



New species of *Livonia* (Mollusca, Gastropoda, Volutidae) from the Northeast Shelf and Central Eastern Shelf Provinces of Queensland, Australia

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Abstract

The *Livonia mammilla* 'group' (Gastropoda, Volutidae) is reviewed following examination of museum material of geographically disjunct (120–450 km separation distance) and conchologically distinct populations from southeastern Australia and deepwater off the Northeast Shelf and Central Eastern Shelf Transition Provinces of Queensland, Australia. The following four deepwater Queensland populations are herein recognised as new allopatric species, all having some, presumably close, relationship with *L. mammilla* (G.B. Sowerby I, 1844): *Livonia mooloolaba* sp. nov. from the Tweed–Moreton region, *L. capricornia* sp. nov. from the Capricorn–Swains Reef region, *L. hydrographica* sp. nov. from the Mackay–Hydrographer's Passage region, and *L. pithensis* sp. nov. from Innisfail–Pith Reef region. A key, diagnoses, descriptions, specimens examined, and figures are presented for each species. In addition, a neotype is designated for *Livonia mammilla* (G.B. Sowerby I, 1844) with a new diagnosis, re-description and figures. That species is here regarded as restricted to the waters off southeastern Australia. *Livonia pithensis* sp. nov. substantially expands the recorded range of *Livonia* into the Northeast Shelf of tropical Queensland making it comparable to the recorded latitudinal range of the genus on the North–West Shelf of tropical Western Australia.

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Introduction

Livonia Gray, 1855 is a relatively small genus of medium to large volute snails endemic to Australia and with a known fossil record extending back to the late Oligocene (Darragh, 1989; Darragh & Ponder, 1998; Goudey, 2018). Their unusual, greatly enlarged and bulbous protoconch (of deviated, paucispiral type – see Cox, 1960) makes them a candidate for the largest emergent larva of all direct-developing snails. Like probably all Volutidae, they lack a long-distance-dispersal mechanism, and this contributes to their local endemism and allopatric speciation due to geographical isolation.

Six currently accepted (WoRMS-listed) living species of *Livonia* have been described, three comparatively recently (Poppe, 1987; Poppe & Goto, 1992; Bail & Poppe, 2001; Bail & Limpus, 2010). Based upon museum records, from east to west: *L. mammilla* (G.B.Sowerby I, 1844) is well known from New South Wales (from Trial Bay southwards), eastern Victoria, Tasmania and possibly as far west as Kangaroo Island, South Australia; *L. roadnightae* (McCoy, 1881), with two described subspecies (Sprague, 2024) has the widest distribution from about Jervis Bay, New South Wales to Rottnest Island, Western Australia; *L. nodiplicata* (Cox, 1910) has the next widest range from about Cape Jervis, South Australia to Jurien Bay, Western Australia, and three species *L. joerinkensi* (Poppe, 1987), *L. limpusi* Bail, 1999 and *L. mervcooperi* Bail & Limpus, 2010 have been described from the Central Western Shelf Transition and North West Shelf of Western Australia. A seventh nominal species, *L. quisqualis* Iredale, 1957 is variously considered a synonym of *L. roadnightae* or of *L. mammilla* or, most commonly as an intergrade between these two (Abbott-Smith, 1969; Limpus 2009). No *Livonia* species have to date been formally described from Queensland waters, with all Queensland records hitherto attributed to *L. mammilla* (see Weaver & DuPont, 1970; Poppe & Goto, 1992; Wilson, 1994; Bail & Poppe, 2001; Coucom, 2010).

New material from four widely disjunct ranges with affinity to *L. mammilla* have been collected by deepwater research vessels and commercial fishing in the tropical Northeastern Shelf Province and subtropical Central Eastern Shelf Transition Province of Queensland. We nominate a neotype for *L. mammilla* and circumscribe this species as occurring in temperate SE Australian waters. In addition, we describe four new species for the disjunct tropical and subtropical populations from what we here term the *Livonia mammilla* 'group' (reflecting the fact that all Queensland *Livonia* reported in the literature have been assigned to this species). One of these new species occurs in deepwater within the Central-Eastern Shelf Transition (from SE Queensland to northern New South Wales) and was previously figured and discussed, but not formally described (e.g. see Abbott-Smith, 1969; Poppe & Goto, 1992; Evans, 2001; Robin,

2008). The other three species described herein occur in the tropical Northeast Shelf Province, with three disjunct ranges, of which only the southernmost has been figured previously (Coucom, 2010).

Methods

All type materials nominated are deposited in the Queensland Museum Mollusc collection (QMMO) and Australian Museum Conchology collection (AM).

Material and images were examined from the following museums and personal collections:

AM – Australian Museum, Sydney, New South Wales, Australia.

MAGNT – Museum and Art Gallery of the Northern Territory, Darwin, Northern Territory, Australia.

MNHN – Muséum national d'Histoire naturelle, Paris, France.

NHMR – Natural History Museum Rotterdam, Netherlands.

NHMUK – Natural History Museum London, United Kingdom.

QMMO – Queensland Museum Mollusc collection, Brisbane, Queensland, Australia.

RMNH – National Museum of Natural History, Leiden, Netherlands.

SAM – South Australian Museum, Adelaide, South Australia, Australia.

ZMA – Zoologisch Museum Amsterdam, Netherlands.

E.H.Brown coll. – Edward Harold Brown, Townsville, Queensland.

T.Daymond coll. – Teena Daymond, Brisbane, Queensland.

A.R.Field coll. – Ashley Raymond Field, Cairns, Queensland.

G.Rowse coll. – Glenda Rowse, Townsville, Queensland.

Photographs of additional materials were examined from online databases to confirm the consistency of conchological features and range (Australian Museum, 2021; Goud et al. 2023; Chagnoux, 2023; Slieker et al., 2023). Distribution information was also obtained through interviews with Queensland trawl-fishermen who originally collected the material as listed in the acknowledgements. Locality coordinates here given in square brackets, e.g. [20°25'S, 151°10'E] were determined from the described location and depth data has been converted where necessary from feet or fathoms to meters.

In the protoconch descriptions given herein, 'exserted' has been used to describe a protoconch position where the suture of the teleoconch whorls joins the proto-

conch below its widest circumference and more than half to all of the protoconch is exposed above the teleoconch whorls. Conversely, 'low' and 'half-embedded' have been used where the suture of the teleoconch whorls joins the protoconch roughly at its widest circumference and half of the protoconch is exposed and half is embedded in the teleoconch. Although a number of authors have asserted that a siphonal (anterior) fasciole is absent in *Livonia* (Darragh, 1989; Bail, 1999; Bail & Limpus, 2015) we adopt the definition given in Beesley et al., (1998, p. 1143) "group of strongly curved growth lines near base of columella marking previous positions of siphonal notch" which is clearly applicable in all *Livonia* specimens examined. The term 'fasciolar plate' is used to describe an extension of the inner lip which is folded over the anterior fasciole to form a false umbilicus.

Discussion

The collections examined provided firm evidence for five disjunct allopatric populations within the *Livonia mammilla* 'group', all having distinguishing shell characteristics. Each disjunction was more than 100 km, which

is a significant gap for a direct developing species with no dispersal stage. *Livonia mammilla* ranges from the intertidal zone to at least 250 m across four connected Integrated Marine and Coastal Regions (IMCRA v. 4.0: Commonwealth of Australia, 2006) bioregions: the Central Eastern Shelf, Southeastern Shelf Transition, Tasmanian Shelf and Bass Strait Shelf Provinces. The species shows consistent conchological features throughout this continuous geographic and bathymetric range. The collections examined suggest a distributional gap of approximately 370 km between the *L. mammilla* northernmost record at Trial Bay, NSW and the southernmost record of *L. mooloolaba* sp. nov. off Cape Moreton, Queensland. This distributional gap is coincident with a change in shell characteristics from moderately heavy, ovate shells showing subsutural spiral sculpture and a false umbilicus, to large, light-weight and very inflated, shells lacking both subsutural sculpture and a false umbilicus. We interpret this as evidence of them being two allopatric species.

