

Mollusca Polyplacophora : Deep-water Chitons from New Caledonia

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ABSTRACT

Five French deep-sea cruises made around New Caledonia during the years 1985-1987 brought altogether 92 specimens of chitons, representing 10 species in 5 families ; 8 species are

new to science. The new genus *Vermichiton* is described for a small vermiform species ; this genus is compared with *Connexochiton* Kaas, 1979.

RÉSUMÉ

Mollusca Polyplacophora : Chitons bathyaux et abyssaux de Nouvelle-Calédonie.

Cinq campagnes françaises réalisées autour de la Nouvelle-Calédonie, de 1985 à 1987, ont permis la récolte de 92

spécimens de chitons, appartenant à cinq familles et comprenant dix espèces dont huit nouvelles. Le nouveau genre *Vermichiton* est décrit pour une petite espèce vermiforme ; ce genre est comparé avec *Connexochiton* Kaas, 1979.

INTRODUCTION

During the years 1985-1987 several deep-sea cruises were made around New Caledonia. In 1985 the BIOCAL cruise, on the research vessel "*Jean Charcot*", procured 43 specimens of Polyplacophora from 8 stations S and SE of New Caledonia, in depths varying from 235 to 2 340 m. They belong to 6 species, 4 of them new to science. Later in 1985 the MUSORSTOM 4 cruise, on the research vessel "*Vauban*", hauled 36 specimens of chitons from 12 stations NW and SE of New Caledonia in depth from 75 to 720 m, representing 6 species, 4 new to science, one had also been procured by the BIOCAL cruise. In 1986 the CHALCAL 2 cruise added 11 more specimens, belonging to 3 species, two already found by the aforementioned cruises and one new. The same year the SMIB 2 and the SMIB 3 cruises, on the "*Vauban*", added two more specimens of species also found by the foregoing cruises. Altogether 92 specimens were captured, representing 10 species, 8 of which are new to science.

B. RICHER DE FORGES (1990) wrote a narrative of the cruises and provided a list of stations.

Thanks are due to Dr Philippe BOUCHET of the Muséum national d'Histoire naturelle, Paris, who participated in the BIOCAL, MUSORSTOM 4 and CHALCAL 2 cruises, for affording the author an opportunity to study and describe the material.

List of abbreviations :

- AMS = Australian Museum, Sydney.
 MNHN = Muséum national d'Histoire naturelle, Paris.
 NMNZ = National Museum of New Zealand, Wellington.
 RMNH = Rijksmuseum van Natuurlijke Historie, torie, Leiden. Now Nationaal Natuurhistorisch Museum.
 VB = Private collection of R. A. VAN BELLE, Sint-Niklaas, Belgium.

SYSTEMATIC ACCOUNT

Order NEOLORICATA

Suborder LEPIDOPLEURINA

Family LEPTOCHITONIDAE

Genus *LEPTOCHITON* Gray, 1847Subgenus *LEPTOCHITON* s.s.*Leptochiton (L.) belknapi* Dall, 1878

Leptochiton belknapi Dall, 1878 : 1. — KAAS & VAN BELLE, 1987 : 23, fig. 10 (bibliography and synonymy). — KAAS, 1990 : 176.

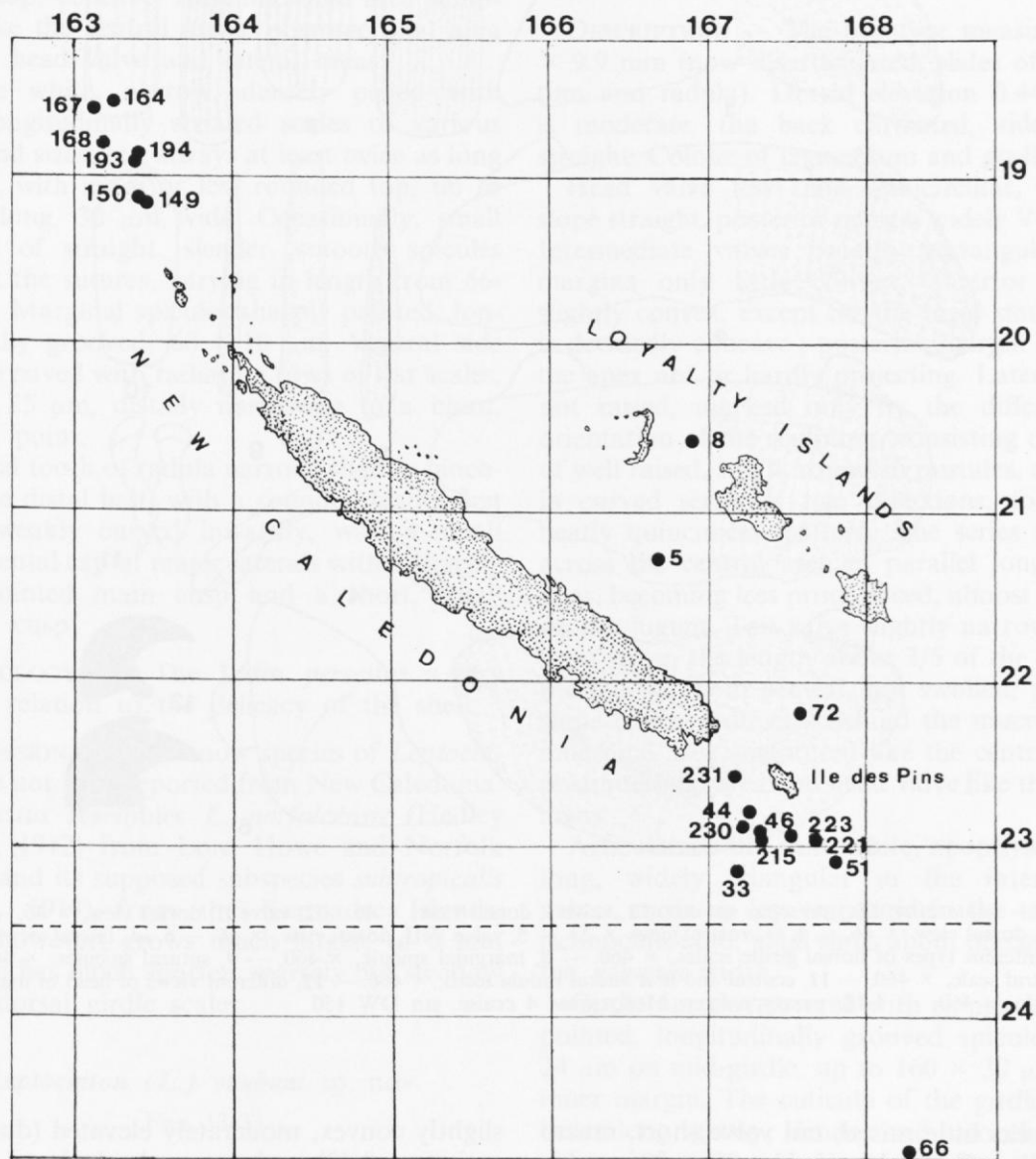
MATERIAL EXAMINED. — **New Caledonia.** BIOCAL : stn CP 05, 21°16' S, 166°44' E, 2 340 m, 11.VIII.1985 : 1 spm. — Stn DW 33, 23°10' S, 167°10' E, 675-680 m, 29.VIII.1985 : 1 spm. — Stn CP 72, 22°10' S, 167°33' E, 2 100-2 110 m, 04.IX.1985 : 2 spms.

Leptochiton (L.) perscitus sp. nov.

