A PRELIMINARY STUDY OF THE DISTRIBUTION OF CALCIUM IN THE COCHIN BACKWATER

ABSTRACT

Dissolved calcium distribution in the Cochin Backwater was studied in December 1973 at forty station. The ratio of calcium to chlorinity value in the estuary was found to deviate discontinously as compared to sea water. The ratio of calcium to chlorinity ranged from 0.02122 to 0.02246 and 0.0714 for different samples. In a majority of the samples, higher values of calcium relative to chlornity were found with decreasing chlorinity. The distribution of calcium-chlorinity ratio of the estuarine waters at different stations showed 5 to 15% increase over at the adjacent sea water.

CALCIUM is one of the important biogenic salts required by the living animals in soil and water. It is also of major importance as a limiting factor in the distribution of certain animals in the ecosystem. The present communication reports the distribution of calcium in the Cochin Backwater (Latitudes 09° 40′ - 10° 10′ N and 76° 10′ - 76° 25′E), a tropical estuary in the southwest coast of India.

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Material and methods

Dissolved calcium distribution in the Cochin Backwater was studied in December 1973. Forty stations were selected, of which 37 were in the estuary and three outside the bar mouth (Fig. 1). Samples for study were taken from subsurface waters and just above the bottom.

Calcium was determined by two methods; the first one was EDTA complexometric titration method reported by Pate and Robinson (1958) and the second method involved the use of 1:2 bis- [–2–di (carboxymethyl)–Aminoethoxy]-ethane *ie.* (EGTA) reported by Culkin and Cox (1966). Percentage deviation of the data as obtained between the two methods was less than ±0.5 (Table 1). However, the former method was found to be simple and quick. In this study the mean value of both determinations were calculated and presented. The values of calcium were corrected for strontium content where required for Sr/Cl $‰$ ratio of 0.00042. Chlorinity was determined by Knudsen's Silver nitrate method.

Table 2 gives the ionic composition of the sea water as revealed at stations 15, 16 and 17 which were located in the inshore area off Cochin (Fig. 1). The data of sodium, potassium, magnesium and calcium contents agree closely with those recorded for the typical marine environment. The distribution of calcium–chlorinity ratio at different stations in the estuary is given in Tables 3, 4 and 5.

On the basis of the data presented, the study area was differentiated into three regions according to the calcium-chlorinity ratio (Ca/Cl). The first category indicate the stations where Ca/Cl/ratio closely followed that of seawater (Table 2).

TABLE 1. *Comparison of the two titration methods adopted for the estimation of calcium*

Complexon	Meq taken	Meq of Ca found	Percentage deviation
EDTA	0.4544 Ca	0.4555	M0.2
	0.4500 CaM	0.4488	M0.2
	30 mg Mg.		—0.25
	0.4500 CaM	0.4485	—0.3
	60 mg Mg.		
EGTA	0.4544 Ca	0.4556	M0.2
	0.4500 CaM	0.4518	M0.35
	30 mg Mg		
	4500 CaM	0.4520	M0.44
	60 mg Mg		

TABLE 2. *Ionic composition of the samples collected from stations outside the estuary*

Station	Chlorinity ‰	Na (g/kg) Cl‰	Mg (g/kg) Cl‰	K (g/kg) Cl‰	Ca (g/kg) Cl‰
15 S	26.45	0.5554	0.06672	0.02061	0.02123
15 B	28.48	0.5555	0.06674	0.02058	0.02125
16 S	26.52	0.5556	0.06681	0.02071	0.02123
16 B	28.5	0.5558	0.06676	0.02058	0.02128
17 S	26.46	0.5554	0.06674	0.0206	0.02125
17 B	28.82	0.5559	0.06672	0.0207	0.02125

S - Surface Sample; B - Bottom Sample.

TABLE 3. *Stations where Ca/Cl ratio is similar to that of sea water*

Station	Chlorinity	Wt. of Ca per kg Chlorinity ‰
14 S	13.91	0.02124
14 B	15.41	0.02125
18 S	14.66	0.02128
18 B	16.76	0.02132
19 S	11.9	0.02130
19 B	14.33	0.02132
20 S	13.39	0.02127
20 B	16.31	0.02130
21 S	11.48	0.02124
21 B	15.56	0.02128

Mean=0.02128; Standard deviation=M0.004; S - Surface sample; B - Bottom sample.

