Intertidal chitons (Mollusca: Polyplacophora) from the coast of Jordan, Red Sea, with the description of a new species of *Parachiton* Thiele, 1909

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ABSTRACT Of the 22 (+1) recorded species of chitons living in the Red Sea, 13 species are known to have been found in Jordan. During our two field trips to Jordan (1997-1999) we were able to collect and determine 12 species. A single specimen belonging to the subgenus *Parachiton* Thiele, 1909 could not be identified as belonging to any known species, except that it showed close resemblance to *Leptochiton (Parachiton)* sp. (1 tail valve) mentioned by Hermann L. Strack (1993), and is hereby described as *Leptochiton (Parachiton) jordanensis* sp. nov. Several specimens of *Tonicia (Lucilina) perligera* (Thiele, 1909), which was known only from a few complete specimens and some loose valves, were collected. This confirms the reports of H. Strack and adds some additional information about this very rare species. The unusual finding of 5 abnormal specimens of *Tonicia (Lucilina) sueziensis* (Reeve, 1847) with 7 plates is reported and illustrated for the first time. Furthermore, a single juvenile specimen of *Acanthochitona* cf. *mahensis* Winckworth, 1927 was collected. As this species was hitherto only known to occur in the Indian Ocean, this record may mean a considerable range extension of this species and bring the number of Red Sea species to 24. Further records are nevertheless needed to confirm the presence of this species in the Red Sea. This paper is mainly based on material collected during field work and is a contribution to a better understanding and determination of intertidal chitons of the Red Sea. As most species are already adequately described in the literature, the descriptions in this paper are brief, though supplemented with personal notes and observations. This contribution concludes with a key for the chitons of the Gulf of Aqaba based on external features.

RIASSUNTO Il presente lavoro si basa principalmente sul materiale raccolto nel corso di due viaggi in Giordania (1997, 1999), e rappresenta un contributo ad una migliore conoscenza dei poliplacofori intertidali del Mar Rosso. La descrizione delle specie è espressa in forma ridotta ed è completata con osservazioni personali in considerazione del fatto che molte di queste specie sono già state adeguatamente descritte in letteratura. Tredici specie di Poliplacofori, sulle 22 (+1) viventi in Mar Rosso, sono segnalate in letteratura per la Giordania. Nel corso dei nostri due viaggi in Giordania siamo stati in grado di raccogliere e determinare 12 specie: *Callochiton vanninii* Ferreira, 1983, *Ischnochiton yerburyi* (E.A.Smith, 1891), *Chiton (Tegulaplax) hululensis* (E.A.Smith, 1903), *Chiton (Rhyssoplax) affinis* Issel, 1869, *Chiton (Rhyssoplax) maldivensis* (E.A.Smith, 1903), *Acanthopleura vaillantii* de Rochebrune, 1882, *Tonicia sueziensis* (Reeve, 1847), *Tonicia perligera* (Thiele, 1909), *Acanthochitona penicillata* (Deshayes, 1863), *Acanthochitona mastalleri* Leloup MS, Strack, 1989, *Craspedochiton laqueatus* (Sowerby, 1842), *Notoplax curvisetosa* (Leloup, 1960). Non è stato possibile identificare un singolo individuo appartenente al s.gen. *Parachiton*, che è stato confrontato con le specie di *Leptochiton (Parachiton)* conosciute per l'Oceano Indiano. Questa specie, molto simile a *Leptochiton (Parachiton)* sp. descritto da Strack (1993) su di una sola valva posteriore, viene qui descritta come *Leptochiton (Parachiton) jordanensis* sp.nov. Sono stati raccolti diversi individui di *Tonicia perligera*, specie precedentemente nota solo per pochi individui completi ed alcune valve sciolte. Questi ritrovamenti confermano le segnalazioni di Strack ed aggiungono qualche informazione ulteriore su questa rara specie. Viene anche illustrato per la prima volta il non comune ritrovamento di 5 esemplari anomali di *Tonicia sueziensis* (Reeve,1847) con 7 valve. E' anche stato raccolto un individuo giovanile di *Acanthochitona* cfr. *mahensis* Winckworth, 1927. Questa segnalazione estende notevolmente l'areale di distribuzione di questa specie, conosciuta per l'Oceano Indiano, e consente di portare a 24 il numero delle specie viventi nel Mar Rosso. Saranno comunque necessari ulteriori ritrovamenti per confermare la presenza di questa specie in Mar Rosso. Per concludere, viene fornita una chiave di determinazione per i chitoni del Golfo di Aqaba.

KEY WORDS: Polyplacophora, Jordan, Gulf of Aqaba, Red Sea, *Leptochiton (Parachiton) jordanensis* sp. nov., abnormalities, key, synopsis.

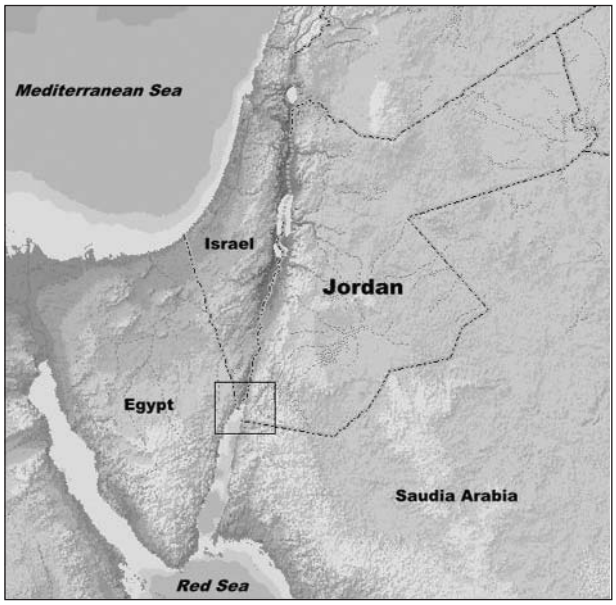
INTRODUCTION

The southern part of Jordan (see maps 1, 2) has a narrow coastline of about 26 km along the Gulf of Aqaba. In August 1997 we made a first trip to this area and at the end of our stay we fortuitously discovered some chitons. Once home we identified 5 different species, some only represented by a single specimen. On consulting the literature, we saw that more species could be observed there. We therefore planned a second trip in July 1999 to try to find more species and map the whole Jordanian coastline. Twelve previously known and one new species were found from collections made along nearly the entire coastline. We noticed differences in species diversity from one collecting site to another, probably due to minor ecological differences. For example, *Craspedochiton laqueatus* (Sowerby, 1842) was mainly found near the Saudi border (locality #6) under very large granite boulders at a depth of –0.5 m. Of the 13 species collected, *Tonicia (Lucilina) sueziensis* (Reeve, 1847) was the most abundant and was found along most of the coastline.

Locality	
#1	Hotel Aquamarina I, Aqaba, concrete jetty and private beach
#2	North Beach (north of Aqaba commercial harbour)
#3	Club Murjan (south of Aqaba commercial harbour)
#4	North of National Tourist Camp
#5	North of Royal Diving Club
#6	Saudi-border, near Potash salt factory

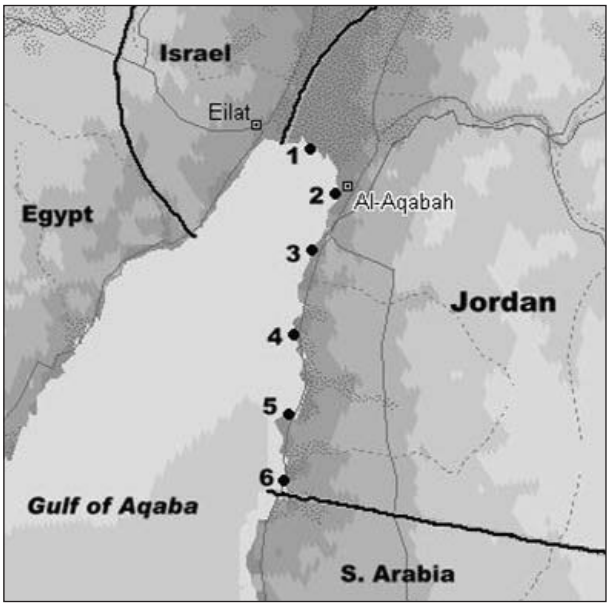
Table 1: Sampling localities

Tab. 1: Località di raccolta



Map 1: Map of Jordan

Mappa 1: Mappa della Giordania



Map 2: Detail of the Coast of Jordan with the collecting sites

Mappa 2: Dettaglio delle coste della Giordania con le località di raccolta

MATERIALS & METHODS

All specimens were hand-collected intertidally down to a depth of approximately -6 m using snorkelling equipment. All sampling sites are shown in map 2 and detailed in table 1. Collected specimens were carefully removed from the substrate, sometimes by means of a sharp knife, and placed in a plastic collecting jar containing a few smooth stones and fresh seawater. Once settled on the walls of the jar or stones, the specimens were carefully removed and immediately placed on glass microscope-slides (for smaller specimens) or plastic strips (for larger ones). The specimens were then tied down lengthways using nylon-thread to prevent curling and fixed in alcohol. Some of the specimens were later dried and some were placed in a container with isopropyl-alcohol/glycerine (50%/50%) preserving solution. A different method was used to investigate and preserve the single specimen of *Leptochiton (Parachiton) jordanensis* sp. nov. The originally dried specimen was partially soaked in distilled water to extract the radula and a piece of girdle which were mounted on SEM-stubs and deposited as such together with the animal (in alcohol).

The number of specimens collected was deliberately restricted so as not to disturb the local fauna. Care was taken to minimise disturbance of habitats when collecting and all stones were put back in their original position. Most specimens are in the private collections of the authors.

SEM images (except of *L. (P.) jordanensis* sp. nov.) were kindly made by Dr. B. Dell'Angelo with a *JEOL* mod. JSM-5200 SEM. The SEM images of the holotype of *L. (P.) jordanensis* sp. nov. were obtained with a Philips XL 20 SEM and optical pictures of the specimens were photographed using a *Leica* MZ12 stereo microscope with a *Kappa* DX30 digital camera, both at the ZSM (Munich, Germany). SEM images of paratype I are by courtesy of H.L. Strack.

The systematics in this paper is according to the classification of Kaas & Van Belle (1998). Descriptions start with the reference of the original description followed by a list of known synonyms and a limited list of references in which species are illustrated

by means of pictures or drawing.

ABBREVIATIONS

app. = approximately
BA = Private collection Bruno Anseeuw
CAS = California Academy of Sciences, San Francisco, U.S.A.
ES = Private collection Enrico Schwabe
HLS = Private collection Hermann L. Strack
KBIN = Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels, Belgium
PA = Private collection Patrick Anseeuw
RMNH = Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands
sp. = specimen
sps = specimens
TL = Total tail valve Length
v = valve
VB = Private collection Richard A. Van Belle
YT = Private collection Yves Terryn
ZMHU = Zoologisches Museum and der Humboldt Universität, Berlin, Germany
ZSM = Zoologische Staatssammlung München, Germany

RESULTS

Class POLYPLACOPHORA Gray, 1821
Order NEOLORICATA Bergenhayn, 1955
Suborder LEPIDOPLEURINA Thiele, 1909
Family LEPTOCHITONIDAE Dall, 1889

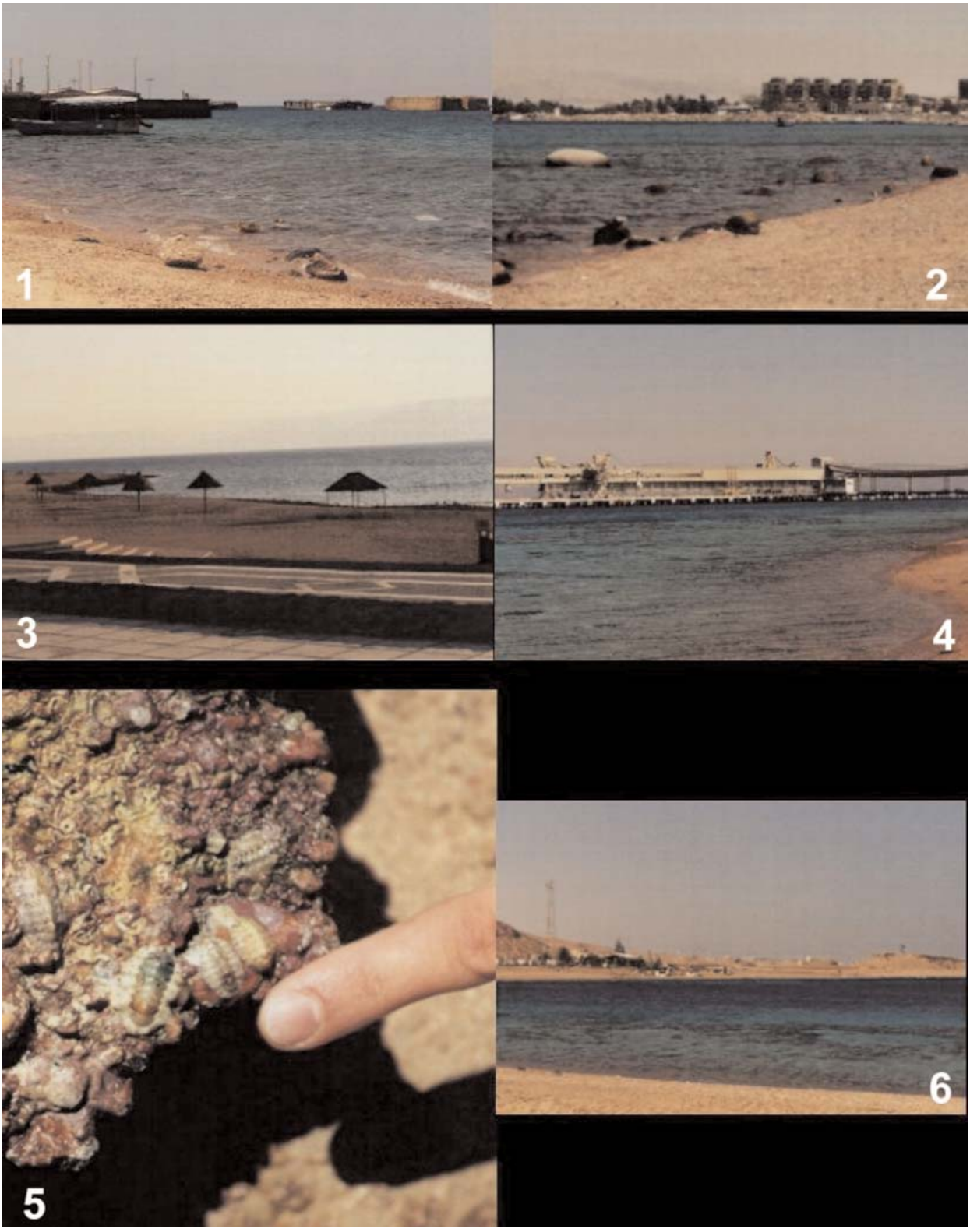


Plate 1
1. North Beach (loc. #2), with view of commercial harbour of Aqaba. **2.** North Beach (loc. #2), with view of loc. #1. **3.** Club Murjan (loc. #3). **4.** Locality # 6: Potash factory. **5.** Granite rock from loc. #6, showing *Tonicia (L.) sueziensis, Chiton (R.) affinis* and *Notoplax curvisetosa* (in situ). **6.** Locality #6: near Saudi border.

