



OSTRACOD GENUS *ROSTROCYTHERIDEA* FROM THE BAGH FORMATION (UPPER CRETACEOUS) OF NARMADA BASIN, MADHYA PRADESH AND GUJARAT, INDIA

MAYA CHAUDHARY, M. L. NAGORI* and S. C. KHOSLA

DEPARTMENT OF GEOLOGY, MOHANLAL SUKHADIA UNIVERSITY
51, SARASWATI MARG, UDAIPUR 313002, INDIA

*Corresponding author e-mail: madan.nagori@gmail.com

ABSTRACT

Rostrocytheridea is a gondwanine genus which was erected by Dingle (1969) from the Upper Valanginian to Hauterivian of the Algoa Basin of South Africa. During early Albian time (105 Ma), the genus migrated from southern margins of Gondwanaland to Australia and India. In India, the first reported occurrence of the genus was from the Albian-Turonian of Jaisalmer Basin (Singh, 1997). In the Bagh Formation of Narmada Basin, the genus appeared during Cenomanian-Turonian and probably continued there up to Coniacian? time. In this basin the genus flourished well and was represented by six species. Of these two species - *R. decurtata* and *R. divergens* are new; one species shows close affinity with *R. cerasmoderma* Ballent and Whatley, 2007 described from West-Central Argentina; two species - *R. baghensis* (Jain, 1975) and *R. jaisalmerensis* Singh 1997, were previously described from the Narmada and Jaisalmer Basins respectively; and one species is left in open nomenclature.

Keywords: Narmada Basin, Bagh Formation, Upper Cretaceous, Ostracoda, *Rostrocytheridea*

INTRODUCTION

Dingle (1969) erected the genus *Rostrocytheridea*, with the type species *R. chapmani*, from the Algoa Basin of South Africa. The genus is strictly gondwanine in its distribution and ranging in age from the Upper Jurassic (Tithonian) in South Africa and west-central Argentina to the Upper Cretaceous (Campanian) of Antarctic Peninsula.

Dingle (1982) recorded *Rostrocytheridea* sp. from the Brenton Formation (?Portlandian) of South Africa. Ballent and Whatley (2007) described *R. opisthorhynchus* from the late Tithonian-Berriasian of the Neuquen Basin in Argentina. Probably above two species form the oldest record of the genus from Jurassic time. Further their simultaneous occurrences confirm short distances of marine migration routes along the southern margin of Gondwana at that time. It was the time when there was an opening of a shallow intermittent epicontinental seaway between southern South Africa and southern Argentinian Patagonia, which favoured faunal interchange.

Rostrocytheridea species were unable to swim and also lacked pelagic larvae and hence they could, therefore, only migrate as far as they could walk or be transported by marine agencies.

During Valanginian-Hauterivian, three species appeared in South Africa viz. *Rostrocytheridea* sp. McLachlan *et al.*, 1976, *R. chapmani* Dingle, 1969 and *R. ornata* Brenner and Oertli, 1976 and four species in Argentina viz. *R. sp.*, *R. cerasmoderma* Ballent and Whatley, 2007, *R. covuncoensis* Musacchio, 1979 and *R. ornata* Brenner and Oertli, 1976.

During breakup of the Gondwanaland, which commenced in mid-Jurassic times, seaways developed across the supercontinent via Falkland Plateau and southern Africa, to Madagascar, India, and Australia (Dingle, 1988). In Albian time *Rostrocytheridea* made its way to India and Australia along the southern margins of Gondwanaland (Ballent and Whatley, 2006).

Rostrocytheridea arrived in Australia in the Albian-

Cenomanian (*R. ? allaruensis* Krommelbein) and continued up into the Upper Cretaceous with *R. westraliensis* (Chapman) in Santonian of Gingin Basin and *R. canaliculata* Bate, 1972 in Carnarvon Basin of Santonian-Campanian ages.

Rostrocytheridea first appeared in India during Albian-Turonian of Jaisalmer Basin (*R. jaisalmerensis*, Singh, 1997) and the same species inhabited in western part of Bagh Formation in Bilthana (Gujarat) during Cenomanian-Turonian-Coniacian time. From Jaisalmer Basin only one species *R. jaisalmerensis* Singh is reported, while the species of the genus flourished well in Narmada basin, Upper Cretaceous, Bagh Formation and represented by six species. In eastern part of Bagh Formation (Bagh type locality and Man Valley), *Rostrocytheridea* species commonly occurs with the abundant species of *Cythereoidea* and a few species of planktonic and many species of benthic foraminifers. *Cythereoidea* is suggestive of a warm water environment (Sohn, 1962), which favor an inner shelf environment of deposition in a subtropical or warm waters. While in western part of the basin (Bilthana and Amba Dungar), *Rostrocytheridea* species occurs together with *Sapucariella*, *Cytheropteron* and *Eocytheropteron* and a very few *Cythereoidea*. From the eastern part of Narmada Basin Nayak (1987) and Rajshekhar (1995), have reported planktonic foraminifers viz. *Hedbergella*, *Ticinella*, *Heterohelix*, *Archaeoglobigerina* and *Discorbis* and benthonic forms viz. *Ammobaculites*, *Flabellamina*, *Dorothia*, *Lagena*, *Bullupora*, *Nonionella*, *Miliamina*, *Gavelinella*, etc.

