CHAPTER - 5

SEDIMENTOLOGICAL STUDIES

CHAPTER - FIVE

SEDIMENTOLOGICAL STUDIES

INTRODUCTION

Beach sediments occupy a significant portion of the Dahanu-Kora Coast. Various aspects of the studies on beach has been done by number of workers in past. The more important contributions are made by Bascom (1951), King (1951), Fuller (1962), Friedman (1961,1967,1979), Vishev (1969), Sonu (1972,1973),Stapor and Tanner (1975), Nordstrom (1977), Fraser and Nester (1977), Chaudhri et al (1981) and others. The present investigations are aimed at establishing the gross text and parameters of beach and dune sediments of the study area and to delineate the field of beach environment by binary plots between more significant size parameters.

SAMPLING

In order to obtain factual information on the relationship between the coastal sedimentary environments and the textural characteristics representative samples were collected using a grid system. Twenty cross traverses, each consisting of four samples were spaced at interval of 3 to 4 kilometres along the coastline (Fig.V.1). In all 60 beach samples and 20 dune samples were collected and analysed. To avoid lag sediments, the top six-inches layer of sand was removed before collecting the samples.

METHODS OF INVESTIGATION

Coastal sediments of the study area, had been subjected to following investigations.

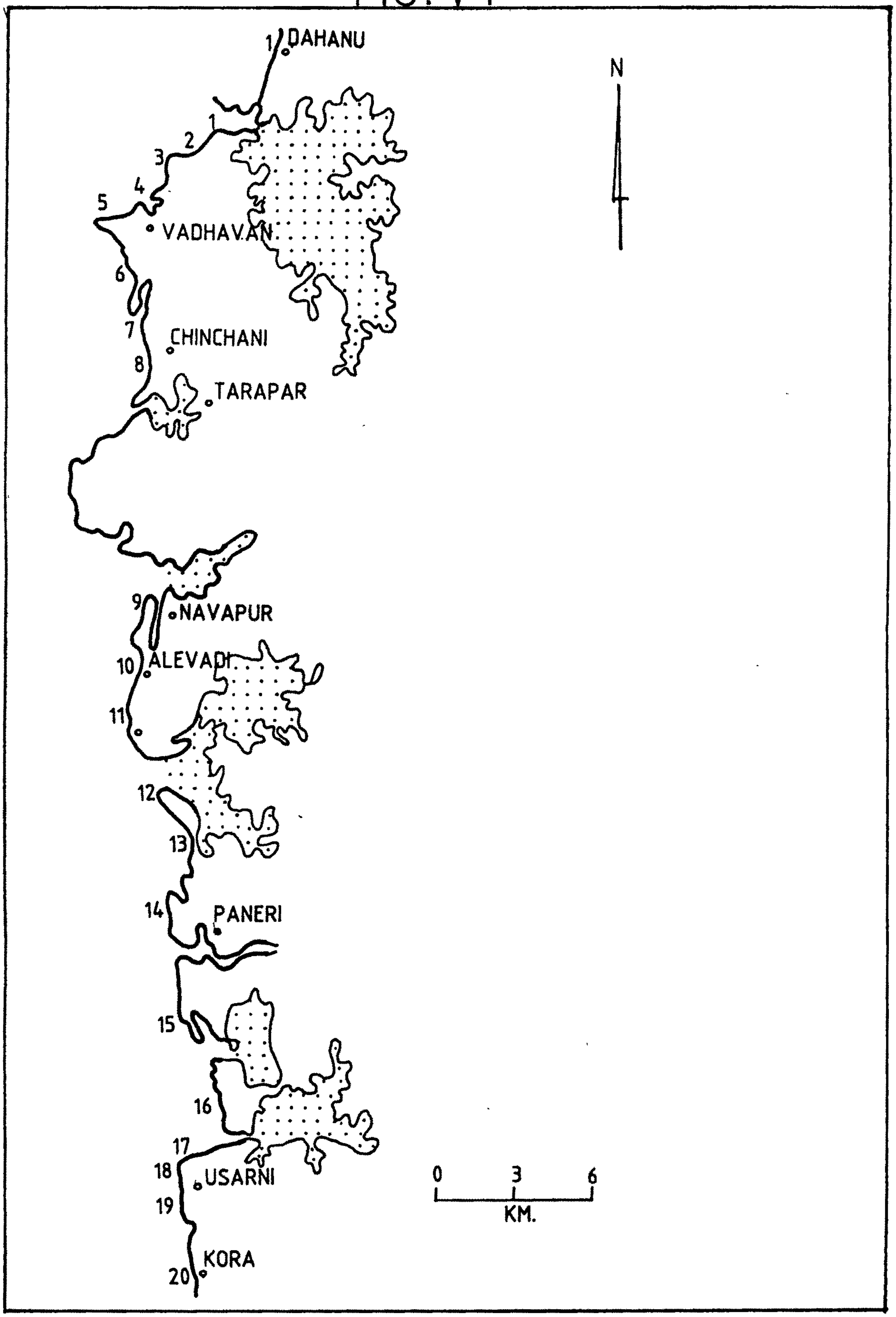
I. MAGASCOPIC AND LITHOLOGICAL STUDIES

Study of various constituents of the beach sands to identify provanance and energy conditions.

2. GRAIN SIZE

The detailed granulometric analysis is carried out. The samples are disintegrated by gentle pounding in poercelain mortar. These samples were treated with dilute hydrochloric acid (approx 10%) to remove any calcreous matter present and is further washed throughly with water to remove the acid completely. Care is taken to retain all the clay fraction while washing. The samples are dried in an oven at temperature of about (90-95). A fixed weight of dried samples are subjected to seiving by using ASTM standard seive at 1/2 PHI interval. The results obtained from selving are plotted as comulative

FIG. V·1



INDEX MAP SHOWING SAMPLE LOCATIONS
FOR SEDIMENTOLOGICAL STUDIES

percentages on a alog probability paper. Selected percentiles are read from these curves and following statistical parameters are calculated (Folk, 1965).

Graphic Mean - MZ (ϕ)

The graphic mean gives an idea of the average grain-size of the sediments transported. It also reflects the competency of the depositional medium involved.

Inclusive Graphic Standard Deviation - $\sigma\phi$

Standard deviation is a measure of the sorting of the sediments. It reflects dominance or prolonged effect of one particular mode of transportation and depostion.

Inclusive Graphic Skewness - SKI

Skewness reflects the importance of the supporting mode of transportation. These modes, though subordinate in nature are quiet significant as they bring out the characters of the coarse and fine tails of a grain size distribution.

These parameters have been further analysed on the following lines.

