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# Reinstatement of the genus *Terenochiton* (Mollusca: Polyplacophora) with a genus diagnosis emendation

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**ABSTRACT.** It is proposed to restore the old name of the genus, *Terenochiton* for *Leptochiton norfolcensis* (Hedley et Hull, 1912). We also provide a new description for the genus since the old description does not reflect the main features associated with the development of the articulamentum. All valves of the genus have rudimentary unslitted insertion plates. Similar rudimentary insertion plates have evolved independently in different families of the primitive chitons.

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## Introduction

While studying the New Zealand chitons received from Bruce Marshall (NMNZ), I was surprised to see the rudimentary insertion plates at all valves in *Leptochiton norfolcensis* (Hedley et Hull, 1912). Sirenko [1997] discussed the importance of the development of articulamentum for chiton taxonomy. The evolution of the insertion plates was an important development in chitons as they increased the space for muscle attachment. Rudimentary unslitted insertion plates formed independently in different groups of the primitive chitons. These rudiments are traceable in the genera *Ferreiraella* Sirenko, 1988 (family Abyssochitonidae Dell' Angelo et Palazzi, 1989), *Deshayesiella* (Carpenter MS) Dall 1879 and *Oldroydia* Dall, 1894 (family Protochitonidae Ashby, 1925) and *Hanleya* Gray, 1857 (family Hanleyidae Bergenhayn, 1955). However, we did not know about these advanced characteristics in the species of the large family Leptochitonidae Dall, 1889. This article provides a new description for the genus *Terenochiton* and its type species.

## Material and methods

Specimens of *Lepidopleurus norfolcensis* Hedley et Hull 1912 were obtained from Bruce Marshall (1 spm, from Norfolk Island) and from J.R. Penprase

(2 spms, from Lord Howe Island). Norfolk specimen and one of the Lord Howe specimens were prepared for scanning electron microscopy (SEM) and for light microscopy. They were boiled in 7% KOH for 5–10 minutes, then boiled twice in fresh water. Several valves (usually the valves I, II, IV, V and VIII), a large section of the radular ribbon and a portion of the girdle were then chosen for a scanning electron microscope FEI SEM Quanta 250 Scan. The remains of the radula and the girdle were dried and put in Canada balsam for examination under the light microscope.

**Abbreviations:** **AM**, Australian Museum, Sydney; **BL**, body length; **spm(s)**, specimen(s); **MZUSP**, Museum of Zoology of the University of São Paulo; **NMNZ**, Te Papa Tongarewa Museum of New Zealand (formerly National Museum of New Zealand), Wellington; **ZISP**, Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

## Systematics

Class Polyplacophora Gray, 1821  
Subclass Neoloricata Bergenhayn, 1955  
Order Lepidopleurida Thiele, 1909  
Family Leptochitonidae Dall, 1889

Genus *Terenochiton* Iredale, 1914

**Type species:** *Lepidopleurus (Terenochiton) subtropicalis* Iredale, 1914, by original designation = *Leptochiton (Leptochiton) norfolcensis* (Hedley et Hull, 1912), fide Kaas et Van Belle [1985].

As in the old descriptions of the genus *Terenochiton* [Iredale, 1914; Iredale, Hull, 1925, 1929, 1930] the main characteristics of the genus were not included I give an updated diagnosis of the genus.

**Renewed diagnosis.** Chitons of small size. Shell

low, subcarinated. Hind margin of intermediate valves rolled down. Postmucronal area of tail valve deeply concave. Tegmentum covered with flattened granules, each granule with 5–6 aesthetes. Articulation well developed, each valve has rudiments of the insertion plates. Apophyses sloping gently towards the jugal sinus and continuing back in the form of rudiments of unslitted insertion plates. Girdle closed with curved scales, each scale with 9–10 double high ribs, interstices deep. Cusp of major lateral teeth of radula unidentate, sharply pointed.

