CHAPTER - I

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

PURPOSE OF STURY

Heron (1953) in his classic work has put forth a very elaborate geological framework for the Precambrian rocks of Rajasthan. He has attempted to correlate the various occurrences of metasedimentaries, basic, and granitic rocks to the successive well defined events in the overall geological evolution of Rajasthan and his work till this date, remains an important source of information on north Gujarat also. However, the well defined concepts developed by Heron for Rajasthan do not appear to be fully applicable to north

Gujarat, though for all practical purposes the rocks here comprise their south-western extension. The geology of north Gujarat still poses numerous problems which are not fully understood. Considerable uncertainty prevails in respect of the depositional history, structure and metamorphism of the various metasedimentary sequences. The basic igneous rocks and the granites also need a detailed reinvestigation.

Some recent studies to which the present author will allude in due course, have already shown that in north Gujarat, the Delhi rocks and the associated basics and granites do not conform to the picture as envisaged by Heron and other earlier workers.

It was in this context that the author decided to take up the present study. The Ambamata area though, forming only a small portion of the north Gujarat Precambrian terrain, comprises a geologically crucial area wherein answers to many confusions could be obtained. In this thesis, the author has presented many new facts on the geology of the area investigated. His observations and conclusions throw new light on the sedimentation, structure and igneous activities related to the Delhi System. The reader will find in the various chapters of this thesis details which point to a considerably modified picture of the Precambrian evolution of north Gujarat.

DETAILS OF THE STUDY AREA

Location

The study area (Fig. I-1) lies on the border of north Gujarat and south Rajasthan and comprises about 160 sq.km. (N. latitudes 24°16' and 24°23' & E. Longitudes 72°47'30" and 72°54') of the terrain shared by the districts of Banaskantha (Gujarat) and Sirohi (Rajasthan). Ambamata (Ambaji, Amba Main) town, the main Hindu pilgrimage centre, is situated in the centre of the area. Panchha (Pancha), Rinchhri (Risri), Chikla (Sinkla), Jhari Vav (Jariba), Koteshwar (Kotesar), Jetwas (Jetua), Ghoda Tankni (Ghoratankri), Kumbhariya (Kumbaria), Parli Chhapri (Pedlio Ka Chhapra), Khokribil and Deri etc. are the small hamlets scattered all over the area.

Physiography

The area is rather hilly and the topography is characterised by the presence of several steep and rugged peaks like 737 m (Δ 2420 ft.), 597 m (Δ 1959 ft.), 921 m (Δ 3027 ft.), 780 m (Δ 2539 ft.) etc. The rest of the area consists of linear hills and ridges, ranging in height from 10 to 50 metres or more from the ground level. The southern portion is comparatively less rugged (Plate I-1). The ridges run NNE-SSW in the northern and central part, while they

