CHAPTER - V

GRANULOMETRY AND TEXTURAL ATTRIBUTES

GENERAL

For many years sedimentary petrographers have attempted to use grain size to determine sedimentary environments. Many excellent contributions have been made during the sixties and seventies, each providing new approaches and insights into the nature and significance of grain size distributions. In the late seventies, attempts have been made to relate grain size distribution with the depositional processes responsible for their formation. The actual problem was in establishing the relation of sedimentary processes to textural responses.

PREVIOUS WORK

Doeglas (1946) made one of the most significant remarks on texture by concluding that grain size distributions followed an arithmetic probability law. Two major contributions by Doeglas were that; (1) grain size distributions were a mixture of two or more component distributions or populations and, that (2) these distributions were produced by varying transport conditions.

Relating sedimentary dynamics to texture, Inman (1949) recognised three fundamental modes of transport viz. surface creep, saltation and suspension. He utilized the existing knowledge concerning fluid mechanics to analyse the modes of transport of sedimentary particles. Mass (1962, 1963) has contributed towards an understanding of the relation of grain size distributions to depositional processes. He used shape and size of grains to distinguish subpopulations produced by the three types of sediment transport described by Inman (1949) and Bagnold (1956). He described at length the transportation of clastic particles at the sedimentary interface. He also illustrated the subdivision of three sub-population and showed that the position of truncation, sorting and mean size of these populations were different in different samples.

Other aspects of textural evidence for environmental identification have been perused by Folk and Ward (1957), Mason and Folk (1958), Harris (1959), Friedman (1961, 1967), Visher (1969), Glaister and Nelson (1974), and Friedman and Sanders (1978). These authors have used statistical measures of meansize, standard deviation, skewness and kurtosis. to separate beach, dune, aeolian flat and fluvial environments. Work of Passega and others (1957, 1967) has led to the development of C/M plots, to distinguish suspension, traction, graded suspension and other sedimentary processes.

In the present study an integrated approach of textural analysis along C/M plots and binary plots have been taken into account to understand the genesis of individual sand units of sediments under reference.

GRAIN SIZE ANALYSIS

The particle size analysis of clastic sequence of Jurassic sediments of Jaisalmer basin were carried out by techniques suggested by

Friedman and Johnson (1982).

The friable clastic samples were sieved for 10-15 minutes utilising ASTM sieve sets at 1/4ϕ intervals. The detailed methodology of grain size analysis has been discussed in Chapter-III. The lithified samples which were difficult to disintegrate were analysed after preparing their thin section and measuring individual grains under polarising microscope following the methods of Glaister and Nelson (1974).

COMPUTATION OF STATISTICAL PARAMETERS OF GRAIN SIZE ANALYSIS

The cumulative curves were plotted on arithmetic probability papers and various percentile value like 1st, 5th, 16th, 25th, 50th, 75th, 84th and 95th percentiles were recorded. In the present work, the following four parameters of grain size (Folk 1968) have been calculated:

1. Graphic mean (M_Z)
2. Inclusive graphic standard deviation
3. Inclusive graphic skewness (SK_I)
4. Graphic kurtosis (K_G)

1. Graphic mean (M_Z)

This is a measure of average size and it is the best graphic measure for determining average size. The formula used by Folk (1965) is

$$M_Z = \frac{\phi 16 + \phi 50 + \phi 84}{3}$$

2. **Inclusive Graphic Standard Deviation (σI)**

This is a measure of average dispersion of spread of the distribution around the mean size. Following Folk (1965), the formula for obtaining this measure is

$$\sigma I = \frac{\phi 84 - \phi 16}{4} + \frac{\phi 95 - \phi 5}{6.6}$$

This measure has been used in this present work to have idea for average measure of sorting following verbal classification scale for sorting by Folk (1965).

σI under 0.35 - very well sorted

0.35 to 0.50 - well sorted

0.50 to 0.71 - moderately well sorted

0.71 to 1.00 - moderately sorted

1.00 to 2.00 - poorly sorted

2.00 to 4.00 - very poorly sorted

over to 4.00 - extremely poorly sorted

3. **Inclusive Graphic Skewness (SK_I)**

Skewness is measure of the symmetry around the mean, it denotes the degree of asymmetry as well as the sign ie., depending upon whether a curve has an asymmetrical tail on the right or left.

Folk (1965) has improved the earlier methods of measurements and has introduced the term Inclusive Graphic Skewness represented by the following formula:

$$SK_I = \frac{\phi16 + \phi84 - 2\phi50}{2(\phi84 - \phi16)} + \frac{\phi5 + \phi95 - 2\phi50}{2(\phi95 - \phi5)}$$

This is the most suitable skewness measure because it determines the skewness of the tails as well as the central part of the curves. The tails are very important as they decide the modality of the sediments.

Symmetrical curves have $SK_I = 0.00$, those with excess fine material (a tail to right) have positive skewness, and those with excess coarse material (a tail to the left) have negative skewness. The more the skewness value departs from 0.00, the greater the degree of asymmetry. The following verbal limits on skewness have been suggested by Folk (1965):

SK_I 1.00 to + 0.30 - strongly fine skewed

+ 0.30 to + 0.10 - fine skewed

+ 0.10 to - 0.10 near symmetrical

- 0.10 to - 0.30 - coarse skewed

- 0.30 to - 1.00 - strongly coarse skewed

4. Graphic Kurtosis

Kurtosis measures the ratio of sorting in the tails of the distribution as compared to the sorting in the central part and as such is a sensitive test of the normality of distribution. It is noteworthy that many curves considered as "normal" by the skewness measure turn out to be markedly non-normal (Folk, 1965) when the kurtosis is computed. The graphic kurtosis is given by Folk (1965) in the formula

$$K_G = \frac{(\phi95 - \phi5)}{2.44\ (\phi75 - \phi25)}$$

In the normal probability curve the diameter intervals between the $\phi 5$ and $\phi 95$ points should be exactly 2.44 times the diameter interval between the $\phi 25$ and $\phi 75$. Thus using the above equation, normal curves will have K_G = 1.00.

The following verbal limits for the kurtosis measure have been suggested by Folk (1965) :

K_G under 0.67-very platykurtic
0.67 to 0.90 - platykurtic
0.90 to 1.10 - mesokurtic
1.11 to 1.50 - leptokurtic
1.50 to 3.00 - very leptokurtic
over to 3.00 - Extremely leptokurtic

The histograms and frequency curves were drawn and their data have been taken into consideration for the interpretation. However, the diagrams are not included in this thesis, considering space.

UNIVARIATE ANALYSIS

Univariate analysis deals with the variations in individual statistical parameters. The statistical parameters of grain size distribution of representative clastic sequence of Jurassic sediments are given in Table V.1 and V.2. The characteristic features of grain size parameters of different formations are presented below-

Lathi Formation

The mean size of clastic sequence in Odania Member ranges from 2.05-4.20 ϕ where as in upper part of Lathi, i.e. in Thaiyat Member it varies

TABLE V. 1 STATISTICAL PARAMETERS OF GRAIN SIZE DATA (GRAPHIC METHODS)

FORMATION	MEMBER	Sample No.	Graphic Mean size (M_Z)	Inclusive graphic Standard deviation (σ_I)	Inclusive graphic Skewness (SK_I)	Graphic Kurtosis (KG)	Gross Lithology of representative sample	Average Textural Characteristic of individual member
BHADASAR	MOKAL	MBR-1	1.70	0.95	0.34	1.30	Poorly sorted sandstone	Fine to med. sands
		MBR-2	1.76	0.95	0.14	1.22	Gritty sandstone.	Poorly to moderately sorted
		MBR-3	2.76	1.05	0.72	1.15	Fine grd. sandstone.	
		MBR-4	3.25	1.14	0.51	0.84	Fine grained Bio-turbated sandstone.	-Fine to strongly fine skewed
	KOLAR	MBR-5	3.58	1.35	0.36	0.99	Poorly sorted Sandstone.	-Very fine sands occ.. gritty in nature
		MBR-5A	3.16	1.23	0.53	0.79	Ferr. sandstone.	
		MBR-6	3.30	1.16	0.47	0.87	Calc.gritty sandstone	-Poorly sorted
		MBR-7	3.13	1.21	0.52	0.81	Ferr. sandstone	-Strongly fine skewed
		MBR-8	3.68	1.16	0.15	0.66	Ferr.gritty sandstone	-Predominantly platykurtic
	DUNGAR	MBR-8A	3.52	2.37	0.29	0.64	Fine grd. ferr. sandstone.	
		MBR-9	3.31	1.19	0.35	0.77	Fine grd. calc sandstone.	
		MBR-10	3.56	1.21	0.44	0.89		
		MBR-10A	3.38	1.26	0.51	1.12	Fine grd. sandstone	

FORMATION	MEMBER	Sample No.	Graphic Mean Size (O) (M_Z)	Inclusive graphic Standard deviation (σ_I)	Inclusive graphic Skewness (SK_I)	Graphic Kurtosis (KG)	Gross Lithology of Representative sample	Average Textural Characteristic of individual member
BAISAKHI	RUPSI	BR-10	3.00	1.16	-0.23	0.80	Fine grd. sandstone	- Poorly sorted
		BR-11	3.55	0.55	-0.10	2.75	Fine grd. sandstone	-Moderately well sorted to poorly sorted
		BR-13	3.31	1.22	0.32	0.67	-do-	
		BR-14	3.46	1.23	0.39	0.73	Fine grd. sandstone	-Fine to strongly fine skewed.
		BR-15	3.53	0.73	0.19	1.72	-do-	
		BR-16	3.86	0.83	0.30	1.51	-do-	-Platykurtic to leptokurtic
		BR-17	2.30	1.58	0.26	0.75	Fine to med.grd. sandstone	
		BR-18	3.13	0.99	0.24	0.91	Fine grd. sandstone	
		BR-19	3.30	1.12	0.33	1.00	-do-	
		BR-20	3.35	1.31	0.30	0.65	Fine grd. sandstone	
		BR P-1.	3.36	1.21	0.36	0.97	-do-	
		BR P-1A	3.60	1.14	0.04	0.70	-do-	
		BR P-2	3.36	1.09	0.18	0.85	-do-	
		BR P-3	3.93	0.98	0.40	0.93	-do-	
	LUDHARWA	BRL-1	3.30	1.21	0.35	0.85	Calc V. Fine grd, sandstone	-Fine to V. Fine sandstone
		BRL-2	3.20	1.08	0.45	0.87	Fine grd, sandstone	-Mod. well sorted to poorly sorted
		BRL-3	2.97	0.60	0.28	1.10	-do-	

FORMATION	MEMBER	Sample No.	Graphic Mean Size (Ø) (M_Z)	Inclusive graphic Standard deviation (σI)	Inclusive graphic Skewness (SK_I)	Graphic Kurtosis (KG)	Gross Lithology of Representative sample	Average Textural characteristic of individual member
BAISAKHI	LUDHARWA	BRL-4	3.28	1.13	0.41	0.88	-do-	Fine to strongly fine skewed
		BRL-5	3.18	0.77	0.32	1.53	Fine grd. calc. sandstone	-Platy to mesokurtic
	BAISAKHI	BB-1	3.58	1.30	0.11	0.70	V.Fine grd.sandstone	-Fine to V.fine sand.
		BB-2	3.51	1.25	0.12	0.74	-do-	
		BB-6	3.55	1.01	0.098	0.97	Calc. siltstone	-Mod to poorly sorted
		BB-7	2.61	0.31	0.49	1.22	Fine to coarse grained	-Fine skewed to near symmetric
		BB-8	3.56	0.87	-0.083	1.36	-do-	-Platykurtic to leptokurtic
JAISALMER	KULDHAR	BJ-1	2.36	1.70	0.23	0.86	Calc. sandstone	-fine to V.Fine sand
		BG-11	3.45	0.22	-0.43	-0.43	Calc. sandstone	-Well sorted to poorly sorted; strongly fine skewed
	BADABAG	BG-8	2.81	0.31	0.83	1.02	Calc. sandstone	-Fine grd, very well
		BG-7	2.75	0.32	0.80	1.12	-do-	sorted, mesokurtic

FORMATION	MEMBER	Sample No.	Graphic Mean Size (M_Z)	Inclusive graphic standard deviation (σ_I)	Inclusive graphic skewness (SK_I)	Graphic Kurtosis (KG)	Gross Lithology of Representative sample	Average Textural characteristic of indivisual member
	FORT	F-1	2.89	0.39	0.28	1.46	Calc. sandstone	-Fine sand; very well sorted; fine skewed leptokurtic
		F-2	2.23	0.29	0.15	1.27	-do-	
JAISALMER	JOYAN	TH-17	2.95	1.16	0.50	1.09	Calc. sandstone	Fine to V. fine sands
		TH-19	3.50	1.12	0.17	0.76	Calc. sandstone	-Predominantly poorly sorted
		TH-20	3.06	1.54	0.029	0.69	Yellow, fine grd, calc. sandstone	
		TH-21	3.40	0.45	0.27	1.05	Fine grd, gritty sandstone	-Predominantly fine skewed
		TH-22	3.75	1.28	0.21	0.65	-do-	-Platykurtic
		TH-23	3.76	1.25	0.11	0.64	Fine grd, sandstone	
		TH-12	2:67	1.22	0.21	0.74	Fine grd, sandstone	
	HAMIRA	H-1	2.90	1.35	0.40	0.64	Calc. Sandstone	-Fine to V.fine sands
		H-2	3.70	0.77	0.18	1.08	-do-	-poorly sorted
		H-4	2.93	1.63	0.33	1.00	-do-	-Fine to strongly fine skewed
		TH-1	2.85	1.44	0.16	0.93	Fine grd, sandstone	

FORM - ATION	MEM BER	Sample No.	Graphic Mean size (M_Z)	Inclusive Graphic Standard Deviation (σI)	Inclusive graphic skewness (SK_I)	Graphic Kurtosis (KG)	Gross lithology of representative sample	Average Textural chara- cteristic of individual member
JAISALMER	HAMIRA	TH-2	3.00	1.24	0.14	0.96	Calc sandstone	-Platykurtic to mesokurtic
		TH-4	2.96	1.16	0.055	0.84	-do-	
		TH-5	3.55	1.30	0.45	0.96	V. Fine grd, sandstone	
		TH-8	3.00	1.38	0.36	0.83	Fine grd, calc . sandstone	
LATHI	THAIYAT	TL-1	3.51	1.40	-0.15	0.82	V. fine grd, sandstone	
		TL-2	4.33	0.50	0.30	1.29	V. fine sandstone	-V. well sorted to poorly sorted
		TL-3	4.03	1.37	0.19	0.74		
		TL-4	3.91	0.94	-0 .028	1.13	V.fine grd. sandstone	-Coarse skewed to strongly fine skewed
		TL-6	4.01	0.30	0.54	1.50	-do-	
		WL-1	3.05	1.16	0.19	1.26	-do-	-Platykurtic to very leptokurtic
		WL-2	3.76	1.18	-0.05	0.85	V.fine grd. sandstone	
		WL-3	3.77	0.98	-0.16	2.23		
		WL-4	3.38	0.40	0.14	2.39	Fine grd. sandstone	
		L-9	3.40	1.10	0.12	0.74	Fine grd. sandstone	
		L-10	4.20	1.00	-0.18	1,09	-do-	