[**Обновленный диагноз.** Хитоны небольшого размера. Раковина слегка килеватая. Задний край промежуточных щитков подвернут вниз. Постмукрональное поле последнего щитка глубоко вогнуто. Тегментум покрыт уплощенными гранулами с 5–6 эстетам. Артикуламентум хорошо развит. Каждый щиток имеет зачатки инсерционных пластинок. Апофизы полого спускаются к югальному синусу и продолжают назад в виде зачатков инсерционных пластинок. Перинотум покрыт изогнутыми чешуйками, каждая чешуйка с 9–10 двойными высокими ребрами, промежутки между ребрами глубокие. Наконечник крючковой пластинки радулы однозубцовый, заостренный.]

*Terenoichiton* differs from other genera of the family Leptochitonidae by having rudiments of insertion plates at all valves and unique dorsal scales with high double ribs and deep interstices.

**Genus distribution:** Norfolk, Lord Howe and Kermadec Islands, Recent.

*Terenoichiton norfolcensis*  
(Hedley et Hull, 1912)  
(Figs 1–5)

*Lepidopleurus norfolcensis* Hedley, Hull 1912: 273, pl. 11: figs 1, 1a–c.

*Terenoichiton norfolcensis*. – Iredale, Hull 1929: 77, pl. 9: figs 7–10.

*Lepidopleurus catenatus* Hedley, Hull, 1912: 273, pl. 11: figs 2, 2a–c.

*Terenoichiton catenatus*. – Iredale, Hull, 1929: 78, pl. 9: figs 14–17.

*Lepidopleurus (Terenoichiton) subtropicalis* Iredale, 1914: 28, pl. 2: figs 10, 17.

*Terenoichiton subtropicalis*. – Iredale, Hull 1929: 78, pl. 9: figs 11, 12.

*Leptochiton (Leptochiton) norfolcensis*. – Kaas, Van Belle 1985: 151, fig. 68, map 27.

*Leptochiton (Leptochiton) norfolcensis subtropicalis*. – Kaas, Van Belle, 1985: 154, fig. 69.

**Type material.** Lectotype (AM C.33111) and paralectotype (C.149665).

**Type locality.** Norfolk Island.

**Distribution.** Norfolk, Lord Howe and Kermadec Islands, intertidal.

**Material examined.** East Australia, Norfolk Island, Cemetery Bay, 29°3.50'S, 167°57.90'E, stn 19922016, under stones in intertidal pool, 1 spm, BL 2.8 mm, November 1992; west coast of Lord Howe Island, near Sylph Hole, off Dawson



FIG. 1. *Terenoichiton norfolcensis*, Lord Howe Island, near Sylph Hole, off Dawson Point, BL – 5.2 mm: whole animal, dorsal view.

РИС. 1. *Terenoichiton norfolcensis*, о. Лорд Хау, вблизи Силф Хол, у Давсон Поинт, длина тела 5.2 мм: вид животного сверху.

Point, bottom of large basalt rocks embedded in sand, below zero tide level, 2 spms, BL. 5.0–5.2 mm, 30.06.1977, leg. J.R. Penprase.

**Diagnosis.** See renewed diagnosis of genus *Terenoichiton*.

**Re-description or Results of the present examination.** Animal of small size, BL up to 8.0 mm, elongate oval, low elevated (dorsal elevation of valve V 0.32), valves subcarinated, not beaked. Color of tegmentum and girdle white (Norfolk specimen) or pale reddish-yellow by environmental deposits (Lord Howe specimens).

Head valve semicircular, anterior slope slightly concave, posterior margin notched in the middle. Intermediate valves wide and short, anterior margin concave at the jugal area, except for valve II, which is decidedly longer and with convex anterior margin, hind margin of intermediate valves rolled down, side margins evenly rounded, lateral areas little raised. Tail valve rather small, oval, mucro slightly posterior, antemucronal slope convex, postmucronal slope deeply concave.

