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Ancient Monuments Laboratory
Report 1/88

Wroxeter Baths Site, Soil Report

Matthew Canti

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Summary

Buried soils and soil materials from Wroxeter Baths (site 340) have been analysed by micromorphology, grain size and organic matter tests. The natural soil at the site appears to have been a Typical Brown Earth developed in River Terrace alluvium, which was sealed by the construction of the rampart from similar local material.

At the interface between the Early Civilian and Hadrianic construction there is evidence for inputs to the soil of building waste and charcoal, as well as an increased silt content in relation to the rampart and pre-rampart materials. While the former is clearly the result of human activity, it is suggested that the latter reflects localised variations in the original sedimentation at the site.

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WROXETER BATHS SITE
SOIL REPORT

1.INTRODUCTION

At Wroxeter Baths site (Directed by Graham Webster),two areas of possible pedological interest have been identified. Firstly, the rampart (97/249) and its log "corduroy" base (97/250) overlie material presumed to represent the natural pre-rampart soil (97/252). Secondly, buried "soil" layers (84/137 and 414) are found between the Early Civilian (90-125 A.D) and the Hadrianic construction (125+ A.D.).

2.METHODS

2.1 Sampling

Monoliths - 2 were taken from the rampart, corduroy and pre-rampart soil.

Kubiena boxes - 2 were taken from the buried soil at 84/137

Bulk samples - 3 from buried soil 84/414
2 from buried soil 84/137
5 from corduroy rampart base at 90/250

2.2 Analysis

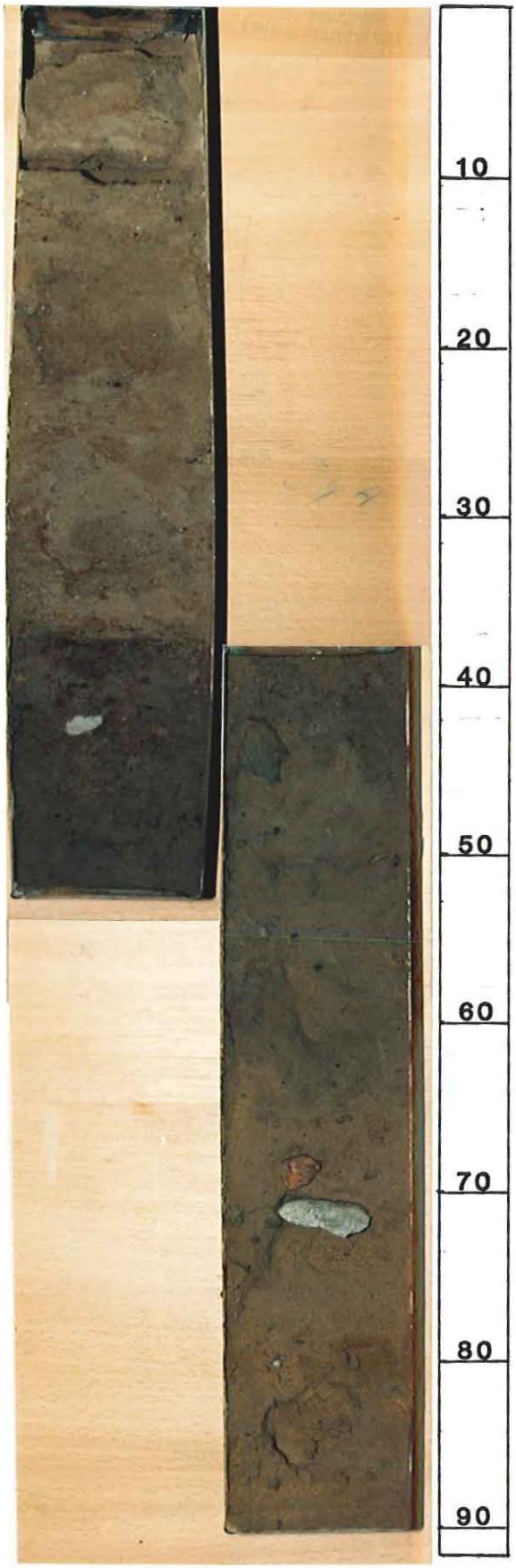
The monoliths were described, photographed and subsampled. Micromorphological description (Brewer 1964) was carried out on thin sections prepared from the Kubiena boxes. The bulk samples, along with the subsamples from each of the monoliths, were subjected to particle size analysis and loss on ignition tests.