Numerous specimens of *L. mooloolaba* sp. nov. in museums and private collections provide evidence of a deep-water distributional range restricted to the



Figure 1 Comparison of type specimens: **A.** neotype (here designated) of *Livonia mammilla* (G.B.Sowerby I, 1844) (QMMO86414); **B.** holotype of *L. mooloolaba* sp. nov. (QMMO86408); **C.** holotype of *L. capricornia* sp. nov. (QMMO86411); **D.** holotype of *L. hydrographica* sp. nov. (QMMO86412) and **E.** holotype of *L. pithensis* sp. nov. (QMMO86413).



Figure 2 Distribution map of *Livonia pithensis* sp. nov., *L. hydrographica* sp. nov., *L. capricornia* sp. nov., *L. mooloolaba* sp. nov. and revised *L. mammilla*.

Tweed-Moreton Bioregion. Intensive deepwater commercial fishing and exploration to the north of this range offshore from Tin-Can Bay supports their being another 250 km distributional gap in *Livonia* between *L. mooloolaba* sp. nov. from N of Stradbroke Island to *L. capricornia* sp. nov. E Lady Elliot Island. This distributional gap is coincident with a change in shell characteristics from large, lightweight, highly inflated shells with a half-embedded protoconch in *L. mooloolaba* sp. nov. to small, very thick shells with a small exerted protoconch in *L. capricornia* sp. nov. We interpret this as evidence of them being two allopatric species. We hypothesise that the narrow continental shelf eastward of northern K'gari (Fraser Island) may have acted as a geographic barrier between these two species.

The Capricorn-Swains Reefs region has been well-explored by commercial fishing and moderately explored by research trawling, but specimens of *L. capricornia* sp. nov. remain rare. This suggests it is, at best, an uncommon species and greatly restricted in its range and habitat. The area north of the Capricorn-Swains Reefs region is less intensively explored but based on

40-years of fishing and exploration, two further disjunctions in the distribution of *Livonia* are evident. A 250 km disjunction was observed between *L. capricornia* sp. nov. from the Swain Reefs and *L. hydrographica* sp. nov. off Mackay. This disjunction is coincident with a change in shell characteristics from low-spired shells with a brown protoconch nucleus and heavily decorated with brown zig-zag axial pattern in *L. capricornia* sp. nov. to high-spired, narrower shells with a cream protoconch nucleus and two cream spiral bands with no brown zig-zag axial pattern. Fishing exploration in this area continued for multiple years, but *L. hydrographica* sp. nov. was only found in one season in a restricted area (R.H.Arnison, S.Parker pers. comm. to A.R.Field) suggesting it is both rare and has a restricted range.

The largest range disjunction of >400 km was observed between *L. hydrographica* sp. nov. off Mackay and *L. pithensis* sp. nov. the northeast-most species of *Livonia* north of Pith Reef. This range disjunction was coincident with a change from small, relatively narrow, completely unpatterned shells in *L. hydrographica* sp. nov. to larger, taller-spired shells with a brown axial zig-zag pattern,

a peach-orange aperture and a smaller, more exerted protoconch and a posteriorly extended lip in *L. pithensis* sp. nov. We interpret this as evidence of *L. hydrographica* sp. nov. and *L. pithensis* sp. nov. being two allopatric species.

Our classification increases the number of recognised *Livonia* species from 6 to 10, with the majority of species being allopatric. Only *L. roadnightae* appears to be sympatric with other species, occurring with or adjacent to *L. mammilla* throughout much of SE Australia, and with or adjacent to *L. nodiplicata* in S and SW Australia. The recorded distribution of *Livonia* now extends from the Northeast Shelf of tropical Queensland at 18° S to the Northwest Shelf of tropical Western Australia at 15° S. The number of species from the tropics and subtropics is comparable to that in temperate regions. All species of deepwater *Livonia* are poorly known and live material for anatomical and DNA analyses has yet to be collected. The living *Livonia* spp. appear to be divisible into three broad 'groups' (1) the *L. mammilla* 'group' (*L. mammilla*, *L. capricornia* sp. nov., *L. hydrographica* sp. nov., *L. pithensis* sp. nov., *L. mooloolaba* sp. nov.); (2) the *L. roadnightae* 'group' (*L. roadnightae*, *L. limpusi*, *L. mervcooperi*) and (3) the *L. nodiplicata* 'group' ('*Cottonia*') (*L. nodiplicata*, *L. joerinkensi*). As Darragh (1989) has amply demonstrated, *Livonia*, as redefined by him to also include *Cottonia* and *Pterospira*, has a prominent and reasonably well-documented record from the late Oligocene to the present. He also indicated a probable point of origin for the genus in Victoria. If so, then most living species may have arisen from northwards movement (via New South Wales into tropical Queensland) and westwards movement (Western Australia). Future work should be directed towards a combined morphology + molecular phylogenetic study to test the ages of divergence of Australia's rich living *Livonia* fauna hitherto only hinted at through the fossil record (see (Darragh, 1989; Darragh & Ponder, 1998; Goudey, 2018).

Key to *Livonia* of Eastern Australia

The following key was prepared for mature shell specimens, but can be used for juvenile specimens by examining the colour of the protoconch nucleus, the size and degree of exertedness of the protoconch, and teleoconch colour pattern (see Figures 1,2).

- 1a Teleoconch and spire with pronounced axial ribs and coarse subsutural spiral sculpture; protoconch < 15 mm in diameter
Livonia roadnightae
- 1b Teleoconch and spire without axial ribs, subsutural spiral sculpture, if present fine; protoconch > 15 mm in diameter 2
- 2a Fine spiral subsutural sculpture present on spire and body whorl; inner (columellar) lip developed to form a fasciolar plate and false umbilicus; mid New South Wales to Victoria, Tasmania, (? South Australia)
Livonia mammilla

- 2b Subsutural spiral sculpture absent on the spire and body whorl; inner (columellar) lip thin and adpressed, not projecting as a plate forming a fasciolar plate and false umbilicus; Queensland and northern New South Wales 3
- 3a Shells large (260–300 mm) and lightweight, with a half-embedded protoconch, low spire and a large inflated, body whorl; spire and body whorl heavily patterned with two broad spiral bands of brown featuring numerous pale tents; columellar plaits usually 4 (or 3 with a weak posterior 4th); Tweed-Moreton Bioregion
Livonia mooloolaba sp. nov.
- 3b Shell small to medium sized (150–240 mm) and relatively solid, with a more than half-exserted protoconch; spire and body whorl with well-spaced, brown jagged lines or with no lines at all; columellar plaits usually 3 (or 3 with a weak posterior 4th); Central and northern Queensland 4
- 4a Shell narrowly-ovate with weak posterior extension of outer lip; protoconch very large in proportion to remainder of shell; spire and body whorl lacking any brown patterning. NE Shelf East of Mackay outside Hydrographer's Passage
Livonia hydrographica sp. nov.
- 4b Shell broadly-ovate with strong posterior extension of outer lip; protoconch relatively small in proportion to remainder of shell; spire and body whorl with axial patterning of brown jagged lines. Central Queensland and Northern Queensland 5
- 5a Protoconch orange-cream, with brown dot on nucleus; spire low; teleoconch and spire whorls with brown, jagged, axial lines well marked. Swain Reefs, Capricorn Channel to Lady Elliot Island
Livonia capricornia sp. nov.
- 5b Protoconch cream without brown dot on nucleus; spire relatively high, teleoconch and spire whorls with sparse, axial brown, jagged lines tending to obsolescence on body whorl; NE Shelf N of Pith Reef
Livonia pithensis sp. nov.

Taxonomy

Class GASTROPODA Cuvier, 1795

Order NEOGASTROPODA Wenz, 1938

Family VOLUTIDAE Rafinesque, 1815

Subfamily CYMBIINAE H. Adams & A. Adams, 1853

Genus *Livonia* Gray, 1855

Scapha (*Livonia*) Gray, 1855: 8.

