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MINERALOGICAL COMPOSITION OF THE CLAY FRACTION, IN RELATION TO LITHOLOGY, TOPOGRAPHY AND DEPOSITIONAL ENVIRONMENTS IN THE NORTHERN COASTAL ZONE OF THE NILE DELTA

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ABSTRACT: Seven soil profiles representing four geomorphological units alluvial deposits, fluvio locustrine deposits, coastal barrier plains and coastal sand dunes were selected morphologically described and subjected to mineralogical analysis of the clay fractions, in relation to lithology, topography and depositional environments in the northern coastal zone of the Nile delta.

The results of the research can be summarized as follows:

1. Soil salinity (EC): between 0.9and 60.4 ds/m and it was very high in the coastal barrier plains.
2. The cotion exchange capacity (CEC) varied between 2 and 40 meq/100g soils, it indicated a high rate in the alluvial deposits land and a lowest rate in the costal sand dunes.
3. Total $CaCO_3$: between 0.8 and 20.1%, the highest increase was in the costal barrier plains.
4. Soil texture: according to the accurate study for the fraction composition; the soil texture in the studied area is generally sand to clay.
5. The mineralogical composition of the clay fraction:

The analysis by x-ray showed that there is some similarity in the mineralogical composition of the clay where the montomorillonite, kaolinite, hydrousmica, virmiculite were the dominate minerals in addition to some qurtiz, fildisbar, palygorskite and calcite.

Data revealed that the clay fraction of soils of Nile alluvial deposits is dominated by montmorillonite, kaolinite which are mostly inherited from parent materials (alluvium). Regarding the soils of fluvio-lacuctrine are sandy clay loam which contain some calcareous and dominated by the montmorillonite, hydrousmica, kaolinite, palygroskite. These soils come from the original matter (fluvio–lacustrine deposits). Concerning the soils of coastal barrier plains are loamy sand which contain a high percentage of $CaCO_3$ and so salts and dominated by the montmorullonite, mica, kaolinite, vermicolite, palygroskite, these deposits come from the pedogenic or inherited from parent origin sediments derived wholly or in part, from lacustrine or calcareous. On the other hand the soils of coastal sand dunes are loamy sand and contain a middle percentage of $CaCO_3$ and salts, these soils formed by aeolain and marine deposits.

6. Regarding the topography:

The effect of the low topography appeared by the effect of the salinity and the marine nature of the depositions on the clay minerals which exist specially in the coastal barrier plains where these conditions helped to turn original clay minerals to mixed layers as a transformational stage as result of the dominate chemical desertation. Also, the effect of the high topography appeared in the sand dunes movement and the creping of sands from north to south also played an important role in the distribution of clay minerals in the studied area.

7. The dominateal depositional conditions in the area.

The depositional environments which formed the studied area contain the soils of Nile alluvial plains formed by Nile deposits materials, But the soils of fluvio lacustrine, thought derived from two different parent sediments, namely lacustrine and alluvium. While the soils of coast barrier plains formed by the sea, and so the soils of coastal sand dunes formed by the aeolian and marine deposits.

Key words: Fluvio locustrine deposits, X- ray diffraction, mineralogical,lithology, topography and coastal zone.

INTRODUCTION

The studied area is located in the northern part of the Nile Delta region. It lies between longitudes 30° 20' - 31° 50' east and 31° 10' -31° 50' latitude in the north. It extends 170km along the coast of the Mediterranean sea from Damietta branch in the east of Idku lake in the west with width of 60km inland from the coastal shore line in the north to the old cultivated lands in the south localities (fig. 1).

The area under study has an elevation that varies from about 1m below the sea level (profiles Nos. 4 and 5) to about 5m above sea level (profies Nos. 6 and 7).

The topography is mostly flat to undulating. Abo El-Izz (1971) found that the elevation of Damitta branch is higher than that on the western side i.e Rosetta branch, approximately 2m. Serag El-Din (1989) Indicated that the topography of the triangular Delta region is easily distinguished and slopes from 17 m. a. s. l. at EL-Kanater to the zero level at the Mediterranean shore line. The northern half of the Delta region has an elevation less than 5m, a.s.l. while the southern half has elevation ranging from 5 to 17m.a.s.l. The land surface of the central northern part of the Delta slopes directly to the north .On both sides of the Delta central part, i.e,east and to the northern west, respectively. The soils of the northern zone of the Nile Delta is characterized by the presence of four main geomorphic unites (1) Nile alluvial deposits (2) fluvio-lacustrine deposits (3) coastal barrier plains, (4) coastal sand dunes. (F.A.O studies, 1963)

Barakat *and Imam* (1973) and Mansour, (1983). The examined soils are mainly of fine and medium to coarse textured, Hanna and Magd (1979) reported that the soils of the coastal zone in the north of Nile Delta is composed predominantly of sandy soils and sandy dunes. The soils which are located on the transition zone between the fluvio-lacustrine deposits and the coastal soils, contain relatively higher percentages of clay and silt.

