

FOSSIL SPATANGOIDS (ECHINODERMATA) FROM THE INDIAN SUBCONTINENT – A REVIEW

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ABSTRACT

An attempt has been made to revise and update 40 species of 15 spatangoids (echinoid genera) recorded by earlier workers from the Cretaceous to Miocene sediments exposed in the Indian subcontinent up to generic and subgeneric level in the light of latest taxonomic procedures as per the *International Code of Zoological Nomenclature* and the Treatise. However, their specific status has been retained.

Key words: Spatangoid echinoids, Taxonomy, Indian subcontinent, Cretaceous, Eocene, Oligocene and Miocene.

INTRODUCTION

The present paper is an attempt to revise and update spatangoid taxa (Echinodermata) of the Indian subcontinent in the light of latest taxonomic procedures as per the *International Code of Zoological Nomenclature* (1964) and the Treatise on Invertebrate Palaeontology (Fischer, 1966). Since they were described in *Palaeontologia Indica* and other journals, echinoid research has undergone marked changes leading to the need for revision of the taxa. This will also help in revising echinoid biostratigraphy of the Indian subcontinent and bringing it closer to global stratigraphic resolution.



Fig. 1. The geographic distribution of spatangoid taxa in the Indian subcontinent.

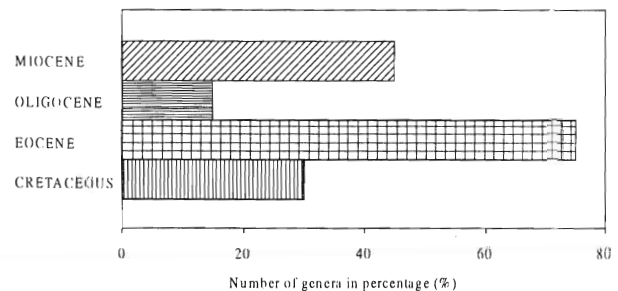


Fig. 2. The stratigraphic distribution of spatangoid genera of the Indian subcontinent (recorded by earlier workers).

A total of 20 spatangoid genera have been reported so far from the Cretaceous to Miocene sediments of the Indian subcontinent (fig. 1; Table 1) and their stratigraphic distribution (in percentage) which is controlled primarily by geographical barriers and oceanic currents besides nature of substratum, hydrodynamic regime, predation, salinity temperature, food availability, depth and behaviour is shown in fig. 2. The earliest report of these echinoids is from the Cretaceous rocks of South India (Forbes, 1845). Six spatangoid genera are recorded from this period. Spatangoid echinoids are also known from the Cretaceous sediments of Assam (Das Gupta, 1920 and Spenglar, 1923), Karakoram (Steffani, 1928), Narbada (Duncan, 1865 and 1887; Fourtau, 1918; Chiplonkar, 1937, 1939 and 1987; Chiplonkar and Badve, 1972) and South India (d'Orbigny, 1847; Stoliczka, 1873 and Kossmat, 1897).

The Eocene Epoch saw a prolific development of these echinoids from which time 15 genera have

Table 1. The Stratigraphic distribution of Spatangoid taxa of the Indian Subcontinent (recorded by earlier workers)

TAXA	EARLY LATE CRETACEOUS	EOCENE		MIDDLE OLIGOCENE	EARLY MIOCENE
		Early	Middle		
<i>Breynia</i>			+	+	+
<i>Brissopatagus</i>			+		
<i>Brissopsis</i>			+		+
<i>Brissus</i>	+				+
<i>Ditremaster</i>			+		
<i>Eupatagus</i>		+	+	+	+
<i>Euspatangus</i>			+	+	
<i>Hemiaster</i>	+	+	+	+	
<i>Heteraster</i>	+				
<i>Linthia</i>	+	+			
<i>Macropneustes</i>			+		
<i>Meoma</i>			+		+
<i>Metalia</i>		+			+
<i>Micraster</i>	+		+		
<i>Moira</i>			+		+
<i>Opissaster</i>	+				
<i>Peripneustes</i>			+		
<i>Prenaster</i>		+			
<i>Schizaster</i>		+	+	+	+
<i>Troschelia</i>					+

been recorded. These indicate a shallow water condition in the area with normal temperature and salinity where water was less turbulent with plenty of food under tropical to subtropical climate. These echinoids occur in the Eocene sediments of Assam (Spengler, 1923), Kachchh (Duncan and Sladen, 1883; Srivastava and Srivastava, 1990), Kohat & Salt Range (Theobald, 1881; Davies, 1943) and Sind (d'Archiac and Haime, 1853; Duncan and Sladen, 1882 - 1886).

During the Oligocene Epoch, the reported number of these echinoid genera is reduced to four. The rare occurrence of these echinoids at this time may be attributed to the unfavourable conditions for their development. They have been recorded from Kachchh (Wynne, 1872; Duncan and Sladen, 1883 and Srivastava, 1981) and Sind (Blanford, 1876 and 1879; Duncan and Sladen, 1882 - 1886 and Vredenburg, 1906).

The number of spatangoid genera in the Miocene Epoch is slightly greater, with nine genera have been recorded. They have been found in the Miocene sediments of Kachchh (Duncan and Sladen, 1883; Srivastava, 1981 and Jain, 2002), Kathiawar (Duncan and Sladen, 1883; Jain, 2002 and Srivastava, 2003), Sind (Duncan and Sladen, 1882 - 1886) and South India (Sahni and Sastry, 1958).

The type specimens of 40 species of 15 spatangoid genera recorded by earlier workers from the Cretaceous, Eocene, Oligocene and Miocene sediments exposed at various localities in Assam, Karakoram, Kachchh, Kathiawar, Kohat, Narbada, Salt Range, Sind and South India have been studied in detail to revise and update these echinoids at generic and subgeneric level in the light of more recent taxonomic research (Table 2). The stratigraphic distribution of the studied echinoids (in percentage) between the Cretaceous and Miocene epochs is

Table 2. Spatangoid taxa from the Indian Subcontinent reidentified.

Sl. No.	GSI Type No.	Taxa	Locality	Age	Reidentified as (Present work)
1.	2666 - 2667	<i>Brissopsis sufflatus</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 203, Pl. 35, Figs. 17 - 24.	Sind	middle Eocene	<i>Eupatagus (Eupatagus) sufflatus</i> (Duncan & Sladen) n. comb. Pl. VI, Figs. 1 - 4.
2.	1654 - 1655	<i>Epiaster nobilis</i> Stoliczka Stoliczka, 1873, 90: Pl. 13, Figs. 7 - 8.	South India	early Late Cretaceous	<i>Heteraster nobilis</i> (Stoliczka) n. comb. Pl. II, Figs. 1 - 4.
3.	2867	<i>Euspatangus affinis</i> Duncan & Sladen Duncan and Sladen, 1883: 46, Pl. 12, Fig. 2.	Kachchh	middle Eocene	<i>Eupatagus (Eupatagus) affinis</i> (Duncan & Sladen) n. comb. Pl. VI, Figs. 5 - 6.
4.	2686	<i>Euspatangus avellana</i> d'Archiac & Haime Duncan and Sladen, 1882 - 86: 235, Pl. 38, Fig. 13.	Sind	middle Eocene	<i>Eupatagus (Eupatagus) avellana</i> (d'Archiac & Haime) n. comb. Pl. VI, Figs. 9 - 12.
5.	2687	<i>Euspatangus cordiformis</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 238, Pl. 38, Fig. 14.	Sind	middle Eocene	<i>Eupatagus (Eupatagus) cordiformis</i> (Duncan & Sladen) n. comb. Pl. VII, Figs. 9 - 11.
6.	2868	<i>Euspatangus patellaris</i> d'Archiac & Haime Duncan and Sladen, 1883: 70, Pl. 12, Figs. 3 - 5.	Kachchh	early Miocene	<i>Eupatagus (Eupatagus) patellaris</i> (d'Archiac & Haime) n. comb. Pl. VI, Figs. 7 - 8.
7.	2837 - 2839	<i>Euspatangus rostratus</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 240, Pl. 38, Figs. 15 - 18; Pl. 43, Fig. 6.	Sind	middle Oligocene	<i>Eupatagus (Eupatagus) rostratus</i> (d'Archiac) n. comb. Pl. VII, Fig. 8.
8.	2655	<i>Hemiaster apicalis</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 193, Pl. 34, Figs. 1 - 7.	Sind	middle Eocene	<i>Brissopsis apicalis</i> (Duncan & Sladen) n. comb. Pl. VI, Figs. 13 - 15.
9.	2657	<i>Hemiaster carinatus</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 198, Pl. 34, Figs. 12 - 14.	Sind	middle Eocene	<i>Hemiaster (Hemiaster) carinatus</i> (Duncan & Sladen) n. comb. Pl. IV, Fig. 5.
10.	2863	<i>Hemiaster carinatus</i> Duncan & Sladen Duncan and Sladen, 1883: 35, Pl. 11, Figs. 1 - 4.	Kachchh	middle Eocene	<i>Opissaster carinatus</i> (Duncan & Sladen) n. comb. Pl. IV, Fig. 2.
11.	1649 - 1652	<i>Hemiaster cristatus</i> Stoliczka Stoliczka, 1873, 87: Pl. 13, Figs. 2 - 5.	South India	early Late Cretaceous	<i>Hemiaster (Mecaster) cristatus</i> (Stoliczka) n. comb. Pl. II, Figs. 7 - 8.
12.	2834	<i>Hemiaster decipiens</i> Duncan & Sladen Duncan and Sladen, 1883: 34, Pl. 6, Figs. 3 - 5.	Kachchh	middle Eocene	<i>Hemiaster (Hemiaster) decipiens</i> (Duncan & Sladen) n. comb. Pl. II, Figs. 10 - 11.
13.	2661 - 2663, 2698	<i>Hemiaster digonus</i> d'Archiac Duncan and Sladen, 1882 - 86: 240, Pl. 35, Figs. 4 - 9.	Sind	middle Eocene	<i>Ditremaster digonus</i> (d'Archiac) n. comb. Pl. III, Figs. 3 - 5.
14.	2574 - 2578	<i>Hemiaster elongatus</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 78, Pl. 19, Figs. 7 - 15.	Sind	early Eocene	<i>Ditremaster elongatus</i> (Duncan & Sladen) n. comb. Pl. III, Figs. 11 - 14.
15.	1634 - 1638	<i>Hemiaster front - acutus</i> Stoliczka Stoliczka, 1873, 83: Pl. 11, Figs. 7 - 8.	South India	early Late Cretaceous	<i>Hemiaster (Mecaster) front - acutus</i> (Stoliczka) n. comb. Pl. II, Fig. 9.
16.	1640 - 1641	<i>Hemiaster inaequalis</i> (Forbes) Stoliczka, 1873, 84: Pl. 12, Figs. 2 - 3.	South India	early Late Cretaceous	<i>Hemiaster (Mecaster) inaequalis</i> (Forbes) n. comb. Pl. I, Figs. 11 - 14.
17.	1644, 1645, 1648	<i>Hemiaster indicus</i> Stoliczka Stoliczka, 1873, 84: Pl. 12, Figs. 6 - 7; Pl. 13, Fig. 1.	South India	early Late Cretaceous	<i>Hemiaster (Hemiaster) indicus</i> (Stoliczka) n. comb. Pl. I, Figs. 3 - 5.
18.	2656	<i>Hemiaster nobilis</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 196, Pl. 34, Figs. 8 - 11.	Sind	middle Eocene	<i>Hemiaster (Hemiaster) nobilis</i> (Duncan & Sladen) n. comb. Pl. IV, Fig. 12.
19.	11948 - 11949, 4306	<i>Hemiaster oldhami</i> Fourtau Fourtau, 1918: 46, Pl. 2, Figs. 2 - 3.	Narbada and South India	early Late Cretaceous	<i>Hemiaster (Hemiaster) cenomanensis</i> (Cotteau) n. comb. Pl. II, Figs. 12 - 15.
20.	1646, 1647,	<i>Hemiaster pullus</i> Stoliczka Stoliczka, 1873, 88: Pl. 12, Figs. 8 - 9.	South India	early Late Cretaceous	<i>Hemiaster (Mecaster) pullus</i> (Stoliczka) n. comb. Pl. I, Figs. 1 - 2.
21.	6563	<i>Hemiaster pullus</i> Stoliczka Kossmat, 1897: 95, Pl. 10, Figs. 6a - d	South India	early Late Cretaceous	<i>Opissaster pullus</i> (Stoliczka) n. comb. Pl. III, Figs. 6 - 8.

