

## Micromorphological Studies of some Egyptian Soils.

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### ABSTRACT

The current investigation was carried out to study the micromorphological features of some soils of Egypt represent the main soil orders, Aridisols, Entisols and vertisols. Undisturbed soil samples were collected from seven soil profiles to prepare thin section using standard techniques and examined by polarized microscope. The obtained results can be summarized in the following; the aridisols Typic Haplosalids are characterized by salic horizon, presence of halite crystals in some Vughs Voids and argillasepic plasmic Fabric was found in the lower layers. Entisols, Typic Torripsamment are characterized by single grains of sandy materials, simple packing Voids and the plasmic Fabric is sillasepic. The skeleton grains consist mainly of quartz grains with different shapes of angular and sub angular roundness and usually distributed randomly with feldspars and some opaque minerals. Vertisols, Typic Torrerts are characterized by argillasepic plasmic Fabric Voids are generally decreasing in size with depth and vughs and channels are the dominated Typic. Pedological features observed are residual partially decomposed plant Tissues with humified organic materials in black and brown colors especially in the surface layers. Lime and ferric nodules are found in the subsurface layers. The related descriptions pattern is porophyrosklic.

**Keywords:** Micromorphological, Entisols, Aridisols and Vertisols, Egyptian soils.

### INTRODUCTION

According to the American system of soil classification (soil taxonomy 1975) Vertisols, Aridisols and Entisols are the most widespread soil orders in Egypt. Micromorphological studied of soils are important and significant to understand their genesis and formation.

The current work aims to study the micromorphological characteristics of some soils of Aridisols, Entisols and Vertisols in Egypt

#### Location:

Seven soil profiles representing Aridisols, Entisols and Vertisols were selected (Fig 1) soil profile No1 and 2 from EL-Manzala; profile No3 and 4 Kabrit; profile No 5 Wadi EL-Ryan; profile No 6 Wadi EL-Faregh; soil profile No 7 in EL-Hammam.

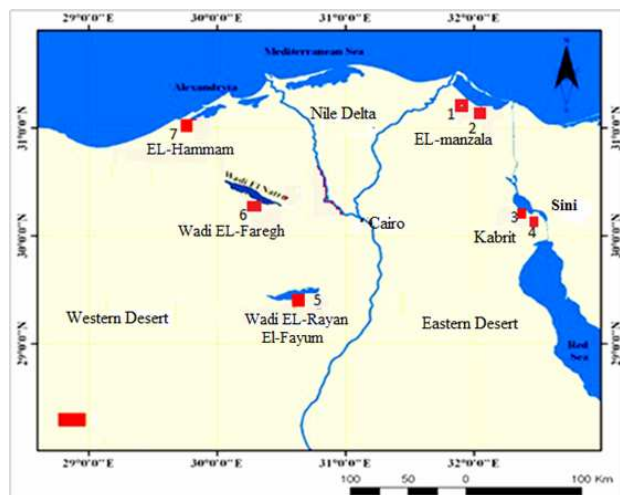


Fig. 1. Locations of the studied profiles.

#### Climate:

The climate in the selected areas is arid characterized by long hot rainless summer, short rainy winter, high evaporation rate and low relative humidity.

### MATERIALS AND METHODS

Seven soil profiles representing the main soil orders in Egypt were studied. They were morphologically described in the field, according to the USDA, (2012).

Soils samples were finely grounded crushed to pass through 2 mm sieve and stored for analyses. Soil physical and chemical analyses were done according to Soil Survey Laboratory methods (USDA,2004).

Undisturbed soil samples were collected from the studied soil profiles to prepare thin sections using the method described by Altemuller (1962). Brewer terminology (1964), was generally used in this work in addition to that of Stoops (1976).

### RESULTS AND DISCUSSION

The morphological characteristic of the studied soil profiles are summarized in Table 1. The physical and chemical properties of the studied soil profiles are in Tables 2 and 3. The obtained results indicate that soil profiles No1 and 2 represent Vertisols order, Torrerts and Haplotorrerts. (according to the soil survey staff 2006), where the soil texture is clay. The clay contents ranged from 46.6% to 41% and structure varied from granular to strong angular blocky.

The calcium carbonate contents ranged between 1.69% and 3.04%. Electrical conductivity values of the saturation extract indicate that the soil profiles 1 and 2 are moderately to low saline. Soil profile No 3 represents Entisols order, fluvents and torrifluvents. The obtained results indicate that they have loamy sand to sandy loam texture, while the soil profile No 4 all layers have sandy loam texture. Calcium carbonate ranged between 0.51 to 16.5%.

