Research Paper

Volume : 4 | Issue : 8 | Aug 2015 • ISSN No 2277 - 8179

Assesment of Structural Condition in Thelateritic Badland of Western Part of Medinipur (West) District, West Bengal, India

Geography

KEYWORDS : Microstructure, Dip, Strike,

Dr.Subhendu Ghosh

Department of Geography and Disaster Management Tripura University (A Central University), Suruamaninagar

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. The author has measured Dip And Strike to assess the stratiographichierarchy of the study area. Samples have been collected in aascending manner form the gully head to the gully floor in a fixed intervals. These samples Have been analysis by ORIGINE-LAB softwareThree materials are used for the study, the stratigraphy, micro-structure 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. Trace fossils, found in the sediment layers of this area, also strongly support the point that the environment of this area was remained dynamic during the Quaternary period. From the study it can be said that the evolution of this place can bedefined into three phases. The late Tertiary deposition shows that during that period this area was nourished by marine-coastal (tidal dominated) with low flow energy conditions which normally develops in hot and humid condition. During late Tertiary to early Quaternary period macro tidal coast became mesotidal (wave dominated). The second phase is the mid-Pleistocene period when the environment was stable and that influenced a continuous deposition of finer partials under low to medium flow energy condition. The third phase of the recent geological time is marked by shoreline shifting and modification of the environment. During the early to middle Holocene the shoreline started to shift which modified the geomorphic condition of this place from coastal to estuarine and then finally an inland fluvial area.

INTRODUCTION:

the study has been conducted mainly on the lateritic highland of the district of Paschim Medinipur Which covers the lower basins of 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.

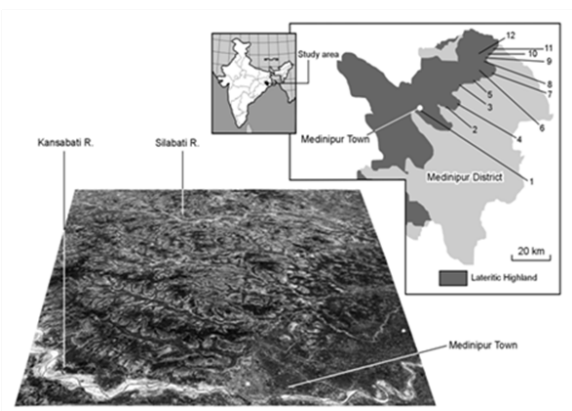

Figure-1: Location of the study area

In the present study area total five (5) typical *lunate* sediment structures have been observed in different depths namely plane beddings (conglomerate and silt beddings), graded bedding, cross bedding, trough bedding and wave ripples(Plate-1). Two types of plane beddings are found in this place. In the southern part of the study area, near the Kangsabati River, a hard conglomeratic plane structure has been found (0.2 cm to 8 cm thickness). Some borrows are developed in this beddings by the removal of gravels. Sometimes organic matters also create this type of holes on the sediment layers (Dey,2002, 2003). In the northern part along the Silabati River another hard laterised plane bedding formed by silts (5-9 cm thick) has been observed beneath 4-8 m from the surface (f). A trough bedding structure, formed by medium to fine silt (5 to 12 cm thickness), were also found during the fieldworks (Plate-1d). Beneath that structure a single set cross stratification has been found. It consists of thin beds with 2mm to 2cm thickness. Some thick beds of fine silt to loam are found in this area which forms antidunes (e). Two types of ripple marks exist below the plane beddings and tough beddings. The first one is asymmetrical and formed by wave and the second one is symmetrical and a result of tidal action. In this tidal ripple several marks of landslides are found which indicates a changing condition of the environment (Dey.2009). Graded bedding (Plate-1a) and flame structure graded bedding (Plate-1b) are also observed in this place. The graded bedding is marked by high angled deep (45°-50°) and very thick beds of 20 cm 50 cm beds. On the other hand the flame structured beds are having 5° to 10° deep and 4cm to 6 cm thickness.