Tavola 1
1. North Beach (loc. #2), con vista del porto commerciale di Aqaba. **2.** North Beach (loc. #2), con vista della loc. #1. **3.** Club Murjan (loc. #3). **4.** Località # 6: Fabbrica di potassa. **5.** Rocce granitiche nella loc. #6, con *Tonicia (L.) sueziensis, Chiton (R.) affinis* e *Notoplax curvisetosa* (in situ). **6.** Località #6: vicino al confine saudita.

Subfamily LEPTOCHITONINAE
Genus *Leptochiton* Gray, 1847
Subgenus *Parachiton* Thiele, 1909

***Leptochiton (Parachiton) jordanensis* sp. nov.**
(Figs 7-17; 32-35)

Leptochiton (Parachiton) sp. Strack, 1993: 6, pl.2, figs 5-7.

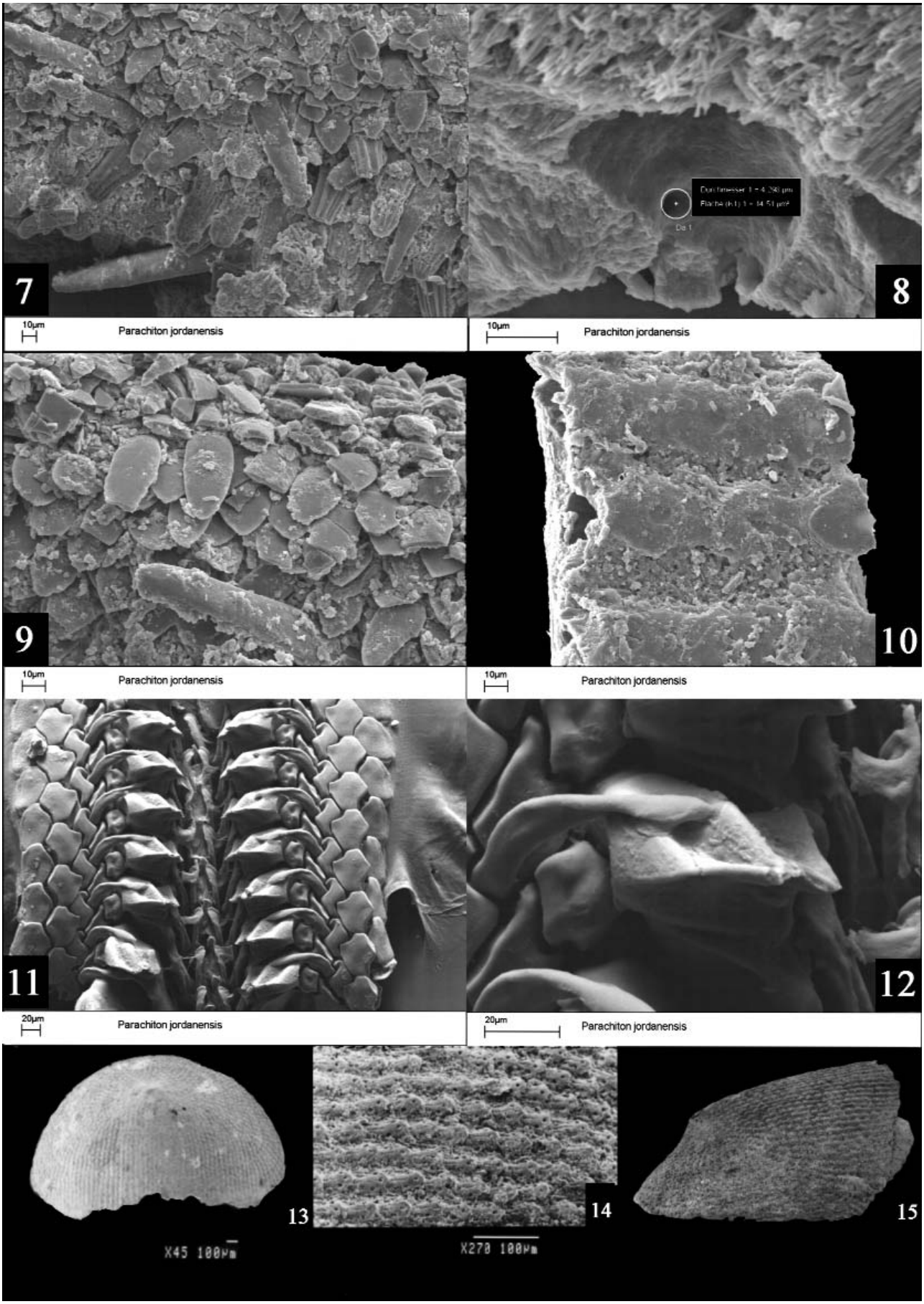
Holotype. KBIN IG 29.342 Type # 492, South Jordan, Red Sea, between Saudi Border and Potash Salt factory (Locality #6), 10.VII.1999, BA & YT leg., 5.0 x 2.9 mm, preserved flat in alcohol; piece of radula preserved in alcohol, pieces of girdle (dorsal and ventral), radula and jugal tegmentum of valve II separately mounted on SEM-stubs, deposited together with the animal.
Paratype I: HLS 2031/1v, Hurghada, Egypt, VII.1987, J.L. Gonzales & J. Uhia leg., valve VIII, 1.4 x 2.4 mm;
Paratype II: ES 54/1v, in shell grit from a small peninsula, Makadi Bay, 30 km south of Hurghada, Egypt, X.1999, I. Kurtz leg., valve VIII , 1.4 x 2.4 mm.

Diagnosis. Animal small, shell thin, colour pale brownish yellow-white, brownish flecks near the jugum, elongate, valves III-VI slightly broken in jugal area, valve VII broken in one lateral area, back rounded, dorsal elevation up to 0.40. Intermediate valves not beaked, lateral areas slightly raised. Tegmentum sculptured with longitudinal chains of granules in central area of intermediate valves and antemucronal area of tail valve, and with radiating rows on head valve, in lateral areas of intermediate valves and in postmucronal area of tail valve. Concentric growth marks at anterior and posterior outer edges of shell, inconspicuous on intermediate valves. Girdle narrow, covered dorsally with different types of scales.

Description. Head valve semicircular with inconspicuous growth band near outer front edge, tegmentum sculptured with about 75 radiating rows of small, separate granules.
Intermediate valves rectangular, posterior margins slightly convex, lateral areas hardly raised, distinguishable by the difference in tegmental sculpture; side slopes convex, growth mark at outer edge of lateral areas. Tegmentum of central area covered with 45-50 longitudinal chains of small, round, flattened granules, sometimes coalescing on jugum. Lateral areas covered with about 10-12 radiating rows of clearly separated granules that are slightly larger than in central areas.
Tail valve as wide as head valve, mucro posterior, situated at about 4/5 of total length of tail valve, postmucronal slope concave, growth band on outer edge. Antemucronal area covered with about 50 longitudinal, chains of round to slightly oval granules, coalescing in central part. Postmucronal area densely covered with small, round granules, sometimes coalescing, mostly juxtaposed. Disposition of granules in postmucronal area is in about 75 radiating rows (see figs 32-35; 13-15). Articulamentum white.
The single macropore-opening on each granule is about 10 µm in diameter and macropore pocket is about 30 µm in diameter. The macropore is surrounded by 4-6 not clearly visible micropores, 4 µm in diameter. Distance between centres of two macropores measured in jugal area of valve II was about 45-50 µm. The surface openings of the micropores are presumably on the sides of the granules as they are not visible on the top surface (see figs 8, 10, 14).
Girdle narrow, light brown, covered dorsally with three types of girdle elements, all directed outwardly: (1) flat, elongated, teardrop-shaped, blunt-pointed scales near valves, largest measuring about 45 x 23 µm; (2) long, flat, rectangular, blunt-pointed scales with up to six equidistant ribs, situated near outer margin, largest measuring 40 x 15 µm; (3) long, pointed, tubular spines, up to 15 µm in diameter and up to 120 µm in length, interspersed between type (2) girdle elements at the outer margin of the girdle (see figs 7, 9). We were not able to study the ventral scales because they are embedded in the soft parts due to the preparation method.
Radula measuring almost half total length of animal. Major lateral teeth with broad tridentate cusps having sharply pointed denticuli, total width about 60 µm. Shaft of major lateral presumably short and not visible. Spatulate tooth, up to 100 µm long, reaching back end of major lateral (see figs 11-12).
Gills could not be investigated due to shrinking of the soft parts during preparation.

Habitat. Found on a dead *Terebra dimidiata* Linnaeus, 1758, on sandy bottom, -3 m, in open space in coral flat, near Saudi Border, south Jordan.
Paratype I (single valve) was found in shell grit from 2-20 m, Hurghada Egypt. Paratype II (single valve) was also found in shell grit on a beach 30 km south of Hurghada, Egypt.

Plate 2
7. *Leptochiton (Parachiton) jordanensis* sp. nov., loc. #6, holotype, dorsal girdle elements. 8. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, holotype, detail aesthete channel. 9. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, holotype, detail dorsal girdle elements. 10. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, holotype, detail of jugal area valve II. 11. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, holotype, radula. 12. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, holotype, detail radula, major lateral tooth and spatulate unical tooth. 13. *Leptochiton (P.) jordanensis* sp. nov., Hurghada, Egypt, 1.4 x 2.4 mm, paratype I (HLS 2031), valve VIII, dorsal view. 14. *Leptochiton (P.) jordanensis* sp. nov., Hurghada, Egypt, paratype I (HLS 2031), valve VIII, detail tegmental sculpture. 15. *Leptochiton (P.) jordanensis* sp. nov., Hurghada, Egypt, 1.4 x 2.4 mm, paratype I (HLS 2031), valve VIII, lateral view.
Tav. 2
7. *Leptochiton (Parachiton) jordanensis* sp. nov., loc. #6, olotipo, elementi dorsali del perinoto. 8. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, olotipo, dettaglio dei canali degli esteti. 9. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, olotipo, dettaglio degli elementi dorsali del perinoto. 10. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, olotipo, dettaglio dell'area jugale della piastra II. 11. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, olotipo, radula. 12. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, olotipo, dettaglio della radula, secondo dente laterale e dente spatolato. 13. *Leptochiton (P.) jordanensis* sp. nov., Hurghada, Egypt, 1.4 x 2.4 mm, paratipo I (HLS 2031), piastra VIII, vista dorsale. 14. *Leptochiton (P.) jordanensis* sp. nov., Hurghada, Egypt, paratipo I (HLS 2031), piastra VIII, dettaglio della scultura del tegmentum. 15. *Leptochiton (P.) jordanensis* sp. nov., Hurghada, Egypt, 1.4 x 2.4 mm, paratipo I (HLS 2031), piastra VIII, vista laterale.


7
10µm
Parachiton jordanensis
8
10µm
Parachiton jordanensis
9
10µm
Parachiton jordanensis
10
10µm
Parachiton jordanensis
11
20µm
Parachiton jordanensis
12
20µm
Parachiton jordanensis
13
X45 100µm
14
X270 100µm
15

Distribution. Probably endemic to the northern Red Sea; known from Gulf of Aqaba to south of Hurghada, Egypt; probably shallow subtidal.

Discussion. This species was first remarked by Hermann Strack (1993) as different from *Leptochiton (Parachiton) hylkiae* Strack, 1993, the only representative of the subgenus in the Red Sea. As the author was only able to study a single tail valve, there was limited information for complete diagnosis. He noted that it differed from *L. (P.) hylkiae* mainly in mucro position and granule arrangement in the postmucronal area. The mucro of *L. (P.) hylkiae* is terminal, overhanging (or almost) the posterior edge. The mucro of *L. (P.) jordanensis* sp. nov. is situated at about 4/5 of the total length of the tail valve and does not overhang the posterior edge. Strack also found differences in the number of rows of granules in the antemucronal area of the tail valve and their setting in the postmucronal area of the tail valve. *L. (P.) jordanensis* has about 50 longitudinal rows of small granules in the antemucronal area and about 75 radiating rows in the postmucronal area. *L. (P.) hylkiae* has up to 85 longitudinally arranged rows in the antemucronal area and the arrangement in the postmucronal area is similar to that on the head valve.

Furthermore, the number of rows of granules in the central area of the intermediate valves of *L. (P.) jordanensis* is about 45-50, whereas *L. (P.) hylkiae* has about 70-95 such rows, clearly discernible. Moreover, the granules of *L. (P.) hylkiae* almost always coalesce, creating a chained appearance, whereas in L. (P.) jordanensis this phenomenon is rarely seen. Only a few rows are of this kind or are limited to specific areas, such as the jugal area of intermediate valves and the central part of the antemucronal area of the tail valve, but certainly not all over the tegmental surface. Specifically, this coalescing character is not found in lateral areas of the intermediate valves, but here the granules are very distinct from each other.

Strack (1993) remarked that this species could be closely related to *Leptochiton (Parachiton) eugenei* Kaas & Van Belle, 1985 from Madagascar and *Leptochiton (Parachiton) indecorus* Kaas & Van Belle, 1990 from Natal, South Africa, as they live in the same zoogeographical area (western Indian Ocean). The lateral outline of the tail valve of *L. (P.) jordanensis* is however quite different from these species.

In our opinion *L. (P.) jordanensis* is also related to *L. (P.) ronaldi* Kaas & Van Belle, 1985 from the Andaman Islands. *L. (P.) jordanensis* can be distinguished from *L. (P.) ronaldi* by the sculpture of the head valve, lateral areas and postmucronal area which have radiating rows of clearly separated granules, whereas the granules of *L. (P.) ronaldi* are arranged in quincunx and the dorsal elevation of *L. (P.) jordanensis* is much greater. Furthermore, *L. (P.) ronaldi* has a steep hind slope and is reported to be endemic to the Andaman Islands, whereas the hind slope of *L. (P.) jordanensis* is concave with a clearly visible concave dent near the mucro and the species is probably endemic to the northern part of the Red Sea.

A complete overview of the clear external characteristics of the species mentioned above is given in table 2 by way of comparison. Where possible, the number of longitudinal rows of granules in the central and antemucronal areas is mentioned; in other areas it is mentioned otherwise.

Considering all the differences, we conclude that the species is different from all known members of the subgenus and is therefore hereby described as new.

Remarks. In the course of our study, the holotype was damaged (valve II) but this gave us the opportunity to study the microstructure of the pustules by SEM without completely taking the specimen apart.

Etymology. *Leptochiton (Parachiton) jordanensis* is here named after the country in which the holotype was found.

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

Callochiton vanninii Ferreira, 1983 (Fig. 37)

Callochiton vanninii Ferreira, 1983: Ital. J. Zool., N.S., Suppl. 18 (9): 259, figs 11-19.
Callochiton platessa Leloup, 1981 (non *Chiton platessa* Gould, 1846)
Non: *Callochiton vanninii* Kaas & Van Belle, 1985 (= *Callochiton levatus* Kaas & Van Belle, 1998)

Callochiton vanninii - Strack, 1993: 6-7, pl. 2 fig. 8; Slieker, 2000: 46, pl. 11 fig. 5.

Type locality. Gesira, Somalia.

Material. This species was not found during our field trips.