A - Univariate analysis

B - Bivariate analysis

C - C.M. Pattern

D - Log Probability curve analysis

1 - MEGASCOPIC AND LITHOLOGIC STUDIES

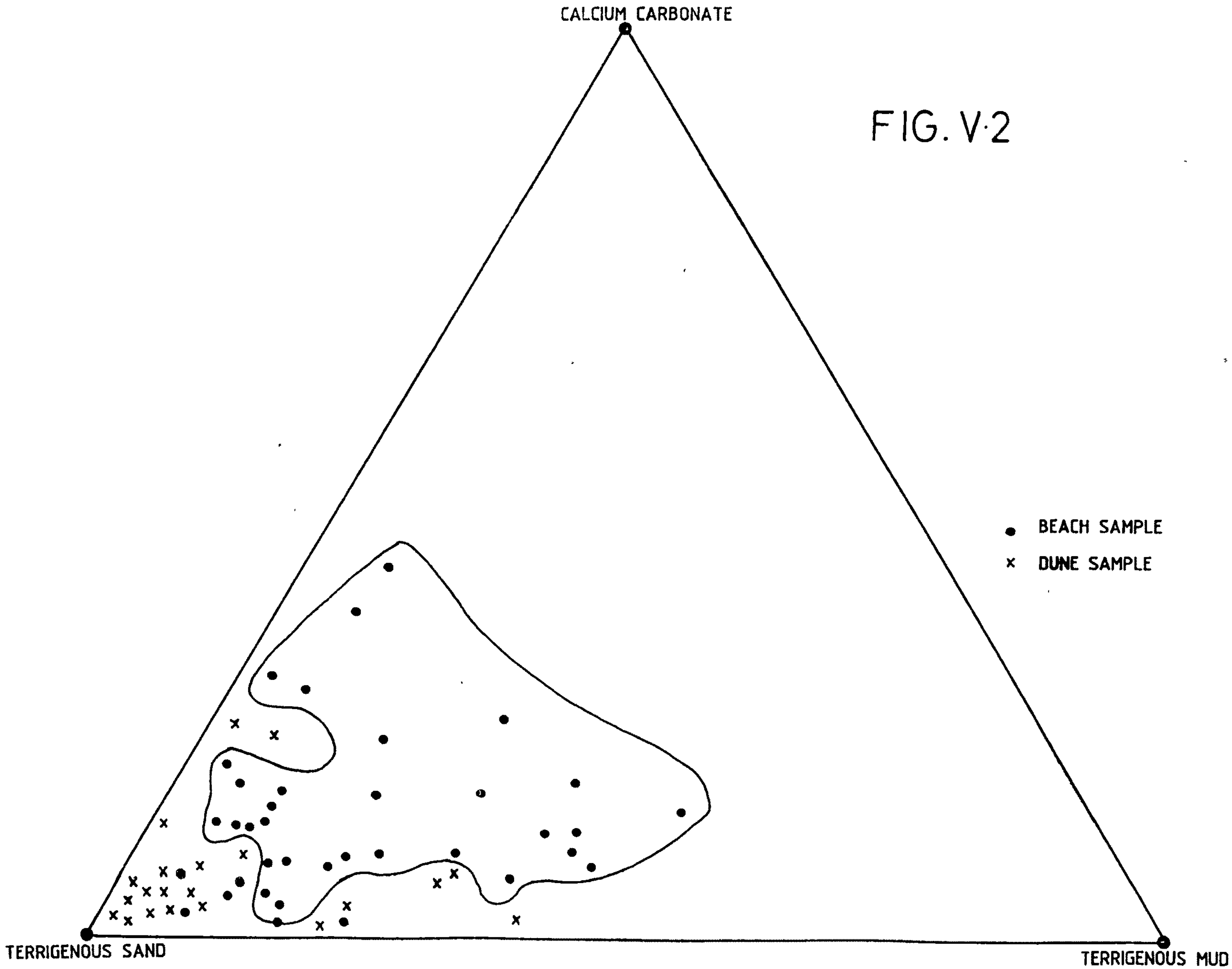
These studies were very useful to understand the various dynamic processes influencing the sediment supply, provenance and energy level of deposition operating at that environment. 10 grams of the samples were taken on a petridish and washed very carefully with water so as not to lose the finer fractions during decantation. A few grams of the washed samples were analysed under binocular microscope and their bulk lithology (minerology of grain), physical characters, textural characters were studied. The coastal sand comprises mainly of biogenic material rock fragments and quartz grains. Thte biogenic material mostly molluscan shell fragments and benthic foraminiferal tests in different stages of abrasion. bryozans, echinodern spines, plantonic foraminiferal are also found as minor proportion in this beach sands. Among the foraminifers, there is an abundance of Elphidium crispum, Eponides repandus, Quinqueloculina, spirolacalina, Triloculina, ammonia dentatum, Cibicides Sp, Nonian labrodoricum and siphogenerine rephanus. The remaining part consist of grains of quartz feldspar, heavies (magnetite, ilmenite, pyroxene hornblende, biotite etc.) and rock fragments. The visual percentages of rock fragments shell fragments and Quartz grains were computed for 20 samples of middle foreshore to gain insight of the compositional variations of the coastal sands.

Compositional variations of 60 samples of the foreshore, backshore and dunes areas were studied. The samples have been found to be generally made up of sand grains (Terrigenous sand), mud and shell fragments (Fig.V.2 - Table.V.1). The sands are generally medium to coarse in size and comprise rock fragments, shell fragments, quartz grains, volcanic glass, chalcedony, magnetic minerals and other heavies. The rock fragments, are mostly basaltic and are subrounded to rounded. The larger fragments show smooth and more or less polished surface but a few show percussion marks which indicate an energetic environment. Vesicular fragments are filled with secondary quartz, zealite, calcite, and chalecdony.

Quartz grains are rather fine, subangular to subrounded - Cryptocrystalline silica such as jasper, agate, chert and flint are occasionally observed. Though the average percentage of quartz grains is merely 66.6 %, at Muramba, it shows a maximum concentration of 93 % (Table V.2), while at dalpada it shows a minimum concentration of quartz grains (8%). The maximum concentration of shell fragments is found at Tadalpada (41 %) while at Muramba it shows a minimum concentration of shell fragments (2 %). At Gungwada the concentration of rock fragments reach maximum 64% then decrease to 5 % at Muramba. The maximum concentration of shell fragments found on beaches rather than dunes.

A tendency for the gradual increase in the terrigenous sand is observed from lower foreshore to coastal sand dunes at Dahanu, Tadalpada, Vadhavan, Varor, Dandepada, Tarapur, Navapur, Alewadi,

