

# Spatial Study of Geology and Geomorphology in Shahdol District, Madhya Pradesh

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**Abstract:** *Geology and Geomorphology both are provide a foundation for resource use, disaster safety, and sustainable development of any region. They provide a comprehensive view of any human and physical activities that affect the development of a region. The main objective of the present study is to present the spatial study of geology and geomorphology of Shahdol district. There are five different stratigraphic horizons and geological ages are exposed within the geological structure such as Bijawar Group (Paleoproterozoic age), Lower Vindhyan Supergroup (Mesoproterozoic age), Gondwana Supergroup (Late Palaeozoic age), Lameta Formation (Late Cretaceous age) and Deccan Traps (Late Cretaceous age). Shahdol district is divided into three key distinctive geomorphic units, which represents the complex nature of landforms: Geomorphic units of extrusive origin, Geomorphic units of structural origin, Geomorphic units of denudational origin. As Basin divider, Escarpment, Hogback, and Lineament also appear in the study area.*

**Keyword:** Geology, Geomorphology, Development, Extrusive, Structural, Denudational

## 1. Introduction

Geology is the scientific study of the Earth, its materials (rocks, minerals, soils), internal processes, and the history of its formation and development. Geomorphology is the study of the Earth's landforms, their origin, development, and the processes that shape them. Geology provides the base material (rocks, minerals, structures) while Geomorphology explains the shape and modification of that material by natural forces. Together, they help us understand Earth's evolution, resources, and hazards. The study of geology and geomorphology of any area is very important because it helps us understand the earth's materials, processes, landforms, and their influence on human life and development. Geology tells us about the "materials and processes" of Earth, while geomorphology explains the "landforms and their evolution." Together, they provide a foundation for resource use, disaster safety, and sustainable development of any area.

## 2. Study Area

Shahdol District is located in the North-Eastern part of Madhya Pradesh. It is situated between 23° 1'N to 24° 29'N latitude and 81° 00'E to 82° 00'E longitude. The tropic of Cancer passes nearly through the centre of the district. It is circumscribed by the Anuppur district in the South-East, Satna and Sidhi district in the North and Umariya district in the west. The eastern boundary of the district shares with the Koriya district of Chhattisgarh state. The rural area of the district is 6048.13 square kilometres, and the rural population was reported 8,46,463 according to the census of India 2011.