Sl. No.	GSI Type No.	Taxa	Locality	Age	Reidentified as (Present work)
22.	1642 - 1643	<i>Hemiaster rana</i> (Forbes) Stoliczka, 1873, 85: Pl. 12, Figs. 4 - 5.	South India	early Late Cretaceous	<i>Hemiaster</i> (<i>Hemiaster</i>) <i>rana</i> (Forbes) n. comb. Pl. IV, Fig. 10.
23	1628	<i>Hemiaster similis</i> Stoliczka Stoliczka, 1873, 80: Pl. 11, Figs. 1a - b.	South India	early Late Cretaceous	<i>Hemiaster</i> (<i>Hemiaster</i>) <i>similis</i> (Stoliczka) n. comb. Pl. I, Figs. 6 - 8.
24.	6562	<i>Hemiaster tamulicus</i> Kossmat Kossmat, 1897: 96, Pl. 5, Figs. 5a - d	South India	early Late Cretaceous	<i>Ditremaster tamulicus</i> (Kossmat) n. comb. Pl. IV, Figs. 3 - 4.
25.	1630 -1632	<i>Hemiaster tuberosus</i> Stoliczka Stoliczka, 1873: 82, Pl. 11, Figs. 3 - 6.	South India	early Late Cretaceous	<i>Hemiaster</i> (<i>Hemiaster</i>) <i>tuberosus</i> (Stoliczka) n. comb. Pl. II, Figs. 5 - 6.
26.	1639	<i>Hemiaster vicinus</i> Stoliczka Stoliczka, 1873: 83, Pl. 12, Fig. 1.	South India	early Late Cretaceous	<i>Hemiaster</i> (<i>Hemiaster</i>) <i>vicinus</i> (Stoliczka) n. comb. Pl. I, Figs. 9 - 10.
27.	2685	<i>Macropneustes rotundus</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 232, Pl. 38, Figs. 6 - 7.	Sind	middle Eocene	<i>Macropneustes</i> (<i>Macropneustes</i>) <i>rotundus</i> (Duncan & Sladen) n. comb. Pl. VII, Figs. 12 - 13.
28.	2684	<i>Macropneustes speciosus</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 229, Pl. 38, Figs. 1 - 5.	Sind	middle Eocene	<i>Macropneustes</i> (<i>Macropneustes</i>) <i>speciosus</i> (Duncan & Sladen) n. comb. Pl. VII, Figs. 5 - 7.
29.	2842, 2846	<i>Maira antiqua</i> Duncan & Sladen Duncan and Sladen, 1883: 64, Pl. 8, Figs. 1 - 6.	Kachchh	early Miocene	<i>Maira</i> (<i>Mairopsis</i>) <i>antiqua</i> (Duncan & Sladen) n. comb. Pl. V, Figs. 5 - 7.
30.	11950	<i>Opiaster subsimilis</i> Fourtau Fourtau, 1918: 50, Pl. 2, Fig. 5.	Narbada	early Late Cretaceous	<i>Hemiaster</i> (<i>Malwaster</i>) <i>subsimilis</i> (Chiplonkar & Badve) Pl. III, Figs. 1 - 2.
31.	11951	<i>Opiaster</i> sp. Fourtau, 1918: 51, Pl. 2, Fig. 4	Narbada	early Late Cretaceous	<i>Hemiaster</i> (<i>Malwaster</i>) <i>holoambitatus</i> (Chiplonkar & Badve) Pl. IV, Fig. 1.
32.	2830	<i>Peripneustes insignis</i> Duncan & Sladen Duncan and Sladen, 1883: 42, Pl. 5, Figs. 1 - 4.	Kachchh	middle Eocene	<i>Meoma</i> (<i>Schizobrissus</i>) <i>insignis</i> (Duncan & Sladen) n. comb. Pl. VII, Figs. 1 - 4.
33.	2572 - 2573	<i>Prenaster oviformis</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 90, Pl. 19, Figs. 1 - 6.	Sind	early Eocene	<i>Prenaster</i> (<i>Prenaster</i>) <i>oviformis</i> (Duncan & Sladen) n. comb. Pl. V, Figs. 8 - 9.
34.	2585 - 2586	<i>Schizaster alveolatus</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 87, Pl. 20, Figs. 10 - 14.	Sind	early Eocene	<i>Schizaster</i> (<i>Schizaster</i>) <i>alveolatus</i> (Duncan & Sladen) n. comb. Pl. V, Figs. 12 - 16.
35.	2831 - 2832	<i>Schizaster</i> var. <i>baluchistanensis</i> d'Archiac Duncan and Sladen, 1883: 38, Pl. 5, Figs. 5 - 8.	Kachchh	middle Eocene	<i>Schizaster</i> (<i>Paraster</i>) var. <i>baluchistanensis</i> (d'Archiac) n. comb. Pl. IV, Figs. 6 - 8.
36.	2709 - 2710	<i>Schizaster granti</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 268, 339, Pl. 43, Figs. 4 - 6.	Sind	early Miocene	<i>Schizaster</i> (<i>Schizaster</i>) <i>granti</i> (Duncan & Sladen) n. comb. Pl. IV, Fig. 9; Pl. V, Figs. 1 - 4.
37.	2658	<i>Schizaster simulans</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 223, Pl. 34, Figs. 15 - 16.	Sind	middle Eocene	<i>Schizaster</i> (<i>Schizaster</i>) <i>simulans</i> (Duncan & Sladen) n. comb. Pl. V, Fig. 10.
38.	2762	<i>Schizaster suffatus</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 339, Pl. 49, Figs. 7 - 9.	Sind	early Miocene	<i>Schizaster</i> (<i>Paraster</i>) <i>suffatus</i> (Duncan & Sladen) n. comb. Pl. IV, Fig. 11; Pl. V, Fig. 11
39.	2683	<i>Schizaster symmetricus</i> Duncan & Sladen Duncan and Sladen, 1882 - 86: 220, Pl. 37, Figs. 15 - 21.	Sind	middle Eocene	<i>Opissaster symmetricus</i> (Duncan & Sladen) n. comb. Pl. III, Figs. 9 - 10.
40.	2840 - 2841	<i>Troschelia tuberculata</i> Duncan & Sladen Duncan and Sladen, 1883: 67, Pl. 7, Figs. 9 - 12.	Kachchh	early Miocene	<i>Hikelaster tuberculata</i> (Duncan & Sladen) n. comb. Pl. VII, Figs. 14 - 17.

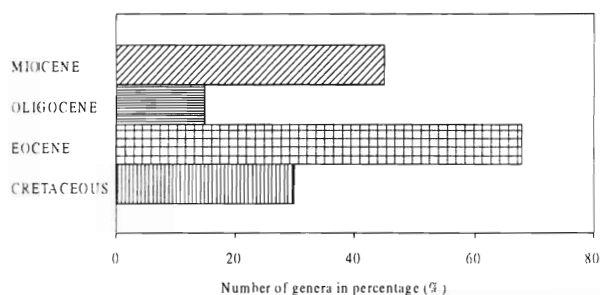


Fig. 3. The stratigraphic distribution of studied spatangoid genera of Indian subcontinent.

shown in fig. 3. Recently, Srivastava (2003) has revised *Metalia harshadae* described by Jain (2002) from the early Miocene rocks of the Gaj Formation from Kathiawar, Gujarat, India and reidentified it as *Brissopsis harshadae*. However, no attempt has been made at this stage to merge the specific status of the studied echinoid taxa.

SYSTEMATIC PALAEOLOGY

[The GSI type Nos. in **bold** have been studied and photographed]

Order **Spatangoida** Claus, 1876

Suborder **Toxasterina** Fischer, 1966

Family **Toxasteridae** Lambert, 1920

Genus **Heteraster** d'Orbigny, 1853

(Type species: *Spatangus oblongus* Brongniart, 1821, p. 555; SD Lambert & Thiéry, 1924, p. 438)

Heteraster nobilis (Stoliczka) n. comb.

