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MIDDLE JURASSIC OSTRACODA FROM THE NORTHERN ISLAND BELT, RANN OF KACHCHH, GUJARAT, INDIA

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ABSTRACT

Seventy-four ostracod species from the Middle Jurassic of the Northern Island belt, including Bela, Khadir and Pachchham islands, Rann of Kachchh, Gujarat are described. Twenty-seven species – *Citrella belaensis, Cytheropteron micropunctata, Fastigatocythere belaensis, F. elongata, F. flebilis, F. indica, F. jakhari, F. kachchhensis, F. mouwanaensis, F.? pachchhamensis, Galliaecytheridea gujaratensis, G. lodraniensis, Glabellacythere hussaini, Mandawacythere kachchhensis, M. multicostata, Mandelstamia biswasi, M. kachchhensis, Monoceratina mouwanaensis, M. rannensis, Morkhovenicythereis rectangularis, Neurocythere? kachchhensis, Paracypris kachchhensis, P. mohani, Pseudoperissocytheridea concentrica, Timiriasevia khadirensis, Trichordis amraparensis,* and *T. hadibhadangensis* – are new. Forty species are assigned to already known taxa and seven species are left in open nomenclature.

Based on the distribution of ostracods, five zones are proposed for the Middle Jurassic of the Northern Island Belt. They are, in ascending order: *Trichordis hadibhadangensis* Assemblage Zone (Bajocian-Bathonian), *Cytheropteron micropunctata* Assemblage Zone (Bathonian), *Progonocythere laeviscula* Assemblage Zone (late Bathonian-early Callovian), *Fastigatocythere mouwanaensis* Assemblage Zone (Callovian), and *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone (middle-late Callovian). The correlation of these beds with those of Mainland Kachchh, the composition, age and palaeozoogeography of the ostracod fauna are also discussed.

Key words: Middle Jurassic, Ostracoda, Bela, Khadir, Sadhara Dome, Rann of Kachchh

INTRODUCTION

The Middle Jurassic (Bajocian-Bathonian-Callovian) of Kachchh District has long been known to the geoscientists. These beds crop out in six highland areas, which Biswas (1971) grouped into three geological provinces *viz.* Mainland Kachchh, Pachchham Island and Eastern Kachchh comprising Khadir, Bela and Chorar islands and the Wagad area (an isolated landmass, separated from Mainland Kachchh by an alluvium covered strip bounded by faults) (fig. 1). These beds represent marine facies and are rich in both macro and micro-faunas.

Considerable work has been done on the stratigraphy and palaeontology (chiefly cephalopods, echinoids, corals, brachiopods, bivalves and foraminifers) of these beds for the past 164 years, since they were first systematically described by Grant (1840). As far as ostracods are concerned, they were little known until 1960, when Lyubimova and Mohan (in Lyubimova *et al.*) described eight species from two localities, Khavda and Lodai. Thereafter, further works on the Jurassic ostracods of Mainland Kachchh and the adjoining Banni Rann were by Guha (1977), Neale and Singh (1986), Khosla *et al.* (1997), and Khosla and Jakhar (1999). However, there has been

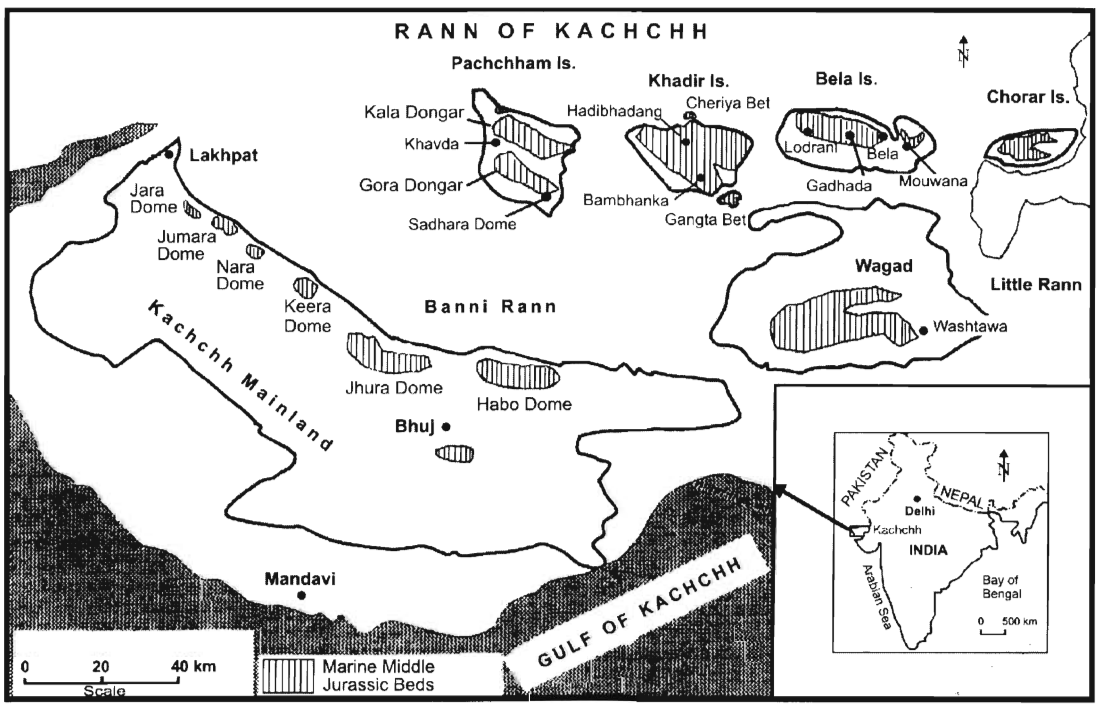


Fig. 1. Sketch map of Kachchh and the adjoining regions.

no record of the occurrence of ostracods from the Jurassic of Eastern Kachchh. Also, little or no work has been done on the Jurassic ostracods from Pachchham Island (except Khavda) and localities south of Bhuj, district Headquarter of Kachchh.

With the intention of enhancing our knowledge of Jurassic ostracods of a greater part of Kachchh District, the first author (SCK), under the DST-sponsored research project, initiated in 1999 a study based on different stratigraphical sections covering the entire Kachchh District. The present work is part of this project. Nine sections, one from the Sadhara Dome in the southeastern most part of Pachchham Island, three from Khadir Island and five from Bela Island were systematically sampled. All these sections yielded a rich and well preserved ostracod fauna of 74 species, of which 27 are new, 40 are assigned to previously known taxa and seven are left in open nomenclature. The distribution of ostracods in Khadir and Bela islands and systematic descriptions of *Lophocythere vertipolycostata* n. sp., *Progonocythere jaisalmerensis* n. sp. and *P. sadharaensis* n. sp. are given elsewhere (Khosla *et al.*, 2003a, b, c; 2004).

PREVIOUS WORK

Ostracods from the Jurassic of Kachchh were first described by Lyubimova and Mohan (in Lyubimova *et al.*, 1960), who recorded 8 species (all new) from two localities, viz. Khavda and Lodai. These were: *Cytherella disjuncta, C. obscura, Cytherelloidea difficila, Paracypris contermia, Progonocythere grumosa, P. implicata, P. laeviscula* and *P. prolata*.

Subsequently, Guha (1977) recorded 18 species, including one new, from the late Jurassic and early Cretaceous subsurface of well No. 2, Banni Rann, Kachchh. The check list of these ostracods is as follows: *Cytherella index* Oertli, *Cytherella* sp. cf. *C.* 962 Grekoff, *Cytheropteron corrosum* Grekoff, *Fastigatocythere accessa* (Grekoff), *Fastigatocythere* sp., *Majungaella brentonensis* Dingle, *M. nematis* Grekoff, *M. perforata* Grekoff, *Mantelliana* sp., *Paracypris contermia* Lyubimova and Mohan, *Paracypris* sp., *Pirileberis prognata* Grekoff, *Pontocyprella* sp., *Progonocythere befotakaensis* Grekoff (specific name miss spelt as *befotkaensis*), *P. kutchensis* Guha, *P. laeviscula* Lyubimova and Mohan, *Trichordis* sp. cf. *T. praetexta crispa* Grekoff, and Ostracoda gen. indet. Although all the species were illustrated, no description was given of the new taxon.

Neale and Singh (1986) re-examined the ostracod fauna of the previously mentioned well No. 2, and reported the presence of a much richer fauna comprising 34 species. These included the following 19 new species: *Cytherella guhai, C. indica, C. rannensis, Cytheropteron banniensis, C. guhai, C. kutchensis, Galliaecytheridea wahii, Hutsonia asiatica, Majungaella biswasi, Mandawacythere? curvicosta, Metacytheropteron posteroacuminata, M. ventrocostata, Nophrecythere orientalis, Paracypris salmiformis, Polycope kutchensis, P. rotunda, P. unituberculata, Progonocythere banniensis,* and

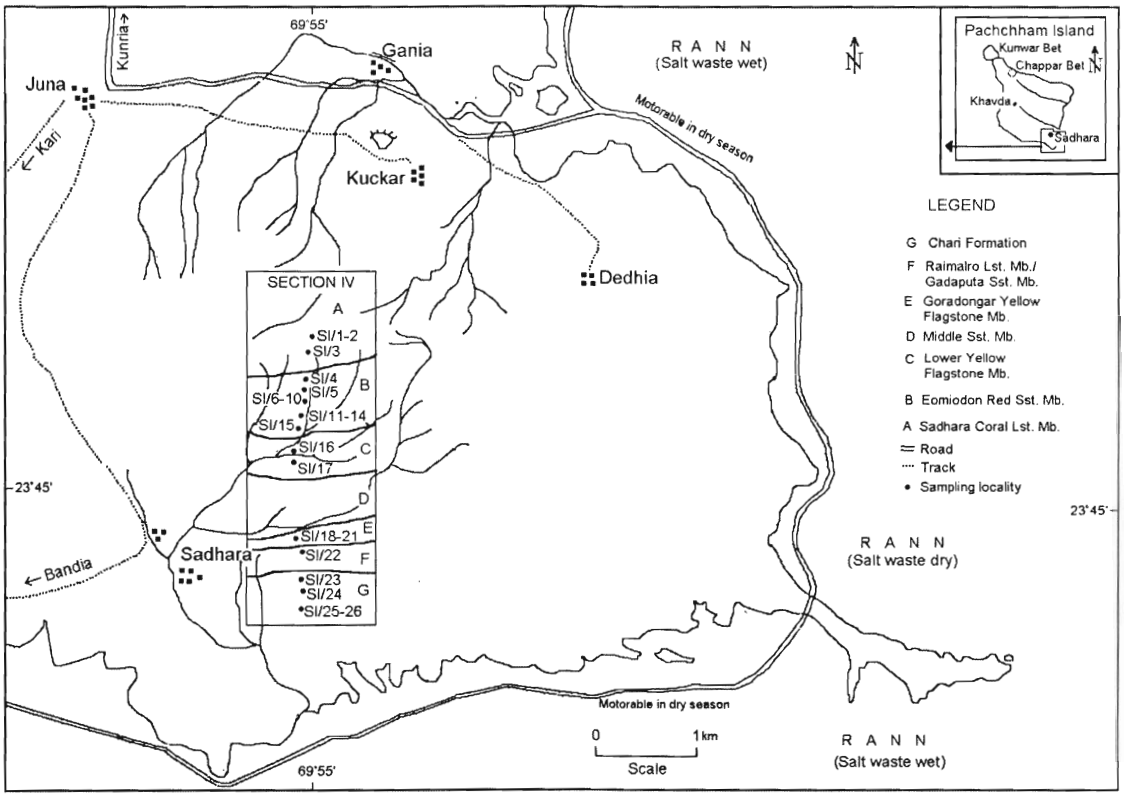


Fig. 2. Index map of the southeasternmost part of the Pachchham Island showing location of the section I.

Pseudoperissocytheridea indica. Other recorded species are: *Afrocytheridea*? sp., *Bairdia* sp., *Cytherella* aff. *C. guhai* Neale and Singh, *Fastigatocythere*? sp., *Galliaecytheridea*? sp. juv., *Metacytheropteron* sp., *Pontocypris* sp., *Rhadinocythere*? sp., *Trichordis* sp. cf. *T. triangular* Bate, *Trichordis* sp. juv.?, Genus A, Genus B, Incertae Sedis sp. 1, Incertae Sedis sp. 2, and Incertae Sedis sp. 3.

Khosla *et al.* (1992) observed that Bate (1975) incorrectly designated *Procytheridea ihopyensis* Grekoff (1963) as the type species of the genus *Amicytheridea*. Therefore, they approached the International Commission on Zoological Nomenclature to use its plenary powers to set aside all designations of type species made prior to the ruling requested for the genus *Amicytheridea* Bate, 1975 and having done so

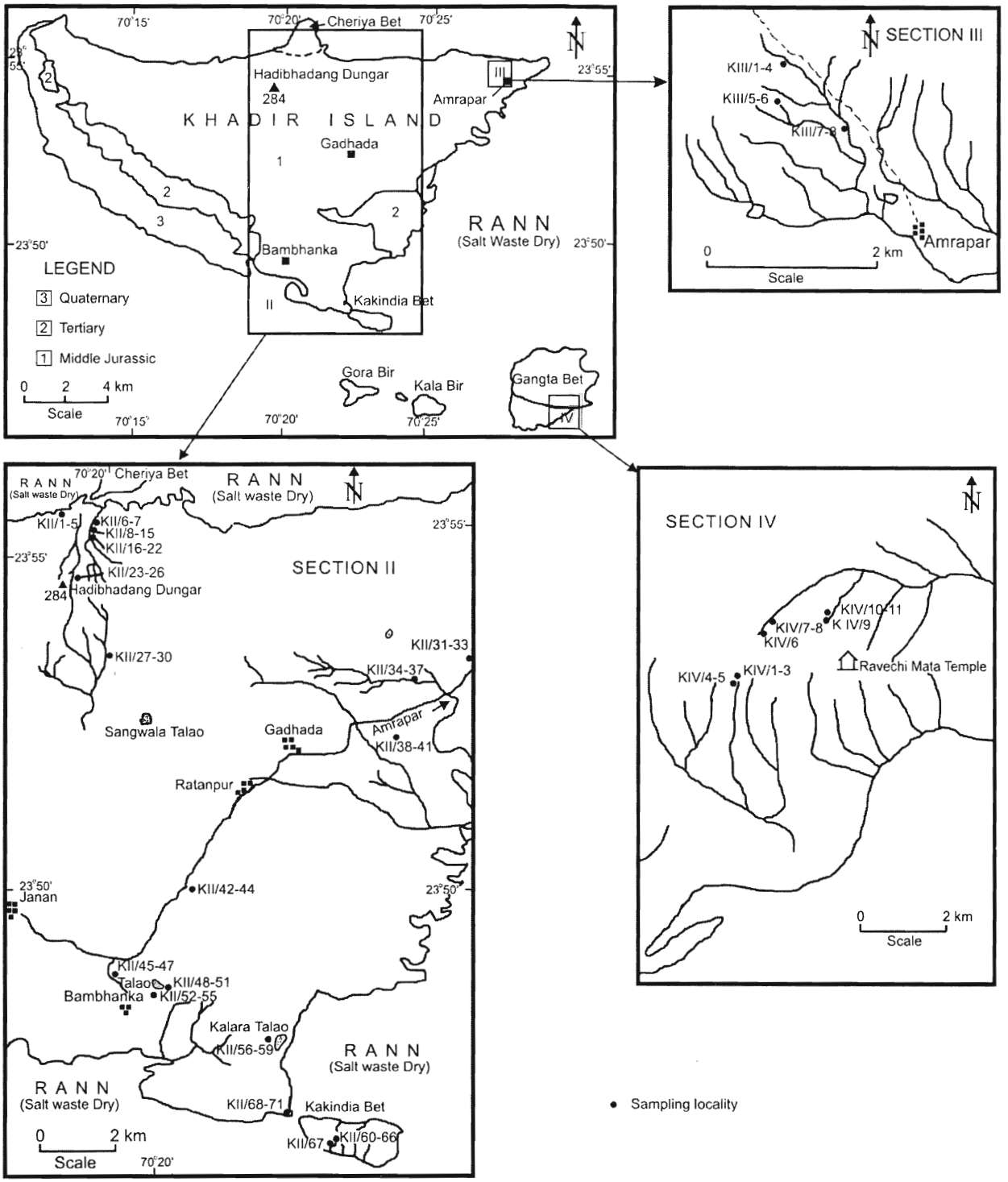


Fig. 3. Index map of the Khadir Island showing location of Sections II-IV.

to designate *A. triangulata* Bate 1975 as the type species of that genus. The Commission passed the resolution in favour of these authors.

Khosla and Jakhar (1993) described two species of *Amicytheridea* - *Amicytheridea triangulata* Bate, 1975 and *Amicytheridea* sp. - from the Jurassic of the Habo Dome, Mainland Kachchh. In addition, they established a new subgenus *Paratrichordis* to accommodate four species including one new, *Trichordis triangulata* Bate, 1975 (type species), *T. (Paratrichordis) devexa, T. (P.) grumosa,* and *T. (P.) parvicarinata* n. sp. The occurrences of the last three species have been reported from the Jurassic of Kachchh.

Khosla *et al.* (1997) described 49 ostracod species from the Jurassic of the Habo Dome, in which two genera (*Batella* and *Habocythere*), 20 species and one subspecies are new. The new taxa are: *Batella clavata, Batella depressa, Cytherella kalajarensis, Cytherelloidea bhujensis, C. dhrangensis, C. langijarensis, C. paradifficila, Cytheropterina devai, C. pandeyi, C. sajjaniae, Habocythere diluta, H. ventrisulcata, Majungaella perforata kachchhensis, M. rasilis, Mandelstamia depecheae, Mesocytheridea? mathuri, Nophrecythere whatleyi, Procytheridea kachchhensis, Progonocythere haboensis, Schuleridea (Eoschuleridea) soodani,* and *Trichordis (Trichordis) gujaratensis*. Other recorded species are: *Acrocythere*? sp., *Amicytheridea triangulata* Bate, *Amicytheridea* sp., *Batella befotakaensis* (Grekoff), *B. falcula* (Grekoff), *Cytherella disjuncta* Lyubimova and Mohan, *C. masuguluensis* Bate, *C. obscura* Lyubimova and Mohan, *Cytherella* sp., *Cytherelloidea* sp. cf. *C. atlantolevantiana* Rosenfeld and Honigstein, *C. ipis* Grekoff, *Cytherelloidea* sp., *Habocythere bicruciata* (Grekoff), *H. malgachica* (Grekoff), *Habocythere* sp., *Majungaella perforata* Grekoff, *Mandelstamia* sp., *Nophrecythere denticulata* (Kulshreshtha *et al.*), *N. jaisalmerensis* (Kulshreshtha *et al.*), *Paracypris contermia* Lyubimova and Mohan, *Pirileberis remota* (Grekoff), *Procytheridea ihopyensis* Grekoff, *Progonocythere laeviscula* Lyubimova and Mohan, *Progonocythere* sp., *Trichordis (Paratrichordis) devexa* (Grekoff), *T. (P.) grumosa* (Lyubimova and Mohan), *T. (P.) parvicarinata* Khosla and Jakhar, and *T. (Trichordis) praetexta* Grekoff.

Khosla and Jakhar (1999) recorded 28 species from the Jurassic of the Jumara Dome. Of these, 25 species have been assigned to taxa already described from the Chari Formation of the Habo Dome by Khosla *et al.* (*supra cit.*), while three species have been left in open nomenclature. These are: *Anchistrocheles* sp., *Bairdia* sp. A., and *Bairdia* sp. B.

Khosla *et al.* (2004) reported 49 species from the Jurassic of the Jhura Dome, of which the following six have been described as new: *Bairdia badiensis, B. jhuraensis, Cytherelloidea badiensis, Cytheropterina agrawali, Mandawacythere chariensis,* and *Pirileberis satyendrai.* Seven species have been left in open nomenclature. They are: *Bairdia* sp. A, *Bairdia* sp. B, *Bairdia*? sp. C, *Batella*? sp., *Habocythere* sp. A, *Habocythere* sp. B, and *Mandelstamia* sp. Thirty-six species have been assigned to the previously described species from the Chari Formation of the Habo Dome by Khosla *et al.* (*supra cit.*).

Besides Kachchh, Jurassic ostracods from other parts of India have been studied by Singh and Jaikrishna (1969), Singh and Kulshreshtha (1973), Jain and Mannikeri (1975), Singh and Kumar (1978), Kulshreshtha *et al.* (1985), and Mannikeri (1996).

Important contributions to our understanding of Jurassic Ostracoda from other countries bordering the Indian Ocean, with which Kachchh ostracods have affinities, are by Grekoff

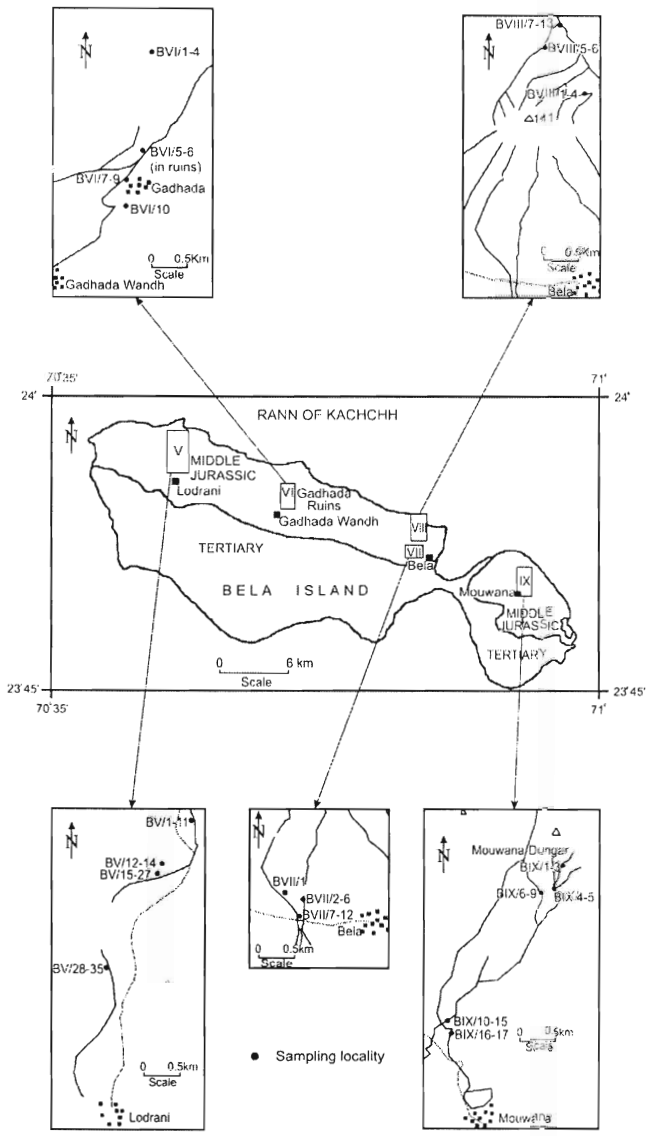


Fig. 4. Index map of the Bela Island showing location of Sections V-IX.

(1963), Bischoff (1964), Dingle (in Dingle and Klinger, 1972), Bate (1975, 1976, 1977), Basha (1980), Dépêche (in Dépêche *et al.*, 1987), Rosenfeld *et al.* (1987, 1988), Rafara (1990), and Rosenfeld and Honigstein (1991).

STRATIGRAPHY

Biswas (1971, 1980, and 1993) grouped the Mesozoic sediments of the Eastern Kachchh, of which Khadir and Bela islands are the part, in three rock units. These are the Khadir and the Washtawa formations and the Wagad Sandstone, named after their respective strato-types. The Khadir Formation represents the oldest unit in the region and is extensively exposed in Khadir, Bela and Chorar islands. The other two units are exposed in the Wagad region. The Washtawa Formation corresponds to the upper part of Khadir Formation, while the Wagad Sandstone is the youngest unit. The Khadir Formation in its type area, Khadir Island, has been further subdivided into five members. They are, in ascending order: (i) Cheriya Bet Conglomerate Member, (ii) Hadibhadang Shale Member, (iii) Hadibhadang Sandstone Member, (iv) Gadhada Sandstone Member (v) Bambhanka / Gangta Member.

Fürsich *et al.* (2001), based on certain marker beds, gave a different classification for the Jurassic of Eastern Kachchh. They divided these beds (earlier grouped in the Khadir Formation by Biswas, 1971) in three formations, in ascending order, the Khadir, Patcham and Gadhada formations. This classification is yet to be formalized.

Agrawal and Kacker (1978, 1980), Singh and Rai (1980) and Agrawal and Tripathi (1980) worked out a partial succession of the Jurassic of Bela and Khadir islands. These authors established a very large number of beds (28 in Eastern Bela, 31 in Western Bela and 15 in Khadir) without giving their precise thickness or characteristics. It has not proved possible to recognize these successions in the field in their totality.

In so far as the Sadhara Dome of Pachchham Island is concerned, Fürsich *et al.* (1994), among others, produced a detailed stratigraphy. They classified the rocks exposed in this dome into three formations viz., in ascending order, the Khavda, Patcham and Chari formations. The Khavda Formation was further subdivided, in ascending order, into the following six members: (i) Sadhara Coral Limestone Member, (ii) Eomiodon Red Sandstone Member, (iii) Lower Yellow Flagstone Member, (iv) Middle Sandstone Member, (v) Goradongar Yellow Flagstone Member and (vi) Gadaputa Sandstone Member.

In the present work, the authors have followed Biswas (1980) for the classification of the stratigraphical successions of the Middle Jurassic in Khadir and Bela islands and Fürsich *et al.* (1994) for the Sadhara Dome.

LOCATION OF THE SECTIONS

Samples were collected from nine sections. These include one section from the Sadhara Dome, three sections in Khadir Island and five sections in Bela Island. The locations of these sections are given below and in figs. 2-4.

Sadhara Dome

Section I, exposed in a dome, north of Sadhara Village (23°44'38" N: 69°54'40"E), in the southeasternmost part of Pachchham Island.

Khadir Island

Section II, N-S cross-country section passing through Gadhada Village (23°52´06"N: 70°20´15"E) from the Cheriya Bet (23°56´15"N: 70°20´15"E) in the north to the Kakindia Bet (23°46´02"N: 70°23´35"E) close to the southernmost tip of Khadir Island.

Section III, extending N-S from the Rann of Kachchh to near Amrapar Village (23° 54' 32" N: 70° 27' 02" E).

Section IV, exposed in a dome around the Ravechimata Temple and an old Fort (23°45´15"N: 70°30´06"E) in Gangta Bet, southeast of the Khadir Island.

Bela Island

Section V, exposed along Lodrani-Kuda track, north of Lodrani Village (23° 54' 29" N: 70° 37' 25" E).

Section VI, exposed at about 1 km NW of Gadhada Ruins (23° 54' 17" N: 70° 41' 30" E).

Section VII, exposed along a stream about 1 km northwest of Bela Village (23° 52' 35" N: 70° 48' 13" E)..

Section VIII, exposed along a north-south trending stream, northern escarpment of Bela Range, near Bela Village.

Section IX, exposed along northern and southern escarpments of Mouwana Hill, (23° 49' 50" N: 70° 52' 03" E).

In Section I, 27 samples (S /1–27) were collected from the basal Sadhara Coral Limestone Member to the Lower Macrocephalus beds.

