CHAPTER - III

G E O M O R P H I C S E T U P

MAIN PHYSIOGRAPHIC DIVISIONS OF KUTCH

The Kutch peninsula provides an interesting diversity of landscape and landforms of various dimensions occurring at different altitudes. The geomorphology of Kutch appears to be essentially controlled by the important factors of lithology and structure of rocks and paleoclimates. Broadly its terrain is divisible into four zones from north to south:

1. The Ranns
2. The low-lying Banni Plains
3. The Hilly region and
4. The Southern Coastal Plains

The Rann forms a unique salt-crusted wasteland to the north and east of the Mainland Kutch, and comprises a flat geomorphic terrain, rising slightly above the sea level (2-3 m). It is divided by the highland of Kutch into the Great Rann and the Little Rann. The latter lies to the ESE of the former. The Rann area mostly remains dry except for the rainy season when it is covered by saline waters. During summer and winter seasons, practically the whole region is covered with a fairly hard salt-encrustation.

The Banni Plains lie between Pachham island in the north and Mainland Kutch in the south and cover a wide area. Banni area rises a little higher than the surrounding Rann and is covered with grass and other shrubs.

The Hilly Region comprises three parts viz.

(a) Island belt: This consists of four islands i.e. Pachham, Khadir, Bela and Chorar from west to east.

(b) Mainland : The area lying to the south of 'Banni' and extending upto the Gulf of Kutch in the south is called 'Mainland'.

(c) Wagad : This region lies to the NE of the Mainland and forms an isolated land mass.

The Southern Coastal Plains border the Mainland against the Gulf of Kutch in south and Arabian sea in west.

Physiographically, the Kutch region comprises a number of E-W hill ranges in Island belt, Mainland and Wagad area, separated by large tracts of low ground. All hill ranges and low ground in between almost run parallel - a characteristic feature in this part of the country giving some clue to the fact that topography has been controlled by the geological and structural features. The highest peak in Kutch is that of Kala-Dongar (465 m) in Pachham island. In the Mainland Kutch the Nana Dongar forms the highest peak having 432 m altitude above M.S.L.

GEOMORPHIC DIVISIONS OF STUDY AREA

The miliolite occurrences are restricted to the Kutch Mainland, forming a well-defined SW-NE zone that extends from the upper fringes of the Coastal Plains to the foot of the Northern Hill Ranges of the Mainland. Laterally, they extend from Nakhatrana in the west to Bhachau in the east. The topography and drainage of this part of the Mainland has been responsible for the deposition of miliolite rocks by providing appropriate obstacles and sheltered sites for the wind-borne material that were lifted from the Southern coast and dumped inlandward.