STRATIGRAPHY

The marine rocks of Bagh Formation (Upper Cretaceous) are exposed as detached outcrops in the Narmada Valley. The marine exposures in the eastern part (Barwaha up to East of Alirajpur) are lithologically quite different to those of western part (West of Alirajpur-Kawant - Rajpipla) of the Narmada Valley (Fig. 1).

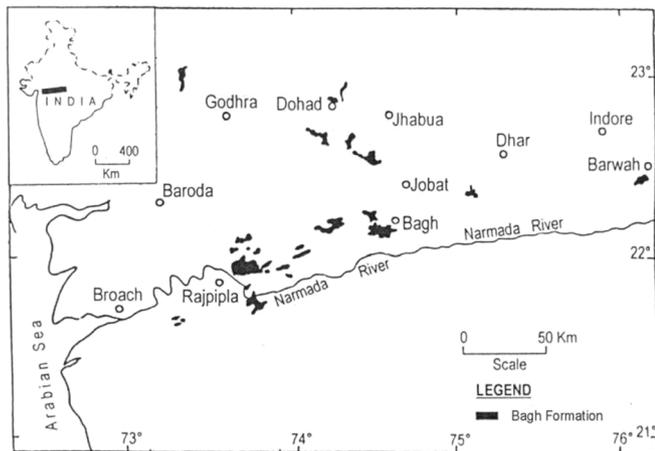


Fig. 1. Outcrops of Bagh Formation along Narmada Valley (Modified after Jain, 1975).

The first geological account of Narmada Valley was given by Stewart (1821). However, Blanford (1869) gave a comprehensive geological account of the region. After this several stratigraphical classifications (Bose 1884; Murty *et al.*, 1963; Poddar 1964; Sastry and Mamgain 1971; Dassarma and Sinha 1975; Chiplonkar *et al.*, 1975 and Guha 1976) have been proposed. However, among these all, the most widely accepted classification is the one proposed by Bose (1884, Table 1).

Table 1. The stratigraphy of the Bagh region proposed by Bose (1884).

Age	Formation	Lithology
Uppermost Cretaceous	Deccan	Traps Basalts
	Lameta Beds	Cherty Limestone, Calcareous Sandstone
Upper Cretaceous	Bagh Beds	Coralline Limestone Deola-Chirakhan Marl Nodular Limestone
Lower Cretaceous		Nimar Sandstone
Archean	Bijawar Formation	Metamorphics

The Nodular Limestone is the most consistent lithounit of the Bagh Formation in eastern exposures, while in western exposures (Kawant to Rajpipla), there is no unanimity amongst the workers over its consistency and has been designated as Navagam Limestone (Poddar 1964) and Rajpipla Limestone (Dassarma and Sinha 1975).

Blanford (1869) designated "calcareous shale" the rocks immediately overlying the sandstone in Rajpipla region and correlated it with the Nodular Limestone of Man river section. On this basis he concluded that difference in the lithological

characters of two regions Man-Hatni-Uri (eastern) and Kawant-Rajpipla-Deva regions (western) but there is no scope to divide it into two separate lithounits.

Later on Bose (1884) noticed its fossiliferous nature and supported Blanford's view about the continuity of the Nodular Limestone from Man River section in the East to Rajpipla region in the West in Narmada Basin. Both of them have further observed that the Nodular Limestone of the western region represents deeper water facies than the limestone of the eastern region.

Dassarma and Sinha (1975) gave a new name Rajpipla Limestone for a thick sequence, exposed near Gora colony at Rajpipla. According to them this limestone has conformable relation with the underlying Oyster bed and is unfossiliferous and chemically deposited. According to them Rajpipla Limestone is much younger in stratigraphic position than the Nodular Limestone of Man-Hatni region and considered it to be of Senonian age. Further they concluded that a second marine transgression might have taken place which extended only up to Kawant. This invasion was followed soon by the regression thus accounting for the little thickness of the sediments in Kawant area.

