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ROSEIRES SOIL SURVEY

REPORT No. 1

GEZIRA EXTENSION AREA SOIL SURVEY AND LAND CLASSIFICATION

VOLUME II

APPENDIX 1. THE SAMPLE AREAS

APPENDIX 2. SPECIMEN PROFILE DESCRIPTIONS

HUNTING TECHNICAL SERVICES LTD.
4 ALBERMARLE STREET
LONDON, S.W.1

SIR M. MACDONALD & PARTNERS
CONSULTING ENGINEERS
LION HOUSE
RED LION STREET
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MAY 1963

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(i)

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AREA 1: GEZIRA EXTENSION

A P P E N D I X 1

THE SAMPLE AREAS

Seven areas, each of 1 square mile (617 feddans), were selected at relatively equal intervals within the boundaries of Area 1 as originally received (two and part of a third of these areas actually lie outside the Area 1 boundary as finally agreed, but they are not far outside it and give valuable information about neighbouring lands). The sample areas were originally chosen from the aerial photographs to include as far as possible all the variations of surface pattern suggestive of soil and vegetation units.

Fifteen 2 m. soil pits dug at regular intervals in each sample area were examined and sampled. On receipt of the analytical data, the pits were classified according to the system described in Chapter 5.

They were then plotted as accurately as possible on the 1:20,000 scale Sudan Survey Department Contoured Map of the Gezira. Soil boundaries were drawn on the aerial photographs and transferred graphically on to the maps.

The classification used was similar to that for the semi-detailed reconnaissance soil survey, with two important differences. First, an attempt was made to determine small profile differences due to soil moisture conditions, relating them to the aerial photographic image and ground contours. Secondly, in Sample Areas 2 and 3 the frequent mounds of aggregated clay were grouped as soil complexes with the surrounding soils. These mounds were present in Sample Areas 2, 3 and, to a small extent, in 4. The soil of these mounds is a distinctive pedon of the Vertic Orthustents (see description of Pit C247). Where they cover more than 20 percent of the land surface in this sample area, the soil class is considered to be a soil complex composed of these mounds and the surrounding soil series and designated e.g. "V4 - Vertic Orthustent complex".

These "phase" and "complex" units were mapped on Figures 1-7 but were not separated on the main soil and land classification maps submitted with this report.

General descriptions of the Sample Areas with a statement of the pattern discernible in each follows:-

SAMPLE AREA 1

Latitude $15^{\circ}19' N - 15^{\circ}20' N$. Longitude $32^{\circ}45' - 32^{\circ}46' E$.
Location - Just beside the railway bend at Gedeid El Kheleif.
(See Figure 1)

This area ran between a seasonably swampy patch beside the railway line to a somewhat bushy area a mile to the south. It was all uncultivated.

Only three main soil types were recognized, V2, V10 and V12. Only one site was classified as V12 and five as V2. These last stand so nearly at the same topographic level that small profile differences cannot be correlated with this. The other nine sites fall into soil Class V10 and these lie mainly on a north-south line falling overall from a height of about 384.3 m. in the south to 383.9 m. in the north, which is only 40 cm. in 2.3 km., or about 1 in 5,750. In such circumstances little profile differentiation can be expected. The following table summarizes such differences as are discernible:-

TABLE 1:
COMPARISON OF PROFILES IN VIO SOILS OF SAMPLE AREA 1

	Height metres	Depth of Surface Horizon	Change of E.C. 1st-2nd Horizon	Change of E.C. 2nd-3rd Horizon	E.C. Top Horizon	% C. Top Horizon	Change of % C 1st-2nd Horizon	Change of % C 2nd/3rd Horizon	pH Top Horizon	Change of pH 1st-2nd Horizon	Change of pH 2nd-3rd Horizon
E 108	384.2-3	40	+4.44	-3.00	0.76	45	+14	-10	9.6	-0.9	+0.6
C 133	384.1-2	25	+6.23	-4.10	0.66	42	+12	-22	9.7	-0.7	+0.5
C 127	384.1-2	20	+4.88	-4.50	1.12	41	+10	-6	9.7	-0.4	+0.3
C 128	384.1	20	+1.62	+6.56	0.26	39	+6	-8	9.9	0	-0.2
E 107	384.1	40	-0.20	-0.20	1.50	43	+4	-36	9.6	0	-0.2
C 131	384.0-384.1	20	+0.26	+1.00	0.84	48	+10	-8	9.7	-0.5	+0.2
C 130	384.0-384.1	20	+0.89	+0.01	1.20	42	+6	-2	9.8	-0.3	+0.2
C 129	384.0-384.1	30	-0.46	-0.20	1.66	41	-16	+21	9.6	0	+0.1
E 106	383.9-384.0	25	+0.44	-0.96	1.60	47	-6	-22	9.5	+0.1	+0.2

Few consistent changes in depth of surface horizon, change in % clay, E.C. or pH can be seen or correlated with the slight topographical and photographic image differences which can be seen, and no significant "phase" differences could be recognized. The only facts which emerge are that the higher sites tend to be much more saline in their second horizons than the others.

SAMPLE AREA 2

Latitude $15^{\circ}07'$ - $15^{\circ}08'$ N. Longitude $32^{\circ}39'$ - $32^{\circ}40'$ E.
Location - round El Mansurab Village, about 7 km. east-north-east of Wad El Habil. (See Figure 2)

This area extends across an area of scattered rain dura fields with many clay mounds and a black area on the photograph due to burning before the photograph was taken. It includes the village of El Mansurab and its small hafir. The slope of the ground is east-west and maximum fall about 30 cm. only.

The whole area has relatively low E.S.P. and no Mazusterts or Entisols were seen. Of the fifteen sites, one was V1 and one V3 which occupied opposite corners of the area only. Of the others, eight were V2 and five were V4; the diagnostic difference is that the latter have over 50 percent clay in the topsoil. The sites lie in too ill-defined a topographic relationship to one another for slope and drainage differences to be visible, but the frequency of the low hummocks formed of aggregated clay particles makes it possible to 'shade' the large area of Orthic Grumustert/Vertic Orthustent complex where they cover over 20 percent of the surface. Soil boundaries within this indicate respectively the V2/, V3/ and V/4 soils associated with Vertic Orthustents within this complex.

Because of the map scale it was impossible to outline the land classes, but the shaded area must all be regarded as having a topographic limitation (t) in addition to its soil limitations, though nowhere is this limitation serious enough to downgrade land to Class 6.

