CHAPTER IV

I.N L A N D G E O M O R P H O L O G Y

IV.1 GEOMORPHIC SUB-DIVISIONS

The inland areas provide a considerable diversity of geomorphic features, controlled essentially by geology and tectonism. Based on these factors, the terrain away from the coastline, has been classified as under :

1) Eastern Mainland
2) Okha Rann
3) Okha Mandal Block

The terrain characteristics of these three units differ from each other in the following aspects :

1) Topographic expression
2) Surface features
3) Soil cover
4) Forest and vegetation
5) Stream channel characters
6) Groundwater conditions.

IV.2 EASTERN MAINLAND

Morphologically, the eastern part of the study area is divided into three distinct units :

1) Southern hilly terrain
2) Northern and western gentle sloping region
3) Coastal plain

A brief geomorphic account of the above three units, is given in the following pages.

1) Southern hilly terrain

This region lying between the Longitudes $70^{\circ}0'$ and $70^{\circ}15'$ East and Latitutes $22^{\circ}5'$ and $22^{\circ}10'$ North, is made up of a large number of parabolic, circular and irregular hill peaks, the height of which range

between 220 to 230 m above MSL. The hill tops are broad and convex, mostly barren, and very few of these are covered with forest. The slopes show gradients ranging from 1 : 1 to 1 : 5 or sometimes even less. The slopes are dissected by stream channels giving considerable ruggedness to slope surfaces. Most of these peaks show locally radial drainage patterns. The streams of this region are mainly ephemeral, their life being very short and water flows during rains only. The stream sinuosity (Leopold et al. 1964) is less than 1.5 and hence they are classified as straight streams of youth stage.

2) Northern and western gently sloping region

To the north and west beyond the hilly terrain, the second phase of the topography starts. Westward, (on the western side of Longitude 69°55' East) beyond Kanalus Gop Katkola section of Western Railway, the hilly terrain flattens out to a broad convex top with sporadic barren peaks. The slopes of these peaks are gentler than the eastern region hills. The gradient of the slope varies between 1 : 10 to 1 : 12, much less than the eastern region. The gradient of the northerly flowing drainage basins varies between 1 : 4 to 1 : 11. Streams channels are more or less

straight and nowhere braided patterns indicating old age are observed. Streams are ephemeral. Streams show sinuosity less than 1.5.

To the north, occurs the gently sloping plain covered by either agricultural soil or stone waste with small bushes.

The major part of surface is covered with agricultural soil with 5 to 15 cm depth. Soil is of residual type derived from underlying country rock. Hill peaks and local elevations are devoid of soil cover. Small elongated hills with a height of 30-40 m are sporadically lying on this plain. In addition to this the ruggedness of the ground is increased by stream channels and river valleys.

The stony waste lands are mostly barren with a spread of rock fragments of various sizes and shapes. These are the residual products of weathering and erosion. Erosion being active, no residual soil blanket is present. Patches of stony waste are sporadically spread all over the region and their areal extents vary from a square kilometer to several square kilometers. Their surface may be flat, convex, concave or undulating, sometimes supporting small bushes.

The gradient of the slope varies between 1 : 300 1 : 400. The drainage pattern is dendritic. Drainage density and drainage frequency are comparatively low as compared to the hilly terrain. The low gradient has given rise to considerable meandering courses to the stream channels. Here the sinuosity is more than 1.5. Shifting of channels is a common phenomenon in this region though it is on a limited scale. The country rock being quite hard (Deccan Trap basalt), the lateral and downward cutting is a very slow process. On the inner side of the curvature deposition of sediment has taken place in the form of point bars. These point bar deposits vary in grain size from fine sand to coarse gravels. Though the stream channels show meandering courses, they don't have levees or flood plains. Vertical walls are present mainly in the meandering course of outer bank and range from 1 to 14 metres or sometimes more in height.

3) The Coastal Plain

The coastal plain is devoid of any prominent hill. Here, the rivers have reached their old age, stream channels are straight and braided with sinuosity less than 1.5. Good examples of braiding are shown by

Nagmati, Sasoi, and Phuljar rivers. Sediment deposits in this zone are fine clays mixed with medium to coarse sand.

West of Pindara and Mahadevia the ground has a smooth slope. The slope is so gentle that the streams around Mahadevia are braided and they terminate abruptly on the plain ground.

Static groundwater level is very near to the surface due to which intense growth of vegetation has taken place. The dense forests of Babul trees are present near the villages Bed, Amra and Vasai in the vicinity of Sasoi river. Similar types of forest and vegetal growth are present in the vicinity of Ghi and Phuljar rivers also.

