

ANOMIID BIVALVES FROM THE LOWER MIOCENE OF KOLASIB, MIZORAM

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ABSTRACT

A small collection of Anomiidae (two new species of *Anomia* and one species of *Placuna*) is described from a thin Calcareous Sandstone bed exposed at Quarry Veng of Kolasib in Mizoram. The bed is of the Upper Bhuban Formation of the Surma Group. Biostratigraphically, it falls in the Zonule IIA(b): *Conus (Dendroconus) lorioisii* - *Archimediella (Torculoidella) angulata* Zonule, and is assigned to the Burdigalian.

Keywords: Bivalves, Anomiidae, Systematics, Surma Group, Upper Bhuban Formation, Burdigalian, Kolasib, Mizoram

INTRODUCTION

Two new species of *Anomia* viz. *Anomia (Anomia) bhubanicus* and *Anomia (Anomia) collinsi* and one of *Placuna* are being reported for the first time from the Upper Bhuban Formation of Kolasib, Mizoram. The fossils are poorly preserved. These fossils reveal important palaeogeographic and palaeoecological information.

Anomiid bivalves are preserved rarely in sediments because of their thin shells that are easily destroyed by strong currents, bioturbation or compaction of the sediments. Preservation records of the delicate *Anomia* valves are meager. Previous study of Miocene invertebrate fauna from India; and its adjoining area reveals that *Anomia* are recorded from the Cretaceous of Assam (Spengler, 1923), Miocene of the Garo Hills (Mukerjee, 1939) and Burdigalian of Persia (Cox, 1936). Excepting the Garo example, all others are not identifiable up to the species level. Though, at present, the genus *Placuna* is restricted to eastern seas (Vredenburg, 1924), its fossil record is much better than that of *Anomia*. In most cases, right valves of *Anomia* are not found, it may be due to unstable structure and mineralogy of the valves, and thus preservation is rare (White, 1883). Modern *Anomia simplex* d'Orbigny, commonly attaches to shells, pebbles, logs, wharves or boats (Stanley, 1970; Abbott, 1974). Hasenmueller and Hattin (1990) are of the opinion that individuals of *Anomia* species that attach to broad flat surfaces develop valves that are broad and flat, whereas individuals that grow on small objects with curved surfaces develop inflated valves that accommodate increase of body size without extending the shell beyond the substrate limit. Complications in species identification occur for non-uniform valve morphology of the biota. The range of dimensional ratios of the Kolasib fauna manifests Hasenmueller and Hattin's view. However, Mukerjee's collection of *Anomia* from the Garo Hills is represented by right valves. This can be attributed to the favourable synecological conditions of the fauna in the Garo Hill sediments.

Lithologically, anomiid-bearing Calcareous sandstone bed of Kolasib is fine to medium grained, dark grey in colour, and at places becomes more calcareous containing shell fragments. Presence of pyrite in this bed indicates deposition under reducing environment.

LOCALITY

The locality marked as K5, is situated near 2 km stone of

the Kolasib-Silchar road along National Highway No. 54, and lies to the left side of the road section. It is a large sandstone quarry (24° 14'08'' : 92°41'17'') in Quarry Veng locality of Kolasib (Fig. 1).

STRATIGRAPHY

Mizoram is a part of Tripura-Mizoram miogeosynclinal basin (Evans, 1964). The area is represented by argillaceous and arenaceous sediments, which occur in alternation. These sediments form N-S trending, longitudinally plunging anticlines and synclines (Ganju, 1975; Ganguly, 1983). Strike of the strata is N-S with variable amounts of dips from 20° to 50° either eastward or westward (Karunakaran, 1974). The stratigraphic position of the Upper Bhuban Formation of the Surma Group in Mizoram is given in Table 1.

In the fossil locality, the Upper Bhuban Formation consists of three beds namely, Grey Sandstone bed at the base Calcareous sandstone bed in the middle and Silty Sandstone bed at the top. Exposed thickness of beds is 14.6m, 1.2m, and 1.4m respectively (Fig. 2).

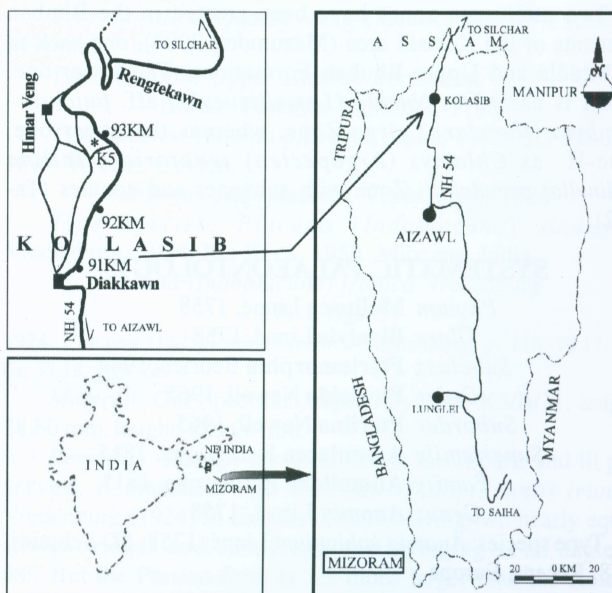


Fig. 1. Location map, showing the fossil locality.