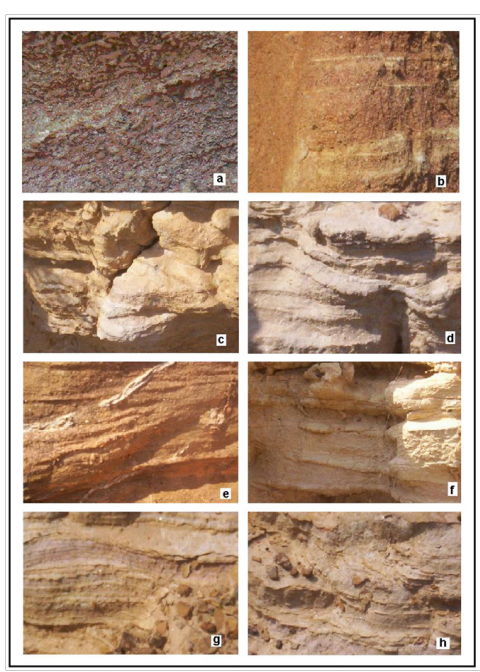

Plate-1: Bedding patterns of the study area: a. Graded bedding, b. Graded (flame shaped), c. Part of anti-dunes, d. Trough cross bedding, e. Cross lamination, f. Plane bedding (silt), g. Wave ripples, h. Tidal symmetrical ripples with marks of early landslides.

MEASUREMENT OF DIP AND STRIKE

The motion of the Indian continent slowed markedly from the Early Eocene to Early Oligocene and then resumed in a north–northwesterly direction (Sclater and Fisher, 1974). Thick Tertiary deposits accumulated in the Bengal basin beginning in the Late Eocene, with deposition accelerating with the arrival of clearly orogenic sediments in the earliest Miocene (Uddin and Lundberg, 1998a). The Bengal basin is a large basin occupied dominantly by the Ganges–Brahmaputra delta. From at least Miocene to the present, the Ganges–Brahmaputra and associated or ancestral rivers have been transporting clastic sediments to the Bengal basin. Sedimentation was in deltaic and open-shelf environments along the basin margins, whereas turbidites were controlling the sedimentation in the central and southern areas (Alam, 1989). Strike and dips are one of the most significant features for assessing structural condition of any place. In the present study the author have selected total ten sampling sites (5 from Kangsabati River and 5 from Silaboti River), since those places are marked by prominent natural exposure. In case of southern part of the study area (near Kansai R.)

Strike and dips are one of the most significant features for assessing structural condition of any location. In the present study the author have selected total ten sampling sites (5 from Kangsabati River and 5 from Silaboti River), since those places are marked by prominent natural exposure. In case of southern part of the study area (near Kansai R.) normal apparent dips of plane bedding are measured within 4.9° to 5.1°. The bearings of plane beddings are S 62.0° W, S 81.0° W and S 50.0° W, S 71.0° W. On the basis of survey by simple Bruuntone compass true dips are measured 5.0° to 5.1°. It is a remarkable fact that strike of the rocks is extended NE-SW. In the sample sites strike bearings were measured 011.7 and 032.6. Apart from plane bedding & cross bedding a clear plastic deformation character has been exposed near Kansai R. band which strongly support tertiary quaternary thrust in this area (tectonic influences). The apparent dips in the lower parts of the exposed fold layer is recorded and true dip is calculated 20.0˚, 17.0˚. The measured orientation in the lower part is S 25.0˚ W and S 15.0˚ W. The extension of strike (perpendicular to true dip) is measured 025.2 (towards east). The upper beds of this place shows similar plastic deformation pattern. In the site E of this place apparent dips are recorded 15.0˚ and 12.0˚ and true dips measured 39.7˚.(Table-1)

Table-1: measurement of Strikes and dips for assessing structural condition in the study area.

