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SOIL REPORT ON THE "DARK EARTH" AT G.P.O.75, LONDON

The site at G.P.O. 75 has been excavated over the last four years by the Department of Urban Archaeology(site supervisor Steve Roskams), and has exposed sections from the Roman, through presumed "dark earth" to a Medieval cemetery. Within the "dark earth" itself three samples were taken from a 45cm. thick section, approximately representing the upper (A), middle (B), and lower zone (C). These samples were analysed for texture, inclusions, loss on ignition, alkali extractable humus, and phytolith content. In addition, small quantities of soil pollen were extracted by R. G. Scaife from the middle level, while this zone was also examined in thin sections. These analyses were carried out to try and characterise this material at G.P.O. 75 and allow it to be compared with "dark earth" elsewhere.

Physically the "dark earth" is very poorly sorted, and varies between a sand and a loamy sand, and can be regarded as moderately stony (see Table I). Clay content is very low for each zone, whilst silt quantities differ greatly. The latter may relate to how much natural has been mixed, as here it is a silty "brickearth". Much of the coarse material (i.e. more than 2mm) is comprised of introduced anthropogenic debris (see Table 2), such as bone, tile, mortar, pottery, charcoal and shell (mussel). In addition, stones and the mainly sandy matrix must also be regarded as exotic in an area dominated by a silty parent material.

The three levels have a similar alkaline pH, although their response to a rapid Phosphate test varies from Trace (see Table 3) in the lowest level (C) to Weak in level B, and Positive in level A. As phosphate tends to become irreversibly unavailable on drying, especially when there is much local mineral material, this may account for the low levels. The more Positive response in level A may be related to inhumations of a later date in the cemetery above.

Alkali humus content is similar to that found in Southwark "dark earth", although it is half as low as that present elsewhere at the GPO (POM 79). Still, these figures (see data) must be regarded in the light of the organic content of the underlying "brickearth" and probable reduction in organic status through oxidation. The figures suggest that mobile organic matter is uniform throughout the deposit, whilst loss on ignition reveals very real differences in charcoal, bone and other organic content, indicating a heterogenous mix within a homogenously organic (previously) deposit.

Three large slides of the central horizon of the "dark earth" at the GPO were examined under the microscope (see Micromorphology). Generally, the "dark earth" has a dark brown to opaque (Plane Polarised Light, PPL) agglomeroplasmic (after Brewer, 1964) fabric with areas which are more porphyroskelic in nature. Cursory point counting showed the material to be quite dense with good channel structures. Skeletal material comprises much sand and silt, but also inclusions of ceramics and calcite/aragonite shell occur. In addition, recognisable charcoal fragments are present, and it seems likely that more finely comminuted material may be attached to the intimately mixed iron-clay complexes in such a way as to make them opaque. Indeed, evidence of earthworm activity which would account for this dense agglomeroplasmic fabric is common-place. For example, the thin sections contain pedotubles (after Brewer, 1964) comprised of silts without any dark colouration showing how earthworms have burrowed through the "dark earth" into the "brickearth" beneath. Such fresh evidence indicates areas where the "dark earth" has yet not been intimately mixed with the "fines" in the natural. Such mixing is apparent in the textural analysis of the site.

As these findings are in agreement with those from the micromorphology of "dark earth" from Southwark it is apparent that the activities of earthworms have been important in both. Thus we have an alkaline material with a former earthworm population. It is therefore not surprising that much of the organic content has disappeared. Certainly the soil pollen content is poor, another indication of earthworm activity in a high base status environment, and often only those grains with thick exines have survived (see R. G. Scaife). Nevertheless, enough information has been gathered to aid the further environmental study through phytoliths.

Phytolith analysis included the extraction of fine soil (less than 1mm), after pre-treatment with HCl and ashing of organic material. Three samples, each from layers A, B and C were mounted on glass slides using Naphrax (Refractive Index 1.74). Phytoliths were identified on individual slides producing total counts for each layer of between 460 and 569. Percentage types were calculated and clearly indicate a predominance of Festucoid grass types that, although varying in composition, most probably represent a waste-ground flora as evidenced through pollen analysis. The differences (see Figure 1) between levels A, B and C illustrate a variation in the flora, but generally only within the Festucoid types; for Panicoid grass types as revealed by the presence of dumbells (Twiss, et al, 1969; Rovner, 1971) are in only minor quantities. Even so, more Panicoid grass types occur at this GPO site than ever found at St. Bartholomew's (Bart, 1979). Thus levels even though disturbed by earthworms whether chronological or otherwise have been affected by a variation in flora, whether local or imported. The cereal pollen present is most likely to have derived from cess (R. G. Scaife), as there was no phytolith evidence of cereals. Yet other pollen types clearly suggest a waste-ground environment, one with a much more diverse flora than identified here - as noted by R. G. Scaife - and so the suite of phytoliths present should be regarded in this light. Indeed, such grass genera as Hordeum, Poa, Bromus, Agrostis and Festuca are likely candidates although it should be remembered that the grasses are a very diverse group and inhabit a variety of niches.