Description. Animal small, largest specimen mentioned in literature measures 12.5 x 7.9 mm (Strack, 1993). Tegmentum glossy, very finely granulated; colour varies from greyish white with a pale rose tinge, through reddish brown to dark red, sometimes with small white spots in jugal area. Girdle wide, usually of similar colour to tegmentum, with four characteristic pale bands at sutures of valves I-II and VII-VIII. Articulamentum dark red, slit formula 15-16/2/15-16. The girdle is covered dorsally with many long, smooth, minute, inwardly directed, needle-like imbricating spicules. Major lateral teeth of radula have tridentate head, with central denticle somewhat larger than the others.

Gills holobranchial, almost reaching anterior edge of foot, adanal with interspace.

A detailed and comprehensive description of *C. vanninii* is given by Strack (1993: 6-7, pl. 2 fig. 8).

Habitat. Mostly under dead coral or stones at depths of 0.5-1.0 m.

characteristics	*hylkiae*	*indecorus*	*eugenei*	*ronaldi*	*jordanensis* sp. nov.
dorsal elevation	0.38	0.32	0.28	0.32	0.40
head valve	radiating granular rows, growth lines evident	close, fine radial grooves	quincunxially arranged granules	quincunxially arranged granules	about 75 radiating rows of granules
central area	70-95 longitudinal chains of granules	about 60 longitudinal chains of granules	about 45 longitudinal chains of granules	about 60 longitudinal chains of granules	45-50 longitudinal chains of granules
lateral area	about 20 radiating granular rows; growth lines evident	quincunxially arranged granules	quincunxially arranged granules	quincunxially arranged granules	10-12 radiating rows of granules
antemucronal area	60-85 longitudinal chains of granules	about 60 longitudinal chains of granules	about 45 longitudinal chains of granules	40-45 longitudinal chains of granules	about 50 longitudinal chains of granules
postmucronal area	about 90 radiating rows of granules	quincunxially arranged granules	quincunxially arranged granules	quincunxially arranged granules	about 75 radiating rows of granules
mucro	terminal, sometimes overhanging	not prominent, slightly enlarged, at 4/5 of TL	not prominent, slightly enlarged, at 2/3 of TL	pointed, almost terminal	prominent, at 4/5 of TL
hind slope	steep and straight	rather steep, almost straight	straight to slightly convex	steep almost straight	concave, with dent near mucro
overall arrangement and shape of granules	coalescing, small	round, not coalescing	squarish	roundish, weakly pronounced, juxtaposed	weakly pronounced, mostly not coalescing, roundish

Table 2: Comparative table

Tab. 2: Tabella di confronto

Distribution. Besides the Red Sea, *Callochiton vanninii* is also known from Somalia, the Arabian Gulf, Madagascar and the Mozambique Channel.

Remarks. Although this species was not found during our collecting campaign, reports of single valves confirm that this species can be found in Jordan. Complete specimens of *C. vanninii* have been found in intertidal zones of the nearby city of Elat, Israel.

Subfamily ISCHNOCHITONINAE
Genus *Ischnochiton* GRAY, 1847

Subgenus *Ischnochiton*
***Ischnochiton (Ischnochiton) yerburyi* (E.A. Smith, 1891)**
(Figs 16-23; 38-39)

Chiton (Ischnochiton) yerburyi E.A. Smith, 1891: Proc. zool. Soc. Lond.: 420, pl. 33 fig. 6.
Ischnochiton rufopunctatus Odhner, 1919
Ischnochiton (Radsiella) delagoaensis Ashby, 1931
Ischnochiton haersoltei Kaas, 1954.

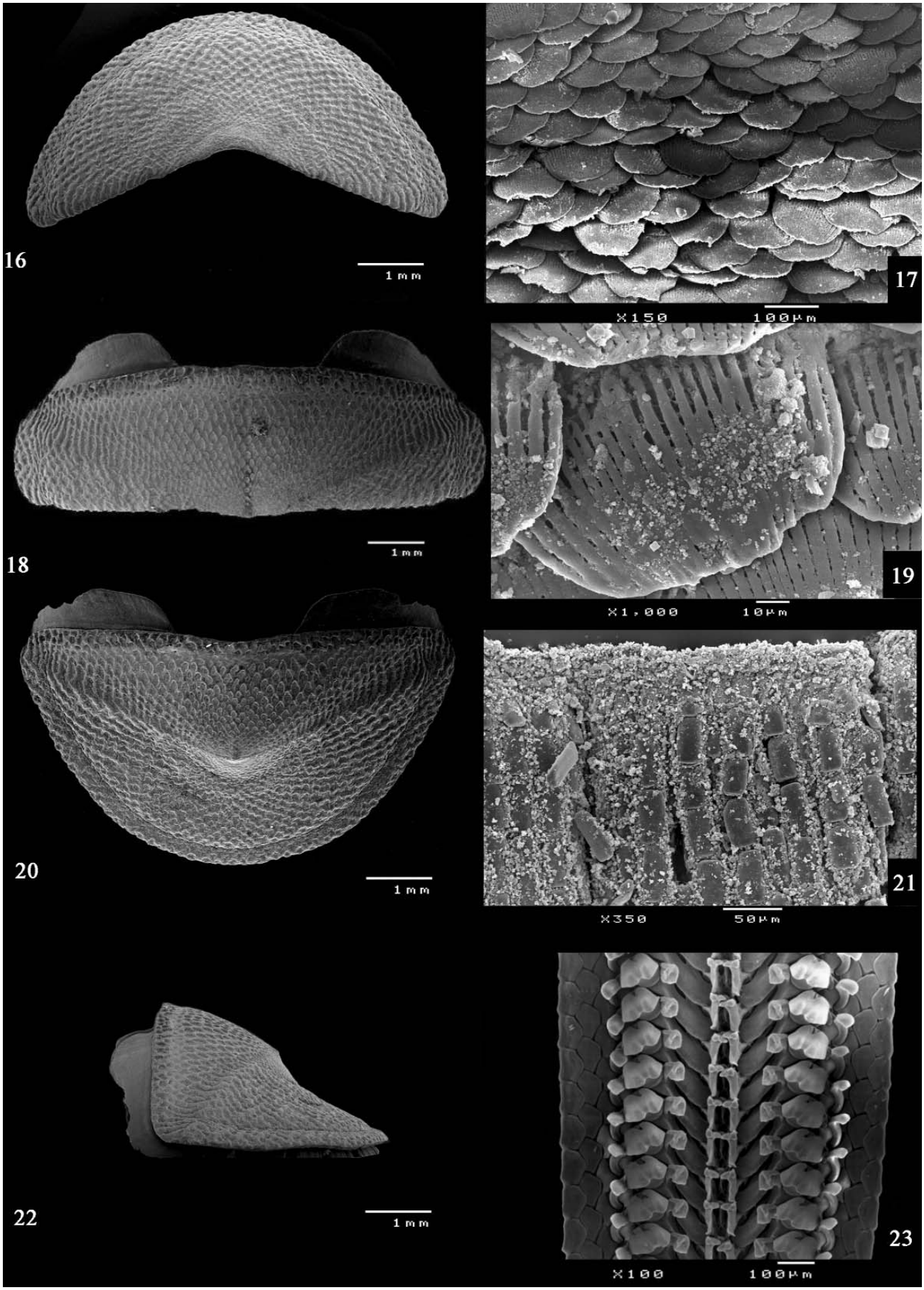

16
1 mm
17
X150
100µm
18
1 mm
19
X1,000
10µm
20
1 mm
21
X350
50µm
22
1 mm
23
X100
100µm

Plate 3
16. *Ischnochiton (Ischnochiton) yerburyi*, loc. #2, 18.2 x 10.5 mm, valve I. **17.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, dorsal girdle scales. **18.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, intermediate valve. **19.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, detail dorsal girdle scales. **20.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, valve VIII. **21.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, ventral girdle scales. **22.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, lateral view valve VIII. **23.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, radula.

Tav. 3
16. *Ischnochiton (Ischnochiton) yerburyi*, loc. #2, 18.2 x 10.5 mm, piastra I. **17.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, scaglie dorsali del perinoto. **18.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, piastra intermedia. **19.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, dettaglio delle scaglie dorsali del perinoto. **20.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, piastra VIII. **21.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, scaglie ventrali del perinoto. **22.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, vista laterale della piastra VIII. **23.** *Ischnochiton (I.) yerburyi*, loc. #2, 18.2 x 10.5 mm, radula.

Ischnochiton yerburyi - Leloup, 1960: 35-36, fig. 5; Kaas, 1979: 856-857, pl. 1 figs 1-5 (as *I. delagoaensis*); Ferreira, 1983: 251-254, figs 1-2; Kaas & Van Belle, 1988: 116-117, figs 2-7; Kaas & Van Belle, 1990: 124-127, fig. 53, map 21; Van Belle & Wranik, 1991: 368-370, fig. 13; Strack, 1993: 9-10, pl.3 fig. 2, pl. 7 fig. 3; Slieker, 2000: 46, pl. 11 fig. 9.

Type locality. Aden, Yemen.
Material. Locality #1: 2 sps, 12.7 x 8.0 mm – 14.1 x 7.9 mm (BA); 2 sps, 8.8 x 5.1 mm – 16.4 x 9.1 (YT); **Loc. #2:** 20 sps, 3.8 x 2.7 mm – 20.0 x 10.7 mm (BA); 25 sps, 5.9 x 4.0 mm – 18.5 x 10.3 mm (YT); **Loc. #3:** 7 sps, 4.0 x 2.7 mm – 18.9 x 9.6 mm (BA); 5 sps, 7.3 x 4.5 mm – 17.8 x 9.0 mm (YT); **Loc. #4:** 5 sps, 4.0 x 3.0 mm – 10.5 x 6.4 mm (BA); 4 sps, 6.0 x 3.6 mm – 8.2 x 4.9 mm (YT); **Loc. #5:** 4 sps, 6.2 x 4.0 mm – 19.3 x 9.4 mm (BA); 3 sps, 7.9 x 5.0 mm – 16.8 x 9.9 mm (YT); **Loc. #6:** 1 sp., 12.0 x 7.3 mm (BA); 1 sp., 14.4 x 8.2 mm (YT).

Description. Animal of small to moderate size, largest specimen examined 20.0 x 10.7 mm, but may grow slightly larger. Tegmentum with characteristic reticulate, thimble-like sculpture; colour of collected specimens varies from creamy white through yellowish orange to brick-red, dark green or dark brown, usually speckled with dark and pale dots. Some of the observed specimens had a blackish or whitish band on the jugum. Articulamentum whitish, slit formula 10-11/1/11-13. The dorsal girdle has thin, oval, normal-sized scales sculptured with 24-25 very fine riblets (see figs 17, 19). Major lateral teeth have a bicuspid head with a much stronger inner than outer denticle (see fig. 23).
Gills holobranchial, adanal with interspace.
A detailed description of *I. (I.) yerburyi* is given by Kaas & Van Belle (1990: 124-127).

Habitat. The collected specimens were mostly found intertidally under medium-sized granite rocks or dead coral slabs, slightly buried in coarse sand; at depths from 0.5 m to 4.0 m.

Distribution. This intertidal to shallow subtidal species is widespread in the Red Sea and has also been reported from the shores of Pakistan, the Arabian Gulf, Oman, the Gulf of Aden, Kenya, Tanzania and Mozambique.

Remarks. This species is easily recognised by its typical tegmental sculpture, being the only reported representative of its type in the Gulf of Aqaba. Red Sea and Indian Ocean Ischnochitons with thimble-like tegmental sculpture have caused a lot of confusion.
Kaas & Van Belle (1990) investigated this problem. They succeeded in distinguishing two distinct species and reported close similarity between *I. (I.) yerburyi* and *Ischnochiton (Ischnochiton) sansibarensis* Thiele, 1909. The main external differences reported by these authors are the number of riblets on the dorsal girdle scales and the overall robustness of the tegmental sculpture of I. (I.) yerburyi (see figs 16, 18, 20, 22), so the species readily distinguished by external characters. In *I. (I.) yerburyi* the number of riblets on the dorsal girdle scales may be 24 or 25 (see figs 17, 19, 21) and the thimble-like tegmental sculpture is quite evident. In *I. (I.) sansibarensis*, the number of riblets on narrower (1/2) dorsal girdle scales is 12-15 and tegmental sculpture is less evident and some specimens with mixed characteristics have been reported.
The radula of both is still a point of discussion. The major lateral tooth of *I. (I.) yerburyi* should be clearly unequally cusped but we found only minor evidence (fig. 23) of this in specimens with all the external characteristics of the species *yerburyi*. The inner parts of the major lateral teeth of the specimen photographed is slightly longer than those of the others but this phenomenon can only be seen in lateral view in some teeth. This is actually a characteristic of the radula of *sansibarensis*, which is creating further confusion.
We also collected some juvenile specimens that had sculpture very close to *I. (I.) sansibarensis*. The specimens are now under close investigation by both authors. The results of this study will hopefully be published.

Family CHITONIDAE Rafinesque, 1815
Subfamily CHITONINAE
Genus *Chiton* Linnaeus, 1758
Subgenus *Tegulaplax* Iredale & Hull, 1926

***Chiton (Tegulaplax) hululensis* (E.A. Smith, 1903)**
(Figs 40-41)

Ischnochiton hululensis E.A. Smith, 1903: In: Gardiner, Fauna & Geogr. Maldive & Laccadive Archipelago 2 (2) 1: 619, pl. 36 figs 3-6.
Ischnochiton ravanae Sykes, 1903.
Chiton imbricatus Nierstrasz, 1905.
Chiton (Clathropleura) platei Thiele, 1909.
Chiton howensis Hedley & Hull, 1912
Tegulaplax matthewsi Iredale & Hull, 1926 (juv.)