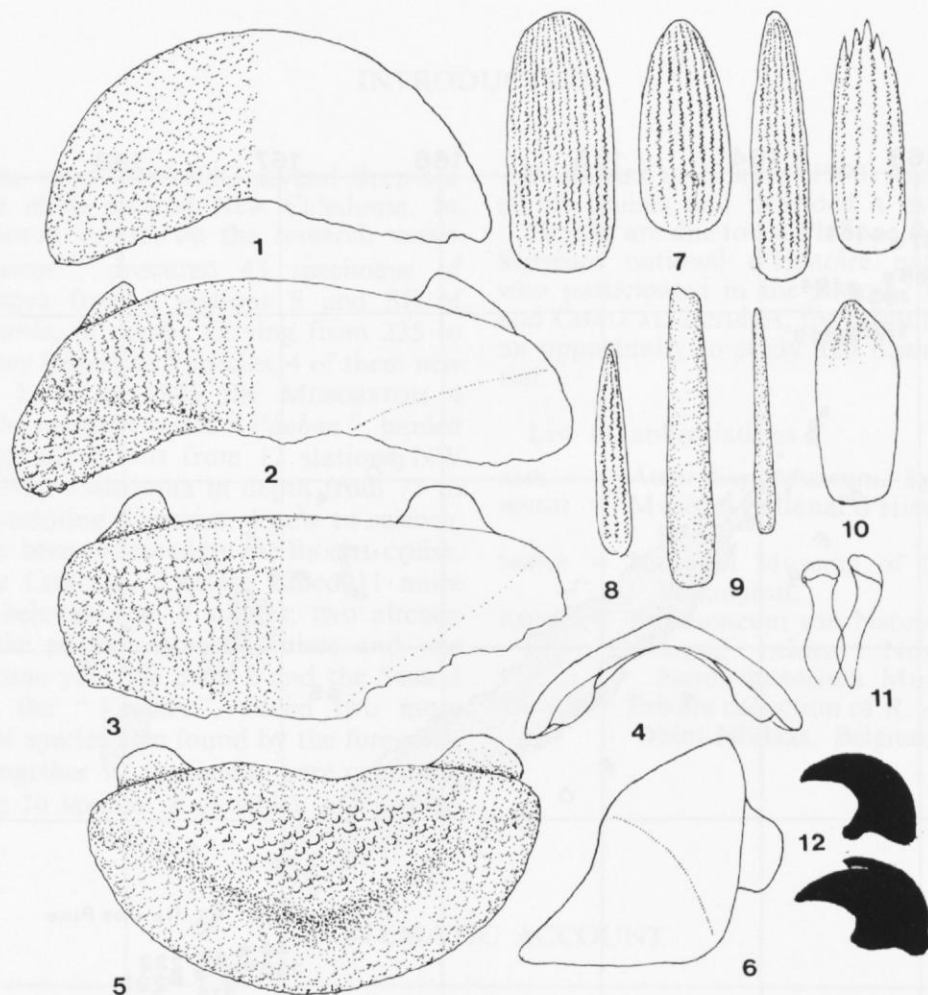
Figs 1-12

MATERIAL EXAMINED. — **New Caledonia.** MUSORSTOM 4 : stn DW 149, 19°08' S, 163°23' E, 155 m, 14.IX.1985 : 18 spms, paratypes (MNHN/12, RMNH 9264/2, VB 2983/2, NMNZ/1). — Stn DW 150, 19°07' S, 163°22' E, 110 m, 14.IX.1985 : 3 spms, holotype and disarticulated paratypes (MNHN).

DIAGNOSIS. — Animal c. 2 mm long, moderately elevated, subcarinated, valves not beaked,



Map showing stations of the cruises BIOCAL, 1985 (numbers < 100) and MUSORSTOM 4, 1985 (numbers > 100).



FIGS 1-12. — *Leptochiton (L.) perscitus* sp. nov.: 1, valve I, dorsal view, $\times 46$. — 2, valve II, dorsal view, $\times 46$. — 3, valve VII, dorsal view, $\times 46$. — 4, *id.*, rostral view, $\times 23$. — 5, valve VIII, dorsal view, $\times 46$. — 6, *id.*, lateral view, $\times 46$. — 7, different types of dorsal girdle scales, $\times 460$. — 8, marginal spicule, $\times 460$. — 9, sutural spicules, $\times 460$. — 10, ventral scale, $\times 460$. — 11, central and first lateral radula teeth, $\times 460$. — 12, different views of head of major lateral tooth, $\times 460$. — 1-12, paratype from MUSORSTOM 4 cruise, stn DW 150.

lateral areas little raised, tail valve short, mucro post-median. End valves and lateral areas weakly quincuncially granulated, central and antemucronal areas with larger, roundish granules in longitudinal series. Girdle with finely striated scales, at the sutures occasionally small bunches of spicules. Dental cap of major lateral tooth bicuspid.

DESCRIPTION. — Animal very small, the largest 2.1×1.8 mm (curled), at most 2.5 mm long when stretched, oval, subcarinated, side slopes

slightly convex, moderately elevated (dorsal elevation c. 0.40), valves not beaked.

Valve I somewhat less than semicircular, quincuncially sculptured with weakly pronounced, rounded granules. Intermediate valves rectangular, anterior margin convex in valve II, straight to a little concave in the others, posterior margin almost straight, often damaged as the valves are very thin and brittle. Lateral areas weakly raised, quincuncially granulated like head valve, central areas with longitudinal rows of well pronounced, round granules, more weakly developed on the

jugum. Apophyses small, short, triangular to trapezoid, widely spaced, jugal sinus almost flat. Tail valve short, length less than half its width, the mucro post-median, not swollen, posterior slope steep, concave. Antemucronal area sculptured like the central areas, postmucronal area like the head valve and lateral areas.

Girdle white, narrow, densely paved with finely longitudinally striated scales of various forms and sizes, but always at least twice as long as wide, with more or less rounded top, up to 75 μm long, 30 μm wide. Occasionally, small bunches of straight, slender, smooth spicules occur at the sutures, varying in length from 66-100 μm . Marginal spicules sharply pointed, longitudinally grooved, 60 \times 10 μm . Ventral side of girdle paved with radiating rows of flat scales, c. 55 \times 25 μm , distally narrowing to a blunt, grooved point.

Central tooth of radula narrow, slightly pinched in the distal half, with a rounded blade, first lateral weakly curved inwardly, with a small blade, dental cap of major laterals with a sharply bent, pointed main cusp and a short, small external cusp.

ETYMOLOGY. — The Latin *perscitus* = very fine, in relation to the delicacy of the shell.

DISCUSSION. — Until now species of *Leptochiton* have not been reported from New Caledonia. *L. perscitus* resembles *L. norfolcensis* (Hedley & Hull, 1912) from Lord Howe and Norfolk Islands and its supposed subspecies *subtropicalis* (Iredale, 1914) from the Kermadec Islands, which, however, grows much larger, to 6 mm long and has much shorter, sparsely but strongly ribbed dorsal girdle scales.

Leptochiton (L.) vaubani sp. nov.

Figs 13-23

MATERIAL EXAMINED. — New Caledonia. MUSORSTOM 4 : stn DC 168, 18°48' S, 163°11' E, 720 m, 16.IX.1985 : 1 spm, holotype (MNHN).

DIAGNOSIS. — Animal c. 2 \times 1 cm, elongate oval, moderately elevated, carinated. Colour white. Valves not beaked, lateral areas not raised, mucro almost central. Apophyses ischnochitonoid, rather wide. End valves and lateral areas with small, elevated pustules arranged in curved series, continuing on central areas, where

they are longitudinally arranged and less elevated. Girdle with elongate, striated spicules. Major lateral teeth of radula with bicuspid dental cap.

DESCRIPTION. — The holotype measures 19.8 \times 9.9 mm (now disarticulated, slides of perinotum and radula). Dorsal elevation 0.44, which is moderate, the back carinated, side slopes straight. Colour of tegmentum and girdle white.

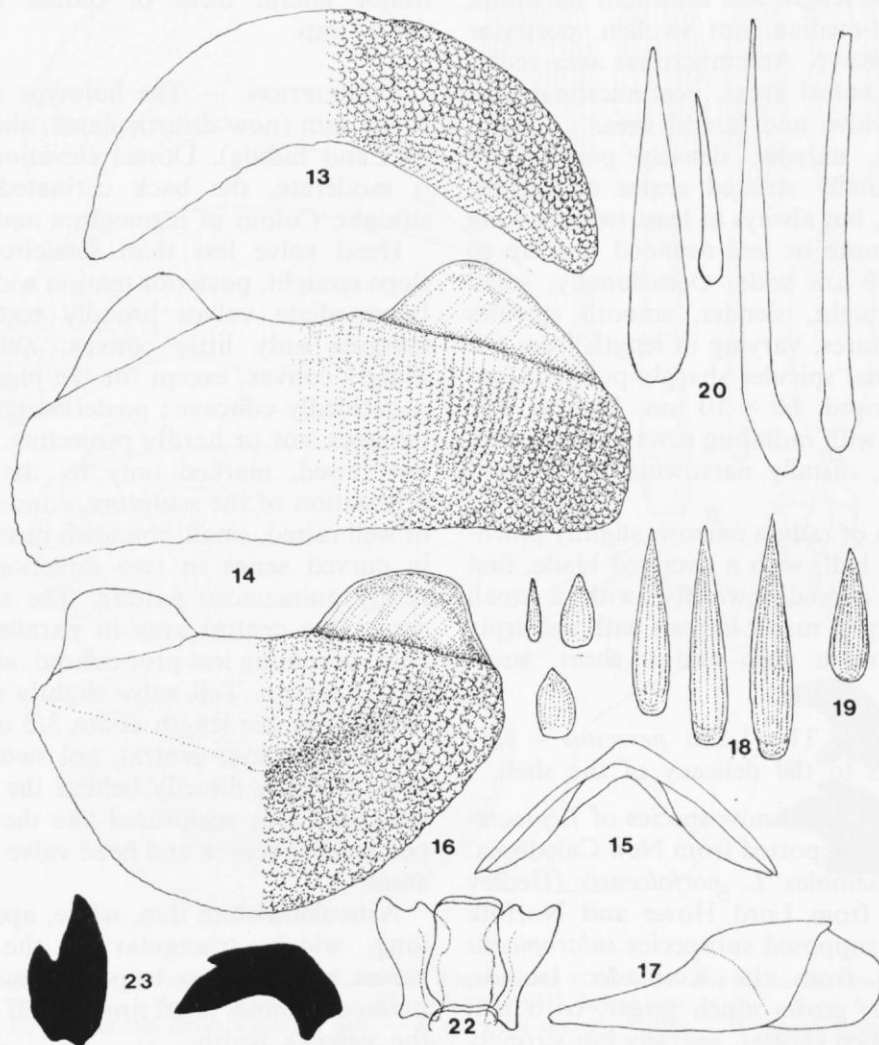
Head valve less than semicircular, anterior slope straight, posterior margin widely V-shaped. Intermediate valves broadly rectangular, side margins only little convex, anterior margin slightly convex, except for the jugal sinus which is decidedly concave; posterior margin straight, the apex not or hardly projecting. Lateral areas not raised, marked only by the difference in orientation of the sculpture, consisting of chains of well raised, small, roundish pustules, arranged in curved series in two directions, forming a neatly quincuncial pattern. The series continue across the central area in parallel longitudinal lines, becoming less pronounced, almost obsolete on the jugum. Tail valve slightly narrower than head valve, the length about 3/5 of the breadth, the mucro about central, not swollen, posterior slope concave directly behind the mucro. Antemucronal area sculptured like the central areas, postmucronal area and head valve like the lateral areas.