FIG. V·2



PERCENTAGE VARIATIONS OF CALCIUM CARBONATE-TERRIGENOUS SAND AND TERRIGENOUS MUD - HOLOCENE SEDIMENTS DAHANU - KORA COAST

TABLE V - I PERCENTAGE VARIATIONS OF CALCIUM CARBONATE
TERRIGENOUS SAND - TERRIGENOUS MUD
DAHANU COAST

NO.	Lacality Name	Location of Sample	Calcium Carbonate	Terrigenous sand	Terrigenour mud
1.	DAHANU	DUNE	22	75	3
		MIDDLE FORESHORE	15	74	11
		LOWER FORESHORE	8	71	21
2.	TADALPADA	DUNE	9	81	10
		MIDDLE FORESHORE	41	52	7
		LOWER FORESHORE	11	51	39
3.	GUNGWADA	DUNE	8	90	2
		MIDDLE FORESHORE	27	68	5
		LOWER FORESHORE	12	76	12
4.	VADAPOKHRON	DUNE	5	87	8
		MIDDLE FORESHORE	35	59	6
		LOWER FORESHORE	8	70	22
5.	VADHAVAN	DUNE	3	74	23
		MIDDLE FORESHORE	16	51	33
		LOWER FORESHORE	10	49	41
6.	VAROR	DUNE	5	64	31
		MIDDLE FORESHORE	23	52	25
		LOWER FORESHORE	14	38	48
7.	DANDEPADA	DUNE	2	60	38
		MIDDLE FORESHORE	14	57	29
		LOWER FORESHORE	9	50	41
8.	TARAPUR	DUNE	3	92	5
		MIDDLE FORESHORE	6	83	11
		LOWER FORESHORE	4	81	15
9.	NAVAPUR	DUNE	3	92	5
		MIDDLE FORESHORE	15	77	8
		LOWER FORESHORE	7	50	43
10.	ALEVADI	DUNE	1	98	1
		MIDDLE FORESHORE	7	78	15
		LOWER FORESHORE	2	70	28
11.	MURAMBA	DUNE	3	96	1
		MIDDLE FORESHORE	21	64	15
		LOWER FORESHORE	6	58	36
12.	SATPATI	DUNE	4	93	3
		MIDDLE FORESHORE	12	66	22
		LOWER FORESHORE	8	61	31
13.	VADRAI	DUNE	2	95	3
		MIDDLE FORESHORE	6	89	5
		LOWER FORESHORE	5	84	11
14.	SHIRGAON	DUNE	16	77	7
		MIDDLE FORESHORE	15	79	6
		LOWER FORESHORE	10	68	22
15.	MAHIM	DUNE	11	88	1
		MIDDLE FORESHORE	12	80	8
		LOWER FORESHORE	3	81	16
16.	MANGELVAD	DUNE	1	97	2
		MIDDLE FORESHORE	2	91	7
		LOWER FORESHORE	1	77	22
17.	USARNI	DUNE	2	92	6
		MIDDLE FORESHORE	8	84	8
		LOWER FORESHORE	7	79	14
18.	MATHAND	DUNE	6	87	7
		MIDDLE FORESHORE	12	79	9
		LOWER FORESHORE	11	76	13
19.	YEDVAN	DUNE	4	94	3
		MIDDLE FORESHORE	7	79	14
		LOWER FORESHORE	2	81	17
20.	KORA	DUNE	3	87	10
		MIDDLE FORESHORE	10	83	7

TABLE V.2

COMPOSITIONAL VARIATIONS OF BEACH SANDS OF DAHANU-KORA COAST

NO.	Lacality Name	Quartz Grains	Rock Fragments	Shell Fragments
1.	DAHANU	68	17	15
2.	TADALPADA	8	81	41
3.	GUNGWADA	9	64	27
4.	VADAPOKHRON	24	41	35
5.	VADHAVAN	63	21	16
6.	VAROR	61	16	23
7.	DANDEPADA	70	16	14
8.	TARAPUR	84	10	6
9.	NAWAPUR	64	21	15
10.	ALEWADI	81	12	7
11.	MURAMBA	93	5	2
12.	SATPATI	72	16	12
13.	VADRAI	84	10	6
14.	SHIRGAON	62	23	15
15.	MAHIM	74	14	12
16.	MANGELVAD	91	7	2
17.	USARNI	82	10	8
18.	MATHAND	78	10	12
19.	YEDVAN	87	6	7
20.	KORA	76	14	10

Muramba, Satpati, Uadrai, Mangelvad, Usarni, Mathana and Kora coast. The increase in terrigenous sands especially near the high water line where coarser fractions are seen to consist of trap, fragments agate, chalcedony, quartz and molluscan shell fragments. This increase in terrigenous sands from lower forewhore to upper foreshore is due to a combine effects of longshore current and strong swash action. Beach shelly sands derived their material by the shoreward transport of the thriving masses of invertebrate organisms living directly offshore. The presence of clastic grains is due to the fact that besides invertebrate fossil debris, admixture of other clastics brought by rivers from the mainland Gujarat and subsequently this clastic material reworker by longshore current. The presence of heavy mineral like pyroyene, hornblende, biotite, suggests basalt as source.

2. GRAIN SIZE

Statistical parameters : The graphic mean size (MZ) of the beach sands ranges from coarse silt (4.02 phi) to coarse, Sand (0.97 phi) and that of dune sands ranges from very fine sand (3.82 phi) to fine sand (2.1 phi) (Table V - 3). The inclusive graphic standard deviation ($\sigma\phi$) of beach sands varies from poorly sorted (1.71 phi) to very well sorted (0.11 phi). Among the beach samples, 15 are poorly sorted, 22 are moderately sorted, 13 are moderately well sorted, 5 are well sorted and the remaining 5 show very well sorted, while dune sands range from moderately sorted (0.86 phi) to very well sorted (0.08 phi). Out of 20 dune samples, 7 are moderately well sorted, 5 are well sorted, 5 are

TABLE V.3

TEXTURAL PARAMETERS OF BEACH SEDIMENTS
DHANUA COAST

NO.	Locality	MZ				θ				SK			
		DUNE	B.S	U.S	L.S	DUNE	B.S	U.S	L.S	DUNE	B.S	U.S	L.S
1.	DAHANU	3.2	1.3	2.90	3.45	0.40	1.14	0.89	0.33	0.12	-0.39	-0.44	-0.10
2.	TADALPADA	3.27	2.45	3.11	3.08	0.63	0.47	0.63	0.73	0.06	-0.49	-0.17	-0.18
3.	GUNGWADA	2.2	1.3	3.1	3.60	0.86	1.06	0.90	0.31	0.78	-0.37	-0.60	-0.09
4.	VADAPOKRON	3.3	1.5	3	3.40	0.60	0.73	0.77	0.70	0.01	-0.25	-0.38	-0.14
5.	VADHAVAN	3.62	1.5	2.9	4.02	0.79	1.07	0.40	0.93	0.99	0.22	-0.36	-0.51
6.	VAROR	3.7	1.35	3.24	4	0.46	0.25	0.52	0.40	0.46	0.11	-0.20	-0.17
7.	DANDEPADA	3.5	1.4	1.8	3.8	0.75	0.81	0.58	0.76	0.15	-0.16	0.43	-0.23
8.	TARAPUR	3.2	2.2	2.6	3.3	0.58	0.47	0.75	0.60	0.12	-0.10	-0.23	-0.28
9.	NAWAPUR	2.9	1.5	2.5	3.2	0.60	0.92	1.18	0.11	0.07	0.32	-0.67	-0.61
10.	ALEWADI	2.20	1.88	3.00	3.92	0.80	1.19	0.61	1.23	0.12	-0.26	-0.04	-0.15
11.	MURAMBA	2.0	1.00	1.83	3.50	0.15	0.48	1.02	0.66	0.13	0.69	0.40	-0.61
12.	SATPATI	2.8	1.3	2.2	3	0.27	1.14	0.55	0.77	0.30	-0.45	-0.19	-0.38
13.	VADRAI	2.6	1.8	2.4	3.7	0.39	0.41	0.82	0.54	0.40	-0.25	-0.32	-0.38
14.	SHIRGAON	3.6	2.8	2.9	3.8	0.35	1.48	0.87	0.51	0.12	-0.58	-0.16	-0.15
15.	MAHIM	2.2	1.7	2.6	2.77	0.88	1.01	1.60	1.61	0.40	0.36	-0.33	-0.02
16.	MAGELVAD	3.7	1.65	2.47	3.4	0.40	1.01	0.62	0.52	0.01	0.39	-0.39	-0.19
17.	USARNI	3.06	0.97	3.27	3.4	0.52	1.71	0.55	0.76	0.27	-0.33	-0.07	-0.25
18.	MATHANA	2.8	2.2	2.6	3.2	0.61	0.58	1.04	0.50	0.40	-0.05	-0.33	-0.28
19.	YEDVAN	2.1	1.3	1.7	2.3	0.50	0.06	0.01	0.93	0.13	0.61	0.17	-0.08
20.	KORA	2.2	1.5	1.8	2.5	0.62	0.73	0.80	0.91	0.35	0.53	0.19	-0.15