3.RESULTS

3.1 The Rampart and underlying soil

The following profile description covers both monoliths and

the photographs are positioned as seen:-



0 - 36/37cm
Brown (7.5yr 5/4) moist, with streaks of iron-staining to Reddish Brown (5yr 4/4) colouring around 25% of the face. Occasional flecks of Brownish Yellow (10yr 6/8) crumbled stone. Apedal single grain.1-2% very small and small, subangular and subrounded stones. Occasional flecks of charcoal. Sharp smooth boundary to:-

36/37cm Red (2.5yr 4/6), moderately cemented iron pan.

97/249/X at 15cm
97/249/Y at 28cm

36/37 - 64/66cm
Brown (7.5yr 4/4) moist; common, very fine, distinct, clear mottles of Reddish Brown (5yr 4/4) occupying top 10cm of horizon; Sandy loam; Apedal single grain; 2-5%, small and medium, subangular and subrounded stones. Charcoal flecks in top 10cm of horizon. Smooth, abrupt boundary to :-

97/249/Z at 45cm
97/252/W at 45cm
97/252/X at 57cm

64/66 -
Yellowish Brown (10yr 5/6) moist; Loamy sand; Apedal single grain; 2-5% small and medium, stones (all shape classes).

97/252/Y at 75cm
97/252/Z at 85cm

Weakly cemented pans/iron staining at 81/82cm and 89/90cm

Figure 1 shows the particle size analyses of 97/249/Z (the base of the upper monolith) and 97/252/W,X,Y and Z (samples from top to bottom of the lower monolith; see profile). This group of results represent the complete profile of the original pre - rampart soil.

The parent material is mostly a water-sorted sand forming a river terrace well above the modern floodplain; this has given rise to a Typical Brown Earth (Avery 1980). The grain size distributions of the horizons are more or less the same although there is a slight variation noticeable in 97/252/Z. This change has become the site of Fe deposition (at 81/82cm) which suggests some degree of acidification, but this may have occurred post-burial. The gleying mottles evident in the upper 30 cm of the soil are undoubtedly post-rampart since such a coarse textured soil could not become waterlogged at the surface.

Under natural conditions this soil might possibly have supported closed-canopy woodland, but is more likely to have been colonised by patchy woodland and scrub.

Figure 2 shows the grain size distributions of the rampart samples and the corduroy replicates. Again, there is a close grouping implying the same source area for the construction material. The group as a whole have higher silt and lower sand contents than the buried soil group on Figure 1. This is unlikely to be the result of any pedological processes and probably reflects slight changes in the depositional factors during the formation of the terrace.

