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Calcium Phosphate Saturation in Seawater around the Andaman Island

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Ionic product (IP) of calcium phosphate is calculated at some stations around Andaman Island. The depthwise variations of the ionic product of calcium phosphate seem to follow a normal trend with maximum saturation value between 100 to 200 m. Using apparent solubility product of 4×10^{-20} at 20°C given by Kester and Pytocowicz[7] the maximum percentage saturation works out to be 67, 65, 95 and 97 respectively towards west, east, north and south. The inorganic mineral phosphate and calcium content in the sediment samples are also estimated to check the possibility of calcium phosphate precipitation. The mineral phosphate as well as calcium in the sediment samples in the western region are higher than the other areas, which may be suggestive of the precipitation of calcium phosphate in this region.

During the cruises of *I N S Krishna* in 1963, abnormally high concentrations of inorganic phosphate in the waters around Andaman Islands were reported by Reddy *et al.*[1]. They observed that the water was highly turbid and milky white in appearance and suspected the precipitation of calcium phosphate in this area. In view of this calcium phosphate saturation was studied in seawater in relation with the calcium and phosphate content of the sediments in the region.

Seawater and sediment samples were collected during the 67 cruise of *R V Gaveshani* (4 to 26 Jan. 1980). Water samples were obtained from standard hydrographic depths at stations (Fig. 1) using TPN