Articulamentum thin, white, apophyses rather long, widely triangular in the intermediate valves, more or less trapezoid in the tail valve, ischnochitonoid, jugal sinus about one quarter of the valves's width.

Girdle narrow, covered with elongate, sharply pointed, longitudinally grooved spicules, 88 \times 24 μm on mid-girdle, up to 160 \times 30 μm at the inner margin. The cuticula of the girdle bridges bears long, glassy, slender and smooth needles, up to 300 \times 20 μm . Ventral scales ovoid with pointed top, slightly striated, c. 28 \times 24 μm .

Radula with a short and relatively wide central tooth, slightly bulbous proximally, with a narrow, straight blade; first laterals widening distally, ending in a shallow sinus, without a blade; major laterals with a strong, curved, bicuspid dental cap, the cusps pointed, the central one much larger than the outer one.

Gills merobranchial abanal; c. 18 ctenidia per side.



FIGS 13-23. — *Leptochiton (L.) vaubani* sp. nov. : 13, valve I, dorsal view, $\times 9.6$. — 14, valve IV, dorsal view, $\times 9.6$. — 15, *id.*, rostral view, $\times 4.8$. — 16, valve VIII, dorsal view, $\times 9.6$. — 17, *id.*, lateral view, $\times 9.6$. — 18, dorsal girdle spicules along valve margin, $\times 200$. — 19, *id.*, from mid-girdle, $\times 200$. — 20, needles from girdle bridges, $\times 200$. — 21, ventral spicules, $\times 200$. — 22, central and first lateral radula teeth, $\times 100$. — 23, head of major lateral tooth, $\times 100$. — 13-23, holotype.

ETYMOLOGY. — After the research vessel “*Vauban*”.

DISCUSSION. — *L. vaubani* does not resemble any known species of the genus. It is unique in the possession of strongly developed, ischnochitonoid apophyses, in the spiculate girdle and the needle-bearing girdle-bridges.

Leptochiton (L.) sp. indet.

MATERIAL EXAMINED. — New Caledonia. BIOCAL : stn CP 05, $21^{\circ}16' S$, $166^{\circ}44' E$, 2 340 m, 11.VIII.1985 : 2 spms, too small to identify. — Stn DW 51, $23^{\circ}05' S$, $167^{\circ}45' E$, 680-700 m, 03.IX.1986 : 4 spms, smashed, unidentifiable.

Suborder ISCHNOCHITONINA
 Family ISCHNOCHITONIDAE
 Subfamily ISCHNOCHITONINAE

Genus *VERMICHITON* gen. nov.

DIAGNOSIS. — Animal small, narrowly elongate, more than four times longer than wide, highly elevated, carinated, apophyses connected by a jugal plate, articulamentum with many/1/

many slits, girdle closely beset with bluntly pointed, juxtaposed spicules, directed towards the outer margin.

Type : *V. vermiculus* sp. nov.

Vermichiton vermiculus sp. nov.

Figs 24-36

MATERIAL EXAMINED. — New Caledonia. BIOCAL : stn DW 46, 22°53' S, 167°17' E, 570-610 m, 30.VIII. 1985 : 1 spm, partly disarticulated, holotype (MNHN).

DIAGNOSIS. — Animal small, c. 5 mm long, 1 mm wide, valves highly elevated, carinated, hardly or not beaked. End valves and lateral areas pustulose, central areas finely longitudinally punctate-striate, apophyses connected by a jugal plate, slit formula of insertion plates many/1/many. Girdle with callochitonoid spicules.

DESCRIPTION. — Animal small, narrowly elongate, 5.12 × 1.36 mm, highly elevated (dorsal elevation 0.63), sharply carinated, side slopes almost straight, valves not beaked, apices hardly indicated, lateral areas raised. Girdle relatively wide, covered with callochitonoid spicules. Colour of valves and girdle white.

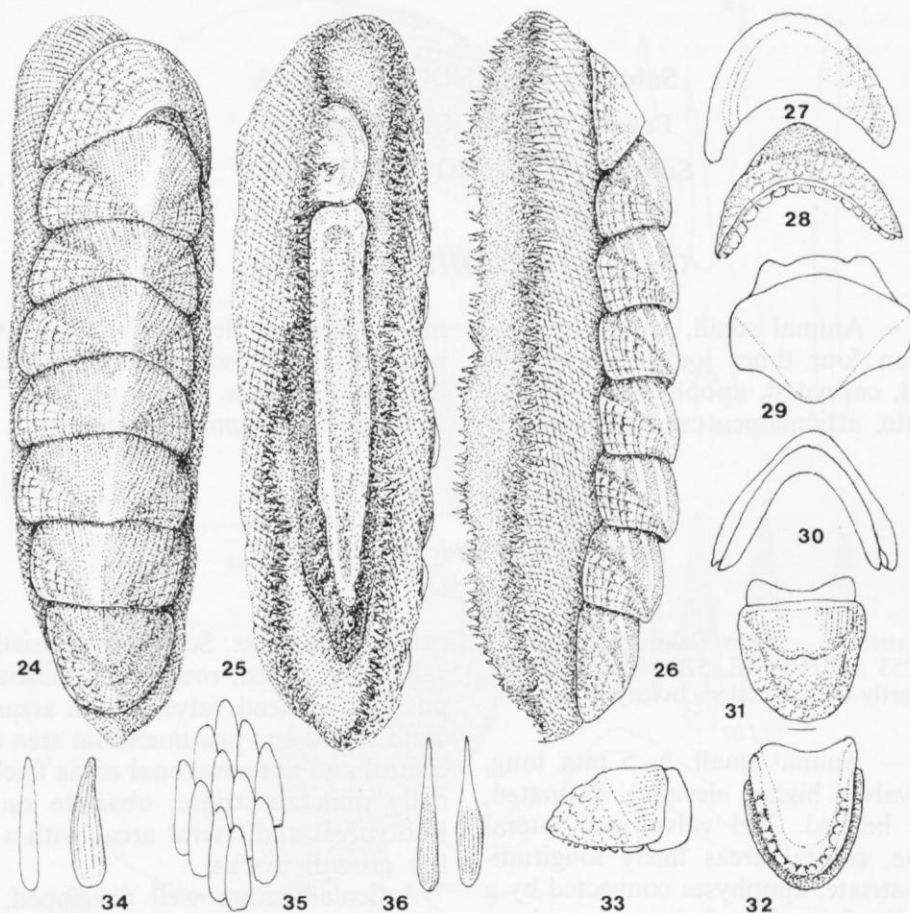
Head valve little more than semicircular, anterior slope steep, straight, posterior margin bay-like ; intermediate valves relatively long, not or slightly beaked, lateral areas clearly indicated, raised, anterior margin almost straight, convex in valve II, which is longer than the others, side margins straight, side slopes steep, almost straight. Posterior valve as long as wide, the mucro central, slightly directed forwardly, poste-

rior slope convex. Sculpture consisting of relatively large, raised, round, quincuncially arranged pustules on head valve, lateral areas of intermediate valves and postmucronal area of tail valve ; central and antemucronal areas finely, longitudinally punctate-striate, obsolete on the jugum. End valves and lateral areas with a few concentric growth marks.

Articulamentum well developed, white, produced forwardly in valves II-VIII as to form a relatively long jugal plate, connecting the apophyses. As a result the jugal sinus is very shallow. Valve I with 14 slits, the insertion teeth smooth, eaves solid ; intermediate valves with 1-1 short slits, valve VIII with 16 slits, the teeth very short and blunt. There are no slit-rays.