Soil physical and chemical properties is considered as the resultant of changes in the mineralogical composition of the clay fraction. Soil mineralogical composition of the Nile Delta have been reported by many investigators Hamdi and Naga (1952) indicate that illite is dominating the clay fraction (2um)of the Nile mud beside other minerals. Hashad and Mady (1961) found from D.T.A studies on the clay fractions that small amounts of smectite accompanied the dominate 10 A° minerals (illite).

They reported that the alkaline earth ions which were carried out by the Nile water under poor drainage condition may be the cause of the increasing semectite contents.

EL-Gabaly and Khadr (1962), studied the clay fraction (1 um) separated from the soils of the middle and northern Delta parts and concluded that semectite is the predominate mineral with smaller proportions of kaolinite and illite.

The aime of the current investigation is to identify the clay mineral composition of some soils occupying in the north coast of Nile Delta and its relation to topography, lithology, depositional environments.

MATERIALS AND METHODS

Seven soils profiles represented four geomorphic features of the north coast Delta region , Egypt were investigated in this study .Soils profiles Nos 1and 2represented Nile alluvial deposits, soil profileNo .3 represnted fluvio-lacustrine deposits, profiles Nos. 4and 5represented coastal barrier plains and Nos. 6 and 7 coastal sand dunes.

Soil profiles were dug to a depth of water tableand described carefully according to (FAO, 1990). Fourteen soils samples were collected from soil profiles representing the soils of the different geomorphic units, localites (Fig.1).

Physical and Chemical analysis of soil samples were carried out according to Piper, (1950), Richards, (1954) and Jackson, (1962).

The clay fraction (<2um) were separated using the piptte method .These methods described by Jackson, (1964). X-ray differaction patterns of the Mg-saturated , air dried , glycolated and K-heated at 550°c were obtained X-ray diffractograms figers 3 and 4 are used for the identification of clay and accessory minerals following the criteria established by whitting and Jacson, (1995), Brown, (1961) and Dixon *et al.*, (1977).

RESULTS AND DISCUSSION

1. Morphological features in the field:

The morphological description of the studied soils, table (1)

2. Physical and chemical properties of the studied soils:

The particle size analysis of the studied soils ,table (2)showed that soil texture of the Nile alluvial deposits soils is clayey. Whereas, the clay contents of the studied soil profiles Nos .1 and 2 ranged from 50.0 to 64.0%, Table (2). The contents of the clay for these studied alluvial plain soils are due to the environmental deposit system of the clay on the low relief of these studied soils. The electrical conductivity values (EC) for these studied Nile alluvial plain soils are ranged from 0.9 to 2.0 dS/m, Table (2). Therefore these soils are considered non saline according to soils survey staff (1990).The cation exchange Capacity (CEC)ranged from 29.9to 40.0 meq/100 g soils , table (2).These high values of CEC are due to their high contents of clay and indicate the high fertility of these studied soils. The sub angular blocky structure of the studied soils is related to the high shrink-swell process of these clayey texture soils. According to Soil Survey Staff, (1990), these soils could be classified as vertic torrifluvent .

The soil texture of the fluvio –lacustrine soils, soils profile No.3 is loamy to sandy clay loam , tables 1 and 2. Their weak subangular blocky structure is due to their moderate clay contents (20.0 -22.5%) table (2). The EC values for the surface layers ranged from 4.0 to 6.2 dS/m which is considered as very slightly saline to moderate saline according to Soil Survey Staff (1990) whereas, the subsurface layer which had EC values of 12.5ds/m is considered as moderately saline soils. The EC values for these studied fluvio-lacustrine deposits soils is increased with soil depth, which is due to leaching process. The moderate values of CEC, Table (2) which is ranged from 13.0 to 15.0me/100g soil is related to their moderate contents of clay. According to Soil Survey Staff, (1990). These studied fluvio-lacustrine soils could be classified as typic torrifluventes.

The soil texture of studied soil profile Nos. 4 and 5 which represented the coastal barrier plains is sandy laom to sandy clay loam, Tables 1 and 2. Their clay contents ranged from 13.5to 23%the occurrence of weak structure for these studied soils, Table (1) is due to these relatively moderate contents of clay. Also, the low CEC values which ranged from 7 to 13.0 me/100g soil is due to their moderate clay contents.

The EC values for studied coastal plain soils were high reached from 23.1 to 60.4 dS/m, soil profil Nos. 4 and 5 Table (2), which considers a strongly saline according to Soil Survey Staff (1990). Therefor, the soil profile No. 4 contained a salic horizon through the whole soil profile No. 4 and the sub surface of soil profile No 5 due to salinization process, also both studied soil profiles Nos. 4 and 5 of these coastal plain soils contained a calcic horizon at the bottom layers due to their contens of calcium carbonate which were 15.5 and 20.1%, respectively due to the occurrence of calcification process. Therefore, these studied coastal plain soils could be classified as Calcic Haplosalids, according to Soil Survey Staff, (1990).

