CHAPTER - VIII

R E S U M E

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In this investigation, the author has aimed at a total appraisal of the South Gujarat landscape especially the Trappean Highlands, and has tried to highlight this morphotectonic aspects. The landscape provides a unique example of the dominant role played by tectonic features. Not only the coastline, but the Trappean Highlands also provide a wide variety of terrain features which point to a strong tectonic control.

The entire area, is criss-crossed by two fracture directions N-S to NNE-SSW and E-W to ENE-WSW, faults and joints related to these directions, sometimes closely spaced and sometimes wide apart. These are reflected in the topography.

The study area is broadly divisible into three geomorphic zones trending NNE-SSW, quite distinct from one another. They are (1) Coastal plains, (2) Uplands, and (3) Trappean Highlands.

Two major regional faults appear to be responsible for this landscape variation. A NNE-SSW fault delineates the Uplands from the Trappean Highlands. Similarly, in the eastern parts of the highlands, the well pronounced escarpment also points to a regional fault. Also, the physiographic subdivisions of the Trappean Highlands from N to S are based on a sequence of E-W faults.

South of Narmada river, the geological formations range from Cretaceous to Holocene and nowhere older rocks are reported to occur, whether on-surface or in sub-surface. Geologically, the South Gujarat has evolved with the break up of the Gondwanaland, Sedimentation and volcanism initiated during early Cretaceous with the marine transgression along the Narmada geofracture gave rise to the equivalents of Bagh beds. Subsequent events comprised Deccan volcanism and development of the Cambay basin (Cambay and Narmada-Tapi grabens) which became the site of the Tertiary sediement accumulation. Quaternary deposits are equally well-developed and mostly comprise alluvial accumulations and coastal marine deposits.

Within the limits of the study area, only the basalts of Deccan Trap and the Quaternary deposits are encountered. The hilly terrain is occupied by the basalts, whereas the Quaternaries make up the Coastal plains. The total thickness of exposed basaltic rocks in the study area is around 700 m and are seen to comprise a mass of repetitive flows of (i) hard, compact, dark grey, finegrained basalts, (ii) coarse, porphyritic basalts (iii) amygdaloidal basalts and (iv) andesite. The basaltic terrain is criss-crossed by numerous dolerite and basaltic dykes.

The landscape diversity of South Gujarat essentially points to the role of degradational and aggradational processes operating over a terrain made up of near-horizontal basaltic rocks of varying composition and texture, which have been cut by

a several sets of faults and fractures of all dimensions. Horizontality of the successive lava flows, has played a very important role in sculpturing the landscape.

The two major NNE-SSW faults that cut across the study area comprise a set of step faults progressively downfaulted to the west, and are located on the eastern flank of the Cambay Graben. These two faults are typically reflected in the geomorphic sub-divisions, the eastern fault marks the Trappean escarpment, whereas the junction between the Coastal plains and the Uplands, forms the other fault. From south to north, the various ENE-WSW faults, have again given rise to a progressive downfaulting; these belong to the Narmada-Tapi Graben System. The decrease in the heights from south to north, and from east to west has been observed to indicate original step-like topography, comprising progressively downfaulted blocks from south to rorth and east to west respectively. The various fracture systems consisting of smaller faults, fractures and joint sets, are related to the megafractures.

The drainage characteristics also ideally reflect the tectonic features of the study area, and also reveal a lot about the successive events of the landscape evolution and the controlling factors. The area provides a good example of drainage diversity, and its close relationship with various factors of landscape evolution. Drainage characteristics point to strong evidences of a morphotectonic control. The morphometry of the various drainage basins brings out the dominant role of

fractures and joints. In the higher elevations, quite a few low order streams are slope controlled, but this is restricted to steeply sloping areas. On the other hand, low order streams flowing on plateaus or gently sloping ground, at most places follow joints and fractures. Other important factors in drainage development are those of, (i) the near horizontality of basaltic rocks, (ii) lithological variations and related response to erosion and (iii) spacing, density, and magnitude of the variouus sets of fractures. Higher order streams are, by and large, fracture-controlled and their zig-zag courses point to their flowing along more than one sets of intersecting joints. The trunk streams are following major structural lineaments, viz. Tapi and Purna rivers.

Following important facts have emerged from the present study :

(1) The South Gujarat landscape reveals a strong influence of two major fracture directions. viz. ENE-WSW and NNE-SSW

(2) The progressive decrease in altitude from south to north and east to west is to a considerable extent controlled by several more or less parallel faults in the two directions.

3) The junction between the Coastal plains and the hills marks a fault line (Cambay Basin Eastern Boundary Fault), and also the base of the eastern escarpment is a regional fault (Great Escarpment Fault).

4) The southern portion of the area to the south of river Damanganga is dominated by numerous ENE-WSW faults which have dissected the area into several horsts and grabens. To the north of the Damanganga the widely spaced fractures in both the dirctions have given rise to rather expansive plateaus, tablelands and uplands,

5) The NNE-SSW and ENE-WSW faults are the reflections of deep seated fractures in the craton reactivated in post Mesozoic time. Whereas the ENE-WSW are related to the Narmada geofracture, the NNE-SSW fractures are obviously part and parcel of the Cambay Basin tectonics, (parallel to the East Cambay basin boyunding system) which in turn, are manifestation of the rifting of the western continental margin of India.

6) The present day landscape, marked by a variety of flat topped hills, ridges and tablelands, and exhibiting an overall step-like topography, typically reveals an example of the control exercised by tectonic features on erosional and depositional processes operating over a horizontally layered basaltic sequence.

The investigation has to be viewed in the larger context of the regional tectonism, namely the NNEward drift of the Indian landmass and the formation of the Tertiary Cambay basin.

Structural data throws much light on the relationship that exists between the fracture pattern and the tectonic framework of this part of West Coast of India. The entire fracture pattern, and post-Mesozoic tectonism is related to rifting along pre-existing lineaments and to the stresses generated during the north-eastward drift of the Indian plate. Tensional stresses during the earlier (rifting) stage resulted into the development of Cambay and Narmada - Tapi Grabens. The later stage of plate movement when (India collided with Asia) was marked by a compressional phase. During this phase considerable reactivation took place along pre-existing fractures, and also new sets of related fractures were generated and various fracture-bound, blocks uplifted.

The study area is unique in the sense that its landscape ideally reflects the tectonic features related to an important global tectonic phenomenon, i.e. a post-Mesozoic rifting of the western continental margin and its subsequent northeastward drift. This phenomenon has manifested itself into a complex fracture pattern, which in turn has controlled the geological and geomorphological evolution of Gujarat region in general and the South Gujarat in particular.