CHAPTER - I

INTRODUCTION

PREAMBLE

The Mainland Gujarat, Kutch and Saurashtra terrain in Western India are dotted with scattered exposures of Mesozoic Sandstones. The sandstones exposed in central and southern part of Mainland Gujarat are known as Nimar sandstones while those occurring in northern part are referred to as Himatnagar sandstones. The present investigation encompasses the sandstone exposures lying around Himatnagar town of Sabarkantha District in North Gujarat (Fig. I.1).

The geographical limits of the patchy exposures of Himatnagar sandstones are broadly bounded by N.Latitudes 23° 20′ & 23° 45′ and E.Longitudes 72° 45′ & 73° 12′ 30", covering approximately 2200 sq.km. area. The Himatnagar sandstones are

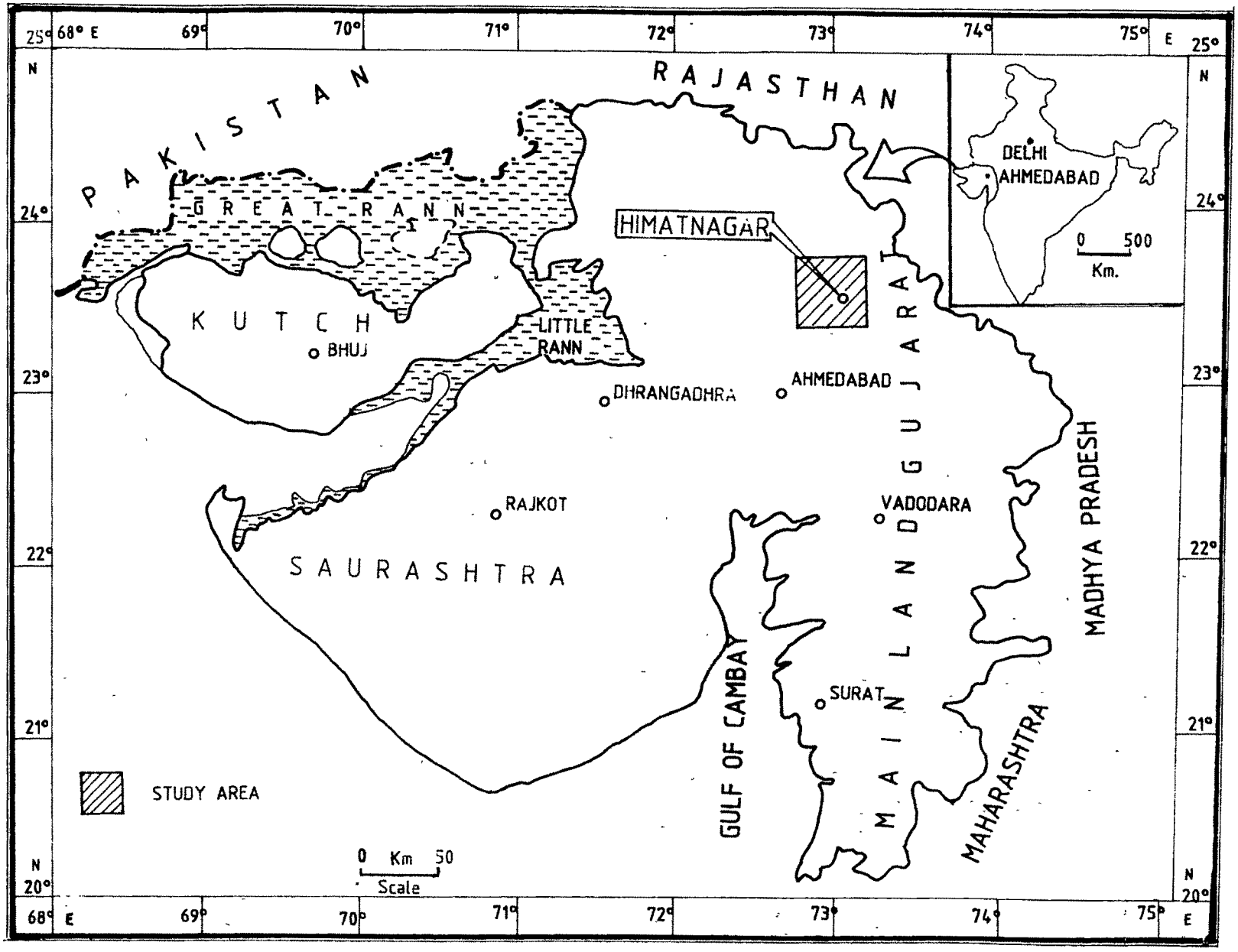

FIG. I 1. LOCATION MAP

limited by Aravallis & Delhis in the northern, northeastern and eastern part and by Deccan Traps in the southeastern part while they merge with the alluvium in the southern and western part.