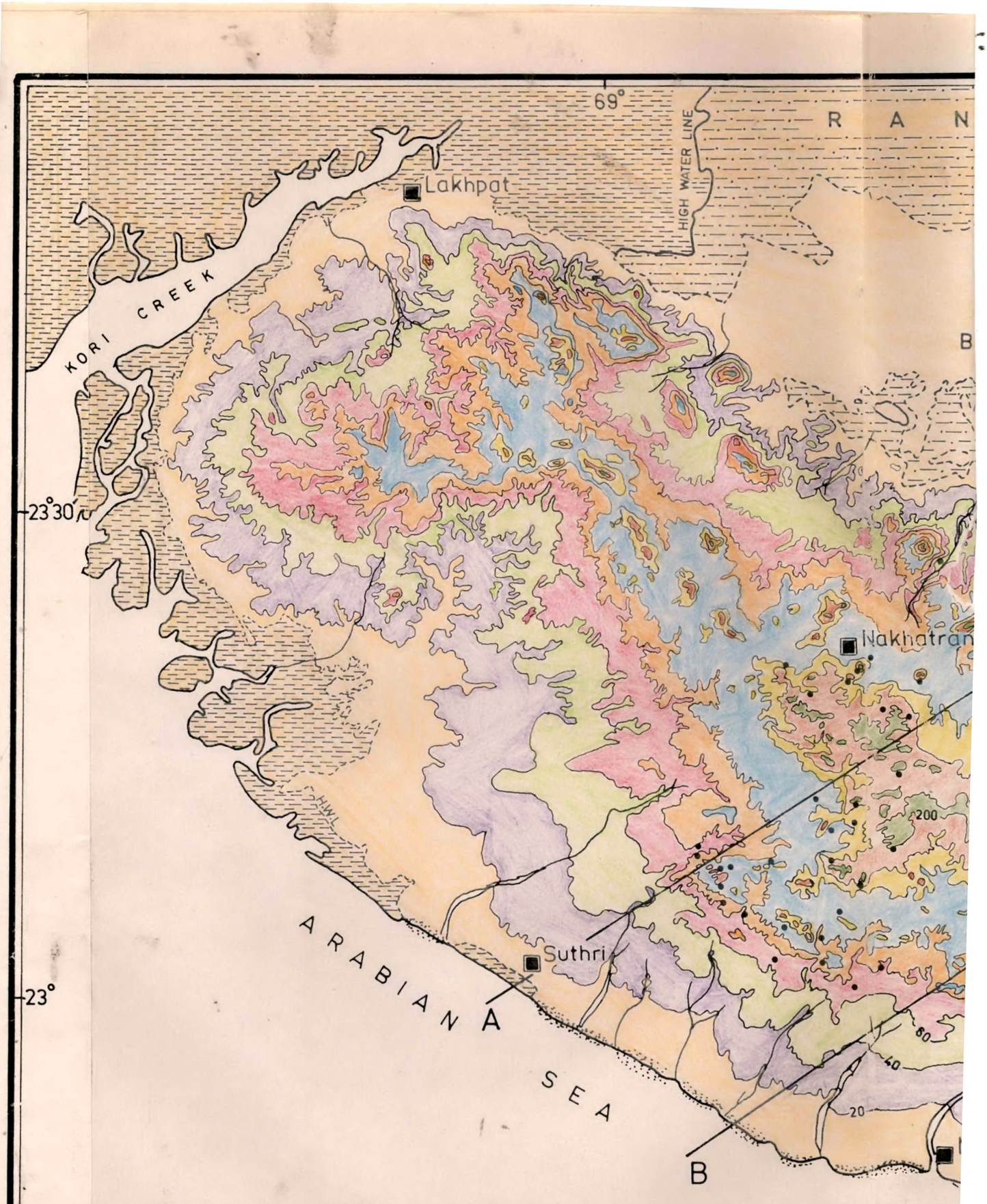
In order to have a clear geomorphic feature of the Mainland Kutch, the author prepared a detailed topographic

map by considering the contours of 20, 40, 60, 80, 100, 140, 160, 200 metres and above. The major rivers have also been delineated (Fig. III.1). On the basis of the above map, the Mainland Kutch comprising the zone of miliolite occurrences can be divided into the following three main physiographic divisions (Fig.III.2).