On the other hand, the studied dunes soils ,profiles Nos. 6 and 7 have coarse textured class which are sandy to loamy sand, tables Nos. 1and 2 their sand contents ranged from 81.0 to 95.0%.Their low CEC values ranged from 2.0 to 7.0 me/100g soil are due to their high contents of sand and low contents of clay , table (2).The EC values for these studied dunes, soil profiles Nos. 6and 7 ranged from 4.6 to 7.4 dS/m at the surface layers and 13.2 to 15.6 at the bottom layers which were considered as saline and moderately saline at surface and bottom layers, respectively according to Soil Survey Staff, (1990), also these studied dunes soils could be classified as torriorthents according to Soil Survey Staff (1990).

3.Mineralogical composition of the studied soils

As shown in the X-ray diffraction for the studied soils Figs. (2,3) and the semi-quantitative analysis of clay minerals, Table (3) the studied soils profiles Nos. 1 and 2 which represent the Nile alluvial deposits are dominated with semectite minerals (montmorillonite) which constitute 35. 8 - 40.0%, followed by kaolinite minerals 14.0-21.3% mica 12.1-14.0% and vermiculite 7.7-9.6%. This order of composition indicates that these minerals are inherited from the Nile deposits .Also related to the environmental deposition system of the plain geomorphic features which is a relatively low surface. The mineralogical composition of the studied soils developed an fluvio-lacustrine deposits, Fig. (2) and Table (3), soil profile No.3 indicated that montmorillonite minerals are the majority 24.5-

34% wherease the mica minerals 19.1 -21.7% vermiculite 13.5-17. 3% and kaolinite 12.5 -15.3 are the minority, also the intermixed layer minerals constitute an announcement quantity at the subsurface layer 7.3% and calcite 5.7 .This is related to their inherited from the fluvio–lacustrine materials. On the other hand, the mineralogical composition of the coastal barrier plains dominated by montmorillonite 22.7-24.8% followed by intermixed layers minerals 16.5-23.1% mica 13.2-20.8%, kaolinite 8.1-9.7% calcite 7.3 -11.5% and atabolgate 5.0-7.1%. This is related to their saline environmental conditions of the marine deposits and calcareous materials which are favorable to the formations of the semectite minerals (montmorillonite)and interstratified minerals (mixed layers), Shendi (1990) and also is related to their low topography or low elevation.

The Clay minerals of the dunes deposits are constituted of montomorillonite which is the majority 24.1-34.3 followed by kaolinite 13.2-20.3 which is the minority, vermiculite 13.6-18.1%, mica 7.5-16.1% and quarlz 10.5-14.8%.

The relatively high quantity of quartiz is inherent from the parent material and due to the environmental deposits as these soils are high elevation .Also occurrence of montmorillonite and kaolinite are due to the weathering of parent materials

4. Relation of clay minerals to lithology, topography and depositional environments.

Tables 1,2 and 3 reveals that the soils of Nile alluvial plains, derived from Nile deposits materials but the soils of fluvio-lacustrine deposits, thought derived from two different parent sediments, namely, lacustrine and alluvium, yet their clay minerals suite is dominated by semectite and kaolinite. These minerals are almost inherited from the parent material with minimal mineralogical changes resulting from pedogenesis as indicated by the presence of weather able minerals such as feldspars.

While the soils of coast barrier plains the circular mineral, plagroskite seems to be present almost exclusively in the calcareous deposit .However, there are considerable controversy concerning its origin, whether authigenic, pedogenic or inherited from parent sediments derived wholly, or inpart, from lacustrine or calcareous origin. The findings concerning the relationship between clay minerals assemblage and lithology are in harmony with the previous findings of Millot (1964), Barshad (1964), El-Demerdash *et al.*, (1971) and Abdel-Aal *et al.*, (1977). In case of the soils of duns deposits are composed of two different parent material sediments deposits; marine deposits and aeolain sand sediments. Regarding the relation of clay minerals to topography, Table (1) reveals that the topographically-low land have clay minerals suite that reflect the prevailing salt affected conditions which encourage the accumulation of alkalies and alkaline earths. These favor the transformation of the principal clay minerals to form interstratified ones. Marin intrusion may also play a significant role in modifying the clay minerals suite.

The topographically-high lands, soil formed on dunes are almost undulating, through of different elevation. Sand dunes movement and the creeping of sands from north to south also played an important role in the distribution of clay minerals in the study area. To clarify the relation of clay minerals to environments of deposition these soils are originated under various conditions comprising alluvial, lacustrine, marine and Aeolian conditions, Van Der Marel, H.W., (1966), EL-Demerdash *et al.*, (1971), Abdel – Aal *et al.*, (1977) and Noaman *et al.*, (1987).

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Table (1): Morphological Characteristics of the Studied Soil Profiles.