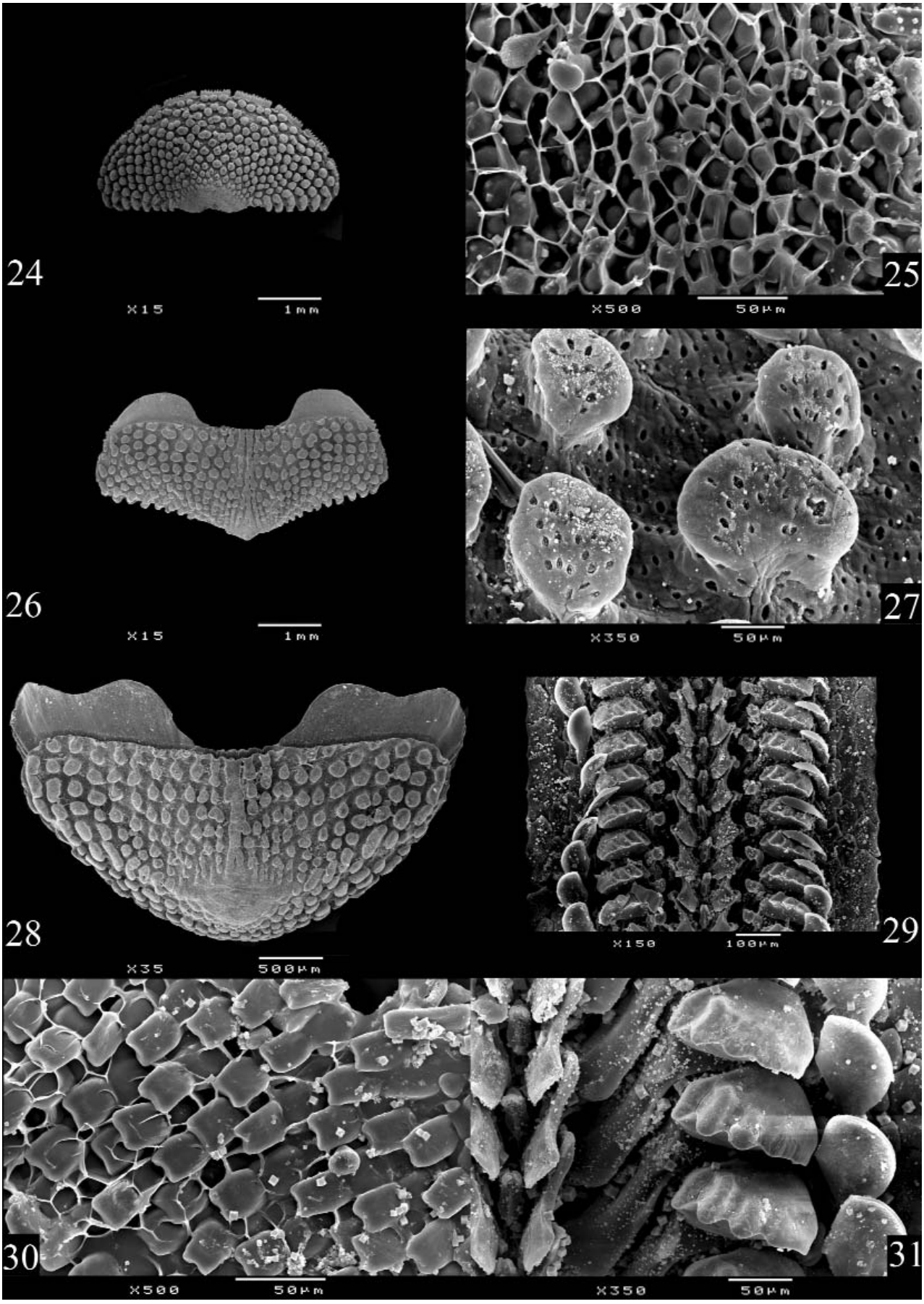

24
X15
1mm
25
X500
50µm
26
X15
1mm
27
X350
50µm
28
X35
500µm
29
X150
100µm
30
X500
50µm
31
X350
50µm

Plate 4
24. *Tonicia (Lucilina) perligera*, loc. #2, 9.3 x 6.1 mm, valve I. **25.** *Tonicia (L.) perligera,* loc. #2, 9.3 x 6.1 mm, ventral girdle scales. **26.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, intermediate valve. **27.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, detail tegmental pustules. **28.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, valve VIII. **29.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, radula. **30.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, dorsal girdle scales. **31.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, detail radula.

Tav. 4
24. *Tonicia (Lucilina) perligera*, loc. #2, 9.3 x 6.1 mm, piastra I. **25.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, scaglie ventrali del perinoto. **26.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, piastra intermedia. **27.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, dettaglio delle pustole del tegmentum. **28.** *Tonicia (L.) perligera,* loc. #2, 9.3 x 6.1 mm, piastra VIII. **29.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, radula. **30.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, scaglie dorsali del perinoto. **31.** *Tonicia (L.) perligera*, loc. #2, 9.3 x 6.1 mm, dettaglio della radula.

Chiton (Tegulaplax) hululensis; Nierstrasz, 1905: 79-81, pl. 2 fig. 37, pl. 7 figs 188-194 (as *Chiton imbricatus*); Leloup, 1960: 37-38, fig. 3 (as *Chiton (C.) platei)*; Kaas, 1979: 866-868, pl. 2 figs 11-19; Ferreira, 1983: 290-291; Van Belle & Wranik, 1991: 370-371, fig. 15; Strack, 1993: 12-13, pl. 3 fig 9, pl. 7 figs 8-9; Saito, 1998: 153-154, fig. 2H, 5; Slieker, 2000: 48, pl. 12 fig 17; Dell'Angelo & Smriglio, 2001: 184-188, pls 62-63, fig. 112.

Type locality. Hulule Island, Maldives.

Material. Locality #2: 13 sps, 6.1 x 3.6 mm – 22.4 x 12.2 mm (BA); 11 sps, 6.2 x 3.7 mm – 20.7 x 11.2 mm (YT); **Loc. #3:** 5 sps, 6.8 x 3.6 mm – 16.7 x 9.2 mm (BA); 6 sps, 11.0 x 6.6 mm – 21.8 x 13.0 mm (YT); **Loc. #4:** 2 sps, 15.2 x 8.9 mm – 17.4 x 9.0 mm (BA); 5 sps, 11.5 x 6.6 mm – 19.2 x 12.1 mm (YT); **Loc. #5:** 1 sp., 11.7 x 6.8 mm (BA); 2 sps, 12.1 x 7.3 mm – 15.3 x 8.3 mm (YT).

Description. Animal of small to medium size, largest specimen collected 22.4 x 12.2 mm; may grow to approximately 26 mm. Colour extremely variable but the specimens collected were mostly pinkish, light brown or pale green with numerous irregularly multicoloured spots. Tegmentum glossy, central areas and antemucronal area of tail valve appearing smooth, lateral areas and end valve with irregular, wavy, concentric wrinkles. Articulamentum translucent white; slit formula 7-10/1/11-13. This species has a wide, usually banded girdle; dorsally clothed with scales that are invariably decorated with 12-14 very fine longitudinal riblets. Major lateral teeth of radula with discoid head having sharp, evenly rounded edge. Gills holobranchial, abanal.
A detailed description of *Chiton (T.) hululensis* is given by Saito (1998: 153-154, fig. 2H, 5) and by Dell'Angelo & Smriglio (2001: 184-188, pls 62-63, fig. 112).

Habitat. The specimens were found under small or medium-sized granite rocks or under dead coral slabs partially embedded in coarse sand. They were found just below low tide down to a depth of –4 m. This species is known to occur at depths of -30 m and more.

Distribution. This widespread species is quite common through the Red Sea as well as almost the entire Indo-West Pacific region. Southernmost record in the west is Mozambique and in the east (Pacific) Lord Howe Island. The northernmost records are the Goto Islands (Japan) in the east and the northern Red Sea and the Mediterranean coast of Israel in the west.

Remarks. The presence of this species in the Mediterranean is the only known Lessepsian migration of chitons (Strack, 1993; Dell'Angelo & Smriglio, 2001).

Subgenus *Rhyssoplax* Thiele, 1893
***Chiton (Rhyssoplax) affinis* Issel, 1869**
(Figs 5 *(in situ)***; 42-43)**

Chiton affinis Issel, 1869: Malac. Mar Rosso: 234.
Lepidopleurus bottae de Rochebrune, 1882
Callistochiton heterodon Pilsbry, 1893, var. *savignyi* Pilsbry, 1893
Rhyssoplax janeirensis Thiele, 1893, non *Chiton janeirensis* Gray, 1828.

Chiton (Rhyssoplax) affinis - Pilsbry, 1892: 181, pl. 35, fig. 93; Leloup, 1952: 27-31, fig. 11, pl. 4 fig. 4 (as *Chiton (R.) olivaceus* var. *affinis*); Kaas & Van Belle, 1988: 122-123, figs 34-40; Van Belle & Wranik: 1991: 372, fig. 18; Strack, 1993: 13-14, pl. 4, fig. 1; Schwabe, 1997: 26-27 (2 figs); Slieker, 2000: 48, pl. 12 figs 13-13a.

Type locality. Gulf of Suez.

Material. Locality #2: 3 sps, 6.1 x 4.1 mm – 15.9 x 8.4 mm (BA); 2 sps, 9.5 x 5.9 mm – 16.6 x 9.7 mm (YT); **Loc. #3:** 5 sps, 6.2 x 4.3 mm – 21.6 x 13.0 mm (BA); 6 sps, 13.3 x 7.7 mm – 17.6 x 9.7 mm (YT); **Loc. #4:** 2 sps, 13.0 x 7.4 mm (BA) – 18.4 x 9.6 mm; 2 sps, 12.1 x 7.4 mm – 19.2 x 10.8 mm (YT); **Loc. #5:** 2 sps, 7.5 x 5.0 mm – 16.1 x 9.4 mm; 1 sp., 8.9 x 6.0 mm (YT); **Loc. #6:** 1 sp., 14.5 x 8.4 mm (BA); 2 sps, 14.9 x 8.0 mm – 17.8 x 10.3 mm (YT).

Description. Animal of small to moderate size, largest specimen observed 21.6 x 13.0 mm, but usually smaller. Colour very variable, mostly multicoloured, with a predominance of creamy yellow. Valves elevated, valve I with 12-20 strong radial ribs, lateral areas with 2-3 ribs, valve VIII with 10-12 ribs, interstices pitted. Central areas and antemucronal area with strong longitudinal grooves, becoming broader towards the girdle, not reaching the anterior margin of the valve near jugum. Articulamentum translucent white, slit formula 8/1/11-13. Girdle covered with imbricating scales, ornamented with 6-10 broad, flat, weakly convergent ribs, separated by narrow grooves. Major lateral teeth of radula with broad, oval head having sharply edged free margin. Gills holobranchial,

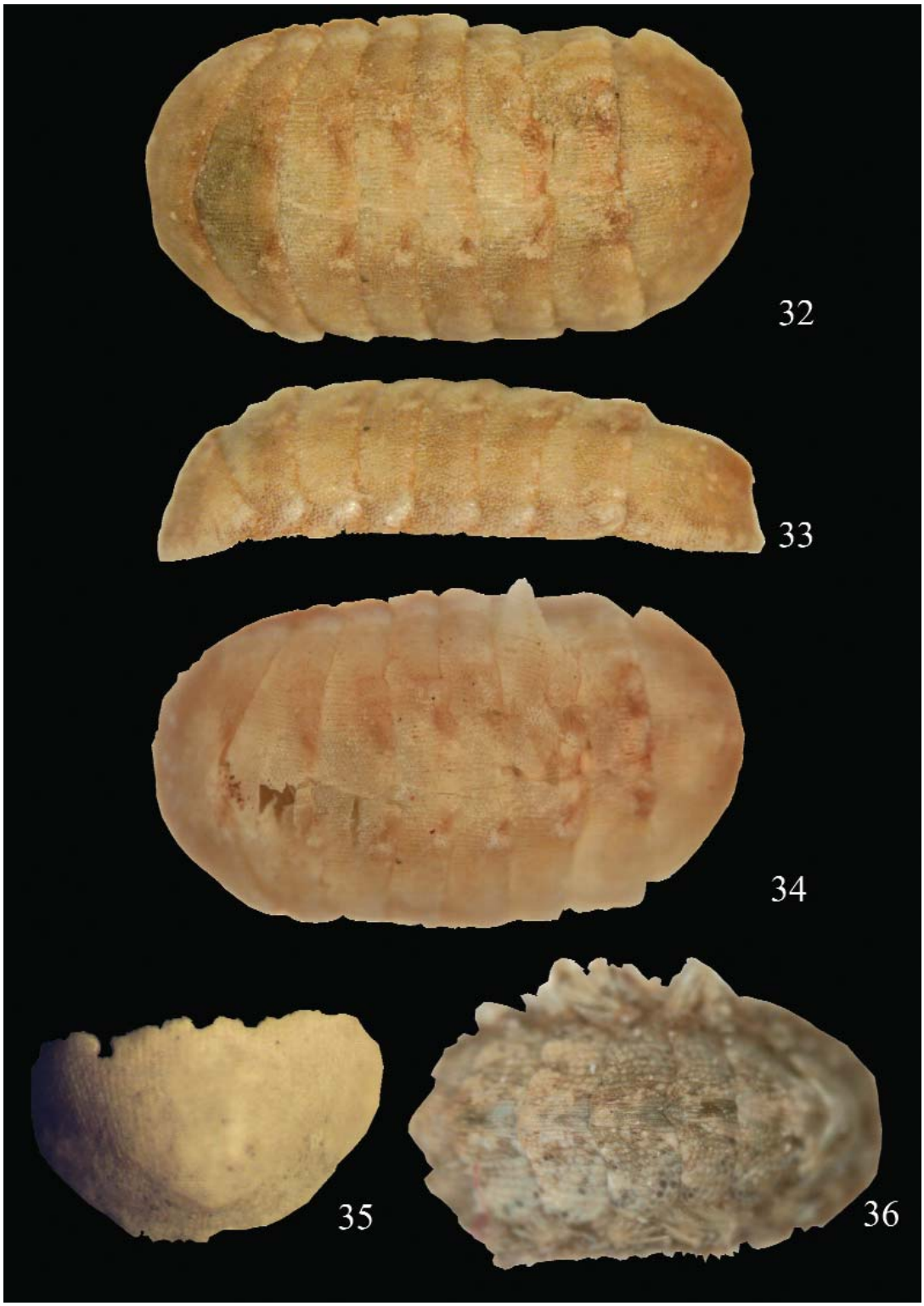


Plate 5

32. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, 5.0 x 2.9 mm, holotype, dorsal view, prior to radula extraction. **33.** *Leptochiton (P.) jordanensis* sp. nov., loc. #6, 5.0 x 2.9 mm, holotype, lateral view, prior to radula extraction. **34.** *Leptochiton (P.) jordanensis* sp. nov., loc. #6, 5.0 x 2.9 mm, holotype, dorsal view, after radula extraction. **35.** *Leptochiton (P.) jordanensis* sp. nov., 30 km south of Hurghada, Egypt, 1.4 x 2.4 mm, paratype II (ES 54), valve VIII, dorsal view. **36.** *Acanthochitona* cf. *mahensis*, loc. #4, YT, 7.0 x 4.3 mm, dorsal view.

Tav. 5

32. *Leptochiton (P.) jordanensis* sp. nov., loc. #6, 5.0 x 2.9 mm, olotipo, vista dorsale, prima dell'estrazione della radula. **33.** *Leptochiton (P.) jordanensis* sp. nov., loc. #6, 5.0 x 2.9 mm, olotipo, vista laterale, prima dell'estrazione della radula. **34.** *Leptochiton (P.) jordanensis* sp. nov., loc. #6, 5.0 x 2.9 mm, olotipo, vista dorsale, dopo l'estrazione della radula. **35.** *Leptochiton (P.) jordanensis* sp. nov., 30 km a sud di Hurgada, Egitto, 1.4 x 2.4 mm, paratipo II (ES 54), piastra VIII, vista dorsale. **36.** *Acanthochitona* cf. *mahensis*, loc. #4, YT, 7.0 x 4.3 mm, vista dorsale.