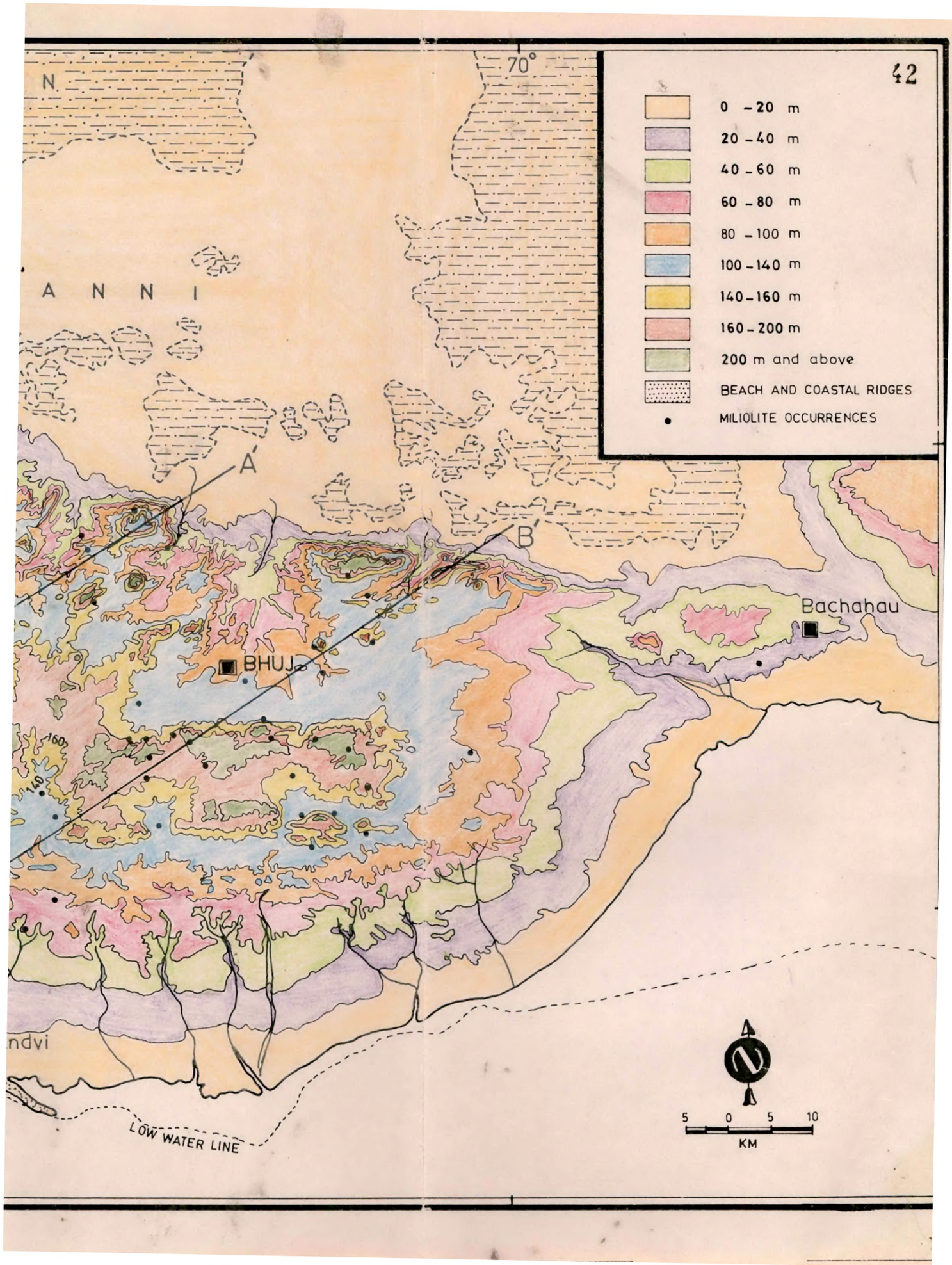
1. Southern Coastal Plains,
2. Central Highland and
3. Northern Hill Range.

SOUTHERN COASTAL PLAINS

The Coastal Plains overlooking the Gulf of Kutch and the Arabian sea, form the southern part of the Mainland Kutch and is situated to the south of the Central Highland. Within the limits of the study area, the Coastal Plains extending from Suthri in the west to Mundra in the east, are made up of Tertiary and Quaternary sediments, comprising a 25-30 km wide belt with very low gradient and devoid of any significant topographic features. From the sea level, the Plains rise rather gradually to the altitude of 80 m, beyond which they tend to show a rather more conspicuous rise, merging into the Central Highland with a steeper gradient. On the geomorphic map, the major rivers in this part of the Kutch terrain, show meandering just above 25 to 30 m altitudes, below which, upto the present day coastline they show almost a straight course.