Girdle relatively wide, directed downward, appearing narrow when viewed from above, dorsally covered with juxtaposed, bluntly pointed, elongate-ovoid, white spicules, neatly arranged in quincunx, c. 150 × 40 μm. There is a marginal fringe of two kinds of small, pointed spicules : white, smooth, slender ones, c. 120 × 15 μm, and stout, longitudinally grooved ones, 120 × 30 μm. Ventral spicules arranged in radiating rows, the basal half distinctly striated, distally abruptly narrowing to a needle-like point, 90 × 16 μm.

Animal white, with a rounded head about the



FIGS 24-36. — *Vermichiton* gen. nov. *vermiculus* sp. nov.: 24-26, dorsal, ventral and lateral view respectively, $\times 18.75$. — 27-28, valve I, dorsal and anterior view respectively, $\times 18.75$. — 29-30, valve II, dorsal and rostral view respectively, $\times 18.75$. — 31-33, valve III, dorsal, ventral and lateral view respectively, $\times 18.75$. — 34, two types of marginal spicules, $\times 150$. — 35, dorsal girdle spicules *in situ*, $\times 75$. — 36, ventral scales, $\times 300$. — 24-36, holotype.

length of the foot, which is narrow, the width at most $1/7$ of the length. Gills merobranchial, abanal, about 20 ctenidia per side.

Radula not examined.

ETYMOLOGY. — From the Latin *vermis* = worm, so worm-like chiton; *vermiculus* = diminutive of *vermis*, meaning little worm, relating to the scantiness and worm-like appearance of the animal.

DISCUSSION. — This remarkable species shows some affinities to the genus *Callochiton* Gray,

1847, especially in the slitting of the insertion plates and the presence of a jugal plate in the valves II-VIII. The texture of the tegmentum, however, along with the elongate shape of the animal and the absence of extrapigmentary eyes in the shell plates, are of a more ischnochitonoid character. That is why the new genus *Vermichiton* has been created for this unique species, which should be classified with *Connexochiton* Kaas, 1979.

Genus *CONNEXOCHITON* Kaas, 1979*Connexochiton discernibilis* sp. nov.

Figs 37-49

MATERIAL EXAMINED. — New Caledonia. BIOCAL : stn DW 44, 22°47' S, 167°14' E, 440-450 m, 30.VIII. 1985 : 17 spms, MNHN/holotype + 10 paratypes ; RMNH 9265/2 paratypes ; VB 2984/2 paratypes ; AMS/1 paratype ; NMNZ/1 paratype.

DIAGNOSIS. — Animal small, elongate oval, up to 7.5 × 3.5 mm, white, highly elevated, side slopes straight, back carinated.

Lateral areas raised, with 5-7 radial sulci crossed by numerous fine, concentric lines. Central areas with a vague pattern of depressions, parallel to the diagonal ridges, crossed by concentric striae. Head valve and postmucronal area sculptured like lateral areas. Apophyses connected by a jugal plate, showing a small sinus in the median line of valves III-VII. Girdle narrow, covered with small, striated scales.

DESCRIPTION. — Animal elongate oval, twice as long as wide, small, the largest c. 7.5 × 3.5 mm, highly elevated (dorsal elevation c. 0.58), side slopes straight, the back sharply carinated. Valves slightly though sharply beaked. Colour of tegmentum and girdle white.

Head valve semicircular, posterior margin widely V-shaped, anterior slope steep, straight. Valve II longer than the others, forwardly produced in the jugal region, the anterior margin concave at both sides of the jugum. Valves III-VII transversely rectangular, anterior and posterior margins almost straight, but for the apex, forming a small but well marked beak. Side margins a little convex. Lateral areas slightly raised. Posterior valve crescent-shaped, more than twice as wide as long, anterior margin barely concave, mucro not prominent, central, posterior slope rather flat, only little excavated directly behind the mucro. Sculpture weakly pronounced, consisting of 6-8 fine radial grooves in the lateral areas, 25-30 in the head valve, less in the postmucronal area of the tail valve, separating weakly granulose riblets and crossed by numerous fine, concentric lines. Central areas

vaguely sculptured with a series of wavy depressions parallel to the diagonal ridges, crossed by concentric striae, the jugum practically smooth.

Articulamentum well developed, forming a rather long jugal plate between the apophyses, dorsally with a few striations, in valves III-VII with a very small, narrow median sinus. Slit formula of insertion plates 9/1/8, teeth sharp, slit rays distinct, eaves solid.

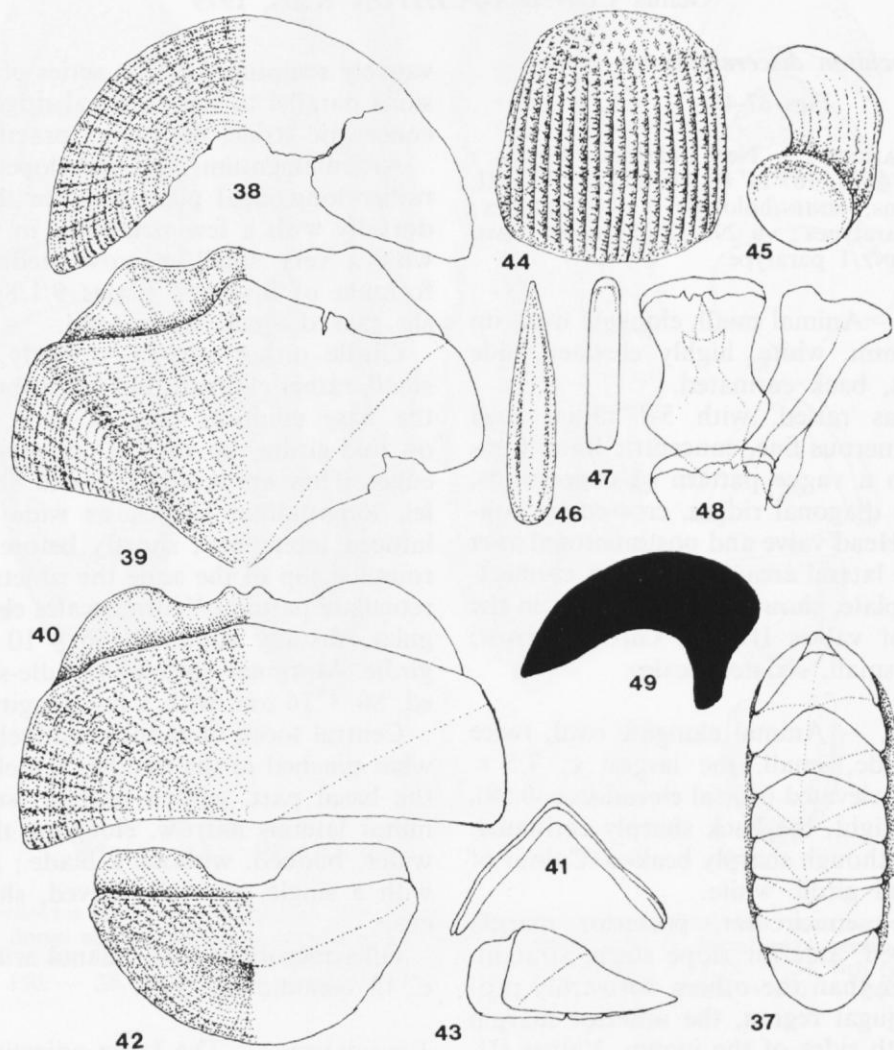
Girdle rather narrow, dorsally covered with small, rather elongate, curved, imbricating scales, the base elliptical, 72 μm wide, 80 μm high on mid-girdle, up to 130 μm along the valves' edges. They are sculptured with about 18 parallel, longitudinal riblets, as wide as the finely latticed interstices ; shortly before reaching the rounded top of the scale the riblets break into a reticulate pattern. Ventral scales elongate rectangular, distally rounded, 56 × 10 μm on mid-girdle. Marginal spicules spindle-shaped, pointed, 80 × 16 μm, with a few longitudinal riblets.

Central tooth of radula relatively wide, somewhat pinched in the middle, acutely widening in the basal part, with a narrow, straight blade ; minor laterals narrow, elongate, the distal edge wider, bilobed, without a blade ; major laterals with a single, strongly curved, sharply pointed cusp.

Gills merobranchial, adanal with interspace ; c. 13 ctenidia per side.

ETYMOLOGY. — The Latin adjective *discernibilis* means discernible, as the species is easy to distinguish.

DISCUSSION. — This is the first *Connexochiton* described from the Pacific Ocean, the three previously reported species are found in the deep water of the Atlantic, viz. *C. platynomenus* Kaas, 1979, the type of the genus, from the eastern side (Brittany to Morocco and in the Mediterranean Sea), *C. moreirai* (Righi, 1973) and *C. bromleyi* (Ferreira, 1985) from the tropical western side. *C. discernibilis* is easily recognizable by the absence of a pustulose tegmental sculpture and by its highly arched, sharply carinated shape.