Good exposures of sandstones are encountered in the river sections and in the gently undulatory hilly terrain. However in majority of the area, these rocks are seen covered by a thin to moderately thick (2 to 30 m) alluvium. The sub-surface data obtained from number of the dug-wells/bore-wells remained very useful in delineating the extent and thickness of the sandstones so as to establish the tectonic framework of the area.

PURPOSE AND SCOPE

So far, indepth studies of Himatnagar sandstones have not been attempted. The present investigation is thus an attempt to understand the geology of the Himatnagar sandstones with special emphasis on their mode of occurrence, composition, diagenesis, depositional environments and tectonism that took place in subsequent period. Though Himatnagar Sandstones have been described as a formation comprising predominantly sandstones with minor conglomerates, siltstones, shales/clays, the present studies pertains to the sandstones under the heading Himatnagar sandstones.

The geological mapping was carried out on 1:50,000 Survey of India Toposheets Nos. 46 A/14 & 15 and 46 E/2 & 3. Almost all the sandstone exposures were visited and their modes of occurrence,

thickness, lithology, depositional structures and lateral & vertical extents were observed in the field. In order to delineate the relative textural & structural variations viz. colour, composition, grain size, sedimentary structures etc., the close sampling (0.3 to 1 m interval) was made from vertical sections which were then studied critically in the laboratory.

TOPOGRAPHY AND DRAINAGE

TOPOGRAPHY

Geomorphologically the area around Himatnagar is characterised by hilly terrain and low lying areas. As it is rather very difficult to incorporate the various topographic features in a small scale map, the author preferred to prepare an altitude map by taking the heights (MSL) of the various spots of the study area and this certainly provides a broad picture of the topography (Fig. 1.2). The eastern, northeastern and south eastern area has elevated hilly ridges ranging in altitude from 195 to 352 m. Near villages Ghorwada, Berna, Gamdi, Wantra, Pedhmala, Adpodra and Bodi the "flat topped" ridges (Plate I.1) are seen peeping out from alluvial terrain while some hilly ridges form "cuestas" (Plate 1.2); the former characterises the horizontal to sub horizontal strata while latter indicates the sloping hilly terrain. Most of the hilly ridges forms the 'middle land' topography (> 200 m MSL) having plain or flat relief. The