SAMPLE AREA 3

Latitude $15^{\circ}00'$ N. Longitude $32^{\circ}42'$ - $32^{\circ}44'$ E.
Location - extending east from the north end of Abu Nawwa Inein canal, just north-east of Laot village and including part of Umm Uweid and Far villages, though these seem to have changed considerably since the maps were made (c.1930).
(See Figure 3)

The area extends from the edge of irrigation across some rain fields to an open, bare, grassy area passing a locally dense accumulation of clay mounds, which were probably originally windborne and which range in diameter from 2 m. to about 10 m. The country rises E.S.E. from the irrigation canal from level 388.3 m. to about level 388.8 m., an insignificant difference of 50 cm. in 2.6 Km. The mounds were used as an old village site, now mainly abandoned, with at least one small hafir. It is probable that the houses were originally built on the small wind-blown mounds which they somewhat enlarged and flattened. The mounds themselves are classed as Vertic Orthustents and where they cover over 20 percent of the land surface it is mapped as a V4/Vertic Orthustent complex.

All but three of the fifteen sites are V4. The others are one each of V2, V3 and V10. This relative soil uniformity is not reflected in the land classes due mainly to the highly variable subsoil salinity which shows no geographical pattern which can be correlated with contours or aerial photographs. Of the twelve V4 sites, four are Class 2, six are Class 3 and two are Class 6 land. To preserve the map from too much detail no attempt was made to draw boundaries between these land classes.

SAMPLE AREA 4

Latitude $14^{\circ}51'$ - $14^{\circ}52'$ N. Longitude $32^{\circ}38'$ - $32^{\circ}40'$ E.
Location - in an area of low scattered dunes (qoz) about
13 Km. due west of Kheiran village which lies at the western
end of the Abu Khaya branch of the Abu Quta canal.
(See Figure 4)

The area includes a patch of qoz which covers part of a
clay plain which has some fields of rain dura but is mainly uncultivated.
All the pits lay on unused land.

Of the fifteen pits, five were of soil Class V2, five of V4,
two of V12 and one each of V1, V10 and E6. They do not map readily
into blocks and the only clear pattern relates to the distribution of
soil textures. Although only one site had less than 35 percent clay
(E6), the distribution of the coarser textured V1, V2 and V10 soils
coincides generally with the dune-type pattern on the aerial photo-
graphs and the higher ground although the maximum height difference
in the area is only just about 1 m. The finer textured V4 and V12
soils are confined to the clay plain.

Land classes are again variable, even on similar soils,
mainly due to variations in subsoil salinity and no attempt was made
to outline these on the map.

SAMPLE AREA 5

Latitude $14^{\circ}39'$ - $14^{\circ}41'$ N. Longitude $32^{\circ}41'$ E.
Location - between Hashaba and El Humeira Villages.
(See Figure 5)

The northern half of the sample area lies on low, gently
undulating, uncultivated qoz , the southern half on an area of clay
plain three-quarters of which is used for rain dura. The slope of the
land is generally down towards the north so that water tends to impound
on the southern side of the qoz The land falls 2 m. from south to north
but the contours on the map do not reveal the fact that the qoz presents
a very slight local rise above the plain to the south of it. Land
classes were not mapped in this area. This sample area brings out
several points of considerable pedological interest.

- (1) All the qoz soils in the north are readily recognizable by
their sandier textures, although these are variable, as also
is the alkalinity.
- (2) There is a transitional zone of soils with 35-50 percent clay
between the north and south ends of the area (V2 and V10 soils),
and the soils at the south end are heavy clays (V4 soils).
- (3) Two of the sites in the intermediate zone (E104 and L115)
have high alkalinity which suggests leaching of salts in a
ponded portion in the presence of much soil sodium.
- (4) Salinity is a noticeable problem only in the heavy clays at
the south end (sites E105 and L112) where fine texture and
a less water-receiving position retain more soluble, as against
exchangeable, sodium.

SAMPLE AREA 6

Latitude $14^{\circ}44'$ N. Longitude $13^{\circ}53' - 13^{\circ}55'$ E.
Location - just south of El Gebailia village, which lies off the western end of the Mahala branch of the Moreibi'a canal. (See Figure 6)

This area extends across clay plain more than half of which was under rain dura when the photographs were taken. The two ends of the area, which are about 3.2 Km. apart, are at the same level but halfway between them the land falls to a slight hollow, only 20 cm. or so lower. Pit No. C222 near El Gebeiliya Village at the edge of the area, lies near a saline sandy patch (supporting some Acacia tortilis) which is used partly as a graveyard. It is also the home of many burrowing animals and some large land snails. The sand is probably riverborne though the presence of some moderately coarse gravel makes this somewhat uncertain.

All the fifteen sample area pits are on clay soil. Eight are Class V4, three are V2, two are V10 and one each are V6 and V12. The less fine textured V2, V6 and V10 soils lie nearest to the sandy patch. It is not possible to find a clear correlation between soil salinity or alkali on the one hand and soil texture, site altitude or the presence or absence of cultivation on the other.

Land classes were mapped in this sample area. Again it will be seen that they do not coincide with soil classes and, again, this is mainly due to the high variability of subsoil salinity which is considered more significant in land than in soil classification.

SAMPLE AREA 7

Latitude $14^{\circ}31' - 14^{\circ}32'$ N. Longitude $33^{\circ}03' - 33^{\circ}04'$ E.
Location - 2 Km. south-east of Umm Duwana Village which lies just off the west end of the Dabbab Minor branch of the Wad Shair Major canal. (See Figure 7)

This was the only sample area which was square. It covers a part of the clay plain fairly intensively covered with rain dura fields and with only occasional unused patches. The land falls gently and uniformly down towards the west but only by 40 cm. in a distance of 1.6 Km.

Only three soils were found - V2 (5 pits), V4 (8 pits) and V12 (2 pits); V2 differs from V4 in having less than 50 percent clay, and from V12 in having a lower E.S.P. as well as this texture difference. The three soil types come together into simple clear zones on the map. The V2 soils form a continuous less fine textured patch which is remarkable in that it can neither be correlated with the contours nor with any particular photographic image. Land classes correlate fairly well with soil classes in this area, with small differences due to variable levels of subsoil salinity. On the whole this sample area is representative of the best land in Area 1. About half of it was Class 2 and only 20 percent Class 6.

The conclusions from this study of the Sample Areas are as follows:-

- (1) The country is flat and the soil observations and analyses were unable to determine small "phase" differences due to drainage conditions with accuracy, especially as the exact sites of the soil pits cannot be transferred with great accuracy from prints to old 1:20,000 maps on which the contours are drawn.

- (2) The small scale of the photographs was unsuitable for stereoscopic interpretation. Pits only appear 1-2 cm. apart on a photograph in a uniform area and photo-interpretation can help little in drawing the boundaries.
- (3) Photographic interpretation is at its most valuable where clear topographic and vegetation differences exist. Such differences were relatively rare in Area 1. It was, however, possible to outline qoz and areas of frequent clay hummocks in this way.
- (4) Sample Area 5 showed the greatest visual contrast on the photographs and also suggested certain facts - notably the transition from a qoz via an area of alkaline, coarser textured Vertisols in the ponded area just to the south of it to the fine textured Vertisols on higher sites still farther south retaining higher subsoil salinity and relatively lower exchangeable sodium.