FIGS 37-49. — *Connexochiton discernibilis* sp. nov. : 37, complete specimen, dorsal view, $\times 6.6$. — 38, valve I, dorsal view, $\times 20.5$. — 39, valve II, dorsal view, $\times 20.5$. — 40, valve III, dorsal view, $\times 20.5$. — 41, *id.*, rostral view, $\times 10$. — 42, valve VIII, dorsal view, $\times 20.5$. — 43, *id.*, lateral view, $\times 20.5$. — 44, dorsal scale from mid-girdle, dorsal view, $\times 415$. — 45, *id.*, from inner margin, ventral view, $\times 205$. — 46, marginal spicule, $\times 415$. — 47, ventral scale, $\times 415$. — 48, central and first lateral radula teeth, $\times 415$. — 49, head of major lateral tooth, $\times 415$. — 37-49, paratypes (MNHN).

Genus *ISCHNOCHITON* Gray, 1847Subgenus *STENOSEMUS* von Middendorff, 1847*Ischnochiton (Stenosemus) delicatus* sp. nov.

Figs 50-56

MATERIAL EXAMINED. — **New Caledonia.** MUSORSTOM 4 : stn CP 167, 18°36' S, 163°06' E, 575 m, 16.IX.1985 : 1 spm, holotype (MNHN). — Stn DW 221, 22°59' S, 167°37' E, 515-560 m, 29.IX.1985 : 1 spm, incomplete, paratype (MNHN).

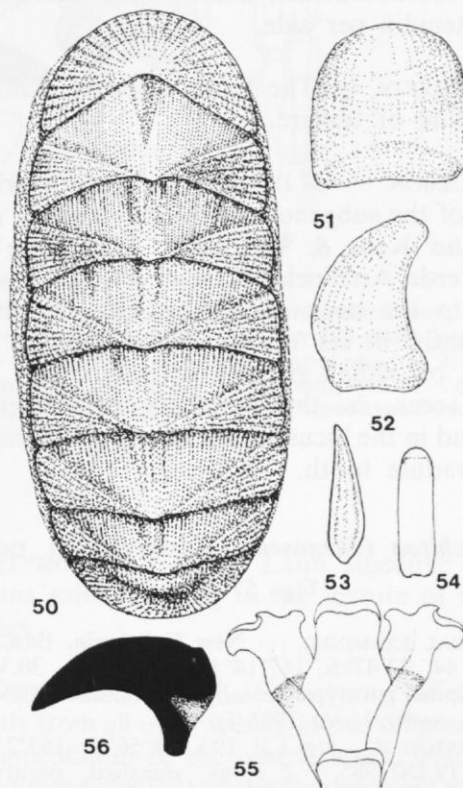
DIAGNOSIS. — Animal of small to moderate size, elongate oval, more than twice as long as wide, rather elevated, valves slightly beaked, lateral areas little raised. Tegmentum white, finely granulated; head valve, lateral and postmucronal areas with many weak radial grooves, crossed by fine, close-set concentric lines, central and antemucronal areas with many parallel longitudinal chains of very fine granules, obsolete on the jugum; mucro of tail valve slightly antemedian. Girdle with short, globular, almost smooth scales. Dental cap of major lateral radula tooth with a single cusp.

DESCRIPTION. — Animal white, rather elongate oval, 17.5 × 7.0 mm, highly arched (dorsal elevation 0.47), carinated, side slopes weakly convex. Intermediate valves of about equal width, only slightly beaked, lateral areas little raised. Tegmentum granular, girdle narrow, scaly.

Head valve semicircular, posterior margin widely V-shaped, with a small notch at the apex, anterior slope straight, tegmentum granular, the granules transversely oval, arranged in radiating rows, separated by narrow, shallow grooves in the lower half. Intermediate valves rectangular, front margin nearly straight, except in valve II, which is forwardly produced, strongly convex between the apophyses, hind margin straight, with a small, hardly protruding apex. Side margins little convex. Lateral areas well marked, weakly raised, sculptured like head valve, with c. 10 shallow grooves; central area with 30 or more longitudinal rows of roundish, separated, little elevated granules on the pleural sides, obsolete on the jugum. Tail valve with the mucro

a little anterior, not swollen, the posterior slope straight, with only a slight excavation directly behind the mucro. Antemucronal area sculptured like central areas, postmucronal area like head valve.

Articulamentum well developed, white, apophyses moderately wide, broadly rectangular with rounded top, connected by a very short jugal plate, hardly projecting beyond the tegmentum. Insertion plates rather short, smooth-edged in valves I-VII, finely toothed in VIII. Slit-formula 7/1/7, slit rays distinct, eaves narrow, solid.



FIGS 50-56. — *Ischnochiton (Stenosemus) delicatus* sp. nov. : 50, whole specimen, dorsal view, × 4.5. — 51, dorsal girdle scale, × 187.5. — 52, *id.*, lateral view, × 187.5. — 53, marginal spicule, × 187.5. — 54, ventral scale, × 187.5. — 55, central and first lateral radula teeth, × 187.5. — 56, head of major lateral tooth, × 187.5. — 50-56, holotype.

Girdle rather narrow, partly folded under, regularly paved with dorsally globular, almost smooth to obsolete striated, ventrally concave scales, up to $110 \times 120 \mu\text{m}$ on mid-girdle, rapidly decreasing in size towards the outer margin, which bears a short fringe of conical, weakly ribbed spicules, up to $100 \mu\text{m}$ long, $24 \mu\text{m}$ thick at the base. Ventral side of girdle covered with radial rows of rectangular scales, slightly emarginate proximally, rounded distally, $90 \times 25 \mu\text{m}$ on mid-girdle, shorter towards the outer margin.

Radula 7.3 mm long, which is c. 40 percent of the length of the body, with 28 rows of mature teeth. Central tooth bulged in the proximal half, with a weakly bilobed blade, first laterals of about equal length, distally with small projections in- and out-wardly, dental cap of major lateral tooth with a single, sharply pointed, strongly bent cusp.

Gills merobranchial, adanal with interspace; c. 22 ctenidia per side.

ETYMOLOGY. — The Latin adjective *delicatus* means fine of texture.

DISCUSSION. — Of the eight hitherto described species of the subgenus *Stenosemus* only *L. (S.) substriatus* Kaas & Van Belle, 1989 from the Cape Verde Archipelago, bears a slight resemblance to the new species, although it differs significantly in its much smaller size, in the absence of radial grooves in end valves and lateral areas, in the decidedly ribbed girdle scales and in the bicuspid dental cap of the major lateral radula tooth.

Ischnochiton (Stenosemus) robustus sp. nov.

Figs 57-67

MATERIAL EXAMINED. — New Caledonia. BIOCAL : stn DW 44, $22^{\circ}47' \text{S}$, $167^{\circ}14' \text{E}$, 440-450 m, 30.VIII.1985 : 5 spms, paratypes, totally disarticulated (MNHN/2, AMS/1, NMNZ/1, VB 2985/1).

MUSORSTOM 4 : stn CP 193, $18^{\circ}56' \text{S}$, $163^{\circ}23' \text{E}$, 415 m, 19.IX.1985 : 2 spms, smashed, paratypes (MNHN). — Stn CP 194, $18^{\circ}53' \text{S}$, $163^{\circ}22' \text{E}$, 545 m, 19.IX.1985 : 1 spm, paratype (MNHN). — Stn DW 221, $22^{\circ}59' \text{S}$, $167^{\circ}37' \text{E}$, 535-560 m, 29.IX.1985 : 2 spms, holotype (MNHN) and paratype (RMNH 9266). — Stn DW 230, $22^{\circ}57' \text{S}$, $167^{\circ}12' \text{E}$, 390-420 m, 30.IX.1985 : 1 spm, paratype (MNHN).

SMIB 2 : stn DW 10 : $22^{\circ}55' \text{S}$, $167^{\circ}16' \text{E}$, 490-495 m, 18.IX.1986 : 1 spm dry, paratype (MNHN).