Fig·III·1 TOPOGRAPHIC MAP OF MAINLAND KUTCH


70°
N
A N N I
A
A'
B
B'
BHUJ
Bachahau
160
140
ndvi
LOW WATER LINE
0 – 20 m
20 – 40 m
40 – 60 m
60 – 80 m
80 – 100 m
100 – 140 m
140 – 160 m
160 – 200 m
200 m and above
BEACH AND COASTAL RIDGES
MILIOLITE OCCURRENCES
5 0 5 10
KM

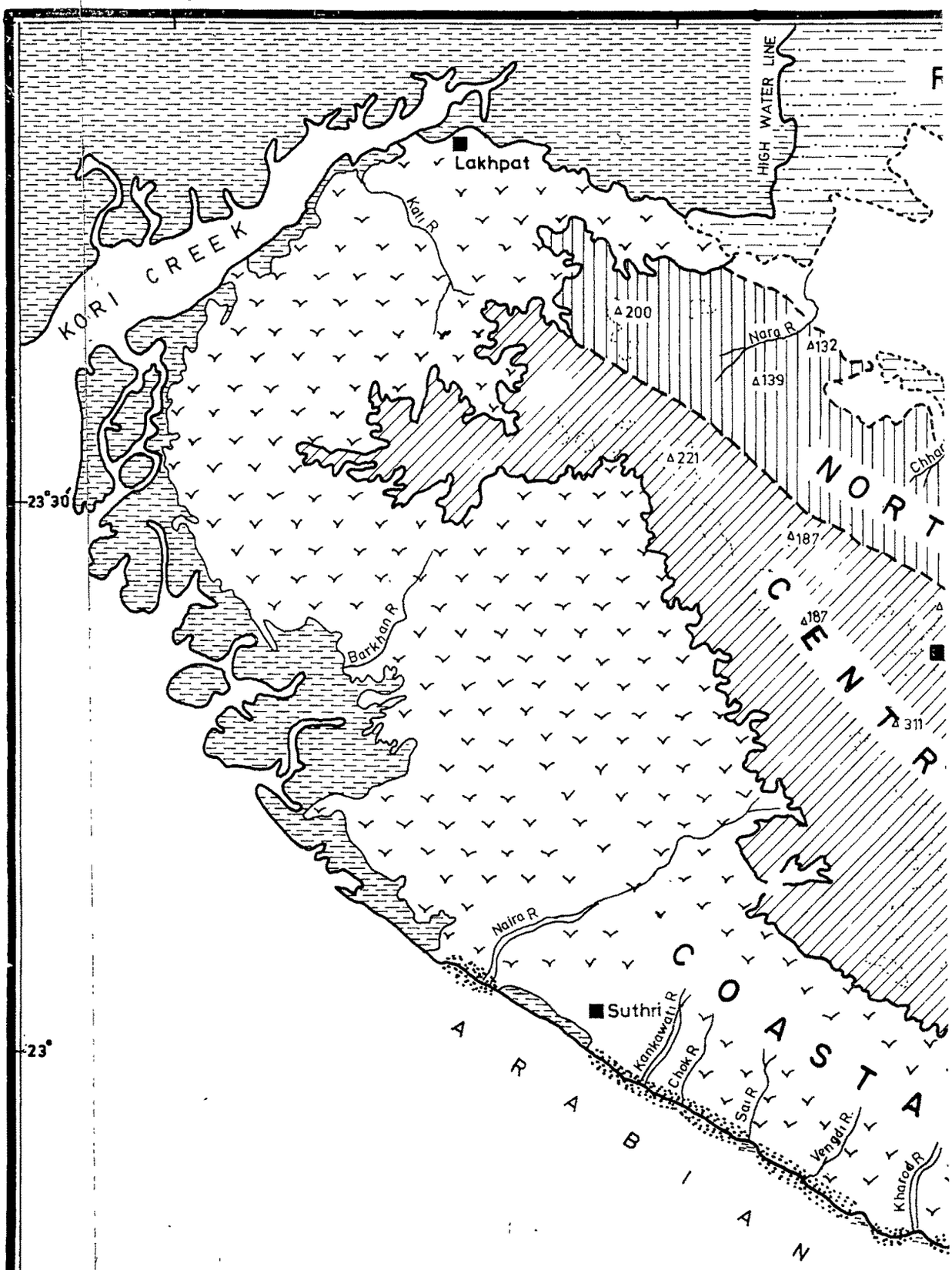
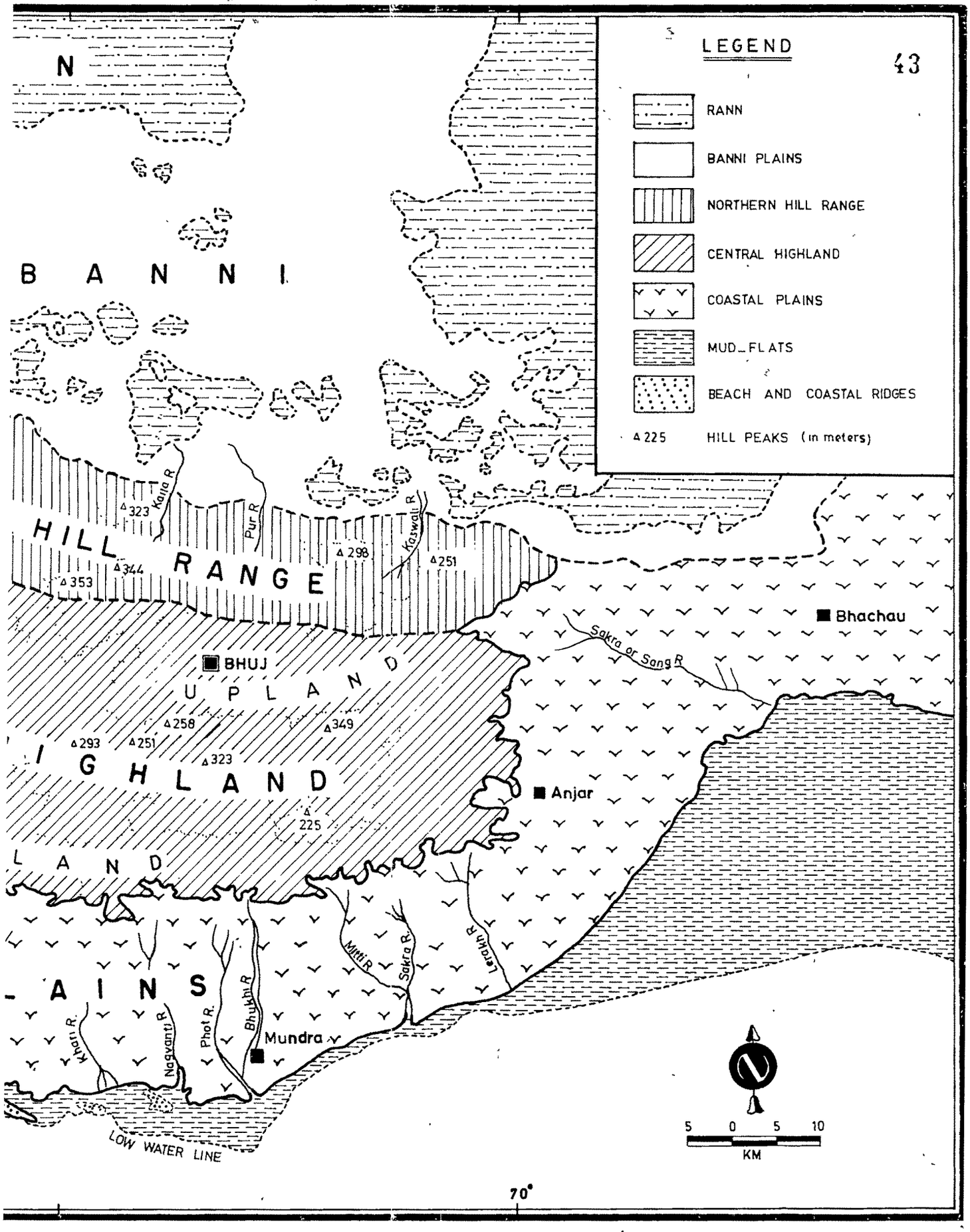


