Chitons (Mollusca, Polyplacophora) from bioclastic sands of the Ifaty-Tuléar back reefs (Madagascar, Western Indian Ocean)

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ABSTRACT Coarse-grained skeletal sediments forming around coral reefs in the region of Ifaty-Tuléar (Madagascar, western Indian Ocean, c. 23°30' Lat S) provided disarticulated plates belonging to 16 species of Polyplacophora (chitons). Most of the species recognised in our samples were already known from Madagascar. Detailed SEM illustration of tegmentum characteristics of most taxa is provided for the first time.

RIASSUNTO Numerose piastre di poliplacofori sono state identificate in campioni di sedimento bioclastico raccolto in ambienti di scogliera corallina della regione d'Ifaty-Tuléar (Madagascar, Oceano Indiano occidentale, c. 23°30' Lat S). Tale materiale proviene principalmente da campionamenti effettuati nel 1995 nell'ambito del progetto TESTREEF dell'Unione Europea ma anche da raccolte effettuate privatamente in altre localita' (Nosi Komba, Manghily). Sono state identificate 16 specie: *Lepidopleurus (Leptochiton) nierstraszi, Lepidopleurus (Parachiton)* sp., *Callochiton vanninii, Callochiton clausadeae, Ischnochiton (I.) yerburyi, Callistochiton barnardi, Chiton (C.) barnardi, Chiton (C.) kaasi, Chiton (C.) laterorugosus, Chiton (Tegulaplax) hululensis, Acanthopleura gemmata, Tonicia (Lucilina) carnosa, Acanthochitona penicillata, Notoplax curvisetosa, Choneplax indica, Cryptoplax sykesi*. Particolare importanza e' stata data alla illustrazione (SEM) delle caratteristiche delle piastre, molte delle quali vengono qui illustrate per la prima volta. In alcuni casi e' stato necessario verificare il materiale tipo delle specie *{Lepidopleurus (Leptochiton) nierstraszi, Chiton (C.) kaasi)}* o di specie simili *{Lepidopleurus (Leptochiton) gloriosus, Lepidopleurus (Parachiton) eugenei, Lepidopleurus (Parachiton) indecorus, Acanthochitona limbata}*. Per il materiale tipo sono state incluse nel lavoro le foto realizzate al SEM, anche se di qualità modesta, non essendo stato possibile metallizzare il materiale. Tutte le specie raccolte sono gia' state segnalate per il Madagascar, ad eccezione di *Lepidopleurus (Parachiton)* sp., la cui posizione tassonomica non e' al momento chiara, e di cui sono state raccolte soltanto 4 piastre intermedie in non perfette condizioni.

KEY WORDS: Polyplacophora, taxonomy, bioclastic sands, coral reefs, Madagascar, Western Indian Ocean

INTRODUCTION

Disarticulated valves of Polyplacophora (chitons) may occasionally be a relatively significant quantitative component of fossil and recent biogenic sediments, most typically sourced from hard-bottom intertidal and shallow-sublittoral environments (e.g., Cherns, 1999, Dell'Angelo *et al.*, 1999).

A case in point is the coarse-grained bioclastic sand forming around coral reefs in the region of Ifaty-Tuléar (Madagascar, western Indian Ocean, c. 23°30' Lat S). Sixteen species of Polyplacophora were identified in the sandy fraction of sediments collected at various back-reef stations in the lagoons of Tuléar, Ifaty and Nossi Ve' (**Fig. 1**).

The aim of the present paper is to describe the shell morphology of these species, discuss their taxonomic status with respect to the chiton fauna of the Western Indian Ocean, and comment their biogeographic distribution. Furthermore, this article provides the first detailed SEM documentation of tegmentum sculpture for these taxa.

MATERIALS & METHODS

The material considered in the present study was mostly obtained by sedimentological and biological sampling done in 1995 by a European team of SCUBA-DIVING researchers acting in the framework of the E.U. project TESTREEF (1994-1998). This programme was mainly focused on the late Quaternary paleoclimate and paleoceanography of the western Indian Ocean through the study of coral-reef historical records. As such, south-western Madagascar was targeted for drilling cores into modern *Porites* heads. All TESTREEF stations were located in back-reef areas of the "Grand Recif" of Tuléar, one of the World's most extensive barrier reefs (Fig.1). The very patchy nature of the TESTREEF sediment sample grid in Ifaty and Tuléar fully reflects clusters of coral-drilling in limited sectors on the sheltered side of the barrier where suitable *Porites* colonies were present at depths generally shallower than 18 m (**Table 1**). Some significant integration came from collection done by team-members involved in biological and ecological assessments of the Ifaty lagoon and Nossi Vè.

Samples sourced from unpublished fauna collections of Madagascar by one of the authors (B.S.) and Antonio Callea, were also considered in this paper.

All material collected in the framework of the TESTREEF project is stored in the Malacological Laboratory of the Zoological Museum, University of Bologna (MZB).

Abbreviations. The following abbreviations are used:

MZB Zoological Museum University of Bologna (Italy);

IRSN Institut Royal des Sciences Naturelles de Belgique, Brussels (Belgium) ;

MNHN Muséum National d'Histoire Naturelle, Paris (France);

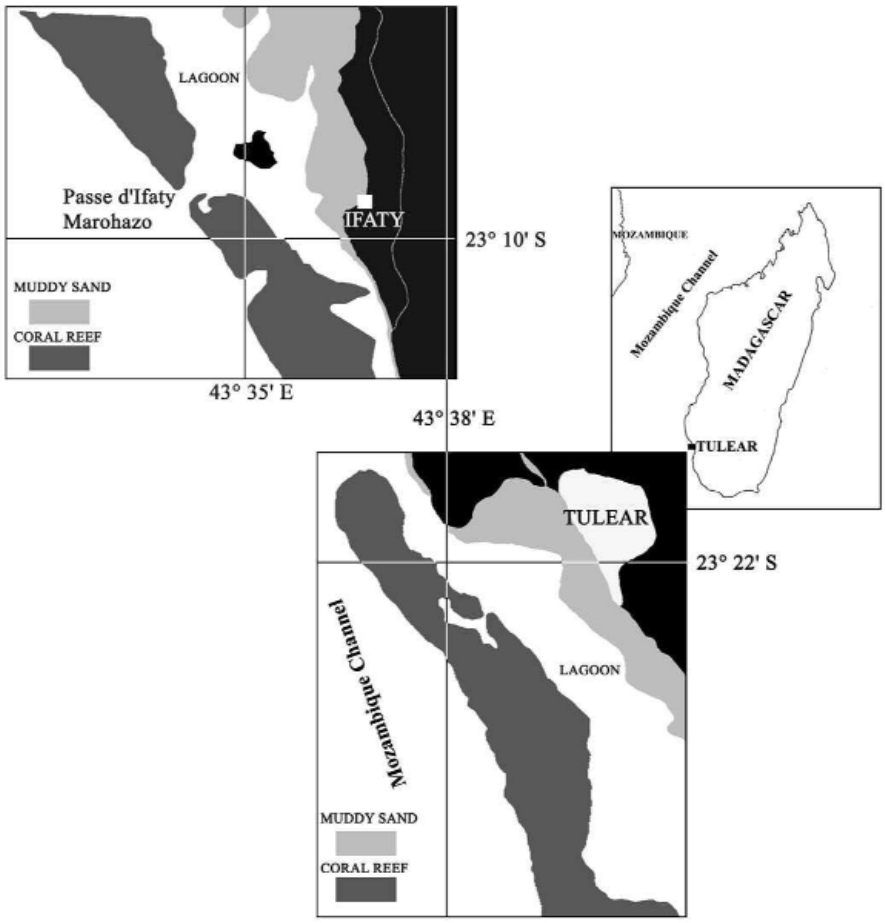

Fig.1: Map of Madagascar, with the collecting sites.
Fig.1: Mappa del Madagascar, con le localita' di raccolta.

NM Natal Museum, Pietermaritzburg (South Africa).

Polyplacophora of Madagascar Historical Background:
Knowledge of recent shallow-water Polyplacophora fauna from Madagascar began with the contribution of Thiele (1917) on Western Indian Ocean molluscs in which the new species *Callistochiton madagassicus* was described, and Odhner (1919) who listed six species from Madagascar, including some new taxa, i.e. *Ischnochiton rufopunctatus (= I.sansibarensis)*, *Acanthochites aberrans {= Craspedochiton laqueatus* (Sowerby, 1842), *fide* Gowlett-Holmes, 2001] and *Choneplax indicus*.

Dautzenberg (1923, 1929) published important contributions on the marine mollusc fauna of Madagascar but included little information on chitons, merely recording the same six species reported by Odhner. Sparse information on the chiton fauna of this area is then found in various contributions on the Western Indian Ocean: Barnard (1963) reported *Chiton barnardi* from the island of Nossi Bè; Bullock (1972) described two new species (*Chiton salihafui* and *C. fosteri*) whose ranges extend to the shores of Madagascar.

The first comprehensive study of Madagascar chitons is due to Leloup (1981), who listed as many as 28 species, including a number of new taxa. However, some of the Australasian taxa recorded for the region by Leloup are not substantiated by the critical revision of Kaas (1986). This revision is mostly based on extensive fauna collection from coral reefs of Tuléar, south-western Madagascar, built-up over the years by the French ecologist Bernard Thomassin and is considered a milestone in our understanding of Madagascar Polyplacophora.

The present contribution is a further step in the assessment of shallow-water chiton fauna from Madagascar and introduces some new information on the taxonomy and biogeography of this class as well as proper images of shell features of four taxa, previously unavailable **(Table 2)**. We also report major references for each taxon considered as well as synonymy (limited to Western Indian Ocean).

Table 1 – TESTREEF Stations

Station/Locality	
Ifaty IFT4	beach drift
Ifaty IFT5	–1.5m
Ifaty IFT11	–6.5m *Thalassodendrum*, *Alofita* and *Siringodium* seagrass
Ifaty IFT12	–4.5m *Thalassodendrum* seagrass
Ifaty IFT14	–18m outer reef Lakana Vezo
Ifaty IFT18	–4m *Thalassodendrum* seagrass
Nosi Komba	
Tuléar	0–3m
P465	Tuléar, Manghily (25 km N. of Tulear), -5-8m inside coral reef, leg. A.Callea summer 2000, B. Dell'Angelo Coll.

