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CYCLOSTOME BRYOZOA FROM THE CENOZOIC SEDIMENTS OF WESTERN KACHCHH, GUJARAT, INDIA

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ABSTRACT

Systematic descriptions are given of seven species of cyclostome bryozoans occurring in the Cenozoic sediments of the western Kachchh, Gujarat. Taxa belong to the families Tubuliporidae, Oncousoeciidae, Plagioeciidae, Crisiidae and Lichenoporidae. These species are *Crisia elongata* (Milne-Edwards), *Mecynoecia* sp., *Exidmonea babiensis* nov. sp., *Exidmonea* cf. *undata* (Reuss), *Disporella* sp., *Proboscina* sp. indet and *Disporella* aff. *radiata* (Audouin). The fauna is cosmopolitan in composition having Indo-Pacific and Atlantic affinities.

Keywords: Cenozoic, Cyclostome, western Kachchh, Bryozoa, Gujarat.

INTRODUCTION

The marine Cenozoic rocks exposed in western Kachchh, Gujarat (Text Fig.1) occupy the shelf zone adjoining Mesozoic sequences. A complete succession from Palaeocene to Holocene occurs in this region (Table 1). The thickness of the entire Cenozoic succession is about 900 m (Biswas, 1992). Fossil bryozoan fauna have been collected from rocks belonging to the Harudi Formation (Middle Eocene, Lutetian), the Fulra Formation (Middle Eocene, Bartonian), the Maniyara Fort Formation (Rupelian-Chattian), and the Khari Nadi Formation (Early Miocene, Aquitanian-Burdigalian).

The Harudi Formation is exposed 2 km NW of Harudi village close to Naliya- Narayan Sarovar Road (GPS position: 23^0 30' 30"N; 68^0 41' 10"E) (Fig.A) is richly fossiliferous, consisting of three parts, from the base upwards: calcareous shale with gray shale; ferruginous claystone; and white nummulitic limestone. Bryozoans have been collected from the ferruginous, gypseous clayey marlite band. The Fulra Formation is best exposed 1.7 km SW of the Fulra village around Babia Hill (GPS position: 23° 42' 30?N, 68°47' 12?E) (Fig.2B), Waghopadhar (GPS position: 23^0 42' 18"N; 68^0 43' 19"E), Kharai (GPS position: 23^0 28'17"N; 68^0 40' 15"E), Lakhpat GPS position: 23° 49' 50? N; 68° 46' 35? E), Ber Nani (GPS position: 23^0 27' 07"N; 68^0 36' 12"E) and Harudi (GPS position: 23° 31' 25? N; 68° 41' 07? E) villages. Bryozoans are found in the buff-coloured limestone and black argillaceous soft clay at Fulra, Kharai, and in the Waghopadhar and Lakhpat sections. The Maniyara Fort Formation has two parts foraminiferal limestone and basal glauconitic siltstones – and is very well exposed in Waior stream (GPS position: 23°25' 30?N; 68° 41' 58?E) (Fig.2C), Ramania stream (GPS position: 23^0 27' 22" N; 68^0 47' 12"E) and the Bermoti River bed (GPS position: 23^0 27' 41"N; 68^0 36' 07"E). The Miocene rocks rest unconformably over the Maniyara Fort Formation. They belong to two stratigraphical stages, Aquitanian and Burdigalian, represented by the Khari Nadi Formation and the Chhasara Formation respectively. The Khari Nadi Formation is subdivided into three parts: yellowish siltstone; fine-grained

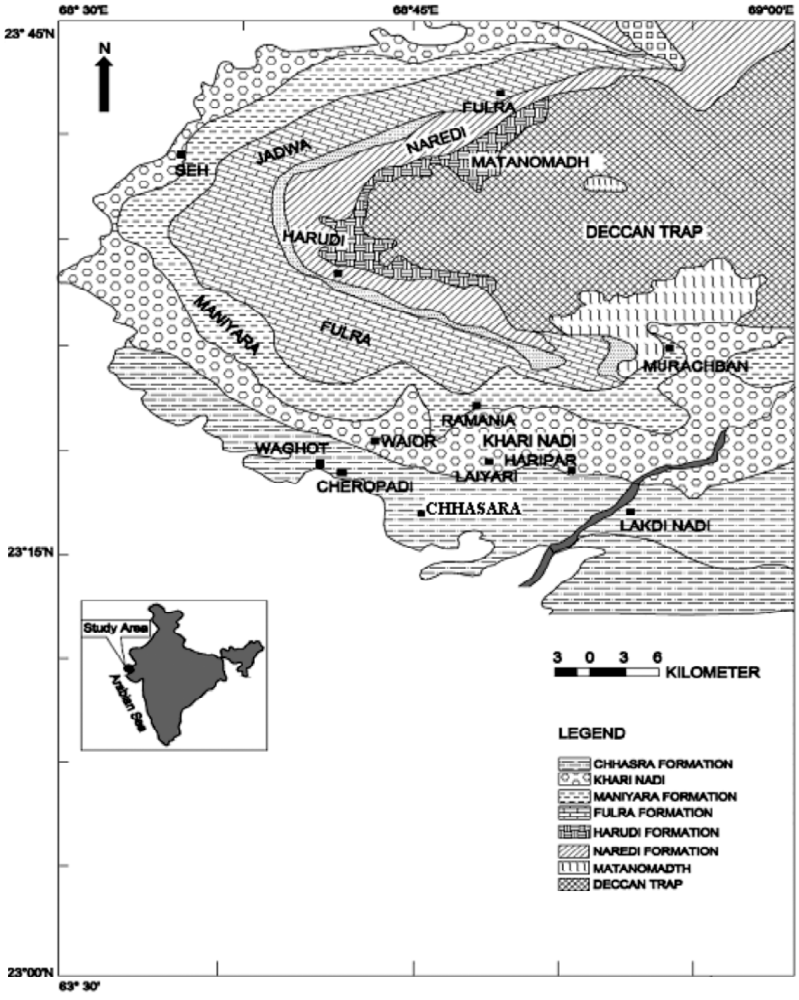

Fig. 1. Geological map of Western Kachchh, Gujrat (after Biswas, 1992)

sandstone; and brown gypseous claystone. Outcrops of the Khari Nadi Formation are extensively exposed between Haripar and Matanomadh Road at Laiyari (GPS position: 23^{0} 24' 09? N; 68° 48' 56? E) (Fig. 2D), Goyla (GPS position: 23^{0} 25' 45"N; 68^{0} 48' 00"E), Murachban (GPS position: 23^{0} 30' 10" N; 68^{0} 52' 09"E), Lakdi River (GPS position: 23^{0} 19' 19"N, 68^{0} 56' 14"E) and Waghot (GPS position: 23^{0} 23' 56? N; 68° 48' 56? E) (Fig.2D) where bryozoans occur with an abundance of *Turritella* beds.