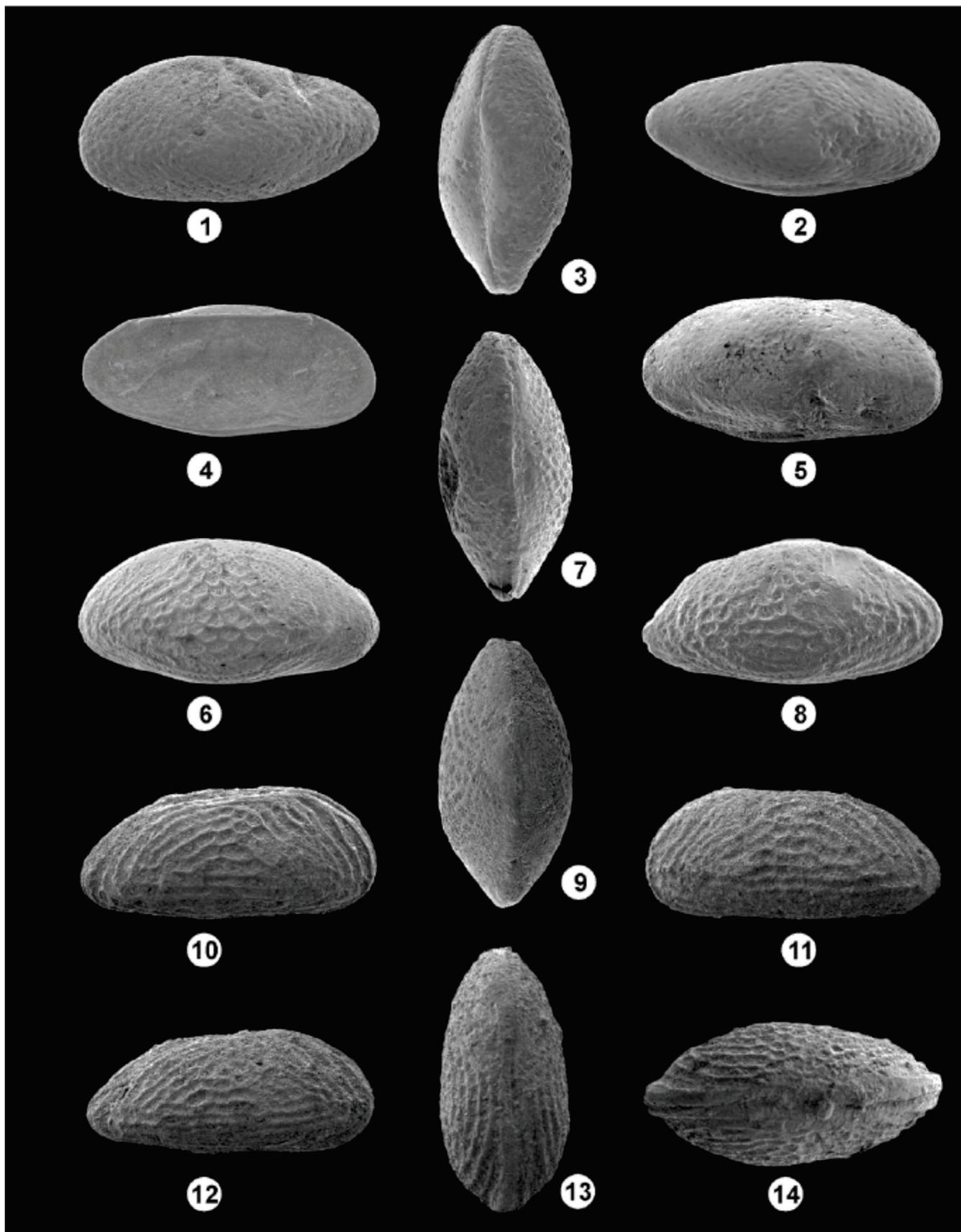
Present authors during their course of study of ostracodes, carried out an extensive sampling in Man Valley, Bagh type locality and Bilthana-Kawant area. We noticed that the limestone exposed at Bilthana shows a conformable relation with the underlying Oyster bed and this limestone is 14 feet thick, fossiliferous, moderately hard, greyish-pink, splintery and cherty in nature. Coralline Limestone and Marl sequences of eastern Bagh Formation are absent here.

Our observations on the basis of ostracodes reported from this limestone of Bilthana area match with the views expressed by Dassarma and Sinha (1975) regarding ages i.e. Bagh Formation in the East from Barwaha to Alirajpur range in age from Cenomanian-Turonian and partly Coniacian, while the formation in the West from Kawant to Rajpipla shows clearly an age not earlier than Turonian-Coniacian or at least up to upper Senonian? Rajshekhar and Atpalkar (1995) while studying the foraminifers (planktonic and benthonic) from Bilthana area stated that Nodular Limestone of Bilthana and Man River section are considered to be the same lithounit, though different stratigraphic nomenclature have been used for two regions. They concluded that in general Bagh Formation were late Albian-Cenomanian in age, which indicates prevalence of shallow water (with in shelf) conditions for deposition of sediments.

With the intention of revising the ostracode fauna of the Bagh Formation, two of us (MC and MLN) collected samples from five different localities viz. near Jeerabad Village in Man Valley, Bagh type locality near Bagh town, Dhar District, Madhya Pradesh and Bilthana, Bharuch District, Gujarat (Fig. 2). The locations of these localities are given in the sequel. The stratigraphic successions at localities 1 to 5 are given in figs. 3-4.

EXPLANATION OF PLATE I

Figs. 1-5. *Rostrocytheridea baghensis* (Jain). 1, a male carapace (SUGDMF No. 1344), left valve view, X64; 2, a female carapace (SUGDMF No. 1345), right valve view, X758; 3, a female carapace (SUGDMF No. 1346), dorsal view, X56; 4, a male left valve (SUGDMF No. 1347), internal view, X53; 5, a ?male carapace (SUGDMF No. 1348), right valve view, X52. Figs. 6-9. *Rostrocytheridea* sp. cf. *R. cerasmoderma* Ballent and Whatley. 6, a male carapace (SUGDMF No. 1349), left valve view, X69; 7, a male carapace (SUGDMF No. 1350), dorsal view, X56; 8, a female right valve (SUGDMF No. 1351), lateral view, X78; 9, a female carapace (SUGDMF No. 1352), dorsal view, X67. Figs. 10-14. *Rostrocytheridea decurtata* n. sp., 10, holotype (SUGDMF No. 1353), a male carapace, right valve view, X57; 11, paratype I (SUGDMF No. 1354), a male carapace, left valve view, X54; 12, paratype II (SUGDMF No. 1355), a female carapace, right valve view, X61; 13, paratype III (SUGDMF No. 1356), a male carapace, dorsal view, X56; 14, paratype IV (SUGDMF No. 1357), a female carapace, dorsal view, X67.



