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Soil report on the barrow and buried soil at Sproxton, Leicestershire. (IL400 1978)

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In the early autumn of 1978 the Bronze Age round barrow (c. 1500 BC) at Sproxton (GR SK857278) was excavated by the Leicestershire Museums Archaeological Field Unit (Field Officer, Patrick Clay). The round barrow constructed of and resting on a loamy soil material also included pieces of the solid geological substratum, namely Lincolnshire Jurassic oolitic limestone. The soil material itself seemed generally unrelated to the limestone except for narrow areas of red clay, which due to weathering had concentrated in solution hollows. Beneath the barrow a sandy silt loam B horizon was present, whilst the mound was comprised of sandy loam material which exhibited a number of layers in places.

The archaeologist, besides requesting a few minor questions answered, was mainly interested in the nature of these layers and the relationship of the mound material to the buried soil. It was wondered whether the layers were in reality soil "turf" horizons or artifacts produced by the heaping of soil onto the barrow. Additionally, it was felt that the soil material resting on the limestone could be aeolian in origin, and if so the stratification of the soil horizons from the original soil would be preserved in the barrow and thus would be identifiable through their heavy mineral suites.

The soils were therefore described and sampled for chemical and grain-size analyses. Undisturbed samples were also taken of the mound layers and the buried soil for micromorphological analysis, while in addition fine fractions of the soils were to be scrutinised for heavy minerals. In particular, the thin sections would allow the true character of the mound layering to be ascertained, and also, when compared with the sample from the buried soil would permit some interpretations to be made on Bronze Age soil formation. In a wider sense, the latter study would reveal further information on the effects of a burial on soils.

Field examination revealed the soils to be typical brown calcareous earths. The layering in the mound comprises narrow (approximately 1 cm.) dark brown horizons (namely, (F8) layers 122 and 124) separated by thicker (approximately 7-8 cms.) less dark zones (namely, (F8) layers 123 and 125) as shown below.

F8 Layer	Colour
122	dark brown (7.5YR4/4)
123	yellowish red (5YR4/6)
124	dark brown (10YR4/4)
125	brown (7.5YR4/4)

Textural analysis of layers 124 and 125 showed them to be sandy loams, while the B horizon of the burieddsoil (namely, (F33) layer 19) is a sandy silt loam by virtue of containing slightly more silt and clay (Table, 1). The latter horizon is reddish brown to yellowish red (5YR4/3-4/6) and exhibited relatively well developed prismatic structures and old root channels which now contain greyish white calcium carbonate efflorescence. It can be here noted that this material also commonly characterised the locations of charcoal (e.g. F.37). In addition, pink rock fragments were not the result of burning but purely due to the natural colouration of the limestone.

Scrutiny of the layers within the mound revealed little obvious structure, but this was most probably due to compaction. However, organic carbon analysis showed one dark horizon (layer 124, F8) to have a much higher organic status than either the underlying horizon (i.e. layer 125, F8) or the buried soil (i.e. layer 19, F8) which was in situ (see Table, 1), clearly suggesting layer 124 could be an A horizon. Thus, five thin sections were made of soil samples which included layers 123, 124 and 125 of Feature 8, while in addition two further slides were made of layer 123. To extend the study, four slides of layer 19, Feature 33 were also manufactured.

Thin section description (see Micromorphological Description) and semi-quantitative analysis (i.e. a 100-150 point count) of the microfabric (Table, 2) demonstrated for all the soils that pedogenesis had been under freely-draining, high base status conditions (see Table, 1), in that erde fabrics were common throughout, with the few soil segregations present, only being weakly formed glaebules. Indeed, little difference could be identified between the microfabrics of layers 123, 124 and 125 in terms of fabric analysis, even though layer 124 exhibited slightly darker plane polarised (P.P.L.) and reflected light (R.L.) colours, which relate to a stronger admixture of amorphous organic matter than in the layers above and below. Nevertheless, layer 124 could also be identified by its high content of gravel-sized limestone fragments. These comprised mainly ooliths, but some shell fragments were also present.

