Chapter 8

Summary and Future Scope

8.1. Summary

The significant findings based on the study of foraminifera in surface and subsurface sediments collected from the region off central east coast of India, are summarized below.

i) A total of 360 species belonging to 146 genera, 69 family, and 7 suborders are reported from the study area. Out of 360 species, 22 species belong to planktic foraminifera. Foraminifera belonging to Rotaliina suborder are dominant in the study area with 158 species and 74 genera, followed by Miliolina (59 species and 15 genera), Lagenina (56 species and 14 genera), Textulariina (56 species and 26 genera), Globigerina (22 species and 14 genera) and Robertinina (3 species and 3 genera) while foraminifera belonging to Spirillina are represented with only 2 species and 1 genera.

ii) Q-mode cluster analysis grades the benthic foraminiferal fauna into four dominant clusters. Cluster A is composed of 23 samples ranging in depth from 170 to 2841 m, representing deepwater assemblages. Cluster B is composed of 10 samples, ranging in depth from 25 to 44 m, representing the shallow water assemblages. Cluster C is composed of two clusters, C1 and C2. Subcluster C1 is composed of 21 samples and represents shallow water assemblage with depth ranging from 20-77 m, except one station of 976 m.

iii) Occurrence of relict fauna at three different depths 110-80 m, 80 to 60 m and 30 m probably indicates different sea stands, suggesting episodic sea level rise during Late Pleistocene and early Holocene. A tentative sea level curve is proposed for the period between ~14,000 to ~9,000 years B.P. for the central east coast of India.

iv) *Hyalinea balthica* exhibit dimorphism.

v) Based on downcore variations in mean proloculus size of *H. balthica* a major climatic boundary is noticed at ~560 years BP. The period from ~700 to 560 yrs BP is marked with better monsoon rainfall conditions, followed by decline in
rainfall. Last ~ 200 years shows further increase in rainfall. Rate of sedimentation supports this conclusion.

vi) Spectral analysis of MPS data show a climatic cycle of 22±3 years. This cycle is modulated by The "The Hale double sunspot cycle".

vii) Spectral analysis of downcore variation in angular asymmetrical morphogroup, *Uvigerina* sp. and *Bulimina marginata* shows a cycle of 200±50 years. This cycle is known as "Suess cycle" and is related to solar variability.

viii) This study is the first time report of foraminiferal evidences of 22±3 years cycles from Indian waters and 200±50 years cycles from the Bay of Bengal sediments.

ix) Climatic fluctuations with special reference to paleomonsoonal variations during last ~ 700 years indicate a possible relationship with solar variables.

8.2. Future Scope

Though the surface distribution of benthic foraminifera from the region off central east coast of India, has been well documented as part of this study and the relationship of benthic foraminifera with prevailing environmental parameters have also been documented, still there is scope to study the influence of seawater temperature, salinity, organic matter content, etc on the benthic foraminiferal distribution. Such studies could not be carried out due to paucity of time. The reconstruction of paleosealevel variation over the Bay of Bengal region during the last few thousand years is still in its infancy. A comprehensive sea level curve for the Bay of Bengal similar to the one proposed for the eastern Arabian Sea (Hashimi *et. al.*, 1995) is the need of the hour. The subsurface samples studied as part of this work provide very high resolution information about past climatic changes. A few more long cores from carefully selected areas will help extend this high-resolution paleoclimatic reconstruction work to larger time-intervals.

There also exists a need for laboratory culture experiments on a few selected species from the region off east coast of India. It will strengthen the claim of such species to be used as proxy for paleoclimatic reconstructions. At National Institute of Oceanography, Goa, the first foraminiferal culture laboratory in South Asia is established and results of culture experiments on few foraminiferal species from the Arabian Sea have already been published. Having actively participated in these
experiments and being a co-author of papers (Nigam et al., 2008; Linshy et al., 2007, Panchang et al., 2006), I am aware of methodology and scope of these studies in paleoclimatic reconstructions. Besides paleoclimatic applications, these experiments also exhibit the utility of foraminifera in pollution monitoring (Saraswat et al., 2004, Nigam et al., 2009). In view of the forgoing, culture experiments on foraminiferal species from the east coast of India need to be taken up on priority basis.