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THE RECENT BOTTOM SEDIMENTS OF EL-BURULLUS LAGOON

B - Sedimentological studies as a tool explaining environments

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ABSTRACT

This article is based on the sedimentological and mineralogical studies of El-Burullus lagoon sediments, to gather an information about the factors controlling sediment distributions and to relate the distributions to their conditions of formation. For these purposes, the grain size and heavy mineral analyses are carried out on 25 grab sediment samples collected at depth varies between 38 cm and 155 cm, in addition to some measurement concerning salinity (chlorosity) and depth.

The bottom configuration of the lagoon is mainly developed as a result of sublagoon processes in the form of islands and depressions. The wind generate currents are propogated SSW where as the near circulation system is propagated clockwise direction. The highest chlorosity value (19.28 ‰) was recorded at the north eastern portion of the lagoon which gradually decreases westward direction where its minimum value was reached (1.06 ‰).

El-Burullus lagoon sediments are characterized by clayey silty sand type. The sand fraction is mainly represented as carbonate skeletal remains. The most important factors affecting sediments are depth, chlorosity and particle size.

The Recent bottom sediments of El-Burullus lagoon may reflect an evidence of river source, drain to the lagoon by turbidity flow currents and were deposited *under quiet water in low energy environment.*

The heavy minerals which were recorded through out the lagoon are opaques, amphiboles, mica, pyroxenes, garnet, zircon and staurolite. On the bases of heavy mineral distribution, El-Burullus lagoon may be divided into westerm relatively deep agitated lagoon and eastern shallow quiet lagoon environments.

INTRODUCTION

El-Burullus lagoon has an augin shape like form, with a length of about 64 Km and width varies from 5 and 16 km. It has an area of about 505 km2 which occupies the north central area of the delta. It is separated from Mediterranean sea by long curved barrier broaden toward the west.

The present day lagoon attains its area from the old lake "Boto" by expanding east and south east direction due to lowering the northern part of the delta through the Romanian time (Malaty, 1960).

El-Burullus lagoon attains its load from different sources, the water comes from the Mediterranean sea via Boughaz El-Bourg during storms, the water comes from rainfall and seeps from the adjacent territory in addition to the fresh water coming from the southern drains (seven drains).

Geomorphologically, the north central area of the lagoon is characterized by flat straight sandy beach while the southern coast is characterized by irregular muddy shore with bonds. Owing to the continuous land reclamation projects, lagoon area had been decreased at the time being.

The present work deals with sedimentological and mineralogical studies of Recent bottom sediments of El-Burullus lagoon to gather an information about their distributions and to relate the distributions to their pattern of formations. For these purposes 25 grab sediment samples were collected in such a way to represent ther lagoon area. Their coordinates are varied between longitudes 30° 30 & 31° 10 E and latitudes 31° 21 & 31° 26 N (Fig. 1). The coordinates and the field observations including depth and chlorosity are listed in Table (1).

BOTTOM CONFIGURATION

El-Burullus lagoon has a depth varies between 38 cm and 155 cm with an average 101 cm. The shallower area is recorded near the inlet (38 cm) whereas, the deeper area is noticed at the constriction between the broadest area and narrow one.

The irrigularities that may present on the bottom of the lagoon are mainly developed due to sublagoon processes in the form of islands and depressions (Fig.2).

CURRENT REGIME

The wind affecting the lagoon prevailed NNW direction most of the year. Wind generated currents are propagate SSW direction. The near circulation systems are resulted from the main drift currents and directed from east to west along southern coast and returned again from wrest to east along the northern coast of the lagoon (i.e. clockwise direction) (Fig. 3).

Table (1) : The coordinates and the field observations of the collected sediment samples.

Sample No.	Depth cm	Salinity ‰	Chlorosity ‰	Suspended remains gm / l.	Coordinates Longitude	Coordinates Latitude	Sediment types
1	100	24.00	13.47	0.0839	31° 03′ 00″ E	31° 33′ 00″ N	Grey mud
2	87	34.00	19.28	0.1448	31° 01′ 00″	31° 34′ 00″	Black to grey mud
3	38	23.50	13.19	0.126	30° 58′ 00″	31° 35′ 00″	Plastic mud
4	75	24.00	13.47	0.1258	30° 59′ 00″	31° 32′ 00″	Sandy mud
5	63	23.00	12.91	0.1254	30° 57′ 00″	31° 34′ 30″	Shelly mud
6	106	23.80	13.41	0.1086	30° 57′ 00″	31° 32′ 30″	Cardita shelly mud
7	105	20.50	11.50	N. D.	30° 57′ 30″	31° 28′ 30″	Grey mud
8	103	20.50	11.50	N. D.	30° 55′ 00″	31° 32′ 00″	Shelly mud
9	120	17.00	9.51	0.0899	30° 53′ 00″	31° 32′ 00″	grey compacted mud
10	120	15.50	8.72	0.0538	30° 54′ 00″	31° 28′ 30″	Mud
11	115	11.00	6.14	N. D.	30° 32′ 00″	31° 25′ 30″	Shelly sandy mud
12	92	12.00	6.70	N. D.	30° 50′ 30″	31° 29′ 00″	Greyish black mud
13	94	4.00	2.19	0.1095	30° 43′ 30″	31° 29′ 30″	Grey shelly mud
14	105	9.00	5.01	0.0645	30° 44′ 30″	31° 25′ 00″	Shelly mud
15	110	3.00	1.63	N. D.	30° 47′ 30″	31° 28′ 00″	Grey black mud
16	65	7.00	3.88	N. D.	30° 47′ 40″	31° 24′ 30″	Shelly sandy mud
17	120	3.28	1.78	N. D.	30° 46′ 00″	31° 29′ 00″	Grey mud
18	125	4.50	2.47	0.029	30° 47′ 30″	31° 22′ 30″	Sandy mud
19	125	3.00	1.63	N. D.	30° 45′ 00″	31° 28′ 30″	Shelly mud
20	130	3.10	1.68	N. D.	30° 44′ 00″	31° 26′ 30″	Mud
21	130	4.00	2.19	N. D.	30° 43′ 30″	31° 28′ 30″	Sandy mud
22	125	2.00	1.06	N. D.	30° 44′ 00″	31° 23′ 00″	Mud
23	125	3.00	1.63	N. D.	30° 42′ 00″	31° 23′ 30″	Sandy mud
24	155	2.50	1.34	0.0886	30° 40′ 00″	31° 24′ 00″	Plastic mud
25	120	2.00	1.06	N. D.	30° 38′ 00″	31° 23′ 30″	Mud
Average	101	11.97	6.69	0.0921			