Geomorphic units	Profile No.	Surface Features	Depth (cm)	Colour	Texture	Structure	Consistency	Secondary Formations
Nile alluvial deposits	1	Almost flat and cultivated wheat	0-10 10-40 40-70 70-100	loy R3/3,d. loy R4/2,m. loy R4/3,m. loy R5/4,m.	Clay Clay Clay Clay	Weak fine subangular blocky st. md. Subangular blocky mo.md.subangular blocky w.fine subangular blocky	Hard Firm Firm S.firm	- - - -
	2	Almost flat and cultivated	0-15 15-50 50-90 90-120	loyR4/2,m. loyR4/3,m. loyR3/3,m. loyR3/4,m.	Clay Clay Clay Sandy Clay	massive mo.fine subangular blocky mon.fine subangular blocky w.fine subangular blocky	S.firm Firm Firm S.firm	 Few hard lime concretion Few hard lime concretion
Fluvirio lacustrine deposits	3	Almost flat, partly Disturbed by man and cultivated clover	0-20 20-60 60-100	loyR3/,D. loyR5/4,m. loyR5/3,m.	Sandy clay loam Sandy clay Loam Loam	Massive w.fine subangular blocky w.fine subangular blocky	S.hard S.firm S.firm	Few hard concentration Few gypsum gysum Viens
Coastal barrier plains	4	Almost flat, Thin sand sheet and Scattered vegetation	0-20 20-55 55-70	loyR5/4,m. loyR7/2,m. loyR7/3,m.	Sandy clay Sandy loam Sandy loam	Massive w.fine crumb w.fine and md.crumb	s.firm friable friable	Few soft lime segregation Mo. Hard lime concretion
Coastal barrier plains	5	Almost Flat, Crust Salt and few Scattered vegetation	0-10 10-45 45-80	10yR6/3.D. 10yR5/6,M. 10yR6/4,M.	Sandy loam Sandy loam Sandy loam clay	Massive Mo.fine and Md.Cruml W.fine Subangular	S.hard friable S.frim	Mo. Hard lime concertion and few Gypsum Vieus Mo. Soft lime segregation
Coastal sand dunes	6	Undulating, many wide mamd accumulated gullies with vegetation	0-20 20-60 60-90	loyR6/1,m. loyR5/1,m. loyR4/1,m.	Loamy sand Loamy sand Loamy sand	Massive Massive Massive	Friable Friable Friable	Few hard time concretion. Mo. Hard lime conceretion
	7	Undulating, thick sheets of windblown sand, dunes Acottered Vegetation	0-25 25-60 60-100	loyR6/2,M. loyR6/4,M. loyR4/1,M.	Loamy sand Sand loamy sand	Massive Single grain Massive	Friable loose Friable	- - Mo. Soft lime segregation

Mo. = moderate md. = medium st. = strong s.= slightly w.= week

Table (2). Some physical and chemical properties of the investigated profiles.