Location	Site no	App. Dip (0°)	Orientation (0°)	True dip measured (0°)	Strike asm	Strata
Southern part near Kangsabati River	A	4.9	S 62.0 W	5.1	011.7	Plane bedding
		5.1	S 81.0 W			
	B	10	S 50.0 W	5.0	032.6	Plane bedding
		4.9	S 71.0 W			
	C	20	S 25.0 W	25.4	334.8	Plane bedding / thrust evidence observed as plastic deformation signatures are present
		17	S 15.0 W			
	D	16	S 32.0 W	33.6	067.6	
		25	S 13.0 W			
	E	15	S 18.0 W	39.7	036.9	
		12	S 22.0 W			
Northern part near Silabati River	A	3	N 85.0 E	12.2	279.0	Plane bedding,Single-set cross bedding, Dunes, Ripple marks, Large-scale slumping by weathering and water erosion, elastic deformation probably by tertiary Quaternary tectonic stress developement
		6	N 70.0 E			
	B	10	N 40.0 E	15.2	359.5	
		15	N 80.0 E			
	C	25	N 87.0 E	25.9	011.6	
		15	N 45.0 E			
	D	14	N 40.0 E	14.9	330.5	
		10	N 12.0 E			
	E	12	N 60.0 E	55.2	068.6	
		5	N 65.0 E			
	F	14	N 80.0 E	14.9	330.5	
		11	N 25.0 E			

Stratigraphic complexity of the northern part of my study area proofs that depositional environment changes several times to the geological past. The variation of strike and dip in this area strongly support the change of flow direction and depositional orientation during Tertiary and Quaternary periods. In this part of my study area minimum true dip was measured 12.2 and maximum was 55.2. Average true dip angles are comparatively greater than the southern part. In the northern part southern part general strike direction is N-S and NE-SW (Maximum bearing 359.5°). In some places (d and f of figure-2). NW-SE direction has been observed (330.5° for both the cases. However in case of cross bedding a clear change in strike direction and orientation has been found in (a) of figure-3 (bearing-279°) and (e) of figure-3 (bearing 68.5°)

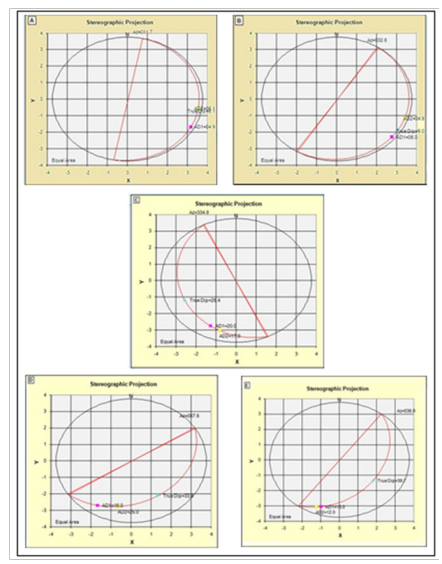

FIGURE-2: SOUTHERN HEMISPHERE STEREOGRAPHIC PROJECTION SHOWING DIP AND STRIKE POSITIONS OF THE SOUTHERN PART OF THE STUDY AREA (ALONG KANGSABATI RIVER)2. ROCK MICRO-MORPHOLOGY AND MICROSTRUCTURE

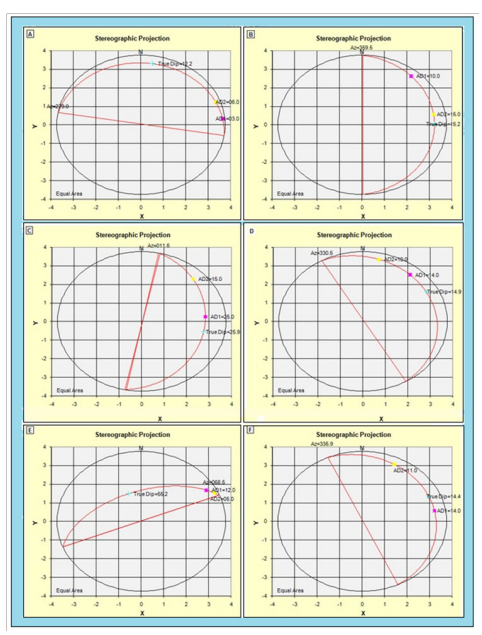

Figure-3: Northern hemisphere stereographic projection showing dip and strike positions of the northern part of the study area (along Silaboti River)

Volume : 4 | Issue : 8 | Aug 2015 • ISSN No 2277 - 8179

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 geoscientists 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.

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.

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