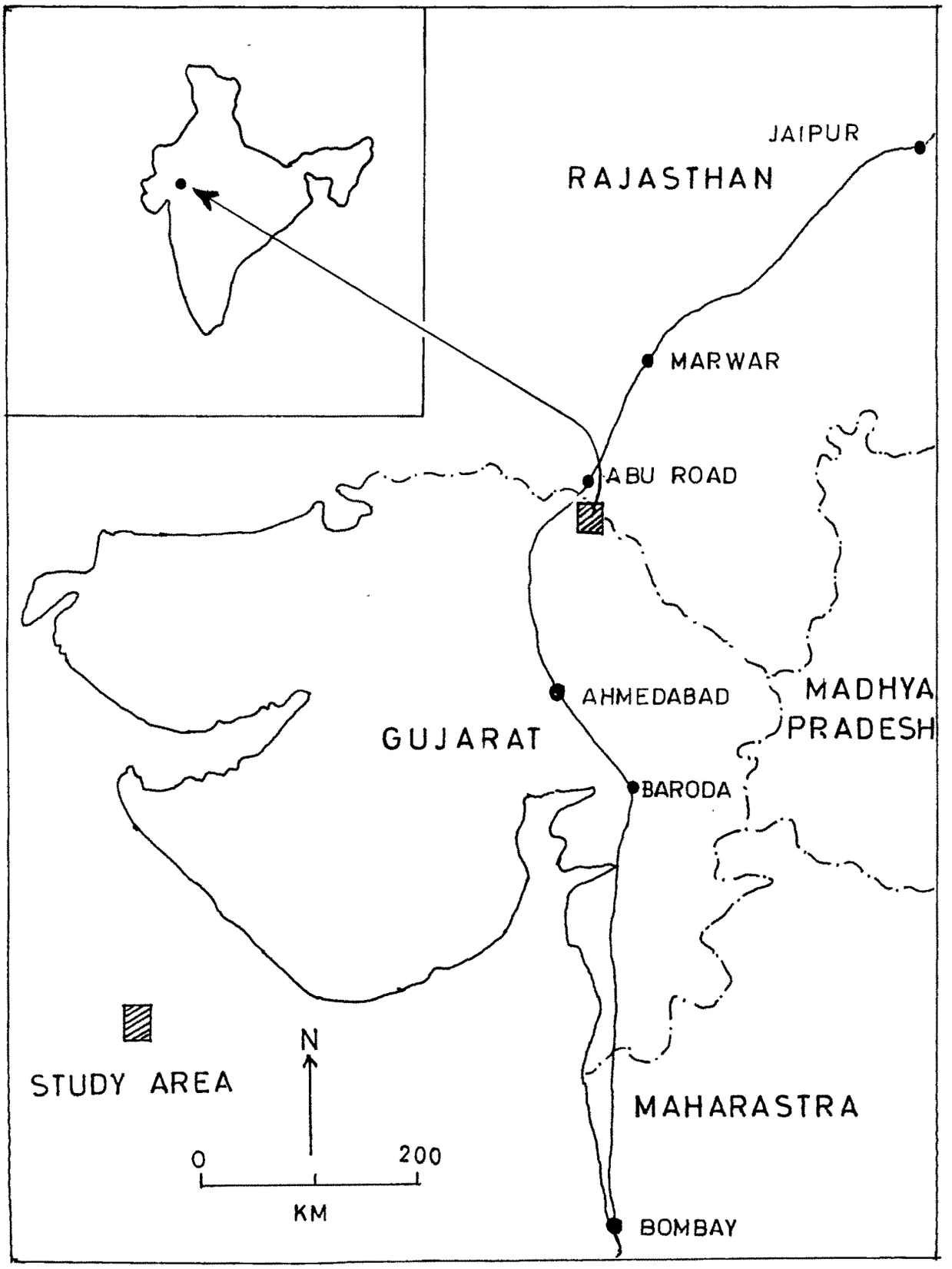

FIG. I.1 - LOCATION MAP

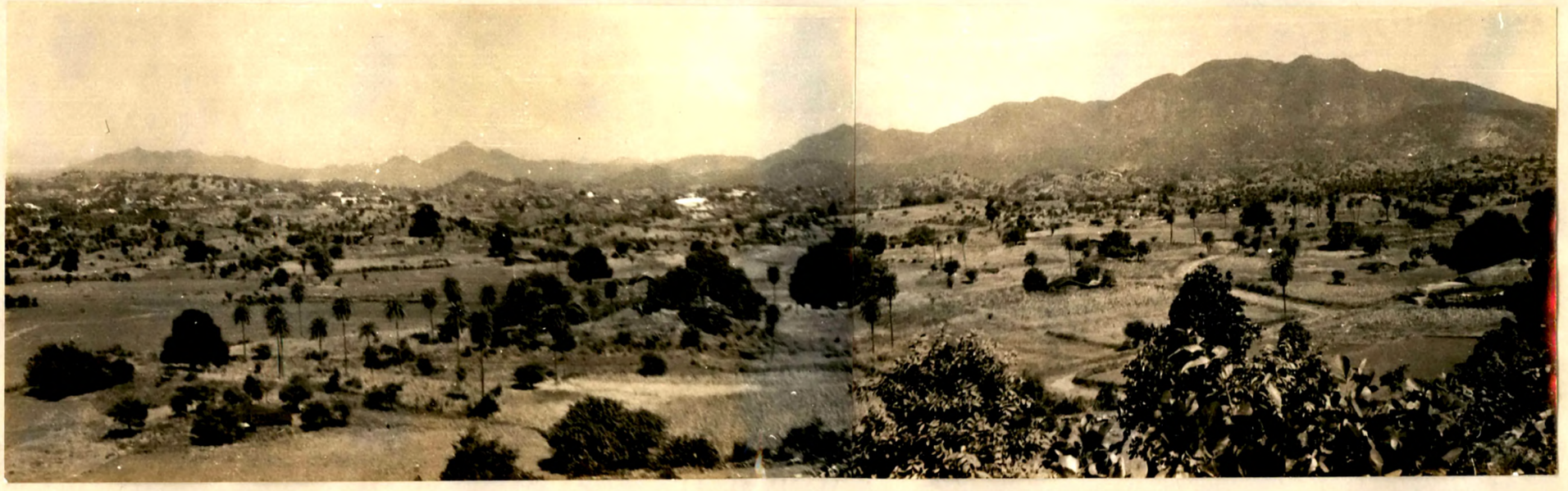

PLATE I.1

Panaromic view of Ambamata valley looking north from Rinchhri

extend in E-W direction in the southern part of the area. The topography is essentially controlled by the lithology and structure of the rocks. The granitic rocks form prominent peaks. High to low linear ridges are characteristic of the limestone country and low hillocks and shallow valleys are typical of the pelitic and semipelitic terrain. Cultivable plains are seen only near Ambamata, Kumbhariya, Jetwas, Chikla and Jhari Vav.

Drainage

The area does not have any perennial river. The two major streams, Teliya and Gabbar, however, do contain some water for a larger part of the year, though drying up during the summer.

The Teliya stream originates in the hilly area to the south of Ambamata, and flows more or less in northerly direction towards Deri. Near Deri it suddenly changes its flow towards west and forms conspicuous meanders. Another stream originating from the hills near Panchha flows due north and drains the area west of the Gabbar hill (△ 1959 ft. 597 m.), and meets the Teliya stream 2 km. north-west of Parli Chhapri. This stream is locally known as the Gabbar Nadi. These streams show dendritic patterns (Fig. I-2), the lower order streamlets are mostly straight but higher orders are sinuous. The segments of the stream basins before their confluence are of the fifth order.