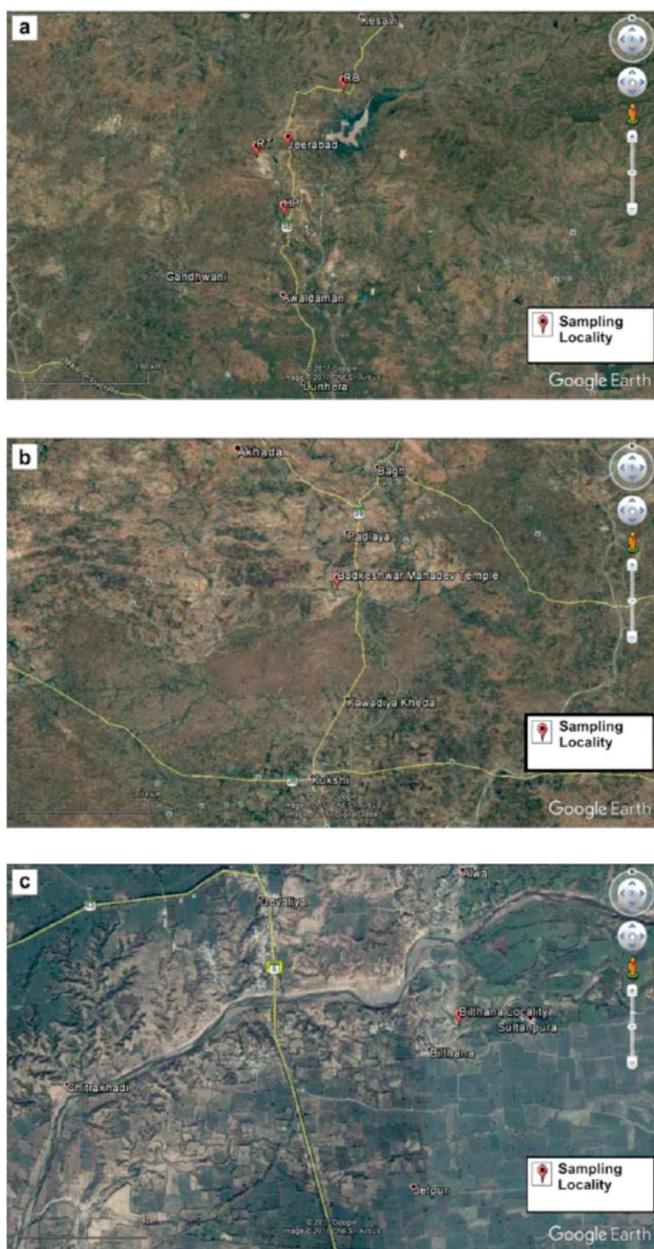


Fig. 2. Google map showing sampling localities (a. Rosebaida, Ratitalai and Hanumanpura; b. Badkeshwar Mahadev Temple; c. Bilthana)

Locality 1: Around 500mts. SW from Rosebaida Village, in a nala section, (N 22°26': E 74° 56')

Locality 2: Near Ratitalai Village, 6 kms. SW from Jeerabad Town (N 22° 24': E 75° 03')

Locality 3: Near Hanumanpura Village (N 22° 22': E 75° 04')

Locality 4: Infront of Badkeshwar Mahadev Temple, near Bagh Town (N 22° 18': E 74° 36')

Locality 5: In a stream section, Bilthana Village, Gujarat (N 21° 57': E 73° 39')

Repository: All the described specimens are deposited in the micropaleontology laboratory, Department of Geology, Mohanlal Sukhadia University, Udaipur.

CLASSIFICATION OF OSTRACODS

The prevalent classification of Ostracods by Pokorný (1958), Moore (1961), and Morkhoven (1962, 1963) cannot be utilized successfully for the classification of Cretaceous ostracods of Narmada basin, because of the fact that a number of genera viz., *Nigeroloxoconcha*, *Sapucariella*, *Veeniacythereis*, *Makatinella*, *Haughtonileberis*, *Curfsina*, *Majungaella*, *Amicytheridea* and *Rostricytheridea* have been established after the publication of these classifications. In the present work the authors have assigned ostracods genera to families following either original designations proposed by their respective authors or Reyment (1963), Deroo (1966), Dingle (1969 and 1984), Gründell (1973), Bate (1975) and Puckett *et al.* (2016).

SYSTEMATIC PALAEOLOGY

- Subclass* **Ostracoda** Latreille, 1806
- Order* **Podocopida** Müller, 1894
- Suborder* **Podocopina** Sars, 1866
- Superfamily* **Cytheroidea** Baird, 1850
- Family* **Cytherideidae** Sars, 1925
- Subfamily* **Cytherideinae** Sars, 1925
- Genus* **Rostricytheridea** Dingle, 1969

Rostricytheridea baghensis (Jain)
(Pl. I, figs. 1-5)

Macrocypris? baghensis Jain, 1961, p. 341.