Interpretation

The "dark earth" contains a high proportion of anthropogenic debris, both recognisable at the coarse (more than 2mm) level and under the microscope. These represent structural material (mortar, "tile", etc.), utensils (pot), foodstuffs (bone and shell) and the results of burning (charcoal). It is a waste deposit, yet in the latter case is there any evidence of hearths or ash layers? Disturbance, both by usage and by fauna may easily have obscured these, in such a dark material. The "dark earth" is primarily a sand or loamy sand with small quantities of silt and clay which, from the micromorphological evidence, seem to relate to the underlying "brickearth" for the most part, even whilst some silts may also derive from abraided pottery etc. These small amounts of "fines" therefore indicate that the "brickearth" or natural plays only an insignificant part in the formation of the "dark earth". Thus, it can be quite clearly stated that the "dark earth" is not a disturbed upper horizon or horizons of the natural soil. Further, as far as horizonation is considered, no real difference can be identified between the three layers examined, either morphologically, physically or chemically; for pedologically these are the same.

Interestingly, the "dark earth" has the character of a high base status brown earth profile. In fact, many of the processes active in this soil type can be recognised in the "dark earth". Firstly, the "dark earth" is alkaline, with surviving fragments of calcium carbonate, and has been reworked thoroughly by earthworms. Also, soil structure formation relates closely to this faunal activity as well as to wetting and drying. Certainly, it seems probable that the dark colouration of the matrix is the result of the intimate mixing of organic matter and charcoal with the mineral soil, again by these agencies.

The present-day low organic status of the "dark earth" cannot be regarded as its original content, because much organic material is likely to have been destroyed in these high base status conditions by fauna and oxidation. Indeed, "dark earth" from wet sites contain two to four times as much extractable humus. The presence of secondary cereal pollen, which is believed to be evidence of cess content in the GPO dark earth, further links this deposit with "dark earth" from York, which has these greater quantities of organic material. At York, not only were secondary cereal pollen grains common, but also the presence of parasite eggs again reaffirms the view that cess material may have contributed to the "dark earth". However, as stated by R. G. Scaife "problems of interpreting urban assemblages arise due to the diversity of taxa present and the complexity of human factors involved", especially when viewed alongside the full pollen analysis of riverine cess material from Broad Sanctuary (Inner London Unit Report, R. G. Scaife) which indicates the full diversity of biological imput into the urban environment.

Additionally, analyses of "dark earth" from POM 79 (D.U.A.), Arcadia Buildings (Southwark Unit) and Keays Lane (Carlisle) suggest overall similarities, if not between origins, which cannot be fully understood, but between the resulting deposits. Very comparable pH's occur, while colours are usually identical. Often quantities of alkali extractable humus only vary according to how wet or dry the site is, whilst loss on ignition demonstrates a variability expected of such heterogenous materials. Further, samples included in the study are known to encompass the Medieval (POM 79, and Keays Lane) and so it is probable that origins of the "dark earth" may be similar throughout this period, for certainly the resulting present-day deposits are closely comparable. Essentially then, urban usage of the Medieval period may well be worth investigating as a more easily accessible source of records.

A comparison of dark coloured material resting on Roman occupation areas at Lechlade (Oxfordshire Unit) with the "dark earth" of urban areas allows some interpretation of its origin and accumulation; because in the case of Lechlade short-time occupation and an unrestricted site has led to little vertical accretion. In contrast, urban areas, with their restricted space are characterised by the accumulation of this material into a thick deposit. This cannot therefore be indicative of site abandonment, but instead signifies intensive usage. The material itself comprises refuse and includes anthropogenic debris and cess, produced both by the usage of the site, and, just as likely, the dumping of similar material from elsewhere. Undoubtedly, man's disturbance and reworking by fauna may easily have obscured many of the tell-tale layers, whilst phytolith evidence from GPO 75, St. Barts 79 and York clearly indicate a variety of in-put into individual deposits. The exact nature of the "dark earth" for each site differs of course with, for instance, smaller amounts of organic matter present at St. Barts 79, whilst a layer from York has a very high cess content; yet it can be generally assumed in London at least that it had a far greater organic content formerly, and was waste-ground employed for a number of purposes including a dumping area for domestic refuse and in some cases used for live stock. Evidence of the latter comes from York where fodder material is possibly indicated in the pollen and phytolith data.