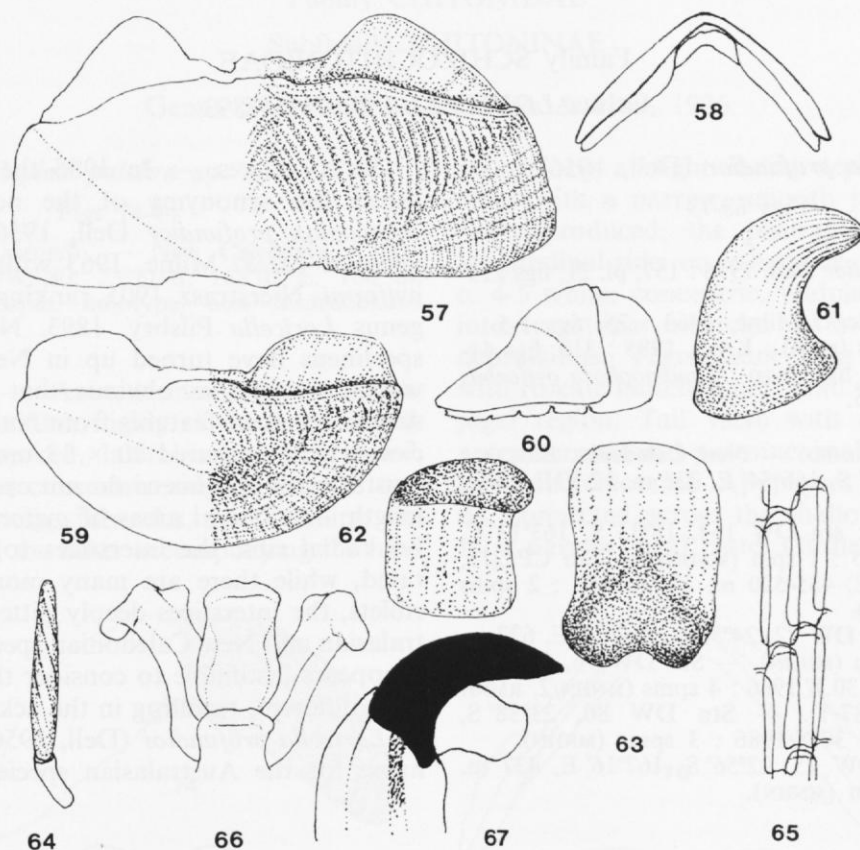
DIAGNOSIS. — Animal of moderate size, elongate oval, twice as long as wide, c. $30 \times 15 \text{ mm}$, rather highly elevated, carinated, valves not beaked, lateral areas weakly raised, obsolete radially ribbed, central areas with close-set, forwardly converging sulci. Head valve and postmucronal areas of tail valve sculptured like lateral areas. Colour white. Girdle with curved, bulbous, finely striated scales. Head of major lateral radula tooth unicuspid.

DESCRIPTION. — Animal elongate oval, holotype $29.8 \times 14.8 \text{ mm}$, highly elevated (dorsal elevation 0.50), carinated, side slopes straight. Valves of equal width, the intermediate ones truncated at the outer margins, not beaked.

Head valve semicircular, posterior margin widely V-shaped with a rounded apical notch, anterior slope steep, straight, sculptured with c. 40 obsolete radial grooves. Intermediate valves rectangular, about twice as wide as long, front margin somewhat sinuate, with the jugal sinus slightly convex, the pleural parts concave, forming a sharp angle with the side margins; posterior margin straight, the apex not projecting, hardly discernible. Lateral areas well marked, only slightly raised, with 6-8 obsolete radial grooves, crossed by numerous fine growth lines, especially towards the outer margin. Central area with c. 30 forwardly converging, well marked sulci on either side, hardly narrower than the flat riblets in between. Tail valve short, outer margin $1/3$ of a circle, front margin straight, but for a slight projection in the jugal sinus, mucro almost central, slightly swollen, postmucronal slope concave. Antemucronal area sculptured like the central areas, postmucronal area like the head valve and lateral areas.

Articulamentum well developed, white, apophyses rather long and wide, bluntly triangular in intermediate valves, trapezoid in tail valve, always connected by a narrow but distinct, dorsally striated jugal plate; sinus straight to somewhat convex. Insertion plates with 10/1/10-12 inequidistant slits, slit-rays distinct; eaves solid.

Girdle moderately wide, paved with curved, dorsally bulbous, finely striated scales, c. $100 \mu\text{m}$ wide, up to $140 \mu\text{m}$ high on mid-girdle. There is a marginal fringe of fine, cylindrical, bluntopped, spirally grooved spicules, $112 \times 16 \mu\text{m}$. Ventral scales rectangular, distally rounded, $80 \times$



FIGS 57-67. — *Ischnochiton (Stenosemus) robustus* sp. nov.: 57, valve IV, dorsal view, $\times 5$. — 58, *id.*, rostral view, $\times 2.5$. — 59, tail valve, dorsal view, $\times 5$. — 60, *id.*, lateral view, $\times 5$. — 61, dorsal girdle scale from mid-girdle, lateral view, $\times 210$. — 62, *id.*, from side margin, ventral view, $\times 210$. — 63, *id.*, from mid-girdle, ventral view, $\times 210$. — 64, marginal spicule, $\times 210$. — 65, ventral scales, $\times 210$. — 66, central and first lateral radula teeth, $\times 210$. — 67, major lateral tooth, $\times 210$. — 57-60, paratype from MUSORSTOM 4, stn DW 223 (MNHN). — 61-67, paratype from BIOCAL, stn DW 44 (MNHN).

24 μm on mid-girdle, shorter towards the outer margin, arranged in partly overlapping radial series.

Central tooth of radula rather short, widest in the proximal half, with a narrow, faintly bilobed blade; first laterals relatively longer, with an excurved blade, projecting exteriorly; major laterals with a unicuspid dental cap, the cusp curved, sharply pointed.

ETYMOLOGY. — The Latin adjective *robustus* means solid, relating to the texture of the shell plates.

OBSERVATIONS. — *I. (S.) robustus* differs significantly from all other species in this subgenus by the ornamentation of the central areas, which somewhat resembles that of certain delicately sculptured forms of *Chiton tuberculatus* Linnaeus, 1758.

Family SCHIZOCHITONIDAE
Genus *LORICELLA* Pilsbry, 1893

Loricella profundior (Dell, 1956)

Figs 68-73

Paricoplax profundior Dell, 1956 : 157, pl. 21, figs 213-219.

Componochiton raceki Milne, 1963 : 25, figs 1-5.

Loricella oviformis (pars) - KAAS, 1985 : 310, figs 41-45 ; 1990 : 178, figs. Non : *Squamophora oviformis* Nierstrasz, 1905.

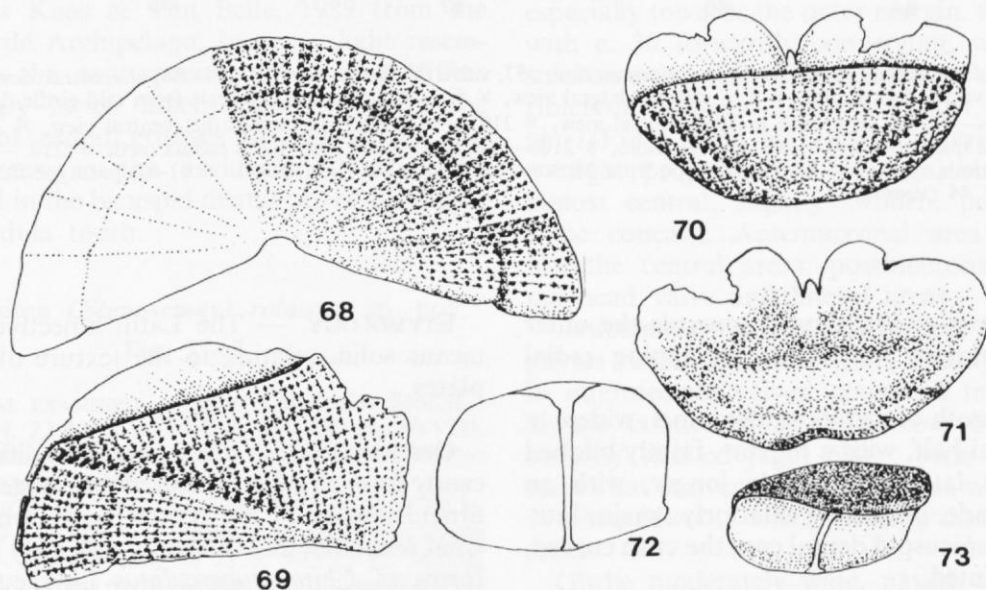
MATERIAL EXAMINED. — **New Caledonia.** BIOCAL : stn DW 08, 20°34' S, 166°54' E, 235 m, 12.VIII.1985 : 1 spm (MNHN).

MUSORSTOM 4 : stn DW 164, 18°33' S, 163°13' E, 255 m, 16.IX.1985 : 1 spm (MNHN). — Stn CP 215, 22°56' S, 167°17' E, 485-520 m, 28.IX.1985 : 2 spms (MNHN/1, RMNH/1).

CHALCAL 2, stn DW 72, 24°55' S, 168°22' E, 627 m, 28.X.1986 : 1 spm (MNHN). — Stn DW 76, 23°41' S, 167°45' E, 470 m, 30.X.1986 : 4 spms (MNHN/2, RMNH K2731/1, VB 2987/1). — Stn DW 80, 23°38' S, 167°43' E, 435 m, 30.X.1986 : 3 spms (MNHN).

