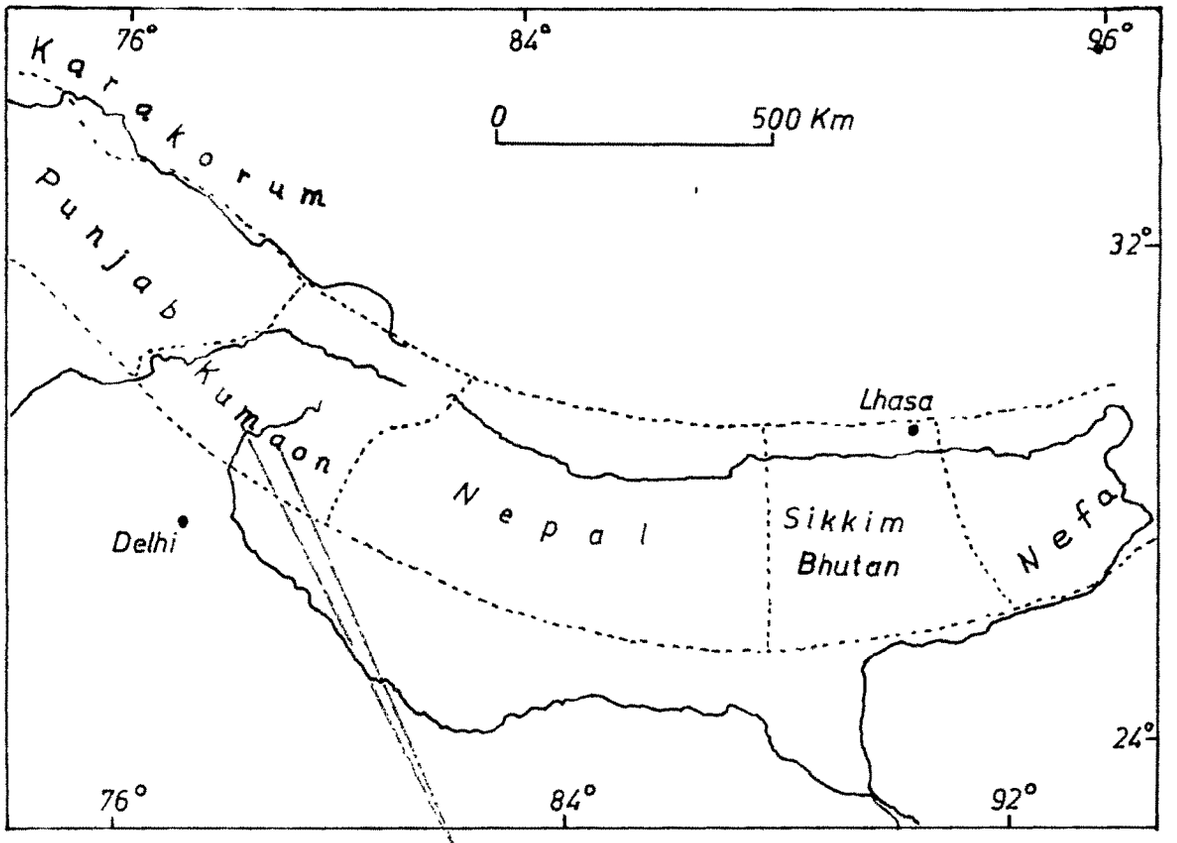
CHAPTER I

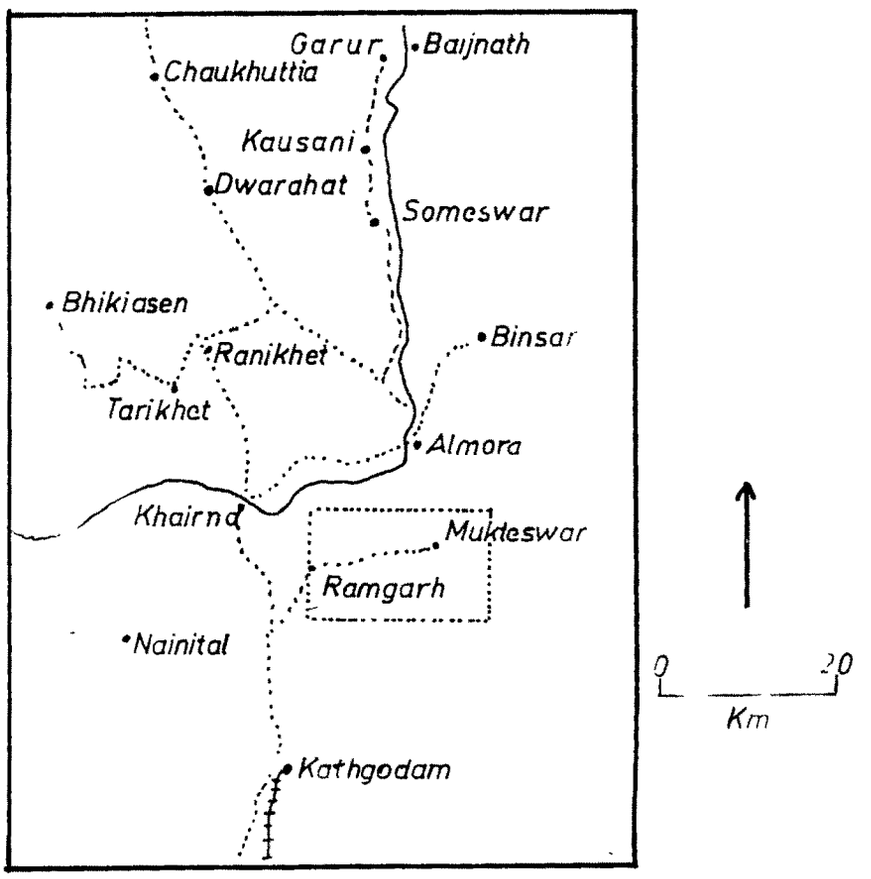
I N T R O D U C T I O N

The Ramgarh-Mukteswar area is one of the crucial and geologically important terrains of the Kumaon Himalaya (Fig.I.1). In the past, several workers have mapped this area but none have worked out correctly its stratigraphy and structure, and as a result, a number of problems related to the geology of the Kumaon region as a whole have remained unexplained. The author took up the present study to decipher in detail all aspects of the geology of the area with a view to understand the regional problems. The subject matter of the

Location Map

Fig.I.1.





thesis, which is a faithful account of the author's investigations, and interpretations, fully justifies the need and scope of the present study.

HIMALAYAS IN GENERAL

The Himalayas have been attracting geologists for the last hundred years or more. Their studies have contributed much toward the proper understanding of the geology of this magnificent mountain chain. Himalayas, however still pose a big problem, and inspite of the attention which they have received of late, only the fringes of the problems connected with their origin, age, lithology, metamorphism, structure and mineral resources, have been explored.

The Himalayan mountains geographically consist of the following four sections:

(1)	Panjab Himalaya	between the rivers Indus and Sutlej	550 km long
(2)	Kumaon Himalaya	between the rivers Sutlej and Kali	320 km long
(3)	Nepal Himalaya	between the rivers Kali and Tista	800 km long
(4)	Assam Himalaya	between the rivers Tista and Brahmputtra	720 km long

The Himalayas are also classified into the following three longitudinal or parallel zones:

(1) The Great Himalayas are the innermost line of high ranges, rising above the snowline. Their average height extends to 6,080 metres. The major peaks included in it are Mt. Everest, Karakoram, Kanchenjunga, Dhaulagiri, Nanga Parbat, Gasherburm, and Nanda Devi etc.

(2) The Lesser Himalayas or the middle ranges are closely related to former, but are of lower heights, from 3648 to 4560 metres. The lesser Himalayas form an intricate system of interconnected ranges, their average width being 80 km.