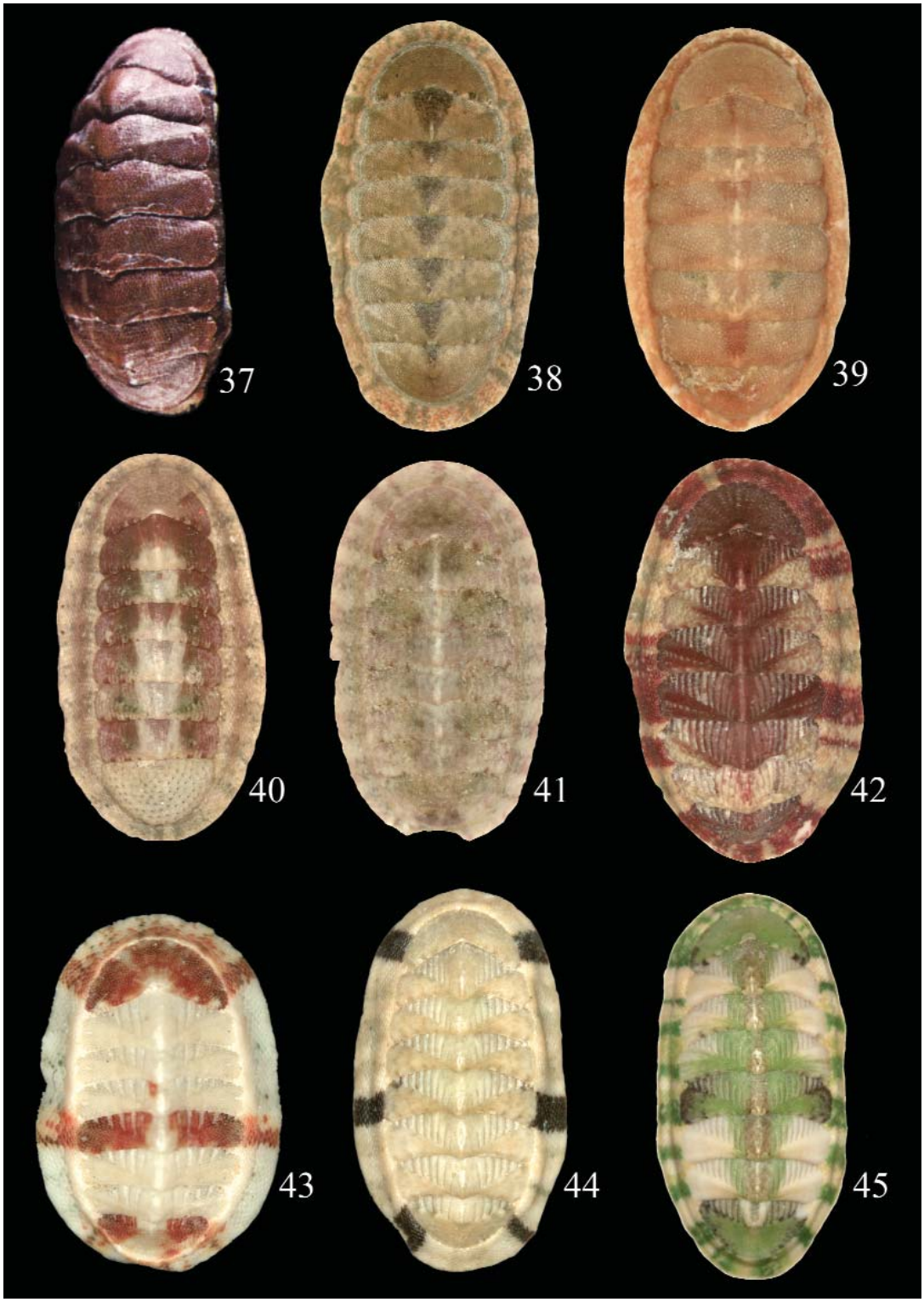


Plate 6

37. *Callochiton vanninii*, Gesira, Somalia, paratype (CAS 031758), 9.5 x 4.8 mm, (taken from original description). **38.** *Ischnochiton (I.) yerburyi*, loc. #2, BA, 19.6 x 10.3 mm. **39.** *Ischnochiton (I.) yerburyi*, loc. #2, BA, 9.4 x 5.4 mm, juvenile. **40.** *Chiton (Tegulaplax) hululensis*, loc. #2, BA, 16.9 x 8.7 mm, valve VIII encrusted with coralline algae. **41.** *Chiton (T.) hululensis*, loc. #2, YT, 6.4 x 3.7 mm, juvenile. **42.** *Chiton (Rhyssoplax) affinis*, loc. #6, BA, 14.2 x 8.6 mm. **43.** *Chiton (R.) affinis*, loc. #4, YT, 5.0 x 3.6 mm, juvenile. **44.** *Chiton (Rhyssoplax) maldivensis*, loc. #4, BA, 10.2 x 6.1mm. **45.** *Chiton (R.) maldivensis*, loc. #4, BA, 13.0 x 6.2 mm.

Tav. 6

37. *Callochiton vanninii*, Gesira, Somalia, paratipo (CAS 031758), 9.5 x 4.8 mm, (preso dalla descrizione originale). **38.** *Ischnochiton (I.) yerburyi*, loc. #2, BA, 19.6 x 10.3 mm. **39.** *Ischnochiton (I.) yerburyi*, loc. #2, BA, 9.4 x 5.4 mm, esemplare giovanile. **40.** *Chiton (Tegulaplax) hululensis*, loc. #2, BA, 16.9 x 8.7 mm, piastra VIII incrostata con alghe coralline. **41.** *Chiton (T.) hululensis*, loc. #2, YT, 6.4 x 3.7 mm, esemplare giovanile. **42.** *Chiton (Rhyssoplax) affinis*, loc. #6, BA, 14.2 x 8.6 mm. **43.** *Chiton (R.) affinis*, loc. #4, YT, 5.0 x 3.6 mm, esemplare giovanile. **44.** *Chiton (Rhyssoplax) maldivensis*, loc. #4, BA, 10.2 x 6.1mm. **45.** *Chiton (R.) maldivensis,* loc. #4, BA, 13.0 x 6.2 mm.

abanal.
More information on *Chiton (R.) affinis* is given by Kaas & Van Belle (1988: 122-123, figs 34-40).

Habitat. Most specimens were found under stones and dead coral partly embedded in coarse sand or sludge, at depths from -0.5 m to -2.0 m. Most specimens were sighted and collected at Club Murjan, where a broad, sandy ledge emerges at low tide. Behind this flat, the coral cliff drops to deeper water. The main vegetation on the muddy flat is common sea grass, growing single or in small colonies between solitary rocks surrounded by long-spined sea urchins (*Diadema* sp.).

Distribution. Besides the entire Red Sea, this species is also know from Somalia, Gulf of Oman and the Arabian Gulf.

Remarks. Although this species is usually fairly common in the Red Sea, we came across few specimens.

Chiton (Rhyssoplax) maldivensis (E.A. Smith, 1903) (Figs 44-45)

Ischnochiton maldivensis E.A. Smith, 1903: In: Gardiner, Fauna Geogr. Maldive & Laccadive Archipelago 2 (2) 1: 620, pl. 36 figs 7-10.
Chiton (Clathropleura) rueppelli Thiele, 1909

Chiton (Rhyssoplax) maldivensis - Van Belle & Wranik, 1991: 374, fig. 19; Strack, 1993: 15-16, pl. 4 fig.2, pl. 7 figs 10-16; Schwabe, 1997: 26, figs 2-3; Slieker, 2000: 48, pl. 12 fig. 20.

Type locality. Felidu Atoll, Maldives.

Material. Locality #3: 3 sps, 7.8 x 4.9 mm – 15.1 x 7.4 mm (BA); 3 sps, 10.8 x 6.0 mm – 15.4 x 8.4 mm (YT); **Loc. #4:** 3 sps, 10.5 x 6.0 mm – 18.4 x 8.4 mm (BA); 3 sps, 5.0 x 3.6 mm – 13.9 x 6.5 mm (YT); **Loc. #5:** 1 sp., 12.0 x 7.0 mm (BA).

Description. Animal elongate oval, small, largest specimen observed 18.4 x 8.4 mm, but usually 10-13 mm. Colour extremely variable, generally multicoloured, rarely uniformly coloured. Valves elevated, head valve and lateral areas smooth, except for a few concentric growth lines. Central areas and antemucronal area sculptured with 6-12 grooves, not reaching the anterior margin of the valve near smooth jugum. Articulamentum white with a greyish blue hue, slit formula 8-9/1/10-13. Girdle ornamented with oval, imbricating scales, sculptured with app. 20, mostly very faint grooves. Major lateral teeth of radula with broad, discoid, head bearing, small tubercle on outer margin. Gills holobranchial, adanal with interspace.
A detailed description of *Chiton (R.) maldivensis* is given by Strack (1993: 15-16, pl. 4 fig. 2, pl. 7 figs 10-16).

Habitat. The specimens collected were living on the underside of small to medium-sized granite stones, intertidally down to -2 m. The species is known to live to a depth down to -64 m.

Distribution. Besides the Red Sea, *Chiton (R.) maldivensis* has only been collected in the Gulf of Aden and the Maldives.

Remarks. This species is quite uncommon and is only known from a few complete specimens. We mostly found it closely associated with *Chiton (R.) affinis*.

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

Acanthopleura vaillantii de Rochebrune, 1882 (Figs 46-47)

Acantopleura (sic!) *vaillantii* de Rochebrune, 1882: Bull. Soc. philom. Paris (7) 6: 192.
? *Chiton punctatus*, non Linnaeus, 1758, sive *Chiton testudo* Spengler, 1797
Acanthopleura haddoni Winckworth, 1927.

Acanthopleura vaillantii - Winckworth, 1927: 206, pl. 28 (as *A. haddoni*); Sharabati, 1984: 16, pl. 1 fig. 4 (as *A. haddoni*); Kaas & Van Belle, 1988: 123-124; Van Belle & Wranik, 1991: 374-375, fig. 20; Kaas & Knudsen, 1992: 63, fig. 9 (as *Chiton punctatus*); Strack, 1993: 17-18, pl. 4 figs 3-4; Schwabe, 1997: 25-26, fig. 1 (as *A. haddoni*); Slieker, 2000: 50, pl. 13 fig. 24.

Type locality. Suez Canal.

Material. Locality #1: 11 sps, 26 x 17 mm – 54 x 31 mm (BA); 10 sps, 27 x 17 mm – 55 x 30 mm (YT); **Loc. #4:** 2 sps, 36 x 22 mm, 29 x 17 mm (BA); 1sp., 29 x 18 mm (YT).

Description. Animal large, broadly oval, moderately raised, back almost rounded. The largest specimen we observed measured 55 x 30 mm, but it is known to reach almost 100 mm. Colour varies from greyish to cream through reddish brown to almost black. Some specimens have a lighter coloured band on the jugum. Tegmental sculpture, often indistinguishable on account of erosion and incrustations, normally consists of small, roundish tubercles arranged in irregular, more or less concentric rows. Articulamentum posteriorly dark brown and bluish anteriorly, slit formula 10/1/9-10. Girdle wide, densely covered with creamy, brown or blackish (mostly arranged in irregular bands) calcareous spines of different sizes. Major lateral teeth of radula with unicuspid head, denticle sharply pointed. Gills holobranchial, adanal (not abanal as mentioned in Kaas & Van Belle, 1988).
A detailed description of *Acanthopleura vaillantii* is given by Kaas & Van Belle (1988: 123-124).

Habitat. The specimens collected were almost all found on a large concrete hotel wall, at sea level or just above. We also observed some in small rock pools at low tide, with a very high water temperature. This species is mainly found intertidally and in the splash-zone on solid rock and concrete walls.

Distribution. Besides the Red Sea, this species has also been reported from the Yemen, Oman and the Arabian Gulf.

Remarks. As it is the only species of *Acanthopleura* living in the northern Red Sea, it is easily recognised as the largest Red Sea polyplacophoran. The determination of *Acanthopleura* species is sometimes confusing due to variability, erosion and similarities between species in this genus. It is remarkable that, unlike the Egyptian population, only smaller specimens (up to 60 mm alive) were recorded on our field trips. This species prefers to forage at low tide, above the low tide mark, on (vertical) rock and concrete surfaces. As these biotopes are rather scarce in Jordan, the population is small and confined to specific areas such as locality #1 (concrete jetty), #4 (rock flats) and probably also in the commercial harbour (docks) of Aqaba (see fig. 1), but it is prohibited and unsafe to collect there because of vessel traffic.
This chiton is probably the best known from the Red Sea among collectors. Together with *Lambis truncata sebae* (Kiener, 1843), it has long been a source of food for coastal Bedouin tribes of the Sinai desert (Mienis, 2000). 12 valves were found in the Sinai desert, Egypt, in Bedouin kitchen middens during excavations in 1956. Presumably the large foot is the only edible part of the chiton.

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

***Tonicia (Lucilina) sueziensis* (Reeve, 1847)**
(Figs 5 *(in situ)*; **50-54)**

Chiton sueziensis Reeve, 1847: Conch. Icon. 4: pl. 20 sp. & fig. 134.
Tonicia ptygmata de Rochebrune, 1884
Tonicia costata Leloup MS, Mergner, 1979 (*nom. nud.*)
Non *Chiton (Tonicia) sueziensis*; Issel, 1869 (*pars*) (= *? Acanthopleura vaillantii* de Rochebrune, 1882)

Tonicia (Lucilina) suezienis - Kaas & Van Belle, 1988: 124-125, fis. 41-44; Van Belle & Wranik, 1991: 375, fig. 21; Strack, 1993: 19-20, pl. 5 fig. 1, pl. 6 figs 1-2; Slieker, 2000: 50, pl. 13 fig. 28.

Type locality. Suez Canal.

Material. Locality #2: 21 sps, 5.4 x 3.6 mm – 30.3 x 17.5 mm (BA); 24 sps, 7.2 x 4.6 mm – 25.8 x 13.0 mm (YT); **Loc. #3:** 13 sps, 5.0 x 3.0 mm – 29.0 x 16.5 mm (BA); 6 sps, 12.6 x 7.3 mm – 20.7 x 12.0 mm (YT); **Loc. #4:** 3 sps, 12.5 x 7.8 mm – 24.8 x 12.7 mm (BA); 11 sps, 8.0 x 6.0 mm – 23.1 x 10.9 mm (YT); **Loc. #5:** 5 sp., 7.0 x 3.7 mm – 20.2 x 12.4 mm (BA); 6 sps, 8.2 x 4.9 mm – 23.6 x 13.1 mm (YT); **Loc. #6:** 5 sps, 15.1 x 8.3 mm – 21.5 x 13.5 (BA); 5 sps, 6.6 x 4.8 mm – 29.2 x 13.9 mm (YT).

Material (7-plated). Locality #2: 3 sps, 13.6 x 8.1 mm (BA), 15.5 x 9.6 mm (YT), 12.1 x 7.0 mm (PA); **Loc. #3:** 18.1 x 9.4 mm (YT); **Loc. #5:** 20.9 x 11.6 mm (BA).

Description. Animal of medium size, length of largest observed specimen 30.3 x 17.5 mm. Strack (1993) reported an unusually large specimen (37.0 x 23.5 mm) but most observed by us were between 20 and 25 mm. Colour of the specimens mostly cream to pale yellow or orange mottled with brown, white and/or black; rarely uniformly coloured. Tegmental sculpture extremely variable; head valve and lateral areas with shiny black shell eyes (ocelli) and ornamented with irregular granular ribs, granules sometimes dispersed without forming ribs on head valve. Central areas and antemucronal area of valve VIII sculptured with longitudinal granular rows, granules sometimes being joined to form almost uniform ribs. Jugal area mostly smooth, but some specimens have ribs and only a small ribbon-like smooth area on jugum. Some specimens have broad, flat ribs with narrow interstices between them. Articulamentum white, slit formula 9/1/8. Girdle leathery, moderately wide, colour cream to yellow with brownish irregular spots; dorsally appearing naked to the eye but when magnified covered with extremely minute, bullet-shaped spicules; top with 4-5 short riblets on visible half. Major lateral teeth of radula with tetracuspid head, denticles short, bluntly rounded. Gills holobranchial, abanal.
A detailed description of the radula and girdle elements is given by Kaas & Van Belle (1988: 123-124) and a good general description is given by Ferreira (1983: 270-274).