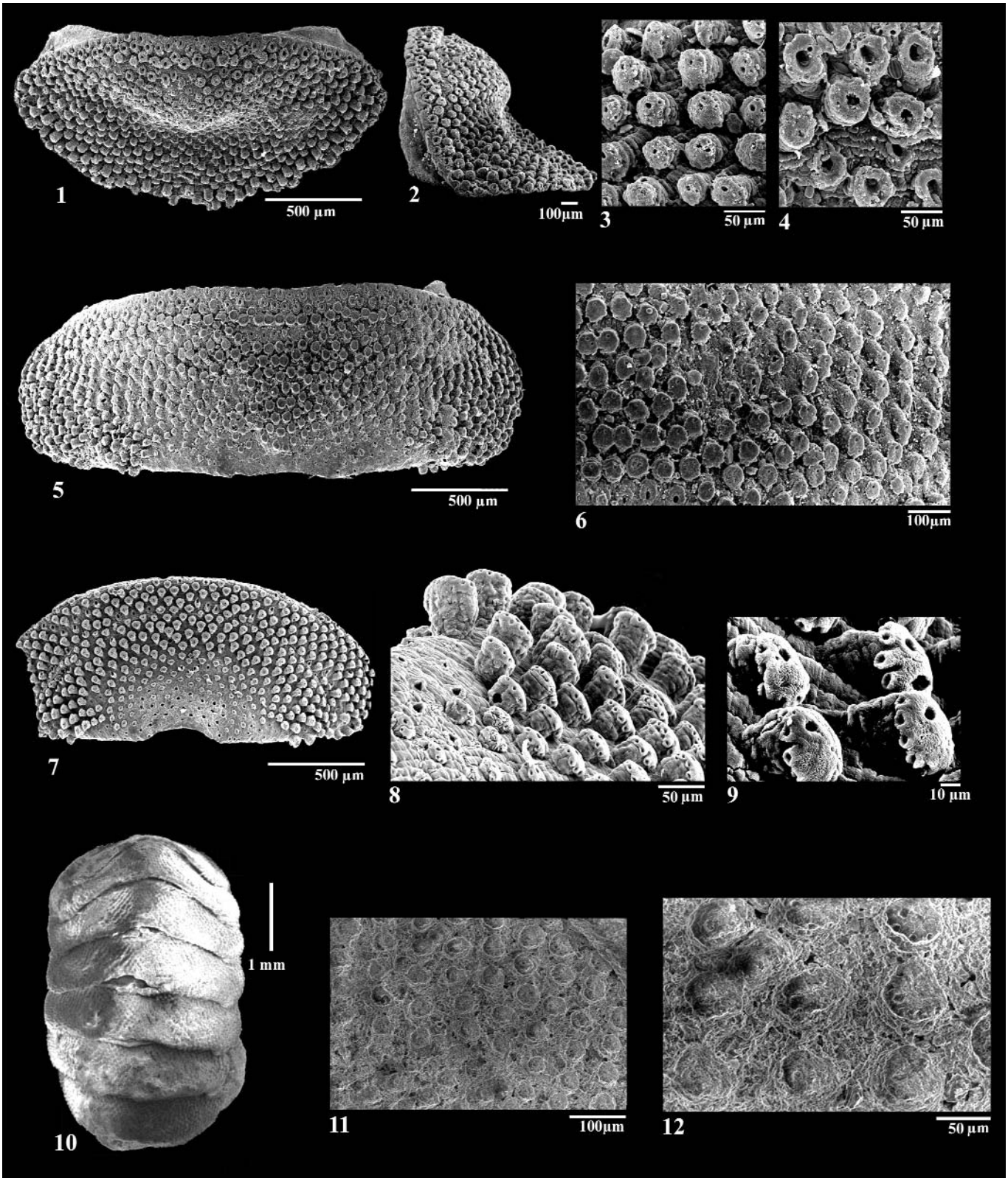

Plate 1
Figs 1-9: *Lepidopleurus (Leptochiton) nierstraszi*: Figs 1-4 tail valve (IFT14); Figs 5-6 intermediate valve (P465); Figs 7-9 head valve (P465). **Figs 10-12**: *Lepidopleurus (Leptochiton) nierstraszi*, holotype (IRSN).

Tav. 1
Figg. 1-9: *Lepidopleurus (Leptochiton) nierstraszi*: Figg. 1-4 piastra posteriore (IFT14); Figg. 5-6 piastra intermedia (P465); Figg. 7-9 piastra anteriore (P465). **Figg. 10-12**: *Lepidopleurus (Leptochiton) nierstraszi*, olotipo (IRSN).

Table 2 – Survey of Madagascar Polyplacophora.
Tab. 2 – Polyplacophora del Madagascar.

	species	this paper	Kaas, 1986	Leloup, 1981	Dautzenberg, 1923, 1929 Odhner, 1919	other papers
1	*Lepidopleurus (Leptochiton) nierstraszi*	X	X	X		
2	*Lepidopleurus (Leptochiton)* sp.		X	*Lepidopleurus* sp.		
3	*Lepidopleurus (Parachiton) eugenei*		X	*Parachiton mestayerae*		
4	*Lepidopleurus (Parachiton)* sp.	X				
5	*Callochiton clausadeae*	X	X			
6	*Callochiton levatus*		*Callochiton vanninii*	*Callochiton platessa*		SCHWABE, 2003
7	*Callochiton vanninii*	X				
8	*Stenoplax madagassica*		X	*Ischnochiton sinuosus* + var. *varius*		
9	*Lepidozona* sp.		X	X		
10	*Ischnochiton yerburyi*	X	X	*Ischnochiton delagoaensis*		
11	*Ischnochiton sansibarensis*				*Ischnochiton rufopunctatus*	
12	*Callistochiton barnardi*	X	X	X		
13	*Callistochiton rotondus*		X	X		
14	*Callistochiton crosslandi*		X	*Callistochiton madagassicus* + *Chiton ashbyi*		THIELE, 1909,1917 (*Callistochiton madagassicus)*
15	*Plaxiphora parva*		*P.parva* + *P.granulata*	*Plaxiphora granulata*		
16	*Plaxiphora tulearensis*		X	X		
17	*Chiton mauritianus*		X	X		
18	*Chiton kaasi*	X	X	*Callistochiton kaasi*		
19	*Chiton barnardi*	X	X			
20	*Chiton laterorugosus*	X	X			
21	*Chiton salihafui*					BULLOCK, 1972
22	*Chiton fosteri*					BULLOCK, 1972
23	*Chiton (T.) hululensis*	X	X	*Chiton platei*		
24	*Acanthopleura gemmata*	X	X	*Acanthopleura spiniger*	*Acanthopleura spiniger*	THIELE, 1917 *(Acanthopleura spinigera)*
25	*Tonicia carnosa*	X	X	*Tonicia indica*		
26	*Tonicia dilecta*			*Lucilina dilecta*		
27	*Onithochiton maillardi*		X	X	*Onithochiton lyelli ?*	
28	*Acanthochitona penicillata*	X	X	X	X	
29	*Acanthochitona limbata*		X	*A.zelandicus doubtlessensis*		
30	*Acanthochitona quincunx*		X	X		
31	*Notoplax curvisetosa*	X	*N.elegans*	*Notoplax elegans*		
32	*Notoplax sp.*		X	*Acanthochiton sp.*		
33	*Notoplax productus*		X	*Craspedochiton isipingoensis*		
34	*Craspedochiton sp.*				*Acanthochites aberrans*	
35	*Cryptoconchus burrowi*		X	*Cryptoconchus porosus*		
36	*Choneplax indica*	X	X	*Choneplax parvus*+C.sp.	X	
37	*Cryptoplax sykesi*	X	X	*Cryptoplax striatus*		
38	*Cryptoplax dupuisi*					ASHBY, 1931
	total	**16**	**31**	**30**	**6**	

SYSTEMATICS

Class POLYPLACOPHORA Gray, 1821
Order NEOLORICATA Bergenhayn, 1955
Suborder LEPIDOPLEURINA Thiele, 1910
Family LEPIDOPLEURIDAE Pilsbry, 1892
Genus *Lepidopleurus* Risso, 1826
Subgenus *Leptochiton* Gray, 1847

***Lepidopleurus (Leptochiton) nierstraszi* Leloup, 1981**
(Pl. 1 Figs 1-9)

Lepidopleurus (Pilsbryella) nierstraszi Leloup, 1981a: 27, fig.13, pl.2, fig.1.

Leptochiton (L.) nierstraszi – Kaas & Van Belle, 1985a: 130, fig.58.
Leptochiton (Leptochiton) nierstraszi – Kaas, 1986: 9.
Leptochiton nierstraszi – Strack, 1993: 3, pl.1, fig.1; pl.7, figs 1-2. – Slieker, 2000: 46, pl.11, fig.1.

Material. Tuléar: 2 valves, 1 intermediate (width 2.4 mm) and 1 tail (width 1.5 mm); IFT5: 3 intermediate valves (maximum width 2 mm); IFT14: 1 tail valve (width 2 mm); P465: 9 valves, 5 head (maximum width 2.5 mm), 3 intermediate (maximum width 2.6 mm) and 1 tail (width 2.1 mm).