N.D. = Not detected

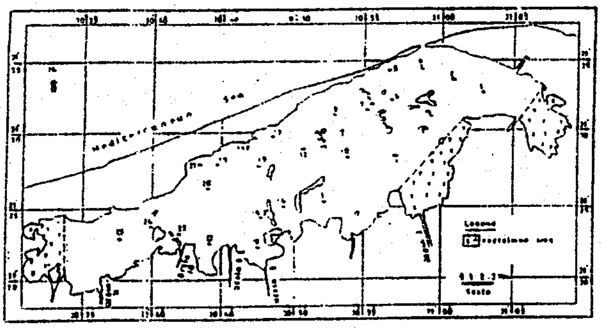


Fig. (1)

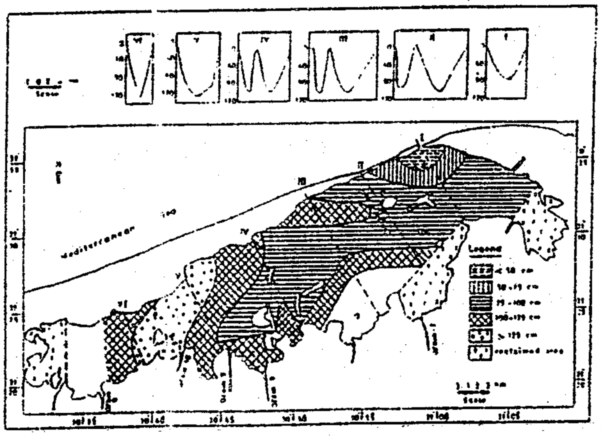


Fig. (2)

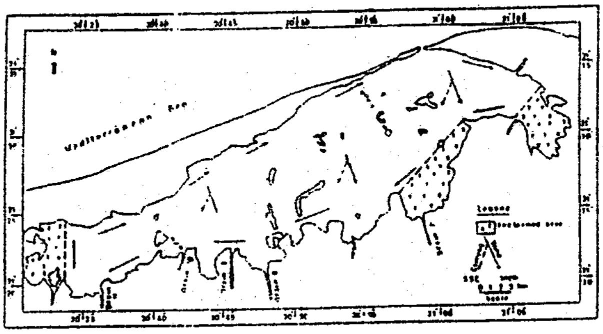


Fig. (3)

CHLOROSITY

Chlorosity was estimated near the bottom at each stations, which was varied between 1.06‰ and 19.28‰ with an average 6.69‰. The data derived from analysis is listed in table (1).

From the value of chlorosity at each station, a chlorosity distribution map was illustrated (Fig. 4) with contour interval 3‰. The highest chlorosity value (19.28‰) was recorded at the north eastern portion of the lagoon (brackish water) which gradually decreases westward where it is reached about 1.06‰. However, chlorosity may be nearly constant along lagoon transverse axis with some anamolies.

GRAIN SIZE RELATIONS

The grain size relations have a great significance in determining the environmental condition under which the sediments were depostied. The grain size relations are based on the data derived from mechanical analyses which were carried out on twenty-five grab sediment samples distributed allover El-Burullus lagoon. The grain size analysis is based on the technique used by Krumbien and Pettijohn (1938), whereas the statistical parameters are calculated according to the equations proposed by Folk & Ward (1957).

It is to be noted that the statistical parameters were calculated by computer, type Tandy 1000 TL, using Basic language for calculations, whereas grapher version 1, 75, copy wricht (1988) is used for drawing graphs. The data derived from calculation together with some other data obtained from grain size analysis are listed in table (2).

Table (2) : The data derived from mechanical analysis and their statistical parameters .

Sample No.	Depth cm	Chlorosity ‰	Md Ø	Mz Ø	σ_I	SK_I	K_G	Sand %	Silt %	Clay %	Sediment types
1	100	13.47	4.30	4.23	3.09	-0.11	0.92	48.00	30.30	21.70	Clayey Silty Sand
2	87	19.28	3.20	3.70	2.96	0.12	0.78	58.30	24.37	17.33	Clayey Silty Sand
3	38	13.19	3.10	3.53	1.44	0.59	1.34	71.54	21.69	6.77	Silty Sand
4	75	13.47	3.50	3.53	2.77	-0.01	1.05	60.40	31.44	8.16	Silty Sand
5	63	12.91	2.70	1.80	3.85	-0.32	1.11	74.00	18.24	7.76	Silty Sand
6	106	13.41	3.00	3.27	3.02	0.07	0.84	61.77	26.32	11.91	Silty Sand
7	105	11.50	4.90	4.43	2.70	-0.20	0.84	36.70	45.67	17.63	Clayey Sandy Silt
8	103	11.50	4.00	4.10	3.27	-0.04	0.96	50.32	28.13	21.55	Clayey Silty Sand
9	120	9.51	4.90	4.57	2.94	-0.14	0.61	43.68	30.20	26.12	Clayey Silty Sand
10	120	8.72	5.10	4.57	2.72	-0.23	0.75	38.10	40.70	21.20	Clayey Sandy Silt
11	115	6.14	2.80	3.40	3.23	0.17	1.04	63.72	20.13	16.15	Clayey Silty Sand
12	92	6.70	3.50	3.57	2.92	0.03	0.60	52.30	35.50	12.20	Silty Sand
13	94	2.19	5.90	4.23	3.70	-0.51	0.71	30.10	30.30	38.60	Sandy Silty Clay
14	105	5.01	2.90	3.17	3.06	0.09	0.93	64.00	23.00	12.50	Silty Sand
15	110	1.63	6.20	4.90	3.84	-0.56	1.00	29.88	32.33	37.73	Sandy Silty Clay
16	65	3.88	3.20	2.80	3.56	-0.21	0.99	61.30	30.00	8.70	Silty Sand
17	120	1.78	5.80	4.13	4.33	-0.56	0.74	41.43	26.52	32.05	Clayey Silty Sand
18	125	2.47	4.25	4.18	2.85	-0.50	0.82	47.80	35.40	16.80	Clayey Silty Sand
19	125	1.63	6.20	5.12	2.96	-0.48	0.81	28.50	31.89	39.61	Sandy Silty Clay
20	130	1.68	3.00	3.28	3.83	-0.02	0.83	57.62	17.14	25.24	Clayey Silty Sand
21	130	2.19	4.80	4.57	2.75	-0.13	0.86	41.90	36.60	21.50	Clayey Silty Sand
22	125	1.06	5.20	4.60	2.71	0.28	0.76	35.40	43.60	21.00	Clayey Silty Sand
23	125	1.63	4.20	3.57	3.73	-0.30	0.96	46.25	36.34	17.41	Clayey Silty Sand
24	155	1.34	4.00	4.23	2.80	0.10	0.65	50.15	25.57	24.28	Clayey Silty Sand
25	120	1.06	3.20	3.20	3.98	-0.03	1.16	66.70	22.03	11.27	Silty Sand
Average	101	6.69	4.15	3.87	3.12	-0.12	0.88	50.39	28.68	19.81	

