

KUTCH MICROFAUNA; OLIGOCENE FORAMINIFERA AND OSTRACODA FROM WAGHOPADAR, SOUTHWESTERN KUTCH

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ABSTRACT—Fifteen foraminifera and eight ostracoda have been recorded from the Nari stage (Oligocene) of Kutch. The deposits are warm shallow water and were laid over the denuded edges of the Middle Kirthars (Middle Eocene).

INTRODUCTION

THE Oligocene rocks of Kutch directly overlie the Middle Kirthars (Middle Eocene). The material for the present investigation was collected from the *Sandy bed with calcareous basal partings*, bed No. 6 of Tewari (1957, p. 144), of Waghopadar-Sanosra section, exposed at a distance of about two miles southwest of Waghopadar ($23^{\circ} 29' : 68^{\circ} 47'$). The Oligocene rocks are relatively thinner and more arenaceous as compared to the underlying Middle Kirthars and the unconformably overlying Lower Gaj (Aquitaniian) beds. The bed is characterised by the presence of reticulate *Nummulites* such as *N. intermedius* d' Archiac, *N. clipeus* Nuttall, *N. subclipeus* Nuttall, and *N. fischтели* Micheloti.

The Oligocene rocks appear to have been deposited after the underlying Eocene rocks were uplifted and eroded, as the former contain many rolled forms derived from the Eocene beds. However, there are some forms which are in a bad state of preservation, and whether they are derived also can not be said without doubt. Hence these forms, noted below, are not described here.

Nonion scapha (Fitchell and Moll) var. *indica* Jacob and Sastri

Quinqueloculina lamarchiana d' Orbigny,
Pseudoglandulina laevigata (d' Orbigny)
Operculinella sp.,
and some rotalids.

PALAEOECOLOGY

The occurrence of *Clavulina pacifica* Cushman, *Gypsina globulus* (Reuss) and *Cibicides lobatulus* (Walker and Jacob) in the Oligocene beds of this section suggests that they were laid under shallow warm water conditions. *Clavulina pacifica* Cushman is known from the shallow warm waters of Samoa (Cushman, 1924). *Gypsina globulus* (Reuss) the most common form in our material, is reported by Cushman (1924, p. 46) to be an abundant form of the Indo-Pacific coral reefs. *Cibicides lobatulus* (Walker and Jacob), another cosmopolitan but essentially a shallow water form is commonly found in our material. The presence of *Streblus beccarii* (Linne) var. *annectens* (Parker and Jones), a brackish water to shallow water form, might suggest that the deposits were not distant from the mouth of an estuary, the form is still living in the shallow seas of western India (Bhatia, 1956).

The marked arenaceous character of the Oligocene sediments in comparison to the Eo-

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cene beds might be an indication of gradual shallowing of the basin.

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SYSTEMATIC DESCRIPTION

Order FORAMINIFERA

Family TEXTULARIIDAE

Genus TEXTULARIA Defrance, 1824

TEXTULARIA sp.

Plate 10, figure 1

The form is badly preserved and very scantily represented in the samples. Consequently its specific identification is not possible.

Family VALVULINIDAE

Subfamily VALVULININAE

Genus CLAVULINA d'Orbigny, 1826

CLAVULINA PACIFICA Cushman

Plate 10, figure 3

Clavulina pacifica Cushman, 1924, *Carnegie Inst. Publ.* 342, p. 22, pl. 48, figs. 22-24.-Bhatia & Mohan, 1959, *Jour. Pal.* vol., 33, p. 648, tf. 1, figs. 6-7.

It is also found in the underlying Eocene beds.

Rare

Family MILIOLIDAE

Genus PYRGO Defrance, 1824

PYRGO BULLOIDES (d'Orbigny)

Plate 10, figure 14a, b

Biloculina bulloides d'Orbigny, 1826, *Ann. Sci. Nat.*, vol. 7, p. 297, pl. 16, figs. 1-4

Pyrgo bulloides (d'Orbigny) Marks, 1951, *Contr. Cush. Found. Foram. Res.*, vol. 2, pt. 2, p. 41.

Also reported by Bhatia and Mohan (1959, p. 652) from the Burdigalian beds of Kathiawar.

Common.