SMIB 3 : stn DW 25, 22°56' S, 167°16' E, 437 m, 24.V.1987 : 1 spm (MNHN).

OBSERVATIONS. — In 1985 the author established the synonymy of the nominal species *Paricoplax profundior* Dell, 1956 and *Componochiton raceki* Milne, 1963 with *Squamophora oviformis* Nierstrasz, 1905, ranking them with the genus *Loricella* Pilsbry, 1893. Now that more specimens have turned up in New Caledonian waters it becomes obvious that they differ in several constant features from NIERSTRASZ's species, which measured 20 × 13 mm, whereas the Australasian specimens do not exceed 13 mm in length. The lateral areas of *oviformis* show only 7-9 radial ribs, the interstices solid, not perforated, while there are many more, much finer riblets, the interstices deeply pitted, in the Australasian and New Caledonian specimens, so that it appears justifiable to consider them as specifically different, resulting in the acknowledgement of *Loricella profundior* (Dell, 1956) as the valid name for the Australasian species.



FIGS 68-73. — *Loricella profundior* (Dell, 1965) : 68, head valve, dorsal view, × 10. — 69, left half of valve II, dorsal view, × 10. — 70, valve VIII, dorsal view, × 10. — 71, *id.*, ventral view, × 10. — 72, 73, dorsal girdle scales, × 210. — 68-73, spm from "Vauban" cruise, 1978/79, sta. 16 (from KAAS, 1985).

Family CHITONIDAE
Subfamily CHITONINAE

Genus *TEGULAPLAX* Iredale & Hull, 1926

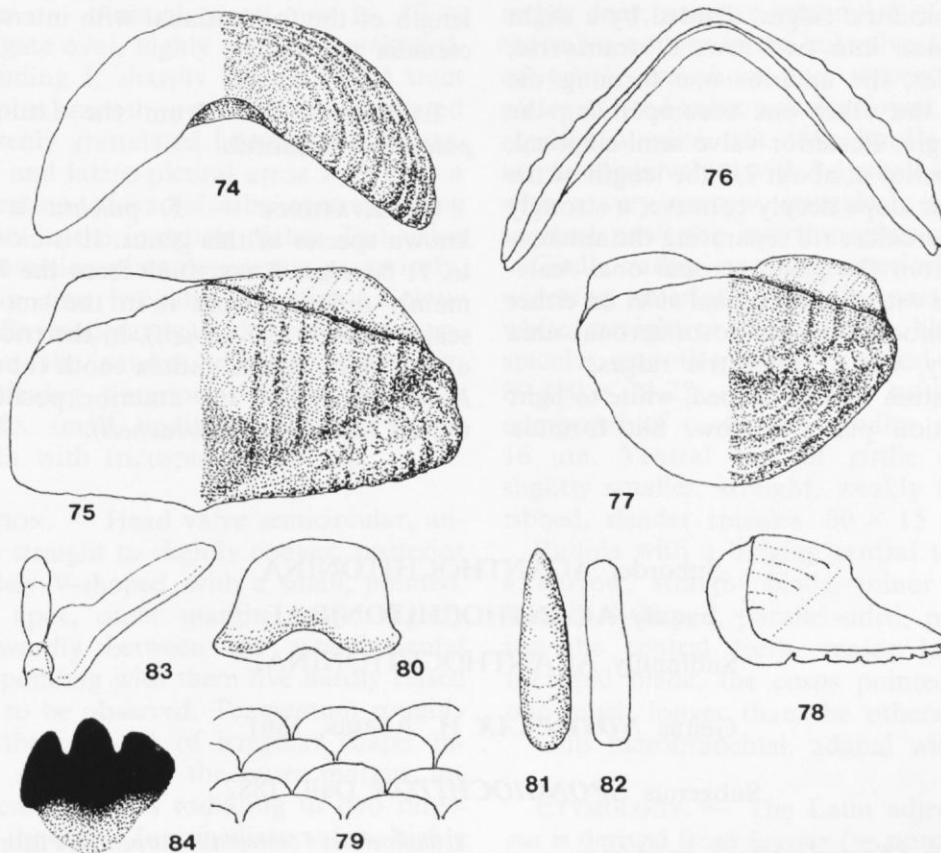
Tegulaplex pulchra sp. nov.

Figs 74-84

MATERIAL EXAMINED. — **New Caledonia.** CHALCAL 2 : stn DW 80, 23°27' S, 168°02' E, 160 m, 30.X.1986 : 1 spm, holotype, now disarticulated (MNHN).

DIAGNOSIS. — Animal small, 7 × 3.5 mm, elongate oval, rather highly elevated, carinated. Valves little beaked, lateral areas well raised, with 6-8 white, concentric ridges, cut into two rows of transverse tubercles, one forming the diagonal ridge, the other accompanying the hind

margin, by a slight radial depression. Central areas with a narrow, smooth jugal part, anteriorly produced, the pleurae with c. 8 deep longitudinal sulci on either side. End valves with c. 4-5 white, concentric, undulating ridges, cut into transverse tubercles by 8-10 vague radial depressions. Tegmentum light flesh-coloured, with roseate blotches and small white dots in the jugal region. Tail valve with mucro anterior, antemucronal and postmucronal areas separated by a tuberculose rib. Apophyses regularly rounded, connected across the shallow, convex sinus by a narrow jugal plate. Girdle roseate banded



FIGS 74-84. — *Tegulaplex pulchra* sp. nov. : 74, valve I, dorsal view, × 21. — 75, valve IV, dorsal view, × 21. — 76, *id.*, rostral view, × 21. — 77, valve VIII, dorsal view, × 21. — 78, *id.*, lateral view, × 21. — 79, dorsal girdle scales, dorsal view, × 105. — 80, *id.*, ventral view, × 210. — 81, marginal spicule, × 420. — 82, ventral scale, × 420. — 83, central and first lateral radula teeth, × 420. — 84, head of major lateral tooth, × 420. — 74-84, holotype.

with white, covered with imbricating, smooth scales. Dental cap major lateral radula tooth tricuspid. Gills merobranchial, adanal.

DESCRIPTION. — The unique type measures 6.8×3.6 mm, slightly curled before being disarticulated, elongate oval, carinated, dorsal elevation c. 0.57, side slopes convex. Head valve semi-circular, anterior slope straight, the apex slightly notched, tegmentum ornamented with 4-5 white, concentric, wavy ridges, cut into transverse tubercles by c. 8 faint radial depressions, the marginal tubercles strongest developed. Intermediate valves less than twice as wide as long, the anterior margin convex, since the central area is decidedly produced anteriorly; valve II relatively longer than the others. Posterior margin almost straight, the pointed apex barely protruding. Central area with 6-8 deep, longitudinal, parallel sulci, with only the innermost not reaching the front margin. Lateral areas well raised, with up to 8 white concentric ridges, divided by a slight radial depression into two rows of transverse, raised tubercles, the anterior one forming the diagonal rib, the other one accompanying the posterior margin. Posterior valve semi-elliptical, the mucro anterior at about $2/5$ the length of the valve, posterior slope deeply concave, a strongly developed tuberculose rib separating the antemucronal area from the postmucronal one. Antemucronal area with 5 longitudinal sulci on either side of the smooth jugum, postmucronal area with 5-6 wavy, white, concentric ridges.

Articulamentum well developed, white to light roseate, insertion plates narrow. Slit formula

9/1/11, slits inequidistant, slit rays hardly conspicuous, teeth finely striated outside, eaves finely porous. Apophyses rather short, regularly rounded, close together, separated from a narrow jugal plate across the shallow, convex sinus, by distinct grooves.

Girdle moderately wide, dorsally clothed with small, imbricating, bluntly rounded, smooth scales, up to 120×80 μm (mean 108×52 μm), ventrally with a roundly emarginated base. Marginal spicules smooth, bluntly pointed, 60×16 μm , ventral scales elongate rectangular, truncated at both sides, 56×12 μm .

Radula short, c. 1.6 mm long, with c. 25 rows of mature teeth. Central tooth small, narrow, bearing an acorn-shaped blade, minor laterals twice as long, widely diverging, more or less wing-like, major laterals with a short, tricuspid head, the cusps bluntly rounded, the central one longest.

Gills merobranchial, occupying c. $3/4$ of the length of the foot, adanal with interspace, c. 18 ctenidia per side.

ETYMOLOGY. — From the Latin adjective *pulcher* = beautiful.

OBSERVATIONS. — *T. pulchra* is the third known species of this genus. It is closely related to *T. boucheti* Kaas, 1989 from the Philippines, mainly differing from it in the smooth dorsal scales (ribbed in *boucheti*), in the tricuspid head of the major lateral radula tooth (non-cuspid in *boucheti*) and in the anterior position of the mucro (posterior in *boucheti*).

