SUMMARY
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The Holocene rocks of the Maharashtra and Goa constituting the shell limestones, plastic muds and sandy clays abounding in a variety of well preserved marine fauna. These rocks usually occur above the tidal level in a narrow coastal strip as long stretches parallel to the coast-line. They seldom exceed more than 400-500m. in outcrop width and develop a maximum thickness of 10m. The present study embodies the systematic revision of the bryozoan fauna recovered from these rocks. A critical study of the bryozoan assemblage from the different Quaternary rock formations has helped in deciphering the palaeoecology and depositional environment of these rocks. Besides this, the author has made emendations to already existing classification of the Holocene rocks.

STRATIGRAPHY:

The Holocene rocks observed along the Raigad district have previously been classified by Badve et al. (1984) under "Raigad Group" comprising the Nagaon Formation for the argillaceous soft lithologies overlain by the Dive Agar Formation containing the calcareous shelly limestones. However, in the present study the entire coastal tract of the Maharashtra and Goa states have been surveyed for the fossil
collections and lithological observations. There are two distinct conditions observed as follows: 1) Marine argillaceous sediments followed by marine calcareous sediments. 2) Marine argillaceous sediments followed by estuarine argillaceous sediments. Thus, considering the recent information on these rocks, the author has emended the former classification. In this classification the previous "Raigad Group" has been given the "Formation" status considering their large lateral extent. The subdivisions of this "Raigad Formation" have been given the "Bed" status according to the International Code of Stratigraphical Nomenclature. Thus, the suggested classification is as follows:

RAIGAD FORMATION
Dive Agar Karal beds = Koparkhairna clay beds (estuarine)
Nagaon clay beds (marine)

FOSSIL BRYOZOA:

The systematic revision of the bryozoan fauna with the help of high resolution microscopy using SEM micrographs for the detail illustration of each species, is the significant contribution of the present work. The bryozoan fauna described here comes from the rocks classified under "Raigad Formation". The bryozoans have represented by 55 species shared amongst 30 genera representing the
suborders: Malacostegina, Neocheilostomina and Ascophorina.

The suborder Malacostegina includes 11 malacostegan and 2 pseudomalacostegan cheilostomes. *Biflustra akshiensis* described here is new to science. The suborder Neocheilostomina is represented by 11 species distributed among five genera belonging to the families Thalamoporellidae, Poricellariidae, Farceiniariidae and Cabereidae. Under the family Cabereidae a new species *Scrupocellaria raigadensis* is described. Abundance of *Nellia*, *Poricellaria*, and *Scrupocellaria* is observed among the present bryozoan assemblage. The suborder Ascophorina is the most dominant being represented by as many as 23 species. These species are shared amongst 16 genera belonging to the families Cribriinidae, Catenicellidae, Smittinidae, Petrallidae, Microporellidae, Margarttidae, Celleporaridae, Hippopodinidae, Hippoporidridae and Phidoloporidae. *Catenicella elongata*, *Microporella serrata* and *Mucropetra unicornata* described here are new to science. The order Cyclostomata is represented by only eight species belonging to genera *Crisia*, *Exidmonia*, *Filicrisia*, *Meceynoecia* and *Yebseloecia*.

The bryozoan fauna retrieved from the Holocene rocks exhibits long geological ranges. Most of the
species have Indopacific affinities, barring both the cosmopolitan and the Atlantic elements.

PALAEOECOLOGY AND DEPOSITIONAL ENVIRONMENT:

The bryozoan fauna recovered from the Holocene rocks such as, shell limestone, plastic muds and sandy clays mainly represents thanatocoenosis of typical tropical to subtropical, warm water assemblage enjoying normal (euhaline to euryhaline) salinity. However, bryozoan assemblage occurring at Koparkhairna and Mulund region is a true biocoenose. The analysis of the sediments of these rocks show common zoarial forms indicating fairly identical ecological setup that existed during their deposition. Thus, in the case of the present assemblage frequency and diversity of Bryozoa are not related to the sediment nature.

Further, on the basis of the statistical analysis of the total bryozoan assemblage, correlation of the zoarial form with their habitat has been carried out. The statistical analysis shows the dominance of cellariiform zoarial type and other zoarial types have different frequencies in the various localities. These zoarial types exhibit mixed environment indicating shallow water, near shore, open marine ecological conditions for the deposition of these rocks.

Besides these, salinity, temperature,
bathymetry, substrate, larval distribution, stability, etc., influence the bryozoan distribution. As stated above the bryozoan fauna occurring in the Holocene rocks enjoyed euhaline to euryhaline salinities. Along the west coast in the estuaries during monsoon salinity is considerably reduced due to the influx of freshwater. Certain bryozoan species can tolerate salinity variance. Among them Membranipora amoyensis, Biflustra savartii, Electra bellula, Electra tenella and Celleporaria aperta are found in euhaline to polyhaline (30-18%) zone. E.bengalensis found in euhaline to pleiomesohaline (18-8%) zone. Conopeum seurati is the only species found in euhaline to meiomesohaline (8-3%) or even oligohaline (<3%) zones. This is a true brackish water species shows wide tolerance of salinity and current speeds. Thus, bryozoan species distributed along the west coast can tolerate salinity variance. Moreover, the ecological implications of the bryozoans found in Koparkhairna and Mulund area have been dealt as a case study.