Family NONIONIDAE

Genus NONIONELLA Cushman, 1926

NONIONELLA AFRICANA LeRoy

Plate 10, figure 4a-c

Nonionella africana LeRoy, 1953, *Amer. Geol. Soc.*, no. 5, p. 42, pl. 10, figs. 9-11

Nonionella sp. reported by Jacob and Sastri (1950) from the Eocene of Bikaner (Rajasthan) has very close resemblance to this form.

Rare.

Family HETROHELICIDAE

Subfamily GUMBELININAE

Genus STAINFORTHIA Hofker, 1956

Subgenus CHILOGUEMBELINA Loeblich and Tappan

CHILOGUEMBELINA sp. aff. C. VENEZUELANA (Nuttall)

Plate 10, figure 2

Gumbelina venezuelana Nuttall, 1935, *Jour. Pal. Menasha.*, vol. 9, p. 126, pl. 15, figs. 2-4

Stainforthia venezuelana (Nuttall) Hofker, 1956, *Jour. Pal.* vol. 30, no. 4, pp. 908-910.

Chiloguembelina venezuelana (Nuttall) Loeblich and Tappan, 1956, *Jour. Washington Acad. Sci.*, vol. 6, no. 11, p. 340.

Stainforthia (*Chiloguembelina*) *venezuelana* (Nuttall) Hofker, 1960, *Contr. Cush. Found. Foram. Res.*, vol. 11, pt. 3, pp. 79-80.

Typical forms of this species were found in the underlying Eocene beds. Specimens from this bed are not so inflated as that of Nuttall's.

Rare.

Family ROTALIIDAE

Subfamily ROTALIINAE

Genus ROTALIA Lamarck, 1804

ROTALIA ASANOI Uchio

Plate 10, figure 8a-c

Rotalia asanoi Uchio, 1951, *Jour. Geol. Soc. Japan*, vol. 51, p. 375.

It is also found in the underlying Middle Eocene rocks.

Common.

ROTALIA STELLATA Reuss

Plate 10, figure 12a-b

Rotalia stellata Reuss, 1856, *Sitz. Akad. Wien.*, Bd. 18, Heft., p. 242, pl. 5, fig. 54.

The form also occurs in the underlying Middle Eocene rocks.

Rare.

Genus STREBLUS Fischer, 1817

STREBLUS BECCARII (Linne) var.

ANNECTENS (Parker & Jones)

Plate 10, figure 9a-c

Rotalia beccarii (Linne) var. *annectens* Parker and Jones, 1865, *Philos. Trans.*, vol. 155, pp. 387, 422, pl. 19, fig. 11a-c.

Surprisingly only internal casts of the form were found.

Rare.

Genus EPONIDES Montfort, 1808

EPONIDES sp. indt.

Plate 10, figure 15a-b

Several forms have been found but all were very badly preserved making specific identification impossible.

Family GLOBIGERINIDAE

Subfamily GLOBIGERININAE

Genus GLOBIGERINA d'Orbigny, 1826

GLOBIGERINA LINAPERTA Finlay

Plate 10, figure 7a.b

Globigerina linaperta Finlay, 1939, *Trans. Roy. Soc. Newzealand*, vol. 69, pt. 1, p. 125, pl. 13, figs. 55-57.

It is also found in the underlying Eocene rocks.

Fairly common.

Family ANOMALINIDAE

Subfamily ANOMALININAE

Genus ANOMALINA WAGERENSIS

Tewari & Bhargava

Plate 10, figure 6a-c

Anomalina wagerensis Tewari and Bhargava, 1959, *Jour. Pal. Soc. India.*, vol. 4.

This form was originally described from the overlying Aquitanian beds.

Rare.

ANOMALINA sp. indt.

Plate 10, figure 5a-c

Only one specimen has been found which does not show the characters clearly.

Subfamily CIBICIDINAE

Genus CIBICIDES Montfort, 1808

CIBICIDES LOBATULUS (Walker and Jacob)

Plate 1, figures 10a-c and 16a-c

Nautilus lobatulus Walker and Jacob, 1798, *Adams Essays. Knamachers* ed., p. 642, pl. 14, fig. 36.