Remarks.
Our material includes all three valve types (5 head, 7 intermediate and 3 tail); the tegmentum is covered by well separated, almost equally sized granules arranged in quincunx, 36-53 µm in diameter, with a central macroaesthete and 1 to 4 microaesthetes around the granule, mainly on the same side; granules are very elevated, particularly those along the side margins of the valves (up to 80 µm), rounded, almost cylindrical but narrower at the base than at the top, resulting in a remarkable mushroom-like form (Pl.1, Fig.9).
One tail valve shows the peculiar feature of granules flat hollow tops and another displays partially open granules on the head margin with visible microaesthetes.
Only one species of the genus *Lepidopleurus (Leptochiton)* is known from Madagascar, namely *L. nierstraszi* Leloup, 1981; this taxon has sculpture with granules quincuncially arranged; Kaas & Van Belle (1985a) described intermediate valve sculpture: *"on the jugal area consisting of well separated, round, hollow pustules, neatly arranged in quincunx; on the pleural areas the pustules are slightly smaller, arranged in 12-14 more or less juxtaposed longitudinal rows, slightly diverging posteriorly, separated by rather wide interstices"*. Figures provided by Leloup (1981a) and Kaas & Van Belle (1985a) do not show granules with characteristics that match those of our valves. However, Strack (1993: Pl.1, Fig.1) illustrated an intermediate valve found in the Red Sea at Hurghada (Egypt). Examination of the holotype of *L. nierstraszi* preserved at IRSN revealed that tegmentum characteristics are somewhat obliterated and masked by dirt but otherwise match the present material perfectly (Pl.1, Figs 10-12). The same holds true for granules diameter (36-53 µm), similar to 45-51 µm of the holotype and 40-60 µm of Red Sea specimens.
We examined the type material of *Lepidopleurus (Leptochiton) gloriosus* (Kaas, 1985) collected at 480-550 m in the Mozambique Channel off Grande Glorieuse Island, and kept in the MNHN; this taxon is also characterized by rather uniform quincuncial sculpture with well separated, raised granules (Pl.2, Figs 1-3), but differs from *L. nierstraszi* mainly in girdle characteristics.
Distribution. *L. nierstraszi* is known from Madagascar, Réunion and the Red Sea.

Subgenus *Parachiton* Thiele, 1909

***Lepidopleurus (Parachiton)* sp.**
(Pl. 2 Figs 4-6)

Material. IFT14: 1 intermediate valve, width 2.7 mm; IFT18: 2 intermediate valves, one complete (width 3 mm), the other incomplete (width 2.3 mm); P465: 1 intermediate valve, width 3.5 mm.

Remarks. Our material consists of four intermediate valves, fairly well to poorly preserved, displaying some diagnostic features of the subgenus *Parachiton*: absence of laminae inserting into the girdle, rectangular shape of intermediate valves with rounded corners, low elevation, little prominent apex, almost straight lower margin. The central area displays longitudinal striae (50-55) of rhomboidal granules, well separated but sometimes coalescing into longitudinal chains. The granules typically show three aesthaetes of equal size, arranged in an angular fashion. Lateral areas are smooth. Unfortunately, we lack valve VIII, the shape and mucro position of which are of specific value in the subgenus *Parachiton*.
The only *Parachiton* recorded from Madagascar so far is *Lepidopleurus (P.) eugenei* (Kaas & Van Belle, 1985). This taxon, collected at Tulear by B.Thomassin, was originally identified as *Lepidopleurus (Parachiton) mestayerae* Iredale, 1914, by Leloup (1981a); the latter, however, seems endemic to the Kermadec islands and differs in details of the girdle. We compared our intermediate valves with type material of *Lepidopleurus (Parachiton) eugenei*, preserved in the MNHN; this taxon shows differences in sculpture (Pl.2, Figs 7-8), namely fewer and wider longitudinal striae, as well as more decisively coalescent granules.
Comparison of our material with the holotype of *Lepidopleurus (P.) indecorus* (Kaas & Van Belle, 1990) from depths of 12-70 m off Natal, preserved in NM, showed some differences, in particular evident granules arranged in quincunx in lateral areas of *Lepidopleurus (P.) indecorus*, whereas our material is smooth; moreover, the distance between the granules in the pleural area is more clearly distinct and the granules are more roundish in *Lepidopleurus (P.) indecorus*.
Another allied species from the western Indian Ocean is *Lepidopleurus (P.) hylkiae* (Strack, 1993), at present only known

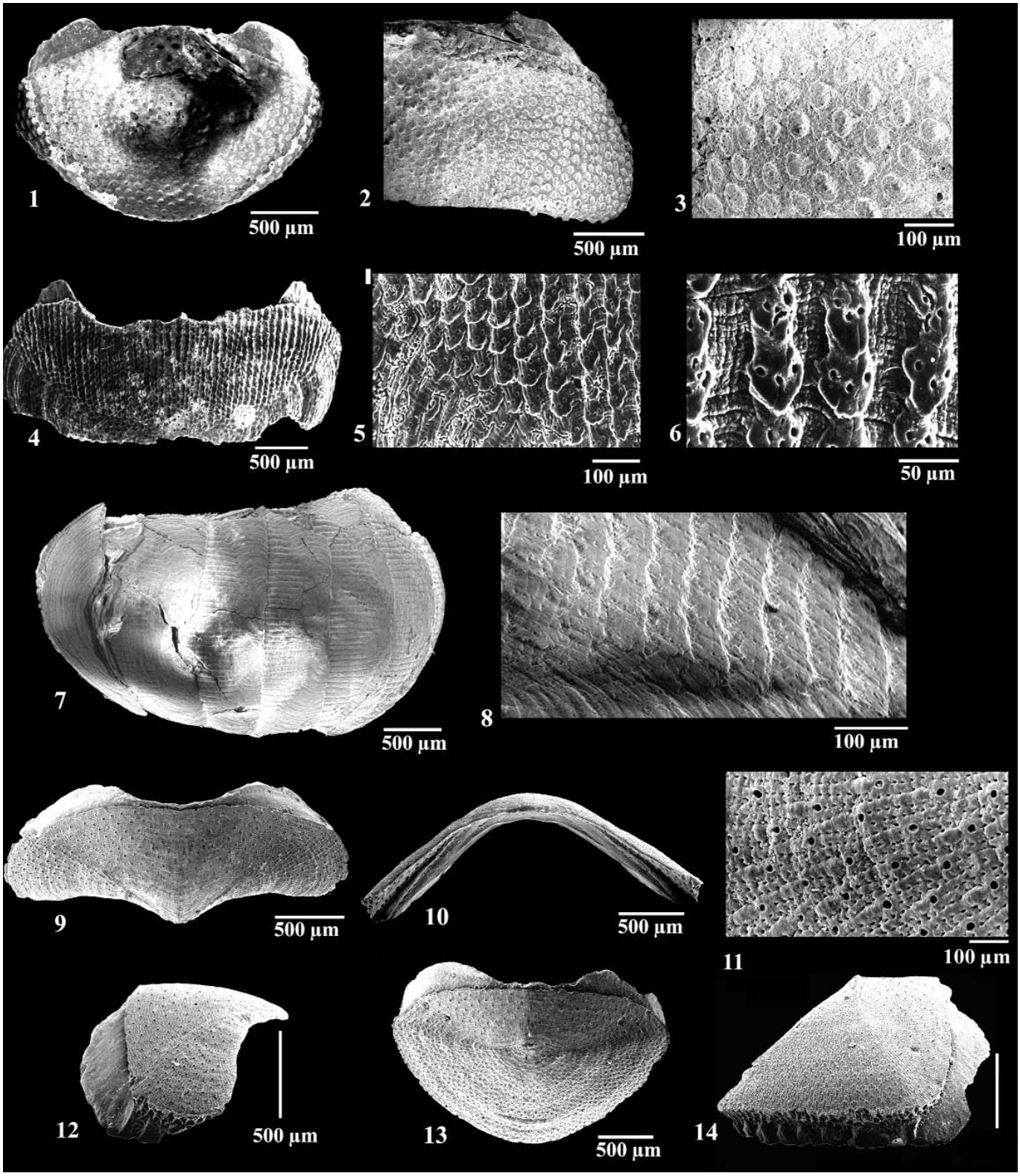

Plate 2

Figs 1-3: *Lepidopleurus (Leptochiton) gloriosus*, holotype (MNHN): Fig.1 tail valve; Fig.2 intermediate valve; Fig.3 granules of lateral area. **Figs 4-6:** *Lepidopleurus (Parachiton)* sp., intermediate valve (IFT18). **Figs 7-8:** *Lepidopleurus (Parachiton) eugenei*, holotype (MNHN), intermediate valve. **Figs 9-14:** *Callochiton vanninii*: Figs 9-12 intermediate valve (IFT5); Figs 13-14 tail valve (IFT14).

Tav. 2

Figg. 1-3: *Lepidopleurus (Leptochiton) gloriosus*, olotipo (MNHN): Fig.1 piastra posteriore; Fig.2 piastra intermedia; Fig.3 granuli dell'area laterale. **Figg. 4-6:** *Lepidopleurus (Parachiton)* sp., piastra intermedia (IFT18). **Figg. 7-8:** *Lepidopleurus (Parachiton) eugenei*, olotipo (MNHN), piastra intermedia. **Figg. 9-14:** *Callochiton vanninii*: Figg. 9-12 piastra intermedia (IFT5); Figg. 13-14 piastra posteriore (IFT14).

from the Red Sea. This species has a considerably greater number of longitudinal striae (68-95) in the central sectors of intermediate valves.
Because of the lack of adequate material and the above mentioned differences with respect to known *Lepidopleurus (Parachiton)* taxa described from the western Indian Ocean and Red Sea, we prefer not to define the nomenclature of our taxon.

Distribution. Only known from Madagascar.

Suborder ISCHNOCHITONINA Bergenhayn, 1930
Family ISCHNOCHITONIDAE Dall, 1889
Subfamily CALLOCHITONINAE Plate, 1901
Genus *Callochiton* Gray, 1847

***Callochiton vanninii* Ferreira, 1983**
(Pl. 2 Figs 9-14)

Callochiton vanninii Ferreira, 1983: 259, figs 11-19.

Callochiton vanninii – Strack, 1993: 6, pl.2, fig.8. – Van Belle, 1994: 3. – Slieker, 2000: 46, pl.11, fig.5.
Non *Callochiton vanninii*; Kaas, 1985: 327. – Kaas & Van Belle, 1985b: 44, fig.18 – Kaas, 1986: 10, fig.6 (= *Callochiton levatus* Kaas & Van Belle, 1998).