BS - BACKSHORE US - UPPERSHORE LS - LOWERSHORE moderately sorted and the remaining 3 show very well sorted. The graphic inclusive skewness (SKI) of beach sands varies from strongly fine skewed (0.69) to strongly coarse skewed (-0.67 phi) whereas that for the dune sands, ranges from strongly fine skewed (0.99) to nearly symmetrical (0.01).

Univariate Analysis

Univariate analysis deals with the variations observed in the individual parameters. These parameters are sensitive to the depositional environment and processes and are, therefore, very useful. Both lateral and transverse variations of parameters were studied.

a. Lateral Variation in Parameters

There is a significant variation in the textural characters of the beach sediments length wise along the coast line from north to south graphic mean size of the beach sands shows a wide range of variation from north to south. This could be due to the difference in marine processes, morphology of coast and sediment supply. The poor sorting of the sediments suggests that the supply of the elastics is more than the energy of the coastal processes. The variations of skewness values from fine to coarse is obviously due to the amount and nature of the sediments and the source of supply. In the northern part beach derives its coarser fraction from Rocky foreshore of Dhanua, Tarapur and Muramba. In contrast the Southern beach derived its sediments from shelf, which comprised medium to fine sand size particles and the coarser fractions which are presents in a minor proportion have been contributed by various rivers.

b. **TRANSVERSE VARIATIONS OF PARAMETERS**

Twenty cross traverses, spaced at regular intervals along the shoreline were taken. Though all the samples from a particular major environments have been considered together, but it is found that even within one environment there is a gradual transverse change in the samples from lower to upper foreshore (Fig. V.3, Table V.4). The details of which are as follows :

Dune Sands

Dunes were sampled at 20 sites throughout Dhanua-Kora coast sea. The sands from these sites reveal the following grain size characters.

Mean grain size (MZ) - samples grouped in the category are fine (50 %) and very fine (50 %) sands. Inclusive graphic standard deviation ($\sigma\phi$) - most of the sand samples group in the category show well sorted (40 %) to very well sorted (25 %) and moderately sorted (20 %) with a minor amount of samples (15 %) showing very well sorted.

Inclusive graphic skewness (ski) - Skewness of samples ranges from strongly fine skewed. (35 %) through fine skewed (45 %) and nearly symmetrical (20 %).

FIG. V·3
FREQUENCY PERCENTAGE OF STATISTICAL PARAMETERS
OF DAHANU KORA - COASTAL SEDIMENTS

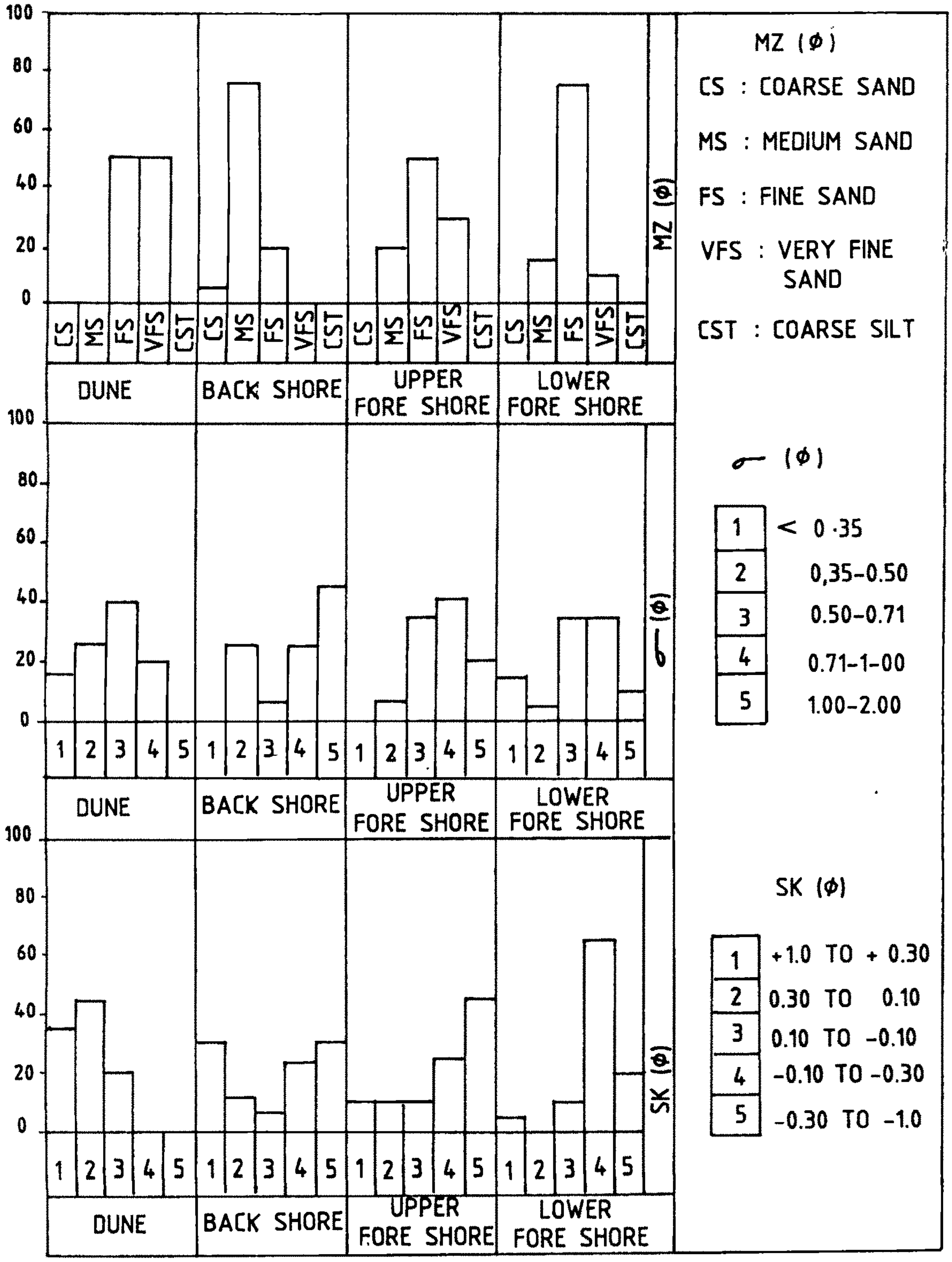


TABLE V.4

TEXTURAL PARAMETERS OF DUNE

BEACH SEDIMENTS - DAHANU COAST

PARAMETERS	DAHANU-USARNI SHORE ZONE			
	DUNE	BS	US	LS
Graphic mean (MZ)				
0 to 1	0	5	0	0
1 to 2	0	75	20	0
2 to 3	50	20	50	15
3 to 4	50	0	30	75
4 to 5	0	0	0	10