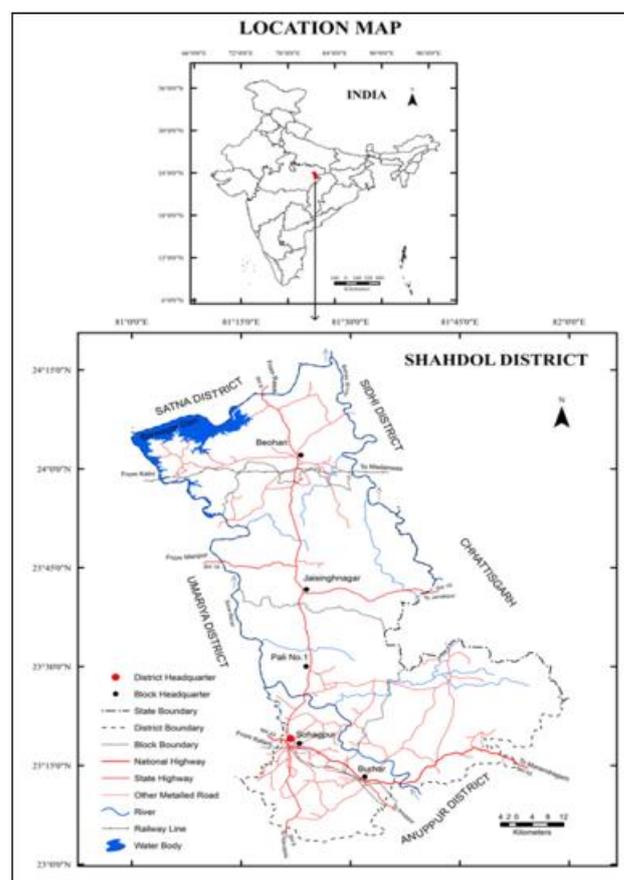


Figure 1: Study Area Map

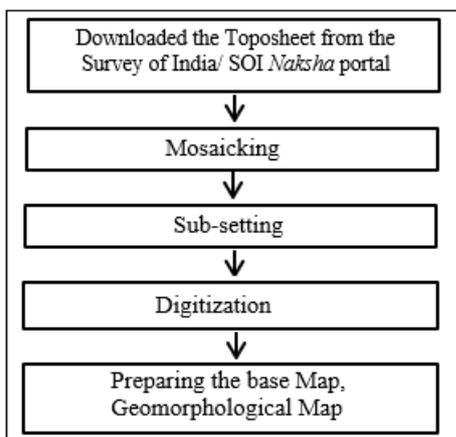
The district consists of five Community Development Blocks namely, Beohari, Jaisinghnagar, Sohagpur, Burhar and Pali No.1. The Pali No.1 block have another name is Gohparu. There are 391 Gram Panchayats and 844 villages in the district, 814 are inhabited and the remaining 30 are reported as uninhabited villages (Census of India, 2011). (Fig. 1)

### 3. Objective

The aim of this research paper is to spatial study of Geology and Geomorphological units in Shahdol district.

### 4. Database & Methodology

Database means what types of data are used for this work and methodology is a process in which various methods adopted to carry out research work are presented. In this research paper mainly secondary data has been used. District (Shahdol) Gazetteer 1994 has been used to present the geology of the study area and NATMO map is used for Geomorphological map. Along with this supported websites have also been visited like Bharat map, Bhokosh, Indian Geo platform of ISRO, State GIS Portal, Bhuvan, Esri India, USGS, Google Earth pro and Google Maps are also visited to verifying to prepared maps. Survey of India Toposheets on 1:50,000 scale (63H/4, 63H/7, 63H/8, 63H/12, 64E/1, 64E/2, 64E/5, 64E/6, 64E/7, 64E/8, 64E/9, 64E/10, 64E/11, 64E/12, 64E/14, 64E/15, 64E/16) have been used for the preparation of the base map with the help of QGIS (Fig 2). The process are:



### 5. Result and Discussion

This paper presents a study of the Geology and Geomorphology of the Shahdol district which has greatly influenced the development of this area. The result of the study has been divided into two parts. In the first part, the Geology and Geomorphological structure of Shahdol district is described with the help of map under the physical aspect and in the second part; the impact of these two physical aspects on the development of the district has been presented.

#### Geological Aspect

In the study area, rocks of five different stratigraphic horizons and geological ages are exposed within the geological structure: 1. Bijawar Group (Paleoproterozoic age): 2. Lower Vindhyan Supergroup (Mesoproterozoic age), 3. Gondwana Supergroup (Late Palaeozoic age), 4. Lameta Formation (Late Cretaceous age) and 5. Deccan Traps (Late Cretaceous age) (Ramakrishnan, M., & Vaidyanadhan, R. 2010). Bijawar Rocks, consisting of quartzites, gneisses, and schists as primary rocks type, spread over the Beohari block and show moderate weathering. The Semri series group represent lower Vindhyan rocks included porcellanitic, shales, sandstone and basal conglomerates of massive origin. Gondwana rocks consist of coarse sandstone and extensive coal deposits. These are evidence of the riverine environment. Several plant fossils are also preserved in these rocks, which are evidence of the luxuriant growth of trees during that time. Lameta rocks are sedimentary rocks, which are also known as intertrappean beds. They occur sandwiched between the basalt layers and consist of sandstone and cherty limestone as significant rock types. Deccan traps are huge flow basalt rocks, which are exposed to a large area. Those are igneous rocks of volcanic origin and represent episodes of silent fissure type eruptions. These rocks are spread over the topography in the form of that top hill (Table 1).