Material. Tuléar: 1 intermediate valve, width 3 mm; IFT5: 1 spm, length 5.5 mm, and 1 intermediate valve; IFT14: 6 valves, 2 intermediate (maximum width 4 mm) and 4 tail (maximum width 3.2 mm); IFT18: 2 valves, 1 intermediate (width 2.8 mm) and 1 tail (width 2 mm); P465: 12 valves, 3 head (maximum width 2 mm), 5 intermediate (maximum width 3.2 mm) and 4 tail (width 2.2 mm).

Remarks. *Callochiton vanninii* was originally designated on the basis of two specimens collected in Gesira, Somalia. The descriptions of this species in Kaas & Van Belle (1985b) and in Kaas (1986) are based on *Callochiton levatus* Kaas & Van Belle, 1998 (Schwabe, 2003: 23). In the same paper, Schwabe describes the differences between *C. vanninii* and *C. levatus*. The species is easily identified on the basis of uniform granulation over the tegmentum, absence of scars in pleural areas and no evidence of ocelli at any magnification. Slit formula of the material examined was 16-18/2/13-17, which is closer to the original description provided by Ferreira (16/2-3/16). According to Strack (1993), the Red Sea report of *Callochiton laevis* by Leloup (1980) actually regards *C. vanninii*.

Distribution. *C.vanninii* is known from Somalia, Madagascar, Red Sea, and Bahrain (Arabian Gulf).

***Callochiton clausadeae* Kaas & Van Belle, 1985**
(Pl. 3 Figs 1-3)

Callochiton clausadei Kaas & Van Belle, 1985b: 42, fig.17.
Callochiton clausadeae – Kaas, 1986: errata p.10, figs 3-5. – Kaas & Van Belle, 1987: 29. - Slieker, 2000: 46, pl.11, fig.3.
Callochiton clausadei – Drivas & Jay, 1998: 32, fig.4.

Material. Tuléar: 1 intermediate valve, width 1.8 mm; IFT12: 1 intermediate valve, width 2.1 mm; IFT14: 2 valves, 1 intermediate (width 2.7 mm) and 1 tail (width 2.2 mm); P465: 2 valves, 1 head (width 1.6 mm) and 1 intermediate (width 2.5 mm).

Remarks. *Callochiton clausadeae* is characterized by 4-6 short deep scars in the pleural areas. The original denomination (*clausadei*) was incorrect and was amended by Kaas, 1986. The taxon has been described upon some specimens collected by M.Peyrot-Clausade in Tulear and Trou aux Biches (Mauritius).

Distribution. *C. clausadeae* is known from Madagascar, Mauritius, and Réunion.

Subfamily ISCHNOCHITONINAE Dall, 1889
Genus *Ischnochiton* Gray, 1847
Subgenus *Ischnochiton* s.s.

***Ischnochiton (I.) yerburyi* (E.A.Smith, 1891)**
(Pl. 3 Figs 4-7)

Chiton (Ischnochiton) yerburyi E.A.Smith, 1891: 420, pl.33, fig.6.
Ischnochiton (Radsiella) delagoaensis Ashby, 1931: 40, pl.6, figs 63-66.
Ischnochiton haersoltei Kaas, 1954: 5, figs 7-9.

Ischnochiton yerburyi – Leloup, 1960: 35, fig.5. – Ferreira, 1983: 251, figs 1-2. – Strack, 1993: 9, pl.3, fig.2; pl.7, fig.3. – Slieker, 2000: 46, pl.11, fig.9.
Ischnochiton (I.) yerburyi – Kaas & Van Belle, 1988: 116, figs 2-7. – Kaas & Van Belle, 1990: 124, fig.53.
Ischnochiton (Ischnochiton) yerburyi – Kaas, 1986: 11, fig.8.
Ischnochiton (Simplischnochiton) yerburyi – Van Belle & Wranik, 1991: 368, fig.13. – Van Belle, 1994: 2.
Ischnochiton delagoaensis – Kaas, 1979: 856, pl.1, figs 1-5.

Material. Tuléar: 3 valves, 1 head (width 6 mm), 1 intermediate (width 5 mm) and 1 tail (width 4.1 mm); IFT11: 1 tail valve, width 6 mm; IFT14: 10 valves, 1 head (width 4.3 mm), 8 intermediate (maximum width 6.7 mm) and 1 tail (width 3.4 mm); IFT18: 1 spm, length 10.5 mm slightly curled and 13 valves, 1 head (width 4.2 mm), 11 intermediate (maximum width 5.8 mm) and 1 tail (width 4.4 mm); P465: 3 valves, 1 head (width 4 mm) and 2 intermediate (maximum width 5 mm).

Remarks. All western Indian Ocean *Ischnochiton* with reticulate, thimble-like sculpture (e.g. *I. sansibarensis* Thiele, 1910, *I. rufopunctatus* Odhner, 1919, *I. delagoaensis* Ashby 1931 and

I. kilburni Kaas, 1979) were assigned to a single taxon, *Ischnochiton yerburyi* (E.A.Smith, 1891), by Ferreira (1983). On the other hand, Kaas & Van Belle (1990) identified two species, the strongly sculptured *I. yerburyi* (syn. *I. delagoaensis* and *I. haersoltei* Kaas, 1954), and *I. sansibarensis* (syn. *I. rufopunctatus* and *I. kilburni*). The latter differs from the former by virtue of finer sculpture, quincuncially granulated jugal, lateral and terminal areas with network of squarish pits limited to pleural areas, and differences in radula and girdle characters. Our material has main shell characteristics similar to those of *I. yerburyi*; the only appreciable difference is slit formula, 10-11/1/8-9 as against 10-11/1/11-13 reported by Kaas & Van Belle (1990).

Distribution. Widespread in the western Indian Ocean and Red Sea.

Subfamily CALLISTOPLACINAE Pilsbry, 1893
Genus *Callistochiton* Dall, 1879

***Callistochiton barnardi* Leloup, 1981**
(Pl. 3 Figs 8-13)

Callistochiton (Callistassecla) barnardi Leloup, 1981a: 10, fig.4.

Callistochiton barnardi – Kaas, 1985: 330. – Kaas, 1986: 13, figs 11-17. – Kaas & Van Belle, 1994: 142, fig.57.

Material. IFT14: 15 valves, 3 head (maximum width 2.7 mm), 8 intermediate (maximum width 3.5 mm) and 4 tail (maximum width 2.8 mm); IFT18: 4 valves, 1 head (width 2.6 mm) and 3 intermediate (maximum width 2.3 mm); P465: 13 valves, 2 head (maximum width 2.7 mm), 8 intermediate (maximum width 3 mm) and 3 tail (maximum width 2.5 mm).

Remarks. *Callistochiton barnardi* is well characterized by the sculpture of longitudinal cords in the central area, with coalescent chains of irregular transversely oval, connected granules (Leloup, 1981a: fig.4).
Although our material is only fairly preserved, we have observed a tendency to bifurcation of the radial cords on the lateral areas of intermediate valves.

Distribution. *Callistochiton barnardi* is known from Madagascar and Glorieuses Islands, Northern Mozambique Channel.

Family CHITONIDAE Rafinesque, 1815
Subfamily CHITONINAE Rafinesque, 1815
Genus *Chiton* Linnaeus, 1758
Subgenus *Chiton* s.s.

***Chiton (C.) barnardi* Ashby, 1931**
(Pl. 3 Figs 14-17; Pl. 4 Fig. 3)

Chiton barnardi Ashby, 1931: 46, pl.6, figs 74-76; pl.7, fig.77.
Callistochiton viaderi Leloup, 1941: 2, figs 1-4, pl.1.
Chiton barnardi – Barnard, 1963: 343. – Giles & Gosliner, 1983: 2. – Slieker, 2000: 48, pl.12, fig.14.
Chiton (Chiton) barnardi – Kaas, 1979: 863. – Kaas, 1986: 16, figs 33-35.
Rhyssoplax barnardi – Bullock, 1988: 146.

Material. IFT14: 20 valves, 6 head (maximum width 2.8 mm), 11 intermediate (maximum width 3.2 mm) and 3 tail (maximum width 2.5 mm); IFT18: 4 spm (length 9.1 mm, 9 mm, 8.8 mm curled, 5 mm curled), 1 intermediate valve, width 2.6 mm; P465: 7 valves, 3 head (maximum width 2.6 mm), 1 intermediate (width 3 mm) and 3 tail (maximum width 2.5 mm)

Remarks. *Chiton barnardi*, originally described from Mozambique Island, was first recorded from Madagascar (Nossi-Bé) by Barnard (1963). *Callistochiton viaderi* Leloup, 1941 described from Mauritius was synonymized by Kaas (1979). *C. barnardi* is allied to *Chiton kaasi*, from which it differs basically in larger size (up to 15 mm), more pronounced sculpture, tail valve shape (triangular in *C. kaasi*), more numerous longitudinal grooves in pleural areas of intermediate valves, and girdle dorsal scale shape. Kaas (1986) proposed that the two taxa may be conspecific while we prefer to keep them separate since they can be easily distinguished on the basis of shell features.
Distribution. *Chiton barnardi* is known from Madagascar, Mozambique, Mauritius, and the Comoro Archipelago.

***Chiton (C.) kaasi* (Leloup, 1981)**
(Pl. 4 Figs 1-2)

Callistochiton kaasi Leloup, 1981a: 11, fig.5, pl.1, fig.6.

Chiton (Chiton) kaasi – Kaas, 1985: 330. – Kaas, 1986: 14, figs 26-32. – Drivas & Jay, 1998: 33.
Chiton kaasi – Slieker, 2000: 48, pl.12, fig.18.

Material. Tuléar: 5 valves, 1 head (width 2.3 mm), 3 intermediate (maximum width 3.5 mm) and 1 tail (width 2 mm); IFT5: 2 intermediate valves (maximum width 2 mm); IFT14: 45 valves, 5 head (maximum width 2 mm), 34 intermediate (maximum width 3 mm) and 6 tail (maximum width 2 mm); IFT18: 1 spm (length 5 mm), 5 intermediate valves (maximum width 3 mm); P465: 45 valves, 10 head (maximum width 2.4 mm), 23 intermediate (maximum width 2.8 mm) and 12 tail (maximum width 2 mm).

