Chapter – 9

CONCLUSIONS

The present field and GPR based study has led to the following conclusions.

1. The geomorphic setup and the drainage of the Katrol Hill Range in southern Mainland Kachchh provide several lines of evidence for neotectonic activity along the KHF. The E-W trending line of north facing range front scarps, the conformity of the overall landscape with the tilt block structure, the E-W trending back valleys, the sharp division of the drainage system into south flowing and north flowing rivers, the incising nature of the drainage, development of gorges, the mode of occurrence of Quaternary colluvial and fluvial sediments and their stratigraphic development testify to the continued uplift of the range in a tilted manner due to periodic tectonic movements along the KHF during the Quaternary period. The close association of the crest line and the drainage divide, progressive reduction in the topography and incision by south flowing rivers suggest southward directed noetectonic tilting of the range due to movements along the KHF.

2. The sequence of the Quaternary deposits starts with the bouldery colluvium, aeolian miliolite, valley fill miliolite, alluvium and scarp-derived colluvium (Table 4.1). The Quaternary deposits are incised by various north flowing rivers. The bouldery colluvium contains large fragments of shale and sandstone and overlain by miliolites along the Katrol Hill Range. The miliolite deposits of the area are separated into two categories. The older miliolites occur on hill slopes which comprise well lithified fine grained miliolitic sand and is of aeolian origin. It also occurs as obstacle dunes and occupy topographic depressions and hollows in the slopes of high hills and ridges. The valley fill miliolite occur along incised cliffs and show stratification with pebble to cobble size clasts of Mesozoic rocks suggesting role of fluvial activity in their deposition. The scarp-derived colluvium is the youngest Quaternary deposit that occurs in the form of small aprons over the older sediments.

3. The study reveals uplift of the range in well marked phases during Quaternary that took place in response to differential uplift along the KHF. Based on the geomorphic and stratigraphic data presented in this study, at least three major phases of tectonic uplift of the Katrol Hill Range during Quaternary are discussed. The oldest being the pre-miliolite phase (middle Pleistocene) followed by a prominent post-miliolite phase (early Holocene) which resulted in fluvial incision with Formation of gorges and the last one during late Holocene that continues at present. The uplift of the range in well

marked phases during Quaternary took place in response to differential uplift along the KHF under an overall compressive stress regime.

4. The KHF originated as a near vertical fault in extensional regime during the rifting phase of the Kachchh basin, however, it is characterised by reverse movements during Quaternary. The GPR profiles show that the KHF is a steeply dipping reverse fault in the shallow subsurface that becomes vertical at deeper levels. The dip of the KHF progressively decreases as it propagates upward from the Mesozoic to Quaternary sediments. Since the KHF indicates similar stress conditions from Mesozoic rocks below to Quaternary sediments above, this may be attributed to changes in rheology of the overlying rocks and the ongoing stress regime. The reverse movement indicated by faulting in Quaternary sediments, splaying nature of the fault and changes in the geometry of the fault plane towards the surface indicates periodic reactivation of the KHF in compressive stress regime.

5. At least three events of active faulting have occurred along the KHF during the late Quaternary. Each of these events had offset the then existing topographic surface as well. Based on the stratigraphy of Quaternary sediments, it is suggested that the Event 1 occurred sometime in the late Pleisotocene, while Events 2 and 3 occurred in the early Holocene and <2 ka respectively.

6. The segmented nature of the KHF delineated in the present study suggests existence of heterogeneous stress distribution along its length. Field evidence shows that the KHF has been repeatedly ruptured preferentially in the close vicinity of transverse faults and other parts are gaps of relatively lower stresses. It is concluded that though the gaps of low stress cannot be ruled out as sites for future earthquakes, they are less likely to be nucleation sites for earthquakes and earthquake swarm activity.