INCLUSIVE GRAPHIC STANDARD DEVIATION (@)

< 0.35	15	0	0	15
0.35 - 0.50	25	25	5	5
0.50 - 0.71	40	5	35	35
0.71 - 1.00	20	25	40	35
1.00 - 2.00	0	45	20	10
2.00 - 4.00	0	0	0	0

INCLUSIVE GRAPHIC SKEWNESS (SKi)

+1.0 to +0.30	35	30	10	5
+0.30 to +0.10	45	10	10	0
+0.10 to -0.10	20	5	10	10
-0.10 to -0.30	0	25	25	65
-0.30 to -1.0	0	30	45	20

BS - BACK SHORE US - UPPER FORESHORE LS - LOWER FORESHORE

Unit of MZ, @, SKi, are (phi)

In short Dune sample are mostly fine to very fine grained, moderately to very well sorted, strongly fine to nearly symmetrical.

Backshore Sands

These sands have been studied from backshore zone and reveal the following characters.

Mean grain size (MZ) - The size ranges from coarse sand to fine in which medium sand (75 %) dominate, fine sand (20 %) and coarse sand contribute a minor amount (5 %).

Inclusive graphic standard deviation ($\sigma\phi$) - The sorting shows a wide range from poorly sorted (45 %) through moderately sorted (25 %) and moderately well sorted (5 %) to well sorted (25 %).

Inclusive graphic skewness (ski) - Skewness values shows a wide range from strongly coarse skewed (30 %) to coarse skewed (25 %) and strongly fine - skewed (30 %) to fine skewed (10 %) with a few sample having nearly symmetrical (5 %).

Upper-fore Shore Sands

These sands have been studied from upper fore shore zone and reveal the following characters.

Mean grain size (MZ) - The size ranges from medium to very fine sands in which fine sand (50 %) dominate, very fine sand (30 %) and medium sand contributes (20 %).

Inclusive graphic standard deviation ($\sigma\phi$). The sorting shows a wide range from moderately sorted (40 %) through moderately well sorted (35 %) and poorly sorted (2 %) to well sorted (5 %).

Inclusive graphic skewness (ski) - Skewness values shows a wide range from strongly coarse skewed (45 %) and coarse skewed (25 %) to strongly fine skewed (10 %), fine skewed (10 %) and nearly symmetrical (10 %).

Lower Fore Shore Sands

These sands have been studied from lower foreshore zone and reveal the following characters. Mean grain size (MZ) - The size ranges from very fine sand (75%) to fine sands (15%) with minor amount of coarse silt (10%). Inclusive Graphic standard deviation. The sorting shows a wide range from moderately sorted (35%) through moderately well sorted (35%) and very well sorted (15%) to poorly sorted (10%) with a minor amount of samples (5%) show well sorted.

Inclusive Graphic Skewness (SKi) most of the samples show coarse skewed (65%) and strongly coarse skewed (20%) nature.

Near symmetrical samples contribute a small amount (10%) amd a few samples are strongly fine skewed (5%).

Bivariate Analysis

Bivariate analysis involves plotting of any two significant grain size parameters against each other to discriminate between different depositional environments. Many workers have contribute, valuable information to this approach and have shown that grain size parameters can be useful in differentiating the difeferent environments as they are sensitive to the environment of deposition. Pionier studies have been done by Udden (1914), Wentworth (1929), Otto (1939), Douglas (1946), Vanandel and Potuma (1954) and Inman et.al (1955). Among the recent workers, maximum data have been presented by Folk and Ward (1957), Mason and Folk (1958), Friedman (1961, 1967, and 1979), Moiola and Weiser (1968) and Hailes et. al (1969).

In the present study, three such plots have been used. The first plot shows skewness is quite sensitive to the environment especially beaches, and dunes. Beaches tend to be negatively skewed as compared to dune sands. The second plot involves plotting skewness against standard deviation. The third plot involves plotting mean size against standard deviation.

1. Graphic Mean (MZ) vs Inclusive Graphic Skewness (sk) (ski)

In this plot skewness for beach and dune sands is plotted against the graphic mean using the phi scale. The point represents beach sands lie for the most part in a different area of the graph from those for dune sands. A nearly complete separation is found for the two depositional environments. The dune sands being for the most part positively skewed, and the ocean beach sands generally negatively skewed. (Fig. V.4A)