From this table, it was found that, median diameter (Md Ø) is varled between 2.7Ø and 6.2Ø with an average 4.15 Ø. However, mean size (MzØ) is ranged between 1.8 Ø and 5.12 Ø with an average 3.87 Ø. It is to be noted that, the average median exceed (Md Ø) diameter mean size (Mz Ø), which may reflects a deposition under low energy environment (Mohamed, 1991). The sorting coefficient (s I) varies between 1.44 Ø and 4.33 Ø with an average 3.12 Ø. The variation in sorting may due to a variation in particle size that reflects a very poorly sorted sediments. The skewness (Sk1) is ranged from -0.56 to 0.59 with an average -0.12. This means that, El-Burullus lagoon sediments are skewed toward the coarse fractions rather than to the fine fractions. It is to be noted that. the sediment samples of sandy type are mainly composed from carbonate skeletal remains. Kurtosis (KG) is varied between 0.60 and 1.34 with an average 0.88. This means that, El-Burullus sediments are varied between platykurtic and leptokurtic with an average mesokurtic, which reflects an action of quiet water.

From sand, silt and clay percentages, the sediment types were drawn (Fig.5) and deduced from the diagram proposed by Pettijohn et. al. (1972). The sediment types of El-Burullus lagoon are clayey silty sand (48 %), silty sand (32%), clayey sandy silt (8 %) and sandy silty clay (12 %) which are arranged according to their distribution in the lagoon.

From the value of median diameter at each station, a median diameter distribution map is drawn (Fig. 6) with contour interval one phi. This map reveals that, the areas characterize by coarse fractions (shell fragments) are located around Boughaz El-Bourg and the south western part of the lagoon near the drains (drains 7 & 8) with some anamolies. There are some patches characterised by fine fractions over 5 Ø and are located at the north western part of the lagoon with some anamolies. Generally, El - Burullus lagoon is characterised by clayey silt sand.

On the bases of sand, silt, clay ratio, a sediment distribution map is drawn (Fig. 7). From this map, it was found that, the west northern portion of the lagoon is characterised by a patch of sandy silty clay. There are two other patches of silty sand, one around the inlet and the other is located at the central southern portion of the lagoon. However, clayey sandy silt sediments are presented in two patches, one is located at the south eastern portion while the other is located at the south western portion of the lagoon.

To interpret the distribution of the lagoon sediments, a scatter diagrams were made, showing the interrelations between some of statistical parameters and both depth & chlorosity effects. The interrelation between median diameter and depth (Fig. 8) reveals that, the larger the grain, the shallower the depth. The interrelation between median diameter and chlorosity (Fig. 9) reflects no distinct relation with chlorosity lower than 3‰, but there is a direct relation with chlorosity greater than 3‰. The interrelation between sorting and depth (Fig. 10), reflects no distinct relation, however sorting versus chlorosity (Fig. 11) reflects a decreases in sortng with increasing chlorosity. So, the most important factors affecting sediments are depth, chlorosity and particle sizes.

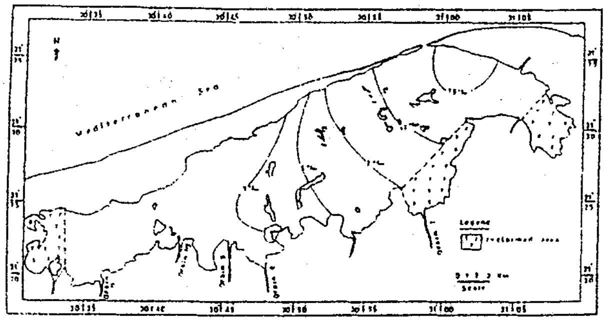
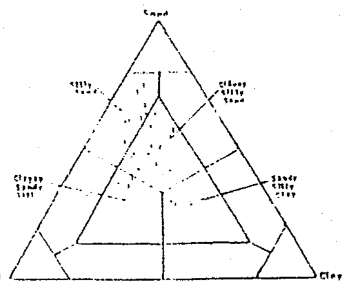


Fig. (4)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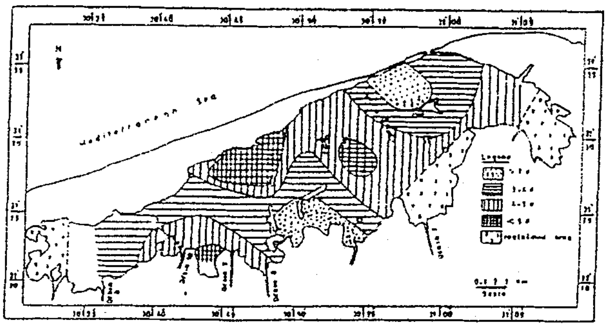


Fig. (6)

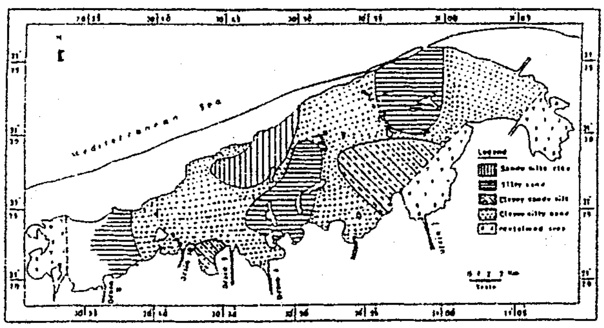


Fig. (7)

ENVIRONMENTAL EVIDENCES

In order to know the sources of the materials composing El-Burullus lagoon sediments, a scatter diagrams were made, showing the interrelations between their statistical parameters. An interrelation between sorting and skewness (Fig. 12) reveals that the materials composing sediments may be derived from river deposits (Freidman, 1957). The interrelation between sorting and mean size (Fig. 13) also reflects river sources (Moiola & Weiser, 1962). The median diameter versus skewness (Fig. 14) may be supported the above mentioned relations which reflects river source (Stewart, 19958).

The mechansim of deposition of the sediments was deduced from the interrelation between median diameter and sorting (Fig. 15) which reveals that, the sediments of the lagoon were deposited from quiet water (Stewart. 1958).

The depositional environments were deduced from the discriminant functions of Sahu (1964) which reflects deltaic environment (Table, 3).

So. from the above, it can be concluded that the Recent bottom sediments of El-Burullus lagoon reflects an evidence of river deposis, drained to the lagoon and were deposited under quiet water forming deltaic environments.

SOURCE OF THE SEDIMENTS

The environmental evidence indicates that, El-Burullus lagoon sediments may attain their materials from river source. In

Table (3) : The data dervied from the application of discriminant functions of Sahu (1964) on the present sediment samples.

