Chapter I

Introduction
Geomorphology is an important subject among the earth sciences. It’s main focus is the study of nature and genesis of landforms and their implications vis-à-vis human life.

The Murwara basin is an important micro region of the central scarpland of India. It occupies a typically significant location just in the closer vicinity of the Vindhyan range and lies at the water parting zone of the east-west oriented Narmada–Son valleys.

The region is physiographically a part of the Narmada–Son valley in the Central India region. Geologically the region lies on the southern margin of the great Vindhyan Basin and the northern boundary of the Gondwana Basin.

The region therefore assumes importance for the study of the geological and geomorphic forces which have operating at the margins between the Vindhyan and Gondwana Basin at different episodes (epicycle) of the earth history.

Murwara basin is characterised by a typical physiographic trends alongwith a very interesting geological structure.

The region lies in the closer proximity of the great Boundary fault of the Narmada–Son valleys. The Vindhyan is seen quite disturbed here.
The remnants of Deccan lava rocks are found to cover several areas of the region. The Murwara hence becomes a micro geomorphic unit where interplay of endogenic and exogenic geomorphic forces operating in the areas of Indian foreland are easily observable for the understanding of the forces which have shaped the geomorphic destiny of the Indian plate.

Geologically the region lies in the hing zone of Narmada-Son valleys. The areas on the northern and southern parts of this zone seem to be have been moving up and down in relation to each other ever since the early ages of earth’s geological history.

Keeping these facts in view, the Murwara basin has been selected for an in-depth geomorphological study so that geomorphic implications may be investigated for proper understanding of the processes which have been in operation in this part of the Indian plate during the past geological periods.

Recent seismic disturbances in different parts of the Indian areas have suggested that the Indian plate has become quite active. The implications and consequences of this seismocity also need to be investigated.

Another important aspect of the present study of the basin is to study the area as regard to effect of geomorphology on the socio-
economic aspects of the society. Second aspect of the study of the region is that till now, no systematic work on geomorphology of this area has been done. This area has remained quite unexplored. With these facts in view, the proposed area has been selected for a closer examination of the geomorphic evolution and geomorphic making of this region.

The aim of the present study is thus to explore geomorphic knowledge of the Murwara basin and to apply the information in the development of this part of the country which is in the early stage of its socio-economic development. The information may provide suitable guidelines for construction of dams and roads and in exploring the groundwater potentials and to provide knowledge about soils and other land resources.

Previous Work

Substantial work of geological nature has been done on Vindhyan, Gondwana, Deccan Traps and Bijawar the central highland region of India of which this study region is a part. Among such workers mention may be made to the magnificent survey report of the Geological Survey of India. Mallet, Oldham, Vrendenburg (1869, 1901, 1906). There are again several research works on the geomorphology of Vindhyan and other geological unit of the central highland region. Such workers include these by west (1964). Dixey

Geomorphology of quite several areas of the central highlands region has been studied by several workers. The geomorphic studies of Murwara region has not been studied in its all ramifications and hence need to be closely examined, analysed and interpreted.

**Objective of the Work**

Murwara basin, apart of the Narmada-Son valleys in the central Indian regions which has been viewed as a line of weakness since the early history of the earth as a line separating the northern and southern part of the Indian peninsula into distinct geomorphic regions.

Narmada-Son valleys of which this area form a part has been unstable ever since the early parts of the earth history. It has quite interesting physical landscapes which indicates an interesting geomorphic evolution of the area. The region exhibits some very interesting morphometric features. The fast development of mining and other industries in this area provides as interesting field for the
study of the evolution of the primitive structure of the society under the impact of industrial growth in the surrounding region.

The analysis of the abundant natural resources of this region is expected to throw considerable light on the possibilities of future development and help in planning for the proper exploitation of natural mineral wealth of the area.

The study will also help understanding of the dominant problems of socio-economic development of the region. The present study will help reconstruction of the past geomorphic events of the region as well as presentation of present features and their evolution. The present study will be able to bring out some facts and these facts will help in the trace out the sequence of evolution of landforms, drainage and study of resurrected precretaceous features.