The occurrence of fossil bryozoans in the Cenozoic rocks of Kachchh was first reported by Tewari *et al*. (1960) and Tewari and Srivastava (1967). Subsequently, Guha and Gopikrishna (2004a, b, 2005 b-f, 2007 a-d) described rich and diverse bryozoan faunas from this region. Considering their diversity in these rocks, there is a need to update their systematics using a bed-by-bed study. The present communication reports seven species of cyclostome Bryozoa from the Khari Nadi, Maniyara Fort, Harudi and Fulra Formations. They belong to the families Tubuliporidae, Oncousoeciidae, Plagioeciidae, Crisiidae and Lichenoporidae. These species are *Crisia elongata* (Milne-Edwards), *Mecynoecia* sp., *Exidmonea babiensis* nov. sp., *Exidmonea* cf. *undata* (Reuss), *Disporella* sp. *Proboscina* sp. indet and *Disporella* aff. *radiata* (Audouin).

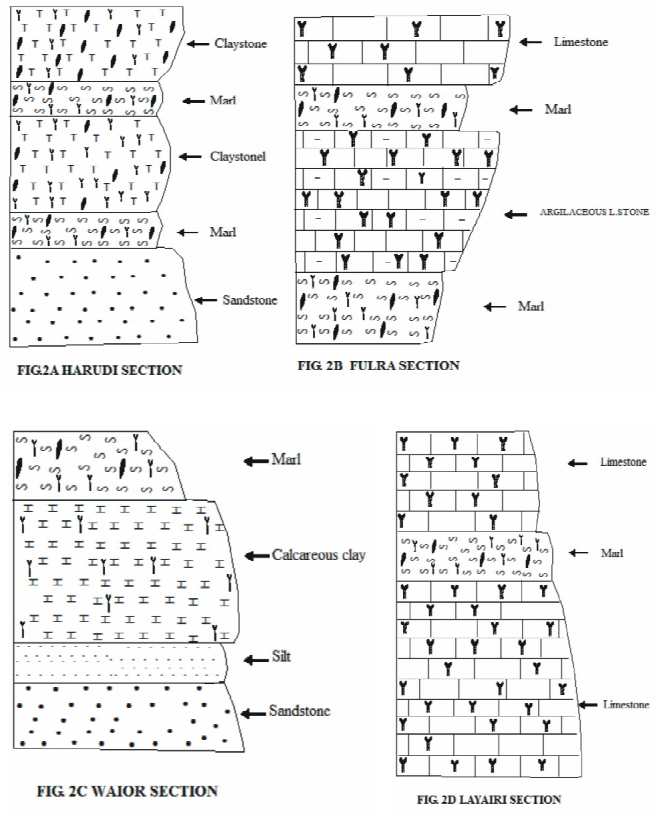

Fig. 2. Lithocolumns showing the sequence of beds in western Kachchh.

Table 1: Tertiary Stratigraphy of Kachchh (after Biswas, 1992).

TIME IN M.Y.	SERIES	STAGES	LITHOSTRATIGRAPHY FORMATIONS	LITHOLOGY
MIOCENE	UPPER	MESSINIAN	SANDHAN ---Unconformity---	Sandstones, minor limestones and shales
		TORTONIAN		
	MIDDLE	SERRAVALLIAN		
		LANGHIAN		
	LOWER	BURDIGALIAN	CHHASARA	Silty shales and impure
		AQUITANIAN	KHARI NADI ---Unconformity---	Variegated siltstones and sandstone
OLIGOCENE	UPPER	CHATTIAN	MANIYARA FORT	Foraminiferal limestone shales and coral bioherms, lumpy claystone
	LOWER	RUPELIAN		
EOCENE	UPPER	PRIABONIAN		
	MIDDLE	BARTONIAN	FULRA	Dense foraminiferal limestones
		LUTETIAN		
	LOWER	YPRESIAN	HARUDI ---Unconformity---	Claystones / limestones, coquina, etc.
PALAEOCENE	UPPER	THANETIAN	NAREDI ---Unconformity---	Claystones / limestones,
	LOWER	DANIAN	MATANOMDA ---Unconformity---	Volcanoclastics, shales and sand-
			DECCAN TRAP	Basalt

EXPLANATION OF PLATE I

1-3. ***Crisia elongata*** (Milne-Edwards) GIS/B- 1302

1. Complete internode showing inflated gonozooid on the top; 2. Close-up view of gonozooecium no ooeciopore seen; 3. Close-up view of gonozooid; 4,5; ***Mecynoecia*** sp. GIS/B-1381; 4. View of a fragment of a branching colony; 5. Oblique view of branch frontal surface; 6. ***Exidmonea babieaensis*** n. sp. GIS/B-1302; 6. close-up view perforated gonozooecium; *7.* ***Disporella*** aff. ***radiata*** (Audouin, 1826) GIS/B-1405, complete colony showing centrally depressed region and slanting uniserial autozooidal tubes away from the centre.