2. Inclusive Graphis Standard Deviation vs Inclusive Graphic Skewness (ski)

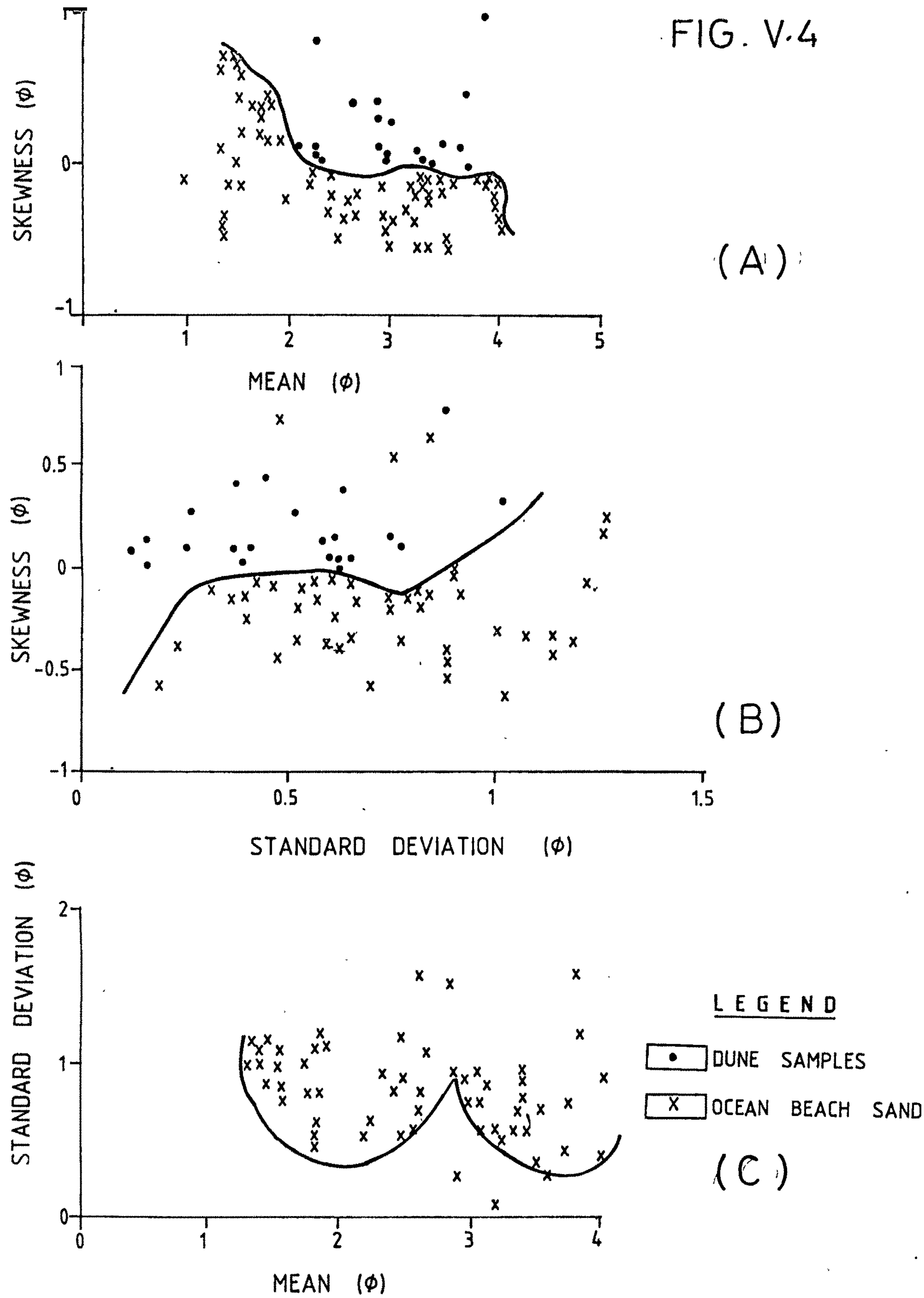
This plot is a sensitive indicator of environments and the distinction between dune and beach deposits is easily made up. A nearly complete separation is found between dune and beach sands. (Fig. V.4B)

3. Inclusive Graphic Standard Deviation ($\sigma\phi$) vs Graphic Mean (MZ)

Sorting is dependent on the grain size of the material available for deposition, kind of sedimentation, current conditions, and on the rate of sedimentation. A plot (Fig.V.4C) of sorting versus mean size produces asinusoidal curve. This pronounced a sinusoidal trend depends on the effecctiveness of the surface of waves, the force of erosion, and the shape of the bioclastics (Folk and Robles, 1964). The plot shows a complex sincus pattern which indicates high energy environments.

C-M PATTERN ANALYSIS

C-M patterns are obtained by plotting `C´ the first coarsest percentile of the grain size distribution against `M´ the median



SCATTER DIAGRAM OF DAHANU - KORA COASTAL SEDIMENTS of the 50th percentile. C represents the maximum compentency of the transportation media being the coarsest first percent fraction while M represents the average competency of the media. By plotting these two parameters from a number of samples against each other, different operative processes give different patterns which are easily identifiable and which can easily be interpreted in terms of energy levels, processes operative during transportation and deposition of sediments in a particular depositional environment.

The patterns thus obtained may vary in size and shape depending upon the energy conditions present during the processes of transportation. The patterns may comprise one or more segments indicating changes in energy levels in different parts of the same depositional system.

These patterns can also be compared with the basic patterns put forward by Passega (1957,1964) and Passega and Byramji (1969). These basic patterns represent river and tractive currents, turbidity currents, beach processes and pelagic suspension.

Following the procedure suggested by him the present author has prepared C-M diagram for the study area. The grain size analysis was carried out and data was represented on a probability paper obtaining the cumulative curve . From these curves, the values of one percentile and median percentile m were obtained by intersection the cumulative curves at 1 percent and

50 percent. The values of c and m for different samples thus obtained in phi unit were converted in to micron (Table V.5) and then plotted on double log paper to obtain CM diagram (Fig.V.5). The C-M pattern obtained is confirming with that of beach pattern of Passega (1957).

It is concluded from the above study that about 50 % of the samples have been deposited by rolling where in `c´ is more than 1000 microns. This indicates higher energy. Most likely the effecct of wave processes was responsible for deposition of these particular sediments. The remaining samples group in and around pq and qr segments of Passega diagram. It reveals that these sediments were deposited by graded suspension (QR) and rolling associates with graded suspension (PQ). A few samples from Dhanua-Kora Coast show deposition by uniform suspension indicating lower energy uniform suspension. The sediment particle representes on the C-M diagram suggest that the lower foreshore sediments transport mainly by graded suspension whether upper-fore shore sediments transport mainly by rolling and suspension.

LOG PROBABILITY CURVE ANALYSIS

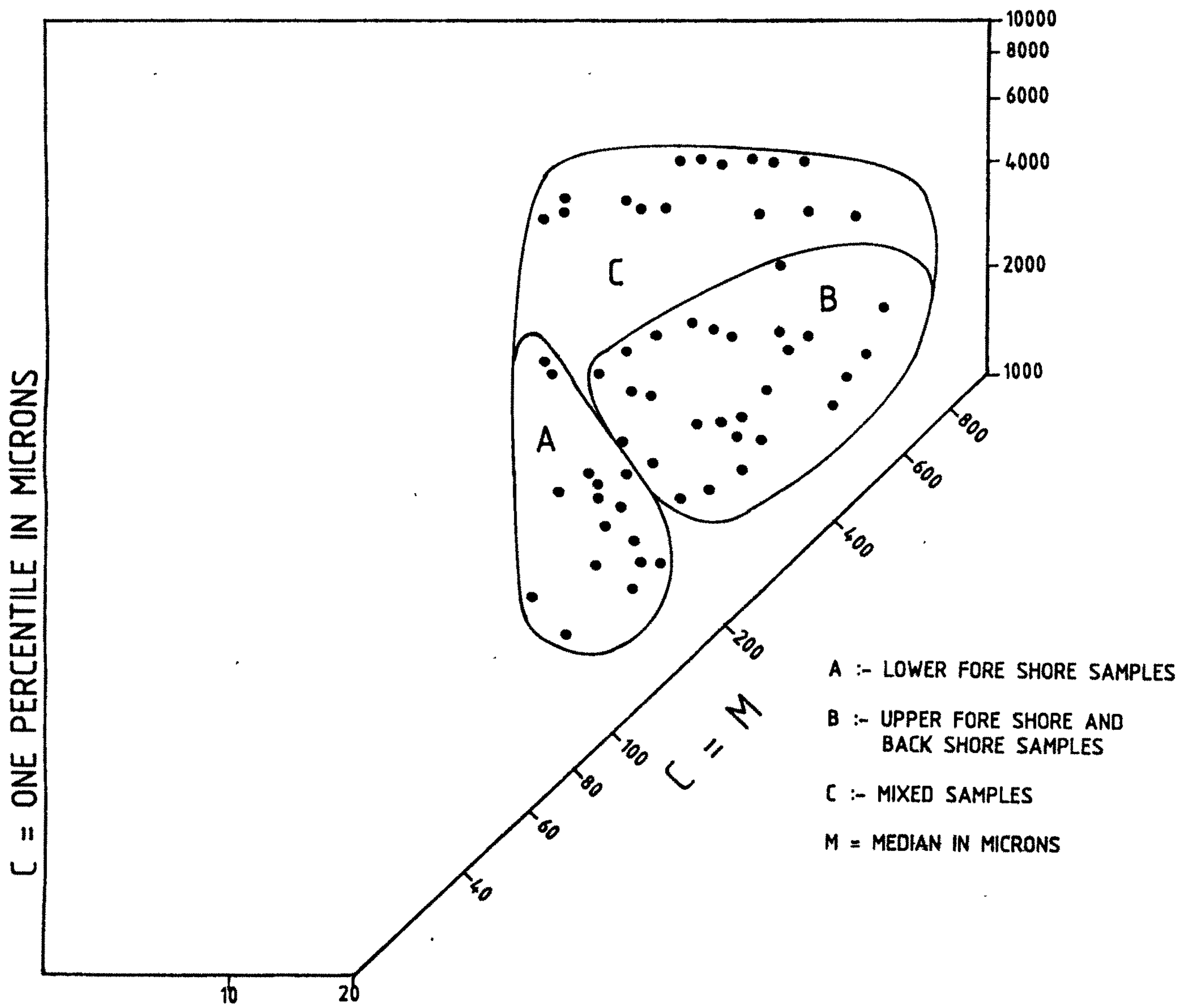
Grain size analysis is being used successfully to understand the depositional processes and the environment since long. In this respect, significant contributions have been made by Doeglas

