PART I : GENERAL

CHAPTER 1

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

The Himalayas have always posed a challenge to the geologist. The enigmatic nature of the geology of the Himalayas has made their study both exciting and rewarding, and it is only after investigations for about a century that a fairly clear outline of the geological evolution of the Himalayas is now beginning to emerge. Nevertheless, the results obtained so far are a minor fraction of the answers sought; much more still remains to be done to understand the Himalayas fully.

The investigations in the Someshwar area by the author comprise a part of the bigger programme of

detailed mapping of the Central Kumaon Himalayas by Professor S.S. Merh and his students of the M.S. University of Baroda, and the results that are included in this thesis reveal interesting stratigraphic and structural details hitherto unknown. The study area includes parts of the three major tectonic units of Kumaon - viz. the Almora nappe, the Krol nappe and the Baijnath nappe.

HIMALAYAS IN GENERAL

Geographically, the Himalayan mountains can be divided into four major sections:-

	Extent	Length
Punjab Himalayas	Between the rivers Indus and Sutlej	560 km
Kumaon Himalayas	Between the rivers Sutlej and Kali	320 km
Nepal Himalayas	Between the rivers Kali and Tista	800 km
Assam Himalayas	Between the rivers Tista and Brahmputra	720 km

The Himalayas have also been longitudinally divided into three parts.

The Great Himalayas form the innermost line of the mountain ranges above the snow-line. The average height of these extends upto 6080 metres. The major peaks

included in the Great Himalayas are Nanda Devi, Gosainathan, Nanga-Parbat, Dhaulagiri, Kanchenjunga, Karakoram and Mount Everest etc.

The Lesser Himalayas are at a considerably lower elevation than the Great Himalayas, but are closely related to the latter. They do not generally rise beyond 4500 metres. The average width of the Lesser Himalayas is about 80 km within which they form an intricate system of interconnected ranges.

The Outer Himalayas or the Siwalik Ranges show a considerable variation in width, from 8 to 48 km, and are the last chain of hills before the plains begin. The average height of these low foot-hills varies from 900 to 120 metres.

Another important general classification of the Himalayas is based on their age and structure. According to this, the Himalayas have been divided into three broad belts or zones which do not necessarily correspond to the geographic zones.

The Northern Tibetan Zone lies beyond the line of highest elevation, viz. the Central Himalayan axis, and is characterised by a continuous series of marine

sedimentary rocks with well preserved fossils in them. The age ranges from early Palaeozoic to Eocene. Except in Hazara and Kashmir, rocks belonging to this zone are not known to occur south of the lines of snowy peaks.

The Central or Himalayan Zone consists of the Great Himalayas and the Lesser Himalayas grouped together, and is composed mainly of crystalline and metamorphic rocks - gneisses, schists and granites, and also unfossiliferous sedimentary deposits of Purana age.

The Outer or Sub-Himalayan Zone corresponds to the Outer or the Siwalik ranges and is predominently upper Tertiary sedimentary river deposits.

Considering the structure of the Himalayas as a whole the Sub-Himalayan ranges or the Outer Himalayas are relatively simpler, consisting chiefly of a series of broad anticlines and synclines. The characteristic tectonic features of the Sub-Himalayas are the reversed overthrust faults. The most prominent among these is the Main Boundary Fault extending along the length from Punjab to Assam.

A belt of more compressed isoclinal folds follows which, in turn is followed by a system of recumbent

overfolds, severed by thrust planes, along which large parts of the area show sliding southwards. This characterises the Nappe Zone of the Himalayas.

The geology of the Inner Himalayas remains more or less unsolved and it is not possible to arrive at conclusions without a great deal of investigations.

