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ORIGIN , UNIFORMITY AND DEVELOPMENT OF EL-SALHIYA AREA IN THE EASTERN DESERT OF EGYPT

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ABSTRACT: *Six soil profiles were select representing the soils of El-Salhiya project . These soils were studied in order to evaluate their genesis , formation and development .*

Studied grain size distribution and statistical parameters indicate that these soils have mainly moderately to poorly sorted sediments with near symmetrical to fine skewed materials and leptokurtic to mesokurtic pattern . These parameters indicate that these soils are formed under water or both water and wind action.

With regard to the petrographic examination , data show that the light fraction are composed essentially of Quartz . The other associated minerals such as Feldspars are detected in small amounts . On the other hand , heavy minerals are dominated by opaque minerals . The non-opaque minerals are dominated by pyroboles (pyroxenes+amphiboles) and epidote . Zircon , rutile and tourmaline are presence in moderate amounts . Garnet , staurolite , kyanite and silimanite are found in less pronounced amounts.

Moreover , the results indicate that these soils are formed from heterogeneous materials either due to their multiorigin or due to a subsequent variation along the course of sedimentation . Therefore , they are pedologically considerd as weak developed and young .

Key words : *Origin , Uniformity and heavy minerals .*

INTRODUCTION

One of the most stressing problems which face Egypt country is that preserving the food and shelter for the rapidly growing of population . The government of Egypt being aware of such problem , the horizontal agricultural expansion by reclaiming new lands and preserving the required irrigation water are the main track to resolve this problem .

Reclamation the desert lands which extending on the two sides (east and west) of the Nile delta and valley and preserve its required irrigation water are achieved the aim . The eastern desert of Egypt is stretch eastwards of the Nile valley and delta , occupies an area of about 223.000 Km. (21% of the total area of Egypt) .

One of the most important agricultural projects which laying in the eastern desert of Egypt is El-Salhiya project . This project located at north Ismailiya canal and Cairo-Ismailiya agricultural road , it is stretching on the eastwards from Ezbet El-Waburot to Ezbet El-Bakarsha and on the northwards to El-Salhiya village .

Generally , El-Salhiya project occupies an area of 23.000 Feddans and lies between longitudes 31° 39' and 32° 00' East and latitudes 30° 20' and 30° 38' North Fig. (1) .

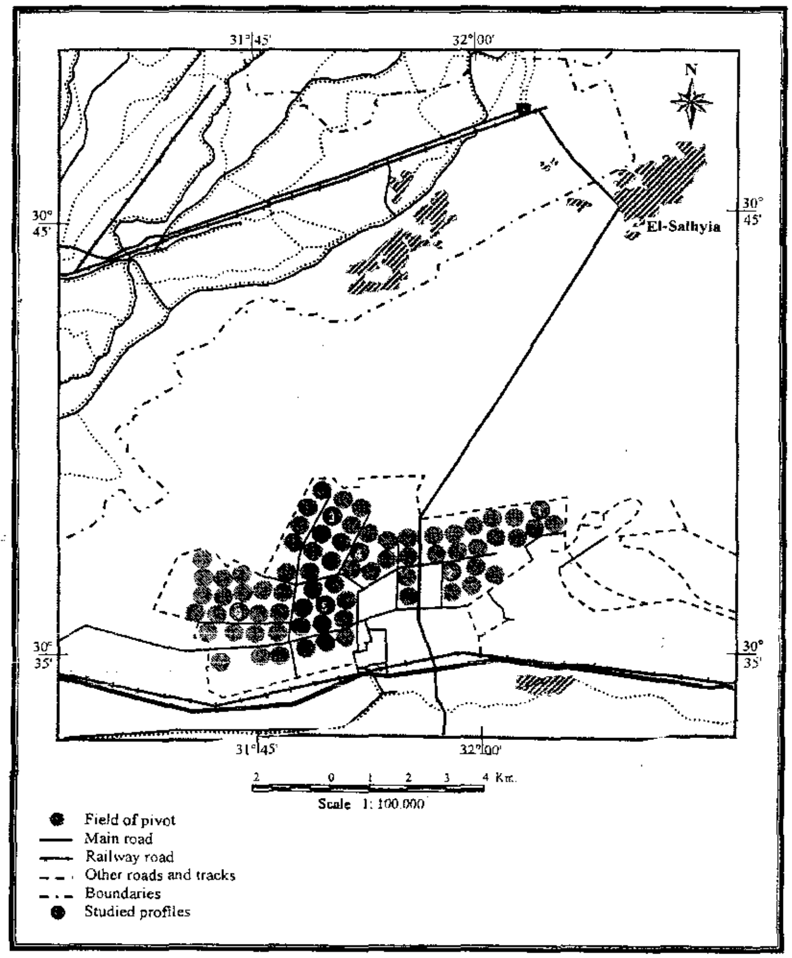

Fig. (1) : Location of the studied soil profiles .

Geology of the studied area :

Acoording to El-Fayoumy (1968) , the studied area essentially occupied by different rocks belonging to Quaternary formation which could be summarized in the following :

The surface deposits of Pleistocene and Holocene ages cover a great portion of the present origin , particularly the area north Ataqa – El-Mokattam plateau , the red sea coastal plain and the old water course . they comprise a variety of continental and epi-continental deposits including the following :

A – Aeolian deposits : Mainly of losses quartzitic sand dunes , hummocks and sheets in El-Khanka sand dunes .

B – Lacustrine deposits : mainly gypsum , alternating with sand and clay beds , dominating the isthmus depression and the inland drainage system .

C – Fluvio-marine deposits : Clay occasionally gypsifferous of ferroginous and /or capped with limestone or sand facies lie around El-Manzala and the red sea coastal plain particularly close to the delta of the old water sourse .