Cibicides lobatulus (Walker and Jacob) Cushman, 1931, *U. S. Nat. Mus., Bull.*, 104, pt. 8, p. 118, pl. 21, fig. 3.

Also found in the underlying Kirthar stage (Middle Eocene).

Common.

CIBICIDES PSEUDOUNGERIANA (Cushman) var. *io* Cushman

Plate 10, figure 11a-c

Cibicides pseudoungeriana (Cushman) var. *io* Cushman, 1931, *U. S. Nat. Mus., Bull.* 104, pt. 8, p. 125, pl. 23, figs 1-2.

The form is also reported from the overlying Aquitanian beds.

Rare.

Family PLANORBULINIDAE

Genus GYPSINA Carter, 1877

GYPSINA GLOBULUS (Reuss)

Plate 10, figure 13

Cerriopora globulus Reuss, 1847, *Haidengers Nat. Abh.*, vol. 2, pl. 5, fig. 7.

Gypsina globulus (Reuss) Brady, 1884, *Rep. Voy. Challenger, Zoology*, vol. 9, pl. 101, fig. 8.-Cushman, 1919, *Carnegie Inst., Pub.* 291, p. 44, pl. 4, fig. 7.

The form is very well preserved and is also reported from the overlying Lower Gaj stage (Aquitanian).

Abundant.

Order OSTRACODA
Suborder PODOCOPA
Family BAIRDIIDAE

Subfamily BAIRDIINAE
Genus BAIRDIA M'Coy, 1884
BAIRDIA KIRTHARENSIS Tewari and Tandon
Plate 11, figure 1a-b

Bairdia? *Kirtharensis* Tewari and Tandon, 1960, *India, National Inst. Sci., Proc.*, vol. 26, B, no. 4, p. 149, tf. 1, fig. 4a, b.

Open valves of this form are not found. It is also reported from the Middle Kirthar stage (Middle Eocene) of Vinjhan-Miani and Waghopadar section.

Rare.

Family CYTHERIDAE
Subfamily CYTHERIDEINAE

Genus KRITHE Brady, Crosskey and Robertson, 1874
KRITHE INDICA Tewari and Tandon
Plate 11, figure 4a, b

Krithe indica Tewari and Tandon, 1960, *India, National Inst. Sci., Proc.*, vol. 26, B, no. 4, p. 152, tf. 2, fig. 4a-c.

The form is originally described from the Middle Kirthar stage (Middle Eocene) of Vinjhan-Miani and Waghopadar sections.

Abundant.

Subfamily TRACHYLEBERINAE

Genus ACTINOCYTHEREIS Puri, 1953
ACTINOCYTHEREIS GUJARATENSIS Tewari and Tandon
Plate 11, figure 5a, b

Actinocythereis gujaratensis Tewari & Tandon, 1960, *India, National Inst. Sci. Proc.*, vol. 26, B, no. 4, p. 154, tf. 3, figs. 1a, b.

It was described by Tewari and Tandon (*Op cit*) from the Lower Gaj stage (Aquitanian) of this very section.

Common.

Subfamily HEMICYTHERINAE

Genus HEMICYTHERE Sars, 1925
HEMICYTHERE SAHNII Tewari and Tandon
Plate 11, figure 2a, b

Hemicythere sahnii Tewari and Tandon, 1960, *India, National Inst. Sci., Proc.*, vol. 26, B, no. 4, p. 157, tf. 4, fig 1a-d.

The form was described from the Middle Kirthar beds (Middle Eocene) of this very section.

Rare.

