

KUTCH MICROFAUNA: AQUITANIAN FORAMINIFERA FROM WAIOR, SOUTH-WESTERN KUTCH

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ABSTRACT — Twenty-seven species of foraminifera, including two new species and one new variety, have been recorded and illustrated from the Lower Gaj (Aquitanian) stage of Kutch. The fauna bears a typical Indo-Pacific affinity and suggests that the deposits were laid in a shallow basin under warm conditions.

INTRODUCTION

IN the northern and central portion of the Kutch district, Middle Jurassic and Lower Cretaceous rocks occur in the form of domes (Raj Nath, 1942). These are overlain by the Deccan Trap and are intruded by basic dykes and laccoliths (Tewari, 1948), which may be connected with the Deccan Trap activity. The south-western and eastern portions are covered by Tertiary rocks.

The larger foraminifera of the Tertiary rocks of the area have been described by Sowerby (1837), Vredenburg (1906-8), Nuttall (1925 & 1926) and Tewari (1952).

Except for a few casual references by the senior author (1956 & 1957), smaller foraminifera have not yet received adequate attention.

The material under study was collected from the Marl bed No. 4 of Tewari (1957, p. 144) occurring in between Waior ($23^{\circ}29' : 68^{\circ}47'$) and Cheropadi ($23^{\circ}25' : 68^{\circ}44'$). The rocks are made up of intercalated grey argillaceous sands with bands of nodular and impure limestones; the thickness of the beds is about 75 feet. It is succeeded by Burdigalian rocks and is underlain by Oligocene rocks.

The following is the sequence of beds in this region :

(Burdigalian beds)

4. Grey argillaceous sands with bands of nodular and ferruginous, impure limestones with *Operculina*, *Spiroclipeus* sp., *M. irregularis*, *A. howchini*, *Nephrolepidina*, *Textularia*, *Miogypsinoides dehaarti*, *Turritella*, fossil Algae, and *Hypoprion*.
3. Ferruginous sandstones with tubes of worms
2. Cream-coloured compact limestone with *Spiroclipeus ranjanae*, *Gypsina globulus*, *Operculina*, *Ostrea*, *Rotalia*, *Eponides*, *Schizaster granti*, and rare *Nephrolepidina* and *Miogypsina* s.l.]

Break of about 2 furlongs.

Waior beds 250'
(Aquitanian)

1. Sandy bed containing *Nummulites intermedius*, *N. clipeus*, *N. subclipeus*.

Lattorfian and/or
Rupelian (Nari)

(Base not seen)

The bed Nos. 2-4 in the above sequence have been assigned by the senior author (Tewari, 1957) to Aquitanian on the basis of the association of *Miogypsina* s.l. and *Spiroclypeus ranjanae* Tewari. Subsequently, a similar assemblage containing *Miogypsina* and *Spiroclypeus ranjanae* has been reported upon by Eames, Banner, Blow and Clarke (1962, pp. 12 & 15) from the Middle Asmari limestone of the Middle East, attributed to the Aquitanian.

In addition to the forms described in the present paper the following larger foraminifera have also been found in the bed under study:

Archaias kirkuensis Smout & Eames

Spiroclypeus ranjanae Tewari

Austrotrillina howchini (Schlumberger)

Lepidocyclina (*Nephrolepidina*) *börneensis* Provalé

Lepidocyclina (*Nephrolepidina*) *sumatrensis* Brady

Miogypsina (*Miogypsina*) *irregularis* (Michelotti)

Miogypsina (*Miogypsinoides*) *dehaarti* (Vlerk)

PALAEOECOLOGY

The faunal assemblage of the bed suggests that the deposits were laid down in a shallow basin under warm water conditions. *Textularia pseudogramen* Chapman & Parr, *T. foliacea* Heron-Allen & Earland, *Nonion umblicatula* (Montagu) var. *pacifica* Cushman and *Gypsina globulus* (Ruess), which are present in the material under investigation, have been reported by Cushman (1924) to be still living in the shallow seas of Samoa. *Operculina bartschi* Cushman, which is abundant in the material, has been reported by Cushman (1921) from the Philippine Sea at a depth of 25 fathoms. Similarly, *Elphidium indicum* Cushman, which is typically known from the shore sands of Bombay (Cushman, 1936), is prolific in our material. Again, the abundance of forms like *Asterigerina*, *Archaias*, *Quinqueloculina* and

Austrotrillina too is indicative of tropical conditions during deposition.