(Pl. II, figs. 1 - 4)

Epiaster nobilis Stoliczka, 1873. *Pal. Ind.*, Ser. 8, 4(i - v): 90, Pl. 13, figs. 7 - 8.

Material: Two specimens; preservation good. GSI Type Nos. **1654, 1655.**

Lectotype: GSI Type No. **1654.**

Remarks: The genus *Epiaster* d'Orbigny, 1854 has been kept under synonymy within the genus *Heteraster* d'Orbigny, 1853 (Fischer, 1966). *H. nobilis* (Stoliczka) has been recorded and described by Stoliczka (1873) from the Cretaceous sediments of South India.

Locality: South India.

Horizon: early Late Cretaceous.

Suborder **Hemiasterina** Fischer, 1966

Family **Hemiasteridae** Clark, 1917

Genus **Ditremaster** Munier-Chalmas, 1855

(Type species: *Hemiaster nux* Desor, 1853, p. 278; SD Cotteau, 1887, p. 422)

Ditremaster digonus (d'Archiac) n. comb.

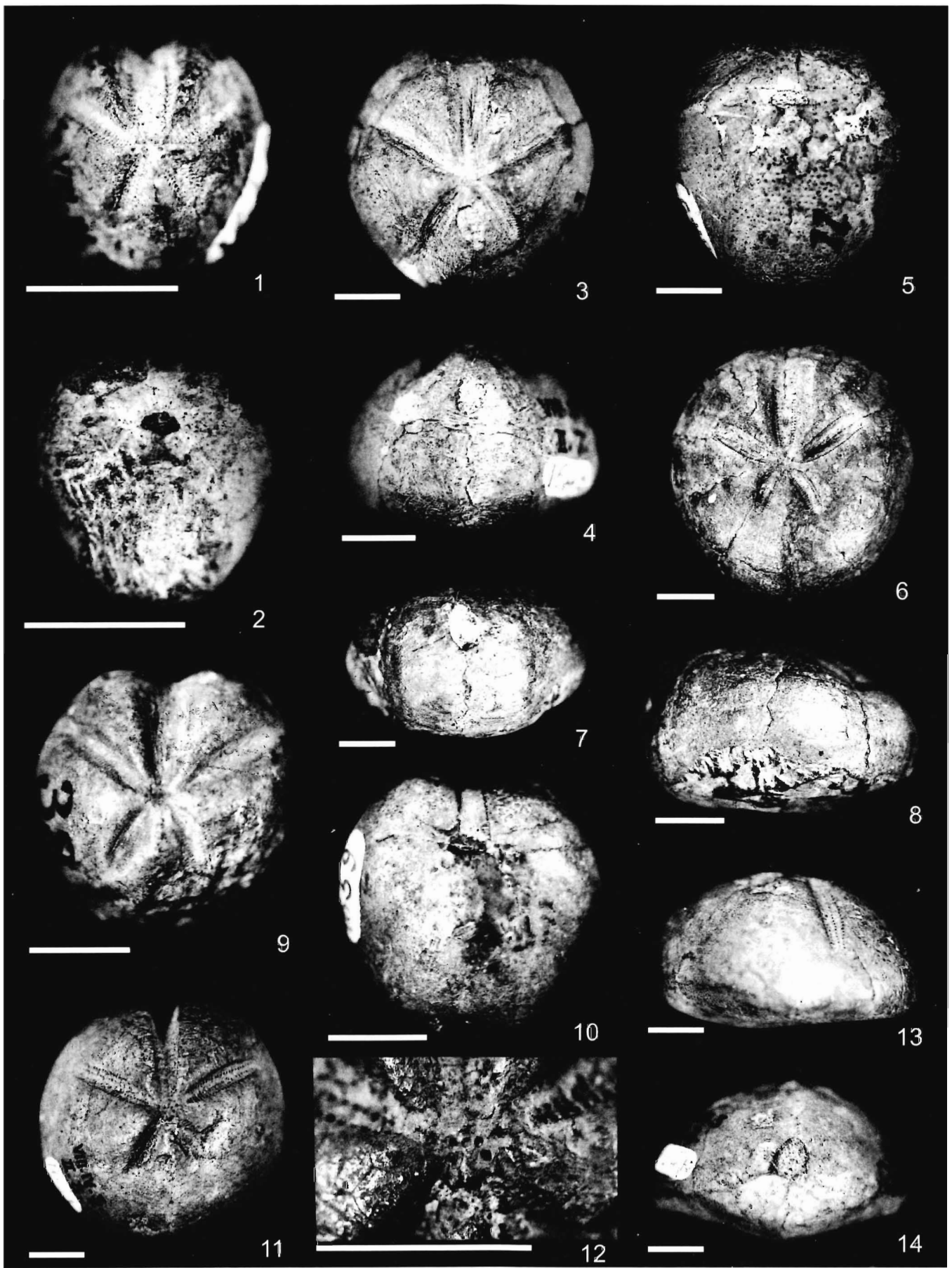
(Pl. III, figs. 3 - 5)

Hemiaster digonus d'Archiac, 1853. Duncan and Sladen, 1882-1886. *Pal. Ind.*, Ser. 14, 1(iii): 240, Pl. 35, figs. 4 - 9.

EXPLANATION OF PLATE I

(Bar represents 10.00 mm)

1. *Hemiaster (Mecaster) pullus* (Stoliczka) n. comb., Aboral view; GSI Type No. 1646
2. *Hemiaster (Mecaster) pullus* (Stoliczka) n. comb., Oral view; GSI Type No. 1646
3. *Hemiaster (Hemiaster) indicus* (Stoliczka) n. comb., Aboral view; GSI Type No. 1645
4. *Hemiaster (Hemiaster) indicus* (Stoliczka) n. comb., Posterior view; GSI Type No. 1645
5. *Hemiaster (Hemiaster) indicus* (Stoliczka) n. comb., Oral view; GSI Type No. 1645
6. *Hemiaster (Hemiaster) similaris* (Stoliczka) n. comb., Aboral view; GSI Type No. 1628
7. *Hemiaster (Hemiaster) similaris* (Stoliczka) n. comb., Posterior view; GSI Type No. 1628
8. *Hemiaster (Hemiaster) similaris* (Stoliczka) n. comb., Lateral view; GSI Type No. 1628
9. *Hemiaster (Hemiaster) vicinus* (Stoliczka) n. comb., Aboral view; GSI Type No. 1639
10. *Hemiaster (Hemiaster) vicinus* (Stoliczka) n. comb., Oral view; GSI Type No. 1639
11. *Hemiaster (Mecaster) inaequalis* (Forbes) n. comb., Aboral view; GSI Type No. 1641
12. *Hemiaster (Mecaster) inaequalis* (Forbes) n. comb., Apical disc; GSI Type No. 1641
13. *Hemiaster (Mecaster) inaequalis* (Forbes) n. comb., Lateral view; GSI Type No. 1641
14. *Hemiaster (Mecaster) inaequalis* (Forbes) n. comb., Posterior view; GSI Type No. 1641



Material: Four specimens; preservation good. GSI Type Nos. **2661** - 2663, 2898.

Lectotype: GSI Type No. **2661**.

Remarks: The studied specimen is characterised by a subglobular test with mild frontal sinus. The apical system is ethmophract, slightly excentric posteriorly with two genital pores. The petals I & V are very short.

Locality: Sind.

Horizon: middle Eocene.

Ditremaster elongatus (Duncan and Sladen) n. comb.

(Pl. III, figs. 11 - 14)

Hemiaster elongatus. Duncan and Sladen, 1882-1886. Duncan and Sladen, *Pal. Ind.*, Ser. 14, **1**(iii): 78, Pl. 19, figs. 7 - 15.

Material: Five specimens; preservation good. GSI Type Nos. 2574, **2575**, 2576, 2577 and **2578**.

Lectotype: GSI Type No. **2578**.

Remarks: The specimens described by Duncan and Sladen (1882-1886) have a suboval test; apical system is central to slightly excentric posteriorly with two genital pores. Petals I & V are very short. The peripetalous fasciole is feebly developed.

Locality: Sind.

Horizon: early Eocene.

Ditremaster tamulicus (Kossmat) n. comb.

(Pl. IV, figs. 3 - 4)

Hemiaster tamulicus Kossmat. 1897. Kossmat, 1897. *Rec. Geol. Surv. Ind.* **30**(2): 96, Pl. 5, figs. 5a-d.

Material: Single specimen; preservation good. GSI Type No. **6562**.

Remarks: The specimen recorded and described by Kossmat (1897) has an oval test with very mild frontal sinus. The apical system is ethmophract, slightly excentric posteriorly with two genital pores. The petals I & V are very short.

Locality: South India.

Horizon: early Late Cretaceous.

Genus Hemiaster Agassiz, 1847

(Type species: *Spatangus bufo* Brongniart, 1822, p. 84; SD Savin, 1903, p. 22)

Subgenus Hemiaster


[= *H. (Integraster)* Lambert & Thiéry, 1924, p. 504 (type *Hemiaster ligeriensis* d'Orbigny, 1853, p. 255)]

Hemiaster (Hemiaster) carinatus (Duncan and Sladen) n. comb.