HEMICYTHERE sp. aff. *H. AMYGDALA* Stephenson
Plate 11, figure 3a, b

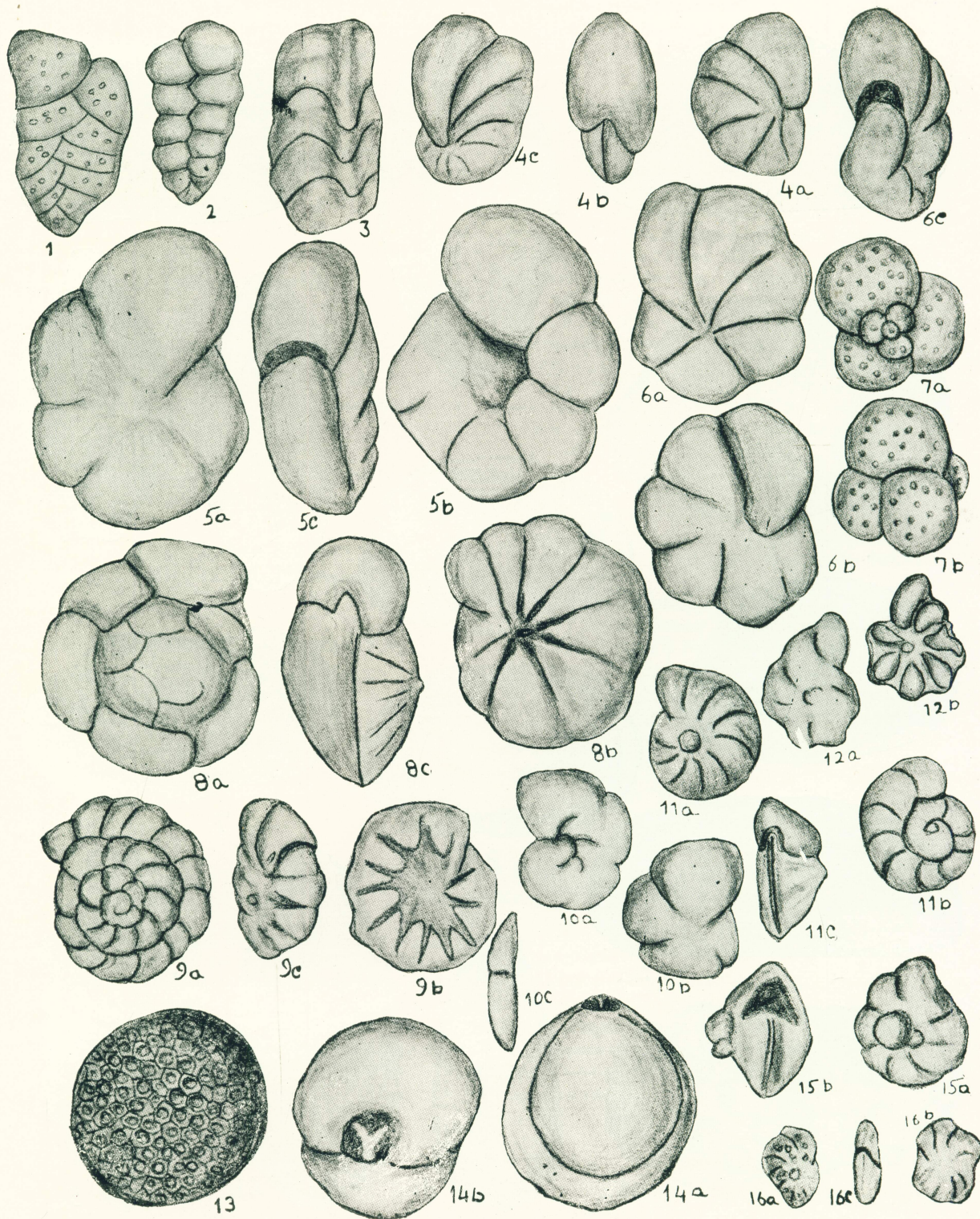
Hemicythere amygdala Stephenson, 1944, *Jour. Pal.*, vol. 18, p. 158, pl. 28, figs. 8-9