DESCRIPTION

Family TEXTULARIIDAE

Genus TEXTULARIA DeFrance, 1824

TEXTULARIA FOLIACEAE Heron-Allen & Earland

(Plate 1, fig. 1)

Textularia foliacea Heron-Allen & Earland, 1915, *Zool. Soc. Lond.*, Vol. 20, Pl. 47, figs. 17-20, p. 628.

Abundant.

TEXTULARIA PSEUDOGRAMEN Chapman & Parr

(Plate 1, fig. 2)

Textularia pseudogramen Chapman & Parr, 1937, *Sci. Repts., Australia*, Vol. 1, Pl. 43, figs. 9, 10, p. 153.

Abundant.

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

QUINQUELOCULINA SEMINULUM (Linnaeus)

(Plate 1, figs. 6a, b)

Serpula seminulum Linnaeus, 1758, *Systema Nat.*, Edn. 10, p. 786.

Quinqueloculina seminulum (Linnaeus) d'Orbigny, 1826, *Ann. Sci. Nat.*, Vol. 7, No. 44, p. 303; Cushman, 1917, *U.S. Nat. Mus. Bull.* 71, Pt. 6, Pl. 11, fig. 2, p. 44; Bhatia and Mandwal, 1957, *Journ. Pal. Soc., India*, Vol. 2, text-figs. 3a, b, p. 166.

Abundant.

QUINQUELOCULINA sp. indt.

(Plate 1, figs. 7a, b)

Only a few specimens with broken apertures were found making specific identification impossible.

Family LAGENIDAE

Genus LAGENA Walker & Jacob, 1798

LAGENA SUBSTRIATA Williamson

(Plate 1, fig. 12)

Lagena substriata Williamson, 1848, *Ann. Mag. Nat. Hist.*, Vol. 2, Pl. 1, fig. 12, p. 15.

Rare.

Family NONIONIDAE

Genus NONION Montfort, 1808

NONION UMBLICATULA (Montagu) var. PACIFICA
Cushman

(Plate 2, figs. 8a, b)

Nonion umblicatula (Montagu) var. *pacific*
Cushman, 1924, *Publ. Carnegie Inst.*,
No. 21, Pl. 16, fig. 3, p. 48.

Rare.

Genus NONIONELLA Cushman, 1916

NONIONELLA MIMETISSINA Todd

(Plate 2, figs. 3a, b)

Nonionella mimetissina Todd, 1952, *U.S.*
Geol. Surv., Prof. Paper, Pl. 3, fig. 30, p. 24.
Rare.

Genus ELPHIDIUM Montfort, 1808

ELPHIDIUM INDICUM Cushman

(Plate 1, fig. 9)

Elphidium indicum Cushman, 1936, *Contr.*
Cush. Lab. Foram. Res., Vol. 12, Pl. 14,
figs. 10a, b, p. 83; Bhatia and Mandwal,
1957, *Journ. Pal. Soc. India*, Vol. 2, text-fig.
11, p. 167.

Abundant.

ELPHIDIUM AFRICANUM LeRoy

(Plate 1, fig. 8)

Elphidium africanum LeRoy, 1953, *Geol.*
Soc. Amer., Mem. 54, Pl. 3, figs. 11, 12,
p. 78.

Common.

Family NUMMULITIDAE

Genus OPERCULINA d'Orbigny, 1826

OPERCULINA BARTSCHI Cushman

(Plate 1, fig. 13)

Operculina bartschi Cushman, 1921, *U.S.*
Nat. Mus. Bull. 100, Vol. 4, text-fig. 13,
p. 376.

Very common.

Family BULIMINIDAE

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA PSEUDOPUNCTATA Högländ

(Plate 1, fig. 11)

Bolivina pseudopunctata Högländ, 1947,
Uppsala Univ., Zool. Bidrag. Bd. 26, Pl. 24,
figs. 5a, b; Pl. 32, figs. 23, 24; text-figs. 280,
281, 287; pp. 273, 268, 269.

Rare.