FORMATION	MEMBER	Sample No.	Graphic Mean size (M_Z)	Inclusive graphic Standard Deviation (σ_I)	Inclusive graphic skeness (SK_I)	Graphic Kurtosis (K_G)	Gross Lithology of Representative sample	Average Textural characteristic of individual member
LATHI	ODANIA	AL-1	3.10	0.41	0.33	1.87	Fine to med. grd	-Predominantly v. fine sands with occ fine sands
		AL-2	2.86	0.43	0.33	1.15	-do-	
		AL-3	3.30	0.59	0.13	1.45	-do-	-Poorly to well sorted
		AL-8	2.85	0.45	0.32	1.12	-do-	
		AL-10	3.18	1.19	0.48	0.89	Fine grd. gritty sandstone	-Coarse skewed to strongly fine skewed
		AL-11	2.15	1.30	0.34	0.89	Poorly sorted sands	Platykurtic to very leptokurtic
		L-1	3.65	1.34	0.23	0.64	Fine to med.grd, sandstone	
		L-2	2.12	1.35	0.35	0.90	-do-	
		L-3	3.06	0.95	0.25	0.90	Fine grd. sandstone	
		L-6	3.11	0.54	0.091	1.01	-do-	
		L-7	3.51	0.57	0.11	1.63	-do-	
		L-10	4.20	1.00	0.18	1.09	V. fine grd. sandstone	
		L-11	3.96	0.78	0.25	1.30	Fine grd. sandstone	
		L-12	3.48	1.37	-0.67	0.63	Siltstone	
		L-13	3.05	1.46	0.43	0.81	Fine grd. sandstone	
		L-14	2.63	1.18	0.22	1.47	Fine grd. sandstone	
		L-17	3.16	1.17	-0.05	1.15	Siltstone	

TABLE V.2 : DISTRIBUTION OF SIZE STANDARD (MEAN AND RANGE VALUES) OF CLASTIC SEQUENCE IN JURASSIC SEDIMENTS

FORMATION	MEMBER	MEAN-SIZE (ø)	STANDARD DEVIATION (ø)	SKEWNESS	KURTOSIS
BHADASAR	MOKAL	2.59 (1.76-325)	1.05 (0.95-1.14)	0.45 (0.14-0.72)	1.07 (0.84-1.22)
	KOLAR DUNGAR	3.40 (3.13-3.68)	1.34 (1.16-2.37)	0.40 (0.15-0.53)	0.83 (0.64-1.12)
BAISAKHI	RUPSI	3.36 (2.30-3.93)	1.09 (0.73-1.31)	0.21 (-0.10-0.40)	1.06 (0.65-2.75)
	LUDHARWA	3.18 (2.97-3.30)	0.95 (0.60-1.21)	0.36 (0.28-0.45)	1.05 (0.85-1.53)

FORMATION	MEMBER	MEAN-SIZE (ø)	STANDARD DEVIATION (ø)	SKEWNESS	KURTOSIS
BAISAKHI	BAISAKHI	3.38 (2.61-3.65)	0.95 (0.31-1.30)	0.15 (-0.083-0.49)	0.99 (0.70-1 .36)
JAISALMER	KULDHAR	2.91 (2.36-3.45)	0.96 (0.22-1.70)	-0.10 (-0.43-0.23)	1.05 (0.86-1.23)
	BADABAG	2.78 (2.75-2.81)	0.31 (0.31-0.32)	0.85 (0.83-0.88)	1.07 (1.02-1.12)
	FORT	2.56 (2.23-2.89)	0.34 (0.29-0.39)	0.22 (0.15-0.28)	1.37 (1.27-1.46)
	JOYAN	3.30 (2.67-3.76)	1.15 (0.45-1.54)	0.21 (0.029-0.50)	0.80 (0.64-1.05)

FORMATION	MEMBER	MEAN-SIZE (Ø)	STANDARD DEVIATION (Ø)	SKEWNESS	KURTOSIS
JAISALMER	HAMIRA	3.11	1.28	0.25	1.02
		(2.85-3.70)	(0.77-1.44)	(0.05-0.45)	(0.64-1.08)
LATHI	THAIYAT	3.75	0.94	0.08	1.28
		(3.05-4.33)	(0.30-1.40)	(-0.18-0.54)	(2.39-0.74)
	ODANIA	3.08	0.95	0.17	1.12
		(2.05-4.20)	(0.41-1.46)	(0.67-0.48)	(0.64-1.87)

varies from 3.05-4.33Ø suggesting fining upward trend in the sequence. The mean size data also suggest that basal part of Lathi Formation is comparatively coarse than the upper part.

The inclusive graphic standard deviation (σ_I) is a measure of average dispersion around the mean size, suggesting overall picture of sorting. The sorting of grains in lower and upper part of the Lathi Formation varies from 1.30 to 1.46 Ø with an average value of 0.95Ø suggesting poor to moderately sorted nature of grains.

The skewness values for clastic sequence in Odania Member vary from 0.67 to 0.48 suggesting strongly fine skewed, while in Thaiyat Member coarse to fine skewed (0.18 to 0.54).

The kurtosis values of sands in Odania Member varies from 0.64 (platykurtic) to 1.27 (leptokurtic) while in Thaiyat Member it is between 0.74 to 2.39 (platykurtic to very leptokurtic).

Jaisalmer Formation

The average mean grain size of clastic sequence in Jaisalmer Formation varies from 3.30 to 2.56Ø, showing predominance of fine to very fine grained sand and suggest coarsening upward trend in the sequence. The sorting of grain size in clastic sequence in Hamira Member varies from 0.77 Ø (moderately sorted) to 1.44 Ø (poorly sorted), in Joyan Member varies from 0.45Ø (well sorted) to 1.54Ø (poorly sorted), in Fort Member 0.29 to o.39Ø (very well sorted to well sorted); Badabag Member 0.31 to 0.32 Ø (very well sorted), while in Kuldhar Member 0.22 Ø to 1.70 Ø (very well sorted to poorly sorted).

The grain size distribution pattern in clastic sequence of Hamira, Joyan & Fort members is predominantly fine skewed to strongly fine skewed (0.15 to 0.50), while in the upper sequence i.e. in Kuldhar Member, it is coarse skewed to fine skewed (0.43 to 0.23).

Kurtosis values vary from 0.64 (very platykurtic) to 1.08 (mesokurtic) in clastic samples of Hamira and Joyan members, 1.27 to 1.46 (leptokurtic) in Fort Member, 1.02 to 1.12 (mesokurtic) in Badabag Member and 0.86 to 1.23 (platykurtic to leptokurtic) in Kuldhar Member.

Baisakhi Formation

The average mean size of clastic grain in Baisakhi, Ludharwa and Rupsi members varies from 3.18 to 3.38 Ø, suggesting predominance of very fine sand grade particles in the sequence. However, the mean size pattern in vertical section shows fining upward trend.

The standard deviation of grain size in clastic sequence varies from 0.31 to 1.30 (Poorly sorted to well sorted) in Baisakhi Member, 0.60 to1.21Ø (moderately well sorted to poorly sorted) in Ludharwa Member and 0.73 to 1.31Ø(moderately sorted to poorly sorted) in Rupsi Member. However, the average sorting of grains varies from 0.95 to 1.09 Ø suggesting average dominance of moderately sorted grains in clastic sediments in the sequence under reference.

The degree of asymmetry of grain size distribution observed are strongly coarse skewed (0.49) to coarse skewed (-0.83) in Baisakhi

Member, fine skewed (0.28) to strongly fine skewed (0.45) in Rupsi Member and in Ludharwa Member coarse skewed (-0.10 to -0.40). As a whole they are at average level fine skewed (0.15-0.30).

Kurtosis nature measured for normality of distribution of grain size varies from 0.70 to 1.36 (platykurtic to leptokurtic) in Baisakhi Member, 0.85 to 1.53 (platykurtic to very leptokurtic) in Ludharwa Member and 0.65 to 2.75 (very platykurtic to very leptokurtic) in Rupsi Member.

Bhadasar Formation

The average mean size of clastic grain in Kolar Dungar and Mokal members of Bhadasar Formation vary from 3.40 to 2.59Ø suggesting predominance of very fine sand grade particles in the sequence. There is no definite trend in mean size of grains in vertical profiles of Kolar Dungar Member. Coarsening upward trends have been observed in the sand sequence of Mokal Member.

Higher side of sorting value ranging from 1.16 to 2.37Ø suggests poorly sorted grains in Kolar Dungar Member, while 0.96 to 1.14Ø (moderately sorted to poorly sorted) in Mokal Member. An overall the grain size are poorly sorted in Bhadasar Formation.

The grain size distribution curves in Kolar Dungar and Mokal members are positively skewed and shows skewness value ranging from 0.40 to 0.45 at average level. The kurtosis value for clastic vary from 0.64 to 1.12 in Kolar Dungar Member suggesting very platykurtic to leptokurtic while in Mokal Member 0.84 to 1.22 suggesting platykurtic to leptokurtic.

BIVARIATE ANALYSIS

For more than 40 years workers have attempted to identify sedimentary environments on the basis of textural parameters. Folk and Ward (1957), Mason and Folk (1958), Friedman (1961, 1967), Duane (1964) Moiola and Weiser (1968), Glaister and Nelson (1974) suggested that statistical grain size parameters like mean, standard deviation, skewness and kurtosis may be utilised as sensitive indicators of dune, beach and fluvial environments.

In the present study, the following scatter plots have been drawn and studied :

1. Skewness versus standard deviation, discriminatory line between beach and river sands, referred by Moiola and Weiser (1968).
2. Mean diameter versus standard deviation, discriminatory line between beach and river sands referred by Friedman (1967).
3. Skewness versus standard deviation, discriminatory line between beach and river sands referred by Friedman (1967).
4. Mean versus standard deviation, discriminatory line between beach and river sands referred by Moiola and Weiser (1968).
5. Standard deviation versus mean grain size showing gradational changes in sorting and maturity of the sand with environments by Glaister and Nelson (1974).

Skewness Versus Standard Deviation

Figure V.1 is a plot of skewness versus standard deviation of samples of clastic sequence of Jurassic sediments. The discriminatory line drawn between beach and river sands referred by Moiola and Weiser (1968) has been taken as reference line to distinguish the different depositional facies. It has been observed that majority of samples of Jaisalmer Formation, part of Baisakhi Formation are lying in beach deposit region, majority of samples of Lathi Formation and upper part of Bhadasar Formation in river deposit region, while samples from upper part of Jaisalmer and Baisakhi formations are lying in transitional zone. Similar scatter plots have been drawn on skewness versus standard deviation, taking reference line referred by Friedman 1967, (Fig V.3) which also shows similar observation as observed earlier in Fig. V.1.

Mean Diameter Versus Standard Deviation

Fig. V.2 is a plot of mean diameter versus standard deviation. The discriminatory line drawn between beach and river sand referred by Friedman (1967) has been taken as reference line to distinguish the different depositional facies. From Fig. V.2, it has been observed that majority of samples from Hamira, Joyan and Fort members of Jaisalmer Formation are lying in beach region while most of sample plots of Lathi and Bhadasar formations are falling in river deposit region. The samples from upper part of Jaisalmer Formation and Baisakhi Formation are falling in transitional zone.

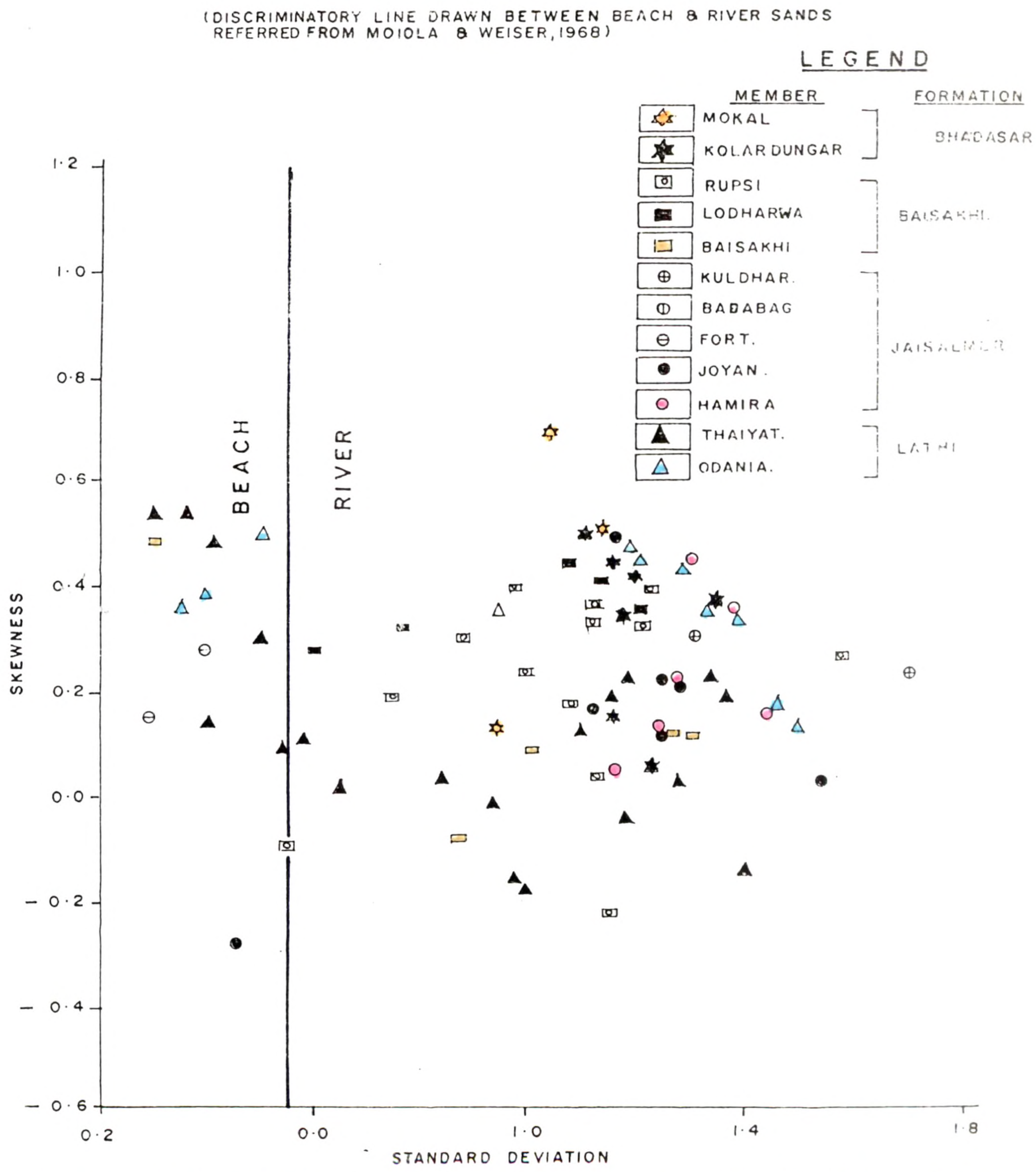


FIG. V·1: BINARY PLOTS: SKEWNESS VS STANDARD DEVIATION OF JURASSIC SEDIMENTS, JAISALMER BASIN, RAJASTHAN.