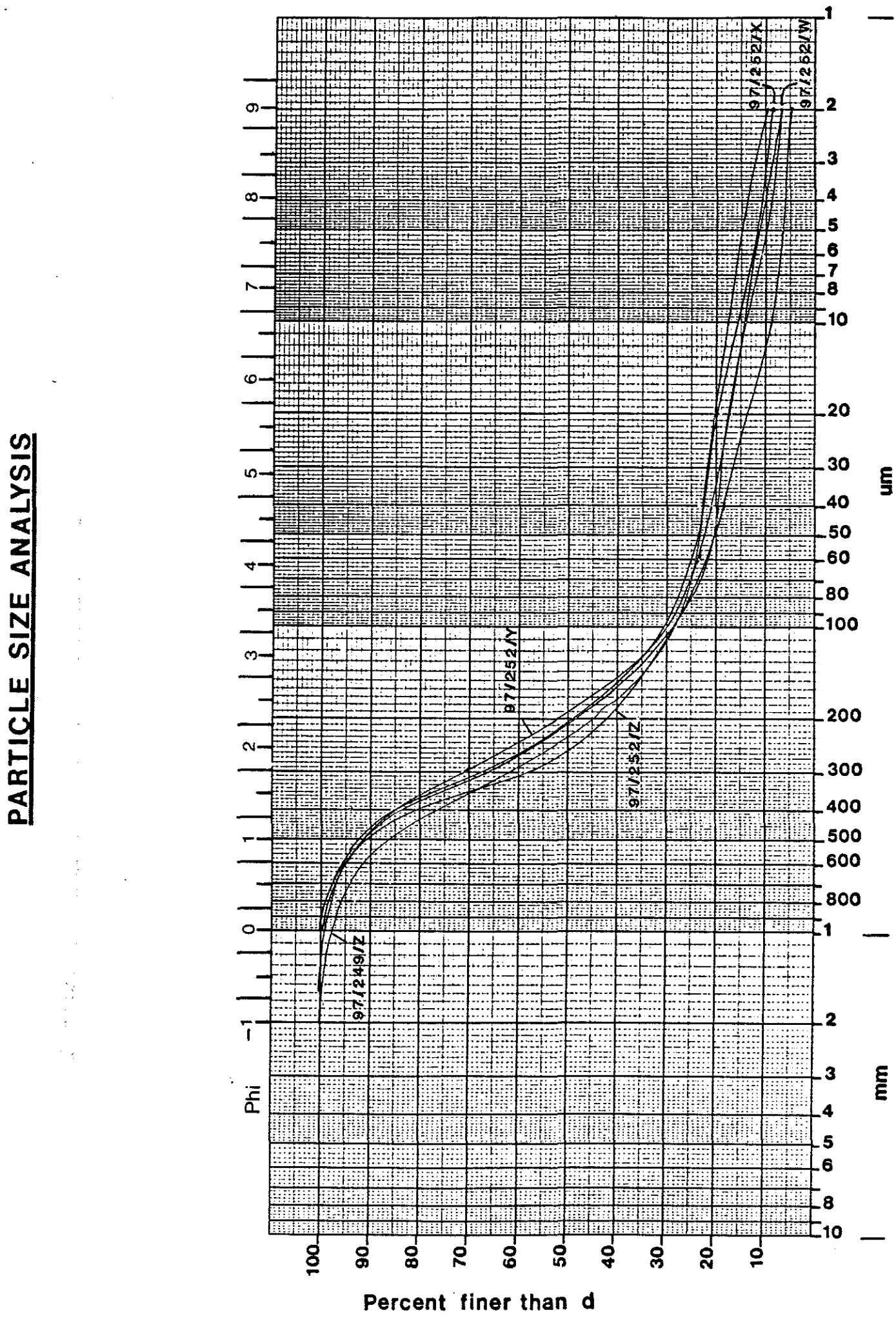
The construction of the rampart out of such a coarse textured soil is worth considering. There would certainly be very little cohesion in such a soil without the binding effect of grass roots; this implies that turf cover was to be found close to the site. Furthermore, there is ample boulder clay to the East of the site (British Geological Survey, 1959) which would provide a considerably more stable building material, albeit requiring transportation.

3.2 Buried soil at 84/414 and 84/137

Figure 3 shows the grain size distributions of the buried soils. It is noticeable that the 84/414 group have considerably less silt (60um to 20um) than the 84/137 soils. In this respect the 84/414 soils show strong similarity with the natural soil buried under the rampart (Fig 1). Organic matter percentages (see Appendix 2) have proved inconclusive since all but one (probably anomalous) sample are very similar.

Plates 1 and 2 show typical micromorphologies from 84/137 for which a description follows :-

Fig I


PARTICLE SIZE ANALYSIS
Phi
9
8
7
6
5
4
3
2
1
0
−1
97/1249/Z
97/1252/Y
97/1252/Z
97/1252/X
97/1252/W
1
2
3
4
5
6
7
8
10
20
30
40
50
60
80
100
200
300
400
500
600
800
1
2
3
4
5
6
8
10
um
mm
Diameter d
100
90
80
70
60
50
40
30
20
10
Percent finer than d

