CHAPTER - VIII

R E S U M E

RESUME

1. The Rajpipla hills and the neighbouring coastal plains, that form a part of Central Gujarat provide an unique assemblage of the erosional and depositional landforms, whose morphology ideally reflects the sequence of geological events dating back since the beginning of the Cenozoic Era.

2. The most interesting feature of the area is the significant altitude variation,- M.S.L. to as much as 880 m high trappean hills. The rugged hilly terrain undulating over the uplands, finally roll over the alluvial plains upto the Gulf of Khambhat. The entire landscape from the east to west has been divided as under :

1. The eastern trappean rugged relief of ridges, hills and plateaux with intermontane valleys.
2. The undulating uplands with ridges and hills.
3. The alluvial and coastal plains with low summit hills and mounds.

The study reveals role of lithological and structural controls that have influenced the evolution of the terrain. Geologically, the oldest rocks are the sedimentaries. Cretaceous age (Bagh beds) which occur is inliers within the basalts of the Deccan Trap (Cretaceous - Eocene). The Tertiary rocks - sandstones and limestones rest over the Deccan Trap, while the Plaistocene alluvium

either comes directly over the trap or is resting over the Tertiaries. A combination of lithology and structure has played significant role in sculpturing the landscape. The study area lies within the two major fault zones, represented by two 'en-echelon' ENE-WSW trending faults, Ankleshwar fault and Hanfeshwar fault, and there are several off-shore faults which are extended along the shoreline. The Deccan Trap basalts with their several sets of joints which provide an intricate network of minor fractures dominate the area. These joints and fractures pattern have controlled shape and slope of the relief features and the drainage patterns. The Quaternary tectonism is another geological factor which has contributed to geomorphic diversity of the terrain. The entrenched meanders of the streams, tributaries and rivers in the depressions (Lows) reveal factors of neotectonism and eustatic sea-level changes during the Quaternary period. The extended river-channels on the coast from the coastal plains, the estuarine river mouths with islands and the coastal sandy ridges, dunes and mudflats etc., all these reveal rise and fall of the sea-level related to glacial and inter-glacial stages of the Quaternary period.

3. The E-W, S-N or NE-SW and SE-NW coursed linear and parallel streams flow straight towards the west from the basaltic and Vidhyan hills, drain the plateaux and uplands and flood the plains with alluvium and finally meet the Gulf of Khambhat. The entire area is dissected by 52340

streams that fall within 12 river systems. On this 180 km wide and 80 km broad terrain, the Narmada which forms the principal river is a 210 km long consequent stream provides the backbone of the drainage system, comprising 11 main rivers, 25 tributaries and about 95 sub-tributaries. The area is drained by the WSW flowing Narmada which divides the drainage into two parts to its south and north. The various river systems provide a variety of drainage patterns. Even an individual rivers, on surface from the eastern hills and following over the western plains, typically show marked variation in the pattern because of diverse conditions of slope, structure and lithology prevailing in the different parts of the stream course.

4. The study has shown that the abundance of curves and loops along the stream courses is controlled by following entirely unrelated factors.

1. In the upper reaches of the streams, where they flow within traps, their courses tend to become 'zig-zag' because they flow along numerous joint sets oriented in the different directions. This resembles meandering.

2. In the uplands and the coastal plains, the streams flow over a surface which has very low gradient, and the surface rocks are soft. The lack of gradient is responsible for meandering, while the neotectonic uplifts or sea-level changes, have caused incision of the meandering courses.

The vertical cutting of the channels is obviously related to the neotectonic uplift of a low gradient terrain, mostly the areas in between the parallel E-W aligned 'highs' and ridges.

5. The relative (comparative) relief in terms of altitude and areal distribution forms the main aspect of the relief analysis, which reveals the following salient features.

1. The plateaux comprising 85 sq.km area with two levels at 600 m and 400 m.

2. The uplands terrain with an area of about 2700 sq.km is marked by two types, (i) the trappean uplands in the east, and (ii) the Tertiary uplands towards west.

3. The plains of about 3500 sq.km area and make up the largest relief features in the region, these plains are of three types, (i) the western alluvial plains (N. of Narmada), (ii) the Narmada flood plains, and (iii) the coastal plains.

6. To the north of river Narmada, the main trappean highlands slope into alluvial plains, the uplands being almost absent, while in the south, they are flanked by uplands which further west merge into coastal plains.

7. The successive levels in the hilly terrains and the uplands are characterised by linear ridges, linear-rows of conical flat topped hills and cluster of smaller hills separated by low-lying areas, the coastal plains

and the northern alluvial plains contain sporadic ridges and hills. The intermontane valleys in the basaltic terrain, are narrow and steep while those in the uplands are shallow and wide. A distinct transition is observed in the characteristics of the high and low grounds of the two units. By and large, the high altitude terrain, is marked by a more rugged relief and narrow steep valleys and khadis. The slopes of hills in general are steep concave. The relatively low altitude hilly terrain representing lower lava flows is characterised by a much less rugged topography. Though the landforms continue to be identical, they are broader with gentle concave slopes.

8. To the south of Narmada on proceeding towards the uplands, there is not only a marked fall in the altitude, but the overall relief also shows a distinct change. Even within the uplands, the trappean upland is somewhat different from the Tertiary uplands. The former comprises a low relief trappean ground not so rugged with scattered hills and ridges the entire landscape is undulating. Tertiary uplands show comparatively a much subdued topography and the undulations representing alternate highs and lows, reflect the anticlinal and synchinal flexures of the sedimentary formations. The slopes are gentle and concave.

