CHAPTER I

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

GENERAL

Nepal, the largest Himalayan kingdom, extends 800 km along the southern slopes of Himalaya between Longitudes 80° to 88° E and Latitudes 26° to 30° N. The country covers 14,100 sq. km., and average breadth is 160 km, and forms the central and longest section of the Himalaya. It not only provides the loftiest mountains of the world, but also is a land of close juxtaposition of contrasting altitudinal levels varying from 100 m to 8,848 m, with a wide variety of terrain and exceptionally rugged relief.

Geologically, Nepal Himalaya has not been adequately studied during the early half of the present century. Only after 1950, considerable geological work has been done in this section of Himalaya. Even then, the geology of Nepal remains exciting, rewarding as well as mysterious. Various aspects of the geological problems are completely untouched and those worked out are also subjected to controversies.

Most of the European workers (Auden, 1935; Hagen, 1969; Bordet, 1961; Bordet et al., 1964; Fuchs, 1967; Fuchs & Frank, 1970; Frank & Fuchs, 1970; Stocklin & Bhattarai, 1977; Remy, 1975) have recognised various thrust sheets comparable to those of Kumaon and Garhwal Himalaya, and have invoked a similar tectonic set up for the Nepal Himalaya.

On the other hand, the geologists from India, USSR and Japan have invoked a different tectonic set up , questioning the validity of long distance displaced thrust sheets. Nadgir & Nanda (1966), Talalov (1972) and Ohta & Akiba (1973), do not agree with the nappe concept, and have invoked block uplift and folding as the main tectonism of the Nepal Himalayan architecture.

Apart from the tectonic considerations, the Nepal Himalaya also show a disputed metamorphic history; the

rocks having recorded several events of metamorphism. The apparent metamorphic reversal according to the 'allochthonists' is due to the long distance horizontal thrusting of different tectonic units, while to the 'autochthonists', this phenomenon is due to a regular repetition of the strata and selective granitic intrusions in the normally lying rock successions.

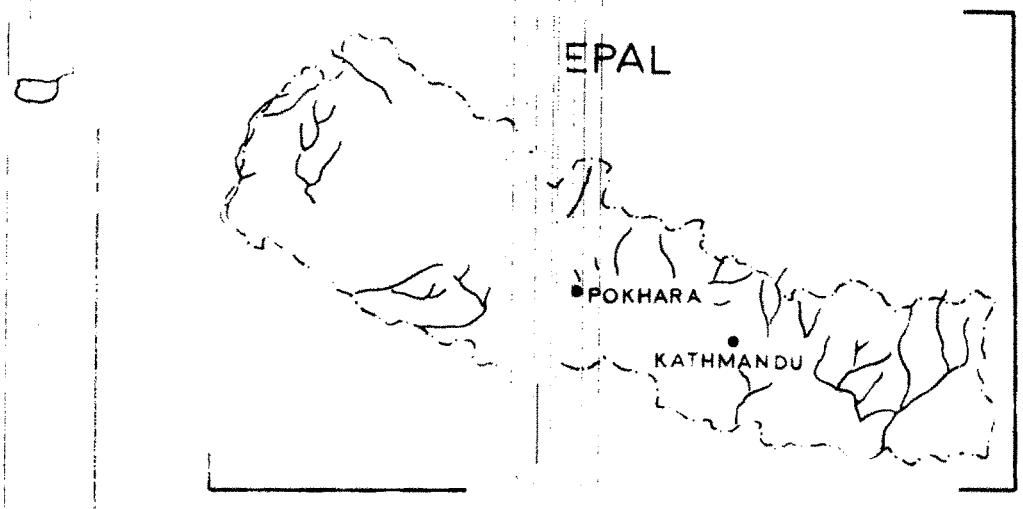
Of considerable interest is the stratigraphic correlation of the unfossiliferous Lesser Himalayan formations. Some workers have correlated them with the known lithoformations of the Western Himalaya, while the others have equated them with the lithoformations of Alps, lying 6,000 km apart. Yet another group prefers to correlate these rocks with that of Dharwars and Vindhyans of the Peninsular India.

