Geomorphology in its widest sense, is the natural science for the purpose of understanding the relationship of man to his geomorphological environment. Broadly speaking, geomorphology is the science of landforms and of landforming processes. Yet another view sees geomorphology not merely as a study of landforms and processes but also for more practical application in the field of soil science, economic geology and for rural and urban planning as well as for agricultural planning; especially in a country like India.

Actually widespread work in the field of geomorphology has come about within the past few decades, nonetheless work was done by Keith (1894) as long ago as in 1894. In India, in recent years, considerable amount of work has been done by several scientists on geomorphology especially in the geomorphological mapping and aerial photographs. M.B. Pithawalla's (1939) classification
of the physiographic region of India was based on the geography and topography as controlled by the internal and external agencies working on them, and subsequently he revised it taking into account structural and erosional characteristics of each of the seventeen physiographic provinces. A classification of the major physiographical divisions of India on the million scale has been suggested by S.P. Chatterjee (1962). This division is based on the structural and topographic characteristics. S.P. Chatterjee and B. Basu (1944) divided the greater part of Madhya Pradesh into nine physiographic regions on the same basis and regional geomorphological studies of parts there of, The Sagar Damoh Plateau; The Murwara Basin; The Narmada Valley; the northern foothill zone of Satpura; the Satpura hills; the Purana Valley; the Southern plains; the Balaghat-Bhandara hills; The Ajanta plateau; The Bundelkhand plateau and Vindhyan country have been done. The Bundelkhand plateau and Vindhyan country fall in the Lower Ken Basin.

**Location**: The region under study comprises an area of 4329 square miles and is situated in $24^\circ15'$ to $25^\circ45'$ N and $79^\circ15'$ to $80^\circ30'$ E (Fig. 1). The region enjoys the humid mesothermal type of climate and Thornthwaite's moisture index of the region is cwg.

Administratively, the Lower Ken Basin roughly comprises of parts of Chhatarpur and Panna districts of Madhya Pradesh, and Hamirpur and Banda districts of
Uttar Pradesh.

The Ken river is one of the major tributaries of the Yamuna. Two major tributaries of the Ken drain the Sagar-Damoh plateau and has been designated as Upper Ken Basin or Sonar Bearma Basin by Rai (1969). After the confluence of Sonar-Bearma, the Ken enters Panna district and crosses the Vindhyan scarp northwards. It transverses the 'Jamuna Par' plain and falls in Jamuna. Across the Vindhyan scarp Ken flows through a deep gorge and its tributaries make several waterfalls. The Gangau dam has been constructed in this gorge and the water is being used for irrigation in its lower plain. However, the present area under study is drained by the lower Ken and its tributaries like the Barana, Burma, Bane, Mirhasan, Kunti, Urmal, Kail and Chandrawali nadi.

The Lower Ken basin lies chiefly in the Bundelkhand upland, which stretches between the banks of the Yamuna and the outer scarps of the Vindhyan plateau. The southeastern or hilly portion is composed of the sandstone hills which forms the northwards escarpment of the great table land of central India. In the west the watershed of the basin is between the tributaries of the Dhasan and the Ken. While on the eastern side the basin is bounded by the Rewa plateau and the Tons basin (Fig. 2).

This region comprises of Vindhyan sandstones, Bijawars and the Bundelkhand gneiss which have their imprint
on the landforms and the drainage. The northern part of the Lower Ken Basin has been seamed by a wide area of recent deposition. The western part of the basin has vast area of old formations of Bundelkhand gneisses. The southern and eastern parts of the basin has Vindhyan sandstone and at places remnants of Bijawars are also found; especially in the western part.

Physical features: For a clear understanding of the physical and geomorphological features of the Lower Ken Basin it can be divided into some physical regions such as: The south eastern highland, the middle undulating peneplain and the north eastern alluvial plain.

The south eastern highland is also known as Bijawar Panna range, which has its maximum width in this area. This is an area of the maximum height of the basin which is about 1744' at Pandor pahar in the Bijawar country. Sharp ridges separated by narrow valleys form the water-parting and are conspicuous features of this region. Such ridges are found everywhere in the south eastern highland, especially notable are the Lawaniso Pahar and Dentla Pahar which are about 8 miles in length. It is noticed that the south western part of this region is more prominent than the south eastern part.

It has been observed that the rivers which flow across the Vindhyan scarp are of transverse nature and make deep gorges and plunge through several water falls.
The Ken river poses a major question, for it flows through precipitous gorge some 60 kms long across the three high ridges of massive sandstone. On the contrary, the Ken in its upper basin flows in an open valley. This is the main problem of the region under study and has been dealt with in detail in the section of the evolution of drainage. After crossing the Vindhyans scarp the Ken flows from south western to north eastern direction towards the Yamuna river. Its important tributaries are Saimri, Burana, Barana, Bane and Mirhasan which are flowing into deep gorges or narrow valleys. It may be noted that a number of small streams originate from the Panna range and before the confluence with the Ken, they develop a number of waterfalls in this region.