Fig III.2 GEOMORPHIC MAP OF MAINLAND KUTCH


LEGEND
RANN
BANNI PLAINS
NORTHERN HILL RANGE
CENTRAL HIGHLAND
COASTAL PLAINS
MUD-FLATS
BEACH AND COASTAL RIDGES
Δ 225 HILL PEAKS (in meters)
N
B A N N I
HILL RANGE
Δ323
Kaila R
Pur R
Δ298
Kaswati R
Δ251
Δ344
Δ353
BHUJ
U P L A N D
Δ258
Δ349
Δ293
Δ251
Δ323
I G H L A N D
Δ 225
L A N D
- A I N S
Bhachau
Sakra or Sang R
Anjar
Mitti R
Sakra R.
Lakhpat R
Khari R.
Nagvanti R.
Phot R.
Bhukhi R
Mundra
LOW WATER LINE
5 0 5 10
KM
70°

The coast between Suthri and Mandvi is rather straight, trending WNW-ESE and is marked by wide sandy beaches flanked at the back by narrow coastal dune ridges and bpund on both sides by extensive tidalflats. The actual coastline is all along marked by a prominent ridge of loose quartzo-carbonate sands, extending almost in a WNW-ESE direction. Wherever the shoreline is dissected by the river mouths, the sandy ridge is seen to form spits and bars with lagoonal patches of tidal mud behind the ridge. The beach though narrow is well defined, and varies in width from 50-100 m, with the backshore sandy ridge rising abruptly to almost 5 to 10 m above the bermline. The off-shore profile is also gentle and the continental shelf is shallow and broad, extending upto distances varying from 10-20 km.

The coastline further east beyond Mandvi outside the limit of study area shows increasing development of tidalflats. On the map, these tidalflats are seen gradually merging into the Little Rann. In this part the actual shoreline is crenulated on account of numerous river mouths. The thickness of the mud is seen gradually increasing eastward.

The coastline to the NW of Suthri upto Koteshwar is muddy and is characterised by extensive foreshore tidalflats; the shoreline is cut by numerous creeks and is highly crenulated. There is a near total absence of development of sandy beaches and coastal dunes. The mudflats support a

luxuriant growth of mangroves.

Underlying the Coastal Plains is alluvium, consisting of a thin veneer of sediments brought by the river Kankawati, Vengdi, Kharod, Rukmavati, Nagvanti, Bhukhi etc. that cut across the Plains and meet the Gulf.

CENTRAL HIGHLAND

The Central Highland occupies the heart of the Kutch Mainland and is seen to consist of a number of hill ranges. This Highland area rises to an average altitude of 200 m or more above which the terrain shows NW-SE and E-W ridge complex with some of the summits as high as 363 m (Lakharia Dongar), 266 m (Roha), 432 m (Nana Dongar), 348 m (Dhrubya Dongar), 295 m (Gurukul Dongar), 293.7 m (Samtiya Dongar) 251 m (Chadwa Dongar), 323 m (Kirgiriya Dongar), 349 m (Katrol hill) etc. The cluster of hills and their peaks, aggregate into a crescentic rocky rugged terrain. From south to north the highland shows a gradual rise between 80 m and 140 m; above 140 m the gradient is rather steep. The foot-hill areas to the south between 80 and 140 m could be described as comprising an 'upland' with a number of sporadic ridges and peaks rising 20 m or more above the ground level. Northward, the highland again slopes down into an intervening stretch of 'upland' (80-140 m), which rises again further north into the Northern Hill Range- a

chain of well defined conical and domal peaks with intervening broad valleys. In fact, the Central Highland through a valley dissected low ground, slopes down quite markedly into the plains of Banni and the Great Ramn of Kutch.