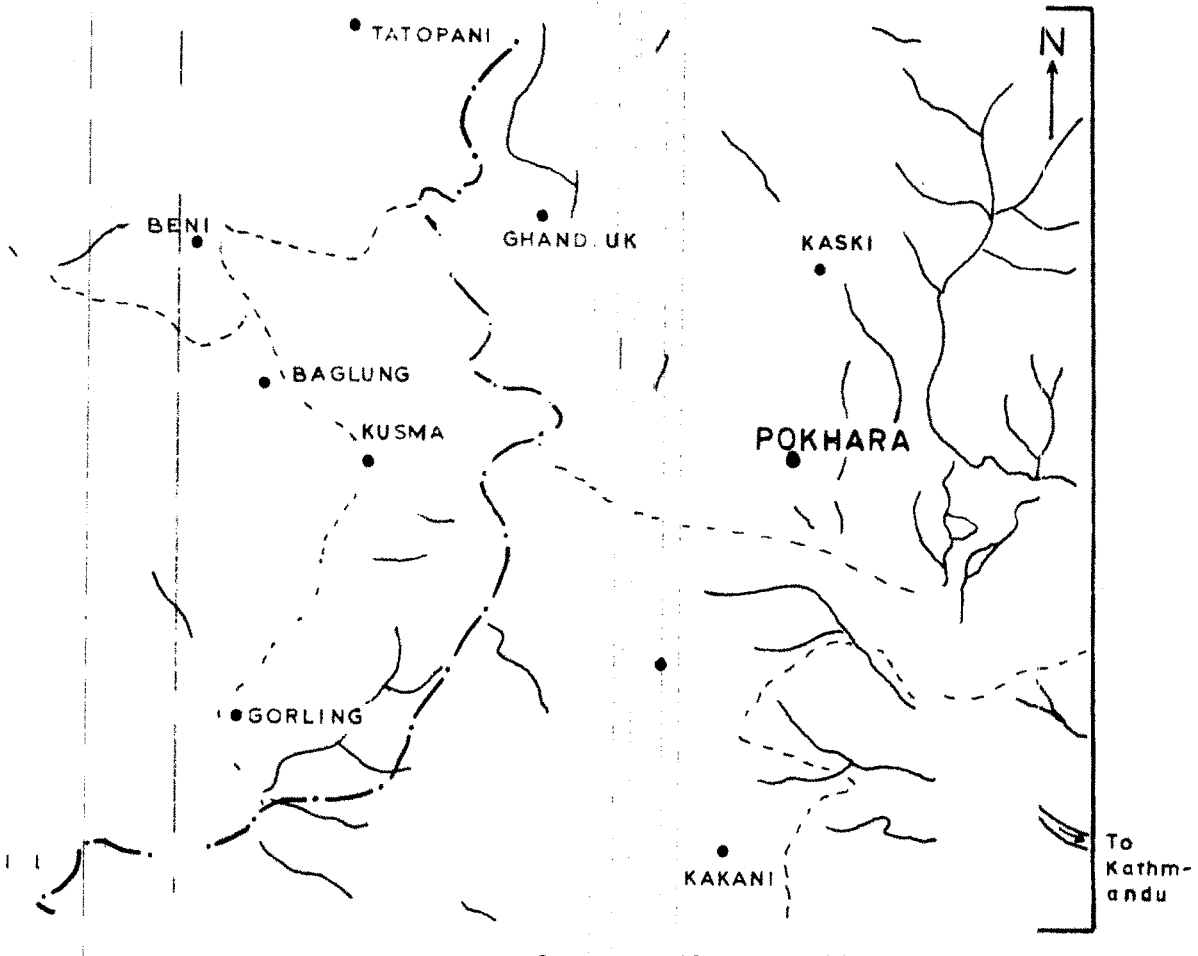
LOCATION

The area (Fig. I.1), over which this account dwells, forms a part of Toposheet No.62 P/12 (Survey of India) and comprises a rectangular terrain of about 120 sq km, bounded by the Longitudes 83° 37' to 83° 45' E and the Latitudds 28° 8' to 28° 15' N. It is situated within the Dhaulagiri Administrative Zone and comprises parts of

Fig. 1.1

OCATION MAP





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Km.

