EVOLUTION OF RIVER TERRACES IN THE MIDDLE SUBARNAREKHA BASIN GHATSILA, JHARKHAND

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ABSTRACT

River terraces of the middle Subarnarekha basin area at particular geomorphic interest in the study of the consequences of the base level change being associated with the tectonic actions in the Subarnarekha basin. After analyses of characteristics and dimensions of the terraces found to be developed along the Subarnarekha and its tributary Gara abroad classification can be made by two approaches i.e. genetically and hierarchical approach. The middle and upper terraces i.e. made of alluvial deposits (fine alluvium mixed with pebbles and cobbles) are genetically classified as alluvial terraces or cut and fill terraces and hierarchically classified as non pair terraces, because its height not matches with the same terraces of opposite bank of the river. These terraces result from infilling of the river valley with sediment i.e. aggradation and incision of the aggradation deposits. The lower terraces that are characterized by steep rocky scarp is genetically classified as bed rock terrace and hierarchically classified as paired terrace, because height is match with the of opposite bank. This rock cut terrace result from stream incision.

Key words: Cut and fill terraces, rock terraces, pair terraces, non pair terraces, aggradation deposits.

PROLOGUE:

River terraces are environmental geomorphic indicators and are the remnants of former channel floor standing at higher elevation in respect of the present water level under the current cycle or epicycles of erosion. River terraces provide a great deal of evidences about the geomorphic history of river and its surrounding regions. Fluvial terraces are the benches, approximately parallel to the channel or valley walls which usually represent former level of flood plains or valley floor. Terraces may be continuous or discontinuous down the valley; it

is common of the lowest terraces in a sequence to be more continuous or young than those at higher elevations, which are older, more eroded dismembered. Terraces are separated from one another by steep risers have nearly flat surface, which sometimes have old flood plain features on them and which usually dip down valley at an angle which may be similar to or different from that of modern flood plain.

The Subarnarekha basin (middle as well as upper) which is sustained by The Chotanagpur Plateau is a classic area of precambium metamorphic tectonics and characterized by variegated topographic forms which bespeak its multi cyclic development. The present dessert work is concerned with the study of the evolution of river terraces both quantitative and qualitative way in the polycyclic middle Subarnarekha basin at Ghatsila and its surrounding areas, Jharkhand state.

LOCATION OF STUDY AREA:

The study area is located in Ghatsila and its surrounding areas of Purbi Singbhum district, Jharkhand. Problem selected i.e. the evolution of river terraces in middle Subarnarekha river basin and for this purpose three sites i.e. the confluence point of Subarnarekha and Gara River at Galudhi, confluence point of Lekhjoria and Subarnarekha River at Rajbari area and left bank side of Subarnarekha river at Dahigora near Apurpath, Ghatsila were selected The latitudinal and longitudinal extension of these sites are 22°30'40" N to 22 ° 30'41"N and 86° 23'35"E , 22°34'12" N to 22°34'14" N and 86°29'05"E to 86°29 'E ,22°35'05' N to 22°35'12"N and 86°27'55"E to 86°28'02"E respectively. The selected region is topographically represented by the topographical map 73 j/6.

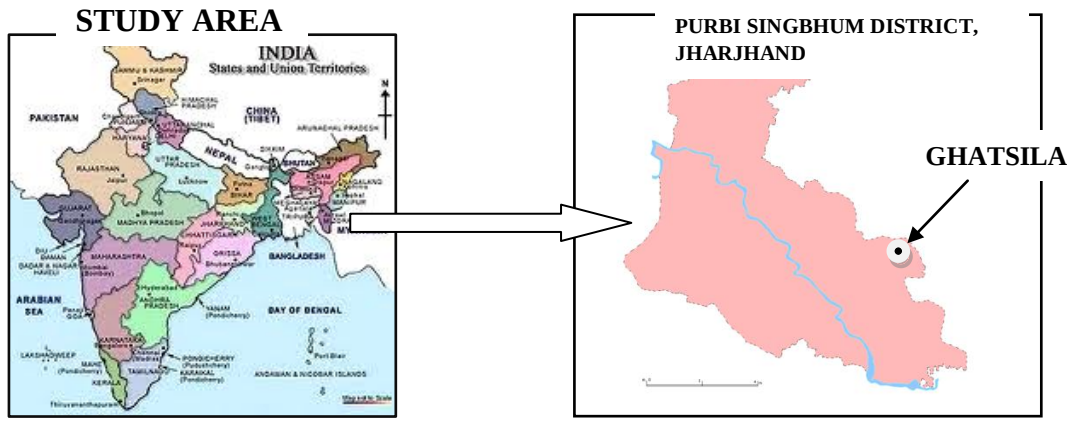

Fig. 1. LOCATION MAP OF STUDY AREA

HYPOTHESIS:

The multi tier river terraces are the indicators of repeated changes of base level under neo tectonic movement (shearing activity) one hand and climatic changes on the other hand in the middle Subarnarekha basin area at Ghatsila and its surrounding areas.