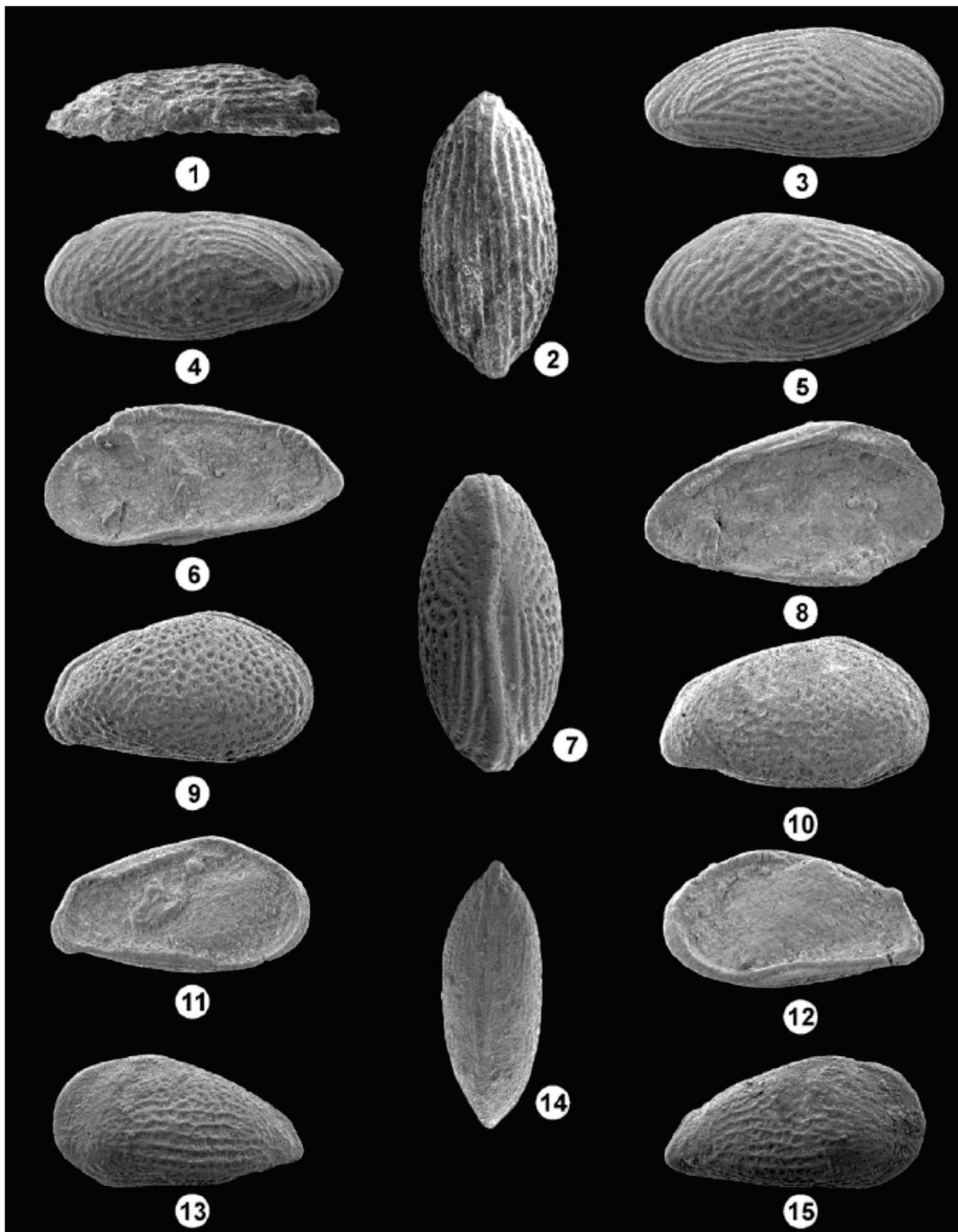
Acuticytheretta baghensis (Jain), 1975, p. 202, pl. 1, figs.12a-c,13; pl. 3, fig. 35.

Material: 96 carapaces and 31 valves.

Remarks: The species was originally described as *Macrocypris? baghensis* by Jain (1961), who subsequently, transferred it to the genus *Acuticytheretta* (Jain, 1975). However, on the basis of hinge and other characters the species is herein transferred to the genus *Rostricytheridea*. Our specimens are identical with the types of *M.? baghensis*. The species further differs with *R. ornata* Brenner and Oertli (1976) described from the Hauterivian, Algoa Basin, South Africa in size. The latter species is much smaller in size (L 0.67, H 0.32).

EXPLANATION OF PLATE II

Figs. 1-2. *Rostricytheridea decurtata* n. sp., 1, paratype V (SUGDMF No. 1358), a female right valve, dorsal view, X65; 2, paratype VI (SUGDMF No. 1359), a female carapace, ventral view, X64. Figs. 3-8. *Rostricytheridea divergens* n. sp., 3, holotype (SUGDMF No. 1360), a male carapace, right valve view, X62; 4, paratype I (SUGDMF No. 1361), a male left valve, lateral view, X57; 5, paratype II (SUGDMF No. 1362), a female left valve, lateral view, X67; 6, paratype III (SUGDMF No. 1363), a female right valve, internal view, X72; 7, paratype IV (SUGDMF No.1364), a male carapace, dorsal view, X62; 8, Paratype V (SUGDMF No. 1365), a female left valve, internal view, X78. Figs. 9-12. *Rostricytheridea jaisalmerensis* Singh. 9, a female carapace (SUGDMF No. 1366), right valve view, X88; 10, a male carapace (SUGDMF No. 1367), right valve view, X82; 11, a female left valve (SUGDMF No. 1368), internal view, X90; 12, a female right valve (SUGDMF No. 1369), internal view, X86. Figs. 13-15. *Rostricytheridea* sp. 13, a female carapace (SUGDMF No. 1370), left valve view, X82; 14, a female carapace (SUGDMF No. 1371), dorsal view, X82; 15, a male carapace (SUGDMF No. 1372), right valve view, X76.