Sample No.	Y_1	Y_2	Y_3	Depositional environments
1	23.36	709.70	- 82.01	Deltaic deposition
2	21.39	649.60	- 76.14	Deltaic deposition
3	1.96	227.70	- 20.10	Deltaic deposition
4	19.06	578.30	- 66.05	Deltaic deposition
5	52.40	1014.24	- 127.37	Deltaic deposition
6	24.65	668.90	- 79.50	Deltaic deposition
7	14.13	559.30	- 61.40	Deltaic deposition
8	28.03	784.10	- 92.30	Deltaic deposition
9	17.93	649.30	- 73.85	Deltaic deposition
10	13.89	567.20	- 62.34	Deltaic deposition
11	29.28	759.20	- 90.95	Deltaic deposition
12	20.61	627.17	- 73.70	Deltaic deposition
13	38.90	970.98	- 116.40	Deltaic deposition
14	25.92	681.48	- 81.25	Deltaic deposition
15	41.41	1054.80	- 125.10	Deltaic deposition
16	40.38	889.94	- 108.99	Deltaic deposition
17	58.14	1300.40	- 190.30	Deltaic deposition
18	17.79	613.71	- 69.73	Deltaic deposition
19	17.60	660.40	- 72.67	Deltaic deposition
20	45.16	1029.50	- 127.30	Deltaic deposition
21	14.60	581.15	- 64.16	Deltaic deposition
22	13.76	564.50	- 61.70	Deltaic deposition
23	42.31	981.40	- 119.24	Deltaic deposition
24	15.76	595.98	- 68.04	Deltaic deposition
25	25.06	653.47	- 76.55	Deltaic deposition

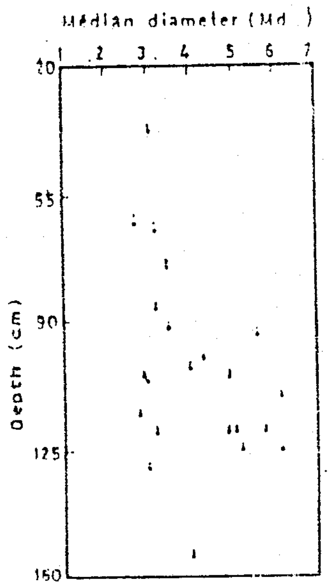


Fig. (8)

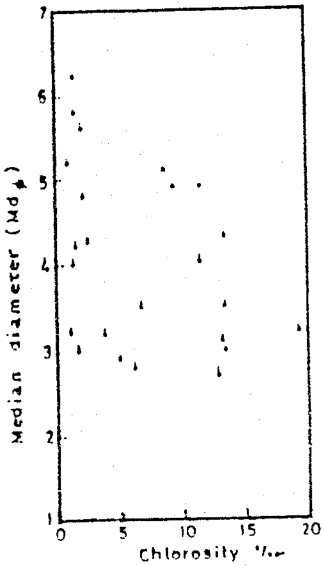


Fig. (9)

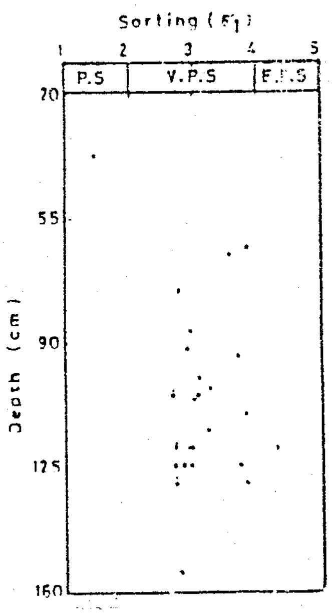


Fig. (10)

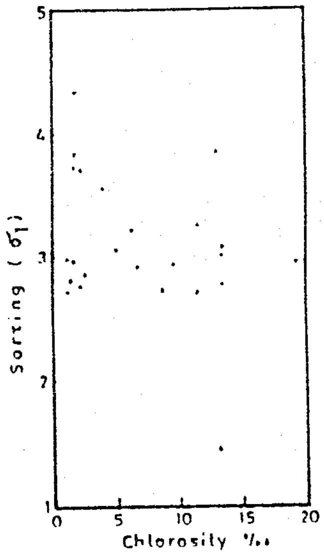
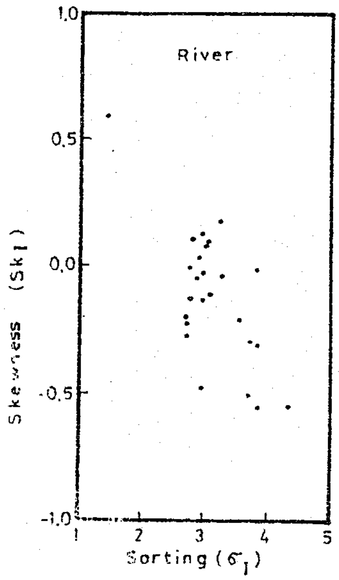


Fig. (11)



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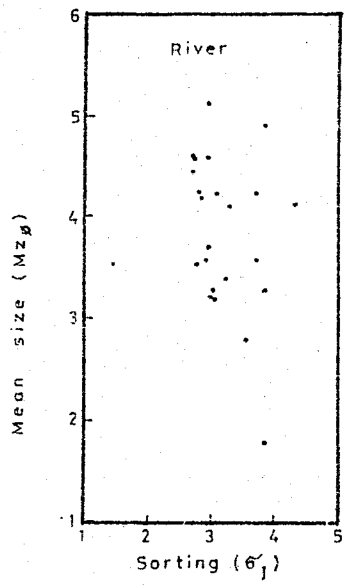

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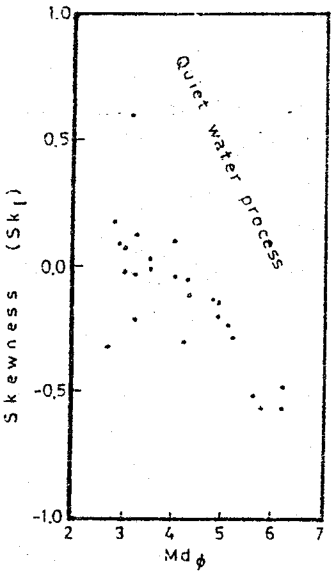

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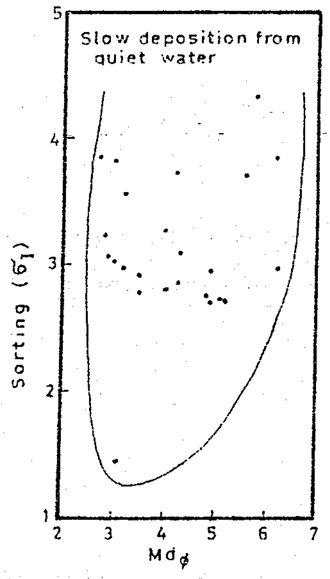

Fig. (15)

order to prove that, a mineralogical studies have been carried out on 25 grab sediment samples, using heavy mineral identification as a tool explaining origin.

