SUMMARY

The Kutch basin is peri-cratic rift basin constitutes sediments ranging in age from Bajocian to Recent. The entire sequence is exposed only in the main land of Kutch. Mesozoic rocks cover a large area in Kutch and are overlain by the Deccan Trap lava flows. Tertiary sediments take up the outer parts of the basin adjoining Mesozoic uplifts. The Tertiary sequence is about 900 meter thick exposed in the western and southern parts of Kutch. The present study embodies the systematic revision of the bryozoan fauna retrieved from these sequences. A critical study of the bryozoan assemblage from the Tertiary sequences has helped in deciphering the palaeoecology and depositional environment of these sequences. Besides this, the author has done phylogenetic analysis of the bryozoan genera and species using PAST software.

Stratigraphy:

Fossil Bryozoa:

The systematic revision of the bryozoan fauna with the help of high resolution microscopy using SEM micrographs for the detailed illustration of each species is the significant contribution of the present work. The bryozoan fauna described here comes from the Tertiary sediments of the western Kutch. The bryozoans have represented by 60 species shared among 36 genera belonging to 29 families representing the suborders Malacostegina and Neoechilostomina.

The suborder Malacostegina includes one malacostegan cheilostome *Biflustra barchanensis* described here is new to science. The suborder Neoechilostomina is represented by 30 species distributed among 13 genera belonging to the families Calloporidae Norman, 1903; Quadriceellariidae Gordon, 1984; Cupuladriidae Lagaij, 1952; Microporidae Gray, 1848; Steginoporellidae Hincks, 1884; Thalamoporellidae Levinsen, 1902; Chlidoniidae Busk, 1884; Poricellariidae Harmer, 1926; and Skytoniidae Sandberg, 1963. Under the family Calloporidae two new species *Planicellaria guhai* and *Vincularia feddeni* are described. Under Steginoporellidae three new species such as, *Steginoporella mathuri*, *S. Murachbanensis* and *S. chiplonkari* are described. Further, in Thalamoporellidae, three new species viz., *Thalamoporella harudiensis*, *T. naliensis* and *T. badveii* are described. In the family Poricellariidae, two new species like *Poricellaria waioriensis* and *P. sakurkari* are described. Abundance of *Nellia*, *Vincularia*, *Cupuladria*, and *Thalamoporella* is observed among the present bryozoan assemblage. The Infraorder Ascophora is dominant being represented by as many as 22 species. These species are belonging to 16 genera belonging to the families Catenicellidae Busk, 1852; Bitectiporidae McGillivray, 1895; Tetraplariidae Harmer, 1957; Porinidae d’Orbigny, 1852; Margarettidae Harmer, 1957; Gigantoporididae Bassler, 1935; Microporellidae Hincks, 1879; Calwellidae McGillivray, 1887; Escharinidae Tillbrook, 2006; Didymoellidae Brown, 1952; Syphonicytaridae Harmer, 1957; Mamilliporidae Canu & Bassler, 1927; Celleporidae Johnston, 1838; Phidolporidae Gabb & Horn, 1862. *Ditaxipora lakiensis*, *Schizomavella gharei*, *Margaretta amplipora*, *Malakosaria gordonii*, *Siphonicytara robertsonae*, *Iodicytum brevipora* described here are new to science. The order Cyclostomata is represented by only 7 species belonging to 6 genera belong to the families Crisiidae Johnston, 1838; Tubuliporidae Johnston, 1838;
Oncousoeciidae Canu, 1918; Plagioeciidae Canu, 1918; Lichenoporidae Smitt, 1867. Under the family Tubuliporidae a new species Exidmonea babiensis is described.

The bryozoan fauna recovered from the Tertiary sequences exhibits long geological ranges. Most of the species have Indo-Pacific affinities, barring both the cosmopolitan and Atlantic elements.

**Paleoecology and depositional Environment:**

The bryozoan fauna recovered from the Tertiary sediments such as, fossiliferous yellowish/ ochre coloured limestone, white nummulitic limestone, argillaceous claystone and gypseous shales are principally characterised by typical tropical to subtropical, warm water assemblage enjoying normal (i.e. euhaline to euryhaline) salinity.