IV. 3 OKHA RANN

An interesting geomorphic feature lying between the Saurashtra mainland and Okha Mandal Block is the trench like flat terrain made up of saline sediments comprising clay, mud and sand. It is a linear NNE-SSW extending depressed terrain with a length of about 21 kilometers. Its breadth in eastwest direction varies from place to place, the maximum width being near its mouth in the north,

10 kilometers, and a minimum of 3 km near Gurgat-Charakla in the south. The total areal extent is about 120 sq km. The Okha Rann terminates in the south near Arabian sea between Okha Madhi and Kuranga, abutting against an isthmus between Saurashtra mainland and Okha Mandal Taluka.

The Rann is mostly dry during the greater part of the year, but in monsoon it gets flooded, the flooding being partly due to rain water and partly due to the sea water pushed inward from the Gulf of Kutch side by strong southwest monsoon winds that blow for several weeks steadily with great velocity. The flood recedes as soon as the intensity of monsoon wind is reduced leaving a wide smooth plain of fine saline earthy clay and mud.

The isthmus against which the Rann terminates in the SSW, is about 3 km long and ½ km wide at its narrowest part. The western side of the isthmus near the coast is covered by a ridge of white carbonate blown sand of about 10 m height, which covers the bed rock. The bed rock is exposed behind the Okha Madhi village and is seen to comprise a fossiliferous limestone of Gaj formation.

IV.4 OKHA MANDAL BLOCK

The far western part of the study area of Okha Mandal has altogether a different geomorphology. It occupies an area of about 600 sq km in quadro-circular shape. The general elevation of the land is about 10-20 m above the sea level. The country rock being limestone, it has given a distinctive topography. Light coloured clays with limestone boulders, pebbles and sand yield a different scene than the Trap topography. The climate being semi arid, growth of cactus is dominant in this terrain.

The western side is semi-circular facing the Arabian sea between Okha Madhi and Okha, while the northern side between Okha and Positra, is rugged and irregular facing the Gulf of Kutch. The eastern border is a straight line running parallel to Okha Rann between Positra and Okha Madhi and is marked by vertical coastal cliffs. These cliffs are of 10 to 15 m high, the unusual maximum height is 40 m near Khatumba. These cliffs are carved out by the sea waves to develop caves, blow holes, stacks and natural bridges.

The western border except at Dwarka and Varwala is fringed by a sandy ridge.

On the whole, the Okha Mandal Block, forms a slightly elevated tableland, characterised by low rocky hillocks and linear ridges. Comparatively, the northwestern portion is more elevated and is characterised by a ridge that extends from Varwala coast to 8 km inland, bearing from Dhrasanvel northwards through Gadechi towards low country around Aramda. The height of this ridge varies from 10 m or so around Varwala to 20 to 30 m between Dhrasanvel and Gadechi. After Gadechi the ridge starts sloping down to sea level near Aramda ending up as a coastal cliff. To the east, a large number of scattered hills ranging between 20-30 m are present between Hamusar and Rajpura. These hills are covered by thorny bushes, babul trees and cactus, the former being dominant. Gradually the proportion of cactus progressively increases towards south. In the eastern half, an irregular spread of ridges and peaks start from Positra to Okha Madhi varying in heights between 20 m to 40 m. A 40 m high peak lies very near the coast of Khatumba. The area being of limestone, shows a very rugged topography. The hill tops are flat and form small plateaux, more or less scarped round their tops.

The streams of northern region flow towards north and those of southern region flow towards Okha Rann and the Arabian sea. The overall drainage is somewhat radial.

In the western part of the block, there are numerous water estuaries along Mithapur, Mojap, Sivarajpur, Rupen Bandar and south east of Dwarka. These water bodies are connected with open sea by creeks cutting across coastal sandy ridge. The sea water feeding the estuaries, is controlled by changes in the tide level of the sea. At high tide water enters through the creek and drains during low tide. When filled, the depth of water is as much as, 4 m or more. These estuaries never get dried and some water is retained in their deeper parts. Because of this, profuse growth of water plants and mangroves on muddy surface is seen, sometimes in patches. The muddy surface is rough with sporadically lying boulders and pebbles. The shapes of these water estuaries are quite irregular and elongated with very gently sloping borders, their sizes varying from 2 to 4 sq km. Gomti Creek (Dwarka) is developed by the headward erosion of Gomti river, whereas other creeks have no relation with the stream channels or river mouths.