**Table 1: General Geological Succession in Shahdol District**

Age	Lithostratigraphic Unit	Lithology
Recent to Sub Recent	Alluvium, Laterite	Sandy loam, silty and coarse, medium laterite
Cretaceous to Eocene	Deccan Trap	Basaltic lava flows and older, dolerite dykes and sills.
Upper Cretaceous	Lameta	Sandstone, Siliceous limestone, marl and Shales
Lower Cretaceous	Chandia Parsora Gondwana Supergroup Tihki Pali	White clays and medium- grained sandstone
Upper Triassic		Coarse-grained sandstone variegated shale and lilac coloured clays.
Lower Triassic		Coarse-grained sandstone grey shale, red shale, red green and mottled clay with col bands
Late Permian	Barakar	Sandstone, Shales and Coal seams
Upper Carboniferous to Lower Permian	Talchir	Tillite, sandstone and green shale
Mesoproterozoic	Lower Vindhyan (Semri series)	Porcellanitic shales sandstone basal conglomerates
Paleoproterozoic	Bijawar	Quartzite, Gneisses, Granite, Schists

Source: General Ground Water Resource Report, Shahdol District, 2013

The basalts are highly jointed, fractured and weathered. Overall lithology of Shahdol district can be divided into five categories: (i) Basaltic and dolerite intrusive exposed in thin patches along the hills from south to west (ii) Sandstone, limestone sandy shales exposed worthy in Jaisinghnagar and Beohari blocks, with some impact in southern Sohagpur (iii)

Sandstone and shales with coal seams spread over Burhar and western Sohagpur Block (iv) Conglomerates and sandstone found in the fragile and swell pact of norther Beohari exposed in the river section (v) Pink granite with pegmatites and metasediments in the north Beohari and eastern Sohagpur in patches. In Shahdol district, Sone-

Narmada South Neotectonic and Bahmani- chilpa fault pass through the district and coal mining in Sohagpur because it is considered an earthquake-prone area.

### Geomorphological Aspect

Geomorphology is the science which deals with the evolution of landforms, whether it is denudational or structural (Joshi, R. C., & Rawat, A. S. 1998). Landforms are the most common features of 'better clues' for

understanding the various land use land cover, cropping pattern and crop production, and hydrological conditions (Mishra, S. P. & Chaubey, S. K. 1999). According to the Geological Survey of India (2002), the Shahdol district is divided into three key distinctive geomorphic units, which represents the complex nature of landforms: (i) Geomorphic units of extrusive origin (ii) Geomorphic units of structural origin (iii) Geomorphic units of denudational origin (Fig.3)