The Central Highland is characterised by several hill ranges having steeper gradient on the northern slopes and a gentler gradient on the southern slopes which almost coincides with the dips of the strata. The basaltic hill ranges in the south and west show moderately steep slopes on the northern sides.

Lithologically, the Central Highland comprises Mesozoic rocks which have been separated from the Tertiary rocks and Southern Coastal Plains by the intrusion of basic rocks bordering it. The lithology has played a very important role in the formation of present geomorphic features of Kutch peninsula.

The northern slopes of the NW-SE and E-W ridge complexes of the Central Rocky Highland have been affected by the 'Vigodi Fault' and 'Katrol Hill Fault' respectively, which have caused the steepness of the slopes on its northern side (Fig. I.5). On account of absence of faulting on the southern slopes, the gradient has remained gentler, as a result, the numerous streams in this part of terrain

have given rise to a dissected topography marked by numerous gentle valleys and depressions. These have provided ideal shelters for the accumulation of miliolitic sands.

NORTHERN HILL RANGE

The Northern Hill Range is located to the north of Central Highland and runs almost parallel to it. It is bordered by Banni Plains and the Rann in the north, and by the 80-140 m high upland areas in the south. This hill range forms a chain of domes of Jurassic and Cretaceous rocks, and is flanked by the E-W 'Kutch Mainland Fault' From west to east, it comprises a series of domes like Jara, Jumara, Manjal, Keera, Lyari, Chari and Dhar Dongar, and anticlines like Jurio, Habo and Kas. Major peaks show altitudes of 251 m (Kas Hill), 298 m (Habo Hill), 323 m (Jhura$_{\text{Hill}}$) etc. A few isolated almost conical trappean hills are also seen rising above the plain ground. Dhinodhar Dongar is one such hill having 388 m altitude.

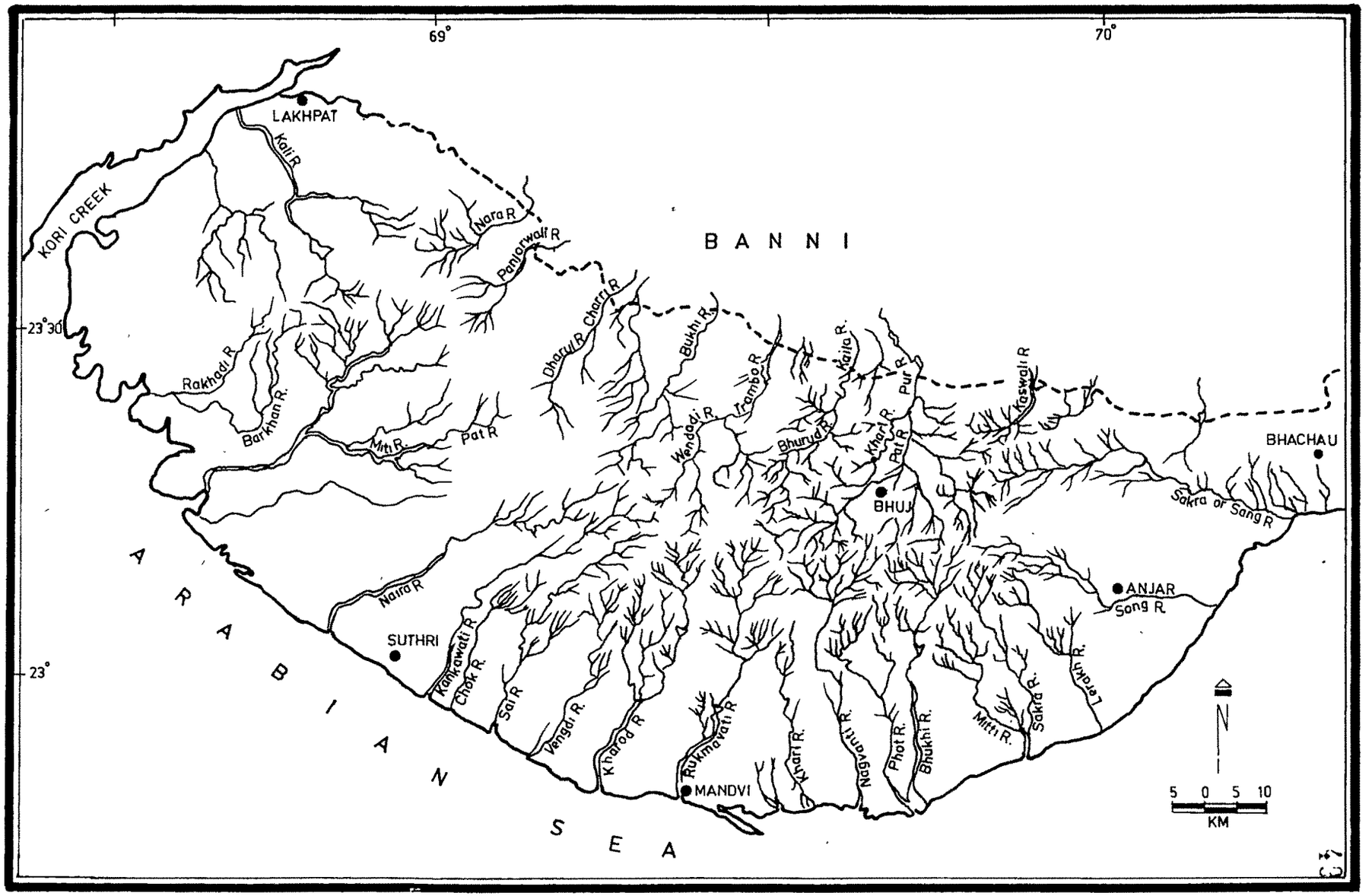
Structurally, this series of hill range is characterised by an E-W 'Kutch Mainland Fault' that has significantly controlled the physiography of this part of terrain. On account of this fault, the northern slopes are steep whereas the southern slopes that coincide with