Baglung and Parbat Districts. The Zonal Headquarter Baglung lies only 3 km north of the area. Kusma, the District Headquarter of Parbet lies in the northern part of the area. About 200 km west of Kathmandu, the nearest approachable town and the Headquarter of Gandaki Zone is Pokhara, which lies about 35 km air distance north-east of the area. No transportation facilities are available in the area. The nearest motorable road is the National Highway (Sunauli-Pokhara Rajmarga) which can be approached from 15 km east of the area at Nag Danda and Syangja stops. Recently, a small airport has been constructed at Balewa, which is in operation only in winter and spring seasons.

In the east, the area is flanked by a hill range passing through the villages of Karkinetta, Gyandikot and Ramja, while its northern border could be demarcated by an east-west imaginary line passing through the villages Pang and Ramja. The western side of the area is bound by the north-south running Balewa hill range in the north and Chokya hill in south. The southern limit of the area is bound by the line joining the Thana hills in the east and the Sumsa village in the west.

TOPOGRAPHY

Topographically, the area exhibits typical rugged landform complicated by complex ramifications of numerous north-south and east-west running hills and valleys. Kali Gandaki Valley, which forms the lowest ground of the area, runs approximately north-south in the central-west portion of the area. The river is flanked on its either side by step-like terrace flats and abruptly elevated high hills and minor east-west valleys. The hill ranges running north-south (Karkinetta-Gyandikot hills in east, and Balewa-Chokya hills in the west) comprise the highest ground exceeding 2,000 metres. The east-west spurs of these main ranges divide the area into different minor valley compartments. The high land in the area gradually slopes down to the Kali Gandaki valley, and slopes in general towards south. The highest summits of the area are Gyandikot (1665 m), Limikot (1549 m), Debithan (2059 m) and Ramjakot (1477 m).

DRAINAGE

Kali Gandaki, a snow fed river descending from the Tibetan Marginal Range, drains the area flowing due south. Modi Khola draining the southern slopes of Annapurna, joins Kali Gandaki at Modi Beni, south of the village Kusma. Both

these rivers flow approximately south in the area, whereas the other minor tributaries join them nearly at right angles and flow east-west. Most of the tributaries have their headwaters inside the study area and only a few of them enter from outside. All these tributaries are perennial and spring fed, though the seasonal discharge volumes vary considerably, being maximum during the monsoon period. Only some minor tributaries remain dry during summer, being fed by the monsoon waters. The overall drainage pattern of the area is dendritic (Fig. I.2) and is controlled obviously by structures, lithology and topography.

CLIMATE

Owing to the topographic variation, a bioclimatic vertical zonation to a certain extent, is seen in the study area. As a result, the area enjoys a mixed type of climate varying from Moist-Sub-Tropical in the valleys to Temperate in the high hills. However, the overall climate of the area is pleasant, cool and invigourating. The summers are milder, but the winters are cold. The seasonal variation in temperature is 35°C during summer (Mid April and June) and 1°C with occasional frost during winter (November - January). Summer rains are very heavy,

and are brought by westerly monsoon wind from June to August. The area receives about 1500 - 1700 mm rainfall annually. The higher hills occasionally receive snowfall during the month of January.

FLORA

The vegetation of the area also depends upon the altitude variations. In the regions lying below 1000 m, trees characteristic of tropical deciduous forest attain luxuriant growth. Typical tropical trees accounted are Shorea robusta (sal), Salmalia malabarica (simal) with bushes of Zyziphus jujuba (bair) and Pinus longifolia (chir). Above 1000 m and as high as 2000 m, the sub-tropical wet-hill forest trees become common, the dominant trees are broad leaf Schima wallichii (chilaune), Castonopsis indica (katus), Dendrocalamus (bans), Alnus nepalensis (utis), Rhododendron arboreum (gurans) and Pinus excelsa (sallo). On the wetter slopes, Juglans arboreum (okhar) and Arunclinaria (nigalo) are encountered.

Among fruit trees, mango, lichi and katahar grow in the valleys, whereas on the hills orange is characteristically common. Banyan trees and Pipal trees are the other commonly planted trees.

FAUNA

Felis jabula (leopards), Virsustor quatus (black bears), Cavis qureus (jackals), pigs, langures and monkeys are the common wild animals living in the forested areas. Besides, a wide variety of domesticated animals like dogs, buffalos, cows, bullocks and goats are very common. In addition to this birds, snakes and lizards of wide variety form the common animals that inhabit the area.