SAMPLE AREA 6

SAMPLE AREA 7

Orthic Grumusterts SOIL SURVEY OF IRRIGABLE LANDS Series;
 (This is tending toward IN THE SUDAN).

Site: R272

Location: AREA 1: GEZIRA EXTENSION Date: 27/12/62

A P P E N D I X 2

Topography: Flat and level

Cultivation and Dura field. It may receive occasional irrigation

Specimen Profile Descriptions, together with Laboratory Data, of 15 Soil Series and One Member of a Complex Described as follows:-

Vegetation: Sparse *Aristida* spp.

Surface: Loose dry mulch with occasional moderate cracks, few pits and common kank

ORDER OF VERTISOLS SERIES NO.

Orthic Grumusterts V.1

" " V.2

0-5 cm. 10YR5/2. Grey loam. Dry, slightly hard, single grain, structureless with many fine vertical and horizontal cracks. Rapidly water absorbent. Frequent roots, 6% kankars, some shells and quartz grains.

" " V.3

" " V.4

5-39 Orthic Mazusterts clay. Almost dry, hard, fine sub-angular blocky with strong vertical cracks. Rapidly water absorbent. Frequent roots, 4% kankars. Some shells and mica, 4% gypsum, 4% carbonate concretions.

" " V.6

" " V.8

Natrargidic Mazusterts V.9

39-90 cm. 7.5YR5/2 Clay. Moist, firm, massive with strong vertical cracks. Slowly water absorbent. Occasional roots, 3% kankars, 10-12% gypsum, 8% carbonate. Gypsum decreases downwards.

" " V.10

" " V.11

90-200 cm. 10YR5/3. With occasional softening, clay moist, firm, massive with occasional vertical cracks. Slowly water absorbent. No roots. 4% gypsum, 4% carbonate.

" " V.12

ORDER OF ENTISOLS

Oxic Psammusterts E. 2

Orthic Orthusterts E. 3

Depth (cm.)	(2-2.5 mm)	(.05-.02 mm)	(Under .02 mm)	B.C. at 25° C. Sat. Ext.	Sol. No. wt/100	Sol. 4 wt/100g.	Phase
	"	"	"				
	"	"	"				
5-39	45	12	43	21.5	0.5	1.0	7.85
9-90	37	8	55	7.8	1.3	14.2	7.95
0-120	Vertic Orthustent			58	17.0	-	32.0

V,1 SOIL:

Orthic Grumustert 2.210; Clay, 35 - 50%; Saline Series;
(This is tending towards a Calcorthid).

Pit: R272

Location: 15°10' N; 32°43' E; Date: 27/12/62

SURFACE:

Topography: Flat and level

Cultivation and Land Use: Dura field. It may receive occasional irrigation water from canal, although it is outside the irrigated area.

Vegetation: Sparse Aristida spp.

Surface: Loose dry mulch with occasional moderate cracks, a few pits and common kankars.

PROFILE DESCRIPTION:

0-5 cm. 10YR3/2. Clay loam. Dry, slightly hard, single grain, structureless with many fine vertical and horizontal cracks. Rapidly water absorbent. Frequent roots. 6% kankars, some shells and quartz grains.

5-39 cm. 10YR3/2. Silty clay. Almost dry, hard, weak fine sub-angular blocky with strong vertical cracks. Rapidly water absorbent. Frequent roots, 4% kankars. Some shells and mica. 4% gypsum, 4% carbonate concretions.

39-90 cm. 7.5YR5/2 Clay. Moist, firm, massive with strong vertical cracks. Slowly water absorbent. Occasional roots. 3% kankars, 10-12% gypsum, 8% carbonate. Gypsum decreases downwards.

90-200 cm. 10YR5/3. With occasional mottling, clay. Moist, firm, massive with occasional vertical cracks. Slowly water absorbent. No roots. 4% gypsum, 4% carbonate.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm)	% Si (.05-.002 mm.)	% C. (Under.002 mm.)	E.C. mmhos/cm. at 25° C. Sat. Ext.	Sol. Na. meq/100g.	Sol & Exch. Na. meq/100g.	pH Paste
5-39	45	12	43	21.5	0.5	1.8	7.85
39-90	37	8	55	7.8	1.3	14.2	7.95
90-120	30	12	58	17.0	10.4	32.0	8.1

V.2 SOIL:

Orthic Grumustert (2.210), Clay 35-50%. Non-saline series.

Pit: R326

Location: 15°15' N; 32°35' E; Date: 7/1/63.

SURFACE:

Topography: Flat and level

Cultivation and Land Use: Grassland: grazed.

Vegetation: Close cover of Aristida spp.

Surface: Hard crust without cracks or pitting, and with frequent kankars.

PROFILE DESCRIPTION:

0-17 cm. 10YR4/2 Clay loam. Dry, slightly hard, moderate fine subangular blocky with a few fine cracks. Rapidly water absorbent. Frequent roots. 8% kankars with some shell fragments and quartz grains.

17-40 cm. 7.5YR5/2 Clay. Dry, hard, moderate medium subangular blocky with occasional fine cracks. Moderately water absorbent. Occasional roots, 5% kankars, 2% carbonate concretions. Some quartz grains and fine sand lenses.

40-86 cm. 10YR4/1-5/2 Clay. Slightly moist, very firm and massive, without cracks. Slowly water absorbent. No roots. 3% kankars and 6% carbonate in fairly large concretions and some shells.

86-200 cm. 10YR4/1 Clay. Slightly moist, very firm and massive, without cracks. Slowly water absorbent. No roots. 10% kankars and 3% carbonate concretions at top, rising to 5% at 155 cm. and then decreasing.

Calculated by summation, except in second horizon where repeatedly was 70 mg. Ca have been found.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm)	% Si (.05-.002 mm.)	% C (Under .002 mm)	Incorp. Carbonate %	pH	
					Soil Paste	1:5 Soil Suspension
0-17	48	16	36	4.40	8.0	8.37
17-40	47	8	45	4.45	8.3	8.3
40-86	36	5	59	3.82	8.2	8.70
86-130	33	11	56	4.95	8.75	9.55

Depth (cm.)	E.C. mmhos/cm. Sat. Ext	Total N %	Total Org. C %	TOTAL EXTRACTABLE	
				Phosphate mg./100g. Soil	Potash mg/100g. Soil
0-17	2.4	0.028	0.62	43	260
17-40	5.5	0.025	0.46	43	285
40-86	9.6	0.028	0.24	55	305
86-130	3.2	0.025	0.31	55	295

Depth (cm.)	Soluble Anions in Sat. Ext. meq/litre				Soluble Cations in Sat. Ext. meq/litre			
	CO ₃	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg
0-17	0.5	8	4	11	11	0.1	21.5	5
17-40	-	16	15	39	59	0.2	18	7
40-86	1	9	17	70	54	0.2	15	10
86-130	-	-	5	6	33	0.1	0.5	1.5

Depth (cm.)	Exchangeable Cations meq/100 g. Soil				Exchange Capacity meq/100g. Soil*
	Na	K	Ca	Mg	
0-17	2.5	0.45	33.5	2.0	38.5
17-40	11.2	0.3	74.0	4.5	90.0
40-86	20.9	0.1	37.0	7.5	74.5
86-130	25.7	0.9	14.0	5.5	46.1

* Calculated by summation, except in second horizon where repeatedly over 70 meq. Ca have been found.