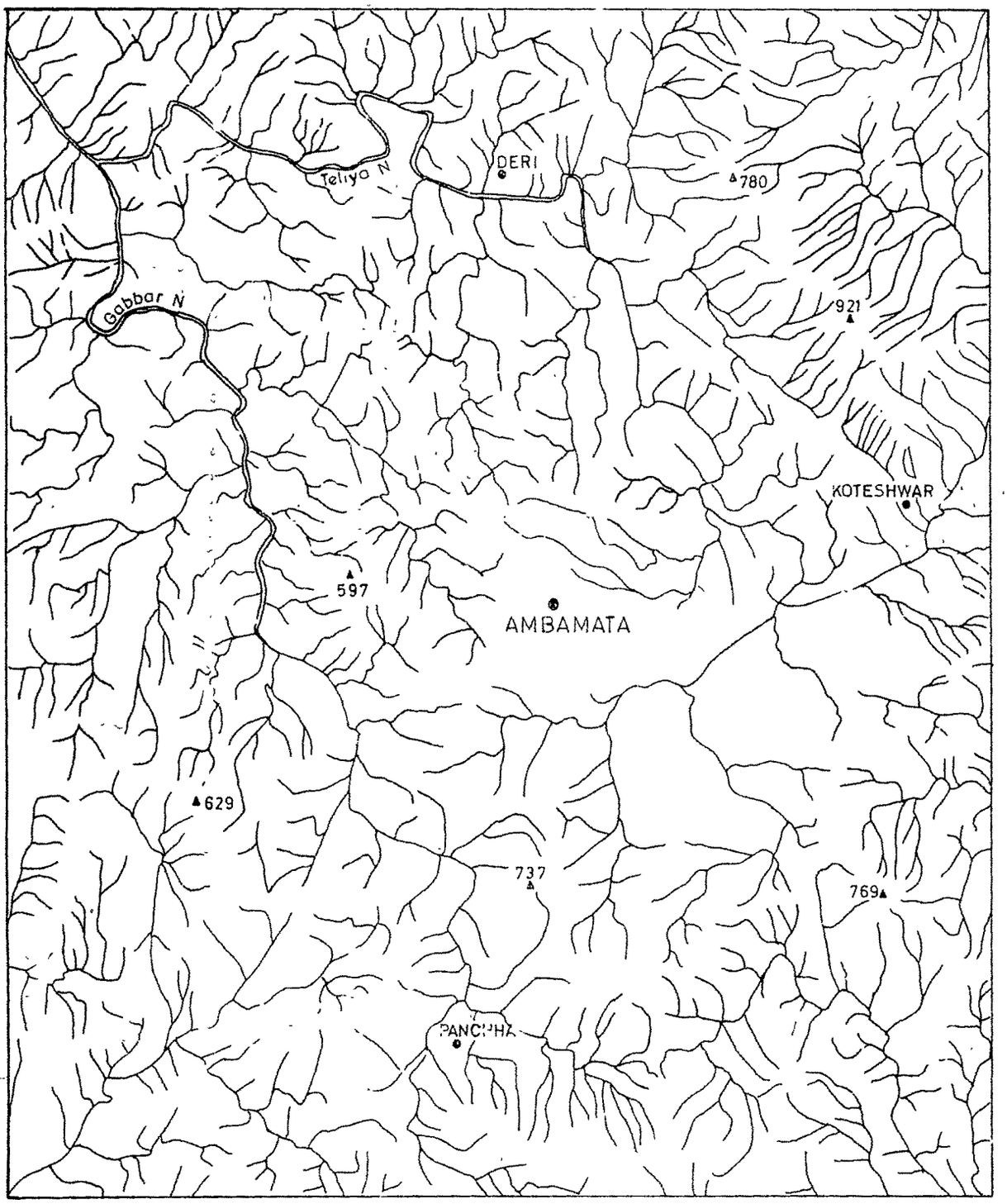

Fig.I.2-DRAINAGE MAP

Climate

The climate of the area is typically semi-arid monsoonal. July to October is the rainy season, the average annual rainfall being about 800 mm. Rainy season is followed by winter that continues till the end of February during which the minimum temperature sometimes reaches even upto $4^{\circ}C$. The summer season starts in March and continues upto the end of June. The days are very hot during summer with the average maximum temperature of $40^{\circ}C$. while the nights are comparatively cool.

Flora

Fairly dense mixed jungle with bamboo is encountered in the western and south-western part of the area where granitic rocks are exposed. The same type of jungle is also seen in the metasediments of quartzo-felspathic composition, just south of Ghoda Tankni. As one moves east i.e. from the granitic area towards metasedimentaries, the change in flora is seen to comprise a progressive disappearance of bamboo and appearance of open scrubs. In the plain area near Kumbhariya, Jetwas, Rinchhri and Chikla, palm and palmyra trees are very common.

The forests, in general, belong to the tropical dry deciduous type, and because of scanty rainfall and poor soils, are comparatively of inferior quality, as regards the density,

height and the girth of tree species. The common plant species in the valleys are Butea monosperma, Diospyros melanoxylon, Alanguim salvifolium, Limonia acidissima, Aegle marmelos etc. At the base of the hillocks Acacia nilotica ssp. indica, Tamarindus indica, Xeromphis spinosa, Zizyphus xylopyra, Bueta monosperma, Balanites aegyptiaca etc. are commonly seen. Wrightia tinctoria, W. tomentosa, Diospyros melanoxylon, Alangium salvifolium, Bauhinia recemosa, Anogeissus sericea, A. latifolia, Dendro calamus strictus, Terminalia cremulata etc. grow on the hilly slopes. On the top of the hillocks, tall trees of Iannea coromandelica, Boswellia serrata, Bombax ceiba, Sterculia urena and Ailanthus excelsa are generally observed. Open scrubs are characterised by trees like Zizyphus mauritiana, Z. glabrata, and Capparis grandis along with shrubby bushes of Balanites aegyptiaca, Zizyphus nummularia, Capparis decidua, Mimosa hamata and others.