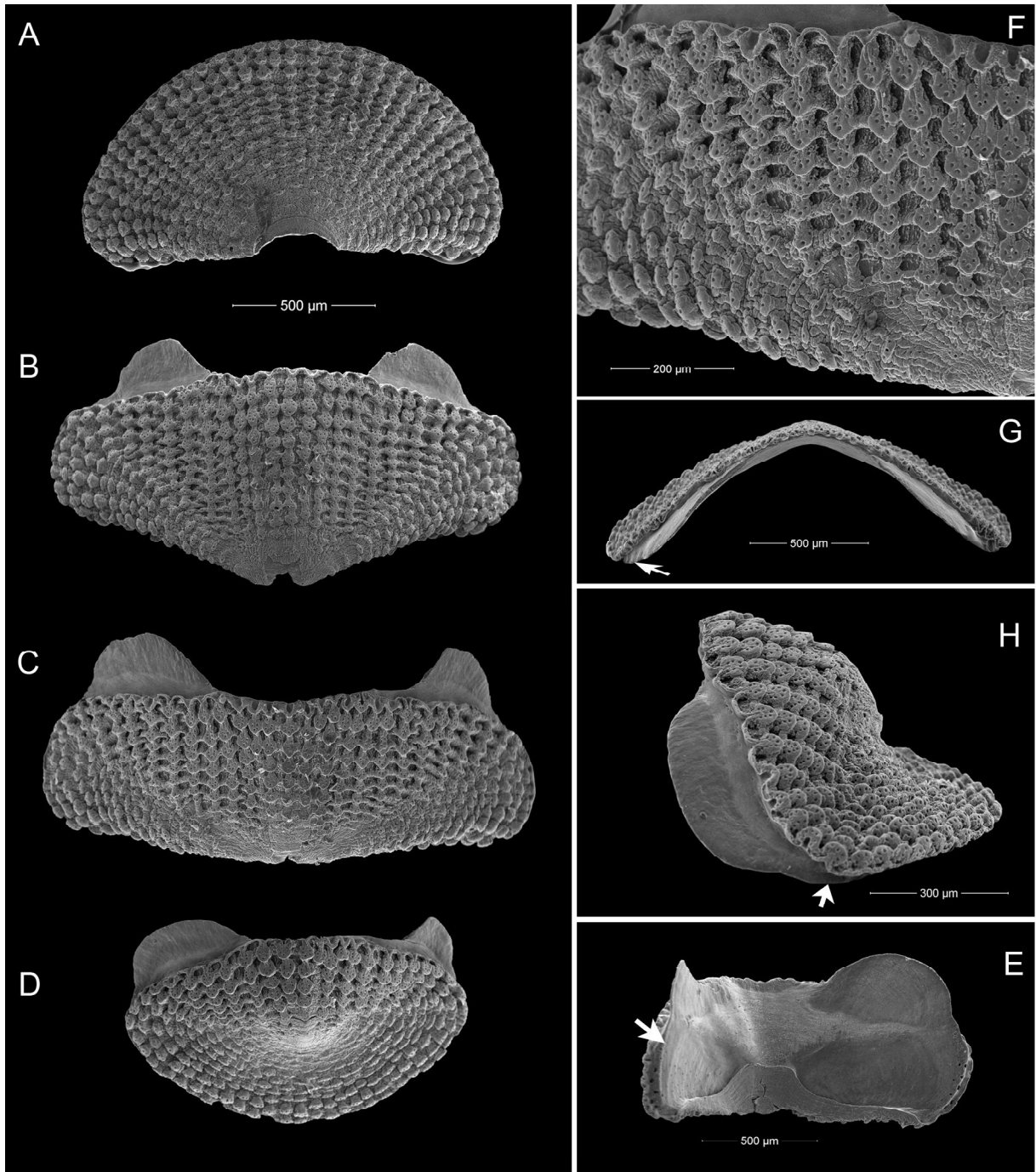


FIG. 2. *Terenochiton norfolcensis*, Norfolk Island, Cemetery Bay, stn 1992016, BL – 2.8 mm: **A.** Valve I, dorsal view. **B.** Valve II, dorsal view. **C.** Valve V, dorsal view. **D.** Valve VIII, dorsal view. **E.** Valve IV, ventral view. **F.** Valve V, tegmentum sculpture in central and lateral areas. **G.** Valve V, rostral view. **H.** Valve VIII, lateral view. Arrows show rudiments of the insertion plates.