V.3 SOIL:

Orthic Mazustert (2.220): Clay over 50%. Saline Series.

Pit: L230

Location: 14°58' N; 32°37' E; Date: 19/12/62.

SURFACE:

Topography: Flat

Cultivation and Land Use: Rain dura field colonized by grasses.

Grazing only.

Vegetation: Aristida spp., frequent Acacia nubica and Capparis decidua.

Surface: Loose mulch with crumb structure and no visible cracking. Abundant kankars and traces of shell fragments.

PROFILE DESCRIPTION:

0-38 cm. 10YR3/3 Clay. Dry, slightly hard, weak medium to coarse subangular blocky. Strong vertical cracking extending to 55 cm. producing a massive pseudo-columnar structure. Traces of pin point porosity. Rapidly water absorbent. Frequent roots and traces of old root channels. 2% kankars and traces of carbonate at bottom of horizon.

38-90 cm. 10YR3/2 Silty clay. Slightly moist, firm, moderate, medium to coarse subangular blocky. Moderate vertical and horizontal fracturing, producing parallelepiped structures, moderately water absorbent. 5% carbonate decreasing with depth. Traces of gypsum. 3% greyish-blue kankars.

90-160 cm. 10YR3/3 Silty clay. Slightly moist, very firm, massive with weak vertical and horizontal cracking. Moderately water absorbent. 1-2% carbonate. Traces of gypsum and greyish-blue kankars.

Below this depth, observation was by auger:-

160-200 cm. 10YR3/3 Silty clay. Slightly moist, firm and without visible structure (massive). Rapidly water absorbent. 4% carbonate. Traces of gypsum and greyish-blue kankars.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm.)	% Si (.05-.002 mm.)	% C (Under .002 mm.)	E.C. mmhos/cm. at 25° C. Sat. Ext.	Sol. & Exch. Na meq/100g.	Exch. Na meq/100g	pH Paste
0-38	29	15	56	4.75	7.7	4.3	7.90
38-90	26	11	63	6.0	30.0	19.6	8.29
90-160	26	11	63	6.0	31.6	24.6	8.56
160-200	21	13	66	3.6	30.6	25.9	8.46

V.4 SOIL:

Orthic Grumustert (2.210) Clay over 50%. Non-saline Series.

Pit: C225

Location: 14°42' N; 32°48' E; Date: 18/12/62

SURFACE:

Topography: In a flat lumpy clay hollow, halfway between two qoz areas.

Cultivation and Land Use: A patch of rain dura still green nearby and some of last year's stubble showing.

Vegetation: Scattered Aristida spp., and also some "tagha", Convolvulus sp. and other green weeds. On the clay plain occasional Acacia tortilis var. raddiana is the only tree. There is some Striga hermonthica.

Surface: Bumpy (amplitude 9 inches), and much cracked clay; cracks are 1m. apart, up to 5 cm. wide and 30 cm. deep; approaching gilgai formation.

PROFILE DESCRIPTION:

0-60 cm. 10YR3/2 Clay. Moist, very firm, massive and almost plastic, not being too difficult to dig. Moderately water absorbent, few roots, 2% kankars. Merging into:-

60-140 cm. 10YR3/2 Clay. Moist, very firm and otherwise similar to horizon above. Few roots. An average of 4% carbonate concretions rising from 2% at the top to 8% at the bottom. Very abrupt change to:-

140-200 cm. 10YR3/2 Silt. Almost dry, soft and massive but laminated and easily breaking up. Very readily water absorbent. Few roots. 4% carbonate concretions.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm)	% Si (.05-.002 mm.)	% C. (Under .002 mm.)	Incorp. Carbonate %	pH	
					Soil Paste	1:5 Soil Suspension
0-60	37	11	52	6.50	8.20	9.10
60-140	23	21	56	9.80	8.28	9.38
140-200	44	*	*	1.53	7.90	9.10

* In this sample the soil repeatedly flocculated in spite of increasing additions of sodium hexa metaphosphate and sodium carbonate.

Depth (cm.)	E.C. mmhos/cm. Sat. Ext.	Total N %	Total Org.C %	TOTAL EXTRACTABLE	
				Phosphate mg/100g. Soil	Potash mg./100g. Soil
0-60	0.60	0.045	0.60	69	660
60-140	1.50	0.028	1.50	75	620
140-200	2.35	0.036	0.12	53	480

Depth (cm.)	Soluble Anions in Sat. Ext. meq./litre				Soluble Cations in Sat. Ext. meq./litre			
	CO ₃	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg
0-60	1	21	4	0	9	.1	1	2
60-140	1	3	5	15	15	.2	1	2
140-200	1	13	9	13	35	.2	3	3

Depth (cm.)	Exchangeable Cations meq./100g. Soil				Exchange Capacity meq/100g. Soil*
	Na	K	Ca	Mg	
0-60	4.6	1.3	27.4	5.8	39.1
60-140	8.4	1.1	31.5	7.0	48.0
140-200	7.8	0.65	26.5	11.5	46.5

* By summation only

V.6 SOIL:

Orthic Mazustert (2.220). Clay 35-50%. Non-saline series.
(Only 3 of this series were recognized. Sites C160, E144 & R166)

Bore: C160

Location: 14°48' N; 32°53' E; (East of Sarhan town)

Date: 5/12/62.

SURFACE:

Topography: Flat and level

Cultivation and Land Use: Widely scattered fields of rain dura.

Vegetation: Very widely scattered Acacia tortilis var. raddiana and A-nubica. Patches of Aristida to 30 cm. or so high, but much of it is burnt.

Surface: Hard, smooth with a thin surface crust which has a fungus skin on it giving a colour of 10YR2/1 when wet. There are some potholes and cracks. Surface is scattered with kankars and some bleached sand grains.

Remarks: This is the best example of a Mazustert seen by the observer in this area.

PROFILE DESCRIPTION:

0-100 cm. 10YR3/2 Clay with some sand grains appearing below 75 cm. Dry at top, becoming moister downwards and slightly hard. Beneath the platy surface there is probably some blocky structure, but it soon becomes massive. It is hard to determine structure in auger samples. Readily water absorbent, becoming slower down the horizon. 5% kankars at top, becoming finer and only 1% from 25-50 cm., and changing to 2% gypsum from 50-75, and 4% gypsum from 75-100 cm. Moisture and consistency merge into:-

100-200 cm. 10YR4/2 becoming redder towards the bottom, sandy clay. Slightly moist, hard, massive and moderately water absorbent. 3% CaSO₄ disappearing below 175. 2% Kankars appear below 125, and 2% soft carbonate reappears below 175 cm.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm.)	% Si (.05-.002 mm.)	% C (Under .002 mm.)	E.C. mmhos/cm. at 25° C. Sat. Ext.	∞ Exchangeable Na. meq./100g. Soil
0-50	53	8	39	0.92	3.9
50-100				5.50	
100-200				7.00	

V.8 SOIL:

Orthic Mazustert (2.220). Clay over 50%. Non-saline soil.