Table 1: Cenozoic stratigraphy of Mizoram, after Karunakaran, 1974 and Ganju, 1975.

Rock unit	Geological age	
Alluvium	Recent	
Tipam Group	Early Pliocene to Late Miocene	
Unconformity		
Surma Group	Miocene to Upper Oligocene	
Bokabil Subgroup		
Conformable and transitional contact		
Bhuban Subgroup		
Upper Bhuban Formation		
Conformable and transitional contact		
Middle Bhuban Formation	Upper Oligocene	
Conformable and transitional contact		
Lower Bhuban Formation	Oligocene	
Unconformity obliterated by fault		
Barail Group		
Lower contact not seen		

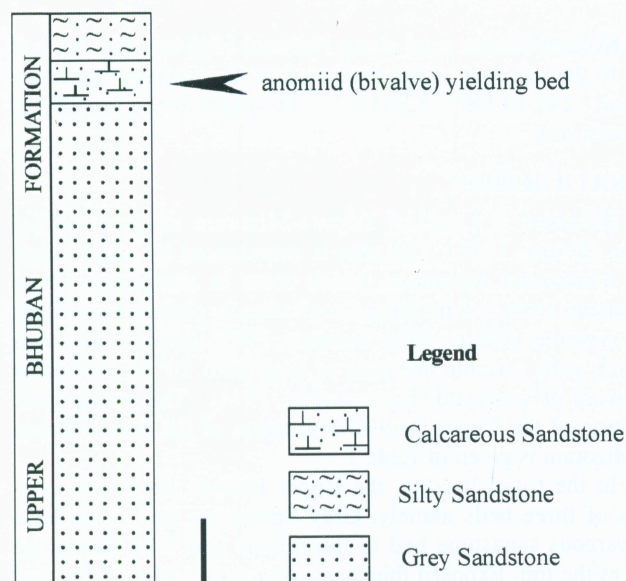


Fig. 2. Columnar section at locality K5. Scale bar equals 2m.

BIOSTRATIGRAPHY

Two molluscan zones have been erected in the Bhuban sediments of the Kolasib area (Mazumder, 2004), one each in the Middle and Upper Bhuban Formations. The lower one, Zone-I is named as *Nucula (Lamellinucula) aff. pulchra - Nuculana (Nuculana) virgo* Zone, whereas the upper one, Zone-II as *Chlamys (Argopecten) senatoria - Tellina (Tellinella) pseudohilli* Zone with subzones and zonules (Table 2).

SYSTEMATIC PALAEOONTOLOGY

- Phylum **Mollusca** Linné, 1758
 Class **Bivalvia** Linné, 1758
 Subclass **Pteriomorpha** Beurlen, 1944
 Order **Pterioida** Newell, 1965
 Suborder **Pteriina** Newell, 1965
 Superfamily **Anomiacea** Rafinesque, 1815
 Family **Anomiidae** Rafinesque, 1815
 Genus **Anomia** Linné, 1758

Type species: *Anomia ephippium* Linné, 1758; SD Schmidt, 1818. Recent; Europe.

Subgenus *Anomia* (s. s.)

Anomia (Anomia) bhubanicus n.sp.

(Pl. I, figs. 1, 2)

Material: Two, rather well preserved left valves.

Derivation of Name: The trivial name has been derived from the Bhuban sediments in which it occurs at Kolasib, Mizoram.

Measurement in mm:

Sp. no.	length, l	height, h	thickness, t	h/l%	t/l%	valve
K5/B/14	15.50	14.20	4.00	91.61	25.81	left holotype
K5/B/38	13.20	12.50	3.60	94.70	27.27	left paratype

Diagnosis: Left valve medium, very thin, slightly inequilateral, with bright pearly lustre; outline trigonally ovate; dorsal margin convex, posterodorsal margin straight to slightly concave, anterior and ventral margins form nearly uniform convex curve, posteroventral margin narrowly rounded, anterodorsal is straight; valve moderately inflated, maximum inflation being at mid-height of the valve; surface ornamented in reticulate fashion; beak orthogyre to slightly opisthogyre.