PARTICLE SIZE ANALYSIS

Sample:_____

90/250/2-90/250/6
97/249/Y 97/249/X

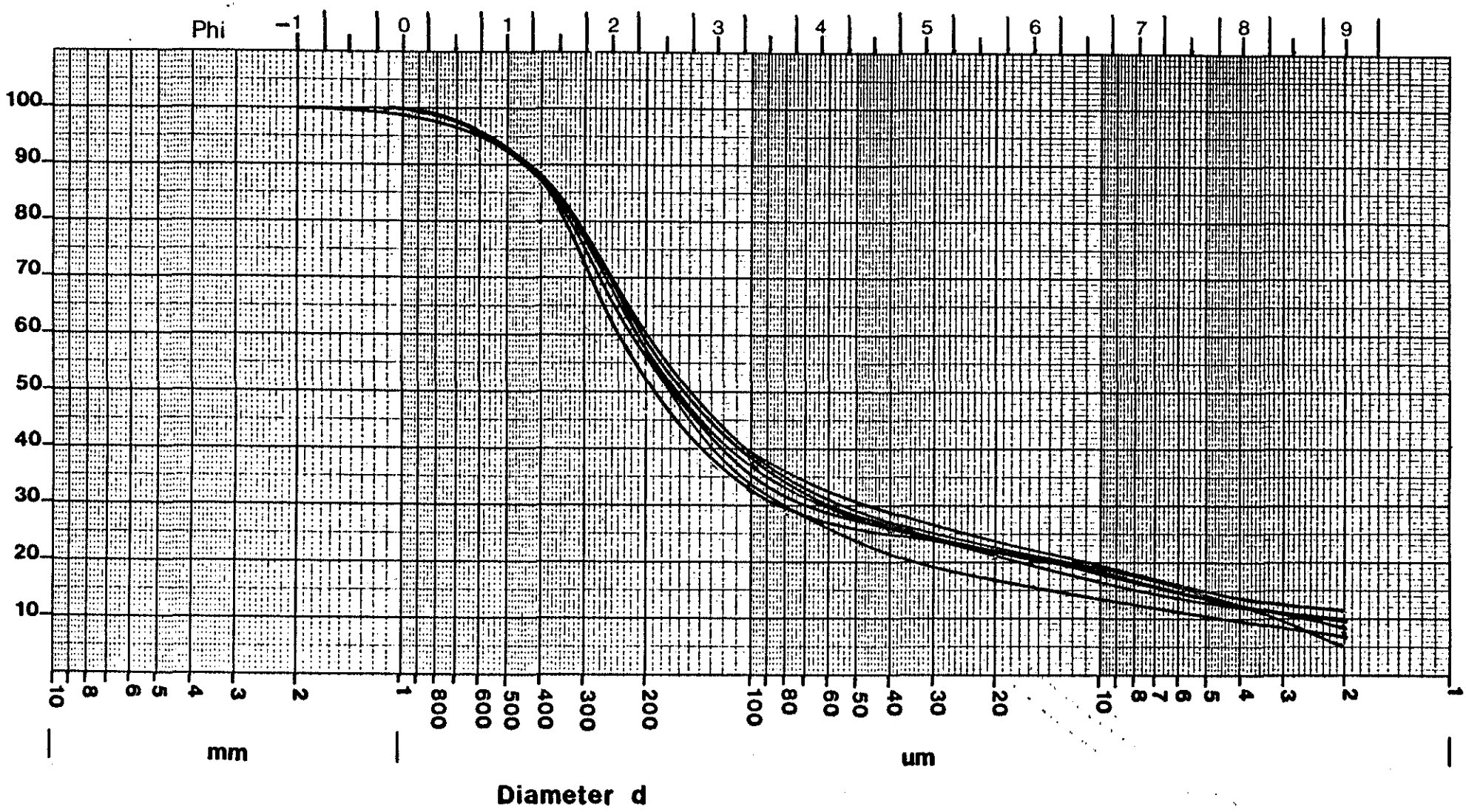


Fig 2

PARTICLE SIZE ANALYSIS

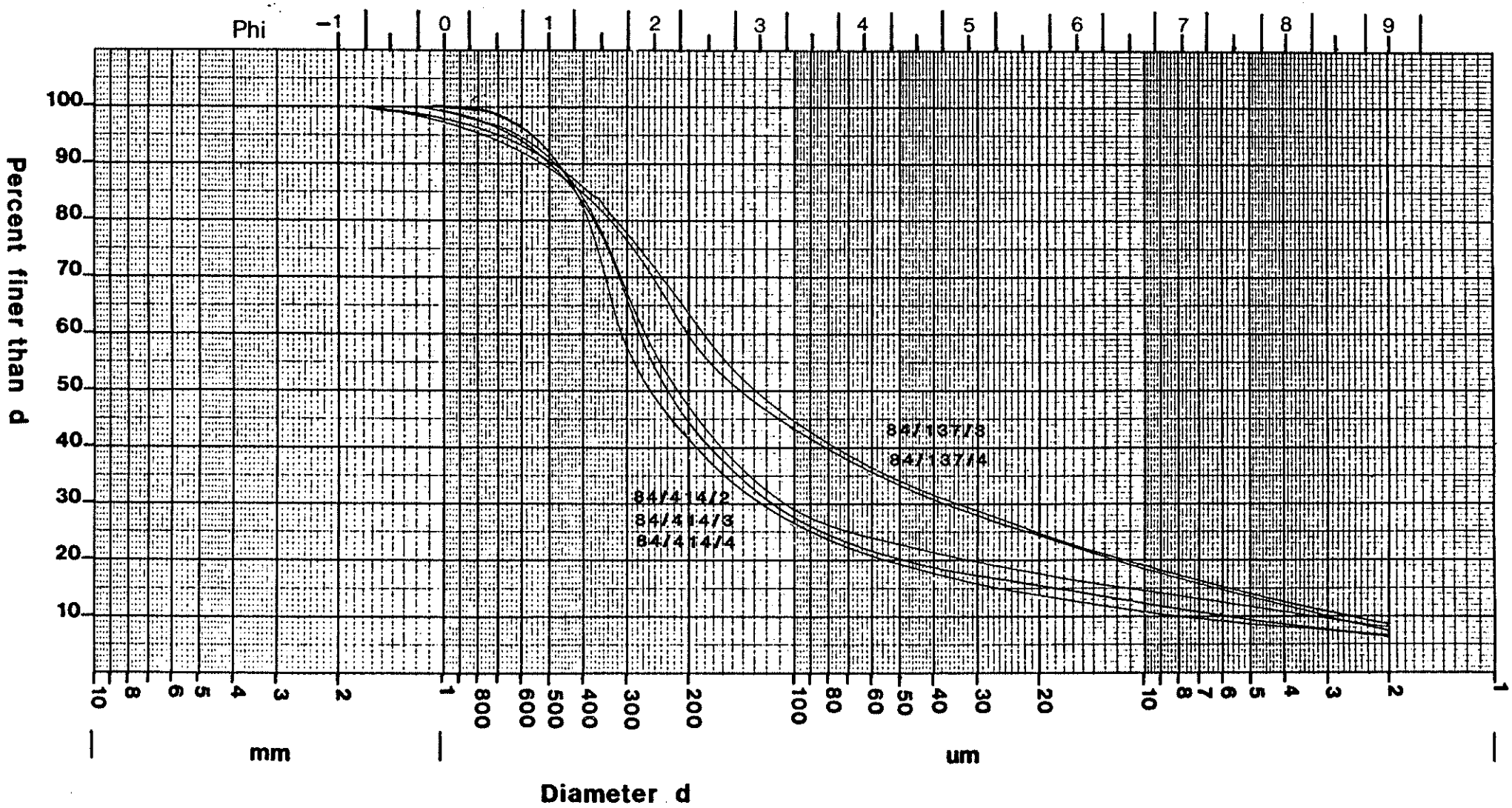


Fig 3

Structure:	Predominantly skeletal free-grain organisation with very occasional plasma separations; aggregates absent.
Porosity:	20%; almost exclusively simple intrapedal packing voids.
Mineral:	Coarse/fine, 80/20
	Coarse: Dominant fine/medium/coarse sub-rounded/subangular sand and silt sized quartz; occasional very large (15mm) but more frequently small (3-8mm) rounded sandstone fragments.
	Fine: Dominant dark brown/black (PPL)
Organic:	Infrequent amorphous organic matter of wide ranging size distribution. Occasional charcoal fragments.
Groundmass:	Low birefringence, crystal plasmic fabric.
Pedofeatures:	Fabric: Occasional, very localised occurrence of argillasepic fabric.
	Amorphous:Weathering of arenaceous material to form argillic/arenaceous melange. Occasional Fe nodules.
Other:	Tile or brick fragments.

