Sci. J. Fac. Sci. Menoufia Univ.
Vol.III(Geology & Chemistry)1989.

THE CARBONATE AND ORGANIC CARBON DISTRIBUTION IN RECENT BOTTOM SEDIMENTS OF LAKE QARUN.

Mamdouh A. Mohamed & Kamal A. Dahab

Geology Department, Menoufyia Univ.

ABSTRACT

This work deals with the distribution of carbonate and organic carbon contents to comment othe rigin of the Recent bottom sediments of lake Qarun. For this purpose 26 sediment samples were collected from the bottom of the lake and investigated.

The Recent bottom sediments of lake Qarun are characterized by moderate carbonate content. The variation in carbonate content between one locality and another may be partly attributed to the variation in the rate of supply of eolian deposits. The carbonate minerals recorded are mainly calcite, aragonite, Mg-calcite and dolomite.

The Organic carbon content (represented as organic carbon) tends to accumulate in the areas of lower energy and fine sediments. It has a slightly higher value relative to shallow water arid basins, but lower value than that of the world average for shallow water sediments.

Therefore Recent bottom sediments of lake Qarun appear of mixed terrestrial brachish, and saline water origin.

INTRODUCTION:

Lake Qarun occupies the lowest portion of El-Faiyum depression, (Fig.1.). Geogrophically it is divided into two parts (the eastern and the western parts). The western parts is more deep relative to the eastern part. The bottom configuration of the eastern part has a shallow basin with

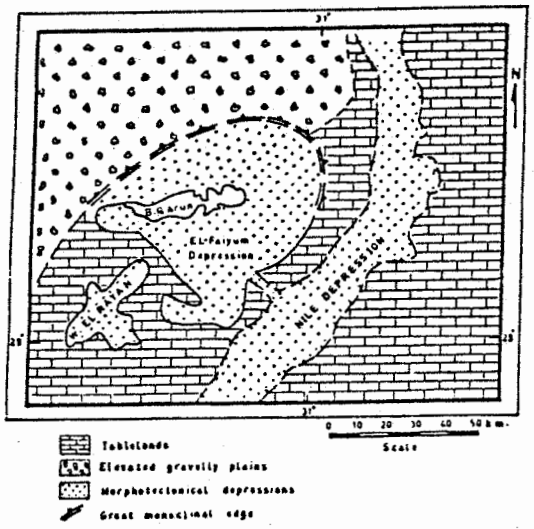


Fig.(1):Geomorphological map of El-Faiyum area and its vicinities(modified after Tamer, 1968).

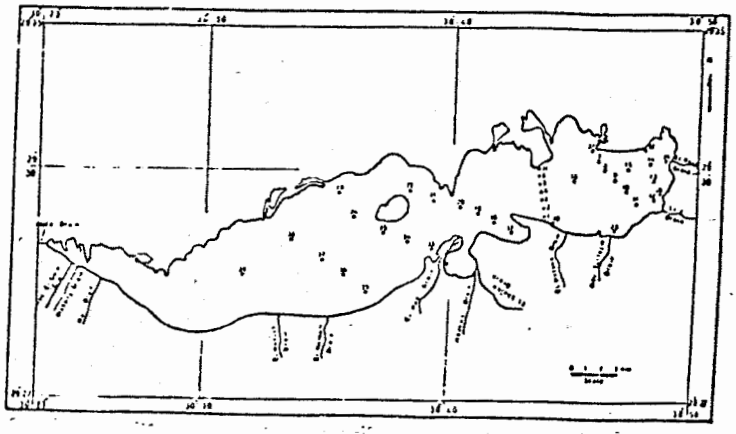


Fig.(2)Localtion map showing the distribution of thirty sediment samples collected from lake Qarun.

broad V-shape cross section which is nearly symmetrical. However, the western part has a relatively deep asymmetrical profile (Mohamed, 1990).

The average salinity recorded in the easten part is 37.5% whereas, the average salinity measured in the western part is 41%. Lake Qarun sediments are mainly deposited under shallow agitated marine environment. The texture of bottom sediments changes irregularly with respect to shoreline. The fine fraction is deposited directly off the main drains (El-Bats and El-Wadi drains) and located nearly in the middle part of the lake, at which the greater depth is recorded. There are several areas where the coarse sediments exist on the marginal parts of the lake rather than on the inner part (Mohamed, 1990).