The heavy minerals were identified in the fractions with mesh size 0.125 & 0.25 mm. The other fractions were found to be very low in their heavies, consequently were neglected. The data derived from heavy mineral identifications together with some other data necessary for interpretation are listed in Table (4).

The weight percentage of heavy minerals are ranged from completely absent to 0.806% with an average 0.287%. From the weight percentage of heavy minerals at each station, a heavy mineral distributions map was made (Fig. 16) with contour interva 0.2 %.

The areal distribution of heavy minerals indicate that, they are relatively concentrated at the most eastern edge of the lagoon (near Boughaz El-Bourg) and then gradually decrease westward till the central portion of the lagoon where zero value is reached. The area off drain "8" is characterized by a relatively high amount of heavy minerals. The heavy minerals increase again from the center of the lagoon to the north west direction.

The heavy mineral constitiuents are opaques, amphiboles, mica, pyroxenes, garnet, zircon and staurolits.

Opaques

Opaques constitute the major part of the heavy minerals which are reached an average 3.22%. They are represented as iron oxides

Table (4) : The data dervied from heavy mineral identifications togther with depth and sorting.

Sample No.	Depth cm	Sorting	Opaques %	Amphibole %	Mica %	Pyroxene %	Garnet %	Zircon %	Staurolite %	Wt %	index figure
1	100	3.09	33.57	42.86	20.00	--	--	3.27	--	0.8060	0.0081
2	87	2.96	12.90	28.38	20.00	3.23	29.03	3.23	3.23	0.7300	0.0075
3	38	1.44	28.00	27.21	40.00	3.40	--	1.36	--	0.1850	0.0019
4	75	2.77	27.00	29 00	40.00	--	2.00	2.00	--	0.3580	0.0036
5	63	3.85	--	43.00	40.00	17.00	--	--	--	0.2200	0.0023
6	106	3.02	30.00	25.00	30.00	--	15.00	--	--	0.1590	0.0016
7	105	2.70	40.00	39.00	21.00	--	--	--	--	0.2900	0.0029
8	103	3.27	40.00	30.00	20.00	--	10.00	--	--	0.4250	0.0043
9	120	2.94	50.00	35.00	15.00	--	--	--	--	0.1363	0.0014
10	120	2.72	--	--	--	--	--	--	--	--	--
11	115	3.23	--	--	--	--	--	--	--	--	--
12	92	2.92	50.00	35.00	15.00	--	--	--	--	0.1086	0.0011
13	94	60.00	25.00	15.00	--	--	--	--	--	0.6490	0.0065
14	105	3.06	--	--	--	--	--	--	--	--	--
15	110	3.84	100.00	--	--	--	--	--	--	0.2500	0.0030
16	65	3.56	--	--	--	--	--	--	--	--	--
17	120	4.33	100.00	--	--	--	--	--	--	0.3700	0.0040
18	125	2.85	43.00	35.00	--	14.00	8.00	--	--	0.4580	0.0046
19	125	2.96	63.00	37.00	--	--	--	--	--	0.2900	0.0031
20	130	3.83	50.00	43.00	--	--	--	5.00	2.00	0.67.00	0.0072
21	130	2.75	--	--	--	--	--	--	--	--	--
22	125	2.71	--	--	--	--	--	--	--	--	--
23	125	3.73	--	--	--	--	--	--	--	--	--
24	155	2.80	47.00	39.00	--	3.00	5.26	5.26	--	0.6610	0.0067
25	120	2.98	56.00	44.00	--	--	--	--	--	0.3800	0.0040
Average	101	3.12	33.22	22.30	11.04	1.62	2.77	0.805	0.21	0.2870	0.0030

in the form of subrounded to round grains. Their areal distributions (Fig. 17) reveal that, Opaques are relatively concentrated at the north western portion of the lagoon and gradually decrease in all directions which are reached their minimum value (zero) near the south and east southern part of the lagoon.

Generally, Opaques are concentrated at the north western portion rather than to the north eastern and the south portions of the lagoon.

To know the factors controlling Opaques distribution, a scatter diagrams were made showing the interrelation of Opaques with depth (Fig. 18) and sorting (Fig. 19). Opaques are increased westward direction and also with increasing depth and sorting. It is to be noted that, the dots representing Opaques on the graph are grouped around the vicinity of 3 vlue of sorting.

Amphiboles

Amphiboles are recorded in most of the sediment samples as hornblend in green and bluish green colour. They have an elongated grains with rounded edges. Their frequency perecentages are ranged from zero and 44% with an average 22.30%.

The areal distribution of amphiboles (Fig. 20) reveal that, they are concentrated in the eastern tip and at the northern portion (west Boughaz El-Boug) of the lagoon. However, they were not recorded or present in relatively rare amount in the middle part of the lagoon. Generally, amphiboles are increased westward with depth (Fig. 21). On relating amphiboles with sorting (Fig. 22) a little relation is noticed but the sediment samples are grouped

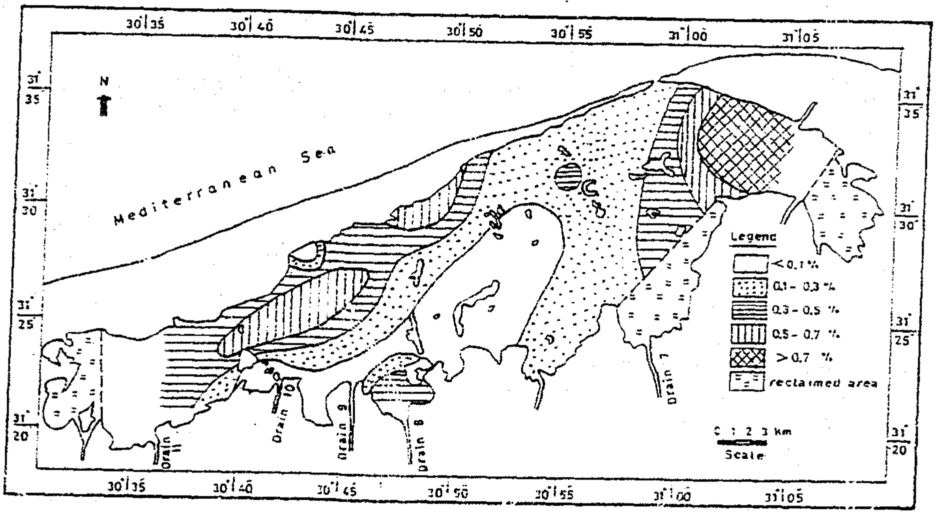
Mediterranean Sea
N
Legend
< 0.1 %
0.1 - 0.3 %
0.3 - 0.5 %
0.5 - 0.7 %
> 0.7 %
reclaimed area
Scale
Drain 11
Drain 10
Drain 9
Drain 8
Drain 7