Soil profile No 4 represents Aridisols, salids and haplosalids soils. The electrical conductivity values of the saturation extract ranged between 38.31 to 24.15  $\text{dsm}^{-1}$

Soil profile No 5 represents Entisols Psammments and TorriPammments. These soils are characterized as sandy texture, the coarse sand ranged from 70.47 to 64.87% and the clay contents ranged from 5.97 to 4.62%. The structure is massive. The calcium carbonate ranged from 32.12 to 18.59. The data indicate also that the soils are almost natural to slightly alkaline, pH values ranged between 7.7 to 7.8.

Soil profile No 6 represents Entisols, Psammments and Torripsammments. These soils are

characterized as sandy texture. The coarse sand fraction ranged from 69.24 % to 75.03 % , while clay content ranged from 6.14 % to 5.61 % calcium carbonate contents ranged between 1.01 to 1.77% .

Soil profile No7 represents Entisols , Orthent, and Torriorthents These soils are characterized as sandy loam texture and the coarse sand fraction ranged between 45.62% to 48.26% . The organic matter content ranged from 0.21 to 0.27%.

**General conclusions of the micromorphological description.**

Micromorphological descriptions of soil samples from the different horizons of the studied soils are

obtained in Table (4) Descriptions of fabric elements are given below;

**1)-Skeleton grains;**

The mineralogical composition of the skeleton grains of the studied profile consists mainly of quartz grains of different sizes with feldspars mica and some opaque minerals. The grains ranged from rounded to sub rounded and they have a random distributions pattern.

**2)-Plasmic fabric;**

The plasmic fabric in the studied soils is mostly as epic (argillusepic to sill aseptic). The presence of the as epic plasmic fabric may be explained by the fact that these soils are formed by the sedimentation processes and not muds development processes occurred.

**Table 1. Main morphological features of soil profile.**

Profile No.	Location	Depth	Color		Texture	Structure	Consistence			
			Dry	Moist			Dry	Mst	Stk	Pls
1	Elmanzala	0-30	10 YR 5/2	10 YR4/3	C	ABK	Vh	vfi	VS	VP
		30-60	10 YR5/2	10 YR4/3	C	ABK	Vh	vfi	VS	VP
		60-130	10YR6/3	10YR 5/3	CL	MA	Eh	efi	VS	VP
2	Elmanzala	0-25	2.5Y5/1	2.5Y4/2	C	MA	Eh	efi	VS	VP
		25-60	10 YR4/2	10 YR4/3	C	MA	Eh	efi	VS	VP
		60-85	10YR4/1	10YR 3/1	C	MA	Eh	efi	VS	VP
3	Kabrit	0-30	10 YR 6/3	10 YR5/3	LS	SBK	S	fr	SO	PO
		30-50	10 YR6/3	10 YR5/3	LS	SBK	S	fr	SO	PO
		50-140	10 YR6/3	10 YR5/3	S	SGR	Lo	lo	SO	PO
4	Kabrit	0-30	10 Y7/2	10 Y6/2	SL	MA	Sh	fr	SO	PO
		30-85	10 Y7/2	10 Y6/2	SL	MA	Sh	fr	SO	PO
5	Wadi ElRyan	0-25	2.5 Y5/4	2.5 Y4/6	S	SBK	S	fr	SO	PO
		25-60	2.5 Y7/3	2.5 Y6/3	S	MA	S	fr	SO	PO
		60-110	5Y7/3	5Y6/3	S	MA	S	fr	SO	PO
6	Wadi El Faregh	0-25	2.5 Y7/6	10YR5/8	S	MA	Lo	lo	SO	PO
		25-60	2.5 Y8/3	10YR6/6	S	MA	Lo	lo	SO	PO
		60-120	10YR8/4	10YR6/6	S	SGR	Lo	lo	SO	PO
7	ELHam-mam	0-35	10 YR 7/4	10 YR 5/6	LS	MA	H	fi	SS	SP
		35-150	10 YR 7/4	10 YR 5/4	LS	GR	Sh	fi	SS	SP