MATERIAL AND METHOD

Thirty-mine grab samples were collected from the bottom of lake Qarun at depth between 0.3 to 7.2 m from water surface Its corrdination ranges between latitude 29^{o} - 20^{-} & 29^{o} - 30^{-} N and longitude 30^{o} - 23^{-} & 30^{o} - 50^{-} E.

The coordination and field observation of the collected samples in addition to depth and salinity measurement are listed in table (1).

Table (1): The coordination and field description of the collected samples in addition to depth and salinity measurements.

Sample No	Depth (m)	Latitude (N)	Longitude (E)	Salinity (‰)	Field description of samples
1	1.65	29°.8.44"	30°.44.6"	36.200	Brown sands with numerous shells
2	3.00	29°.28.56"	30°.44'	35.000	Blackish brown mud with shells
3	3.5	29°.29.12"	30°.43.54"	34.900	Blackish brown mud with shells
4	4.55	29°.29.24"	30.43.48"	35.000	Blackish brown nud with shells
5	4.80	29°.29.42"	30°.43.42"	36.000	Green mud with numerous shells
6	4.41	29°.29.56"	30.43.40"	37.000	Green mud with numerous shells
7	2.55	29°.30.16"	30°.46.24"	36.000	Green mud with numerous shells
8	3.80	29°.30.3"	30°.46.37"	36.00	Blackish brown mud with shells
9	3.90	29°.29.46"	30°.47.9"	33.700	Green mud with shells
10	3.5	29°.29.29"	30°.47.36"	36.000	Green mud
11	3.20	29°.29.10"	30°.48.9"	37.000	Green sandy mud with shells
12	1.60	29°.29.15"	30°.48.56"	38.300	Green shands with Algae
13	2.60	29°.29.49"	30°.48.51"	38.000	Green mud
14	1.60	29°.30.13"	30°.48.36"	36.500	Green sands
15	3.30	29°.30.6"	30°.49.42"	38.250	Mud with numerous shells
16	4.10	29°.29.48"	30°.45.30"	36.500	Mud with numerous shells
17	1.80	29°.28.13"	30°.42.45"	70.000	Green sandy mud
18	2.55	29°.28.30"	30°.41.54"	40.000	Green mud
19	5.20	29°.28.55"	30°.41.8"	40.000	Green sandy mud with shells
20	5.50	29°.28.56"	30°.40.18"	39.000	Green mud with shells
21	5.25	29°.29.6"	30°.39.12"	39.500	Green mude with shells
22	6.85	29°.29.28"	30°.38.12"	40.000	Green mud with shells
23	6.0	29°.29.20"	30°.35.20"	41.000	Green sands with numerous shells
24	7.20	29°.28.38"	30°.36.00"	42.000	Green sandy mud with shells
25	3.75	29°.28.18"	30°.37.9"	40.000	Shells with few sands
26	0.40	29°.30.20"	30°.49.15"	36.000	Green mudy sands
27	0.34	29°.30.36"	30°.46.24"	37.000	Blackish brown sands
28	0.3	29°.29.26"	30°.44.11"	36.000	Brown mudy sands
29	0.4	29°.28.22"	30°.47.7"	36.000	Brown sands
30	0.20	29°.28.33"	30°.44.24"	40.000	Brown sands
31	0.30	29°.30.4"	30°.43.38"	39.000	Brown sands
32	0.4	29°.30.47"	30°.48.24"	39.000	Blackish brown sands
33	0.56	29°.27.42"	30°.39.13"	36.500	Mudy sands with few shells
34	3.60	29°.27.53"	30°.38.11"	37.500	Green mud
35	2.10	29°.26.22"	30°.36.40"	41.000	Green mud with shells
36	4.25	29°.26.49"	30°.36.43"	42.000	Green mud with shells
37	5.20	29°.27.18"	30°.34.52"	42.000	Green mud with shells
38	6.86	29°.27.55"	30°.33.30"	42.000	Green mud
39	5.37	29°.26.34"	30°.31.43"	43.000	Green mud

The carbonate analysis was carried out on 26 sediment samples following the technique used by Anwar and Mohamed (1970).