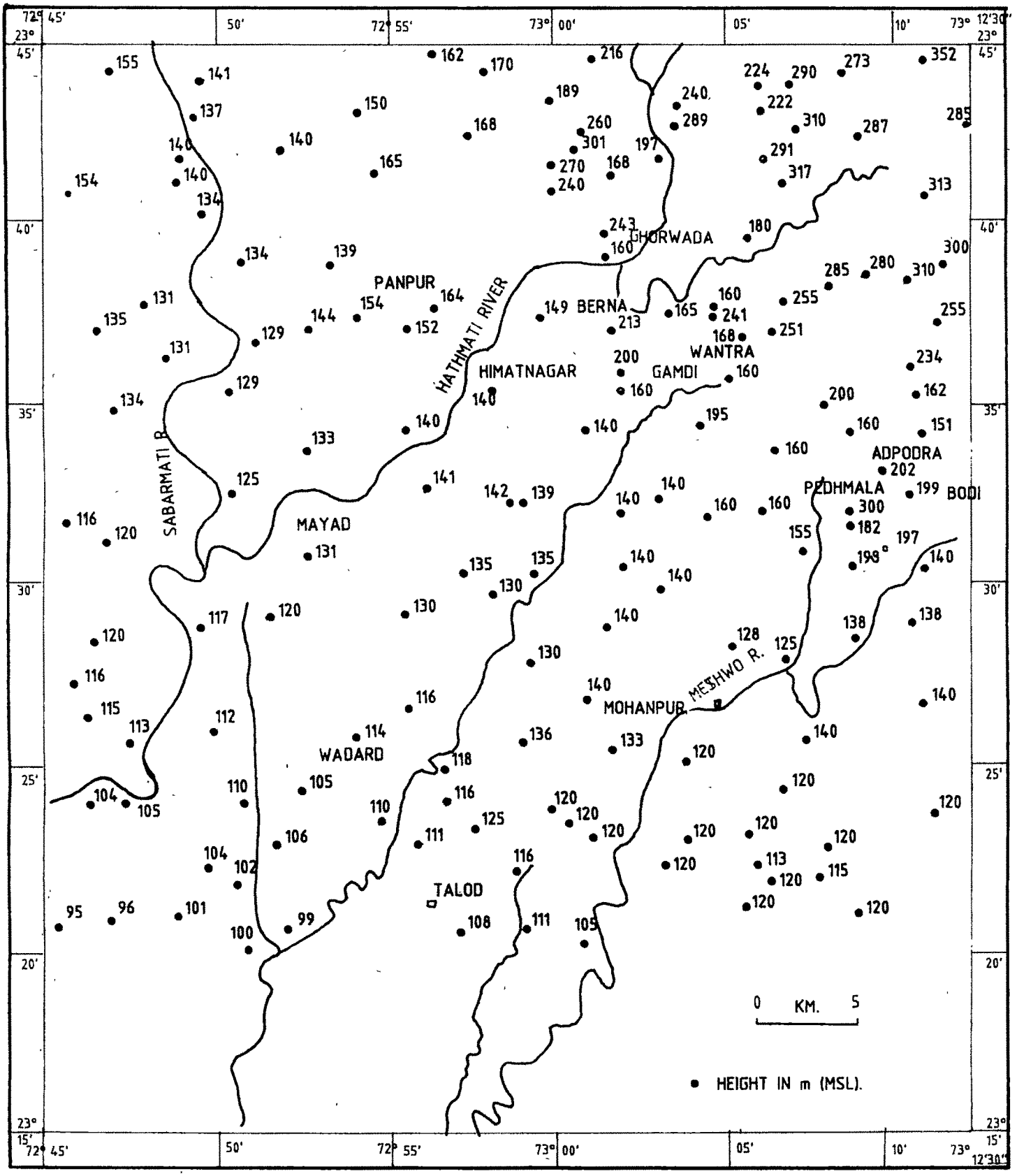

FIG. I.2 ALTITUDE MAP - HIMATNAGAR AREA

PANORAMIC VIEW OF HIMATNAGAR SANDSTONES

PLATE I.1

PLATE I.2

Flat Topped Sandstone Hill
(Loc : Adpodra)

PLATE I.3

Quartzite Hill Showing 'Cuesta' Feature
(Loc : Vavdi)

rest of the area is characterised by low relief with undulatory topography and gentle southwestern slope; the altitude decreases from NE (180m) to SW (< 100m).

DRAINAGE

The Sabarmati, Hathmati, Meshwo and their tributaries flow through Himatnagar area (Fig.I.3). Hathmati and Meshwo rivers flow from northeast while the Sabarmati river flows from north. The low gradient of the terrain is indicated by the sinuousity of stream channels near village Ged in the vicinity of Sabarmati-Hathmati confluence area. Nearly NS swing of the Hathmati meander trend between Berna & Ghorwada perhaps suggests its flow along fault related to ancient basement grains. It is observed that the lithology and lineaments have influence in the drainage development of Himatnagar area which has been described at length in chapter IV.

The general drainage pattern of the study area is 'dendritic' with irregular branching of tributary streams in different directions. This pattern suggests uniform resistance and lack of structural control in the alluvial areas, horizontally bedded sedimentary rocks or massive igneous rocks (Subramanyan, 1987). The sabarmati river and Hathmati river in the lower reaches are characterised by 'badland topography'. This 'badland topography' leads to fine drainage texture suggesting the region of low relief, gentle slope, young age