OBJECTIVES OF THE STUDY:

The primary objective of the study is to analyze the evolution of river terraces both qualitatively and quantitatively. It also includes detailed measurement of the multitier terraces at Ghatsila area, Jharkhand in order to establish the positive role of neotectonic and fluvial erosion.

METHODOLOGY:

PRE-FIELD METHOD: In the pre-field method, various maps were collected from relevant organizations, such as topographical map from survey of India, geological map from GSI and books. After that various literatures were reviewed before going to the field a plane of works was set in mind, because field work will done within short period.

FIELD METHOD: It includes the measurement of the land forms like terraces, slope, et. Collection of soil samples rock samples.

POST FIELD METHOD: It includes compilation of evidences, analysis of the soils presentation of report. The report is completed through the application of software like M.S. Excel, 21th century GIS application.

GEOLOGY:

In middle Subarnarekha Basin i.e Singhbhum crustal province, the major rock formations were apparently laid down during a number of distinct geological eras, each of which separated from the next by prolonged periods of erosion, earth movements or igneous activities (Mukhopadhyay, 1980). The rocks of the Singhbhum area show two, an unmetamorphosed one in the south and the other heavily metamorphosed one in the north, separated by a major thrust zone **(Singhbhum Shear Zone)** extending from **Porhat** in western Singhbhum through **Chakradharpur, Amada, Rakha mines, Mosaboni** and **Sunrgi** into **Mayurbhanj** covering a distance of 160 km (Krishnan) has an east west course in western part and turns to the southeast in the eastern part. This thrust or shear zone marks the over folded limb of anticline.

The purpose of analysis of general geology in connection with the study of geomorphological problem of the Subarnarekha Basin, the primary objective has been to present the areas distribution of the various rock groups and to indicate the role of these rock formations in the development of present landscape of the basin. The unequal uplifts or tilts in the different parts of the basin have also caused the developments of striking differences in the topographic expressions within the basin.

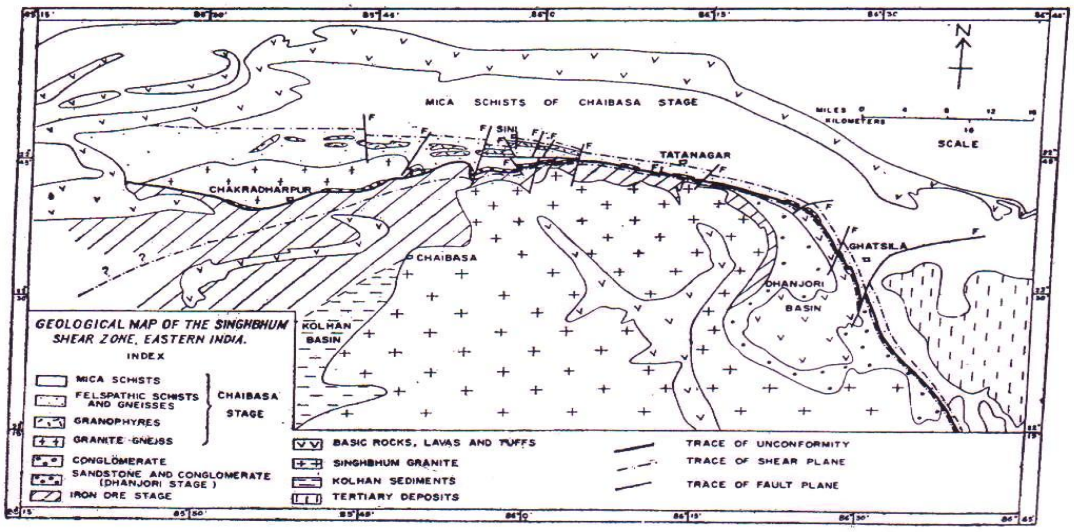

Fig. 2.GEOLOGICAL MAP OF THE SINGHBHUM SHEAR ZONE, IN THE SUBARNAREKHA BASIN
SOURCE: i> Benerjee,1969, ii> Geomorphology of Subarnarekha basin,1980

CLIMATE:

The geomorphological processes in a region vary with changes of climatic conditions. For example, fluvial processes are found to be dominated under humid climatic conditions aeolion processes are found to be dominated in arid climatic conditions.