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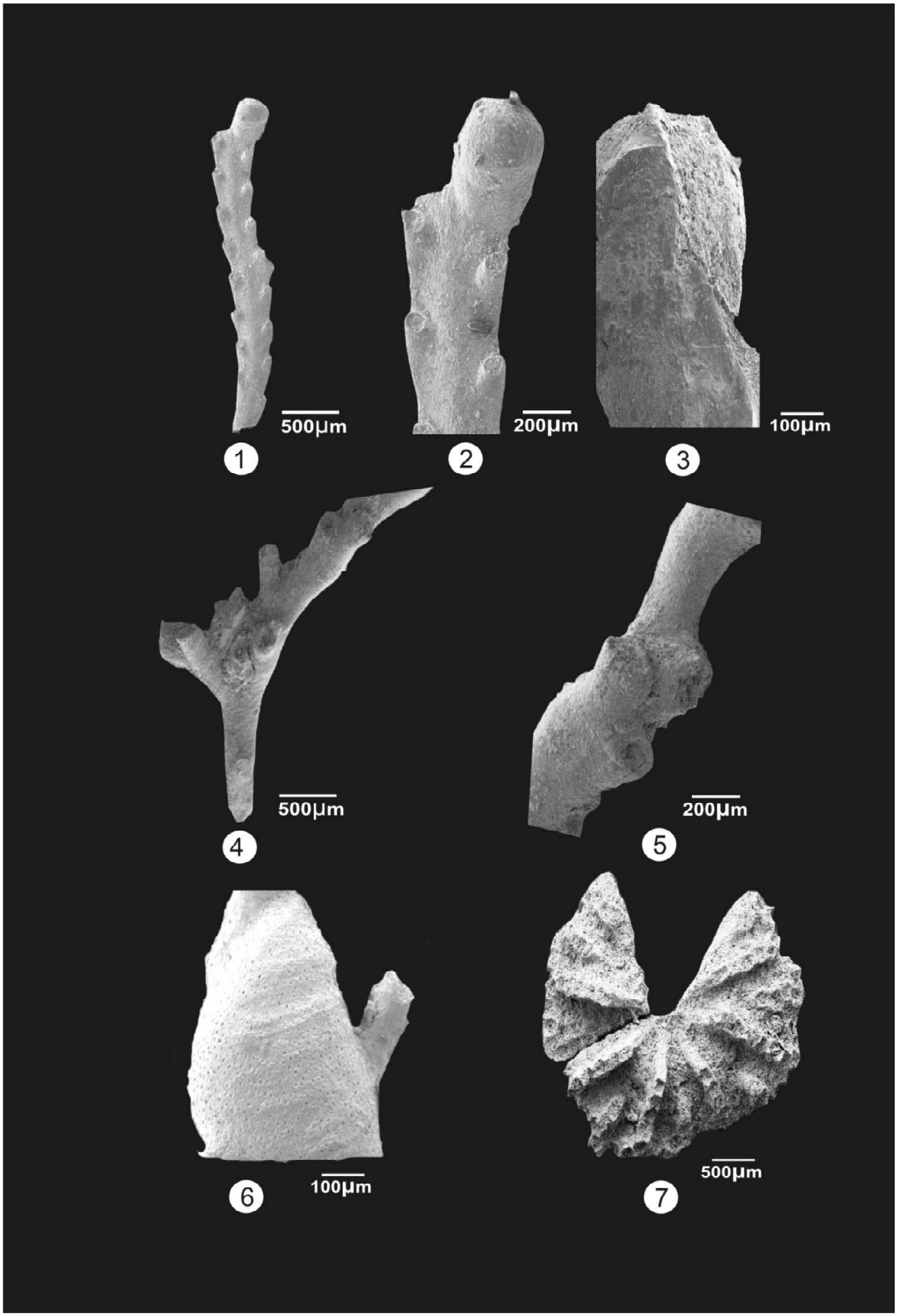
Plate I



MATERIAL AND METHODS

Encrusters on bivalve and gastropod shells were directly collected in the field. About 250 gms of weathered, gently crushed limestone, mudstone, shale were treated with 50% concentrated H_2O_2 for 48-72 hours. Samples were gently washed over a set of standard sieves with mesh sizes (10f-60f), conventionally used in foraminiferal analysis. Colonies and internodes of bryozoans were picked from different fractions for identification. Before identification specimens were cleaned by soaking in dilute acetic (5%) acid solution, as described by Zágoršek and Vávra (2000). The apertures of autozooidal tubes and colony surface were cleaned using a very thin metallic needle. Colony surfaces were scrubbed in sodium nitrate solution and under tap water with a hard 0.2 mm brush. The specimens were identified and photographed with the help of a JEOL/EO, Version-0.1 SEM. Measurements were taken with 15X ocular micrometer in a Nikon SMZ-800 stereoscopic zoom microscope following standard measurements. All dimensions were fractions of millimetre, the observed range expressed to the nearest 0.01 mm, and the mean calculated. For conciseness, the following micrometric parameters have been used in the systematic part of this paper.

(Lz) Length of Zooid, (Wz) width of zooid, (Wp) Width of Peristome, (Df) interfasicular (lor) orifice width, (Dor) Diameter of orifice, (Lov) length of ovicell, (Wov) width of ovicell, (N) Number of zooids, Mean, Standard deviation (SD), Coefficient of variation (CV).

The systematic part of this paper follows, except where otherwise indicated, the bryozoan "Treatise on Invertebrate Paleontology" (Part G) of R.S. Bassler (1953) and the Bryozoa home page: http//www.nhm.ac.uk hosted_home_page/default html. The described types are housed in the Museum of Geology, P.G. Department of Geology, Government Institute of Science, Aurangabad-431004 under the catalogue numbers indicated in the text.

SYSTEMATIC PALAEONTOLOGY

Class **Stenolaemata** Borg, 1926
Order **Cyclostomata** Busk, 1852
Suborder **Articulata** Busk, 1859
Family **Crisiidae** Johnston, 1847
Genus ***Crisia*** Lamouroux, 1812
Crisia cf. *elongata* Milne-Edwards,1838
(Pl. I, figs.1, 2, 3)

Crisia elongata Milne-Edwards, 1890, Kirkpatrick, p.170. - 1838 Pl. 1 figs.1, 2 & 3.- Harmer, 1915, p.96, pl.8, figs. 1-8.- Osburn, 1953, p.648, pl. 71, fig. 9.- , Winston, 1982, p.154, figs. 92-93. Braga & Barbin, 1988, p.505, pl.1, fig. 2.- *Crisia holdswarthi* Busk, Thornely, p. 127.- *Crisia denticulate* Lamarck, Waters, 1910, 2, pl.24, figs. 1-3.