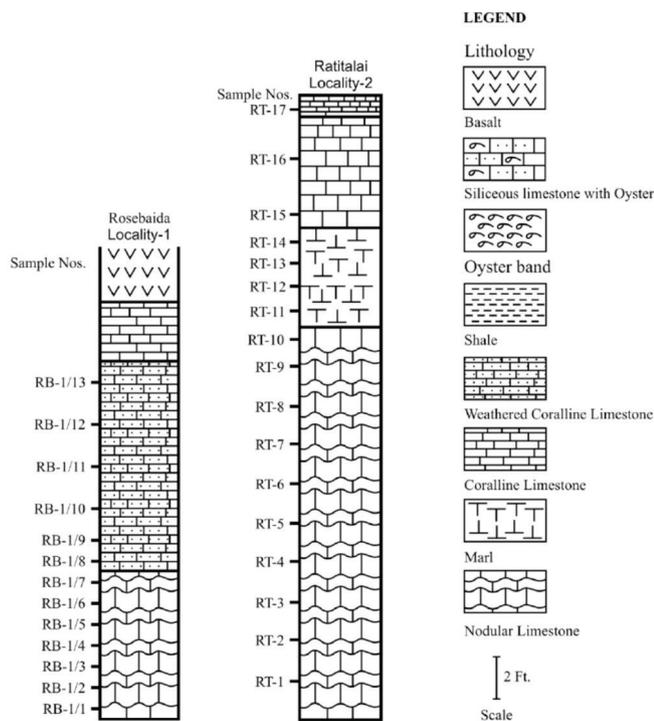


Fig. 3. Stratigraphic columnar sections of Upper Cretaceous, Bagh Formation at locality 1 to 2.

The species has following characteristics: Carapace large, elongate in lateral outline; sexual dimorphism and overlap distinct. Dorsal margin convex, declining towards the posterior end from the point of greatest height; ventral margin convex medially; anterior margin obliquely rounded; posterior margin narrow, drawn out backwardly near mid-height, forming a beak. In dorsal view, the carapace inflated, ovoid with maximum width at mid-length. Surface ornamented with fine and delicate punctuations, disposed concentrically, in lower half rows of pits parallel to ventral margin. Inner lamella moderately wide along anterior and posterior margins; selvage present, more distinct along ventral margin. Hinge antimerodont, with an accommodation groove above median bar in left valve.

Dimensions (mm)	Length	Height	Width
A male carapace (SUGDMF No.1344)	0.87	0.43	0.32
A female carapace (SUGDMF No.1345)	0.94	0.46	0.33
A female carapace (SUGDMF No.1346)	0.89	0.45	0.33
A male left valve (SUGDMF No.1347)	1.04	0.50	--
(?)A male carapace (SUGDMF No.1348)	1.08	0.51	0.49

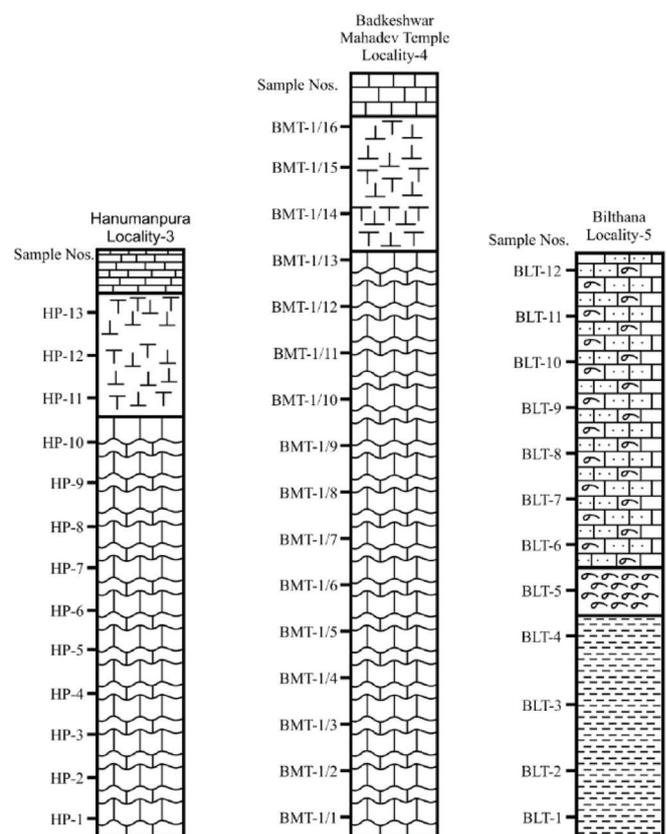
Occurrence: Rosebaida, Ratitalai, Hanumanpura and Badkeshwar Mahadev Temple.

Rostrocytheridea sp. cf. *R. cerasmoderma*
Ballent and Whatley
(Pl. I, figs. 6-9)

cf. *Rostrocytheridea cerasmoderma* Ballent and Whatley, 2007, pp. 117-118, figs. 2, I-M, W.

Material: 9 carapaces and 6 valves.

Remarks: Present specimens recorded from the Bagh Formation show close affinity with *R. cerasmoderma* Ballent and Whatley (2007), originally described from the Late Hauterivian of Neuquen Basin, West-Central Argentina.



Legends same as in Fig. 3.

Fig. 4. Stratigraphic columnar sections of Upper Cretaceous, Bagh Formation at locality 3 to 5.

