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AN ANALYSIS OF GEOLOGICAL FORMATIONS AT PUNPUN BASIN IN MAGADH REGION OF BIHAR, INDIA

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ABSTRACT

This paper aims at a study of geological formations and an analysis of different rock types and its distribution at the Punpun basin in the Magadh region of Bihar. The Geological formations of the Punpun basin comprise mainly rocks of Archaean, vindhyan and Gondwana ages. The northern portion has recent alluvium. Calc, Granulite, Limestone Band, Quartzite, Mica Schist, Gneiss, Granite, Migmatite and Dolerites etc. are the main rocks found in this region.

Keywords: *Alluvium, Rocks, Granite, Gneiss, Quartzite, Schist*

1. INTRODUCTION

The river Punpun originates from Chotanagpur hills in Hariharganj Block of Palamu district in Jharkhand at an elevation of 442 m and at latitude $24^0$11' N and longitude 84°9'E. The basin covers partially the areas of 8 districts viz. 32.51 per cent of the area of Patna district, 75.20 per cent of Jehanabad and Arwal districts, 52.60 per cent of Gaya district, 82.41 per cent of Aurangabad district, 0.88 per cent of Nalanda district, 6.26 per cent of Palamu district and 6.11 per cent of the area of the district of Hazaribagh (old). This river basin consists of a number of small tributaries like the Morhar, the Dardha, the Batane, the Madar, the Ramrekha, the Bakri, the Adri, the Neera, the Senane, the Begi, the Khudwa, the Mavaria and the Panchanva etc. which join the main river Punpun. The drainage basin is bounded by the Sone basin on the West, the Kiul-Harohar-Phalgu basin on the East, the Ganga basin on the North and the North Koel basin on the South. The Punpun basin is situated between latitudes 24°6'N and 25°37'N and longitudes 84°0'E and 85°19'E.

Geologically, the southern part of the basin mainly consists of the rocks of the Archaean Era. Granite, gneiss, porphyritic granite, biotite granite, augen gneiss and migmatites are the main rock types of the area. The rocks belonging to the Gondwana formations have also been observed in the south-eastern part in the Surhar basin in the bed of the river Surhar near Gangati 52 km south-west by west of Shergheti end 6.4 km west by south of Imamganj. This formation is Talchir shales and is entirely surrounded by alluvium. The northern part of the basin is overlain by alluvial deposits.

2. STUDY AREA

The study area is a drainage basin. The total length of the river is about 235 km. The river receives a substantial portion of discharge from its right bank tributaries. Majority of the tributaries originate from the same range of hills in Palamu, Aurangabad and Gaya districts of Jharkhand and Bihar respectively.

The study area is characterised by hills, hillocks, escarpment, plateau surface, channels, channel bars, badlands, winding divides, flood plains, natural levees and slopes of various types. Tors on the hill tops and on the foothills present some other important geomorphic features. The Dome-shaped hills formed due to spheroidal weathering and exfoliation is also very common in the basin. Spanning over the parts of Palamu and Chatra districts of Jharkhand and Aurangabad, Gaya, Jehanabad, Arwal, Patna and Nalanda districts of Bihar it covers an area of nearly 9025.75 km which is nearly one per cent of the total area of the Ganga sub-basin in the country.

The Grand Trunk Road (NH-2) divides the catchment into two parts in such a way that almost all the hilly parts of the basin falls on its south and plain areas on its north. The upper catchment which lies in the districts of Palamu and Chatra is characterized by low hills mostly covered under forest and the slopes with depression and valleys. The lower part of the catchment area are in the districts of Aurangabad, Gaya, Nalanda, Jahanabad, Arvai and Patna is mostly plain or having some uniform mild slope and are being used for cultivation. The elevation of the Punpun basin varies from 442 m above MSL near the origin of the river to about 50 metres above MSL near its outfall into the Ganga. But the highest point of the basin is represented by Bijai Glr (610.0 metres above MSL) which lies in the south-western part of the study area.

3. GEOLOGICAL FORMATIONS

Rocks play a very important role in determining the characteristic features of several types of erosional landforms because the nature and magnitude of erosion largely depends upon the structure and composition of rocks. The Geological formations of the Punpun basin comprise mainly rocks of Archaean, vindhyan and Gondwana ages.

ARCHAEANS

The important rock types met within this area are of Archaean era. The way in which the Archaean crystalline rocks have been originated is not well understood yet and various modes of formations have been ascribed to these rocks. Some of the examples of archaean rocks are as below

1. Granulite, Limestone, Quartzite and Mica Schist

These rocks are among the oldest formations in the study area. The mica schists are very limited in distribution and is seen in patches eg. North west of Pratappur and Sarajamatu. Good exponents of Calcareous Granulite bands are

observed near Pandeypur Village. It lies in the south eastern part of the basin. Quartzite in small dimension occurs at few places near Pandeypur and Raksi.

2. Amphibolite and Hornblende Gneiss

Amphibolite is with an oriented fabric. Hornblende is a mineral of the amphibole group. Gneiss containing Hornblende is a Hornblende Gneiss. Such rocks occur near Karimatanr in the extreme south eastern part of the study area. T hey are chiefly made up of hornblende, minor amount of feldspar and quartz.