Description: Left valve medium, very thin, slightly inequilateral, white in colour, translucent with pearly lustre; trigonally ovate in outline. Dorsal margin convex, anterior and ventral margins convex and curved uniformly, convexity of dorsal margin is slightly more in large specimen, anterodorsal is straight. Valves are moderately convex, maximum convexity is at mid-height of shell; valve surface exfoliated or are internal moulds, but in parts of paratype no. K5/B/38 is ornamented with faint closely spaced concentric growth lines which are crossed over by faint closely spaced radial threads. Beak small, orthogyrous to slightly opisthogyrous, commonly extend a little above the hinge line.

Remarks: The species under study is comparable to the Turonian form, *Anomia (Anomia) pfeiferensis* designed by Hasenmueller and Hattin (1990, p. 107, figs. 6.1-6.10) reported from the Green Horn Limestone, Central Kansas; particularly with figure 6.9, in shape, position of umbo, however, the Central Kansas form is large and surface marked by subdued growth wrinkles. The Recent *Anomia ephippium* Linné, described by Dance (1974, p. 238), is irregularly circular and has a scaly surface. *Anomia* cf. *ephippium* Linné, is recorded by Mukerjee (1939, p. 30) from the Miocene of Garo Hills. Its length (18.0mm and 13.3mm), height (16.5mm and 15.0mm) and inflation (5mm

Table 2: Biostratigraphy of the Bhuban sediments (Surma Group) of Kolasib, Mizoram (Mazumder, 2004).

M I O C E N E	Age	Formation	Faunal Zones	
	Burdigalian	Upper Bhuban	Zone II. <i>Chlamys (Argopecten) senatoria</i> - <i>Tellina (Tellinella) pseudohilli</i>	Subzone IIB. <i>Callista (Costacallista) erycina</i> - <i>Antigona granosa</i> - <i>Trisidos semitorta</i>
	Burdigalian			Zonule IIA(b). <i>Conus (Dendroconus) loroisii</i> - <i>Archimediella (Torculoidella) angulata</i>
	Burdigalian to Aquitanian			Zonule IIA(a). <i>Conus (Lithoconus) ineditus</i> - <i>Diplodonta (Diplodonta) incerta</i>
Aquitanian	Middle Bhuban	Zone I. <i>Nucula (Lamellinucula) aff. pulchra</i> - <i>Nuculana (Nuculana) virgo</i>		

and 3.5mm;) indicate variable shape. Inflation in these specimens is much lower than the Kolasib specimens. The Burdigalian fauna of Persia known from Cox (1936, p. 46) as *Anomia* sp. is orbicular, about 40mm diameter and possesses faint bifurcating ribs. Australian form *Anomia walteri* Hector (Dance, 1974, p. 238) is similar in shape to the present form, but former is larger (60mm-95mm), with surface covered with coarse radials and concentric ridges.

Type Locality: Quarry Veng (locality no. K5), Kolasib, Mizoram.

Type Horizon: Upper Bhuban Formation.

Anomia (Anomia) collinsi n.sp.
(Pl. I, figs. 3, 4)

Material: Four left valves are examined.

Name: The species has been named in honour of the palaeontologist, Prof. J. S. H. Collins, Forest Hill, London.

Measurement in mm:

Sp. no.	length, l	height, h	thickness, t	h/l%	t/l%	valve
K5/B/25	13.20	12.50	3.80	94.70	28.79	left
holotype						
K5/B/11	13.00	12.20	3.20	93.85	24.62	left
paratype						
K5/B/29	17.00	15.60	3.80	91.76	22.35	left
paratype						
K5/B/17	21.00	17.20	4.00	81.90	19.05	left
paratype						

Diagnosis: Left valve medium, thin, inequilateral, with pearly lustre; small valve obliquely elliptical, large one roughly semicircular in outline; dorsal and posterodorsal margins straight, anterodorsal rounded in small valve, straight to slightly concave in large one, anterior posterior and ventral margins forms a continuous convex curve, convexity of anterior and posterior margins is more in large valve; inflation is moderate; surface marked by sub-equally spaced subdued growth wrinkles, which bear close and fine growth lines, apart from these, they carry fine radial threads; beak prosogyrous and do not extend above hinge line.

Description: Left valve medium in size, thin, inequilateral, white in colour, and pearly lustre; outlines of small valves obliquely elliptic, large valves are semicircular; dorsal margin straight and approximately one-half of shell length, posterodorsal is also straight, anterodorsal is convex in small

valves, straight to slightly concave in large valves, both anterodorsal and posterodorsal margins meets the dorsal one at an obtuse angle, but the latter one is much obtuse; anterior and posterior margins convex, so also the ventral margin; anterior, posterior and ventral margins form a continuous curve. Valves are moderately inflated, maximum inflation being along the umbonal ridge, which runs from umbo to the mid-height of the valve. Beak small, well developed, prosogyrous and do not occur above hinge line. Surface ornamentation is not very well preserved, the surface of holotype and paratype no. K5/B/11 are marked by sub-equally spaced subdued growth wrinkles which bear close and fine growth lines, apart from these they carry fine radial threads.