Voluta (*Mamillana*) Crosse, 1871: 308.

Voluta (*Pterospira*) Harris. 1887: 100.

Cottonia Iredale, 1934: 57-58.

Livonia (*Livonia*) Poppe & Goto, 1992:

See Darragh (1989) for full synonymy.

Type species: *Voluta mammilla* G.B.Sowerby I, 1844 (by subsequent designation, Hedley 1915).

Diagnosis for *Livonia*

Shell - medium to very large (10–300+mm), fusiform, ovate; protoconch - very large, prominent and bulbous, smooth, paucispiral with deviated nucleus; teleoconch - outer lip often extended posteriorly, shoulder smooth or with nodules of coarse axial ribs, shoulder spiral sculpture variable and often absent; columellar and aperture glazed, 3–4 plaits present, siphonal notch wide and siphonal fasciole present.

Livonia mammilla (G.B.Sowerby I, 1844)

Synonymy and misapplied names

Voluta mammilla G. B. Sowerby I, 1844

Livonia mamilla (sic) *leucostoma* Mayblom, 1951

For full synonymy of historic literature see Weaver & DuPont (1970, pp 48–49).

Type material examined

NEOTYPE: (here designated) QMMO86414, Type locality (here designated): SE of Lakes Entrance [38°10'S, 148°50'E], Victoria, Australia, 100-150m (ex T. Carless coll.) Figure 4.

Description of neotype:

A moderately heavy, thick-shelled adult shell (length 230 mm, width 123 mm) with thick, rolled outer lip; subsutural area with fine spiral sculpture; protoconch large (maximum diameter 22.5 mm), glossy, orange (with small brown dot on nucleus); teleoconch with white-cream background overlain, beneath shoulder area, by two broad bands of brown lines forming a loose, network of white or cream chevrons and triangles (sparser on dorsal surface); aperture and columella orange and glossy; anterior fasciole convex, slightly iron-stained, with columellar lip extended as a plate (fasciolar plate) thereby forming a false umbilicus; columella with four strong plaits; siphonal notch wide and well developed. A heal (natural repair) scar is present on the body whorl approaching the outer lip and the shell has at some time been cleaned of its periostracum.

Comments on neotype designation

The original specimen described by G.B.Sowerby I (1844) is now considered lost (Weaver & du Pont, 1970 *vide* W. Cernohorsky (in litt.)); A. Salvador, NHMUK, pers. comm. to A.R.Field). Sowerby (1844) did not illustrate the specimen but subsequently (1845) did, showing it to be a small, juvenile shell with only the beginnings of the teleoconch and three columellar plaits. Weaver & DuPont (1970) suggested that the specimen illustrated by Gray (1859) (one of three “received from Van Diemen’s Land” (=NHMUK 1859.2.17.1)) may be a suitable neotype, but did not actually make a designation. Unfortunately, this specimen, like the other two shells mentioned by Gray, is also juvenile, and while it is much larger

than the lost holotype and clearly shows fine spiral sculpture on the shoulder, it does not exhibit the mature lip and fasciolar region, contrary Gray’s claim that he was describing the “adult state” of the species. We therefore have chosen a modern, complete, adult specimen from the QM collection as the neotype. This specimen is consistent with *Livonia mammilla* as it is generally known (and here formally re-defined) and perpetuates stable usage of the name. Sowerby (1844) gave the locality of the now presumed lost holotype as “New Holland” (= Australia). Weaver & duPont (1970) credited Gray (1859) with restricting the type locality to Tasmania (“Van Diemen’s Land” of Gray). However, in accordance with Article 76.3 of the ICZN Code (Type locality determined by the neotype) our neotype locality automatically becomes the type locality for *Voluta mammilla* G.B. Sowerby I, 1844.

Revised diagnosis

Shell fusiform, narrowly ovate; moderately heavy; protoconch bulbous partly embedded or exserted, orange-cream often with small brown blotch on nucleus; teleoconch with subsutural spiral sculpture; anterior fasciole convex, slightly raised; inner (columellar) lip forming fasciolar plate and false umbilicus; teleoconch with two broad bands of brown lines featuring network of pale tents; outer lip thickened and slightly extended posteriorly.

Revised description

Shell 244–330 mm long × 133–198 mm wide. Protoconch of bulbous, paucispiral-deviate form, half-embedded to partly exserted, orange when fresh but fading to cream with age with a purple-brown spot on the nucleus, 22.8–27.4 mm wide × 13.7–17.8 mm high. Teleoconch of 2.6–3.1 whorls with a mean spire-to-body whorl ratio of 0.25. Spire relatively high. Fine spiral sculpture on the subsutural area of body whorl, sometimes extending anteriorly. Ground colour pale cream to yellow-orange with a variable pattern of brown lines forming chevrons or zig-zags to a densely reticulating pattern of triangles; pattern usually absent in subsutural area and generally becoming obsolete towards the outer lip. Outer lip thickened and usually reflected upwards, extended posteriorly but not reaching the suture, usually traversing half to two thirds the previous whorl. Inner (columellar) lip thick and developed into a fasciolar and false umbilicus; 3-4 columellar plaits (predominantly 3); anterior fasciole convex and slightly raised. Siphonal notch wide and well developed, notch lip upturned. Aperture cream to orange, inner surface of outer lip rich orange. Periostracum thin and grey-brown. Animal: foot, head, cephalic tentacles and siphon orange, sometimes with a fine linear pattern.

Other material examined

NEW SOUTH WALES. trawled off Bermegui, coll. N.Coleman WSIT 792 (ARF1187 & ARF1186, A.R.Field coll.). trawled off Eden, N.Coleman (ARF4226, A.R.Field coll.). QMMO86416 (1 subadult), trawled off Eden [32°S, 150°30'E] (ex T. Whitehead coll.). QMMO29195 (1 juvenile) Seal Rocks [32°25'S, 152°32'E] (ex F.S. Colliver coll.).