The second category comprised of stations with 5% increase in Ca/Cl ratio over that of the sea water and the third category included stations with 10–15% increase in the Ca/Cl ratio as compared to the adjacent sea water.

TABLE 4. *Stations with 3% increase in CaICl ratio*

Station	Chlorinity	Wt. of Ca per kg/Chlorinity	Station	Chlorinity	Wt. of Ca per kg/Chlorinity
1 S	3.72	0.02252	24 S	7.73	0.02212
1 B	5.13	0.02281	24 B	8.84	0.02214
2 S	7.56	0.02241	25 S	7.2	0.02212
2 B	7.58	0.02246	25 B	12.08	0.02228
3 S	6.907	0.02238	26 S	5.13	0.02241
3 B	7.02	0.02241	26 B	12.47	0.02282
4 S	6.532	0.02241	27 S	8.19	0.02281
4 B	6.75	0.02242	27 B	12.13	0.02286
5 S	8.49	0.02245	28 S	5.58	0.02261
5 B	10.68	0.02275	28 B	10.46	0.02222
6 S	6.76	0.02261	29 S	5.00	0.02264
6 B	7.17	0.02301	29 B	7.27	0.02245
8 S	7.29	0.02241	30 S	4.788	0.02232
8 B	8.19	0.02259	30 B	10.28	0.02242
11 S	2.04	0.02251	31 S	4.95	0.0224
11 B	3.99	0.02252	31 B	12.74	0.02238
12 S	12.21	0.02238	32 S	2.95	0.02245
12 S	12.21	0.02238	32 B	7.13	0.02246
12 B	15.06	0.02246	33 S	4.6	0.02281
13 S	8.72	0.02245	33 B	9.74	0.02260
13 B	10.60	0.02245	35 S	2.82	0.02281
22 S	7.01	0.02234	35 B	4.05	0.02282
22 B	12.08	0.02238	36 S	2.16	0.02281
23 S	9.52	0.02213	36 B	3.81	0.02281
23 B	12.37	0.02224			

Mean value=0.02251; Standard deviation=0.00035: S—Surface sample; B—Bottom sample

The values of Ca/Cl ratio at five stations (14, 18, 19, 20 and 21) situated between the bar mouth and Wellingdon Island were notable for their normal calcium content. The value of Ca/Cl ratio at these stations was comparable with those at the stations 15, 16 and 17 situated outside the bar mouth in the inshore sea. The mean value of Ca/Cl ratio of these five stations was 0.02128. Standard deviation of the ratio for the different stations was ± 0.0004 with an average percentage deviation of ± 0.25 (Table 3). Due to close proximity to sea and relatively greater depth, salinity of these stations were higher than at other stations under study.

Majority of the samples collected were found to have a higher calcium value than recorded with sea water. It was observed that Ca/Cl ratio suddenly increased from a mean value of 0.02127 to 0.02251 for stations which was situated north and south of Wellingdon Island. Under this category came 26 stations. Standard deviation of Ca/Cl ratio was 0.00035 with an average percentage deviation less than 1.2 (Table 4).

Under the third category included eight stations, three on the north (7, 9 and 10) and five towards south (34, 37, 38, 39 and 40). They exhibited a pronounced increase in calcium content than at the stations discussed above. Among these, station 9 showed abnormally high calcium content—about three and a half time greater than that would be normally expected from its chlorinity value. Chlorinity of the water at this station-both bottom and surface was 0.15‰. The samples from other stations were found to have variable calcium content with an increase of 10–15% from the typical sea water relative to their chlorinity. The general pattern of distribution increase of calcium content with decrease in chlorinity was in agreement with these samples also.

