CHAPTER I

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

PURPOSE OF STUDY

The investigations in the Bhimtal area by the author form a part of the programme of detailed mapping of the parts of central Kumaon Himalaya by Prof.S.S.Merh and his research associates at the M.S. University of Baroda. The various adjoining areas have already been or are being investigated (Patel, 1972, Devendra Pal 1973, Shah 1973).

The Bhimtal area of Kumaon has attracted many geologists in the past. The various lakes situated in this region have intrigued almost all the previous

PLATE 1.1

Panoramic view of Bhimtal valley (looking from Bhowali)

workers, and considerable attention has been paid by them to explain the origin of these lakes. Equally interesting are the basic rocks of Bhimtal area. For the last several decades, these trappean rocks and the associated and overlying metasedimentaries, have been an object of much interest. A number of workers have referred to these rocks in their reports and papers. But unfortunately, none of the previous worker has dealt with the geological complexity and nature of the basic rocks of the Bhowali-Bhimtal area. Professor S.S. Merh, who has been working in the Naini Tal and Almora districts of Kumaon since last 12 years, in the course of his brief visits to Bhowali and Bhimtal, realised that if this area was studied in detail many new and important facts might be revealed.

It was at the instance of Prof. Merh that the author took up this study. This thesis contains a detailed account of the investigations carried out by him on the Bhimtal area, and the subject matter contained in the following pages amply justifies the study. The author has been able to throw much light on many hitherto unexplained problems connected with the geology of the Bhimtal area and his contribution goes a fairly long way towards a correct understanding of the stratigraphy of

the rocks and the nature of the metabasics. The author has also succeeded in unravelling the complexity of the peculiar anticlinal structure, within the core of which occur the trappean rocks.

THE STUDY AREA

The study area (Fig. 1.1) comprises the terrain of about 80 sq km, enclosed by E longitudes 79°30" to 79°36' and N latitudes 29°19' to 29°24' (Survey of India, Topo Sheet No. 53 O/11).

The famous lake of Bhimtal lies almost in the centre of the area. Within its limits, also lie the lakes of Sat Tal, Puna Tal and Nakuchhiya Tal.