Material: 487 internode fragments (GIS/B: 1302-1380)
Measurements:

	Range	Mean	N	SD	CV
Lz	0.04-0.06	0.0475	08	0.0027	5.76
Wz	0.004-0.006	0.00475	08	0.00027	5.76

Description: Colony erect, flexible with biserial internodes. 5-10 autozooids per internode present, surfaces pseudopunctate. Zooecial apertures present on frontal side of internodes but absent on dorsal sides. Apertures are circular with a low peristome which is slightly curved laterally. Gonozooecium observed at the top of the branch, broadly inflated, wider distally. Ooeciopore not clearly visible.

Remarks: The present species agrees with *Crisia elongata* (Milne-Edwards) (see Winston 1982, p. 154, figs. 92, 93) in all essential characters. However, the specimens are not well preserved and ooeciopore of the gonozooecium is not found on the surface. Hence, the species is being placed provisionally under *Crisia elongata* (Milne-Edwards), till well preserved material is studied. Although spines are not evident on each internode of the present material, *Crisia aculeata* (Hassall) (see Harmelin 1990, p..1602, figs 2, 3-6) shows some resemblance with the present species but differs in the position of gonozooecium. *Crisia hoernesii* (Reuss) (see Zágoršek 2003, p.108, Pl.1, fig. 2) differs in having striations on the frontal wall.

Occurrence: Fulra -76 internodes from claystone (Middle Eocene, Lutetian). Waior -88 internodes from white nummulitic limestone (Upper Oligocene, Chattian). Harudi -166 internodes from gypseous shales (Middle Eocene, Lutetian). Lakdi River - 157 internode fragments from yellow limestone (Lower Miocene, Burdigalian).

Distribution: This species has a cosmopolitan distribution in the Indo-Pacific region. Eocene: France; Oligocene: France and Italy; Miocene: France, Italy and USSR; Recent: West Africa, Gulf of California, West coast of India.

Family **Entalophoridae** Reuss, 1869
Genus ***Mecynoecia*** Canu, 1918
Mecynoecia sp.
(Pl. I, figs. 4, 5)

Material: Six internodes **(**GIS/B: 1381-1387).
Measurements:

	Range	Mean	N	SD	Cv
Lp	0.2-0.18	0.019	04	0.002	1.05
Wp	0.012-0.016	0.014	0.4	0.00028	2.02

Description: Colony erect, articulated, bifurcating stems. 2 to 3 autozooidal tubes arranged about the colonial axis. Apertures circular, placed on long peristomes often making an acute angle with the long axes of the branch. Frontal surface of tubes smooth, convex. Peristome slightly raised frontal striations. Gonozooecium not observed.

Remarks: The specimens from Kachhch were slightly misleading in generic placement because very small internode fragments having infertile autozooidal tubes were available. The present species resembles *Mecynoecia proboscidea* (Milne-Edwards) (Zágoršek, 2010, p.32, pl.18, figs. 1-5) in having long peristomes with circular to oval apertures However; *M. proboscidea* has 3 to 5 autozooidal tubes and globular gonozooecium. *Mecynoecia proboscideoides* (Smitt, 1872) (see Taylor, 2001, p.585, figs.5.4-5.6) differs from the present species in having 4 to 5 autozooidal tubes unevenly distributed around the perimeter. According to Taylor (2001, p.583) *M. proboscideoides* has a tendency for autozooidal apertures to be distributed unevenly around the perimeter of the branch,

EXPLANATION OF PLATE II

1-3. ***Exidmonea babiaensis*** n. sp. GIS/B-1388
1. Frontal view of branch; 2. Frontal view of bifurcating branch with gonozooecium; 3. Enlargement of 2-6 ***Exidmonea*** cf. ***undata*** (Reuss) GIS/B-1401; 4. Frontal view of fertile branch; 5. Gonozooecium; 6. view of branch reverse surface.

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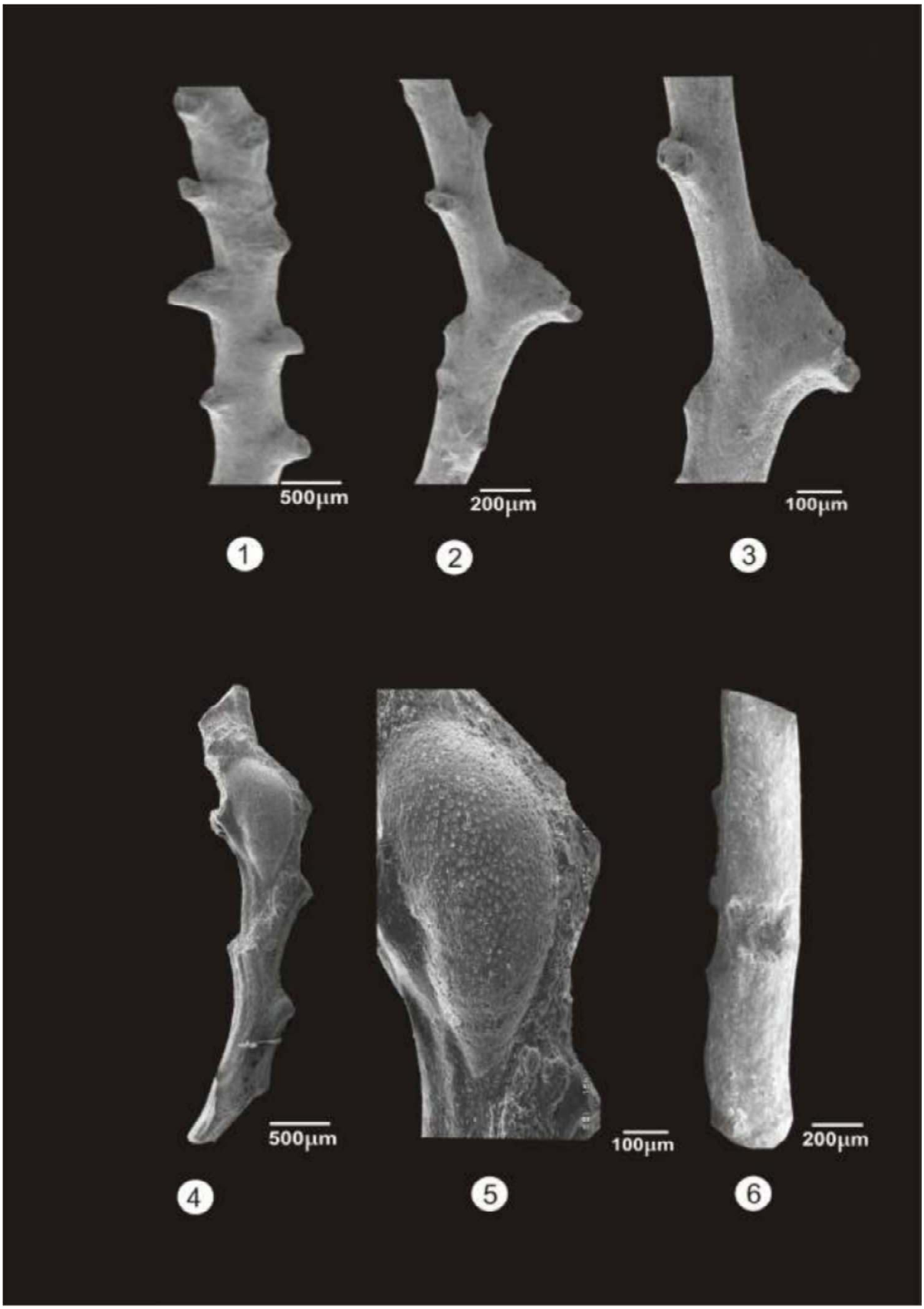
Plate II



