CHAPTER - 1

INTRODUCTION

PURPOSE AND SCOPE OF THE STUDY

The landscape of Kachchh is unique in the sense that it shows a complex interplay of geologic and tectonic history. It has evolved essentially as a result of several phases of tectonic movements since Late Jurassic. The various geomorphic units of Kachchh reflect the tectonic framework of Central Mainland Kachchh. The present study is thus aimed at identification of various tectonogeomorphic and structural features and different erosional surfaces that suggest episodic evolution of the Khari drainage basin of Central Kachchh Highland.

The first order topography and the youthful Kachchh landscape indicates continuous rejuvenation of the area which has kept pace with the erosional processes. The various structural features like domes, folds, associated intrusive rocks and the youthful nature of the fault scarps suggest a complicated tectonic history. A glance at the geomorphic map of the Central Kachchh Highland apparently indicates the undeniable role of active tectonics in the evolution of the contemporary landscape. Various geomorphic features like deeply entrenched rivers, incised cliffs of Quaternary and Mesozoic rocks, active fault scarps, alluvial and colluvial fans along various faults, deeply cut gorges in hard rocks, cuesta cliffs, conical hills and vertical scarps point to the role of active tectonism in the evolution of the Central Kachchh Mainland. The high seismicity of the area indicates that the various fault systems are still active. The present landscape of the Kachchh highland therefore seems to have mainly evolved on account of several phases of tectonism.

The present study aims at understanding the role of pre-Quaternary as well as Quaternary tectonism in the evolution of the landscape of the Khari river basin. An attempt has been made to delineate the phases of tectonic activity which significantly altered the landscape of the area. An evolutionary model of the basin has also been attempted. The present study is of considerable importance in understanding the evolution of the Central Kachchh Mainland in particular and the Kachchh basin in general.

GEOGRAPHIC LOCATION

The study area comprises the entire Bhuj taluka and parts of Mandvi and Mundra talukas of Kachchh district, Gujarat state. It occupies

approximately 700 sq. km of land surrounding the town of Bhuj, the district headquarter of Kachchh. The study area is covered under the Survey of India Toposheet numbers 41E/11, 41E/12, 41E/15, and 41E/16. The author has also investigated other distant areas providing vital information.

The triangular shaped Khari River basin is bounded between East longitude 68^0 58′ to 69^0 52′ and North latitude 23^0 10′ to 23^0 30′ (Fig.1.1). The center of this upright triangular basin of river Khari is highly populated area in the district. The district head quarter Bhuj town marks the center of the basin.

PHYSIOGRAPHY

Kachchh is an unique segment in Western India, for all aspects be it geologic, geographic, climatic or ethnic. The various geomorphic facets of Kachchh landscape such as the land surfaces, the drainage characteristics, the relief patterns and the plains and Ranns clearly reveal a complex interplay of tectonism, sea level changes, lithology and the Cenozoic processes of erosion and deposition.

The present area of investigation covers a very small part of the Mainland Kachchh (Plate 1.1). It constitutes three small rivers and makes a triangular Khari river basin surrounding Bhuj town. It is a sort of depression developed between two major hill ranges - the Katrol hill range and Northern Mainland domal uplift. Geologically, it is a graben structure between two normal faults. Physiographically, the area is broadly divided into four divisions (Fig. 1.2):