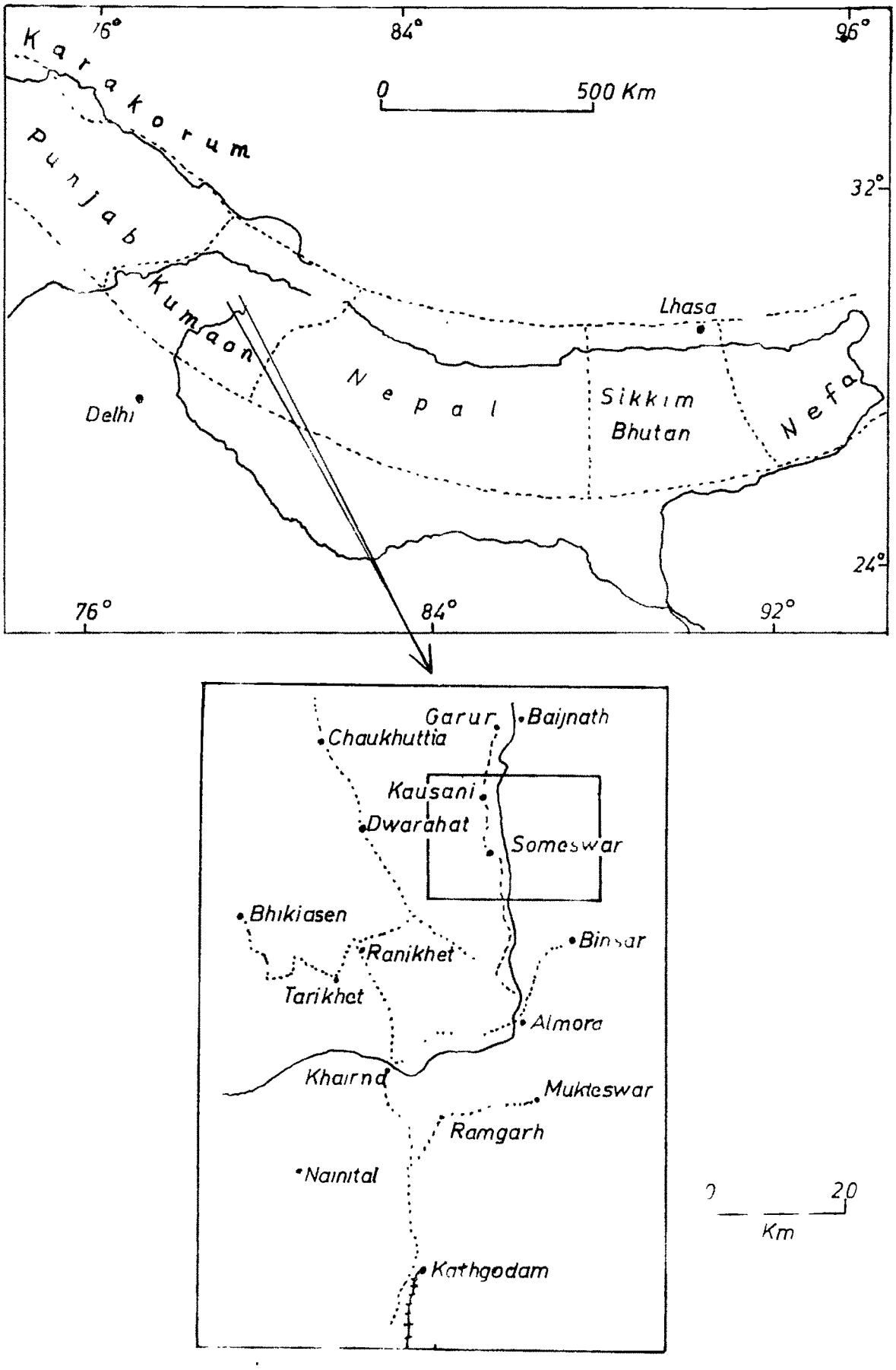
THE STUDY AREA

Location

The Someshwar valley lies about 40 km N of the town of Almora in the Almora District of Kumaon Himalayas (Fig.I.1). The area is a part of the Borarau Valley, famous for its fertile fields. The rocks investigated cover an almost rectangular area of about 166 sq km enclosed by E.Longitudes 79°31' to 79°40' and N.Latitudes 29°43' to 29°51'. The western extremity of the area is marked by the NS line west of the village of Lod, once famous for its tea estates, while the well-known temple of Gananath falls just outside the eastern boundary of the area. The northern portion is bounded by the EW line along Kausani - a place known for its view of the Himalayan snow ranges. The EW line south of the village of Manan marks the southern boundary of the study area.

Location Map

Fig.1.1



Topography

The area shows a highly undulating terrain and forms a part of the Nag-Tibba ranges of the Lesser Himalayas. The physiographic features of the area are structurally and lithologically controlled, and include such features as broad valleys, low hills, escarpments, gorges, nallas and rivers (Plate I.1). The higher grounds, though generally irregular, tend to show elongation at places. The north-western portion of the area is the highest, approaching about 1745 metres in altitude. In general, both the western and the eastern parts of the area are relatively high grounds which slope down towards the river Kosi which flows due south almost in the middle of the area. The heights of the ground in the west vary from 1830 metres to 2135 metres, while the eastern ground does not exceed 1830 metres except in the region about a mile south of Phaliati where the height approaches 2079 metres on account of a pronounced east-west ridge. About a mile south of the town of Someshwar, the area rises to a height of about 2000 metres rather abruptly and then levels down to gentle undulations right upto the southern extremity of the area. The lowest part of the ground, with an average elevation of 1300 metres is along the course of the river Kosi.

PLATE 1.1

Panoramic view of the Someshwar Valley

The river Sai flowing eastward from Lod to Someshwar, divides the western part of the area into two high grounds to the north and south of the river course.