3. Biotite Gneiss and Amphibolite

It is grenitiferous and is found in patches within granite gneisses. The patches of biotite Gneisses are seen near Kumu and Karkata in the South western part of the basin. Hills south of Kuku are mainly composed of Biotite Gneiss. At places, Amphibolite is found within Granite Gneiss.

4. Mica Schisat and Phylite

Small isolated patches of these rocks occur within the granite and granite gneisses. Typical exposure of mica schists are found near Ahirtola. At places these rocks grade to quartz mica schist. Exposure of Phyllites have been observed in about 0.8 Km South of Pipragarhia.

5. Quartzite

In the South eastern part of the basin, quartzite occurs both as small hillock and high ridges showing more and less massive character. Only at few places the bedding is identified with difficulty. In the Nagobar hills and in adjacent small hillock tying to the west and east of it pink coloured quartzite is found with Jasper and cherty masses. This quartzite is highly brecciated and silicified.

LOWER VINDHYAN SYSTEM

The lower Vindhyan system of rocks has been divided into the following stages:

1. Rohtas Stage- Consisting of lime stones and shales
2. Kheinju Stage- Consisting of glauconite beds, fawn lime stone and olive shales
3. Porcellanite Stage- Porcellanites etc.
4. Basal Stage- Kajarahat lime stone, Basal conglomearate

South of the Sone, there are several scattered and narrow outcrops of vindhyan rocks belonging mainly to the Basal, Porcellanite and Kheinjua Stages. The rocks of the Porcellanite group are indurated and silicified volcanic ashes. In the south-western part of the basin, there is a large outcrop of the lower Vindhyan Strata which appears to be a part of the main lower Vindhyan formation of the Rohtas Plateau. Bhaunathpur is situated in the eastern part of the main outcrop which is just near the boundary of the study area. There is a small outlier nearly 8 km south-east of Hussainabad near Japla. The shales and lime stones of Kheinjua group are mostly concealed by alluvium near the south-western boundary of the basin. South of this at a distance of 3.5 km is a place called Kalapahar. The

Kalapahars are group of very conspicuous and remarkable dome hills formed of an acid volcanic rock. Other hills between Japla and Nabinagar are made up of volcanic tuff of varying coarseness and Porcellanite which may be beded.

THE GONDWANA SYSTEM

The study area is devoid of any other formation after the Vindhyan system of rocks upto Devonian. Either these formations have totally been removed by the various agencies of denudation or these formations could not develop in the present basin. Since the Archaean, the study has not experienced any Epeirogenetic earth movement. Though Gondwana system of rocks have developed in trough but in the study region such deposits are of lacustrine type. Rocks of Talchir series and of Barakar stage have been found in the South eastern part of the basin mainly in the Surhar valley.

1. Talchir series

It is the bottom most horizon of Gondwana succession. The Basal member of the series is a Glaciated boulder bed consisting of polished facetted and striated boulders of rhyolites and other igneous rocks embedded in a greenish silty matrix. The boulder bed is overlain by sandstones and greenish shales, the sandstones containing undecomposed grains of feldspar due to low temperature. The rocks which appear to be of Talchir age occurring in two parts of the study are:

i. In the south eastern part, this rock is found in the bed of the Surhar river between Maigra and Gangati and consist of bedded shales and sandstones. The shales are olive in colour, thinly bedded and consisting of lenses of sandstones. Sandstones which is massive and grey, is slightly felspathic and occurs in the bed of the river Surhar near Maigra. The feldspar found in the sandstone is mostly unaltered about 1.5 Km west of Panchamah.

ii. One large and one small patch of Talchir series are observed in the eastern part of the basin also. The eastern poatch is larger and extends for about 16 Km in length and 5 Km in width. Starting south of Lupugarh, it extends beyond the basin boundary in the east. The rock constituents include Basal sandstones of about 3 to 4 mtrs thickness followed by a boulder bed which in turn is succeded by siltstones and clay.

2. Damuda series

The Talchir series is succeded by Damuda Series, the second division of the Gondwana System. The series consist of 4 stages, viz. Karharbari, Barakar, Iron stone shales or the barren measure and the Raniganj, the first named being the oldest. Of this series, Barakar stage is the first formations in the study area and rests conformably upon the Talchir series.

About 2 Km west of Panchamah in the south eastern portion of the basin, the lower Gondwana rocks comprising boulder bed, Talchir shale and Barakar sandstones with a total thickness of 12m to 15 m are exposed. Barakar

sandstones is well developed and attains a thickness of 10 mtr. It is fine to medium grained buff coloured and highly felspathic.

3. Dolerites

Dolerite Dykes and Sills are most common in the southern part of the study region and represent the youngest rock of the area and are intrusive in almost all the formations. Such rocks are very common in Gneisses and Talchir rocks. Sometimes, even a single dyke after some distance takes the form of a Sill as seen in north east of Dhardhari Toli.

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