occasionally giving a "dorsal" with few or no apertures. *Mecynoecia? exterogemma* Taylor & McKinney, 2006 differs from the present species in having encrusting branches giving rise to erect branches. The present species differs from *Mecynoecia virgula* (Hagenow, 1840) (see Guha & Nathan, p.62, Pl.6, figs. 6-7) in having autozooidal peristomes making an acute angle with the long axis of the branch.

Occurrence: Waior: 6 internode fragments from white nummulitic limestone (Upper Oligocene, Chattian).

Suborder **Tubuliporina** Milne-Edwards, 1838

Family **Tubuliporidae**, Johnston, 1838

Genus ***Eximonea*** Mongereau, 1969

Exidmonea babiaensis n. sp.

(Pl.I, fig.6; Pl.II, figs. 4, 5 & 6)

Material: (Holotype: GIS/B: 1388; Paratypes: GIS/B: 1389-1400).

Measurements:

Holotype: GIS/B: 1388	Range	Mean	N	SD	CV
Lz	0.2-0.18	0.018	03	0.0053	02
Wz	0.04-0.046	0.045	04	0.001	0.2
Lp	0.02-0.016	0.017	04	0.008	0.4
Df	0.04-0.048	0.038	04	0.017	0.4

Type horizon and locality: The argillaceous sediments of the Harudi Formation from the cliff, north of Harudi village by the side of the road from the Waior village to Narayan Sarovar.

*Age***:** Middle Eocene (Lutetian).

Description: Colony erect dichotomously branched. The autozooids are arranged in rows, usually 3-4 autozooecia in each row, alternating on either side of the branch midline, protruding beyond the branch margin. Dorsal surface consisting of vertical thin distinct, wavy striations. Gonozooecium large, placed at bifurcation, triangular distal end broad, tapering proximally, frontal surface perforated by small pseudopores, ooeciopore not clearly observed.

Remarks: The present species closely resemblance with *Exidmonea atlantica* (see Taylor and Voigt 1992, p. 84) but differs in having distinct vertical striations. *Exidmonea giebeli* Stoliczka, Zágoršek, 2010 (p. 28, pl. 7, figs. 1-4) shows close resemblance with present species but differs in having additional apertures present, a slightly convex dorsal surface and perforated frontally. *Exidmonea dorsata* (von Hagenow) (see Taylor & Voigt, 1992, p.124, figs. 1-5, pl.1, figs. 1-8) closely resembles the present species but differs in having less uniform autozooids, apertures lacking peristomes, and gonozooids located medially. *Exidmonea concava* Braga and Barbin, 1988 (p.506, pl. 1. fig. 3-4) shows similar appearance but differs in having flat or convex dorsal surface.

Occurrence: Harudi: 15 internode fragments from gypseous shales (Middle Eocene, Lutetian). Fulra: 8 internode fragments from argillaceous claystone (Middle Eocene, Lutetian).

Derivation of name: The species is named after Babia Hill where the type section of the Fulra Formation is exposed.

Exidmonea cf. *undata* (Reuss)

(Pl. II, figs.1, 2 & 3)

2010 *Exidmonea undata* (Reuss), 1977,Vávra, p.28 (cum. syn.).-Zágoršek, p.29, pl.7, figs. 1-4.

Material: 3 Specimens (GIS/B: 1401-1403).

Measurements:

	Range	Mean	N	SD	Cv
Lz	0.04-0.042	0.039	04	0.005	0.12
Wz	0.04-0.018	0.044	04	0.001	0.02
Lp	0.02-0.016	0.017	04	0.008	0.4
Df	0.04-0.048	0.038	04	0.017	0.4

Description: Colony erect, oval in transverse section, dichotomously branched, usually with 2-3 autozooecia arranged in each row, alternating on either side of the branch midline, slightly protruding beyond the colony margin. Apertures rectangular to oval. Dorsal surface convex, smooth, without striations. Gonozooecium not observed.

Remarks: This species is comparable to *Exidmonea undata* (Reuss) (see Zágoršek 2010, p. 29, pl. 7, figs. 1-4) in having an oval transverse section, 2 to 3 autozooids with rectangular to oval apertures. However, the present species has a convex, smooth dorsal surface without ribs. Hence, we tentatively place it under *E. undata* (Reuss) until more material is at hand. *Exidmonea hornesi* (Stoliczka) (see Mongereau 1969, p. 238, pl. 18, figs .8, 9) shows some resemblance with the present species in having an oval transverse branch section, and a smooth, convex dorsal surface; however, it differs in having 5 to 6 apertures in each row of autozooids. *Exidmonea villaltae* (Reguant) (see Mongereau, 1969, p. 252, pl. 21, figs. 4-5, 10 and 13) also shows a close resemblance with the present species in having three apertures per row, a convex, smooth dorsal surface and in lacking gonozooids. However, the present species differs from *E. villaltae* in having an oval transverse branch section and autozooids placed on the lateral side of the branch.