Fig. (16)

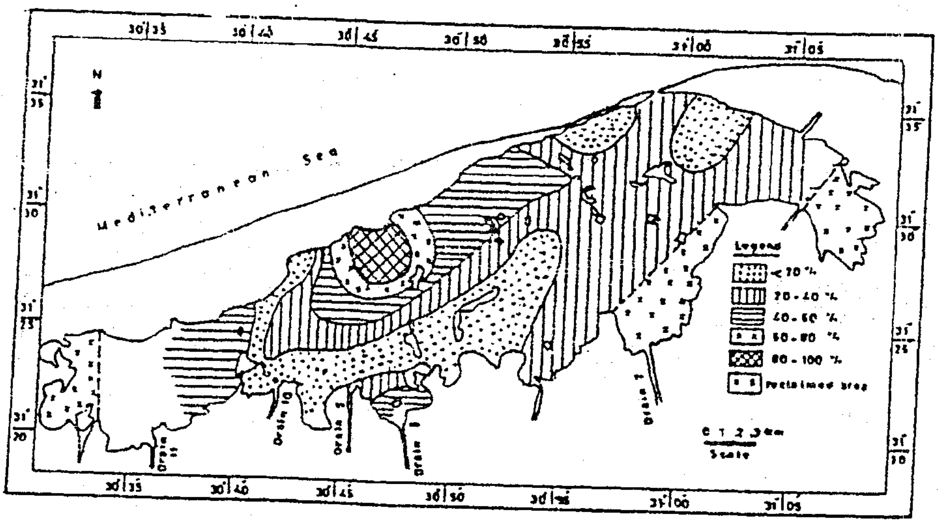
Mediterranean Sea
N
Legend
Scale
Drain 10
Drain 8
Drain 7

Fig. (17)

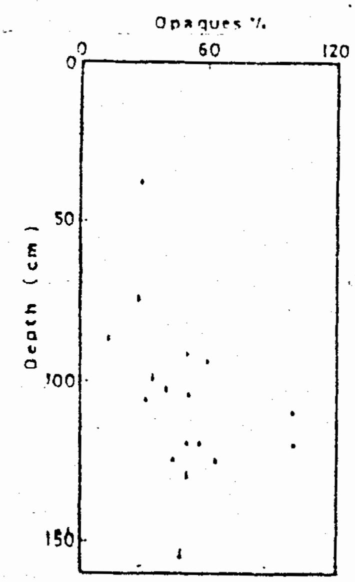

Fig. (18)

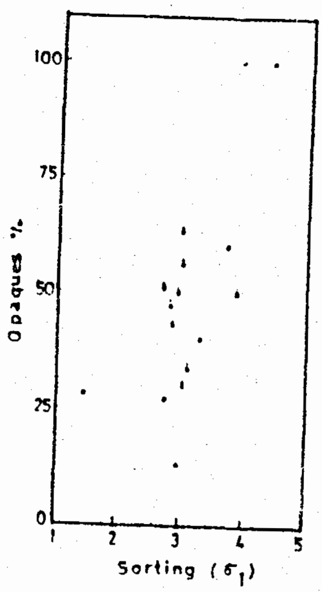

Fig. (19)

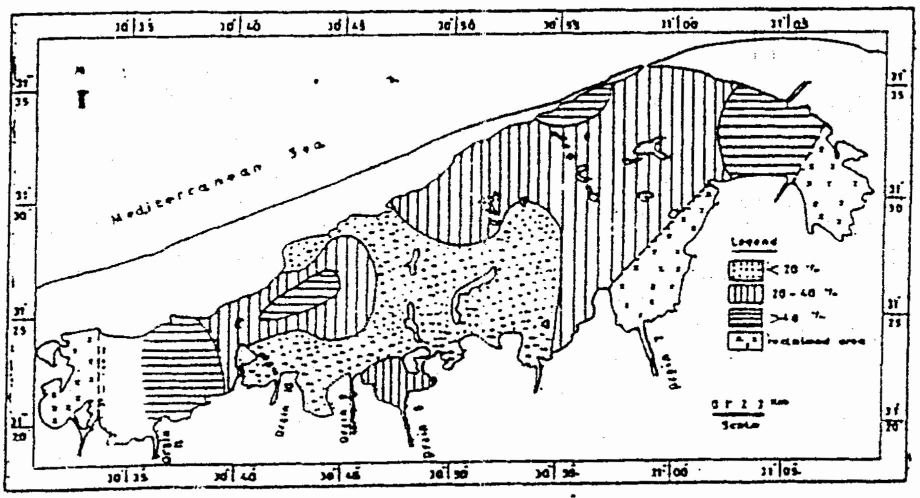

Fig. (20)

around 3 Ø value.

Mica

Mica is recorded in eleven stations as muscorrte, however, the rest of the lagoon is nearly free from mica. It has a reounded grains with brownish yellow colour. The frequency percentages of mica are ranged from zero to 40% with an average 11.04%. Mica is concentrated at the eastern part of the lagoon whereas, there is no recorded mica in the western part (Fig. 23). Mica is relatively concentrated in the eastern part of the lagoon rather than in the western part. It increases with decreasing depth (Fig. 24), that is mean, mica may reflect the areas with low current strength and high rate of sedimentation. Mica has no distinct relation with sorting (Fig. 25), but the dots representing samples are grouped around 3 Ø value.

Pyroxenes

Pyroxenes are recorded only in five stations as augite, the rest of the lagoon is nearly free pyroxenes. They are ranged from zero to 17% with an average 1.62%. They have a colourless rounded grains. They show a little relation with geographic position of the sediments and depth, however have no relation with sorting (Fig. 26). But the dots representing pyroxenes on the graph, are grouped around 3 Ø value.

Garnet

Garnet is recorded only in six stations however the rest of the lagoon is free. It has a colourless to pink colour rounded grains.