.pl82
.pn98

Table V.5
The values in Micron of
"C" and "M" Percentiles - Dahanu Coast

Sample number	Locality name	Location of sample	C	M
1	DAHANU	LOWER FORESHORE	280	92
2		UPPER FORESHORE	640	110
3		BACKSHORE	4000	320
4	TADALPADA	LOWER FORESHORE	1000	110
5		UPPER FORESHORE	380	130
6		BACKSHORE	720	180
7	GUNGHADA	LOWER FORESHORE	190	80
8		UPPER FORESHORE	2800	105
9		BACKSHORE	2500	310
10	VADAPOKHRON	LOWER FORESHORE	940	88
11		UPPER FORESHORE	8400	110
12		BACKSHORE	2000	320
13	VADHAVAN	LOWER FORESHORE	470	76
14		UPPER FORESHORE	1000	420
15		BACKSHORE	1000	120
16	VAROR	LOWER FORESHORE	250	62
17		UPPER FORESHORE	320	105
18		BACKSHORE	800	400
19	DANDEPADA	LOWER FORESHORE	1100	72
20		UPPER FORESHORE	620	330
21		BACKSHORE	1600	380
22	TARAPUR	LOWER FORESHORE	435	93
23		UPPER FORESHORE	580	155
24		BACKSHORE	620	240
25	NAWAPUR	LOWER FORESHORE	2650	88
26		UPPER FORESHORE	1100	125
27		BACKSHORE	3000	470
28	ALEVADI	LOWER FORESHORE	3000	64
29		UPPER FORESHORE	4000	200
30		BACKSHORE	4000	180
31	MURAMBA	LOWER FORESHORE	2000	350
32		UPPER FORESHORE	3000	76
33		BACKSHORE	4000	175
34	SATPATI	LOWER FORESHORE	540	110
35		UPPER FORESHORE	660	205
36		BACKSHORE	1250	290
37	VADRAI	LOWER FORESHORE	435	92
38		UPPER FORESHORE	820	125
39		BACKSHORE	660	230
40	SHIRGAON	LOWER FORESHORE	250	70
41		UPPER FORESHORE	3100	140
42		BACKSHORE	3000	78
43	MAHIM	LOWER FORESHORE	1000	70
44		UPPER FORESHORE	1800	140
45		BACKSHORE	1000	78
46	MANGELVAD	LOWER FORESHORE	380	98
47		UPPER FORESHORE	440	180
48		BACKSHORE	960	420
49	USARNI	LOWER FORESHORE	470	88
50		UPPER FORESHORE	360	105
51		BACKSHORE	4000	380
52	MATHANA	LOWER FORESHORE	280	105
53		UPPER FORESHORE	1250	150
54		BACKSHORE	580	220
55	YEDVAN	LOWER FORESHORE	1550	190
56		UPPER FORESHORE	800	340
57		BACKSHORE	1150	580
58	KORA	LOWER FORESHORE	1600	185
59		UPPER FORESHORE	820	135
60		BACKSHORE	1250	295

FIG. V·5



CM-DIAGRAM FOR DAHANU-KORA COASTAL SEDIMENTS

(1946), Inman (1949), Bagnold (1954,1956) Sindowski (1958) and Visher (1965,1969).

Doeglas (1946) concluded that grain size distributiion are a mixture of two or more component populations and products of varying transport mechanisms. He made an attempt to relate these populatiions with specific sedimentary environments. Inman (1949) recognised three major modes of transportation viz. surface creep, saltation and suspension. He also analysed the grain size distribution in terms of mean size, sorting, skewness, etc., and derived their formation. He, however, did not attempt to relate these parameters to the presence of populations or to the total grain size distribution. Bagnold (1954,1956) dealt specifically with transport mechanisms of sediments and provided a theoritical basis for the interpretation of sediment textures. Sindowski (1958) described shapes of graine size distribution curves from recent and ancient environments referring to Doeglas (1946) but used log probability plots. His investigations present a careful study of the relations of sediment textures from known environments to the shape of grain size distribution curves and allows environmental identification. He, however, did not direcctly correlates the shape of grain size curves with the processes or depositional environments. Moss (1962, 1963) made a major contribution towards understanding of grain size distributions and depositional processes. He concluded that the mean size, sorting and truncation points were different in different types of grain size distributions and that the three populations (Inman, 1949) could be present in a single grain size disitribution. Visher (1965,1969) studied the grain size distribution curves with specific environments taking into consideration the amount of sub-populations, their sorting and truncation points and intermixing of these sub-populations.