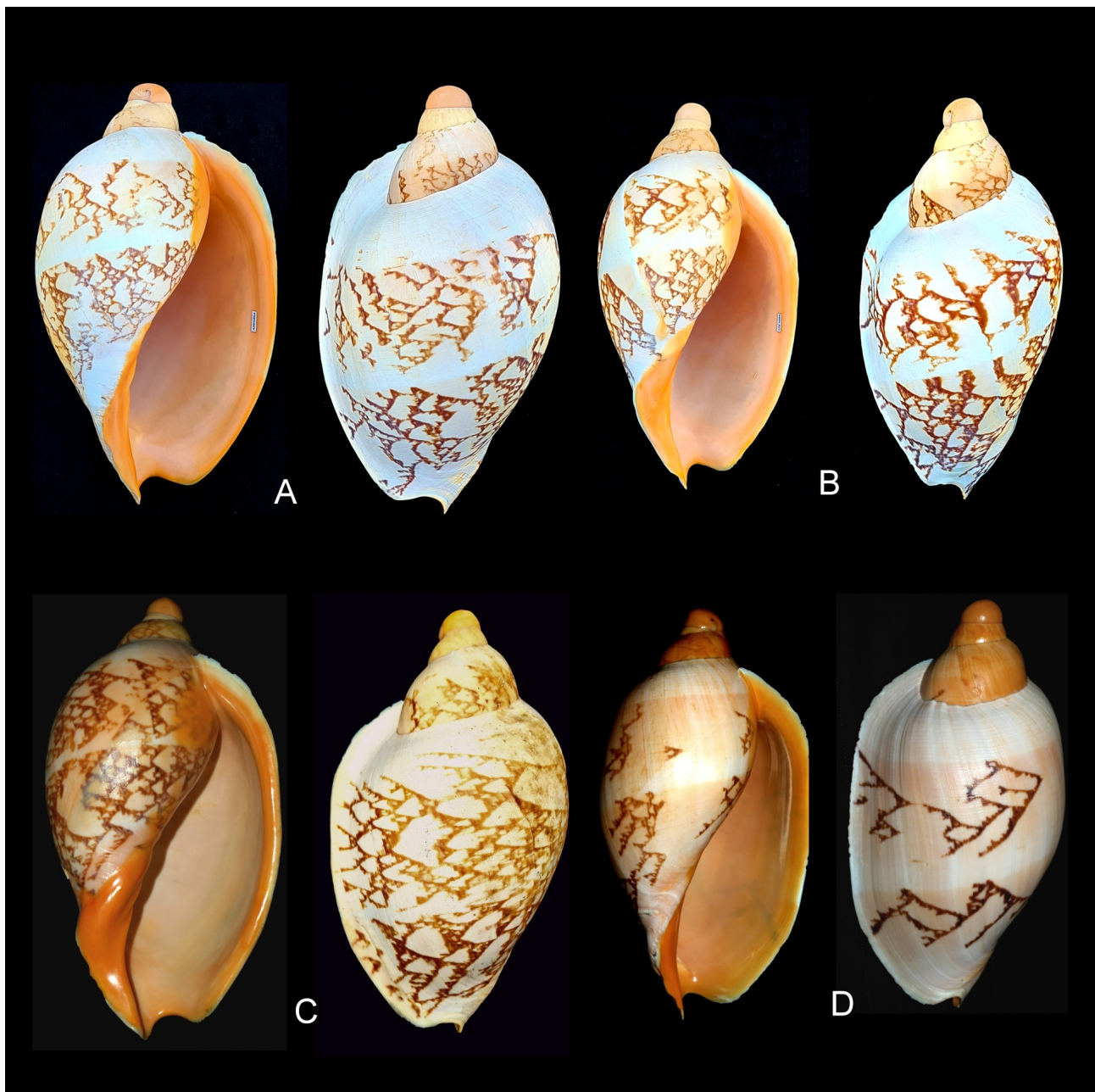


Figure 3 *Livonia mammilla* **A** trawled in Bass Strait NE of Georgetown, 80 m, on muddy sand, Jan 2013, A.R.Field 4264 (A.R.Field coll.), 265 × 163 mm, female specimen. **B** trawled in Bass Strait NE of Georgetown, 80 m, on muddy sand, Jan 2013, A.R.Field 4265 (A.R.Field coll.), 267 × 141 mm, male specimen. **C** trawled SE of Maria Island, 80–100 m, on muddy sand, 16 Jan 2007, A.R.Field 2395a (A.R.Field coll.), 247 × 149 mm, female specimen. **D** trawled SE of Maria Island, 80–100 m, on muddy sand, 16 Jan 2007, A.R.Field 2395a (A.R.Field coll.), 250 × 130 mm, male specimen.

VICTORIA. trawled off Lakes Entrance, A.E.Johnson (ARF1185, A.R.Field coll.). trawled Bass Strait, A.E.Johnson (ARF1524, A.R.Field coll.). QMMO94 (3 adults, 6 juveniles) Green Cape to Gabo Island, 40 km S. of Snowy River [37°30'S, 150°30'E], 91–182 m, 1914, FV *Endeavour*. QMMO20300 (1 adult), Bass Strait [40°S, 146°E] (ex F.S. Colliver coll.). QMMO55406 (1 juvenile) Bass Strait [40°S, 146°E] (ex H. Watkins coll.). QMMO56791 (1 adult) Bass Strait [40°S, 146°E]. QMMO65389 (1 adult, albinotic) trawled off Lakes Entrance [38°19'S, 148°30'E], 146 m (ex K. Lamprell coll.); QMMO 65392 (1 subadult), trawled off Lakes Entrance [38°19'S, 148°30'E]. QMMO65397 (1

adult), trawled off Lakes Entrance [38°19'S, 148°30'E], 146 m (ex K. Lamprell coll.). QMMO86414 (1 adult), trawled off Lakes Entrance [38°19'S, 148°30'E] (ex T. Carless coll.). QMMO86415 (1 adult, albinotic), trawled off Lakes Entrance [38°19'S, 148°30'E] (ex T. Whitehead coll.). **TASMANIA.** trawled in Bass Strait NNE of Georgetown [40°47'S, 146°42'E], 80 m, on muddy sand, Jan 2013, A.R.Field 4264 and 4625 (A.R.Field coll.). trawled SE of Maria Island [42°47'S, 148°09'E], 80–100 m, on muddy sand, 16 Jan 2007, A.R.Field 2395a & 2395b (A.R.Field coll.). QMMO 8921 (1 adult) north coast of Tasmania [40°30'S, 146°40'E].

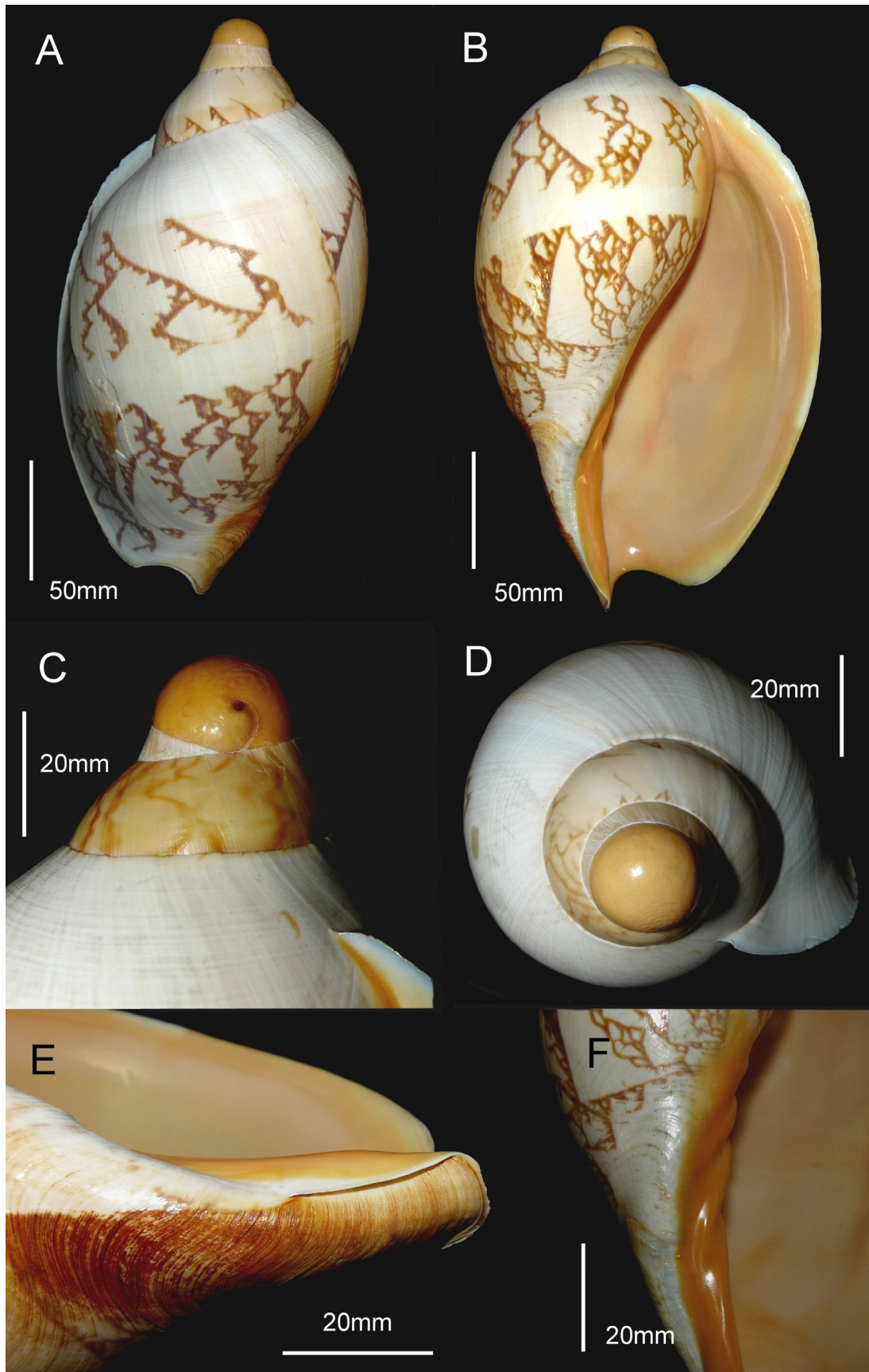


Figure 4 *Livonia mammilla* neotype QMMO 86414. Type locality: SE of Lakes Entrance [38°10'S, 148°50'E], Victoria, Australia, 100-150 m. **A.** Dorsal view. **B.** Aperture view. **C.** Protoconch detail showing purple-brown nucleus. **D.** Spire with fine subsutural spiral sculpture. **E.** Inner lip plate developed over anterior fasciole forming false umbilicus. **F.** Columella showing four plaits.