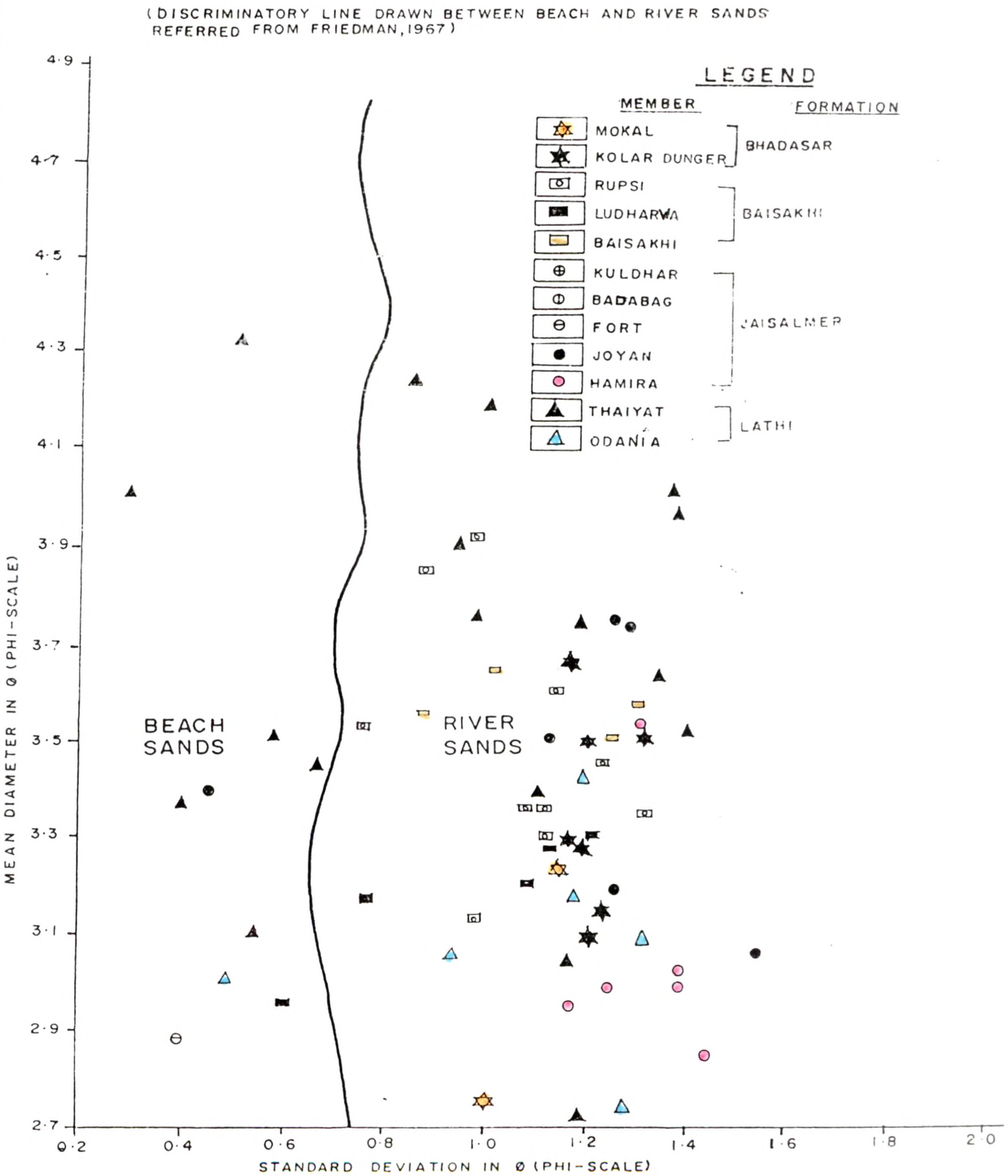


FIG.V·2 BINARY PLOTS : MEAN DIAMETER VS STANDARD DEVIATION OF JURASSIC SEDIMENTS, JAISALMER BASIN, RAJASTHAN.

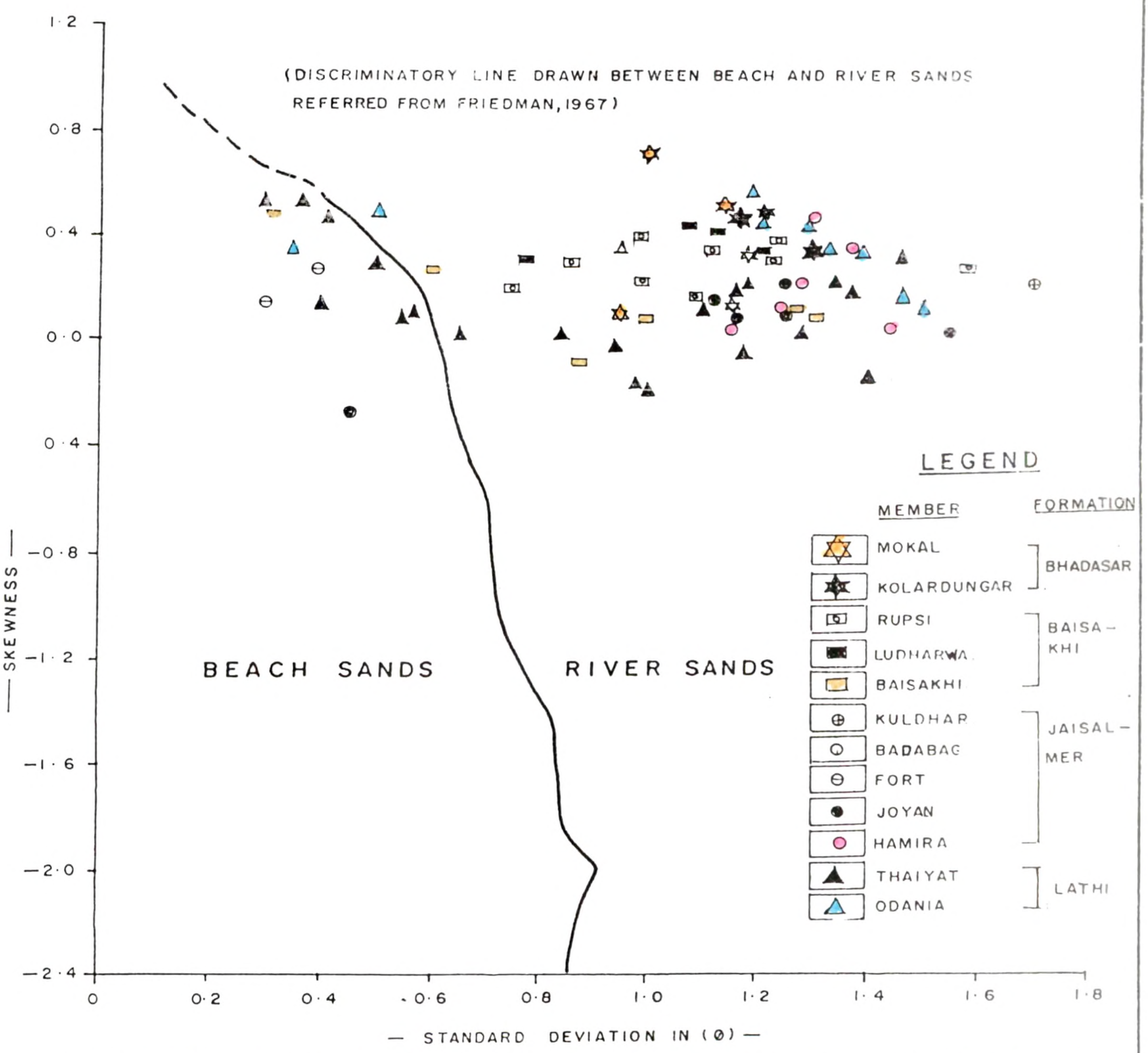


FIG.V-3 : BINARY PLOTS : SKEWNESS VS STANDARD DEVIATION OF JURASSIC SEDIMENTS, JAISALMER BASIN, RAJASTHAN.

Taking the descriminatory line drawn between beach and river sands by Moiola and Weiser (1968) as reference line for the plots-mean diameter versus standard deviation (Fig. V.4), it has been noticed that majority of samples of Lathi and Bhadasar formations are falling in tidal effected region of river sands while samples from Jaisalmer and Baisakhi formations are lying in transitional zone as shore line deposits.

Sorting versus mean grain size

Figure V.5 is a plot of sorting expressed in terms of standard deviation versus mean grain size. The mean grain size is a function of both the energy of the transporting medium and the size range of available materials. Sorting depends on several factors including source of material, nature of sedimentary process (e.g. wave or current) and uniformity and persistence of energy conditions.

As the arrow in Fig. V.5 shows, there is progressive increase in sorting going from alluvial and fluvial deposits to mature beaches, reflecting a definite textural maturity (Glaister & Nelson, 1974).

Examination of Fig. V.5 indicated that majority of samples from clastic section of Lathi, upper part of Baisakhi and Bhadasar formations are falling in river deposit in interdistributary channel, while samples of clastic section of upper part of Jaisalmer Formation are lying in transitional zone in delta front and mature beach region.

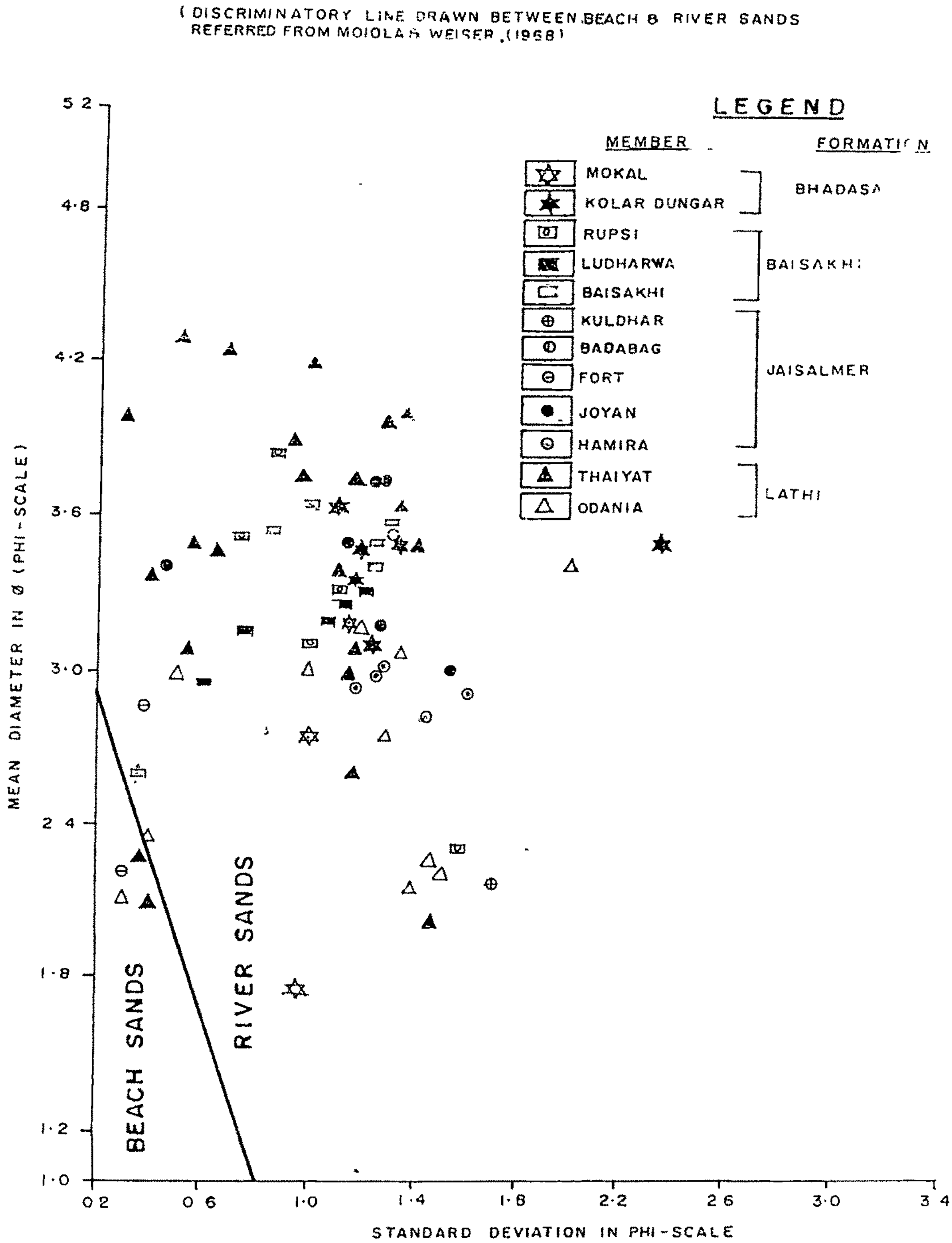


FIG.V·4 BINARY PLOTS : MEAN DIAMETER VS STANDARD DEVIATION OF JURASSIC SEDIMENTS, JAISALMER BASIN, RAJASTHAN.