The population identified in the study area appear to justify Visher's suggestion that bed-load tracction and saltation under reversing flow conditions produce three population associated with wave action. The double saltation components have been produced experimentally by Kolmer (1973) although Clifton (1969) point out in some cases upper foreshore laminations are produced with in bed flow during the backwash only. There is a noticeable increase of a fine particle population in the lower foreshore sand (Table V.6) due to rip current action. Examination of the size curve segments illustrates, (1) lack of very coarse population particles (2) an increase in the saltation particles, (3) lack of a very fine population except in lower foreshore. The relative lack of a coarse bed traction component reflects the inadequacy of wind in generating bed creep movement (Bagnold,1941) while the presence of a very fine population suggests deposition of fines from suspension (moss, 1963). Dune samples having a dominance of one population of particles (saltation) supports the long held view that the major transporting mode of wind is by saltation (Bagnold, 1941) giving rise to a highly selected set of particles in the framework population. Beach sands of Dahanu are deposited most commonly by the saltation mechanism with suspension

PERCENTAGE VARIATIONS OF TRANSPORTATION

MODES - DAHANU COAST

NO.	Lacality Name	Location of Sample	Traction	Saltation	Suspension
1.	DHANUA	LOWER FORESHORE	0.15	90.85	9
		UPPER FORESHORE	16	68	16
		BERN	8	90	2
		DUNE	0.7	95.3	4
2.	TADALPADA	LOWER FORESHORE	2	90	8
		UPPER FORESHORE	0.3	96.7	3
		BERN	3.5	94	2.5
		DUNE	3	85	12
3.	GUNGWADA	LOWER FORESHORE	0.1	87.9	12
		UPPER FORESHORE	7	91.6	1.4
		BERN	5	93	2
		DUNE	1	97	2
4.	VADAPOKHRON	LOWER FORESHORE	1	83	16
		UPPER FORESHORE	1.4	86.6	12
		BERN	5	92.5	2.5
		DUNE	1.4	87.6	11
5.	VADHAVAN	LOWER FORESHORE	30	65	5
		UPPER FORESHORE	0.5	67.5	32
		BERN	10	89.4	0.6
		DUNE	0.8	79.2	20
6.	VAROR	LOWER FORESHORE	0.15	14	85.85
		UPPER FORESHORE	0.04	94.96	5
		BERN	8	92	0
		DUNE	0.1	65.9	34
7.	DANDEPADA	LOWER FORESHORE	1.2	64.8	34
		UPPER FORESHORE	1	95	4
		BERN	4	92	4
		DUNE	0.50	87.50	12
8.	TARAPUR	LOWER FORESHORE	0.1	84.9	15
		UPPER FORESHORE	5	79	16
		BERN	15	80	5
		DUNE	1	83	16
9.	NAVAPUR	LOWER FORESHORE	2	44	52
		UPPER FORESHORE	19	47	34
		BERN	8	80	12
		DUNE	0.3	95.7	4
10.	ALEWADI	LOWER FORESHORE	3.50	52.50	44
		UPPER FORESHORE	0.30	94.70	5
		BERN	9	88.50	2.50
		DUNE	5	93.40	1.60
11.	MURAMBA	LOWER FORESHORE	17	71	12
		UPPER FORESHORE	4	92	4
		BERN	1.2	91.8	7
		DUNE	0.05	99.35	0.60
12.	SATPATI	LOWER FORESHORE	1	93	6
		UPPER FORESHORE	16	83	1
		BERN	15	83.4	1.6
		DUNE	1.4	94.6	4
11.	VADRAI	LOWER FORESHORE	0.6	84.4	15
		UPPER FORESHORE	5	91	4
		BERN	3	81	16
		DUNE	0.6	95.4	4
14.	SHIRGAON	LOWER FORESHORE	6	54	40
		UPPER FORESHORE	4	92	4
		BERN	0.50	57.50	42
		DUNE	0.2	93.8	6
15.	MAHIM	LOWER FORESHORE	4	86	10
		UPPER FORESHORE	22	62	16
		BERN	30	68.4	1.6
		DUNE	5	94	1
16.	MANGELVAD	LOWER FORESHORE	18	74	8
		UPPER FORESHORE	0.03	99.67	0.30
		BERN	41	58.10	0.90
		DUNE	0.7	95.30	4
17.	USARNI	LOWER FORESHORE	0.7	90.3	9
		UPPER FORESHORE	0.3	83.7	16
		BERN	30	66	4
		DUNE	0.3	93.7	6
18.	MATHAND	LOWER FORESHORE	1	94	5
		UPPER FORESHORE	1	96	3
		BERN	1	97	2
		DUNE	1	92	7
19.	YEDVAN	LOWER FORESHORE	2	80	18
		UPPER FORESHORE	1.6	96.6	1.8
		BERN	1.8	94.2	4
		DUNE	1.8	92.2	6
20.	KORA	LOWER FORESHORE	1.8	81.2	17
		UPPER FOPESHORE	1.4	84.6	14
		BERN	1	91	8
		DUNE	0.6	97	2.4

population more prominent at lower foreshore. The degree to which grains of the different population segregates depend upon the activity of sand movement projection (Rocky fore shore) and vegetation. Dune sands of study area showing clear decrease in the coarse traction population is matched by an increase in the major saltation population. The truncation of the saltation population occurs at 2 phi. Most of the beach sample of the study area show three to four populations with two saltation population.

Along "Dhanua-Kora Coast" there are variations in energy level of deposition as evidenced by unnatural percentages of sub populations in different micro environments. Lower foreshore has traction population values between (0.10 % and 30 %), saltation population having a wide range in percentage variations with values between (14 % and 94 %), suspension population having ranging between (5% and 85-85 %). Upper foreshore area has traction population range between (0.03 % and 22 %) saltation population range between (47 % and 99-67) and suspension population range between (0-30 % and 34 %). The berm zone has traction population values range between (0.50 % and 41 %), saltation population range between (57.50 % and 97%), and suspension population values range between (0.40 % - 42 %). Dune sands having minor the population values range between (0.05-5), saltation population values range between (65-9 % - 99.35 %) and suspension population values range between (0.60 % -20 %). (Table V.7).

TABLE V.7

MAXIMUM AND MINIMUM VALUES OF TRANSPORTATION MODES TRANSVERSE AND ACROSS (DHANUA-KORA COAST)

NO.	MODE OF TRANSPORT	ENVIRONMENTS	MAXIMUM VALUES IN PERCENTAGE	MINIMUM VALUES IN VALUES	LOCALITIES OF MAX. VALUES	LOCALITIES OF MIN.
1.	TRACTION	DUNE	5	0.05	Alevadi Mahim	Muramba
2.	SALTATION	DUNE	99.35	65.9	Muramba Kora	Varor
3.	SUSPENSION	DUNE	20	0.60	Vadhavan	Muramba
4.	TRACTION	BERM	41	0.50	Mangelvad	Shirgaon
5.	SALTATION	BERM	97	57.50	Mathana	Shirgaon
6.	SUSPENSION	BERM	42	0.90	Shirgaon	Mangelvad
7.	TRACTION	UPPER FORE SHORE	22	0.03	Mahim	Mangelvad
8.	SALTATION	UPPER FORE SHORE	99.67	47	Mangelvad	Nawapur
9.	SUSPENSION	UPPER FORE SHORE	34	0.30	Nawapur	Mangelvad
10.	TRACTION	LOWER FORE SHORE	30	0.10	Vadhavan	Gungwada
11.	SAITATIION	LOWER FORE SHORE	94	14	Mathana	Varor
12.	SUSPENSION	LOWER FORE SHORE	85-85	5	Varor	Vadhavan Mathana