Geomorphic units	Profile No.	Depth (cm)	Particle size distribution				Texture class	O. M. %	$CaCO_3$ %	Chemical analyses of soil paste											CEC me / 100 g soil
			Clay %	Silt %	Sand %					SP	pH	EC dS/m	Cations me / l				Anions me / l				
					Fine	Coarse							Ca	Mg	Na	K	Cl	HCO_3	CO_3	SO_4	
Nile alluvial deposits	1	0 – 10	60	25	12	3	C.	2.15	1.0	62	7.5	1 . 5	4.2	1.81	8.1	0.89	7.5	2.8	0	4.7	35
		10 – 40	50	29	17	4	C.	0.95	1.3	58	7.4	1 . 2	4.7	1.16	5.3	0.84	6.3	2.5	0	3.2	31
		40 – 70	64	23	10	3	C.	0.73	0.8	65	7.6	1 . 3	3.8	2.01	6.4	0.79	8.4	2.6	0	2.0	40
		70 - 100	55	20	19	6	C.	0.47	1.2	62	7.3	1 . 8	8.4	3.69	5.1	0.81	6.3	3.1	0	8.6	31
	2	0 – 15	54	30	10	6	C.	1.70	1.45	60	7.4	0.9	3.2	1.71	3.5	0.59	5.2	2.0	0	1.8	32
		15 – 50	50	33	12	5	C.	0.76	1.11	57	7.5	1.6	5.7	2.47	7.2	0.63	7.0	2.8	0	6.2	29
		50 – 90	58	18	15	9	C.	0.48	1.8	62	7.5	1.9	5.6	2.31	10.4	0.69	9.0	3.0	0	7.0	35
		90 – 120	52	31	13	4	C.	0.25	1.5	65	7.3	2.0	6.2	4.86	8.2	0.74	12.3	3.6	0	4.1	31
Fluvio – lacustrine Deposits	3	0 – 20	22	7	65	6	S.C.L	1.23	3.7	37	7.5	4.0	14.5	3.87	21.1	0.53	25.7	4.2	0	10.1	15
		20 – 60	22	14	59	5	S.C.L	0.53	6.1	35	7.4	6.2	18.3	8.62	34.5	0.58	37.3	3.6	0	21.1	15
		60 – 100	20	30	47	3	L.	0.11	8.5	40	7.4	12.5	36.5	17.58	70.3	0.62	60.7	5.2	0	59.1	13
Coastal barrier plains	4	0 – 20	23	13	60	4	S.C.L	0.10	10.1	36	7.5	55.2	196.3	280.5	345.0	6.2	361.2	9.1	0	457.7	13
		20 - 55	13	15	65	7	S. L	0.13	12.8	32	7.4	60.4	161.4	392.2	404.4	8.4	530.7	10.5	0	425.2	7
		55 - 70	15	14	66	5	S . L	0.20	15.5	34	7.6	39.7	101.6	208.5	189.4	7.5	290.6	7.8	0	208.6	8
	5	0 – 10	14	12	70	4	S. L	0.19	11.7	33	7.7	23.1	55.1	110.6	106.4	3.9	125.3	8.3	0	142.4	9
		10 – 45	13	16	65	6	S . L	0.13	14.7	31	7.4	40.5	136.2	172.3	204.8	6.7	289.2	7.2	0	223.6	9
		45 – 80	21	17	58	4	S.C.L	0.06	20.1	35	7.5	31.7	142.5	130.8	124.4	5.3	141.0	8.1	0	253.9	13
Coastal sand dunes	6	0 – 20	8	10	80	2	S . L	0.45	4.8	28	7.8	4.6	16.5	8.1	20.8	0.2	24.5	6.2	0	15.3	5
		20 – 60	7	12	78	3	S . L	0.08	7.7	26	7.5	7.4	30.6	14.3	35.8	0.7	45.1	7.2	0	29.1	4
		60 – 90	10	6	76	8	S . L	0.11	9.5	27	7.6	15.6	55.6	29.1	101.8	0.7	92.3	6.4	0	88.5	7
	7	0 –25	7	11	81	1	S . L	0.39	3.7	29	7.8	5.3	17.2	14.3	20.9	0.6	22.4	6.0	0	24.6	5
		25 – 60	3	2	92	3	S	0.05	6.2	19	7.6	7.2	28.7	12.5	37.3	0.7	40.6	7.5	0	31.1	2
		60 – 100	9	7	75	9	S . L	0.03	8.3	28	7.4	13.2	50.2	25.3	82.3	0.6	75.4	8.2	0	74.8	5

C : Clay . S . C . L . : Sandy clay loam . L : Loam . S . L : Sandy loam .

L . S : Loamy sand . S . Sand

Table (3): Semi quantitative of soil mineralogy of the studied soils.

Geomorphic Units	Profile No.	Depth Cm.	Mont	Kaol	Mica	Verm.	Palygorskite	Inter	Calcite	Qurtz	Felds	Others	Atabolgate
Nile Alluvial Plains	1	0-10	40.0	21.3	12.1	7.7	-	24.1	-	5.2	5.3	1.8	-
		40-70	38.8	18.3	13.3	8.1	-	22.5	-	7.1	6.7	1.4	-
	2	0-15	35.8	14.0	13.0	9.6	-	33.2	-	4.1	3.3	1.1	-
		50-90	37.6	20.6	12.7	8.8	-	16.3	-	7.0	5.6	2.7	-
Fluvio lacustrine terraces	3	0-20	34.0	15.3	19.1	13.5	2.3	21.0	1.5	5.8	5.5	1.0	-
		60-100	24.5	12.5	21.7	17.3	6.7	17.3	5.7	3.1	3.1	0.9	-
Coastal barrier plains	4	0-20	24.8	15.4	17.3	10.2	7.8	23.1	7.3	3.5	1.5	0.5	5.1
		55-70	22.7	16.2	18.6	15.5	12.4	17.3	9.7	6.1	1.7	0.4	6.5
	5	0-10	24.3	18.2	20.8	16.3	8.5	19.3	7.1	6.5	5.1	0.2	5.0
		45-80	22.8	15.3	13.2	11.5	13.7	16.5	11.5	5.1	6.0	0.5	7.1
Dunes deposits	6	0-20	24.1	15.0	16.1	15.8	3.1	23.5	1.1	11.7	6.1	1.5	-
		20-90	34.3	13.2	8.5	13.6	5.3	17.1	5.5	10.5	5.5	1.8	-
	7	0-25	23.0	18.7	15.7	18.1	1.6	14.1	2.1	14.8	5.1	1.5	-
		60-100	30.6	20.3	7.5	16.6	3.2	26.5	5.1	14.3	4.1	1.7	-