BOLIVINA sp. aff. B. ZANZIBARICA Cushman

(Plate 1, figs. 15a, b)

Bolivina zanzibarica Cushman, 1936, *Cush.*
Found. Foram. Res., Spec. Publ. 6, Pl. 8,
fig. 12, p. 58.

Only two specimens have been found.

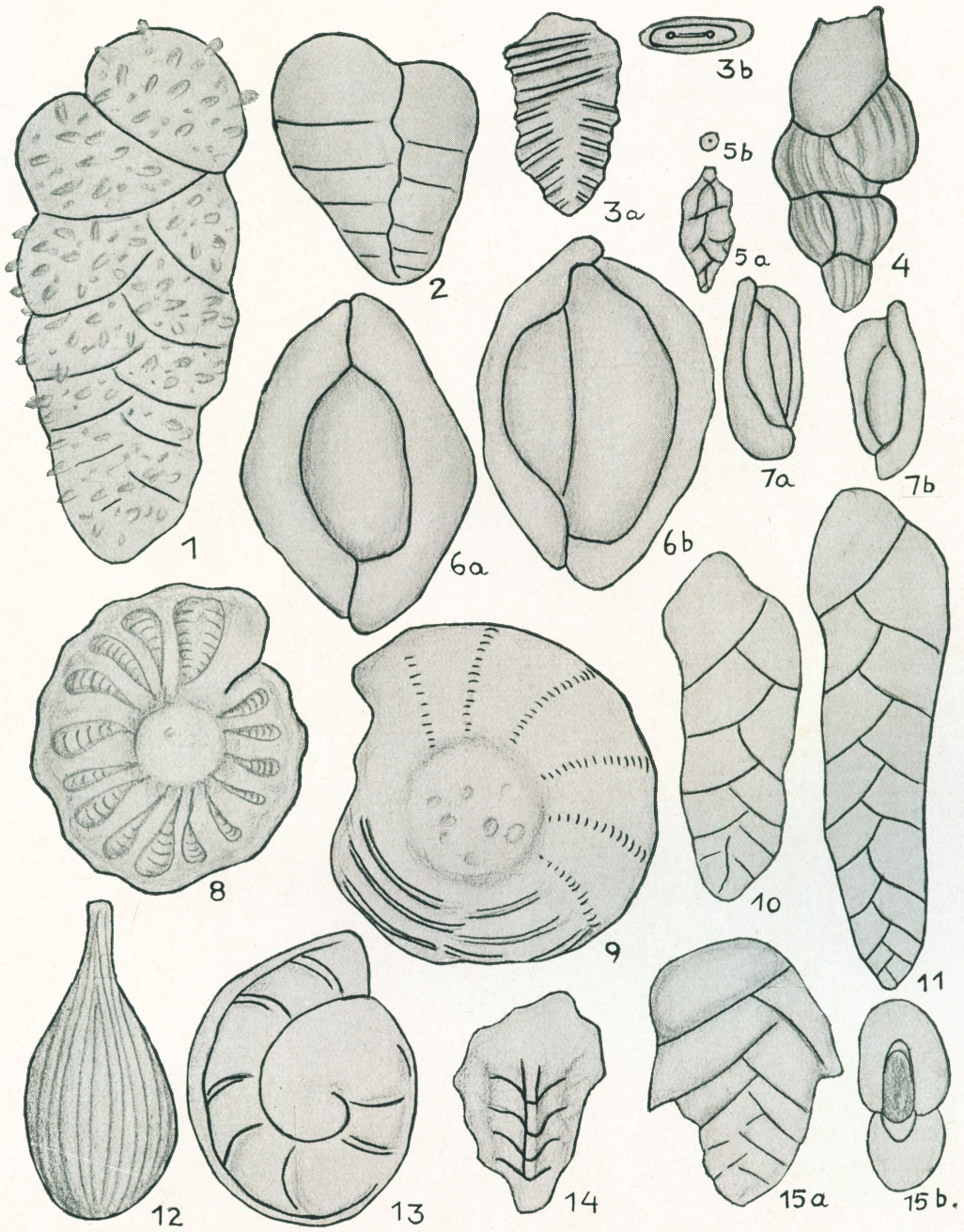
BOLIVINA sp. indt.