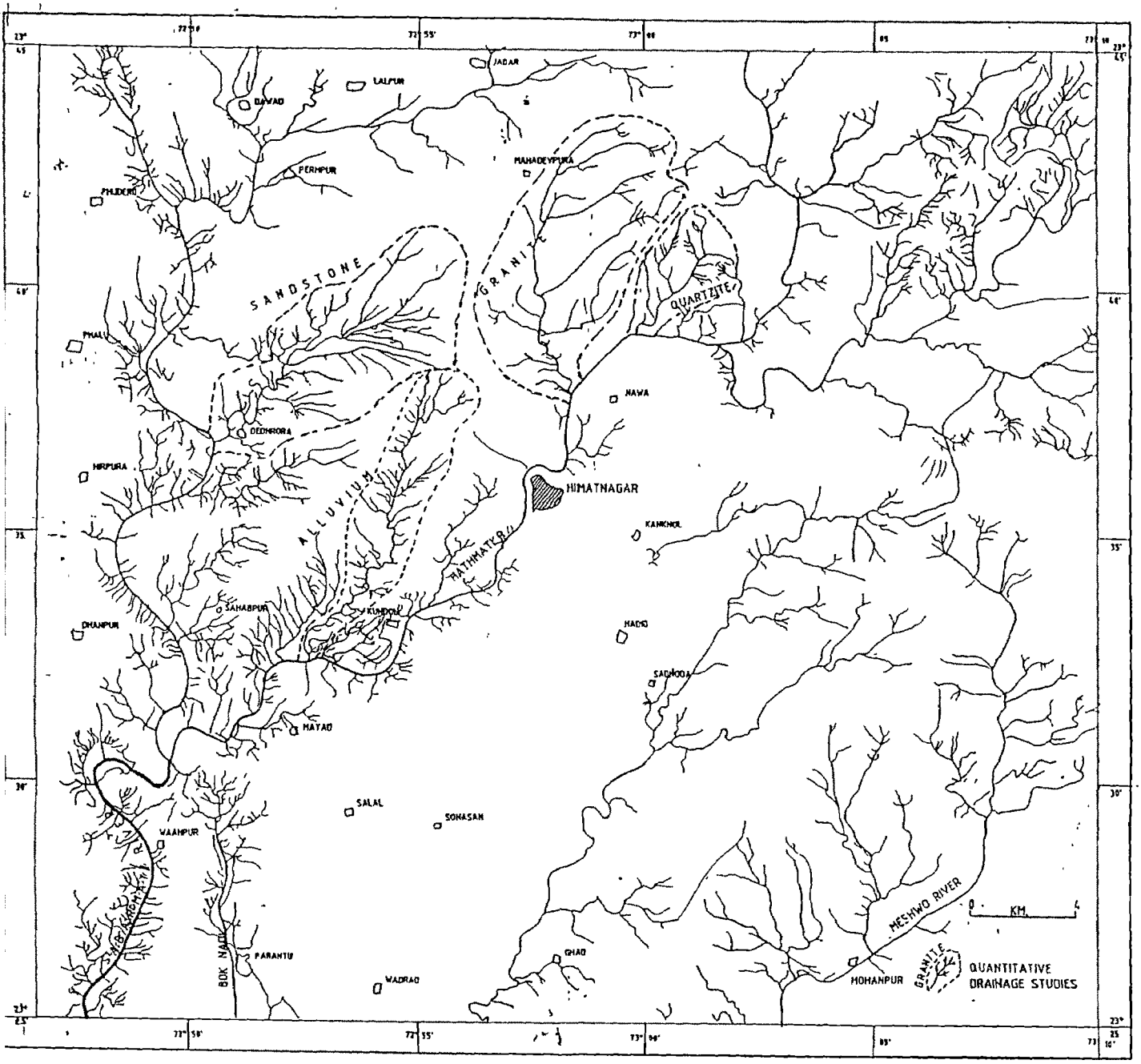

FIG. I.3 DRAINAGE MAP - HIMATNAGAR AREA

topography and maturity of river. It also suggests the occurrence of impermeable clays, shales, low vegetation and dash rainfall.

FLORA AND FAUNA

FLORA

The study area, on the whole is devoid of any forest growth. The vegetation of the area is poor and shruby. However in the north eastern corner, on a Pre-Cambrian metamorphic terrain a thinly forested area comprising mainly the teak trees is encountered. The low lying peneplained and fairly undulatory Mesozoic terrain contains scattered teak trees besides the usual trees of domestic use.

The most common flora in the hilly teak forest are teak, sag (Tectona grandies), sadada (Terminalia tomentosa), shisham (Dalbergia latifolia), tanach (Ougeinia dalbergioides), bia bibla (Pterocarpus marsupium), kalam (Mitragyna parviflora), sawar (Salmalia malbarica), timru (Diospyros melanoxylon), humb (miliusa tomentosa), saran shivan (Gmelina arborea), salai (Boswellia serrata), neem (Azadirachta indica), kalo or pilo shirish (Albizzia lebbek), kada, Karai, kadhai (Stercula urens), mayano (Lannea coromondelica), mahuda (Madhuka latifolia), dhav dhavdo (Anogeissus latifolia) etc.

On the low lying flat terrain the variety of trees and bushes of various genera are supported by kakad (Garuga pinnata), baval (Acacia arabica), karanji (Pongamia pinnata), amla (Embilica officinalis), bili (Aegle marmelos), rohan (Soymida febrifuga), saragwa (Moringa pterigosperma), khakhro (Butea monosperma), vind (Capparis grandis), kagar, khaigar (Acacia ferruginea), aniyar (Acacia lencophlea), alledi, alladi (Randia dumatrorum), hingol (Balanites agevptica), ghat bor (Zizyphus xylopyra), vico (Gymnosporia montana), bamboo (Dendrocalamus strictus), awal (Cassia auriculata), kher (Capparis aphylla) etc.