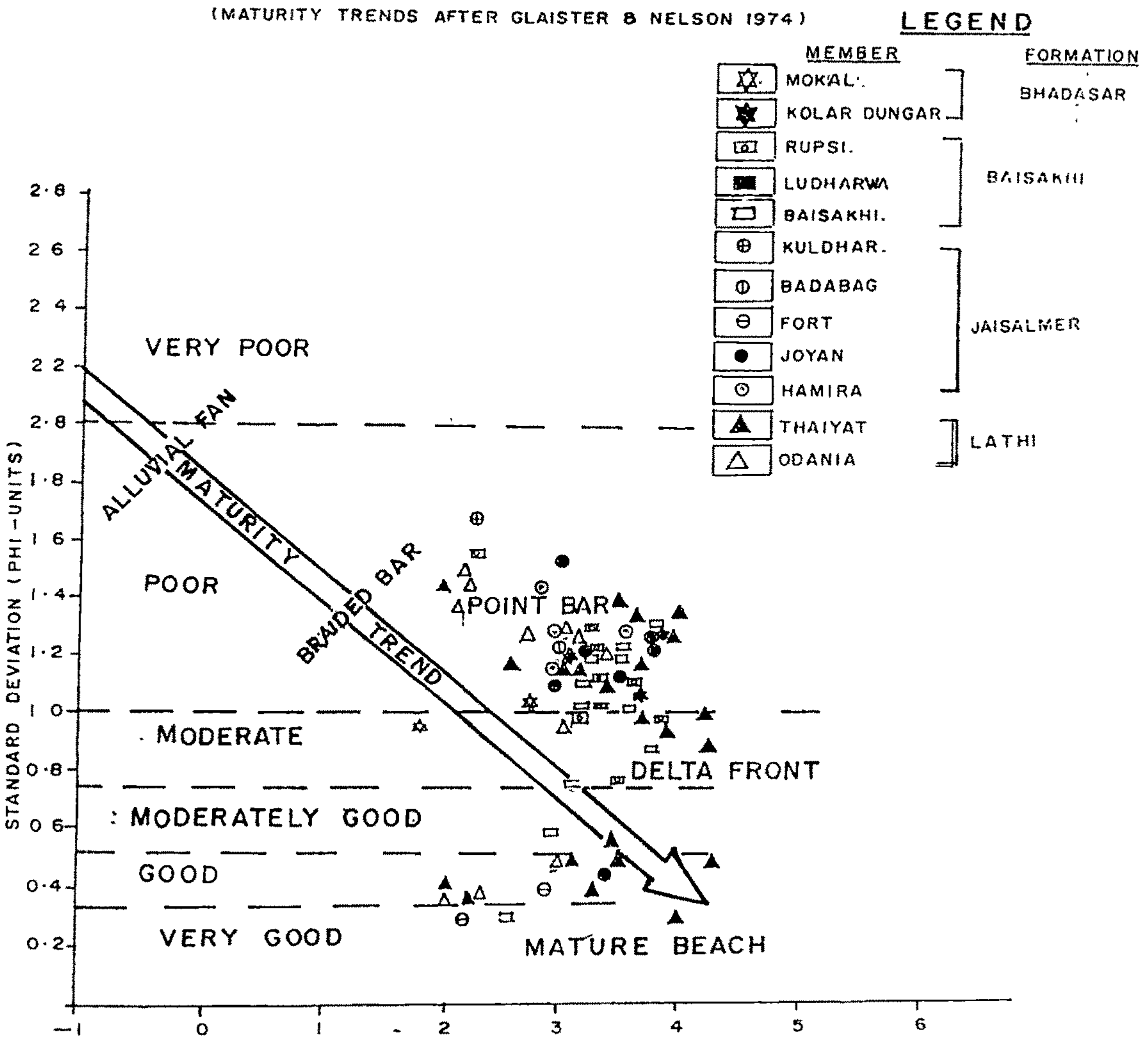


FIG.V·5 DIAGRAM SHOWING GRADATIONAL CHANGE IN SORTING AND GRAIN SIZE WITH ENVIRONMENT OF JURASSIC SEDIMENTS, JAISALMER BASIN, RAJASTHAN.

CM Diagram

The C-M diagram is formed by sample points of a deposit defined by C , at one percentile and M, the median of the grain size distribution and plotted at logarithmic scale originally by Passega (1957), Passega and Byramjee (1969). For more convenience, the C-M diagram was constructed converting the micron value to Ø scale (Pandey et. al, 1974) and sample points of clastic sequence of Jurassic sediments were ploted (Fig. V.6). The 'C' & 'M' values were taken from Arithmatic probability curves. (Table V.3).

The complete C-M pattern (Fig V.6) can be subdivided by points N, O, P, Q, R and S into segments, each of which corresponds to a particular sedimentation mechanism. Position and size of these segments may vary although some are much more common than others.

Segment QR represents deposits formed by graded suspension (Passega, 1957). Values of C are proportional to those of M . The maximum value of C in this segment CR is an index of the maximum bottom turbulence which is seldom greater than 1000 µ. Segment RS is formed by sediments transported as uniform suspension. The maximum value of C in this segment CU is seldom greater than 250 µ (Passega, 1957) and the maximum value of M is seldom greater than 100 µ. Segment PQ of the C-M pattern is formed by suspension sediments represented by point Q and rolled grains in small proportion that does not affect the value of median (Passega, 1957, 1964). Segment OP of the C-M pattern represents a mixture in variable proportion of rolled grains and suspension sediments (Passega, 1964). Values of C are generally higher than 800 µ. Segment NO (Passega, 1964) represents a deposit

TABLE V.3 'C' AND 'M' VALUES CALCULATED FOR GRAIN SIZE (Sieve analysis) DATA FOR CM DIAGRAMS

FORMATION	MEMBER	SAMPLE No.	'C' ONE PERCENTILE (Ø)	'M' MEDIAN PERCENTILE (Ø)
BHADASAR	MOKAL	MBR-1	1.50	1.80
		MBR-2	1.55	1.80
		MBR-3	1.60	2.30
		MBR-4	2.10	2.85
	KOLAR-DUNGAR	MBR-5	1.65	3.20
		MBR-5A	1.45	2.70
		MBR-6	1.55	2.90
		MBR-7	1.75	2.70
		MBR-8	1.90	3.55
		MBR-9	1.75	3.00
		MBR-10	1.55	2.95
		MBR-10A	1.60	2.90
BAISAKHI	RUPSI	BR-10	0.50	3.20
		BR-11	0.80	3.55
		BR-13	1.50	3.00
		BR-14	1.60	3.10

FORMATION	MEMBER	SAMPLE No.	ONE 'C' PERCENTILE (Ø)	MEDIAN 'M' PERCENTILE (Ø)
BAISAKHI	RUPSI	BR-15	1.70	3.45
		BR-16	1.90	3.65
		BR-17	1.00	2.10
		BR-18	1.40	3.00
		BR-19	1.50	3.05
		BR-20	1.35	3.05
		BR P-1	1.70	3.10
		BR P-1A	1.55	3.55
		BR P-2	1.53	3.20
		BR P-3	2.00	3.60
	LUDHARWA	BRL-1	1.40	3.00
		BRL-2	1.60	2.85
		BRL-3	1.85	2.90
		BRL-4	1.70	2.90
		BRL-5	1.75	3.05
		BB-1	1.30	3.45
		BB-2	1.30	3.40
	BAISAKHI	BB-6	1.70	3.60
		BB-7	2.10	2.55
		BB-8	1.60	3.65

FORMATION	MEMBER	SAMLE No.	'C' ONE PERCENTILE (Ø)	'M' MEDIAN PERCENTILE (Ø)
JAISALMER	KULDHAR	BJ-1	-0.10	2.10
		BG-11	0.45	3.45
	BADABAG	BG-8	2.10	2.80
		BG-7	2.00	2.75
	FORT	F-1	2.15	2.85
		F-2	1.62	2.22
	JOYAN	TH-17	0.70	2.50
		TH-19	1.70	3.40
		TH-20	0.45	3.00
		TH-21	2.00	3.50
		TH-22	1.90	2.55
		TH-23	1.80	3.65
		TH-12		

FORMATION	MEMBER	SAMPLE No.	'C' ONE PERCENTILE (Ø)	'M' MEDIAN PERCENTILE (Ø)
JAISALMER	HAMIRA	H-1	0.80	2.40
		H-2	2.05	3.60
		H-4	0.12	2.60
		TH-1	0.60	2.65
		TH-2	0.65	2.90
		TH-4	0.46	2.90
		TH-5	1.35	3.10
		TH-8	0.60	2.60
LATHI	THAIYAT	TL-1	0.65	3.70
		TL-2	2.70	4.25
		TL-3	1.85	4.15
		TL-4	1.80	3.90
		WL-1	1.35	2.95
		WL-2	1.40	3.80
		WL-3	1.60	3.90
		WL-4	2.40	3.40
		WL-5	2.35	3.40
		L-9	1.60	3.30
		L-10	1.65	4.30
	ODANIA	AL-1	2.05	3.00
		AL-2	2.10	2.80
		AL-3	2.00	3.30
		AL-8	2.10	2.85
		AL-10	1.55	2.75

FORMATION	MEMBER	SAMPLE No.	'C' ONE PERCENTILE (Ø)	'M' MEDIAN PERCENTILE (Ø)
		AL-11	0.10	1.90
L		L-1	1.80	2.30
	O	L-2	2.00	2.20
A	D	L-3	1.85	4.75
	A	L-6	2.10	3.75
T	N	L-7	2.15	3.50
	I	L-10	1.65	4.30
H	A	L-11	2.05	3.80
		L-12	1.05	3.60
I		L-13	0.15	1.60
		L-14	0.65	2.50
		L-17	0.75	3.30

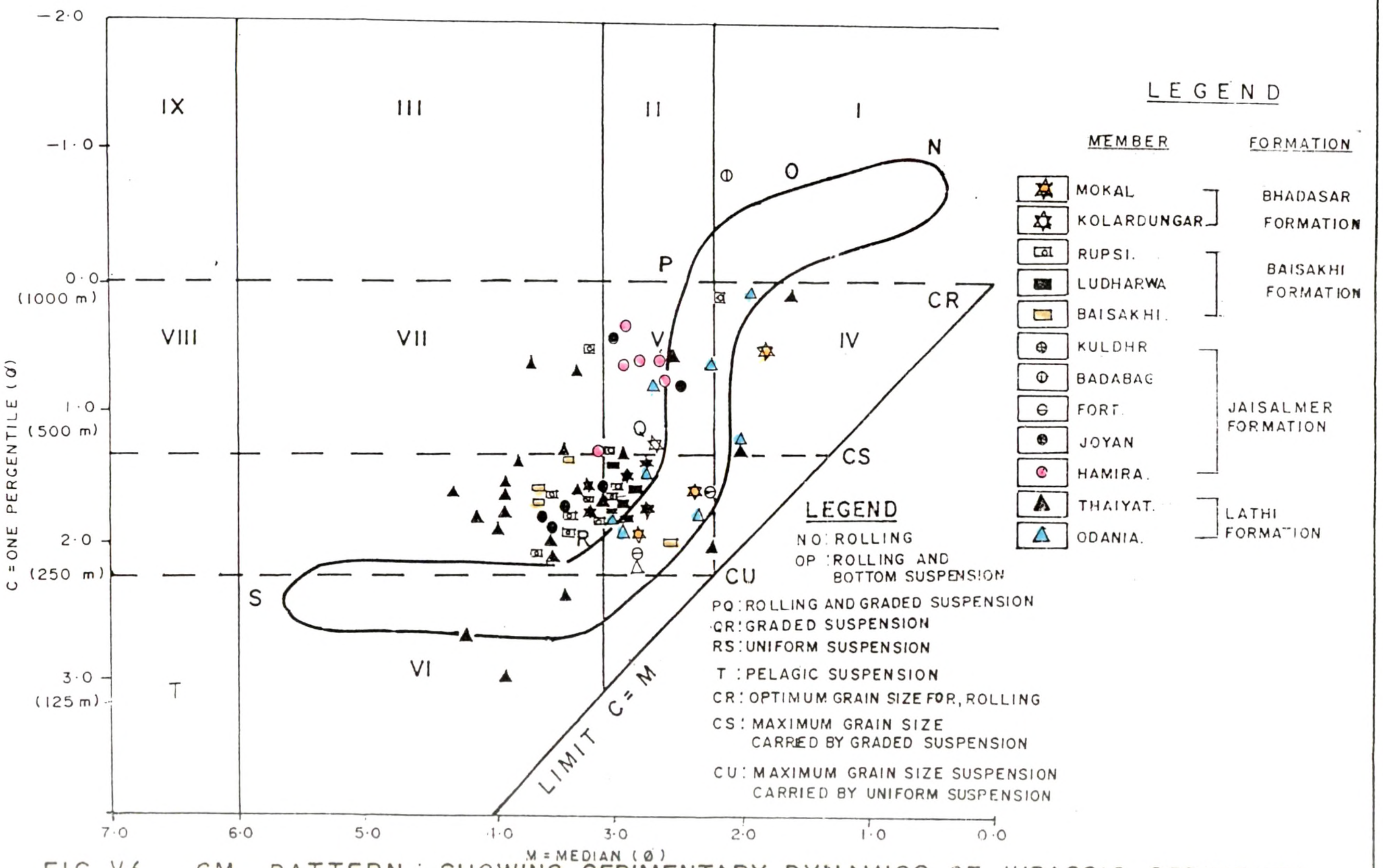


FIG. V-6 CM PATTERN : SHOWING SEDIMENTARY DYNAMICS OF JURASSIC SEDIMENTS, JAISALMER BASIN, RAJASTHAN.

formed mostly by rolled grains. Bend OPQ of the diagram was explained by the fact that sediments intermediate in suspension and those easily rolled are scarce (Passega, 1964).

The C-M diagram plotted, based on textural analysis of clastic sequence of the area under study (Fig V.6) shows that majority of the sample plots of Lathi Formation, upper part of Jaisalmer Formation Baisakhi Formation and lower part of Bhadasar Formation are falling mostly in QR and partly in SR segments, suggesting that the sediments were formed by graded suspension, since part of the sample are falling in RS segment which indicates that stronger currents were bottom currents during deposition of the sediments and resisted when the particles transported by uniform suspension settled.

Log probability curve shapes

Extensive textural study of both modern and ancient sands (Visher, 1969) has provided the basic genetic interpretation of sand texture. In the present study the cumulative probability curves were plotted for comparison with the curve shapes provided by Visher (1969) for different sedimentary environments. The striking aspect of the log probability plot is that (1) it normally exhibits two or three straight line segments and (2) the tails of simple 'S' shaped cumulative frequency curves appear as straight lines allowing for easy comparisons and measurements.

The curve shapes are drawn for representative clastic units of sediments under study which shows three modes of transport

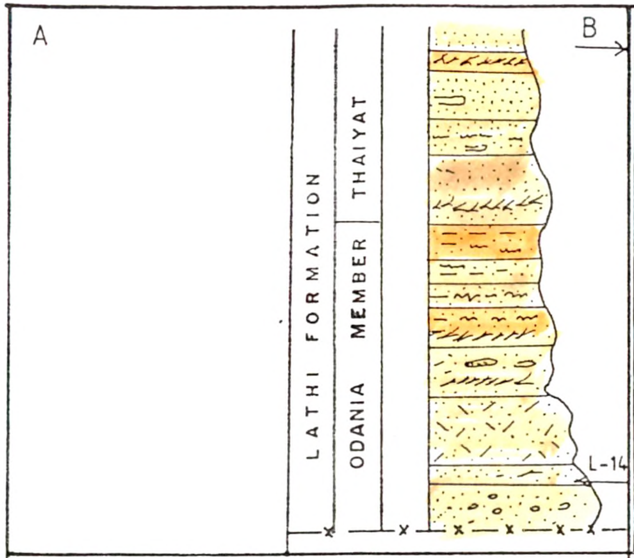
(1) suspension (2) saltation and (3) surface creep or rolling. Each of these are developed as a separate sub population within a grain size distribution. The slope of the cumulative curve on a probability plot reflects the degree of sorting. The number, amount, size-range, mixing and sorting of these populations vary systematically in relation to provenance, sedimentary processes and sedimentary dynamics.