РИС. 2. *Terenochiton norfolcensis*, о. Норфолк, залив Цемерти, станция 1992016, длина тела 2.8 мм: **A.** Щиток I, с дорсальной стороны. **B.** Щиток II, с дорсальной стороны. **C.** Щиток V, с дорсальной стороны. **D.** Щиток VIII, с дорсальной стороны. **E.** Щиток IV, с вентральной стороны. **F.** Щиток V, скульптура тегмента на центральном и боковом полях. **G.** Щиток V, вид с роострума. **H.** Щиток VIII, вид сбоку. Стрелки показывают зачатки инсерционных пластинок.

Tegmentum uniformly granulose, in Norfolk specimen with body length 2.8 mm the small flattened granules arranged in radiating as well in concentric rows on head valve (36 radiating rows), on lateral areas of intermediate valves (6 rows) and on postmucronal area of tail valve (25 rows), in longi-

tudinal as well in concentric rows on central areas of intermediate valves (23–28 longitudinal rows) and on antimucronal area of tail valve (16 rows). Larger specimens have more numerous rows on all valves. Each granule with 5–6 aesthete pores.

Articulamentum strongly developed, head valve

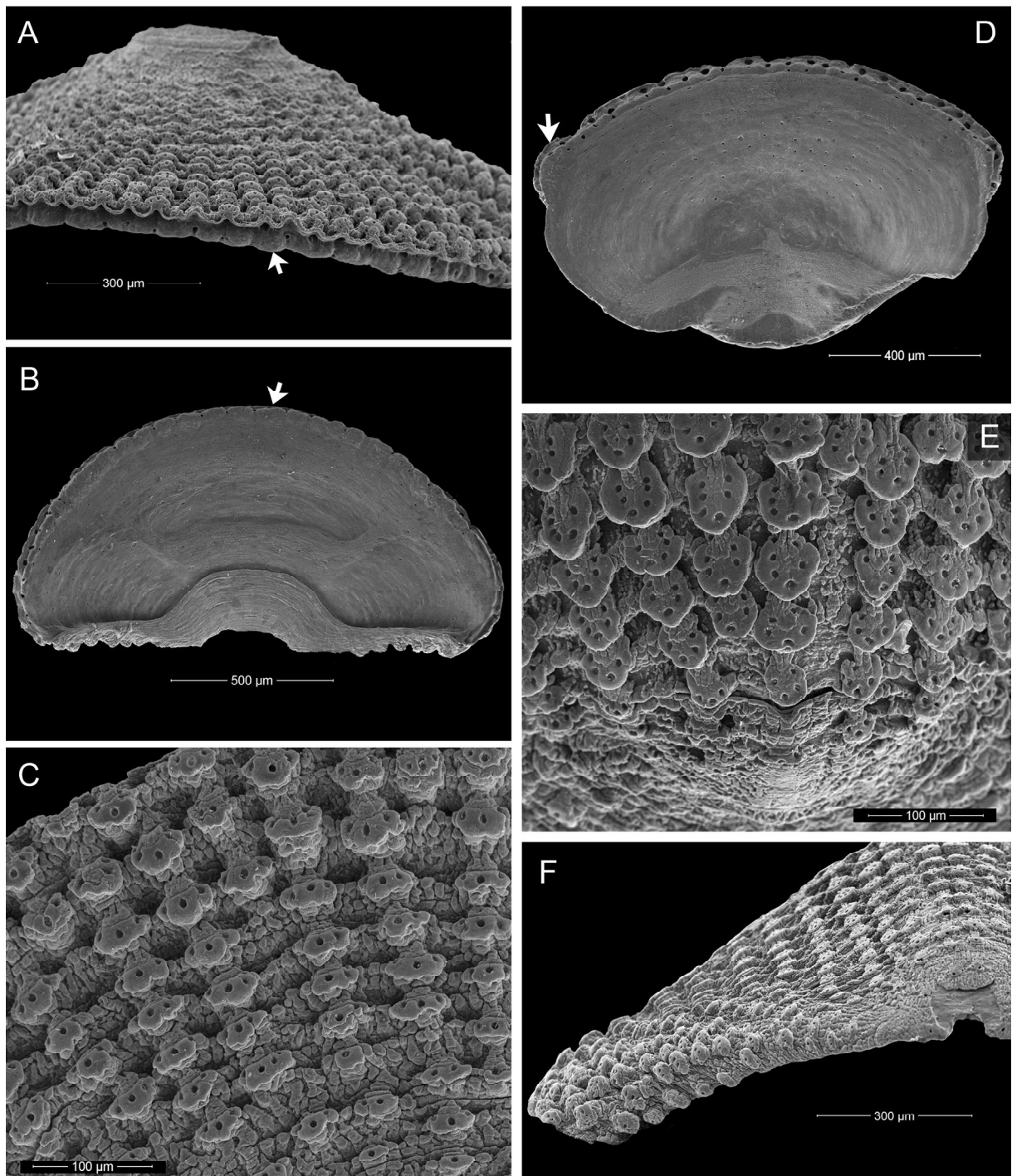


