

Mineralogical Analysis of Lateritic Badland of Western Part of Medinipur (West) District, West Bengal, India

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ABSTRACT

This paper concentrates on the study of sedimentary evidences for assessing the environmental dynamics of a palaeo-coastal part of Bengal basin during Quaternary period. Samples have been collected in an ascending manner from the gully head to the gully floor in fixed intervals. These samples have been analysis in terms of mineral contamination by the author to asses, the stratigraphy, microstructure of the sediment depositions and trace fossils. Forms of the sedimentary structures are studied during field work. It has been observed that various forms of sedimentary structure developed Quaternary period which represent the influences dynamic process condition in the present study area.

KEYWORDS : Microstructure, Fossils, stratigraphy.

1. INTRODUCTION

The study area which I selected is the district of Paschim Medinipur as a whole with an extension of 20° 23' - 22° 56'N latitude and 86° 34' -87° 54' E longitudes. But, though the topics deals with the evolution and morphology of gully on lateritic tract, the study has been conducted mainly on the lateritic highland of the district of Paschim Medinipur Which covers the lower basins of Subarnarekha, Kansabati, Silabati from south-west to north-east (Figure-1) Tectonically this is a part of western geo-province of the Bengal Basin. Depositions of rivers like Subarnarekha, Kansabati, Silabati etc play the vital role for the morphological development of this area during Tertiary and Quaternary periods. Various geological evidences are preserved in this area which strongly supports existence of marine coastal environment of this area which is now nearly 90-100 Km away from the present.

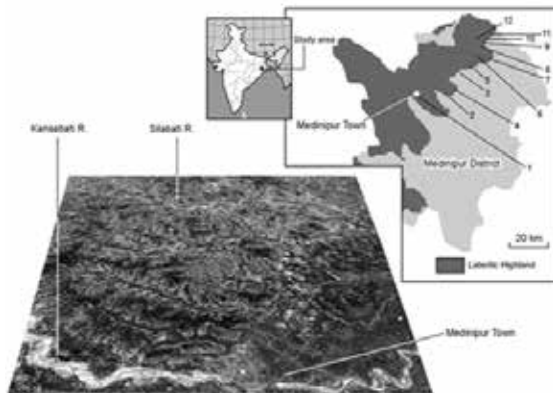


Figure-1: Location of the study area

2. METHODOLOGY

Laboratory practice is one of the important parts in microstructure study and paleo-environmental assessment. Processing of the samples and thin section making is the first task for a researcher in laboratory. A good laboratory set-up can support a researcher to perform at satisfactory level. For imaging the author has tried to get map of rocks composition using Origin Lab 9.0 software The basic steps used for analysis of the selected samples are as follows(Figure-2)

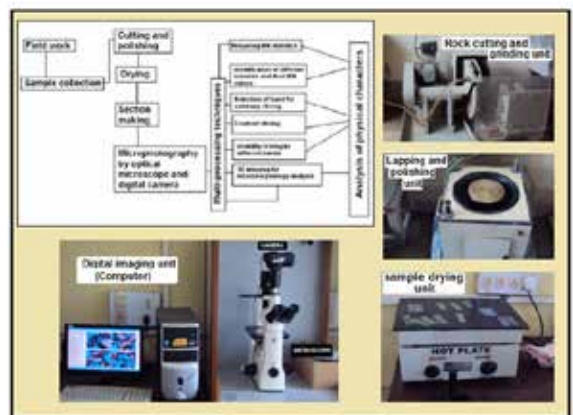


Figure -2: Thin sectioning and image processing in laboratory

3. ROCK Micro-Morphology and Microstructure

Apart from the general micro geomorphology and microstructure study, a study was conducted by the present authors on the individual morphological structure of the depositional features like gravels and pebbles of different size, keeping it in mind that each rock has some specific micro-morphology / microstructure which is related to their place of origin. It is very remarkable that study on microstructure is a very rare interest of the geo-scientists in India. The only known work has been done recently by Mamtani et al (2007) for explaining the banded iron formation (BIF). Here the present authors attempted to analyze the microstructure of the gravels and other depositions in present study area for understanding the significance of the previous depositions. This study was totally done in the laboratory on the collected rock samples during the fieldwork (Table -1)

Table-1: General features of conglomerate layers

Radius of the deposited material	Average Surface Coverage (number in 36 cm ²)	Geomorphic indications
> 2cm	2	High intensity of processes
1-2 cm	12	High intensity of processes
<1cm	45	Low to medium intensity of processes.