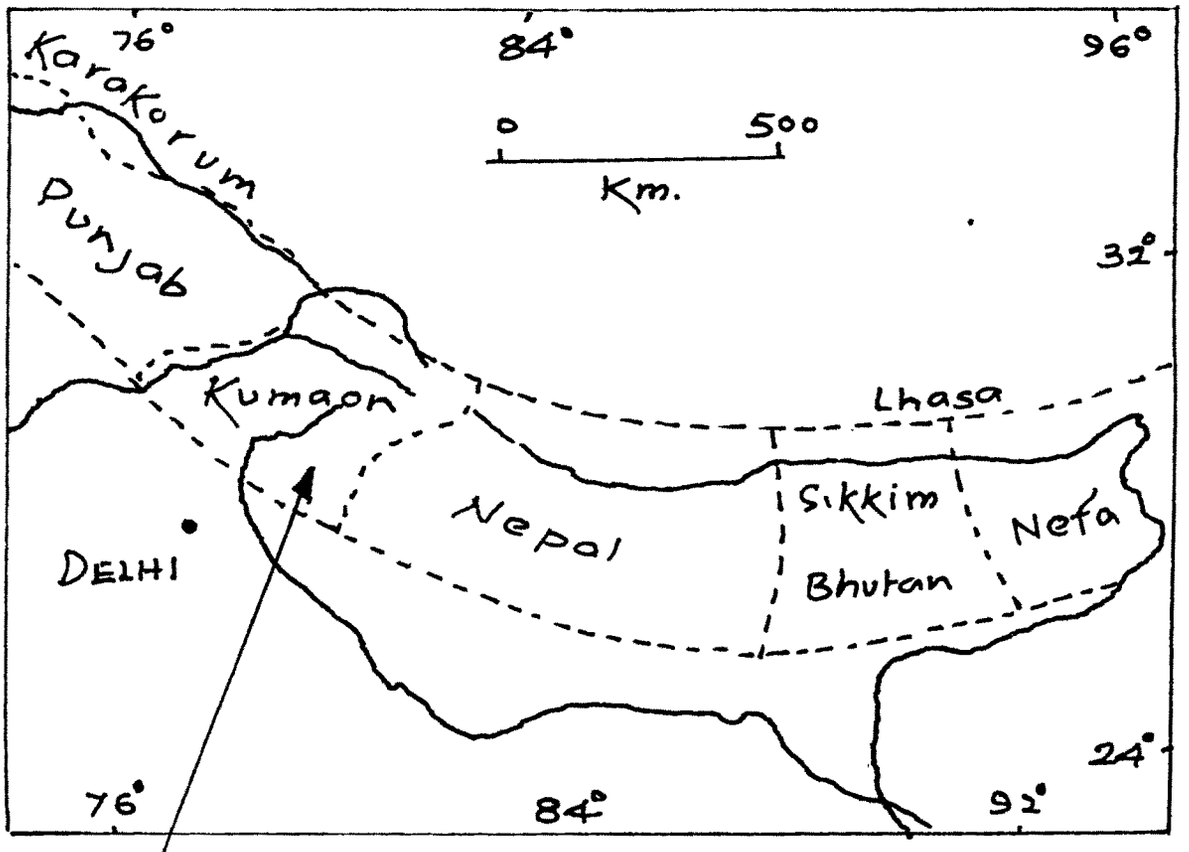
Location

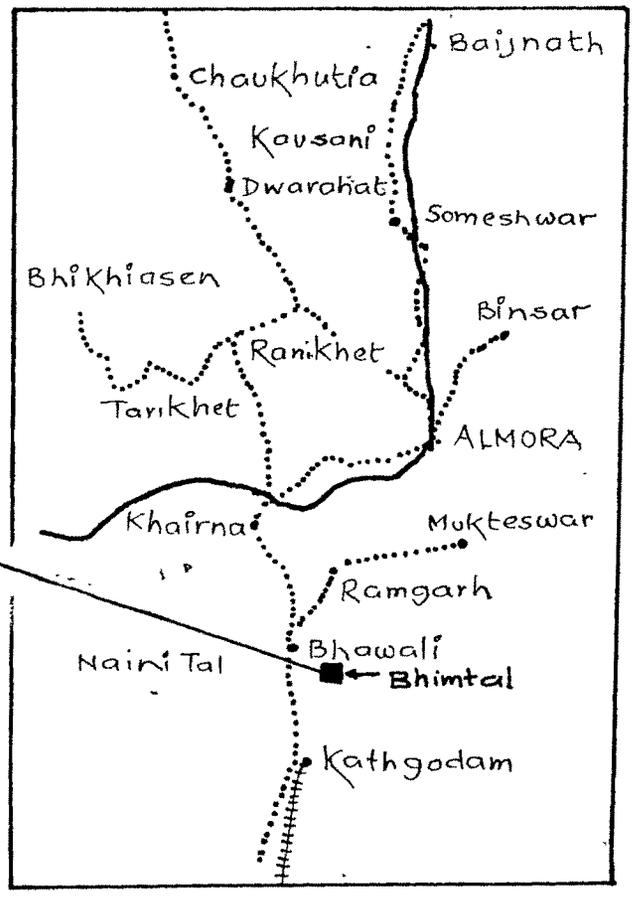
The northern and southern limits of the area are marked by the E-W lines passing through Bhowali Sanitorium and Nakuchhia Tal respectively, while the eastern and western limits are marked by the N-S lines passing through Champigad and Sat Tal respectively.