FIG. 3. *Terenochiton norfolcensis*, Norfolk Island, Cemetery Bay, stn 1992016, BL – 2.8 mm: **A.** Valve I, rostral view. **B.** Valve I, ventral view. **C.** Valve I, sculpture of tegmentum. **D.** Valve VIII, ventral view. **E.** Valve VIII, sculpture of tegmentum near micro. **F.** Valve V, view from behind. Arrows show rudiments of the insertion plates.

РИС. 3. *Terenochiton norfolcensis*, о. Норфолк, залив Цеметери, станция 1992016, длина тела 2.8 мм: **A.** Щиток I, вид с рострума. **B.** Щиток I, с вентральной стороны. **C.** Щиток I, скульптура тегмента. **D.** Щиток VIII, с вентральной стороны. **E.** Щиток VIII, скульптура тегмента у микро. **F.** Щиток V, вид сзади. Стрелки показывают зачатки инсерционных пластинок.

has well visible rudiment of insertion plate, apophyses of intermediate and tail valves sloping gently towards the jugal sinus and continuing back in the form of rudiments of unslitted insertion plates.

Girdle dorsally covered with strongly bent, round-

topped scales (60 x 60 µm) with 9–10 double ribs, interstices deep, and intersegmental groups of 2–4 striated needles up to 250 µm. Marginal spicules with distinct simple or double ribs (up to 80 µm). Ventral side covered with closely set, radiating rows

