EGYPTIAN JOURNAL OF AQUATIC RESEARCH 1687-4285
VOL. 31, SPECIAL ISSUE, 2005: 38-44.

INVESTIGATION OF SOME MAJOR IONS ANOMALIES IN ALEXANDRIA COASTAL WATER (APRIL, 1999)

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Keywords: Major ions – Alexandria water – Chlorinity ratio – Coastal area

ABSTRACT

The present work aims to evaluate some major ions level in Alexandria coastal water and their chlorinity ratios relevant to the corresponding normal oceanic ones. This study of some major constituents in Alexandria coastal waters is based on the analysis of 36 samples taken from 6 sections collected during April 1999 starting from Rashid to Agami .According to the total average of the analyzed samples concentration, the studied ions levels were as follows: Ca 421 mg/L, Mg 1379 mg/L, SO4 2.717 g/L, and alkalinity 2.82 meq/L. The corresponding chlorinity ratios for these ions are: 0.02013, 0.06609, 0.1311 and 0.1314 respectively. By all the average chlorinity ratios of the cations and anions deviations from the respective oceanic values can be detected. The marked dilution effect caused by the Nile water in front of Rashid branch in addition to the waste effluents discharge at some points of the coast is considered as the main contribution of these anomalies. Calcium / chlorinity ratio deviates negatively below the normal oceanic ratio. Magnesium content is about 3.4 folds that of calcium and tends to increase seawards and downwards. Most of samples reflect Mg/Cl as well as SO4/Cl ratios below the normal oceanic ones while the specific alkalinity deviates positively above the oceanic ratio.

INTRODUCTION

The investigation of some major ions ;Ca , Mg .,SO4 as well as total alkalinity in seawater is carried out on 36 samples collected at 16 locations (six sections, A - F) during April 1999 covering the coastal area from Rashid to Agami (Fig. 1). This work displays the study of ionic relationships and salinity problem. Declination of ions-chlorinity ratios from the normal oceanic ones summarize the influence of dilution effect resulted from the discharge of different types and amounts of land- based effluents and Nile water into the coastal area.

MATERIAL AND METHODS

Water samples were collected from 16 sites represent Alexandria coastal area .The sampling was done at surface, 10, 20, and 30 meter depth during April1999 using Niskin.

Bottle of 5L capacity. Salinity was calculated from the electrical conductivity which measured by induction Beckman Salinometer, Model.R.S.7B. using standard tables and making temperature corrections. Chlorinity was calculated from salinity values according to the empirical formula:

$$S‰ = 1.80655\ Cl‰$$

Calcium, magnesium and strontium were determined titrimetrically according to the method of Heron and Mackereth (1960) using EDTA standard solution and EBT indicator. Calcium and strontium were titrated against EDTA and using another indicator, Murexide, the values of both elements were considered as Ca-content. Magnesium was computed as a difference between total hardness and calcium value. Sulphate was

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determined gravimetrically according to the method of Bather and Riley, 1954 and mentioned by Grasshoff (1976). Total alkalinity was analyzed by titration against standard HCl using Methyl Orange as indicator (Harvey, 1955).

RESULTS AND DISCUSSION

The calcium content in surface water of Alexandria coastal area recorded its maximum level of 471.3mg/l at Abu-Qir area (Sec.B2). The highest sub-surface value was reported in front of Sidi-Bishr (Sec.D3) away from the shore, being 452.1 mg/l. The lowest value of 355.9 mg/l was found near Rashid shore (Sec. A1, bottom) which reflect also a minimum of chlorinity ratio (0.01695). The water column away from the shore tends to show a downward increment in Ca-content. Such enrichment of calcium content near the bottom is probably associated the decrease in water temperature and increase in the amount of CO2 and actively dissolve of Ca CO3 constituting the frustules of dead plankton falling from the surface. The sudden drop in CO2 present in the upper surface water through photosynthetic process leads to the precipitation of calcium carbonate. Calcium content and its corresponding chlorinity ratio tends to deviate from the normal oceanic levels under the effect of dilution caused by fresh Nile water in front of Rosetta branch or other terrestrial effluents discharge along the coast in addition to calcium consumption by calcareous organisms .Mahmoud (1998) found that the lowest concentrations of Ca, Mg and Na ions in Alexandria coastal water were recorded in April, the same month of sampling of the present work. Three exceptional peaks of Ca/Cl ratios reported in front of Rashid ,A2s (0.0218), Abu-Qir, B2s (0.0219) and at Agami ,F3b (0.0263).With respect to regional average, the eastern water in front of Rashid , section A, exhibited the lowest level (404 mg/l) while the western one , Agami , reported the highest of 427 mg/l, the intermediate area contained a range of 420 – 425 mg/l. Calcium chlorinity ratio (on average) reflect also a more or less slight increments from east to west (0.0192 – 0,0201) . The total average of calcium/chlorinity ratio of 0.0201 is relatively higher than those of; Alexandria Eastern harbour (0.0188) reported by Shridah (1982),Shridah and Emara(1992), Western harbour (0.0186) estimated by Nessim (1988) and El Mex Bay (0.0198) recorded by Nessim (1994) but still lying below the normal oceanic ratio (0.0216) published by Culkin and Cox (1966).