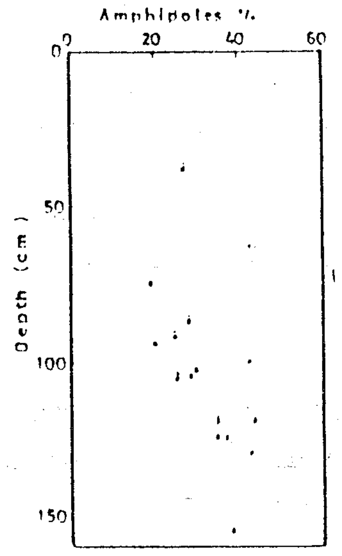

Fig. (21)

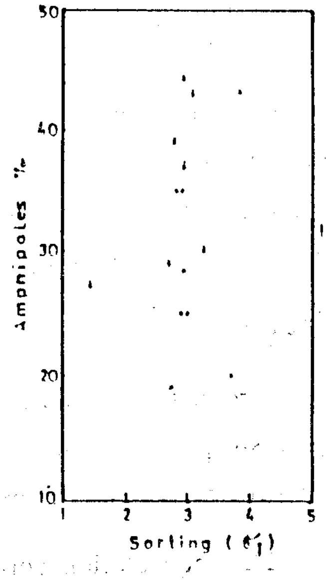

Fig. (22)

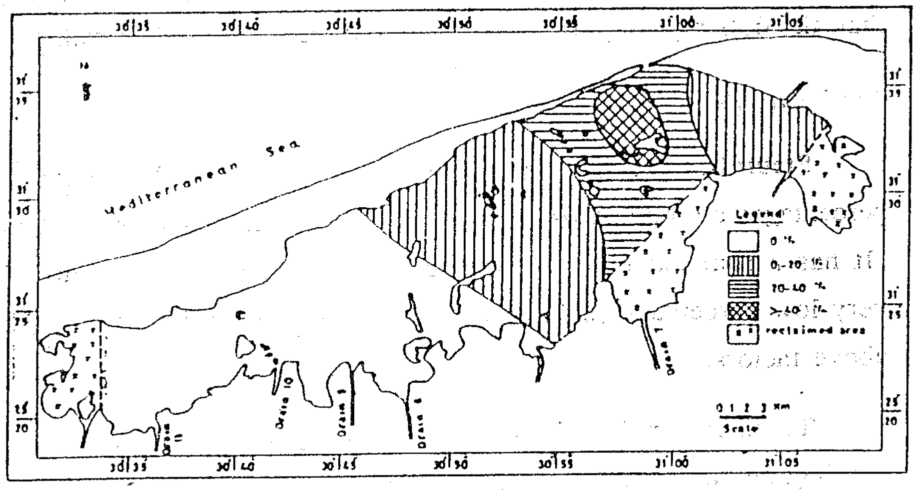

Fig. (23)

The frequency percentages of Garnet are ranged from zero to 29.03% with an average 2.77%.

Garnet is increased eastward direction (Fig. 27) where the depth is decreased (Fig. 28). The interrelation between Garnet and sorting (Fig. 29) reflects no distinct relation but the dots representing Garnet on the graph are grouped around 3 Ø value.

Zircon

Zircon has a small prismatic grains with rounded edges and brownish green colour. The frequency percentages of zircon are ranged from zero to 5.26% with an average 0.805%.

The interrelation between Zircon and the geographic position of the sediments (Fig. 30) reflects its preferential mechanicl concentration in the western pat of the lagoon which is relatively deep (Fig. 31). Its interrelation with sorting (Fig. 32) reveals that, the dots representing zircon are grouped around 3 Ø value.

Staurolite

Staurolite was recorded only in two stations. Its frequency percentages are ranged from zero to 3.23% with an average 0.21%. It has a rounded honey brown grains. Owing to its presence in very low percentage (0.21%) it is difficult to relate it to any of the above factors.

To interpret the distribution of heavy minerals through out the lagoon, it is necessary to take into consideration the bottom configuration, the current propagation and the physical properties of the heavy minerals contained in the sediments.

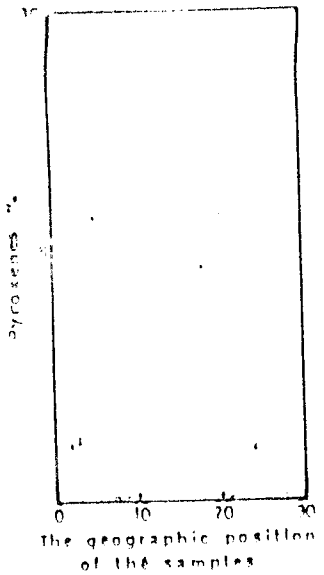

Fig. (24)

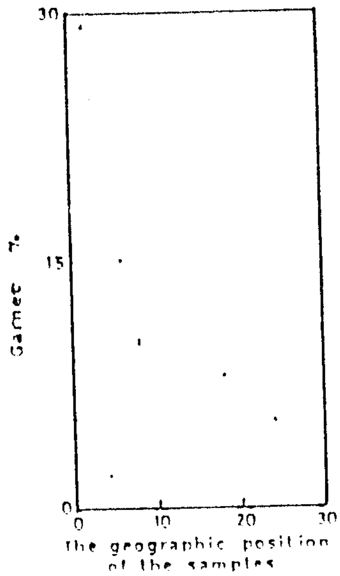

Fig. (25)

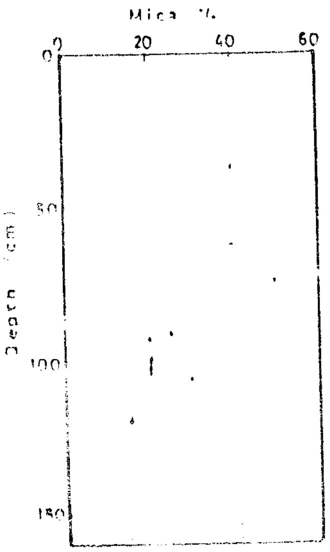

Fig. (26)

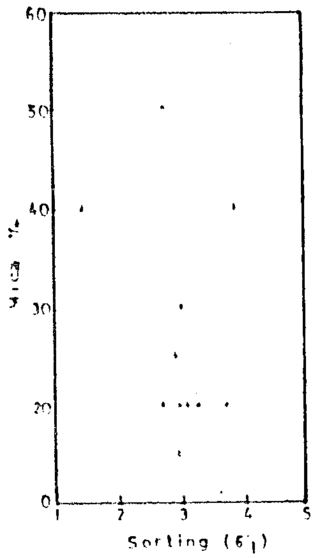

Fig. (27)

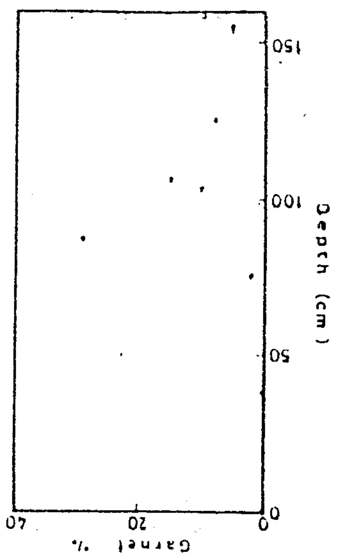

Fig. (28)