The mineral composition of the carbonate was studied by the X-ray differaction technique. For this purpose, a shamadzu X-ray differactmeter was used and runs with Ni filter and Cu radiation (= 1.541 $\AA^{o}$) at 30 KV and 20 MA Patential were made. The time constant is 2 second, scanning speed 10 and chart speed is 10 mm/min.

The Organic carbon contents were determined for twenty-six sediment samples following the technique used by El-Wakeel and Rily (1957).

The data obtained from carbonate and organic crabon contents are listed in table (2).

RESULT & DISCUSSION

From the data listed in table (2), it was found that the carbonate content ranges between 13.16 % and 68.87 % with arithmatic average 29.29%.

Table (1): The carbonate and organic carbon content in addition to depth and Median diameter.

Sample No	Depth (m)	Median diameter (Md)	Carbonate content %	Organic carbon %	Organic matter %
1	1.65	1.80	43.3	0.26	0.44
4	4.55	6.30	34.29	0.32	0.55
6	4.40	3.20	28.5	0.12	0.21
7	2.55	5.90	33.0	0.34	0.58
9	3.90	5.30	25.0	0.26	0.44
11	3.20	5.75	32.2	0.17	0.29
13	2.6	5.80	18.0	0.19	0.32
14	1.60	4.08	17.32	0.12	0.20
17	1.80	6.30	27.15	0.26	0.44
18	2.55	6.20	34.8	0.22	0.37
20	5.50	5.00	38.18	0.36	0.61
22	6.85	5.60	41.5	0.32	0.56
23	6.00	6.10	42.3	0.31	0.53
24	7.20	6.03	40.0	0.27	0.46
25	3.70	3.15	68.87	0.43	0.73
26	0.40	2.50	14.0	0.21	0.36
27	0.34	1.45	26.0	0.070	0.12
28	0.30	4.90	15.13	0.16	0.27
29	0.40	2.85	13.16	0.100	0.17
33	0.56	3.20	32.5	0.14	0.24
34	3.60	6.90	47.6	0.25	0.43
35	2.10	6.90	33.0	0.17	0.29
36	4.25	6.00	32.3	0.26	0.44
37	5.20	6.0	40.0	0.20	0.34
38	6.86	6.1	32.2	0.30	0.51
39	5.37	6.15	31.21	0.30	0.51

In order to find the factors controlling the carbonate distribution in the sediments of lake Qarun, the following relationships have been investigated:

1- Salinity and carbonate content (Fig.3).

2- Depth and carbonate content (Fig.4).

3- Median diameter and carbonate content (Fig.5).

4- Organic matter and carbonate content (Fig.6).

From these interrelationships, it has been found that, carbonate varies pathetically with salinity, organic matter and depth. Carbonate increases with increasing depths, Organic matter and salinity. However, there is also a direct relation noticed between carbonate and the Median diameter (Md). The fines the texture of the sediments the higher the carbonate content.

AREAL DISTRIBUTION OF CARBONATE CONTENT

From the data of carbonate contents a carbonate distribution map was made (Fig.7). From this map, it was found that the lake area can be divived into two geographic units.

a) Eastern part is caracterized by a relatively low carbonate content. Carbonate increases nearly in the middle of this part of the lake where it reaches its maximum values (40%) near khashm El-Zena and rapidly