<u>Magnesium variations:</u>

The average magnesium content, as expected, is 3.3 folds that of calcium. Its surface value varied from 1399mg/l in front of Eastern harbour (sec. E3) to 1254 mg/L at Agami (sec. F1). The bottom water sustained relative higher level fluctuating from 1317 mg/L in front of Eastern harbour (sec.E1) to 1558mg/L in front of Rashid (sec.A3). It is evident from the data that magnesium content tends to increase seawards away from the dilution effect caused by land based sources as well as downwards. A direct significant correlation of magnesium value with salinity was computed ($r=0.36$, $p<0.001$). Since the main part of the combined fraction of magnesium is paired with sulphate (Millero, 1974), we computed a significant correlation between both ions ($r= 0.41$, $p<0.001$) confirms this fact.

A slight lateral increase in Mg-content or decrease in its chlorinity value from east to west could be detected starting from Rashid till Eastern harbour area. With respect to the Mg-chlorinity ratio of oceans reported by Culkin and Cox, 1966 (0.0669), most of reported Mg-chlorinity ratios deviate negatively below it. The near bottom water taken in front of Agami (sec.F3) show high chlorinity ratio, 0.0873, resulted from unexpected drop in salinity without any excess in magnesium content. The positive declination in Mg-chlorinity ratio reported by Kremling, 1970, on the other hand, in Baltic Sea indicates a relative excess of magnesium ions. The calculated Mg/Cl ratio with its total average of 0.0650 is negatively deviated below the normal oceanic ratio (0.0669) of Culkin and Cox (1966) or even those recorded by Shridah 1982 and Nessim 1988 in Alexandria Eastern and Western harbours, respectively.

Sulphate variations

A wide range of fluctuations in sulphate content of the coastal water could be found (1.942 – 3.182 g/L. Similar to Ca and Mg-chlorinity ratios, SO4/Cl ratio of most studied samples deviates strongly negative below the normal oceanic one (0.140) reported by Morris and Riley , 1966(Fig 2). A few samples, on the other hand, showed little higher deviations above normal (>0.140 – 0.150).Owing to the relative low concentration of sulphate in fresh Nile water if compared with seawater (nearly one – tenth) its chlorinity ratio reached up to 1.6878 which is more than twelve times that of seawater (Morcos, 1967) . The sulphate chlorinity ratio of the coastal water could be rise under the dilution effect. At Port Said, Morcos (1967) found a SO4/ chlorinity ratio of 0.1405 for seawater. Thompson *et al* (1931) found a chlorinity ratio of 0,1414 for the Baltic sea, Morcos (1970) gave an average of 0.1400 for seawater ,Nessim and Schlungbaum , 1980 recorded higher ratios in the inland water connected with the Baltic sea (up to0.2521). Shridah .1982 reported an average ratio of 0.1392 for the Eastern Harbour water. El-Samra (1973) found an average of 0.1607 for Abu-Qir Bay. Our average of sulphate chlorinity ratio of 0.1309 is relative lower than the previously mentioned ratios.

Alkalinity variations

A wide range in alkalinity of the studied samples was detected fluctuating between 2.08 meq/L at Rashid, A3s and 3.18 meq/L at Eastern harbour, E3s. It is noticeable that most of surface water which suffered from dilution by land – based sources and consequently relative lower in salinity reflects higher values of alkalinity or specific alkalinity (Grasshoff, 1975). Nessim. 1988 found high alkalinity in surface water of the Western harbour associated with a sharp drop in salinity.

