Imprints of Neotectonic Activity in Mahuadanr Valley, Palamu, Bihar*

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The surface morphological features in and around Mahuadanr Valley have been studied. The area of the valley is characterized by almost flat horizontal terrain mostly utilised for active cultivation. Number of streams (Jhumri, Rampur and Aksi, etc.) have cut the recent sediments at several places and formed characteristic badland topography. It is the result of active erosion of soil and soft sediments. It seems that the severe gullying is the result of rejuvenation of the area due to neotectonic activity. The rise of the basin floor is related to the uplift of the entire Chotanagpur Plateau probably due to the impact of major tectonic activity in the Himalaya.

Key-words—Neotectonism, Tertiary, Mahuadaur Valley, Bihar.

INTRODUCTION

THE Mahuadanr Valley (also known as Chechari Valley) is a small saucer shaped, depression located in the Palamu District of southern Bihar. The valley is surrounded by hills of granite and gneisses of Chotanagpur region (Survey of India Toposheet No.73 A/3 : North latitudes 23°24′00" and 23°27′30" and East longitudes 84°06′20" and 84°09′10"). Mahuadanr is a small town in this area and is situated about 116 km South of Daltenganj. It is approachable by a metalled road connecting Daltenganj and Mahuadanr which passes through the dense forest.

The Mahuadanr Valley lies at an altitude of about 650 m and is surrounded on all sides by hills rising more than 1000 m in height which are covered by thick vegetation. However, the main area of the valley is characterized by almost flat horizontal terrain, occupied by the local population for extensive cultivation.

The area is drained by northerly flowing rivers and nalas. Rampur and Bahera nalas originate from the hills present on the eastern side, while Natki and Bera nalas originate from the hills on the western side of Mahuadanr. These nalas flow northwardly and meet the Birha river, which flows towards north-west and meets the Burha river. The Burha is the main river of the valley which has perennial source of water and ultimately flows into the Koel river in the North. A very important feature is the development of a beautiful water-fall on the upper reaches of the Burha river. It falls from a height of about 120 m and forms the famous Ḷodh falls of Bihar, which are locally known as 'Burha Ghagh'. This is a point from where the river enters into the Mahuadanr Valley and forms the main drainage. The rivers and nalas in Mahuadanr Valley have a tendency of cutting their channel floor by an active erosion of the soft unconsolidated soils (older and newer alluvium) and semiconsolidated Cenozoic sediments. At places along these nalas and streams, the gullying action has converted the area into badlands.

GENERAL GEOLOGY

The present area of investigation falls under Chotanagpur granite and gneissic terrain (Roy Chowdhury in West 1948). However, the Deccan Trap flows extend into the South-western corner of Palamu District and form the high plateau areas around Mahuadanr, the top portion of which is usually weathered and altered into laterite or bauxite. The sedimentary formations in the valley, have been developed over the basement of granite and gneisses which are exposed over a length of only about 2.6 km

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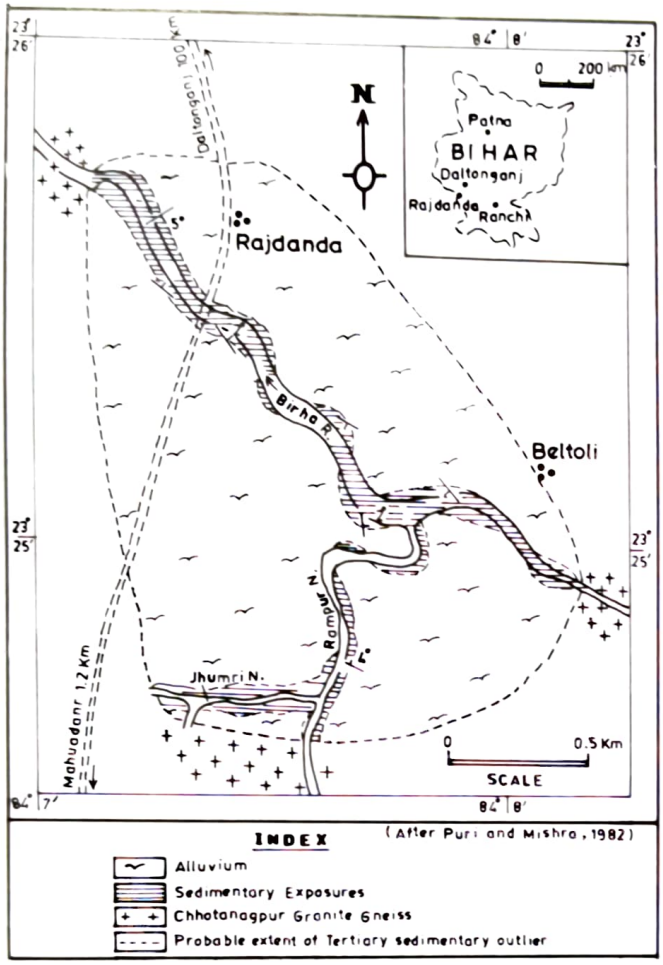