D – Fluviatile deposits : Coarse – textured materials with thin clay beds , doming the Nile terraces and deltaic plain .

E – Old deltaic deposits : Mainly loess of quartizitic sand and flinty pebbles .

Geomorphological features of the studied area :

According to El-Fayoumy (1968) and Abu Al-Izz (1971) , there are two main landforms in this region :

1 - Old deltaic plain : The old deltaic plain occupies much of the almost flat area between the cultivated land and the Suez canal zone . This plain extends presumably further eastwards into Sinai , but its nature was modified by dredging of the Suez canal . The surface slopes regionally from south to north at a rate of 1 m./Km. from an elevation of (+100 m.) to (+20 m.) over a distance of about 80 Km. . Their surface is mostly coverd by desert pavement and barren from natural vegetation except along the course of some drainage channel .

Under this geomorphic unit , two main terraces are distinguish :

1 – Middle terrace : Occupying the area south of El-Tumulate depression with an elevation of (+60 m.) and geographically known as the Tenth of Ramadan district . The component material was deposited under typical deltaic conditions and constitutes a mixture of sediments brought the Nile itself and sediments brought by old rivers dissecting the upland to south .

2 – The lower terrace : Occupying much of the area to the north of El-Tumulate depression with an elevation of (+ 40 m.) and the component materials were deposited under typical deltaic conditions and were

essentially brought by the Nile river from the middle terraces , then reworked into the deposits of the lower terraces .

2 - Wadi El-Tumulat depression : This depression is considered the oldest branch of the Nile and its course can still be followed , whereas the other branches disappeared . Generally , it is shallow elongated depression which extends in an east – west direction for a distance of about 50 Km. with an average width of about 5 Km. and a mean elevation not exceeding +7m. , its northern and southern sides are both surrounded by the old deltaic terraces of early Pleistocene periods .

The aim of the present work is to study the morphological and mineralogical properties , genesis and soil formation of these soils to elucidate its mode of formation , identify minerals within sand subfraction and their relation to soil development as a degree of uniformity of parent material .

MATERIALS AND METHODS

Six soil profiles were selected for this study to represent the new reclaimed project in the eastern side of the Nile delta (El-Salhiya project)

The morphological description for the studied soils was done according to Soil Survey Staff (1993) , Table (1) .

The collected soil samples (total of 18 soil samples) were air-dried and sieved through 2 mm. sieve and subjected to the following analyses :

1 - Particle size distribution was mechanically conducted by sieving (Piper , 1950) . then , the data were statistically evaluated according to Folk and Ward (1957) .

2 - Separation of heavy and light minerals of the sand fraction (0.125 – 0.063mm.) after the ordinary pretreatments (Jackson , 1973) , these minerals has been proved to be the most suitable for the microscopic study (El-Hinnawi , 1966)

The separation of the aforementioned fraction into heavy (specific gravity $< 2.87 g/cm^3$) was conducted by means of the Bromoform . The light and heavy minerals were collected and washed with Alcohol and dried . Mounting of light and heavy fractions was undertaken according to the method of Brewer (1964) in which grains were permanently mounted by Canada Balsam .

The systematic identification of light and heavy minerals was carried out using the polarizing microscope principles of identification reported by Kerr (1959) and Milner (1962) .

The graduate mechanical stage for traverse counts was run as suggested by Krumbien and Pettijohn (1938) and Milner (1962) . An average of 500 grains were counted as a balance between accuracy and time involved . The percents of different groups of heavy and light minerals were calculated .

Table (1) : The main morphological features of the studied soil profiles .

Profile No.	Depth (cm)	Soil colour			Texture class	Soil structure	Consistency			Boundary
		Hue	Value/Chroma				Dry	Moist	Plasticity	
			Dry	Moist						
1	0 - 15	10YR	5/6	4/6	SL	SG	so	s.st	n.pl	CS
	15 - 80	7.5YR	6/6	5/4	LS	SG	so	s.st	s.pl	CS
	80 - 150	7.5YR	6/8	5/6	S	SG	l	n.st	n.pl	
2	0 - 30	10YR	6/6	5/6	SL	SG	so	s.st	s.pl	CW
	30 - 70	10YR	6/8	5/8	SL	SG	so	m.st	m.pl	CS
	70 - 120	10YR	8/6	7/6	SL	SG	so	m.st	m.pl	
3	0 - 35	10YR	6/6	5/6	SL	SG	f	m.st	m.pl	CW
	35 - 70	5YR	5/3	5/2	LS	GR	so	s.st	s.pl	CS
	70 – 115	5YR	7/6	6/6	SL	SG	so	s.st	s.pl	
4	0 - 30	10YR	6/3	5/3	SL	SG	so	s.st	s.pl	CW
	30 - 75	10YR	6/6	5/4	SL	SG	so	s.st	s.pl	CW
	75 - 120	10YR	8/6	6/8	LS	GR	l	s.st	s.pl	
5	0 - 30	10YR	3/3	2/2	SL	SG	so	s.st	s.pl	CW
	30 - 65	10YR	6/6	5/4	LS	GR	so	s.st	s.pl	CW
	65 - 115	10YR	8/6	6/6	SL	SG	so	s.st	s.pl	
6	0 - 40	10YR	6/3	5/2	SL	SG	so	m.st	m.pl	CW
	40 - 90	10YR	5/6	4/6	LS	GR	so	s.st	s.pl	CW
	90 - 120	10YR	5/4	3/4	SL	SG	l	s.st	s.pl	

<u>Soil structure</u> :
GR =Granular
SG =Single grains

<u>Soil texture</u> :
S = Sand
SL = Sandy loam
LS = Loamy sand

<u>Soil consistence</u>:
so = soft
f = firm
l = loose
st = sticky
pl = plastic
s = slightly
m = moderately

<u>Boundary</u>:
CS = Clear smooth
CW = Clear wavy

RESULTS AND DISCUSSION

Folk and Ward (1957) were used the particle size distribution of the soil profiles as a criterium for determining their genesis and uniformity. In this connection , many investigators use cumulative curves characterizing sedimentary materials .