Suborder ACANTHOCHITONINA

Family ACANTHOCHITONIDAE

Subfamily ACANTHOCHITONINAE

Genus *NOTOPLAX* H. Adams, 1861

Subgenus *SPONGIOCHITON* Dall, 1882

Notoplax (Spongiochiton) producta (Carpenter in Pilsbry, 1892)

Spongiochiton productus Carpenter in Pilsbry, 1892 : 26.

Acanthochites (Notoplax) carpenteri Pilsbry, 1893 : 33, pl. 1, figs 14-22.

Acanthochites (Notoplax) involutus Carpenter in Pilsbry, 1893 : 35, pl. 1, figs 27-35.

Craspedochiton liberiensis Thiele, 1909 : 33, pl. 4, figs 29-35.

Notoplax foresti Leloup, 1965 : 155, figs 1-3, pls 1-2.
— KAAS, 1979 : 873.
Notoplax (Spongiochiton) producta - KAAS, 1989 : 109.

MATERIAL EXAMINED. — **New Caledonia.** MUSOR-STOM 4 : stn DW 231, 22°34' S, 167°10' E, 75 m, 01.X.1985 : 2 spms (MNHN).

Genus *CRASPEDOCHITON* Shuttleworth, 1853

Craspedochiton hystricosus sp. nov.

Figs 85-96

MATERIAL EXAMINED. — **New Caledonia.** BIOCAL : stn DW 66, 24°55' S, 168°22' E, 505-515 m, 03.IX.1985 : 9 spms (MNHN/holotype and 4 paratypes, RMNH 9267/1 paratype, VB 2986/1 paratype, AMS/1 paratype, NMNZ/1 paratype).

CHALCAL 2 : stn DW 72, 24°55' S, 168°22' E, 627 m, 28.X.1986 : 1 spm, paratype (MNHN). — Stn DW 76, 24°40' S, 168°38' E, 573 m, 29.X.1986 : 1 spm, paratype (MNHN).

DIAGNOSIS. — Animal small, up to 12 × 6 mm, elongate oval, highly elevated, carinated, valves, including I, sharply beaked, jugal tract narrow, almost smooth, not distinctly separated from the evenly granulated latero-pleural areas. Head valve and latero-pleural areas with only a vague indication of radial ribs corresponding with the slits in the insertion plates. Tail valve small, the insertion plate degenerate posteriorly, with only a fine irregular dentition. Colour white. Girdle moderately wide, somewhat encroaching at the sutures, narrow posteriorly, slightly widening anteriorly, finely spiculate. Sutural tufts small, indistinct. Major lateral radula tooth with tricuspid dental cap.

DESCRIPTION. — Head valve semicircular, anterior slope straight to slightly convex, posterior margin widely V-shaped, with a small, pointed, protruding apex, outer margin wavy, slightly curving inwardly between the articulamental slits, corresponding with them five hardly raised radials are to be observed. Tegmentum roughly granulate, the granules of irregular shape, increasing in size towards the outer margin, arranged in curved series radiating in two directions from the apex. Intermediate valves highly arched, dorsal elevation c. 0.55, strongly carinated, side slopes straight to a little concave at both sides of the narrow jugal tract. Front margin rounded at both sides of the narrow,

concave jugal sinus, side margins very short, more or less truncated, posterior margin concave at both sides of the sharply pointed, decidedly projecting apex. Tail valve small, the length c. 2/3 of the width, mucro slightly posterior, not prominent, back slope almost straight, front margin regularly rounded, antemucronal area sculptured like latero-pleural areas, postmucronal area like head valve.

Articulamentum thin, white, transparent. Intermediate valves with moderately wide, regularly rounded apophyses, close together, sinus rather deep, concave, about 1/6 of the width of the valve, convex in the tail valve, the apophyses of which are short and trapezoid. Insertion plates of head valve well developed, with 5 short, equidistant slits, slit rays hardly perceptible; intermediate valves with 1-1 small slits, tail valve with a very narrow, irregularly and shallowly toothed posterior insertion plate.

Girdle rather narrow posteriorly, somewhat widening anteriorly, dorsally coated with fine, white, straight or slightly bent, bluntly pointed spicules, smooth to weakly striated distally, up to 80-100 × 20-25 μm. Sutural tufts very small, composed of c. 40 fine needles, up to 800 × 16 μm. Ventral side of girdle covered with slightly smaller, straight, weakly longitudinally ribbed, slender spicules, 80 × 15 μm.

Radula with a bulging central tooth, bearing a narrow, straight blade, minor lateral teeth weakly S-shaped, parallel-sided, partly embracing the central teeth, major lateral with a tricuspid blade, the cusps pointed, the central one much longer than the others.

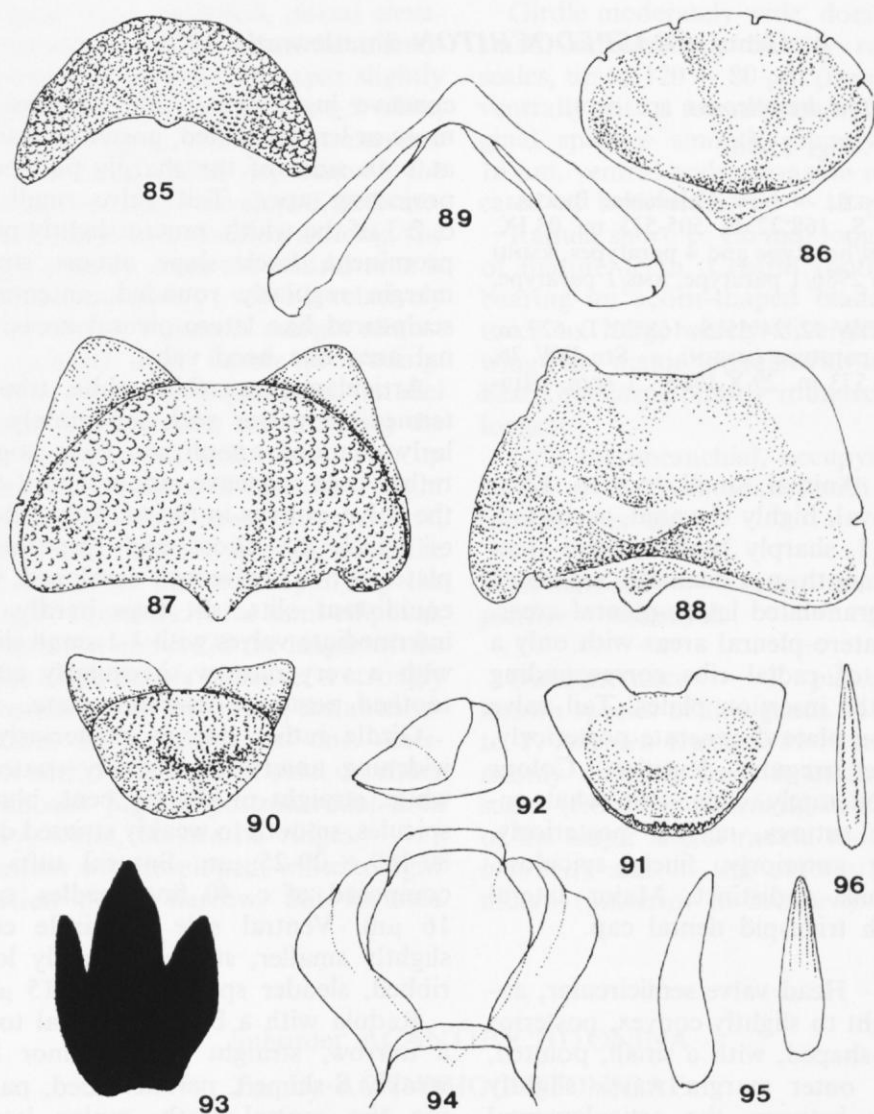
Gills merobranchial, adanal with interspace.

ETYMOLOGY. — The Latin adjective *hystricosus* is derived from *hystrix* (= porcupine), meaning spinous, relating to the nature of the girdle.

OBSERVATIONS. — *C. hystricosus* differs from all the known Australasian and West Pacific

species of *Craspedochiton* by the lack of well developed radiating ribs on the head valve and latero-pleural areas, by the small, hardly percep-

tible sutural tufts and especially by its sharply carinated, strongly beaked valves.



FIGS 85-96. — *Craspedochiton hystricosus* sp. nov. : 85, valve I, dorsal view, $\times 11$. — 86, *id.*, ventral view, $\times 11$. — 87, intermediate valve, dorsal view, $\times 11$. — 88, *id.*, ventral view, $\times 11$. — 89, *id.*, rostral view, $\times 11$. — 90, valve VIII, dorsal view, $\times 11$. — 91, *id.*, ventral view, $\times 11$. — 92, *id.*, lateral view, $\times 11$. — 93, head of major lateral radula tooth, $\times 230$. — 94, central and first lateral radula teeth, $\times 230$. — 95, dorsal girdle spicules, $\times 230$. — 96, ventral spicule, $\times 230$. — 85-96, paratype from BIOCAL, stn DW 66 (MNHN).

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