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Grain Size Distribution Of Tipam Sandstones In Tipong Pani River Section, Assam

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ABSTRACT

The granulometric study of clastic sediments is an important textural parameter related to the hydrodynamics of the basin of transportation and deposition The grain size analysis of the Tipam Sandstones of Upper Assam exposed along the Tipong pani river section reveals the dominance of suspension and saltation populations over the rolling population in the transporting medium at the time of deposition of the sandstones. The sandstones are moderately sorted to poorly sorted indicating a wide range of fluctuations in the transporting medium. The various interrelationships of size parameters indicate that the sediments were primarily deposited in a fluvial environment under the action of river tractive current.

Keywords : Grain size, Tipam Sandstone, Tipong pani river, Assam

Introduction

The area of present investigation is situated in the northeastern part of the Tinsukia district of Assam near Tipang colliery within 27°13'N-27°20'N latitude and 95°30' E - 95°55' E longitude (Figure-1). It falls within the Naga Hills ranges, which is a part of the Assam Arakan geological province. Almost all the Tertiary rock strata are well developed in the area. The river Tipong Pani is flowing across the hills from south to north direction in this area. The Tipong Pani river section is on the southern limb of the Namdang syncline and it exposes most of the Tertiary rock strata. The occurrence of coal and petroleum in the sedimentary sequence has increased the importance of the area. The grain of the clastic sediments is an important textural parameter related to the hydrodynamics of the basin of transportation and deposition. In the present study an attempt has been made to point out the environmental significance of bivariant plot of different size parameters of Tipam Sandstones of Tipong Pani River section to discriminate the environment of deposition.

Materials and Methods

Samples have been collected at regular interval from the exposed Tipam Sandstone Formation along the Tipong-Pani River section of Upper Assam basin. Proper care has been taken to avoid the weathered samples. Grain size analysis and its interpretation have been done in the department of Applied Geology, Dibrugarh University, Assam.

Results and Discussion

The Tipam Sandstone Formation in the Tipong pani river section is mainly comprises of sandstone which is massive in nature with alternation of shale and sandstone at places. They are medium to fine grained and characterized by typical salt and pepper texture. The data obtained from grain size analysis may be plotted directly in mm., using a logarithmic base paper; or they may be plotted in phi units in which case arithmetic base paper is used. The later one is much more convenient and accurate to read. In the present study, interpretation of grain size distribution is made from the study of histograms, cumulative curves and their shapes, the statistical parameters and their interrelationships.

The study of histogram of the rocks of the Tipam Sandstone Formation shows that, the samples are both unimodal and bimodal. The cumulative curves obtained from grain size distribution of the sediments of Tipam Sandstone Formation reveals that the coarser tails are restricted near +0.5 Ø. The curve shapes are in general, convex and some are concavo convex. The finer tails in the curves have gentle to steeper slope. Cumulative curves of almost all the samples reflect no major and sudden changes in the depositional condition during the deposition of the sediments. The size distribution curves of the Tipam Sandstone Formation Sediments shows some similarities to the fluvial type of distributions. The slope, truncation points and other characteristics on the log-probability plots have meaningful relationship with depositional processes. Using these plots, Visher (1969) has assigned specific curve shapes and combination of sub-populations to the sediments formed in various modern as well as ancient environments of deposition. In the present study, this approach has been made in interpretation of grain size distribution. The histogram, frequency distribution curve, cumulative curve and the log probability plots of samples of Tipam sandstone Formation are shown in Figure 2 (a-f).

The statistical grain size parameters viz. the graphic median (Md), mean size (Mz), deviation (σ), skewness (Ski) and kurtosis (Kg) have been calculated using the formula as proposed by Folk and Ward (1957) and the results and their respective characteristics are presented in Table- 1. Considering Friedman's (1967) discriminatory fields of river and beach it is observed that 80% of Tipam Sandstone samples are scattered in tidal current sand and remaining are undecided. Using the environment boundary of Friedman (1961, 1967) it is observed that, majority of Tipam Sandstone samples cluster in river field. In another bi-variate scatter plot of Mz vs. σ using the discriminatory fields of river and wave process of Gold Berry (1980), it is found that 65% of samples fall in river process and the remaining samples plots in the wave process. The various cross plots are presented in figure 3 (a-f). The relationship between skewness vs. kurtosis can be analysed in the manner suggested by Thomas et. al. (1972) .and it is found that all the samples cluster around the normal curve in zone A and D (Figure 4a).

It indicates fine to medium sand in the sediments and high to low energy condition of deposition of the sediments. Thomas et. al. (1972) defined four zones as A, B, C, D and related these zones to hydraulic energy controlling the-sorting or mixing process. Zone A is high energy with decreasing level B and C to D. Passega (1957) developed four basic patterns after considering the CM patterns of sediments collected from known depositional environments. These patterns are (1) I, IV, V,-rivers tractive currents, (2) II, VIa, VIb,-turbidity currents, (3) III -quite water currents and (4) beaches. Again these patterns can be subdivided into basic elements, which seem to correspond with basic type of depositions. The basic elements may also define some attributes of the agent of deposition such as competency and turbulence. Passega (1964) modified the tractive current pattern into various segments depending upon the mode of transport. These are as follows:

N/O = Well sorted sediments transported by rolling along the river bed.