Fauna

A few decades back, a variety of wild animals like panther, bear, tiger, leopard etc. used to inhabit the region confined to thickly forested hill slopes. However, most of these wild species, especially the tiger has practically disappeared. Monkey, wild cat, jackal, hyena etc. are found throughout the area. The domestic animals like bullock, cow, buffalo, goat,

sheep etc., are tamed by inhabitants for one or other purposes. The common birds are sparrow, parrot, peacock, crow, pigeon etc.

Agriculture

Agriculture is the main occupation of the people, though there is less cultivable land in the area, the terrain being mostly hilly. The main Kharif crop of the area is maize. It is grown not only in low plain areas, but also on the gentle slopes of the hills. No irrigation facilities, except for a few shallow dug wells, are available. Therefore, winter (Rabi) crops are not common. In the vicinity of Ambamata, in addition to maize, vegetables, flowers and fruits are also grown.

Population

Permanent residents of Ambamata town are only a few thousands; but floating population of pilgrims is several times more. There is rush of pilgrims, especially heavy on holidays, sundays and full-moon days. The villagers from scattered villages predominantly Adivasis are engaged in agriculture and cattle grazing. People from various states like Rajasthan, Punjab, Tamil Nadu etc. have also settled in Ambamata. To meet the needs of pilgrims, the permanent residents of Ambamata are engaged in various trades like hotels, various shops,

taxi service, lodging and boarding houses and dharmashalas etc. A few are also employed in the Base metal mining project.

Communication

There are three all weather motorable metalled roads connecting Ambamata with Ahmedabad (via Khedbrahma), Palanpur (via Danta) and Abu Road. Ambamata being a famous pilgrimage centre, all the important cities and towns of Gujarat are connected with it by the State Transport buses. A number of private buses, cars and taxis also run on these roads. The area has a number of unmetalled roads and tracks connecting Koteshwar, Gabbar and Jhari Vav marble quarries and other interior villages. The hilly terrain is criss-crossed by a number of foot paths. Abu Road which is situated 20 km. NNW of Ambamata is the nearest railway station on Ahmedabad-Delhi metre gauge railway line.

Methods and Techniques

The author visited the area during the summer and winter vacations. After conducting a reconnaissance of the broad geological features of the area, he realised that petrologically as well as structurally the area is not as simple as made out by earlier workers. The area, though showing good exposures, did not provide well defined contacts between the different rock-types and various planar and linear structures, and as

such, the mapping was rendered quite difficult. In order to prepare a detailed geological map, the author visited all parts of the area, noted down the structural features and collected the various rock types systematically. He could prepare a good and authentic geological map only with the help of a critical evaluation of the rock types in the laboratory. He utilised the petrologic data in working out the structural pattern of the study area. Geological mapping was carried out on the 1:15840 (4 inches = 1 mile) scale base map, enlarged photographically from the Survey of India 1 Inch Topo Sheet No. 45 D/15.

About 1300 readings were taken in the field to understand the exact lithological characters, structural features and field relationship of the various rock types. About 600 rock samples were collected and megascopically studied, 300 thin sections were prepared and their microscopic characters were critically examined. The mineral identification was done with the help of optical data using petrographic microscope and 5-axes Universal stage. Staining methods were also employed for identifying some minerals. Modal analyses of coarse grained rocks were carried out by using the Swift's Point Counter. The chemical analysis of 45 samples comprising granitic, basic, pelitic and calcareous rocks was undertaken. Weight percentage of various oxides like SiO_2, Al_2O_3, Fe_2O_3, FeO, CaO and MgO were determined by using the traditional

chemical method of silicate analysis, while Na_2O and K_2O values were obtained by using the EEL Flame Photometer. The chemical data, plotted on various diagrams, was critically interpreted.

In order to understand the structure and stratigraphy of the study area, the author visited the neighbouring areas like Balaram and Posina-Kherod to the SW and E respectively. Long traverses were taken to ascertain the structure and regional stratigraphy. Satellite Imageries were used to substantiate the regional structure.

The author in this thesis has attempted to provide a critical account of all his observations and conclusions, fitting them with the neighbouring areas which have been very recently reinvestigated by his colleagues.