Specimen images seen

AUSTRALIA. *leg.* B.Wright (ZMA_MOL_226591). **NEW SOUTH WALES.** from fish trap off South West Rocks, Trial Bay, Apr 1960, J.Kerslake (AM C.99143). off Port Stephens, 150 m, 6 Dec 1978, coll. R.Rudman, P. Colman & K. Handley FV *Kapala* (AM C.363726). **VICTORIA.** Western Port, 1920, M.M.Sherman (ZMA_MOL_226594). **TASMANIA.** North of Flinders Island, 216 m, (MNHN 2019-22618). Tasmanië, J.Mulber (RMNH_MOL_233458). Devonport, 1942 (AM C.496554).

Remarks

The authorship of *Livonia mammilla* has been variously attributed to 'Gray (1844)', 'Gray in G.B.Sowerby I (1844)' and most frequently as 'G.B.Sowerby I (1844)'. In this case the confusion stems from the fact that Sowerby, for some unspecified reason, introduces the name as "*Voluta mammilla*, Gray", in a paper entitled "Descriptions of six new species of *Voluta*". Gray later claimed authorship for the species ("young specimen of a shell (...) which I named *Voluta mamilla*" (Gray 1859)). Whether Gray wrote the name on a label originally associated with the shell (both now lost), included it in a draft of a paper, or provided a description to Sowerby is not known. In our opinion the most likely explanation is that Gray had written a name on the original label and that Sowerby had simply used it in his description of the species. After detailed examination of Gray's published work and that of Sowerby I, Petit (2009, 2012) concluded that Sowerby I alone should be credited as the author of the name '*Voluta mammilla*', and this is followed here for consistency with recent taxonomic work and the World Register of Marine Species (WoRMS).

Livonia mammilla differs from *L. mooloolaba* sp. nov., *L. capricornia* sp. nov., *L. hydrographica* sp. nov. and *L. pithensis* sp. nov. by having shells with subsutural spiral sculpture, and by the presence of a fasciolar (inner lip) plate and false umbilicus. It also differs from *L. mooloolaba* sp. nov. by its generally much heavier shell, higher spire and more exerted protoconch, from *L. capricornia* sp. nov., *L. hydrographica* sp. nov. and *L. pithensis* sp. nov. by its larger size (244–330 mm versus 165–217 mm) and from *L. hydrographica* sp. nov. and *L. pithensis* sp. nov. by its purple-brown nucleus. See Figures 1, 2, 3 & 4.

Livonia mammilla is well known in southeastern Australia, being the most frequently encountered species of *Livonia*. Shells are occasionally found on beaches and living individuals are sometimes observed intertidally and by SCUBA divers (Richmond (1992) reports a large (310 mm), presumably fully adult specimen occurring in shallow water off the Freycinet Peninsula, Tasmania). Typically, however, it is caught in dredges, trawl nets and crayfish pots and subsequently sold for food and the specimen shell trade. *Livonia mammilla* has been recorded from about Trial Bay, New South Wales, to south of Bruny Island, Tasmania and west to Lakes

Entrance, Victoria with two isolated records from South Australia (Vivonne Bay, Kangaroo Island AM C. 496009; mouth of Murray River – SAM unregistered specimen (see Cotton, 1957)). Despite some authors claiming that *L. mammilla* occurs in South Australia (e.g. Short & Potter, 1987; Poppe & Goto, 1992; Wilson, 1994; Robin et al., 2024) the presence of the species in those waters and indeed off western Victoria requires confirmation through collection of live material. Although the Atlas of Living Australia records specimens of this species from Thursday Island, Queensland (SAM - D8387) and Iluka, New South Wales (SAM - D64487), examination of photographs of shells and labels of those two lots (courtesy S. Sorokin, SAM) indicate that both of these records must be disregarded (D8387 having no original locality data; D64487 original donor's label pertaining to *Cymbiola magnifica* (Gebauer, 1802) a volute frequently collected by trawling off New South Wales (including Iluka) and Queensland. *Livonia mammilla* lives on sand and muddy-sand substrates from the intertidal zone down to at least 250 m. A sample of eight, adult, commercially-fished individuals from Tasmania examined by one of us (A.R.Field) yielded four males and four females (see Figure 3). The females were slightly larger with rounder, heavier shells (mean length width ratio 0.6) and they had a large ovary and nidamental gland. The males were slightly smaller with lighter and slightly narrower, more cylindrical shells (mean length width ratio 0.5), they had a penis and distinctly purple-coloured hypobranchial gland. In this sample, the older thicker and more heavily fouled shells were generally female and the thinner and less heavily fouled shells were male. A larger sample needs to be examined to determine if these initial observations are genuinely indicative of sexual dimorphism of shells.

Livonia mamilla[sic] *leucostoma* Mayblom, 1951 is merely an albinotic colour variant (showing pure white protoconch, aperture and background colour) occurring off southern New South Wales and eastern Victoria and is not here given any taxonomic status. The albinotic condition has also been observed in *L. roadnightae* (McCoy, 1881) as in certain other genera of Australian Volutidae (see Weaver & duPont, 1970). Of more interest is *Livonia quisqualis* Iredale, 1957 which appears to be conchologically intermediate between *L. mammilla* (colour pattern, large protoconch) and *L. roadnightae* (heavier shell with coarse axial and spiral sculpture on spire and body whorl). Opinions differ as to the status of this nominal taxon; it being variously regarded as a variant of *L. mammilla* or *L. roadnightae* or a hybrid between the two. Iredale (1957) has suggested that his new species might even form a transitional link with fossil (Tertiary) *Livonia*. Judgement as to the status and significance of *L. quisqualis* must be reserved until more material is available. According to Darragh (1989) fossil material of *L. mammilla* "or a closely related species" has been recovered from two Pliocene sites in Victoria (Jemmys Point,

Kalimna (near Lakes Entrance) and Flinders Island), but yet there is no fossil record of *L. roadnightae*.

***Livonia capricornia* sp. nov.**

urn:lsid:zoobank.org:act:725E72DB-1192-4274-9BF0-DAC0AC4A3EDB

Synonymy and misapplied names

Livonia mammilla Sowerby 1, 1844 - non *Livonia mammilla* (Sowerby 1, 1844), Coucom (2010, p. 5, colour supplement 1, Fig. 10).

Type material examined

HOLOTYPE: QMMO86411 (1 adult, 176 × 104 mm) Capricorn Channel [22°50'S, 152°20'E], Queensland, Australia, 128 m (ex K. Lamprell coll.) Figures 1C, 5, 6.

PARATYPE: QMMO86255 (1 juvenile, 84 × 44 mm) trawled, ESE of Hixon Cay [22.47°S, 153.76°E], site 152, Great Barrier Reef, Queensland Australia, 348 m, 30 Sept 2023, CSIRO Southern Surveyor bottom trawl (SSBT).

Diagnosis

Shell fusiform, broadly ovate; heavy; protoconch bulbous, relatively small in portion to rest of shell, orange-cream, usually with small brown blotch on nucleus; teleoconch with relatively low spire and lacking subsutural spiral sculpture; anterior fasciole straight, lacking inner lip plate and false umbilicus; teleoconch with well-spaced brown axial zig-zag (lightning pattern) markings; outer lip with very thick edge, strongly extended posteriorly.