Remarks. This species was described by Leloup (1981a: as *Callistochiton*) based on a number of specimens from Madagascar, Réunion, and Mauritius. It is close to the previous taxon (see remarks under *Chiton barnardi*) but distinguishable on the basis of smoother sculpture, triangular shape of posterior valve and fewer longitudinal grooves in pleural areas of intermediate valves.
We examined the holotype preserved in the MNHN (Pl.4, Figs 4-6) which has a rather eroded shell with barely visible longitu-

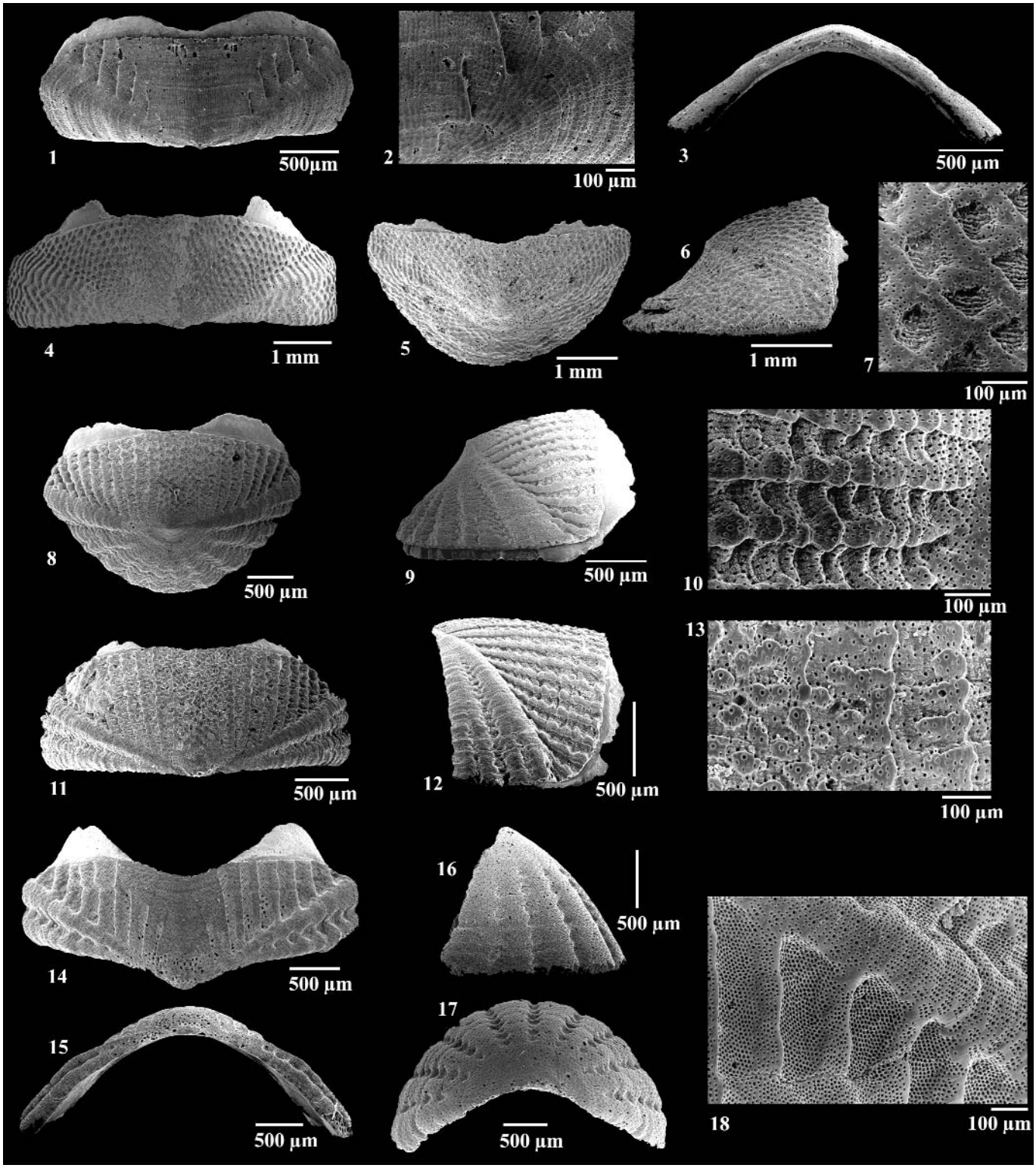

Plate 3
Figs 1-3: *Callochiton clausadeae*, intermediate valve (IFT14). **Figs 4-7:** *Ischnochiton yerburyi*: Fig.4 intermediate valve (IFT18); Figs 5-7 tail valve (IFT18). **Figs 8-13:** *Callistochiton barnardi*: Figs 8-10 tail valve (IFT14); Figs 11-13 intermediate valve (IFT14). **Figs 14-18:** *Chiton barnardi*: Figs 14-15, 18 intermediate valve (IFT14); Figs 16-17 head valve (IFT14).

Tav. 3
Figg. 1-3: *Callochiton clausadeae*, piastra intermedia (IFT14). **Figg. 4-7:** *Ischnochiton yerburyi*: Fig.4 piastra intermedia (IFT18); Figg. 5-7 piastra posteriore (IFT18). **Figg. 8-13:** *Callistochiton barnardi*: Figg. 8-10 piastra posteriore (IFT14); Figg. 11-13 piastra intermedia (IFT14). **Figg. 14-18:** *Chiton barnardi*: Figg. 14-15, 18 piastra intermedia (IFT14); Figg. 16-17 piastra anteriore (IFT14).

dinal grooves in the central area.

Distribution. *Chiton kaasi* is known from Madagascar, Réunion, Mauritius, and the Comoro Archipelago.

***Chiton (C.) laterorugosus* Kaas, 1986**
(Pl. 4 Figs 7-11)

Chiton (Chiton) laterorugosus Kaas, 1986: 16, figs 36-43.
Chiton laterorugosus – Slieker, 2000: 48, pl.12, fig.19.

Material. Tuléar: 4 valves, 3 intermediate (maximum width 5 mm) and 1 tail (width 4 mm).

Remarks. This species was previously only known from the type material, consisting of 16 specimens collected at Tulear. The valves are easily identified by the characteristic sculpture of the lateral areas of the intermediate valves "*with two or more radiating rows of little warts or rugae, sometimes concentrically connected*" and terminal valves.

Distribution. Only known from southern Madagascar.

Subgenus *Tegulaplax* Iredale & Hull, 1926

***Chiton (Tegulaplax) hululensis* (E.A.Smith in Gardiner, 1903)**
(Pl. 4 Figs 12-14)

Ischnochiton hululensis E.A.Smith, 1903: 619, pl.36, Figs 3-6.
Ischnochiton ravanae Sykes, 1903: 178, pl.1, fig.4.
Chiton (Clathropleura) platei Thiele, 1909: 92, pl.9, Figs 46-48.

Chiton hululensis – Leloup, 1952: 23, 56, fig.10, pl.3, fig.5. – Slieker, 2000: 48, pl.12, fig.17.
Chiton (Chiton) hululensis – Van Belle & Wranik, 1991: 370, fig.15.
Chiton (Tegulaplax) hululensis – Kaas, 1979: 866, pl.2, figs 11-19. – Kaas, 1986: 17, figs 44-45. – Strack, 1993: 12, pl.3, fig.9; pl.7, figs 8-9. – Dell'Angelo & Smriglio, 1999: 184, pls.62-63, fig.112.
Chiton platei – Leloup, 1981a: 17.

Material. Tuléar: 1 spm, length 7 mm (4 valves left); IFT5: 1 tail valve (width 5 mm); IFT14: 1 head valve (width 5 mm).

Remarks. *Chiton hululensis* is widely but discontinously distributed throughout the Indo-West Pacific region and synonyms are numerous. These species and *C. ravanae* were described in 1903, but Smith's description slightly predates that of Sykes (Kaas, 1979). It is a Lessepsian immigrant into the Mediterranean, where it has been found along the coasts of Israel (Barash & Danin, 1977). The taxon is characterized by its sculpture consisting of small irregular concentric costae, sinuose in the center and in lateral areas of the intermediate and terminal valves.

Distribution. Most of the Indian Ocean from Madagascar and Mozambique to Australia, Red Sea, Japan (Goto Islands), Mediterranean (Levantine basin).

Subfamily ACANTHOPLEURINAE Dall, 1889
Genus *Acanthopleura* Guilding, 1829

***Acanthopleura gemmata* (de Blainville, 1825)**
(Pl. 5 Figs 1-3)

Chiton gemmatus de Blainville, 1825: 544.
Chiton spiniger Sowerby, 1840: 287, suppl.: 16, fig.2.

Acanthopleura gemmata – Ferreira, 1983: 278, fig.30. – Ferreira, 1986: 225, figs 7-23, 113C. – Kaas, 1986: 17. – Wellens, 1988: 20. – Slieker, 2000 : 54, pl.15, fig.8.
Acanthozostera gemmata: Wu, 1975: 70, figs 14-28.
Acanthopleura spiniger – Odhner, 1919: 21, 42. – Dautzenberg, 1923: 58. – Dautzenberg, 1929: 346. – Leloup, 1981a: 9.

Material. IFT4: 11 valves, 7 intermediate (maximum width 35.8 mm) and 4 tail (maximum width 30 mm); Nosi Komba: 1 intermediate valve, width 14.5 mm.

Remarks. This large species (up to 120 mm) is characterized by a noticeable degree of variability in tegmentum sculpture, girdle ornamentation, colouration of the articulamentum and shape of the insertion teeth, often further complicated by shell character obliterations due to erosion. Not surprisingly then, the taxonomy of this species is very confused. Ferreira (1986) prefers to consider a single, widely distributed taxon. *A.gemmata* is inplaces (African coasts from Somalia to Mozambique, Madagascar) sympatric with *A.brevispinosa* (Sowerby, 1840), that can be distinguished by its radial sculpture on the terminal and lateral areas. Red Sea specimens referred to as *A.vaillantii* de Rochebrune, 1882 (= *A.haddoni* Winckworth, 1927) can be distinguished from *A.gemmata* by Kaas & Van Belle (1988) and Strack (1993), as detailed by Winckworth (1927) and Leloup (1937). The systematic status of Red Sea and Indian Ocean species of *Acanthopleura* has not yet been fully assessed, with the exception of *A.brevispinosa*.