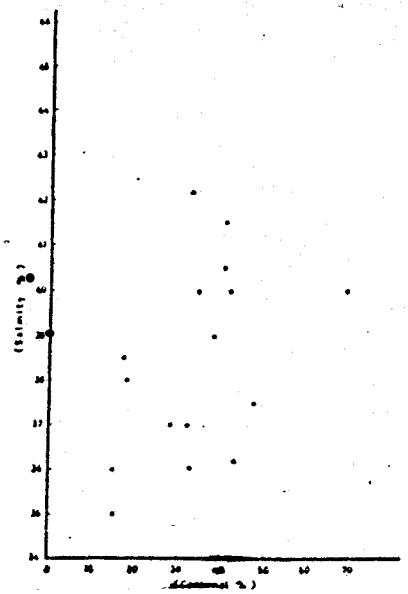


Fig.(3):Interaction between carbonate salinity and carbonate content

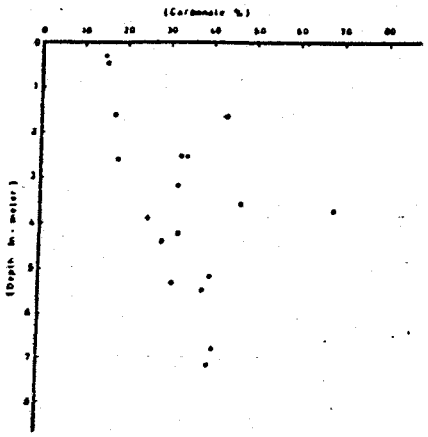


Fig.(4):Interaction between carbonate content and depth.

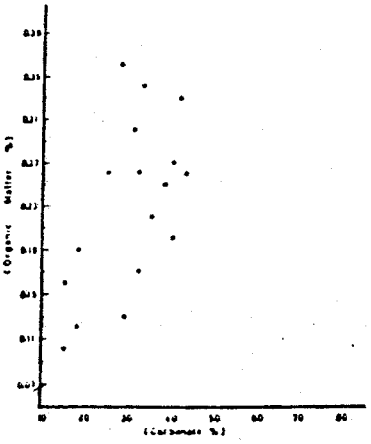


Fig.(6):The interrelation between organic matter content and carbonate content.

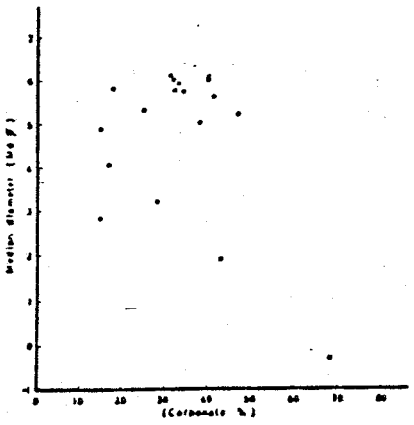


Fig.(5):Interrelation between carbonate and median diameter.

decrease towards the coast of the lake where it reaches 15%.

b) Western part is relatively riched in carbonate contents. The carbonate is concentrated mainly around the Golden Horn Island where its content reaches a maximum value (68.87 %) and gradually decreases SSW direction where it reaches less than 35%.

Genarally, the sediments in the central part of the lake, tend to be rich in carbonate content.

THE MINERALOGICAL COMPOSITION OF THE CARBONATE SEDIMENTS

The mineralogical composition of carbonate material in lake Qarun was studied by X-ray differaction analysis. For this purpose, eight samples were selected in such way to represent the lake area.

The semiquantitative identification of the carbonate minerals brought about the following results: calcite and aragonite are present in variable proportions, Mg-calite and dolomite are also identified in all the samples (Fig. 8).

The variable proportions of calcite and aragonite in the samples reflect the difference in derivation (aeolian and biogenous remains). Mg-calcite is abundant in all samples

