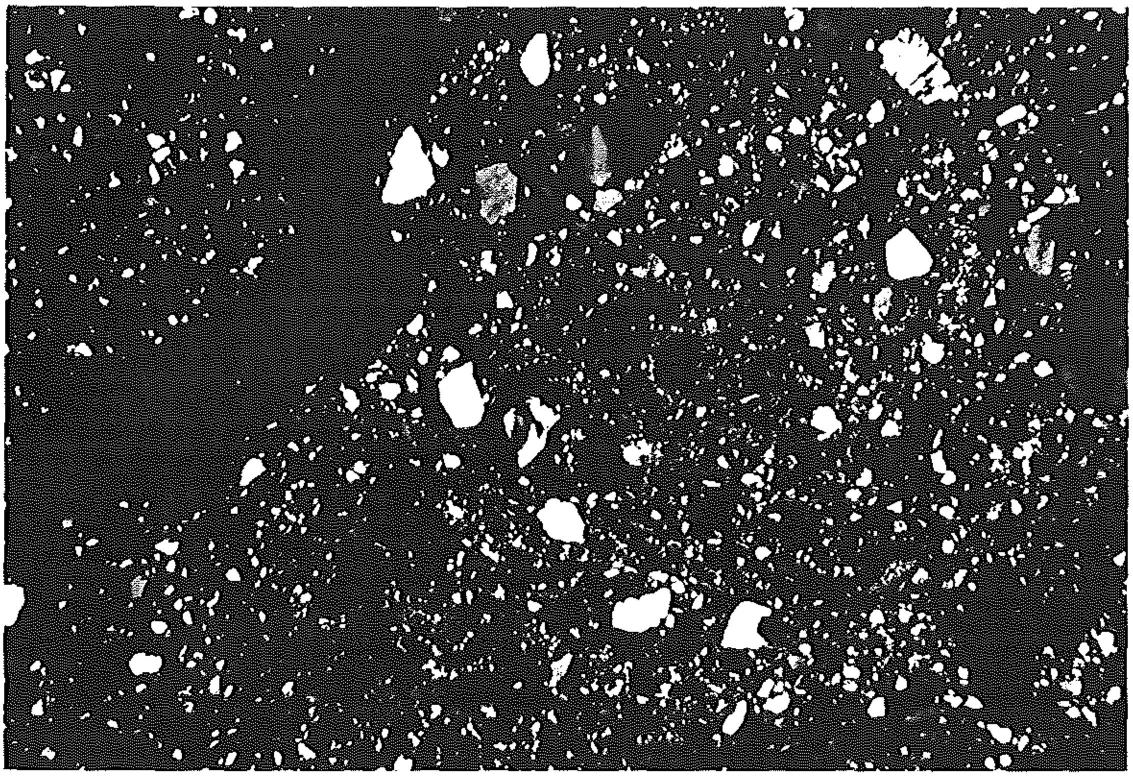

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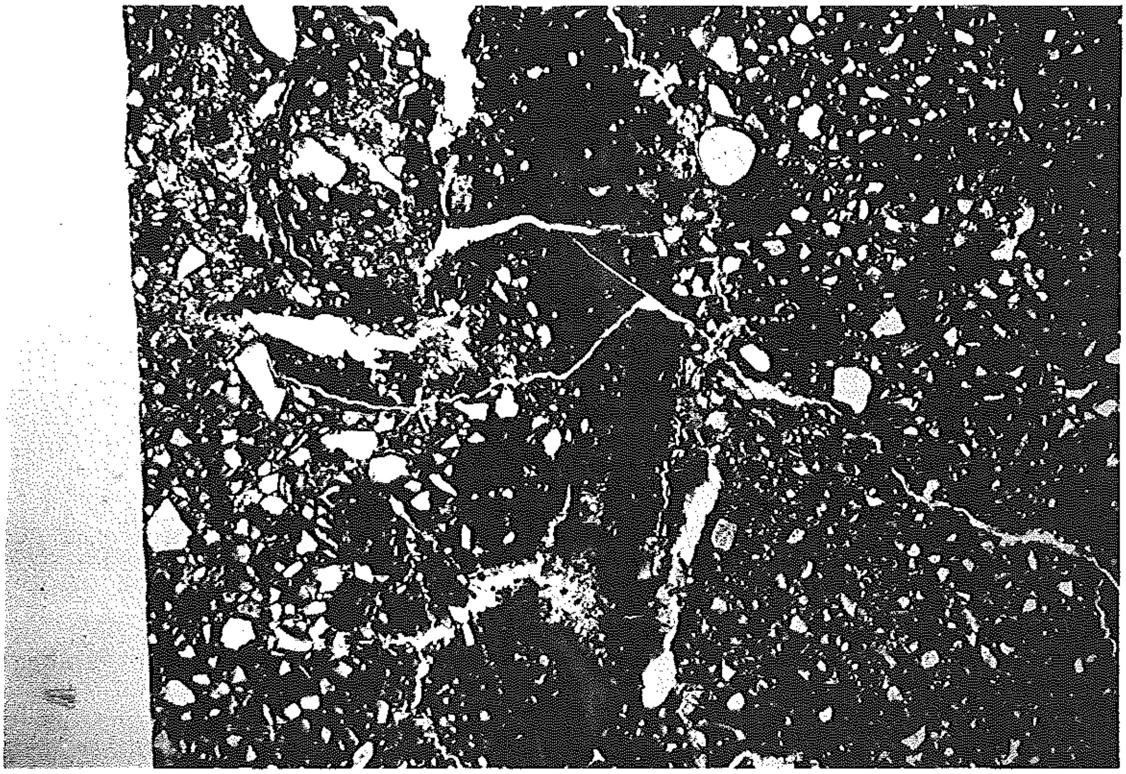

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