Distribution. *Acanthopleura gemmata* is possibly the most widely distributed intertidal chiton, spanning almost continuously from 32°E to 140°W, encompassing the entire Indo-West Pacific region. Previously reported from Madagascar by Ferreira (1986) at Pointe de Tafandro, Nossi Be and Nossi Iranja, and Leloup (1981a) in Tuléar.

Subfamily TONICIINAE Pilsbry, 1893
Genus *Tonicia* Gray, 1847
Subgenus *Lucilina* Dall, 1882

***Tonicia (Lucilina) carnosa* Kaas, 1979**
(Pl. 5 Figs 4-9)

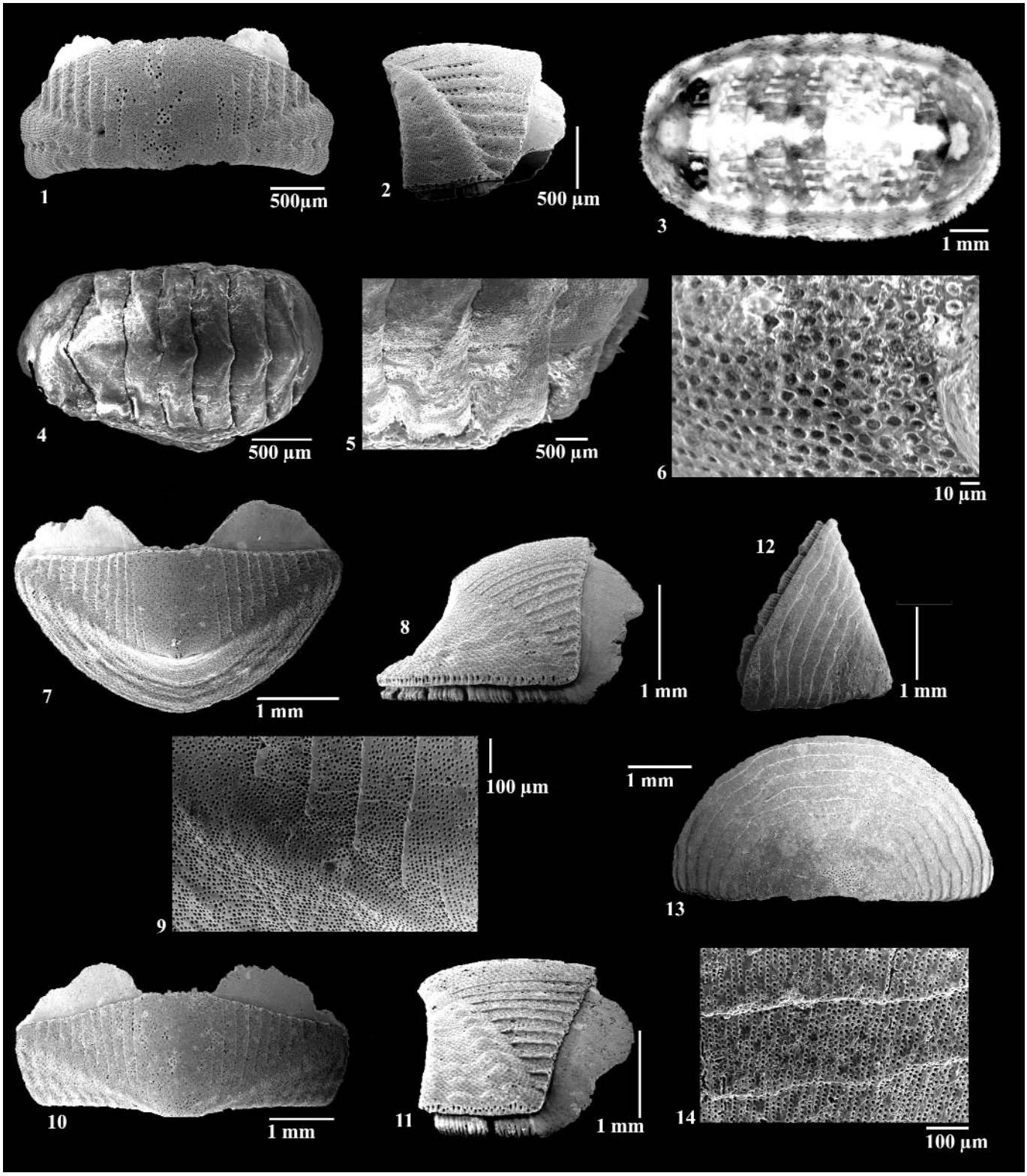

Plate 4

Figs 1-2: *Chiton kaasi*, intermediate valve (IFT14). **Fig.3:** *Chiton barnardi* (IFT18). Figs 4-6: Chiton kaasi, holotype (MNHN). **Figs 7-11:** *Chiton laterorugosus*: Figs 7-9 tail valve (Tuléar); Figs 10-11 intermediate valve (Tuléar). **Figs 12-14:** *Chiton hululensis*, head valve (IFT5).

Tav. 4

Figg. 1-2: *Chiton kaasi*, piastra intermedia (IFT14). **Fig.3:** *Chiton barnardi* (IFT18). **Figg. 4-6:** *Chiton kaasi*, olotipo (MNHN). **Figg. 7-11:** *Chiton laterorugosus*: Figg. 7-9 piastra posteriore (Tuléar); Figg. 10-11 piastra intermedia (Tuléar). **Figg. 12-14:** *Chiton hululensis*, piastra anteriore (IFT5).

Tonicia (Lucilina) carnosa Kaas, 1979: 869, pl.3, figs 1-10.
Tonicia indica Leloup, 1981a: 40, textfig.22, pl.2, fig.7; pl.3, fig.1.

Tonicia (Lucilina) carnosa – Kaas, 1985: 331. – Kaas, 1986: 18, figs 46-48. – Drivas & Jay, 1998: 32, fig.3.
Tonicia carnosa – Slieker, 2000: 50, pl.13, fig.25.
Lucilina carnosa – Kaas, 1996: 372.

Material. Tuléar: 1 intermediate valve, width 3.5 mm; IFT14: 11 valves, 2 head (maximum width 3.2 mm) and 9 intermediate (maximum width 4.6 mm); IFT11: 1 head valve, width 4.3 mm; IFT18: 18 valves, 5 head (maximum width 4.3 mm), 11 intermediate (maximum width 5 mm) and 2 tail (maximum width 3 mm); P465: 58 valves, 7 head (maximum width 5.1 mm), 31 intermediate (maximum width 4.5 mm) and 20 tail (maximum width 3.8 mm).

Remarks. Two specimens collected at Conducia Bay, Mozambique have been identified as *Tonicia carnosa*. This species resembles *Tonicia sueziensis* (Reeve, 1847) to which it has been synonymized by Ferreira (1983). However, *T. carnosa* has more evident sculpture and differs in various details of the girdle. Valves are quite variable; in our material, valve VIII is semi-elliptical in outline rather than triangular, as reported in Kaas' original description (Kaas, 1979: fig.4). The species has quite characteristic ocelli; anterior valves in our material generally have eight rows of almost straight ocelli that split into two or three rows towards margin in a few cases, as in the original description of this taxon. Slit formula: 8/1/9-12, although, as admitted by Kaas (1979), it is difficult to count the number of slits on the tail valve.

Distribution. *Tonicia carnosa* is known from Madagascar, Mozambique, Réunion, Seychelles, and Amirante Islands.

Suborder ACANTHOCHITONINA Bergenhayn, 1930
Family ACANTHOCHITONIDAE Simroth, 1894
Genus *Acanthochitona* Gray, 1821

***Acanthochitona penicillata* (Deshayes, 1863)**
(Pl. 5 Figs 10-16)

Chiton penicillatus Deshayes, 1863: 41, pl.6, figs 8, 10.

Acanthochiton penicillatus – Leloup, 1952: 9, textfig.4, pl.1, fig.3; pl.2, fig.5. – Leloup, 1980: 6. – Leloup, 1981a: 5. – Kaas, 1985: 339. – Kaas, 1986: 18.
Acanthochites penicillatus – Thiele, 1909: 45, pl.6, Figs 10-12. – Dautzenberg, 1923: 58. – Dautzenberg, 1929: 347.
Acanthochitona penicillata – Van Belle & Wranik, 1991: 379, fig.25. – Strack, 1993: 23, pl.5, fig.6. – Kaas, 1996: 372. – Drivas & Jay, 1998: 33, fig.11. – Slieker, 2000: 52, pl.14, fig.37.
Acanthochitona cf. *A.penicillata* – Ferreira, 1983: 284, fig.32.

Material. Tuléar: 8 valves, 7 intermediate (maximum width 5.7 mm) and 1 tail (width 2.2 mm); IFT5: 1 tail valve, width 1.5 mm; IFT14: 8 valves, 4 head (maximum width 3 mm), 3 intermediate (maximum width 4.5 mm) and 1 tail (width 1.8 mm); IFT18: 25 valves, 4 head (maximum width 2 mm), 18 intermediate (maximum width 3 mm) and 3 tail (maximum width 3.6 mm); P465: 36 valves, 5 head (maximum width 4 mm), 25 intermediate (maximum width 4.3 mm) and 6 tail (maximum width 3 mm).

