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# Preparation of vertical lithosection and granulometric study of the Tipam Sandstones exposed along Dilli River section, Assam

KEYWORDS: Vertical lithosection, Tipam Sandstone, Granulometry, Dilli River, Assam

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**ABSTRACT** *The Tipam Sandstones are mainly hard and massive nature alternating with shales and siltstones along the Dilli River section. The bottom part of the section is gritty in nature and in certain places iron concretions as well as embeded limestone boulders are recorded. The sandstones show typical salt and pepper texture and they are fine to medium grained. The presence of cross beddings indicates that the sediments were deposited under fluviatile environment. The sediments were transported in graded suspension with small amount as rolling sediments. Bivariant plots also reveal that the sediments were deposited in fluviatile environment.*

**Introduction :**
Dilli Jeypore is located at the foothills of Naga-Patkai Range. This area is traversed by the Dilli River and is dissected into two sectors, Dilli and Jeypore. It is bounded by latitude 27008/22// – 27008/22// N and longitude 95021/13// – 95022/10// E

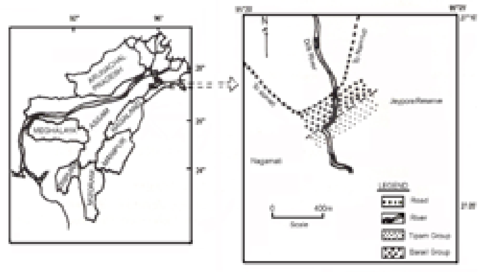
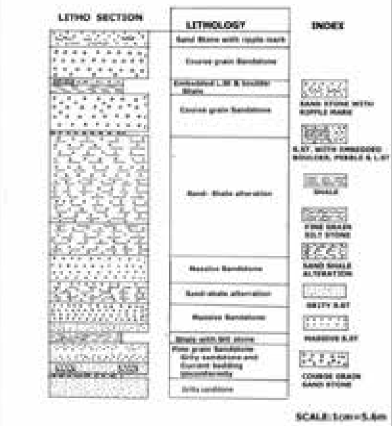


Fig. Location Map of the Area Showing the Dilli River Section

(Figure 1). The Barail (Oligocene) and the Tipam (Miocene) Groups of rocks are exposed in the present study area, the former being associated with coal seams. The coal bearing Barail sediments approximately run along the border of Nagaland, Assam and Arunachal Pradesh. The Naga Thrust, which is the north-western boundary of Belt of Schuppen, passes through this coal belt and separates it from the adjoining alluvial plains. Due to structural complexity, the lower part of the Barail Group and the underlying Disang Group are not exposed in this area. The present study covers a part of the Tipam Group of rocks exposed along the Dilli river section

**Objective :**
There is sporadic information regarding the sedimentology of the rocks exposed along the Dilli River section. A detail mapping associated with sedimentological study of these rock units might give some clue for the better understanding of these sediments with respect to their sediment transport history and environmental conditions of deposition. Keeping this view mind it is planned to carryout a detail granulometric study associated with preparation of vertical lithfacies of the Tipam Sandstone in this area.

**Results and discussion:**
Vertical Lithosection Study : The vertical litho-section of the Tipam Sandstone Formation is prepared by observing the distinctive megascopic characteristics viz. the lithologic features, including composition, grain size, bedding characteristics as well as the sedimentary structures of the rock sequence. For preparing of the vertical lithosection of the study area, geological traverse is done along the Dilli river section. Due to logistic problem the true thickness of the lithounits cannot be measured in the field. To get actual thickness of the bed, line of traverse is plotted on a map using map using GPS reading. Using this map thickness correction for the litho units for strike and dip of the bed is made. Using the actual thickness of the lithounits the lithosection is prepared




(Figure 2).

The Tipam Sandstone Formation in the Dilli river section mainly comprises of sandstone which is massive in nature with alteration of shale and sandstone at places. They are medium to fine grained and characterized by typical salt and pepper texture. The bottom most part of the Tipam Sandstone comprises of gritty sandstones which is about 3.63 m thick (Figure 3c). This unit is underlain by a conglomerate band of about 30 cm thick which is considered as the boundary between the Barail and Tipam Group of rocks in the study area

(a)

Volume : 2 | Issue : 2 | November 2012 | ISSN - 2249-555X

(b)

(c)

(d)

(e)

(f)

Figure 3: Field photographs showing (a) Tipam Sandstones exposed along Dilli-River section, (b) conglomerate bed between Barail (right side) and Tipam Group (left) of roks (c) Gritty sandstone in the lower part of Tipam Sandstone (d) cross bedding within Tipam Sandstone, (e) alternation of sandstone and shale (f) limestone boulders embedded in Tipam Sandstone

(Figure-3b). This gritty sandstone is overlain by a comparatively fine grained sandstone bed of about 6.1m thick showing current bedding (Figure 3d). This sandstone unit is overlain by an approximately 3 m thick shale bed with inter-bedded siltstone. All the litho units observed along the river section are recorded with their morphological characteristics and are shown in Figure 2. It is interesting to record iron concretions and embedded limestone boulders in this section (Figure 3f). The limestone boulders might have been transported or drifted from neighbouring area as the study area falls within tectonically highly disturbed belt of Schuppen area. Certain parts in the section are inaccessible due to steep terrain and huge vegetation cover. So, it was not possible to measure the complete thickness of the Tipam Sandstone along the Dilli –River section. Author can measured only 81.03m along this section, which is shown in the Figure 2.