Of the three sections studied in Khadir Island, a more or less complete succession of the Khadir Formation is found in Section II, where all the members from the Cheriya Bet Conglomerate to the Bambhanka are well exposed. Seventy-one samples were collected from this section. Twenty-two samples (K II/1-22) come from the Hadibhadang Shale Member exposed near Khara Talao (23° 55' 36" N: 70° 19' 32" E) in the lower part of Hadibhadang Hill. Four samples (K II/23-26) come from the overlying Hadibhadang Sandstone Member at the top of Hill. Eighteen samples (K II/27-44) come from the successively overlying Gadhada Sandstone in the vicinity of Gadhada Village. Twenty-seven samples (K II/45-71) come from the Bambhanka Member exposed near Bambhanka Village (23°

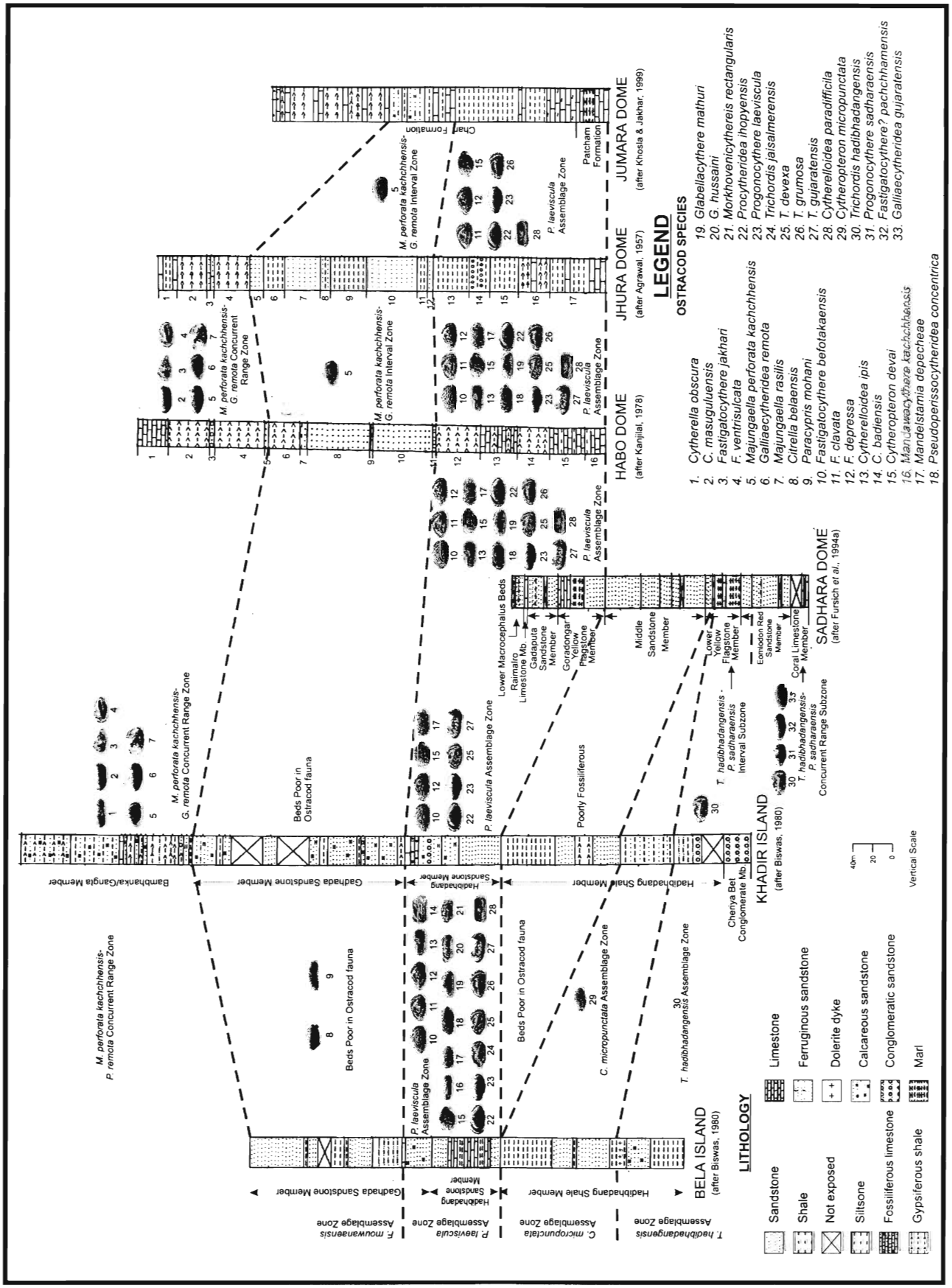


Fig. 5. Ostracod Biostratigraphical correlation of different Middle Jurassic sections exposed in the Island Belt and Mainland Kachchh, Gujarat (lithologs modified after their respective author/s)

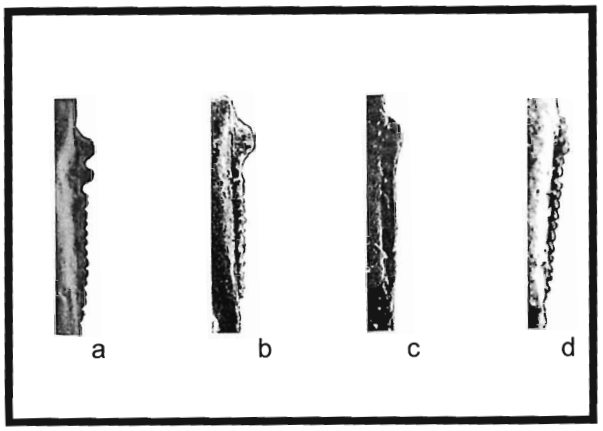


Fig.6a-d, Anteromedian hinge elements in left valve;
a. *Fastigatocythere befotakaensis* (Grekoff, 1963); b, *F. flebilis* n. sp.; c. *F. indica* n. sp.; d, *Fastigatocythere triangulata* Bate, 1975.

48' 10" N: 70° 20' 02" E) and close by Kakindia Bet. In Section III, the Hadibhadang Shale and the Hadibhadang Sandstone members are exposed from where 8 samples (K III/ 1-8) were collected, while in Section IV, 11 samples (K IV/1-11) were collected from the Gangta Member.

In Section V, 35 samples were collected. Of these, 2 samples (B V/1-2) come from the basal grey shales, 7 samples (B V/3-9) from the *Corbula lyrata* rich reddish brown shale, which is traversed by a prominent E-W trending dolerite dyke and 2 samples (B V/10-11) from the successively overlying shales of the Hadibhadang Shale Member. Three samples (B V/12-14) come from the lower part of the Hadibhadang Sandstone Member and 13 samples (B V/15-27) from the upper part of the member (Raimalro Limestone). Eight samples (B V/28-35) come from the Coralline Limestone of the Gadhada Sandstone Member. In Section VI, 8 samples (B VI/1-8) were collected from the part of Gadhada Sandstone Member overlying the Coralline Limestone horizon. In Section VII, 12 samples (B VII/ 1-12) were collected from the Raimalro Limestone of the Hadibhadang Sandstone Member. In Sections VIII, 13 samples (B VIII /1-13) were collected from the Hadibhadang Sandstone Member. In Section IX, 17 samples were collected. Of these, 3 samples (B IX/1-3) come from the upper part of the Hadibhadang Shale Member. Four samples (B IX/4-7) come from the lower part of the Hadibhadang Sandstone Member and 2 samples (B IX/8-9) from the upper part of the member (Raimalro Limestone). Eight samples (B IX/10-17) come from the Gadhada Sandstone Member.

The composite stratigraphical sections for Khadir and Bela islands are given earlier by Biswas (1993), while the stratigraphical section of Sadhara Dome by Fürsich *et al.* (1994). These are given herein in modified form in fig. 5. For further information, reference may be made to these works. The distribution of the Ostracoda in Sections I-IX is given in tables 1-3.

BIOSTRATIGRAPHICAL ZONATION

Based on the distribution of the Ostracoda, the Middle Jurassic of the Sadhara Dome and Khadir and Bela islands are grouped into five zones. These are described, in ascending order, as follows:

Trichordis hadibhadangensis Assemblage Zone

Authors: Khosla, Manisha Kumari and Darwin Felix, n. zone.

This is the lowermost zone occurring in the Sadhara Dome and the Khadir and Bela islands. However, it is more diversified in the first region. This zone is characterized by the restricted occurrence of *Trichordis hadibhadangensis* n. sp., because of which it is named as such. The zone covers Sadhara Coral Limestone to Lower Yellow Flagstone members of the Khavda Formation in Sadhara Dome, while lower part of Hadibhadang Shale Member of the Khadir Formation in Khadir and Bela islands. In Sadhara Dome, *T. hadibhadangensis* Zone is further divisible, into two subzones. They are in ascending order:

Trichordis hadibhadangensis-Progonocythere sadharaensis Concurrent Range Subzone

Type Section: Sadhara Coral Limestone and Eomiodon Red Sandstone members, Khavda Formation, in the core of the Sadhara Dome, north of Sadhara Village, Pachchham Island, Rann of Kachchh.

The subzone is characterized by the concurrent occurrence of *Trichordis hadibhadangensis* n. sp. and *Progonocythere sadharaensis* Khosla *et al.* Other restricted ostracods are: *Fastigatocythere? pachchhamensis* n. sp., and *Galliaecytheridea gujaratensis* n. sp. The predominant associated long ranging ostracods are: *Citrella belaensis* n. sp., *Fastigatocythere dorsoangulata* (Grekoff), *F. flebilis* n. sp., *Lophocythere vertipolycostata* Khosla and Manisha Kumari, *Mandelstamia biswasi* n. sp., *Paracypris kachchhensis* n. sp., and *P. mohani* n. sp.

Trichordis hadibhadangensis-Progonocythere sadharaensis Interval Subzone

Type Section: Lower Yellow Flagstone Member, Khavda Formation, Sadhara Dome.

This subzone covers an interval between the Last Appearance Datum (LAD) of *Progonocythere sadharaensis* Khosla *et al.*, and the LAD of *Trichordis hadibhadangensis* n. sp. The dominant associated long ranging ostracods are: *Fastigatocythere dorsoangulata* (Grekoff), *F. juglandica malgachica* (Grekoff), *Paracypris kachchhensis* n. sp., *P. mohani* n. sp., *Progonocythere jaisalmerensis* Khosla *et al.*

Cytheropteron micropunctata Assemblage Zone

Authors: Khosla, Manisha Kumari and Darwin Felix, n. zone.

Table 1. Distribution of ostracods in the Middle Jurassic beds of Sadhara Dome, Pachchham Island.

Species	Section I		
	T. hadibhadangensis-P. sadharaensis Concurrent Range Subzone	*T. hadibhadangensis-P. sadharaensis* Interval Subzone	*P. laeviscula* Assemblage Zone
Citrella belaensis n. sp.	+		+
Cytherella disjuncta Lyubimova & Mohan			+
C. obscura Lyubimova & Mohan			+
Cytheropteron devai (Khosla, Jakhar & Mohammed)			+
Fastigatocythere depressa (Khosla, Jakhar & Mohammed)			+
F. dorsoangulata (Grekoff)	+	+	
F. flebilis n. sp.	+		
F. juglandica malgachica (Grekoff)	+	+	+
F.? pachchhamensis n. sp.			+
F. triangulata (Bate)	+		
Galliaecytheridea? gujaratensis n. sp.	+	+	
Lophocythere vertipolycostata Khosla & Manisha Kumari	+	+	
Mandelstamia biswasi n. sp.	+		
M. depecheae Khosla, Jakhar & Mohammed			+
Paracypris contermia Lyubimova & Mohan			+
P. kachchhensis n. sp.	+	+	
P. mohani n. sp.	+	+	
Procytheridea ihopyensis Grekoff			+
Progonocythere jaisalmerensis Khosla, Jakhar, Nagori & Darwin		+	
P. laeviscula Lyubimova & Mohan			+
P. sadharaensis Khosla, Jakhar, Nagori & Darwin	+		
Trichordis devexa (Grekoff)			+
T. gujaratensis Khosla, Jakhar & Mohammed			+
T. hadibhadangensis n. sp.	+	+	
T. jaisalmerensis (Kulshreshtha, Singh &Tewari)			+

Type Section: Upper part of the Hadibhadang Shale Member, Khadir Formation, near Amrapar Village, Khadir Island, Rann of Kachchh.

Other occurrence: Hadibhadang Shale Member in the Bela Island covering the highly fossiliferous, reddish-brown shales (lower *Corbula lyrata* band).

This zone is characterized by the restricted occurrence of *Cytheropteron micropunctata* n. sp. It is not traceable in the Sadhara Dome and seems to have been pinched out in the west. Other ostracods restricted to this zone are: *Fastigatocythere kachchhensis* n. sp., *F. retusa* (Grekoff), *Mandelstamia kachchhensis* n. sp., *Paranotacythere* sp. and *Trichordis amraparensis* n. sp. Associated long ranging species are: *Citrella belaensis* n. sp., *Fastigatocythere bicruciata* (Grekoff), *Lophocythere vertipolycostata* Khosla and Manisha Kumari, *Mandelstamia biswasi* n. sp., *Paracypris mohani* n. sp. and *Trichordis jaisalmerensis* (Kulshreshtha *et al.*).

Progonocythere laeviscula Assemblage Zone

Authors: Khosla, Jakhar and Mohammed (1997).

Type Section: Beds 12-16, Black Limestone and Dhrang members of Kanjilal (1978), Chari Formation, Habo Dome, Mainland Kachchh.

Khosla *et al.* (1997) originally described this zone as Zone I – *Progonocythere laeviscula* Zone from the Jurassic of the Habo Dome, Mainland Kachchh. It is renamed as the *Progonocythere laeviscula* Assemblage Zone herein. In Khadir and Bela islands, the zone covers the Hadibhadang Sandstone Member and basal part of the overlying Gadhada Sandstone Member, while in the Sadhara Dome succession from the Gadaputa Sandstone Member to the Lower Macrocephalus beds. It is characterized by the restricted occurrence of *Progonocythere laeviscula* Lyubimova and Mohan. Other restricted ostracods of the zone are: *Cytherelloidea badiensis* Khosla *et al.*, *C. ipis* Grekoff, *C. paradifficila* Khosla *et al.*, *Cytheropteron devai* (Khosla *et*

Table 2. Distribution of ostracods in the Middle Jurassic beds of Khadir Island.

Species	Section II				Section III		Section IV
	T. hadibhadangensis Assemblage Zone	*C. micropunctata* Assemblage Zone	*P. laeviscula* Assemblage Zone	*M. perforata kachchhensis*-*G. remota* Concurrent Range Zone	*C. micropunctata* Assemblage Zone	*P. laeviscula* Assemblage Zone	*M. perforata kachchhensis*-*G. remota* Concurrent Range Zone
Citrella belaensis n. sp.	+						
Cytherella disjuncta Lyubimova & Mohan				+		+	+
C. masuguluensis Bate				+			+
C. obscura Lyubimova & Mohan			+	+		+	+
Cytherelloidea badiensis Khosla, Jakhar & Mohammed						+	
C. ipis Grekoff						+	
C. paradifficila Khosla, Jakhar & Mohammed						+	
Cytheropteron devai (Khosla, Jakhar & Mohammed)						+	
C. micropunctata n. sp.		+			+		
Fastigatocythere befotakaensis (Grekoff)			+			+	
F. bicruciata (Grekoff)		+	+	+	+		+
F. clavata (Khosla, Jakhar & Mohammed)						+	
F. depressa (Khosla, Jakhar & Mohammed)			+			+	
F. dorsoangulata (Grekoff)	+						
F. flebilis n. sp.	+						
F. jakhari n. sp.				+			
F. juglandica malgachica (Grekoff)			+			+	
F. kachchhensis n. sp.					+		
F. triangulata (Bate)				+		+	+
F. ventrisulcata (Khosla, Jakhar & Mohammed)				+			+
Galliaecytheridea remota Grekoff				+			+
G. satyendri (Khosla, Jakhar & Mohammed)			+			+	
Glabellacythere hussaini n. sp.			+			+	
G. mathuri (Khosla, Jakhar & Mohammed)						+	
Glabellacythere sp.						+	
Lophocythere vertipolycostata Khosla & Manisha Kumari	+				+		
Majungaella perforata kachchhensis Khosla, Jakhar & Mohammed				+			+
M. rasilis Khosla, Jakhar & Mohammed				+			
Mandawacythere kachchhensis n. sp.			+				
Mandelstamia biswasi n. sp.					+		
M. depecheae Khosla, Jakhar & Mohammed						+	
M. kachchhensis n. sp.		+			+		
Morkhovenicythereis rectangularis n. sp.						+	
Paracypris contermia Lyubimova & Mohan			+	+		+	+
P. mohani n. sp.		+	+		+		
Paranotacythere sp.					+		
Procytheridea ihopyensis Grekoff						+	
Progonocythere laeviscula Lyubimova & Mohan			+			+	
Pseudoperissocytheridea concentrica n. sp.						+	
Timiriasevia khadirensis n. sp.	+						
Trichordis amraparensis n. sp.					+		
T. devexa (Grekoff)						+	
T. grumosa (Grekoff)						+	
T. gujaratensis Khosla, Jakhar & Mohammed						+	
T. hadibhadangensis n. sp.	+						
T. jaisalmerensis (Kulshreshtha, Singh & Tewari)		+	+	+		+	+

al.), *C. pandeyi* (Khosla *et al.*), *Fastgatocythere befotakaensis* (Grekoff), *F. belaensis* n. sp., *F. clavata* (Khosla *et al.*), *F. depressa* (Khosla *et al.*), *F. indica* n. sp., *Galliaecytheridea lodraniensis* n. sp., *G. satyendrai* (Khosla *et al.*), *Glabellacythere hussaini* n. sp., *G. mathuri* (Khosla *et al.*), *Glabellacythere* sp., *Mandawacythere kachchhensis* n. sp., *Mandelstamia depecheae* Khosla *et al.*, *Morkhovenicythereis rectangularis* n. sp., *Neurocythere*? *kachchhensis* n. sp., *N. whatleyi* (Khosla and Jakhar), *Procytheridea ihopyensis* Grekoff, *Pseudoperissocytheridea concentrica* n. sp., *Trichordis devexa* (Grekoff), *T. grumosa* (Grekoff), and *T. gujaratensis* Khosla *et al.*. The predominant associated long ranging ostracods are: *Cytherella disjuncta* Lyubimova and Mohan, *C. obscura* Lyubimova and Mohan,

Table 3. Distribution of ostracods in the Middle Jurassic beds of Bela Island.

Species	Section V			Section VI	Section VII	Section VIII	Section IX	
	T. hadibhadangensis Assemblage Zone	*C. micropunctata* Assemblage Zone	*P. laeviscula* Assemblage Zone	*F. mouwanaensis* Assemblage Zone	*P. laeviscula* Assemblage Zone	*P. laeviscula* Assemblage Zon e	*P. laeviscula* Assemblage Zone	*F. mouwanaensis* Assemblage Zone
Bairdoppilata badiensis (Khosla, Jakhar & Mohammed)			+		+			
B. jhuraensis (Khosla, Jakhar & Mohammed)			+					
Bairdoppilata sp. E				+				
Bairdoppilata sp. F	+							
Citrella belaensis n. sp.	+	+	+	+			+	
Cytherella disjuncta Lyubimova & Mohan			+		+	+	+	
C. obscura Lyubimova & Mohan			+		+	+	+	
Cytherelloidea badiensis Khosla, Jakhar & Mohammed			+			+	+	
C. dhrangensis Khosla & Jakhar			+					
C. ipis Grekoff			+			+	+	
C. paradifficila Khosla, Jakhar & Mohammed			+		+		+	
Cytherelloidea sp.							+	
Cytheropteron devai (Khosla, Jakhar & Mohammed)			+		+	+	+	
C. kutchensis Neale & Singh					+			
C. micropunctata n. sp.		+						
C. pandeyi (Khosla, Jakhar & Mohammed)			+		+	+	+	
Darwinula sp.	+		+					
Eucytherura sp.			+			+		
Fastigatocythere befotakaensis (Grekoff)			+		+	+	+	
F. belaensis n. sp.			+					
F. bicruciata (Grekoff)	+	+	+	+		+		+
F. clavata (Khosla, Jakhar & Mohammed)			+		+	+	+	
F. depressa (Khosla, Jakhar & Mohammed)			+		+	+	+	
F. dorsoangulata (Grekoff)	+	+	+					
F. elongata n. sp.				+				+
F. indica n. sp.			+					
F. jakhari n. sp.			+		+	+	+	
F. juglandica malgachica (Grekoff)				+				+
F. mouwanaensis n. sp.								+
F. retusa (Grekoff)	+							
F. triangulata (Bate)			+		+	+	+	
Galliaecytheridea lodraniensis n. sp.			+		+	+	+	
Glabellacythere hussaini n. sp.			+		+	+	+	
G. mathuri (Khosla, Jakhar & Mohammed)			+		+	+	+	
Lophocythere vertipolycostata Khosla & Manisha Kumari	+	+		+				+
Mandawacythere kachchhensis n. sp.			+		+	+	+	
M. multicostata n. sp.			+		+	+	+	
Mandelstamia biswasi n. sp.	+	+						
M. depecheae Khosla, Jakhar & Mohammed			+					
M. kachchhensis n. sp.		+						
Monoceratina mouwanaensis n. sp.						+	+	
M. rannensis n. sp.						+	+	
Morkhovenicythereis rectangularis n. sp.			+		+	+		
Neurocythere? kachchhensis n. sp.			+		+			
N. whatleyi (Khosla & Jakhar)			+		+			
Paracypris contermia Lyubimova & Mohan			+			+	+	
P. mohani n. sp.	+	+	+	+		+	+	
P. salmiformis Neale & Singh					+			
Paranotacythere sp.				+				
Procytheridea ihopyensis Grekoff			+		+	+		
Progonocythere laeviscula Lyubimova & Mohan			+		+	+	+	
Pseudoperissocytheridea concentrica n. sp.			+		+			
Trichordis devexa (Grekoff)			+		+	+	+	
T. grumosa (Lyubimova & Mohan)			+		+	+	+	
T. gujaratensis Khosla, Jakhar & Mohammed			+		+	+	+	
T. hadibhadangensis n. sp.	+							
T. jaisalmerensis (Kulshreshtha, Singh & Tewari)	+	+	+	+	+	+	+	+

Fastigatocythere juglandica malgachica (Grekoff), *F. triangulata* (Bate), *Paracypris contermia* Lyubimova and Mohan, and *Trichordis jaisalmerensis* (Kulshreshtha *et al.*).

Progonocythere laeviscula Assemblage Zone in Khadir Island is overlain by middle and upper part of Gadhada Sandstone Member, which is dominantly composed of unfossiliferous sandstone, though some horizons abound in megafossils. The ostracod fauna is rather poor, being represented by only a few long ranging species: *Citrella belaensis* n. sp., *Fastigatocythere flebilis* n. sp., *F. kachchhensis* n. sp., and *Paracypris mohani* n. sp. There are no species restricted to it. Based on their stratigraphical position, the beds may be equivalent to those of Zone II – Poorly Fossiliferous Zone Khosla *et al.* (1997) of the Habo Dome. The latter zone is herein renamed as the *Majungaella perforata kachchhensis-Galliaecytheridea remota* (earlier designated as *Pirileberis remota*) Interval Zone as it represents the interval between the First Appearance Datum of *M. perforata kachchhensis* Khosla *et al.* and G. *remota* (Grekoff) in the Habo Dome. No younger succession is developed over the *P. laeviscula* Assemblage Zone in the Sadhara Dome.

Fastigatocythere mouwanaensis Assemblage Zone

Authors: Khosla, Manisha Kumari and Darwin Felix, n. zone.

Type Section: Succession of the Gadhada Sandstone Member overlying the *P. laeviscula* Assemblage Zone, exposed north of Mouwana Village, Bela Island.

It covers that part of the Gadhada Sandstone Member comprising buff, medium to coarse-grained sandstones containing *Pholadomya* at certain horizons and grey, gypsiferous shale. *Fastigatocythere mouwanaensis* n. sp. is the dominant, restricted species of the zone. The other restricted species is *Fastigatocythere elongata* n. sp. Associated long ranging species are: *Citrella belaensis* n. sp., *Fastigatocythere bicruciata* (Grekoff), *Lophocythere vertipolycostata* Khosla and Manisha Kumari, *Paracypris mohani* n. sp., and *Trichordis jaisalmerensis* (Kulshreshtha *et al.*).

Majungaella perforata kachchhensis-Galliaecytheridea remota Concurrent Range Zone

Authors: Khosla, Jakhar and Mohammed (1997).

Type Section: Beds 1-4, Rudramata and Lodai members of Kanjilal (1978), Chari Formation, Habo Hill.

Khosla *et al.* (1997) described this zone as Zone III – *Galliaecytheridea remota* Zone originally from the Habo Dome. It is herein renamed as the *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone based on the concurrent occurrence of *Majungaella perforata kachchhensis* Khosla *et al.* and *Galliaecytheridea remota* (Grekoff). In Khadir Island, it covers the Bambhanka and Gangta members of the Khadir Formation. The other ostracods restricted to the zone are as follows: *Cytherella kalajarensis* Khosla and Jakhar, *C. masuguluensis* Bate, *Fastigatocythere jakhari* n. sp., *F. ventrisulcata* (Khosla *et al.*), and *Majungaella rasilis* Khosla *et al.* The associated long ranging ostracods are: *Cytherella disjuncta* Lyubimova and Mohan, *C. obscura* Lyubimova and Mohan, *Fastigatocythere bicruciata* (Grekoff), *F. triangulata* (Bate), *Majungaella perforata kachchhensis* Khosla *et al.*, *Paracypris contermia* Lyubimova and Mohan, and *Trichordis jaisalmerensis* (Kulshreshtha *et al.*).

CORRELATION

The correlation of the Middle Jurassic beds of the Northern Island belt and those of Mainland Kachchh is attempted in this section and given in fig. 5. As stated earlier, five assemblage zones have been recognized for these beds in the Northern Island belt. They are, in ascending order: *Trichordis hadibhadangensis* Assemblage Zone, *Cytheropteron micropunctata* Assemblage Zone, *Progonocythere laeviscula* Assemblage Zone, *Fastigatocythere mouwanaensis* Assemblage Zone, and *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone. In Sadhara Dome, the first zone is further divisible into two subzones, which are: *Trichordis hadibhadangensis-Progonocythere sadharaensis* Concurrent Range Subzone, and *Trichordis hadibhadangensis-Progonocythere sadharaensis* Interval Subzone.

The *Trichordis hadibhadangensis* Assemblage Zone is undifferentiable in Khadir and Bela islands where it is overlain by the *Cytheropteron micropunctata* Assemblage Zone. The latter zone pinches out towards the west and is not developed in the Sadhara Dome. The succeeding *Progonocythere laeviscula* Assemblage Zone is quite distinct and easily traceable in all the three islands. The succession ceases after this zone in the Sadhara Dome and in the western part of Bela Island, while in the eastern part of the island the *Progonocythere laeviscula* Assemblage Zone is overlain by the *Fastigatocythere mouwanaensis* Assemblage Zone. The *Progonocythere laeviscula* Assemblage Zone in Khadir Island is overlain by dominantly unfossiliferous part of the Gadhada Sandstone Member. This has not been assigned to any particular ostracod zone, however, based on the stratigraphical position it can be correlated with the *Fastigatocythere mouwanaensis* Assemblage Zone of eastern Bela Island. The uppermost *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone occurs only in the southernmost part of Khadir Island and in the Gangta Bet.