Communication

Kathgodam is the nearest railway station, a terminus of NE Railway. It connects the town of Bhowali in the north by a 35 km all-weather motorable road. Bhimtal is only 8 km SE of Bhowali, and is connected by a motorable

Fig.1.1 LOCATION MAP





tar road. On the main road at a distance of about 2 km from Kathgodam, a road bifurcation near Ranibag also leads to Bhimtal directly. Buses ply on both these routes. Apart from the roads, there are numerous mule-tracks and foot tracks which connect different parts of the area and are generally used by the local people.

Topography

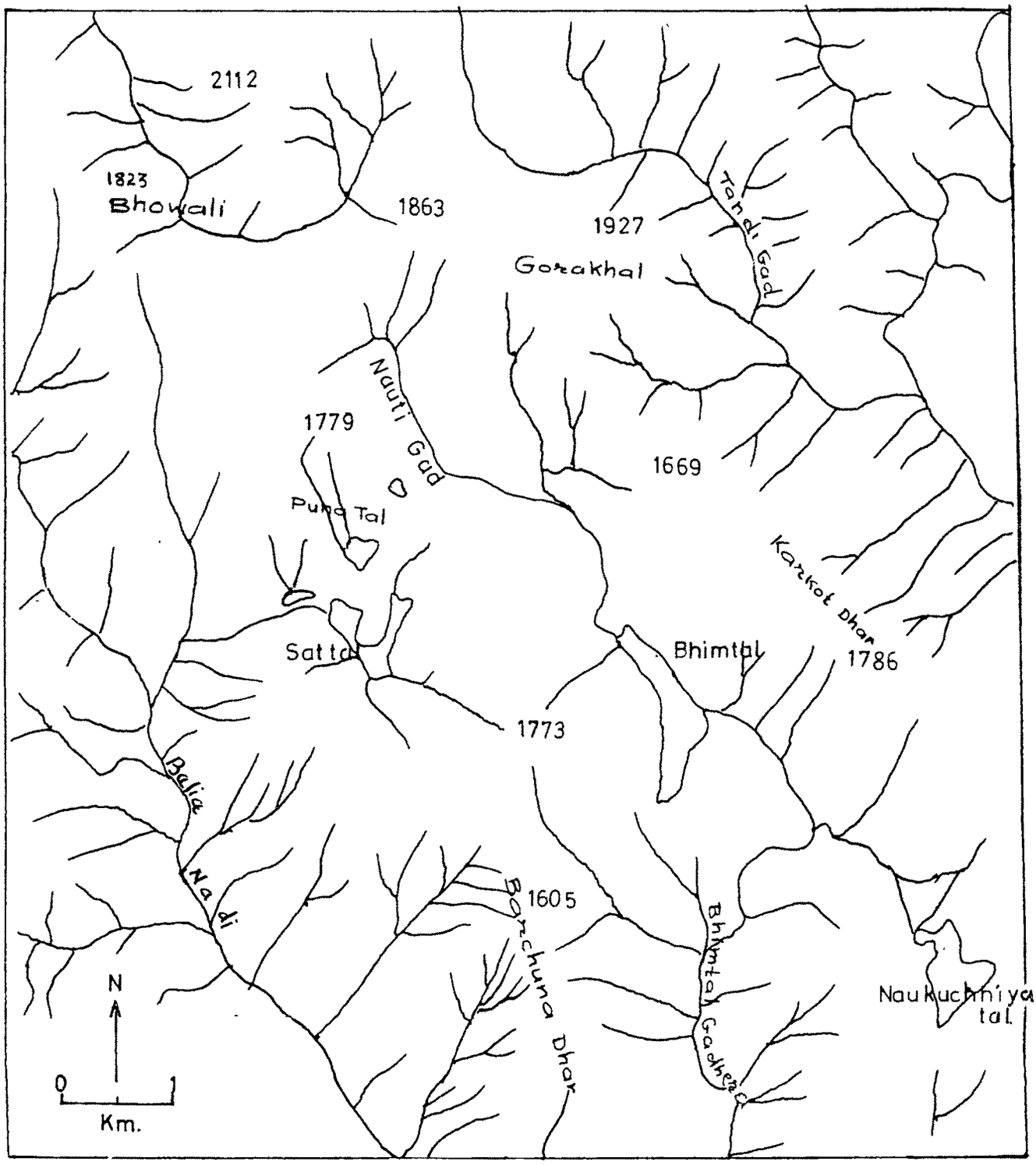
As far as topography is concerned the terrain is highly rugged and comprises such features as broad valleys, low and high hills, escarpments, gorges, nalas and rivers. The NW-SE extending median portion forms a step like broad valley containing various lakes and intervening terrace like flats. To the east and west of this line of lakes lie the high hills with cappings of quartzites, below which lie the trappean rocks. These ridges on both the sides of the diagonal valley represent the two flanks of an assymetrical anticline. It is obvious that the denuding agents have played an effective role in carving out a wide erosional valley sloping towards Nakuchhiya Tal, thus exposing the trappean rocks of the core portion of the anticline. All over the area, the NW-SE trending sharp elongated ridges, generally slope gently towards NE but rise more steeply along their SW slopes. The ground to the NE of the line of lakes, includes