**METHODOLOGY OF STUDY**

Initially the topographical sheets, geological data and maps concerning to the study area have been taken for the analysis of topographical and available geological data on the region. Other sources of data like (G.I.S.) and remote sensing have also been used for better understanding of the geological and geomorphological aspects of the area.
Following topographical sheets of the area have been used (one inch toposheet no. \( \frac{64}{1}, \frac{64}{2}, \frac{64}{5}, \frac{64}{6}, \frac{64}{9}, \frac{64}{10} \)) Map morphometry of the area has been conducted on these maps.

For physiographic study profiles of average slope map, elements of slope, drainage pattern and geology of the area has been measured and mapped. Stream orders analysis has been done according to Strahler's methods (1952).

To measure the stream length the method using opisometer as well as thread technique was utilized.

To conduct the morphometric analysis of the area methods of Horton, Strahler, Wentworth (1930) were followed. Stream order has been determined by method of Strahler. Strahler's formula was used to determine the bifurcation ratio.

Drainage frequency and drainage density was calculated by Horton's method.

Average slope map was prepared by method of Wentworth (1930). Relief map was prepared according to Smith method.

Stream length ratio was calculated by following the method of Strahler (1969).
Hypsometric curve and area height curve were also prepared and studied and analysed.

Superimposed profiles and longitudinal profiles were also prepared to have better understanding of the relief aspects and land configurations.

For the study of applied geomorphology soils forms, vegetational features and soil distribution patterns have been also studied. Ground water, hydrology, engineering, agriculture and industrial aspect have been also discussed.

**OUT-LINE OF THE WORK**

This study of the Murwara basin is presented in eight chapters.

The first chapter deals with the Introduction of the subject and the general information about the Murwara basin.

The chapter Two analyses the ‘Geology’ of the Murwara basin. The area comprises of rocks belonging to Mahakoshal group, Vindhyan, Gondwana, laterites and Dharwars.

Geological rocks formation, their location and nature has been described in this chapter, since the Vindhyan rocks (sandstone, limestone) and Gondwana cover a major part of the area they have been described in detail.
'Geomorphic processes' have been analysed in detail in chapter Three.

In this chapter impact of climate on weathering, erosion and mass-wasting, has been discussed in detail.

Analysis of different types of weathering i.e. chemical weathering, physical weathering, biological weathering and their effects in the area are also discussed.

Matters related to 'morphometric analysis' have been presented in the chapter Four. In this chapter detailed morphometric analysis of the basin including drainage basin morphometry has been carried out.

The stream segments of the basin have been ordered, numbered and their bifurcation ratios determined.

Their total length, mean and ratios of length are calculated. In continuation the drainage density, drainage frequency and longitudinal profile of the whole drainage system has been analyzed.

Fifth chapter deals with the study of erosion surfaces.

Using the data of morphometric analysis such as Superimposed Profiles, Longitudinal Profile, Hypsometric curve, Area Height curve
and field observations, erosion surfaces have been identified and correlated.

Analysis of the slope features and the development of slope profile in various rocks, average slope and relative relief has been analysed in chapter Six.

Seventh chapter deals with the applied geomorphology. The role of applied geomorphology in the field of soils, vegetation, minerals resources, development of industries, Hydrology, Engineering have been described in this chapter.

In the Eighth and last chapter which is the concluding part of the thesis the problems associated with the Murwara basin, suggestions regarding to overcome the problems and results have been given.

**Regional setting**

Murwara basin forms a part of the Narmada Son valleys in the central Indian Region. It is drained by the Murwara and its tributaries, which forms a part of the Mahanadi basin, a tributary of the Son. It occupies a part of the Murwara district of Jabalpur division in Madhya Pradesh. The region lies on the south central boundary of the great Vindhyan basin.
Source: Survey of India, Atlas
The Katni river with its tributaries like Niwar, Sumrar, Bhimarr, Amrar, Jilhari and Koilari Nadi forms the main drainage axis of the region. Politically, Murwara basin falls in the northern part of the Jabalpur district bounded by North latitude 23°32' and 24°00' and east longitude 80°7' and 80°10'. It is bounded on the north by the Satna and Panna districts, on the east by Shahdol district on the south by the areas of Sihora tahsil of the Katni district, and on the west by the areas of Jabalpur district.

The study region of the basin covers an area of some 450.66 square kilo meters.