Map1. Geological map of the area around Mahuadanr, Palamu, Bihar.

and a width of 1.5 km along the Birha river and its tributaries, between Rajdanda (23°25'43" : 84°07'30") and Mahuadanr (23°23'15" : 84°06'40") villages (Map-1). Pyroclastic rocks, conglomerates, sandstones and shales occur as important sediment types.

The stratigraphic sequence after Puri and Mishra (1982) is as under:

Recent	Newer Alluvium	
Holocene	Older Alluvium	
----------Unconformity----------		
	Shale bed	3.2 m
Upper Tertiary	Sandstone bed	3.0 m
	Conglomerate bed	2.0 m
----------Unconformity----------		
	Pyroclastic rocks	6.0 m
----------Unconformity----------		
Precambrian	Chotanagpur granite gneiss	

The Upper Tertiary sedimentation in Mahuadanr Valley starts with the deposition of a conglomerate and fine to medium grained ripple laminated sandstone indicative of fluvial conditions. The sandstone unit has become gritty and bouldery at places indicating occasional higher energy conditions. This sandstone is overlain by finely laminated shales. The alternating sandy and clayey layers in the shale unit suggest the prevalence of fluctuating conditions in the basin of deposition. Clayey fraction represents deposition in quieter conditions as compared with the sand rich bands.

The deciduous nature of the forests in the vicinity contributed large amount of organic matter, mainly rich in foliage content and the existence of stable reducing conditions resulted in the sequential degradation of organic matter and the preservation of plant fossils. The shales have a characteristic basal cleavage which allows them to break in large and thin paper-like flakes. Therefore, these shales may also be termed as paper shales.

The excellent preservation of fossils including leaves, flowers and seeds suggests that the organic material was not transported from a long distance before deposition. It appears that the deposition of organic matter has taken place in almost autochthonous or hypoautochthonous conditions. After the deposition of shale unit the depositional cycle in the basin was disrupted which is marked by the presence of an unconformity. The youngest sediments in the sequence are represented by the older and newer alluvium. These are semiconsolidated and unconsolidated in nature.

Fossil content - A well preserved angiospermic flora, comprising impressions and compressions of leaves, flowers, fruits and silicified woods has been described from the Upper Tertiary beds (P1.1, fig.1) of Mahuadanr (Prakash *et al.*, 1988; Bande & Srivastava 1990; Srivastava & Bande 1992; Srivastava *et al.* 1992). It consists of 32 species belonging to twenty nine genera of seventeen families of flowering plants (Dicotyledons). Family Asclepediaceae and genera *Spondias*, *Erythrina*, *Combretum*, *Mitragyana*, *Alstonia* and *Cryptolepis* constitute the first record from the Cenozoic sediments of India.

It is believed that most of the areas in peninsular region are under relatively stable condition. The evidences of recent tectonic activity are known mainly from coastal and extrapeninsular areas. Affect of active neotectonism has been recorded at several places from Saurashtra and other parts of western coast. The most part of peninsular shield still remains unaffected from recent tectonic activity. However, the evidences of neotectonic activity are recorded mainly in the develop-

ment of large areas of badlands in the southern part of Gangetic plain and in the form of considerable down cutting by some of the rivers in Central India. The initiation of the formation of badlands and deep cut channels in Mahuadanr Valley, therefore, become an important feature showing effect of neotectonism in the Chotanagpur region and forms an important aspect of the present study.

IMPORTANT LANDFORMS

Most part of the Mahuadanr Valley is represented by a flat horizontal surface which is under active cultivation. Only few trees break the monotony of the area representing the left overs of the thick vegetation cover of the past. The remaining area is characterized by a rough, uneven terrain mainly located along the streams and nala channels. In this area considerable erosion of alluvium, soils and soft sediments has taken place.This has resulted in the formation of badlands (P1.1, figs 2 & 3) due to gullying along the channels. The streams and nalas have also cut fairly deep channels (Rampur nala, P1.1,fig.3) within the soil and semiconsolidated sediments. The characteristic development of gullies (P1.1, fig. 2) can be observed near the Aksi river bridge from the road connecting Mahuadanr town with Daltenganj. Similar erosion of soft valley sediments can be observed at some places along the margins of the valley. One can also observe these features from the roads connecting Lodh Falls (P1. 1, fig.4) and Netrahat through the Mahuadanr Valley.