The species has medium to large carapace, subtriangular in lateral view, with greatest height in middle. Left valve larger than right valve, overlapping all along periphery, more prominently along dorsal margin. Dorsal margin straight, declines posteriorly from anterior cardinal angle; ventral margin broadly concave and with a poorly marked posteroventral incision; anterior margin broad, obliquely rounded; posterior margin with a beak pointing downwardly. In dorsal view carapace biconvex, with greatest width at mid-length in males, while posteriorly in females. Valve surface ornamented with coarse reticulation, subparallel to margins. Dimorphism prominent, males larger than females and with distinct cardinal angles; posterior beak wider in males than females. Hinge antimerodont.

Dimensions (mm)	Length	Height	Width
A male carapace (SUGDMF No.1349)	0.83	0.41	0.45
A male carapace (SUGDMF No.1350)	0.89	0.39	0.50
A female right valve (SUGDMF No.1351)	0.72	0.37	--
A female carapace (SUGDMF No.1352)	0.75	0.38	0.44

Occurrence: Ratitalai and Hanumanpura.

Rostrocytheridea decurtata n. sp.
(Pl. I, figs. 10-14; Pl. II, figs. 1-2)

Name: From Latin *curtailed* meaning to shorten by cutting off.

Material: 24 carapaces and 3 valves

Type level and locality: Sample No. RB 1/2, Nodular Limestone, Upper Cretaceous, Bagh Formation, Rosebaida village, Man valley, Dhar District.

Diagnosis: Carapace elongate in lateral outline, with greatest height at anterior 1/3 of length. Surface ornamented by 7-8 fine ridges/riblets, arranged in more or less triangular pattern; in lower half five longitudinal ridges parallel to ventral margin; inter-area in between ridges reticulated.

Holotype: A male carapace SUGDMF 1353 (Pl. I, fig. 10).

Description: Carapace large to very large, elongate in lateral outline, with greatest height at anterior 1/3 of length. Sexual dimorphism prominent, males more elongated than females. Dorsal margin straight between cardinal angles, sloping down posteriorly. Ventral margin straight in males and undulating in females; Anterior margin obliquely rounded with apex below midheight; Posterior margin drawn out in a blunt 'beak' in ventral half, pointing backwardly. In dorsal view carapace biconvex, with maximum width posterior to middle. Surface of each valve ornamented by 7-8 fine ridges/riblets, arranged in more or less triangular pattern; in lower half five longitudinal ridges parallel to ventral margin; inter-area in between ridges reticulated. Hinge antimerodont. Other internal features not visible.

<i>Dimensions</i> (mm)	Length	Height	Width
Holotype (SUGDMF No.1353), a male carapace	0.98	0.41	0.46
Paratype I (SUGDMF No.1354), a male carapace	1.01	0.44	0.47
Paratype II (SUGDMF No.1355), a female carapace	0.89	0.43	0.42
Paratype III (SUGDMF No.1356), a male carapace	1.01	0.44	0.47
Paratype IV (SUGDMF No.1357), a female carapace	0.83	0.42	0.40
Paratype V (SUGDMF No.1358), a female right valve	0.85	0.42	
Paratype VI (SUGDMF No.1359), a female carapace	0.84	0.43	0.40

Discussion: Present species closely resembles with *Rostrocytheridea cerasmoderma* Ballent and Whatley 2007, described from the Hauterivian of Neuquen basin, West-Central Argentina. However, in later species valve surface is ornamented by coarse reticulation, unlike the present species. Further the latter species is much smaller in size (L 0.55mm) than our species. The species also differs with *R. divergens* n. sp., described herein this work, in having fine ridges/riblets and inter-area reticulation between ridges spread all over the surface.

Occurrence: Rosebaida and Ratitalai.

Rostrocytheridea divergens n. sp.
(Pl. II, figs. 3-8)

Name: Latin, *divergens* meaning divergent, with reference to the ornamentation in the anterior and posterior half.

Material: 64 carapaces and 147 valves

Type level and Locality: Sample No. BLT-11, Siliceous Limestone with Oyster, Upper Cretaceous, Bagh Formation, Bilthana (Gujarat).

Diagnosis: Surface ornamented with coarse ridges and reticulation arranged in triangular pattern, apices pointing dorsal margin; five-six longitudinal ridges parallel to ventral margin in lower half, coarse reticulation present in between ridges, more prominent in median region, less so towards in peripheral region.

Holotype: A male carapace SUGDMF 1360 (Pl. II, fig. 3).

Description: Sexual dimorphism pronounced, males more elongate, less high and wide than females. Carapace elongate, sub-triangular in lateral view, with greatest height at anterior 1/3 of length. Left valve larger than right valve, overlapping it all along the periphery. In females dorsal margin straight, declining posteriorly; ventral margin medially concealed by overhanging valve surface, otherwise straight; anterior margin broad, obliquely rounded; posterior margin drawn out in a narrowly rounded beak, apex slightly below mid-height; in dorsal view carapace biconvex with greatest width slightly posterior to middle. In males dorsal margin gently arched, declining posteriorly; ventral margin concealed in anterior 2/3 of length by overhanging valve surface, posteroventral margin concave; anterior margin evenly rounded; posterior margin drawn out ventrally truncated beak below mid-height. Valve surface ornamented with coarse ridges and reticulation arranged in triangular pattern, apices pointing dorsal margin; five-six longitudinal ridges parallel to ventral margin in lower half, coarse reticulation present in between ridges, more prominent in median region, less so towards in peripheral region. Hinge antimerodont; five anterior and seven posterior dentate elements in right valve, separated by straight, depressed crenulated groove. Hinge complementary and with an accommodation groove above median bar in left valve. Inner lamella moderately wide. Other internal features not observed.