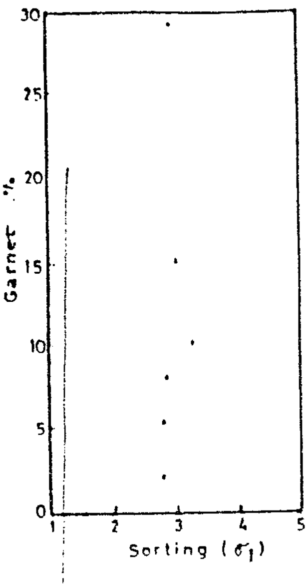

Fig. (29)

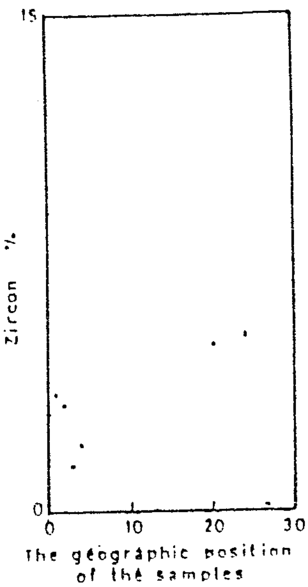

Fig. (30)

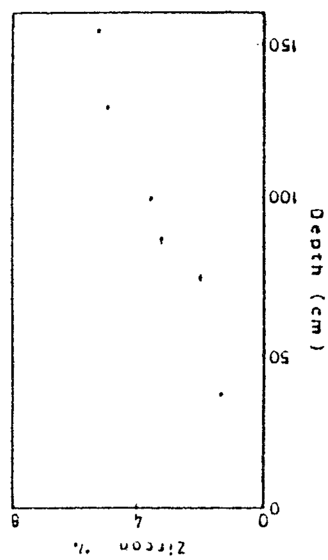

Fig. (31)

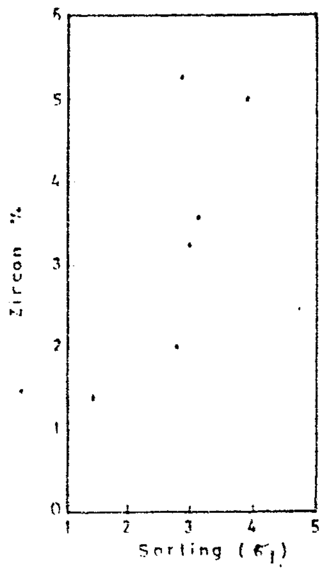

Fig. (32)

From the above mentioned interrelations between heavy mineral components and depth, the bottom configuration has a considerable effect on the heavy mineral distributions, that is mean, the bottom configuration is affected zircon, amphibole and opaque distributions which partly deposited when they were drained to the lagoon, however the other part may be rolled or floated with currents. This may explain their rlative concentration in the deep area off the drains (western part of the lagoon). The deposition of opaues, zircon and les dominant amphiboles may be referred to their preferential mechanical concentration on account of their specific gravity (Shukri & Philip, 1959; Mohamed, 1989).

Mica is also affected with the bottom configuration. It was recorded in shallow eastern area and nearly free from the western half of the lagoon. This means that. the relative abundance of Mica may referred to its cleavable nature which may assist mica to float with water currents to areas of lowest hudraulic nature. The area marks the presence of mica flakes may be referred to quiet energy environment (Malvina, 1966; Mohamed, 1968).

On relating the distribution of heavy minerals to the propagation of the current regime, the south western area of the lagoon was marked with the pouring place of drains. The effect of the drains on the western part of the lagoon may affect the distribution of the chlorosity, consequently, the density of lagoon waters. This may help the heavy minerals of high specific gravity to be deposited rather than those with relatively low specific gravity such as Mica. Thus, the relative low abundance of mica or nearly absent in the sediments may be reflected its hudraulic nature which prevents its settling in high energy environment (Malvina, 1966). Similarly, amphibole and pyroxene may also reflect their presence in quiet energy environment.

The Recent bottom sediments of El-Burullus lagoon are badly sorted with an average 3.26%. The heavy minerals were grouped around the vicinity of 3 value of sorting. This may be indicated that El-Burullus lagoon attains its sediments from the river deposit, drained to it through southern drain systems (Mohamed, 1968).

From the above, it can be concluded that :

- The area under investigation is originated from river deposit which comes through the southern drain systems.

- On the bases of heavy mineral distributions, El-Burullus lagoon may be divided into wastern relatively deep agitated lagoon and eastern shallow quiet lagoon environments.

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رواسب القاع الحديثة للاجون البرلس

ب – دراسة رسوبيه كأداة لتفسير البيئة

ممدوح عبد المقصود محمد ، جمال الدين عطيه ، ماجدة محمد أبو الصفا

هذا البحث يعتمد أساسا على الدراسات الترسيبيه والمعدنيه لرواسب لاجون البرلس بفرض معرفه العوامل المؤثره فى توزيع هذه الرواسب وأصل تكونيها.

وتضاريس قاع لاجون البرلس نشأ أساساً كنتيجة لعمليات لاجونيه فى صورة جزر ومنخفضات كما أن التيارات الناتجه بفعل الرياح مصدرها هو الرياح الجنوبيه الغربيه بينما التيارات الشاطئيه تأخذ الأتجاه المرادف لعقرب الساعه

واماكن الملوحه العاليه (٢٨ر١٩. ٪) سجلت فى الجزء الشمالى الشرقى الذى منه تبداء الملوحه فى الانخفاض التدريجى حتى تصل الى أقل نسبه (٦ر١٠. ٪) فى الجزء الغربى من اللاجون

رواسب لاجون البرلس تمتاز بالمكونات الغرينية الطميه والرمليه. والرمال المحتواه فى الرواسب هى عباره عن هياكل حيوانات لاجونيه كربونانيه.

والعوامل المؤثره فى هذه الرواسب هى العمق، الملوحه، وحجم قطر الحبيبات وراوسب لاجون البرلس ربما تعكس اصل تكونيها كرواسب نهرييه جرفت الى اللاجون بفعل التيارات الفكره وترسبت فى بئيه هادئه

والمعادن الثقيله التى سجلت فى رواسب لاجون البرلس هى معادن الجديد، الامفبيول، الميكا، البيروكسين، الجارنت، الزركون والاشتوروليت.

وعلى اساس توزيع المعادن الثقيله فى رواسب اللاجون يمكنا تقسيم لاجون البرلس الى منطقه غربيه ذات بيئه عكرة وقاع عميق تسبيا ومنطقه شرقيه ذات بيئه هادئه وقاع ضحل نسبيا