Habitat. Intertidal to shallow subtidal under stones and dead coral slabs partially buried in coarse sand.

Distribution. Besides the entire Red Sea, this species has also been recorded from Somalia, Rodriguez and Coetivy Island, the Seychelles, Gulf of Aden and the Arabian Gulf.

Remarks. *Tonicia (Lucilina) sueziensis* is the most common chiton species of the coast of Jordan. Some larger stones had up to 6 specimens living underneath them (see fig. 5). This species is also very variable, with a tegmentum sculpture ranging from a faint-ridged sculpture to a clearly pustulose-ridged sculpture, creating similarities and giving rise to misidentifications with *T. (L.) perligera*. We found 5 abnormal specimens with 7 plates instead of the usual 8 (see figs 52-54). This is the first time that specimens with 7 plates have been recorded and illustrated in this species. Being very common, many specimens were observed and about 1% of the population was found to have this abnormality. This phenomenon is not so exceptional as many specimens of other species have been found with this abnormality (Baschieri, 1994; Burghardt & Burghardt, 1967; Dell'Angelo *et al.*, 1990; Iredale, 1934; Langer, 1978; Schwabe, 2000; Taki Iw., 1932; etc.).

***Tonicia (Lucilina) perligera* (Thiele, 1909)**
(Figs 24-31; 48-49)

Lucilina perligera Thiele, 1909: Zoologica Stuttg. 22: 97, pl. 10 figs 51-52.
? *Tonicia scabiosus* Leloup MS, Strack, 1993 (*nom. nud.*)

Tonicia (Lucilina) perligera - Strack, 1993: 20-21, pl. 4 figs 7-9; Slieker, 2000: 50, pl. 13 fig. 27.

Type locality. Red Sea.

Material. Locality #2: 5 sps, 8.0 x 5.4 mm – 18.9 x 10.4 mm (BA); 5 sps, 6.5 x 4.4 mm – 11.9 x 7.2 mm (YT); 1 sp., 9.3 x 6.1, disarticulated for SEM-pictures (see figs 24-31).

Description. Animal of small to medium size, largest collected specimen measuring 18.9 x 10.4 mm, but according to Strack(1993) it may attain a length of about 25 mm (based on a single valve). As our largest specimen was very eroded, we do not think this species grows much larger. Most observed specimens were between 10 and 15 mm in length. Colour resembling that of *Tonicia (L.) sueziensis*; mostly creamy yellow mottled with orange, reddish brown or dark grey. Complete tegmentum uniformly densely covered with large (diameter up to 280 µm), well-separated and highly elevated (up to 180 µm), round to oval granules. The shape of the granules imparts a mushroom-like appearance. Separate granules are connected at the base by a weakly pronounced ridge (see fig. 27). Jugal sinus of intermediate valves pectinated, posterior margin of valves I-VII serrated with larger granules. Shell eyes present but hardly discernible. Tail valve sculptured like intermediate valves, mucro posterior, post-mucronal slope rather steep, straight to slightly convex. Articulamentum white, insertion plates well developed, slightly sulcated on the outside; slit formula 8/1/8-13.
Gills abanal and merobranchial.

Habitat. Not hitherto reported in the literature, mainly because most findings have been based on information gleaned from isolated valves (most found in shell grit from depths of 2-30 m). We found this species in 1-3 m of water attached to the underside of smooth granite rocks together with *T. (L.) sueziensis*.

Distribution. Probably endemic to the Red Sea. Known from Hurghada, Egypt and Aqaba, Jordan. We only encountered the species at one collecting site (locality #2) (a public beach near the commercial harbour of Aqaba city).

Remarks. Many specimens of *Tonicia (Lucilina) sueziensis* have been misdetermined as *perligera* although the differences between them are quite distinct. The problem may largely be due to the rarity of the species and the variability of *T. (L.) sueziensis*. Only 3 complete specimens (holotype in ZMHU, one specimen in KBIN labelled *T. scabiosus*, one in VB) have ever been found, so our findings will add valuable information about the radula and girdle elements of this rarely sighted species. Dorsally, the girdle is densely covered with flattened, round to squarish spicules (diameter up to 25-30 µm). The spicules have a broad central longitudinal groove, somewhat pointed at the base (see fig. 30). Ventrally the girdle is densely covered with smaller (diameter up to 15 µm) round spicules, sharply pointed at the base (see fig. 25).
Denticle of major lateral tooth of radula about 140 µm wide with 4 to 5 (5th very minor) bluntly rounded denticles, giving a toe-like impression. Unical teeth hardly developed. Spatulate unical tooth long (up to 140 µm) and wide at the top (up to 60 µm), covering the posterior side of the major lateral tooth. Central tooth very narrow (18 µm) (see figs 29, 31).

Suborder ACANTHOCHITONINA Bergenhayn, 1930
Family CRYPTOPLACIDAE H. & A. Adams, 1858
Genus *Cryptoplax* de Blainville, 1818

Cryptoplax sykesi Thiele, 1909 (Fig. 55)

Cryptoplax sykesi Thiele, 1909: Zoologica Stuttg. 22: 545, pl. 6 figs 83-86. Nom. nov. pro *Cryptoplax striatus*; Sykes, 1907, non Lamarck, 1819.
Cryptoplax enigmaticus Leloup, 1980
Choneplax parvus Leloup, 1981

Cryptoplax sykesi - Leloup, 1940: 9-13, fig. 3, pl. 2; Leloup, 1980: 14, pl. 1 figs 1-2, pl. 2 fig. 1 (as *Cryptoplax enigmaticus)*; Ferreira, 1983: 275, fig. 33; Kaas, 1986: 22, figs 73-81; Strack, 1993: 27-28, pl. 5 fig. 9; Slieker, 2000: 50, pl. 13 fig. 31.

Type locality. Gimsah Bay, Red Sea.

Material. This species was not encountered during our fieldwork.

Description. Animal of medium size, largest specimen mentioned in the literature measures 31 mm (Ferreira, 1983), but generally smaller. Animal vermiform; valves small, elongate and convex; not interspaced. Tegmentum with smooth raised jugum and 4-7 rows of generally coalescent granules, forming longitudinal riblets on each side of the jugum; colour white or light brown mottled with reddish or dark brown. Articulamentum light brownish, slit formula 3/0/0. Girdle wide for the genus; uniformly covered with erect, translucent brown and white spicules. Major lateral teeth of radula with tricuspid head.
A detailed description of *C. sykesi* can be found in Leloup, 1940: 9-13, fig. 3, pl. 2 figs 1-2.

Habitat. Intertidal to 25 m depth, in dead coral and under stones.

Distribution. Western part of the Indian Ocean from the northern part of the Red Sea to Durban, South Africa; Madagascar, Réunion and Mauritius.

Remarks. Although this species was not collected during our two field trips, reports of single valves and a single specimen (KBIN IG 24.835/1) confirm that it can be found along the coast of Jordan (Strack, 1993). It probably lives in the subtidal zone, which could explain why we did not find it, as our dive range was

limited to about -6 m.

Family ACANTHOCHITONIDAE Simroth, 1894
Subfamily ACANTHOCHITONINAE
Genus *Acanthochitona* Gray, 1821

***Acanthochitona penicillata* (Deshayes, 1863)**
(Figs 56-57)

Chiton penicillatus Deshayes, 1863: Cat. Moll. Réunion: 41, pl. 6 figs 8-10.
Acanthochites nierstraszi Sykes, 1907

Acanthochitona penicillata - Pilsbry, 1893: 15, pl. 4 fig. 84, pl. 8 figs 29-30; Ferreira, 1983: 275, fig. 32; Van Belle & Wranik, 1991: 376, fig. 25; Strack, 1993: 23-25, pl. 5 fig. 6; Schwabe, 1997: 27-28 (2 figs); Slieker, 2000: 52, pl. 14 fig. 37.

Type locality. Réunion Island.

Material. Locality #2: 5 sps, 6.0 x 3.0 mm – 19.0 x 10.0 mm (BA); 5 sps, 5.7 x 3.3 mm – 16.0 x 7.7 mm (YT); **Loc. #3:** 3 sps, 5.5 x 3.5 mm – 16.5 x 8.0 mm (BA); 2 sps, 9.0 x 5.1 mm – 16.5 x 7.8 mm (YT); **Loc. #4:** 1 sp., 14.0 x 9.5 mm (BA); 2 sps, 10.5 x 7.4 mm – 11.0 x 5.7 mm (YT); **Loc. #5:** 2 sps, 9.0 x 6.0 mm – 15.2 x 7.9 mm; 1 sp., 6.8 x 4.5 mm (YT).

Description. Animal of moderate size, largest collected specimen measures 19 x 10 mm, but can grow to about 27 mm. Colour variable but mostly cream variegated with black, green and brown. One specimen had totally black valves (see fig. 56). Tegmentum densely covered with variable (in size and shape), mostly tear-drop-shaped, flattened granules. Jugum smooth, except for a few growth lines and on average about 10-12 striae shining through (for adult specimens). Articulamentum white to bluish; slit formula 5/1/2. Girdle brownish or creamy; dorsally covered with numerous straight or slightly curved glassy spicules of different sizes, largest ones at sides; sutural tufts (18) consisting of long (up to 2 mm), sharply pointed, whitish or brownish, glassy bristles. Major lateral teeth of radula with tricuspid head. Gills abanal and merobranchial.
A detailed description of *A. penicillata* is given by Ferreira (1983).

Habitat. This species usually lives under stones or dead coral slabs, from low water to -4 m.

Distribution. Besides the entire Red Sea area, *A. penicillata* has also been recorded from Oman down to Madagascar.

Remarks. This species is relatively rare in Jordan as we encountered very few specimens.

***Acanthochitona* cf. *mahensis* Winckworth, 1927**
(Fig. 36)

Acanthochitona mahensis Winckworth, 1927: Proc. malac. Soc. Lond. 17: 207, pl. 29 fig. 9-10.
Acanthochiton ashbyi Leloup, 1937.

Acanthochitona mahensis - Leloup, 1941: 1-6, pl. 1-3; Slieker, 2000: 50, pl. 14 fig. 35.

Type locality. Mahé, Madras, India.

Material examined. Locality #4: 1 sp., 7.0 x 4.3 mm (YT).

Description. As little is known about this species, the original description of Winckworth is hereby reproduced: *"Shell elongate, somewhat elevated, hardly carinate. General colour dark grey or brown; on either side of the jugum is a yellow or orange band forming an open V. Interior whitish with dark waxy grey centrally and in sinus. The median valves are distinctly though slightly beaked when not eroded. Lateropleural areas covered with coarse, oval, close-packed granules, becoming more elongated anteriorly up to _ mm in length. Dorsal areas narrowly triangular and longitudinally striate as usual in the genus. The sutural plates well developed and longer in proportion to the tegmentum than in any other species I am acquainted with in nature or in literature. The insertion plates do not extend laterally much beyond the tegmentum; the posterior valve is remarkable in that the posterior margin of the tegmentum extends beyond the articulamentum. This feature with the shape of the posterior tegmentum, which is much wider than long, and of the posterior sutural plates which are rhomboidal, at once distinguish the species. The slits are as usual in the genus. A. tristis, Rochebrune, approaches nearest this species in the tail valve, and A. thileniusi, THIELE, in the median valves, but are sufficiently distinguished in other characters (v. THIELE, Zoologica, 56 (1909), plate vi, figs. 41-6 and 54-60). The girdle is closely matted, encroaching but little at the sutures; it bears eighteen tufts of brown spicules".*

Habitat. Unknown. We found the specimen attached to the underside of a small, smooth, granite rock in the intertidal zone.

Distribution. Indian Ocean: India (Madras), Seychelles, Andaman Islands

Remarks. This probably juvenile specimen was confusing to determine. It showed no resemblance to the known Red Sea Acanthochitonids. We compared it with specimens from the Indian Ocean in the collection of Richard A. Van Belle, namely *A. jugotenuis* Kaas, 1979, *A. limbata* Kaas, 1986, *A. quincunx* Leloup, 1981, *A. woodwardi* Kaas & Van Belle, 1988, *A. penetrans* Winckworth, 1933 and *A. mahensis* Winckworth, 1927. The specimen only closely resembled the latter. It had characteristics of *A. asbyi* Leloup, 1937 as well, but the latter is synonymised with *A. mahensis* Winckworth, 1927 by Kaas & Van Belle, 1998. The two types are very similar and both provide valuable information about *A. mahensis.*
The lateropleural areas of our specimen are covered with large, round to oval pustules, densely packed, with a slightly convex top and a faint bluish hue. The sutural tufts consist of 15-20 hard thick, white to yellowish brown, relatively long hairs. The