Remarks. Although it is difficult to reliably evaluate this species-group, we attribute our material to *A. penicillata* mainly on the basis of the smooth jugal area, shape of granules and distribution of aesthetes; the latter match Leloup's (1952) figures (pl. 2, Fig.5) and description: "*les granules en triangle isocèle aigu, anguleux et plus rapprochés… Les aesthètes, bien qu'allongés, sont épais; le macraesthète terminal est accompagné de 2-3 micraesthètes courts et épais qui prolongent l'aesthète vers l'umbo. Disposés peu régulièrement, plus ou moins en quinconce dans la région jugale,… ils affleurent en quinconces réguliers dans la région pleurale, à peu près au centre d'ouvertures sensiblement triangulaires*".
In fact, three species of *Acanthochitona* have been reported so far from Madagascar, i.e. *A. penicillata*, *A. limbata* and *A. quincunx* Leloup, 1981, which admittedly are not easy to distinguish from each other. As Ferreira (1983: p.286) observes, "*Acanthochitona remains a confused and confusing group. In Acanthochitona, time-honored characters such as shape of plates, shape of latero-pleural granules, appearance of jugal area, and shape of tail plate are, by themselves, unreliable indicators upon which to differentiate and identify species*". This problem is compounded when dealing with loose valves. Deshayes' original description of *Chiton penicillatus* is vague (Ferreira, 1983), and a potential source of confusion. For example, Leloup (1952) admits that *Chiton penicillatus* is indistinguishable from the Mediterranean *A. fascicularis* (Linnaeus, 1767). The shape of intermediate valves of our material is extremely variable.
A.limbata was established by Kaas (1986) on the basis of 54 specimens collected in Tulear, and compared with *A. curvisetosa* Leloup, 1960, from the Red Sea ("*which has an almost identical girdle armature; but differs in the absence of a marginal fringe and in the large, polygonal granules on the tegmentum*"); Kaas (1986) also designs material designated by Leloup (1981a) as *Acanthochiton zelandicus doubtlessensis* to this species. We examined the type material of *A. limbata* kept at MNHN (Pl. 6, Figs 1-5). The granules are drop-shaped and thus different from those of *A.penicillata*, the granules of which are decisively triangular; furthermore, the jugal area is longitudinally striated, whereas in *A.penicillata* it is not. Surprisingly, we did not find any valve belonging to *A.limbata* although its type area is Tulear.
A. quincunx differs from the above species in the pattern of its granulations (Leloup, 1981a: 6 "*couvertes de petits grains semi-sphériques en quinconce*") and the shape of its tail valve.

Distribution. Only known from Red Sea, Suez Canal, Madagascar, Tanzania, Somalia, Seychelles, Réunion, and Mauri-

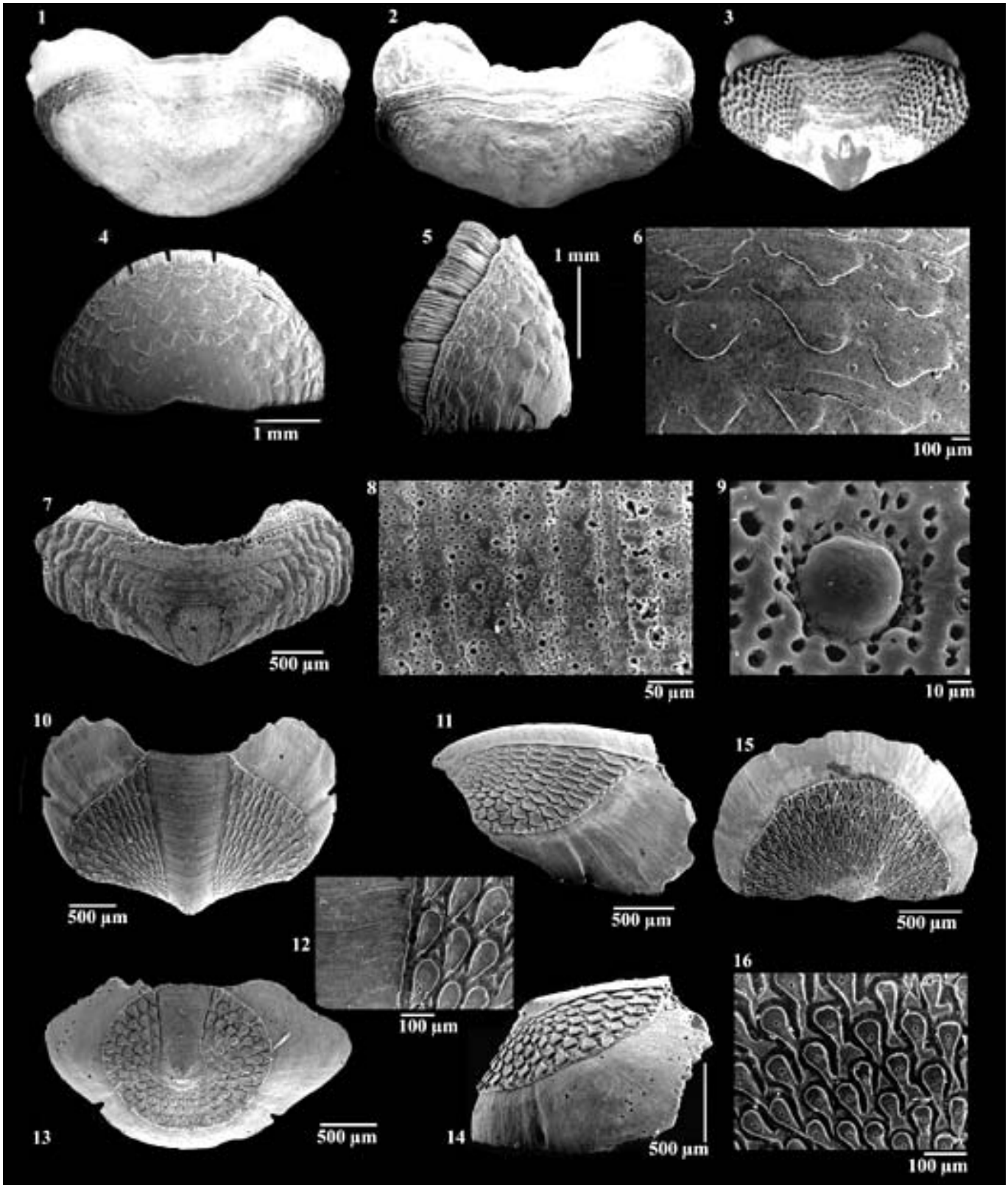

Plate 5
Figs 1-3: *Acanthopleura gemmata*: Fig.1 tail valve (IFT4); Figs 2-3: intermediate valve (IFT4). **Figs 4-9:** *Tonicia carnosa*: Figs 4-6, 9 head valve (P465); Figs 7-8: intermediate valve (P465). **Figs 10-16:** *Acanthochitona penicillata*: Figs 10-12 intermediate valve (P465); Figs 13-14 tail valve (P465); Figs 15-16 head valve (IFT14).

Tav. 5
Figg. 1-3: *Acanthopleura gemmata*: Fig.1 piastra posteriore (IFT4); Figg. 2-3: piastra intermedia (IFT4). **Figg. 4-9:** *Tonicia carnosa*: Figg. 4-6, 9 piastra anteriore (P465); Figg. 7-8: piastra intermedia (P465). **Figg. 10-16:** *Acanthochitona penicillata*: Figg. 10-12 piastra intermedia (P465); Figg. 13-14 piastra posteriore (P465); Figg. 15-16 piastra anteriore (IFT14).

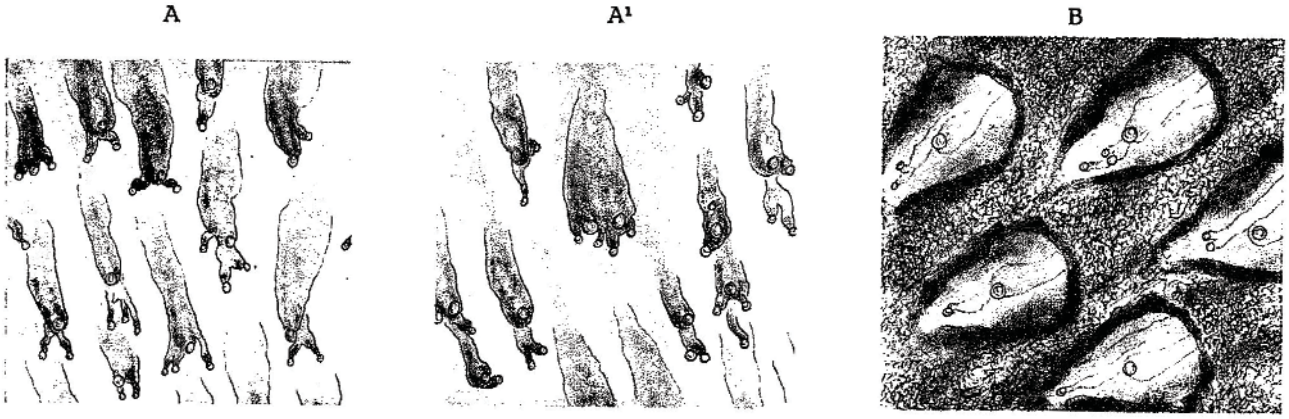

Fig. 5. - *Acanthochiton penicillatus* (DESHAYES, 1863).

Aesthètes, x 175.
A : aire médiane, région jugale, A¹ : près du bord, B : aire latérale.

Fig. 2 – *Acanthochitona penicillata*: granules and aesthetes (from Leloup, 1952)
Fig. 2 – *Acanthochitona penicillata*: granuli ed esteti (da Leloup, 1952)

Genus *Notoplax* A.Adams, 1861

Notoplax curvisetosa (Leloup, 1960)
(Pl. 6 Figs 6-7)

Acanthochiton curvisetosus Leloup, 1960: 29, textfig.1, pl.1, fig.2.
Notoplax elegans Leloup, 1981a: 33, textfig.17, pl.3, fig.3.

Acanthochiton curvisetosus – Leloup, 1981b: 1.
Notoplax (Leptoplax) curvisetosa – Strack, 1993: 26, pl.5, fig.8.
Notoplax (Notoplax) elegans – Kaas, 1986: 20.

Material. IFT18: 1 intermediate valve, incomplete, width 7 mm; P465: 2 intermediate valves, maximum width 4 mm.

