CHAPTER 1

INTRODUCTION

The work included in this contribution entitled 'Contribution to the Geology of Dalhousie-Chamba Area, Himachal Pradesh, India' embodies the results of investigation carried out in a small area (about 200 square kilometres) of Dalhousie and Chamba region. The area forms a part of the Dhauladhar Range which is an oblique westward branch from the Central Crystalline Zone. The range essentially consists of crystalline rocks which were originally grouped by Stoliczka (1866) under 'Central Gneiss'. It has recently been observed that some of the gneissic rocks mapped by the early workers as Central Gneiss are in fact crystalline complexes made up of ancient metasedimentaries intimately mixed up with granitic rocks resulting at quite a number of places into regional migmatite complexes. The investigations by Gupta (1967) in the Central Gneiss Zone of the Dhauladhar Range north of Dharamsala showed that most of the gneisses and granites of that area are the result of migmatisation and metasomatic transformation of the metasediments rather than the forceful injection, and these migmatites, gneisses and associated metamorphites were transported to their present position during the later phases of the Himalayan orogeny.
Since Dalhousie region of the Lesser Himalayas forms a part of the Dhauladhar Range, the present author was assigned the investigation of the metamorphic and granitic rocks of this area to decipher the deformational history, mode of emplacement and age of granites.

Before outlining the geological set up of the area and details of the investigation carried out by other workers in this particular region, it would be in the fitness of things to give the longitudinal and transverse divisions of the Himalayas to facilitate understanding of certain terms used in the sequel.

Burrard and Hayden (1907-1908) subdivided longitudinally the Himalayan Range into four belts which from south to north comprise (Fig. 1.1):

i) The Sub-Himalayas forming the foot-hill zone with the average height from 900 to 1,200 metres and with width varying from 8 to 80 kilometres.

ii) The Lower Himalayas with an average height of 3,900 to 4,500 metres and width varying from 32 to 80 kilometres.

iii) The Higher Himalayas rising above 6,000 metres and comprising peaks like the Everest, the
Fig. 1.1. Map of the Himalayas showing various sub-divisions (after GANSSER, 1964) and location of study area.
Fig. 1.2. Map to show the relationship between the Great Himalayan Range (GHR) and the Central Crystalline Axis, Z.R. = Zanskar Range.
According to Sharma et al. (1973) 'The gradual passage of the fossiliferous Triassic rocks into the oldest Central Gneiss and schists suggests that these rocks are rooted here itself, and occur as autochthon and not as nappe as suggested by Wadia'. Wadia (1934) considered the Zanskar Range as a part of the Central Crystalline Axis. Subsequently various workers (Pande and Saxena, 1968; Fuchs, 1968; Saxena, 1971b) re-demarcated this axis in order to put the Kashmir valley on the northern side of it (Fig. 1.2).

No satisfactory answer to this problem has been reached and it is still under investigation by various workers in view of the conflicting evidences. However, the present investigation is confined to a small area which has been considered a part of the re-demarcated Central Crystalline Axis, i.e., the Pir Panjal-Dhauladhar Range (Fig. 1.2).

1.1 LOCATION AND MEANS OF COMMUNICATION

The area forms a part of the Chamba district in Himachal Pradesh, India (Fig. 1.3), and falls in the Survey of India toposheet Nos. 43 P/14 (2 centimetres to a kilometre) and 52 D/2 (1 inch to a mile). The area is bounded by East longitudes 75° 54' 30" : 76° 07' 25" and North latitudes 32° 31' 15" : 32° 38' 00". An all-weather metalled road connects Dalhousie and Chamba with Pathankot - the nearest railway station. Dalhousie is also connected to Chamba by a jeepable 56 kilometres road which passes through Khajiar - a well known tourist spot.
1.2 TOPOGRAPHY AND DRAINAGE

The area constitutes a part of the Dhauladhar Range, which literally means the "white crest" or the "white ridge". The Dhauladhar Range separates the basin of the Beas from that of Ravi. This range gradually declines in height, finally ending on the left bank of the river Ravi near Dalhousie.

The area possesses a marked relief with steeply rising hills and deep valleys. The maximum and minimum heights encountered in the area are 2756 metres and 708 metres above the mean sea level. The landscape of the area is mainly attributed to the parameters of lithology, structure and weathering agencies. Towards the north the general contour of the range presents a marked and striking contrast. The mountain sides are much less precipitous and the spurs splay off in long and gentle slopes, which decline gradually till they reach the river Ravi. The abrupt and almost perpendicular drop on the southern flank, and more gradual decline towards the north, is a general and prominent feature. The river Ravi is the main stream in the area. For the most part of its course, within the Chamba district, the river Ravi flows in a north-westerly direction. The valley is generally open but at Rajnagar it becomes narrow. Here the river takes a swing towards the west, and soon afterwards, is joined by the Siul river, its largest tributary. Still flowing westward, it enters the Jammu territory. The Siul river brings down
the entire drainage of the north-western portion of the Chamba valley.