(3) The Outer Himalayas or the Siwalik Ranges have average height of 912 - 1216 metres and their width varies from 8 to 48 km.

On the basis of geological structure and age, the Himalayas are divided into three broad stratigraphical belts or zones. These zones do not correspond to the geographical zones as a rule.

The northern or Tibetan zone is composed of a continuous series of highly fossiliferous marine

sedimentary rocks, ranging in age from the early Paleozoic to Eocene age. On the Indian side, except near the north western extremity (in Hazara and Kashmir), rocks belonging to this zone are not encountered. This zone lies behind the highest elevation (i.e. the central axis corresponding to the Great Himalayas).

The Central or Himalayan zone includes the Lesser or Middle Himalayas together with the Great Himalayas. It is mostly composed of crystalline and metamorphic rocks, granites, gneisses and schists with unfossiliferous sedimentary deposits.

The outer or Sub-Himalayan zone corresponding to the Siwalik ranges, and composed almost entirely of Tertiary, and principally of upper Tertiary sedimentary river deposits.

The outer or sub-Himalayas are structurally quite simple. The series of broad anticlines and synclines of the normal type and reversed overthrust fault characterise these sub-Himalayan ranges. The Main Boundary Fault which separates this zone from central zone is a prominent thrust which extends all the length of the Himalayas from Panjab to Assam.

The succeeding zone is a belt of more compressed isoclinal folds, strictly autochthonous in their position. This, in turn is generally followed by a system of recumbent overfolds severed by thrust plane; along which large slices of mountains have moved bodily southwards, characterising the nappe zone of Himalayas.

The structure of the Inner Himalayas has not been investigated, and a great deal of work remains to be done before anything definite about the structures of these parts can be said.

RAMGARH-MUKTESWAR AREA

Location:

The terrain investigated comprises a rectangular area of about 150 sq km enclosed by E. Longitudes 79°30' to 79°40' and N. Latitudes 29°30' to 29°45'15", and within its limits lie the villages of Ramgarh and Mukteswar. In the west, the area extends upto Holi village, while its eastern boundary is marked by the village Led Banga. On its southern boundary is the village Musakharak while the northern limit runs from the villages Lohali in the west to Chhataula village in the east.

Ramgarh is about 11 Air-km to the east of the famous hill station of Naini Tal.

Topography:

The area shows a highly rugged terrain (Plate I.1). The hills belong to Gagar range of Kumaon and form the outer part of Nag-Tibba range of the lesser Himalayas. The physiographic features of the area, expressed as hills of varying heights dissected by a number of valleys of rivulets, rivers and nalas, and gorges, are related to and controlled by the lithology and structure of the rocks. The shape of the high ground in general tends to show elongation in one direction with tendency for flat tops. On the whole, there are three trends of ridges. Ramgad river separates two ridges, one in the northern and the other in the southern part, both extending almost E-W. These two ridges are joined by a NNW-SSE ridge, in the eastern part of the area. This ridge is made up of Almora nappe rocks, and its direction is almost parallel to the strike of the formations. The elevation of the region varies approximately from 969 to 2508 metres. The highest hill of the area is that of Khaprad (2508 m). The

PLATE I.1

Panoramic view of the Ramgarh-Mukteswar area.

other conspicuous summits are Hartola (2282 m), Mukteswar Mahadev temple (2331 m) and Somerford orchard (2321 m).

Mechanical and chemical erosions have played an important role in the evolution of the landscape of the region. The action of frost aided by rain and running water is the dominant agent of denudation in carving out the ravines. The fast and rapid decay of softer rocks, has given rise to steep slopes.

Drainage:

The principal stream of the area is Ramgad, which flows from east to west and meets Kosi river between Ratighat and Garampani. Deep valleys have formed at a number of places all along its course.

The hills in the NE and SW exhibit a stream pattern which radiate in all directions from the hill tops. In the rest of the area, dendritic pattern is seen developed due to presence of competent and incompetent beds i.e. phyllites interbeded with quartzites. Most of the streams are seen to flow along weak zones and foliation planes.