Remarks. *N. elegans* has been described on the basis of 45 specimens collected at Tuléar but appears to be indistinguishable from *N. curvisetosa*, both described by Leloup. Our valves show rather conspicuous polygonal granules in the latero-pleural area.

Distribution. Only known from Red Sea, Madagascar and Glorieuses Islands.

Family CRYPTOPLACIDAE H. & A.Adams, 1858
Genus *Choneplax* Dall, 1882

***Choneplax indica* Odhner, 1919**
(Pl. 6 Figs 8-13)

Choneplax indicus Odhner, 1919: 40, pl.3, figs 44-45.
Choneplax parvus Leloup, 1981a: 18, textfig.9, pl.1, fig.4.

Choneplax indica – Kaas, 1985: 331. – Kaas, 1986: 20, figs 62-72. – Slieker, 2000: 50, pl.13, fig.32.
Choneplax indicus – Dautzenberg, 1923: 58. – Dautzenberg, 1929: 347.
Choneplax sp. – Leloup, 1981a: 19, pl.2, fig.6.

Material. Tuléar: 5 valves, 2 intermediate (maximum width 2 mm) and 3 tail (maximum width 2.2 mm); IFT12: 1 intermediate valve, width 2 mm; IFT14: 16 valves, 10 intermediate (maximum width 2.3 mm) and 6 tail (maximum width 2 mm); IFT18: 28 valves, 18 intermediate (maximum width 2 mm) and 10 tail (maximum width 1.8 mm); P465: 31 valves, 2 head (maximum width 1.3 mm), 15 intermediate (maximum width 2.2 mm) and 14 tail (maximum width 2.1 mm).

Remarks. The characteristics of our valves agree with the description of the species given by Kaas (1986). The large jugal area is smooth, never granulose, and the arrangement of the aesthetes is clearly visible. The latero-pleural areas are invariably sculptured with well raised, elliptical granules sometimes coalescing, arranged in longitudinal rows diverging forward from the apex. The granules have clusters of aesthetes formed by a central macroaesthete and a series of 6-8 microaesthetes irregularly spaced all along, and another macroaesthete at the border of the granules.
In Madagascar, *Choneplax indica* coexists with *Cryptoplax sykesi*. Although juveniles of both species are morphologically somewhat similar, *Choneplax indica* is distinguished by its narrower jugal area and the sculpture of latero-pleural areas, which is granule-free in *Cryptoplax sykesi*. Strack (1993) considers *Choneplax parvus* to be a junior synonym of *Cryptoplax sykesi*.

Distribution. Only known from Leven Bank (north of Mozambique Channel), Madagascar, Réunion and Mauritius.

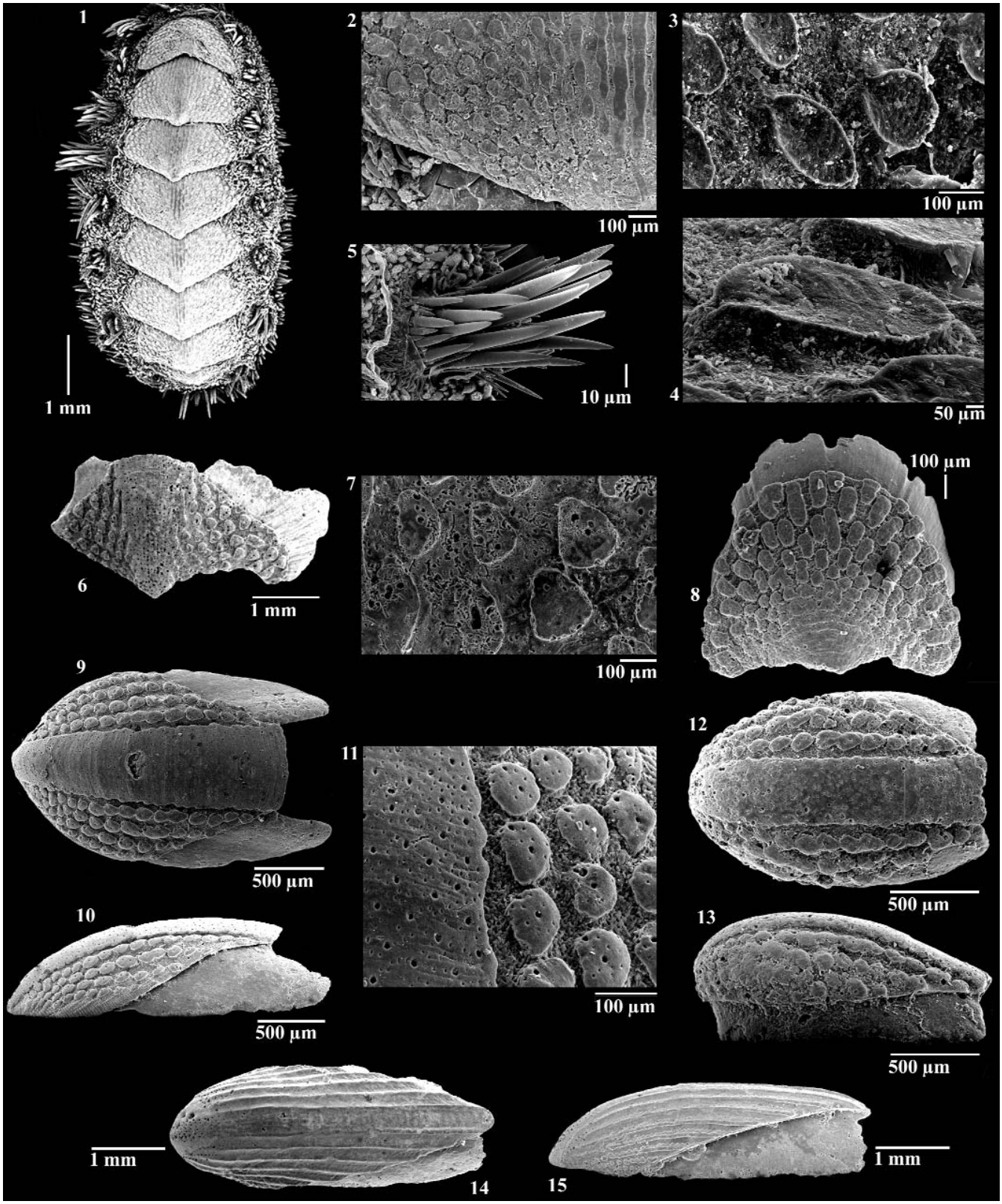

Plate 6
Figs 1-5: *Acanthochitona limbata*, paratype (MNHN). **Figs 6-7:** *Notoplax curvisetosa*, intermediate valve (IFT18). **Figs 8-13:** *Choneplax indica*: Fig.8 head valve (P465); Figs 9-11 intermediate valve (P465); Figs 12-13 tail valve (Tulear). **Figs 14-15:** *Cryptoplax sykesi*, intermediate valve (Tuléar).

Tav. 6
Figg. 1-5: *Acanthochitona limbata*, paratipo (MNHN). **Figg. 6-7:** *Notoplax curvisetosa*, piastra intermedia (IFT18). **Figg. 8-13:** *Choneplax indica*: Fig.8 piastra anteriore (P465); Figg. 9-11 piastra intermedia (P465); Figg. 12-13 piastra posteriore (Tuléar). **Figg. 14-15:** *Cryptoplax sykesi*, piastra intermedia (Tuléar).

Genus *Cryptoplax* de Blainville, 1818

***Cryptoplax sykesi* Thiele, 1909**
(Pl. 6 Figs 14-15)

Cryptoplax sykesi Thiele, 1909: 53, pl.6, figs 83-86.
Cryptoplax enigmaticus Leloup, 1980: 7, pl.1, figs 1-2; pl.2, fig.1.

Cryptoplax sykesi – Leloup, 1952: 53. – Kaas, 1979: 877. – Ferreira, 1983 : 287, fig.33 – Kaas, 1985: 333. – Kaas, 1986: 21, figs 73-81. – Kaas, 1996: 373. – Slieker, 2000: 50, pl.13, fig.31.
Cryptoplax enigmaticus – Ferreira, 1983: 289.
Cryptoplax striatus (non *Chitonellus striatus* Lamarck, 1819) – Leloup, 1981a: 21.

Material. Tuléar: 1 intermediate valve, width 4.4 mm; IFT14: 4 intermediate valves (maximum width 3.5 mm); IFT18: 14 valves, 1 head (width 5.3 mm), 8 intermediate (maximum width 3.5 mm), and 5 tail (maximum width 2 mm); P465: 17 valves, 12 intermediate (maximum width 4 mm) and 5 tail (maximum width 2.8 mm).

Remarks. Our determination is based on the interpretation of *Cryptoplax sykesi* provided by Ferreira (1983) and Kaas (1986). *C. sykesi* was originally described by Thiele, on the basis of a specimen collected from Gimsah Bay (or Gemsa, Egypt) in the Red Sea. Thiele indicated differences with respect to *C. striata* (Lamarck, 1819), a taxon to which east African *Cryptoplax* (Zanzibar and Natal) were previously assigned. The relationship between *Cryptoplax sykesi* and *C. dupuisi* Ashby, 1931, recorded from Madagascar, needs to be explored.

Distribution. Western Indian Ocean, Amirante Islands, Geyser Bank (North of Mozambique Channel), Natal and Red Sea.

CONCLUSIONS

Bioclastic sediment forming around *Porites* heads and other coral buildups in back-reef areas of the Grand Recif are particularly rich in chiton valves compared to Ifaty lagoon. Loose valves belonging to 16 species of class Polyplacophora were identified in the sandy fraction of bioclastic sands collected at shallow depths (< 18 m) around coral reefs in the Tulear-Ifaty region, Madagascar. With the exception of *Lepidopleurus (Parachiton)* sp., whose taxonomic position is unclear at present, all taxa were recorded by Kaas (1986) in his list of Madagascar Polyplacophora. However, the valve characteristics of many taxa were imperfectly known and without SEM documentation. Our contribution provides the first throughout SEM documentation of individual valves of these taxa.

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