Sediment Transport history : The grain of the clastic sediments is an important textural parameter related to the hydrodynamics of the basin of transportation and deposition. Many workers have attempted to interpret depositional environment and agencies of transportation from the studies of grain size distribution (Inman 1949, 1952; Passega 1957, 1964; Folk and Ward 1957; Friedman 1961, 1967; Moss 1962, 1963; Visher 1965, 1969; Sahu 1964; Klovan 1966). Folk and Ward (1957) stressed on the interrelationship between various size parameters by studying the sediments of the Brazos river bar. Friedman (1961, 1967 and 1979) was the first to point out the environmental significance of bivariant scatter plot of different size parameters to discriminate different environments. Reineck and Singh (1975) have tried to relate the grain size to the energy of the depositing medium.

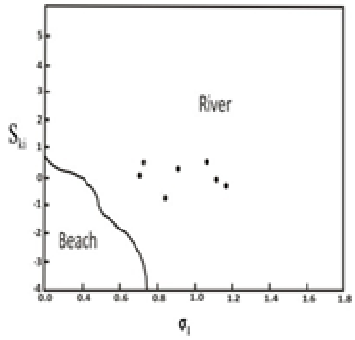
The data obtained from grain size analysis may be plotted in many different ways. The grain size analysis may either be plotted directly in mm, using a logarithmic base paper; or they may be plotted in phi units in which case arithmetic base paper is used. The later one is much more convenient and accurate. In the present study, interpretation of grain size distribution is made from the study of histograms, cumulative curves and its shapes, the statistical parameters and their interrelationships. Statistical size parameters of grains are useful to make comparison between grain size data and depositional condition. The graphic technique of Folk and Ward (1957) used for the calculation of size parameter and the results are presented in Table-1.

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

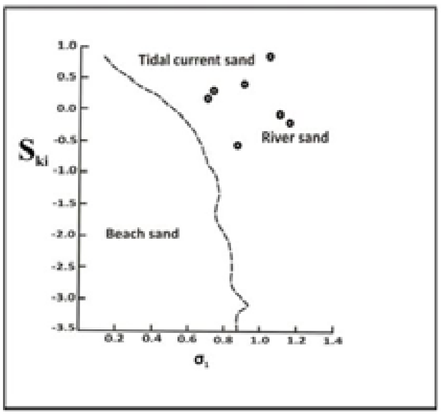
Volume : 2 | Issue : 2 | November 2012 | ISSN - 2249-555X

| Sample No: | Md | Mz | σ1 | Ski | Kg | σ1 | Ski | Kg |
|---|---|---|---|---|---|---|---|---|
| T-01 | 2.25 | 2.10 | 1.15 | -0.14 | 1.20 | PS | CS | Leptokurtic |
| T-02 | 2.10 | 2.12 | 1.00 | 0.07 | 1.44 | MS | NS | Leptokurtic |
| T-09 | 2.38 | 2.47 | 0.84 | 0.09 | 1.65 | MS | NS | Very Leptokurtic |
| T-11 | 2.49 | 2.59 | 0.69 | 0.22 | 1.31 | MWS | FS | Leptokurtic |
| T-13 | 1.40 | 1.63 | 0.88 | 0.44 | 1.19 | MS | VFS | Leptokurtic |
| T-15 | 2.65 | 2.52 | 1.01 | -0.19 | 1.15 | MS | CS | Leptokurtic |
| T-16 | 1.88 | 2.00 | 0.73 | 0.28 | 1.93 | MS | VFS | Very Leptokurtic |

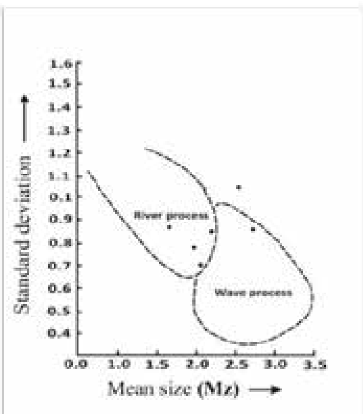
Considering Friedman's (1967) discriminatory fields, as shown in figures