In general, layers 123, 124 and 125 have relatively dark reddish brown (P.P.L.) porphyroskelic fabrics which are vughy (metavughs) with common fine channels. The fabric can also be silasepic, and is made up of many fine (0.1-0.3 mm) secondary peds; the sort of fabric produced by a high earthworm population. Thus, layers 123, 124 and 125 most probably make up a sequence of an A12 horizon, an A1 horizon and an A12 horizon, respectively of a calcareous brown earth. Compaction, and post-burial pedogenesis had had the effect of partially homogenising the layers, even whilst there is only minor differences between undisturbed A1 and A12 horizons. However, the semi-quantitative analysis did show that the A1 horizon (layer 124) to have rather more void space (see Table, 2) than the A12 horizons above and below, and this relic characteristic most probably relates to its higher organic status (see Table 1 and Micromorphological Description) and the original nature of the A1 horizon.

The microfabric of the B horizon of the buried soil (F33, layer 19) is in many ways similar to the soils described above. Again, the soil has a reddish brown to brown (P.P.L.) porphyroskelic fabric, that is in part vughy (metavughs), with well developed secondary peds, that are separated by medium and fine channels. Even tertiary peds are evident, bounded by coarse channels which may contain pale brown iron-clay plasma along their boundaries. Once more, the fabric is typical of a high base status brown earth and the horizon can be described as a Cambic B or Bw horizon. It is really by the structure of this Bw horizon that it can be differentiated from the A12 horizons described earlier, for its organic matter status is only slightly less (see Table 1).

Heavy mineral counts were made of layers 124, 125 (both F8) and layer 19 (F33). The fine sand and silt was divided into size ranges; namely, >125 microns, >63 microns and <63 microns; so that the heavy mineral suites could be more conveniently counted and interpreted. Both non-opaque and opaque minerals were included. In addition, the zircon : tourmaline ratio was calculated, because although both tourmaline and zircon are resistant minerals, tourmaline weathers more rapidly and so a soil profile formed in a uniform material will have an increasing Z : T ratio nearer the surface of the soil because here weathering is more potent.

The heavy mineral data is presented in Table 3 where it can be seen that throughout the three samples the non-opaque minerals, zircon, tourmaline, garnet and rutile are similarly common, as are the opaque minerals magnetite, haematite, leucoxene and ilmenite. However, layer 19 (F8) contains significantly more non-opaques than the overlying two horizons, and furthermore has much more fluorite. Indeed, although there are small variations in the minor non-opaque mineral content between layers 124 and 125, this is far more marked between them and layer 19. Finally, the layers 124, 125 and 19 demonstrate anomalous zircon : tourmaline ratios, namely 1.61, 2.4, 2.86 (after calculation) respectively, and so these horizons although formed in the same basic parent material have all been affected iby additions of new minerals, thus cdearly suggesting an aeolian influence. This variation between the horizons is a product of sequential accumulation of aeolian fine sand and silts forming the soil even whilst this "layering" is bound to have been somewhat disturbed by biological agencies. Essentially them, layers 124 and 125 (F8) are closely related to the buried soil (layer 19, F33), both mineralogically and texturally (see Tables 1 and 3) and have undoubtedly been derived from it.

It may therefore be surmised that the Bronze Age soil, formed of an aeolian loam over limestone, was a high base status brown calcareous earth, similar to those present now. At the site, the soil was truncated as far as the B horizon, and the overlying A1 and A12 horizons forming turves, were used to construct the mound. The thickness of these turmes identified in the mound is certainly less than they would have been originally, because of compaction and the oxidation of the organic material in the A1 horizon. Few a mull type surface organic horizon of a brown calcareous soil is much less likely to survive, when compared with for example a peat turf from an acid podzolised soil. In addition, the effect of compaction and oxidation has been to homogenise the boundary between turves and to destroy recognisable organic matter, as it should be hoted that some pedological processes may certainly have continued even after the turf stack was formed, slightly mixing the horizons. Even so, the erde fabric, the nature of the fine peds, and the morpohology of the channels in these A1 and A12 horizons still testifies towards a finely rooted, earthworm influenced surface soil. Hosever, it may be here reported that the concentration of small stones in the A1 horizon (see Micromorphological

Description, layer 124, F8) is unusual for a soil purely reworked by earthworms, and it may be conjectured that the site may have been slightly disturbed prior to the construction of the barrow.