On the basis of the statistical analysis of the total bryozoan assemblage correlation of the zoarial growth forms with their habitat is carried out. The statistical analysis shows dominance of erect-flexible-articulated branching cheilostomes and other zoarial growth forms have different frequencies in the various localities. These zoarial growth forms indicate only cheilostomes are abundant in Kutch area and they are able to live in a wide range of water depths. Bryozoan abundance and growth form diversity increases with depth. Although depth ranges of different growth forms coincide and bryozoan fragments may be transferred from their growth habitats, bryozoan morphotype associations, occupying different depth zones, are giving significant information on palaeoenvironment.

**Evolutionary Significance of Kutch Bryozoa:**

The Tertiary sequences of western Kutch are very rich in bryozoan faunal content and yielded very diverse assemblage. There are certain genera and species which exhibit distinctive morphological characters; they have evolutionary and phylogenetic significance. Phylogenetic analyses of the species of neocheilostomine and steginoporellid bryozoa have been carried out using PAST (version-2.06). six
neocheilostomine species and four steginoporellid species have been taken for analysis. There are very few characters that are available in both groups. Phylogram of neocheilostomine species shows the genus *Nellia*, formerly regarded as far distant from this group, as ancestral to the poricellariids. Hence, *Nellia tenella* is out group and it does not become ancestor of both *Poricellaria* and *Vincularia*. Whereas, the phylogram of steginoporellid bryozoans shows *Steginoporella murachbanensis* and *S. bhujensis* are phylogenetically and morphologically similar species hence forming same clade, however, *S. mathuri* is very distinct species from the other three species of *Steginoporella*.

From Kutch region, Guha and Gopikrishna (2007) reported a rich and diverse assemblage of steginoporellid bryozoans. These genera are *Labioporella* (Harmer, 1926), *Reniporella* (Guha & Gopikrishna, 2004) and *Steginoporella* (Smit, 1873). Among them they have reported two species of *Labioporella* and one species each of *Steginoporella* and *Reniporella*. In the present study we are reporting five species of *Steginoporella*. These species are very diverse in morphological characters. These species clearly shows in Kutch region during the Tertiary period two radiations occurred like the lower and middle Eocene of Central American province and a second radiation similar to the European Tethyan province during Upper Oligocene and early Miocene. However, the third stage of radiation in Australian province during the late Miocene and the Pliocene is either absent or overlooked for bryozoans.

**Conclusions:**

1) The fossil group studied here includes the phylum Bryozoa. total number of species studied is over 60. The taxonomy of these species has been revised with the help of high resolution microscopy.

2) The fauna studied indicate dominant Indo-Pacific affinities. Indicating both cosmopolitan and the Atlantic elements. However, some species with their roots in distant or apparently unrelated basins also occur, number of such species is very less.
3) The bryozoan fauna occurring in the Tertiary sediments such as, fossiliferous yellowish/ochre coloured limestone, white nummulitic limestone, argillaceous claystone and gypseous shales principally characterised by typical tropical to subtropical, warm water assemblage enjoying normal (i.e. euhaline to euryhaline) salinity.

4) On the basis of the statistical analysis of the total bryozoan assemblage correlation of the zoarial growth forms with their habitat is carried out. The statistical analysis shows dominance of erect-flexible-articulated branching cheilostomes and other zoarial growth forms have different frequencies in the various localities. These zoarial growth forms indicate only cheilostomes are abundant in Kutch area and they are able to live in a wide range of water depths.

5) Phylogenetic analyses of the species of neocheilostomine and steginoporellid bryozoan have been carried out using PAST (version-2.06). Six neocheilostomine species and four steginoporellid species have been taken for analysis. The phylogram shows Nella tenella is out group and it does not become ancestor of both Poricellaria and Vincularia. While, Steginoporella murachbanensis and S. bhujensis are phylogenetically and morphologically similar species hence forming same clade, however, S. mathuri is very distinct species from the other three species of Steginoporella.

6) Bryozoan species occurring in these rocks were ranging in age from the Palaeocene to the Recent. However, there are certain species which are restricted to particular stage.