Bore: R164

Location: 14°53' N; 32°43' E. Date: 6/12/62.

SURFACE:

Topography: Flat and level. Perhaps a slight depression

Cultivation and Land Use: Grassland. Recently burned.

Vegetation: Very scattered Aristida spp.

Surface: Fairly hard crust about 2 cm. thick. Deeply pitted. Frequent kankars.

PROFILE DESCRIPTION:

0-50 cm. 10YR3/2 Sandy clay. Slightly moist, firm, and moderately water absorbent. Structure not visible in bore. Some shell fragments and quartz grains. 5% Kankars.

50-115 cm. 10YR4/1 Fine sandy clay. Slightly moist, firm, and rapidly water absorbent. Structure not visible in bore. Some quartz. 2% Gypsum, 5% carbonate and 3% kankars.

115-160 cm. 10YR5/2 Clay loam. Almost dry, hard, and moderately water absorbent. Structure not visible in bore. Some quartz. 7% carbonate, 4% kankars. Trace of gypsum.

160-200 cm. 10YR5/2 Loam. Dry, hard, moderately water absorbent. Structure not visible in bore. Much quartz, 4% kankars, 5% carbonate decreasing to only a slight concentration at about 200 cm.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm.)	% Si (0.5-.002 mm.)	% C (Under .002 mm.)	E.C. mmhos/cm. at 25° C. Sat. Ext.	Exchangeable Na. meq./100g. Soil
0-50	33	14	53	1.00	4.6
50-115				10.00	
115-160				6.75	

V.9 SOIL:

Natrargidic Mazustert (2.22 - 4.23). Clay 35-50%. Saline series.

Pit: E.226

Location: 15° 00' N; 32° 40' E;

Date: 20/12/62.

SURFACE:

Topography: Flat and level

Cultivation and Land Use: Uncultivated rough grazing.

Vegetation: Aristida spp. dominant with occasional Acacia nubica.

Surface: Top 2 cm. loose and dusty under a thin surface crust. Kankar-strewn.

PROFILE DESCRIPTION:

0-30 cm. 10YR3/2 Very dark greyish brown Loam. Slightly moist, loose to friable, moderate medium subangular blocky with vertical cracks to 40 cm. Moderately water absorbent. Fibrous Aristida roots, 10% Kankars, 10% quartz grains, 15% carbonate. Trace of gypsum and perhaps platz shell fragments.

30-80 cm. 10YR3/3 dark brown clay loam. Moist, friable, weak coarse subangular blocky. Moderately water absorbent. 3% carbonate, 1% gypsum, 1% kankars, 10% fine quartz grains.

80-160 cm. 10YR3/2 very dark greyish brown silty clay. Moist, friable, massive, moderately water absorbent. 2% Kankars, 2% carbonate, traces of gypsum, and 5% fine quartz grains.

Pit ended at 160 cm. - below this was augered:-

160-200 cm. 10YR4/2 dark greyish brown clay. Moist, firm, massive, moderately water absorbent. 5% carbonate, and 1% kankars.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm.)	% Si (0.5-.002 mm.)	% C (Under.002 mm.)	E.C. mmhos/cm at 25° C. Sat. Ext.	Sol Na meq/100g.	Sol. & Exch. Na meq/100g	pH Paste
0-80	41	19	40	6.0	7.3	16.0	8.3
80-160	63	5	32	13.5	-	35.5	-
160-200	21	13	66	5.5	6.8	32.4	8.6

V.10 SOIL:

Natrargidic Mazustert (2.22 - 4.23), Clay, 35-50%.
Non-saline Series.

Pit: R 327

Location: 15°15' N; 32°33' E; Date: 7/1/63.

SURFACE:

Topography: Flat and level

Cultivation and Land Use: Grassland, grazed.

Vegetation: Close cover of Aristida sp.

Surface: Hard crust, uncracked but with frequent pitting. Frequent Kankars.

PROFILE DESCRIPTION:

0-29 cm. 10YR4/2 Sandy clay to clay. Dry, hard, moderate medium subangular blocky with frequent vertical cracks. Moderately water absorbent. Frequent roots. 4% Kankars and some shell fragments and sand lenses.

29-67 cm. 10YR4/1 Clay loam to clay. Dry, hard, moderate medium subangular blocky with a fine mosaic of cracks and occasional roots. 3% Kankars, 3% carbonate concretions, some shells, quartz and mica.

67-156 cm. 10YR5/2 Clay loam. Dry, very hard, massive and uncracked. Slowly water absorbent. No roots. 2% Kankars. 15% Carbonate, some quartz, mica and dark Mn staining.

156-200 cm. 10YR4/3 Loamy fine sand to silty fine sand. Dry, slightly hard and structureless. Uncracked but rapidly water absorbent. No roots. 6% Carbonate at top, decreasing to 4% below 160 cm. Some quartz, mica, and manganese concretions.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm)	% Si (.05-.002 mm.)	% C (Under .002 mm.)	Incorp. Carbonate %	pH	
					Soil Paste	1:5 Soil Suspension
0-29	48	10	42	7.30	8.75	10.0
29-67	34	21	45	5.25	8.6	9.70
67-156	58	14	28	12.0	8.6	9.50

Depth (cm.)	E.C. mmhos/cm. Sat. Ext.	Total N %	Total Org.C %	TOTAL EXTRACTABLE	
				Phosphate mg./100g. Soil	Potash mg./100 g. Soil
0-29	1.27	0.031	0.17	44	340
29-67	4.8	0.028	0.57	63	395
67-156	2.4	0.025	0.34	60	240

Depth (cm.)	Soluble Anions in Sat. Ext. meq./litre				Soluble Cations in Sat. Ext. meq./litre			
	CO ₃	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg
0-29	1.5	12	6	0	18	0.1	0.5	0.5
29-67	1.5	12	23	61	56	0.2	16	5
67-156	1	14	12	22	31	0.1	1	1

Depth (cm.)	Exchangeable Cations meq./100 g. Soil				Exchange Capacity meq./100g. Soil*
	Na	K	Ca	Mg	
0-29	24.1	0.65	13.0	2.5	40.3
29-67	21.8	0.75	23.0	4.0	49.6
67-156	22.8	0.15	9.0	3.0	35.0

* By summation only

V.11 SOIL:

Natrargidic Mazustert (2.22 - 4.23). Clay, over 50%. Saline Series.