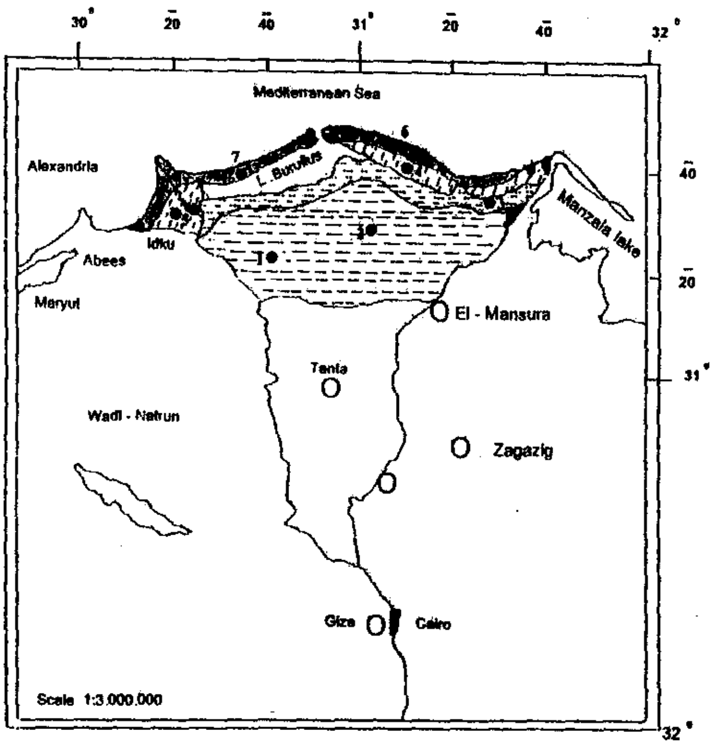
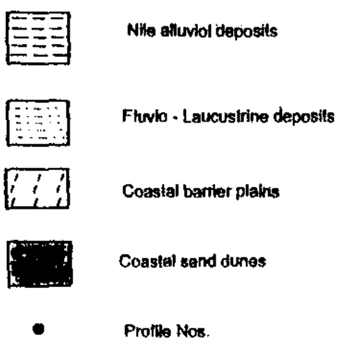


Fig (1). Location of Geomorphic units and soil profiles in the study area.