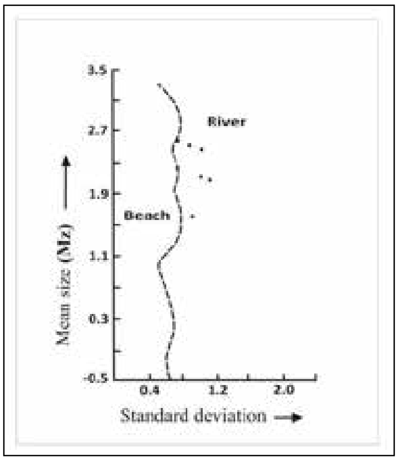

**(a) (after Friedman, 1965)**



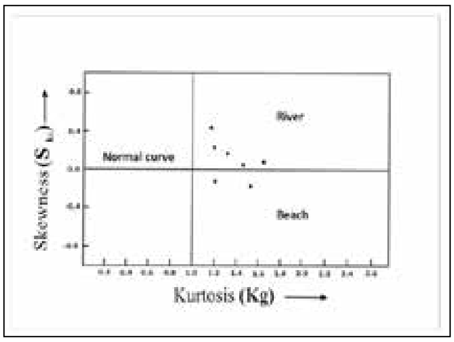

**(b) (after Friedman, 1967)**



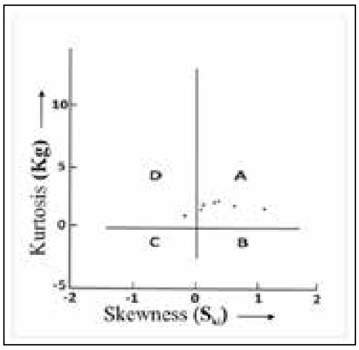

**(c) (after Friedman,1967)**




**(d) (after Friedman,1967)**




**(e) (after Friedman, 1961)**




**(f) ( after Thomas et. al. 1972)**

**Figure 4 : Interrelationship between various statistical size parameters.**

(Figure 4), it is observed that 80% of the samples Tipam Sandstone Formation are scattered in river environment and the remaining are undecided. In another bi-variate plot of Mz vs. σ1 proposed by Gold Berry, it is found that 70% of the samples fall in river process and some in the wave process. Thompson et. al (1972) defined four zones as A, B, C and D by considering the skewness and kurtosis values. These zones are related to hydraulic energy condition which controls the sorting and mixing of the sediments in the depositional environment. Zone A represents high energy condition with decreasing levels in B and C to D sectors. In the figure, it is observed that 85% of the samples fall under Zone A and the rest fall in Zone D. On the otherhand, Passega (1957, 1964) has shown that C (1 percentile) and M (50 percentile) values are characteristics of depositional processes and it is also possible to establish a relationship between texture of sediments and process of deposition. Position of sediments in a CM diagram depends on the mode of deposition of sediments. 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, VI a, VI b,-turbidity currents, (3) III -quite water currents and (4) beaches. Again these patterns can be further 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) again modified the tractive current pattern into various segments depending upon the mode of transport. These are as follows:

A) N/O = Well sorted sediments transported by rolling along the river bed.
B) O/P = Rolling sediments with some suspension sediments.
C) P/O = Sediments deposited primarily by graded suspension with some rolled sediments.
D) Q/R = Graded suspension (Saltation)
E) R/S = Uniform suspension.

The values of C and M for the samples of present study are computed and then converted into microns and are plotted in a log-log plot as shown in Figure-5.

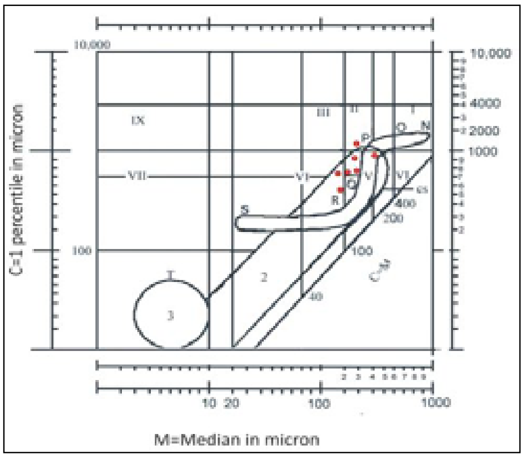



**Figure 5 : CM pattern of the sediments (after Passega 1964)**

From the figure it is inferred that the mode of deposition of the sediments are mainly by river tractive current in which the sediments were transported primarily in graded suspension with small amount of rolling sediments. The position of the sample points falling in the PQR segments in the V segment of CM diagram indicates that the energy condition is not very high during the deposition of the sediments.

**Conclusion :**

The Tipam Sandstones are mainly massive in nature alternating with thin beds of shale and siltstone. The sandstones show typical salt and pepper texture and they are fine to medium grained in nature. They show cross bedding as well as flaser bedding structure indicating fluctuation in energy condition of deposition. In certain places they show iron concretions and limestone boulders embedded in the sandstones. The limestones perhaps transported or drifted from neighbouring area, as the study area in located within tectonically disturbed belt of Schuppen. The size distribution curves show some similarities to the fluvial type depositions. The samples are moderately well sorted to poorly sorted, very fine skewed to coarse skewed, leptokurtic to very leptokurtic. The sediments were deposited in fluviatile environment with high energy condition with occasional fluctuations. The sediments were transported mainly by river tractive current in graded suspension with small amount as rolling sediments.

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