Bore: L 181

Location: 14°48' N; 32°44' E; Date: 11/12/62

SURFACE:

Topography: Flat

Cultivation and Land Use: Grazing only

Vegetation: Aristida spp. scattered clumps of Acacia nubica and Calotropis procera.

PROFILE DESCRIPTION:

0-65 cm. 10YR2/2 Clay. Dry, soft, rapidly water absorbent. No visible structure in bore. 1% Kankars and traces of carbonate and gypsum.

65-165 cm. 10YR3/3 Silty Clay. Dry, soft, rapidly water absorbent. No visible structure in bore. 5% carbonate increasing to 7% with depth. Traces of gypsum. Traces of greyish-blue Kankars.

165-200 cm. 10YR4/4 Silty Clay. Dry, soft, rapidly water absorbent. No visible structure in bore. 5% carbonate, 1% gypsum.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm.)	% S1 (.05-.002 mm.)	% C. (Under .002 mm.)	E.C. mmhos/cm. at 25° C Sat. Ext.	Exchangeable Na meq./100g.
0-65	34	15	51	9.00	17.0
65-165				3.20	
165-200				2.40	

V.12 SOIL:

Natrargidic Mazustert (2.22 - 4.23). Clay over 50%. Non-saline Series.

Pit: C 266

Location: 15°15' N; 32°47' E; Date: 7/ 1/63.

SURFACE:

Topography: Flat and level

Cultivation and Land Use: Near a small patch of recently harvested rain dura, but generally on an open clay plain.

Vegetation: Near an Acacia tortilis tree with a few seedlings round it. Patches of Aristida sp. but mainly a burnt bare surface.

Surface: Pitted and with a thin surface skin over a dust mulch. Scattered with Kankars.

PROFILE DESCRIPTION:

0-38 cm. 10YR3/3 Clay. Dry, slightly hard, moderate coarse subangular blocky with some quite large vertical cracks. Moderately water absorbent. Some roots. 1% carbonate and some shell fragments.

38-90 cm. 10YR3/1-2/1 Clay. Slightly moist, firm and massive, crumbling to weak medium subangular blocky. No cracks. Moderately water absorbent. Few roots. Carbonate rises from 1% at top to 4% at bottom, averaging 2%.

90-145 cm. 10YR4/2 Silty clay loam. Almost dry, very hard, massive to weak medium subangular blocky. Moderately water absorbent. No roots. 10% hard carbonate concretions.

145-192 cm. 10YR4/2 Loam. Almost dry, slightly hard to hard, massive. Readily water absorbent. No roots. Micaceous. 2% hard carbonate concretions which finally stopped the auger at this depth. The pit was to 170 cm.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm)	% Si (.05-.002 mm.)	% C (Under .002 mm.)	Incorp. Carbonate %	pH	
					Soil Paste	1:5 Soil Suspension
0-38	43	7	50	5.9	8.50	9.60
38-90	39	11	50	6.60	8.10	9.07
90-145	54	18	28	12.3	8.32	9.50
145-192	74	8	18	1.47	8.32	9.55

Depth (cm.)	E.C. mmhos/cm. Sat. Ext.	Total N %	Total Org. C %	TOTAL EXTRACTABLE	
				Phosphate mg./100g. Soil	Potash mg./100g. Soil
0-38	0.65	0.039	0.83	45	295
38-90	5.0	0.036	0.93	58	310
90-145	2.0	0.025	0.40	51	240
145-192	2.0	0.028	0.90	48	225

Depth (cm.)	Soluble Anions in Sat. Ext. meq./litre				Soluble Cations in Sat. Ext. meq./litre			
	CO ₃	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg
0-38	1	12	5	8	15	0.1	1.5	1.5
38-90	1	13.3	26	42	73	0.2	8	2
90-145	1	8	12	0	29	0.1	1.5	0.5
145-192	0.5	11	12	0	24	0.1	2	2

Depth (cm.)	Exchangeable Cations meq/100 g. Soil				Exchange Capacity meq./100g. Soil*
	Na	K	Ca	Mg	
0-38	9.4	0.75	20.9	6.3	37.4
38-90	11.8	0.55	23.6	6.6	42.6
90-145	10.9	0.25	15.9	5.8	32.9
145-192	9.0	0.2	5.7	4.3	19.2

* By summation only

E.2 SOIL:

Oxic Psammustent (1.31 - 9). Clay 5-15%. Non-saline series.

Pit: L 246

Location: 14°41' N: 32°48' E; Date: 21/12/62.

SURFACE:

Topography: Raised mound above clay plain.

Cultivation and Land Use: Rough grazing only in close proximity to rain dura.

Vegetation: Acacia nubica, A. seyal, A. tortilis var. raddiana, Aristida mutabilis, A. funiculata, Panicum turgidum, Balanites aegyptiaca, Phyllanthus iruri, Morettia phileana, Cenchrus biflorus, Citrullus colocynthis.

Surface: Fine sand, predominantly subangular to sub-rounded. Quartz grains slightly pitted with 3% dark minerals, probably amphiboles and pyroxenes. Well rounded granitic and quartz pebbles.

PROFILE DESCRIPTION:

- 0-53 cm. 7.5 YR3/2 fine sand. Dry, loose, structureless - fine to medium single grain. No cracks visible, but stratification planes prominent. At depth of 21 cm. weak convolutions suggestive of current bedding or possibly attributable to turbidity currents. Alternating bands of fine and coarse material 1-2 mm. apart. Rapidly water absorbent. Occasional fine roots. Insect burrows (0.1 - 0.5 cm.) penetrate profile face. Traces of shell fragments and traces of greyish-blue Kankars at 53 cm.
- 53-80 cm. 7.5YR3/2 fine sand. Dry, loose. Stratification planes dip at approximately 10°. At 100 cm. resumption of horizontal bedding. Coarser material more evident between laminations. Band of coarser material 1 cm. thick at 68 cm. Structureless fine to medium single grain. Rapidly water absorbent. Small roots less frequent than in horizon above.
- 80-100 cm. 7.5YR3/2 fine sand. Dry, loose, structureless fine to medium single grain. Stratification planes dip at approximately 20°. Rapidly water absorbent.
- 100-123 cm. 10YR3/3 fine sand. At 107 cm. distinct band of coarser material. At 123 cm. coarser fraction contains pebbles subangular and rounded with 0.5 cm. diameter. Dry, loose, structureless fine to medium single grain. Rapidly water absorbent. Taproot 1 cm. in diameter at 103 cm. Traces of shell fragments. Abrupt change to:-

123-200 cm. 10YR3/2 fine to medium sand. Dry, slightly hard, massive, without visible structure. Rapidly water absorbent. Maximum depth of root system 173 cm. At 178 cm. traces of carbonate (up to 1%) and traces also of gypsum and greyish-blue kankars, but no visible shell fragments.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm.)	% Si (.05-.002 mm.)	% C. (Under .002 mm.)	E.C. mmhos/cm. at 25° C. Sat. Ext.	Sol. & Exch. Na meq/100g	Exch. Na meq/100g	pH Paste
0-53	87	3	10	0.34	0.5	0.43	7.51
53-80	82	3	15	0.25	0.7	0.63	7.82
80-123	82	3	15	0.30	0.7	0.60	7.83
123-200	82	3	15	0.66	0.4	0.33	7.55

Vegetation: Mainly bare, but with scattered *Amelita* "legha" and, round the edge of the mound *Acacia tortilis* var. *raddiana* and *Acacia* shrubs.