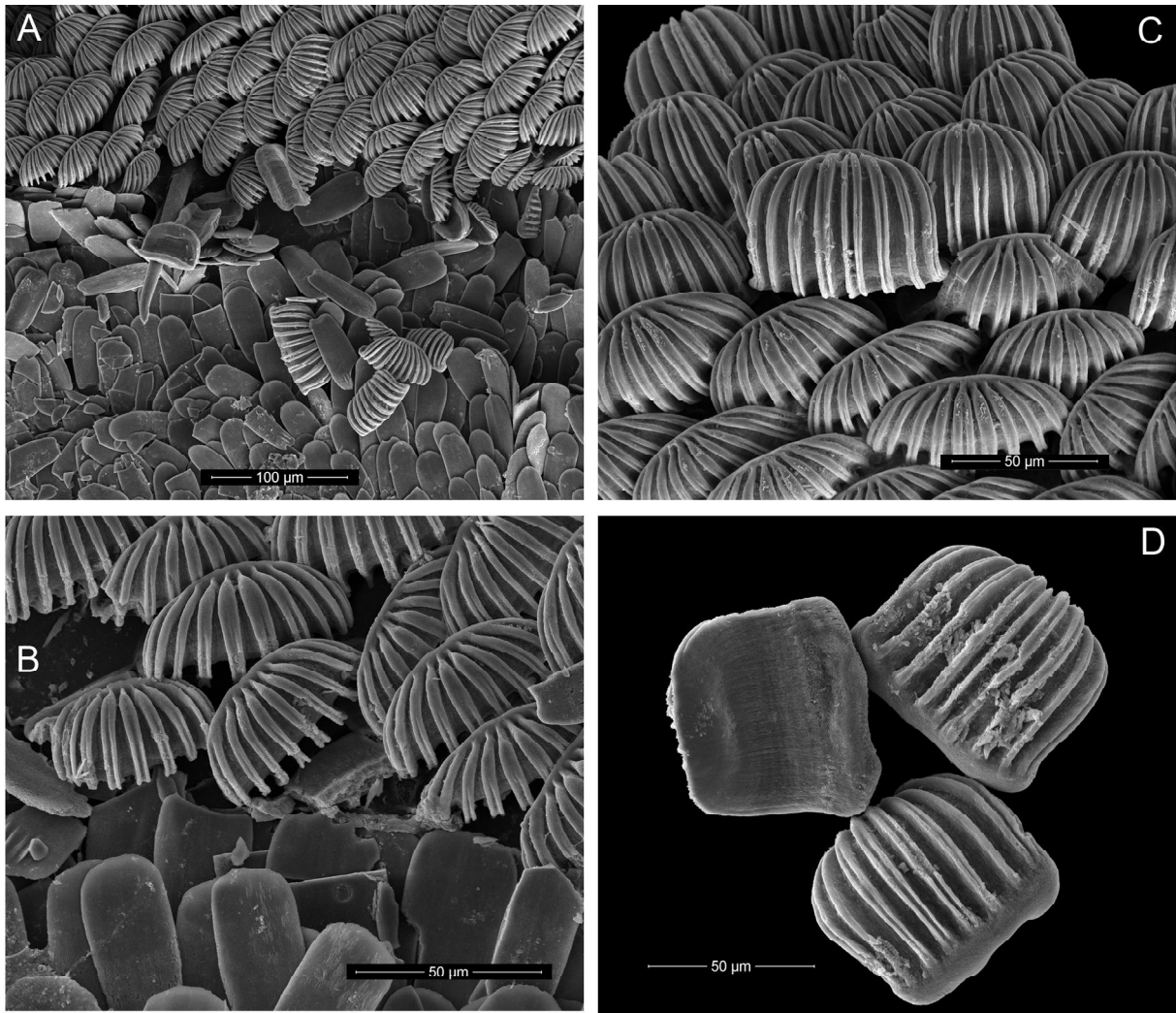


FIG. 4. *Terenochiton norfolcensis*, Norfolk Island, Cemetery Bay, stn 1992016, BL – 2.8 mm: **A, B**. Dorsal and ventral scales. **C, D**. Dorsal scales.

РИС. 4. *Terenochiton norfolcensis*, о. Норфолк, залив Цемерери, станция 1992016, длина тела 2.8 мм: **A, B**. Дорсальные и вентральные чешуйки. **C, D**. Дорсальные чешуйки.

of small, imbricating, smooth, elongate scales (60 x 20 μm), those near margin have 4–5 short, weak ribs on the distal half in ventral side.

Radula of Norfolk specimen (BL – 2.8 mm) 1.0 mm long with about 70 transverse rows of mature teeth. Central teeth narrowing in front to a small blade, first lateral tooth somewhat wing-shaped, widest in front, major lateral teeth with long unidentate, sharply pointed cusps.