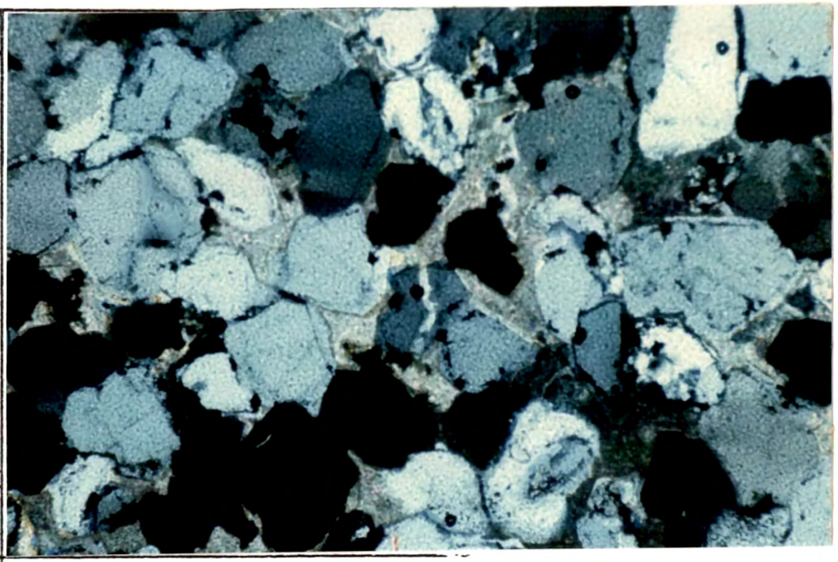
Attempt has been made in the present study to compare the probability curve shape of representative clastic samples with their grain and matrix relation. The characteristic features of the textural analyis of different formation are shown in representative diagram, presented in this chapter.

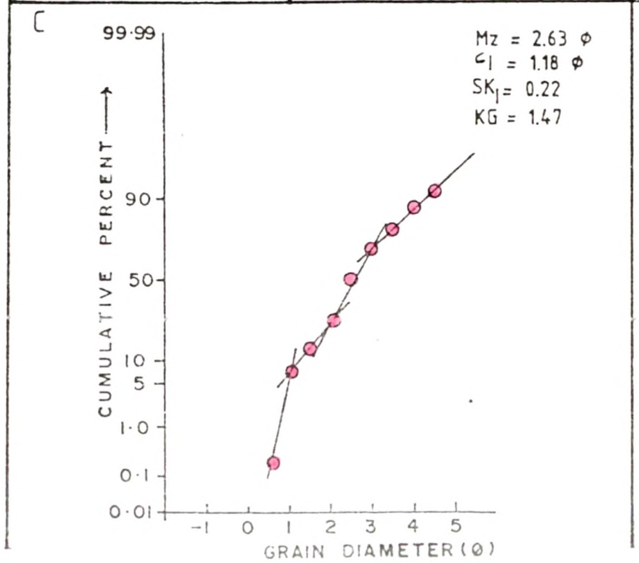
Lathi Formation

The lower part of the Lathi Formation is characterised by moderately sorted, fine to medium grained quartz arenite, (Fig V.7 to V.8). The probability curve shapes are characterised by moderately sorted saltation population with minor occurrence of poorly sorted surface creep populations ranging from 15 to 35 percent of the distribution (Fig. V.7). The moderately well sorted saltation population also observed from Odania Member of Lathi Formation which ranges from 2.0Ø to 3.5Ø (Fig. V.8). The textural characteristic of the sediments suggest their deposition as distributary deposit in deltaic regime.

The upper part of Lathi Formation is predominantly fine grained, moderately to well sorted sandstone which has been classified as quartz





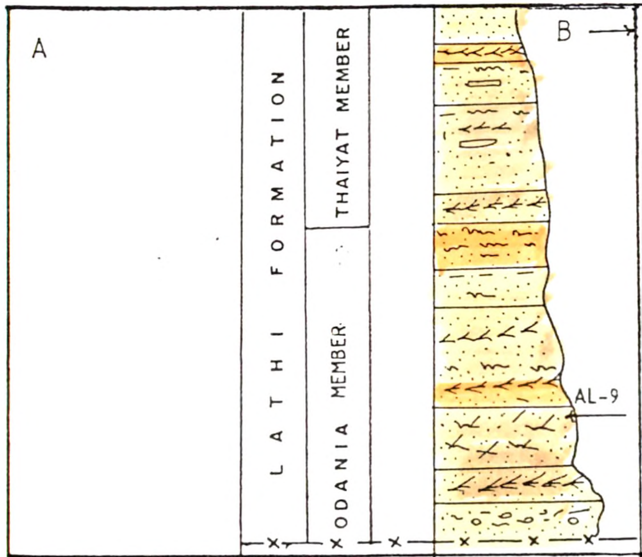


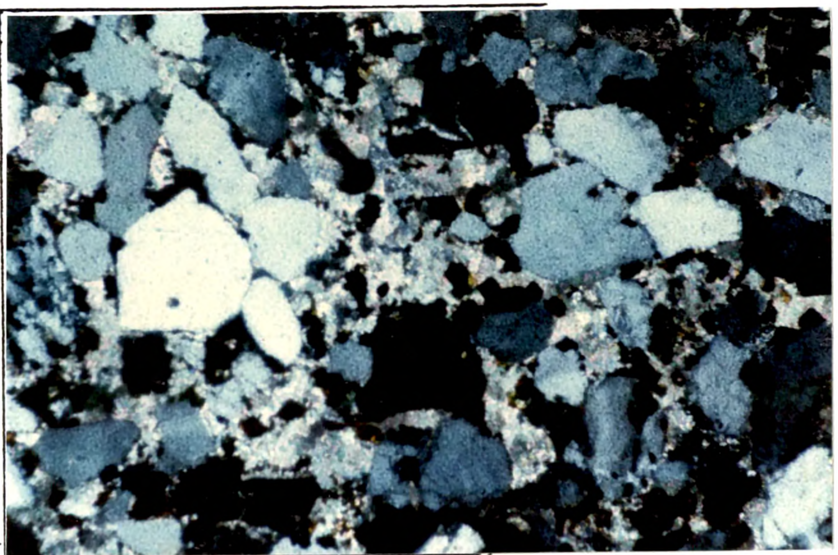
A LITHOLOGICAL SEQUENCE SHOWING THINLY BEDDED, JOINTED FINE TO MED. GRAINED SANDSTONE, WITH CROSS BEDDED FEATURE: ODANIA MEMBER, LATHI FORMATION.

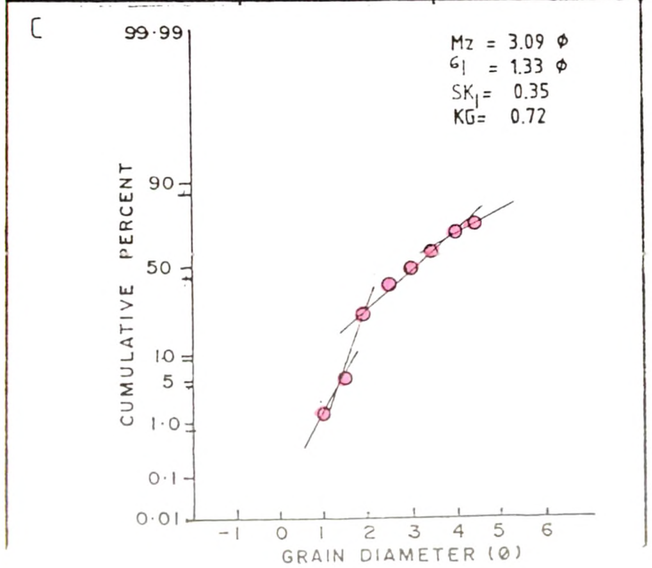
B PHOTOMICROGRAPHS OF REPRESENTATIVE SAMPLE SHOWING CALCAREOUS QUARTZ ARENITE : FINE TO MED GRAINED, MOD. SORTED : WITH LINE AND CONCAVOCONVEX GRAIN CONTATS :XN. X 40.

C TEXTURAL ATTRIBUTES OF REPRESENTATIVE BASAL PART OF CLASTIC SEQUENCE OF ODANIA MEMBER SHOWING PREDOMINANCE OF SALTATION POPULATION WITH MINOR OCCURENCE OF SUSPENSION POPULATION.

FIG. V, 7 : LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS, AND TEXTURAL ATTRIBUTES OF REPRESENTATIVE SAMPLES OF ODANIA MEMBER, LATHI FORMATION, JAISALMER BASIN, WESTERN RAJASTHAN.







A LITHOLOGICAL SEQUENCE SHOWING CROSS BEDDED, HIGHLY JOINTED, FINE TO MED GRAINED, SANDSTONE OF ODANIA MEMBER, LATHI FORMATION,

B PHOTOMICROGRAPH REPRESENTING BASAL PART OF ODANIA MEMBER AS A CALCAREOUS QUARTZ ARENITE, MOD SORTED, MOD. LITHIFIED SHOWING LINE AND CONCAVOCONVEX GRAIN CONTACTS,

C TEXTURAL CHARACTERISTICS OF CLASTIC SEQUENCE OF ODANIA MEMBER REPRESENTING MOD SORTED SALTATION POPULATION HAVING STEEP SLOPE WITH MOD. OCCURRENCE OF SUSPENSION POPULATION

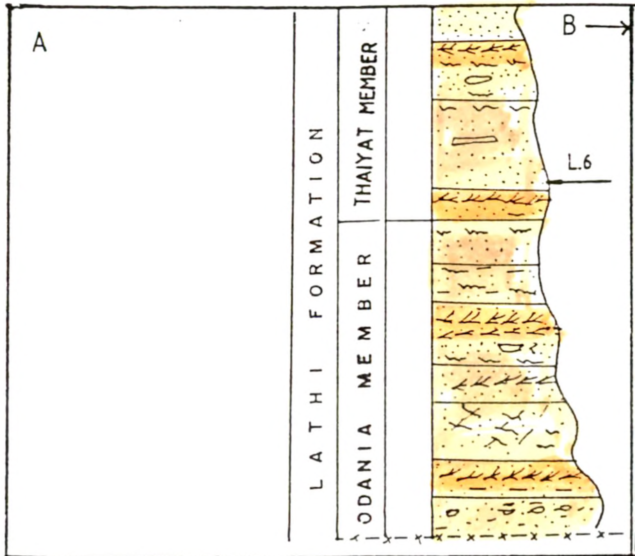
FIG. V-8: SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS, AND TEXTURAL ATTRIBUTES OF SANDSTONE OF ODANIA MEMBER, LATHI FORMATION, JAISALMER BASIN, WESTERN RAJASTHAN.

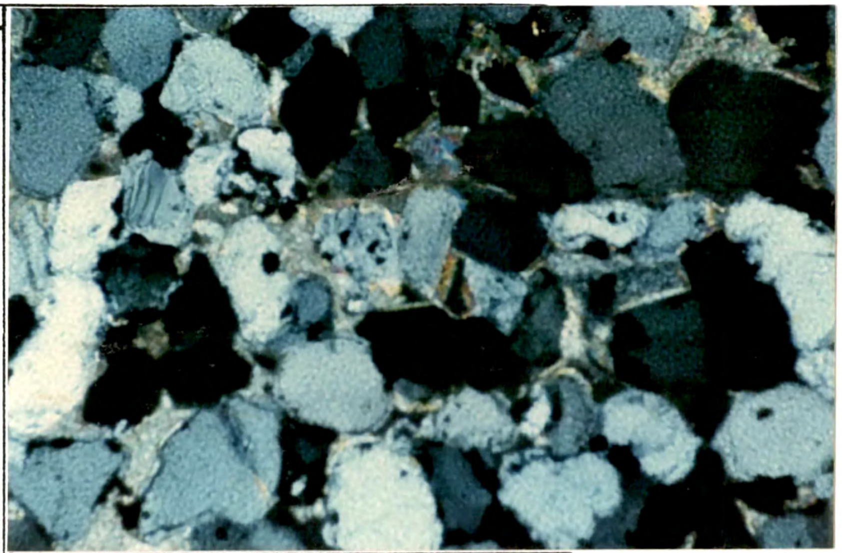
arenite. The textural characteristics show predominance of moderately sorted, truncated and winnowed saltation population having slope of 70°-80° with moderately sorted suspension and surface creep populations (fig. V.9) suggest their deposition in marine condition with small tidal range. Similar type of observation has also been noted in scatter plots of Lathi Formation (Fig V.7 to V.9) suggesting that the lower part of Lathi Formation might have been deposited in deltaic distributary system while upper part was deposited under marine influence.

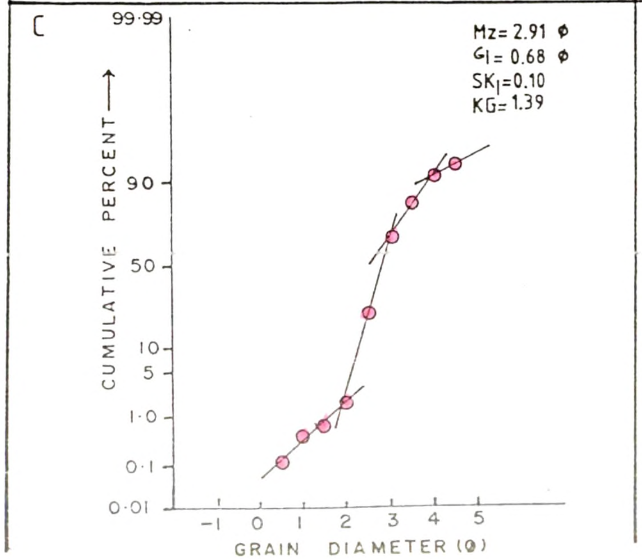
Jaisalmer Formation

The lower part of the Jaisalmer Formation i.e. the Hamira and Joyan members are characterised by cross bedded, fine grained, moderately sorted calcareous sandstone overlain by dolomitic, fine grained bioclastic wackestone. The probability curve shapes of clastic sequence show presence of all three population i.e moderately well sorted suspension and surface creep population (Plate V.10 & V.11) which suggest that these sediments were deposited in shallow marine condition to lagoonal environments.