Description

Shell 165–200 mm long × 86–131 mm wide, relatively solid and heavy. Protoconch of bulbous, paucispiral-deviate form, moderately exerted, cream yellow with a purple-brown spot at the nucleus, 20–23.8 mm wide × 15.1–16.2 mm high. Spire and body whorl comprised of 2.3–2.8 whorls with a mean spire-to-body whorl ratio of 0.24. Spire relatively slender and short compared to

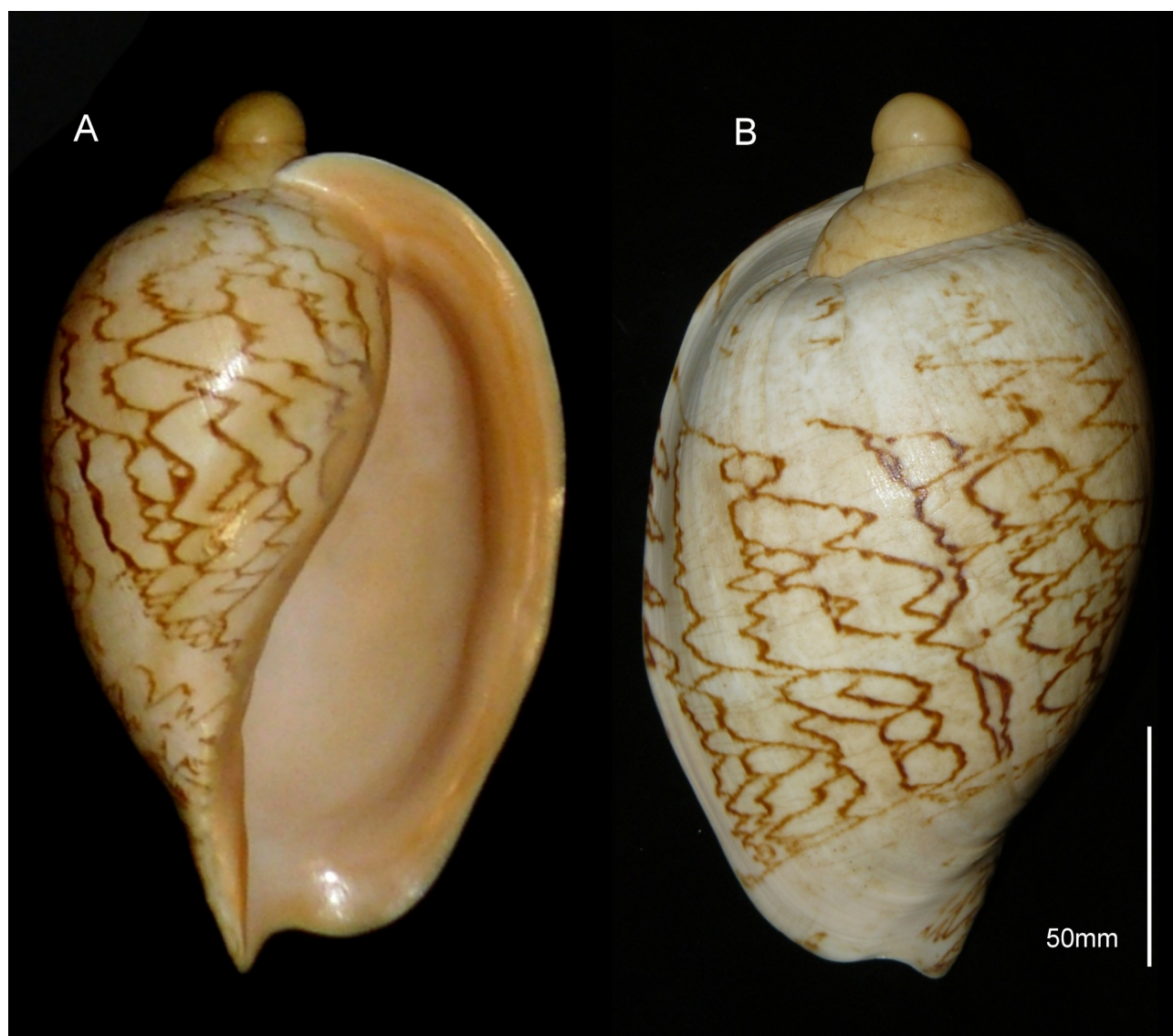


Figure 5 *Livonia capricornia* sp. nov. Holotype QMMO86411, Capricorn Channel, Queensland, Australia, 128 m (ex K.Lamprell coll. , 176 × 104 mm).

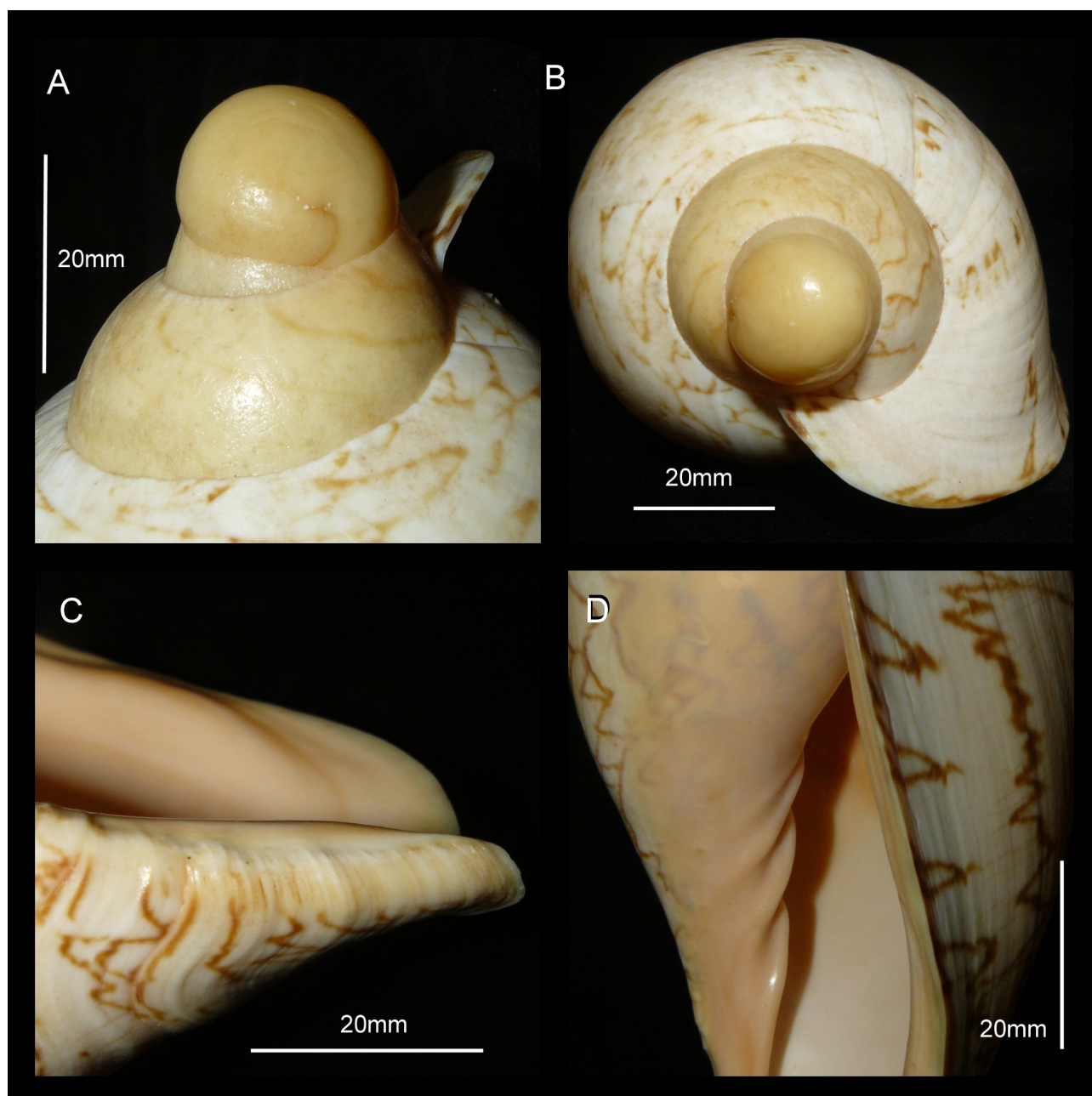


Figure 6 *Livonia capricornia* sp. nov. holotype QMMO86411 shell details. **A.** Protoconch and first portion of teleoconch. **B.** View showing protoconch and marked posterior flaring of outer lip in relation to spire; note also absence of subsutural spiral sculpture. **C.** Anterior fasciole lacking inner lip fasciolar plate and false umbilicus. **D.** Columella with three plait and a weaker fourth plait posteriorly.