Remarks: In broadly elliptical or irregularly elliptical (due to slight prolongation of posteroventral margin) shape and nature of dorsal margin, i.e. straight to slightly arched, the specimens can be compared to *Anomia (Anomia) cobbani* Hasenmueller and Hattin (1990, p. 105, fig. 3.1-3.9) reported from Central Kansas, USA. But the latter is a different form owing to its pronounced beak and presence of strong commarginal wrinkles. No other comparable forms are known to the author.

Type Locality: Quarry Veng (locality no. K5), Kolasib, Mizoram.

Type Horizon: Upper Bhuban Formation.

Genus Placuna Lightfoot, 1786

Type species: *Anomia placenta* Linné, 1758; SD Schmidt, 1818. Recent; Ceylon.

Subgenus Indoplacuna Vredenburg, 1924

Type species: *Placuna (Indoplacuna) sindiensis* Vredenburg, 1924; SD Keen, 1959. Miocene; India.

Placuna (Indoplacuna) iranica Vredenburg
(Pl. I, figs. 5)

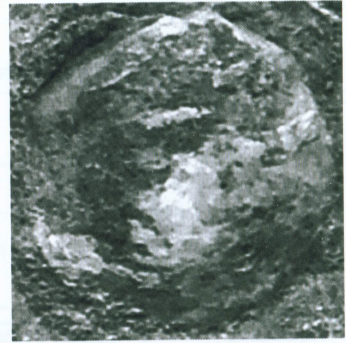
1924. *Placuna (Indoplacuna) iranica* Vredenburg, p. 116, Pl.17, fig. 6a; Pl.18, figs. 6b, c.

Material: One specimen, right valve, no. K5/B/31, length, 28.80 mm, height, c28.00 mm.

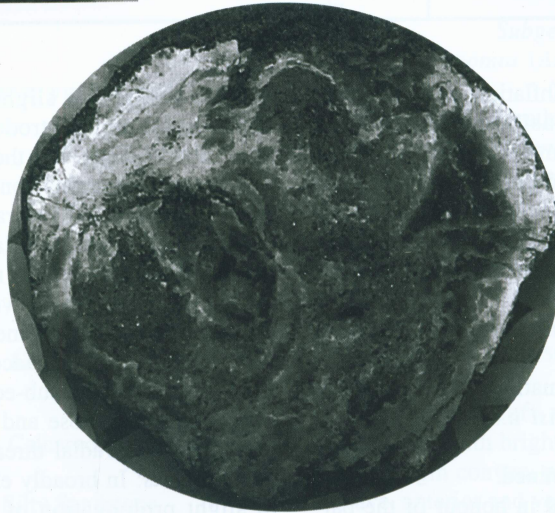
Remarks: Though the specimen is incomplete and ill preserved, it matches with *Placuna (Indoplacuna) iranica* Vredenburg (1924) in circular outline, having two nearly equal, straight ridges and chondrophores diverging at an angle of 68°. But the Persian form is 3.3 times larger than the Kolasib



1



2



5



3



4

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EXPLANATION OF PLATE I

1. *Anomia (Anomia) bhubanicus* n.sp. - Holotype. Locality K5; Upper Bhuban Formation; sp.no. K5/B/14, left valve, x4.
2. *Anomia (Anomia) bhubanicus* n.sp. - Paratype. Locality K5; Upper Bhuban Formation; sp.no. K5/B/38, left valve, x4.
3. *Anomia (Anomia) collinsi* n.sp. - Holotype. Locality K5; Upper Bhuban Formation; sp.no. K5/B/25, left valve, x4.
4. *Anomia (Anomia) collinsi* n.sp. - Paratype. Locality K5; Upper Bhuban Formation; sp.no. K5/B/29, left valve, x4.
5. *Placuna (Indoplacuna) iranica* Vredenburg - Locality K5; Upper Bhuban Formation; sp.no. K5/B/31, right valve, x3.

one and cavity in the latter is away from the center, which may be due to immaturity of the valve. Hence, it is referred to the Vredenburg's form.

Locality: Quarry Veng (locality no. K5), Kolasib, Mizoram.

Horizon: Upper Bhuban Formation.

REPOSITORY

The specimens are housed in the Geology Department of Karimganj College, Karimganj - 788710, Assam, India.

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ANNOUNCEMENT

National Seminar on “**Late Quaternary Geology of the Himalayan Orogen and the Foreland Basin**” is being held at the **Centre of Advanced Study in Geology, University of Lucknow, Lucknow on January 14 and 15, 2011**. The major themes to be covered include: Active Tectonics and Landform Evolution, Natural Hazards and Mitigation, Palaeoclimatic reconstruction and Glacial and Fluvial Chronology. Participants are requested to contact the following for further details.

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