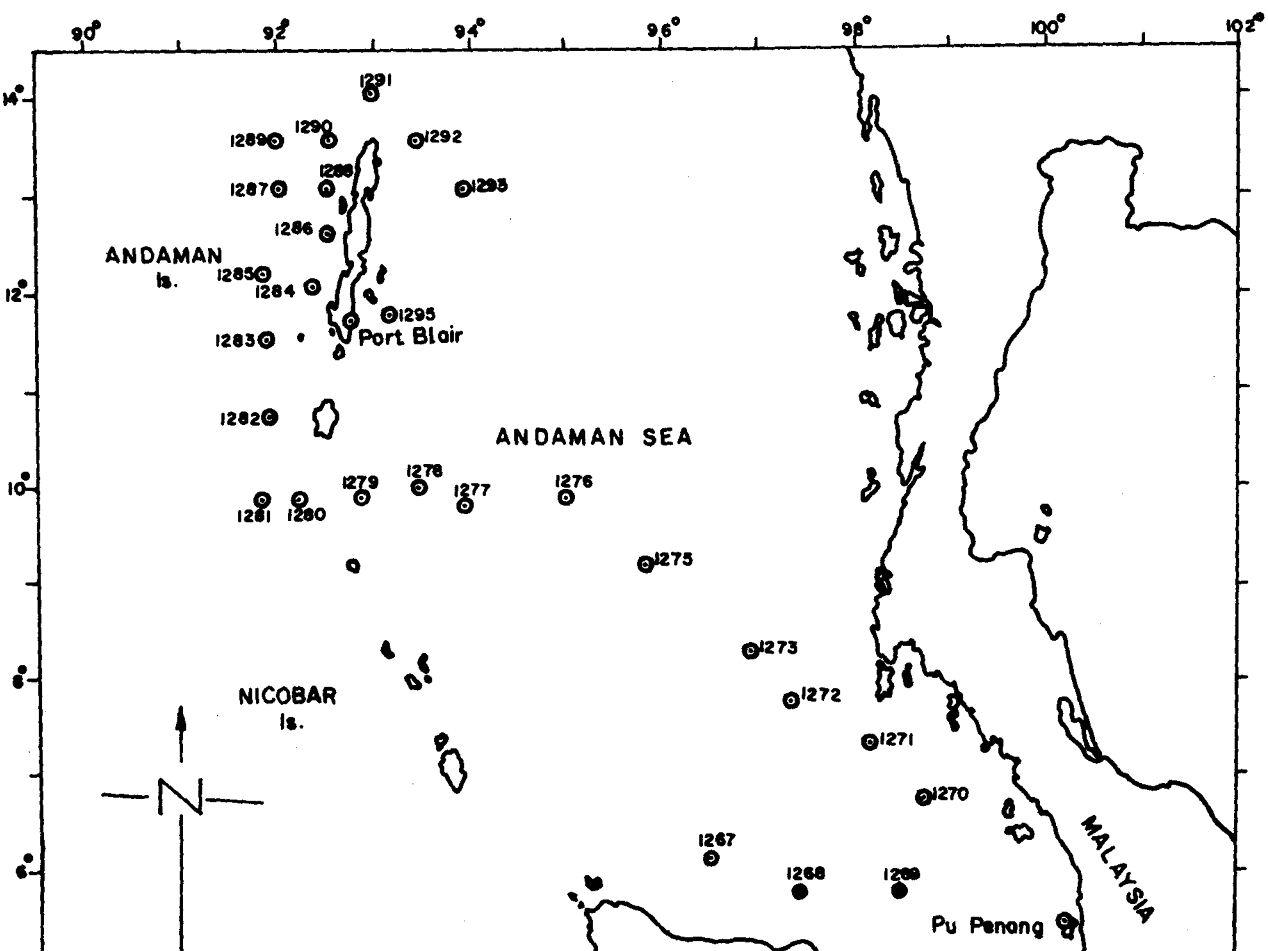

Fig. 1—Station positions

water samplers and analysed on board for pH, salinity and inorganic phosphate[2] and in the laboratory for calcium[3]. As no apparent turbidity was noticed, the unfiltered samples were used for analysis. PO_4^{3-} concentration was calculated from the inorganic phosphate using the dissociation constants of phosphoric acid determined by Dickson and Riley[4]. The ionic product (IP) was computed[5] from calcium and PO_4^{3-} concentration for every station at all depths.

Sediment samples were also collected at some coastal stations. The inorganic mineral phosphate concentration in sediments was obtained from the difference between the total phosphate and the sum of organic and soluble inorganic phosphate concentrations. The total phosphate concentration was estimated by the method of Rochford[6]. The organic and soluble inorganic phosphate concentrations were estimated separately by subjecting the sediment portion to UV oxidation and the oxidised sample was analysed using the standard techniques[2]. Calcium was estimated after digesting the samples with nitric and perchloric acid mixture[3].

The stations covered were divided into 4 groups as those towards the west, east, north and south (10°N lat.) of the Andaman island. Depth profiles of calcium phosphate in these 4 regions are given in Fig. 2. Depthwise variation of the ionic product seems to follow a normal trend as in the Bay of Bengal[5]. The surface layer is characterised by low IP due to low PO_4^{3-} concentration as a result of its assimilation by phytoplankton. The maximum IP is attained between 100 and 200 m at all stations suggesting the optimum possible favourable conditions of pH, salinity, temperature and inorganic phosphate at this depth layer. Using the apparent solubility product of 4×10^{-20} at 20°C given by Kester and Pytkowicz[7] the maximum percentage saturation is worked out to be 67% towards the west, 65% towards the east, 95% towards the north and 97% towards the south.

The process of oxidation of organic matter starts at depth 100-200 m of seawater resulting in a sudden increase in the PO_4^{3-} concentration. This is also a depth at which temperature shows a decreasing trend compared to the mixed surface layer. The IP decreases gradually below this depth, the temperature and pH being the dominant factors influencing the IP at deeper layers. The saturation of seawater with PO_4^{3-} at deeper layers being hindered by high CO_2 content. No abnormal values of phosphate were observed at any depth and the variations in phosphate concentration were quite comparable with the normal oceanic ones. The high values of phosphate observed by Reddy *et al.*[1] around the Andaman island may be characteristic of the particular season in which the sampling was done. Emery and Dietz[8] have pointed out the