the ovate-pyriform body whorl. All whorls smooth without subsutural spiral sculpture. Background colour ivory to pale cream with overlying zig-zag brown lines. Outer lip strongly extended posteriorly, reaching almost to the suture of the previous whorl. Inner (columellar) lip thin and not forming a fasciolar or false umbilicus; columellar plaits usually three ($\pm$ a reduced fourth plait); anterior fasciole slightly convex. Siphonal notch wide and well developed; notch lip and anterior end of fasciole not upturned. Aperture cream to peach, inner surface of outer lip cream to orange but paler on the posterior extension. Periostracum grey-brown. Animal not observed.

Specimens examined as images

Queensland. SE Swain Reefs, Nov 1992 (MAGNT P028380). Capricorn Channel (NHMR 993000050776). off Lady Elliot Island (D.Spann unpublished 1986 privately distributed photograph album, Queensland Museum).

Remarks

Livonia capricornia sp. nov. differs from *L. mammilla* by its smaller (<200 mm versus >244 mm), broader shell, with greater posterior extension of outer lip, absence of subsutural spiral sculpture, and absence of a fasciolar

(inner lip) plate and false umbilicus. It differs from *L. mooloolaba* sp. nov. by its smaller (<200 mm versus >282 mm) much thicker shell, and from *L. hydrographica* sp. nov. and *L. pithensis* sp. nov. by its shorter spire, brown protoconch nucleus, and by having an axial zig-zag pattern on the teleoconch and spire. Figure 1, 2, 5 and 6.

Livonia capricornia sp. nov. is presently known from only a limited number of specimens obtained by deepwater research trawling and commercial prawn trawl fishing. Most of these are dead-taken small juveniles, with only a handful of live-collected adult specimens being available for study. It has been recorded from about 150–350 m on muddy sand in the area between the Swain and Capricorn-Bunker Reefs (A.S.Limpus, pers. comm. to A.R.Field). The area between the Capricorn-Bunker Reefs and the Tweed-Moreton region has been well explored for over half a century by commercial and research trawling and the absence of any intermediate populations is good evidence of the allopatry of *Livonia capricornia* sp. nov. and *L. mooloolaba* sp. nov. The southernmost record known is from off Lady Elliot Island (unpublished annotated photograph album by David Spann, 1986). A highly patterned, higher-spined and larger *Livonia* from the Gladstone-Capricorn Channel area seen by one of us (J.M.Healy, in T. Daymond coll.) and illustrated by Robin et al., (2024, as '*L. limpusi* Bail, 1999' a Western Australian species) and Slieker et al., (2023) may be related or a separate taxon, and we refrain from further comment until museum material becomes available for study.

Etymology: named for the Capricorn Channel from where the type and most known specimens were trawled, and the Capricornia Region of Queensland.

***Livonia hydrographica* sp. nov.**

urn:lsid:zoobank.org:act:6F97EFF9-C123-4A71-AACC-F96BB856ECB8

Synonymy and misapplied names

This taxon has not previously been described or figured.

Type material examined

HOLOTYPE: QMMO86412 (1 subadult, 176 × 96 mm) 50 km E of Muirhead Reef [20°25'S, 151°10'E], Queensland, Australia, 150–250 m (on muddy-sand, Nov 2000, R.H.Arnison et al., FV *Gracie-R*: ARF4685b ex A.R.Field coll.) Figures 1D,7A,8.

PARATYPE: AM C. 175431 (1 juvenile), trawled off Mackay [21°10'S, 149°30'E], Nov 2000 (ex A.S.Limpus ex G.Rowse coll. [original label]) Figure 7C.

Diagnosis

Shell fusiform, narrowly ovate; robust but not heavy; protoconch bulbous, very large in portion to rest of shell and uniformly cream; teleoconch with moderately high spire and lacking subsutural spiral sculpture; anterior fasciole slightly convex, lacking fasciolar (inner lip) plate and false umbilicus; teleoconch completely lacking any

patterning; outer lip with thickened edge and only weakly extended posteriorly.

Description

Shell 165–176 mm long × 86–96 mm wide. Protoconch exerted beyond half-way, pale cream yellow with a cream nucleus, 24–25 mm wide × 15.1–16.2 mm high. Spire and body whorl comprised of 2.3–2.4 whorls with a mean spire-to-body whorl ratio of 0.24. Spire relatively slender and tall compared to the oval body whorl. All whorls smooth without spiral ribs. Ground colour ivory to pale cream yellow with two broad spiral cream yellow bands and no axial brown lines on any part. Outer lip broadly flared posteriorly, almost extending to the suture of the previous whorl. Inner (columellar) lip thin and adpressed to the anterior fasciole, not developing a fasciolar plate or a false umbilicus; anterior fasciole slightly convex; columellar plaits 3. Siphonal notch wide and well developed; notch lip and anterior end of fasciole not upturned. Aperture cream to peach, inner surface of outer lip cream to orange but paler on the posterior extension. Periostracum thin and grey-brown. Animal: foot, head, cephalic tentacles and siphon orange.

Other material examined

Queensland. Great Barrier Reef. trawled off Mackay 20–50 km E of Muirhead Reef [20°25'S, 151°10'E], 150–250 m on muddy-sand, Nov 2000, R.H.Arnison et al., FV *Gracie-R* (ARF4685a, A.R.Field coll.). off Mackay, Nov 2000 (2 dead polished specimens ex coll. E.H.Brown).

Remarks

Livonia hydrographica sp. nov. differs from all species here examined by its lack of any brown colour patterning; from *L. mammilla* by its smaller size (165–176 mm long versus 244–330 mm long), absence of subsutural spiral sculpture, presence of a well-exserted protoconch and by lacking a fasciolar (inner lip) plate and false umbilicus. It differs from *L. mooloolaba* sp. nov. by its smaller size, narrower and thicker shell, and well-exserted protoconch lacking any colour on nucleus. It differs from *L. capricornia* sp. nov. by its narrower shell, larger protoconch, taller spire and lack of any brown colour patterning. It differs from *L. pithensis* sp. nov. by its smaller size, larger protoconch, narrower shell and much reduced posterior flaring of the outer lip. See Figures 1, 2, 7 & 8.

Livonia hydrographica sp. nov. is known from a small number of specimens obtained as bycatch from deep-water commercial trawl fishing for barking crays (*Linuparus trigonus*) in the area E of Mackay outside the Great Barrier Reef to south of Hydrographers Passage and north of T-Line (adjacent the NW section of the Swain Reefs (R.H.Arnison pers. comm., S.Parker pers. comm. to A.R.Field). This species appears to be quite rare and localised, commercial trawling in the area between its



Figure 7 *Livonia hydrographica* sp. nov. **A.** holotype QMMO86412, off Mackay, 50 km E of Muirhead Reef, Queensland, 150–250 m, trawled on muddy sand, Nov. 2000, R.H.Arnison et al. FV *Gracie-R*, (176 × 96 mm). **B.** As previous (ARF4685 A.R.Field coll., 174 × 94 mm). **C.** paratype, as previous (AM C.175431). **D.** As previous, two specimens (ex coll. E.H.Brown).

range and the next species north has not found any intermediate specimens. Three of the freshly live-caught specimens observed had an orange colour and appearance of the foot, head and siphon similar to *L. mammilla* (A.R.Field pers. obs. Nov. 2000). The remaining specimens were juvenile or dead shells. It is interesting to note that although *L. hydrographica* sp. nov. is geographically closest to *L. capricornia* sp. nov. and *L. pithensis* sp. nov., its narrow shell and very large protoconch make it very reminiscent of *L. mammilla*. *Livonia hydrographica* sp. nov. in fact, has one of the largest protoconchs relative to shell length in the genus.