The middle undulating peneplain is the central part of the basin. Contour map (Fig. 14) of the basin shows that the maximum height of this region has been found at the Kandwah village, about 1088', while the minimum height at Rakshpurwa village which is about 889'. Its general slope is from south-west to north-east, and has very moderate slope. As we move from the south-west to north-east, the region revealed that the massif was peneplained at least once in its long history and its rivers were graded. But at present this region is the outcome of the weathering and fluvial erosion and the topography of this region has developed due to the intermittent uplift in different geological periods. It is noticed that the area associated
with big pinkish boulders or 'Tors' which are peculiar features of the Bundelkhand scenery. Another feature of this area is the long narrow serrated ridges which are known as quartz-reefs or dykes. These quartz-reef or dykes have originated due to the intrusion of igneous matter on a massive scale in the Bundelkhand gneisses.

The important rivers which drain in the middle part of the basin are Urmal, Khurar, Kail, and Kutani. The Urmal rises in the south-western part of the Chhatarpur near Bundhor village, flows in north-east direction and joins the Ken river near Sidhbaba hills. Obviously the quartz-reefs and dykes have very frequently intercepted the courses of the streams obliquely and dammed their channels which in turn have cut and flow through narrow gaps with sufferance in the region under study. It is also noticed that mostly the streams have developed dendritic pattern due to the homogenous structure. The study of stream courses and geomorphic features of this region, reveals that this area, since its inception, has remained a stable mass and has withstanded for long the effects of weathering and denudation.

North-eastern alluvial plain lies chiefly in the plain of Bundelkhand, which stretches between the plain of the Ganga and the northern scarp of the Vindhyans plateau. The maximum elevation is found in the southern part of the region about 492' at Amarrar village, while
minimum height is found at Man village and is about 435'. As we move from the margin of the Bundelkhand gneiss towards the north, the region has been associated with the isolated hills and bad land. "Though the hills are usually treeless the scenery is picturesque owing to their rugged outlines, and some of the artificial lakes are exceptionally beautiful. These magnificent reservoirs were constructed by the Gaharwar and Chandel Rajas, before the Mohammdan conquest, as sheets of ornamental water and consists of valleys or depressions named in by rocky hills and massive artificial dams" (1909). Imp. Gaz. Ind.)

Here the important tributaries of Ken are Chandrawali, Kail and Sirbu which originated on the Bundelkhand gneisses. This area has a gentle slope which causes the slow movement of water in the tributaries of river Yamuna which dams their water during floods. It is noticed that all the rivers of this area have developed meanders in their courses. Another peculiar feature of this region is an extensive ravine land found along the main streams as well as their tributaries. It is believed that the ravines are produced after the rejuvenation of the region due to the upliftment in different periods.

The northern undulating plain as a whole is a nearly flatplain with little variations in the general landscape. The plain revealed that the innumerable streams and nallas are flowing from the south-western to north-eastern
direction and have scoured out broad belts of ravine lands. In the greater part of the plain the old rocks are concealed by the alluvium of the trans-Jamuna plain and are the agricultural land of the basin.

**Importance of the area:** It is very interesting to study the evolution of the drainage and geomorphologically it is of great significance in the region. The unconformable behaviour of the Ken and its tributaries with the topography of the land appears significant and pulsforth a geomorphological problem for intensive study. Another important feature of the Ken river is that on right hand side, an account of Vindhyans and Panna range its drainage area is negligible and there is no major tributary.

Geologically the basin reveals different lithological characteristics of rocks, and naturally inspired to undertake the study of correlation of topography with the geology in the region. In the Vindhyans country sharp ridges, separated by narrow valleys from the water - divides are the most important features. While the Bundelkhand gneiss is a peneplained country which is dotted by long narrow serrated wall like ridges and big pinkish boulders or the 'Tors' which are peculiar features of the region. Other conspicuous features which attracted the author to study the geomorphology of basin are the extensive ravine lands in the alluvial plain of the lower reaches. A short and simple account of the geology of the Lower Ken Basin has given some major facts of physiographic interest and
urged the author to study the geomorphology and its relation with human life in the region.