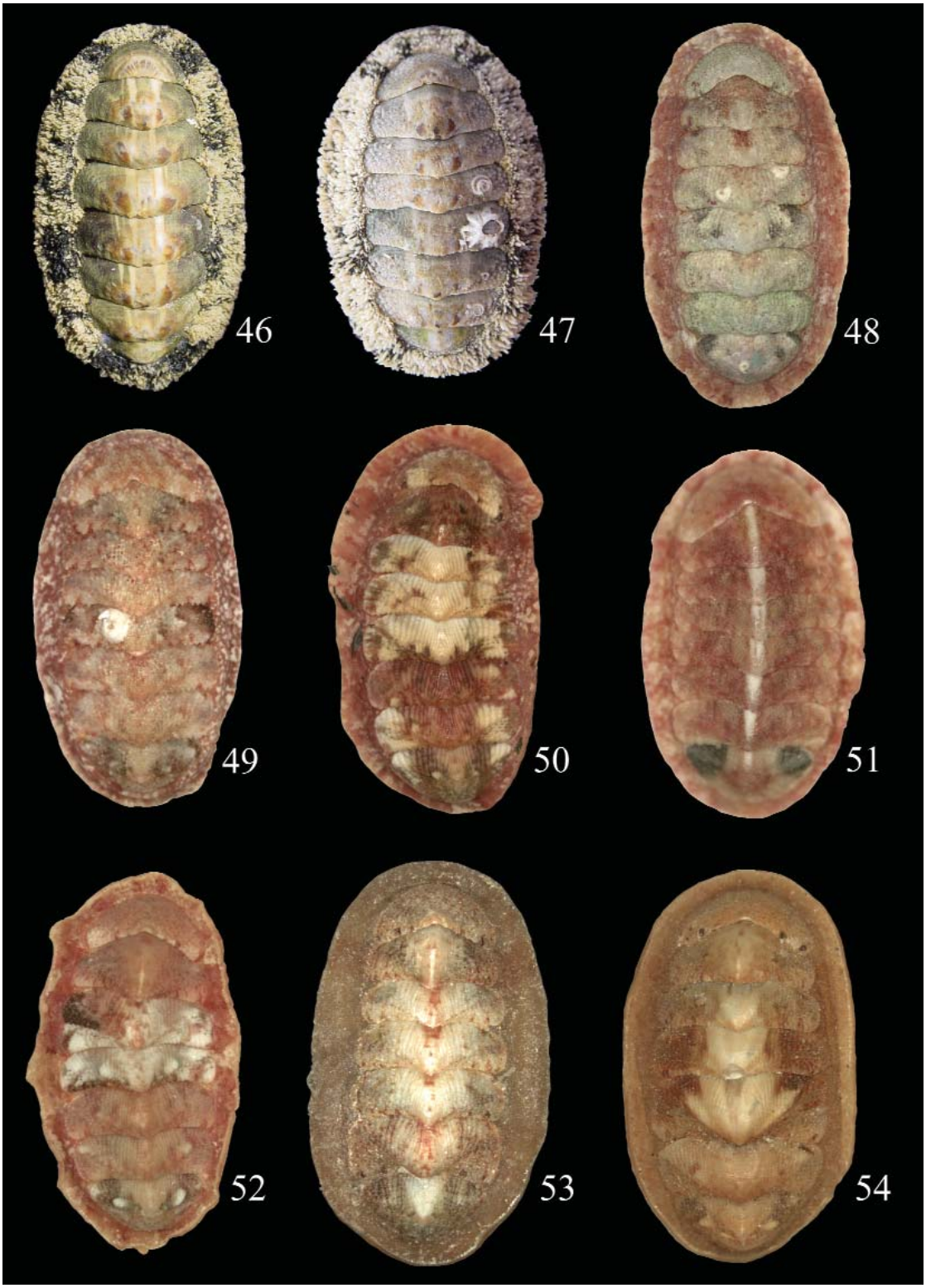


Plate 7
46. *Acanthopleura vaillantii*, loc. #1, BA, 52.6 x 30.8 mm. **47.** *Acanthopleura vaillantii,* loc. #1, YT, 26.8 x 16.9 mm, valve V encrusted with barnacle. **48.** *Tonicia (Lucilina) perligera*, loc. #2, BA, 18.9 x 10.4 mm, gerontic specimen. **49.** *Tonicia (L.) perligera*, loc. #2, BA, 13.3 x 7.4 mm. **50.** *Tonicia (L.) sueziensis*, loc. #3, BA, 14.7 x 8.1 mm. **51.** *Tonicia (L.) sueziensis*, loc. #3, BA, 4.7 x 3.0 mm, juvenile. **52.** *Tonicia (L.) sueziensis*, loc. #2, PA, 11.9 x 6.8 mm, specimen with 7 valves. **53.** *Tonicia (L.) sueziensis*, loc. #2, BA, 13.3 x 7.8 mm. specimen with 7 valves. **54.** *Tonicia (L.) sueziensis*, loc. #2, YT, 15.1 x 9.5 mm. specimen with 7 valves.
Tav. 7
46. *Acanthopleura vaillantii*, loc. #1, BA, 52.6 x 30.8 mm **47.** *Acanthopleura vaillantii*, loc. #1, YT, 26.8 x 16.9 mm, piastra V incrostata con balani. **48.** *Tonicia (Lucilina) perligera*, loc. #2, BA, 18.9 x 10.4 mm, esemplare gerontico. **49.** *Tonicia (L.) perligera*, loc. #2, BA, 13.3 x 7.4 mm. **50.** *Tonicia (L.) sueziensis*, loc. #3, BA, 14.7 x 8.1 mm.**51.** *Tonicia (L.) sueziensis*, loc. #3, BA, 4.7 x 3.0 mm, esemplare giovanile.**52.** *Tonicia (L.) sueziensis,* loc. #2, PA, 11.9 x 6.8 mm, esemplare con 7 piastre. **53.** *Tonicia (L.) sueziensis*, loc. #2, BA, 13.3 x 7.8 mm. esemplare con 7 piastre. **54.** *Tonicia (L.) sueziensis*, loc. #2, YT, 15.1 x 9.5 mm. esemplare con 7 piastre.

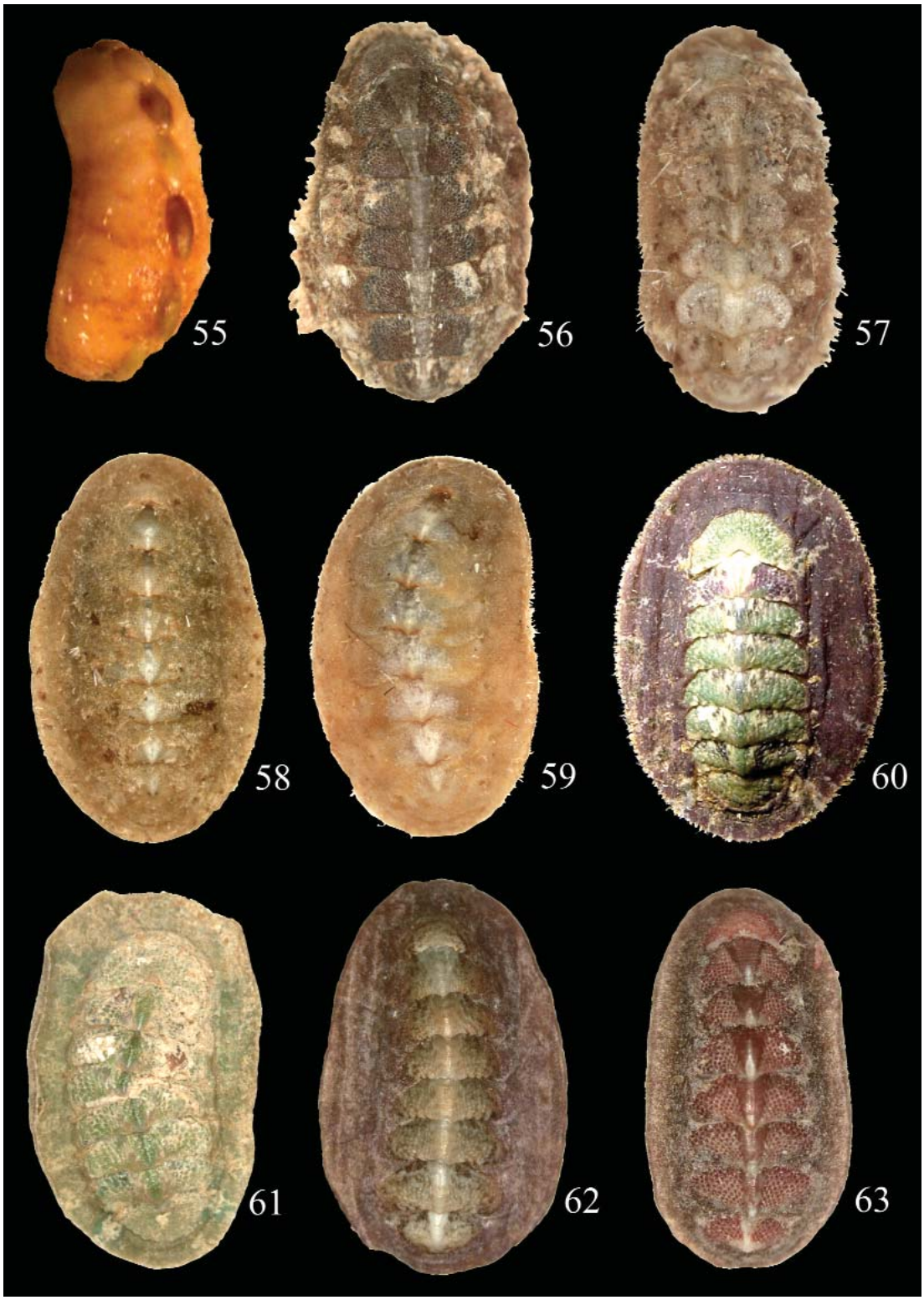


Plate 8

55. *Cryptoplax sykesi*, Tuléar, Madagascar, VB, 15 x 7 mm. **56.** *Acanthochitona penicillata*, loc. #5, BA, 9.0 x 5.8 mm, black specimen. **57.** *Acanthochitona penicillata*, loc. #2, BA, 5.6 x 2.9 mm. **58.** *Acanthochitona mastalleri*, loc. #1, BA, 13.1 x 8.4 mm. **59.** *Acanthochitona mastalleri*, loc. #3, BA, 8.8 x 5.5 mm. **60.** *Craspedochiton laqueatus*, loc. #6, YT, 20.2 x 12.9 mm. **61.** *Craspedochiton laqueatus*, loc. #6, BA, 11.8 x 7.5 mm, valve anomaly (valves IV & V). **62.** *Notoplax curvisetosa,* loc. #4, BA, 15.4 x 9.2 mm. **63.** *Notoplax curvisetosa*, loc. #6, YT, 8.9 x 5.4 mm, brick-red specimen.

Tav. 8

55. *Cryptoplax sykesi*, Tuléar, Madagascar, VB, 15 x 7 mm. **56.** *Acanthochitona penicillata*, loc. #5, BA, 9.0 x 5.8 mm, esemplare scuro. **57.** *Acanthochitona penicillata*, loc. #2, BA, 5.6 x 2.9 mm. **58.** *Acanthochitona mastalleri*, loc. #1, BA, 13.1 x 8.4 mm. **59.** *Acanthochitona mastalleri,* loc. #3, BA, 8.8 x 5.5 mm. **60.** *Craspedochiton laqueatus*, loc. #6, YT, 20.2 x 12.9 mm. **61.** *Craspedochiton laqueatus*, loc. #6, BA, 11.8 x 7.5 mm, con piastre anomale (piastre IV & V). **62.** *Notoplax curvisetosa*, loc. #4, BA, 15.4 x 9.2 mm. **63.** *Notoplax curvisetosa*, loc. #6, YT, 8.9 x 5.4 mm, esemplare rosso-mattone.

girdle is generally covered with shorter hairs having identical characteristics. The jugal area is rather wide, consisting of about 9-10 clearly visible longitudinal striae. The head valve is densely and evenly covered with round to oval pustules, which are a little larger than those in the lateropleural areas. Tail valve covered with smaller and only round pustules. Mucro posterior, hind slope straight to slightly convex.
We were not yet able to investigate the holotype of this species, which is otherwise only known from a few findings. Our investigation convinced us that our specimen closely resembled *A. mahensis* but due to lingering uncertainty we have only tentatively identified it here as *A.* cf. *mahensis*, awaiting further investigation and hopefully comparison with specimens from other areas. If in the end all doubts about this specimen can be resolved and it proves to be *A. mahensis*, it would mean a large range extension of the species, previously known only from India, the Seychelles and the Andaman Islands, and could mean an additional species for the Red Sea.

Acanthochitona mastalleri Leloup MS, Strack, 1989 (Figs 58-59)

Acanthochitona mastalleri Leloup MS, Strack, 1989: J. Conch. Lond. 33: 169, fig. 1, pl 19-20.

Acanthochitona mastalleri - Strack, 1993: 25-26, pl. 5 fig. 7; Slieker, 2000: 52, pl. 14 fig. 36.

Type locality. Merlin Point, 4 km South of Hurghada, Egypt.

Material. Locality #2: 5 sps, 7.5 x 5.2 mm – 13.0 x 8.1 mm (BA); 5 sps, 7.2 x 4.3 mm – 10.2 x 7.4 mm (YT); **Loc. #3:** 3 sps, 8.0 x 4.9 mm – 9.0 x 5.4 mm (BA); 3 sps, 6.3 x 4.3 – 9.1 x 5.2 mm (YT); **Loc. #4:** 3 sps, 8.0 x 4.1 mm – 12.2 x 5.5 mm (BA); 2 sps, 8.0 x 4.1 mm – 9.0 x 5.1 mm (YT).

Description. Animal of small size, largest collected specimen measuring 13.0 x 8.1 mm, but it can grow slightly larger. Colour usually creamy white, maculated with brown, orange or grey. Tegmentum reduced in lateropleural areas; sculptured with irregular, more or less oval, flat topped granules. Jugum raised, narrow, with 4-7 striae. Articulamentum whitish; slit formula 5/1/2. Girdle very wide, partially covering the valves (lateropleural areas); dorsally densely covered with minute smooth, cylindrical spicules interspersed with smooth, slightly curved longer spicules; sutural tufts (18) relatively undeveloped and inconspicuous, consisting of small glassy bristles. Major lateral teeth of radula consisting of sharply pointed tridentate cusp with central denticle longer. Gills abanal and merobranchial.
For detailed description, see original description by Strack (1989).

Habitat. Under stones, dead coral and shells, from just below tidemark to a depth of -1 m.

Distribution. So far recorded from the entire Red Sea and Oman, but a single specimen was found in Mombassa, Kenya, by Patrick Anseeuw in 1972 (BA #464).

Remarks. At first sight *A. mastalleri* gives the impression of belonging to the genus *Cryptoconchus* or *Notoplax* rather than *Acanthochitona*, mainly due to the overlapping dorsal girdle. The slits, however, are similar to *Acanthochitona*. It is the only member of the genus that shows these characteristics and is therefore easily recognised.

Genus *Craspedochiton* Shuttleworth, 1853

Craspedochiton laqueatus (Sowerby, 1842) (Figs 60-61)

Chiton laqueatus Sowerby, 1842: Proc. zool. Soc. London: 104
Angasia tetrica Carpenter *in* Pilsbry, 1893 with var. *calculosa* Carpenter *in* Pilsbry, 1893
Acanthochites aberrans Odhner, 1919

Craspedochiton laqueatus - Pilbry, 1892: 285, pl. 39 figs 42-51, pl. 44 fig. 68; Van Belle, 1983: 142-143, pl. 13 fig. 3; Strack, 1993: 22-23, pl. 5 figs 4-5; Slieker, 2000: 54, pl. 15 figs 13, 13a.

Type locality. Calapan, Mindoro, Philippines

Material. Locality #5: 1 sp., 3.8 x 2.5 mm, juvenile (BA); **Loc. #6:** 13 sps, 8.5 x 5.8 mm – 25.5 x 17.0 mm (YT); 12sps, 9.5 x 7.3 mm – 28.3 x 18.0 mm (BA).

Description. Animal of medium size, largest specimen examined 28.3 x 18.0 mm, anteriorly very wide. Colour variable, tegmentum with different patterns of green, brown and cream, sometimes flecks of purple (mostly on valve II); jugum darker in colour. Girdle mostly orange brown, sometimes with bands of black and/or flecks of white. Head valve broad and flat with 5 or occasionally 6 low ribs, coarsely sculptured with irregularly shaped, round to oval granules. Identical sculpture on tegmentum of intermediate valves, except in older and larger specimens, where jugum is smooth, eroded or covered with coralline algae. Tail valve flat, mucro somewhat anteriorly placed. Articulamentum white, slit formula 5-6/1/7-11. Girdle very broad, densely covered with minute spicules and solitary small yellowish needles which are dispersed over the whole girdle surface, numerous on the outer margin, resulting in a fringe; 18-30 inconspicuous sutural tufts, consisting of about 4-6, long, yellowish, sharply pointed, somewhat curved needles. Ventrally the girdle is covered with 3 distinct types of finely ribbed scales. Gills abanal and merobranchial.
Thiele (1909) and Strack (1993) gave good descriptions of the girdle elements and radula.

Habitat. This species is generally found under rocks in shallow water to depths of 52 m. We only found it under large boulders in 1 m of water in a secluded area (locality #6). A single juvenile specimen (3.8 x 2.5 mm) living in a small crevice in a smooth rock, was recorded from locality #5.

Distribution. *Craspedochiton laqueatus* (Sowerby, 1842) is a species with a wide geographical range. It is recorded throughout the Indo-Pacific area, from the Red Sea to the Philippines and even very remote areas, such as the Saha de Mahla bank (BA #285).