EVOLUTION OF MAHUADANR VALLEY

The process of valley formation in Mahuadanr area seems to have been initiated by the development of a depression in this region of Chotanagpur granites and gneisses during Upper Tertiary. Soon the area became a site of deposition and a thin sequence of Upper Tertiary and Quaternary sediments were deposited. However, the process of sedimentation was disrupted and the deposition of older and newer alluvium has taken place unconformably over the Upper Tertiary sediments.

The interplay of sedimentation and erosion has resulted in the development of erosional surfaces represented by the unconformities. The period of nondeposition seems to be related with the prevalence of periodic rejuvenation of the area. However, the high relief of the surrounding terrain maintained a continuous flow of sediments and almost completely filled the valley to acquire the present shape.

The development of badlands and relatively deeper stream channels in an otherwise flat terrain seems to be the result of another phase of rejuvenation of the area. The rise of valley floor due to neotectonic activities seems to be the cause of such severe erosion of the soft valley sediments. The formation of comparable landforms due to neotectonism has also been reported from several areas of northeastern India (Mukhopadhyay 1995).

Large scale development of badlands is known along the southern margins of Gangetic plain in the states of Uttar Pradesh and Madhya Pradesh. Similarly, the ravine formation is also known from the western flank of Aravali range (Valdia 1996). It has been related to the rejuvenation of the areas represented mainly by the Vindhyan, Bundelkhand and Aravali ranges. The uplift of these areas has also helped in the rise of the marginal soft and semiconsolidated sediments and soils along with the older hard rocks. Thus, the exposure to the erosional agencies converted these marginal areas having soft sediments into badlands. The presence of deep cut channels is also known from several areas of Satpura Basin (Denwa, Sitarewa, Harad and Sakkar valleys, Anand-Prakash, MS). However, similar features from the above areas and Mahuadanr cannot be compared in over all size and magnitude. but the genesis and geomorphic evolution of the features at both the places seems to have taken place on similar lines.

DISCUSSION

The presence of comparable features in Mahuadanr, southern margins of Indo-Gangetic plain and Central India discussed here raises an important question as to whether all of them were evolved under similar conditions or not? It appears that the evolution of geomorphic features has been accomplished under similar conditions. The main cause of the formation of these features is the rejuvenation of the area. This phenomenon is common to all these areas, however, the only difference lies in the magnitude of the uplift in individual regions. It seems that the Mahuadanr area experienced the minimum rise as compared to the other two areas. The scale of the development of these features in various areas is an evidence to this fact.

Plate 1

Figures 1-4 :

1. An exposure of fossil bed on the left bank of Rampur nala.
2. Development of badlands in the areas along Aksi river.
3. A view of the Mahuadanr Valley and a sharply cut channel.
4. A view of the majestic Lodh Falls.