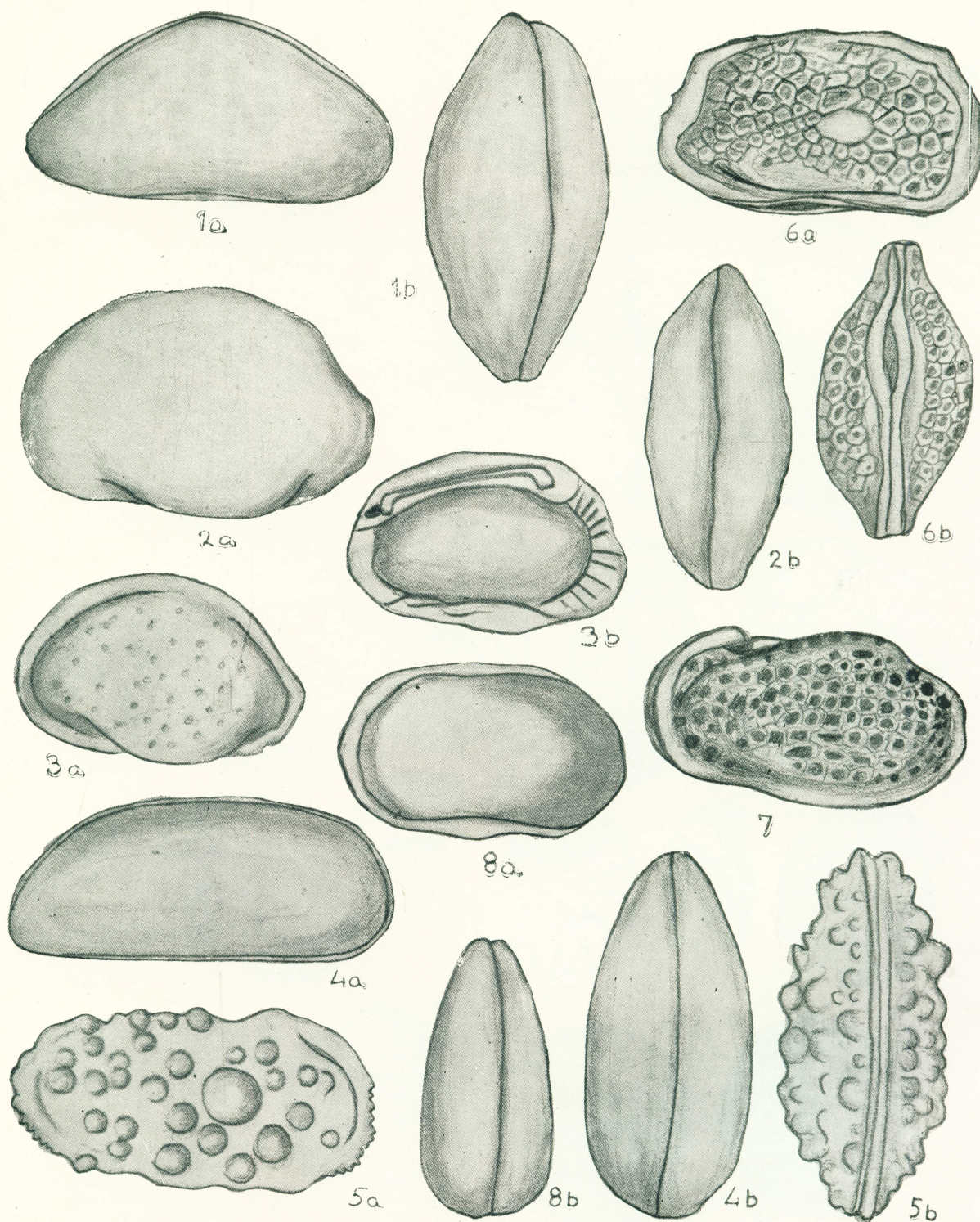
Fairly common.

EXPLANATION OF PLATE 10

All figures X 65

1. *Textularia* sp. Lateral view.
2. *Stainforthia* (*Chiloguembelina*) sp. aff. *S. (G) venezuelana* (Nuttall). Lateral view.
3. *Clavulina pacifica* Cushman. Lateral view.
4. *Nonionella africana* LeRoy. a, dorsal view; b, apertural view; c, ventral view.
5. *Anomalina* sp. indt. a, dorsal view; b, ventral view; c, apertural view.
6. *Anomalina wagherensis* Tewari and Bhargava. a, dorsal view; b, ventral view; c, apertural view.
7. *Globigerina linaperta* Finlay. Opposite views.
8. *Rotalia asanoi* Uchio a, dorsal view; b, ventral view; c, apertural view.
9. *Streblus beccarii* (Linne) var *annectens* (Parker and Jones) a, dorsal view; b, ventral view; c, apertural view.
- 10 & 16. *Cibicides lobatulus* (Walker and Jacob) a, dorsal views; b, ventral views; c, apertural views.
11. *Cibicides pseudoungeriana* (Cushman) var *io* Cushman. a, dorsal view; b, ventral view; c, apertural view.
12. *Rotalia stellata* Reuss. Opposite views.
13. *Gypsina globulus* (Reuss). External view.
14. *Pyrgo bulloides* (d' Orbigny). a, lateral view; b, apertural view.
15. *Eponides* sp. indt. a, lateral view; b, apertural view.





