

CHAPTER V
SUMMARY AND CONCLUSIONS

The present chapter brings out in a nutshell the field and laboratory studies carried out on the rock exposures from the area around Malvan, Sindhudurg district, Maharashtra State. The inferences arrived at from various laboratory studies have also been briefly summarised.

The area selected during the present investigation is approximately 30 km. in length with an average width of about 10 km. and is bounded between the Achra creek in the north and the Karli creek in the south from the Sindhudurg district. The area investigated is covered in the topographic sheet Nos. 47 H/8 and 47 H/12 of the Survey of India. The total area of about 300 sq.km. has been mapped on the scale of 10 cm. = 1 km.,. The study area constitutes for its most part the Deccan basalt lavas of the Continental Tholeiitic Province of India. In the southern part of the area are exposed the sandstones and quartzites of the Kaladgi Supergroup on which the basalt lavas overlie unconformably. The basalts have been lateritised with a layer of lithomarge clay. The basalt lavas have been overlain unconformably by Quaternary sediments which are exposed mainly along the coast and also on either banks of Gad river. The generalised stratigraphic succession has been presented in the

Chapter on the Geology of the Area. As the studies were aimed at only on the sedimentological characteristics of the Quaternaries and also the geomorphological characteristics of the shoreline, emphasis has, therefore, been laid on these aspects in the present investigations.

The field studies indicate that in the area are exposed the Archaean Granites and granitic rocks, mainly in the southern part of the area. However, they occupy a small part of the entire area investigated. These rocks have been overlain by the sedimentary rocks of the Kaladgi Supergroup, which also occupy a small part of the area and are exposed along the coast at Malvan. These are mainly sandstones and quartzites, which strike NW - SE with an average amount of dip of about 60° towards SW. At Sindhudurg fort, these sedimentary rocks have been lateritised. The granular nature and the presence of quartz granules in laterite indicate its formation from the Kaladgi sedimentary rocks. These rocks, in turn, have been overlain by the basaltic lavas. These occupy practically most part of the area investigated. These basaltic lava flows have been lateritised to such an extent that the distinction between lava flows has become difficult. Various sections of laterite have also been observed, which show, at some places, the presence of lithomarge clay at the

base. However, nowhere the source rock of laterite could be observed.

The field studies indicate the presence of the Quaternary sediments that unconformably overlie the basaltic lavas and also the Kaladgi sedimentaries. These occupy the entire coastal tract from north to south. From their depositional characters, it has been inferred that they have given rise to the raised marine terrace and the beach dunes. It has further been observed that there is a series of four parallel palaeo-dune ridges. The longer axis of each beach dune runs nearly in north-south direction and also parallel to the coast. The raised marine terrace has been so termed, because it is separated from the high tide water line mark and is about 1 m. in elevation. It consists of medium to fine grained, white coloured, carbonate sands, containing varying proportions of molluscan shell fragments. Well-developed horizontal laminations in the entire section of the raised marine terrace is its characteristic feature. The beach dune ridges have been classified into two, as stabilised and unstabilised beach dune ridges. The unstabilised beach dune ridges are subjected to wind action even in present days, characterised by constant movement of current ripples on its exposed surfaces. Stabilised beach dune ridges have been

inferred because of the presence of thin vegetation cover on them. These field observations have been detailed in Chapter III.

Chapter III on Geomorphology of the Shoreline brings out in detail various geomorphic features, as observed along the shoreline. These have been identified as of fluvial and marine origin. Geomorphic features of both the groups have further been distinguished on the basis of their origin; as of erosional and depositional nature. Fluvial geomorphic features have been identified as an estuary and mud flats, while geomorphic feature of marine origin have been identified as, island, headlands, sea cliffs and sandbar, raised marine terrace and beach dune ridges. It has been observed that there is no specific spatial distribution pattern of these geomorphic features. From such a distribution pattern, it has been inferred that the coastline is a submerged coastline, which has experienced transgressional and regressional phases of sea during its evolution.

Chapter IV deals with mineralogical and various textural studies carried out on the Quaternary sediments of sand grade. For the purpose, representative samples from the raised marine terrace and the beach dune were collected. For the sake of comparison, the sediment samples from the high tide and low

tide environments adjacent to raised beach sections have also been collected. Such representative samples have been analysed in the laboratory by following standard laboratory procedures. These studies have been presented in Chapter IV, as Part A on heavy mineral analysis and Part B, textural study, including grain size analysis and shape analysis. These studies have been carried out by following the standard procedures. Whereas Part C of the Chapter deals with the inferences derived from these laboratory studies.

Heavy mineral analysis of the Quaternary sediments indicate that the suite is characterised, apart from opaques, by the presence of tourmaline, rutile, garnet, epidote and sillimanite, augite and hornblende. The analysis has indicated more or less even distribution of tourmaline along the coastline from north to south, concentration of garnet at the estuarine mouth of the Gad river, the dispersal of augite and hornblende in the northern and southern part, i.e. on either side of the Gad river and near absence of zircon. From the heavy mineral assemblage, the provenance of the mixed character represented by the Archean Granites and metamorphic and the basaltic lava flows has been inferred.

Granulometric analysis of the sediments from each microenvironment, i.e., low tide, high tide, raised marine

terrace and beach dune has been carried out and the statistical measures, as suggested by Folk and Ward (1957) have been computed. The sediment characteristics have been inferred by considering these statistical parameters individually and also jointly with the help of bivariate plots. From the individual statistical grain size parameters, it has been inferred that the sediments from each microenvironment are of medium sand to fine sand grade, well sorted to moderately well sorted, coarse skewed to nearly symmetrical and mesokurtic to very leptokurtic in their characters. When these statistical measures of the sediments from each microenvironment have been considered with the help of bivariate plots, it has been observed that these represent graded suspension and uniform suspension deposits. The sediments from low tide and high tide environments form their own separate envelope, with a small overlap. When such envelopes are superimposed on the plots of the raised beach and beach dune sediments, it is observed that the raised beach sediments fall within the envelope of low tide sediments. Similarly, the other bivariate plots, viz. mean size vs. standard deviation, mean size vs. skewness, simple skewness measure vs. simple sorting measure have also been made. It has been observed that in these plots also, each microenvironment forms its own envelope and the sediments

of the raised marine terrace fall in the envelope of that of low tide sediments.

In shape analysis of the Quaternary sediments, the sphericity and roundness aspects have been examined. The studies indicated the unimodal distribution in sphericity values and also in roundness values. Relation of sphericity and roundness values has also been examined with respect to size, which however, revealed no clear distinct relationship. Percent frequency distribution of sphericity and roundness values indicated that with the increase in frequency of more spherical grains, there is a corresponding increase in the frequency of more rounded grains. Mean sphericity and mean roundness values for the sediments from each microenvironment have been examined with the help of bivariate plots, that indicated a positive regression, implying there by that with an increase in mean sphericity there is an increase in roundness.

From the shape analysis, it has been inferred that the coastal sediments from the area investigated are immature and primitive sands which have undergone less transportation, having a short abrasion history and derived from a mixed source represented by the Archaean Granites and metamorphics and basaltic lava flows.