In the upper part of Jaisalmer Formation, the Badabag and Kuldhar members are characterised by oolitic and pelletal wackestone facies with interbeds of fine grained calcareous quartz wacke. The probability curve shapes of clastic sequence (Fig V.12) are characterised by well sorted, saltation population ranging from about 2.5 to 3.5 phi, with moderate to poorly sorted suspension population. The surface creep is absent. These curves are thought to be produced by strong tidal





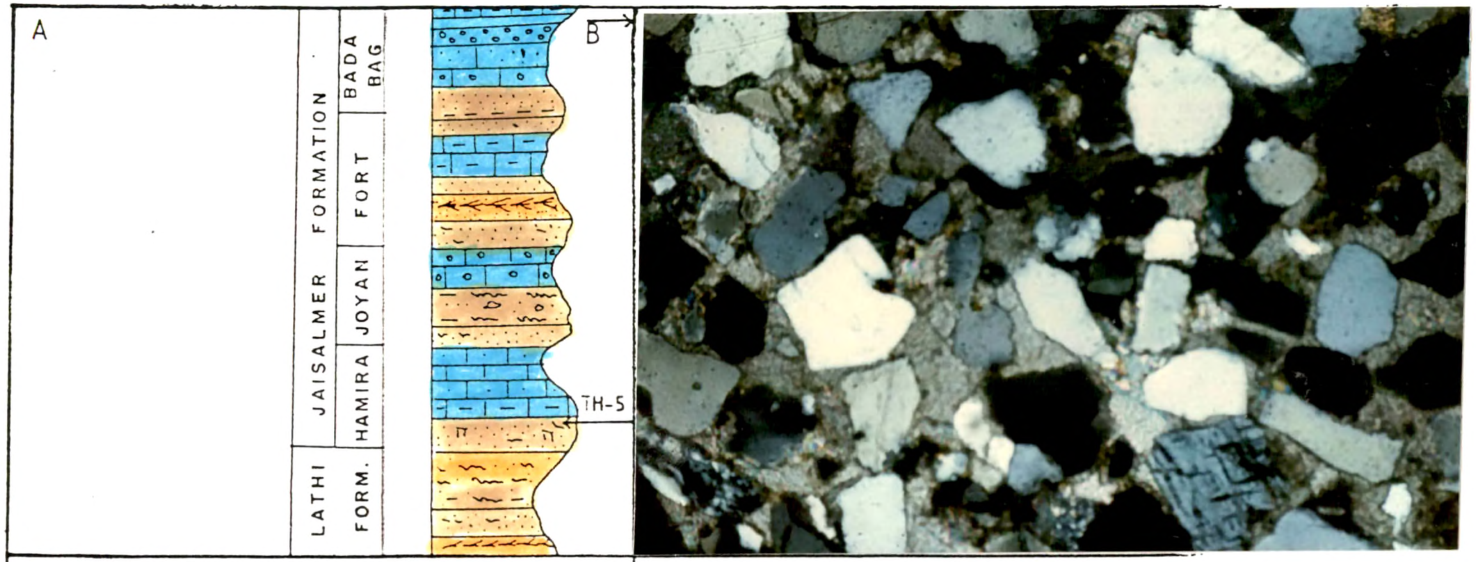


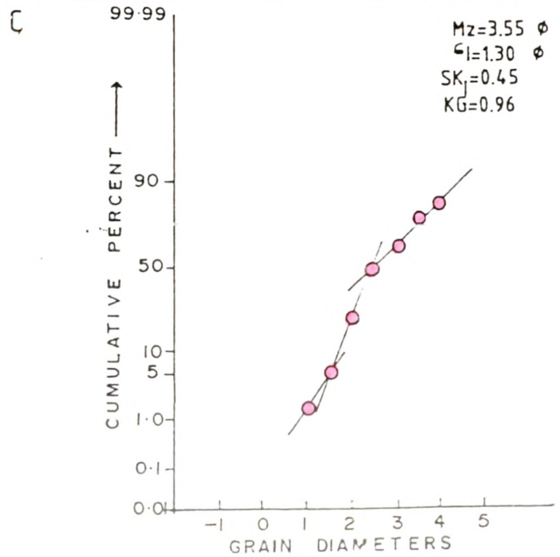
A. LITHOLOGICAL SEQUENCE OF THAIYAT MEMBER, CHARECTERISED BY THINLY BEDDED, BROWN TO DARKBROWN, FERRUGINOUS SANDSTONE SHOWING AT PLACES CROSS LAMINATION AND EMBEDDED FOSSIL WOODS.

B PHOTOMICROGRAPH OF REPRESENTATIVE SAMPLE (L-6) OF ODANIA MEMBER, CHARACTERISED BY QURATZ ARENITE: MED GRAINED, MOD SORTED, SHOWING LINE AND CONCAVOCONVEX GRAIN CONTACTS; XN X 40.

C TEXTURAL ATTRIBUTES OE REPRESENTATIVE SAMPLE (AL-6) CHARACTERISED BY MOD. SORTED SALTATION POPULATION WITH ASSOCIATION OF SUSPENSION AND SURFACE CREEP POPULATION.

FIG. V-9 : SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTER AND TEXTURAL ATTRIBUTES OF UPPER PART OF THAIYAT MEMBER, LATHI FORMATION, JAISALMER BASIN, WESTERN RAJASTHAN.



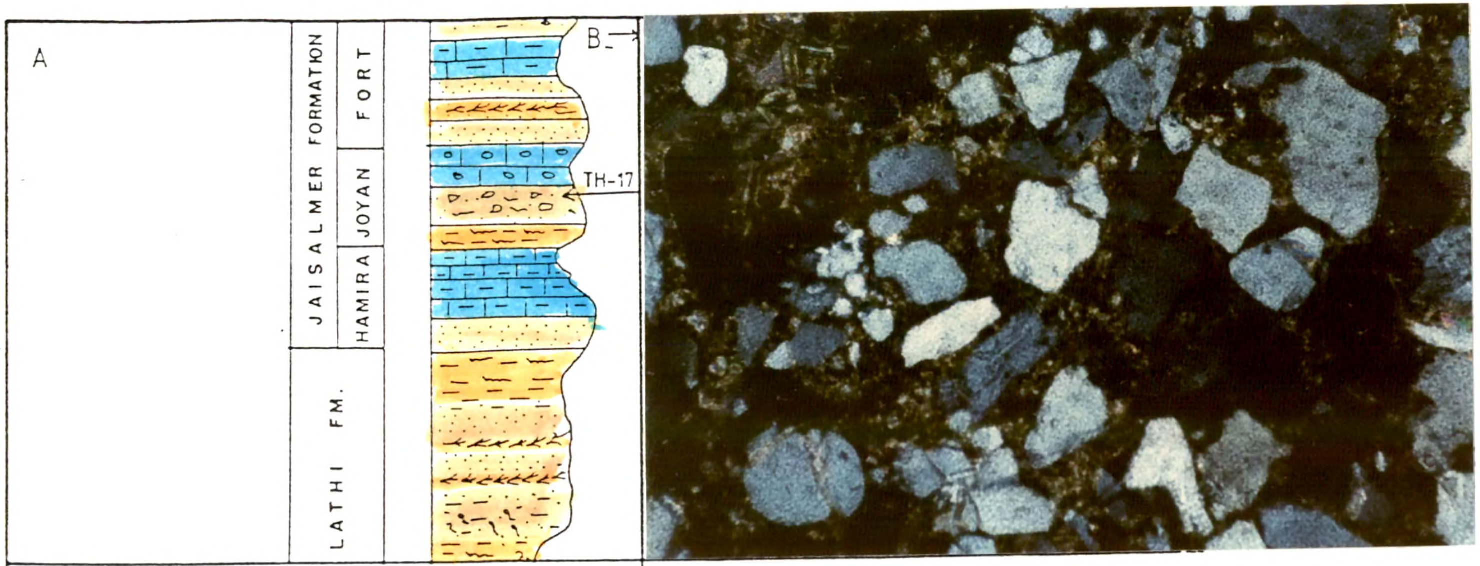


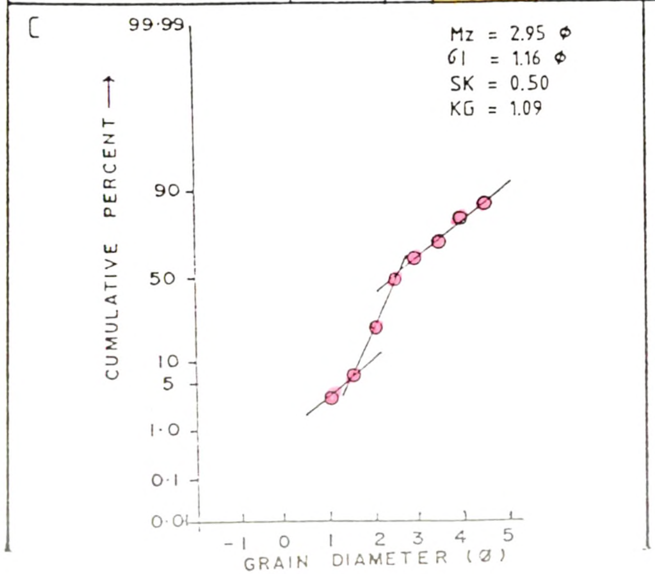
A. LITHOLOGICAL SEQUENCE SHOWING THINLY BEDDED, CALCAREOUS SANDSTONE, FINE TO MED. GRAINED, CROSS BEDDED FEATURE OF BASAL PART OF HAMIRA MEMBER, JAISALMER FORMATION

B. PHOTOMICROGRAPHS OF CALCAREOUS QUARTZ ARENITE: FINE TO MED GRAINED, MOD SORTED QUARTZ, FELDSPARS GRAINS CEMENTED BY CALCITE; SHOWING LINE AND CONCAVOCONVEX GRAIN-CONTACTS; XN X40

C. TEXTURAL ATTRIBUTES OF REPRESENTATIVE SAMPLE OF CLASTIC SEQUENCE OF HAMIRA MEMBER ; SHOWING MODERATELY SORTED SALTATION POPULATION WITH STEEP SLOPE, ALONGWITH MINOR ASSOCIATION OF SUSPENSION POPULATION SUGGESTING SHALLOW MARINE TO LAGOONAL ENVIRONMENTS

FIG V,10: SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS, AND TEXTURAL ATTRIBUTES OF SANDSTONE OF BASAL PART OF HAMIRA MEMBER, JAISALMER FORMATION, JAISALMER BASIN, WESTERN RAJASTHAN.



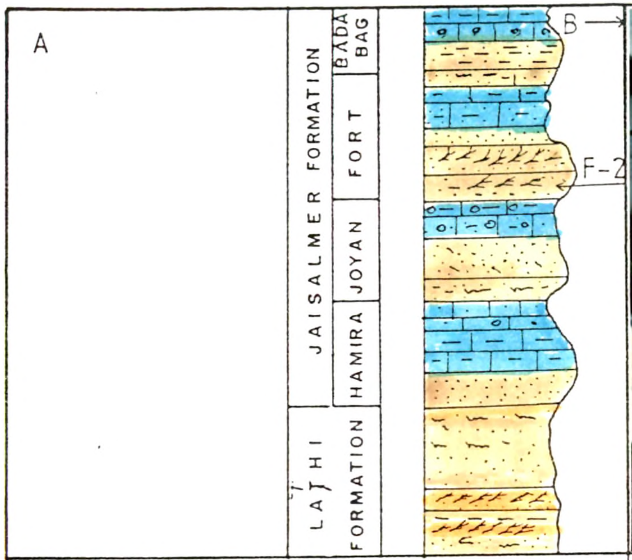


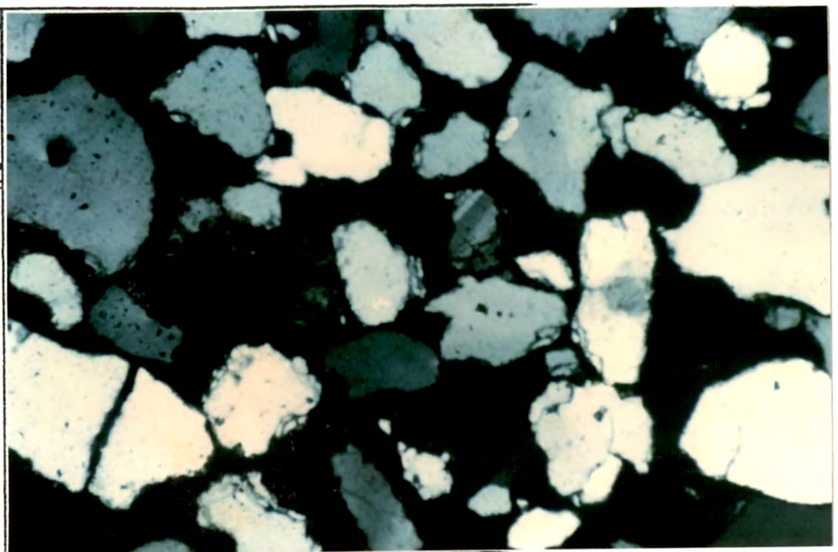
A LITHOLOGICAL SEQUENCE SHOWING CALCAREOUS SANDSTONE BEDS AT BASAL PART OF JOYAN MEMBER OF JAISALMER FORMATION.

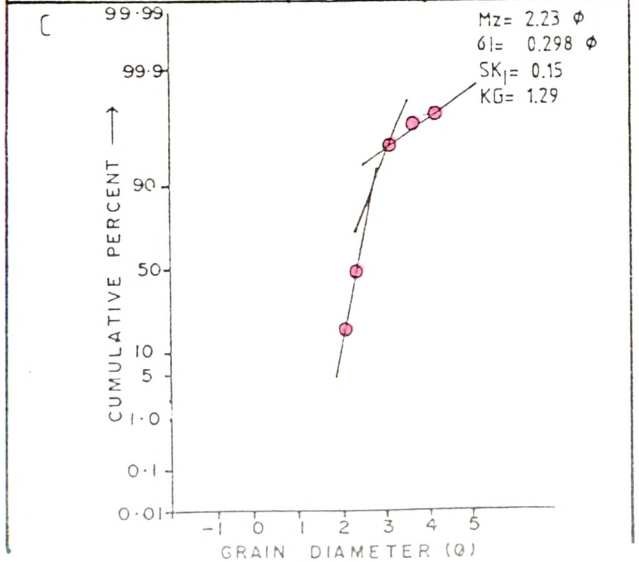
B PHOTOMICROGRAPH OF DOLOMITIC QUARTZ WACKE SHOWING ZONED DOLOMITE AND CLUSTERING OF POORLY SORTED QUARTZ GRAINS SET IN DOLOMITIC CALCAREOUS MATRIX; XN x 40.

C TEXTURAL ATTRIBUTES OF REPRESENTATIVE SAMPLE OF JOYAN MEMBER, SHOWING MOD. TO WELL SORTED SALTATION POPULATION WITH MOD. SORTED SUSPENSION AND MINOR SURFACE CREEP POPULATION.

FIG. V-II: SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS AND TEXTURAL ATTRIBUTES OF REPRESENTATIVE SAMPLE OF CLASTIC SEQUENCE OF JOYAN MEMBER, JAISALMER FORMATION, JAISALMER BASIN, WESTERN RAJASTHAN.