<i>Dimensions</i> (mm)	Length	Height	Width
Holotype (SUGDMF No.1360), a male carapace	0.91	0.39	0.43
Paratype I (SUGDMF No.1361), a male left valve	0.98	0.41	--
Paratype II (SUGDMF No.1362), a female left valve	0.83	0.43	--
Paratype III (SUGDMF No.1363), a female right valve	0.78	0.36	--
Paratype IV (SUGDMF No.1364), a male carapace	0.90	0.42	0.45
Paratype V (SUGDMF No.1365), a female left valve	0.73	0.37	--

Discussion: The present species closely resembles with *Rostrocytheridea decurtata* n. sp. described herein this work from Rosebaida Village, Upper Cretaceous of Bagh Formation. However, the later species differs in having fine ridges/riblets with reticulation all over the surface. The species also resembles with *R. cerasmoderma* Ballent and Whatley 2007, in overall shape but clearly differs in surface ornamentation. In *R. cerasmoderma* surface is marked with coarse reticulation.

Occurrence: Bilthana.

Rostrocytheridea jaisalmerensis Singh
(Pl. II, figs. 9-12)

Rostrocytheridea jaisalmerensis Singh, 1997, p.11, pl. 4, figs. 2-3, 5-6,8,10-12; pl. 5, figs.1,2,4. - Andreu *et al.*, 2007, pl. 5, figs. 11-16.

Material: 60 carapaces and 37 valves.

Remarks: The species was originally described by Singh (1997), from the lower part (Turonian) of Manhera Tibba well-I,

Jaisalmer Basin, Rajasthan. The species was also reported by Andreu *et al.*, 2007 from the Albian-Turonian of Jaisalmer Basin. The specimens recorded herein from the Upper Cretaceous, Bagh Formation of Bilthana (Gujarat) are identical with the types of *R. jaisalmerensis* Singh.

The species has following characteristics: Carapace medium sized, sub-triangular in lateral outline, with greatest height at anterior cardinal angle. Left valve larger than right valve, overlapping it all along margin. Dorsal margin straight, converging posteriorly; ventral margin straight for anterior 2/3 of length, posteroventral margin concave; anterior margin broad, obliquely rounded; posterior margin in upper part steeply sloping down, in lower part produced in a beak. Surface of each valve ornamented by dense concentrically arranged pits, coarse in median region and fine in the peripheral.

Dimensions (mm)	Length	Height	Width
A female carapace (SUGDMF No.1366)	0.57	0.32	0.30
A male carapace (SUGDMF No.1367)	0.61	0.31	0.30
A female left valve (SUGDMF No.1368)	0.53	0.29	--
A female right valve (SUGDMF No.1369)	0.57	0.31	--

Occurrence: Bilthana.

Roastrocytheridea sp.
(Pl. II, figs. 13-15)

Material: 9 carapaces

Description: Carapace medium, sub-triangular in lateral outline; greatest length below midheight and height coincides with anterior cardinal angle; left valve larger than right valve, overlapping it all along periphery; sexual dimorphism distinct, males more elongate, less high and wide than females. Dorsal margin arched, strongly converging posteriorly from anterior cardinal angle; ventral margin medially concealed due to overhanging valve surface, posteroventral incision present; anterior margin broadly rounded; posterior margin very narrow, steeply sloping down in upper part, produced in a blunt beak pointing downwardly in the lower.

Valve surface ornamented by 9-10 fine, delicate longitudinal ridges/riblets and in between fine punctuation in middle 2/3rd part of the valve surface; anterior, posterior and part of dorsal region nearly smooth.

Dimensions (mm)	Length	Height	Width
A female carapace (SUGDMF No.1370)	0.56	0.29	0.24
A female carapace (SUGDMF No.1371)	0.61	0.32	0.25
A male carapace (SUGDMF No.1372)	0.63	0.33	0.26

Remarks: Present species from the Bagh Formation closely resembles with *Roastrocytheridea ornata* originally described by Brenner and Oertli (1976), from the Hauterivian, Sundays River Formation, Algoa Basin, South Africa, in overall shape but differs somewhat in surface ornamentation pattern. In later species surface is finely pitted and riblets are generally running parallel to the outline. The species also resembles with

R. cerasmoderma Ballent and Whatley 2007, described from the Neuquen Basin, Late Hauterivian, Argentina in overall shape but clearly differs in surface ornamentation. In *R. cerasmoderma* surface is ornamented with coarse reticulation.

Occurrence: Bilthana.

CONCLUSIONS

Migration of the genus *Roastrocytheridea* alongwith paleoenvironment of deposition in Bagh group of sediments is inferred on the basis of *Roastrocytheridea*, *Cytherelloidea* and foraminifers. According to Dingle, 1988, in mid Jurassic time breakup of Gondwanaland initiated, resulting seaways across the supercontinent via Falkland plateau and southern Africa to Madagascar, India and Australia. Ballent and Whatley (2006) stated that during Albian time *Roastrocytheridea* migrated to India and Australia along the southern margins of Gondwanaland.

In Jaisalmer Basin of India, Singh (1997) recorded *Roastrocytheridea jaisalmerensis* from Albian-Turonian, while the same species has also been recorded from the Turonian-Coniacian or upto Senonian? of Bagh Formation. In Bagh Formation this genus along with *Cytherelloidea* and benthic as well planktic foraminifers suggest a warm water environment, which favour an inner shelf environment of deposition in subtropical conditions.

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