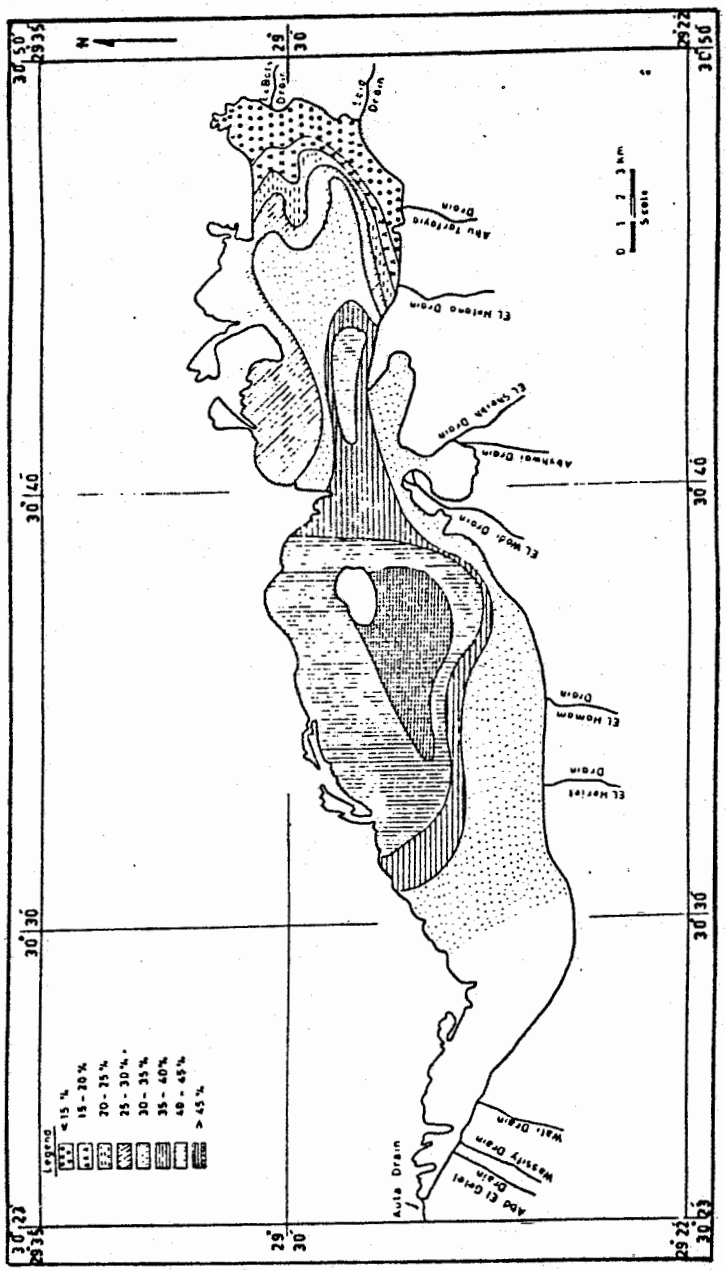
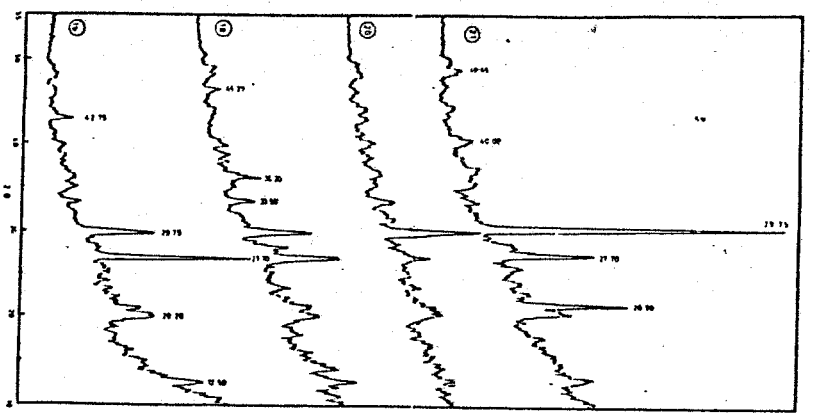


Fig.(7) Carbonate distribution map of lake Qarun.

where aragonite is dominant. This phonomena could be attributed to the texture of the bottom sediments which is composed mainly of skeletal remains of micro and macro. Organism embedded in fine grained marly sediments.

The formation of aragonite as a secondary material due to the influence of water chemistry after the death of organism was reported by Mohamed & Al-Shamlan (1987). (see microphotograph No.1). No particular significance is attributed to the presecne of dolomite except the eolian dust falling into the lake. The dustfall may contain much dolomite derived from the desert country rocks. Moreover, Carbonate has a very low solubility in carbon dioxide-free sea water. Consequently, Carbon dioxide solubility depends upon temperture and salinity (Sverdrup et al., 1970). The resulting rise in temperature tend to cause a reduction in the dissolved carbon dioxide and hence carbonate deposition results directly by promoting evaporation and increased salinity.