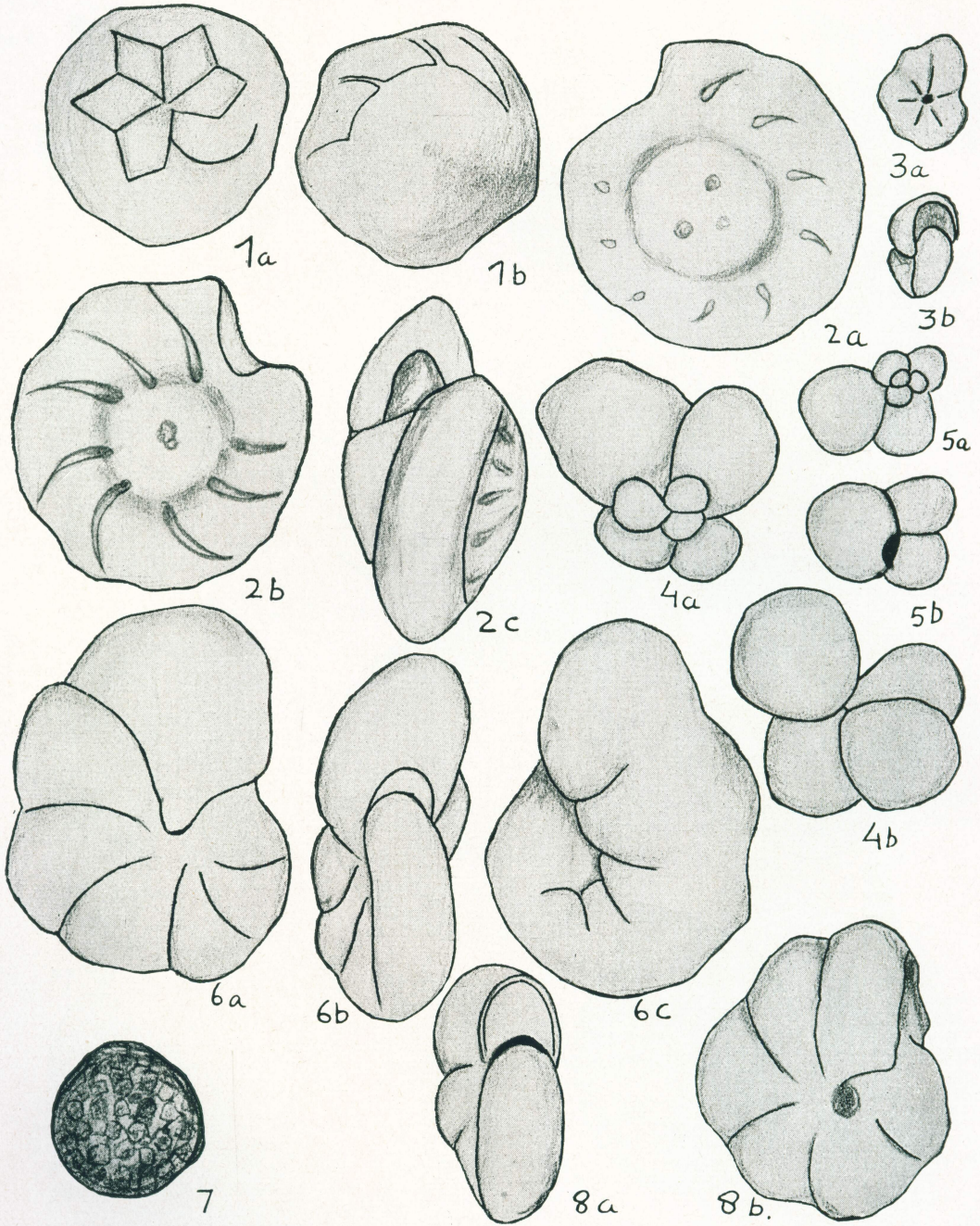
(Plate 1, fig. 10)

Two specimens have been found which
do not resemble any of the previously des-
cribed forms in details.