The specific alkalinity of most samples as well as its total average of 0.131 are still higher than that given by Koczy, 1956, for normal seawater (0.123) or than that obtained for Eastern Harbour by Shridah 1982 (0.127) but still little lower than those for the Western harbour (Nessim, 1988) and the coastal water in front of Mex pumping station (Mahlis *et al,* 1970) or too low if compared with that of Mex Bay (Nessim, 1994).

CONCLUSION

From the above results we have come to the conclusion that land-based sources at different sites along the coast have a marked effect on the chlorinity ratios of the major ions. Most of calcium,magnesium and sulphate ratios were found below the oceanic ratio.

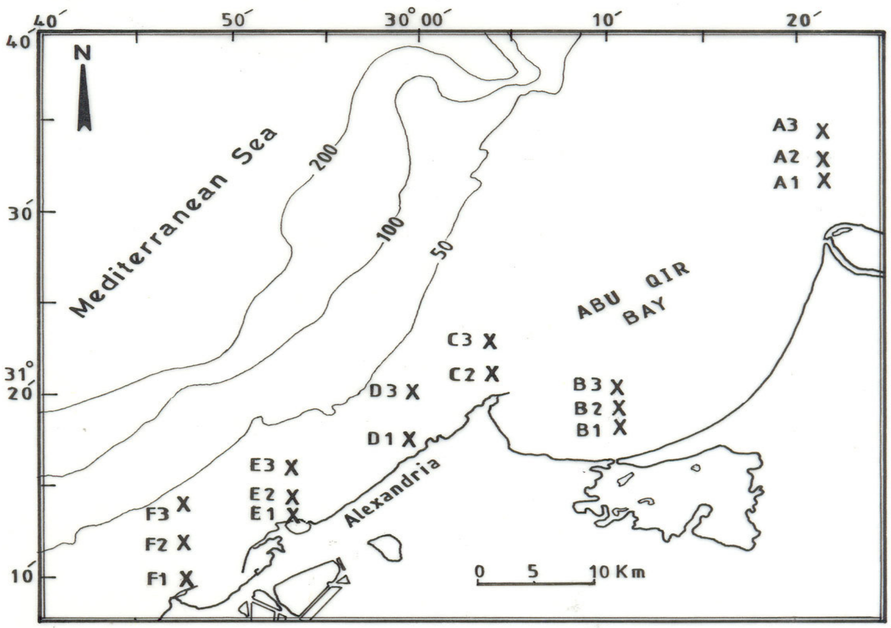

Fig. 1. Location of sampling (X) and stations

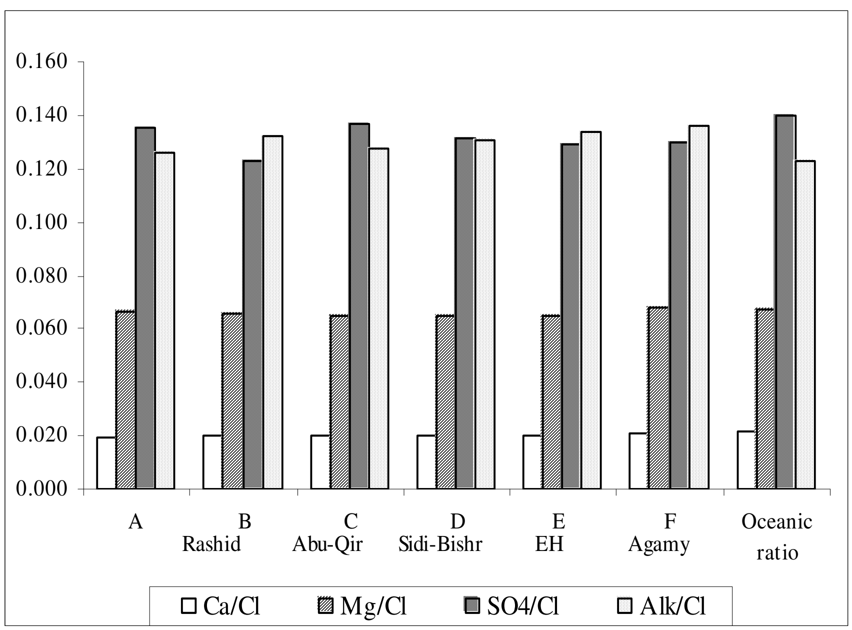

Fig.(2): Deviation of some major ions/ chlorinity ratios from oceanic ratio-Alexandria coastal area ,April 1999

Table 1. Variations of some major ions and their chlorinity ratios in Alexandria coastal water (April 1999).