Therefore, the variation in crabonate content between one locality and the other in the lake can be partly attributed to the variation in the rate of carbonate deposition related to depth and salinity variation However the rate of supply of aeolian deposits can not be disregraded.



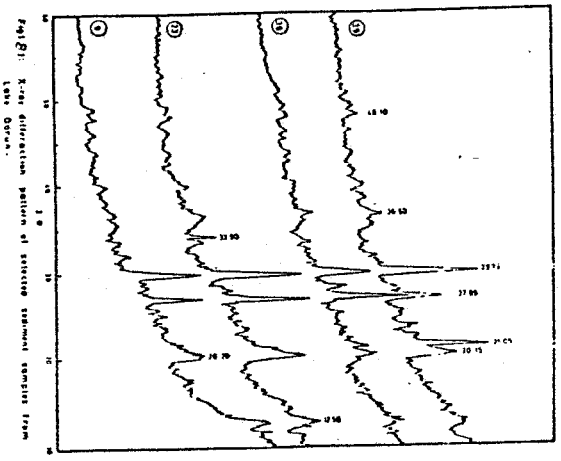


Fig.(8): Sample differactograms.

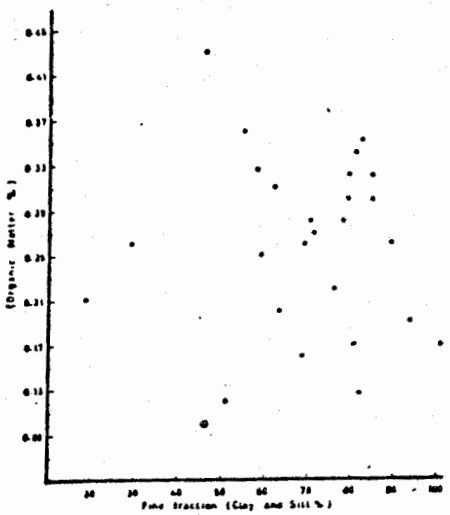


Fig.(11):Interrelation between organic matter content and fine fraction.

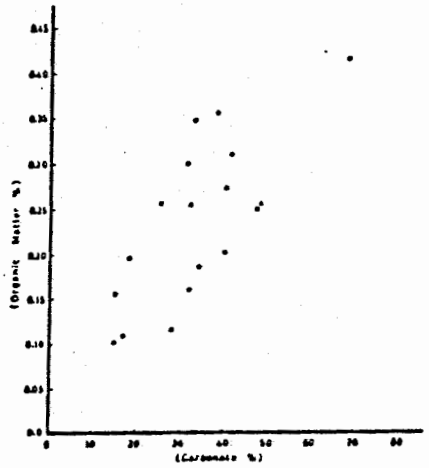


Fig.(12):Interrelation between carbonate content and organic matter content

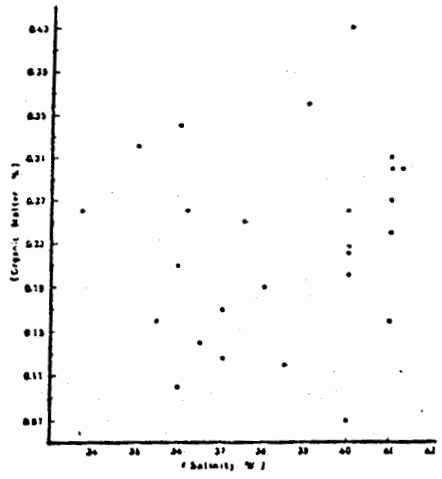


Fig.(12):Interrelation between organic matter content and salinity.

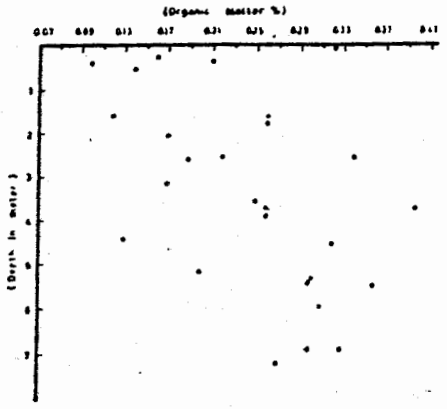


Fig.(13):Interrelation between depth and organic matter content.