The agriculture is the main source of income for local inhabitants and is mainly dependent upon rain. The main crops are rice (Oryza savita), wheat (Trificum aestivum), maize (Zeamays), barley (Hordeum hexastichon), millet (Penicillaria spicata), Indian millet (Sorghum vulgare), cotton (Gossypium herbaceum), sugarcane (Saccharum officinarum), rapseed (Brassica napus) etc. Among the pulses are adad (Phaseolus mungo), mung (Phaseolus radiatus), chana (Cicer arietinum), math (Phaseolus aconitifolius), chola (Vigna cating), val (Dolichos lablan), tuver (Cajanus indicus), guvar (Cymopsis psoralioides) etc. Besides the people grow a variety of vegetables and fruits in the farm or on the river banks.

FAUNA

The fauna in the area is plentiful. The domestic animals are mainly horse, cow, bullock, buffalo, camel, sheep, goat etc. The wild animals are met only in the hilly terrain and are represented by tiger (Felis tigris), bear (Ursus labiatus), panther (Felis leopardus), wolf (Canis pallipes), wild bear (Susindicus), hyaena (Hyaena striata), jackal (Canis aureus), fox (Vulpes bengalenis), stag (Rusa aristotelis), spotted dear (Axis maculatus), antelope (Antelope bezoartica), Indian gazzle (Gazella bennettii), leopard (Felis jabatus), blue bull (Portax pictus), wild cat (Felis chaus), hare (Lepus ruficandatus), monkey etc. Besides a variety of birds are seen in the study area. In the perennial rivers like Sabarmati, Hathmati and Meshwo the fishes like catla (Catla latla), rohu (Labeo rohita), mrigal (Cirrhina mrigal), fresh water shark (Wallago attu), singla (Mystus singhla), buta (Labeo buta), kalbasan (Labeo calbasu) etc. are met.

CLIMATE AND RAINFALL

The climate of the area in general is dry except for monsoon season. The winter begins from December and end in February. It is followed by summer that continues upto middle of June, while the monsoonal rain is confined mainly between middle of June and September retreating slowly in October and November.

During summer, the mean daily temperature is around 40° C; the mean daily minimum temperature being 25° C. In summer the temperature occasionally rises beyond 43° C. In winter season the mean daily temperature is around 15° C and only occasionaly it falls below 4° C. The area falls under the semi-arid zone. The rainfall increases from SW to NE. The average annual rainfall in the area varies between 800 mm and 900 mm.

COMMUNICATION AND TRANSPORT

Himatnagar town, a headquarter of Sabarkantha district, falls on the Ahmedabad-Udaipur Meter-Guage railway tract, and also on Ahmedabad-Delhi National Highway No.8. Himatnagar is well connected by all-weather tar roads with most of the villages of the district. The interior villages are connected with number of all season tar roads, fair weather jeepable roads, cart tracts, foot tracts etc. State transport buses and private jeeps ply regularly to the most of the villages of the area.

BRIEF GEOLOGY

Geologically the rocks of the area belong to Pre-Cambrian and Mesozoic Era. However, the sandstones of Lower Cretaceous age to which this study is confined have drawn a considerable attention of the geologists. The sandstones occur in river beds, lowlying areas and capping the hills of older rocks. In the

eastern northeastern and southeastern part the hilly terrain constitutes mainly the rocks of Aravallis, Delhis and Erinpura granites. In the southeastern part the basaltic rocks (Deccan Traps) also overlie the sandstones while in the southern & western part of Himatnagar the sandstones lie concealed beneath the Recent alluvium. The generalised stratigraphic succession, based on Gupta & Mukherjee (1938), is given in table I.1.

TABLE I-1 GENERALISED STRATIGRAPHY OF HIMATNAGAR AREA

Formation/ System	Lithology	Age	
Alluvium	Alluvial clays, silts, loose sands	Recent to sub-Recent	
Deccan Traps	Mainly basalts	Upper Cretaceous to Early Paleo-cene	
Himatnagar Sandstones	Sandstones with intercalation of shales and conglo-merates	Lower Cretaceous	
Erinpura Granites	Granites, porphyry etc.	Erinpura	P R E
Delhi System	Quartzites, phyllites,schists etc.	Delhis	C A M
Aravalli System	Gneisses,phyllites schists and quart-zites etc.	Aravallis	B R I A N