This area falls in the Survey of India Map Nos. \(64 \frac{A}{1}, 64 \frac{A}{2}, 64 \frac{A}{5}, 64 \frac{A}{6}, 64 \frac{A}{9}, 64 \frac{A}{10}\). The area is approachable throughout the year by National Highway No. – 7 connecting Jabalpur and Katni. The northern part of the area can be approached by Katni Panna and Katni Maihar roads. The interior parts of the area are well connected through unmetalled road and forest roads. Katni is the major railway junction on Jabalpur – Allahabad section of the Central-Western Railways.

The area comprises of older alluvium rocks of Vindhyan Super Group, Bijawars, Dharwars and laterite formations.
The region has quite a variety of interesting physical landscapes which indicates a complex geomorphic evolution of the basin.

The Narmada-Son valleys of which this area forms a part, has been unstable ever since the early parts of the earth history. This is suggested by the disturbed geological beds and by the fact that no Gondwana rocks are found in the areas north of this region and a similar absence of Vindhyan outcrops in areas south of these valleys.

The highest surface of this basin rises to some 600-700 metres of height above the sea level and is covered by the Gondwana and Vindhyan rocks.

The area to the north and north-west is surrounded by Bhandar group of rocks and towards north-east it is covered by Kaimur rocks. Southern and south-western part of the basin is covered by Mahakoshal group of rocks.

The highest elevation found in the area is near Jukehi i.e. in the north-west parts of Murwara basin. The highest peak is located at Bhangrag Pahar (693 meters) in the extreme south-eastern part of the region.
PHYSIOGRAPHY OF THE REGION

Central highlands region is an important physiographic division of India. As suggested by Spread, the Murwara basin falls within the region designated as Vindhyan Ranges and Plateaus by the National Atlas Organisation of India.

As we go to topography of the area to the north and north-west it is surrounded by Bhandar group of rocks and towards north-east it is covered by Kaimur rocks.

Towards east and south the area is surrounded by Bhitrigarh formation of Mahakoshal group of rocks. Various subsidiary hills and spurs of the Bhitrigarh formation are found in the south.

It joins the Vindhyan and the Satpura systems in the west and forms the great central watershed of India.

Thus physiographically the region is divided into three natural regions i.e.

(1) **The Vindhyan Tract**: Bhandar and the Kaimur ranges which belong to the Vindhyan system lie at the northern and western boundary of the study region. Vindhyan represent a sequence of sandstone shale and limestone.
MURWARA BASIN
RELIEF FEATURES

Source: Toposheets 64 A/1, 2, 5, 6, 9, 10
Bhandar group of rocks are the most dominant unit in the study area and are exposed in the Northern part near central railway line.

Upper bhandar sandstone is the youngest lithounit of the Vindhyans.

The higher area of this basin lies within the range of 600 to 700 metres.

Towards east a few scattered outcrops occur in the direction of Lora hill and Bhtrigarh range beyond Sihora. There after with the exception of Deodonga hill, in between it dips to reappear near Jhakehi tahsil and runs through the entire length of Maihar.

At Jhukehi, the strike of the Kaimurs is displaced, producing the only gap in the whole length of the Vindhyan.

Kaimur rocks are observed in the north-eastern part of the study area. Rest of the area of the south of Murwara basin and a little south of it consists of the lower Vindhyans.

Kaimur group is represented by a sand stone unit which lies in the extreme south of Vindhyan exposures and forms a prominent hogback.

(2) **The Bhtrigarh Range**: The Bhtrigarh range runs across the middle of the region from south of the study area. It consists of
metamorphic rocks and meets the spurs of the Satpura nearly at right angle.

To the south-west it appears abruptly from the alluvial plane as an outcrop and has a general elevation of 457 metres to 549 metres above mean sea level.

The highest peak of Bhitrigarh hill is about 623.6 metres.

The Bhitrigarh area is mainly covered by metabasalt of Mahakoshal group in ENE–WSW direction.

The range constitutes the watershed between the catchment of the Hiran in the south and that of the Katni in the north Lora hill, an isolated outcrop of the range lies a few kilometres west of it.

The broken country between the Bhitrigarh range and the Kaimur is studded with hills of varying heights and magnitudes towards west of Sleemanabad and this region consists mainly of a sequence of ridges with poor soil cover on their slope and thicker and better soil in the natural basins here and there.