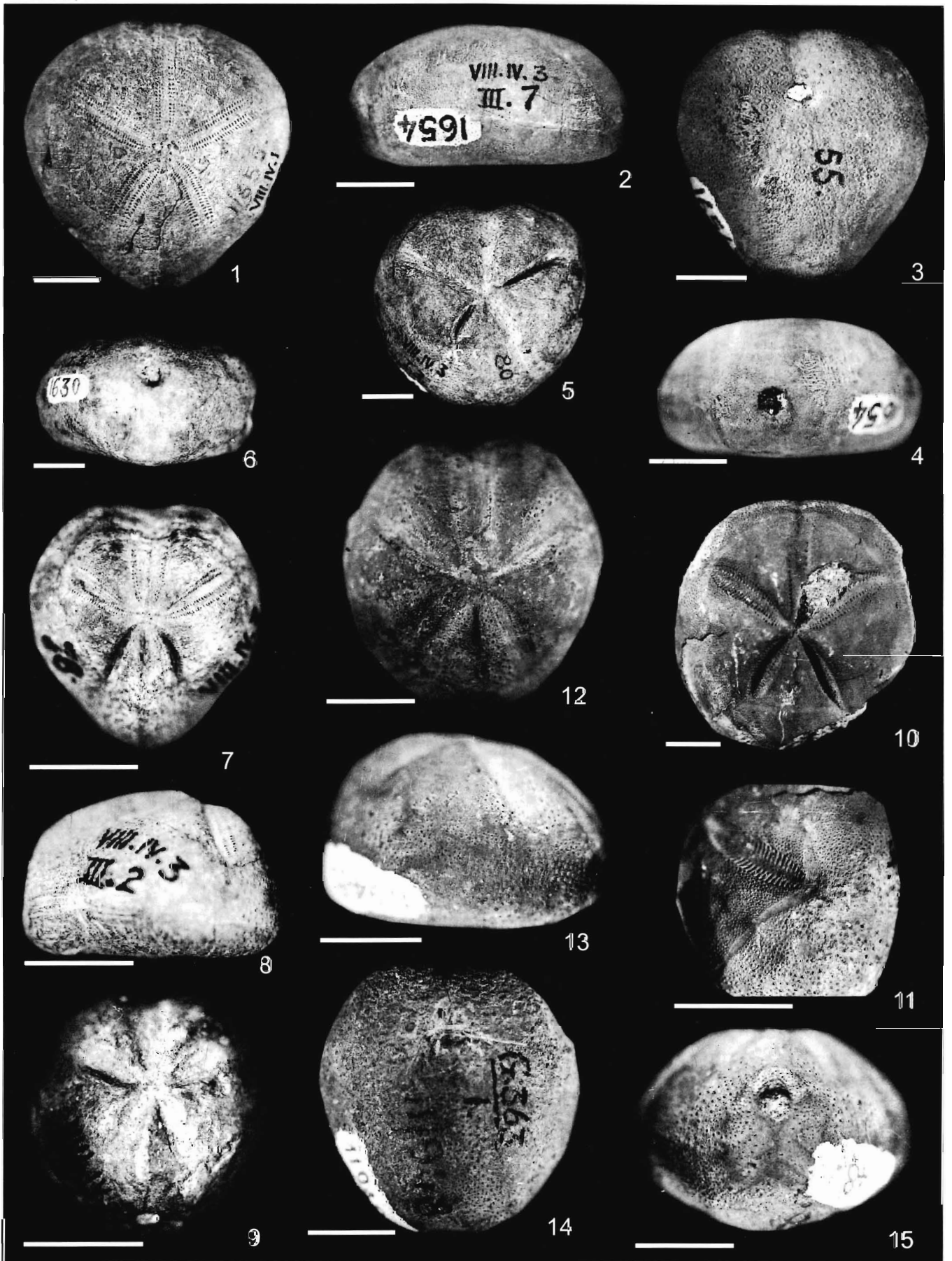
(Pl. IV, fig. 5)

Hemiaster carinatus Duncan and Sladen, 1882 - 1886. Duncan and Sladen, 1882 - 1886. *Pal. Ind.*, Ser. 14, **1**(iii): 198, Pl. 34, figs. 12 - 14.

EXPLANATION OF PLATE II

(Bar represents 10.00 mm) 

1. *Heteraster nobilis* (Stoliczka) n. comb., Aboral view; GSI Type No. 1655
2. *Heteraster nobilis* (Stoliczka) n. comb., Lateral view; GSI Type No. 1654
3. *Heteraster nobilis* (Stoliczka) n. comb., Oral view; GSI Type No. 1654
4. *Heteraster nobilis* (Stoliczka) n. comb., Posterior view; GSI Type No. 1654
5. *Hemiaster (Hemiaster) tuberosus* (Stoliczka) n. comb., Aboral view; GSI Type No. 1630
6. *Hemiaster (Hemiaster) tuberosus* (Stoliczka) n. comb., Posterior view; GSI Type No. 1630
7. *Hemiaster (Mecaster) cristatus* (Stoliczka) n. comb., Aboral view; GSI Type No. 1649
8. *Hemiaster (Mecaster) cristatus* (Stoliczka) n. comb., Lateral view; GSI Type No. 1649
9. *Hemiaster (Mecaster) front- acutus* (Stoliczka) n. comb., Aboral view; GSI Type No. 1634
10. *Hemiaster (Hemiaster) decipiens* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2834
11. *Hemiaster (Hemiaster) decipiens* (Duncan and Sladen) n. comb., showing fasciole; GSI Type No. 2834
12. *Hemiaster (Hemiaster) cenomanensis* (Cotteau) n. comb., Aboral view; GSI Type No. 11948
13. *Hemiaster (Hemiaster) cenomanensis* (Cotteau) n. comb., Lateral view; GSI Type No. 11948
14. *Hemiaster (Hemiaster) cenomanensis* (Cotteau) n. comb., Oral view; GSI Type No. 11948
15. *Hemiaster (Hemiaster) cenomanensis* (Cotteau) n. comb., Posterior view; GSI Type No. 11948



Material: Single specimen; partly broken. GSI Type No. **2657**

Lectotype: GSI Type No. **2657**.

Remarks: The specimen was recorded and described by Duncan and Sladen (1882-1886) as *Hemiaster carinatus* Duncan and Sladen. The apical system is ethmophract, central with four genital pores. The petals I & V are shorter than the petals II & IV.

Locality: Sind.

Horizon: middle Eocene.

Hemiaster (Hemiaster) cenomanensis (Cotteau)
n. comb.

(Pl. II, figs. 12 - 15)

Hemiaster cenomanensis Cotteau, 1856. Duncan and Sladen, 1887. *Rec. Geol. Surv. Ind.* **20(2)**: 91.

Hemiaster oldhami Fourtau, 1918. Fourtau, 1918, *Rec. Geol. Surv. Ind.* **49 (1)**: 46, Pl. 2, figs. 2-3.

Hemiaster fourtau Chiplonkar, 1937. Chiplonkar, 1937, *Proc. Ind. Acad. Sci., Sec. B*, **6(1)**: 64.

Hemiaster (Mecaster) fourtau Chiplonkar, 1939. Chiplonkar and Badve, 1972, *Proc. Ind. Acad. Sci., Sec. B*, **76(4)**: 148, pl. 12, figs. 10 - 14.

Material: Three specimens; preservation good. GSI Type Nos. 4306, **11948** and 11949.

Lectotype: GSI Type No. **11948**.

Remarks: The specimen is characterised by a large globular test with moderate frontal sinus. The

apical system is ethmophract, central with four genital pores. The petals are large and do not reach to the ambitus. The peripetalous fasciole is feebly developed. These specimens were recorded and described by Duncan and Sladen (1887), Fourtau (1918), Chiplonkar (1937, 1939) and Chiplonkar and Badve (1972) as *Hemiaster cenomanensis* Cotteau, *Hemiaster oldhami* Fourtau, *Hemiaster fourtau* Chiplonkar and *Hemiaster (Mecaster) fourtau* Chiplonkar respectively.

Locality: Narbada, South India.

Horizon: early Late Cretaceous.

Hemiaster (Hemiaster) decipiens (Duncan and Sladen) n. comb.

(Pl. II, figs. 10 - 11)

Hemiaster decipiens Duncan and Sladen, 1883. Duncan and Sladen, 1883. *Pal. Ind. Ser. 14*, **1(IV)**: 34, Pl. 6, figs. 3 - 5.

Material: Single specimen; partly broken. GSI Type No. **2834**.

Lectotype: GSI Type No. **2834**.

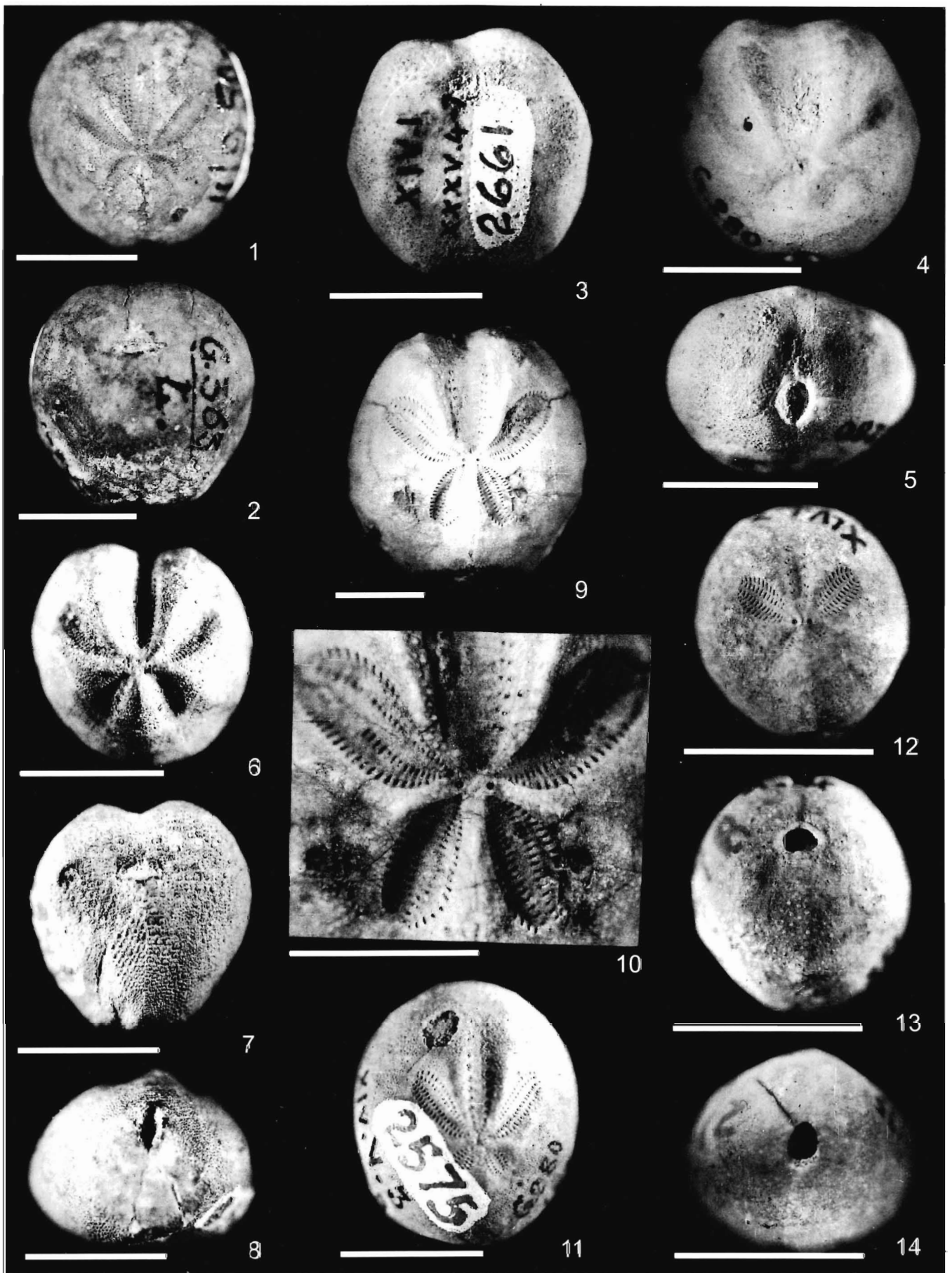
Remarks: The specimen recorded and described by Duncan and Sladen (1883) has a moderate but partly broken test with mild frontal sinus. Its apical system is ethmophract, central with four genital pores. The petals are large, petaloid and sunken; I & V are shorter than the petals II & IV. The peripetalous fasciole is well developed.