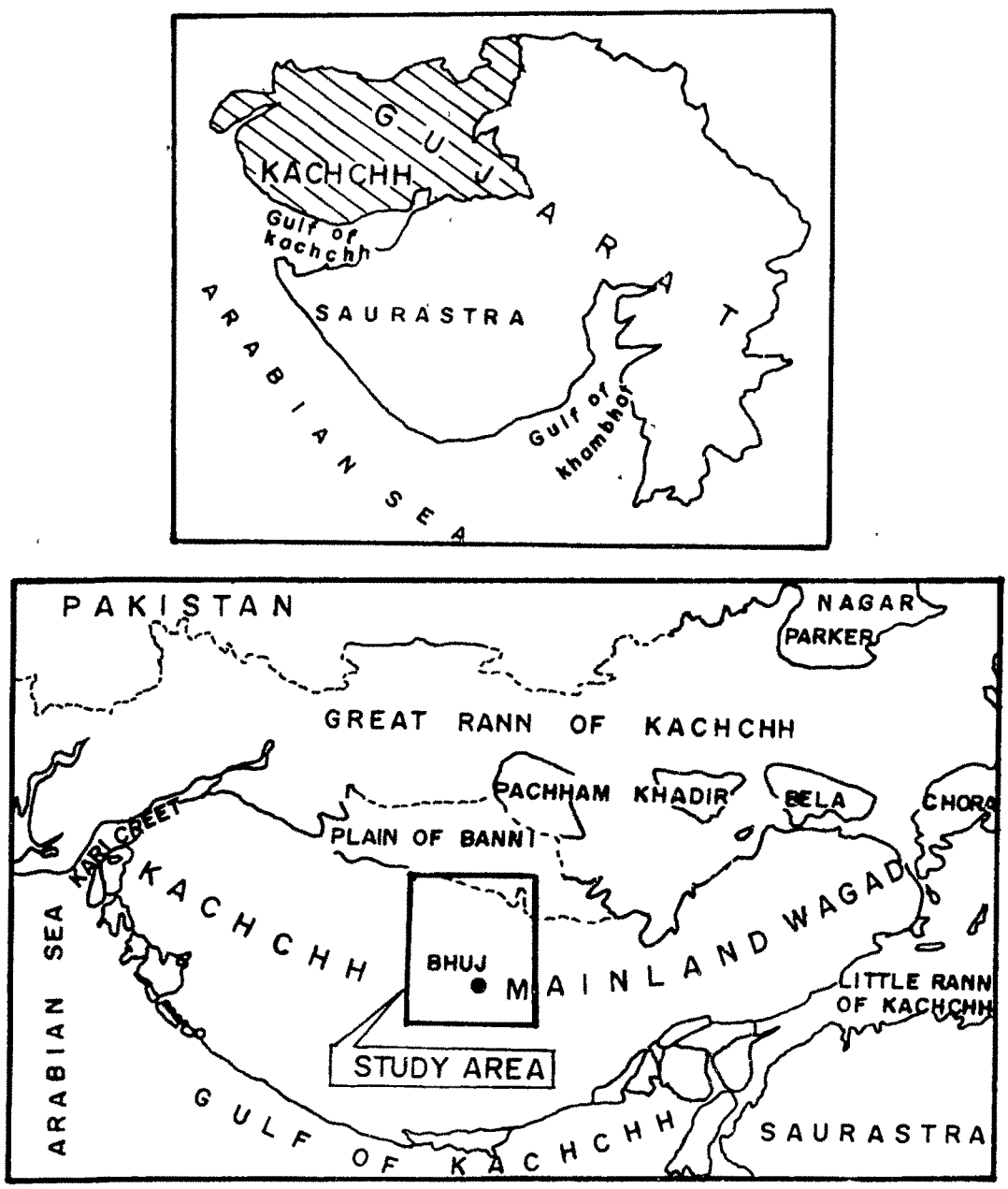

Fig. 1.1 Location map of the study area.