Location		Depth m	S ‰	Ca^{++} mg/l	Mg^{++} mg/l	SO_4 mg/l	Alkalinity meq/l	Ca^{++}/Cl	Mg^{++}/Cl	SO_4^{--}/Cl	Alk./Cl
Rashid	A_1	0	37.618	423.2	1342	2629	2.64	0.0203	0.0644	0.126	0.127
	A_1	10	37.941	355.9	1418	-	5.64	0.017	0.0675	-	0.126
	A_2	0	32.694	394.4	1254	2184	2.8	0.0218	0.0693	0.121	0.155
	A_2	10	38.269	413.6	1383	3182	2.72	0.0195	0.0653	0.15	0.128
	A_3	0	38.506	404	1307	-	2.08	0.019	0.0613	-	0.098
	A_3	10	38.617	432.9	1558	3089	2.56	0.0203	0.0729	0.144	0.12
Abu-Qir	B_2	0	38.822	471.3	1324	2660	2.88	0.0219	0.0616	0.124	0.134
	B_2	10	38.558	413.6	1453	2332	2.72	0.0194	0.0681	0.109	0.127
	B_3	0	38.097	413.6	1383	2863	2.8	0.0196	0.0656	0.136	0.133
	B_3	10	38.337	413.6	1418	-	2.88	0.0195	0.0668	-	0.136
	B_3	20	38.817	442.5	1400	-	2.8	0.0206	0.0651	-	0.13
	C_2	0	37.18	404	1315	2582	2.56	0.0196	0.0652	0.125	0.124
	C_2	10	38.741	413.6	1406	3120	2.56	0.0193	0.0656	0.146	0.119
	C_3	0	37.987	413.6	1324	2925	2.88	0.0197	0.063	0.139	0.137
	C_3	10	38.537	442.5	1400	-	2.8	0.0207	0.0656	-	0.131
Sidi-Bishr	D_1	0	37.742	442.5	1295	2597	3.04	0.0212	0.062	0.124	0.146
	D_1	10	38.509	394.4	1359	2551	2.72	0.0185	0.0638	0.12	0.128
	D_2	0	38.507	442.5	1318	2722	2.56	0.0208	0.0619	0.128	0.12
	D_2	10	38.681	384.8	1435	-	2.8	0.018	0.067	-	0.131
	D_3	0	38.257	413.6	1359	2792	2.72	0.0196	0.0648	0.132	0.128
	D_3	10	38.617	452.1	1453	3151	2.8	0.0212	0.068	0.147	0.131
	D_3	20	38.937	442.5	1458	2956	2.8	0.0205	0.0677	0.137	0.13
Eastern Harbour	E_1	10	38.213	413.6	1317	-	2.48	0.0196	0.0648	-	0.117
	E_2	0	38.003	452.1	1374	2597	2.56	0.0215	0.0641	0.124	0.122
	E_2	10	38.653	432.9	1359	2512	2.8	0.0202	0.0635	0.117	0.131
	E_2	20	38.817	432.9	1446	-	-	0.0202	0.0673	-	-
	E_3	0	38.517	384.8	1399	3136	3.18	0.0181	0.0657	0.147	0.154
	E_3	10	38.733	404	1388	-	3.12	0.0188	0.0648	-	0.146
Agami	F_1	0	31.918	375.1	1254	2590	3.12	0.0212	0.0693	0.147	0.177
	F_1	10	38.697	442.5	1400	-	2.64	0.0207	0.0654	-	0.123
	F_2	0	38.297	442.5	1330	2566	2.64	0.0209	0.0627	0.121	0.125
	F_2	10	38.377	422.5	1400	-	2.72	0.02	0.0659	-	0.128
	F_3	0	38.977	423.2	1365	2824	2.64	0.0196	0.0633	0.131	0.123
	F_3	10	38.857	423.2	1423	-	2.72	0.0197	0.0662	-	0.133
	F_3	20	38.737	423.2	1423	-	2.56	0.0197	0.0664	-	0.119
	F_3	30	29.18	442.5	1411	1942	2.64	0.0263	0.0873	0.12	0.163
X			37.832	420.5	1379	2717	2.82	0.02013	0.06609	0.1311	0.1314
S.D±			2.093	24.08	61.92	318	0.53	0.00151	0.00436	0.0117	0.0143

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