Climate and Rainfall:

The climate of the area is very pleasant and healthy. Average temperatures are 27°C during summer (Mid April-June) and 5°C during winter (November-January). The monsoon by westerly winds, which breaks earlier than the plains, lasts from the middle of June to the end of September, and the area receives about 1500 - 1700 mm of rainfall annually. Considerable snowfall takes place during the month of January.

Flora:

The vegetation varies according to the altitude. Sal (Shorea robusta), the Sain (Terminoua tomenstoa) etc. grow up to the elevation of 1700 metres. Above this altitude, higher up the Chir (Pinus longifolia) and banj oak (Quercus incana) are common. Among the fruit trees, apple, apricot, orange, lemon, peaches, walnut, plums etc. commonly grow. In fact, Ramgarh is famous for its orchards. Besides this, fig and kaphal are the common local fruits. Potatoes, onions, tomatoes, cabbage, peas, cauliflowers and other typical hill vegetables are usually grown by the villagers.

Fauna:

In the forest area, wild animals like leopards (Felis jabuta), Panther (Felis paradus) and black bears (Ursusto quartus) are common. Spotted deer (Carvas unicolar), jackles (Cavis querus) and pigs are more numerous. A wide variety of several species of birds are also found. In the forested valleys, large pythons are also occasionally met with. The domestic animals such as dogs (Canus jamilians), bullocks (Bos indicus), goats (Hemitragus Himalaya) and ponies are confined to the inhabited areas.

Agriculture:

The area available for cultivation is rather limited, and is confined to the terraced fields made on the slopes of the hills. The northern slopes which are facing the snow peaks are suitable for apple gardens. The area is famous for its apples. In the fields low down near the irrigating streams, are grown good quality rice and wheat.

During the year, two crops are obtained, the 'Kharif' and the 'Rabi'. Rice and 'mandua' are the chief Kharif crops, while the principal Rabi crops are wheat, barley and mustard.

The irrigation is mainly accomplished by means of small canals called 'guls' cut along the contours of the hill and fed by springs and hilly streams.

Habitation:

The population mainly comprises of Hindus, though some Muslims and Christians are also there. Most people speak the local dialect Kumaoni, while others speak either Hindi or Urdu as their mother tongue.

Communication:

Ramgarh is connected with the nearest railway station Kathgodam, a terminus of NE railway in south by a 50 km long all-weather motorable road. Mukteswar is 26 km, away from Ramgarh and connected by a motorable tar road. Ramgarh and Mukteswar are also connected with Nainital by a good road. The importance of Mukteswar is on account of the Indian Veterinary Research Institute, which is situated there and is one of the important research institutes of the country.

SCOPE OF PRESENT WORK

The author spent an aggregate period of about 25 weeks in the field during the summer and autumn months of the years 1967, 1968 and 1969. The area forms a part of the 1 Inch Survey of India Topographical

Sheet No. 53 O/11. The mapping was carried out on a 1:15840 scale (enlarged from the original 1" = 1 mile Toposheet).

The rock types encountered in the area, belong two tectonic units - Almora nappe and Krol nappe, separated by the South Almora thrust. The rocks of Almora nappe show a structural and metamorphic history quite distinct from that of the rocks of Krol nappe. The author visited as far as possible, every individual outcrop, and systematically recorded the lithology, field characters and structural elements. In all 1700 foliation and bedding readings were taken, and 400 samples collected. The structural data compiled consisted of 500 readings of linear structures, in addition to those of planar structures.

The field data supported by laboratory studies were utilised to prepare a detailed geological map of the area. The thin section studies of 225 rocks and chemical analyses of 40 specimens were utilised for working out the petrology, metamorphism and migmatisation of the area.

The structural data were plotted on the map and also analysed stereographically on Schmidt Equal Area Net, the results of which were utilised in working out the structural pattern and evolution of the area.