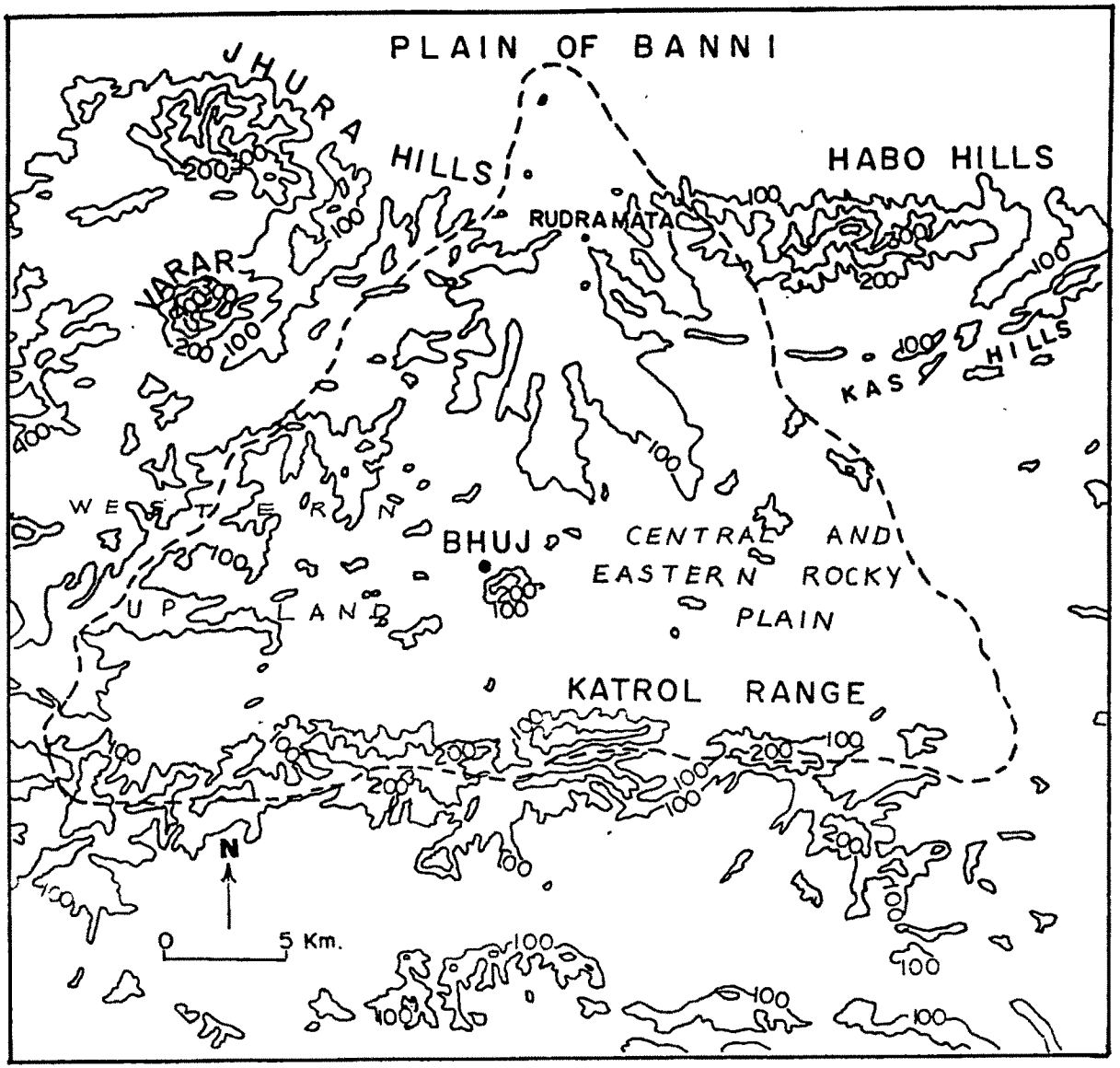

Fig. 1.2 Physiographic map of the Khari river basin.