Occurrence: Harudi: 3 internode fragments from gypseous shales (Middle Eocene, Lutetian).

Distribution: Miocene: Tortonian: Austria.

Family **Oncousoeciidae** Canu, 1918

Genus ***Proboscina*** Audouin, 1826

'Proboscina' sp.

(Pl. III, figs. 1, 2 & 3)

Material: One Specimen **(**GIS/B: 1404).

Measurements:

	Range	Mean	N	SD	Cv
LZ	0.4-0.4	0.0485	04	0.0015	3.10
Lori	0.004-0.006	0.0042	09	0.00018	4.46

Description: Colony encrusting, unilaminar, bifurcating, with fan-shaped ramifications. Autozooids tubular, thin, peristomes slightly raised, apertures circular, arranged quincunxially and placed obliquely relative to the surface. Slight transverse striations and fine pseudopunctate surface frontally on the branches. Gonozooid not observed.

EXPLANATION OF PLATE III

1-3. ***Proboscina*** sp. GIS/B-1404

1. Part of a colony showing bifurcating pluriserial branches.

2. Enlargement of 1; 3. Autozooid with ovate aperture and low peristome; 4, 5. ***Disporella*** sp. GIS/B-1406; 4. Complete view of encrusting, unilaminar colony showing quincuncial arrangement of autozooidal tubes; 5 Close-up of central alveoli showing simple, circular to oval outline.

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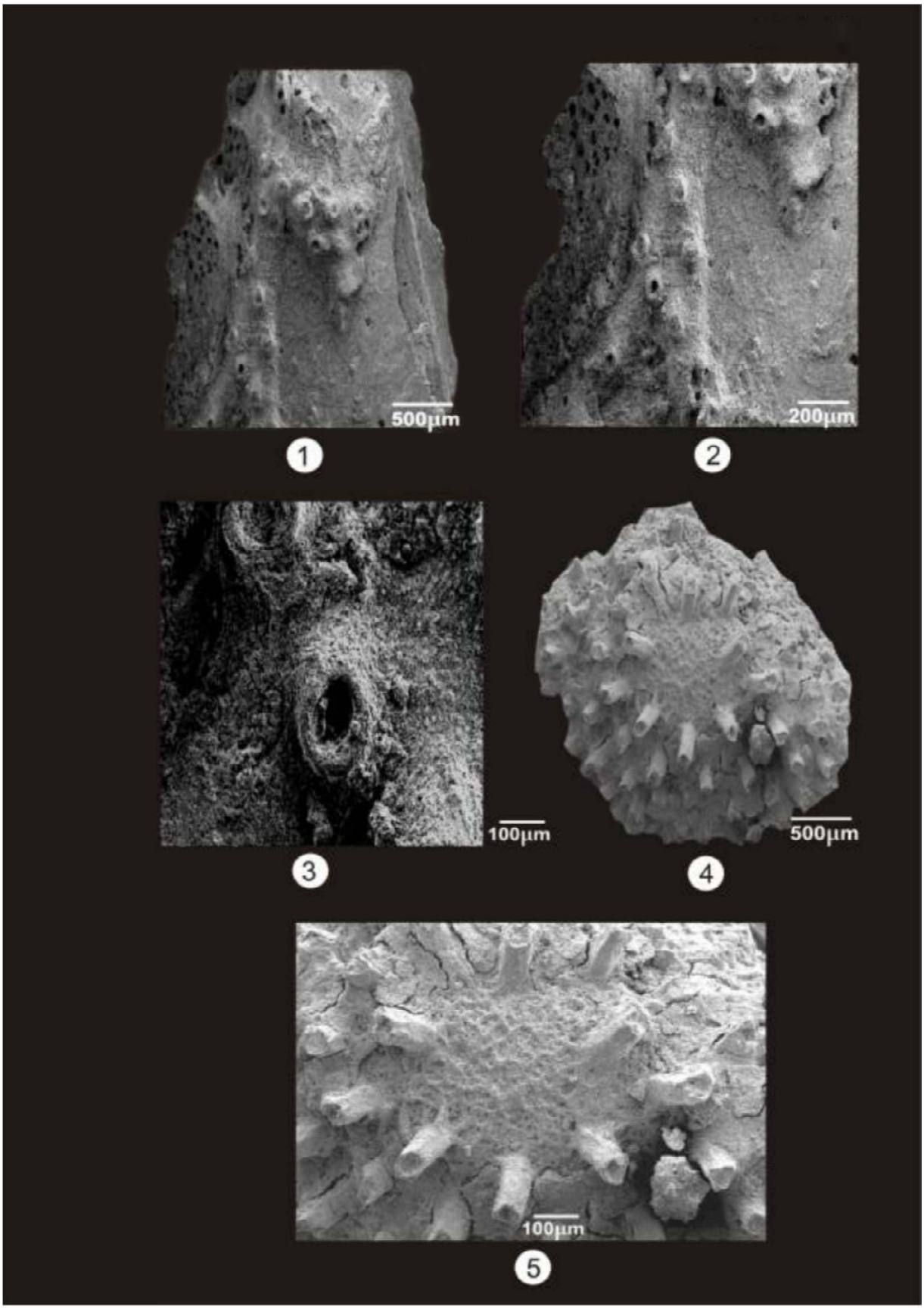
Plate III



Remarks: Only single specimen is present in our collection, encrusting an oyster shell. However, details of the gonozooecium are not preserved, which is a significant character to confirm its identity. The '*Proboscina'* sp. described by Guha and Gopikrishna (2007, pp.1278-77, pl. 2, figs. 5-6) resembles the present species in its unilaminar growth habit, circular apertures, autozooids arranged quincunxially, placed obliquely, with slight striations and pseudopunctate frontal surface. However, in the present species a gonozooecium was not observed.

Occurrence: Laiyari: one colony encrusting oyster shale obtained from yellow limestone (Lower Miocene, Aquitanian).

Family **Lichenoporidae** Smitt, 1867

Genus ***Disporella*** Gray, 1848

Disporella aff. *radiata* (Audouin, 1826)

(Pl. I, fig. 7)

Melobesia radiata Audouin, 1826, p. 235, pl.6 , fig. 3. –*Lichenopora radiata* (Audouin), Canu & Bassler, 1929, p. 556, pl. 88, figs.1-6.- Mawatari & Mawatari, p.355, pl. 30, fig. 4.