EXPLANATION OF PLATE III

(Bar represent 10.00 mm)



1. *Hemiaster (Malwaster) subsimilis* (Chiplonkar and Badve), Aboral view; GSI Type No. 11950
2. *Hemiaster (Malwaster) subsimilis* (Chiplonkar and Badve), Oral view; GSI Type No. 11950
3. *Ditremaster digonus* (d'Archiac) n. comb., Oral view; GSI Type No. 2661
4. *Ditremaster digonus* (d'Archiac) n. comb., Aboral view; GSI Type No. 2661
5. *Ditremaster digonus* (d'Archiac) n. comb., Posterior view; GSI Type No. 2661
6. *Opissaster pullus* (Fourtau) n. comb., Aboral view; GSI Type No. 6563
7. *Opissaster pullus* (Fourtau) n. comb., Oral view view; GSI Type No. 6563
8. *Opissaster pullus* (Fourtau) n. comb., Posterior view; GSI Type No. 6563
9. *Opissaster symmetricus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2683
10. *Opissaster symmetricus* (Duncan and Sladen) n. comb., Apical disc; GSI Type No. 2683
11. *Ditremaster elongatus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2575
12. *Ditremaster elongatus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2578
13. *Ditremaster elongatus* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2578
14. *Ditremaster elongatus* (Duncan and Sladen) n. comb., Posterior view; GSI Type No. 2578



Locality: Kachchh.

Horizon: middle Eocene.

Hemiaster (Hemiaster) indicus (Stoliczka) n. comb.

(Pl. I, figs. 3 - 5)

Hemiaster indicus Stoliczka, 1873. Stoliczka, 1873. *Pal. Ind.*, Ser. 8, **4(IV)**: 1-69, 130-202, Pl. 12, figs. 6 - 7; Pl. 13, fig. 1.

Material: Three specimens; preservation good. GSI Type Nos. 1644, **1645** and 1648.

Lectotype: GSI Type No. **1645**.

Remarks: The specimen recorded and described by Stoliczka (1873) has a moderate globular test with mild frontal sinus. Its apical system is ethmophract, central with four genital pores. The petals are large, petaloid and sunken; I & V are shorter than the petals II & IV. The peripetalous fasciole is well developed.

Locality: South India.

Horizon: early Late Cretaceous.

Hemiaster (Hemiaster) nobilis (Duncan and Sladen) n. comb.

(Pl. IV, fig. 12)

Hemiaster nobilis Duncan and Sladen, 1882 - 1886. Duncan and Sladen, 1882-1886. *Pal. Ind.*, Ser. 14, **1(iii)**: 196, Pl. 34, figs. 8 - 11.

Material: Single specimen; preservation good. GSI Type No. **2656**.

Lectotype: GSI Type No. **2656**.

Remarks: The specimen studied by Duncan and

Sladen (1883) has a globular test with mild frontal sinus. Its apical system is ethmophract, central with four genital pores. The petals are large, petaloid and sunken; I & V are shorter than the petals II & IV. The peripetalous fasciole is well developed.

Locality: Sind.

Horizon: middle Eocene.

Hemiaster (Hemiaster) rana (Forbes) n. comb.

(Pl. IV, fig. 10)

Hemiaster rana (Forbes) Stoliczka, 1873. Stoliczka, 1873. *Pal. Ind.*, Ser. 8, **4(IV)**: 65, Pl. 12, figs. 4 - 5.

Material: Two specimens; preservation good. GSI Type Nos. **1642** and 1643.

Lectotype: GSI Type No. **1642**.

Remarks: The specimen recorded and described by Stoliczka (1873) has a moderately large but broken test. Its apical system is ethmophract, central with four genital pores. The petals are large, petaloid and sunken; I & V are shorter than the petals II & IV. The peripetalous fasciole is well developed.

Locality: South India.

Horizon: early Late Cretaceous.

Hemiaster (Hemiaster) similaris (Stoliczka) n. comb.

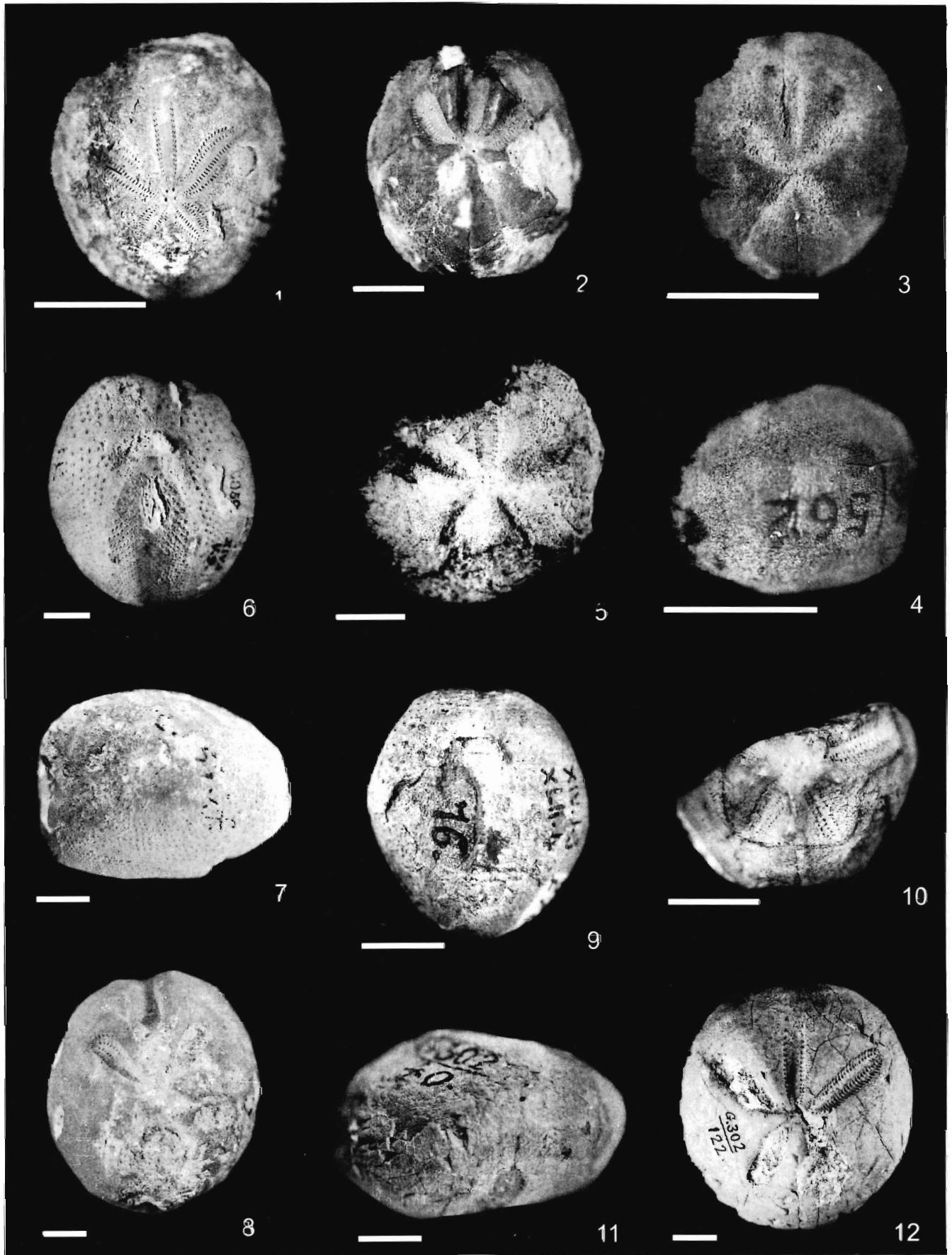
(Pl. I, figs. 6 - 8)

Hemiaster similaris Stoliczka, 1873. Stoliczka, 1873. *Pal. Ind.*, Ser. 8, **4(IV)**: 80, Pl. 11, figs. 1a - b.