Correlation of the Middle Jurassic of the Northern Island Belt and of the Mainland Kachchh

Habo Dome: Kanjilal (1978) gave a detailed account of the stratigraphy of the Chari (= Habo) Formation of the Habo Dome. He recognized 16 beds, which were grouped in five members. Contrary to general practice, Kanjilal gave the number 1 to the youngest bed of the formation and assigned higher numbers to the succeeding older beds. This was done in view of the easily recognizable nature of the topmost bed, the Dhosa Oolite (= Lodai Member), which served as a marker horizon not only in the Habo Dome but throughout Mainland Kachchh and also to maintain uniformity with other workers (Rajnath, 1932; Spath, 1933; Agrawal, 1957; and Maithani, 1968) all of whom adopted the same procedure. Khosla *et al.* (1997) described the ostracod fauna of this succession of the Habo Dome and established three zones, which are re-designated herein, in ascending order, as: *Progonocythere laeviscula* Assemblage Zone, *Majungaella perforata kachchhensis-Galliaecytheridea remota* Interval Zone, and *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone.

The *Progonocythere laeviscula* Assemblage Zone is the lowermost zone in the Habo Dome. It includes five basal beds comprising a black limestone with thin bands of grey shales (Bed 16) at the base, successively overlain by greyish-yellow limestone with bands of shales (Bed 15), yellow gypsiferous shale (Bed 14), alternate sequence of greyish-yellow limestones and gypsiferous shales (Bed 13), and greyish-yellow gypsiferous shale (Bed 12). The ostracod fauna of the *Progonocythere laeviscula* Assemblage Zone of the Northern Island belt is essentially similar to this zone in the Habo Dome. Besides long ranging forms, 14 restricted species are common to the two regions. They are: *Cytherelloidea ipis* Grekoff, *C. paradifficila* Khosla *et al.*, *Cytheropteron devai* (Khosla *et al.*), *Fastigatocythere befotakaensis* (Grekoff), *F. clavata* (Khosla *et al.*), *F. depressa* (Khosla *et al.*), *Glabellacythere mathuri* (Khosla *et al.*), *Mandelstamia depecheae* Khosla *et al.*, *Procytheridea ihopyensis* Grekoff, *Progonocythere laeviscula* Lyubimova and Mohan, *Pseudoperissocytheridea concentrica* n. sp., *Trichordis devexa* (Grekoff), *T. grumosa* (Lyubimova and Mohan), and *T. gujaratensis* Khosla *et al.*

Majungaella perforata kachchhensis-Galliaecytheridea remota Interval Zone is the intermediate zone in Habo Dome. It includes 7 beds, no. 11-5. The lower four beds comprising in ascending order, reddish brown conglomeratic sandstone (Bed 11), highly ferruginous, hard sandstone (Bed 10), black coral limestone (Bed 9), reddish brown friable sandstone (Bed 8) are devoid of ostracods. The succeeding two beds consisting of reddish-brown hard sandstone with thin bands of shales (Bed 7) and yellowish-brown gypsiferous shale (Bed 6) have yielded a few ostracods namely, *Cytherella disjuncta* Lyubimova and Mohan, *C. obscura* Lyubimova and Mohan, *Fastigatocythere diluta* (Khosla *et al.*), and *Majungaella perforata kachchhensis* Khosla *et al.* The top bed, composed of, hard, ferruginous sandstone (Bed 5), although abounding in macrofossils, is devoid of ostracods. *Majungaella perforata kachchhensis-Galliaecytheridea remota* Interval Zone *sensu stricto* has not been encountered in the Northern Island belt, but the beds of the Gadhada Sandstone Member overlying the *Progonocythere laeviscula* Assemblage Zone in Khadir Island can be taken as its equivalent on the basis of stratigraphical position. They too are dominated by arenaceous facies rare in Ostracoda.

The *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone is the uppermost zone in the Habo Dome and includes the top four beds, no. 4-1. They are in ascending order, greyish-yellow gypsiferous shale (Bed 4), greyish-yellow conglomerate full of mega fossils but lacking ostracods (Bed 3), greyish-yellow gypsiferous shale (Bed 2), and an alternate sequence of greyish-brown limestones and shales, the uppermost band becoming oolitic (Bed 1). The zone is also well developed in the Bambhanka / Gangta Member of the Khadir Formation in Khadir Island. Besides long ranging forms, 6 restricted ostracods of the zone are common to the Habo Dome and Khadir Island. They are: *Cytherella kalajarensis* Khosla and Jakhar, *C. masuguluensis* Bate, *Fastigatocythere jakhari* n. sp., *F. ventrisulcata* (Khosla *et al.*), *Majungaella rasilis* Khosla *et al.*, and *Galliaecytheridea remota* (Grekoff).

Jhura Dome: Agrawal (1957) studied the stratigraphy of the Chari (=Habo) Formation of the Jhura Dome. He recognized 18 beds and numbered them in descending order. Khosla *et al.* (2004) based on the distribution of Ostracoda in beds 1-17 of Agrawal reported the presence of three zones, which they had earlier described from the Habo Dome.

The *Progonocythere laeviscula* Assemblage Zone includes five basal beds, no. 17-13, comprising light yellow shales with bands of the Golden Oolite (Bed 17) at the base, successively overlain by yellowish-grey gypsiferous shales with bands of shelly limestone (Bed 16), grey shales (Bed 15), brownish-yellow conglomerate with bands of shale (Bed 14), and brownish-yellow shales (Bed 13). The Ostracoda of this zone are identical with those of the Habo Dome and Northern Island belt. As many as 14 restricted species are common to the three regions. They have been already listed under the *Progonocythere laeviscula* Assemblage Zone of the Habo Dome.

The *Majungaella perforata kachchhensis-Galliaecytheridea remota* Interval Zone includes eight beds, no. 12-5. They are in ascending order, reddish-brown platy sandstone (Bed 12), thinly bedded soft light green shales (Bed 11), yellowish-brown hard compact massive sandstone (Bed

10), grey shales (Bed 9), light pink slabby sandstone (Bed 8), yellowish-brown hard fossiliferous sandstone (Bed 7), grey shales (Bed 6), and yellowish-brown sandy limestone (Bed 5). Like the Habo Dome, this zone in the Jhura Dome is poor in Ostracoda and has yielded only a few long ranging species i.e. *Cytherella disjuncta* Lyubimova and Mohan, *C. obscura* Lyubimova and Mohan, *Fastigatocythere depressa* (Khosla *et al.*), *Majungaella perforata kachchhensis* Khosla *et al.*, and *Neurocythere denticulata* (Kulshreshtha *et al.*). It is correlatable with beds of the Gadhada Sandstone Member of the Khadir Formation in Khadir Island.

The *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone in the Jhura Dome includes top four beds, no. 4-1. They are in ascending order: grey shales often gypsiferous (Bed 4), yellow sandy limestone (Bed 3), yellowish-grey gypsiferous shales (Bed 2), and an alternating sequence of greenish-brown limestone and shale, the topmost band being oolitic (Bed 1). The ostracod fauna of this zone is closely comparable with that of the Habo Dome and Khadir Island, where 7 restricted species are common to the former and 5 to the latter (for details see fig. 5).

Jumara Dome: Khosla and Jakhar (1999) studied the ostracods of the Jumara Dome. They recorded 13 species from the Patcham Formation and 22 species from the overlying Chari Formation, 7 species being common to both formations. Khosla and Jakhar have not formally recognized the ostracod zones in the Jumara Dome. However, their samples J/1 to J/11 coming from the Patcham Formation and the lower part of the Chari Formation viz., Macrocephalus and Rehmanni beds represent the *Progonocythere laeviscula* Assemblage Zone, samples J/12 to J/27 coming from part of the Rehmanni beds and the successively overlying Anceps and Athleta beds of the Chari Formation represent the *Majungaella perforata kachchhensis-Galliaecytheridea remota* Interval Zone, while samples J/28 to J/43 coming from upper part of the Athleta bed and overlying Dhosa Oolite of the Chari Formation represent the *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone described from the Habo and Jhura domes. The ostracod fauna of the three zones of the Jumara Dome compares well with equivalent zones of the Northern Island belt. Seven restricted species of the *Progonocythere laeviscula* Assemblage Zone, two species of the *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zones are common to both the Jumara Dome and the Northern Island belt.

COMPOSITION AND AGE OF THE OSTRACOD FAUNA

The ostracod fauna of the Middle Jurassic of the Northern Island belt comprises 74 species. These belong to 12 families: thirty-two species to the family Progonocytheridae (43.24%), nine species to the family Cytherellidae (12.16%), eight species to the family Cytherideidae (10.81%), seven species to the family Cytheruridae (9.46%), four species each to the families Bairdiidae (5.41%) and Paracyprididae (5.41%), and three species each to the family Loxoconchidae (4.05%) and Protocytheridae (4.05%), two species to the family Bythocytheridae (2.70%), and one species each to the families Darwinulidae (1.35%), and Limnocytheridae (1.35%). An analysis of these is given below zone-wise.

Trichordis hadibhadangensis Assemblage Zone

In all 19 species occur in this zone.

1. Of these, 2 species are left in open nomenclature and 10 species are new. These are of little stratigraphical significance at the moment.
2. Two species - *Lophocythere vertipolycostata* and *Progonocythere sadharaensis* – have recently been described from the Northern Island belt by Khosla *et al.*, (2003a, c). The former species ranges from the *Trichordis hadibhadangensis* Assemblage Zone to the *Progonocythere laeviscula* Assemblage Zone, while the latter species occurs restricted to the *Trichordis hadibhadangensis-Progonocythere sadharaensis* Concurrent Range Zone of the Sadhara Dome.
3. One species – *Trichordis jaisalmerensis* – was originally described from the Kuldhar beds, Jaisalmer Formation, Rajasthan by Kulshreshtha *et al.* (1985). Though these authors assigned it a Callovian-Oxfordian age, Kachhara and Jodhawat (1982) gave a middle Callovian age to the same beds based on certain characteristic ammonoids. Khosla *et al.* (1997) recorded this species essentially from the *Progonocythere laeviscula* Assemblage Zone of the Chari Formation, Habo Dome, with the exception of a single specimen from the basal part of the Katrol Formation. The species occurs throughout the Jurassic of the Northern Island belt.
4. One species – *Fastigatocythere bicruciata* – was originally described from the middle-upper Bathonian and the Callovian of the Majunga Basin, Madagascar (Grekoff, 1963). In Mainland Kachchh, the species has been recorded from the *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone (Khosla *et al.*, 1997, 2004; Khosla and Jakhar, 1999). In the Northern Island belt, it occurs throughout the Jurassic.
5. Two species – *Fastigatocythere dorsoangulata* and *F. retusa* – were described from the middle-upper Bathonian beds of the Majunga Basin, Madagascar (Grekoff, 1963). In India, *F. retusa* has been recorded from the Fort and the Badabag members of the Jaisalmer Formation, Jaisalmer (Mannikeri, 1996). In the Northern Island belt (Bela Island),

F. retusa occurs restricted to the *Trichordis hadibhadangensis* Assemblage Zone, while *F. dorsoangulata* (Grekoff) occurs abundantly in the *Trichordis hadibhadangensis* Assemblage Zone and the basal part of the *Cytheropteron micropunctata* Assemblage Zone, but rarely in the overlying beds.

6. One species - *Fastigatocythere juglandica malgachica* – was originally recorded from the Bajocian-late Bathonian beds of Madagascar (Grekoff). In Mainland Kachchh, the species occurs in the *Progonocythere laeviscula* Assemblage Zone of the Chari Formation, Habo Dome.

Although the majority of the species in the *Trichordis hadibhadangensis* Assemblage Zone are new, the occurrence of *Fastigatocythere dorsoangulata, F. juglandica malgachica* and *F. retusa* suggest a Bajocian to Bathonian age.

***Cytheropteron micropunctata* Assemblage Zone**

Twelve species occur in this zone.

1. Of these, one species is left in open nomenclature and 7 species are new, 3 of which extend from the underlying zone.
2. Four species – *Fastigatocythere bicruciata* (Grekoff), *F. dorsoangulata* (Grekoff), *Lophocythere vertipolycostata* Khosla and Manisha Kumari, and *Trichordis jaisalmerensis* (Kulshreshtha *et al.*) – extend from the under lying zone. Their stratigraphical significance has already been given.

Although none of the ostracod species of the *Cytheropteron micropunctata* Assemblage Zone are age diagnostic, the zone is a part of the Hadibhadang Shale Member and its lower part has been assigned a Bajocian-Bathonian age, possibly this zone too might be Bathonian. This inference is further corroborated by the fact that the zone is succeeded by the *Progonocythere laeviscula* Assemblage Zone to which Khosla *et al.* (1997) have assigned a Bathonian-Callovian age in the Habo Dome.

***Progonocythere laeviscula* Assemblage Zone**

In all 50 species occur in this zone.

1. Seven species are left in open nomenclature, while 13 species are new. Of the latter, one species – *Pseudoperissocytheridea concentrica* – was previously described in open nomenclature as *Mandelstamia* sp. from the *Progonocythere laeviscula* Assemblage Zone of the Habo and Jhura domes (Khosla *et al.*, 1997, 2004).
2. One species – *Galliaecytheridea satyendrai* (Khosla *et al.*) – has been previously described from the *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone of the Chari Formation, Jhura Dome.
3. Three species - *Cytherella disjuncta* Lyubimova and Mohan, *C. obscura* Lyubimova and Mohan, and *Paracypris contermia* Lyubimova and Mohan – occur throughout the Chari Formation of Mainland Kachchh, Pachchham Island and in the Kuldhar beds, Jaisalmer Formation, Jaisalmer (Lyubimova *et al.*, 1960; Kulshreshtha *et al.*, 1985; Khosla *et al.*, 1997). The types of these species are from Khavda, Kachchh.
4. Four species – *Fastigatocythere bicruciata* (Grekoff), *F. dorsoangulata* (Grekoff), *F. juglandica malgachica* (Grekoff), and *Trichordis jaisalmerensis* (Kulshreshtha, *et al.*) – extend from the underlying zones. Their ages have already been discussed. *F. juglandica malgachica* is suggestive of a Bajocian-late Bathonian age, *F. dorsoangulata* a middle-upper Bathonian age, while *F. bicruciata* and *T. jaisalmerensis* a Bathonian to Callovian age.
5. Two species – *Cytheropteron kutchensis* and *Paracypris salmiformis* – were previously described from the Bathonian-Callovian of well No. 2, Banni Rann (Neale and Singh, 1986).
6. Two species – *Fastigatocythere befotakaensis* (Grekoff), and *Procytheridea ihopyensis* Grekoff – extend from the middle/upper Bathonian to the Callovian and in Mainland Kachchh, they occur restricted to the *Progonocythere laeviscula* Assemblage Zone of the Chari Formation (Grekoff, 1963; Khosla *et al.*, 1997). The types of these species are from the Majunga Basin, Madagascar. *F. befotakaensis* has also been recorded from the Bathonian–Callovian of well No. 2, Banni, Rann of Kachchh (Guha, 1977; Neale and Singh, 1986) and the Jurassic of Jaisalmer (Mannikeri, in Bhatia, 1984).
7. One species - *Fastigatocythere triangulata* – was originally described from the middle Callovian of Tanzania (Bate, 1975). It also occurs in the Callovian of Madagascar (Grekoff, 1963), Central Saudi Arabia (Dépêche *et al.*, 1987) and the Chari Formation of Mainland Kachchh (Khosla *et al.*, 1997).
8. Thirteen species – *Bairdoppilata badiensis* (Khosla *et al.*), *B. jhuraensis* (Khosla *et al.*), *Cytherelloidea badiensis* Khosla *et al.*, *C. dhrangensis* Khosla and Jakhar, *C. paradifficila* Khosla *et al.*, *Cytheropteron devai* (Khosla *et al.*), *C. pandeyi* (Khosla *et al.*), *Fastigatocythere clavata* (Khosla *et al.*), *F. depressa* (Khosla *et al.*), *Glabellacythere mathuri* (Khosla *et al.*), *Mandelstamia depecheae* Khosla *et al.*, *Neurocythere whatleyi* (Khosla and Jakhar), and *Trichordis gujaratensis* Khosla *et al.* – have been described from the *Progonocythere laeviscula* Assemblage Zone of the Habo/Jhura domes (Khosla *et al.*, 1997; 2004). *Mandelstamia depecheae* was earlier recorded in open nomenclature from the Callovian of Central Saudi Arabia (Dépêche *et al.*, 1987).

9. Two species - *Progonocythere laeviscula* Lyubimova and Mohan, and *Trichordis grumosa* (Lyubimova and Mohan) – occur restricted to the basal part of the Chari Formation of the Habo and Jhura domes (Khosla *et al.*, 1997, 2004). Both appear to be its characteristic. Besides, *P. laeviscula* has also been reported from the late Bathonian–Callovian of Madagascar and the late Bathonian-mid Callovian of Central Saudi Arabia.
10. Two species – *Cytherelloidea ipis* and *Trichordis devexa* – were described from the Callovian of Madagascar (Grekoff, 1963). They also occur restricted to the *Progonocythere laeviscula* Assemblage Zone of the Chari Formation of Mainland Kachchh (Khosla *et al.*, 1997). *C. ipis* is characteristic of the lower Callovian, while *T. devexa* of the middle Callovian.

Although some of the ostracod species stated above extend from the middle Bathonian to Callovian, the occurrence of *Progonocythere laeviscula* and *Cytherelloidea ipis* suggest a late Bathonian-early Callovian age for this zone. This zone has already been described from the Habo Dome by Khosla *et al.*, (1997) and has as many as 20 ostracod species common with it.

The Gadhada Sandstone Member overlying the *Progonocythere laeviscula* Assemblage Zone are generally poor in ostracods and have yielded only four species. All of these are new and continue from the underlying zone. These beds are possibly early-middle Callovian in age.

***Fastigatocythere mouwanaensis* Assemblage Zone**

In all, 9 species occur in this zone.

1. Two species are left in open nomenclature and 5 species are new.
2. Two species - *Fastigatocythere bicruciata* (Grekoff) and *Trichordis jaisalmerensis* (Kulshreshtha *et al.*) – are continuous from the underlying zones. Their age significance has already been given and they are indicative of Bathonian to Callovian age.

Based on the stratigraphical position, a Callovian age is assigned to the *Fastigatocythere mouwanaensis* Assemblage Zone.

***Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Rang Zone**

Thirteen species occur in this zone.

1. One species is new.
2. Six species - *Cytherella disjuncta* Lyubimova and Mohan, *C. obscura* Lyubimova and Mohan, *Fastigatocythere bicruciata* (Grekoff), *F. triangulata* (Bate), *Paracypris contermia* Lyubimova and Mohan, and *Trichordis jaisalmerensis* (Kulshreshtha *et al.*) - extend from the underlying zones. Their stratigraphical significance has already been given.
3. Four species - *Cytherella kalajarensis* Khosla and Jakhar, *Fastigatocythere triangulata* (Bate), *F. ventrisulcata* (Khosla *et al.*), *Majungaella perforata kachchhensis* Khosla *et al.*, and *M. rasilis* Khosla *et al.* - have been previously described from the Chari Formation of the Habo Dome. *M. perforata kachchhensis* extends from the underlying *Majungaella perforata kachchhensis-Galliaecytheridea remota* Interval Zone to the *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone. The other three species occur restricted to the zone under discussion.
4. Two species - *Galliaecytheridea remota* (Grekoff), and *Cytherella masuguluensis* Bate - described from the middle and late Callovian of Madagascar and the late Callovian of Tanzania respectively, occur restricted to the *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone of the Chari Formation.

The overall ostracod evidence suggests a mid-late Callovian age for the *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone.

PALAEOZOOGEOGRAPHY

The palaeozoogeography of the Ostracoda from the Jurassic of Kachchh has previously been discussed at length by Khosla *et al.* (1997). For details, reference may be made to this work. The ostracods from the Northern Island belt comprise 74 species. Of these, 55 species are known only from Kachchh, while 19 species occur in the equivalent horizons in Rajasthan, Madagascar, Tanzania and Central Saudi Arabia. Their distribution is given in table 3. A perusal of this table shows that as many as 12 species, *Cytherelloidea ipis* Grekoff, *Galliaecytheridea remota* (Grekoff), *Fastigatocythere befotakaensis* (Grekoff), *F. bicruciata* (Grekoff), *F. dorsoangulata* (Grekoff), *F. juglandica malgachica* (Grekoff), *F. retusa* (Grekoff), *F. triangulata* (Bate), *Neurocythere whatleyi* (Khosla and Jakhar), *Procytheridea ihopyensis* Grekoff, *Progonocythere laeviscula* Lyubimova and Mohan, and *Trichordis devexa* (Grekoff), are common to Madagascar. Eight species, *Cytherella disjuncta* Lyubimova and Mohan, *C. obscura* Lyubimova and Mohan, *Fastigatocythere befotakaensis* Grekoff, *F. retusa* (Grekoff), *Paracypris contermia* Lyubimova and Mohan, *Progonocythere laeviscula* Lyubimova and Mohan, and *Trichordis grumosa* (Lyubimova and Mohan), *T. jaisalmerensis* (Kulshreshtha *et al.*), are common to Rajasthan. Two species, *Cytherella masuguluensis* Bate, and *Fastigatocythere triangulata* (Bate), are common to Tanzania. Three species, *Mandelstamia depecheae* Khosla *et al.*, *Fastigatocythere triangulata* (Bate), and *Progonocythere laeviscula* Lyubimova and Mohan, are

common to Saudi Arabia. The overall evidence is in conformity with the findings of Khosla *et al.* (1997) that the Jurassic ostracods of the Kachchh have strongest affinity with those of the Majunga Basin, Madagascar and to a lesser extent with Tanzania and Central Saudi Arabia.

SYSTEMATIC PALAEONTOLOGY

The authors have assigned ostracod genera to the families following original designations proposed by their respective authors or Grekoff (1963), Dépêche (Dépêche *et al.*1987), Whatley and Ballent (1996, 2004), Whatley and Boomer (2000), Whatley *et al.* (2001) and Prof. Whatley (personal communication). The families have been arranged as per classification adopted in the Treatise on Invertebrate Paleontology, Part Q, Ostracoda by Moore and Pitrat (1961). The diagnosis and descriptions are given only for new species. Brief morphological comments are given under the heading "Remarks" in species left in open nomenclature or where taxonomic changes have been proposed. Routine descriptions have been omitted for sake of brevity in already known and established species in which cases only synonymies, material and dimensions are given. All the illustrated specimens are in the collection of the Micropalaeontological Laboratory of the Department of Geology, Mohanlal Sukhadia University, Udaipur, Rajasthan and they are designated by SUGDMF No. in the text and the plate explanations.

Subclass **Ostracoda** Latreille, 1806

Order **Podocopida** Müller, 1894

Suborder **Podocopina** Sars, 1866

Superfamily **Bairdiacea** Sars, 1866

Family **Bairdiidae** Sars, 1888

Genus ***Bairdoppilata*** Coryell, Sample and Jennings, 1935

Bairdoppilata badiensis (Khosla, Jakhar and Mohammed, 2004)

(Pl. I, fig. 1)

Bairdia sp. A Khosla and Jakhar, 1999, p. 45, pl. 3, fig. 9.

Bairdia badiensis Khosla, Jakhar and Mohammed, 2004, pp. 23-24, pl. 1, figs. 2-3.

Material: 4 carapaces.

Remarks: The present specimens from the Bela Island are identical with *Bairdia badiensis* Khosla *et al.* (2004) from the Jurassic of the Jhura Dome. According to Prof. Whatley (personal Communication) the generic name *Bairdia* as per Maddocks (1969) is confined to the Palaeozoic. The present and the following three species belong to the genus *Bairdoppilata* Coryell, Sample and Jennings, 1935.

Dimensions: A carapace (SUGDMF No. 740), length 0.73 mm, height 0.40 mm, width 0.30 mm.

Bairdoppilata jhuraensis
(Khosla, Jakhar and Mohammed, 2004)

(Pl. I, fig. 2)

Bairdia jhuraensis Khosla, Jakhar and Mohammed. 2004, p. 24, pl.1 figs. 4-5.

Material: 3 carapaces.

Dimensions: A carapace (SUGDMF No. 741), length 0.72 mm, height 0.48 mm, width 0.40 mm.

Bairdoppilata sp. E
(Pl. I, fig. 3)

Material: 2 carapaces.

Remarks: The species has the following characteristics: carapace elongate-subdeltoidal in lateral outline, with greatest height about half the length near middle; dorsal margin moderately arched; anterodorsal angle slightly above mid-height, posterodorsal angle at mid-height; ventral margin straight; anterior margin broad and downwardly rounded; posterior margin narrowly rounded in lower half; valve surface smooth.

Bairdoppilata sp. E resembles *Bairdia hilda* Jones, 1884, from the Jurassic of a deep boring at Richmond, Surrey, England in overall lateral outline but differs in its smaller size, narrowly rounded posterior margin and posterodorsal angle at mid-height, while *B. hilda* has a subangulate posterior margin below mid-height. *Bairdoppilata badiensis* (Khosla *et al.*, 2004) differs from *Bairdoppilata* sp. E in its strongly arched dorsal margin.

Dimensions: A carapace (SUGDMF No. 742), length 0.61 mm, height 0.30 mm, width 0.24 mm.

Occurrence: *Fastigatocythere mouwanaensis* Assemblage Zone of Section VI.

Bairdoppilata sp. F

(Pl. I, fig. 4)

Material: 2 carapaces.

Remarks: The species has the following characteristics: carapace bairdoid in lateral outline, with greatest height at middle. Dorsal margin strongly convex; ventral margin nearly straight, gently ascending posteriorly; anterior margin broad and rounded; posterior margin considerably drawn out and narrowly rounded in ventral half; valve surface smooth.

Bairdoppilata sp. F resembles *Bairdia caudifera* Monostori, 1995, from the Bathonian of the Mecsek Mountains,

southern Hungry in overall shape but differs in its straight, posteriorly ascending ventral margin, which is straight, horizontal and symmetrically weakly convex in *B. caudifera*.

Dimensions: A carapace (SUGDMF No. 743), length 0.89 mm, height 0.51 mm, width 0.45mm.

Occurrence: *Cytheropteron micropunctata* Assemblage Zone of Section V.

Superfamily **Cypridacea** Baird, 1845

Family **Paracyprididae** Sars, 1923

Genus ***Paracypris*** Sars, 1866

Paracypris contermia Lyubimova and Mohan, 1960

(Pl. I, fig. 5)

Paracypris contermia Lyubimova and Mohan, in Lyubimova *et al.*, 1960, pp. 22-23, pl. 2, fig. 2. – Guha, 1977, p. 86, pl. 3, fig. 19. – Kulshreshtha *et al.*, 1985, p. 125, figs. 5.14, 5.17. – Neale and Singh, 1986, p. 363. – Khosla *et al.*, 1997, p. 36, pl. 7, fig. 16. – Khosla and Jakhar, 1999, p. 45, pl. 3, fig. 7.

Material: 25 carapaces and 2 valves.