Material: One Specimen (GIS/B: 1405)

Measurements:

	Range	Mean	N	SD	Cv
Lz	0.015-0.01	0.013	06	0.00041	3.11
Wz	0.004-0.005	0.0046	06	0.00011	2.47

Description: Colony encrusting, discoidal, convex with central area depressed, surrounded by inclined autozooidal tubes; tubes adjacent to colony centre somewhat tilted and radiating away from the centre. Autozooidal tubes are arranged in uniserial. 5-6 fascicles present in each row and 10-12 radiating rows separated by grooves. Autozooidal apertures are oval to nearly rectangular, arranged very close to each other, in linear pattern. Gonozooid not recognizable.

Remarks: The single specimen is available in our collection. Provisionally, we have placed this specimen under genus *Disporella* because *Lichenopora*, based on the Miocene type species, has steeply conical colonies, not the encrusting colony-form seen in most of the species which have in the past been assigned to this genus in error but should be placed in *Patinella* instead. The main difference between *Patinella* and *Disporella* is that the alveoli in the centres of the colony (or subcolonies) become subdivided by struts in *Patinella* whereas in *Disporella* they are simple, often with iris-like constrictions (Gordon and Taylor, 1997, p.71). In addition, the ooeciopore is typically located within the central region of alveoli in *Patinella* whereas it may be located further out between the rows of autozooidal apertures in *Disporella*. (Taylor P.D. pers. comm. August 2012). The present species is broken, infertile colony and therefore its recognition to *Disporella* is tentative. *Disporella wanganuiensis* (Waters, 1887) (see Gordon and Taylor, 2001, p. 266, figs.31-36) closely resembles the present species however, differs in having 1-3 autozooids in each row. Our specimens show a close affinity to *Lichenopora radiata* (Audouin) (see Canu and Bassler, 1929, p. 556, pl. 88, figs 1-6; Mawatari and Mawatari, 1974, p. 355. pl. 30, fig, 4) but differs in having more number of uniserial fascicles. *Lichenopora (Domopora) strictolamellosa* Canu & Bassler 1929 (p. 561, pl. 89, figs. 8, 9) shows superficial resemblance with present species, but differs in having biserial fascicles. *Lichenopora verrucaria* (Fabricius) (see Mawatari and Mawatari, 1974, p.355, pl. 30, fig. 4) shows some resemblance with the present species but differs in having a subcircular colony. *Lichenopora betsibokensis* Brood, 1977 (p.80, fig. 20) shows difference in the arrangement of zooidal tubes, and the shape of the colony.

Occurrence: Fulra: one discoid colony from argillaceous claystone (Middle-Eocene, Lutetian).

Genus ***Disporella*** Gray, 1848

Disporella sp.

(Pl. III, figs. 4 & 5)

Material: One Specimen (GIS/B-1406).

Measurements: Mean Length of the colony = 0.012 and width of the colony = 0.006

Description: Colony encrusting, unilaminar, orbicular in outline, with thin and slender zooecia arranged in sub-linear rows. Alveoli placed centrally, simple, small, circular to oval in outline. Autozooecia tubular, thin, long, frontal wall convex, minutely pseudoporous, peristome small, circular to oval in outline, arranged quincunxially and obliquely to the surface. Gonozooecium not observed.

Remarks: The single specimen obtained from Fulra is infertile. *Disporella* sp.*b* (http//www.bryozoa.net/cyclostomata/Lichenoporidae/Disporella/Nmita.html) shows very close resemblance with present species in the nature of autozooidal tubes, however, autozooidal tubes placed in linear rows and the intervening alveoli are rectangular to sub-rectangular in shape with the gonozooid. *Disporella pristis* (MacGillivray, 1884) (http//www.bryozoa.net/cyclostomata /Lichenoporidae/Disporella) also shows superficial resemblance with present species in the shape of autozooidal tubes but, the arrangement of autozooidal tubes and intervening alveoli are of different nature. *Disporella cf. hispida* (Fleming, 1828) (see Zágoršek 2010, p. 39, pl.36, figs. 2-5) appears to be very similar to present species in having uniserial and isolated zooidal tubes, quincunxially arrangement of the apertures however, the present species donot show gonozooid. Because the present material contain only single specimen and details of gonozooecium are not observed, the exact recognition of the species remains uncertain till well-preserved material is studied.

Occurrence: Fulra: one disc shaped colony from argillaceous clay section (Middle Eocene, Lutetian).

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REFERENCES

Biswas, S.K. 1992. Tertiary Stratigraphy of Kutch. *Journal of the Paleontological Society of India.* **37**:1-29.

Bassler, R. S. 1953. Bryozoa, p.1-253. In: *Treatise on Invertebrate Palaeontology* (Part G) (Eds. Moore, R.C. *et al.*), Geological Society of America & University of Kansas Press, New York.

Braga, G. and Barbin, V. 1988. Les Bryozoaires Du Priabonien Stratotypique (Province Vicenza, Italie). *Revue de Paleobiologie,* **7**(2): 495-556.

Brood, K. 1977. Upper Cretaceous Bryozoa from Need's Camp, South Africa. *Palaeontologia Africana,* **20:** 65-82.

Canu, F. and Bassler, R. S. 1929. Contribution to the Biology of the Philippine Archipelago and Adjacent Regions; *Smithsonian Institution United States National Museum, Bulletin 100, United states Government Printing office Washington*, **9**: 01-661.

Gordon D.P. and Taylor, P.D. 1997. The Cretaceous-Miocene genus *Lichenopora* (Bryozoa), with a description of new species from New Zealand. *Bulletin of Natural History London,* (Geol.), **53**(1): 71-78.

Gordon, D.P. and Taylor, P.D. 2001. New Zealand Recent Densiporidae and Lichenoporidae (Bryozoa: Cyclostomata). *Species Diversity*, **6**:242-290.