the high ridges and peaks 1863 m, 1927 m, 1926 m, 1786 m. Further NE, these ridges slope down to form a NW-SE river valley, beyond which the ground rises again. Bhowali in the north-western corner, is situated at a height of 1715 m. The ground to the SW of the Bhowali-Bhimtal line is also fairly rugged and contains tortuous ridges with steep south-westerly slopes. The highest points are marked by the peaks 1779 m, 1773 m, 1605 m. These high peaks slope southward into the valley of the river Gola (Fig. 1.2).

Drainage

Broadly speaking (leaving aside the numerous smaller streams that drain the slopes of the various hills and ridges), the more prominent streams show a south-easterly flow. Due to the ruggedness of the terrain, no clear cut picture of the drainage pattern is seen but, in a general way, it is seen that the various small streamlets flowing down the slopes of the high ridges, join one or the other streams, which ultimately give rise to a few south-easterly bigger streams. There are three big streams of which the most prominent one is the Gola river in the extreme south, just outside the limits of the investigated area. It flows due W and receives water from the various south-west flowing smaller streams that drain the slopes of

FIG. 1.2 Drainage Map



Barchuna Dhar. Another conspicuous stream, Nauti Gad is that which originates near Bhowali and flows due SE and meets the Bhimtal lake. Perhaps it is the same stream which flows out of the lake due south and meets the river Gola. This stream is known as Bhimtal Gadhera. Another important stream is Champi gad in the NE. It originates along the slopes of Tani peak as Tandi Gad, meets Kalsa Nadi (that flows from E to W) and finally flows due SE meeting the Malwa Tal. A very significant feature of Kalsa Nadi and Champi gad is that these show the phenomenon of incised meandering. All these streams except Gola, contain little water during the summer months (Fig. 1.2).

Climate and Rainfall

The climate of this part of Kumaon is pleasant and healthy, and the town of Bhowali is well-known as a health resort since last 100 years. The noted sanitorium here is one of the very old establishment providing treatment to T.B. patients from all over the country. The temperature in the summer does not go beyond 22°C, while in the winter it goes down to 5°C. The low lying valley regions of Bhimtal and Sat-Tal are more enjoyable in winter. 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 anually. The area receives occasional snowfall in the month of January.

Fauna

Numerous wild animals inhabit the region but they are generally confined, to the thickly forested hill slopes, particularly in the Sat Tal region. Some decades back, tigers inhabited the forests, but now they are extinct. The existing wild life comprises leopards, panthers, wolves, and black bears. Spotted deer and jackels are quite common. Many varieties of birds are also met with. The domestic animals such as dogs, cows, buffaloes, goats and ponies are confined to the inhabited areas.