The Middle Subarnarekha Basin area i.e. south eastern part of Chotanagpur plateau is characterized by Monsoonal climate but according to Koppen's climatic classification it falls under the semi arid climate. The temperature and rainfall characteristics vary with change of season. There is a sharp increase in temperature found in the pre monsoon period that is months of March to April until May. During June and October the temperature begins to decrease with the temperature begins to decrease with the onset of South West Monsoon. Most of the seasonal rain fall (above 75%) is occurs in this time. July is the wettest month of this region. The total rainfalls during the years of 2008, 2009 are 1553mm, 1263 mm respectively. The coldest season commences from November and last till the end of February. The January is the coolest month of this basin area. The normal mean temperature of January ranges from 16.4^{o} C to 17.8^{O} C.

The main characteristic of climate of this region is the changes of climatic condition from arid to humid. The existing residual hills found at different parts of this region (for example Phooldungri) average height of which (200m) identified by leading geomorphologists as well as geologists like Mukhopadhyay etc..

EVOLUTION OF RIVER TERRACES:

River terraces of the middle Subarnarekha basin area at particular geomorphic interest in the study of the consequences of the base level change being associated with the tectonic actions in the Subarnarekha basin. It is important to know that apart from the actions of structural movement that is the Singbhum shearing activities in the recent times, the variations of the river water and sediment discharge specially associated with climatic changes causing formation of river terraces are of equally important. In the context of climate change the direct effect of variations in response to the changes into the fluvial processes from aeolian process under arid environment before the tertiary geological period. The dimensions and characteristics of river terraces have been described in the table no-1.

Table- 1: Dimension and characteristics of river terraces in middle Subarnarekha basin, Ghatsila, surrounding area, Jharkhand state with photographs

PLACE	TERRACE	DIMENSION		CHARACTERISTICS WITH PHOTOGRAPHS
		WIDTH (meter)	HEIGHT (meter)	
At Galudih (confluence point of Gara and Subarnarekha)	Upper	20	3	Dissected by fluvial erosion, steep slope, made of alluvium (sandy clay loam) with guttings (calcium concretions) 
	Middle	6.9	1.3	Made of alluvium with slightly mixing of pebbles. 

	Lower	17	2	Bed rock exposure (quartzite, dolerite amphibolites terrace, steep scarp. 
At Rajbari area (confluence point of Lekhjoria and Subarnarekha river)	Upper	40	2	Made of alluvium, marked by steep slope. 
	Middle 1	35	0.8	Made of alluvium. 
	Middle 2	4	1	Made of alluvium with slightly mixing of pebbles.
	Lower	4.5	3	Rock cut terrace with rocky exposure of dolerite quartzite amphibole, marked by the steep slope.

				
At Dahigora near Apurpath	Upper	50	3	Made of sandy clay loam alluvium with guttings (i.e. calcium concretions). 
	Middle 1	90	1.5	Made of alluvium mixing of pebbles. 
	Middle 2	105	1	Made of sandy loam aluuviumwith mixing of pebbles.
	Lower	31	3	Rock cut terrace with rocky exposures of dolerite, quartzite, amphibolite. Marked by steep slope.

				