Table 1 Soil Analytical Data

Sample	pH.	% sand	% silt	% clay	Alk. sol. C. ppm.
L.124, F8	8.3	50	47	3	440
L.125, F8	8.4	53	41	6	264
L.19, F33	8.3	45	48	7	220

Table 2 Micromorphological Analytical Data

Sample:	L.123, F8	L.124, F8	L.125, F8	L.19, F33
Feature%				
Mineral Grain	30	31	31	27
Brown Plasma	45	43	47	46
Channel	8	14	6	15
Vughs	10	9	6	8
Glaebule	6	5	10	4
Total Void Space	18	23	12	23

Micromorphological Description

Layer 123, F8

Yellowish brown to dark brown (P.P.L.) porphyroskelic, and somewhat silasepic fabric, with common channels and vughs (metavughs), between well developed primary and secondary peds. Both manganic and ferric glaebules present. Little evidence of amorphous organic material. Plasma generally yellowish red under reflected light. Fabric is erde type even along channel boundaries, where it may be brownish yellow (P.P.L.). A large channel diffused into fine channels present below in L.124.

L.124, F8

Mainly dark brown (P.P.L.) porphyroskelic, and somewhat silasepic fabric, with common channels and vughs (metavughs) between well developed primary and secondary peds which display an erde fabric. Layer contains much fine gravel comprised of oolitic limestone with numerous individual ooliths (0.30 mm), and shell fragments. Plasma, which is yellowish red to dark brown under reflected light has noticeable quantities of amorphous organic matter associated with the iron/clay complexes. Few glaebules present.

Layer 125, F8

Yellowish brown to dark brown (P.P.L.) porphyroskelic, and somewhat silasepic fabric, with common channels and vughs (metavughs). Secondary peds more well developed than primary peds. Erde fabricsstrong brown under reflected light. Both diffuse and strongly formed fine glaebules present. Little evidence of amorphous organic matter.

<u>Layer 19, F33</u>

Pale yellow brown to yellow brown (P.P.L.) porphyroskelic fabric, that is silasepic in parts. Erde fabric is yellowish red under reflected light. Well structured soil with common well developed large channels, demarcating large secondary peds. Channel margins contain pale yellow brown plasma again with an erde fabric. Little organic matter in evidence. Few glaebules present. Unlike layers 123, 124 and 125 (F8) which are characterised by fine blocky to granular structures, layer 19 (F33) has medium sized blocky to fine prismatic structures shwoing.

All four layers examined reveal high bulk densities, 77%-88%, and this must be a direct result of compaction.

Table 3 SPROXTON: Heavy Minerals

L.124, F8 Count: 663

Opaques

He	Il	Le	Li	Mg	Ma	Py
13	8	12	1.3	20	x	1.0

% opaques 55

Non-opaques

Ga	Ac	An	Au	Di	En	Fl	Ho	Hy	Ky	Mo	(R)
13	1.3	1.6	3.3	2.3	3.3	1.0	1.0	1.0	1.9		5.2

L.125, F8 Count: 843

Opaques

He	Il	Le	Li	Mg	Ma	Py
10	9	12	1.0	20	x	1.6

% opaques 54

Non-opaques

Ga	Ac	An	Au	Di	En	Fl	Ho	Hy	Ky	Mo	(R)
12		1.0	0.2	1.0	2.0	0.2	3.3		1.0	0.4	10.8

yR	rR	Si	St	Tp	To	Zi
7.7	3.1		0.4	1.5	19.2	46

Z : T ratio: 2.4

% Non-opaques 46%

L.19, F33 Count: 1108

Opaques

He	Il	Le	Li	Mg	Ma	Py
8	8	10	2	18	x	x

% Opaques 47

Non-opaques

Ga	Ac	An	Au	Di	En	Fl	Ho	Hy	Ky	Mo	(R)
15	1.7	0.3	1.0	1.7	1.9	3.5	0.3	0.5	1.7	0.1	7.8
yR	rR	Si	St	Tp	To	Zi	Z : T ratio: 2.86				
7.3	0.5	0.1	0.5	1.1	15	43					

% Non-opaques 53%

Key

He Heamatite; Il Ilmenite; Le Leuxocene; Li Limonite; Mg Magnetite; Ma Marcasite; Py Pyrite; Ga Garnet; Ac Actinolite; An Andalusite; Au Augite; Di Diopside; En Enstatite; Fl Fluorite; Ho Hornblende; Hy Hyperathene; Ky Kyanite; Mo Monazite; (R) Rutile; yR Yellow Rutile; rR Red Rutile; Si Sillimanite; St Staurolite; Tp Topaz; To Tourmaline; Zi Zircon.