Flora

The vegetation is generally controlled by the altitude and the soils derived from the different rock types. Sal and Sain grow upto an altitude of 1700 meters. Beyond this, the Chir and Banj oak are common. Among the fruits, apple, apricot, orange, lemon, peach, walnut and plum etc commonly grow in orchards. Besides this, fig

and 'Kaphal' are the common wild fruits. In the villages are grown potatoes, onions, tomatoes, cabbage, peas, cauliflower and other hill vegetables.

Agriculture

Cultivation is confined to the gentle slopes of the hills and in the flat river valleys. The cultivated fields on the hill slopes are terraced. Rice and 'mandua' are the chief Kharif crops, while the principal Rabi crops are wheat, barley and mustard.

Habitation

Bhimtal, though a small place, has always attracted tourists who visit the place for its natural scenic beauty. In recent years, Bhimtal is now gradually being developed to attract more visitors. Bhowali is a bigger place and a well developed small town, known all over the country for its T.B. sanitorium. Recently a Sainik School has been started at Ghorakhal, 3.5 km E of Bhowali. As the town of Bhowali is situated on the main roads that connects Kathgodam and Naini Tal to Ranikhet, Almora and other places further north, it has grown into a fairly good marketing centre.

The population in the area consists mainly of Hindus, though some Muslims and Christians are also present. The

majority of the people speak Hindi and the local Kumaoni language.

SCOPE OF INVESTIGATION

The author has already mentioned the importance of the study area. Geologically, it required a thorough investigation to (1) unravel its structural complexity (2) to establish the age and stratigraphy of the quartzites and slates that overlie the traps and (3) to fully understand the true nature of the trappean rocks.

The author extended his studies as far as the Ramgarh thrust in the NE, so that he could establish the age relationship between the Bhowali Bhimtal fold and the thrust. The scope of his investigation was broad-based and included almost all aspects. He systematically visited all parts of the area and collected samples and structural data from each accessible outcrops. Wide stretches of terrace deposits, inaccessibility in many parts, predominance of quartzites, and abundant and unpredictable joints in trappean rock, were the main handicaps encountered by the author in collecting his data. He could record only a limited number of dependable readings of linear and planar structures. However, carefully planned traverses

and tracing of the exposures of various rock types, enabled the author to prepare a fairly detailed geological map, that reveals not only the distribution and extent of various formations, but also shows the structural pattern very well.

The author was introduced to the area by Prof.S.S.Merh and Dr. N.M. Vashi in the winter of the year 1968, and since then he has spent about 24 weeks in the field during summer and winter months of the years 1968, 1969 and 1970. The mapping was carried out on a map of scale 4" to a mile (R.F. 1:15825) enlarged photographically from the Survey of India Toposheet No. 53 O/11.

In working out the structure and stratigraphy of the rocks, the author has taken help from the mapping done by Shah (1973) in Garampani, and Devendra Pal (1973) in Naini Tal area.

A salient feature of his study is the detailed account of the trappean rocks. The author has attempted to map the area occupied by the traps, delineate its different varieties, and investigate their petrography and chemistry. Of course, the basic rocks required more attention to know more details of their true nature and

origin, but looking to the scope of the present studies, the author's findings, are quite new and revealing. The author has established their spilitic nature and has also shown that they are penecontemporaneous volcanics forming part and parcel of the depositional sequence that overlies them.

The different aspects of investigations conducted by the author, have led him to arrive at the following conclusions:

1. The anticlinal structure of Bhowali-Bhimtal shows effect of two folds events, such that the main anticline (F_1) has been twisted by a late (F_2) fold.
2. The Ramgarh thrust cuts both F_1 and F_2 structures.
3. The basic rocks of Bhimtal form a feebly metamorphosed spilitic suite, and comprise diabase and basaltic varieties associated with tuffs and tuffites.
4. The overlying quartzites and slates perhaps could be correlated with Blaini and not with Nagthat as believed by earlier workers.
5. The spilites represent volcanism that formed an integral part of the geosynclinal event which gave rise to the sedimentary sequence extending without any break upto Naini Tal and which has been correlated with the Krol group (Blaini-Infra Krol-Krol).