**Table 2 Some physical and chemical characteristics of the studied soil profiles.**

Profile NO.	Location	Depth/ cm.	Particale size distribution (%)				Tex-ture	Ca CO <sub>3</sub> %	Gypsum %	Particle density (g cm <sup>-3</sup> )	Bulk density (g cm <sup>-3</sup> )
			C. Sand	F. Sand	Silt	Clay					
1	Elmanzala	0 -30	23.52	16.20	15.6	44.68	C	2.7	2.09	2.11	1.7
		30-60	30.9	14.22	13.6	41.28	SC	1.69	2.11	2.1	1.7
		60-130	31.22	15.10	16	37.68	SC	2.2	2.12	2.12	1.6
2	Elmanzala	0-25	20.50	19.22	13.3	46.98	C	2.7	2.2	2.17	1.8
		25-60	25.9	15.20	13.6	45.30	C	1.93	2.17	2.21	1.8
		60-85	27.22	14.10	15	41.68	C	3.04	1.76	2.25	1.7
3	Kabrit	0-30	46.67	35.44	12.12	5.77	LS	1.69	2.54	2.49	1.7
		30-50	47.13	32.67	15.25	4.95	LS	1.35	2.12	2.5	1.7
		50-140	56.84	32.13	7.9	3.13	S	0.51	2.56	2.62	1.6
4	Kabrit	0-30	52.4	13.53	15.52	18.55	SL	0.42	2.45	2.16	1.6
		30-85	56.8	16.11	11.54	15.55	SL	0.17	2.45	2.4	1.5
5	Wadi El-Ryan	0-25	70.47	20.33	3.23	5.97	S	16.5	2.12	2.64	1.5
		25-60	66.54	22.95	5.63	4.88	S	18.59	2.48	2.7	1.5
		60-110	64.87	24.54	5.97	4.62	S	32.12	2.05	2.73	1.4
6	Wadi El-Faregh	0-25	69.24	18.1	6.52	6.14	S	1.77	2.14	2.6	1.6
		25-60	72.3	15.52	6.22	5.96	S	1.35	2.11	2.61	1.6
		60-120	75.03	13.69	5.67	5.61	S	1.01	1.69	2.65	1.4
7	ELHammam	0-35	45.62	34.58	13.18	6.62	LS	35.9	2.47	2.6	1.6
		35-150	48.26	31.47	12.54	7.73	LS	36.9	2.47	2.63	1.5

**Table 3. Some physical and chemical characteristics of the studied soil profiles.**

Profile No.	Location	Depth /cm	s.p %	Soil pH	EC dSm <sup>-1</sup>	Soluble cations meq/L <sup>-1</sup>				Soluble anions meq/L <sup>-1</sup>			O.M%
						Ca <sup>++</sup>	Mg <sup>++</sup>	Na <sup>+</sup>	K <sup>+</sup>	HCO <sub>3</sub> <sup>-</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>-2</sup>	
1	Elmanzala	0-30	87.84	8.1	3.11	12	2	16.03	.93	4	24	2.96	1.85
		30-60	94.19	8.3	3.96	8	4	25.66	.91	2	18	18.57	0.74
2	Elmanzala	60-110	57.54	8.2	3.11	8	4	27	1.2	2	33	4	0.53
		0_25	76.04	7.2	25.60	14	22	218.2	1.1	2	60	193.3	2.46
3	Kabrit	25_60	92.15	7.4	12.94	28	32	67.28	1.2	2	84	42.28	2.32
		60_85	93.44	7.6	38.4	28	38	316.4	1.6	2	91	291	1.90
4	Kabrit	0_30	24.84	8.1	2.9	8	6	7.29	.62	2	1	18.91	0.32
		30_50	24.09	7.9	2.39	16	-	6.68	1.28	2	2	19.96	1.16
5	Wadi ElRyan	50_140	62.06	8.1	1.61	8	-	7.47	.64	2	4	10.11	0.58
		0_30	73.77	8.1	38.31	28	10	342.6	1.53	2	105	275.13	0.48
6	Wadi El Faregh	30_85	84.58	7.9	24.15	24	12	203.2	1.35	2	89	149.55	0.32
		0_25	22.17	7.7	3.55	8	14	11.54	1.03	2	19	13.57	0.74
7	ELHamam	25_60	26.58	7.9	5.42	10	28	13.66	1.54	2	20	31.2	0.48
		60_110	24.12	7.8	2.32	16	28	7.47	.73	2	6	44.2	0.21
6	Wadi El Faregh	0_25	20.09	7.6	38.33	60	54	263.56	4.81	2	327	53.37	0.37
		25_60	24.07	8	3.46	20	6	6.58	1.04	2	8	23.62	0.37
7	ELHamam	60_120	22.07	7.9	3.87	16	8	13.84	.87	2	7	29.71	0.32
		0-35	20.10	7.78	1.63	5	9	1.9	-	3.5	1	11.4	0.27
		35-150	24.07	8.1	2.6	5	5.5	14	1	2	4.8	18.7	0.21

**3)-Voids;**

The studied soils are characterized by the presence of different kinds of voids; simple and compound packing voids; ortho-vughs; channels and planners. Generally, the voids are greater in the surface layers because these layers are disturbed by cultivation presses. The heavy textured soils have plane and channel voids. may be due to the activity of fauna and plant roots, (fig. 2).

**4)-Pedological features;**

The organic materials could be observed in the thin section with dark to brownish colour, calcareous nodules of different size, coarse and fine with sharp boundary, (fig. 3). Some Fe<sup>+</sup> Mn nodules are also detected.