EXPLANATION OF PLATE 1

1. *Textularia foliacea* Heron-Allen & Earland. Lateral view. $\times 50$.
2. *Textularia pseudogramen* Chapman & Parr. Lateral view. $\times 50$.
- 3a, b. *Geminaricta virgata* Cushman var. *costifera* Cushman. a, lateral view; b, apertural view. $\times 50$.
4. *Uvigerina peregrina* Cushman. Lateral view. $\times 120$.
- 5a, b. *Uvigerina gracilis* Cushman var. *indica* n. var. a, lateral view; b, apertural view. $\times 120$.
- 6a, b. *Quinqueloculina seminulum* (Linnaeus). a, b, opposite views. $\times 50$.
- 7a, b. *Quinqueloculina* sp. indt. a, b, opposite views. $\times 50$.
8. *Elphidium africanum* LeRoy. Side view. $\times 50$.
9. *Elphidium indicum* Cushman. Side view. $\times 50$.
10. *Bolivina* sp. indt. Lateral view. $\times 120$.
11. *Bolivina pseudopunctata* Högländ. Lateral view. $\times 120$.
12. *Lagena substriata* Williamson. Side view. $\times 120$.
13. *Operculina bartschi* Cushman. Side view. $\times 30$.
14. *Reussella* sp. indt. Side view. $\times 120$.
- 15a, b. *Bolivina* sp. aff. *B. zanzibarica* Cushman. a, lateral view; b, apertural view. $\times 120$.





Genus GEMINARICTA Cushman, 1916

GEMINARICTA VIRGATA Cushman var. COSTIFERA
Cushman

(Plate 1, figs. 3a, b)

Geminaricta virgata Cushman var. *costifera* Cushman, 1936, *Cush. Found. Res., Spec. Publ.* 6, Pl. 8, figs. 19a, b, p. 62.

Also reported by Bhatia and Mohan (1959) from the Burdigalian of Kathiawar. Abundant.

Genus REUSSELLA Galloway, 1933

REUSSELLA sp.

A solitary specimen was found which was very badly preserved making specific identification impossible.

Genus UVIGERINA d'Orbigny, 1826

UVIGERINA PEREGRINA Cushman

(Plate 1, fig. 4)

Uvigerina peregrina Cushman, 1923, *U.S. Nat. Mus., Bull.* 104, Pl. 42, figs. 7-10, p. 166.

UVIGERINA GRACILIS Cushman var. INDICA n. var.

(Plate 1, figs. 5a, b)

Description—Test fusiform, round in transverse section, finely perforate, neck small.*Measurements*—Length 0.19 mm.; breadth 0.1 mm.*Diagnosis*—The form is very much similar to *U. gracilis* Cushman, but it has smaller neck and is devoid of spines. Apart from this, the initial portion in this form from Kutch is acuminate.

Common.

Locality and Horizon—Waior; Aquitanian: upper part of the Waior beds.*Type No.*: Holotype L.U. 169.

Family ROTALIDAE

Genus STREBLUS Fischer, 1917

STREBLUS VAUGHATENSIS n. sp.

(Plate 2, figs. 2a-c)

Description—Test asymmetrically trochoid, sutures with depression on both the sides, aperture large.*Measurements*—Diameter 0.48 mm.; thickness 0.32 mm.*Diagnosis*—It resembles *Rotalia beccari* var. *sobrina* (now referred to *Streblus*) in its ventral view, but dorsal view is different. The dorsal sutures of the present species are unique and distinct from those of the former. Moreover, our form is more convex on dorsal side.

Very common.

Locality and Horizon—Waior; Aquitanian: upper part of the Waior beds.*Type No.*: Holotype L.U. 170.

Family AMPHISTEGINIDAE

Genus ASTERIGERINA d'Orbigny, 1839

ASTERIGERINA BRACTEATA Cushman

(Plate 2, figs. 1a, b)

Asterigerina bracteata Cushman, 1929, *Cush. Lab. Foram. Res.*, Vol. 5, Pl. 8, fig. 6, p. 48.

Common.

Family GLOBIGERINIDAE

Genus GLOBIGERINA d'Orbigny, 1826

GLOBIGERINA BULLIFORMIS Mayer-Eymer

(Plate 2, figs. 4a, b)

Globigerina bulliformis Mayer-Eymer, 1887, *Geol. Karte-Schweiz, Bem.* 24, Pl. 352, figs. 19a-c, p. 228.

Rare.