Dimensions: A carapace (SUGDMF No. 707), length 0.64 mm, height 0.25 mm, width 0.20 mm.

Paracypris kachchhensis Khosla and Darwin Felix, n. sp.

(Pl. I, figs. 6-7)

Material: 34 carapaces.

Etymology: After the district of Kachchh.

Diagnosis: A species of *Paracypris* characterized by an elongate-subtriangular outline in lateral view, with greatest height less than half of length near middle; dorsal margin uniformly arched; posterior margin steeply sloping in upper part and rounded in lower.

Holotype: Pl. I, figs. 6.

Description: Carapace elongate-subtriangular in lateral outline, with greatest height less than half of length near middle. Left valve slightly larger than right valve, overlapping along posterodorsal, anterodorsal and mid-ventral margins. Dorsal margin uniformly arched; ventral margin straight; anterior margin broadly rounded; posterior margin steeply sloping in upper part and rounded in the lower. Carapace biconvex in dorsal view, with maximum width near middle. Valve surface smooth. Internal characters not known.

Dimensions: Holotype (SUGDMF No. 744), a carapace, length 0.65 mm, height 0.30 mm, width 0.25 mm. Paratype (SUGDMF No. 745), a carapace, length 0.62 mm, height 0.28 mm, width 0.25 mm.

Remarks: *Paracypris kachchhensis* Khosla and Darwin Felix, n. sp. resembles *Paracypris contermia* Lyubimova and Mohan (in Lyubimova *et al.*, 1960) in general appearance. The latter species, however, differs from the present species in having acutely pointed posterior end and slightly concave ventral margin in right valve. The species also differs from *Paracypris mohani* Khosla *et al.*, n. sp., described herein this work, in details of lateral outline.

Type Locality: Section I, Sadhara Dome, Pachchham Island, Gujarat.

Type Horizon: Coral bearing greyish-white sandy limestone (Sample SI/1), Sadhara Coral Limestone Member (Bajocian-Bathonian), Khavda Formation.

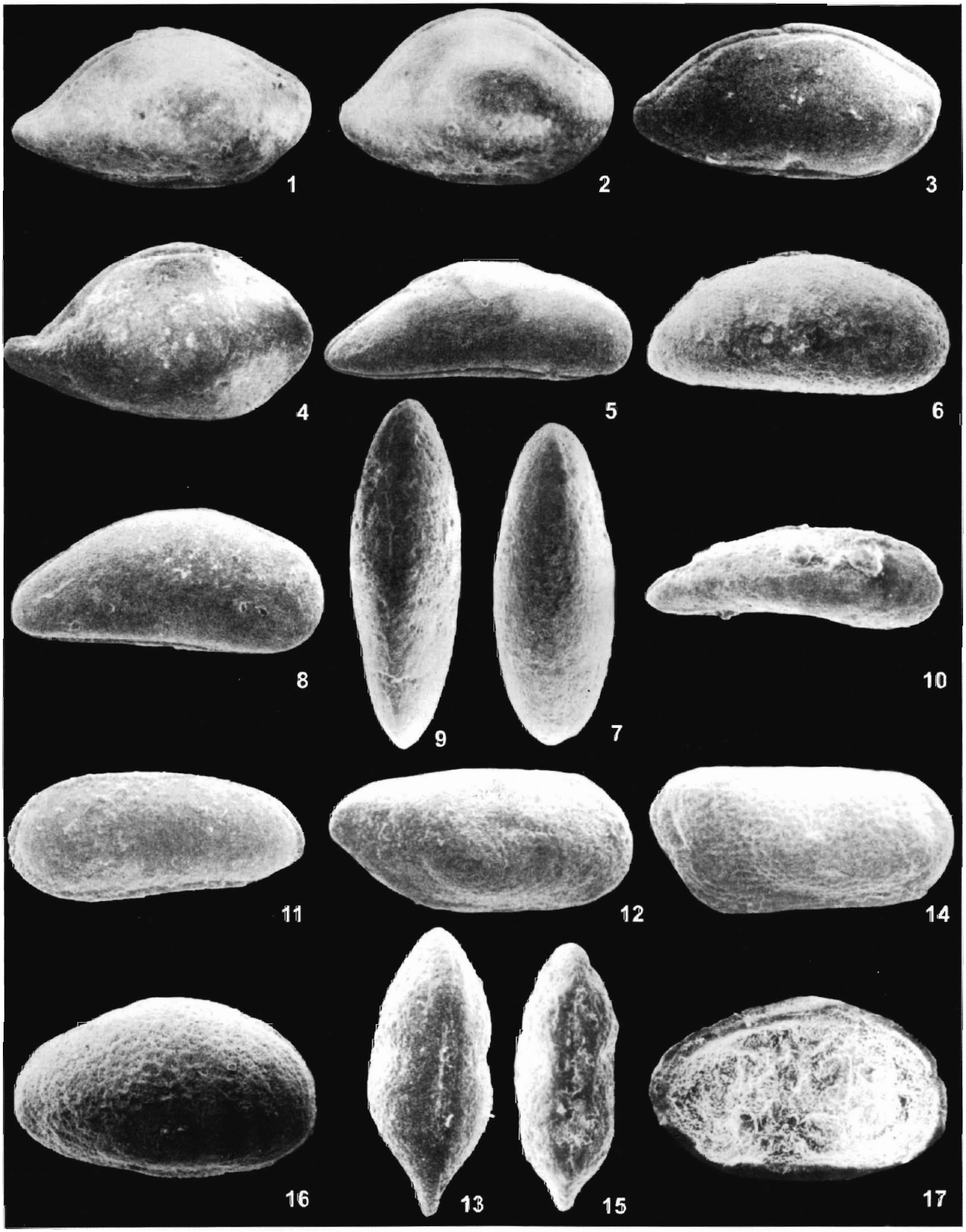
Occurrence: Trichordis hadibhadangensis Assemblage Zone of Section I.

Paracypris mohani Khosla, Darwin Felix and Manisha Kumari, n. sp.

(Pl. I, figs. 8-9)

EXPLANATION OF PLATE I

1. ***Bairdoppilata badiensis*** (Khosla, Jakhar and Mohammed)
   A carapace (SUGDMF No. 740), right valve view, x 77.
2. ***Bairdoppilata jhuraensis*** (Khosla, Jakhar and Mohammed)
   A carapace (SUGDMF No. 741), right valve view, x 72.
3. ***Bairdoppilata*** sp. E
   A carapace (SUGDMF No. 742), right valve view, x 98.
4. ***Bairdoppilata*** sp. F
   A carapace (SUGDMF No. 743), right valve view, x 66.
5. ***Paracypris contermia*** Lyubimova and Mohan
   A carapace (SUGDMF No. 707), right valve view, x 91.
6-7. ***Paracypris kachchhensis*** n. sp.
   6, holotype (SUGDMF No. 744), a carapace, right valve view, x 88; 7, paratype (SUGDMF No. 745), a carapace, dorsal view, x 99.
8-9. ***Paracypris mohani*** n. sp.
   8, holotype (SUGDMF No. 746), a carapace, right valve view, x 78;
   9, paratype (SUGDMF No. 747) a carapace, dorsal view, x 85.
10. ***Paracypris salmiformis*** Neale and Singh
   A carapace (SUGDMF No. 748), right valve view, x 73.
11. ***Darwinula*** sp.
   A carapace (SUGDMF No. 749), right valve view, x 80.
12-13. ***Monoceratina mouwanaensis*** n. sp.
   12, holotype (SUGDMF No. 750), a carapace, right valve view, x 119;
   13, paratype (SUGDMF No. 751), a carapace, dorsal view, x 106.
14-15. ***Monoceratina rannensis*** n. sp.
   14, holotype (SUGDMF No. 752), a carapace, right valve view, x 95;
   15, paratype (SUGDMF No. 753), a carapace, dorsal view, x 83.
16-17. ***Galliaecytheridea? gujaratensis*** n. sp.
   16, holotype (SUGDMF No. 754), a carapace, right valve view, x 119;
   17, paratype (SUGDMF No. 755), a left valve, internal view, x 108.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Material: 55 carapaces.

Etymology: The species is named in honour of Professor S. P. Mohan, Department of Geology, University of Madras, Chennai in recognition of his contributions in Micropalaeontology.

Diagnosis: An elongate-subtriangular species of *Paracypris* with posterior margin moderately rounded in lower half.

Holotype: Pl. I, fig. 8.

Description: Carapace elongate-subtriangular in lateral outline, with greatest height about half the length near middle. Left valve larger than right valve, overlapping distinctly along posterodorsal and ventral margins. Dorsal margin convex, sloping posteriorly; ventral margin straight in left valve and medially concave in right valve; anterior margin broad and evenly rounded; posterior margin moderately rounded in lower half. In dorsal view carapace biconvex, with maximum width slightly anterior to middle. Valve surface smooth.

Dimensions: Holotype (SUGDMF No. 746), a carapace, length 0.75 mm, height 0.36 mm, width 0.25 mm. Paratype (SUGDMF No. 747), a carapace, length 0.78 mm, height 0.36 mm, width 0.25 mm.

Remarks: This species resembles *Paracypris contermia* Lyubimova and Mohan in overall shape but differs in having comparatively broad posterior margin and 2.1 length / height ratio. As against this *P. contermia* has drawn out, subangulate posterior margin and 2.5 length / height ratio.

Type Locality: Section V, north of Lodrani Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: *Corbula lyrata* bearing reddish-brown siltstone (Sample BV/6), Hadibhadang Shale Member (middle–late Bathonian), Khadir Formation.

Occurrence: *Trichordis hadibhadangensis* Assemblage Zone of Section I; *Cytheropteron micropunctata* Assemblage Zone and Gadhada Sandstone Member of Section II; *Cytheropteron micropunctata* Assemblage Zone and *Progonocythere laeviscula* Assemblage Zone of Section V; and *Fastigatocythere mouwanaensis* Assemblage Zone of Sections VI and IX.

Paracypris salmiformis Neale and Singh, 1986

(Pl. I, fig. 10)

Paracypris salmiformis Neale and Singh, 1986, pp. 353-354, pl. 1, fig. 14.

Material: 2 carapaces.

Dimensions: A carapace (SUGDMF No. 748), length 0.77 mm, height 0.28 mm, width 0.24 mm.

Superfamily **Darwinulacea** Brady and Norman, 1889

Family **Darwinulidae** Brady and Norman, 1889

Genus ***Darwinula*** Brady and Robertson (in Jones, 1885)

Darwinula sp.

(Pl. I, fig. 11)

Material: 3 carapaces.

Remarks: The species is characterized by an elongate-subelliptical carapace in lateral outline, with greatest height at posterior 1/3 of length; left valve overlapping right valve all along margin; dorsal margin weakly arched, gently sloping anteriorly; ventral margin nearly straight; anterior margin narrowly rounded; posterior margin broadly rounded; valve surface smooth. It resembles *Darwinula leguminella* Forbes (in Lyell, 1855) from the Early Cretaceous of Sussex, England in overall lateral outline but differs in length / height ratio, which is 2.3 in the present species, while 2.8 in *D. leguminella.* The species is left in open nomenclature for want of more material.

Dimensions: A carapace (SUGDMF No. 749), length 0.69 mm, height 0.29 mm, width 0.24 mm.

Occurrence: *Cytheropteron micropunctata* Assemblage Zone and *Progonocythere laeviscula* Assemblage Zone of Section V.

Superfamily **Cytheracea** Baird, 1850

Family **Bythocytheridae** Sars, 1866

Genus ***Monoceratina*** Roth, 1928

Monoceratina mouwanaensis Khosla and Manish Kumari, n. sp.

(Pl. I, figs. 12-13)

Material: 8 carapaces.

Etymology: After the village of Mouwana, Bela Island.

Diagnosis: A species of *Monoceratina* characterized by elongate-subquadrate outline in lateral view and biconvex with a median constriction in the dorsal; posterior end and posteroventral region compressed; surface smooth.

Holotype: Pl. I, fig. 12.

Description: Carapace elongate-subquadrate in lateral outline; height almost equal in anterior and posterior halves. Overlap indistinct. Dorsal margin nearly straight; ventral margin straight anteriorly and parallel to dorsal margin, but sharply turned upward at posterior 2/5 of length; anterior margin broadly rounded; posterior margin drawn out in a subdorsal caudal process. In dorsal view carapace biconvex with a median constriction, posterior end compressed; maximum width at posterior 1/3 of length. Valve surface marked by a shallow,

vertical sulcus in median region; posteroventral region compressed; rest of area smooth.

Dimensions: Holotype (SUGDMF No. 750), a carapace, length 0.48 mm, height 0.24 mm, width 0.21 mm. Paratype (SUGDMF No. 751), a carapace, length 0.51 mm, height 0.24 mm, width 0.22 mm.

Remarks: *Monoceratina mouwanaensis* Khosla and Manisha Kumari, n. sp. resembles *Monoceratina herburyensis* Sylvester-Bradley, 1948, from the Middle Jurassic of Langston Herring, England in overall lateral outline but differs in having smooth valve surface. Unlike the present species, *M. herburyensis* has four swellings surrounding the dorsal sulcus, the two ventral swellings tend to coalesce into one, and the surface is covered by large, irregular, shallow punctae.

Type Locality: Section IX, northern escarpment of Mouwana Hill, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Brownish-yellow siltstone (Sample BIX/3), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections V and IX.

Monoceratina rannensis Khosla and Manisha Kumari, n. sp.

(Pl. I, figs. 14-15)

Material: 16 carapaces.

Etymology: After the Rann of Kachchh.

Diagnosis: A densely pitted species of *Monoceratina* marked by a vertical sulcus, with swelling on either sides; posteroventral region distinctly compressed.

Holotype: Pl. I, fig. 14.

Description: Carapace elongate-subquadrate in lateral outline, with greatest height at about posterior 1/4 of length. Overlap indistinct. Dorsal margin straight, gently sloping anteriorly; ventral margin nearly straight, swinging upwards backwardly; anterior margin evenly rounded; posterior margin broad, drawn out in a subdorsal caudal process. In dorsal view carapace biconvex, with a median constriction; width almost equal in both halves. Valve surface densely pitted, and marked by a vertical sulcus extending down from mid-dorsal region to median region, with swelling on either sides; posteroventral region distinctly compressed.

Dimensions: Holotype (SUGDMF No. 752), a carapace, length 0.60 mm, height 0.29 mm, width 0.24 mm. Paratype I (SUGDMF No. 753), a carapace, length 0.60 mm, height 0.29 mm, width 0.21 mm.

Remarks: The species resembles *Monoceratina*? *burgensis* Donze, 1964, from the Early Cretaceous of southeastern France in overall lateral outline but differs in having densely pitted valve surface and medially constricted outline in dorsal view. As against this, *M.*? *burgensis* has smooth surface and biconvex outline in dorsal view.

The species also resembles *Monoceratina mouwanaensis* n. sp., described earlier in this work, in surface swelling and outline in dorsal view, but differs in having densely pitted valve surface and broad posterior end, while *M. mouwanaensis* has smooth valve surface and comparatively narrow posterior end.

Type Locality: Section IX, northern escarpment of Mouwana Hill, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Brownish-yellow siltstone (Sample No. BIX/3), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections VII-IX.

Family **Cytherideidae** Sars, 1925

Subamily **Cytherideinae** Sars, 1925

Genus ***Galliaecytheridea*** Oertli, 1957

Galliaecytheridea gujaratensis Khosla and Darwin Felix, n. sp.

(Pl. I, figs. 16-17)

Material: 19 carapaces and 1 valve.

Etymology: After the Indian state of Gujarat.

Diagnosis: A medium, subovate species of *Galliaecytheridea* with greatest height a little less than 2/3 of length near middle; valve surface finely pitted.

Holotype: Pl. I, fig. 16.

Description: Carapace subovate in lateral outline, with greatest height a little less than 2/3 of length near middle. Left valve slightly larger than right valve, overlapping along ventral and anterior margins. Dorsal margin arched; ventral margin weakly convex; anterior margin broad and obliquely rounded; posterior margin narrowly rounded. Carapace biconvex in dorsal view, maximum width near middle. Valve surface finely pitted. Inner lamella moderately wide; avestibulate; selvage peripheral. Other internal characters not known.

Dimensions: Holotype (SUGDMF No. 754), a carapace, length 0.48 mm, height 0.30 mm, width 0.28 mm. Paratype (SUGDMF No. 755), a left valve, length 0.52 mm, height 0.33 mm.

Remarks: The species resembles *Galliaecytheridea remota* (Grekoff, 1963) and *Galliaecytheridea satyendrai* (Khosla *et al.*, 2004) described herein this work in general appearance, but differs in having arched dorsal margin and finely pitted surface.

Type Locality: Section I, Sadhara Dome, Pachchham Island, Gujarat.

Type Horizon: Coral bearing greyish-white sandy limestone (Sample SI/1), Sadhara Coral Limestone Member (Bajocian-Bathonian), Khavda Formation.

Occurrence: *Trichordis hadibhadangensis-Progonocythere sadharaensis* Concurrent Range Subzone of Section I.

Galliaecytheridea lodraniensis Khosla and Manisha Kumari, n. sp.

(Pl. II, figs. 1-4)

Material: 180 carapaces and 30 valves.

Etymology: After the village of Lodrani, Bela Island.

Diagnosis: A medium, subovate, smooth species of *Galliaecytheridea* with left valve distinctly overlapping right valve all along margin.

Holotype: Pl. II, fig. 1.

Description: Dimorphism distinct, males being more elongate, less high and wide than females. Carapace subovate in lateral outline, with greatest height near middle. Left valve larger than right valve, overlapping distinctly all along margin. Dorsal margin convex, sloping posteriorly; ventral margin slightly convex medially; anterior margin broad and evenly rounded; posterior margin narrowly rounded in lower half. In dorsal view carapace biconvex, with maximum width at middle. Valve surface smooth. Inner lamella moderately wide; avestibulate; selvage peripheral; normal pores few and scattered throughout the valve surface; marginal pore canals simple and straight, 10-12 anteriorly and 4–5 posteriorly. Hinge antimerodont; in right valve it comprises an anterior element with 5 teeth, followed by a finely locellate groove and a posterior element with 6 teeth; hinge complementary in left valve.

Dimensions: Holotype (SUGDMF No. 756), a female carapace, length 0.52 mm, height 0.33 mm, width 0.27 mm. Paratype I (SUGDMF No. 757), a male carapace, length 0.56 mm, height 0.32 mm, width 0.25 mm. Paratype II (SUGDMF No. 758), a female left valve, length 0.52 mm, height 0.33 mm. Paratype III (SUGDMF No. 759), a male carapace, length 0.52 mm, height 0.33 mm, width 0.26 mm.

Remarks: The species resembles *Galliaecytheridea remota* Grekoff, 1963, from the middle Callovian of the Majunga Basin, Madagascar in general appearance but differs in details of outline and having smaller size. *G. remota* has straight to weakly arched dorsal margin, convex ventral margin, posterior margin rounded above mid-height and larger size. Besides, the latter species has sparsely pitted valve surface, which is smooth in the present species.

Type Locality: Section V, north of Lodrani Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Reddish-brown siltstone with interbedded shale (Sample SV /20), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections V and VII-IX.

Galliaecytheridea remota Grekoff, 1963

(Pl. II, fig. 5)

Galliaecytheridea remota Grekoff, 1963, pp.1745-46, pl. 6, figs. 152-155.

Pirileberis remota (Grekoff). – Khosla *et al.*, 1997, p. 28, pl. 6, figs. 13-15. – Khosla and Jakhar, 1999, p. 45, pl. 3, fig. 4.

Material: 62 carapaces and 63 valves.

Remarks: Khosla *et al.* (1997) transferred the species to the genus *Pirileberis* based on presence of antimerodont hinge. However, according to Prof. Whatley (personal communication) the genus *Galliaecytheridea* like many other Jurassic Cytherideinae genera *e.g. Asciocythere* Swain, 1952 and *Vernoniella* Oertli, 1957 is characterized by both antimerodont and hemimerodont hinge structures. The species is therefore retained here in the original genus *Galliaecytheridea*.

Dimensions: A female carapace (SUGDMF No. 703), length 0.62 mm, height 0.38 mm, width 0.32 mm.

Galliaecytheridea satyendrai (Khosla, Jakhar and Mohammed, 2004)

(Pl. II, fig. 6)

Pirileberis satyendrai Khosla, Jakhar and Mohammed, 2004, pp. 26-27, pl. 1, figs. 11-13.

Material: 30 carapaces and 1 valve.

Remarks: The species has recently been described as *Pirileberis satyendrai* by Khosla *et al.* (2004) from the Jurassic of the Jhura Dome. It is, however, transferred here to *Galliaecytheridea* on the basis of it similarity with other species of the genus recorded above.

Dimensions: A carapace (SUGDMF No. 760), length 0.48 mm, height 0.28 mm, width 0.24 mm.

Genus ***Glabellacythere*** Wienholz, 1967

Glabellacythere hussaini Khosla, Darwin Felix and Manisha Kumari, n. sp.

(Pl. II, figs. 7-9)

Material: 110 carapaces and 9 valves.

Etymology: The species is named in honour of Dr. S. M. Hussain, Lecturer, Department of Geology, University of

Madras, Chennai in recognition of his contribution to the Recent Ostracoda of India

Diagnosis: An elongate-subquadrate species of *Glabellacythere* ornamented by a coarse reticulation and a shallow, longitudinal depression extending from posterodorsal to anterodorsal region.

Holotype: Pl. II, fig. 7.

Description: Carapace elongate-subquadrate in lateral outline; height, about 2/5 of length, almost equal in anterior and posterior halves. Left valve larger than right valve, overlapping conspicuously along anterodorsal, posterodorsal and ventral margins; right valve over-reaches left valve in mid-dorsal margin. In left valve, dorsal margin straight, and with anterior and posterior hinge-ears; ventral margin concave medially; anterior margin broad, evenly rounded; posterior margin somewhat narrow, asymmetrically rounded; in right valve dorsal and ventral margins straight; anterior margin obliquely rounded; posterior margin angulate at mid-height. Carapace biconvex in dorsal view, with maximum width posterior to middle. Valve surface ornamented by a coarse reticulation and a shallow, longitudinal depression extending from posterodorsal to anterodorsal region. Inner lamella moderately wide; avestibulate; selvage peripheral; marginal pore canals 8-9 anteriorly, 3-4 posteriorly. Hinge antimerodont; in right valve it is composed of an anterior element with 5 large teeth followed by a long locellate groove and a posterior element with 6 teeth; hinge complementary in left valve.

Dimensions: Holotype (SUGDMF No. 761), a carapace, length 0.60 mm, height 0.25 mm, width 0.19 mm. Paratype I (SUGDMF No. 762), a left valve, length 0.56 mm, height 0.24 mm. Paratype II (SUGDMF No. 763), a carapace, length 0.59 mm, height 0.25 mm, width 0.22 mm.

Remarks: The species closely resembles *Glabellacythere reticulata* Whatley, 1970 from the Callovian and Oxfordian of England and Scotland, in overall outline and its strongly reticulate ornamentation. The latter species, however, differs from the present species in the absence of anterior and posterior hinge-ears in left valve and longitudinal depression. *G. mathuri* (Khosla *et al.*) from the Jurassic of the Habo Dome also differs from the present species in its weak reticulation and lack of anterior and posterior hinge-ear in left valve.

Type Locality: Section III, Amrapar Village, Khadir Island, Rann of Kachchh, Gujarat.

Type Horizon: Limestone with interbedded shale (Sample KIII/7), Hadibhadang Sandstone Member (late Bathonian-early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections II-III, V and VII-IX.

Glabellacythere mathuri (Khosla, Jakhar and Mohammed, 1963)

(Pl. II, fig. 10)

Mesocytheridea? mathuri Khosla, Jakhar and Mohammed, 1997, pp. 26-28, pl. 6, fig. 16, pl. 7, figs. 1-2.

Material: 94 carapaces and 68 valves.

Remarks: The species was originally described as *Mesocytheridea? mathuri* (Khosla *et al.*) from the Jurassic of the Habo Dome. Based on outline and surface ornamentation it is here transferred to the genus *Glabellacythere*. The specimens recorded from the Northern Island belt are identical with the types.

Dimensions: A carapace (SUGDMF No. 764), length 0.77 mm, height 0.37 mm, width 0.36 mm.

Glabellacythere sp.

(Pl. II, fig. 11)

Material: 3 carapaces.

Remarks: The species is characterized by elongate-subquadrate carapace in lateral outline and biconvex in the dorsal; greatest height at anterior 1/3 of length; left valve larger than right valve, overlapping conspicuously along anterodorsal, posterodorsal and ventral margins; right valve over-reaches left valve in mid-dorsal margin; valve surface ornamented by net-like reticulation. *Glabellacythere* sp. resembles *G. mathuri* (Khosla *et al.*) in general appearance. The latter species, however, has comparatively larger size, weak reticulation and lacks anterior and posterior hinge-ears in left valve. The species is left in open nomenclature for want of more materials.

Dimensions: A carapace (SUGDMF No. 765), length 0.51 mm, height 0.25 mm, width 0.24 mm.

Occurrence: Progonocythere laeviscula Assemblage Zone of Section III.

Genus ***Morkhovenicythereis*** Gründel, 1975

Morkhovenicythereis rectangularis Khosla, Manisha Kumari and Darwin Felix, n. sp.

(Pl. II, figs. 12-14)

Material: 12 carapaces and 7 valves.

Etymology: From the Latin *rectangulam* meaning rectangular; with reference to rectangular lateral outline.

Diagnosis: A species of *Morkhovenicythereis* ornamented by distinct reticulation and sinuate ribs; two transverse subparallel ribs in anterior half, two transverse ribs in posterior half, two longitudinal ribs in lower half parallel to ventral outline; and a sigmoidal-shaped rib in posterodorsal and median regions.

Holotype: Pl. II, figs. 12.

Description: Carapace subrectangular in lateral outline, height almost equal in anterior and posterior halves. Left valve slightly larger than right valve, overlapping along anterodorsal, anteroventral and posteroventral margins. Dorsal margin nearly straight, ventral margin also straight but obscured by ventrolateral wrinkle; anterior margin squarely truncated; posterior margin subtriangular. In dorsal view carapace sagittate, strongly compressed posteriorly. Eye tubercle / swelling present, prominent in left valve. Valve surface ornamented by distinct reticulation and sinuate ribs; two transverse subparallel ribs in anterior half, one extending down from eye tubercle and other from mid-dorsal region; two transverse ribs in posterior half, extending down from posterodorsal region; two longitudinal ribs in lower half parallel to ventral outline; and a sigmoidal-shaped rib in posterodorsal and median regions; all transverse ribs join the lower ventrolateral rib in anteroventral and posteroventral regions; upper longitudinal rib in ventral half joins inner transverse rib anteriorly and posteriorly. Inner lamella moderately wide; selvage peripheral; avestibulate; normal pore few and scattered throughout the valve surface. Hinge antimerodont, in right valve it comprises an anterior element with 5-6 teeth, followed by a narrow, loculate groove and a posterior element with 7 teeth; hinge complementary in left valve.

Dimensions: Holotype (SUGDMF No. 766), a carapace, length 0.43 mm, height 0.28 mm, width 0.26 mm. Paratype I (SUGDMF No. 767), a carapace, length 0.47 mm, height 0.26 mm, width 0.30 mm. Paratype II (SUGDMF No. 768), a right valve, length 0.44 mm, height 0.24 mm.

