

Interstitial and adsorbed phosphates in shelf sediments off Visakhapatnam, east coast of India

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Spatial distribution of interstitial and adsorbed phosphates in the shelf sediments shows an increasing trend with distance from coastal to inshore region. Maximum concentration ranges of interstitial and adsorbed phosphates are 16-19 and 40-50 $\mu\text{g.g}^{-1}$ respectively in the inshore regions. Significant positive correlations between these fractions of phosphate and texture of sediments are noticed.

Most of the earlier work in the shelf sediments off Visakhapatnam has been mainly confined to the particle size, coarse fraction constituents and calcium carbonate^{1,2}, organic matter³, clay minerals^{4,5} and textural characteristics⁶. Rao and Rao⁷ have studied the geochemical distribution of iron, titanium and manganese in the shelf sediments off Visakhapatnam coast. Less work has been done on the distribution of phosphorus in sediments off the east coast of India⁸. The present study on the distribution of adsorbed and interstitial phosphates in the shelf sediments off Visakhapatnam is undertaken to confirm the phosphate enrichment in the sediments.

The sampling stations extend from shore to 100 m depth in the Appikonda-Bhimunipatnam region. Sediment samples were collected at 31 stations (Fig. 1) on 15 and 22 December 1980 and 20 and 22 January 1981 using La Fond Deitz snapper. Representative subsamples of each sediment sample were taken for analyses of interstitial and adsorbed fractions of phosphate⁹ and fine size ($< 63 \mu\text{m}$) fraction¹⁰.

The sampling stations are conveniently classified as (i) coastal (sts 1-3; 6-9; 17-18 and 26-29), (ii) nearshore (sts 4-5; 10-12; 19-22 and 30) and (iii) offshore (sts 13-16; 23-25 and 31) in order to explain the distribution of interstitial and adsorbed phosphates in the present study.

Textural characteristics and concentrations of interstitial and adsorbed phosphates in the sediments are presented in Table 1. The coastal sediments contain mostly sand with uniform reduction in the coarse grain fraction. The fine size fraction dominates with maximum percentage (80-90%) in the inshore

sediments. The distribution of sediments off Visakhapatnam and off Bhimunipatnam coasts reveals clear zonation of grain size fractions as reported earlier^{5,11}.

The interstitial phosphate concentration increases from 1.1-19 $\mu\text{g.g}^{-1}$ from coastal to inshore regions and thereafter decreases in the offshore sediment samples (sts 13-16 and 23-25). The maximum distribution of adsorbed phosphate also shows a similar pattern to that of interstitial phosphate. Maximum concentration range of interstitial and adsorbed phosphates are 16-19 and 40-50 $\mu\text{g.g}^{-1}$ respectively in the inshore sediment samples.

Concentration levels of adsorbed and interstitial phosphate closely correlate with texture of sediments

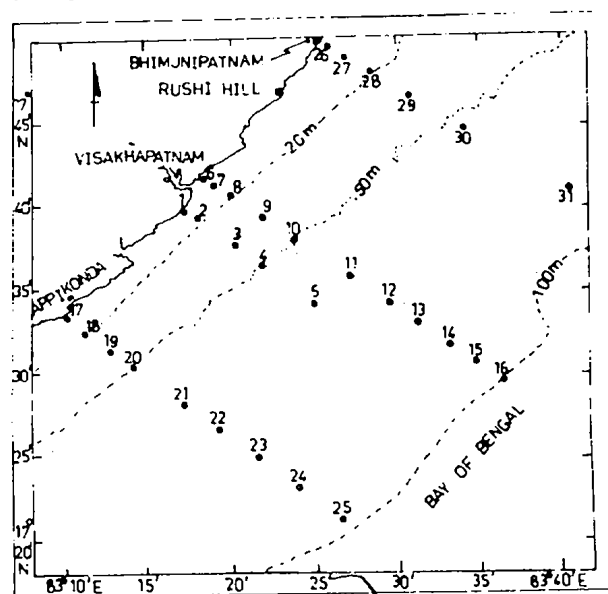


Fig. 1—Station locations

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Table 1—Texture and concentration of interstitial and adsorbed phosphates in the shelf sediments off Visakhapatnam

Station No. (Depth in m)	Nature of sediment	Size fraction ($< 63 \mu\text{m}$) (%)	Interstitial phosphate ($\mu\text{g.g}^{-1}$)	Adsorbed phosphate ($\mu\text{g.g}^{-1}$)
1 (5)	S	3	1.1	2.0
2 (15)	S	3	1.4	4.3
3 (30)	SS	29	9.2	11.3
4 (50)	C	97		40.7
5 (60)	C	96	16.8	35.0
6 (5)	S	2	2.1	1.1
7 (10)	S	2	1.6	0.5
8 (20)	S	7	5.1	2.4
9 (30)	SS	32	7.5	13.7
10 (50)	SC	94	13.0	63.1
11 (60)	SC	93	19.0	66.5
12 (70)	SC	74	15.1	37.1
13 (75)	SS	68	15.1	38.3
14 (80)	SS	46	12.4	24.5
15 (90)	SS	46	12.9	25.2
16 (100)	SS	45	13.5	27.7
17 (5)	S	2	1.3	1.1
18 (20)	SS	60	13.3	32.1
19 (30)	SC	89	15.5	46.4
20 (50)	SC	90	17.4	45.7
21 (60)	C	96	16.8	51.6
22 (70)	SS	33	9.3	13.9
23 (80)	SS	46	11.3	20.9
24 (90)	SS	38	12.6	16.4
25 (98)	SS	36	12.8	21.8
26 (5)	S	3	1.4	4.1
27 (10)	S	3	1.8	4.3
28 (20)	S	2	4.6	2.6
29 (30)	SS	49	14.8	15.5
30 (55)	SS	83	16.7	22.4
31 (80)	SC	83		30.7

S=Sand; C=Clay; SS=Sandy silt; SC=Silty clay

in the study region. Significant positive correlations are observed between finer fractions and these fractions of phosphates viz. interstitial phosphate ($r=0.78$ at $P=1\%$) and adsorbed phosphate ($r=0.82$ at $P=1\%$) respectively.

In a recent study on the nature and composition of sediments in the nearshore region off

Visakhapatnam¹², the average percentage of total phosphorus content in 50 m depth (inshore) region is reported to be 0.04. Thus the high concentrations of phosphates in sediments are also responsible for maximum concentrations of interstitial and adsorbed phosphates in the inshore regions associated with finer sediments. The present investigation provides further evidence to the earlier conclusion¹³ that the enrichment of phosphate in overlying waters at distant stations off Visakhapatnam during postmonsoon season is due to the regeneration from sediments.

The values of interstitial and adsorbed phosphates reported in the Malabar Coast¹⁴ are in agreement with the present investigation. However the present values are much higher than those reported in Kakinada Bay¹⁵ and Visakhapatnam coastal regions¹⁶ which may probably be due to changes in texture of sediments.

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