The Organic Carbon Content :

The orgainc carbon content present in the Recent bottom sediments of lake Qarun were determined in twenty six, sampls following the technique used by El-Wakeel and riley (1957).

The data obtained (see table 2), reveals that the Recent bottom sediments of lake Qarun are characterized by small amouns of organic carbon ranging between 0.07% and 0.43% with an averager value 0.225%. Their corresponding organic matter ranges between 0.130% and 0.739%.

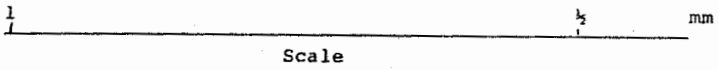
The organic carbon values were drawn on a map to show their regional distribution (Fig. 9). From this map, it is evident that there are a distinct areas with a relatively higher organic carbon content. This are noticed north eastern part and in the northern area from the western part of the lake. These areas corresponds to a higher carbonate content with different type sediments.

An attempt was made to find out the factors affeting organic carbon distribution in the lake, this was made by plotting the organic carbon content (Organic matter) with :

1- Carbonate content (Fig. 10).

2- Fine fraction (Fig. 11).

3- Salinity (Fig. 12).



Micrograph (1): The thickening of wall structure of microgastropod by deposition of aragonite needle after the death of organism.

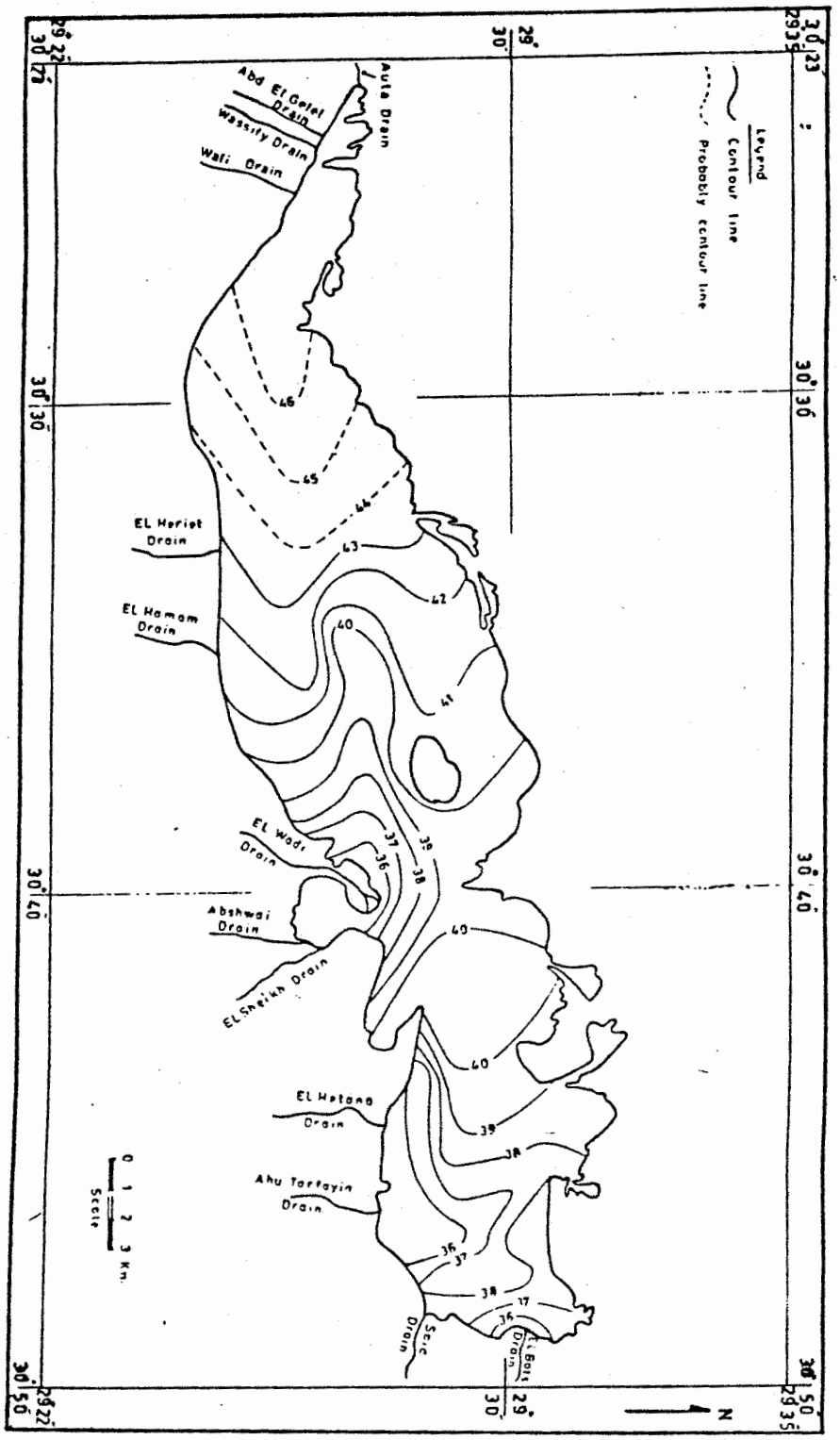


Fig.(21): Salinity distribution map.

2- The variable proportions of calcite and aragonite reflect the difference in derivation (aeolian and biogeneous remains).

3- The eolian dust falling into the lake contain dolomite.

4- The variation in carbonate content between one locality and the other in the lake can be partly attributed to the variation in the rate of carbonate deposition.

5- the distribution of organic matter is affected by depth, salinity and grain size.

6- The organic matter content reveals that this area under investigation characterised by lower energy environment.

So, Lake Qarun Sediment is considered as a mixture from terrestrial, brackish and saline water origin.