the dip of strata are gentler. Here also the basaltic hills show moderately steep slopes on the northern sides.

Northern as well as southern slopes of most of the hills, hill ranges and ridges in this highland are marked by notches and depressions. These are of the nature of rain gullies, and comprise triangular pit like depressions. These have provided ideal sites for the accumulation of miliolitic sands. The saddles between the two adjacent peaks of the hill ranges have provided an 'avenue' or 'passage' for the wind to carry the sands from south to north.

DRAINAGE OF STUDY AREA

The Central Highland forms the main water-shed with numerous consequent streams draining the slopes with a radial pattern and pour into Gulf of Kutch in the south and in the plains of Banni and Rann in the north (Fig.III.3). The south flowing streams join the Naira, Kankawati, Chok, Sai, Vengdi, Kharod, Rukmavati, Khari, Nagvanti, Phot, Bhuki, Mitti, Sakra and Lerakh rivers and empty their waters into Gulf of Kutch and Arabian sea. The streams originating from the northern slopes of the Central Highland join the streams originated from the Northern Hill Ranges and pour their waters into the Chhari, Bhukhi, Trambo, Kaila, Pur and Kaswali rivers which in turn empty themselves into the



Fig·III·3 MAP SHOWING DRAINAGE PATTERN OF MAINLAND KUTCH.

Rann of Kutch.

In general, the Kutch peninsula is characterised by the ephemeral(seasonal) rivers which get flooded during monsoon only. Many rivers like Kankavati, Kaswali and Bukhi in the north show a very broad river bed with occurrences of miliolite rocks on their banks forming vertical cliffs.

The drainage characteristics of the Kutch Mainland and the relatively well-carved valleys which now have only very little flowing water clearly point to the fact that the stream dissection was more effective in the past and experienced more wet climatic phase, during which the streams carried more water. The various sheet occurrences of miliolites on the banks of some of the river valleys, reveal at least two fluvial cycles, intervened by a dry phase during which miliolitic sand filled the valleys.