The results of the particle size distribution are plotted on phi curves . Seven accumulative percentages ($ø_5$, $ø_{16}$, $ø_{25}$, $ø_{50}$, $ø_{75}$, $ø_{84}$ and $ø_{95}$) are recorded graphically for each sample (Table 2) . Four statistical parameters (Mz , So , SKI and KG) are calculated using the formula of Folk and Ward (1957) and given in Table (3) . These values indicate that :

1 – According to the values of graphic mean Mz , most of the studied soil samples of the different profiles fall within the medium sand (1.72 ø – 1.93 ø) except those of the uppermost surface layers of profiles Nos. 2 , 3 and 4 which have Mz values indicating fine sand .

2 – The soil samples have moderately and poorly sorted sediments respectively . So values ranged from 0.68 ø to 0.92 ø and 1.18 ø to 1.48 ø , respectively . The poorly sorted sediments suggest that the soils are deposited mainly under water action , while moderately sorted sediments are transportated and deposited under the action of both water and wind.

3 – According to the values of inclusive graphic skewnes (SKI) , most of the studied samples fall within the range of near symmetry (0.01 ø to 0.13 ø) to fine skewed (0.17 ø to 0.27 ø) , respectively .

4 – Regarding the data of graphic Kurtosis (KG) the values ranged between 0.77 ø to 0.89 ø indicating platy Kurtic pattern, 1.12 ø to 1.36 ø (Leptokurtic) and 0.9 ø to 1.04 ø (mesokurtic) .

The platy kurtic pattern indicate that water is the main factor responsible for soil formation , while mesokurtic and leptokurtic pattern indicate the involvement of wind and water action in the formation of soils.

2. Mineralogy of the sand fraction :

2 . 1 . Mineralogy of the light minerals :

Examination of the light fraction (sp. gr. < 2.85 ± 0.02) shows that it is composed almost intirely from quartz mineral which constitutes more than 92 % (Table 4) . Other associated light minerals are mainly plagioclase , orthoclase and microcline .

Quartz is present as single grains in different degree of roundness and extinction . It constitutes 92.19 % to 97.53 % of the light minerals . The lowest value is detected in the surface layer of profile No. 2 , while the highest value is in the top layer of profile No. 6 . Variations throughout the soil depth are not of pronounced magnitude . The dominance of quartz over other light minerals is related to its resistance to weathering during the process of soil formation and sedimentation .

Table (2) : phi values recorded from the cumulative frequency curves of the particle size distribution in studied soil profiles

Profile No.	Depth cm.	Ø5	Ø16	Ø25	Ø50	Ø75	Ø84	Ø95
1	0 - 15	0.0	0.3	1.0	1.9	2.5	3.5	4.1
	15 - 80	0.5	0.6	1.1	1.9	2.4	3.3	3.8
	80 - 150	0.0	0.4	1.0	1.9	2.5	3.5	4.1
2	0 - 30	0.0	0.8	1.2	2.0	3.2	3.6	4.1
	30 - 70	0.7	0.9	1.0	1.9	3.1	3.5	4.1
	70 - 115	0.5	0.5	1.0	1.9	3.1	3.4	4.0
3	0 - 35	0.1	0.7	1.1	1.9	3.1	4.0	4.1
	35 - 70	0.4	0.4	0.9	1.8	2.9	3.4	3.8
	70 - 115	0.5	0.5	0.7	1.8	3.0	3.9	4.0
4	0 - 30	0.8	1.1	1.4	2.0	3.1	3.5	4.1
	30 - 75	0.0	0.6	1.2	2.2	3.3	3.7	4.2
	75 - 120	0.4	0.6	1.0	1.8	2.8	3.3	3.8
5	0 - 30	0.0	0.4	1.0	1.7	2.5	3.1	3.8
	30 - 65	0.2	0.5	1.0	1.8	2.8	3.2	3.7
	65 - 115	0.1	0.3	0.9	1.7	2.7	3.2	3.8
6	0 - 40	0.1	0.7	1.0	1.6	2.7	3.3	4.1
	40 - 90	0.0	0.7	1.0	1.7	2.8	3.2	3.7
	90 - 120	0.1	0.6	0.9	1.8	2.8	3.2	3.7

Table (3) : The statistical size parameters of the studied soil profiles according to Folk & Ward (1957)

Profile No.	Depth cm.	Mean size Mz	Indication	Sorting		Skewness		Kurtosis	
				So	Indication	Ski	Indication	KG	Indication
1	0 - 15	1.90	m.s	1.42	P.s	0.07	N. sym	1.12	L. K.
	15 - 80	1.93	m.s	1.33	P.s	0.04	N. sym	1.36	L. K.
	80 - 150	1.93	m.s	1.40	P.s	0.02	N. sym	1.12	L. K.
2	0 - 30	2.13	f.s	1.34	P.s	0.07	N. sym	0.84	P. K.
	30 - 70	1.93	m.s	1.48	P.s	0.04	N. sym	0.93	M. K.
	70 - 120	1.92	m.s	1.34	P.s	0.01	N. sym	0.90	M. K.
3	0 - 35	2.20	f.s	1.44	P.s	0.12	N. sym	0.83	P. K.
	35 - 70	1.87	m.s	1.39	P.s	0.01	N. sym	0.86	P. K.
	70 - 115	2.02	f.s	0.68	M.s	0.06	N. sym	0.87	P. K.
4	0 - 30	2.20	f.s	1.10	P.s	0.26	F. sk	0.80	P. K.
	30 - 75	2.17	m.s	1.40	P.s	0.04	N. sym	0.82	P. K.
	75 - 120	1.87	m.s	1.18	P.s	0.17	F. sk	0.77	P. K.
5	0 - 30	1.72	m.s	1.25	P.s	0.10	N. sym	1.04	M. K.
	30 - 65	1.83	m.s	1.21	P.s	0.06	N. sym	0.80	P. K.
	65 - 115	1.73	m.s	0.92	M.s	0.06	N. sym	0.89	P. K.
6	0 - 40	1.80	m.s	1.25	P.s	0.27	F. sk	0.95	M. K.
	40 - 90	1.82	m.s	1.20	P.s	0.13	N. sym	0.87	P. K.
	90 - 120	1.85	m.s	1.23	P.s	0.07	N. sym	0.82	P. K.