Lord Howe specimen (BL – 5.2 mm) has 7 gills on each side, extending from valve VI to near the anus.

**Remarks.** Kaas and Van Belle [1985] studied and illustrated holotype and paratype of *Lepidopleurus norfolcensis* and paratype of *Lepidopleurus (Terenochiton) subtropicalis* and wrote that the latter differs from *Lepidopleurus norfolcensis* and *L. catenatus* only by number of ribs on dorsal scales.

*Terenochiton norfolcensis* is easily distinguished from other species of family Leptochitonidae, because it has rudiments of non-slit insertion plates at all valves. Former information about non-slit insertion plates at head and tail valves of *Leptochiton darioi* (Righi, 1973) [Kaas, Van Belle, 1985] was based on type specimen with a displaced growth ring simulating an insertion plate. I examined the holotype (MZUSP 26.000) and the paratype (MZUSP 23.999) of *L. darioi* and in fact, there are no insertion plates at the head and tail valves.

## Discussion

When Iredale [1914] used *Terenochiton* as the subgenus for *Lepidopleurus (Terenochiton) subtropicalis* he provided almost no description of it. He wrote in his Remarks, “With the type of *Lepido-*

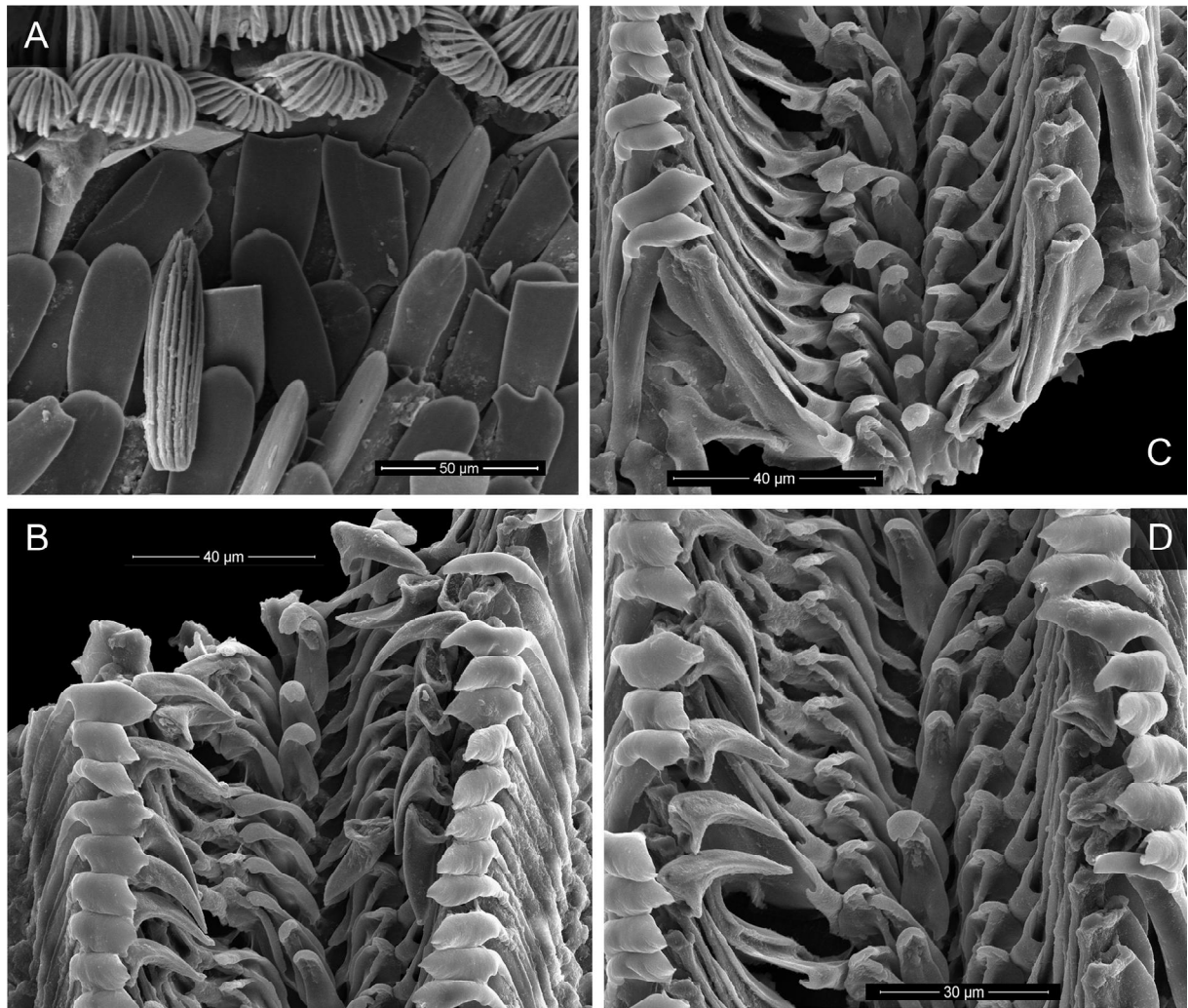


FIG. 5. *Terenochiton norfolcensis*, Norfolk Island, Cemetery Bay, stn 1992016, BL – 2.8 mm: A. Dorsal and ventral scales and marginal spicule. B-D. Radula.

РИС. 5. *Terenochiton norfolcensis*, о. Норфолк, залив Цеметери, станция 1992016, длина тела 2.8 мм: А. Дорсальные и вентральные чешуйки и маргинальная спикула. В-D. Радула.

*pleurus* these small species (*L. norfolcensis*, *L. catenatus* and *L. badius*, my addition) have nothing in common save the absence of insertion-plates. I am therefore introducing the new sub-generic name *Terenochiton* with *L. subtropicalis*, Iredale as type, and would for the present include all the small Australasian ‘*Lepidopleurus*’ under this heading...”