The Khajiar lake lies about 1975 metres above the sea level, between Chamba and Dalhousie. It is an apology to call it a lake, its area being not more than 4000 square metres. The only utility of this body of water, at present, is the superlative touch that it imparts to the general scenic charm of the Khajiar glade and its surrounding forest.

1.3 SCOPE OF THE WORK AND LINES OF INVESTIGATION

The first report on the geology of the area is known from the work of McMahon (1881) who gave a passing reference to the geology of Dalhousie while taking a traverse from Dalhousie to Pangi. The first comprehensive account of the geology of Dalhousie-Chamba areas was given by McMahon (1882) who mapped the area for the first time on 1 inch = 4 miles scale and recognised two bands of granite and called them as the 'Inner Granite Band' (also known as Dalhousie Granite) and the 'Outer Granite Band' of Dalhousie (Fig. 1.4). The 'Outer Granite Band' forms a continuous mass and does not vary much in thickness which is usually from 120 metres to 150 metres. The 'Inner Granite Band' attains a thickness of 10.5 kilometres between Dalhousie and Chamba but thins out rapidly to nearly 75 metres towards northwest in the Ravi river section. It retains the width in its southeasterly
extension. The two granite bodies are separated by a folded sequence of low grade metasedimentaries into which according to McMahon (1882) these granites intruded. These unfossiliferous metasedimentaries, consisting of biotite schist at the base and slates at the top, were assigned a 'Silurian-Cambrian (?)' age by McMahon (1882). A brief account of the microscopic structures of Dalhousie rocks was given by McMahon in 1883. Lydekker (1883) mapped the Kashmir, Chamba and Khagan regions on 1 inch to 16 miles scale and grouped the granitic rocks of the Dalhousie area under 'Central Gneiss'. Subsequently, McMahon (1884, 1885, 1887, 1897) published a series of papers on the geology of surrounding areas in which only casual references appear on the Dalhousie Granite and associated rocks.

West (in Pemmar, 1935) equated the metasedimentaries with those of Chails (Algonkian) of Simla region of the Himalayas. Sehgal (1966) regrouped the various rock types of the Chamba and the adjoining areas, assigned local names and correlated them with those of Simla region. Thus, he suggested the name 'Chamba Group' for McMahon's Lower and Middle Silurian Series. Fuchs and Gupta (1971) compared these metasedimentaries with the Chails of Simla region and the Tanawals (Palaeozoic) of Kashmir valley. Chaku (1972) grouped these metasedimentaries and associated granites into Chail Formation. Rattan (1973) renamed these
metasedimentary rocks as Bhalai Formation and emphasized that there can be no correlation of the rocks of the Chamba area with those of the Simla, because the two regions belong to altogether different tectonic units — the Chamba to the Tethys Himalaya beyond the Great Himalayas, and the Simla to the Lesser Himalayan unit. He further stressed that in these parts of the Himalaya, the equivalents of Bhalai Formation are the Salkhalas of Kashmir and Vaikritas of Spiti which have been considered by Krishnan (1968) of the Lower Precambrian and Archaean age.

Datta (1973) read a paper on the emplacement of Dalhousie Granite in the fourth seminar on Himalayan Geology and the detailed paper has not yet been published.

Sharma et al. (1973) opined that the geology of Bhadarwah area and the Chamba area is identical and the formations of the former area continue into the latter.

From the perusal of the literature on this area, it is clear that besides McMahon's work, no exhaustive report is available on the granitic and metamorphic rocks of Dalhousie area. Therefore, the author intends to touch topics as mode of emplacement, internal structures of the granitic bodies, and the relationships between granitic bodies and their country rock structures and metamorphism.
The area was taken up for preliminary survey in November-December, 1970. The area was mapped in three field seasons, viz., May-June, 1971; May-June, 1972 and September-October, 1973. Keeping in view the nature of the granite bodies and their relationship with the surrounding metamorphosed and deformed rocks, mapping of the area was carried out on 5 centimetres to 1.6 kilometre scale. Detailed geological and structural maps of the area were prepared. During the course of the geological mapping, the relevant structural data including linear and planar structures were recorded. About 300 oriented specimens were collected both along and across the strike. In the case of the two granitic bodies, specimens at regular as well as at random intervals, showing the slightest mineralogical and textural variation, were collected. The structural data collected in the field were plotted on Schmidt's equal area net for further interpretation.

The laboratory investigations include petrographical, optical and chemical studies of the rocks. The petrographic work includes the study of thin sections under advanced petrological microscope. Swift point counter was used to determine the modal composition. Specific optical properties of some minerals, especially those of plagioclase feldspar were determined on Leitz 4-axes Universal Stage. The refractive indices of minerals were determined by immersion method and Abbe's refractometer.
On the basis of microscopic studies, a few rock types were selected for chemical analysis, which was carried out by rapid analysis scheme of Shapiro and Brannock (1962) using Hilger and Watts Uvispek Spectrophotometer and EEL Flame Photometer. Lime, magnesia and iron oxide were determined by titrations. Different variation diagrams were plotted with the help of coordinates calculated from chemical data.

The results of these investigations are incorporated in the succeeding chapters.