O/P = Rolling sediments with some suspension sediments.

P/O = Sediments deposited primarily by graded suspension with some rolled sediments.

Q/R = Graded suspension (Saltation)

E) R/S = Uniform suspension.

In the present study the C, 1-percentile and M (median) 50 percentile values are computed and their corresponding diameters in phi units are recorded. These values in phi are then converted into microns using the table compiled by Passega (1957). The micron values of C and M are plotted in a log-log paper following the procedure adopted by Passega (1957, 1964) the CM patterns are shown in Figure 4b. From the study of the CM pattern it can be inferred that the sediments of Tipam Sandstones were transported under river tractive current primarily in graded suspension with small amount of rolling population. The position of the sample points falling in the PQR segments in the V segment of basic CM pattern indicates that the energy condition is not very high during the deposition of the sediments.

Conclusion

The grain size analysis reveals the dominance of suspension and saltation populations over the rolling population in the transporting medium at the time of deposition of the Tipam Sandstones in Tiong Pani river section. The sediments were transported primarily in graded suspension with small amount of rolling sediments. The turbulence energy was more than the normal at the time of deposition. The sandstones are moderately sorted to poorly sorted and deposited in a fluvial environment under the action of river tractive current.

Table 1: Graphic Statistical Size Parameters and their Categories of Tipam Sandstone Formation

SAMPLE NO.	Md	Mz	σ_1	Ski	Kg	σ_1	Ski	Kg
SN – 3	2.47	2.74	0.74	0.56	1.10	MS	VFS	Mesokurtic
SN – 4	2.7	2.82	0.78	0.33	1.09	MS	VFS	Mesokurtic
SN - 11	2.55	2.54	0.44	0.02	1.35	WS	NS	Leptokurtic
SN – 14	3.2	3.31	0.73	0.23	0.94	MS	FS	Mesokurtic
SN – 15	2.09	2.83	0.74	0.54	0.94	MS	VFS	Mesokurtic
SN – 21	4.5	2.07	0.85	0.05	1.27	MS	MS	Leptokurtic
SN – 26	1.9	4.39	0.45	-0.51	1.42	WS	VCS	Leptokurtic
SN – 31	2.2	2.18	0.82	0.45	1.43	MS	VFS	Leptokurtic
SN – 33	2.0	2.3	0.75	0.38	1.70	MS	VFS	Very Leptokurtic
SN – 35	2.55	2.31	1.04	0.49	5.09	PS	VFS	Extremely Leptokurtic

VFS Very Fine Sand, FS Fine Sand CS Coarse Skewed,
NS Near Symmetrical, FS Fine Skewed,
VCS Very Coarse Skewed, PS Poorly Sorted,
MS Moderately Sorted, MWS Moderately Well Sorted
EPS Extremely Poorly Sorted, CS Coarse Skewed,
NS Near Symmetrical, FS Fine Skewed
VCS Very Coarse Skewed

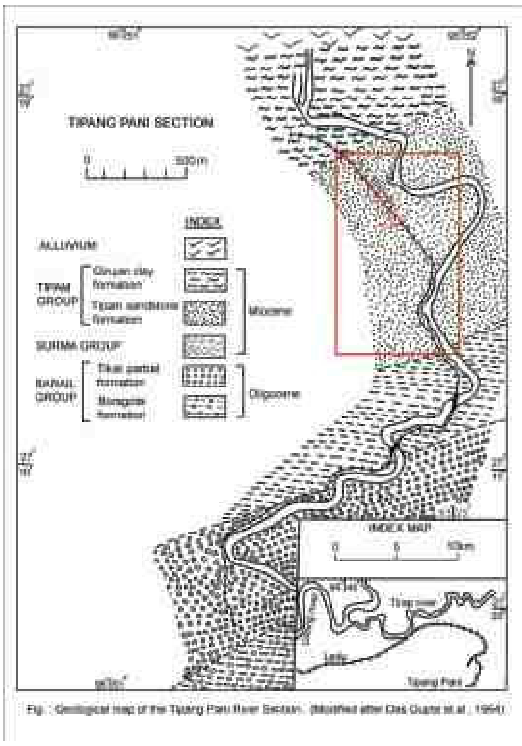


Fig. 2 (a) Histogram of Grain size distribution,
(b) Frequency distribution curve (c) Cmmulative curve
(d) Log-Probability grain size plot of a representative sample of Tipam Sandstone Formation