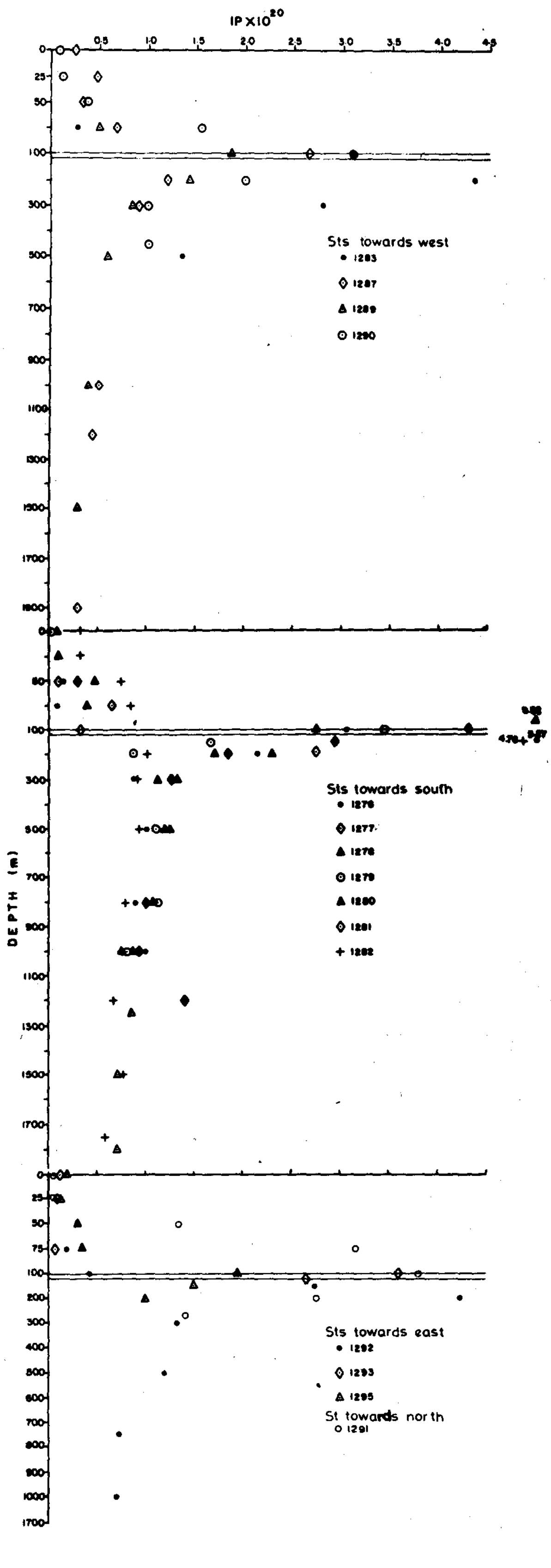

Fig. 2—Depth profile of ionic product of calcium phosphate at stations around the Andaman Island

Table 1—Concentration of Inorganic Mineral Phosphate and Calcium in Sediments around the Andaman Island and Offshore Regions

St No.	PO_4-P $\mu g.g^{-1}$ of silt	Calcium $mg.g^{-1}$ of silt
1283	617	130
1285	619	140
1286	645	140
1288	633	147
1290	631	140
1291	277	86
1295	140	35
1281	340	58
1270	403	21
1272	433	33
1273	435	58
1267	520	11
1268	88	12
1269	335	24

possibility of calcium phosphate precipitation during certain times of the year. The analysis of sediment samples were carried out for inorganic mineral phosphate and Ca content in order to correlate the seawater saturation data with that of the sediments. The inorganic phosphate and Ca in the sediments (Table 1) towards the west of the island show almost constant values of about 0.06 and 14% respectively whereas in the other regions the phosphate concentration varied from 0.009 to 0.05% and that of calcium varied from 1.1 to 8.6%.

No published data are available on inorganic mineral phosphate in sediments for comparison with the present results. However, a comparison of the total phosphate content of the sediments shows that this region contains less phosphate than in the other regions of the Bay of Bengal and the Arabian Sea. The total phosphate content varied from 0.076 to 0.012%. Murthy *et al.*[9] have reported quite high values of total phosphorus in the sediments off the east coast of India which they have attributed to the contribution of rivers from the north and to upwelling and biological activity. Siddiquie *et al.*[10] have found the total phosphate content in sediments varying from 0.06 to 0.4% in the Mangalore area and 0.2 to 0.39% in the Bombay-Ratnagiri area along the west coast of India. Values of phosphate content reported here are quite low compared to those reported by Siddiquie *et al.*[10]. Relatively high concentrations of phosphate as well as calcium observed towards the west of Andaman island as compared to the other parts may be due to the presence of a number of coral banks in the western shelf of the Andaman island[11].

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