Source: Field survey, March, 2011

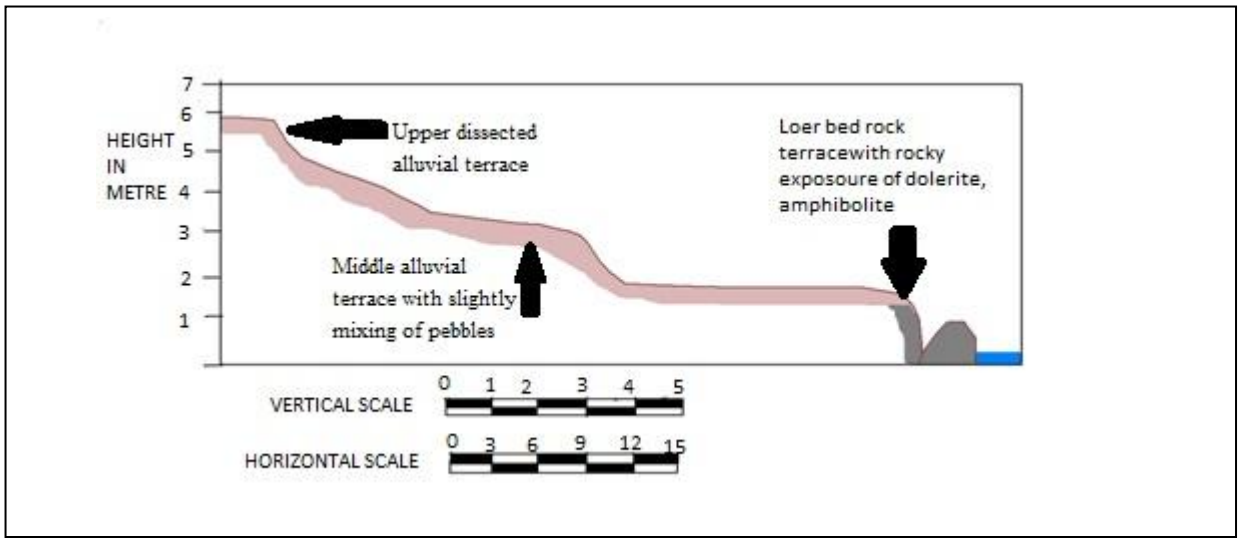

Fig.3. Showing the characteristics of river terraces at Galudih, confluence point of Subarnarekha and Gara River. (Source: Field survey, March, 2011).

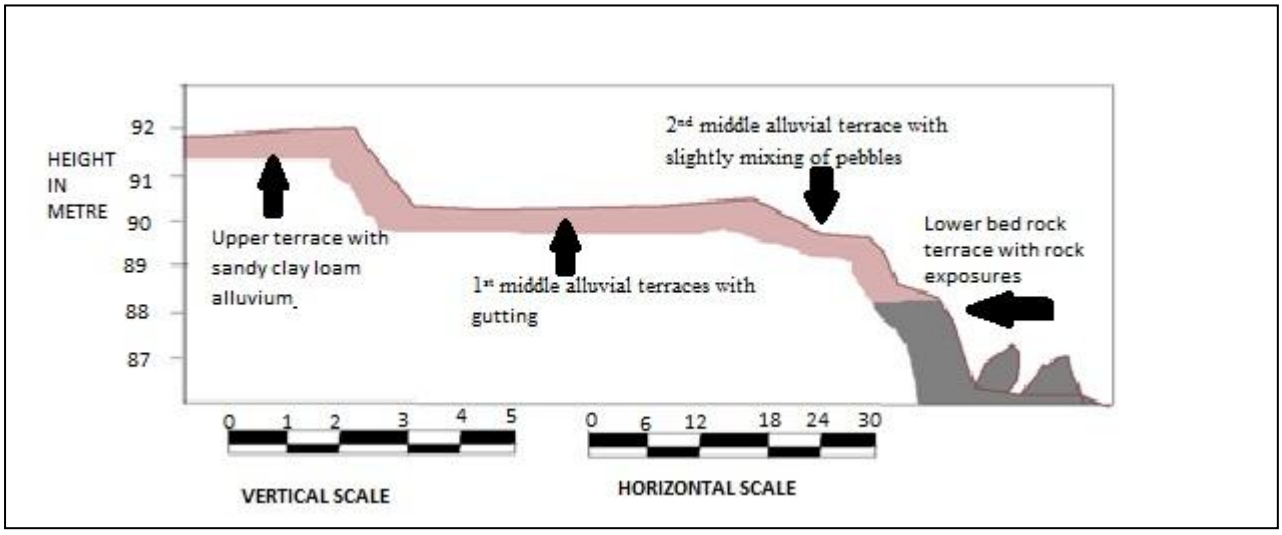

Fig.4. Showing the characteristics of terraces near the confluence point of Subarnarekha and Lekhjoria River at Rajbari area,Ghatsila area. (source: Field survey, March 2011)

