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Soil report on the barrow and buried soil at Lambourn, Berkshire (LB78)

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During the early autumn of 1978 Barrow 19 at Lambourn (G.R. SU 330826) was excavated by the Berkshire Archaeological Unit (field officer, Julian Richards). This Bronze Age barrow has a strikingly heteregeneous mound comprising large areas of white to greyish brown chalky coombe soil and areas of dark brown non-chalky sandy silt loam. Interestingly, the mound and the buried soil are separated by a laterally extensive but narrow (1-2 mm) strong brown (7.5YR5/8) layer. This ochreous zone appeared to be related to the supposed buried soil, and capped the prismatic structures of the truncated B horizon, while in contrast it seemed to have "shrunk" away from the overlying mound material. An opinion shared by the excavator.

The main concerns of the archaeologist were: i) the obvious variation in the composition of the mound; ii) the relationship of this material to the underlying soil and the surrounding soils; and iii) the origin and nature of the ochreous zone. Indeed, it was asked whether this ochreous layer correlated with the old ground surface and was an artefact produced by the levelling of the barrow site through the truncation of the underlying soil? The soils were examined in the field and sampled for grain-size and micromorphological analyses. The latter involved description and point count analysis of the ochreous zone and the interior soil structure of the buried soil. More generally, these analyses will widen our understanding of the effects of burial on soils, especially in the contexts of compaction and processes active along the boundary of the old ground surface.

The environs of the barrow carry generally shallow brown calcareous earths (gleyic brown calcareous earths), which are base-rich sandy silt loams (Soil Analytical Data). These lie on Coombe Rock. No de-calcified soil horizons were present and this most probably relates to the shallow nature of the mineral soil overlying the chalky Coombe Rock parent material. The similarities between the non-chalky mound material and the buried soil, in colour (i.e.both are dark brown, 7.5YR4/4), pH. and texture (see Soil Analytical Data) suggests these non-chalky areas of the mound derive from the B horizons of these local brown calcareous earths. In the same way, the more chalky areas of the mound apparently relate to the Coombe Rock. It may be supposed that the shallow nature of the local soils necessitated the dumping of large quantities of Coombe Rock, in addition to soil B horizon material, to create the mound, which was built upon a purposely levelled area on a slope. The character of the underlying soil is examined below.

The vertical nature of the prismatic structures of the truncated B horizon beneath the barrow, and continuity of this soil with the Coombe Rock parent material clearly indicate the soil is in situ. Additionally, scrutiny of the microstructure of the soil showed a mirroring of the macro-structure just described, in so far as fine and coarse channels within the soil have a predominantly vertical direction.

The relationship of the ochreous zone to the rest of the buried soil, and its possible modes of origin can also be described. Microfabric analysis of five thin sections clearly shows that the ochreous layer is in reality the upper part of the truncated B horizon prismatic structures, and is not a separate clay-rich layer (or massive argillan) or an ironpan, as may be thought purely from field evidence. Still, it should be noted that this zone seems to have merged across the tops of all the peds, encapsulating the whole of the buried soil. The obvious difference between the dense silasepic porphyroskelic fabrics of the ochreous layer and the interior soil, is their colours (Micromorphological Description). In addition, the ochreous zone contains narrow (0.12 mm), sub-horizontal, red (Plane Polarised Light) layers which clearly mark the boundary between the inner and outer ped (Plate, 1). These red layers, which have a fabric seemingly identical with the surrounding plasma, as well as brownish red (P.P.L.) zones are repeated through the ochreous zone (Fig. 1), which also comprises reddish brown (P.P.L.) plasma. Glaebules within both the ochreous zone and the interior soil are predominantly black (P.P.L. and Reflected Light) with dark reddish brown (P.P.L.) surrounds, and so these red layers in the ochreous zone cannot be purely interpreted as glaebules. The interior soil is certainly gleyed (Plate, 2) as shown by the general mottled appearance of the plasma, and by the presence of glaebules, especially along channel boundaries. The dark greenish grey to brown (P.P.L.) plasma, which is dark grey under reflected light, tends to suggest a soil horizon affected by reducing conditions. In sharp contrast, the ochreous zone contains mainly reddish plasma (Table, 1a) which clearly indicates an oxidising environment, and this is in accord with a ped-face position in a gleyed soil. It therefore seems that the ochreous zone is acting as one large ped-face between the gleyed conditions of the buried soil and the oxidising conditions along the junction with the mound. Also, the effect of burial has been to compact the underlying soil so that besides the ped interiors demonstrating little void space (23.8%; see Table, 1b) the actual interface between the buried soil and the mound (i.e. the ochreous zone) has developed a very high bulk density (7.5% voids; see Table, 1a). This latter zone, which most probably has been increasingly compacted through the shrink-and-swell of the underlying soil is also likely to act as a wetting front. The wetting and drying of the buried soil would account for the discontinuity between it and the mound above, noted in the field. A further probable effect of shrink-and-swell are the narrow red layers within the ochreous zone, which perhaps can be interpreted as slickensides, which have preferentially adsorbed iron. Thus, the effect of burial has been to compact the underlying soil, producing a soil-water interface that has become more striking through shrink-and-swell and the oxidising conditions localised along it.