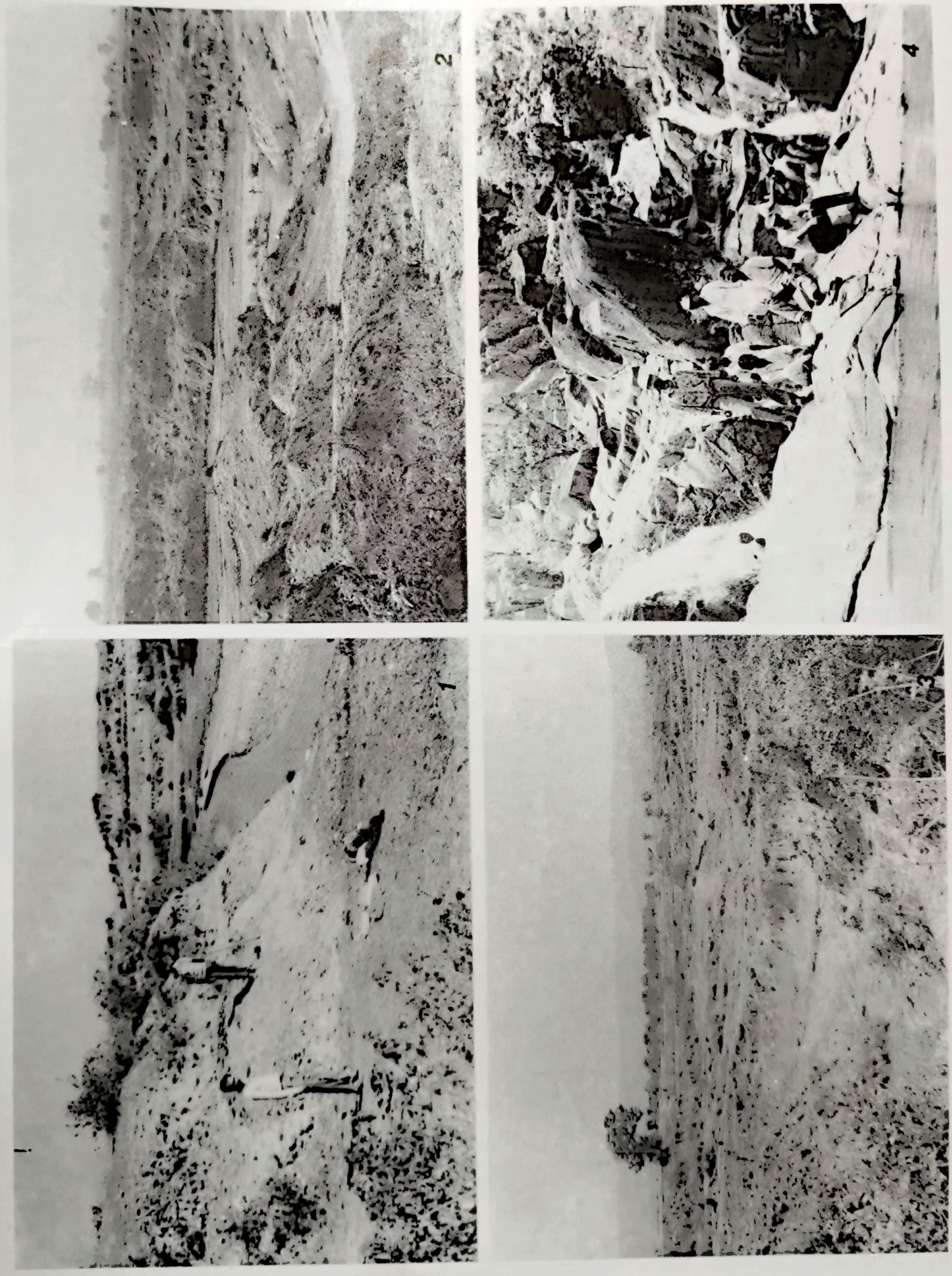

Plate 1

The causative factor for the formation of the above features is the rejuvenation of the area. Therefore, the plausible reasons for the uplift need to be understood, particularly, about the regions falling in relatively stable peninsular part of the Indian sub-continent. The other two sub-divisions of India, i.e, the extrapeninsular region and the Indogangetic plain are in the active tectonic zone. It is now an established fact that the Himalayas are rising due to the impact of the collision of Indian and Asian plates. Subsequently, the Indogangetic plain represents an area of subsidence controlled by the load of incoming sediments. The source areas for the sediments being deposited in this basin are the Himalayas in the north and Vindhyan, Bundelkhand and Aravali regions in the south. A continuous supply of the sediments is being maintained mainly due to the consistent rise of these areas. Out of these, the uplift of the extrapeninsular region is much more pronounced as compared to the areas lying South of the Indogangetic plain. The rejuvenation of Vindhyan, and Aravali ranges has also taken place probably as a consequence to the large scale tectonic activity in the northern margins of the sub-continent.

The presence of some of the characteristic landforms related with the rise of the areas far South of Vindhyan and Aravali ranges in the Satpura and Chotanagpur regions, perhaps suggests the extension of the influence of large scale crustal tectonics of the sub-continent. The reflections of Himalayan events in the Gondwana Sequence and the post-depositional evolution of Gondwana basins have been demonstrated by Ravi Shankar *et al.* (1994). Thus, it is suggested that the regions of Chotanagpur and Satpura are also under the influence of the same tectonic activity and have been rejuvenated though on a comparatively lesser extent. The evolution of features at Mahuadanr in Chotanagpur area is, therefore, the result of the regional uplift which caused considerable erosion of soft valley sediments forming badlands and sharply cut stream channels demonstrating the effect of neotectonism even in the otherwise stable area of peninsular India.

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