Sands	Coarse to fine sands are deposited and consolidated between the gravels or pebbles.	Low intensity of processes.
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A clear morphological and micro structural difference between the conglomerate gravels of older depositions in the sediment layers and recently deposited gravels has been observed. In the older sedimentary beds gravels of various size and shape are found. They are conical, tetragonal, pentagonal etc in shape. Sharp marginal angles are observed in most of these rocks. Some spherical shaped small pebbles are also observed in this deposition. The morphology of these gravels is comparatively smooth than the recent depositions. This type of surface may be created by corrosion for long time when they are carried by the water. It may prove that they are carried from the far distances and deposited here by energy discharge in the geological past.

In the small gravels the marks of very straight and thin parallel 0.01 to 1cm thick sediment layers, formed by very fine sediment, are also observed which does not match with the local sediment characters (Plate-1). It has been tested that the local sediment of this study area is coarser than those fine grains. Some of them are metamorphosed but the micro-layers are still visible by high-resolution lance. Among the recent depositions, flash deposition materials have some same types of characters since they are eroded from the older sediment layers. This also supports the view that these sandstones are transported by the geomorphic agents in geological past. On the other hand the recent depositional materials have very rugged micro-morphology with vesicular structure (Plate-2), which proves that they are originated in this place and carried by the run-off water. Each and every gravels and pebbles have high micro-relief condition with microscopic holes. No arranged sediment layers are found in these materials. These are highly lateritic and sometimes silica, mica etc are very prominent. Presence of silica, mica, gypsum, and iron are very prominent on the surface micro-photographs of the recent depositions

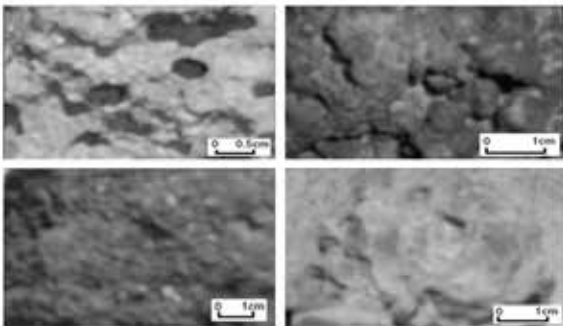


Plate-1: Micro-morphology of the recent lateritic deposition

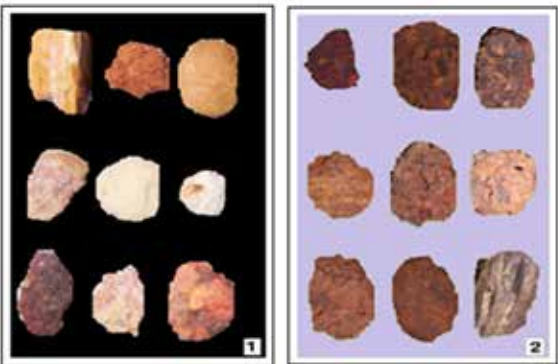


Plate-2: Selected lateritic conglomerate found in the study area
1. Gansani 2. Rangamati

3.1. DIGITAL IMAGING

Digital imaging of microstructure of the sediment layers is not a new experiment in sediment logical researches. In these studies the present authors attempted microstructure mapping by using reflectance quality in gray scale images which is influenced by physical parameter like grain size, colour and grain structure. The main merit of the method is its simplicity. The image processing and slicing operation is brief and level of visibility is very high. The final output of microstructure map has a thematic format which is helpful to interpret depositional pattern easily. The microstructure of the tasted samples shows that the coarser depositions have more complex micro fabric pattern then the finer depositions which indicate number of rapid fluctuations of depositions environment within a short duration in the present study area.

3.2. Mineralogical Analysis

These samples collected from the study area for micro structure study, are mainly composed of sandstone, mudstone, Quartz, laterite, which are commonly found in sedimentary rocks. Basically the shape of these rocks angular to sub-angular in spite of some rounded shape rocks found in the study area. Here the author studied six selected sample to know the major mineral composition by thin sectioning and imaging process (Figure-3, 4&5). These maps are very much essential for realization of landform evolution of the study area. A detail study has been done to find out the rock character and composition of the study area. These maps are very much essential for realization of landform evolution of the study area. A detail study has been done to find out the rock character and composition of the study area. The details about these samples are discussed in the following