Soils: Scattered with shell fragments, sand, ka and quartz pebbles up to 3 cm. in diameter.

PROFILE DESCRIPTION:

0-53 cm. 7.5YR4/3 Loam. Dry, slightly hard, massive, and readily water absorbent. Some large long shell shells and many small holes. Few roots and 4% carbonate concretions at top, rising to 6% at the bottom.

53-93 cm. (at one end of pit only) 10YR3/2 Clay loam. Dry, very hard and massive but with some vertical cracking. Slowly water absorbent. No roots. 8% carbonate concretions.

93-160 cm. 10YR5/3 Loam. Dry, hard, massive and moderately water absorbent. No roots. 5% carbonate concretions, rising to 8% at the bottom.

160-200 cm. 10YR5/4 Clay loam. Dry, very hard and massive though with some sign of cracking. Rather slowly water absorbent. Labourers say large artifact stone with hole through it found in this horizon. No roots. 10% carbonate in hard nodules.

E. SOIL:

Orthic Orthustent (1.320). Clay, 15-25%. Saline Series.

Pit: G 222

Location: 14°44' N; 32°55' E; Date: 13/12/62.

SURFACE:

Topography: On a low rather sandy and stony mound, probably an old village site, just S. of El Gibeiliya Village and N. of Sample Area 6.

Cultivation and Land Use: Some rain dura hawashas in distance, but none at site.

Vegetation: Mainly bare, but with scattered Aristida sp. "tagha" and, round the edge of the mound, Acacia tortilis var. raddiana and Acacia nubica.

Surface: Scattered with shell fragments, sand, kankars, and quartz pebbles up to 5 cm. in diameter.

PROFILE DESCRIPTION:

0-84 cm. 7.5YR4/2 Loam. Dry, slightly hard, massive, and readily water absorbent. Some large long snail shells and many rat-holes. Few roots and 4% carbonate concretions at top, rising to 8% at the bottom.

84-95 cm. (at one end of pit only) 10YR3/2 Clay lens. Dry, very hard and massive but with some vertical cracking. Slowly water absorbent. No roots. 8% carbonate concretions.

95-160 cm. 10YR5/3 Loam. Dry, hard, massive and moderately water absorbent. No roots. 5% carbonate concretions, rising to 8% at the bottom.

160-200 cm. 10YR5/4 Clay loam. Dry, very hard and massive though with some sign of cracking. Rather slowly water absorbent. Labourers say large artifact stone with hole through it found in this horizon. No roots. 10% carbonate in hard nodules.

LABORATORY ANALYSES:

Depth (cm.)	Soil Particles %			Incorp. Carbonate %	pH	
	S (.05-2 mm.)	Si (.002-.05 mm.)	C (Under .002 mm.)		Soil Paste	1:5 Soil Suspension
0-84	80	5	15	5.6	7.55	8.35
84-95	46	10	44	4.3	7.50	7.92
95-160	77	5	18	9.7	7.68	8.40
160-200	59	10	31	11.9	7.78	8.44

Depth (cm.)	E.C. mmhos/cm. Sat. Ext.	Total N %	Total Org.C %	TOTAL EXTRACTABLE	
				Phosphate mg/100g. Soil	Potash mg/100g. Soil
0-84	12.75	0.031	0.49	15	1020
84-95	17.10	0.039	0.74	100	2140
95-160	11.00	0.010	0.49	50	770
160-200	8.50	0.017	0.49	51	1420

Depth (cm.)	Soluble Anions in Sat. Ext. meq/litre				Soluble Cations in Sat. Ext. meq/litre			
	CO ₃	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg
0-84	0	43	62	7	28	43	11	35
84-95	0	19.5	105	21	83	82	12	13
95-160	0	28	42	25	37	50	40	28
160-200	1	17	47	5	44	47	23	23

Depth (cm.)	Exchangeable Cations meq/100g. Soil				Exchange Capacity meq/100 g. Soil*
	Na	K	Ca	Mg	
0-84	0.3	8.1	7.0	1.5	16.9
84-95	0.1	20.3	15.7	5.7	41.8
95-160	4.2	9.4	6.0	2.3	22.9
160-200	1.7	17.9	4.0	2.3	25.9

* Summation of cations only.

E.4 SOIL:

Orthic Orthustent (1.320). Clay 15-25%. Non-saline, non-alkali Series.

Pit: C 224

Location: 14°42' N; 32°48' E; Date: 18/12/62

SURFACE:

Topography: Generally flat and level, but the pit is on a sandy patch with trees, which rises very slightly above the plain.

Cultivation and Land Use: Rough cutting and grazing only.

Vegetation: Acacia tortilis var. raddiana, Zizyphus spina-christi; Balanites aegyptiaca forming a parkland with small weeds and Aristida spp. to about 60 cm. high.

Surface: Bare, smooth and rather sandy with a thin skin, and occasional small potholes.

PROFILE DESCRIPTION:

0-70 cm. 10YR3/2 Clay loam. Very slightly moist, firm and massive without cracks. Moderately water absorbent. Few roots. Some quartz grains and 1% carbonate.

70-150 cm. 10YR4/2 Clay loam. Slightly moist, firm, and massive without cracks and quite easy to dig the whole way. Moderately water absorbent. Few roots. 1% carbonate at top, rising to about 2% at the bottom.

150-200 cm. 10YR4/3 Sandy loam. Slightly moist, friable, and crumbling easily. Rapidly water absorbent. Few roots. 1% hard carbonate nodules.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm)	% Si (.05-.002 mm.)	% C (Under .002 mm.)	Incorp. Carbonate %	pH	
					Soil Paste	1:5 Soil Suspension
0-70	69	8	23	0.38	7.45	8.46
70-150	69	5	26	0.57	7.65	8.68
150-200	82	5	13	9.30	7.97	8.80

Depth (cm.)	E.C. mmhos/cm. Sat. Ext.	Total N %	Total Org. C %	TOTAL EXTRACTABLE	
				Phosphate mg/100g. Soil	Potash mg./100g. Soil
0-70	0.50	0.034	0.58	58	660
70-150	0.42	0.036	0.48	44	480
150-200	0.40	0.031	0.39	61	215

Depth (cm.)	Soluble Anions in Sat. Ext. meq./litre				Soluble Cations in Sat. Ext. meq./litre			
	CO ₃	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg
0-70	0	12	5	1	2	1.5	2	3
70-150	0	18	4	0	4	0.2	1	1.5
150-200	0	12	5	1	2.6	0.2	1	2

Depth (cm.)	Exchangeable Cations meq./100 g. Soil				Exchange Capacity meq./100g. Soil*
	Na	K	Ca	Mg	
0-70	0.4	1.1	16.1	4.8	22.4
70-150	0.6	0.75	10.4	8.6	20.4
150-200	0.6	0.4	11.7	1.5	14.2

* By summation only

E.5 SOIL:

Orthic Orthustent (1.320). Clay, 25-35%. Non-saline/Alkaline Soil.