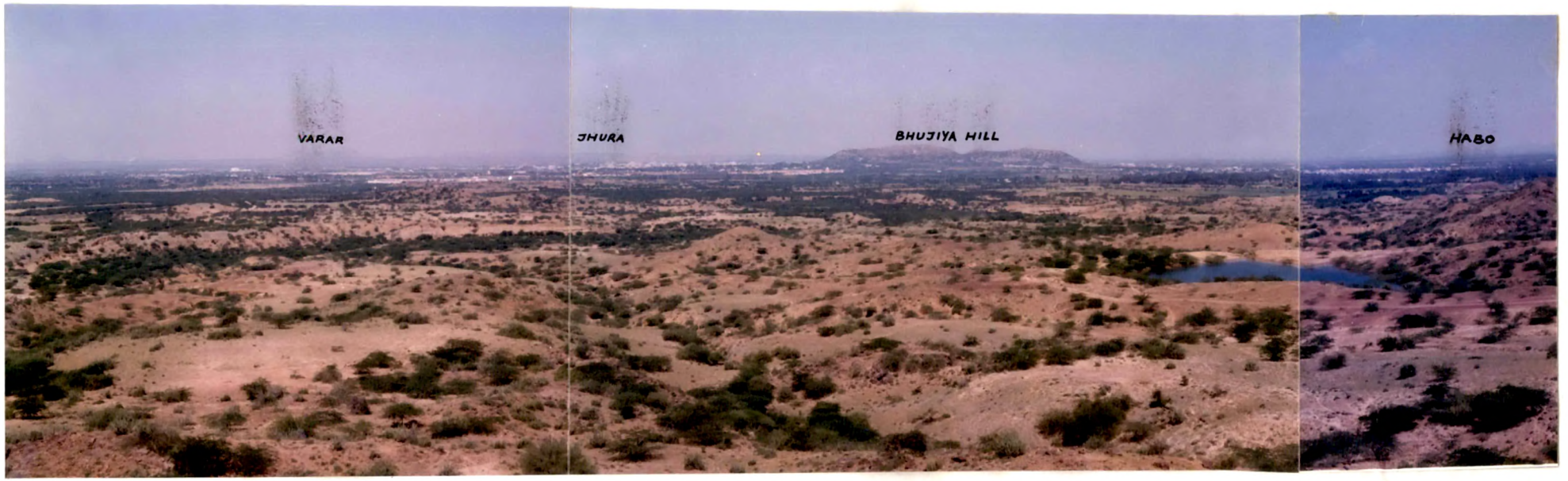

Plate : 1.1 Panoramic view of the study area as viewed from the top of Katrol Hill Range. In the foreground is the rocky plain around Bhuj. The Varar hill, Jura dome and Habo dome mark the sky line in the background. The isolated hill near Bhuj town is the Bhujia hill.

(1) Katrol hill range in south,

(2) Northern domal hills,

(3) Western upland,

(4) Central and eastern rocky plains.

Katrol hill range occurring in the south of the study area trend in E-W direction. The hills are cuesta cliffs sloping steeply towards north and gently to the south. The Katrol hill range constitute a water divide area and extends for nearly 65 km from Ratnal to Roha hill. The range consists of numerous flat topped hills, plateaus and conical hills.

The northern domal hills are uplifted regions along the Mainland Fault. They are domal shaped having steep slopes towards north while gently inclined towards south. The domes expose older beds into the center, therefore they make large inlier structures. Jhura and Habo domal hills (Plate 1.2) are the two such prominent hills situated respectively in the NW and NE part of the study area.

Western upland is a vast region of table topped hills of low height. The highest amongst them is Varar hill (Plate 1.1). The central and eastern rocky plains cover most of the part of the basin. It has the lowest elevation and marks the youngest structural feature. The faults, dykes, gorges are obvious into the river valleys and onto the surfaces of low to moderate height around the streams and rivulets.

DRAINAGE

The Khari river basin is trianguiar in shape (Fig.1.3), the base of the triangle being along the southern hilly range, spire towards north, it merges into the plain of Banni. The Pat and Pur Nadi, arising from