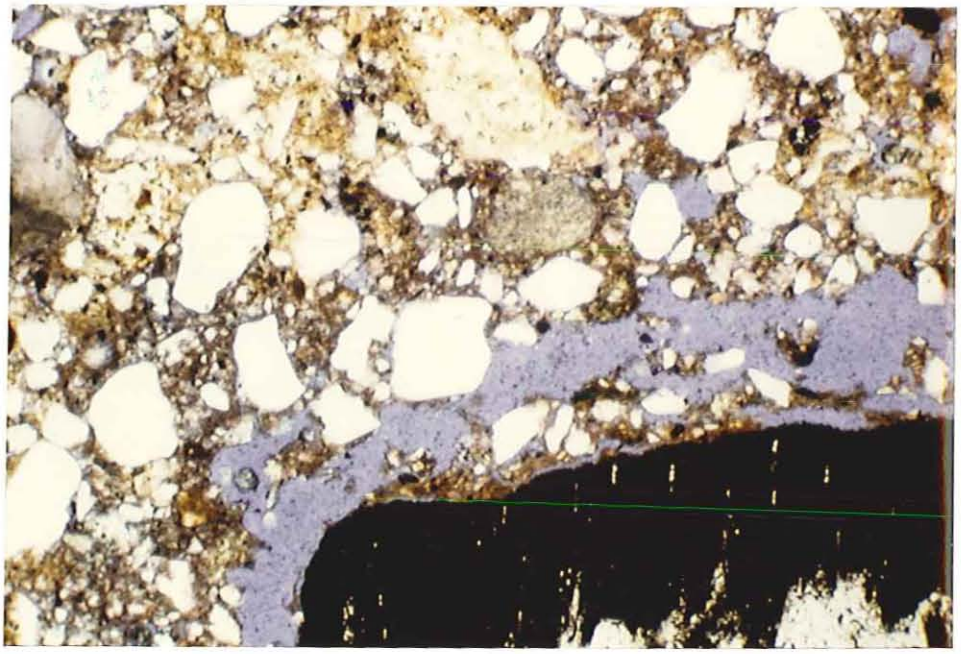


Plate 1
Photomicrograph of 84/137 showing charcoal fragment.