Remarks: The species resembles *Morkhovenicythereis woodwardi* (Sylvester-Bradley, 1948) from the Bathonian beds of England in overall shape and ornamentation. However, unlike the present species, *M. woodwardi* has two oblique median ribs, joining anterior marginal and ventrolateral ribs anteriorly; an oblique depression extending from posterodorsal region to mid-anterior region.

According to Prof. Whatley (personal communication), *Morkhovenicythereis* together with *Oligocythereis* and other taxa constitute a new subfamily of the family Cytherideidae.

Type Locality: Section VII, 1 km northwest of Bela Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Pale-yellow siltstone (Sample SVII/5), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections III, V, VII and VIII.

Subfamily **Schulerideinae** Mandelstam, 1959

Genus ***Procytheridea*** Peterson, 1954

Procytheridea ihopyensis Grekoff, 1963

(Pl. II, fig. 15)

Procytheridea ihopyensis Grekoff, 1963, pp. 1747–1749, pl. 6, figs. 164–172; pl. 10, fig. 237. – Dépêche, in Dépêche *et al.*, 1987, pl. 2, figs. 1–5. – Khosla *et al.*, 1997, p. 11, pl. 2, figs. 1–2. – Khosla and Jakhar, 1999, p. 45, pl. 1, fig. 7.

Material: 93 carapaces and 296 valves.

Dimensions: A male carapace (SUGDMF No. 769), length 0.83 mm, height 0.41 mm, width 0.44 mm.

Family **Cytheruridae** Müller, 1894

Subamily **Cytherurinae** Sars, 1925

Genus ***Eucytherura*** Müller, 1894

Eucytherura sp.

(Pl. II, fig. 16)

Material: 3 carapaces.

Remarks: The species has the following characteristics: carapace elongate-subrectangular in lateral outline and biconvex in dorsal; valve produced in a small wing-like extension ventrally; height almost equal in anterior and

EXPLANATION OF PLATE II

1-4. ***Galliaecytheridea lodraniensis*** n. sp.
1, holotype (SUGDMF No. 756), a female carapace, right valve view, x 104;
2, paratype I (SUGDMF No. 757), a male carapace, right valve view, x 102;
3, paratype II (SUGDMF No. 758), a female left valve, internal view, x 114;
4, paratype III (SUGDMF No. 759), a male carapace, dorsal view, x 100.

5. ***Galliaecytheridea remota*** (Grekoff)
A female carapace (SUGDMF No. 703), right valve view, x 94.

6. ***Galliaecytheridea satyendrai*** (Khosla, Jakhar and Mohammed)
A carapace (SUGDMF No. 760), right valve view, x 113.

7-9. ***Glabellacythere hussaini*** n. sp.
7, holotype (SUGDMF No. 761), a carapace, right valve view, x 93;
8, paratype I (SUGDMF No. 762), a left valve, internal view, x 107;
9, paratype II (SUGDMF No. 763), a carapace, dorsal view, x 102.

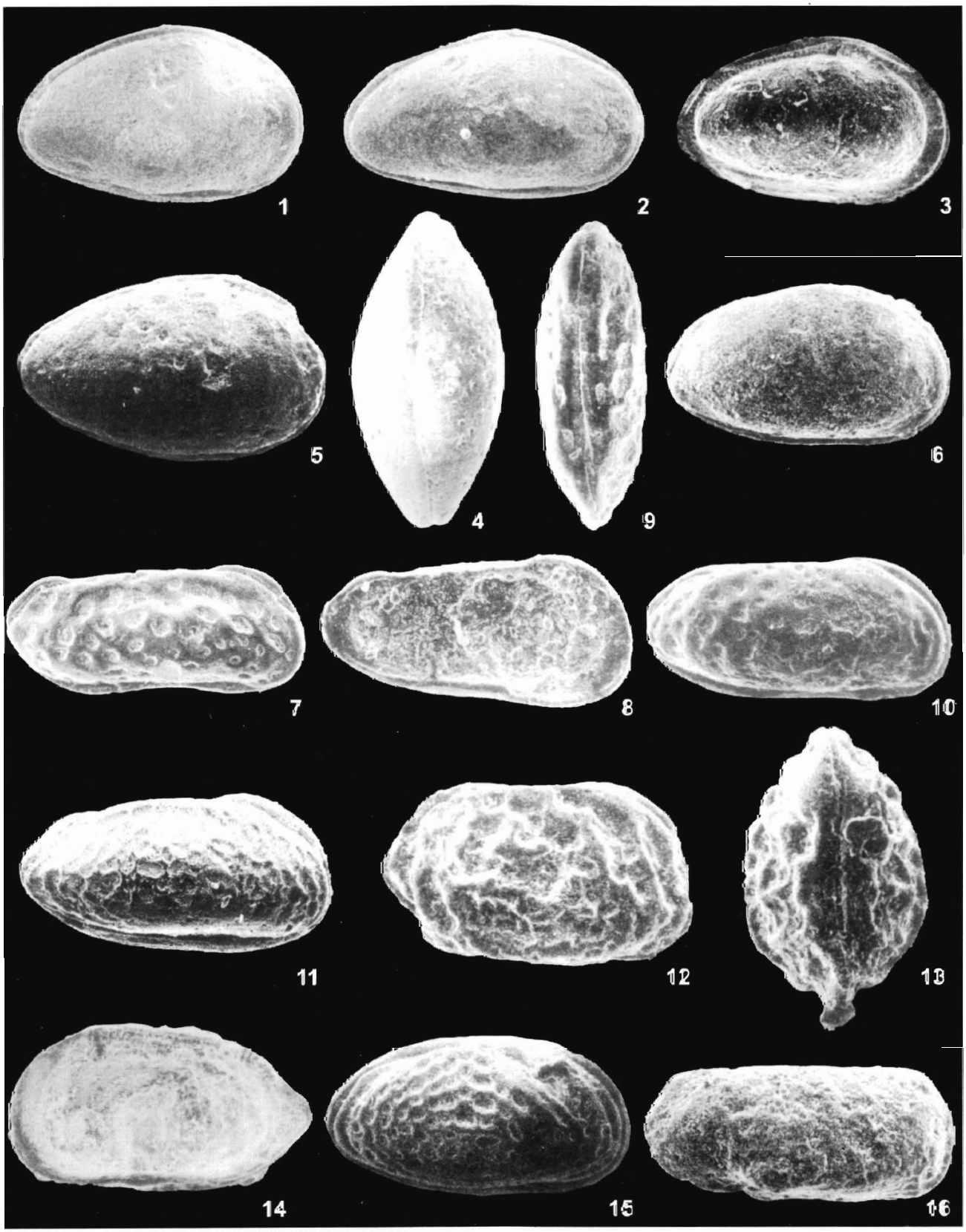
10. ***Glabellacythere mathuri*** (Khosla, Jakhar and Mohammed)
A carapace (SUGDMF No. 764), right valve view, x 74.

11. ***Glabellacythere*** sp.
A carapace (SUGDMF No. 765), right valve view, x 116.

12-14. ***Morkhovenicythereis rectangularis*** n. sp.
12, holotype (SUGDMF No. 766), a carapace, right valve view, x 133;
13, paratype I (SUGDMF No. 767), a carapace, dorsal view, x 121;
14, paratype II (SUGDMF No. 768), right valve, internal view, x 130.

15. ***Procytheridea ihopyensis*** Grekoff
A male carapace (SUGDMF No. 769), right valve view, x 70.

16. ***Eucytherura*** sp.
A carapace (SUGDMF No. 770), right valve view, x 142.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posterior halves; valve surface nearly smooth. It resembles *Eucytherura chapmani* Kaye, 1964, from the Early Cretaceous (Aptian) of Littleton Lane Quarry, Surrey, England and *Eucytherura nuda* Kaye, 1964, from the Early Cretaceous of North Yorkshire, England in overall lateral outline but differs in having smooth valve surface. In contrast to this, *E. chapmani* has elongate nodular process in posterodorsal region, three tubercles in lower half of the anterior margin, an inflated ventral rib parallel to the margin, and finely pitted lateral surface, while *E. nuda* has delicately reticulate, finely pitted surface and ventral swelling.

Dimensions: A carapace (SUGDMF No. 770), length 0.41 mm, height 0.19 mm, width 0.18 mm.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections V and VIII.

Subfamily **Cytheropterinae** Hanai, 1957

Genus ***Citrella*** Oertli, 1959

Citrella belaensis Khosla, Manisha Kumari and Darwin Felix, n. sp.

(Pl. III, figs. 1-3)

Material: 18 carapaces and 11 valves.

Etymology: After Bela Island.

Diagnosis: A small, smooth species of *Citrella* with subovate outline in lateral view and biconvex in the dorsal; ventral margin sinuate; posterior margin broad, with a caudal process.

Holotype: Pl. III, fig. 1.

Description: Carapace subovate in lateral outline, with greatest height 2/3 of length slightly posterior to middle. Left valve larger than right valve, distinctly overlapping along dorsal, anteroventral and posteroventral margins. Dorsal margin convex; ventral margin sinuate, concave anteriorly and convex posteriorly; anterior margin evenly rounded; posterior margin broad, drawn out in a short caudal process at mid height; in dorsal view carapace biconvex, with maximum width slightly posterior to middle. Valve surface smooth. Inner lamella moderately wide; avestibulate; selvage peripheral; marginal pore canals simple and straight, about 7-8 along anterior margin, and 3-4 along posterior margin. Hinge adont, comprising an elongate groove in the left valve.

Dimensions: Holotype (SUGDMF No. 771), a female carapace, length 0.41 mm, height 0.28 mm, width 0.20 mm. Paratype I (SUGDMF No. 772), a female left valve, length 0.37 mm, height 0. 23 mm. Paratype II (SUGDMF No. 773), a female carapace, length 0.39 mm, height 0.26 mm, width 0.20 mm.

Remarks: *Citrella belaensis* Khosla *et al.*, n. sp. resembles *Citrella nitida* Oertli, 1959, from the Bathonian of Les Pichottes quarry, about 14.5 km east of Boulogne-sur-Mer, northwestern France in overall lateral outline and internal characters but differs in details of ventral outline and surface ornamentation. *C. nitida* has convex ventral outline and densely pitted valve surface. Besides *C. nitida* has comparatively more pointed posterior end.

Type Locality: Section V, north of Lodrani Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: *Corbula lyrata* bearing reddish-brown siltstone (Sample SV/7), Hadibhadang Shale Member (middle–late Bathonian), Khadir Formation.

Occurrence: *Trichordis hadibhadangensis-Progonocythere sadharaensis* Concurrent Range Subzone of Section I; *T. hadibhadangensis* Assemblage Zone and Gadhada Sandstone Member of Section II; *Cytheropteron micropunctata* Assemblage Zone and *Progonocythere laeviscula* Assemblage Zone of Section V; and *Fastigatocythere mouwanaensis* Assemblage Zone of Sections VI and IX.

Genus ***Cytheropteron*** Sars, 1866

Cytheropteron devai (Khosla, Jakhar and Mohammed, 1997)

(Pl. III, fig. 4)

Cytheropterina devai Khosla, Jakhar and Mohammed, 1997, pp. 32-34, pl. 7, figs. 7-9. –Khosla and Jakhar, 1999, p. 45, pl. 3, fig. 5.

Material: 29 carapaces and 136 valves.

Remarks: The species was previously described in the genus *Cytheropterina* by Khosla *et al.* (1997) from the Jurassic of Habo Dome but this is not a valid genus. On the basis of its overall resemblance with *Cytheropteron kutchensis* Neale and Singh, 1986, described here in this work, the species is transferred to the genus *Cytheropteron.*

Dimensions: A left valve (SUGDMF No. 774), length 0.46 mm, height 0.32 mm.

Cytheropteron kutchensis Neale and Singh, 1986

(Pl. III, fig. 5)

Cytheropteron kutchensis Neale and Singh, 1986, p. 359, pl. 3, fig. 9.

Material: 2 carapaces.

Dimensions (mm): A carapace (SUGDMF No. 775), length 0.51 mm, height 0.28 mm, width 0.34 mm.

Cytheropteron micropunctata Khosla, Darwin Felix and Manisha Kumari n. sp.

(Pl. III, figs. 6-9)

Material: 105 carapaces and 13 valves.

Etymology: From the Greek *micro*, meaning small + the Latin *punctus*, meaning many dots scattered over surface; with reference to densely pitted valve surface.

Diagnosis: A species of *Cytheropteron* inflated ventrally and produced in a moderate wing-like expansion; surface finely pitted and with 2-3 longitudinal ribs ventrally.

Holotype: Pl. III, fig. 6

Description: Sexual dimorphism distinct, males being more elongate, less high and wide than females. Carapace subtriangular in lateral outline, valves inflated ventrally and produced in a moderate wing-like expansion; greatest height at anterior 1/3 of length. Left valve slightly overlaps right valve along posterodorsal and anterodorsal margins. Dorsal margin asymmetrically arched; ventral margin concealed by ventrolateral inflation; anterior margin obliquely rounded; posterior margin narrowly drawn out below mid-height. Carapace biconvex in dorsal view, with maximum width near middle. Valve surface ornamented by fine pits arranged in rows and 2-3 longitudinal ribs under the ventral surface. Inner lamella moderately wide; avestibulate; selvage peripheral. Hinge antimerodont; in right valve it comprises an anterior element with 2 teeth followed by a long narrow locellate groove and a posterior element with 3 teeth; hinge complementary in left valve.

Dimensions: Holotype (SUGDMF No. 776), a female carapace, length 0.43 mm, height 0.25 mm, width 0.20 mm. Paratype I (SUGDMF No. 777), a female carapace, length 0.44 mm, height 0.25 mm, width 0.20 mm. Paratype II (SUGDMF No. 778), a male carapace, length 0.46 mm, height 0.24 mm, width 0.19 mm. Paratype III (SUGDMF No. 779), a female left valve, length 0.44 mm, height 0.22 mm.

Remarks: The present species resembles *Metacytheropteron ventrocostata* Neale and Singh (1985) from the Jurassic of well No. 2, Banni Rann in overall shape but differs in having finely pitted surface, which is comparatively smooth and has number of finely curved ribs in the latter species. According to Prof. Whatley (personal communication), this is much more inflated and dorsally convex than any known species of *Metacytheropteron* and it is more like the genus *Cytheropteron*.

Type Locality: Section III, Amrapar Village, Khadir Island, Rann of Kachchh, Gujarat.

Type Horizon: *Corbula lyrata* bearing shale (Sample KIII/4), Hadibhadang Shale Member (middle-late Bathonian), Khadir Formation.

Occurrence: *Cytheropteron micropunctata* Assemblage Zone of Sections II-III and V.

Cytheropteron pandeyi (Khosla, Jakhar and Mohammed, 1997)

(Pl. III, fig. 10)

Cytheropterina pandeyi Khosla, Jakhar and Mohammed, 1997, p. 34, pl. 7, figs. 10-12. –Khosla and Jakhar, 1999, p. 45, pl. 3, fig. 6.

Material: 38 carapaces and 12 valves.

Remarks: The species is transferred to the genus *Cytheropteron* on the basis of its overall resemblance with *Cytheropteron kutchensis* Neale and Singh, 1986, and *Cytheropteron devai* (Khosla, Jakhar and Mohammed, 1997) described here in this work.

Dimensions: A carapace (SUGDMF No. 780), length 0.43 mm, height 0.28 mm, width 0.26 mm.

Genus ***Paranotacythere*** Bassiouni, 1974

Paranotacythere sp.

(Pl. III, fig. 11)

Material: 4 carapaces and 1 valve.

Remarks: The species has the following characteristics: carapace subquadrate in lateral outline, with greatest height in anterior half; valve surface marked by a vertical sulcus extending down from mid-dorsal region, a vertical sinuate rib posterior to it, merging with a short horizontal rib in mid-ventral region, a tubercle in anteromedian region and prominent reticulation over rest of the area. It resembles *Paranotacythere diglypta diglypta* (Triebel, 1941) from the Early Cretaceous of North Yorkshire in lateral outline but differs in surface ornamentation. Unlike the present species, *P. diglypta diglypta* is ornamented by sharp, rib-like costae and rounded pits; distinct angulate dorsal rib rises above dorsal margin in posterior half; pits in the intercostal areas. The species is left in open nomenclature for want of more material. This is possibly the earliest record of the genus (Prof. Whatley, personal communication).

Dimensions: A carapace (SUGDMF No. 781), length 0.36 mm, height 0.22 mm, width 0.16 mm.

Occurrence: *Cytheropteron micropunctata* Assemblage Zone of Section III; and *Fastigatocythere mouwanaensis* Assemblage Zone of Section VI.

Family **Limnocytheridae** Klie, 1938

Subfamily **Timiriaseviinae** Mandelstam, 1960

Genus ***Timiriasevia*** Mandelstam, 1956

Timiriasevia khadirensis Khosla and Darwin Felix, n. sp.

(Pl. III, figs. 12-15)

Material: 2 carapaces and 11 valves.

Etymology: After the Khadir Island.

Diagnosis: A species of *Timiriasevia* characterized by

subtrapezoidal outline in lateral view and heart-shaped in the dorsal; valves inflated posteroventrally; surface ornamented by numerous fine ribs giving finger print-like impression.

Holotype: Pl. III, fig. 12.

Description: Carapace subtrapezoidal in lateral outline, with greatest height about 2/3 of length posterior to middle; valves inflated, overhanging along part of ventral and posterior margins; overlap indistinct. Dorsal margin asymmetrically arched sloping anteriorly; ventral margin concealed by surface inflation, otherwise straight; anterior margin narrow, evenly rounded; posterior margin much broader, nearly vertical and with a sinuosity in lower half. In dorsal view carapace heart-shaped, anterior end narrow, posterior end much broader and with a distinct groove, maximum width behind middle. Valve surface ornamented by numerous fine ribs (20-25), running parallel to margins, giving finger print-like impression; a distinct ventrolateral carina extending from the mid-anterior region to posteroventral margin present in some specimens. Inner lamella moderately wide anteriorly, narrow along ventral and posterior margins; avestibulate; selvage peripheral. Hinge lophodont, in left valve it comprises anterior and posterior sockets connected by a smooth median bar; hinge complementary in right valve.

Dimensions: Holotype (SUGDMF No. 782), a left valve, length 0.54 mm, height 0.35 mm. Paratype I (SUGDMF No.783), a right valve, length 0.60 mm, height 0.37 mm. Paratype II (SUGDMF No. 784), a left valve, length 0.48 mm, height 0.30 mm. Paratype III (SUGDMF No. 785), a carapace, length 0.56 mm, height 0.30 mm, width 0.48 mm.

Remarks: *Timiriasevia khadirensis* Khosla and Darwin Felix, n. sp. resembles *Timiriasevia mackerrowi* Bate 1965, from the Bathonian of Oxfordshire, England in overall shape and ornamentation. *T. mackerrowi,* however, clearly differs from the present species in being less high, having moderately arched dorsal margin and presence of tubercles in anterior and posterior regions.

Type Locality: Section II, Northern escarpment of Hadibhadang Hill, close to Khara Talao, Khadir Island, Rann of Kachchh, Gujarat.

Type Horizon: Greyish-yellow siltstone (Sample KII/1), Hadibhadang Shale Member (middle-late Bathonian), Khadir Formation.

Occurrence: *Trichordis hadibhadangensis* Assemblage Zone of Section II.

Family **Loxoconchidae** Sars, 1925

Subfamily **Mandelstaminae**, Whatley and Moguilevsky, 1998

Genus ***Mandelstamia*** Lyubimova, 1955

Mandelstamia biswasi Khosla, Manisha Kumari and Darwin Felix, n. sp.

(Pl. III, figs. 16-17)

Material: 55 carapaces.

Etymology: In honour of Dr. S. K. Biswas, Retired Director, Keshava Dev Malviya Institute of Petroleum Exploration, Oil and Natural Gas Commission, Dehradun.

Diagnosis: A species of *Mandelstamia* ornamented by a shallow, vertical depression and concentrically arranged pits, coarse in median region and fine towards the periphery.

Holotype: Pl. III, fig. 16.

Description: Carapace elongate-subovate in lateral outline,

EXPLANATION OF PLATE III

1-3. ***Citrella belaensis*** n. sp.
1, holotype (SUGDMF No. 771), a male carapace, right valve view, x 132;
2, paratype I (SUGDMF No. 772), a female left valve, internal view, x 157;
3, paratype II (SUGDMF No. 773), a female carapace, dorsal view, x 136.

4. ***Cytheropteron devai*** (Khosla, Jakhar and Mohammed)
A left valve (SUGDMF No. 774), lateral view, x 116.

5. **Cytheropteron *kutchensis*** Neale and Singh
A carapace (SUGDMF No. 775), right valve view, x 114.

6-9. ***Cytheropteron micropunctata*** n. sp.
6, holotype (SUGDMF No. 776), a female carapace, right valve view, x 137;
7, paratype I (SUGDMF No. 777), a female carapace, dorsal view, x 123.
8, paratype II (SUGDMF No. 778), a male carapace, right valve view, x 126;
9, paratype III (SUGDMF No. 779), a female left valve, internal view, x 132.

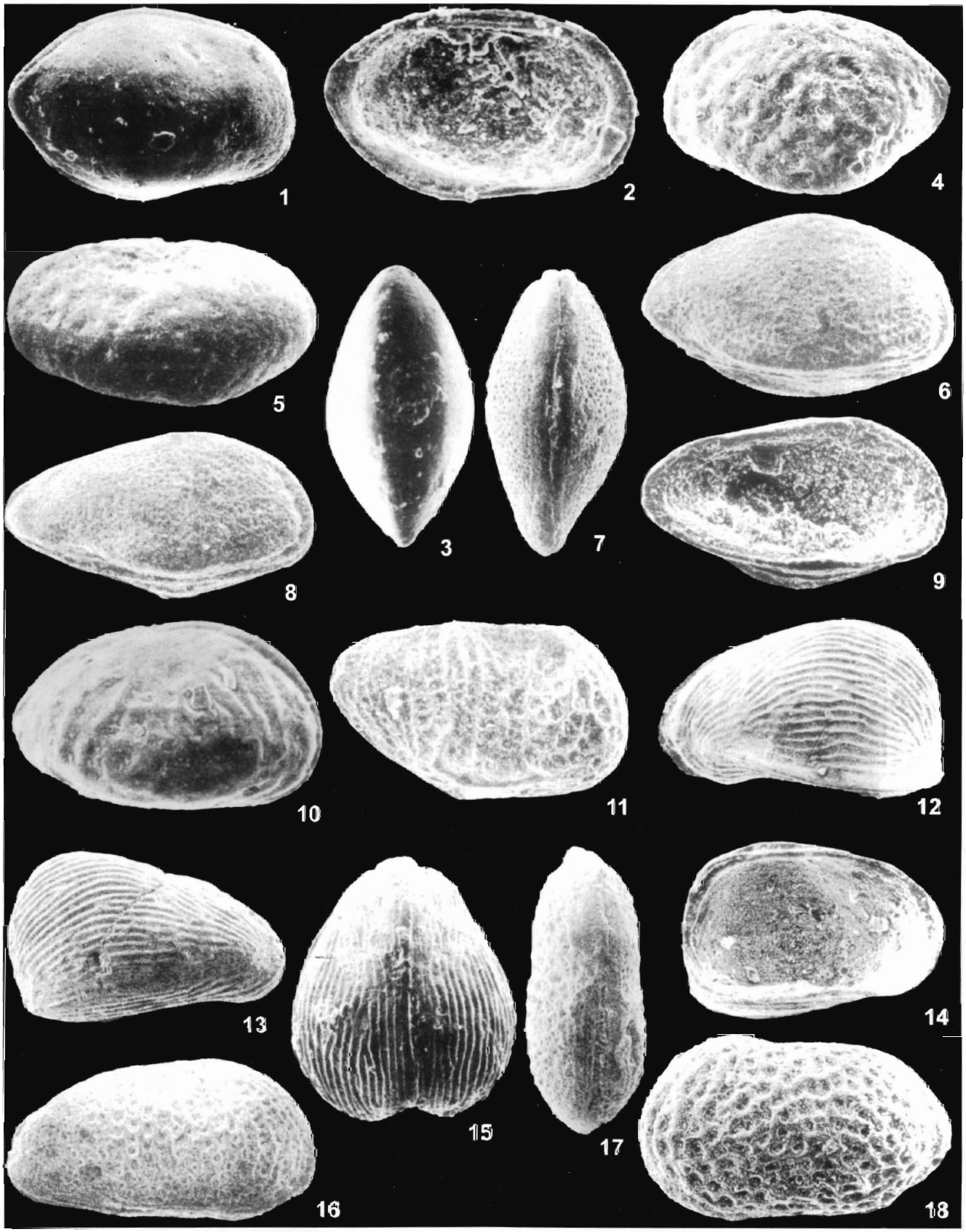
10. **Cytheropteron *pandeyi*** (Khosla, Jakhar and Mohammed)
A carapace (SUGDMF No. 780), right valve view, x 135.

11. ***Paranotacythere*** sp.
A carapace (SUGDMF No. 781), right valve view, x 156.

12-15. ***Timiriasevia khadirensis*** n. sp.
12, holotype (SUGDMF No. 782), a left valve, lateral view, x 102;
13, paratype I (SUGDMF No. 783), a right valve, lateral view, x 95;
14, paratype II (SUGDMF No. 784), a left valve, internal view, x 108;
15, paratype III (SUGDMF No. 785), a carapace, dorsal view, x 100.

16-17. ***Mandelstamia biswasi*** n. sp.
16, Holotype (SUGDMF No. 786), a carapace, right valve view, x 104;
17, paratype (SUGDMF No. 787), a carapace, dorsal view, x 113.

18. ***Mandelstamia depecheae*** Khosla, Jakhar and Mohammed
A left valve (SUGDMF No. 704), lateral view, x 99.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with greatest height at anterior 1/3rd of length. Left valve slightly overlaps right valve along ventral margin. Dorsal margin arched, sloping posteriorly; ventral margin almost straight; anterior margin broad and obliquely rounded; posterior margin sloping in upper half and narrowly rounded below mid-height in lower half. In dorsal view carapace biconvex, with median constriction; maximum width in posterior half. Valve surface ornamented by a shallow vertical depression extending down from mid-dorsal to ventromedian regions; and pits, coarse in median region and fine towards periphery, arranged somewhat in concentric pattern. Internal characters not known.

Dimensions: Holotype (SUGDMF No. 786), a carapace, length 0.56 mm, height 0.38 mm, width 0.32 mm. Paratype (SUGDMF No. 787), a carapace, length 0.48 mm, height 0.25 mm, width 0.19 mm.

Remarks: This species resembles *Mandelstamia grekoffi* Bate, 1975, from the Late Jurassic of Tanzania and *Mandelstamia kachchhensis* Khosla *et al.*, n. sp., described herein this work, in general appearance. However, unlike the present species, *M. grekoffi* has distinctly compressed posterior end, more elongate-subquadrate outline and medially concave ventral margin, while *M. kachchhensis* has straight dorsal margin, evenly rounded posterior margin and comparatively finer pits on the valve surface.

Type Locality: Section V, north of Lodrani Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: *Corbula lyrata* bearing reddish-brown siltstone (Sample SV/7), Hadibhadang Shale Member (middle–late Bathonian), Khadir Formation.

Occurrence: *Cytheropteron micropunctata* Assemblage Zone of Section III and V; and *Trichordis hadibhadangensis-Progonocythere sadharaensis* Concurrent Range Subzone of Section I.

