Chapter - 13

CONCLUSIONS

The present study based on remote sensing and GIS analysis, field based studies, fault-slip analyses and detailed quantitative measurements of drainage basins in the SW Saurashtra region has led to following conclusions.

1. The area of present study in SW Saurashtra region is divisible into two morphotectonic domains. The eastern half of the study area is designated as morphotectonic domain-I while the western half of the area is designated as morphotectonic domain-II.

2. The domains are identified based on variation in geomorphic and morphotectonic set up. Domain-1 shows largely rocky terrain and is controlled by dyke ridges and other structural elements in the Deccan Trap lava flows. The lava flows are tilted in general towards the SE direction and are also profusely intruded by the dyke swarm. The dyke shows dominant structural trend in ENE-WSW further east of the study area, but it swings to NE-SW in the study area suggesting rotation of stress orientation during post-trappean times. The narrow coastal zone in domain-I is occupied by south dipping Tertiary limestone overlain by Late Quaternary miliolites.

3. Four new faults (F1 to F4) are mapped in Domain-I during the present study. The faults were previously unmapped which includes the E-W trending Katar Fault (F1) and other faults (F2-F4) trending in NE-SW to NNE-SSW directions. Faults F1, F3 and F4 cut across the NE-SW trending dyke swarm and the strike of the southeastward tilted Deccan Trap lava flows. Fault slip data collected along exposed fault planes show that all faults have undergone multiple phases of strike-slip to oblique-slip movements in post-Deccan Trap time under an overall compressional stress regime.

4. Detailed fault slip analyses indicates that the Katar Fault (F1) is an oblique slip reverse fault with sinistral slip, Fault F2 is oblique slip normal fault with dextral slip while faults F3 and F4 are oblique slip normal faults with sinistral slip movement. The analyses suggests two phases of reactivations under transpressional stress

regime. The difference in SHmax trend of the offshore region i.e., N7° E to that of the present study area shows anticlockwise rotation by 46° to 13° after the main eruptive phase of Deccan Trap.

5. The present study concludes that the faults developed under transpresssional stress regime induced by the collision and anti-clockwise rotation of the Indian plate and post-date the swing of the dyke swarm from ENE-WSW in the east to NE-SW trend in the area around Rajula in domain-I. The swing of the trend of the dyke swarm and eastward tilt of the trappean lava flows are tentatively attributed to the stresses induced by the large Girnar intrusive body in the NW immediately after the Deccan volcanic activity. The faults show evidence of further multiple reactivations including in post-Miocene and Quaternary times suggesting continuation of transpressional stress regime.

6. Detailed landscape analysis involving drainage basins draining the domain-I was carried out. Three drainage basins of domain-I viz. Dhantarvadi, Raidi and Malan river basins revealed dominating influence of the structural features in Deccan Trap lava flows on landscape configuration. A critical analysis of the parameters sensitive to tectonic indicate that the area is undergoing neotectonic uplift in response to the prevailing transpressional stress regime. This is corroborated by the miliolite cliffs along the coastline, raised notches (dated to 125 ka BP and 6 ka BP by Juyal et al., 1995) and raised mudflats.

7. Morphotectonic domain-II comprises the western part of the study area and show geomorphic characteristics at variance with the largely rocky undulating landscape of domain-I. Major geomorphic zones include the rugged trappean in the north and a prominently southward sloping topographic surface over the miliolites up to the coastline. The morphology of the coastline alternates laterally between well-developed beach-dune complexes and mudflats to cliffy coast comprising miliolite. Detailed investigations in the prominently sloping miliolite zone, termed as the buried pediment zone in the present study, revealed significant role of tectonic uplift in the post-miliolite landscape evolution.

8. Detailed terrain analysis including remote sensing data, DEM and morphotectonic analysis of the drainage basins in domain-II was carried out. Critical evaluation of topographical maps and DEM revealed the presence of multiple miliolite ridges in domain-II. Except around the Hiran River, the ridges curvilinear and are not parallel to the coastline. In general, the ridges possibly correlate with the different sea levels during the middle to late Pleistocene.

9. Domain-II is drained by south flowing parallel drainages that conforms to the southward prominent slope. All drainage basins comprising the Rawal, Machundri, Rupen, Sangawadi, Singwada, Somat and Hiran rivers were analysed in detail in the present study. Of these, the Rupen, Sangawadi and Somat rivers were found to be particularly revealing as major part of these drainage basin are located over the miliolite terrain. The various parameters studies for these river basins are suggestive of post-miliolite tectonic uplift of domain-II.

10. All seven major drainage basins of domain-II are elongated and show high degree of basin asymmetry. Asymmetry of most of the drainage basins suggest westward tilting or inclination of the ground slope. However, the Singwada and Sangawadi river basins in the central part of the domain show opposite ground tilt i.e., towards east. The asymmetry of these two basins is attributed to the anomalous ground slope conditions generated by morphology of the miliolite ridges. The westward tilt shown by other drainage basins, particularly in the western part of the domain, is attributed to the coastward curving of the ridges producing low intensity slope variations directed to the west. The curving of the ridges may be due to topography or structural elements in the Deccan Traps buried below the miliolite cover.

11. The present study shows that miliolite ridges significantly influence the channel morphology including variation in depth of incision observed in the south flowing rivers of domain two. Variations in depth of incision, development of anomalous meander bends, waterfalls and drainage parameters studied like SL index, drainage asymmetry, Vf ratios and hypsometric integral are found to correlate with ridges crossing these river channels. Continued tectonic instability of the domain-II is also evidenced by the recurrent earthquake swarm activity around Talala during the last several decades.