Temperature is one of the most important factors which affects the bryozoan distribution. The bryozoan fauna occurring in the Holocene rocks is typical tropical to warm temperate water assemblage in which, certain species are strictly restricted to tropical or warm temperate waters.
While, some of them are restricted to both warmtemperate to tropical waters. Bathymetry is also one of the important factors which influences the bryozoan distribution. The bathymetric ranges of the different bryozoan species occurring in Sion plastic muds indicating 20 m to 40 m bathymetric range. However, the bryozoan assemblage found in the shell limestone is not useful in deciphering the bathymetric range. Instead of that, the molluscs are useful to decide the depth of deposition of these rocks. They show the bathymetric range of 10 m to 60 m. Substrate is also one of the limiting factors which influences the bryozoan distribution. The beach rocks found along the west coast are of two types: 1) the upper most 2-3 m fine grained, sandy limestone and 2) the lower coarse grained, calcareous shelly limestone. The encrusters and erect bryozoans are dominantly occur in the lower calcareous shelly portion. However, whatever fauna recovered from this portion is thanatocoenose which is deposited in these rocks after their death. Thus, it is very difficult to arrive at any conclusion whether shell limestone provides a substrate to this fauna. Only encrusters found on the molluscan shells can tell something about the substrate. In situ oyster bed occurring at Koparkhairna and Mulund area provide firm substrate for the bryozoans. Luxuriant growth of C.seurati, M.amoyensis and H.indica have
been observed. Moreover, the plastic muds also provide substrate for the erect species and molluscan shells found in these muds are also useful substrates to the encrusting bryozoans.

Larval distribution also affects the bryozoan distribution. Along the west coast the malacostegan and pseudomalacostegan cheilostomes possessing plakotrophic cyphonautes larvae constitutes one-third of the total bryozoan assemblage. However, among the marine bryozoans there is a trend towards reduction of plakotrophic larvae into short lived lecithotrophic larvae. Hence, the neochei1ostominid and ascophoran cheilostomes possessing such short lived larvae were comprising the bulk of the bryozoan assemblage through the coast. Stability also affects the specific diversity. It is evident that the estuaries show biological instability in both time and space. Hence, the brozoan species have adapted to survive in such unstable conditions. Only those species which can survive in such environment occur with greatest frequency. *C. seurati* occurring in Koparkhairna and Mulund area on *in situ* oyster beds is the most stable species in unstable estuarine conditions. Moreover, there are certain species occurring in shell limestones as thanatocoenosis are *N. tenella*,

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P. raticiensi, S. madrensis and C. elongata. These species have capabilities of surviving environmental change and even they can tolerate high salinities. Hence, these species are most diversified in the shell limestones and plastic muds.

*Biflustra commensale* (KIRKPATRICK & METZELAAR) occurring in the present marine tropical to subtropical belt and is symbiont with hermit crab or certain living molluscs. It is characterised by a cyphonautes planktrophic larva having free swimming stage for several weeks, presents an interesting dispersal pattern in the geological times. A migratory route could be traced westward from the Miocene of the Central Sirte basin, Libya through trans-Atlantic water to the east coast of America and to the Pacific ocean before the rise of Panama Isthmus. The palaeoceanic circulation in the North Atlantic, and the Indo-Pacific oceans were established during the Miocene which effected the dispersal pattern.

**CONCLUSIONS**

1) Stratigraphic classification of the Holocene rocks has been emended here under "Raigad Formation" comprising the Nagaon clay beds as the lower member and the Dive Agar karal beds as the upper member. The estuarine
Koparkhairna clay is equivalent to both the Nagaon clay beds and the Dive Agar karal beds. The Nagaon clay bed is chiefly marine calcareous plastic mud. While, the Dive Agar karal bed comprises dominantly the shell limestones. The Koparkhairna clay beds constitute estuarine plastic muds usually resting on the oyster beds. Besides, lithological differences, faunistically also, these three formations, to some extent, are different.

2) The fossil group studied here includes the phylum Bryozoa. Total number of species studied is over 55. The taxonomy of these species has been revised with the help of high resolution microscopy.

3) The fauna studied shows dominant Indo-Pacific affinities, indicating both the cosmopolitan and the Atlantic elements. However, some species with their roots in distant or apparently unrelated basins also occur. Nevertheless, number of such species is very less.

4) The bryozoan fauna occurring in the shell limestone, plastic muds and sandy clays suggests that these rocks were deposited in the tropical shallow water, exhibiting open marine, nearshore ecological conditions.
5) Palaeocirculation has played an important role in the biogeography and dispersal of the Bryozoa.

6) Age wise, these rocks are of sub-Recent origin and may not be older than 5,000-6,000 years. Bryozoan species occurring in these rocks were ranging in age from the Palaeocene to the Recent. However, there are certain species which were ranging in age from the Holocene to the Recent.