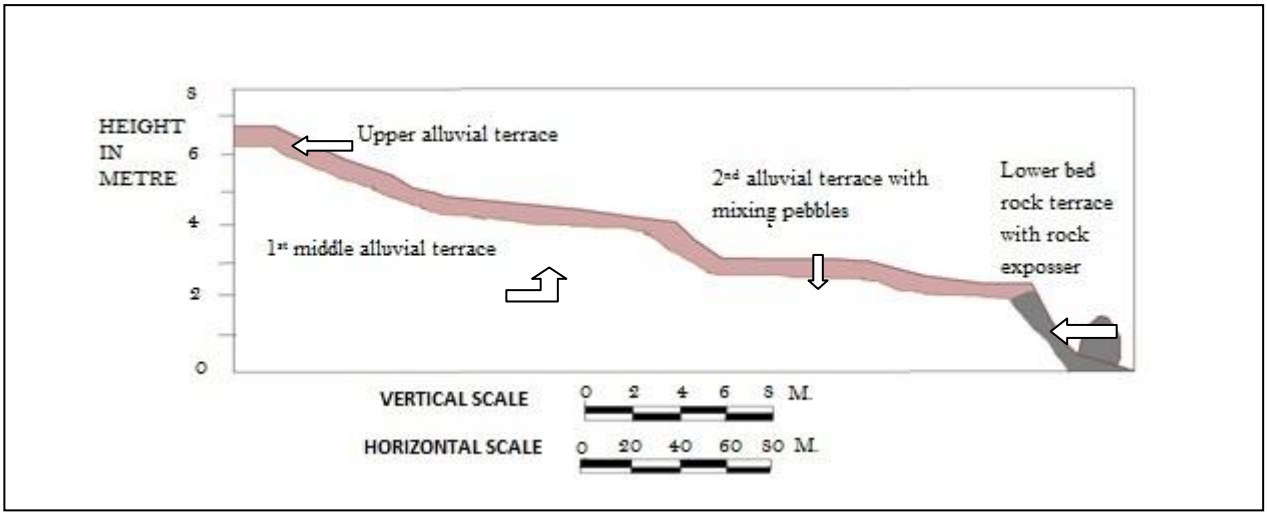

Fig.5. showing the characteristics of river terraces at Dahigora, Ghatsila. (Source: Field survey, March, 2011).

Hence, after analyses of characteristics and dimensions of the terraces found to be developed along the Subarnarekha and its tributary Gara abroad classification can be made by two approaches i.e. genetically and hierarchical approach. The middle and upper terraces i.e. made of alluvial deposits (fine alluvium mixed with pebbles and cobbles) are genetically classified as alluvial terraces or cut and fill terraces and hierarchically classified as non pair terraces, because it' height not matches with the same terraces of opposite bank of the river. These terraces result from infilling of the river valley with sediment i. e. aggradation and incision of the aggradation deposits. The aggradation occur when supply of sediment dominates the capacity of the river to transport it due to decrease in discharge result of a climatic change trend towards aridity and incision of sediment deposits occurs when the stream increases its capacity to transport debris relative to the supply trends towards wetter climate. The lower terrace that is characterized by steep rocky scarp is genetically classified as bed rock terrace and hierarchically classified as paired terrace, because height is match with the of opposite bank. This rock cut terrace result from stream incision. The stream incision may result from either uplift of land or form a fall in sea level due to tectonic activities. Here

the steep rocky scarp of lower terrace, rocky exposures of quartzite, dolerite etc., development of sag pond in the confluence point of Subarnarekha and Gara river at Galudih etc. indicate occurrence of river incision may be due to base level changes by tectonic activities.

therefore, it become evidence that the combined actions of water and sediment discharge variations accompanied by the structural movements being associated with the shearing activities in recent time are responsible for the evolution of the polycyclic landscape including the constituent element like river terraces in the area under study.

CONCLUDING REMARKS:

Various aspect of multi tier river terrace set in the polycyclic middle Subarnarekha basin which are discussed have firmly established the tectonically unstable nature of mid Subarnarekha basin.

It has already been discussed in the geology that the peculiar alignment of the Singbhum Shear Zone (fig.-2), covering the major portions of the rejuvenated Subarnarekha valley played a great role in the problems of the evolution of this spectacular Mid Subarnarekha Basin. Among the major constituent elements of the polycyclic Subarnarekha basin the multitier terraces which are found to be largely dissected under the fluvial erosional processes, along with the adjacent incised valley side sloped have contributed greatly in the evolution of the sets of terraces along the Subarnarekha basin.

It is important to know that these terraces bear the evidences of the positive role of tectonic specially the neotectonic being responsible for the formation of this notable multicyclic terrain of the Middle Subarnarekha Basin. Glowing examples of such terraces may be sited from Galudih, Rajbari, and Dahigora.

It can easily concluded that the evolution of river terraces relates to the justification of this hypotheses The multi tier river terraces are the indicators of repeated change s of base level under neo tectonic movement (shearing activity) one hand and climatic changes on the other hand in the middle Subarnarekha basin area at Ghatsila and its surrounding areas.

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