Remarks. It is remarkable that this species was mainly recorded from the secluded area near the Saudi border (locality #6) and only one juvenile at locality #5. They were predominant at locality #6. Nowhere else along the Jordan shore was this specimen found. Locality #6 is particularly isolated by the Potash factory and has very clear water and almost no currents or waves. It is defined by a wide, shallow coral flat with open areas in between. The single juvenile specimen found at locality #5 has very thin plates and the texture is coarser than that of larger and adult specimens found in locality #6. There appear to be 2-3 streaks in the central area, disposed at an angle to the median, unlike in adults, and heavy granulation on the pleural areas.

Genus *Notoplax* H. Adams, 1861
Subgenus *Notoplax* s.s.

***Notoplax curvisetosa* (Leloup, 1960)**
(Figs 5 (in situ)**; 62-63)**

Acanthochiton curvisetosus Leloup, 1960: Bull. Sea Fish. Res. Stn Israel 29: 29, fig. 1, pl. 2 fig. 2.
Notoplax elegans Leloup, 1981
Notoplax aqabaensis Leloup MS, Vine, 1986 (nom. nud.)

Notoplax curvisetosa - Strack, 1993: 26-27, pl. 5 fig. 8 (as *Notoplax (Leptoplax) curvisetosa).*

Type locality. Elat, Israel.

Material. Locality #2: 3 sps, 8.1 x 5.4 mm – 13.4 x 8.5 mm (BA); 2 sps, 4.5 x 3.3 mm – 11.6 x 7.6 mm (YT); **Loc. #3:** 5 sps, 6.6 x 4.2 mm – 13.5 x 7.7 mm (BA); 8 sps, 5.6 x 3.6 mm – 14.1 x 8.1 mm (YT); **Loc. #4:** 6 sps, 5.6 x 3.1 mm – 15.3 x 10.0 mm (BA); 3 sps, 8.0 x 5.1 mm – 11.6 x 6.8 mm (YT); **Loc. #5:** 4 sps, 4.9 x 3.4 mm – 13.0 x 7.7 (BA); 4 sps, 5.0 x 3.2 mm – 10.9 x 5.4 mm (YT); **Loc. #6:** 4 sps, 5.1 x 3.1 mm – 9.8 x 6.6 mm (BA); 4 sps, 7.8 x 3.9 mm – 12.7 x 7.8 mm (YT).

Description. Animal of small size, largest specimen found 15.3 x 10.0 mm. Moderately elevated, tegmentum grey, brown or dark pink, mostly with whitish flecks; some specimens uniformly reddish brown. Tegmentum sculptured with rather large, wide, triangular granules. Jugum wide and triangular, with 12-15 striae. Tail valve larger than head valve, mucro prominent and somewhat posterior; postmucronal slope straight and rather steep. Articulamentum translucent white, slit formula 5/1/6-8. Girdle rather wide, brownish and fleshy; covered with small spicules and interspersed with larger ones, resulting in a velvet-like appearance; 18 inconspicuous sutural tufts. Major lateral teeth of radula consisting of tridentate cusps, denticles sharp, median one longest.
Gills abanal and merobranchial, 10-13 gills per side.
A good description of the girdle elements and gills was given by Strack (1993).

Habitat. Mostly found under stones and dead coral, from 0.5 m to 36 m depth. Our specimens were mostly found under smooth granite rocks at a depth of 0.5-3.0 m.

Distribution. Red Sea and Madagascar but also recorded from Îles Glorieuses by Leloup (1981) (as *Acanthochiton curvisetosus*).

Remarks. This species is surprisingly abundant on the Jordan shores, although generally reported as being rare. We found it in rather large numbers in all sampling localities, except locality #1.

CONCLUSION & DISCUSSION

The chiton fauna of the Jordan coast has never been thoroughly investigated in the past. Only a few samples have ever been recorded and studied by authors such as E. Leloup and M. Mastaller and often samples consisted only of valves.
Although few complete specimens have been recorded from the Jordan coast, we found surprisingly abundant and diverse chiton fauna along the whole shoreline, when we investigated the shore closely on our second trip in July 1999. Our collecting campaign yielded 60% of all Red Sea species.
After thorough investigation of the collected material and comparison with specimens from different collections and literature, we came across a specimen that is in our opinion new to science, although closely related to *L. (P.) hylkiae*. We describe it here as new, bringing the total members of Leptochitonidae living in the Red Sea up to 3 species.
We hope that collectors will find more specimens in the future so that we can learn more about its bio-geographical range, habitat, growth and intra-specific differences.
Some of the species (e.g. *Callochiton vanninii* and *Cryptoplax sykesi*), mentioned by previous authors reporting on the Red Sea polyplacophoran fauna, were not found on our fieldtrips. This could be due to the fact that our dive-range using only snorkelling gear was limited to about 6 m, and that we did not look within coral branches, a common habitat of the Cryptoplacidae. We deliberately did not investigate the coral habitats because we chose to keep the disturbance of the subtidal fauna and flora, in particular the coral reef, to a minimum according to local and international environmental guidelines and regulation. To our surprise we never found *L. (P.) hylkiae*. The geographical range of this species is probably still limited to the northern part of the Red Sea, i.e. a wide area around the city of Hurghada, Egypt, because most specimens have been taken from that area (Strack, 1993; Schwabe, 1997).
The single specimen of *Acanthochitona* cf. *mahensis* is a very peculiar finding. After thorough investigation we were still unable to confidently identify this specimen. It showed close resemblance to *Acanthochitona mahensis* but as its collecting site is so far from that species' type locality or area we were still unsure. Furthermore, we are dealing here with a semi-juvenile specimen

so not all features are developed. We hope to collect more material or receive more material from collectors to study this peculiar finding in depth.

Tonicia (Lucilina) perligera is here extensively documented for the first time. Previous authors were only able to study the type material or material merely represented by single valves.

Findings of *Ischnochiton (Ischnochiton) yerburyi* and small specimens, showing characteristics of *Ischnochiton (Ischnochiton)* cf. *sansibarensis* will be the topic of our next study, where the type material of *Ischnochiton rufopunctatus* Odhner, 1919; *Ischnochiton (Radsiella) delagoaensis* Ashby, 1931; *Ischnochiton haersoltei* Kaas, 1954 and *Ischnochiton kilburni* Kaas, 1979 will be revised by both of us.

We also hope to be able to revise the type material of *Acanthopleura testudo* Spengler, 1797 to clarify the doubtful circumstances of this species.

As already mentioned before, we were surprised to find such varied chiton fauna in Jordan. There is great species diversity for such a small area (26 km of coast line) and such limited diversity in habitats. The most abundant species are *Tonicia (Lucilina) sueziensis* and *Ischnochiton (Ischnochiton) yerburyi*. It was not surprising to find valve anomalies in such extensive populations, including 5 seven-valved specimens of *Tonicia (Lucilina) sueziensis* (figs 52-54) abnormal growth forms, such as broken and fused valves (see fig. 61), and gerontic as well as juvenile specimens of almost all the species collected. The area with the largest concentration of chitons was collecting site #2, locally known as the public beach 'North Beach', in the centre of Aqaba city. The beach consists mainly of gravel and coarse sand, the intertidal zone densely packed with small and larger, smooth, rounded, granite rocks. Subtidally the habitat consists of dead reef. The beach lies between the commercial harbour and the yacht harbour. The area is often visited by tourists and locals for glass bottom boat excursions and to relax in shade of a Bedouin tent. It is intensively used and therefore visually (paper, plastic, cans…) polluted. The murky water of the public beach is probably also polluted due to nearby marine activities. None the less, it has a very rich and diverse underwater fauna and flora. *Tonicia (Lucilina) sueziensis* and *Ischnochiton (Ischnochiton) yerburyi* are very abundant here, and it was the only sampling area where we were able to find *Tonicia (Lucilina) perligera*. Another very interesting collecting site is Club Murjan (loc. #3). This site is largely a muddy flat with sea-grass colonies, interspersed with small smooth rocks and a deeper reef flat. The most abundant species are *Chiton (Rhyssoplax) affinis* and *Chiton (Rhyssoplax) maldivensis*. Also interesting to us were the isolated findings of *Craspedochiton laqueatus*. We encountered the species only as 26 specimens at the southern part of Jordan, of which all but one were collected near the Saudi border in the lagoon between the border and the Potash factory. The area is only occasionally visited by people, mostly trucks going south to the Saudi Arabian peninsula that use the area as a resting place before the border crossing. The area is still very pristine and has the most abundant underwater fauna and flora of all of Jordan's public beaches. The intertidal and subtidal coral reef is very diverse. It is at this secluded area of the country that we found *Leptochiton (Parachiton) jordanensis* sp. nov. and many *Craspedochiton laqueatus*. In our opinion this species diversity can only continue to increase further down south into Saudi Arabia.

SYNOPSIS OF THE RED SEA POLYPLACOPHORA

1. *Leptochiton (Leptochiton) nierstraszi* (Leloup, 1981)(*)
2. *Leptochiton (Parachiton) hylkiae* Strack, 1993
3. ***Leptochiton (Parachiton) jordanensis* sp. nov.**
4. **Callochiton vanninii Ferreira, 1983**
5. *Lepidochitona monterosatoi* Kaas & Van Belle, 1981
6. *Lepidozona luzonica* (Sowerby, 1842)(**)
7. ***Ischnochiton (Ischnochiton) yerburyi* (E.A. Smith, 1891)**
8. *Callistochiton adenensis* (E.A. Smith, 1891)(***)
9. *Schizochiton jousseaumei* Dupuis, 1917(***)
10. *Chiton (Chiton) peregrinus* Thiele, 1909(***)
11. ***Chiton (Tegulaplax) hululensis* (E.A. Smith, 1903)**
12. ***Chiton (Rhyssoplax) affinis* Issel, 1869**
13. *Chiton (Rhyssoplax) heterodon* (Pilsbry, 1893)(***)
14. ***Chiton (Rhyssoplax) maldivensis* (E.A. Smith, 1903)**
15. ***Acanthopleura vaillantii* de Rochebrune, 1882**
16. ***Tonicia (Lucilina) sueziensis* (Reeve, 1847)**
17. ***Tonicia (Lucilina) perligera* (Thiele, 1909)**
18. *Onithochiton erythraeu*s Thiele, 1909
19. ***Cryptoplax sykesi* Thiele, 1909**
20. ***Acanthochitona penicillata* (Deshayes, 1863)**
21. ***Acanthochitona mastalleri* Leloup MS, Strack, 1989**
22. ***Craspedochiton laqueatus* (Sowerby, 1842)**
23. ***Notoplax curvisetosa* (Leloup, 1960)**

Species reported from Jordan are in **bold.**

(*) Reported as findings of loose valves only (Strack, 1993).

(**) There are no confirmed reports that this species lives in the Red Sea. The only specimen reported from the Red Sea is the lectotype *Lepidopleurus concharum* de Rochebrune, 1884, glued inside a specimen of the Australian bivalve *Circe weedingi* (Cotton, 1934). Thiele did not mention this in his examination of the specimen and radula. As these circumstances are rather contradictory, Kaas & Van Belle rejected de Rochebrune's locality. However, the species is known to occur in the western Indian Ocean, for example in Bahrain, Qatar and the United Arab Emirates (Kaas & Van Belle, 1988). It may possibly be found in the southernmost part of the Red Sea. To our knowledge this has not yet been confirmed and it is therefore still uncertain whether this species lives in the Red Sea.

(***) Only reported from the southern Red Sea.

Last year a list was published reporting the Red Sea shells (Dekker & Orlin, 2000), where *Acanthopleura testudo* Spengler, 1797 was mentioned as a valid species. Given conflicting opinions on this topic (Kaas & Knudsen, 1992; Strack, 1993), it is still unclear whether it is a separate species or a synonym of *Acanthopleura vaillantii* de Rochebrune, 1882 or *Acanthopleura brevispinosa* (Sowerby, 1840). *Chaetopleura (Chaetopleura) chelazziana* Ferreira, 1983, was also listed as present in the Red Sea

(Dekker & Orlin, 2000) but it has previously only been reported well south of the Red Sea, from the Gulf of Aden down to Mozambique (Kaas & Van Belle, 1990). It is possible that this species can be found in the southernmost Red Sea but to our knowledge this has not yet been confirmed.
We deliberately did not include our finding of *Acanthochitona* cf. *mahensis* Winckworth, 1927 in the above synopsis as we are still investigating this species.

KEY TO THE CHITONS OF JORDAN, GULF OF AQABA

The present dichotomous key is intended to allow the determination of known species of chitons from Jordan (Gulf of Aqaba). In constructing the key we have chosen to use exclusively emphasize macroscopic external features of complete animals, visible when using a basic magnifying glass (+/- x 8). This key, combined with the pictures, can be used as a field guide in order to differentiate each occurring species. The following points should be kept in mind when trying to identify polyplacophoran specimens using this key: (1) do not expect precise identifications using very juvenile, badly broken, eroded or worn material; (2) identification will be most successful when a single specimen can be compared to a range of specimens, from young to old, to appreciate variation with age and other subtle patterns of variation between individuals.

1. girdle hairy……..2
   girdle not hairy…….8

2. animal shape oval……..……..3
   animal shape vermiform..……..*C. sykesi*

3. girdle with coarse calcareous spines…..…… *A. vaillantii*
   girdle with fine spicules..……..……4

4. girdle tufts inconspicuous ……..……5
   girdle tufts clearly visible ……..……...7

5. girdle anteriorly dilated……..……...*C. laqueatus*
   girdle not anteriorly dilated....……..…6

6. girdle partially covering valves…….....*A. mastalleri*
   girdle velvet-like…….....……..…..…*N. curvisetosa*

7. tegmental granules numerous and small…....*A. penicillata*
   tegmental granules few and large.....……*A. cf. mahensis*

8. girdle covered with scales…….....9
   girdle appearing naked…….....….....……...13

9. tegmentum with thimble-like sculpturing.....*I. (I.) yerburyi*
   tegmentum without thimble-like sculpturing…....……10

10. tegmentum with granulose sculpture……..*L. (P.) jordanensis*
    tegmentum without granulose sculpture …….....11

11. central areas of valves unsculptured.....….*C. (T.) hululensis*
    central areas of valves sculptured…….. …….....…12

12. lateral areas of valves unsculptured …….....*C. (R.) maldivensis*
    lateral areas of valves sculptured…….....*C. (R.) affinis*

13. tegmentum apparently unsculptured..…….....*C. vanninii*
    tegmentum sculptured....……..……14

14. tegmentum sculptured with large, well separated granules.....*T. (L.) perligera*
    tegmentum sculptured with (granular) ribs..*T. (L.) sueziensis*

ACKNOWLEDGEMENTS

We first of all wish to thank Mr. R. A. Van Belle (KBIN, Belgium) for his readiness to provide the necessary literature on the subject, for helping us determine some of the specimens and for critical reading of the manuscript in the last stages of our investigation. We also gratefully thank Dr. Bruno Dell'Angelo (Italy) for providing the SEM-pictures of several specimens. We also express our gratitude to Enrico Schwabe (ZSM, Germany) and Hermann L. Strack (RMNH, The Netherlands) for pictures and comparative material of *L. (P.) jordanensis* sp. nov.

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Lavoro accettato il 30 settembre 2003