EXPLANATION OF PLATE IV

(Bar represents 10.00 mm) →

1. *Hemiaster (Malwaster) holoambitatus* (Chiplonkar and Badve), Aboral view; GSI Type No. 11951
2. *Opissaster carinatus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2863
3. *Ditremaster tamulicus* (Kossmat) n. comb., Aboral view; GSI Type No. 6562
4. *Ditremaster tamulicus* (Kossmat) n. comb., Lateral view; GSI Type No. 6562
5. *Hemiaster (Hemiaster) carinatus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2657
6. *Schizaster (Paraster) var. baluchistanensis* (d' Archiac) n. comb., Oral view; GSI Type No. 2832
7. *Schizaster (Paraster) var. baluchistanensis* (d' Archiac) n. comb., Lateral view; GSI Type No. 2832
8. *Schizaster (Paraster) var. baluchistanensis* (d' Archiac) n. comb., Aboral view; GSI Type No. 2832
9. *Schizaster (Schizaster) granti* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2709
10. *Hemiaster (Hemiaster) rana* (Forbes) n. comb., Aboral view; GSI Type No. 1642
11. *Schizaster (Paraster) suflatus* (Duncan and Sladen) n. comb., Lateral view; GSI Type No. 2762
12. *Hemiaster (Hemiaster) nobilis* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2656



Material: Single specimen; preservation good.
GSI Type No. **1628**.

Lectotype: GSI Type No. **1628**.

Remarks: The specimen recorded and described by Stoliczka (1873) has a large globular test with mild frontal sinus and keel. The anterior slope is gentler than the posterior slope. The apical system is ethmophract, central at the highest point of the test with four genital pores. The petals are large, petaloid and sunken; I & V are shorter than the petals II & IV. The supramarginal periproct is transversally oval. The peripetalous fasciole is well developed.

Locality: South India.

Horizon: early Late Cretaceous.

Hemiaster (Hemiaster) tuberosus (Stoliczka) n. comb.

(Pl. II, figs. 5 - 6)

Hemiaster tuberosus Stoliczka, 1873. Stoliczka, 1873. *Pal. Ind.*, Ser. 8, 4(IV): 82, Pl. 11, figs. 3 - 6.

Material: Three specimens; preservation good.
GSI Type Nos. **1630**, 1631 and 1632.

Lectotype: GSI Type No. **1630**.

Remarks: The specimen studied by Stoliczka (1873) has a large globular test with moderately deep frontal sinus, its apical system is ethmophract, central with four genital pores. The petals are large and do

not reach to the ambitus, petaloid and sunken; I & V are shorter than the petals II & IV. The peripetalous fasciole is feebly developed.

Locality: South India.

Horizon: early Late Cretaceous.

Hemiaster (Hemiaster) vicinus (Stoliczka) n. comb.

(Pl. I, figs. 9 - 10)

Hemiaster vicinus Stoliczka, 1873. Stoliczka, 1873. *Pal. Ind.*, Ser. 8, 4(IV): 83, Pl. 12, fig. 1.

Material: Single specimen; preservation good.
GSI Type No. **1639**.

Lectotype: GSI Type No. **1639**.

Remarks: The specimen studied by Stoliczka (1873) has a large globular test with moderately deep frontal sinus and keel. The apical system is ethmophract, central at the highest point of the test with four genital pores. The petals are large, petaloid and sunken; I & V are shorter than the petals II & IV. The supramarginal periproct is transversally oval. The peripetalous fasciole is feebly developed.

Locality: South India.

Horizon: early Late Cretaceous.

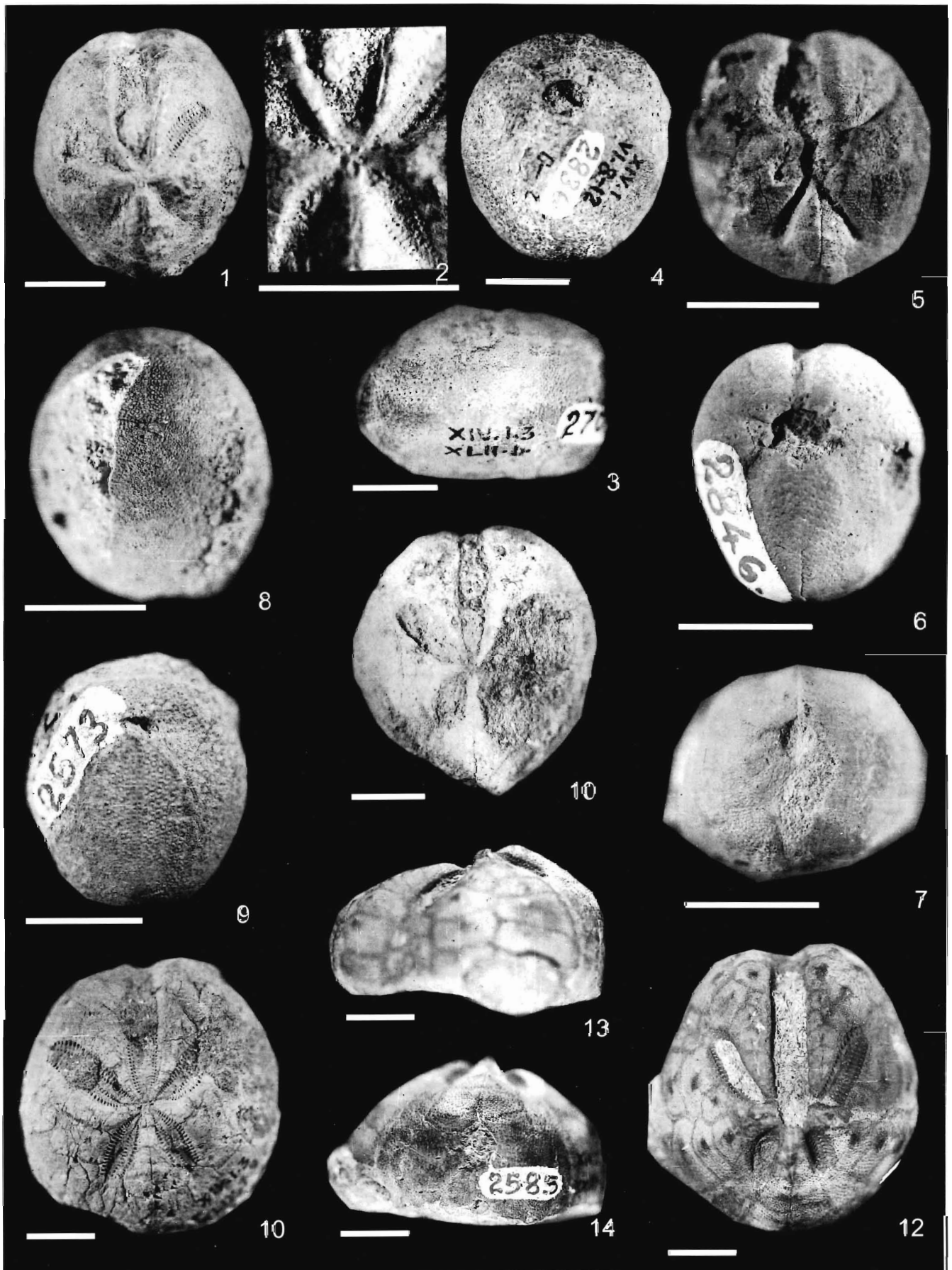
Subgenus Malwaster Chiplonkar and Badve, 1974

(Type species: *Opissaster subsimilis* Fourtau, 1918, p. 50)

EXPLANATION OF PLATE V

(Bar represents 10.00 mm)

1. *Schizaster (Schizaster) granti* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2709
2. *Schizaster (Schizaster) granti* (Duncan and Sladen) n. comb., Apical disc; GSI Type No. 2709
3. *Schizaster (Schizaster) granti* (Duncan and Sladen) n. comb., Lateral view; GSI Type No. 2709
4. *Schizaster (Schizaster) granti* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2709
5. *Moiria (Moiropsis) antiqua* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2842
6. *Moiria (Moiropsis) antiqua* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2846
7. *Moiria (Moiropsis) antiqua* (Duncan and Sladen) n. comb., Posterior view; GSI Type No. 2842
8. *Prenaster (Prenaster) oviformis* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2572
9. *Prenaster (Prenaster) oviformis* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2573
10. *Schizaster (Schizaster) simulans* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2658
11. *Schizaster (Paraster) suflatus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2762
12. *Schizaster (Schizaster) alveolatus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2585
13. *Schizaster (Schizaster) alveolatus* (Duncan and Sladen) n. comb., Lateral view; GSI Type No. 2585
14. *Schizaster (Schizaster) alveolatus* (Duncan and Sladen) n. comb., Posterior view; GSI Type No. 2585



Hemiaster (Malwaster) holoambitus

(Chiplonkar and Badve), n. comb.

(Pl. IV, fig. 1)

Opissaster sp. Fourtau, 1918. Fourtau, 1918. *Rec. Geol. Surv. Ind.* **49** (1): 51, Pl. 2, fig. 4.*Material*: Single specimen; preservation good. GSI Type No. **11951**.*Lectotype*: GSI Type No. **11951**.*Remarks*: The specimen studied by Fourtau (1918) has a large globular test. The apical system is ethmophract, excentric posteriorly with four genital pores. The petals are large, do not reach to the ambitus, petaloid, close and sunken (petal III non-petaloid and open); I & V are shorter than the petals II & IV. The supramarginal periproct is transversally oval. The peripetalous fasciole is feebly developed.*Locality*: Narbada Valley.*Horizon*: early Late Cretaceous.*Hemiaster (Malwaster) subsimilis* (Chiplonkar and Badve) n. comb.


(Pl. III, figs. 1 - 2)

Opissaster subsimilis Fourtau, 1918. Fourtau, 1918. *Rec. Geol. Surv. Ind.* **49** (1): 50, Pl. 2, fig. 5.*Material*: Single specimen; preservation good. GSI Type No. **11950**.*Lectotype*: GSI Type No. **11950**.*Remarks*: The specimen described by Fourtau (1918) has a large suboval test. The apical system is ethmophract, excentric posteriorly with four genital pores. The petals are large, do not reach to the ambitus, petaloid, close and sunken (petal III non-petaloid and open); I & V are shorter than the petals II & IV. The peristome excentric anteriorly, transversally elliptical. The supramarginal periproct is transversally oval. The peripetalous fasciole is feebly developed.*Locality*: Narbada Valley.*Horizon*: early Late Cretaceous.*Subgenus Mecaster* Pomel, 1883(Type species: *H. fourneli* in Agassiz & Desor, 1847, p. 16; OD)*Hemiaster (Mecaster) cristatus* (Stoliczka) n. comb.