9. The coastal plains, are devoid of any ruggedness, except for a few sporadic hills and mounds of Tertiaries,

the ground is flat and gently sloping seward. These consist of Quaternary alluvium, soils and coastal deposits, and the plains thus point to a dominantly a depositional phenomenon. To the north of Narmada, the alluvial plains show comparatively much more variety in respect of relief.

10. The geology and climate are the chief factors controlling the evolution of the landscape and landforms. Lithological and structural aspects are the two main geological controls. The effects of climatic factors, temperature, rainfall and wind, show varied manifestations. The effects of altitude nearness or otherwise from the coastline and rainfall pattern have combined to give rise to several climatic zones and each zone has effected the rocks differently. The weathering is most effective in the hilly terrain; somewhat less effective in the uplands, while its effectiveness in the coastal plains is minimum. Fluvial processes appear to be quite effective almost all over the area, but in the hilly terrain, these cause erosion while in the other two zones, the fluvial action is both erosional as well as depositional.

11. The role of coastal processes is restricted to the neighbourhood of the actual shoreline. The effective agents responsible for sculpturing the coastline, are essentially related to the marine processes; viz.

waves and tides. The action of waves, aided by longshore drifts and currents, has given rise to well defined beaches along the shoreline. Accumulation of tidal muds along the river mouths and other such sheltered spots, are seen to characteristic depositional features that are related to the interference of fluvial and marine processes.

12. Though the study area is economically undeveloped and socially backward, the area has vast developmental potentialities provided its available natural resources are properly harnessed. The area receives relatively substantial rainfall, but in the absence of natural or artificial storage facilities, most of the rainwater escapes to the sea or Narmada, leaving various channels without water for the most part of the year. Comparatively speaking, the availability of water is much better in the alluvial plains to the north of Narmada, the worst areas being within the hilly terrain of the east at one end, and the estuarine mouths to the west. In the first case, there is no water, while in the second case the water is there but it is saline due to tidal contamination.

13. The occurrence and availability of groundwater in the trappean hilly areas is controlled by shear zones and joint planes, or in theweathered portion of the

basalts. In the trappean terrain, the groundwater occurs under unconfined condition and the recovery of water through wells or bores is quite less, except in some cases where the water has been able to accumulate in openings along major factures or weathered zones. In the uplands also, the groundwater behaviour is equally erratic. Wherever occur pockets or tracts of alluvium, the water supply through wells is adequate. It is observed that within the hilly terrain, and the uplands the groundwater is encountered at depths ranging from 6 to 15 m. The groundwater in the alluvial terrain occurs under confined and unconfined conditions. The water levels in alluvial formation vary between 6 to 27 m below ground level. Towards west, i.e. along the coast or in the coastal alluvial terrain where the sea waves, tides and marine erosion largely effect the land, the conditions of the underground water is distinctly different. The dissolved salts increase towards the west, this may be due to the presence of inherent salts in the coastal marine deposits. This makes the groundwater salty. The average water level fluctuates between 3 to 15 m. It is however, interesting to observe that right near the coastline wherever longitudinal sand dunes occur, they contain fresh water at very shallow depths of a few meters only. Of course, this supply is limited and cannot be indiscriminately exploited.

14. The phenomenon of flooding provides an interesting picture of diversity and intensity. No doubt, the floods in the real sense could be attributed to the river Narmada only, but the smaller tributary rivers as well as the low order streams of the hilly terrain also reveal several features of flooding. The hilly streams or Khadis with their narrow and deep valleys, during monsoon, when they cannot contain all the rain water, at such spots where they flow over flat ground or near the confluence of two streams, their banks overflow and cause local floods of short duration. The river Narmada, flowing almost in median part of the study area, is prone to frequent floods. Flood waters inundate its banks almost annually, some times the intensity of flooding is so great that vast areas are affected, especially on the southern banks. Floods in Narmada used to occur at comparatively longer intervals, but during the last two decades, the frequency of floods have increased and so has the magnitude of the floods.

15. Almost 20% of the total study area comes under forests. Most of the hilly terrain as well as some parts of the uplands have moderate to sparse forest covers. The eastern rugged trappean hilly terrain, north and south of Narmada shows relatively dense vegetation of sub-tropical moist climate. Teak is the most

valuable tree of the forests and the other associates are overwood, underwood, shrubs and Herbs, bamboo and grass. It is however a sad thing to observe that in the course of last two or three decades, the forests are being rapidly destroyed. There are many factors, natural and human, causing damage to vegetation and affects the forest and its growth. The need of forests has been realised not only from the point of view of availability of good teakwood, but also from the considerations of other forest produce like bamboo, firewood etc . which provide dependable sources of livelihood to the local population. With the increasing energy crisis faced by the country, there has been now a greater awareness towards biomass (forests etc.) as a relevant alternative source. The eastern and south-eastern hilly portions (S. Narmada) of the study area, have been exclusively reserved for regenerating forests.

16. The study area shows an uneven distribution of agricultural land. The area to the north of Narmada river comprises about 60% of cultivable land, which consists of river alluvium and is more fertile than that of the south of Narmada. The area south of Narmada and west of Karjan consists of 70% cultivable land; except the trappean hilly terrain, rest supports reasonably good agriculture. The eastern and south-

Plate VIII 1 Road across the low altitude Trappean ridge in the upland (road linking the villages Dediapada and Sagbara).

eastern trappean rugged terrain, east of Karjan being mostly rocky, consists hardly of 40% cultivable land, The crop pattern and agricultural production of the area largely depends on rain.

17. The area has been receiving considerable attention of the State Government in respect of its overall development. A large number of new roads have either come up or are being planned. With an increased network of roads, the different parts of the area tends to provide faster means of communication, and thereby accelerating the pace of development. (Plate VIII 1).