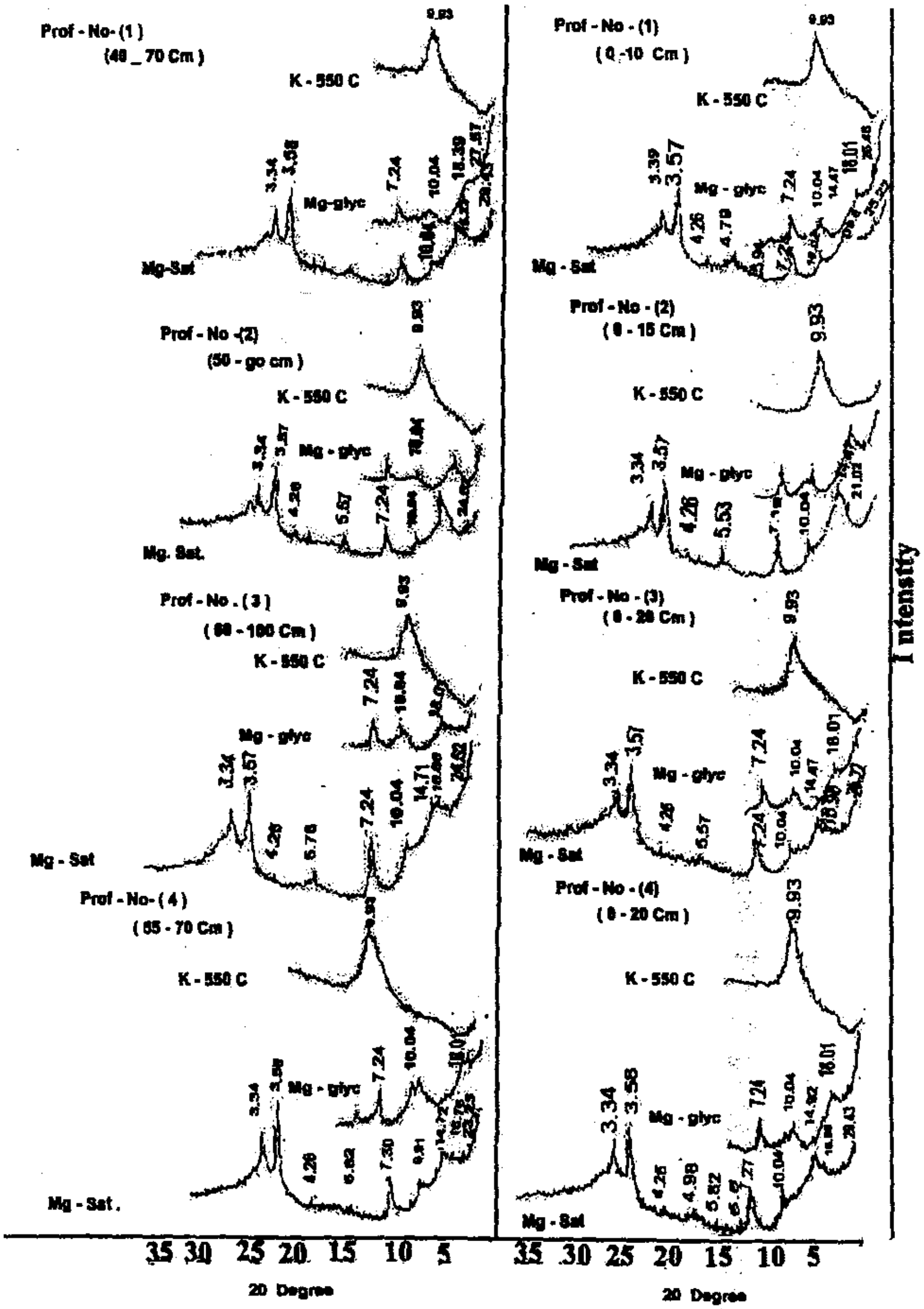


Fig (2) = X - ray diffraction Patterns of the clay fractions of profile No. (1),(2),(3) and (4).

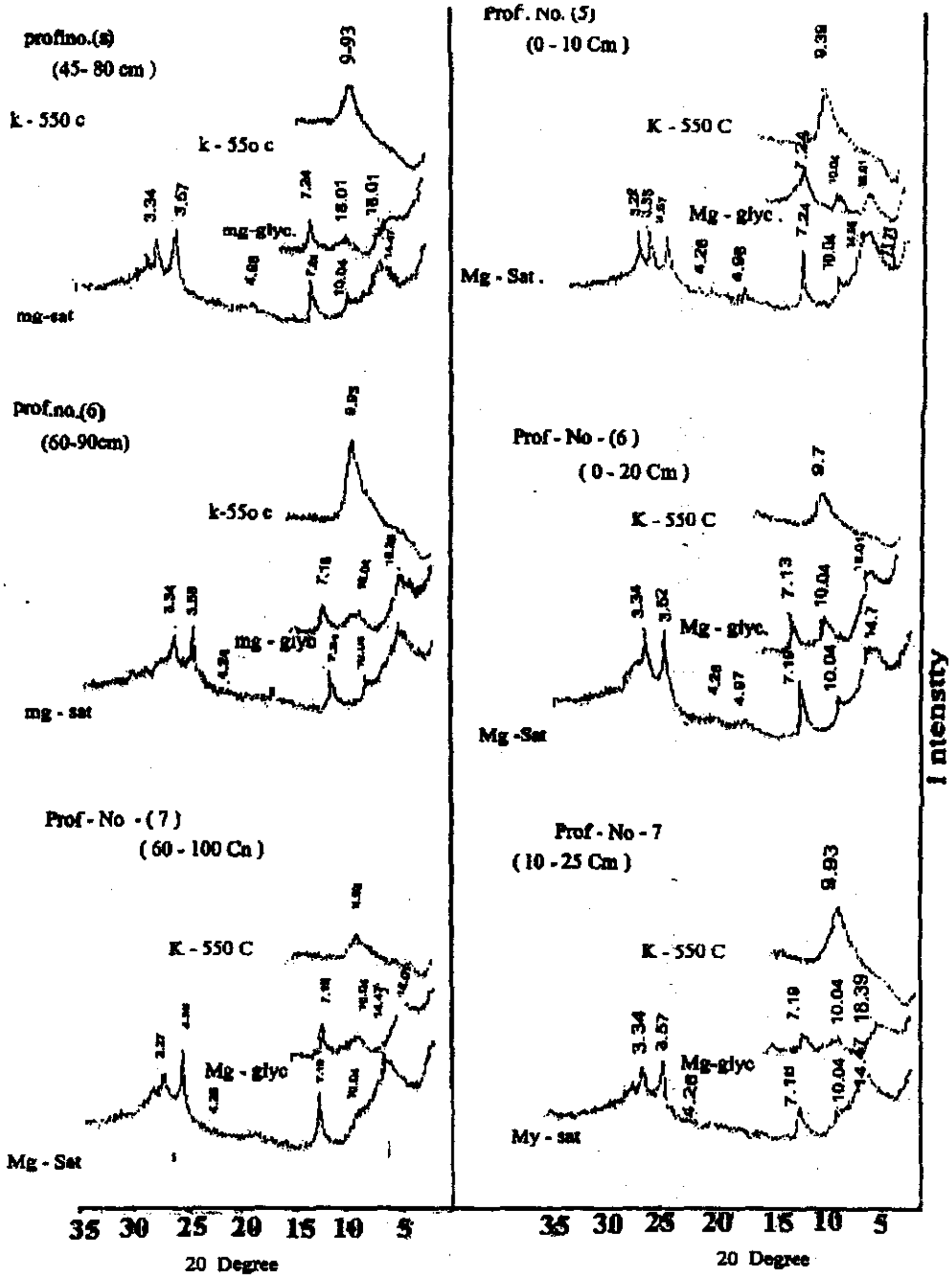


Fig (3) : X- ray diffraction patterns of the clay fractions of profile no - 5.6 and 7 -