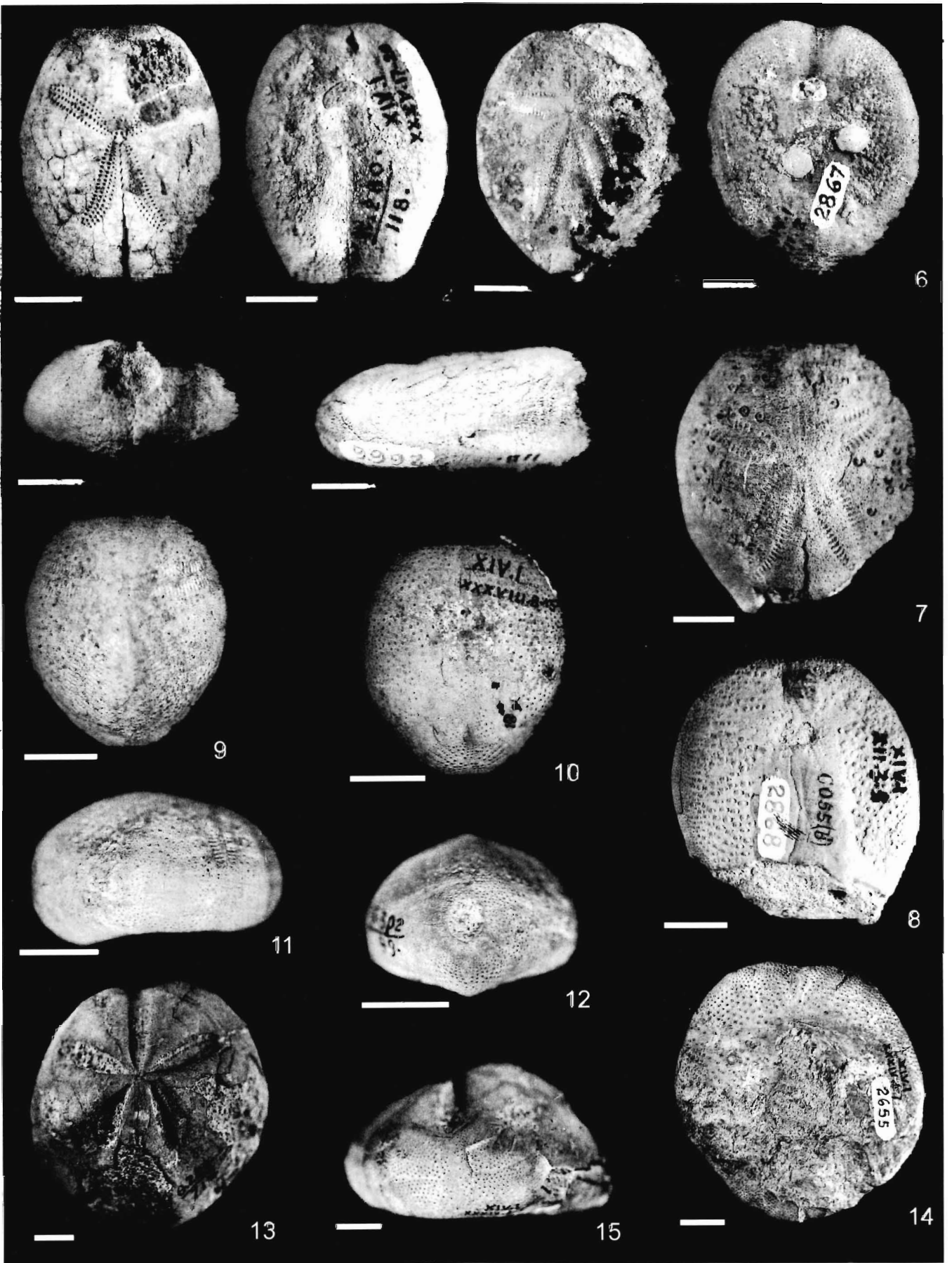
(Pl. II, figs. 7 - 8)

Hemiaster cristatus Stoliczka, 1873. Stoliczka, 1873. *Pal. Ind.*, Ser. 8, **4(IV)**: 87, Pl. 13, figs. 2 - 5.*Material*: Four specimens; preservation good. GSI Type Nos. **1649**, 1650, 1651 and 1652.*Lectotype*: GSI Type No. **1649**.*Remarks*: The specimen described by Stoliczka (1873) has a large subhexagonal test with moderately deep frontal sinus and keel, its apical system is ethmophract, central with four genital pores. The anterior slope is slightly gentler than the posterior slope.

EXPLANATION OF PLATE VI

(Bar represents 10.00 mm) 

1. *Eupatagus (Eupatagus) sufflatus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2666
2. *Eupatagus (Eupatagus) sufflatus* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2666
3. *Eupatagus (Eupatagus) sufflatus* (Duncan and Sladen) n. comb., Lateral view; GSI Type No. 2666
4. *Eupatagus (Eupatagus) sufflatus* (Duncan and Sladen) n. comb., Posterior view; GSI Type No. 2666
5. *Eupatagus (Eupatagus) affinis* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2867
6. *Eupatagus (Eupatagus) affinis* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2867
7. *Eupatagus (Eupatagus) patellaris* (d'Archiac & Haime) n. comb., Aboral view; GSI Type No. 2868
8. *Eupatagus (Eupatagus) patellaris* (d'Archiac & Haime) n. comb., Oral view; GSI Type No. 2868
9. *Eupatagus (Eupatagus) avellana* (d'Archiac & Haime) n. comb., Aboral view; GSI Type No. 2686
10. *Eupatagus (Eupatagus) avellana* (d'Archiac & Haime) n. comb., Oral view; GSI Type No. 2686
11. *Eupatagus (Eupatagus) avellana* (d'Archiac & Haime) n. comb., Lateral view; GSI Type No. 2686
12. *Eupatagus (Eupatagus) avellana* (d'Archiac & Haime) n. comb., Posterior view; GSI Type No. 2686
13. *Brissopsis apicalis* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2655
14. *Brissopsis apicalis* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2655
15. *Brissopsis apicalis* (Duncan and Sladen) n. comb., Lateral view; GSI Type No. 2655



The petals are large, sunken, subpetaloid, and do not reach to the ambitus; I & V are shorter than the petals II & IV. The peripetalous fasciole is well developed.

Locality: South India.

Horizon: early Late Cretaceous.

Hemiaster (Mecaster) front - acutus (Stoliczka) n. comb.

(Pl. II, fig. 9)

Hemiaster front - acutus Stoliczka, 1873. Stoliczka, 1873. *Pal. Ind.*, Ser. 8, **4(IV)**: 83, Pl. 11, figs. 7 - 8.

Material: Five specimens; preservation good. GSI Type Nos. **1634**, 1635, 1636, 1637 and 1638.

Lectotype: GSI Type No. **1634**.

Remarks: The specimen described by Stoliczka (1873) has a large subhexagonal test with moderately deep frontal sinus and keel, its apical system is ethmophract, excentric anteriorly with four genital pores. The petals are large, subpetaloid to open, sunken and do not reach to the ambitus; I & V are slightly shorter than the petals II & IV. The peripetalous fasciole is feebly developed.

Locality: South India.

Horizon: early Late Cretaceous.

Hemiaster (Mecaster) inaequalis (Forbes) n. comb.

(Pl. I, figs. 11 - 14)

Hemiaster inaequalis (Forbes) Stoliczka, 1873. Stoliczka, 1873. *Pal. Ind.*, Ser. 8, **4(IV)**: 84, Pl. 12, figs. 2 - 3.

Material: Two specimens; preservation good. GSI Type Nos. 1640 and **1641**.

Lectotype: GSI Type No. **1641**.

Remarks: The specimen described by Stoliczka (1873) has a large globular test with deep frontal sinus and keel. Its apical system is ethmophract, slightly excentric anteriorly with four genital pores. The anterior slope is slightly gentler than the posterior slope. The petals are large, subpetaloid to open, sunken and do not reach to the ambitus; I & V are slightly shorter than the petals II & IV. The peripetalous fasciole is feebly developed.

Locality: South India.

Horizon: early Late Cretaceous.

Hemiaster (Mecaster) pullus (Stoliczka) n. comb.

(Pl. I, figs. 1 - 2)