m.s = Medium sand
f. s = Fine sand
P.s = Poorly sorted
M.s = Moderately sorted
N.sym = Near symmetrical
F.sk = Fine skewed
L. K. = Leptokurtic
M. K. = Mesokurtic
P. K. = Platty Kurtic

Table (4) : Frequency distribution of light minerals in the sand fraction (0.125 - 0.063 mm.) of the studied soil profiles .

Profile No.	Depth cm.	Quartz %	Feldspars %			
			Orthoclase	Plagioclase	Microcline	Total
1	0 - 15	92.68	2.22	4.04	1.06	7.32
	15 - 80	95.40	1.20	2.75	0.63	4.71
	80 - 150	95.05	0.90	3.73	0.32	4.95
2	0 - 30	92.19	1.80	5.10	0.91	7.81
	30 - 70	94.16	0.90	3.74	1.20	5.84
	70 - 120	95.30	0.95	3.43	0.32	4.70
3	0 - 35	94.35	1.60	3.70	0.35	5.65
	35 - 70	95.21	1.25	2.91	0.63	4.79
	70 - 115	95.19	1.35	2.75	0.71	4.81
4	0 - 30	97.25	1.00	1.30	0.45	2.75
	30 - 75	95.50	1.30	2.56	0.64	4.50
	75 - 120	94.65	1.90	2.52	0.93	5.35
5	0 - 30	96.47	1.65	1.47	0.41	3.53
	30 - 65	96.50	0.97	1.90	0.63	3.50
	65 - 115	97.49	0.73	1.35	0.43	2.51
6	0 - 40	97.53	0.57	1.65	0.25	2.47
	40 - 90	96.85	0.80	1.85	0.50	3.15
	90 - 120	97.10	1.10	1.40	0.40	2.90

Feldspars are detected in all the studied soil samples and are composed essentially of plagioclase , orthoclase and microcline . The frequency distribution in the current soils varies from 0.57 % to 2.22 % orthoclase ,1.3% to 4.04 % plagioclase and 0.25 % to 1.2 % microcline .

The general order of abundance is plagioclase > orthoclase > microcline . The presence of feldspars indicates that the weathering effect was not enough to cause a complete alteration of these minerals .

2 . 2 . Heavy minerals :

Heavy minerals are those having high specific gravity > 2.85 . They are usually primary minerals having high occurrence in rocks may be essential or accessory . They usually constitute a small portion of the soil materials . However, their measuring data can be clear and understand genesis and development as well as the age of the soil .

Frequency distribution of the heavy minerals in the studied soil profiles are given in Table (5) . The description and interpretation of these minerals according to their aboundance in studied soils are in the following :

- Opaque minerals :

Opaque minerals such as hematite , ilmenite , lemonite , magnetite and pyrite are characterized by isotropy between cross nicol and are shaded in appearance in plane light , non peleochronic . They are generally subrounded to rounded .

Data in Table (5) show that opaque minerals ranged from 47.4% to 63.6%. The lowest content is detected in the surface layer of profile No. 3 , while the highest one is counted in the subsurface layer of profile No. 1

Depthwise distribution shows an increase with depth in profiles 3 , 4 and 6 and a decrease with depth in profile 2 and no specific pattern in profile Nos. 1 and 5 .

- Non – opaque minerals :

Table (5) reveals that the weatherable minerals of amphiboles , pyroxenes , Kyanite and epidote are the most abundant varieties . The ultrastable minerals of zircon , rutile and tourmaline are present in small amounts , while parametamorphic minerals (garnet , staurolite and silimanite) and the other minerals are in very small amounts . The description of these minerals is given in the following :

* Amphiboles

These minerals are represented mainly by hornblende with few amounts of actinolite and glaucophane . Amphiboles ranged from 20.3 % to 31.4 % . The lowestvalue is found in the subsurface layer of profile No. 5 , and the highest one is in deepest layer of profile No. 4 .

The vertical distribution of amphiboles shows an irregular pattern in all studied profiles except for profiles 3 and 4 which have an increase with depth. In profile No. 2 , there is a decrease distribution with depth .

Table (5) : Frequency distribution of heavy minerals in the sand fraction (0.125 - 0.063 mm.) of the studied soil profiles .