CULTIVATION

The paucity of the plain ground has forced the mountain dwellers to cultivate the mountain slopes preparing narrow terraced fields. Rain is the only source for certain crops in the high hills. In the Kali Gandaki gravelly terraces, cultivation is facilitated by irrigational canals. The main agricultural products of the area are rice, wheat, maize, millets, potatoes and barley etc.

HABITATION

Being mountainous country, the area is not so thickly populated. The area holds nearly 30,000 people

of different castes and cultures. The main part of the population is concentrated in the villages situated on terrace flats of Kali Gandaki at Pang, Kusma, Balewa, Gyandi and Phalebas. Ethnically, the area forms a transitional zone in physical and cultural terms of the Mongoloid and Caucasoid caste groups.

In the higher altitudes are found the people of Mongoloid race, namely Gurungs and Magars, whereas in the low lying areas, the Caucasoid groups outnumber the Mongoloid heritage.

In spite of the common prevalence of various dialects like Gurung, Magar, Newari and Nepali, the Nepali language is spoken by almost all the inhabitants.

About 98% of the population of the area depend upon the agricultural work, and only 2% is engaged in government jobs and other jobs like foreign military services.

SCOPE OF THE PRESENT WORK

The author took up the present investigation with a view to workout in detail the lithology, metamorphism, tectonics and structural aspects of this valley section.

His main purpose was to establish the successive events of tectonism and metamorphism and their respective inter-relationship. The study has given important clues towards a proper understanding of the major problems of stratigraphy and tectonics of this part of Nepal Himalaya. A detailed geomorphological study of this region has also revealed the sequence of neotectonic activity.

The author spent an aggregate period of seven and half months in the field during the winter and spring months of 1975, 1976, 1977, and 1978. The mapping was carried out on 4" = 1 mile map (photographically enlarged from original 1" = 1 mile Toposheet prepared by the Survey of India).

The author not only demarcated the different lithological types, but also made a systematic record of various structural, sedimentary and metamorphic features. He also recorded all available data either on the map or in the field note book which includes dip and strike of bedding, cleavage, schistosity, joints and the linear structures of various generations.

A number of representative rock samples were collected for laboratory work. The structural data obtained was

analysed with the help of an Equal Area Net, to workout the structural pattern of the area. A number of representative samples were selected for thin section study to understand the textural, mineralogical and metamorphic characters. A few samples were chemically analysed. This thesis incorporates a detailed account of all these aspects.

BRIEF GEOLOGY

The author here has provided a very brief account of the geology of the area as worked out by him, in order to give a suitable background to the reader.

The study area comprises two tectonic units, separated by a thrust running almost WNW-ESE (designated as Phalebas Thrust) along the southwestern corner of the area. The unit lying to the north of Phalebas Thrust (Northern Unit) is comparatively more metamorphosed and is made up of quartzites with spilitic basic intercalations, gritty quartzose phyllites, quartzose phyllites, and phyllites. This sequence, further north is repeated due to a steep angled dislocation, Kusma Reverse Fault, which runs almost parallel to the Phalebas Thrust. The unit to the south of the Phalebas Thrust (Southern Unit) is incipiently metamorphosed and consists of slates, slaty phyllites with thin

intercalations of feldspathic sandstones.

Structurally, the rocks of both the units have preserved evidences of at least four episodes of folding, each having left a permanent imprint on the rocks. The first episode of folding (F_1), which appears to be synchronous with the metamorphism of the Northern Unit has given rise to fairly tight isoclinal to reclined folds showing diverse orientations. The second fold episode (F_2) is represented by the regional NNE-SSW to NW-SE open antiforms and synforms. The third fold episode (F_3) is represented by the very open ENE-WSW to WNW-ESE folds, which are related with movements along the Phalebas Thrust and the Kusma Reverse Fault. The last fold episode (F_4), has a NNE-SSW to NNW-SSE trend, has superimposed over all the earlier structures, and is represented by fine puckers and gentle undulations in the foliation or bedding plane. Related to this episode are the NNE-SSW trending strike slip transverse faults which traverse all the earlier structures.