Later Iredale and Hull [1925, 1929, 1930] used *Terenochiton* as genus for all small leptochitonids of Australia and New Zealand. They also comment on this genus [Iredale, Hull, 1925]: “This group proposed for a Kermadec shell, may include the Austral forms conchologically similar until the animals be examined; the type of *Lepidopleurus* is a very different shell, the conchological northern equivalent being *Leptochiton*”. Their description [Iredale, Hull 1925] does not point on the differences to *Leptochiton* Gray, 1847. Cotton and Godfrey [1940]

added to the description of this genus: “In all species of *Terenochiton*, sutural tufts of a few long curved glassy spicules can be found in living specimens as well as isolated spicules and the spiculate fringe of the girdle.” As recently shown [Sigwart, Sirenko, 2012; Sirenko, 2015], most leptochitonids have the same features, not just the Australian and New Zealand ones. The genus *Terenochiton* was in use until Powell [1979]. Later, Van Belle [1983] synonymized this name with *Leptochiton*. However, he did it in vain because *Lepidopleurus* (*Terenochiton*) *subtropicalis* has a very important features that justify the retaining of the genus *Terenochiton*, namely rudimentary insertion plates in all valves.

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Возвращение старого названия рода *Terenochiton* (Mollusca: Polyplacophora) с новым диагнозом этого рода

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**РЕЗЮМЕ.** Предлагается восстановить старое название рода *Terenochiton* для *Leptochiton norfolcensis* (Hedley et Hull, 1912), и дать новое описание для этого рода, так как старое не отражает главных признаков, которые связаны с развитием артикуламента. Все щитки у этого рода имеют зачатки неразрезанных инсерционных пластинок. Сходные зачатки инсерционных пластинок развились в эволюции у примитивных хитонов разных семейств независимо.