Micromorphological Description

The five slides examined show a narrow (1.2 mm) ochreous zone at the top edge of a greenish brown soil. Using a hand-lens, thin red layers can be seen within the generally brownish red plasma of the ochreous zone. Similarly, large glaebules and pale mottles are clearly visible within the interior of the soil.

Firstly, the ochreous zone (see Plate, 1) has a generally reddish brown to brownish red (P.P.L.) very dense silasepic porphyroskelic fabric, with rare fine voids, very few large voids and few very fine (<0.005 mm) micro-channels. It is dark reddish brown under reflected light. The zone contains narrow (0.12 mm), subhorizontal, semi-continuous, red (P.P.L.) layers. One layer separates the ochreous zone from the brown (P.P.L.) plasma of the interior soil (see Fig., 1). Additionally, the ochreous zone includes brownish red (P.P.L.) areas and reddish brown (P.P.L.) areas. Overall, the soil exhibits a very high bulk density (7.5% voids, see Table, 1a). The mineral grain fraction mainly comprises silt-size quartz.

The interior soil also has a silasepic porphyroskelic fabric, but is greenish grey to brown (P.P.L.) and is dark grey under reflected light. Also, in contrast, the interior of the ped has a lower bulk density (see Table 1, b). Besides fine channels similar to those described from the ochreous zone, the interior soil contains many large (0.5 mm) channels, which can be extensive (6.0 mm). Channels, which are often vertical in direction make up approximately 60% of all void space. Associated with voids and channels are black (P.P.L. and R.L.), manganic and reddish brown (P.P.L.) ferric glaebules (see Plate 2). These vary from linear features to small (0.05 mm) or large (4.0 mm) round mottles. Commonly, the black mottles have reddish-brown (P.P.L.) borders. Areas of pale greenish grey (P.P.L.) plasma may be associated with zones of reduction or loss.

Soil Analytical Data

	pH.	Sand %	Silt %	Clay %
Mound B horizon material	8.1	25	61	14
Buries soil B horizon	8.1	20	70	10

Table 1. Point Count Analysis of Soil Microfabric

a) Ochreous Zone (whole area) 596 points

Feature	%
Red Plasma	15.6
Brownish-red Plasma	35
Reddish-brown Plasma	26.5
Skeletal Grain	14
Void	7.5
Glaebule	1.3

b) Interior Zone 971 points

Feature	%
Brown Plasma	48
Glaebules	19.8
(Black)	(13.5)
(Reddish-brown)	(6.3)
Void	23.8
Skeletal Grain	8.2

FIG. 1. SKETCH DIAGRAM OF JUNCTION BETWEEN OCHREOUS ZONE AND INTERIOR SOIL. SCALE x 10