Mandelstamia depecheae Khosla, Jakhar and Mohammed, 1997

(Pl. III, fig. 18)

Mandelstamia sp. Dépêche, in Dépêche *et al.*, 1987, p. 237, pl. 6, fig. 7.

Mandelstamia depecheae Khosla, Jakhar and Mohammed, 1997, pp. 30–32, pl. 5, figs. 8–10. – Khosla and Jakhar 1999, p. 45, pl. 2, fig. 6.

Material: 4 carapaces and 37 valves.

Dimensions: A left valve (No. SUGDMF 704), length 0.59 mm, height 0.30 mm.

Mandelstamia kachchhensis Khosla, Manisha Kumari and Darwin Felix, n. sp.

(Pl. IV, figs. 1-2)

Material: 46 carapaces.

Etymology: After the district of Kachchh.

Diagnosis: A species of *Mandelstamia* characterized by subrectangular outlie in lateral view and biconvex with a shallow median constriction in the dorsal; ventral margin medially concave; surface ornamented by concentrically arranged pits.

Holotype: Pl. IV, fig. 1.

Description: Carapace subrectangular in lateral outline, height almost equal in anterior and posterior halves. Overlap indistinct. Dorsal margin nearly straight; ventral margin medially concave; anterior margin broadly rounded; posterior margin sloping in upper part and rounded in the lower. In dorsal view carapace biconvex with a shallow median constriction; maximum width in posterior half. Valve surface ornamented by pits, arranged somewhat in concentric pattern, coarse in median region and fine towards periphery. Internal characters not known.

Dimensions: Holotype (SUGDMF No. 788), a carapace, length 0.57 mm, height 0.27 mm, width 0.20 mm. Paratype (SUGDMF No. 789), a carapace, length 0.60 mm, height 0.28 mm, width 0.22 mm.

Remarks: The species described herein resembles *Mandelstamia biswasi* Khosla *et al.*, n. sp. in ornamentation pattern and outline in dorsal view, but differs in having subrectangular lateral outline, which is subovate in the latter species. *Mandelstamia grekoffi* Bate, 1975, differs from the present species in having distinctly compressed posterior end in dorsal view and valve surface ornamented by dense pits of uniform size.

Type Locality: Section V, north of Lodrani Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: *Corbula lyrata* bearing reddish-brown siltstone (Sample SV /7), Hadibhadang Shale Member (middle–late Bathonian), Khadir Formation.

Occurrence: *Cytheropteron micropunctata* Assemblage Zone of Sections II-III and V.

Family **Progonocytheridae** Sylvester-Bradley, 1948

Taxonomic Comments: Whatley and Ballent (1996 and 2004) in two separate papers reviewed the status of 28 progonocytherid ostracod genera related to *Progonocythere* Sylvester-Bradley, 1948 and *Lophocythere* Sylvester-Bradley, 1948. They considered only 13 of these genera as valid and rejected/suppressed the remaining 15, including *Amicytheridea* Bate, 1975, *Dhrumaella* Dépêche, (in Dépêche *et al.*, 1987), *Nophrecythere* Gründel, 1975, and *Trichordis* (*Paratrichordis*) Khosla and Jakhar, 1993 occurring in the Jurassic of Kachchh. The first two genera were regarded as junior synonyms of *Fastigatocythere* Wienholz, 1967, the third

genus a junior synonym of *Neurocythere* Whatley, 1970, while the subgenus *Trichordis* (*Paratrichordis*) was suppressed.

According to Whatley and Ballent (1996), the lobodont hinge of *Amicytheridea* (Bate 1975, p. 193, fig. 11a-c) can be seen to be also entomodont and the difference between the two hinge types is only a matter of degree; in the lobodont (inadvertently misspelt as lophodont) hinge, the denticles on the anteromedian element of the left valve are more distally expanded than in an entomodont hinge. They did not regard this as a generic character. In their opinion, "*Amicytheridea* is synonymous with *Fastigatocythere* Wienholz, mainly because of its subtriangular shape, dorso-lateral inverted chevron ornament, ventro-lateral ribs parallel to ventral margin, and clear eye tubercle and post-ocular sulcus". Further on similar grounds Prof. Whatley (personal communication) has intimated to the first author (SCK) that the genera *Batella* Khosla, Jakhar and Mohammed, 1997, *Habocythere* Khosla, Jakhar and Mohammed, 1997 and *Jainiana* Mannikeri, 1996 also occurring in the Jurassic of Kachchh and Jaisalmer too are junior synonyms of *Fastigatocythere*. According to Prof. Whatley these genera together with *Amicytheridea* and *Dhrumaella* will not figure in the revised Treatise on Invertebrate Paleontology, Part Q, Ostracoda, of which he is both coordinating and principal author. In the present work we have followed the above cited views, and besides others, transferred the species earlier described under the genera *Amicytheridea*, *Batella* and *Habocythere* by Khosla and Jakhar (1993) and Khosla *et al.* (1997) from the Habo Dome to *Fatigatocythere*.

Genus ***Progonocythere*** Sylvester-Bradley, 1948

Progonocythere jaisalmerensis Khosla, Jakhar, Nagori and Darwin Felix, 2003c

(Pl. IV, figs. 3-4)

Progonocythere jaisalmerensis Khosla, Jakhar, Nagori and Darwin Felix, 2003c, p. 173, pl. 1, figs. 7-8; fig. 3c.

Material: 98 carapaces.

Dimensions: A female carapace (SUGDMF No. 790), length 0.53 mm, height 0.35 mm, width 0.32 mm. A female carapace (SUGDMF No. 791), length 0.51 mm, height 0.33 mm, width 0.29 mm.

Progonocythere laeviscula Lyubimova and Mohan, 1960

(Pl. IV, fig. 5)

Progonocythere laeviscula Lyubimova and Mohan, in Lyubimova *et al.*, 1960, pp. 47-48, pl. 4, fig.5. – Grekoff, 1963, pp. 1739–1740, pl. 4, figs. 98–104; pl. 8, figs. 224–226. – Guha, 1977, p. 88, pl. 2, figs. 11, 14 a-b. – Kulshreshtha *et al.*, 1985, p. 127, figs. 7.15-7.17. – Neale and Singh, 1986, p. 363. – Dépêche, in Dépêche *et al.*, 1987, p. 229, pl. 6, figs. 9-12. – Khosla *et al.*, 1997, pp. 22–24, pl. 5, figs. 14–16. – Khosla and Jakhar, 1999, p. 45, pl. 2, fig. 7. - Khosla *et al.*, 2003c, p. 168, pl. 1, figs. 1-2; fig. 3a.

Material: 204 carapaces and 369 valves.

Dimensions: A female carapace (SUGDMF No. 698), length 0.67 mm, height 0.44 mm, width 0.36 mm.

Progonocythere sadharaensis Khosla, Jakhar, Nagori and Darwin Felix 2003c

(Pl. IV, fig. 6-7)

Progonocythere sadharaensis Khosla, Jakhar, Nagori and Darwin Felix, 2003c, pp. 168-173, pl. figs. 3-6; fig. 3b.

Material: 99 carapaces and 230 valves.

Dimensions: Paratype II (SUGDMF No. 736), a female carapace, length 0.72 mm, height 0.48 mm, width 0.43 mm.

Genus ***Fastigatocythere*** Wienholz, 1967

Fastigatocythere befotakaensis (Grekoff, 1963)

(Pl. IV, fig. 8; fig. 6a)

Progonocythere befotakaensis Grekoff, 1963, p. 1733, pl. 3, figs. 77–80; pl. 8, figs. 215, 217. – Guha, 1977, p. 88, pl. 2, figs. 12a, b, 13.

Fastigatocythere befotakaensis (Grekoff). – Wienholz, 1967, p. 25. – Mannikeri, 1981, in Bhatia, 1984, p. 3. - Whatley and Ballent, 1996, p. 933.

Batella befotakaensis (Grekoff). – Khosla *et al.*, 1997, pp. 12–14, pl. 2, figs. 10–13. – Khosla and Jakhar, 1999, p. 45, pl. 1, fig. 8.

Material: 30 carapaces and 52 valves.

Remarks: *Fastigatocythere befotakaensis* although shows entomodont hinge, has merely two denticles in the anteromedian element in left valve (fig. 6e), which were adequately illustrated by Grekoff (1963, pl. 8, figs. 215, 217) and also observed in our material. This type of hinge structure is also present in other species – *F. clavata* and *F. depressa* - earlier described in the genus *Batella* by Khosla *et al.* (1997). As against this according to Whatley and Ballent (1996) themselves the entomodont hinge, *sensu stricto*, is characterized by the presence of 4-5 denticles in anteromedian element. Besides *F. befotakaensis* has 17-20 marginal pore canals anteriorly, which are restricted to 7-8 in the Europen species of the genus *Fastigatocythere*.

Dimensions: A male carapace (SUGDMF No. 792), length 0.66 mm, height 0.36 mm, width 0.33 mm.

Fastigatocythere belaensis Khosla and Manisha Kumari, n. sp.

(Pl. IV, figs. 9-11)

Material: 58 valves.

Etymology: After the Bela Island.

Diagnosis: A medium species of *Fastigatocythere* characterized by its ornament of a prominent hook-shaped depression in dorsomedian and posteromedian regions, with 2–3 distinct peripheral ribs arranged in triangular pattern and coarse intercostal reticulation.

Holotype: Pl. IV, fig. 9.

Description: Valve subtriangular in lateral outline, with greatest height at anterior cardinal angle. In left valve dorsal margin convex, sloping posteriorly; ventral margin obscured by ventrolateral inflation; anterior margin broad and evenly rounded; posterior margin narrowly rounded; in right valve dorsal margin straight, sloping posteriorly; anterior margin obliquely rounded; posterior margin concave in upper part and rounded in lower part. Valve surface marked by a prominent hook-shaped depression in dorsomedian and posteromedian regions; an anterodorsal furrow; a marginal rib in front of it, extending down from the ocular region; 2–3 distinct peripheral ribs arranged in triangular pattern, in upper half diverging downwardly from mid-dorsal region, in lower half parallel to ventral outline; and coarse reticulation between the peripheral ribs. Inner lamella moderately wide; avestibulate; selvage peripheral; marginal pore canals simple and straight, 19 along anterior margin, 5 along posterior margin. Hinge entomodont; in right valve it comprises an anterior element with 4-5 teeth, a postadjacent loculate socket, followed by a narrow locellate groove and a posterior element with 6 teeth; hinge complementary in left valve.

Dimensions: Holotype (SUGDMF No. 793), a right valve, length 0.51 mm, height 0.32 mm. Paratype I (SUGDMF No. 794), a right valve, length 0.52 mm, height 0.34 mm. Paratype II (SUGDMF No. 795), a left valve, length 0.54 mm, height 0.37 mm.

Remarks: *Fastigatocythere belaensis* Khosla and Manisha Kumari, n. sp. resembles *Fastigatocythere depressa* (Khosla *et al.*, 1997), from the Jurassic of the Habo Dome, Kachchh in lateral outline and ornamentation, but differs in the pattern of prominent surface depression. *F. depressa* has a subcircular depression in the dorsomedian region, while the present species has a hook-shaped depression in the median and posteromedian regions. *Fastigatocythere befotakaensis* (Grekoff, 1963) and *Fastigatocythere clavata* (Khosla *et al.*, 1997), described in this work, also differ from *F. belaensis* n. sp. in details of surface ornamentation. *F. befotakaensis* has a crescent-shaped depression in the dorsomedian region, while *F. clavata* has a club-shaped depression in the dorsomedian and median regions.

Type Locality: Section V, north of Lodrani Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Yellowish-brown siltstone with interbedded shale (Sample BV/22), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections V, VII and IX.

Fastigatocythere bicruciata (Grekoff, 1963)

(Pl. IV, fig. 12)

Progonocythere bicruciata Grekoff 1963, pp.1733-34, pl. 3, figs. 69-76; pl.8, figs. 218-221.

Fastigatocythere bicruciata (Grekoff). – Weinholz 1967, p. 25. - Whatley and Ballent, 1996, p. 933.

Habocythere bicruciata (Grekoff). – Khosla *et al.*, 1997, p. 16, pl. 3, figs. 11-14.

Material: 538 carapaces and 55 valves.

Remarks: In *Fastigatocythere bicruciata* and other related species earlier described in the genus *Habocythere* by Khosla *et al.* (1997) the valve surface is marked by two vertical sulci in anterodorsal and dorsomedian regions; 2-3 small v-shaped ribs in posterior half, apices directed backwardly and with reticulation over the rest of area. The marginal pore canals are 7-8 anteriorly.

Dimensions: A female carapace (SUGDMF No. 690), length 0.61mm, height 0.38 mm, width 0.33 mm.

EXPLANATION OF PLATE IV

1-2. ***Mandelstamia kachchhensis*** n. sp.
1, holotype (SUGDMF No. 788), a carapace, right valve view, x 100;
2, paratype (SUGDMF No. 789), a carapace, dorsal view, x 92.

3-4. ***Progonocythere jaisalmerensis*** Khosla, Jakhar, Nagori and Darwin Felix
3, a female carapace (SUGDMF No. 790), right valve view, x 110;
4, a female carapace (SUGDMF No. 791), dorsal view, x 87.

5. ***Progonocythere laeviscula*** Lyubimova and Mohan
A female carapace (SUGDMF No. 698), right valve view, x 82.

6-7. ***Progonocythere sadharaensis*** Khosla, Jakhar, Nagori and Darwin Felix
Paratype II (SUGDMF No. 736), a female carapace; 6, right valve view, x 69; 7, dorsal view, x 69.

8. ***Fastigatocythere befotakaensis*** (Grekoff)
A male carapace (SUGDMF No. 792), right valve view, x 85.

9-11. ***Fastigatocythere belaensis*** n. sp.
9, holotype (SUGDMF No. 793), a right valve, lateral view, x 112;
10, paratype I (SUGDMF No. 794), a right valve, internal view, x 108;
11, paratype II (SUGDMF No. 795), a left valve, dorsal view, x 109.

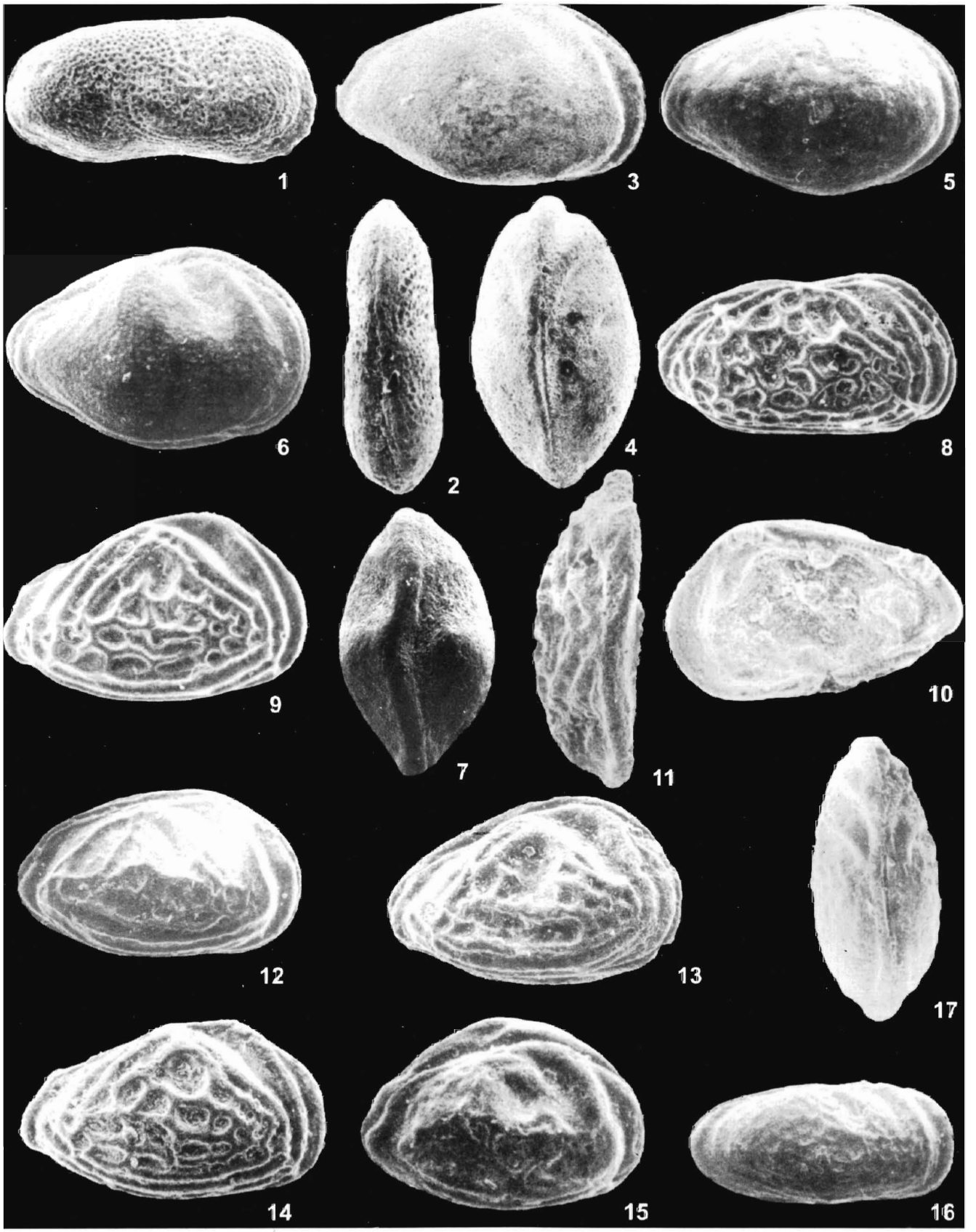
12. ***Fastigatocythere bicruciata*** (Grekoff)
A female carapace (SUGDMF No. 690), right valve view, x 95.

13. ***Fastigatocythere clavata*** (Khosla, Jakhar and Mohammed)
A female carapace (SUGDMF No. 688), right valve view, x 97.

14. ***Fastigatocythere depressa*** (Khosla, Jakhar and Mohammed)
A right valve (SUGDMF No. 689), lateral view, x 100.

15. ***Fastigatocythere dorsoangulata*** (Grekoff)
A carapace (SUGDMF No. 796), right valve view, x 120.

16-17. ***Fastigatocythere elongata*** n. sp.
Holotype (SUGDMF No. 797), a carapace; 16, right valve view, x 81; 17, dorsal view, x 86.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Fastigatocythere clavata (Khosla, Jakhar and Mohammed, 1997)

(Pl. IV, fig. 13)

Batella clavata Khosla, Jakhar and Mohammed, 1997, p. 14, pl. 2, figs. 14–16; pl. 3, fig. 1. – Khosla and Jakhar, 1999, p. 45, pl. 1, fig. 10.

Material: 42 carapaces and 65 valves.

Dimensions: A carapace (SUGDMF No. 688), length 0.56 mm, height 0.37 mm, width 0.36 mm.

Fastigatocythere depressa (Khosla, Jakhar and Mohammed, 1997)

(Pl. IV, fig. 14)

Batella depressa Khosla, Jakhar and Mohammed, 1997, pp. 14–15, pl. 3, figs. 2-6. – Khosla and Jakhar, 1999, p. 45, pl. 1, fig. 9.

Material: 70 carapaces and 63 valves.

Dimensions: A right valve (SUGDMF No. 689), length 0.57 mm, height 0.36 mm.

Fastigatocythere dorsoangulata (Grekoff, 1963)

(Pl. IV, fig. 15)

Procytheridea dorsoangulata Grekoff, 1963, pp. 1746-47, pl. 5, figs. 146-151, pl. 10, fig. 238.

Material: 526 carapaces and 19 valves.

Remarks: The species was originally described as *Procytheridea dorsoangulata* by Grekoff (1963) from the Jurassic of Majunga Basin, Madagaskar and the present specimens are identical with the types. On the basis of surface ornamentaion and entomodont hinge, it is herein transferred to the genus *Fastigatocythere*.

Dimensions: A carapace (SUGDMF No. 796), length 0.41 mm, height 0.30 mm, width 0.29 mm.

Fastigatocythere elongata Khosla and Manisha Kumari, n. sp.

(Pl. IV, figs. 16-17)

Material: 75 carapaces.

Etymology: From the Latin word *elongatus,* meaning lengthened; with reference to its comparatively elongate carapace.

Diagnosis: A species of *Fastigatocythere* characterized by its elongate-subrectangular shape in lateral outline, with greatest height about half the length at middle and surface marked by two narrow transverse sulci in anterior half.

Holotype: Pl. IV, figs. 16-17.

Description: Carapace elongate-subrectangular in lateral outline, with greatest height about half the length at middle. Except for anterior margin, left valve slightly overlaps right valve all along margin. Dorsal and ventral margins nearly straight; anterior margin broad and evenly rounded; posterior margin narrowly rounded. In dorsal view carapace biconvex, with maximum width in posterior half. Valve surface marked by two narrow transverse sulci in anterior half extending down from dorsal margin to mid-height; 2-3 longitudinal ribs in ventral half; rest of area faintly reticulate.

Dimensions: Holotype (SUGDMF No. 797), a carapace, length 0.62 mm, height 0.29 mm, width 0.28 mm.

Remarks: *Fastigatocythere elongata* Khosla and Manisha Kumari, n. sp. resembles previously known species of the genus *Fastigatocythere* in surface ornamentation but differs in having elongate-subrectangular lateral outline and 2.1 length / height ratio. Majority of the other species of the genus have subpyriform to subtriangular lateral outline and 1.3-1.7 length / height ratio.

Type Locality: Section IX, north of Mouwana Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Fossiliferous yellowish-brown siltstone with interbedded shale (Sample BIX/16), Gadhada Sandstone Member (Callovian), Khadir Formation.

Occurrence: *Fastigatocythere mouwanaensis* Assemblage Zone of Sections VI and IX.

Fastigatocythere flebilis Khosla and Darwin Felix, n. sp.

(Pl. V, figs. 1-3; fig. 6b)

Material: 29 carapaces and 69 valves.

Etymology: From Latin *flebilis*, meaning weak or faint; with reference to faint surface ornamentation.

Diagnosis: A species of *Fastigatocythere* characterized by subovate carapace in lateral outline, inflated ventrally; surface ornamented by faint ribs arranged in triangular pattern with apices towards dorsal margin.

Holotype: Pl. V, fig. 1.

Description: Sexual dimorphism distinct, males being more elongate, less high and wide than females. Carapace subovate in lateral outline, inflated ventrally; greatest height near middle. Left valve larger than right valve and except for ventral part overlapping around entire margin. Dorsal margin arched in left valve and straight, sloping posteriorly in right valve; ventral margin obscured by ventrolateral inflation; anterior margin broad and obliquely rounded; posterior margin narrowly rounded. Carapace biconvex in dorsal view, with maximum width posterior to middle. Valve surface ornamented by an oblique anterodorsal furrow and faint ribs arranged in triangular pattern with apices towards dorsal margin; ribs in ventral half parallel to ventral outline. Inner lamella moderately wide;

avestibulate; selvage distinct, peripheral; marginal pore canals simple straight, 7-8 along anterior margin; 3-4 along posterior margin. Hinge in right valve consists of an anterior element with five projecting teeth, a postadjacent deep loculate socket followed by a narrow locellate groove and a posterior element with 6 projecting teeth; hinge complementary in left valve, the anteromedian element faintly bilobate distally and the furrow between the lobes not extending to its base.

Dimensions: Holotype (SUGDMF No. 798), a carapace, length 0.67 mm, height 0.34 mm, width 0.43 mm. Paratype I (SUGDMF No. 799), a left valve, length 0.62 mm, height 0.38 mm. Paratype II (No. 800), a right valve, length 0.57 mm, height 0.35 mm.

Remarks: *Fastigatocythere flebilis* Khosla and Darwin Felix, n. sp. resembles *Fastigatocythere triangulata* (Bate, 1975) from the middle Callovian of Tanzania, in overall shape, ornamentation pattern and marginal pore canals. *F. triangulata*, however, differs from the present species in its subtriangular lateral outline, distinct triangularly arranged ribs and intercostal reticulation.

Type Locality: Section II, Northern escarpment of Hadibhadang Hill, close to Khara Talao, Khadir Island, Rann of Kachchh, Gujarat, India.

Type Horizon: Greyish-yellow siltstone (Sample KII/1), Hadibhadang Shale Member (middle-late Bathonian), Khadir Formation.

Occurrence: *Trichordis hadibhadangensis* Assemblage Zone of Section I-II and Gadhada Sandstone Member of Section II.

Fastigatocythere indica Khosla and Manisha Kumari, n. sp.

(Pl. V, figs. 4-6; fig. 6c)

Material: 29 carapaces and 110 valves.

Etymology: After the country of India.

Diagnosis: A large species of *Fastigatocythere* characterized by its ornament of 3-4 irregular / sinuous ribs forming triangular pattern.

Holotype: Pl. V, fig. 4.

Description: Sexual dimorphism distinct, males being more elongate, less high and wide than females. Carapace elongate-subquadrate in lateral outline, with greatest height at anterior 1/3 of length. Left valve larger than right valve and except for mid-ventral region, overlapping all along margin. Dorsal margin weakly arched; ventral margin partly obscured by ventrolateral inflation, otherwise straight; anterior margin broad and evenly rounded; posterior margin obtusely rounded. Carapace tumid in dorsal view; maximum width in posterior half. Valve surface ornamented by 3-4 irregular / sinuous ribs, in upper half diverging downwards from mid-dorsal region, while in lower half nearly parallel to ventral outline forming triangular pattern. Inner lamella moderately wide; avestibulate; selvage peripheral; normal pores few, widely scattered on whole surface; marginal pore canals simple and straight, 6-8 anteriorly, 4–5 posteriorly. Hinge in right valve consists of an anterior element with 5 teeth, a postadjacent socket, followed by a narrow locellate groove and a posterior element with 4 teeth; hinge complementary in left valve, anteromedian element comprising a single tooth with a slight lobation confined to its distal periphery.

Dimensions: Holotype (SUGDMF No. 801), a male carapace, length 0.72 mm, height 0.39 mm, width 0.40 mm. Paratype I (SUGDMF No. 802), a female carapace, length 0.68 mm, height 0.40 mm, width 0.42 mm. Paratype II (SUGDMF No. 803), a female left valve, length 0.67 mm, height 0.40 mm.

Remarks: The present species from the Bela Island resembles *Fastigatocythere aardaensis* (Basha, 1980) from the Jurassic of Jordan in overall lateral outline and ornamentation. The latter species, however, differs in having uniformly parallel ribs arranged in triangular pattern and a prominent longitudinal median rib.

Type Locality: Section V, north of Lodrani Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Yellowish-brown siltstone with interbedded shale (Sample BV/22), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections V and VII.

Fastigatocythere jakhari Khosla, Darwin Felix and Manisha Kumari, n. sp.

(Pl. V, figs. 7-8)

Habocythere sp. Khosla, Jakhar and Mohammed, 1997, p. 18, pl. 4, fig. 10.

Material: 5 carapaces and 43 valves.

Etymology: The species is named in honour of Dr. S. R. Jakhar, Assistant Professor, Department of Geology, Mohanlal Sukhadia University, Udaipur.