Profile No.	Depth cm.	Opaque minerals %	Non opaque minerals %																			
			Pyroxenes %				Amphiboles %					Parametamorphic				Ultrastable						
			Augite	Hyperthene	Diopside	Total	Hornblende	Glaucophan	Actinolite	Total	Epidote	Garnet	Staurolite	Kyanite	Silimanite	Zircon	Rutile	Tourmaline	Biotite	Monazite	Glouconite	Ziosite
1	0 - 15	60.3	5.8	17.2	1.1	24.1	19.9	1.1	3.8	24.8	13.0	6.5	0.5	3.8	3.2	11.7	4.2	5.8	1.2	0.1	0.3	0.7
	15 - 80	63.6	14.3	17.0	0.8	32.1	23.4	1.3	1.4	26.1	13.9	1.3	1.8	3.6	2.1	8.2	2.7	4.6	1.0	0.9	1.0	0.7
	80 - 150	59.0	8.7	16.0	1.0	25.7	16.6	1.1	3.4	21.1	10.3	1.0	1.8	8.0	0.9	8.0	3.0	4.5	1.4	0.6	1.5	1.4
2	0 - 30	57.6	1.4	16.2	1.2	18.8	25.0	0.5	1.1	26.6	14.1	1.5	2.6	9.4	3.1	9.1	2.0	4.2	0.7	2.4	2.6	2.5
	30 - 70	55.0	5.9	17.4	0.5	23.8	21.6	1.4	3.3	26.3	15.0	5.3	3.3	7.0	2.8	5.4	2.8	3.0	1.6	1.4	1.3	1.3
	70 - 120	51.3	9.2	12.7	1.6	23.5	17.7	1.4	6.4	25.5	9.0	4.6	1.2	10.8	1.6	9.2	2.6	4.8	2.8	1.2	1.6	1.6
3	0 - 35	47.4	7.1	13.3	1.2	21.6	18.9	1.1	6.8	26.8	9.1	7.0	2.6	8.6	4.0	5.8	1.6	3.3	0.8	2.3	2.9	2.8
	35 - 70	48.2	6.1	16.3	0.7	23.1	19.1	1.3	7.4	27.8	9.6	4.6	1.5	9.8	3.2	6.3	2.2	3.8	1.5	2.4	2.5	2.3
	70 - 115	50.7	5.4	12.0	2.5	19.9	20.0	2.0	7.6	29.6	9.2	5.2	1.0	11.7	3.2	7.4	1.2	3.5	1.6	1.1	2.8	2.6
4	0 - 30	51.4	5.5	12.6	1.9	20.0	14.0	4.0	7.2	25.2	11.6	5.5	2.5	7.4	2.7	9.2	4.5	4.0	1.5	1.3	2.5	2.3
	30 - 75	52.0	4.6	13.8	0.5	18.9	19.0	2.9	7.5	29.0	9.8	8.9	3.1	8.6	2.8	5.3	1.7	3.7	1.2	2.6	2.6	1.8
	75 - 120	52.4	4.8	14.6	0.9	20.3	22.2	2.9	6.3	31.4	13.0	7.2	2.2	10.9	1.3	5.0	0.8	2.0	0.8	1.2	2.1	2.2
5	0 - 30	48.0	8.0	14.5	1.9	24.4	17.1	3.3	7.9	28.3	12.9	6.6	1.0	8.0	1.8	5.5	1.0	2.8	0.8	2.7	2.8	1.7
	30 - 65	47.8	8.3	13.4	1.5	23.2	14.0	2.1	4.2	20.3	13.5	6.2	1.1	12.0	3.6	6.6	2.2	3.1	1.5	2.2	2.1	2.5
	65 - 115	50.5	6.3	15.0	1.3	22.6	19.1	5.0	6.8	30.9	12.4	4.5	2.2	9.0	1.2	6.8	0.8	2.5	1.1	0.9	2.1	3.5
6	0 - 40	47.6	6.9	10.7	0.6	18.2	17.1	3.5	6.2	26.8	9.1	3.6	2.5	14.0	5.0	7.4	2.5	2.4	0.7	2.5	2.7	2.6
	40 - 90	49.6	6.5	13.9	1.7	22.1	20.2	1.6	6.0	27.8	14.1	6.3	1.4	10.3	2.6	7.3	1.0	2.2	0.5	1.2	2.1	1.1
	90 - 120	49.9	6.2	10.7	3.0	19.9	17.7	2.8	6.6	27.1	10.8	6.9	2.4	10.2	2.2	7.3	1.1	3.2	2.2	1.6	3.7	1.5

* Pyroxenes

These group are the second aboundant of non-opaque minerals . The most common of them is hyperthene , followed by augite and the lowest is diopside . Their presence in the current study ranges from 18.2 % to 32.1 % of the non-opaque minerals with an irregular distribution pattern with depth . The lowest value is present in the surface layer of profile No. 6 , whereas the highest one is associated with the subsurface layer of profile No. 1 .

These results may be attributed to the variation in parent materials , sedimentation regimes and environments of the studied soil materials .

* Epidote

Epidote content ranges from 9.0 % to 15.0 % of the non-opaque minerals . The highest and lowest values are found in the middle and deepest layers of profile No. 2 , respectively . There are no specific distribution pattern in the studied soil profiles representing the soils of El-Salhiya project .

- Parametamorphic minerals :

This group of minerals include the minerals of kyanite > garnet > silimanite > staurolite according to their frequency distribution in studied soils .

* Garnet

This mineral have values between 1.3 % and 10.0 % of the non-opaque minerals . The lowest content was in the subsurface layer of profile No. 1 and the highest one was in the deepest layer of the same profile .

* Staurolite

This mineral forms 0.5 % to 3.3 % of the non – opaque minerals . The lowest content is detected in the surface layer of profile No. 1 , while the highest content is associated with the subsurface layer of profile No. 2

It exhibits an irregular pattern of depthwise distribution in the studied profiles , except for profile No. 1 where it tends to increase with depth .

* Kyanite

This mineral have values between 3.6 % and 14.0 % of the non-opaque minerals . The lowest content is detected in the subsurface layer of profile No. 1 , while the highest content is recorded in the surface layer of profile No. 6 .

The distribution of kyanite haven't any specific pattern with depth , except for the soils of profiles Nos.3 and 4 where its content tends to increase with depth .