EXPLANATION OF PLATE 2

- 1a, b. *Asterigerina bracteata* Cushman. a, ventral view; b, dorsal view. $\times 50$.
 2a-c. *Streblus vaughatensis* n. sp. a, dorsal view; b, ventral view; c, apertural view. $\times 50$.
 3a, b. *Nonionella mimetissima* Todd. a, side view; b, apertural view. $\times 50$.
 4a, b. *Globigerina bulliformis* Mayer-Eymer. a, b, opposite views. $\times 120$.
 5a, b. *Globigerina bulbosa* LeRoy. a, b, opposite views. $\times 50$.
 6a-c. *Anomalina wagevensis* n. sp. a, dorsal view; b, apertural view; c, ventral view. $\times 50$.
 7. *Gypsina globulus* (Reuss). External view. $\times 25$.
 8a, b. *Nonion umblicatula* (Montagu) var. *pacifica* Cushman. a, apertural view; b, side view. $\times 50$.

GLOBIGERINA BULBOSA LeRoy

(Plate 2, figs. 5a, b)

Globigerina bulbosa LeRoy, 1944, *Colorado School Mines Quart.*, Vol. 39, No. 3, Pl. 3, figs. 26, 27, p. 39.

Common.

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA MENARDII (d'Orbigny)

(Plate 3, figs. 2a, b)

Rotalia menardii d'Orbigny, 1826, *Ann. Sci. Nat.*, Vol. 7, No. 26, mod. No. 10, p. 273.

Rare.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA WAGERENSIS n. sp.

(Plate 2, figs. 6a-c)

Description—Test involute, almost symmetrical; chambers 6-7; periphery rounded, sutures clear; umbilical region concave on both sides; last chamber very prominent; aperture slit-like.

Measurements—Diameter 0.62 mm.; thickness 0.28 mm.

Diagnosis—It closely resembles *A. coronata* Cushman, but differs in having smaller number of chambers and more rounded periphery. It also resembles *A. obtenebrata* Franzanau in coiling and general outline of test, but umbilical region in our form is distinctly concave and sutures clearer.

Fairly common.

Locality and Horizon—Waior; Aquitanian; upper part of the Waior beds.

Type No.: Holotype L.U. 171.

Genus ANOMALINELLA Cushman, 1927

ANOMALINELLA ROSTRATA (Brady)

(Plate 3, figs. 3a, b)

Trancatulina rostrata Brady, 1884, *Challengers Rept.*, Zool., Vol. 9, Pl. 43, figs. 9, 10, p. 65.

Anomalinella rostrata (Brady) Cushman, 1927, *Contr. Cush. Lab. Foram. Res.*, Vol. 3, Pl. 1, No. 39, p. 93.

Common.

Genus CIBICIDES Montfort, 1808

CIBICIDES PSEUDOUNGERINA (Cushman) var. *io* Cushman

(Plate 3, figs. 4a, c)

Cibicides pseudoungerina Cushman var. *io* Cushman, 1931, *U.S. Nat. Mus. Bull.* 104, Pt. 8, Pl. 23, figs. 1, 2, p. 125.

Abundant.

CIBICIDES SOENDAENSIS LeRoy

(Plate 3, figs. 1a-c)

Cibicides soendaensis LeRoy, 1941, *Colorado School Mines Quart.*, Vol. 36, No. 1, Pl. 2, figs. 1-3, p. 119.

Abundant.

Family PLANORBULINIDAE

Genus GYPSINA Carter, 1877

GYPSINA GLOBULUS (Reuss)

(Plate 2, fig. 7)

Cerriopora globulus Reuss, 1847, *Haidengers Nat. Abh.*, Vol. 2, Pl. 5, fig. 7.

Gypsina globulus Brady, 1884, *Challengers Rept.*, Zool., Vol. 9, Pl. 101, fig. 8; Cushman, 1919, *Carnegie Inst. Publ.* 291, Pl. 4, fig. 7, p. 44.

Rare.