Diagnosis: A medium species of *Fastigatocythere* characterized by elongate-subtriangular outline in lateral view; posterior margin drawn out below mid-height; surface marked by two elongate vertical sulci.

Holotype: Pl. V, fig. 7.

Description: Valve elongate-subtriangular in lateral outline, with greatest height at anterior cardinal angle. Dorsal margin straight, sloping backwardly; ventral margin obscured by ventrolateral inflation, otherwise straight; anterior margin broad and evenly rounded; posterior margin narrowly rounded,

drawn out below mid-height. Valve surface marked by two elongate vertical sulci in anterodorsal and dorsomedian regions; 2-3 oblique ribs in posterior half extending downward from mid-dorsal region; an indistinct longitudinal depression in ventromedian region; and sparse pits over rest of the area. Inner lamella moderately wide; avestibulate; marginal pore canals simple, straight, 7-8 along anterior margin, and 3-4 along posterior margin. Hinge entomodont.

Dimensions: Holotype (SUGDMF No. 694), a left valve, length 0.54 mm, height 0.32 mm. Paratype (SUGDMF No. 804), a carapace, length 0.44 mm, height 0.24 mm, width 0.20.

Remarks: This species has earlier been described as *Habocythere* sp. from the Jurassic of the Habo Dome by Khosla *et al.* (1997). It resembles *Fastigatocythere ventrisulcata* (Khosla *et al.*), recorded here in this work, in general appearance, but clearly differs in having subtriangular outline, narrowly drawn out posterior end and elongate dorsomedian sulcus. *F. ventrisulcata*, unlike the present species, has comparatively short dorsomedian sulcus and subpyriform lateral outline.

Type Locality: Section II, near Bambhanka Village, Khadir Island, Rann of Kachchh, Gujarat.

Type Horizon: Calcareous sandstone (Sample KII/48), Bambhanka Member (middle-late Callovian), Khadir Formation.

Occurrence: Fastigatocythere mouwanaensis Assemblage Zone of Section IX; and *Majungaella perforata kachchhensis-Galliaecytheridea remota* Concurrent Range Zone of Section II.

Fastigatocythere juglandica malgachica (Grekoff, 1963)

(Pl. V, fig. 9)

Progonocythere juglandica malgachica Grekoff, 1963, pp. 1731-32, pl.3, figs. 56-62; pl. 8, fig. 216.

Fastigatocythere juglandica malgachica (Grekoff) – Wienholz, 1967, p. 25. - Whatley and Ballent, 1996, p. 933.

Habocythere malgachica (Grekoff). – Khosla *et al.*, 1997, p. 18, pl. 4, figs. 2-6.

Material: 257 carapaces and 11 valves.

Remarks: The species was originally described as *Progonocythere juglandica malgachica* by Grekoff (1963) from the Jurassic of the Majunga Basin, Madagascar and subsequently transferred to the genus *Fastigatocythere* by Weinholz (1967). Khosla *et al.* (1997), who recorded the species from the Jurassic of the Habo Dome transferred it to the genus *Habocythere*. They also assigned an independent status to the species, however Whatley and Ballent, 1996 upholding the original designation recorded it as *Fastigatocythere juglandica malgachica* (Grekoff).

Dimensions: A female carapace (SUGDMF No. 692), length 0.41 mm, height 0.28 mm, width 0.24 mm.

Fastigatocythere kachchhensis Khosla and Darwin Felix, n. sp.

(Pl. V, figs. 10-11)

Material: 12 carapaces and 2 valves.

Etymology: After the district of Kachchh.

Diagnosis: A medium species of *Fastigatocythere* characterized by its ornament of distinct, thick ribs arranged in triangular pattern; intercostal area with few reticulae.

Holotype: Pl. V, fig. 10.

Description: Carapace similar to *Fastigatocythere flebilis* n. sp. in outline. Valve surface ornamented by an oblique anterodorsal furrow and distinct, thick ribs arranged in triangular pattern with apices towards dorsal margin, three inclined ribs each on anterior and posterior regions in upper half, and 4-5 ribs parallel to ventral outline in lower half; intercostal area with few reticulae. Internal charaters not known.

EXPLANATION OF PLATE V

1-3. ***Fastigatocythere flebilis*** n. sp.
1, holotype (SUGDMF No. 798), a carapace, right valve view, x 84;
2, paratype I (SUGDMF No. 799), a left valve, dorsal view, x 92;
3, paratype II (SUGDMF No. 800), a right valve, internal view, x 105.

4-6. ***Fastigatocythere indica*** n. sp.
4, holotype (SUGDMF No. 801), a male carapace, right valve view, x 78;
5, paratype I (SUGDMF No. 802), a female carapace, right valve view, x 88;
6, paratype II (SUGDMF No. 803), a female left valve, dorsal view, x 85.

7-8. ***Fastigatocythere jakhari*** n. sp.
7, holotype (SUGDMF No. 694), a left valve, lateral view, x 106;
8, paratype (SUGDMF No. 804), a carapace, dorsal view, x 118.

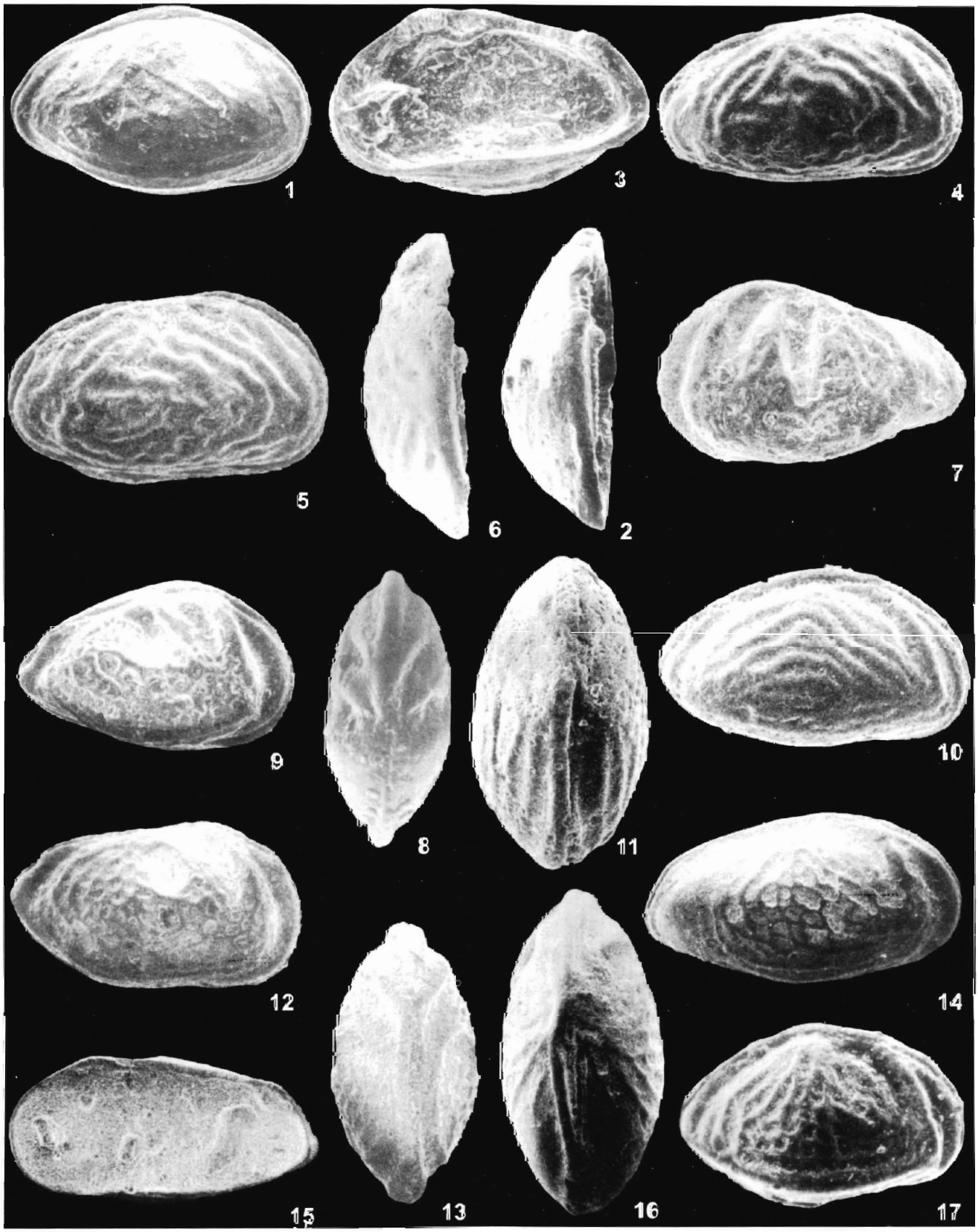
9. ***Fastigatocythere juglandica malgachica*** (Grekoff)
A female carapace (SUGDMF No. 692), right valve view, x 125.

10-11. ***Fastigatocythere kachchhensis*** n. sp.
10, holotype (SUGDMF No. 805), a female carapace, right valve view, x 102;
11, paratype (SUGDMF No. 806), a female carapace, dorsal view, x 114.

12-13. ***Fastigatocythere mouwanaensis*** n. sp.
12, holotype (SUGDMF No. 807), a carapace, right valve view, x 97;
13, paratype (SUGDMF No. 808), a carapace, dorsal view, x 93.

14-16. ***Fastigatocythere? pachchhamensis*** n. sp.
14, holotype (SUGDMF No. 809), a carapace, right valve view, x 57;
15, paratype I (SUGDMF No. 810), a right valve, internal view, x 54;
16, paratype II (SUGDMF No. 811), a carapace, dorsal view, x 61.

17. ***Fastigatocythere retusa*** (Grekoff)
A female carapace (SUGDMF No. 812), right valve view, x 80.



KHOSLA *ET AL.*

Dimensions: Holotype (SUGDMF No. 805), a female carapace, length 0.56 mm, height 0.32 mm, width 0.30 mm. Paratype (SUGDMF No. 806), a female carapace, length 0.51 mm, height 0.30 mm, width 0.30.

Remarks: The present species closely resembles *Fastigatocythere flebilis* Khosla and Darwin Felix, n. sp., described in this work, in general appearance but clearly differs in having distinct, thick, surface ribs and less ventrolateral inflation. As against these, *F. flebilis* is more inflated ventrally and has faint surface ribs.

Type Locality: Section III, Amrapar Village, northeastern part of Khadir Island, Rann of Kachchh, Gujarat.

Type Horizon: Fossiliferous Shale (Sample KIII/3), Hadibhadang Shale Member (middle-late Bathonian), Khadir Formation.

Occurrence: *Cytheropteron micropunctata* Assemblage Zone of Section III and Gadhada Sandstone Member of Section II.

Fastigatocythere mouwanaensis Khosla and Manisha Kumari, n. sp.

(Pl. V, figs. 12-13)

Material: 166 carapaces.

Etymology: After village of Mouwana, Bela Island.

Diagnosis: A medium species of *Fastigatocythere* characterized by subrhomboidal lateral outline; valve surface marked by two vertical sulci in anterodorsal and dorsomedian regions.

Holotype: Pl. V, fig. 12.

Description: Carapace subrhomboidal in lateral outline, with greatest height at anterior 1/3 of length. Left valve slightly larger than right valve, except posteroventral part overlapping all along margin. Dorsal margin nearly straight; ventral margin sinuate; anterior margin broad and evenly rounded; posterior margin subangulate, concave in upper half and truncated in lower half. In dorsal view carapace biconvex, ends compressed; maximum width slightly posterior to middle. Valve surface marked by two vertical sulci in anterodorsal and dorsomedian regions; 3-4 weak longitudinal ribs in ventral half parallel to the margin; rest of area faintly reticulate. Internal characters not known.

Dimensions: Holotype (SUGDMF No. 807), a carapace, length 0.56 mm, height 0.32 mm, width 0.31 mm. Paratype (SUGDMF No. 808), a carapace, length 0.56 mm, height 0.33 mm, width 0.30 mm.

Remarks: *Fastigatocythere mouwanaensis* n. sp. resembles *Fastigatocythere diluta* (Khosla *et al.*, 1997), from the Jurassic of the Habo Dome in overall lateral outline but differs in having 3-4 weak longitudinal ribs in ventral half. *H. diluta*, as against this, has nearly smooth ventrolateral region. *Fastigatocythere bicruciata* (Grekoff) also differs from the present species in having prominent reticulation, presence of 2-3 weak v-shaped ribs in posterior half with apices backwardly directed.

Type Locality: Section IX, north of Mouwana Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Fossiliferous yellowish-brown siltstone with interbedded shale (Sample BIX/16), Gadhada Sandstone Member (Callovian), Khadir Formation.

Occurrence: *Fastigatocythere mouwanaensis* Assemblage Zone of Sections VI and IX.

Fastigatocythere? *pachchhamensis* Khosla and Darwin Felix, n. sp.

(Pl. V, figs. 14-16)

Material: 6 carapaces and 3 valves.

Etymology: After the Island of Pachchham.

Diagnosis: A very large, questionable species of *Fastigatocythere* characterized by ornament of fine ribs arranged in triangular pattern; intercostal area reticulated giving net-like appearance; hinge and inner lamella poorly developed.

Holotype: Pl. V, fig. 14.

Description: Carapace very large, subovate in lateral outline and biconvex in the dorsal; greatest height at anterior 1/3 of length. Left valve larger than right valve and except for ventral region overlapping all along margin. Dorsal margin straight, sloping posteriorly; ventral margin obscured by ventrolateral inflation; anterior margin broadly rounded; posterior margin sloping in upper part and narrowly rounded in the lower. Valve surface ornamented by an oblique anterodorsal furrow and fine ribs arranged in triangular pattern with apices towards dorsal margin; intercostal area reticulated giving net-like appearance. Inner lamella narrow; avestibulate. Hinge in right valve consists of an anterior element with 5 large teeth, a postadjacent locellate groove followed by a posterior element with 6 teeth; hinge complementary in left valve.

Dimensions: Holotype (SUGDMF No. 809), a carapace, length 1.02 mm, height 0.56 mm, width 0.52 mm. Paratype I (SUGDMF No. 810), a right valve, length 1.07 mm, height 0.56 mm. Paratype II (SUGDMF No. 811), a carapace, length 1.00 mm, height 0.56 mm, width 0.50 mm.

Remarks: The species is questionably assigned to the

genus *Fastigatocythere* as hinge structure and inner lamella are poorly developed, otherwise it closely resembles *Fastigatocythere kachchhensis* Khosla and Darwin Felix, n. sp. and *Fastigatocythere triangulata* (Bate) in overall shape and surface ornamentation.

Type Locality: Section IV, Sadhara Dome, Pachchham Island, Gujarat.

Type Horizon: Coral bearing greyish-white limestone (Sample SI/2), Sadhara Coral Limestone Member (Bajocian-Bathonian), Khavda Formation.

Occurrence: *Trichordis hadibhadangensis-Progonocythere sadharaensis* Concurrent Range Subzone of Section I.

Fastigatocythere retusa (Grekoff, 1963)

(Pl. V, fig. 17)

Progonocythere retusa Grekoff, 1963, p. 1737, pl. 3, figs. 81-87; pl. 8, figs. 222, 223.

Jainiana retusa (Grekoff). – Mannikeri, 1996, pp. 400-401, pl. 1, figs. 5a-c; pl. 2, figs. 2a-f.

Material: 13 carapaces.

Dimensions: A carapace (SUGDMF No. 812), length 0.66 mm, height 0.40 mm, width 0.41 mm.

Fastigatocythere triangulata (Bate, 1975)

(Pl. VI, fig. 1, fig. 6d)

Procytheridea? 3330 Grekoff, 1963, p. 1749, pl. 6, figs. 173-175.

Amicytheridea triangulata Bate, 1975, pp. 192-193, pl. 7, figs. 14–16, text-figs. 11a-c. – Khosla and Jakhar, 1993, pp. 143-145, figs. 4.1-5. – Khosla *et al.*, 1997, p. 13, pl. 2, figs. 6-7. – Khosla and Jakhar, 1999, p. 45, pl. 1, fig. 6.

Amicytheridea triangula Bate. – Dépêche *et al.*, 1987, p. 232, pl. 2, figs. 13-17.

Fastigatocythere triangulata (Bate). - Whatley and Ballent, 1996, p. 933, pl. 1, figs. 18-20.

Material: 38 carapaces and 1 open valve.

Dimensions: A carapace (SUGDMF No. 686), length 0.60 mm, height 0.35 mm, width 0.33 mm.

Fastigatocythere ventrisulcata Khosla, Jakhar and Mohammed, 1997

(Pl. VI, fig. 2)

Habocythere ventrisulcata Khosla, Jakhar and Mohammed, 1997, p. 18, pl. 4, figs. 7-9.

Material: 196 carapaces and 17 valves.

Dimensions: A left valve (SUGDMF No. 693), length 0.53 mm, height 0.36 mm.

Genus ***Lophocythere*** Sylvester-Bradley, 1948

Lophocythere vertipolycostata Khosla and Manisha Kumari, 2003a

(Pl. VI, fig. 3)

Lophocythere vertipolycostata Khosla and Manisha Kumari, in Khosla *et al.*, 2003a, pp. 72-73, pl.3, figs.1-8; figs. 3A-B.

Material: 25 carapaces and 7 valves from Khadir and Bela islands; 12 carapaces from Jaisalmer.

Dimensions: A carapace (SUGDMF No. 708), length 0.67 mm, height 0.35 mm, width 0.26 mm.

Genus ***Majungaella*** Grekoff, 1963

Majungaella perforata kachchhensis Khosla, Jakhar and Mohammed, 1997

(Pl. VI, fig. 4)

Majungaella perforata kachchhensis Khosla, Jakhar and Mohammed, 1997, p. 19, pl. 4, figs. 12-14. – Khosla and Jakhar, 1999, p. 45, pl. 2, fig. 2.

Material: 248 carapaces and 27 valves.

Dimensions: A carapace (SUGDMF No. 695) length 0.49 mm, height 0.35 mm, width 0.28 mm.

Majungaella rasilis Khosla, Jakhar and Mohammed, 1997

(Pl. VI, fig. 5)

Majungaella rasilis Khosla, Jakhar and Mohammed, 1997, p. 20, pl. 4, figs. 15-17.

Material: 30 carapaces and 69 valves.

Dimensions: A carapace (SUGDMF No. 696), length 0.52 mm, height 0.38 mm, width 0.28 mm.

Genus ***Neurocythere*** Whatley, 1970

Neurocythere? *kachchhensis* Khosla and Manisha Kumari, n. sp.

(Pl. VI, figs. 6-7)

Material: 65 carapaces.

Etymology: After the district of Kachchh.

Diagnosis: A medium questionable species of *Neurocythere* characterized by ornament of network type longitudinally arranged reticulation and a distinct oblique anterodorsal rib.

Holotype: Pl. VI, fig. 6.

Description: Dimorphism distinct, males being more elongate, less high and wide than females. Carapace elongate-subquadrate in lateral outline, with greatest height at anterior cardinal angle. Left valve larger than right valve, overlapping distinctly along anterodorsal, anterior and posterodorsal margins. Dorsal margin straight, sloping down posteriorly, anterior and posterior cardinal angles distinct; ventral margin nearly straight; anterior margin broad and obliquely rounded; posterior margin in left valve moderately rounded, while in

right valve concave in upper part and narrowly rounded in lower part. In dorsal view carapace biconvex, with maximum width slightly posterior to middle. Valve surface ornamented by prominent network type longitudinally arranged reticulation; a distinct oblique anterodorsal rib extending from mid-dorsal region to anteroventral region. Internal characters not known.

Dimensions: Holotype (SUGDMF No. 813), a male carapace, length 0.48 mm, height 0.24 mm, width 0.20 mm. Paratype (SUGDMF No. 814), a female carapace, length 0.47 mm, height 0.28 mm, width 0.21 mm.

Remarks: The species described above closely resembles *Neurocythere whatleyi* (Khosla and Jakhar) from the Jurassic of the Habo Dome in lateral outline and overall reticulation pattern but differs in absence of longitudinal ribs, present in the latter species.

Type Locality: Section VII, 1 km northwest of Bela Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Pale-yellow siltstone (Sample BVII/5), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections V and VII.

Neurocythere whatleyi (Khosla and Jakhar, 1997)
(Pl. VI, fig. 8)

Lophocythere 323b Grekoff, 1963, p. 1730, pl. 2, fig. 48.

Nophrecythere whatleyi Khosla and Jakhar, in Khosla *et al.*, 1997, pp. 20–22, pl. 5, figs. 6–7. – Khosla and Jakhar, 1999, p. 45, pl. 2, fig. 5.

Material: 41 carapaces.

Dimensions: A female carapace (SUGDMF No. 815), length 0.37 mm, height 0.23 mm, width 0.22 mm.

Genus ***Trichordis*** Grekoff, 1963

Trichordis amraparensis Khosla and Darwin Felix, n. sp.
(Pl. VI, figs. 9-10)

Material: 37 carapaces and 3 valves.

Etymology: After Amrapar Village, Khadir Island.

Diagnosis: A medium, elongate-subquadrate species of *Trichordis* ornamented by three longitudinal ribs running nearly parallel for greater part of length and a curved anteromarginal rib.

Holotype: Pl. VI, fig. 9.

Description: Sexual dimorphism distinct, males being more elongate, less high and wide than females. Carapace elongate-subquadrate in lateral outline, with greatest height at anterior cardinal angle. Left valve larger than right valve, overlapping along anterior and posterior margins. Dorsal and ventral margins straight, nearly parallel; anterior margin broadly rounded; posterior less so, about 3/5 of anterior margin. Carapace biconvex in dorsal view, with maximum width slightly posterior to middle. Valve surface ornamented by curved anteromarginal rib; three longitudinal ribs, dorsal, median and ventral, running nearly parallel for greater part of length, anteriorly all joining with marginal rib, while posteriorly dorsal and ventral ribs converging to meet in posteromedian region, median rib remaining distinctly separate; rest of area faintly reticulated or smooth. Inner lamella moderately wide; marginal pore canals simple, straight and widely spaced; 12-14 anteriorly and 3-4 posteriorly. Hinge entomodont; in right valve it consists of an anterior element with 5 large teeth, a postadjacent anteromedian socket with 4 loculi followed by a narrow, finely locellate groove and a posterior element with 6 large teeth; hinge complementary in left valve.

Dimensions: Holotype (SUGDMF No. 816), a carapace, length 0.65 mm, height 0.40 mm, width 0.32 mm. Paratype (SUGDMF No. 817), a carapace, length 0.64 mm, height 0.38 mm, width 0.30 mm.

Remarks: This species resembles *Trichordis hadibhadangensis* Khosla *et al.*, n. sp. and *T. jaisalmerensis* (Kulshreshtha *et al.*, 1985) in overall shape and surface rib pattern. *T. amraparensis*, however, is easily differentiated from them by its smaller size, having straight, nearly parallel dorsal and ventral margins and the longitudinal ribs, smooth or faintly reticulate surface and lack of anterodorsal furrow. In contrast to these characters, *T. jaisalmerensis* is larger in size and very prominently reticulate, while *T. hadibhadangensis* has strongly convex dorsal rib and moderately reticulate valve surface.

Type Locality: Section III, Amrapar Village, Khadir Island, Rann of Kachchh, Gujarat.

Type Horizon: *Corbula lyrata* bearing Shale (Sample KIII/4), Hadibhadang Shale Member (middle-late Bathonian), Khadir Formation.

Occurrence: *Cytheropteron micropunctata* Assemblage Zone of Section III.

Trichordis devexa (Grekoff, 1963)
(Pl. VI, fig. 11)

Lophocythere devexa Grekoff, 1963, pp. 1729-30, pl. 2, figs. 49-52.

Trichordis devexa (Grekoff). – Khosla and Jakhar, 1993, pp. 149, figs. 5.1-5. – Khosla *et al.*, 1997, pl. 6, fig. 8. – Khosla and Jakhar, 1999, p. 45, pl. 3, fig. 2.

Material: 39 carapaces and 12 valves.

Dimensions: A carapace (SUGDMF No. 699), length 0.54 mm, height 0.33 mm, width 0.27 mm.

Trichordis grumosa (Lyubimova and Mohan, 1960)

(Pl. VI, fig. 12)

Progonocythere grumosa Lyubimova and Mohan, in Lyubimova *et al.*, 1960, pp. 46-47, pl. 4, fig. 4.

Trichordis grumosa (Lyubimova and Mohan). – Khosla and Jakhar, 1993, pp. 149-150, figs. 3B, 5.6-8, 6.1-3. – Khosla *et al.*, 1997, pl. 6, figs. 9-10. – Khosla and Jakhar, 1999, p. 45, pl. 3, fig. 3.

Material: 65 carapaces and 42 valves.

Dimensions: A female carapace (SUGDMF No. 818), length 0.58 mm, height 0.33 mm, width 0.28 mm.

Trichordis gujaratensis Khosla, Jakhar and Mohammed, 1997

(Pl. VI, fig. 13)

Trichordis (Trichordis) gujaratensis Khosla, Jakhar and Mohammed, 1997, pp. 24–26, pl. 6, figs. 3-5. – Khosla and Jakhar, 1999, p. 45, pl. 2, fig. 8.

Material: 111 carapaces and 221 valves.

Dimensions: A female carapace (SUGDMF No. 819), length 0.73 mm, height 0.40 mm, width 0.39 mm.

Trichordis hadibhadangensis Khosla, Darwin Felix and Manisha Kumari, n. sp.

(Pl. VI, figs. 14-17)

Material: 7 carapaces and 34 valves.

Etymology: After the Hadibhadang Shale Member, Khadir Formation.

Diagnosis: A large species of *Trichordis* ornamented by three longitudinal ribs of which dorsal one strongly convex, overhanging margin; an anterior marginal rib; an anterodorsal furrow and faint reticulation over the rest of area.

Holotype: Pl. VI, fig. 14.

Description: Sexual dimorphism distinct, males being more elongate, less high and wide than females. Carapace elongate-subquadrate in lateral outline, with greatest height at anterior cardinal angle. Left valve larger than right valve, overlapping more prominently along anterodorsal and posterodorsal margins. Dorsal margin medially concealed by overhanging rib, otherwise straight, sloping posteriorly; ventral margin straight, turn upward at posterior 1/4 of length; anterior margin broadly rounded; posterior margin less so, about 3/5 of anterior margin. Carapace biconvex in dorsal view, with maximum width slightly posterior to middle. Surface of each valve ornamented by three longitudinal ribs, an anterior marginal rib, an anterodorsal furrow and faint reticulation over rest of area. Of the longitudinal ribs, dorsal rib strongly convex, overhangs a part of margin, in posterior half it turns downwardly and joins median and ventral ribs in posteromedian region; median and ventral ribs straight, nearly parallel for greater part of their length, both meeting with anteromarginal rib in mid-anterior and anteroventral regions. Inner lamella moderately wide; avestibulate; selvage distinct; marginal pore canals simple, straight and widely spaced; 7-8 along anterior margin, and 3-4 along posterior margin. Hinge entomodont.

Dimensions: Holotype (SUGDMF No. 820), a female carapace, length 0.78 mm, height 0.49 mm, width 0.33 mm. Paratype I (SUGDMF No. 821), a male carapace, length 0.81 mm, height 0.48 mm, width 0.41 mm. Paratype II (SUGDMF No. 822), a female left valve, length 0.75 mm, height 0.49 mm.