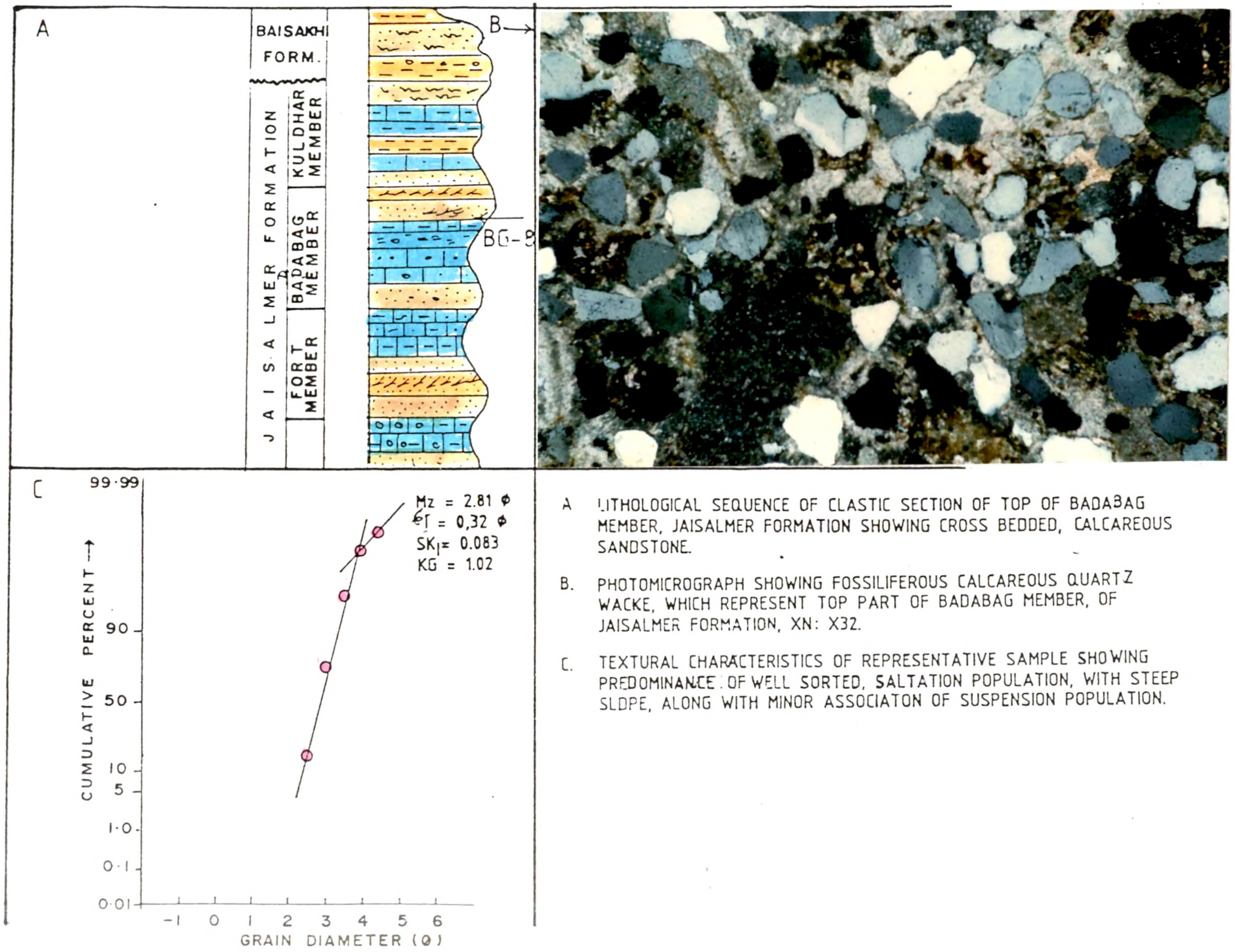


A LITHOLOGICAL SEQUENCE SHOWING CROSS BEDDED, THINLY LAYERED, CALC. SANDSTONE OF BASAL PART OF FORT MEMBER, JAISALMER FORMATION.

B. PHOTOMICROGRAPH OF CALC. QUARTZ ARENITE SHOWING FRAMEWORK OF GRAINS AND THEIR NATURE OF QUARTZ PACKING: REPRESENTING BASAL PART OF FORT MEMBER; XN: X40.

C TEXTURAL CHARACTERISTICS OF REPRESENTATIVE SAMPLE OF CLASTIC SEQUENCE IN FORT MEMBER SHOWING WELL DEVELOPED, MOD SORTED SALTATION POPULATION WITH MINOR ASSOCIATION OF SUSPENSION POPULATION

FIG. V,11A: SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS AND TEXTURAL ATTRIBUTES OF REPRESENTATIVE SAMPLE OF CLASTIC SEQUENCE OF FORT MEMBER, JAISALMER FORMATION, JAISALMER BASIN, WESTERN RAJASTHAN.

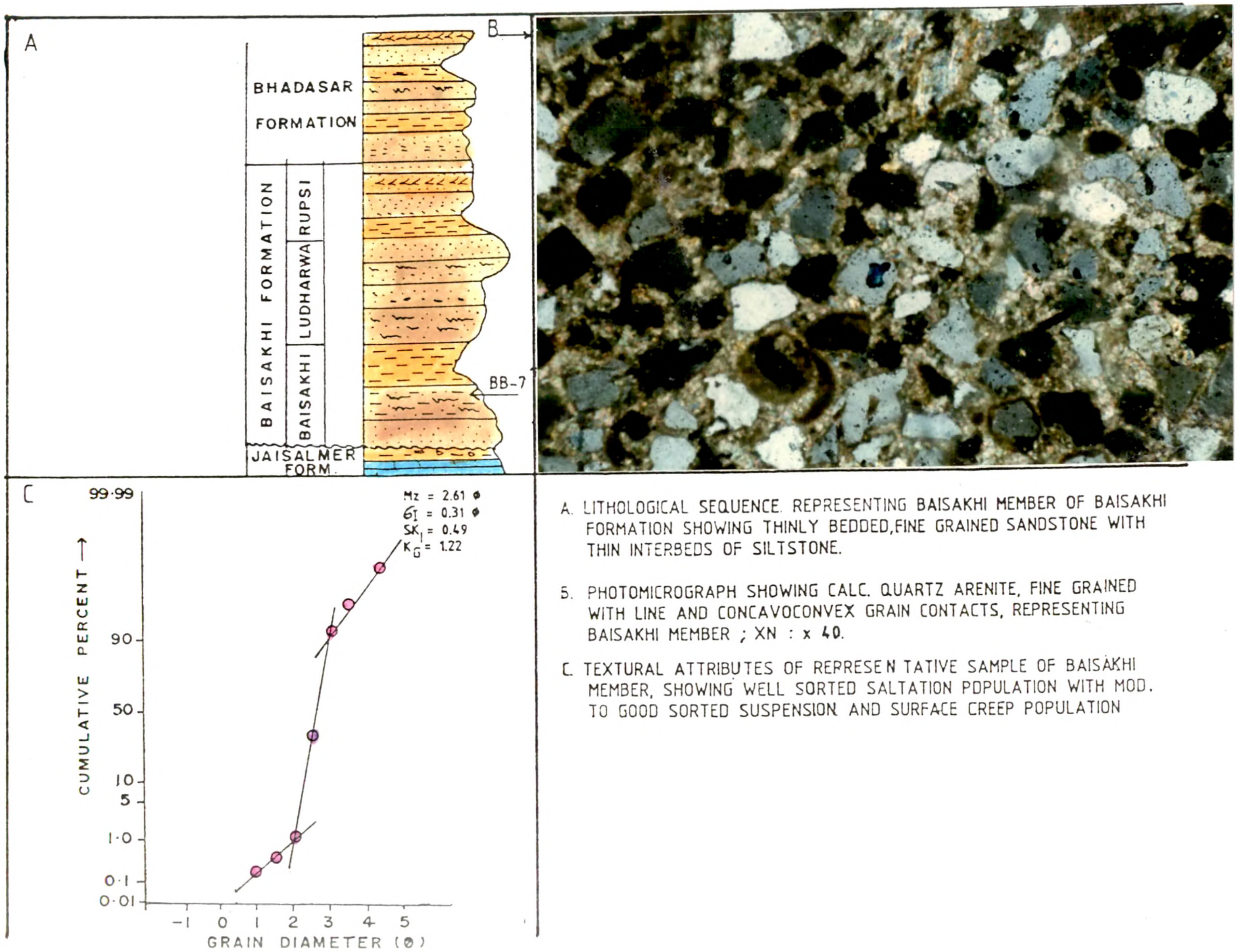


A LITHOLOGICAL SEQUENCE OF CLASTIC SECTION OF TOP OF BADABAG MEMBER, JAISALMER FORMATION SHOWING CROSS BEDDED, CALCAREOUS SANDSTONE.

B. PHOTOMICROGRAPH SHOWING FOSSILIFEROUS CALCAREOUS QUARTZ WACKE, WHICH REPRESENT TOP PART OF BADABAG MEMBER, OF JAISALMER FORMATION, XN: X32.

C. TEXTURAL CHARACTERISTICS OF REPRESENTATIVE SAMPLE SHOWING PREDOMINANCE OF WELL SORTED, SALTATION POPULATION, WITH STEEP SLOPE, ALONG WITH MINOR ASSOCIATON OF SUSPENSION POPULATION.

FIG. V-12: SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS AND TEXTURAL ATTRIBUTES OF REPRESENTATIVE SAMPLE OF CLASTIC SEQUENCE OF BADABAG MEMBER OF JAISALMER FORMATION, JAISALMER BASIN, WESTERN RAJASTHAN.



A. LITHOLOGICAL SEQUENCE. REPRESENTING BAISAKHI MEMBER OF BAISAKHI FORMATION SHOWING THINLY BEDDED, FINE GRAINED SANDSTONE WITH THIN INTERBEDS OF SILTSTONE.

5. PHOTOMICROGRAPH SHOWING CALC. QUARTZ ARENITE, FINE GRAINED WITH LINE AND CONCAVOCONVEX GRAIN CONTACTS, REPRESENTING BAISAKHI MEMBER ; XN : x 40.

C. TEXTURAL ATTRIBUTES OF REPRESENTATIVE SAMPLE OF BAISAKHI MEMBER, SHOWING WELL SORTED SALTATION POPULATION WITH MOD. TO GOOD SORTED SUSPENSION AND SURFACE CREEP POPULATION

FIG. V.13 : SHOWING LITHOLOGICAL DETAILS. PETROGRAPHIC CHARACTERS AND TEXTURAL ATTRIBUTES OF REPRESENTATIVE SAMPLE OF BAISAKHI MEMBER, OF BAISAKHI FORMATION, JAISALMER BASIN, WESTERN RAJASTHAN.

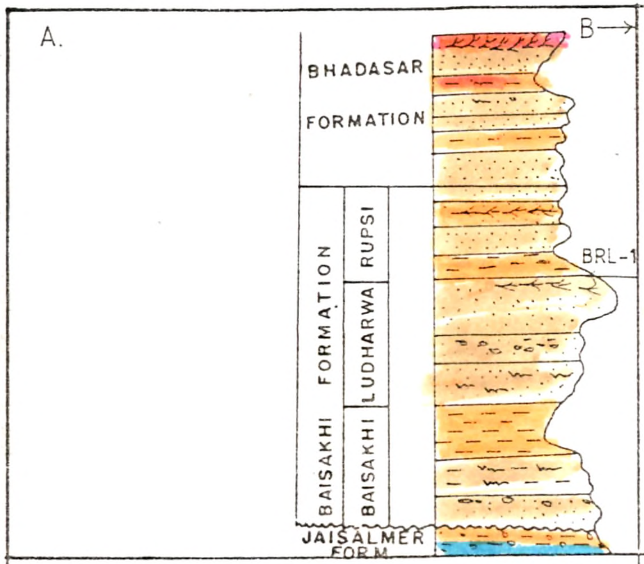
currents, where the surface creep population has been removed, probably in shallow marine to lagoonal condition by tidal channel.

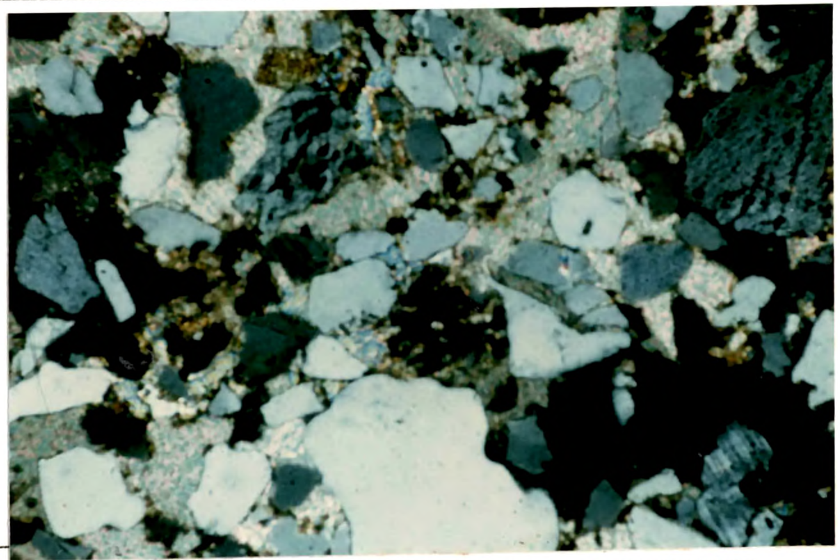
Baisakhi Formation

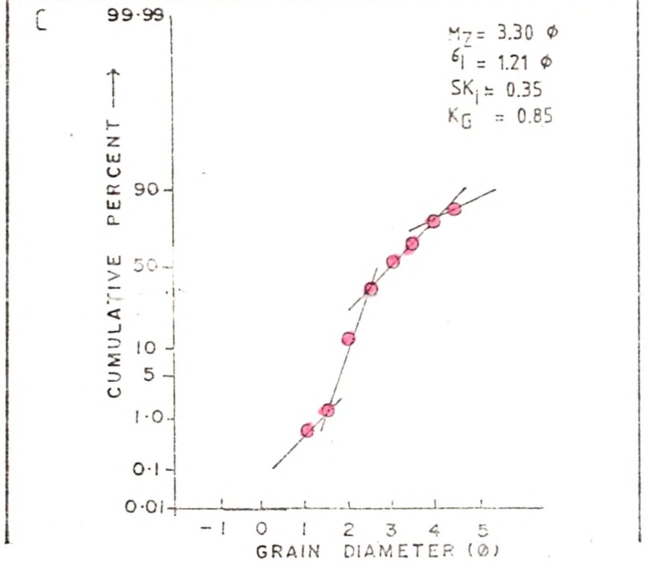
The predominance of fine to very fine grained moderately well sorted sandstone with thin interbeds of siltstone and shale are characteristic lithofacies of Baisakhi Formation. The coarser clastics are quartz arenite characterised by moderately well developed. moderately sorted suspension and surface creep population (Fig V.13 to V.15) and suggest that the sediments were deposited in lower deltaic to shallow marine environment under moderate to low energy condition. The scatter plots of mean Vs standard deviation , skewness Vs standard deviation and skewness Vs. standard deviation of these sediments (Fig V.1 to V.4) also support the above observation.