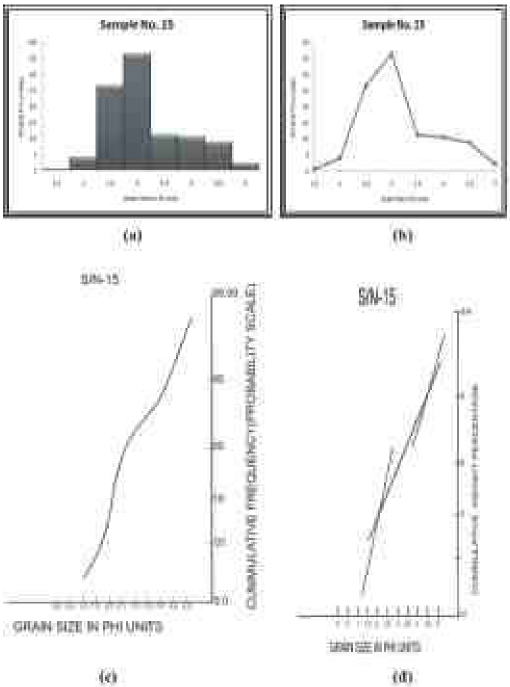


Fig. 3 : Interrelationship between various statistical size parameters (a-c, after Friedman, 1967 ; d, after Goldbery, 1980; e f, after Friedman, 1961)

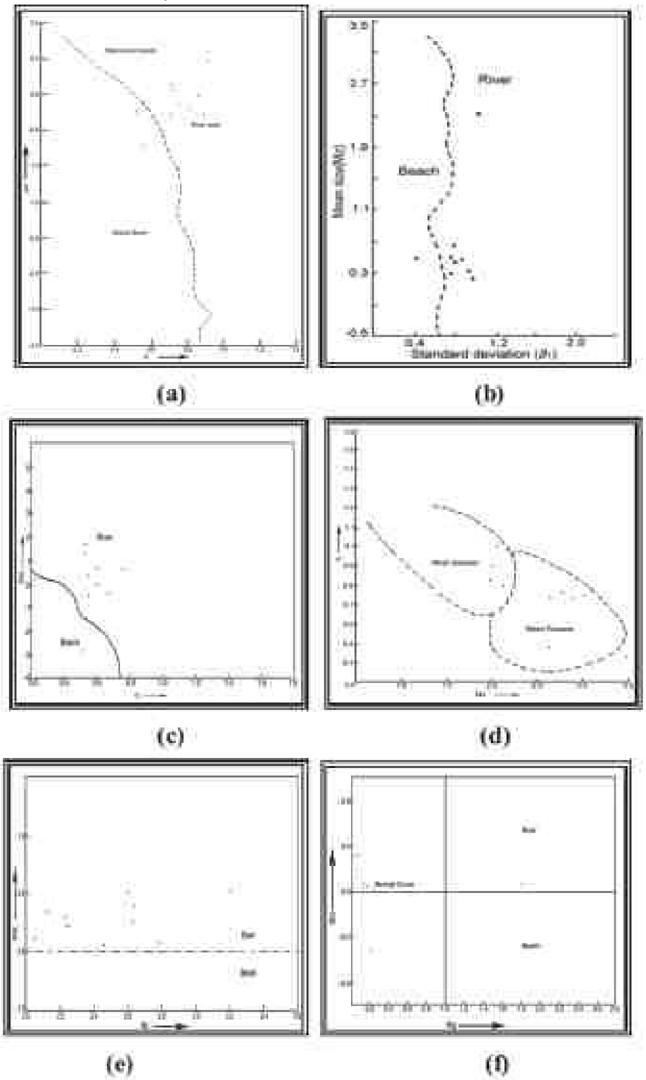
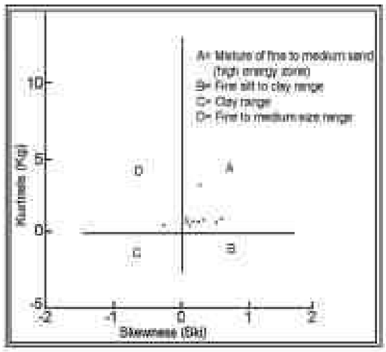
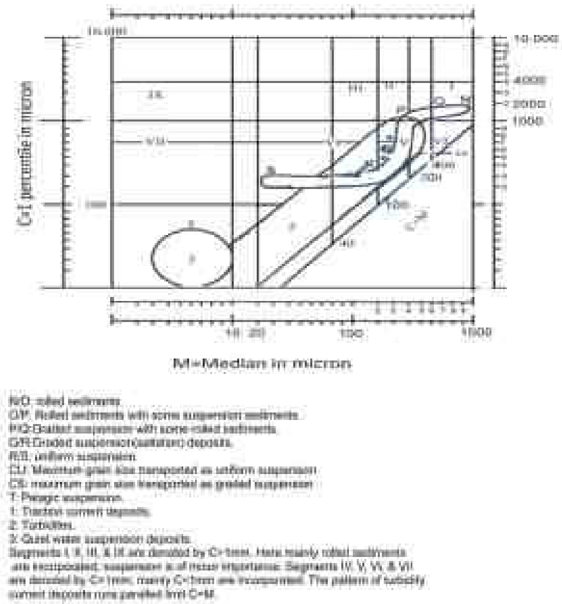


Fig. 4 : a, Interrelation ship between Ski vs Kg, after Thomas et.al, 1972; b, CM pattern, after Passega and Byramjee, 1967.



(A)



(B)

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