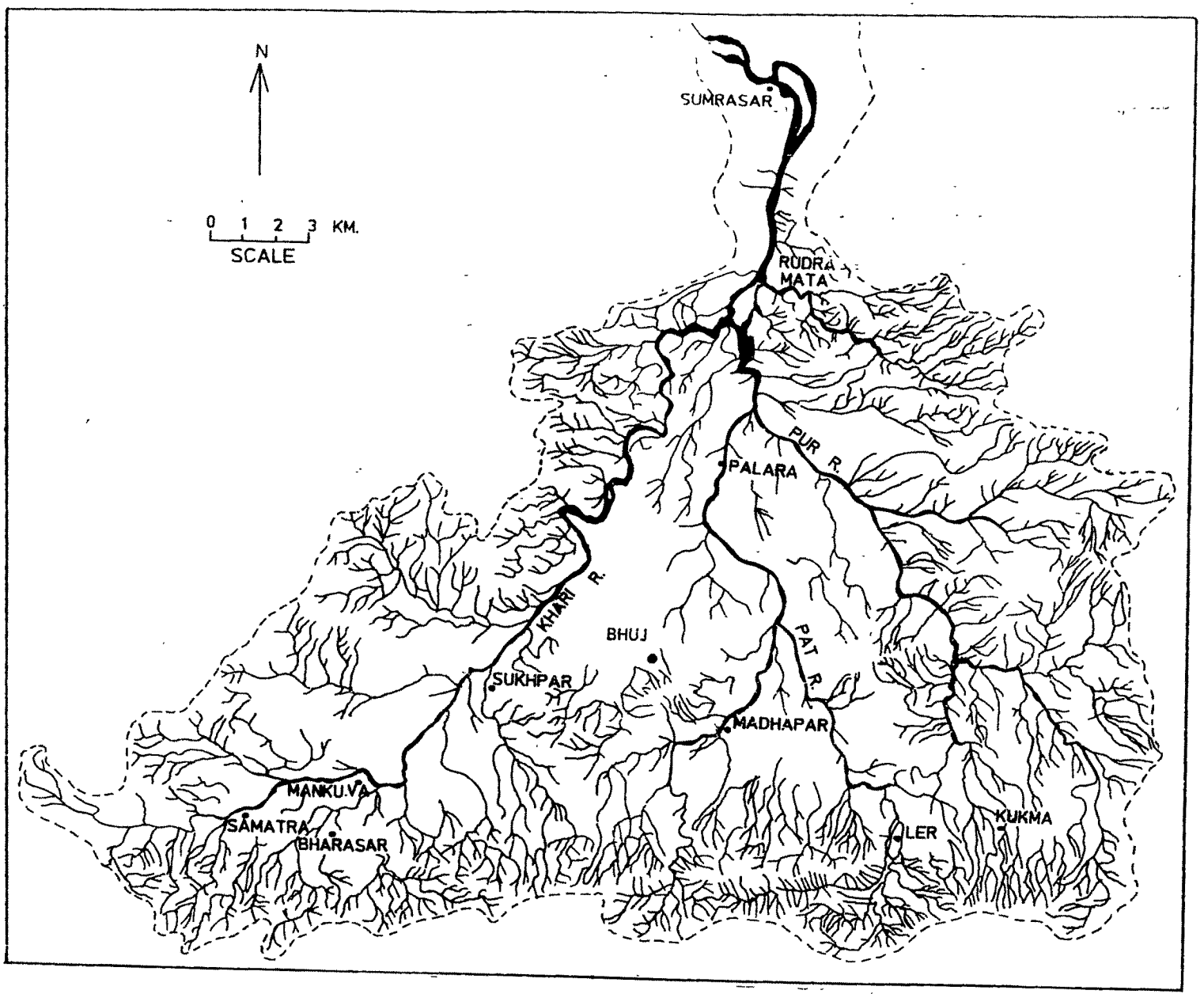

Fig. 1.3 Drainage map of the Khari river basin.

Plate 1.2 North facing Panoramic view of the Habo dome. Note the steeply dipping northern limb marking the Kachchh Mainland Fault. The flat area in the background is the Banni Plain. On the right at the far end is the Kas Hill scarp.

southeasterly hill ranges are the two main tributaries of Khari river. The headward area constitutes the East-West trending Katrol hill range from where numerous first order streams fall with steep gradient onto the base of the range, and construct successive higher order streams. General flow direction of the basin is towards north; while the main channel of the Kari river is flowing towards northeast.

The Pat and Pur flowing in northerly direction meet with Khari river at Rudramata dam. The Khari river continuing its journey swings towards north as a single, wide, sandy channel beyond Rudramata dam and finally merges into a vast saline, savana styled grassy plain of Banni. The final, braided terminal segment turns abruptly towards northwest.