* Silimanite

This mineral constitutes 0.9 % to 5.0 % of the non-opaque minerals . The lowest content is detected in the deepest layer of profile No. 1 , while the highest content is associated with the surface layer of profile No. 6 .

- Ultrastable minerals :

This group are the most ultra-stable minerals including zircon , rutile and tourmaline .

*** Zircon**

This mineral ranges from 5.0 % to 11.7 % of the non – opaque minerals . The lowest contents is detected in the deepest layer of profile No. 4 , while the highest content is associated with the surface layer of profile No.1 . Zircon tends to decrease with depth . This reflects the multi-origin of parent material as well as well its multi-depositional regime .

*** Rutile**

This mineral forms 0.8 % to 4.5 % of the non – opaque minerals with an irregular distribution pattern with depth . Their lowest value is shown in the deepest layer of profile No. 5 , whereas the highest one is in the surface layer of profile No.4 .

The apparent discontinuity in the mineral distribution could be refer to multi-origin parent material as well as different depositional regimes of the studied soils .

*** Tourmaline**

This mineral is the second abundant ultrastable minerals and ranges from 2.0 % to 5.8 % of the non-opaque minerals . Its content shows an irregular distribution with depth .

- Other non-opaque minerals :

This group is represented by biotite , monazite , glauconite and ziosite minerals .

Biotite : This mineral ranged from 0.5 % to 2.8 % of the non-opaque minerals . The lowest value is recorded in the deepest layer of profile No. 5 , while the highest value is detected in the deepest layer of profile No. 2 .

Monazite : This mineral ranged from 0.1 % to 2.7 % of the non-opaque minerals with an irregular distribution pattern with depth . The lowest value is recorded in the top layer of profile No. 1 , while the highest value is detected in the top layer of profile No. 5 .

Glauconite : Constitutes 0.3 % to 3.7 % of the non-opaque minerals with an irregular distribution pattern with depth .

Ziosite : This mineral ranged from 0.7 % to 3.7 % of the non-opaque minerals . The lowest content is detected in the upper most surface layer of profile No. 1 , while the highest content is found in the deepest layer of profile No. 5 .

- Assessment of soil uniformity on basis of mineralogy of the sand fractions :

Mineral analysis is great importance in evaluating the origin uniformity , weathering and development of soil profile .

Variation in heavy mineral species and their frequency distribution in different soil layers help in studying soil genesis . Brewer (1964) and Mitchell (1975) mentioned that weathering would load to a decrease in distribution frequency of less resistant minerals .

Pyroxenes , amphiboles , epidote and garnet have little or no effect on the frequency of the more resistant minerals of zircone , rutile and tourmaline .

El-Demerdashe *et al.* (1979) , Hassona *et al.* (1995) , Hassona (1999) and Abdel Razik (2005) reported assessment of evaluating profile uniformity and development in some Egyptian soils using their mineralogy .

In the present investigation , uniformity of soils are assessed using different parameters . These include frequency distribution of index minerals (zircon , rutile and tourmaline) , and the ratios of zircon with each of rutile , tourmaline and both for the different layers within the soil profile .

Other parameters used to evaluate the soil profile uniformity are those related to resistant minerals. Their ratios are call " weathering ratios "

There are three weathering ratios as follows :

Wr_1 = Pyroxenes + Amphiboles / Zircon + Tourmaline

Wr_2 = Horblende / Zircon + Tourmaline

Wr_3 = Biotite / Zircon + Tourmaline

Data of the uniformity ratios for the resistant minerals and weathering ratios are given in Table (6) and Figures (2 and 3) . Data clear that the soil materials of El-Salhiya project are stratified and heterogeneous as reveald by the abrupt change in the distribution of the index minerals and various ratios of their layers .

This confirms the conclusion that the soils have discontinuity of their parent materials .

Also since the soils have rather high contents of pyroboles than zircon they still weak developed and are young from the pedological point of view .

Table (6) : Uniformity and Weathering ratios of the studied soil profiles .

Profile No.	Depth cm.	Uniformity ratios			Weathering ratios		
		Zr / T	Zr / R	Zr / R+T	* $\frac{P+A}{Zr+T}$	** $\frac{A}{Zr+T}$	*** $\frac{B}{Zr+T}$
1	0 - 15	2.02	2.78	1.17	2.79	0.98	0.07
	15 - 80	1.78	3.04	1.12	4.55	1.33	0.08
	80 - 150	1.78	2.67	1.07	3.74	1.28	0.27
2	0 - 30	2.17	4.55	1.47	3.41	1.22	0.05
	30 - 70	1.80	1.93	0.93	5.96	2.07	0.19
	70 - 120	1.92	3.54	1.24	3.50	0.91	0.20
3	0 - 35	1.76	3.63	1.18	2.32	1.46	0.09
	35 - 70	1.66	2.86	1.05	5.04	1.61	0.15
	70 - 115	2.11	6.17	1.57	4.54	1.10	0.15
4	0 - 30	2.30	2.04	1.08	3.42	0.95	0.11
	30 - 75	1.43	3.12	0.98	5.32	1.53	0.13
	75 - 120	2.50	6.25	1.78	7.40	2.08	0.11
5	0 - 30	1.96	5.50	1.45	6.35	1.75	0.10
	30 - 65	2.13	3.00	1.25	4.48	1.38	0.15
	65 - 115	2.72	8.50	2.06	5.75	1.61	0.12
6	0 - 40	3.08	2.96	1.51	4.60	1.09	0.07
	40 - 90	3.32	7.30	2.28	5.25	1.46	0.05
	90 - 120	2.28	6.64	1.70	4.48	1.02	0.21

Z = Zircon **P = Pyroxenes** * **Wr_1**
T = Tourmaline **A = Amphiboles** ** **Wr_2**
R = Rutile **H = Hornblende** *** **Wr_2**
B = Biotite