Genus HERMANITES Puri, 1953

HERMANITES PURII Tewari and Tandon

Plate 11, figure 6a, b

Hermanites purii Tewari and Tandon, 1960, *India, National Inst. Sci., Proc.*, vol. 26, B, no. 4, p. 158, tf. 5, fig. 1a, b.

The form has been described by Tewari and Tandon (*op cit*) from the Lower Gaj stage (Aquitanian) of this very section.

Rare.

Subfamily CYTHERETTINAE

Genus CYTHERETTA Muller, 1894

CYTHERETTA sp. aff. *C. cheropadiensis* Tewari and Tandon

Plate 11, figure 7,

Cytheretta cheropadiensis Tewari and Tandon, 1960, *India National Inst. Sci., Proc.*, vol. 26, B, no. 4, p. 159, tf. 5, fig. 4a,

Reported from the Lower Miocene Beds of this section. Two closed specimens have been found.

Suborder PLATYCOPA

Family CYTHERELLIDAE

Genus CYTHERELLA Jones,

CYTHERELLA sp. indt.

Plate 11, figure 8a, b

Solitary closed carapace has been found.

REFERENCES

- BHATIA, S. B., 1956, Recent foraminifera from shore sands of western India *Contr. Cush. Found. Foram. Res.* Vol. 7, Pt. 1, pp. 15-25.
- BHATIA, S. B. & MOHAN, K., 1959, Miocene (Burdigalian) foraminifera from Kathiawar, western India. *Jour. Pal.*, Vol. 33, No. 4, pp. 641-661.
- CUSHMAN, J. A., 1924, Samoan foraminifera. *Carnegie Inst. Washington*, Pub. 342, pp. 1-75.
- IDEM, 1948, *Foraminifera: their classification and economic use.* Harv. Univ. Press, Cambridge, Mass.
- ELLIS, B. F., & MESSINA, A. R., 1940-57, A catalogue of foraminifera. *Amer. Mus. Nat. Hist.*
- GREKOFF, N., 1956, Guide pratique pour la des ostracodes postpaleozoiques. *Inst. Franc. Petrole.*
- JACOB, K. & SASTRI, V. V., 1950, Some new microforaminifera from the Fuller's earth, Bikaner. *Science and Culture*, Vol. 16, No. 2, pp. 80-83.
- JONES, D. J., 1956, *Introduction in microfossils.* Harper Geosci. Ser., N. Y.
- TEWARI, B. S., 1957, Geology and stratigraphy of the area between Waghopadar and Cheropadi, Kutch, western India. *Jour. Pal. Soc., India*, Vol. 2, pp. 136-137.
- TEWARI, B. S., & TANDON, K. K., 1960, Kutch microfauna: Lower Tertiary Ostracoda. *Proc. Nat. Inst. Sci. India*, Vol. 26 B, No. 4, pp. 147-167.

EXPLANATION OF PLATE 11

All figures X 65

1. *Bairdia ? kirtharensis* Tewari and Tandon. a, right valve view of complete carapace; b, dorsal view.
2. *Hemicythere sahnii* Tewari and Tandon : a, external view of the left valve; b, dorsal view.
3. *Hemicythere* sp. aff. *H. amygdala* Stephenson : a, external view of left valve; b, internal view of the same.
4. *Krithe indica* Tewari and Tandon : a, right valve view of complete carapace; b, dorsal view.
5. *Actinocythereis gujaratensis* Tewari and Tandon : a, external view of right valve; b, dorsal view.
6. *Hermanites purii* Tewari and Tandon : a, right valve view of complete carapace; b, ventral view.
7. *Cytheretta* sp. aff. *C. cheropadiensis* Tewari and Tandon. External view of left valve.
8. *Cytherella* indt. a, right valve view of complete carapace; b, dorsal view.