Bhadasar Formation

The moderate to poorly sorted nature of sandstone and their cross bedded feature in lower part of Bhadasar Formation show three distinct textural characteristics (Fig V.16) (i) moderately sorted saltation population having size range from 2.0 Ø to 3.5 Ø (ii) traces and minor occurrence of bed load population when present poorly sorted and (iii) suspension population moderately sorted and usually truncated at a size fine than 3.5 Ø. These sands differ from sands of Jaisalmer Formation in degree of sorting of bed load population and the position of truncation of the saltation population. The textural characteristics of





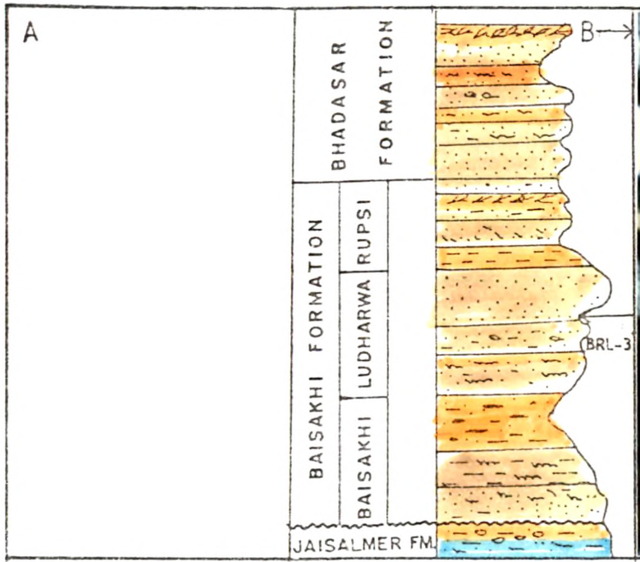


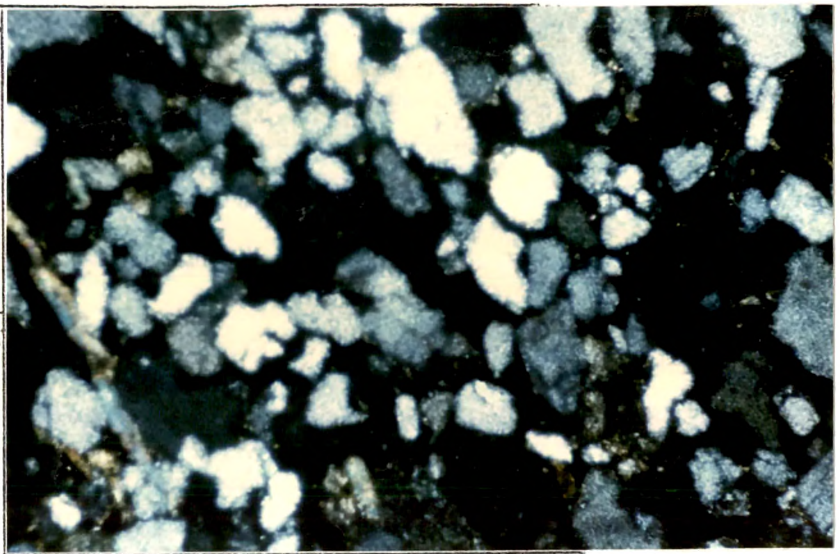
A. LITHOLOGICAL SEQUENCE OF LUDHARWA MEMBER OF BAISAKHI FORMATION SHOWING THICKLY BEDDED FERRUGINOUS SANDSTONE ;

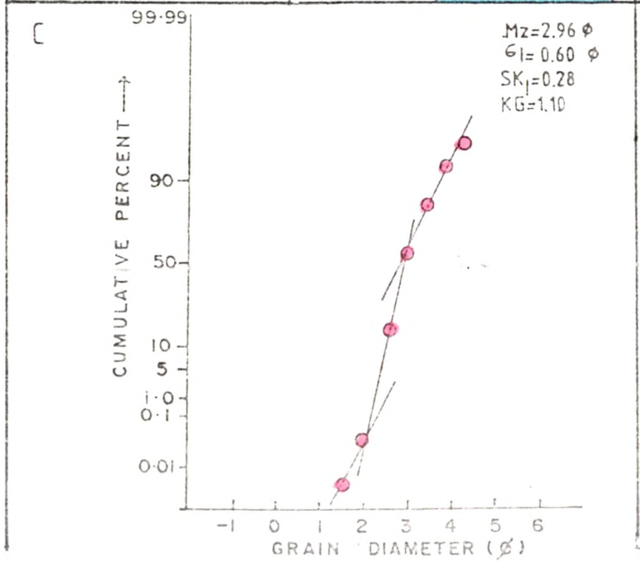
B. PHOTOMICROGRAPH OF REPRESENTATIVE SAMPLE OF UPPER PART OF LUDHARWA MEMBER SHOWING BIOMODAL DISTRIBUTION IN CALCAREOUS QUARTZ WACKE, X N, x 40

C. TEXTURAL CHARACTERISTICS OF SANID IN LUDHARWA MEMBER SHOWING TWO SUB POPULATION IN SALTATION, WITH MINOR OCCURRENCE OF SUSPENSION AND SURFACE CREEP.

FIG. V.14: SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS AND TEXTURAL ATTRIBUTES OF REPRESENTATIVE SAMPLE IN LUDHARWA MEMBER OF BAISAKHI FORMATION, JAISALMER BASIN, WESTERN RAJASTHAN.





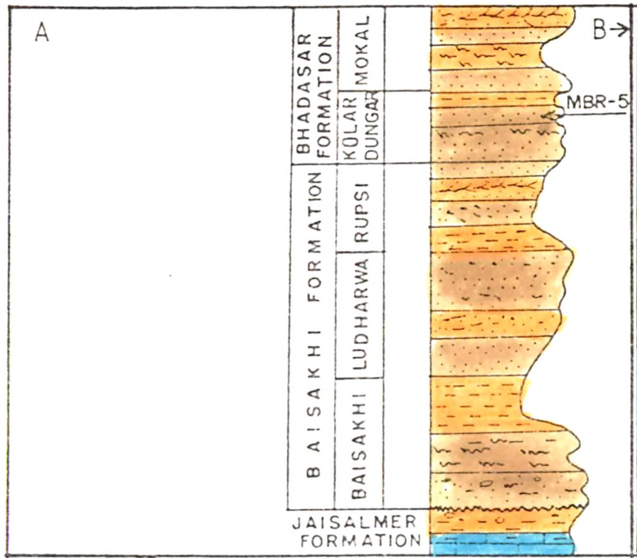


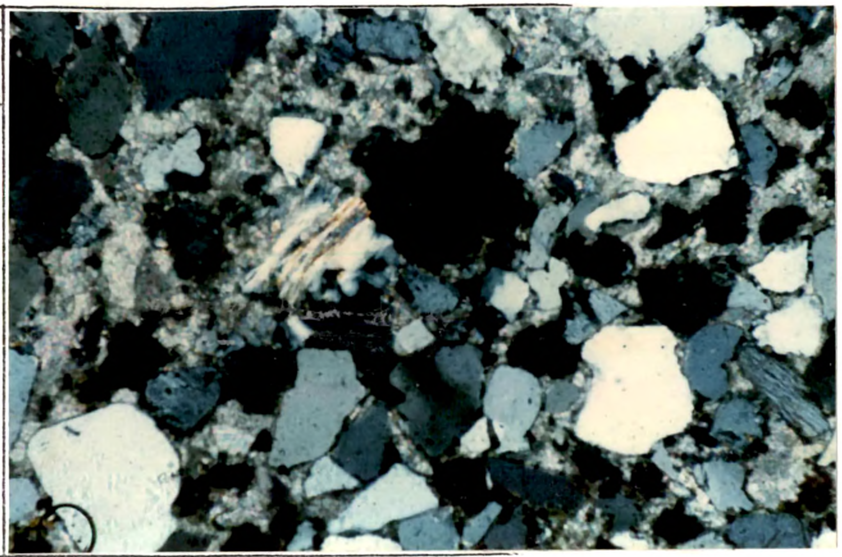
A LITHOLOGICAL SEQUENCE OF UPPER PART OF LUDHARWA MEMBER, LATHI FORMATION SHOWING THCKLY BEDDED, FINE GRAINED SANDSTONE .

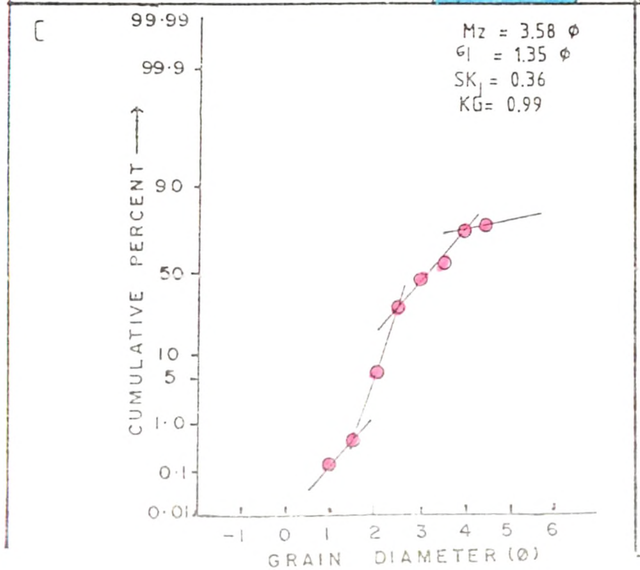
B. PHOTOMICROGRAPH OF REPRESENTATIVE SAMPLE OF LUDHARWA MEMBER, SHOWING QUARTZ ARENITE, MOD. LITHIFIED, HAVING CONCAVO. CONVEX AND SUTURE CONTACT :. XN : X 40.

C WELL DEVELOPED, MOD. SORTED SALTATION POPULATION WITH MOD. OCCURRENCE OF SUSPENSION AND MINOR SURFACE CREEP POPULATION .

FIG. V.15 SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS AND TEXTURAL ATTRIBUTES OF UPPER PART OF LUDHARWA MEMBER, BAISAKHI FORMATION, JAISALMER BASIN, WERSTERN RAJASTHAN.





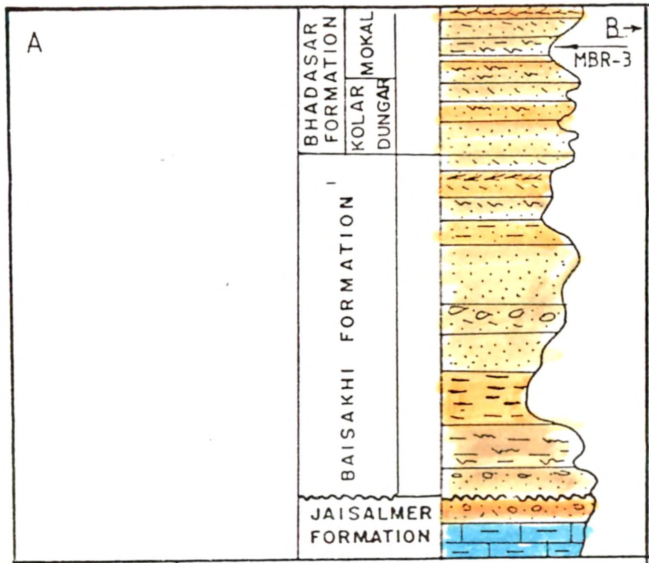


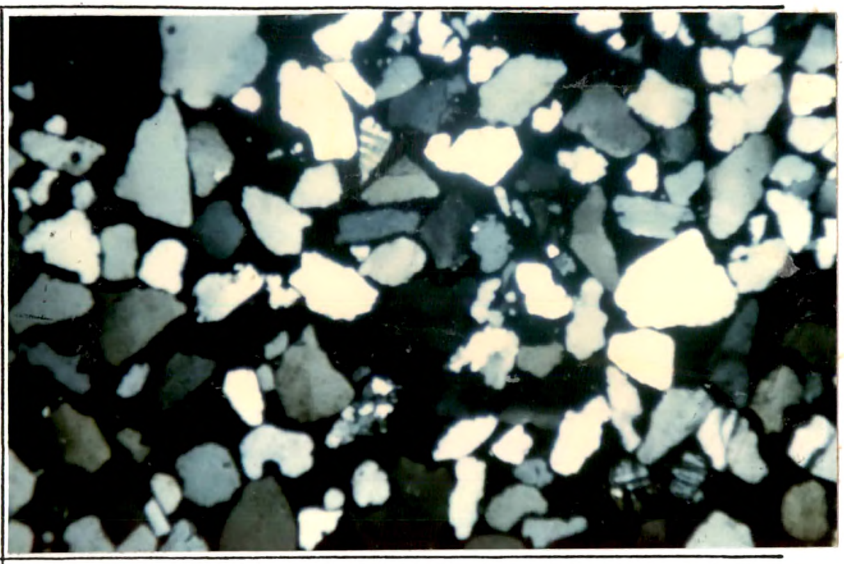
A. LITHOLOGICAL SEQUENCE OF KOLAR DUNGAR MEMBER, BHADASAR FORMATION, SHOWING THINLY BEDDED, FINE GRAINED. CALC. SANDSTONE.

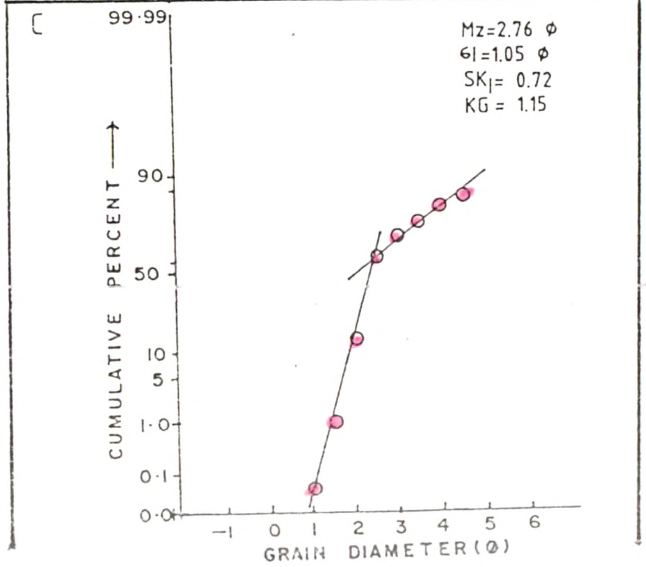
B PHOTOMICROGRAPH OF CALC. QUARTZ ARENITE REPRESENTING LOWER PART OF MOKAL MEMBER, SHOWING BIMODAL DISTRIBUTION OF QUARTZ GRAINS AND CORRODED BOUNDARY OF QUARTZ BY CALCITE CEMENT, XN : X 40

C TEXTURAL FEATURE SHOWING TWO SUBPOPULATION OF SALTATION WITH MOD. OCC OF SURFACE CREEP & SUSPENSION POPULATION

FIG. V.16 : SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS AND TEXTURAL ATTRIBUTES OF KOLAR DUNGAR MEMBER, BHADASAR FORMATION, JAISALMER BASIN. WESTERN RAJSTHAN.







A LITHOLOGICAL SEQUENCE OF MOKAL MEMBER OF BHADASAR FORMATION, SHOWING THINLY BEDDED, FINE GRAINED, COMPACT SANDSTONE.

B. PHOTOMICROGRAPH OF REPRESENTATIVE SAMPLE SHOWING QUARTZ ARENITE, FINE GRAINED, LITHIFIED, MOD. SORTED, HAVING SUBANGULAR TO SUBROUNDED QUARTZ, FELDSPAR GRAINS; XN, X 15.

C. TEXTURAL CHARACTERS SHOW PREDOMINANCE OF MOD. SORTED, STEEPLY SLOPED SALTATION POPULATION WITH ASSOCIATION OF SUSPENSION POPULATION.

FIG. V.17: SHOWING LITHOLOGICAL DETAILS, PETROGRAPHIC CHARACTERS AND TEXTURAL ATTRIBUTES OF UPPER PART OF MOKAL MEMBER, BHADASAR FORMATION; JAISALMER BASIN, WESTERN RAJASTHAN.

lower part of Bhadasar Formation suggest their deposition in lower deltaic to shallow marine condition. The upper part of the formation has become more continental as evidenced by their gritty nature, poorly sorted grain distribution in sandstone and their textural characteristics with predominance of moderately sorted saltation population along with poorly sorted surface creep population (Fig. V.17).