Drainage

The river Kosi marks the principal drainage of the area and flows north to south through the middle of the area. It originates from a point about 8 km west of Kausani and flows southwards for a considerable distance. The Sai river enters the area near Lod and flowing due east and meets Kosi at Someshwar. This stream has a flat broad channel and except during the months following the monsoon, it contains very little water.

A majority of the smaller streams in the area are intermittent and seasonal. They in general, form a rectangular to sub-trellis pattern. The overall trellis pattern is formed by consequent streams flowing parallel to the dip direction and subsequent streams flowing parallel to the strike directions. The most striking feature of these streams is the typical rectangular pattern shown by them in the east-central part between the villages Mahar and Phaliati in the north, and Sunari and Jogiakhali in the south. Here the consequent streams follow a predominently east-west course while the subsequent streams trend north-south. The latter

possibly occupy planes of weakness due to pronounced NS joints in the region. The streams around the village of Subakot appear to be insequent and a result of topography connected to the North Almora thrust.

Streams are far less dense in the southern part of the area occupied by the schists and gneisses. Unlike the rest of the area, they deviate from a straight pattern and show a meandering tendency.

Climate and Rainfall

The Someshwar valley is well known for its pleasant and healthy climate. The average temperatures during the April-June period vary around 27°C and during the November-January period, vary around 5°C. Snowfalls during January are not uncommon. The rainy season lasts from about middle of June to September end. The monsoon arrives in the hill slightly earlier than it does in the plains. The average precipitation for the Kumaon varies from 1500 to 1700 mm.

Flora

In the Himalayas, the vegetation is generally controlled by the altitude. The present area shows growths from tropical to temperate, characterised by Cedars, Oaks and Pines. Upto the altitude of 1700 metres, Sal (Shorea robusta), and the Sain (Terminous tomentosa) grow. Beyond

this, the Chirs (Pinus longifoliea) and Banj Oak (Quercus incana) are common. The summers witness brilliantly coloured alpine spicies of flowers. Among the fruits, most common are apple, apricot, citrous fruits, strawberry, blackberry, and oranges.

Potato, onion, tomato, cabbage and cauliflower are the common vegetables grown by the villagers.

Fauna

The wild animals of the region are Leopards (Felis jabuta), Panthers (Felis paradis) and Black bears (Ursusto quartus). Also common are pigs, jackals (Cavis querus) and spotted deer (Carvas unicolor). The common domesticated animals are ponies, goats, bullocks and dogs. Birds show a wide range of varieties. Fish are abundant in the flowing rivers.

Agriculture

Besides the flat valleys, the other cultivable portions of the region are the gentle hill slopes on which terraced fields are located. The higher portions of the hill slopes contain relatively thinner soil cover, while the seirra lands near the bottom of the slopes are extremely fertile.

The two main crops for the year are 'Kharif' and 'Rabi', the chief products of the Kharif crop being rice and 'madua' and those of Rabi being wheat, barley and mustard.

Habitation

A major part of the population in the region consists of Hindus, both Brahmins and Thakurs. The rest are either Muslims or Christians. An influx of Tibetan refugees has of late taken place. Roughly two thirds of the people speak the local Kumaoni dialect and one third speak Hindi, Hindustani or Urdu. Nepalese is also spoken in some pockets.

Communication

A 40 km all-weather motorable road connects Someshwar to the town of Almora in the south. This road in turn further south connects Almora to the nearest railway station of Kathgodam, which is at a distance of 86 km.

SCOPE OF THE PRESENT WORK

Professor S.S. Merh started detailed geological investigations in these parts of the Kumaon Himalayas almost a decade ago and informative conclusions were drawn by him (Merh and Vashi, 1965) in the neighbouring Ranikhet area. Desai (1968) investigated in detail the Majkhali area and established the structure and metamorphism of the Almora

nappe rocks there. Since then, considerable progress has been made in unravelling the geology of this part of Kumaon. The author was introduced by Professor Merh to the area in the winter of the year 1967, and since then, he has spent a total of about 28 weeks in the field during the winter of 1967 and the summers and winters of the years 1968 and 1969. The area forms parts of the one-inch Survey of India Topographical Sheets No. 53 0/9 and 53 0/10. The mapping was carried out on a 1:15840 scale.

Each accesible outcrop within the area was visited and systematically studied. Various lithological units and their distinctions based on field characters were observed. Besides bedding and cleavage, structural elements such as minor fold axes, lineations and puckers were faithfully observed. The structural data thus obtained was analysed stereographically to elucidate the general structural picture of the area. Thin sections of 150 selected samples were critically examined under the microscope, and about 40 rock samples were chemically analysed. The detailed field mapping and structural analysis supported by a study of the petrography and chemistry, have revealed the true stratigraphy, structure and metamorphism of the area, hitherto unknown. The subject matter of this thesis is a faithful account of the author's investigations and conclusions.