Bore: L 166

Location: 14°36' N; 32°50' E; Date: 9/12/62.

SURFACE:

Topography: Flat

Cultivation and Land Use: Grazing only

Vegetation: Sparse: Grasses only with Aristida spp. dominant.

Surface: Loose porous surface mulch with moderate irregular cracking and abundant Kankars.

PROFILE DESCRIPTION:

0-65 cm. 10YR3/3 Clay to silty clay. Slightly moist, friable, no visible structure due to use of auger, rapidly water absorbent. 2% greyish-blue kankars, traces of shell fragments, and traces of carbonate at bottom of horizon.

65-115 cm. 10YR2/2 Sandy clay. Dry, loose, rapidly water absorbent. Traces of carbonate, shell fragments and greyish-blue Kankars.

115-140 cm. 10YR3/2 Silty clay loam. Dry, loose, rapidly water absorbent. 3% Kankars. Traces of shell fragments.

140-200 cm. 10YR3/4 Sandy clay. Dry, loose, rapidly water absorbent. 5% carbonate, traces of gypsum, 1% kankars. Traces of shell fragments and of manganese concretions.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm.)	% Si (.05-.002 mm.)	% C (Under .002 mm.)	E.C. mmhos/cm. at 25° C. Sat. Ext.	Exch. Na meq./100 g. Soil
0-65	34	36	30	1.50	10.9
65-115				7.50	
115-140				6.75	
140-200				3.70	

E.6 SOIL:

Orthic Orthustent (1.320); Clay, 25-35%. Non-saline, non-alkali Series.

Pit: R 299

Location: 15°14' N; 32°33' E; Date: 30/12/62.

SURFACE:

Topography: Flat and level

Cultivation and Land Use: Burnt Grassland.

Vegetation: None at pit, but Acacia nubica and Capparis decidua nearby.

Surface: Thin loose dust mulch, without cracks or pitting, but with abundant Kankars, and frequent sandstone pieces.

PROFILE DESCRIPTION:

0-36 cm. 10YR3/2-4/2 Loam. Dry, hard, moderate fine subangular blocky with frequent moderate vertical cracks. Rapidly water absorbent. Frequent roots. 5% Kankars. Some quartz and shell fragments.

36-77 cm. 10YR4/1-4/2 Sandy, clay loam. Slightly moist, firm, moderate medium angular blocky with a frequent mosaic of cracks. Moderately water absorbent. Occasional roots. 3% Kankars. 3% Carbonate, and some quartz grains.

77-117 cm. 10YR4/1 Sandy clay loam. Dry, very hard, weak coarse angular blocky tending to massive. Rare vertical cracks. Moderately water absorbent. No roots. 2% Kankars. 5% Carbonate and some quartz.

117-200 cm. 10YR5/2 Loamy sand. Dry, very hard, structureless, massive. No cracks. Rapidly water absorbent. No roots. 1% Kankars. 3% Carbonate. Some quartz.

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm.)	% S1 (.05-.002 mm.)	% C. (Under .002 mm.)	E.C. mmhos/cm. at 25° C Sat. Ext.	Exch. Na meq/100g.	Sol. & Exch. Na meq/100g	pH Paste
0-36	62	8	30	1.8	0.3	4.35	8.5
36-77	60	7	33	1.3	3.1	8.7	8.1
77-117	65	7	28	3.3	1.5	8.35	8.0
117-200	75	5	20	3.1	2.8	5.9	8.4

VERTIC ORTHUSTENT SOIL:

(1.32 - 2) Not separated into family and series, and mapped only as a complex with other soils. Clay mounds.

Pit: C 247

SURFACE:

Topography: Pit was dug on a small windblown clay mound about 10 metres in diameter. The country round about is flat and level.

Cultivation and Land Use: None on the mound. Rough grazing only round about it.

Vegetation: Aristida sp. on the flats and Salvadora persica on the mounds and all round the pit.

Surface: Loose, soft, dusty, uncracked, formed of loose aggregated clay soil.

PROFILE DESCRIPTION:

0-50 cm. 10YR4/2 Clay. Dry, soft, crumbling to fine granular. Readily water absorbent. Some roots. 1% Carbonate flecks.

50-140 cm. 10YR3/3 Clay. Dry, slightly hard and somewhat more compact than horizon above, but crumbling fairly easily to fine granular. Readily water absorbent. Some Salvadora roots and 5% carbonate flecks.

140-200 cm. 7.5YR3/2 Clay. Very slightly moist and very firm - the underlying soil surface onto which the top 140 cm. is windlaid. Moderately water absorbent. Few roots. 4% Kankars and also about 8% carbonate flecks probably washed in from above.

Depth (cm.)	Na	K	Ca	Mg	Exchange Capacity (meq./100g. Soil)
0-50	1.3	1.4	42.6	4.4	48.7
50-140	0.7	0.85	50.0	8.6	60.3
140-200	5.3	1.2	44.0	10.1	50.6

summation only

LABORATORY ANALYSES:

Depth (cm.)	% S (2-.05 mm)	% S1 (.05-.002 mm.)	% C (Under .002 mm.)	Incorp. Carbonate %	PH	
					Soil Paste	1:5 Suspension
0-50	46	13	41	2.8	7.60	7.90
50-140	40	16	44	3.3	7.40	7.90
140-200	33	11	56	7.1	7.70	8.10

Depth (cm.)	E.C. mmhos/cm. Sat. Ext.	Total N %	Total Org.C %	TOTAL EXTRACTABLE	
				Phosphate mg./100g. Soil	Potash mg./100g. Soil
0-50	5.75	0.067	0.75	49	485
50-140	11.0	0.078	0.75	55	570
140-200	5.75	0.042	0.90	49	515

Depth (cm.)	Soluble Anions in Sat. Ext. meq./litre				Soluble Cations in Sat. Ext. meq./litre			
	CO ₃	HCO ₃	Cl	SO ₄	Na	K	Ca	Mg
0-50	1	13	50	22	32	1	53	21
50-140	0	2.1	71	20	47	3	61	43
140-200	0.5	10.3	41	50	75	0.6	20	21

Depth (cm.)	Exchangeable Cations meq./100g. Soil				Exchange Capacity meq./100g. Soil*
	Na	K	Ca	Mg	
0-50	1.3	1.4	41.6	4.4	48.7
50-140	0.7	0.85	50.0	8.6	60.3
140-200	5.3	1.2	44.0	10.1	50.6

* By summation only