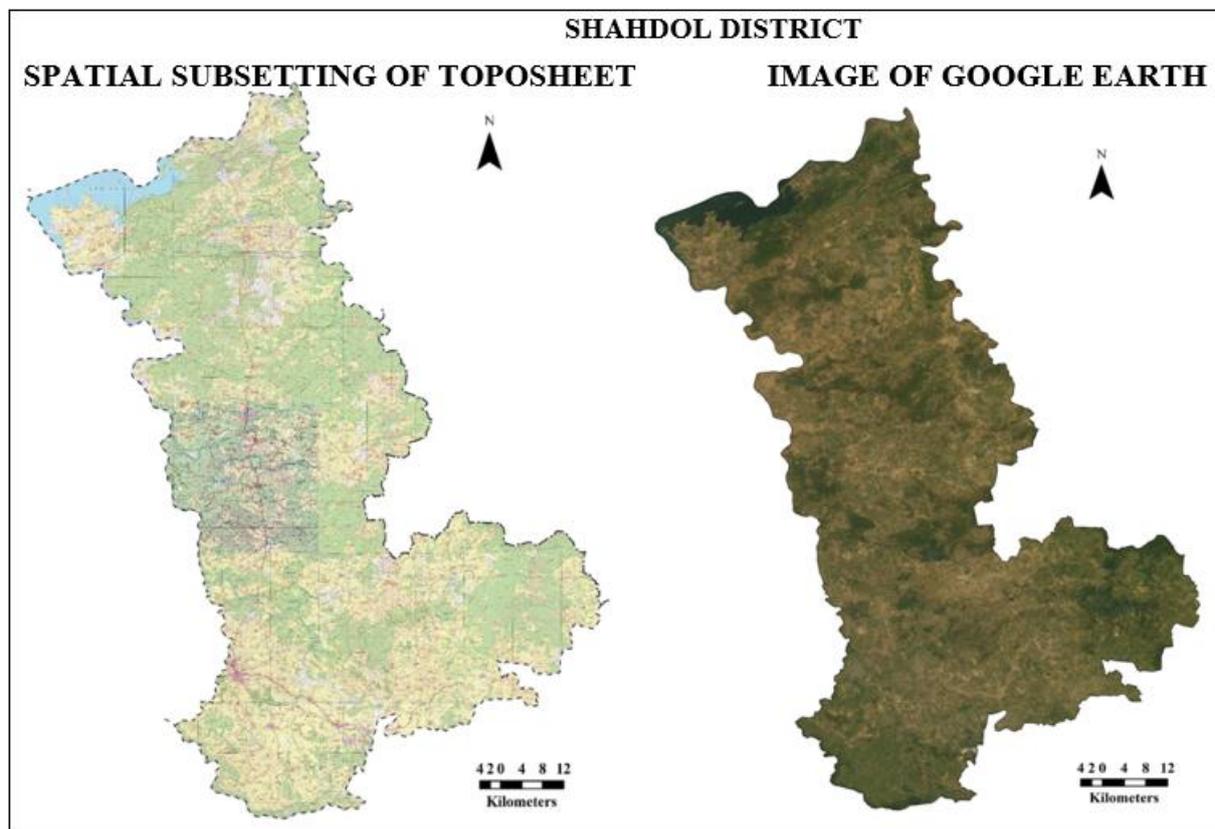
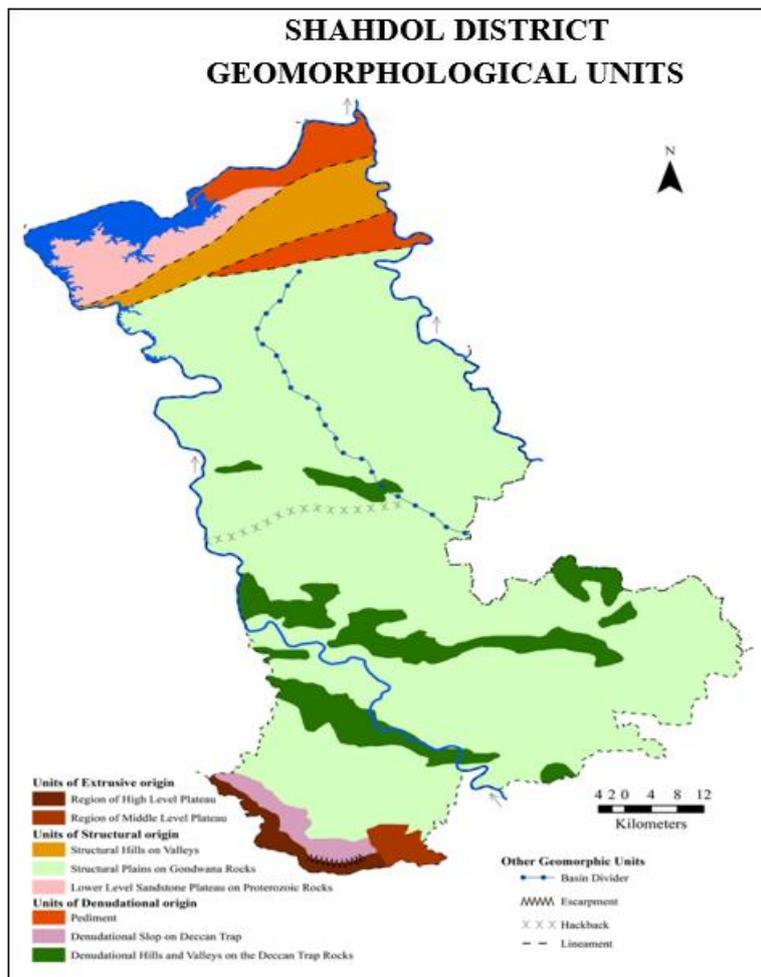


Figure 2: Spatial Sub setting of Toposheet and Image of Google Earth

**Geomorphic Units of Extrusive Origin:** This unit is found in the southern part of the district in the arc shape and it is again classified into two categories: (i) Region of high level plateau: In the study area, a high level plateau is noticed in the south-western part of Sohagpur block, where elevation is observed over 900 meter. This unit covers 1.24 per cent of

the total geographical area (ii) Region of middle level plateau: It covers a nominal area in the south-eastern part of the Sohagpur block and its elevation range is 550 to 900 metres. It covers 0.89 per cent of the total geographical area in the district.