COMMUNICATION AND TRANSPORT

Being the capital of Kachchh, Bhuj is well connected with all other taluka head quarters of Kachchh by state highways, while almost half of the villages are connected directly or indirectly by pucca roads with state highways (Fig.1.4). Bhuj is joined with the states major cities-Ahmedabad and Rajkot by meter gauge railway line, while Gandhidham situated 60 km from Bhuj is connected with Ahmedabad by broad gauge railway line. The capital is also connected by air ways with Ahmedabad and Mumbai. Kandla, located 8 m from Gandhidham is a major port and a Free Trade Zone in India. It has gained tremendous boost after the independence.

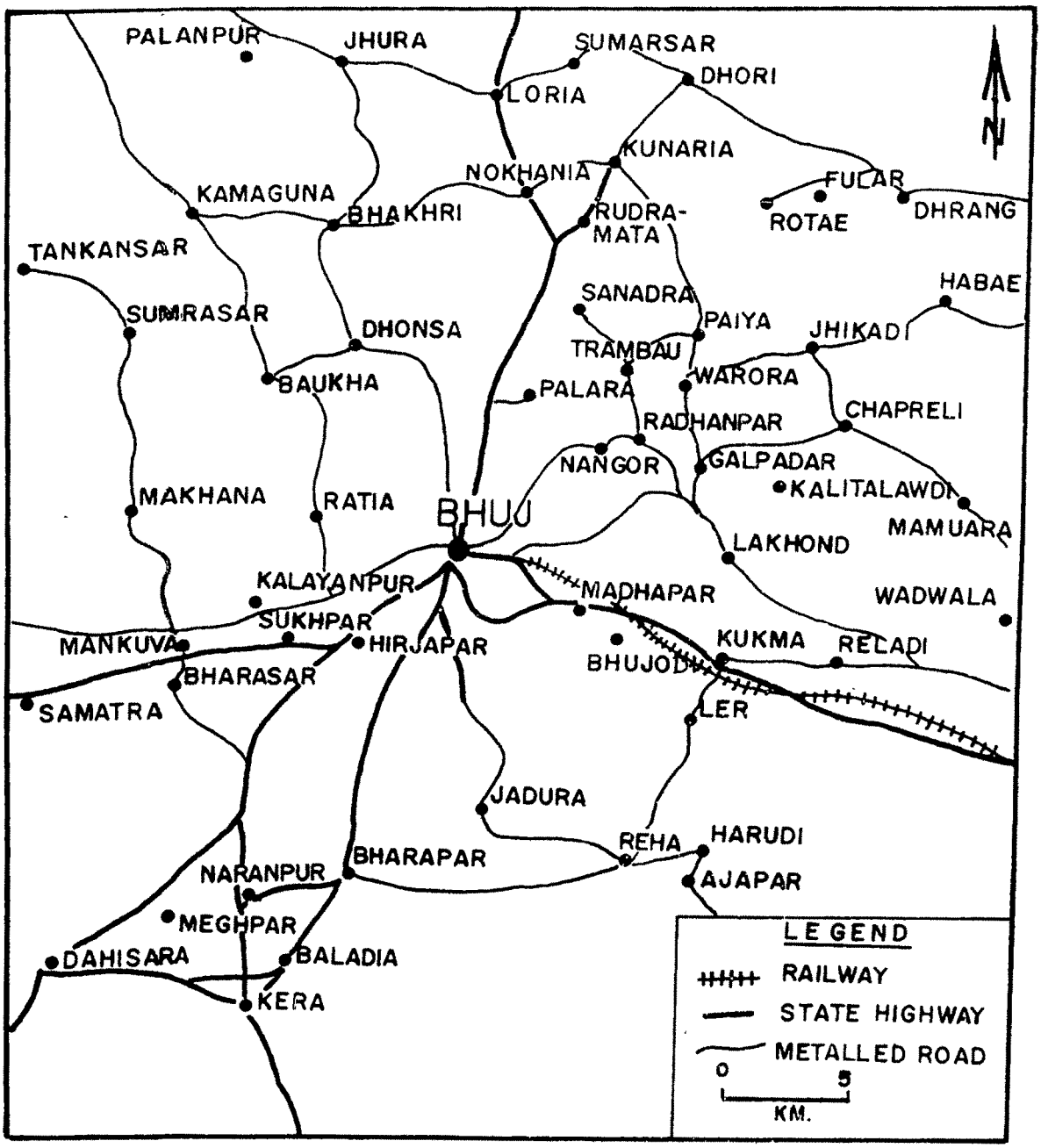

Fig. 1.4 Communication map of the study area.

CLIMATE

Global position of the area shows that it is situated on the tropic of Cancer, therefore the Khari river basin experiences tropical to subtropical climate. Moreover due to its peculiar location at the margin of arid to semi-arid zone of south and southwest Asia, it experiences extremes of climatic condition. Average summer temperature goes to 42-43^0 C, exceptionally it reaches upto 45-47^0 C; but nights are comparatively cooler and pleasant due to desertic climate. Winter temperature rarely approaches to 32^0 C, but quite often the minimum temperature at night, falls to 3-4^0 C, while average minimum temperature is 6-7^0 C. Winter and summer months are generally November to February and March to June respectively.

The average monsoon commences in the beginning of July, while due to the low rate of precipitation the mean rainfall is 130-150 mm that too is quite erratic. Continued aridity, extremes of weather condition, unique geographical features and low moisture retaining capacity of soil and rock have resulted into barren landscape and quite a few cultivated grounds in the area.

PEOPLE AND OCCUPATION

The people in and around Bhuj i.e. within the limit of the basin of Khari river are quite wealthy. However remote villages are below poverty line. Among the major population of Hindus the Jains, Patels and Luhanas are dominant. Muslims are live in the villages of Nana Varnora, Mota Varnora, Raydhanpar, Paiya, Trambov, Sumarasar, Dhori etc. In the