Remarks: *Trichordis hadibhadangensis* Khosla *et al.*, n. sp. closely resembles *T. jaisalmerensis* (Kulshreshtha *et al.*) originally described from the Jurassic of Jaisalmer in overall shape and surface rib pattern. The latter species, however, differs in having distinctly elongate-subtriangular lateral outline, posterior margin very narrowly rounded and prominent reticulation in between ribs, instead of faint one as present in *T. hadibhadangensis*.

Type Locality: Section II, Northern escarpment of Hadibhadang Hill, close to Khara Talao, Khadir Island, Rann of Kachchh, Gujarat.

Type Horizon: Greyish-yellow siltstone (Sample KII/1), Hadibhadang Shale Member (middle-late Bathonian), Khadir Formation.

Occurrence: *Trichordis hadibhadangensis* Assemblage Zone of Sections I-II and V; and *Cytheropteron micropunctata* Assemblage Zone of Section II.

Trichordis jaisalmerensis (Kulshreshtha, Singh and Tewari, 1985)

(Pl. VII, fig. 1)

Lophocythere jaisalmerensis Kulshreshtha, Singh and Tewari, 1985, pp. 140–142, figs. 3.7, 3.10–3.12.

Nophrecythere jaisalmerensis (Kulshreshtha *et al.*). – Khosla *et al.*, 1997, p. 20, pl. 5, figs. 3–5. – Khosla and Jakhar, 1999, p. 45, pl. 2, fig. 4.

Material: 25 carapaces and 14 valves.

Remarks: The species was originally described as *Lophocythere jaisalmerensis* by Kulshreshtha *et al.* (1985) from the Jurassic of Jaisalmer and later on transferred to the genus *Nophrecythere* by Khosla *et al.* (1997), who recorded it from the Habo Dome, Kachchh. As stated earlier the genus *Nophrecythere* is junior synonym of *Neurocythere*, which is characterized by the presence of four horizontal ribs. The present species, however, has three ribs, because of which, it is herein transferred to the genus *Trichordis*. The species also occurs in the Jurassic of the Jumara Dome (Khosla and Jakhar, 1999).

Dimensions: A male carapace (SUGDMF No. 823), length 0.80 mm, height 0.36 mm, width 0.33 mm.

Family **Protocytheridae** Lyubimova, 1955

Genus ***Mandawacythere*** Bate, 1975

Mandawacythere kachchhensis Khosla, Manisha Kumari and Darwin Felix, n. sp.

(Pl. VII, figs. 2-3)

Material: 9 carapaces.

Etymology: After the district of Kachchh.

Diagnosis: A species of *Mandawacythere* characterized by elongate-subrectangular outline in lateral view and strongly compressed at posterior 1/4th of length in the dorsal; surface ornamented by 7–8 longitudinal ribs; intercostal area feebly reticulate.

Holotype: Pl. VII, fig. 2.

Description: Carapace elongate-subrectangular in lateral outline, with greatest height at about anterior 1/4th of length. Left valve slightly larger than right valve, overlapping along anterodorsal, anteroventral and posterior margins. Dorsal and ventral margins slightly concave medially, otherwise straight and subparallel; anterior margin evenly rounded; posterior margin subangulate. In dorsal view carapace with posterior 1/4th of length strongly compressed, otherwise sides gently converging anteriorly; maximum width posterior to middle. Valve surface ornamented by 7–8 longitudinal ribs; first and second ribs from top curved, extending from mid-dorsal to mid-anterior region; third and fourth ribs subparallel, running from posterodorsal region to mid-anterior region; fifth, sixth and seventh ribs run parallel to ventral outline from posterior to anterior margin merging with upper ribs; interarea between ribs feebly reticulate. Internal characters not known.

Dimensions: Holotype (SUGDMF No. 824), a carapace, length 0.51 mm, height 0.20 mm, width 0.16 mm. Paratype (SUGDMF No. 825), a carapace, length 0.50 mm, height 0.20 mm, width 0.16 mm.

Remarks: The species resembles *Mandawacythere multicostata* Khosla *et al.*, n. sp., described herein, in overall lateral outline and surface rib pattern but differs in dorsal outline, overlap and length / height ratio. *M. multicostata* has biconvex dorsal outline, pronounced overlap along anteroventral, ventral and posteroventral margins, and 2.0 length / height ratio, while the present species has posterior 1/4 of length compressed, sides gently converging anteriorly in dorsal outline, indistinct overlap, and 2.6 length / height ratio. *Mandawacythere striata* Bate, 1975, also differs from the present species in having 10 longitudinal ribs and biconvex dorsal outline.

Type Locality: Section VII, 1 km northwest of Bela Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Brownish-yellow siltstone with shell fragments (Sample SVII/12), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections V and VII-IX.

Mandawacythere multicostata Khosla and Manisha Kumari, n. sp.

(Pl. VII, figs. 4-6)

Material: 19 carapaces and 1 valve.

Etymology: From the Latin *multus* meaning many + *costa* meaning a rib; with reference to valve surface rib pattern.

Diagnosis: A species of *Mandawacythere* characterized by biconvex outline in dorsal view; surface ornamented by 7 subparallel longitudinal ribs extending over whole surface.

EXPLANATION OF PLATE VI

1. ***Fastigatocythere triangulata*** (Bate)
   A carapace (SUGDMF No. 686), right valve view, x 97.
2. ***Fastigatocythere ventrisulcata*** (Khosla, Jakhar and Mohammed)
   A left valve (SUGDMF No. 693), lateral view, x 95.
3. ***Lophocythere vertipolycostata*** Khosla and Manisha Kumari
   A carapace (SUGDMF No. 708), right valve view, x 82.
4. ***Majungaella perforata kachchhensis*** Khosla, Jakhar and Mohammed
   A female carapace (SUGDMF No. 695), right valve view, x 110.
5. ***Majungaella rasilis*** Khosla, Jakhar and Mohammed
   A carapace (SUGDMF No. 696), right valve view, x 98.

6-7. ***Neurocythere kachchhensis*** n. sp.
   6, holotype (SUGDMF No. 813), a male carapace, right valve view, x 119;
   7, paratype (SUGDMF No. 814), a female carapace, dorsal view, x 115.

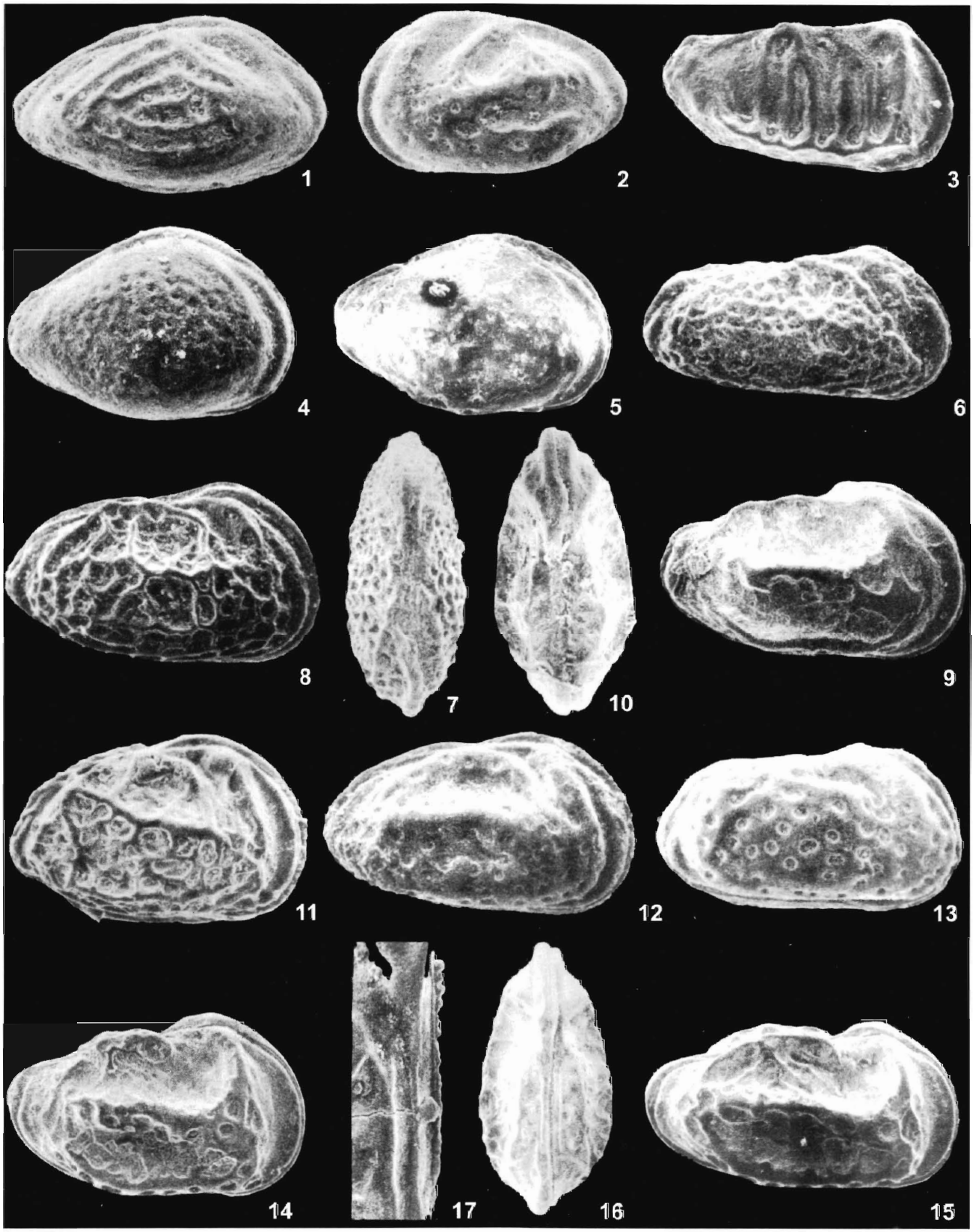
8. ***Neurocythere whatleyi*** (Khosla and Jakhar)
   A female carapace (SUGDMF No. 815), right valve view, x 157.

9-10. ***Trichordis amraparensis*** n. sp.
   9, holotype (SUGDMF No. 816), a female carapace, right valve view, x 86;
   10, paratype (SUGDMF No. 817), a female carapace, dorsal view, x 86.

11. ***Trichordis devexa*** (Grekoff)
   A carapace (SUGDMF No. 699), right valve view, x 102.
12. ***Trichordis grumosa*** (Lyubimova and Mohan)
   A carapace (SUGDMF No. 818), right valve view, x 100.
13. ***Trichordis gujaratensis*** Khosla, Jakhar and Mohammed
   A female carapace (SUGDMF No. 819), right valve view x 78.

14-17. ***Trichordis hadibhadangensis*** n. sp.
   14, holotype (SUGDMF No. 820), a female carapace, right valve view, x 71;
   15 and 16, paratype I (SUGDMF No. 821), a male carapace; 15, right valve view, x 64; 16, dorsal view, x 72;
   17, paratype II (SUGDMF No. 822), a female left valve, median hinge element enlarged, x 186.

Plate VI



Holotype: Pl. VII, figs.4, 5.

Description: Carapace elongate-subquadrate in lateral outline, with greatest height at anterior 1/4th of length. Left valve slightly larger than right valve, overlapping distinctly along anterodorsal, ventral and posterior margins. Dorsal and ventral margins straight, slightly converging backwardly; anterior margin evenly rounded; posterior margin subangulate near mid-height. In dorsal view carapace biconvex, with maximum width slightly posterior to middle. Valve surface ornamented by 7 subparallel longitudinal ribs; four ribs in upper half curved dorsally; three ribs in lower half parallel to ventral outline; second rib from top bifurcates at anterodorsal region; all ribs extending over whole surface and converging anteriorly; interspaces between ribs indistinctly pitted. Inner lamella moderately wide; selvage peripheral; avestibulate. Hinge antimerodont; in right valve comprising an anterior element with 5 teeth, followed by a locellate groove and a posterior element with 6 teeth; hinge complementary in left valve.

Dimensions: Holotype (SUGDMF No. 826), a carapace, length 0.54 mm, height 0.26 mm, width 0.23 mm. Paratype (SUGDMF No. 827), a right valve, length 0.55 mm, height 0.28 mm.

Remarks: This species resembles *Mandawacythere striata* Bate, 1975, from the middle or late Kimmeridgian beds of the Mandawa River, Tanzania in overall shape and surface rib pattern, but differs in having seven longitudinal ribs instead of ten present in the latter species. Besides, *M. striata* has punctate interspaces between ribs and smaller size.

Type Locality: Section VIII, northern escarpment of Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Highly fossiliferous brown siltstone (Sample SVIII/9), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections V and VII-IX.

Subfamily **Kirtonellinae** Bate, 1963

Genus ***Pseudoperissocytheridea*** Mandelstam, 1960

Pseudoperissocytheridea concentrica Khosla, Manisha Kumari and Darwin Felix, n. sp.

(Pl. VII, figs. 7-8)

Mandelstamia sp. Khosla, Jakhar and Mohammed, 1997, p. 32, pl. 5, figs. 11–12.

Material: 11 valves.

Etymology: From the Latin *con* meaning together + the Latin *centrum* meaning centre; with reference to concentric rib pattern.

Diagnosis: A species of *Pseudoperissocytheridea* characterized by ornament of 7-8 concentrically arranged ribs

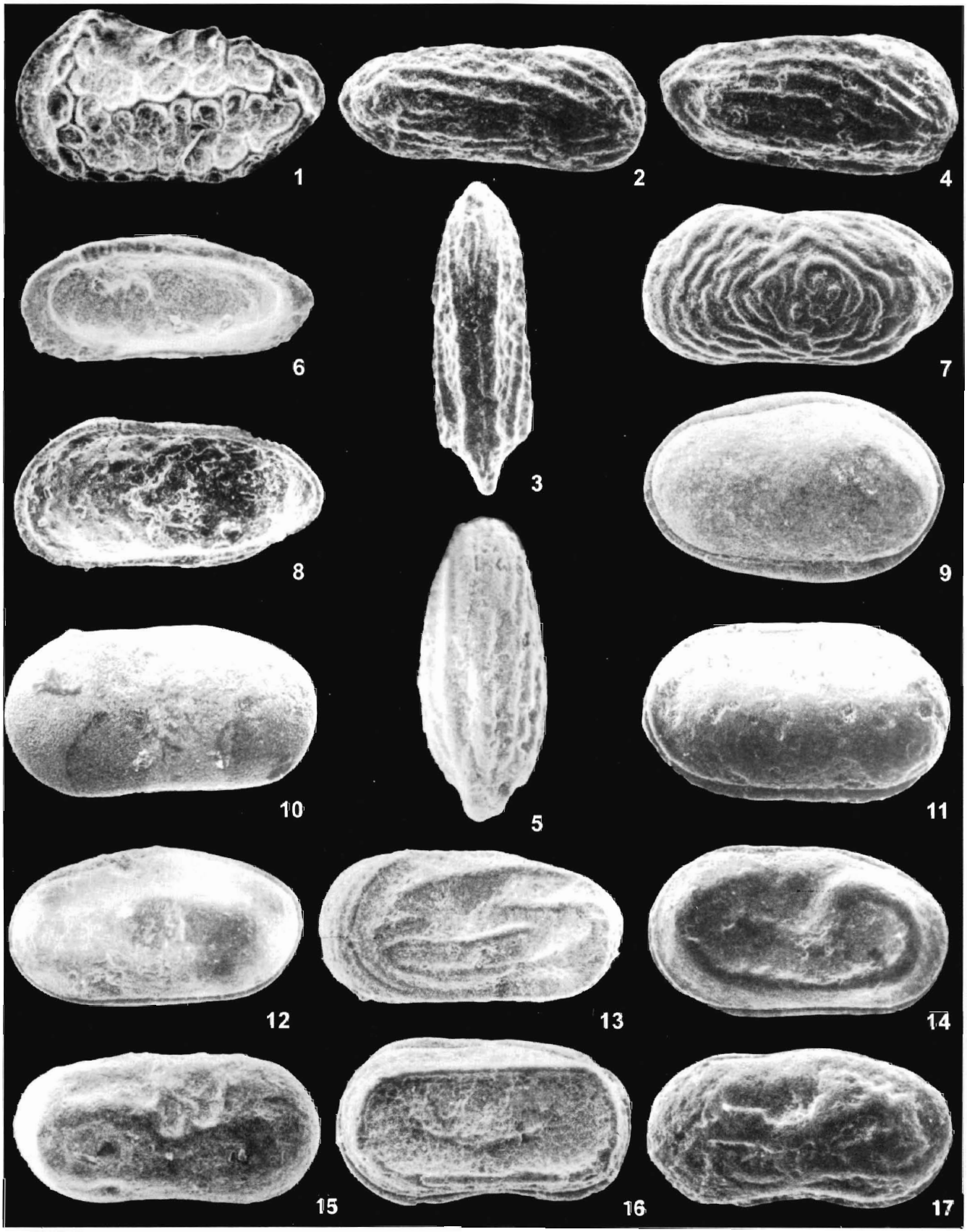
Holotype: Pl. VII, fig. 7.

Description: Valve elongate-subquadrate in lateral outline, with greatest height about 1/2 of length at anterior cardinal angle. Dorsal and ventral margins medially concave, posteroventral margin obscured by ventral swelling, anterior margin broad and obliquely rounded; posterior margin narrowly rounded at mid-height. Valve surface ornamented by 7-8 concentrically arranged distinct ribs. Inner lamella narrow; avestibulate; marginal pore canals simple and straight, about 7-8 along anterior margin and 3-4 along posterior margin. Hinge hemimerodont; in right valve it comprises an anterior element with 5 teeth, followed by a smooth groove and a posterior element with 6 teeth; hinge complementary in left valve.

Dimensions: Holotype (SUGDMF No. 828), a left valve, length 0.57 mm, height 0.30 mm. Paratype (SUGDMF No. 829),

EXPLANATION OF PLATE VII

1. ***Trichordis jaisalmerensis*** (Kulshreshtha, Singh and Tewari)
   A male carapace (SUGDMF No. 823), left valve view, x 73.
2-3. ***Mandawacythere kachchhensis*** n. sp.
   2, holotype (SUGDMF No. 824), a carapace, right valve view, x 114;
   3, paratype (SUGDMF No. 825), a carapace, dorsal view, x 120.
4-6. ***Mandawacythere multicostata*** n. sp.
   4 and 5, holotype (SUGDMF No. 826), a carapace; 4, right valve view, x 104; 5, dorsal view, x 106;
   6, paratype (SUGDMF No. 827), a right valve, internal view, x 100.
7-8. ***Pseudoperissocytheridea concentrica*** n. sp.
   7, holotype (SUGDMF No. 828), a left valve, lateral view, x 102;
   8, paratype (SUGDMF No. 829), a right valve, internal view, x 104.
9. ***Cytherella disjuncta*** Lyubimova and Mohan
   A carapace (SUGDMF No. 678), left valve view, x 64.
10. ***Cytherella kalajarensis*** Khosla and Jakhar
   A carapace (SUGDMF No. 679), left valve view, x 123.
11. ***Cytherella masuguluensis*** Bate
   A carapace (SUGDMF No. 680), left valve view, x 95.
12. ***Cytherella obscura*** Lyubimova and Mohan
   A carapace (SUGDMF No. 830), left valve view, x 88.
13. ***Cytherelloidea badiensis*** Khosla, Jakhar and Mohammed
   A left valve (SUGDMF No. 682), lateral view, x 93.
14. ***Cytherelloidea dhrangensis*** Khosla and Jakhar
   A carapace (SUGDMF No. 831), left valve view, x 82.
15. ***Cytherelloidea ipis*** Grekoff
   A right valve (SUGDMF No. 683), lateral view, x 94.
16. ***Cytherelloidea paradifficila*** Khosla, Jakhar and Mohammed
   A carapace (SUGDMF No. 684), left valve view, x 96.
17. ***Cytherelloidea*** sp.
   A carapace (SUGDMF No. 832), left valve view, x 74.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a right valve, length 0.56 mm, height 0.27 mm.

Remarks: This species has previously been described as *Mandelstamia* sp. by Khosla *et al.*, (1997) from the Jurassic of the Habo Dome, Kachchh. According to Prof. Whatley (personal cummincation) this is unquestionably *Pseudoperissocytheridea*. It resembles *Pseudoperissocytheridea parahieroglyphica* Whatley, 1970 from the lower Oxfordian of Dorset and Scotland in overall surface ornamentaion but differs in having concentrically arranged distinct ribs instead of "U" shaped ribs enclosing a median area of more irregular ribs.

Type Locality: Section V, north of Lodrani Village, Bela Island, Rann of Kachchh, Gujarat.

Type Horizon: Yellowish-brown siltstone with interbedded shale (Sample SV/24), Hadibhadang Sandstone Member (late Bathonian–early Callovian), Khadir Formation.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Sections III, V and VII.

Suborder **Platycopina** Sars, 1866

Family **Cytherellidae** Sars, 1866

Genus ***Cytherella*** Jones, 1849

Cytherella disjuncta Lyubimova and Mohan, 1960

(Pl. VII, fig. 9)

Cytherella disjuncta Lyubimova and Mohan, in Lyubimova *et al.*, 1960, p. 16, pl. 1, figs. 2a–c. – Kulshreshtha *et al.*, 1985, p. 125, figs. 1.7, 1.8, 1.16, 1.19, 1.20. – Khosla *et al.*, 1997, p. 8, pl. 1, fig. 1.

Material: 71 carapaces and 141 valves.

Dimensions: A carapace (SUGDMF No. 678), length 0.88 mm, height 0.57 mm, width 0.38 mm.

Cytherella kalajarensis Khosla and Jakhar, 1997

(Pl. VII, fig. 10)

Cytherella kalajarensis Khosla and Jakhar, in Khosla *et al.*, 1997, p. 8, pl. 1, figs 2-3. – Khosla and Jakhar, 1999, p. 45, pl. 1. fig. 1.

Material: 3 carapaces.

Dimensions: A carapace (SUGDMF No. 679), length 0.48 mm, height 0.25 mm, width 0.19 mm.

Cytherella masuguluensis Bate, 1975

(Pl VII, fig. 11)

Cytherella masuguluensis Bate, 1975, p. 173, pl. 1, figs. 2, 10. – Khosla *et al.*, 1997, p. 8, pl. 1, fig. 4.

Material: 7 carapaces.

Dimensions: A carapace (SUGDMF No. 680), length 0.62 mm, height 0.36 mm, width 0.27 mm.

Cytherella obscura Lyubimova and Mohan, 1960

(Pl. VII, fig.12)

Cytherella obscura Lyubimova and Mohan, in Lyubimova *et al.*, 1960, pp. 15–16, pl. 1, figs. 1a–b. – Kulshreshtha *et al.*, 1985, p. 125, figs. 1.14, 1.15, 1.18. – Khosla *et al.*, 1997, pp. 8-9, pl. 1, fig. 5. – Khosla and Jakhar, 1999, p. 45, pl. 1, fig. 2.

Cytherella rannensis Neale and Singh, 1986, p. 353, pl. 1, figs. 10–11.

Table 4. Distribution of the Middle Jurassic ostracods in part of the Gondwanaland.

	India		Madagascar	Saudi Arabia	Tanzania
Ostracode species	**Kachchh**	**Jaisalmer**			
Cytherella disjuncta Lyubimova & Mohan	+	+			
C. masuguluensis Bate	+				+
C. obscura Lyubimova & Mohan	+	+			
Cytherelloidea ipis Grekoff	+		+		
Fastigatocythere befotakaensis (Grekoff)	+	+	+		
F. bicruciata(Grekoff)	+		+		
F. dorsoangulata (Grekoff)	+		+		
F. juglandica malgachica (Grekoff)	+		+		
F. retusa (Grekoff)	+	+	+		
F. triangulata (Bate)	+		+	+	+
Galliaecytheridea remota Grekoff	+		+		
Mandelstamia depecheae Khosla, Jakhar & Mohammed	+			+	
Neurocythere whatleyi (Khosla & Jakhar)	+		+		
Paracypris contermia Lyubimova & Mohan	+	+			
Procytheridea ihopyensis Grekoff	+		+		
Progonocythere laeviscula Lyubimova & Mohan	+	+	+	+	
Trichordis devexa (Grekoff)	+		+		
T. grumosa (Lyubimova & Mohan)	+	+			
T. jaisalmerensis(Kulshreshtha, Singh & Tewari)	+	+			

Material: 151 carapaces and 175 valves.

Dimensions: A carapace (SUGDMF No. 830), length 0.64 mm, height 0.36 mm, width 0.24 mm.

Genus ***Cytherelloidea*** Alexander, 1929

Cytherelloidea badiensis Khosla, Jakhar and Mohammed, 2004

(Pl. VII, fig. 13)

Cytherelloidea sp. cf. *C. atlantolevantiana* Khosla, Jakhar and Mohammed, 1997, p. 10, pl. 1, figs. 12-13 (Not *Cytherelloidea atlantolevantiana* Rosenfeld and Honigstein, in Rosenfeld *et al.*, 1987, pl. 1, figs. 7-8).

Cytherelloidea badiensis Khosla, Jakhar and Mohammed, 2004, p. 23, pl. 1, fig. 1.

Material: 13 carapaces and 8 valves.

Dimensions: A left valve (SUGDMF No. 682), length 0.61 mm, height 0.32 mm.

Cytherelloidea dhrangensis Khosla and Jakhar, 1997

(Pl. VII, fig. 14)

Cytherelloidea dhrangensis Khosla and Jakhar, in Khosla *et al.*, 1997, pp. 9–10, pl. 1, figs. 9–10.

Material: 3 carapaces and 8 valves.

Dimensions: A carapace (SUGDMF No. 831), length 0.68 mm, height 0.39 mm, width 0.22 mm.

Cytherelloidea ipis Grekoff, 1963

(Pl. VII, fig. 15)

Cytherelloidea ipis Grekoff, 1963, p. 1722, pl. 1, figs. 16–17. – Khosla *et al.*, 1997, p. 10, pl. 1, fig. 11.

Material: 4 carapaces and 8 valves.

Dimensions: A right valve (SUGDMF No. 683), length 0.63 mm, height 0.32 mm.

Cytherelloidea paradifficila Khosla, Jakhar and Mohammed, 1997

(Pl. VII, fig. 16)

Cytherelloidea paradifficila Khosla, Jakhar and Mohammed, 1997, pp. 10–11, pl. 1, figs. 16–17. – Khosla and Jakhar, 1999, p. 45, pl. 1, fig. 4.

Material: 22 carapaces and 24 valves.

Dimensions: A carapace (SUGDMF No. 684), length 0.57 mm, height 0.33 mm, width 0.24 mm.

Cytherelloidea sp.

(Pl. VII, fig. 17)

Material: 2 carapaces.

Remarks: The species has the following characteristics: carapace subrhomboidal in lateral outline, with greatest height near middle; valve surface ornamented by a median and a ventral longitudinal ribs, joined posteriorly; median rib downwardly convex and with a distinct depression both above as well as below it; anterior 1/3 of valve surface smooth.

The species resembles *Cytherelloidea ipis* Grekoff, 1963, in overall ornamentation but differs in outline and its larger size. The species is left in open nomenclature for want of more material.

Dimensions: A carapace (SUGDMF No. 832), length 0.77 mm, height 0.40 mm, width 0.33 mm.

Occurrence: *Progonocythere laeviscula* Assemblage Zone of Section IX.

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