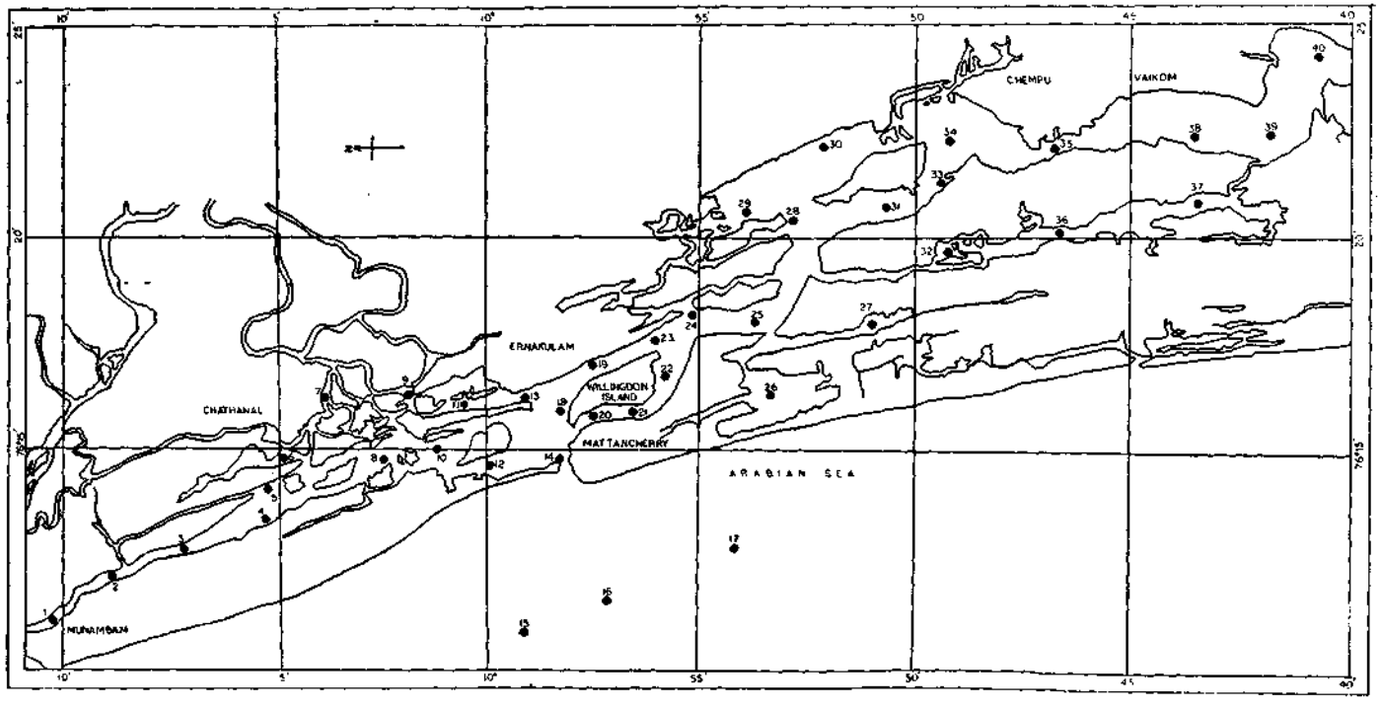

Fig. 1. Station locations from where the samples were collected for the study.

According to Culkin and Cox (1966) higher value of Ca/Cl ratio for bottom layer compared to surface layer in sea water could be explained as due to (1) extraction of calcium from the surface water by animals forming calcareous shells (2) some re-solution of shells of dead animals in the lower layers where the solubility of calcium carbonate is increased by lower temperature and higher pressure. A reasonable explanation for the increased calcium content both for surface and bottom layers may be due to the re-solution of shells of animals. It is supported by the fact that in the southern part of the lake at five places–near the stations 25, 28, 30, 34 and 35 huge deposits of shells of clams were observed. Exploitation of the shells almost round the year causes mixing and dissolution of calcium carbonate in the

TABLE 5. *Stations with 10–15% increase in Ca/Cl ratio*

Station	Chlorinity	Wt. of Ca per kg Chlorinity ‰
7 S	1.15	0.02451
7 B	1.17	0.02581
9 S	0.15	0.0714
9 B	0.15	0.0725
10 S	4.56	0.02323
10 B	8.53	0.02323
34 S	3.2	0.02312
34 B	4.81	0.02314
37 S	1.84	0.02355
37 B	2.96	0.02362
38 S	1.52	0.02312
38 B	2.22	0.02318
39 S	1.48	0.02461
39 B	1.82	0.02462
40 S	0.16	0.02458
40 B	0.18	0.02460

S—Surface sample; B—Bottom sample

lake water and is carried away by downward stream to the Cochin gut. Since the depth at this part of the lake ranges only from 2 to 3.5 metres, surface as well as bottom layers are expected to mix easily. The unusually high value of calcium at station 9 and 10 however, suggests that the increase might have been caused by the industrial waste—which includes sulphate and chlorides of calcium—from the two factories, Fertilizers and Chemicals Travancore Limited and Travancore Cochin Chemicals.

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