ACKNOWLEDGEMENTS

The author wishes to express his deep gratitude to Prof.Dr. M.Sh. Diab, head of geology Department and the Dean of Faculty of Science for his continuous help during the progress of this work.

REFERENCES

Anwar, Y.M., and Mohamed, M.A. (1970) : The distribution of calcium carbonate in coutinental shelf Sediments of mediterrancean sea north of the Nile Delta in U.A.R. Bull. Inst. Ocean and Fisheries, Vol. 1, No. 1, pp. 451-480.

El-Wakeel, S.K.,& Riley, T.P. (1957) : the determination of organic carbon in marine muds. Jour. Cons. Inter. Pour Explor, de la mer vol. 12, pp. 190-193.

Mohamed, M.A. (1990) : Recent Bottom sediment of Lake Qarun. Sci, Jour. Fac. Sci. Menoufiya Univ.

Mohamed, M.A., Al-Shamlan, A.A. (1987) : Origin of carbonate in the deterital Recent sediment of kuwait bay Arabian Gulf. Sci. Jour. Fac. Sci, Menoufia Univ., Vol. 1, No. 1.

Sverdrup, H.V., Johnson, M.W. and Fleming, G.HU. (1970) : The Oceans. (Marine sedimentations P. 964). Prentice Hall, New York.

Winland, H.D. (1969) : Stability of calcium carbonate Polymorphs in warm shallow sea water, Jour. Sedi, Petral. 39. pp. 1579-1587.

4- Depth (Fig. 13).

5- Median diameter (Fig. 14).

From these interrelationships it appears that the organic matter content (organic carbon) is affected to different degrees with depth, fine fraction, Median diameter and carbonte content. However the organic matter contents increases clearly with increasing the fine faraction, carbonte content & depth.

So, the distribuition of organic carbon content is affected clearly by depth, grain size and carbonte content, It tend to accumulate in the areas of lower energy and fine sediments.

The average organic carbon content of the present area (0.255%) is slightly higher relative to shallow water arid basin which ranges between 0.03% and 0.201% (Emery, 1968).

CONCLUSION

From the foregoing discussion the following conclusions are reached :

1- Lake Qarun bottom sediments are characterized by moderate