REPOSITORY

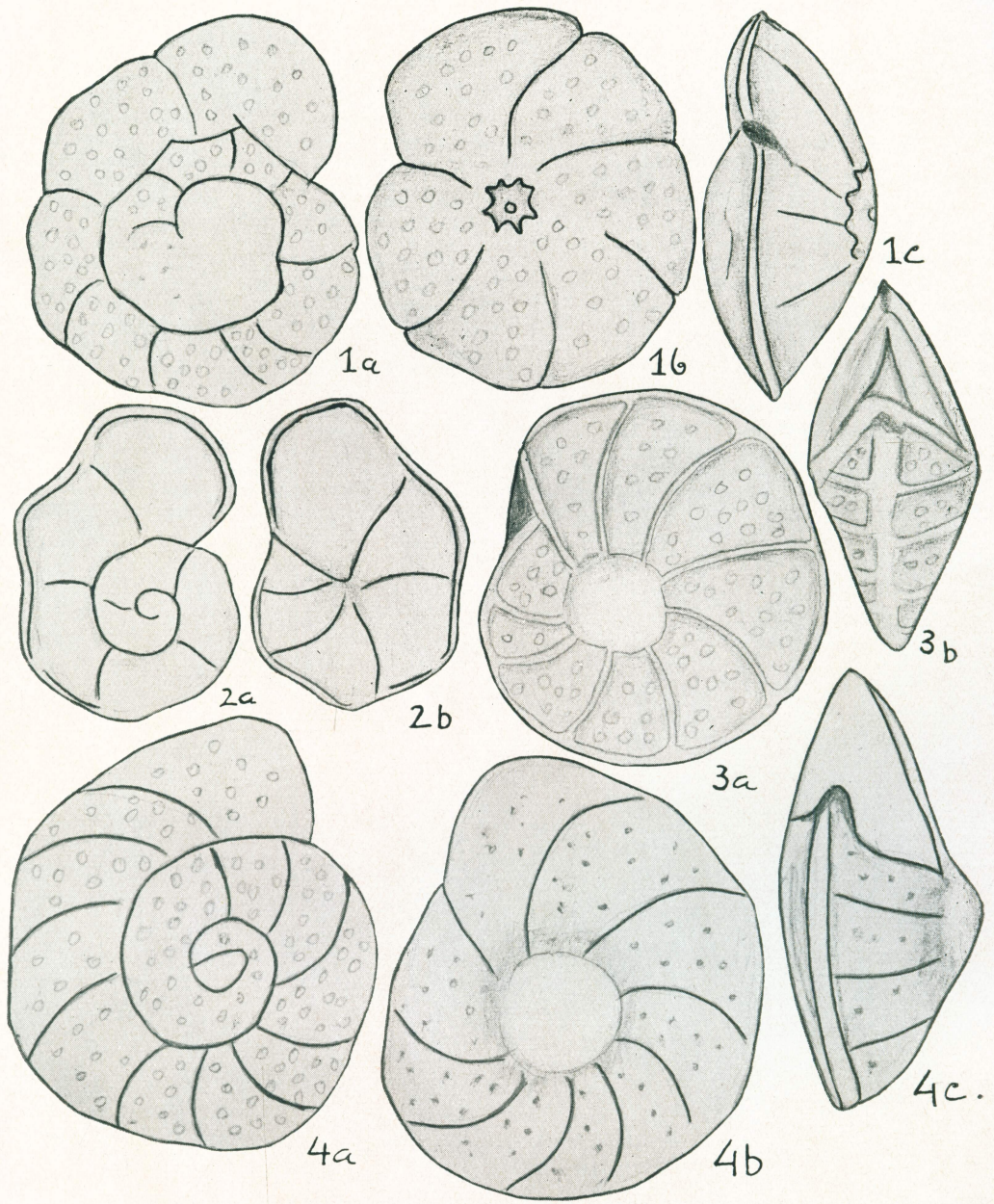
The specimens are deposited in the museum of the Geology Department, Lucknow University.

ACKNOWLEDGEMENT

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EXPLANATION OF PLATE 3

- 1a-c. *Cibicides soendaensis* LeRoy. a, dorsal view; b, ventral view; c, apertural view. $\times 50$.
 2a, b. *Globorotalia menardii* (d'Orbigny). a, dorsal view; b, ventral view. $\times 50$.
 3a, b. *Anomalinella rostrata* (Brady). a, side view; b, apertural view. $\times 50$.
 4a-c. *Cibicides pseudoungerina* Cushman var. *io* Cushman. a, dorsal view; b, ventral view; c, apertural view. $\times 50$.



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