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Short Communications

Grain size parameters as indicator of sediment movement around a river mouth, near Karwar, west coast of India

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The distribution of grain size parameters along 11 km stretch of the beach sediments between Majali and Karwar, reveals that the mean grain size exhibits a marked decreasing trend on either side of the mouth of the Kali river. The variations in standard deviation and skewness support the distribution of mean grain size. Average standard deviation values for different months decrease from river mouth on either side. These variations in the size parameters are attributed to the drifting of sediments on either side of the river, possibly due to cellular flows which develop in the river mouth region.

Grain size parameters are being used as indicators of depositional environments[1-3]. Their distribution can also be used to predict sediment transport in beach and other nearshore environments as well[4-6]. In the present investigation the grain size parameters are used to interpret sediment movement in the beach segment between Majali and Karwar with special mention about the processes operating around the Kali river month.

Sediment samples were collected from high, mid and low tide levels of the beach by pressing a plastic core liner of 5 cm diameter to a depth of about 4 cm. Samples were collected from five locations (Fig.1) for a period of one year with monthly interval from January to December 1983. Sediment samples were treated, sieved and later grain size parameters were computed following standard methods[1,7].

Grain size parameters calculated for different levels of the beach for five stations and for a period of twelve months are presented in Fig. 2. Range and average of grainsize parameters for different levels of the beach are also calculated and presented in Table 1. The grain size parameters studied at five locations of beach segment between Majali and Karwar reveal that the mean grain size decreases (i.e. phi mean increases) on either side of the Kali river (Fig.2). Average standard deviation values for different months, also decrease from river mouth on either side (Fig.2), except for few, during postmonsoon. Number of positively skewed sediment samples are more at Kodibag and Majali whereas number of negatively skewed sediment samples are more at other three locations viz. Ramnath, Sadashivgad and Karwar. Average of foreshore skewness values plotted (Fig. 2) shows change from positive to negative from Kodibag to Karwar. Bivariate diagram plotted (Fig. 3) between mean grain size and standard deviation reveals that as the grain size decreases, sorting improves. This is true when individual profile station is considered and also when the whole diagram is taken into

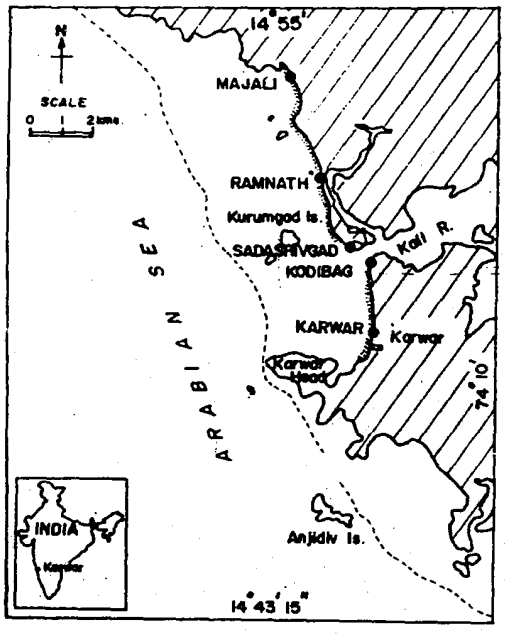

Fig.1.—Location map.

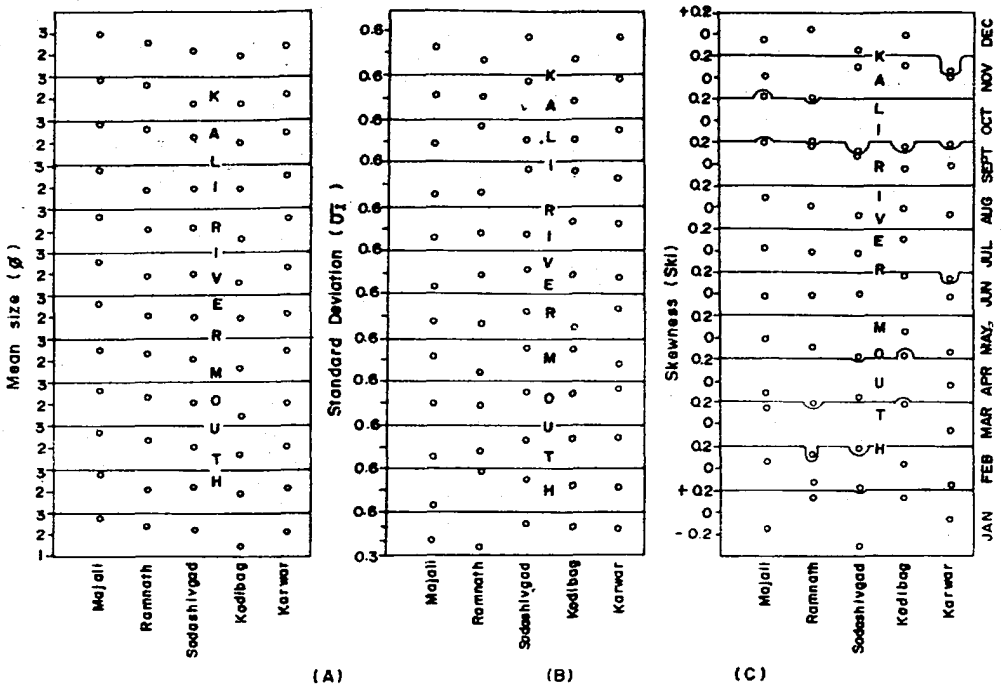

Fig.2.—Distribution of mean size (A) Standard deviation (B) and Skewness (C) of foreshore average.