**Table 4. Micromorphological description of the selected soil profiles.**

Soil profile No.(1)	Depth / Cm	Plasmic fabric	Voids	Related distribution	Pedological Features	Basic fabric
Elmanzala	0 -30	argillasepic	Planes, orth-vughs	porophyroskelic	Humified organic materials calcareous nodules and ferruginous nodules	Planer Porophyroskclie Argillasepic S-matrix
	30-60	argillasepic	Interconnected orth-vughs	porophyroskelic	Carbonate and iron nodules	Vughs porophyroskclie argillasepic S-matrix
Elmanzala	0 -25	argillasepic	Channels and some vughs	porophyroskelic	dark humified organic materials and some lime nodules	Channels Porophyroskclie Argillasepic S-matrix
	25-60	argillasepic	orth-vughs	porophyroskelic	Carbonateand some shells fragments	Vughs Porophyroskclie Argillasepic S-matrix
Kabrit	0 -30	sillasepic	interconnected orth-vughs	porophyroskelic	Carbonate nodules and some gypsum crystals	Vughy porophyroskclie Argillasepic S-matrix
	30-50	sillasepic	orth-vughs	Porophyr oskelic	Carbonate nodules and some ferruginous nodules	Vughy Porophyroskclie Argillasepic S-matrix
Kabrit	0-30	sillasepic	Simple packing voids.	porophyroskelic	Carbonate nodules and few shells	Packing voids, Porophyroskclie argillasepic S-matrix
	30-85	sillasepic	Vughs.	porophyroskelic	Iron- nodules and some gypsum crystals	Vughy Porophyroskclie Argillasepic S-matrix
Wadi El-Ryan	0-25	argillasepic	orth-vughs	porophyroskelic	Carbonate nodules and ferruginous nodules	Vughy Porophyroskclie Argillasepic S-matrix
	25-60	sillasepic	orth-vughs	Granular	Carbonate nodules and ferruginous nodules	Granular sillasepic S-matrix
Wadi ElFaregh	0-25	sillasepic	Simple packing voids.	Granular	Carbonate nodules Ironand nodules	packing voids, granular Sillasepic S-matrix
ELHamam	0-35	sillasepic	Vughy	Granular	Carbonate nodules iron nodules and some gypsum crystals	Vughy granular Sillasepic S-matrix
	35-150	sillasepic	Simple packing voids	Granular	Carbonate and nodules iron Nodules	packing voids, Granularsillasepic S-matrix



Fig. 2. Plane voids and argillasepic plasmic Fabric soil profile No2(35.9x)

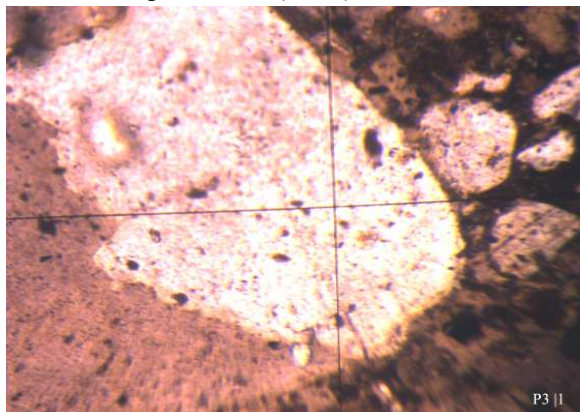


Fig. 3. Lime nodules, soil profile No3 (35.9x)

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## دراسات ميكرومورفولوجية على بعض الاراضى المصرية

محمد احمد مصطفى حماد ، صلاح ابو العنين ، خالد العشرى و امير سامى  
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يهدف هذا البحث الى دراسة الصفات الميكرومورفولوجية لبعض اراضى 3 رتب Aridisols , Entisols و Vertisols فى اراضى جمهورية مصر العربية ويمكن تلخيص النتائج المتحصل عليها فى الاتى : تتميز اراضى الاراضى المدروسة عموما بوجود حبيبات فردية من الرملى والكوارتز والفلسبارات وبعض المعادن المعتمة. توجد فى بعض الاراضى تجمعات موروثية من مادته الاصل على هيئة تجمعات من كربونات الكالسيوم وبعض بلورات الجبس وبعض القواقع خصوصا فى الاراضى ذات مادة الاصل الجيرية. بالنسبة للـ Voids اظهرت الدراسة وجود انواع عديدة من الفراغات ذات الاشكال والاحجام المختلفة لبعضها راجع الى عمليات الخدمة او حركة الكائنات الدقيقة فى معظم الطبقات السطحية توجد بقايا المواد العضوية سوداء اللون المتحللة بدرجات مختلفة وتقل مع العمق.