**Earlier work in the region** : The geomorphology of the region under investigation has not been studied in detail in the past. In different parts of the adjacent area of the basin a large number of studies have been devoted and the work of Choubey (1966), Rai (1969), Pandey (1972), Subramanyam (1973) and Soni (1980), Chatterjee (1962) are significant. West and Choubey (1964) have written a paper on the Sagar-Katangi areas on the erosion surfaces. Two papers have also been written by Dube (1965, 1968) on the 'erosion surface and some aspects of the geomorphology of Rewa Plateau' which is the adjoining area of the region. Physiographic study has been done by Siddiqui (1966) in the physiographic division of Bundelkhand. Another significant work has been done by Dixey (1970) on the 'Geomorphology of Madhya Pradesh'. In the field of geology Mallet (1969) has done work on the eastern part of the Vindhyan basin and published his observations in a Memoir of the Geological Survey of India. Although the work done by Mallet is extensive and does not deal with the details of the geology, but his work is an outstanding contribution on the Vindhyan system. Mathur (1960, 1962) has also done an outstanding contribution on the Bijawar and Vindhyan system at Panna area. W.L. Wilson had also done work on the geology of Sagar Damoh district and mapped it on the scale one inch to two miles. It may be noticed here that this plateau is part of the upper Ken
basin. The study of geology of Lower Ken basin is mainly based on the unpublished geological map of Wilson (1868-70). Using the map 54P, 540, 63C, 63D, toposheets and some part of the published map by the Geological Survey of India; the geological map of the Lower Ken basin has been prepared. Thus it may be said that the geomorphology of the basin has not been systematically studied till now.

Outline of the work: For understanding the geomorphology and its effects on the human life the Lower Ken basin has been divided into various chapters. There are as follows:

After introducing the subject in first chapter the second chapter deals with the geology of the Lower Ken basin. The region comprises of Vindhyans sandstones, Bijawar series, the Bundelkhand gneiss and the recent deposits. In this chapter while discussing the Bundelkhand gneiss its location and extent beyond the area, geological formation, the condition of origin the age and classification has been described. The Bijawar series has been described in terms of lithological characteristics, classification and distribution in the basin. The characteristics, the mode of formation, the conditions of sedimentation, the age and distribution of the Vindhyan system has been analyzed in detail. While discussing the recent deposits, its lithologically characteristics, types and distribution in the basin has been given in detail, and mineral wealth of the region has also been described.
Third chapter deals with the correlation of topography and geology with drainage. While discussing the Bundelkhand gneiss, its effects on rock and relief, the landforms produced, adjustment of drainage has been discussed. In the same way for the Bijawar area the effect of nature of formation on the landforms and drainage has been described. In the discussion of Vindhyan system its influence on landforms and arrangement of drainage has also been described in detail. While discussing the recent deposits their effect on the development of a plain and its pattern of drainage has been highlighted. It is in this region that badland has appeared in the recent geological part.

Geomorphic processes and their analysis has been given in the fourth chapter. In this chapter different types of weathering, the intensity of weathering on various underlying formations has been discussed. In the same way while discussing factors which effect the weathering and the expression in the form of topography has also been discussed. Climate of the region and its influence on the weathering has been discussed in detail. Evolution of the hill side slopes and their elements such as crest, scarp, debris slope and pediment have also been included in this chapter.

Chapter fifth includes an account of the fluvial geomorphic processes and drainage. The nature of fluvial erosion and adaptation of drainage to the underlying formations has been discussed. The evolution of drainage system
and the frequency of the drainage of the whole basin has also been discussed. This is another part of the drainage which gives important results for the geomorphic features of the basin. In this way six streams basins have been selected and their density, frequency, linear and aerial arrangement has been analyzed in detail. Various drainage patterns have also been analyzed in this chapter.

Fluvial geomorphic processes and their effects on the landforms of the basin have been discussed in the sixth chapter. While discussing the simple profile, superimposed profile, longitudinal and cross profiles have been described. In this section the analysis of the average slope has been done, which is based on the map drawn with the help of maximum and minimum slope. Using the morphometric analysis such as superimposed profile, longitudinal and cross profiles, area height curve and altrimetric frequency curve, various erosion surfaces have been identified in the Lower Ken Basin and the adjoining area. The evolution of the drainage system and adaptation of drainage to the underlying structure or the nature of the Ken river has been described in detail.

In chapter seventh the classification and identification of various terrains in the region under study has been analyzed in detail. In the region important terrains are nearly flat plain, irregular or undulating plain, dissected plain, dissected table land and highly dissected table land.
The chapter eighth and the last in the present work contains the application of the geomorphology on the human life, of the region. In this section the human settlements have been discussed in detail. Distribution and growth of population in the region under investigation has been described. Location and pattern of settlements has also been discussing in details. Development of transport and communication of the region has been described. In this chapter attention has been focussed on the correlation of geomorphic features and human settlements of the region under study.
References:


Chatterjee, S.P. (1962) Ibid.