التركيب المعدني لحبيبات الطين وعلاقته بكل من الصخرالأم و الطبوغرافيا وظروف الترسيب في أراضي الساحل الشمالي لدلتا النيل

عاطف عبد العظيم حجاج

معهد بحوث الأراضي و المياه و البيئه – مركز البحوث الزراعية

لإجراء الدراسة تم اختيار سبعه قطاعات أرضيه تمثل أربعه وحدات جيومورفولوجيه هي ترسيبات نهريه، ترسيبات نهريه - بحيرية، سهول ساحليه، كثبان رمليه ساحليه وقد وصفت القطاعات الارضيه المختارة وصفا مورفولوجيا وأجريت عليها التحليلات الطبيعيـة والكيميائية المنزالوجيه بهدف تحديد التركيب المعدني لحبيبات الطـين وعلاقتـه بكـل مـن الصخر الام والطبوغرافياوظروف الترسيب في اراضي الساحل الشمالي لد لتا النيل:

و قد اظهرت النتائج المتحصل عليها ما يلي:

١- **ملوحه التربه:** تتراوح ما بين ٠,٩ ds/m الي ٦٠,٤ حيث كانت عاليه جدا" فى اراضي السهول الساحليه .

٢- **السعه التبادلية الكاتيونيه** : تتراوح ما بين٢ إلي٤٠ ملليمكا فيء /١٠٠جم تربه وكانت مرتفعه في الترسيبات النهريه. وسجلت اقل انخفاض فى اراضي الكثبان الرمليه.

٣- كربونات الكالسيوم الكليه : تتراوح ما بين ٠,٨ إلي ٢٠,١% وسجلت اقصي ارتفاع لها فى أراضي السهول الساحلية.

٤- **قوام التربـة** : من الدراسة الدقيقة للمكونات الحبيبية وجد أن قوام التربه فـى المنطقـه المدروسه يتراوح من الرملي حتي الطيني.

٥- **التركيب المعدني لحبيبات الطين** :

اظهر التحليل بالأشعة السينيه بعض التشابه في مكونات الطين المنزالوجيه حيث كان المنتموريللونيت و الكاؤلينيت و الهيدروس ميكا والفيرميكيوليت هى المعادن السائده بالاضافه الي وجود بعض من الكوارتز والفلسبار والبلاجروسكيت والكالسيت.

وقد أوضحت الدراسة سيادة معدنى المنتموريللونيت و الكاؤلونيت فى اراضى الترسيبات النهريه الطينيه القوام والتى غالبا تكون موروثه من مادة الاصل (رواسب نهريه). اما اراضى الترسيبات النهريه – بحيريه ذات القوام الطمى رملى طينى والتى تحتوى على بعض الجير وتسود فيها معادن الطين المنتموريللونيت والهيدروس ميكا والكاؤلونيت والفيرميكوليت والبلاجروسكيت فهذه الاراضى موروثه من مادة الاصل (رواسب نهريه وبحيريه) بينما اراضى السهول الساحليه ذات القوام الطمى رملى والتى تحتوى على كميات مرتفعه من كربونات الكالسيوم والاملاح ويسود بها معادن الطين المنتموريللونيت والميكا والكاؤلينيت و والفيرميكيوليت والبلاجروسكيت فهذه الترسيبات ذات اصل بيدوجينى او موروثه من الرواسب التى تكون ناتجه كلياً أو جزئياً من اصل بحرى او جيرى. ولكن اراضى الكثبان الرمليه ذات القوام الرملى طمى والتى تحتوى على نسبه متوسطه من $CaCO_3$ والأملاح فهذه مورثه من مادة اصل ناتجه من الرواسب الهوائيه والبحريه.

٦- **بخصوص الطبوغرافيا :**

وضح تأثير الطبوغرافيا المنخفضة تحت تأثير ظروف الملوحة والطبيعة البحرية للرواسب على مجموعة معادن الطين الموجوده خصوصا فى اراضى السهول الساحليه حيث كانت هذه الظروف تعمل على تحول معادن الطين الاصليه الى طبقات مختلطه كمرحله انتقاليه نتيجة التعريه الكيماويه السائدة. كذلك فى أراضى الكثبان الرملية المرتفعة وضح تأثير دور الكثبان الرمليه فى توزيع معادن الطين فى المنطقه المدروسة.

٧- **ظروف الترسيب السائده فى المنطقة:**

بيئات الترسيب التى كونت المنطقة المدروسة تشمل الأراضى الرسوبية التى تكونت بفعل نهر النيل والأراضى التى تكونت بفعل تداخل الترسيبات النهريه مع الترسيبات البحيريه واراضى الترسيبات البحريه التى تكونت بفعل البحر ثم اراضى الكثبان الرمليه التى يتخللها اراضى الترسيبات البحيريه والتى تكونت بفعل الترسيبات الهوائيه والبحيرية.