Figure-3: Depth-wise collection of samples from Gansani area

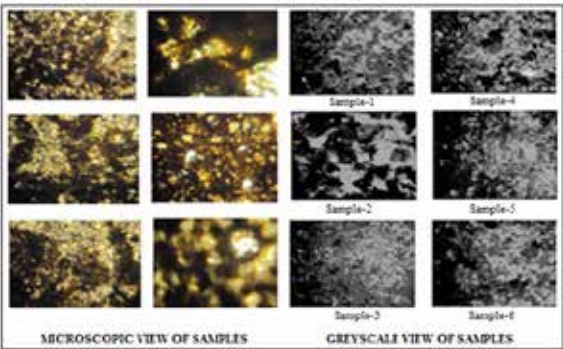


Figure-4: Petro graphic image of the collected samples

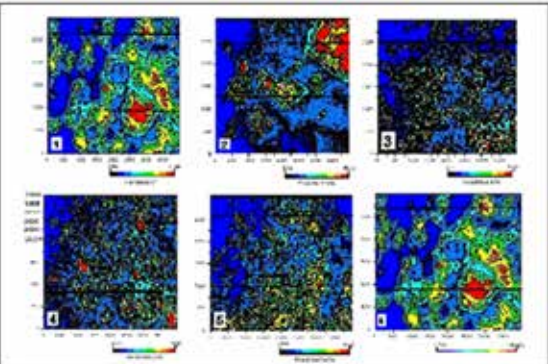


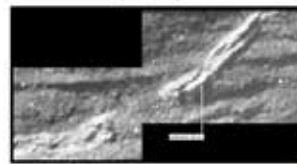
Figure -5: Transmission level of various minerals inside the selected samples

- i) **Sample- 1:** The sample collected from the upper part of Garhbeta lateritic area, are composed of sandstone and mudstone. The shape of these rocks angular to sub-angular in spite of some rounded shape rocks found in the study area. Maturity of the samples is quite high due to the shape of the samples. A very small amount of Quartz minerals has been observed in the 1ST sample.
- ii) **Sample- 2:** The basic minerals' found are sandstone, quartz and conglomerate the cemented sample is characterized structurally by angular to sub-angular pattern. Due to hardness of cemented pattern erosion is less than the other rocks structure.
- iii) **Sample- 3:** The sample which is collected from the third layer of Garhbeta gully basin is characterized by major composition of sandstone and mudstone which is made of finer grains texture. The erosion occurs in this region in a very high rate due to relatively soft and fine grained texture.
- iv) **Sample- 4:** The forth sample is characterized by sandstone, Quartz and iron oxide compact pattern has been observed in our laboratory. The shapes of these minerals are angular to sub-angular and sub-angular to rounded shape. These samples are less erosive than the previous one for its structure and hardness.
- v) **Sample- 5:** The fifth sample is composed of sandstone and iron oxide mainly. Characteristically this sample is same as the sample -3. But the size of the textural particles are larger than sample-3 and erosion is less than sample-3.
- vi) **Sample- 6:** Minerals composition is almost same as like the previous samples. The characteristics of the samples depend on the area of collection of the samples. This is observed in experiment that these samples are matured and very much cemented in structure. Erosion is less predominant in this particular region of sample collection.

3.3. ESTIMATION OF PROCESSES:

The depositional pattern of the present study area shows much environmental significance. The micro structure observation by digital images shows that different of process with different intensity dominates over the study area which resulted various sedimentary bedding and structure. It is quite evident that no intensity of marine costal wave dominated for long time in this area. The ripple mark found in this area strongly supports this technique plane and inclined bedding are also evidence of calm process environment with low to medium intensity. The cross bedding (Plate-3) strongly support the alteration of geomorphic process occur in this place in the geological

past. The plane



Cross bedding



Plate-3: Location of carbonate layer on cross bedding

3.4. ASSESSMENT OF EARLY ENVIRONMENT:

The paleo-environmental condition of this area remains very dynamic through the tertiary quaternary period. Continuous deposition of fine to coarse sediment is deposited under calm and quite environment. Some change of current also occurred which are reflected by the texture of deposition. The evidence of tectonic movement also found this area which might be very influence to change the environment. Clear vertical displacement of sediment layer shows tectonic activity took place during the early quaternary Period. Since it is a fold belt, this displacement might be occurred during the fold sub sediment layer. Another good evidence of alternation of sediment and sampling strongly support that neo- tectonism took place in this area.

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