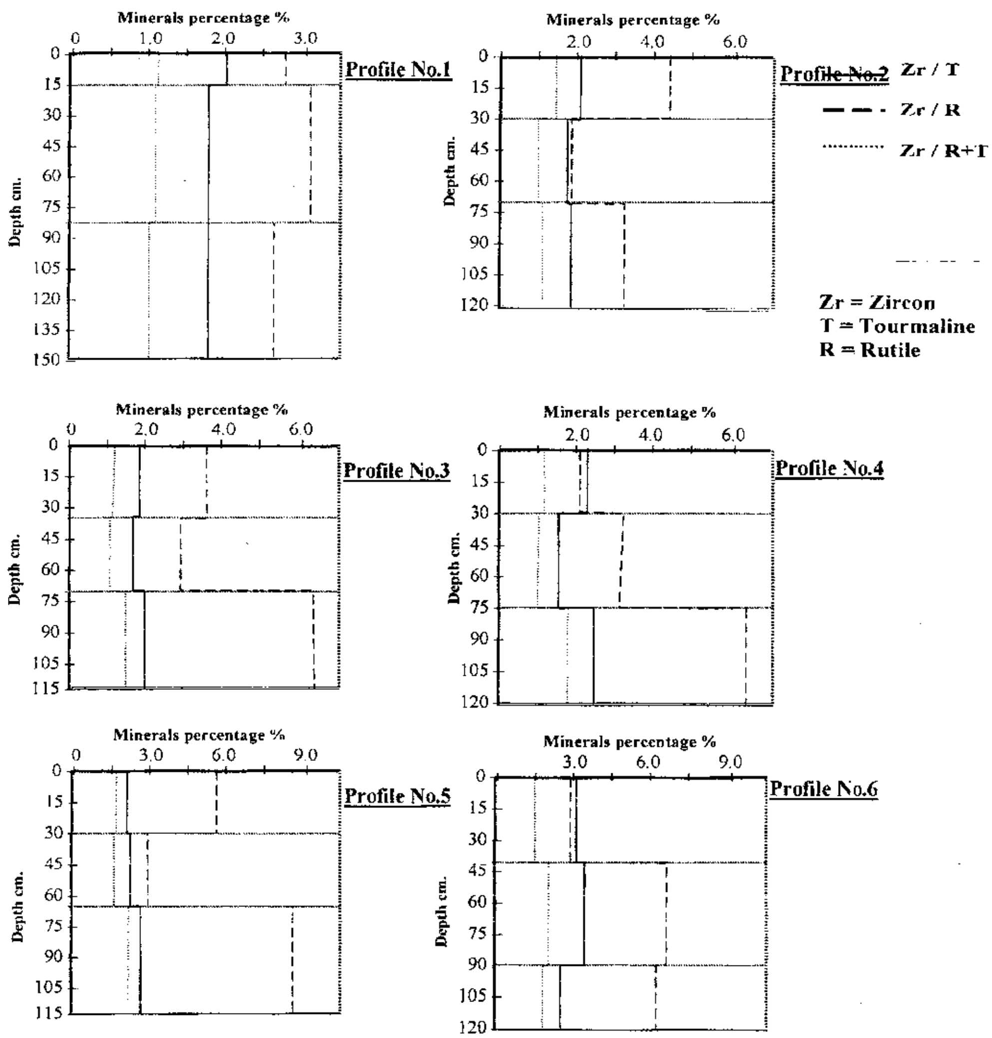

Fig . (2) : Depthwise distribution pattern of uniformity ratios in the studied soil profiles .