Guha A. K. and Gopikrishna, K. 2004a. Fossil Thalamoporella (Bryozoa) from the Tertiary Sequences of Kachchh, Gujarat, India. *Irene Marine McCulloch Foundation Monograph Series*, Hancock Institute of Marine Studies, University of Southern California, Los Angeles, Californis,**7:** 1-50.

Guha, A. K. and Gopikrishna, K. 2004b. *Reniporella gordoni*, a new genus and species of Bryozoa (Cheilostomata: Steginoporellidae) from the Middle Eocene of Western Kachchh, Gujarat, India with a note on its significance. *Neues Jahrbuch fir Geologie and Paläontologie Monatshefte*, **11**: 681-693.

Guha, A. K. and Gopikrishna, K. 2005a. Diversity, evolution and paleoecology of the Tertiary bryozoan assemblages of western Kachchh, Gujarat, India, p. 107-118. In: *Bryozoan Studies* 2004 (Eds. Moyono, G., H. I., Cancino, J.M. and Wyse Jackson, P.N.), A.A. Balkema Publishers: Leiden.

Guha, A. K. and Gopikrishna, K. 2005b. *Archoporella* – a new hippopodinid genus (Bryozoa: Chielostomata) from the Palaeogene of Western Kachchh, Gujarat, India. *Neues Jahrbuch fir Geologie and Paläontologie, Monatshefte*. **7**: 415-30.

Guha, A. K. and Gopikrishna, K. 2005c. New petraliid cheilostome bryozoan taxa from Aquitanian of western Kachchh, Gujarat, India. *Neues Jahrbuch fir Geologie and Paläontologie Monatshefte*. **11**: 694-704.

Guha, A. K. and Gopikrishna, K. 2005d. new Smittinid (Bryozoa, Cheilostomata) species from Tertiary Sequences of Western Kachchh, Gujarat, India. *Freiberger Forschungshefte* C 507: Paläontologie, Stratigraphie, Fazies Freiberg, **13**: 11-25.

Guha, A. K. and Gopikrishna, K. 2005e. Lunulitiform cheilostome bryozoans from the Miocene sequences of western Kachchh, Gujarat, India. *Journal of Palaeontological Society of India*, **50**(2): 13-24

Guha, A. K. and Gopikrishna, K. 2005f. Some fossil anascan bryozoan taxa from the Tertiary sequences of western Kachchh, Gujarat. *Journal of Palaeontological Society of India*, **50**(2): 135-151.

Guha, A. K. and Gopikrishna, K. 2007a. New celleporid (Bryozoa Cheilostomata) species from the Tertiary deposits of western Kachchh, Gujrat, India. *Paläontologische Zeitschrift*, **81**/1: 83-92.

Guha, A. K. and Gopikrishna, K. 2007b. New fossil Steginoporellid and Schizoporellid species (Bryozoa, Cheilostomata) from the Tertiary sequence of western Kachchh, Gujarat, India. *Journal of Geological Society of India,* **69** (4): 801 -812.

Guha, A. K. and Gopikrishna, K. 2007c. Cyclostome Bryozoa from the (Eocene) Lutetian of western Kachchh, Gujarat, India. *Journal Geological Society of India*, **69** (6): 1271-1278.

Guha, A. K. and Gopikrishna, K. 2007d. New Calloporid (Bryozoa, cheilostomata) species from Tertiary sequences of western Kachchh, Gujarat, India. *Journal of the Palaeontological Society of India*, **70** (1): 121-130.

Guha, A. K. and Nathan, D. S. 1996 Bryozoa fauna of the Ariyalur group (Late Cretaceous) Tamilnadu and Pondicherry, India. *Palaeontologia Indica*, **24**: 1-205.

Harmelin, J-G. 1990. Deep-water crisiids (Bryozoa: Cyclostomata) from the northeast Atlantic Ocean. *Journal of Natural History,* **24**: 1597-1616.

Mawatari, S. & Mawatari, S.F. 1974. Notes on the marine Bryozoa from Hokkaido II. Cyclostomata other than Crisiidae. *Journal of the Faculty of Science*, *Hokkaido University zoology* **19**: 349-360.

Mongereau, N. 1969. Le Genere Idmonea Lamouroux, 1821 (Bryozoa-Cyclostomata) Dans Le Tertiaire D'Europ. *Geobios,* **2**: 205-264.

Taylor, P.D. and Voigt, E. 1992. Taxonomic status of the cyclostome bryozoan genus Exidmonea, with a redescription of E. dorsata (Von Hagenow) from the Upper Cretaceous. *Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg*, *(NF)* **33**:121-130.

Taylor, P.D. 2001. Preliminary Systematics and Diversity patterns of cyclostome bryozoans from the neogene of the Central American Isthmus. *Journal of Paleontol*ogy, **75**(3):578-589.

Taylor, P.D. and McKinney, F.K. 2006. Cretaceous Bryozoa from the Campanian and Maastrichtian of the Atlantic and Gulf coastal Plains, United States. *Scripta Geologica (Leiden)*, **132**: 1-346.

Tewari, B.S. and Srivastava, I.P. 1967. On some Fossil Bryozoa from India. *Journal Geological Society of India*, **8**: 18-28.

Tewari, B.S., Bhargava, O.N., and K.K. Tandon. 1960. Two Cheilostome Bryozoa from Lower Miocene Beds of Kutch. *Journal of the Palaeontological Society of India*, **3**: 233-235.

Zágoršek, K. 2010. Sborník Národního Muzea V Praze Rada B- Prirodni Vedy, Acta Musei Nationalis Pragae Series B- *Historia Naturalis,* **66** (1-2): 3-136.

Zágoršek, K. 2003. Upper Eocene Bryozoa from Waschberg Zone (Austria) Wien 2003; *Beiträge zur Paläontologie,* **28**: 101-263.

Zágoršek, K. and Vávra N 2000 A new method for the extraction of bryozoans fromhard rocks from the Eocene of Austria. *Jahrbuch der Geologischen Bundesanstalt, Wien,* **142**: 249-258.

Winston, J.E. 1982. Marine Bryozoans (Ectoprocta) of the Indian River Area (Florida). *Bulletin of the American Museum of Natural History*, **173:** Article 2.

Wynne, A.B. 1872. Geology of Kutch; *Geological Survey of India Memoir,* **8-9**: 1-289.www.homepage bryozoa.com

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