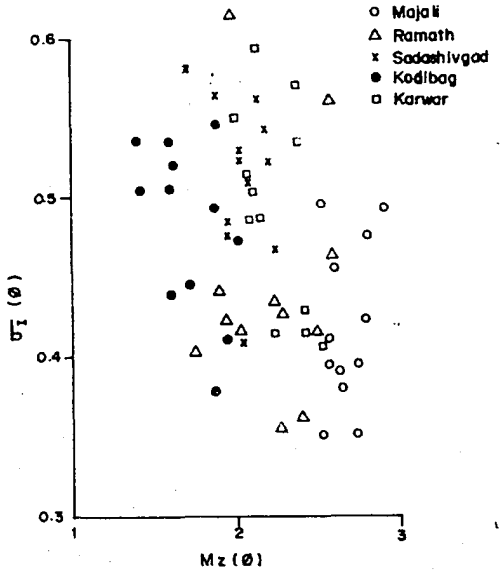

Fig. 3.—Biavariate plot between mean size (m_z) and standard deviation (σ)

account. This diagram has helped to demarcate one station from the other in size and sorting characteristics. The mean grain size show decreasing trend from Kodibag, Sadashivgad/ Karwar, Ramnath to Majali. Sediment samples collected from Majali and Karwar are better sorted compared to Sadashivgad, Kodibag and Ramnath.

The concentration of coarser grainsize sediments at either side of the mouth of Kali river shows that they are not carried away by the coastal processes, similar to heavy minerals[8]. Coarser grainsize and poor sorting indicate high energy environment[9]. Higher energy is expected to produce at the river mouth due to interaction of strong outflow of the river water and incoming wave and tidal currents. The higher energy levels permit deposition of coarser sediments as well as transportation of a much wider range of finer sediments[10]. Positive skewness obtained at Kodibag supports depositional environment at this part of the beach.

Along the coast the transportation and/or concentration of minerals with different size, requires currents with different velocities. The grains with smaller size do not settle in the high energy turbulent environment and instead they drift further on either side along the coast. This must be the reason for decrease in size as we move away from the river mouth and for higher concentration of finer sediments at the station Majali and Karwar.

The wave refraction studies carried out[11] along this coast showed a general near linear southerly

Table 1—Ranges and averages of textural parameters in the study area.

Location		Meansize (ϕ)			Standard deviation(σ)			Skewness(Ski)		
		Tide			Tide			Tide		
		High	Mid	Low	High	Mid	Low	High	Mid	Low
Majali	Range	2.40 to 3.03	2.47 to 2.94	2.51 to 3.01	0.299 to 0.406	0.314 to 0.697	0.374 to 0.701	– 0.265 to +0.231	– 0.331 to +0.374	– 0.308 to +0.204
	Average	2.60	2.72	2.73	0.340	0.418	0.489	+ 0.029	+ 0.060	0.014
Ramnath -	Range	1.66 to 2.54	1.63 to 2.96	1.32 to 2.79	0.319 to 0.530	0.263 to 0.625	0.291 to 0.733	– 0.311 to +0.173	– 0.436 to +0.297	– 0.416 to + 0.461
	Average	2.09	2.33	2.26	0.414	0.434	0.478	– 0.079	– 0.065	– 0.028
Sadashivgad-	Range	1.75 to 2.20	1.76 to 2.21	1.32 to 2.48	0.346 to 0.525	0.375 to 0.658	0.501 to 0.766	– 0.282 to +0.127	– 0.358 to – 0. 28	– 0.390 to +0.396
	Average	2.05	2.01	2.04	0.411	0.502	0.632	– 0.046	– 0.173	– 0.136
Kodibag -	Range	1.27 to 1.91	1.17 to 2.13	1.12 to 2.38	0.359 to 0.563	0.372 to 0.645	0.384 to 0.676	– 0.080 to +0.273	– 0.369 to + 0.374	– 0 .474 to +0.410
	Average	1.63	1.76	1.76	0.431	0.479	0.534	+ 0.110	+ 0.097 – 0.135	– 0.034
Karwar -	Range	2.03 to 2.73	1.82 to 2.55	1.81 to 2.88	0.277 to 0.533	0.391 to 0.629	0.416 to 0.666	– 0.361 to +0.250	– 0.479 to + 0.287	– 0.380 to +0.215
	Average	2.25	2.25	2.21	0.423	0.496	0.554	– 0.131		– 0.086.

drift. Presence of sholas[12] and most coarse sediments towards the southern side (at Kodibag) of the Kali river mouth, agree with this study. However, the sediment size distribution along with other parameters like sorting, strongly indicate dispersal in northern direction also, near the river mouth. This may be due to the variations under the influence of littoral currents occasionally of opposing nature[13] and possibly due to the cellular flows in the region north of Kali river mouth. Heavy mineral distribution studies carried out[8] in this stretch also strongly supports sediment movement on either side of the river mouth.

Continuous supply of material from the Kali river is responsible for developing a shoal. This shoal along with surrounding islands (Fig.1) must be acting as a obstruction to littoral currents and are responsible for changing the direction. The change in direction of sediment movement has resulted in the formation of a bar slightly towards northern side[11] of the river mouth seen specially during postmonsoon. This change in direction which is responsible for the formation of a bar might have reinforced northerly current along the beach which is responsible for the transportation of finer material to Majali.

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