References

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Micromorphology, "Dark Earth" level B at G.P.O. 75

An undisturbed sample of the "dark earth" was air-dried and impregnated with an Araldite mixture, and thin sections (3mm x 1.5mm) were examined under the petrological microscope.

The "dark earth" is heterogenous; black (opaque) to dark brown (P.P.L. - Plane Polarised Light), and black with a medium lustre under reflected light (R.L.). It comprises fine rounded accomodated primary peds forming in most areas more coarse, rounded blocky secondary peds. Total voids equal 20-25%, with mostly compound packing voids which are mainly metavughs or well formed channels both within and between larger peds.

There is approximately 18% skeletal material comprising sub-rounded medium sized (0.2-0.6mm) sand grains and gravel sized (2-6mm) grey shell, and dark red brown (PPL) ceramic material. The "dark earth" contains nearly 20% silt. The shell fragments, which are most probably oyster, exhibit extreme birefringence colours concomitant with a calcite/aragonite composition.

Varying quantities of silt and fine sand sized (0.06-0.2mm) charcoal fragments are present. Reflected light suggests both soil humus and finely divided charcoal are intimately mixed with the iron and clay complexes forming the matrix.

Both manganic and ferric glaebules can occur. Generally, fabric is silasepic; agglomeroplasmic-porphyroskelic.

Pedological features include pedotubles; one of which is 5mm in diameter and has three zones. The outer edge is a greenish colour, most probably due to gleying and demarcates the non opaque soil of the pedotuble from the black, carbon-rich "dark earth". The outer zone is orange-brown (PPL) and silasepic. The inner zone is grey-brown and asepic (free of silt or sand), whilst the centre is void space. It seems likely that this is a faunal burrow (earthworm) which has brought "natural material" (brickearth-silasepic) into "dark earth". The grey-brown iron-clay material in the centre is likely to be fines which have been washed into the burrow through some soil disturbance.

Elsewhere in the "dark earth" there are plasmic separations both in the form of non-birefringent iron-clay channel linings and rare grain and channel argillans indicating some movement of material through disturbance other than faunal.

Thus we have a soil environment where wetting and drying are important processes. In addition, faunal activity is evident through obvious pedotubles and the nature of the soil aggregates or peds, which tend to occur in high base status brown earths. Therefore it is likely that the intimate mixing of charcoal and organic matter with the soil mineral content is liable to have occurred through faunal as well as wetting and drying activity.

It is likely that soil material that has been mobilised and redeposited has originated from the underlying natural brickearth, for these "fines" tend to have no "dark earth" content and thus were most probably not flocculated and thus more readily moved.

Overall, the micromorphology of GPO "dark earth" is similar to that of Southwark "dark earth" except for perhaps there being more large charcoal fragments at Southwark, which notwithstanding is characterised by an agglomeroplasmic fabric and pedotubles.

Data

Table 1 - Texture

Level	Gravel %	Sand %	Silt %	Clay %
A	(19)	86	11	3
B	(21)	79	18	3
C	(17)	82	16	2

Table 2 - % Inclusions less than 2mm

Level	Bone	"Tile"	Mortar	Stones	Pottery	Charcoal	Mussel shell
A	1.2	24.0	43.0	13.0	3.7	0.09	-
B	28.0	17.0	3.5	45.0	7.0	0.06	-
C	12.0	10.0	3.4	70.0	0.2	0.64	3.8

Table 3 - Analytical Data

Level	pH	Phosphate	Alk. Sol. Humus	Loss on Ignition	Colour Wet	Colour Dry
A	7.3	Pos.	54.0	2.7	10YR3/1	10YR4/2
B	7.5	W-Pos.	58.0	15.01	"	"
C	7.6	Tr.	59.0	2.7	"	"
Brick-earth	8.4	W-Pos.	5.9	1.49	10YR5/4	10YR7/4

N.B. a) Alk. Sol. Humus, mgms. per 100 gms. air dry soil

b) Phosphate: Tr. - Trace, approx. 0.08-0.15% P_2O_3
W - Weak, approx. 0.15-0.4% P_2O_3
Pos. - Positive, approx. 0.4-0.8% P_2O_3

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