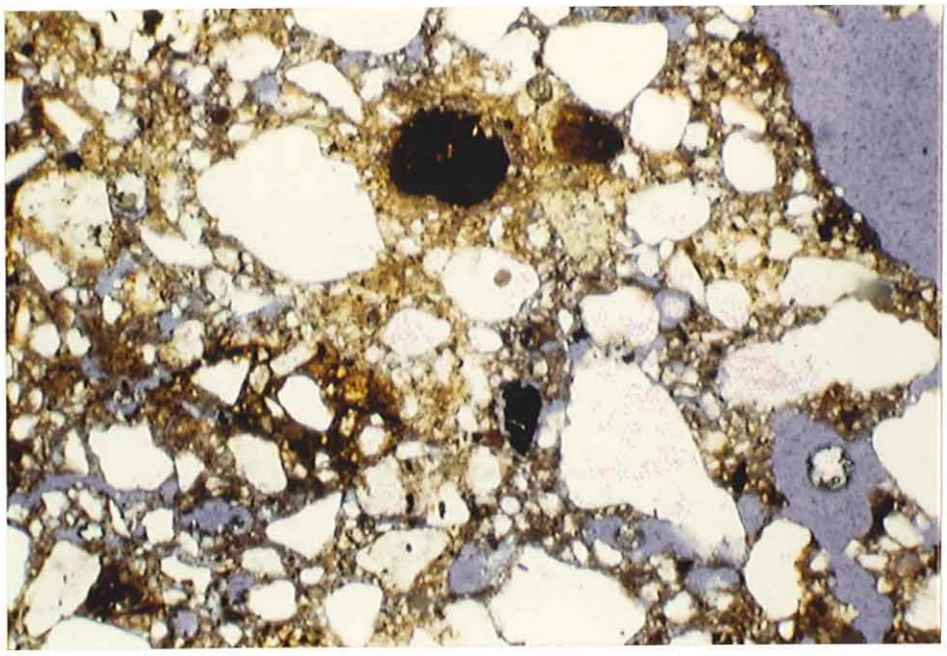


Plate 2
Photomicrograph of 84/137 showing iron nodule

It is evident that this layer consists partly of rubbish e.g charcoal and tile, as well as the sandy soil material found elsewhere. It is suggested that this material was not an in-situ soil, but an artificial layer. This might be, for example, deliberately brought in to level up an area or left behind after rubble was removed.

The excessive silt content of this sediment might be explained as the result of inputs from the daub used for consruction purposes. However, such an input would probably increase the clay (<2um) percentage as well and in any case, there is an apparent increase in silt/clay ratio in the rampart samples which can only be of natural origin.

References

Avery B.W.(1980) "Soil classification for England and Wales" Soil Survey Technical Monograph 14.

British Geological Survey (1959) Sheet 152, Shrewsbury.

Appendix 1

PARTICLE SIZE ANALYSIS.
Values are weight% finer than diameter specified in left-hand column.

um	90/250/2	90/250/3	90/250/4	90/250/5	90/250/6
2000	100	100	100	100	100
1750	99.98	99.95	99.99	99.98	99.97
1500	99.92	99.77	99.95	99.91	99.86
1250	99.79	99.44	99.84	99.74	99.62
1000	99.5	98.9	99.6	99.4	99.2
800	98.85	98.12	99.02	98.48	98.33
600	97.13	96.41	97.47	96	96.08
400	89.02	89.22	90.24	87.57	86.59
300	76.09	78	78.49	75.5	72.39
200	58.88	61.37	61.89	57.32	54.14
100	37.01	38.89	39.77	33.13	32.56
80	32.98	34.52	35.46	28.6	28.9
60	29.59	30.87	31.89	24.72	26.78
40	27.17	28.22	29.23	21.88	25.71
20	21.8	22.26	22.31	16.71	20.8
10	17.45	19.01	18.68	13.86	17.05
6	14.81	16.68	15.74	11.18	14.7
2	9.83	11.12	8.55	7.69	9.94

TEXTURAL DETAILS

These values are the normal weight% in each of the class groups. See Appendix 2 for the class details.

CS	2.9	3.6	2.5	4.0	3.9
MS	38.2	35.0	35.6	38.7	41.9
FS	29.3	30.5	30.0	32.6	27.4
Total S	70.4	69.1	68.1	75.3	73.2
CZ	7.8	8.6	9.6	8.0	6.0
MZ	7.0	5.6	6.6	5.5	6.1
FZ	5.0	5.6	7.2	3.5	4.8
Total Z	19.8	19.8	23.3	17.0	16.8
Total C	9.8	11.1	8.5	7.7	9.9
Text.	SL	SL	SL	SL	SL

PARTICLE SIZE ANALYSES.

um	97/249/X	97/249/Y	97/249/Z	84/414/2	84/414/3	84/414/4
2000	100	100	100	100	100	100
1750	99.95	99.95	99.92	99.94	99.96	99.96
1500	99.78	99.8	99.66	99.76	99.81	99.83
1250	99.45	99.5	99.15	99.39	99.51	99.57
1000	98.9	99	98.3	98.8	99	99.1
800	97.99	98.24	96.61	97.9	98.11	98.24
600	95.87	96.52	92.47	95.82	95.91	96.04
400	87.2	89.01	79.37	84.24	83.65	82.3
300	74.29	77.3	63.49	66.4	64.8	61.09
200	57.23	61.07	46.43	48.19	46.11	42.04
100	35.28	39.1	28.68	29.15	26.55	23.27
80	31	34.59	25.99	26.34	23.55	20.56
60	28.05	31.01	24.53	24.02	21.24	18.61
40	26.28	28.71	24.15	22.28	19.66	17
20	20.16	22.22	20.61	18	15.48	13.64
10	16.09	18.38	17.99	14.86	12.51	10.56
6	13.08	15.43	15.29	12.69	10.18	9.52
2	9.35	5.26	9.63	8.73	6.38	6.94