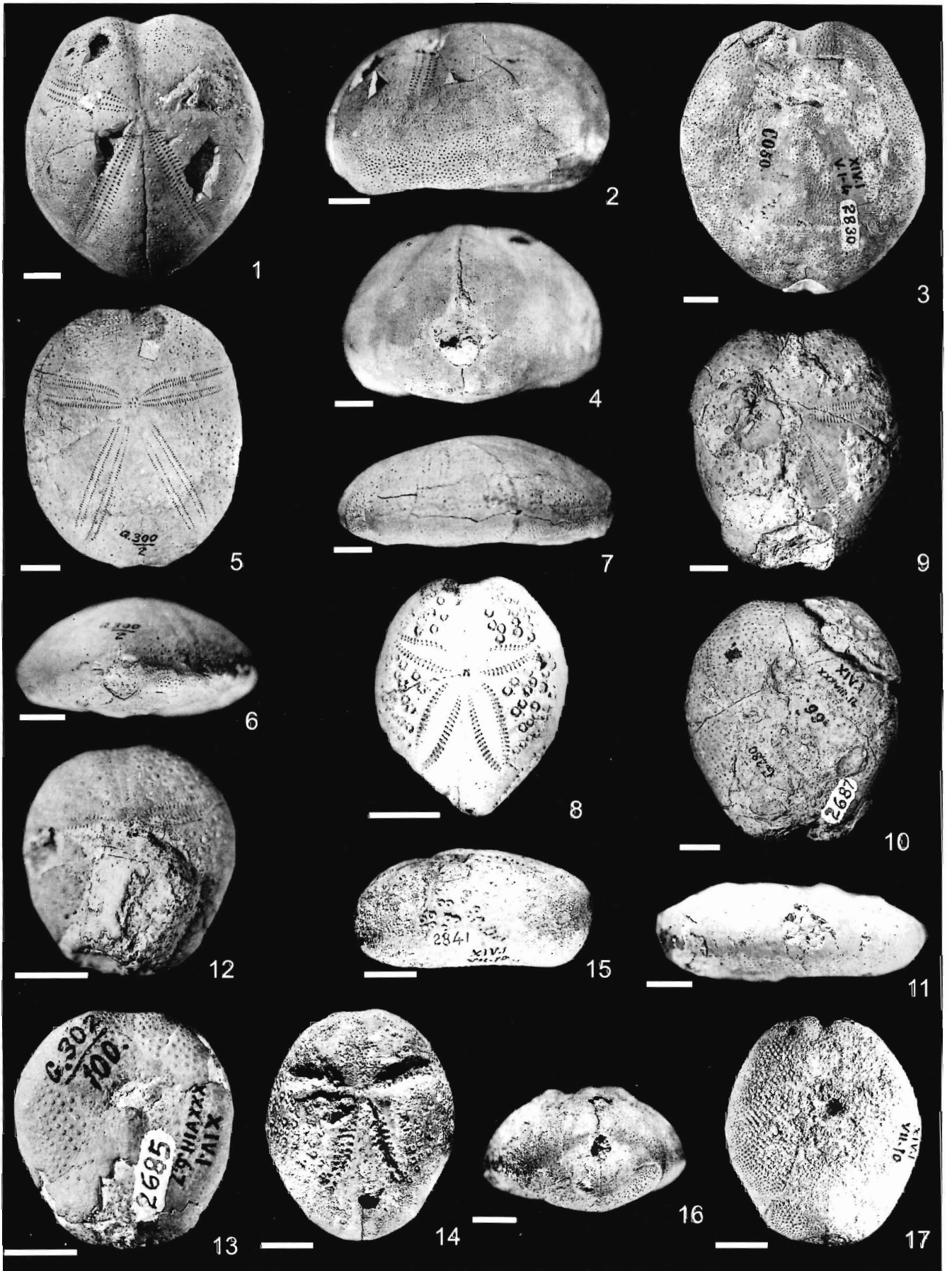
Hemiaster pullus Stoliczka, 1873. Stoliczka, 1873. *Pal. ind.*, Ser. 8, **4(IV)**: 88, Pl. 12, figs. 8 - 9.

Material: Two specimens; preservation good. GSI Type Nos. **1646** and 1647.

EXPLANATION OF PLATE VII

(Bar represents 10.00 mm)

1. *Meoma (Schizobrissus) insignis* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2830
2. *Meoma (Schizobrissus) insignis* (Duncan and Sladen) n. comb., Lateral view; GSI Type No. 2830
3. *Meoma (Schizobrissus) insignis* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2830
4. *Meoma (Schizobrissus) insignis* (Duncan and Sladen) n. comb., Posterior view; GSI Type No. 2830
5. *Macropneustes (Macropneustes) speciosus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2684
6. *Macropneustes (Macropneustes) speciosus* (Duncan and Sladen) n. comb., Posterior view; GSI Type No. 2684
7. *Macropneustes (Macropneustes) speciosus* (Duncan and Sladen) n. comb., Lateral view; GSI Type No. 2684
8. *Eupatagus (Eupatagus) rostratus* (d'Archiac) n. comb., Aboral view; GSI Type No. 2837
9. *Eupatagus (Eupatagus) cordiformis* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2687
10. *Eupatagus (Eupatagus) cordiformis* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2687
11. *Eupatagus (Eupatagus) cordiformis* (Duncan and Sladen) n. comb., Lateral view; GSI Type No. 2687
12. *Macropneustes (Macropneustes) rotundus* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2685
13. *Macropneustes (Macropneustes) rotundus* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2685
14. *Hikelaster tuberculata* (Duncan and Sladen) n. comb., Aboral view; GSI Type No. 2841
15. *Hikelaster tuberculata* (Duncan and Sladen) n. comb., Lateral view; GSI Type No. 2841
16. *Hikelaster tuberculata* (Duncan and Sladen) n. comb., Posterior view; GSI Type No. 2841
17. *Hikelaster tuberculata* (Duncan and Sladen) n. comb., Oral view; GSI Type No. 2841



Material: Three specimens; preservation good. GSI Type Nos. **2837**, 2838 and 2839.

Lectotype: GSI Type No. **2837**.

Remarks: The specimens recorded and described by Duncan and Sladen (1882 - 1886) have a medium, oval test with mild frontal sinus. Its apical system is ethmolytic, slightly excentric anteriorly with four genital pores. The petals are large, subpetaloid (III is non-petaloid), close and do not reach to the ambitus; the petals I & V are larger than the petals II & IV. The peripetalous fasciole is feebly developed; peristome excentric anteriorly; periproct circular, supramarginal. Srivastava (1981) also recorded the species from the Oligocene sediments exposed at Bermota, Guvar, Jhadwa and Khari besides the Miocene sediments of Guvar, Kachchh, India.

Locality: Sind.

Horizon: middle Oligocene.

Eupatagus (Eupatagus) sufflatus (Duncan and Sladen) n. comb.

(Pl. VI, figs. 1 - 4)

Brissopsis sufflatus Duncan and Sladen, Duncan and Sladen 1882 - 1886. *Pal. Ind.*, Ser. 8, 4(i - v): 203, pl. 35, figs. 17 - 24.

Material: Two specimens; preservation good. GSI Type Nos. **2666**, 2667.

Lectotype: GSI Type No. **2666**.

Remarks: The specimen recorded and described by Duncan and Sladen (1882-1886) has a large, oval test with mild frontal sinus; apical system is ethmolytic, excentric anteriorly with four genital pores. The petals are large, subpetaloid (III is non-petaloid), close and do not reach to the ambitus; the petals I & V slightly flares outwards and are slightly larger than the petals II & IV. The peripetalous fasciole is feebly developed; peristome excentric anteriorly and transversally bean shaped; periproct circular, supramarginal.

Locality: Sind.

Horizon: middle Eocene.

Genus Hikelaster Lambert & Thiéry, 1920

(Type species: *Troschelia tuberculata*; OD Duncan & Sladen, 1883, p. 27)

Hikelaster tuberculata (Duncan and Sladen) n. comb.

(Pl. VII, figs. 14 - 17)

Troschelia tuberculata Duncan and Sladen, 1883. Duncan and Sladen, 1883. *Pal. Ind.*, Ser. 14, 1(IV): 67, pl. 7, figs. 9 - 12.

Material: Two specimens; preservation good. GSI Type Nos. 2840 and **2841**.

Lectotype: GSI Type No. **2841**.

Remarks: The specimen recorded and described by Duncan and Sladen (1883) has a medium, oval test; apical system is ethmolytic, excentric anteriorly with four genital pores. The petals are large, petaloid (III is non-petaloid), close, sunken and do not reach to the ambitus; the petals I & V are slightly larger than the petals II & IV. The subanal fasciole is well developed; peristome excentric anteriorly; transversally oval periproct is supramarginal in position.

Locality: Kachchh.

Horizon: early Miocene.

Genus Macropneustes L. Agassiz, 1847

(Type species: *M. deshayesi*; SD Jakson, 1922, p. 4)

Subgenus Macropneustes

(Type species: *M. (M.) deshayesi*)

Macropneustes (Macropneustes) rotundus

(Duncan and Sladen) n. comb.

(Pl. VII, figs. 12 - 13)

Macropneustes rotundus Duncan and Sladen, Duncan and Sladen 1882 - 1886. *Pal. Ind.*, Ser. 8, 4(i - v): 232, pl. 38, figs. 6 - 7.

Material: Single specimen; preservation good but partly broken. GSI Type No. **2685**.

Lectotype: GSI Type No. **2685**.

Remarks: The specimen recorded and described by Duncan and Sladen (1882-1886) has a large, oval test with very faint frontal sinus. Its apical system is ethmolytic, excentric anteriorly with four genital pores. The petals are large, subpetaloid (III is non-petaloid), close and do not reach to the ambitus. The peripetalous fasciole is feebly developed; peristome excentric anteriorly and transversally bean shaped; periproct transversally oval, supramarginal.

Locality: Sind.

Horizon: middle Eocene.

Macropneustes (Macropneustes) speciosus
(Duncan and Sladen) n. comb.

(Pl. VII, figs. 5 - 7)

Macropneustes speciosus Duncan and Sladen, Duncan and Sladen 1882-1886. *Pal. Ind.*, Ser. 8, 4(i-v): 229, pl. 38, figs. 1-5.

Material: Single specimen; preservation good. GSI Type No. **2684**.

Lectotype: GSI Type No. **2684**.

Remarks: The specimen recorded and described by Duncan and Sladen (1882-1886) has a large, suboval test with very faint frontal sinus. Its apical system is ethmolytic, excentric anteriorly with four genital pores. The petals are large, subpetaloid (III is non-petaloid) and almost reach to the ambitus. The petals I & V are slightly larger than the petals II & IV. The peripetalous fasciole is feebly developed; peristome excentric anteriorly; periproct transversally quaderangular, supramarginal.

Locality: Sind.

Horizon: middle Eocene.

Genus Meoma Gray, 1851

(Type species: *M. grandis*; OD)

Subgenus Schizobrissus Pomel, 1869

(Type species: *Briassus cruciatus* Agassiz, 1847, p. 91)

Meoma (Schizobrissus) insignis (Duncan and Sladen) n. comb.

(Pl. VII, figs. 1 - 4)

Peripneustes insignis Duncan and Sladen, 1883. Duncan and Sladen, 1883. *Pal. Ind.*, Ser. 14, 1(IV): 42, pl. 5, figs. 1 - 4.

Material: Single specimen; preservation good. GSI Type No. **2830**.

Lectotype: GSI Type No. **2830**.

Remarks: The specimen recorded and described by Duncan and Sladen (1883) has a large, oval test. Its apical system is ethmolytic, excentric anteriorly with four genital pores. The petals are large, subpetaloid (III is non-petaloid), close, sunken and do not reach to the ambitus; the petals I & V are

larger than the petals II & IV. The peripetalous fasciole reentrenched between paired ambulacral petals. The subanal fasciole is well developed. The peristome excentric anteriorly, crecentric in shape. The transversally oval periproct is supramarginal in position.

Locality: Kachchh.

Horizon: middle Eocene.

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