northern part of the basin. Jains, Patels and Luhanas are amongst wealthiest communities. The major occupation is agriculture and cattle breeding. The Patels are very much connected with construction business in Kachchh as well as in the Gulf Countries.

This triangular area of the Khari basin has so many important institutions and all sorts of government offices. Some of them are meteorological center, seismological laboratory, Central Arid Zone Research Institute (CAZRI), Gujarat Institute of Desert Ecology (GUIDE), Engineering, Polytechnic, Science, Commerce and Arts colleges, All India Radio, T.V. Relay centre etc. Almost all defense wings viz. Army, Military, Air Force, Border Security Force (BSF), Social Security Board (SSB) have their permanent base stations at Bhuj and adjoining areas.

APPROACH AND METHODOLOGY

The present study is mainly aimed at understanding the structural and tectonic setup of the area along with detailed landscape analysis for working out the morphotectonic evolution of the Khari river basin. Detailed geological and structural mapping of the area has been carried out on 1: 50,000 scale. Special attentions is paid to the Quaternary deposits of the area with a view to investigate the Quaternary evolutionary history of the area. The structural peculiarities of the area including fault systems and the various domal structures in pre-Quaternary rocks have helped in reconstructing the pre-Quaternary evolutionary history of the area. An attempt has been made to work out the phases of tectonism which has led to the present geomorphic set up of the area. Detailed mapping of the

various geomorphic features including the erosional surfaces have also been carried out. Effects of faults and periodic movement along them on the geomorphology has also been investigated.

Morphometric analysis of the various geomorphic features has also been attempted for understanding the effects of the neotectonic activity in the evolution of the present landscape. Some of the important parameters calculated mathematically are longitudinal stream profiles, stream gradient, stream gradient index, pseudo-hypsometric integral, valley cross sections, sinuosity index, mountain front sinuosity etc. Based on the data generated, an evolutionary model for the Khari river basin has been attempted which has tremendous implications for the geological evolution of Mainland Kachchh as well.