TEXTURAL DETAILS

CS	4.1	3.5	7.5	4.2	4.1	4.0
MS	38.6	35.4	46.0	47.6	49.8	54.0
FS	29.2	30.1	21.9	24.2	24.9	23.4
Total S	71.9	69.0	75.5	76.0	78.8	81.4
CZ	7.9	8.8	3.9	6.0	5.8	5.0
MZ	7.1	6.8	5.3	5.3	5.3	4.1
FZ	3.7	10.2	5.7	4.0	3.8	2.6
Total Z	18.7	25.8	14.9	15.3	14.9	11.7
Total C	9.4	5.3	9.6	8.7	6.4	6.9
TEXT.	SL	SL	SL	SL	LS	LS

PARTICLE SIZE ANALYSES

um	97/252/W	97/252/X	97/252/Y	97/252/Z	84/137/3	84/137/4
2000	100	100	100	100	100	100
1750	99.94	99.95	99.92	99.93	99.87	99.83
1500	99.76	99.78	99.65	99.68	99.45	99.3
1250	99.39	99.44	99.18	99.21	98.7	98.35
1000	98.8	98.9	98.5	98.5	97.6	97
800	97.88	98.07	97.81	97.58	96.3	95.46
600	95.75	96.16	96.52	95.59	93.85	92.66
400	84.68	85.57	87.14	81.18	86.18	83.74
300	67.79	68.89	70.9	59.49	76.4	72.8
200	49.9	50.56	52.14	44.8	64.03	60.6
100	29.42	30.73	29.87	28.33	45.69	43.51
80	25.8	27.71	25.85	24.68	40.9	39.15
60	22.86	25.47	23.18	21.24	36.98	35.35
40	20.67	23.86	21.72	18.24	34.37	32.61
20	16.24	19.1	16.92	13.15	25.24	23.73
10	13.37	15.26	13.02	8.65	19.18	18.13
6	11.23	12.98	10.45	6.12	15.22	14.76
2	6.49	8.03	6.58	4.22	8.2	9.08

TEXTURAL DETAILS

CS	4.3	3.8	3.5	4.4	6.2	7.3
MS	45.8	45.6	44.4	50.8	29.8	32.1
FS	27.0	25.1	29.0	23.6	27.1	25.3
Total S	77.1	74.5	76.8	78.8	63.0	64.7
CZ	6.6	6.4	6.3	8.1	11.7	11.6
MZ	5.0	6.1	6.5	7.0	10.0	9.0
FZ	4.7	4.9	3.9	1.9	7.0	5.7
Total Z	16.4	17.4	16.6	17.0	28.8	26.3
Total C	6.5	8.0	6.6	4.2	8.2	9.1
TEXT.	LS	SL	LS	LS	SL	SL

LOSSES ON IGNITION

90/250/2	0.94
90/250/3	0.74
90/250/4	1.00
90/250/5	0.86
90/250/6	5.64
97/249/X	0.92
97/249/Y	0.79
97/249/Z	1.08
84/414/2	0.74
84/414/3	0.75
84/414/4	0.59
97/252/W	0.89
97/252/X	1.00
97/252/Y	0.73
97/252/Z	0.29
84/137/3	1.4
84/137/4	1.15

APPENDIX 2.

Particle size classes and textural assessment.

Size Classes :-

SAND (S) 2mm-60um
- Coarse (CS) 2mm-600um
- Medium (MS) 600um-200um
- Fine (FS) 200um-60um

SILT (Z) 60um-2um
- Coarse (CZ) 60um-20um
- Medium (MZ) 20um-6um
- Fine (FZ) 6um-2um

CLAY (C) <2um

Textural assessment:-

Values for Sand, Silt and Clay are entered into the triangular diagram below.