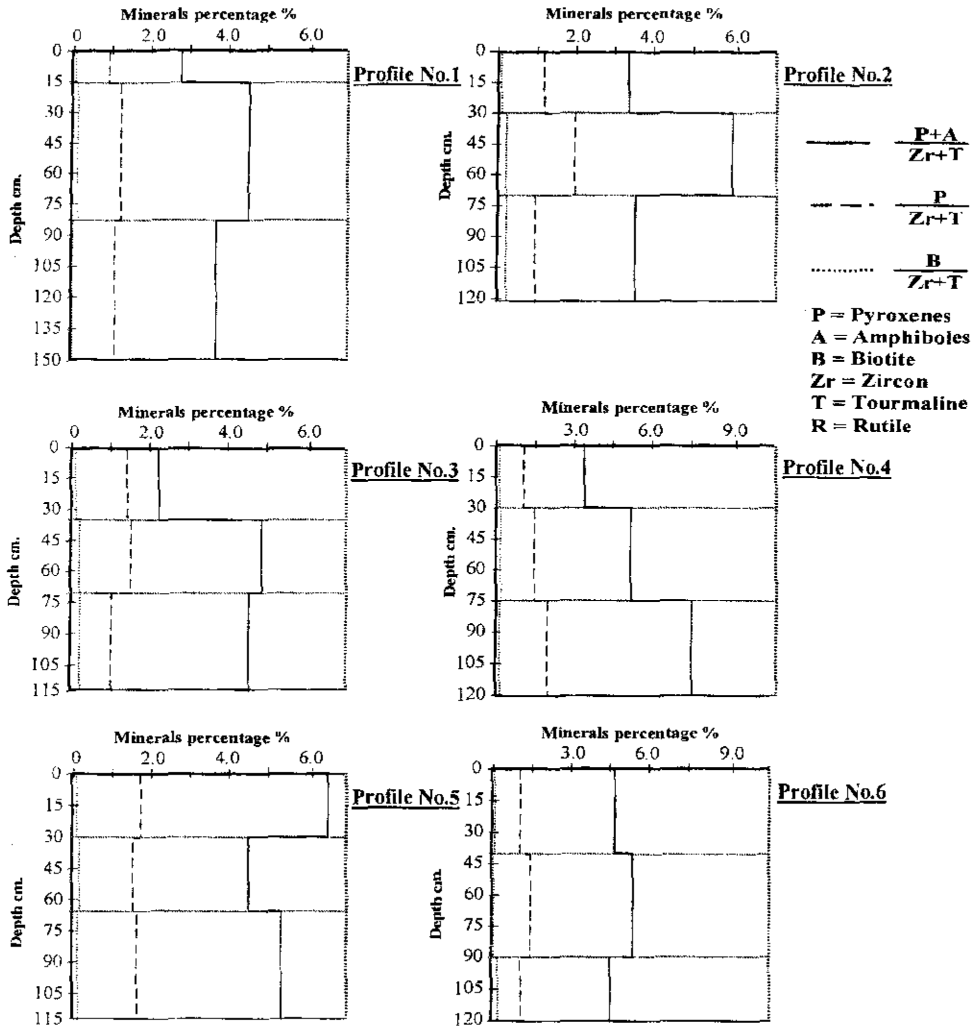

Fig . (3) : Depthwise distribution pattern of weathering ratios in the studied soil profiles .

REFERENCES

Abdel Razik , S. A. (2005). Origin , mode of formation and uniformity of some soils in the north wesrern coast of Egypt . Egypt . J. of App. Sci. . 20 (7) : 377 .

Abu Al-Izz (1971) . Land form of Egypt . The American university in Cairo Press , Egypt .

Brewer , R. (1964). " Fabric and mineral Analysis of soils " John Wiley and Sons , Inc . , NewYork , N.Y.,USA 470PP .

El-Demerdashe , S. , A. A. Elwan and F. M. Abdou (1979). " Mineralogy of the sand fraction of the soil north of wadi El-Natrun of the A.R.E. " , Desert Inst. Bull 29 (1) , 147 .

El-Fayoumy , L.F. (1968). " Geology of ground water supply in the region of the Nile delta " ph.D. Thesis , Fac. Of Sci. , Cairo Univ. , Egypt .

El-Hinnawie, E. E. (1966). " Methods in chemical and mineral microscopy " Elsevier publ . Co. , Amest , the Netherlands .

Folk, R. L. and W. C. A. , Ward , 1957 . " Brazos River bar , a study in the significance of grain size parameters " . J .Sed . Petrol . 27 : 3 – 8 , 3-26 .

Hassona , H. H. ; M. M. , Fahim ; M. E. , El-Hemely and M. , Abdel Mottaleb , 1995. " Mineralogical composition of the sand fraction of soils of El-Nobariya area and its relation to soil genesis " . Egypt . J. Soil Sci . 35 , No. 1 : 33-53 .

Hassona , H. H. , 1999. " Pedological evaluation of the soil of El-kharga Oasis based on the mineralogical composition of the sand fraction " . J. Agric. Sci. Mansoura univ. 24 (6) : 3167 – 3177 .

Jackson , M. I. , 1973. "Soil Chemical Analysis" Prentice – Hall , Inc . Englewood Cliffs , N.J. , U.S.A. .

Kerr , P. F. (1959). " Optical Mineralogy " Mc . Graw – Hill Book Company , Inc, New York , Toronto , London

Krumbien, W. C., and F. J. Pettijohn (1938). "Manual of Sedimentary Petrography " Appleton – Century Co New York , U.S.A. .

Milner, H. B. (1962). " Sedimentary Petrography " (Vol . I and II) George Allen and Unwin Ltd , Museium street , London

Mitchell , W. A. (1975) . "Soil components " . John E . Gieseking , New York , Amercan Assoc. Pet. Geologists. , 41 : No. , 9 , P , 1952 .

Piper , C. S. (1950) . " Soil and plant analysis " Inter . Science Pupl. – Inc. New york , U.S.A. .

Soil Survey Staff , (1993). " Soil Survey Manual " . U . S . Dept . Agri . , Handbook No.18 Government printing office , Washington , D . C .

أصل و تجانس و مدى تطور أراضى الصالحية فى صحراء مصر الشرقية

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الملخص العربي

أجرى هذا البحث على أراضى مشروع الصالحية بغرض التعرف على أصل و تجانس و مدى تطور أراضى هذا المشروع ، و تبعا لذلك اختير عدد ستة قطاعات أرضية لتمثل أراضى المشروع .

و قد أوضحت دراسة التوزيع الحجمى لحبيبات التربة و قيم المتغيرات الأحصائية لها الى انها متوسطة الى فقيرة فى تجانسها و خشنة الأنجراف كما تشير قيم ال **Sorting** لهذه الأراضى .

و قد أستنتج من هذا ان هذه الأراضى قد تكونت تحت الظروف المائية أو المائية و الهوائية معا و أن الماء و الهواء هما العامل الرئيسى المسئول عن نقل و ترسيب هذه الأراضى

كذالك أوضح الفحص البتروجرافى للرمل الناعم الى أن المعادن الخفيفة تميزت بسيادة معدن الكوارتز مع وجود نسبة قليلة من معادن الفلسبارات – أما المعادن الغير معتمة فقد تميزت بسيادة معادن البيروبولز (بيروكسين + أمفيبول) و الكيانيت و الأبيدوت أما معادن الزركون و التورمالين و الروتيل فقد وجدت بكميات متوسطة . كذالك وجدت معادن الجارنت و الأشتروليت و الكيانيت و السليمنيت و لكن بكميات قليلة .

و بدراسة مدى تجانس و تطور القطاعات الأرضية تحت الدراسة أن هذه الأراضى غير متجانسة و يرجع هذا الى تعدد مواد الأصل المكونة لها أو أختلاف ظروف الترسيب كما ان هذه الأراضى ضعيفة التطور و حديثة من الوجهة البيدولوجية .