An undulating plain of poor soil dotted with numerous sandstone hills extends from the Bhitrigarh range in the south to the Deodonga hill in the north-east.
To the north-west of the Bhitigarh range a low and staggering ridge spreads out as far as the confluence of Mahanadi and the Katni rivers.

(3) The North-Eastern Valleys: The north-eastern plain formed by the Mahanadi and Kair occupies the eastern part of the Murwara basin. The plain is bordered by the Kaimur range in the north and in the west of Kanenjua hill traverses the region north of the Mahanadi, from south-west to north-east. The south-eastern and eastern parts of the regions are covered with forests.

It offshoots to the north and the south affect the quality of the soil which other wise is alluvial.

**DRAINAGE SYSTEM**

The katni river is one of the main river of Murwara basin. It belongs to the drainage basin of Ganga. Katni being the main river of the basin rises in Sihora tahsil.

It enters the basin near Ganyari village. Than its flow is in east-west direction and covers approximately ¾ part of the block.

The elongation of the river varies from 1300 feet in west and 1200 feet in east. This river is in its youthful stage. This fact is supported
View of the Katni River
by the fact that a broad ravine lands are developing through out its course of passage.

Another feature supporting this fact is absence of flood plains.

Its main tributaries are (1) Niwar, (2) Sumrar, (3) Bhimrar and (4) Kollari.

Katni river and its tributaries together drain about ¾ area of the Murwara basin. One of the main tributary river i.e. Niwar river rises from Bhitigarh and flows in South-North direction. It drains South-West part of Murwara basin and joins to Katni river near Gulwara village.

Another tributary is Sumrar. It originates near Nawalia and flows in South-North direction almost parallel to Katni-Allahabad railway line and afterwards joins river Katni near Gatakhere village.

Third tributary Bhimrar and its tributary Jarangar drains the eastern portion of the basin.

Afterwards it joins Katni river in Juhli village. Besides the above two more drainage lines are present in the area. One is Keollari river which drains the North-East portion of the basin and the second is Aloni river in the northern border of the Murwara basin. Keollari drains North-Eastern portion of the basin at the same time
MURWARA BASIN
DRAINAGE DENDRITIC

Source: Toposheets 64 A/1, 2, 5, 6, 9, 10
MURWARA BASIN
DRAINAGE RADIAL

Source: Toposheets 6A/1, 2, 5, 6, 9, 10
Aloni drains the northern and north-west portion of the basin. After flowing through the basin it joins Ken river.

The drainage patterns reflect the influence of initial slopes, stage of the river, climate and the recent geologic and geomorphic history of the drainage basin. The region has the following stream patterns:

**[1] Dendritic:** This type of pattern is noticed in the south-east and central part of the basin. The only guiding factor for this pattern seems to be the initial slope of the land. The dendritic pattern is seen in the areas of Sleemanbed, Sansarpur, Devri, Gopalpur, Imalya, Niwar, Kevlari and other places in Murwara basin.

In the area having Mahakoshal group of rocks (Bijawar) the general pattern of drainage lines is dendritic.

**[2] Radial:** Radial type pattern of drainage in the region is observed south of Deodongra village where the hill (532 meters) ends out drainage line in all the direction. In the area around Mohan Packap Pahar also produce the same type of drainage pattern. The radial drainage pattern is also found in the south and eastern part of the Murwara basin.

In the area having Gondwana rocks the general pattern of drainage line is radial. The Amari and Niwar Nadi show a best example of radial pattern.
MURWARA BASIN
DRAINAGE PARALLEL

Source: Toposheets 64 A/1, 2, 5, 6, 9, 10
(3) **Parallel**: The parallel drainage pattern is very common in the northern part of the Murwara basin as for example around the Vijeraghogarh, Jatwara, Piprehta.

Katni, Keollari Nadi and its tributaries also produce the parallel drainage pattern.

The high relief area of the region shows the best example of parallel drainage pattern.

In the area having Vindhyan super group of rocks the general pattern of drainage line is parallel.

North-Western part of the Murwara basin is also found in the parallel drainage basin.

In the area to the presence of horizontal old sand stone beds which have never been favourable for the development of drainage.
REFERENCES