**Figure 3: Geomorphological Units of Shahdol District**

**Geomorphic Units of Structural Origin:** The major structural landforms noticed in the study area in the three different forms: (i) Lower-level sandstone plateau on Proterozoic rocks: This geomorphic unit exists in the north-western part of the Beohari block. This unit covers 5.92 per cent of the total geographical area (ii) Structural Plain on Gondwana Rocks: Most of the area of the district is covered by structural plain on Gondwana rocks. This unit mainly covers 71.85 per cent of the total geographical area (iii) Structural hills on valleys: This landform area with the 5.01 per cent marked in Beohari block as a sandwiched between along western to eastern in the form of parallelogram between the pediments.

**Geomorphic Units of Denudational Origin:** These geomorphic units are observed in three forms: (i) Denudational slop on Deccan trap: it is found in the southern part of Sohagpur block in the form of arc and area is 1.47 per cent to the total geographical area (ii) Pediment: this patch is found in the Beohari block in two parts, one is marked in the northern and another is reported in the southern part. This geomorphic unit is covered by 4.49 per cent (iii) Denudational Hills and Valley on the Deccan Traps rocks: it spread over the district into the small patches in the Burhar, Pali No.1, Jaisinghnagar and Sohagpur block. Maximum parts of this geomorphic unit are reported in the Burhar block which covers 3.24 per cent, Pali No.1 block covers 2.98 per cent, Sohagpur block covers 2.11 per cent

and Jaisinghnagar block covers 0.8 per cent of the total geographical area.

Apart from the above geomorphic units, some other units such as Basin divider, Escarpment, Hogback, and Lineament also appear in the study area. A basin divider is an elevated mountain or mountain upland that separates two drainage basins (Werner, C. 1994). In the study area, Sone and Banas are two main rivers and basin dividers, dividing the area into two river basins on the structural plains of Gondwana rock. An escarpment is a region of the earth where the elevation sharply shifts. It generally refers to a cliff's bottom or a steep slope (Darby, H. C. 1948). It is observed in the southern part of the Sohagpur block and lies between the high level plateau and denudational slop on the Deccan trap in the arc shape. The Hackback is the long, thin and steep gradient ranges formed after erosion (Singh, S. 2010). It is mainly found in Pali No.1 block. A lineament is a landscape feature that manifests an underlying geological structure, such as a fault (McMahon, E. 2010). It is reported in the northern part of the district between two geomorphic units, namely structural hills on the valley and pediment (Fig. 2.2). The highest elevated point is marked in Sohagpur (Shingingarh) and Burhar block (Mohora) which is located southern part of the district.

The Geology and Geomorphology of the study area have greatly influenced the development of this area. This area has a mixed physical features form of both plateau and plain

areas, which has made life possible to some extent here. These areas create a dramatic landscape of hills, plateaus, and narrow valleys along the Son River and its tributaries. The uneven terrain of this area hinders agricultural activities and complicates activities such as urban expansion and road construction, which is a major problem for development related activities. With limited cultivable land, agriculture remains predominantly small-scale and rain-dependent the tibals often rely on subsistence farming and supplementary forest produce like mahua, wood, and seeds for income. In this area, rainfall is seasonal but also excessive, but due to the land being hilly, the water does not stay, hence the availability of water outside the rainy season is also a big problem. Due to the land being rocky, the construction of canals is difficult, which is a big problem for agriculture. Mining is expanding continuously in the study area, which is increasing the environmental problems of the area. Environmental safeguards needed around mining belts.

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**Conflict of interest:** The authors declare no conflict of interest.

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