Etymology: Named for Hydrographer's Passage, adjacent the southern section of which, the type series and all known specimens were trawled.

Livonia pithensis sp. nov.

urn:lsid:zoobank.org:act:D83DBB7D-270B-4E88-89F5-93E1192A0055

Synonymy and misapplied names

This taxon has not previously been described or figured in any literature that we are aware of.

Type material examined

HOLOTYPE: QMMO86413 (1 semi-adult, 193 × 111 mm) 50 km N of Pith Reef [18°05'S, 147°05'E], Queensland, Australia,

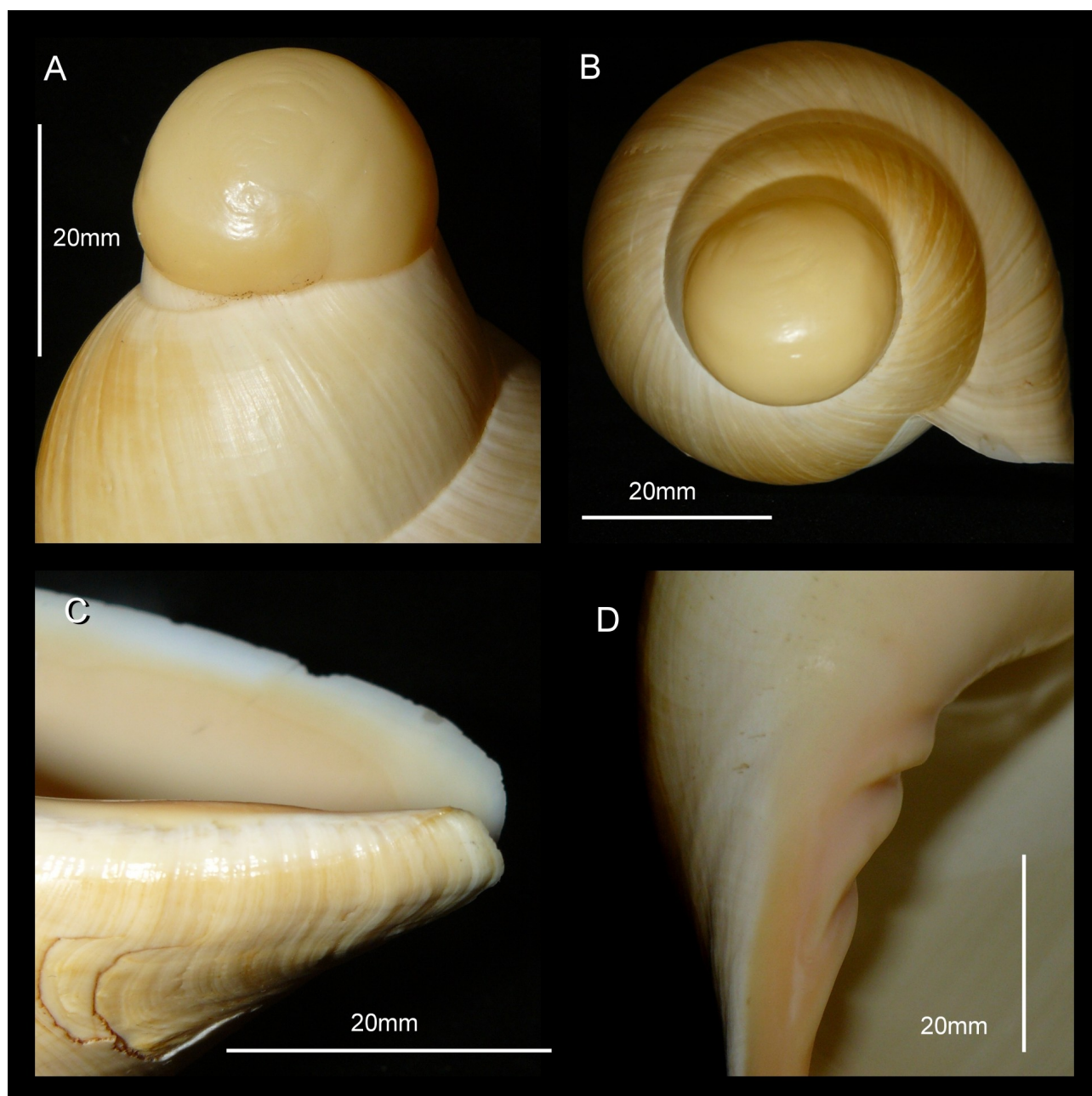


Figure 8 *Livonia hydrographica* sp. nov. Holotype QMMO86412, shell details. **A.** Side view of protoconch (exserted, uniformly cream) and initial region of teleoconch, **B.** Protoconch and spire showing absence of subsutural spiral sculpture. **C.** Columella showing three plaits. **D.** Anterior fasciole lacking inner lip plate and false umbilicus.

150–250 m (on muddy sand, 1998, coll. S. Parker et al. : ARF3328 ex A.R. Field coll.) Figures 1E, 9A, 10.

PARATYPE: QMMO86417 (1 large juvenile with animal, 167 mm long, 85 mm wide) dredged 52 km ENE of Innisfail, NEQ, 17°34'58"S, 146°52'16"E, 480–504 m, James Cook University *Cidarid* expedition, station 43-3 Ref. 894, 15 May 1986.

Diagnosis

Shell fusiform, broad and moderately inflated; heavy; protoconch strongly exserted, cream without blotch on nucleus; teleoconch spire high and lacking subsutural spiral sculpture; anterior fasciole straight, lacking fasciolar (inner lip) plate and false umbilicus; teleoconch unpatterned with two bands of well-spaced brown zig-

zag lines tending to develop on the body whorl; outer lip thick and strongly extended posteriorly.

Description

Shell 193–217 mm long × 110–131 mm wide. Protoconch exserted beyond its widest circumference, cream yellow with a cream nucleus, smooth, 15.6–20 mm wide × 15.1–16.2 mm high. Spire and body whorl comprised of 2.3–2.8 whorls with a mean spire-to-body whorl ratio of 0.24. Spire relatively slender and tall compared to the ovate-pyriform body whorl. All whorls smooth. Background colour ivory to pale cream yellow with two broad pale cream-yellow spiral bands and with a sparse axial pattern of zig-zag brown stripes in two broad spiral



Figure 9 *Livonia pithensis* sp. nov. **A.** holotype, QMMO86412. 50 km N of Pith Reef, Queensland, 150–250 m, trawled on muddy sand, 1998, S.Parker et al. (ARF3328 ex A.R.Field coll., 193 × 111 mm). **B.** N of Pith Reef (E of Tully), Great Barrier Reef, 150–250 m, trawled on muddy sand, 1986, F.Williams et al., F.V.*Apollo VII* (ARF3049, A.R.Field coll., 217 × 138 mm). **C.** 50 km N of Pith Reef, Oct 2001 (ex coll. G.Rowse, 204 mm). **D.** 50 km N of Pith Reef, Oct 2001 (ex coll. G.Rowse, 198 mm).

bands on the latter part of the body whorl towards the final lip. Outer lip broadly flared posteriorly, extending past the suture of the previous spire whorl. Inner (columellar) lip thin and adpressed to the anterior fasciole, thereby not forming a fasciolar plate or a false umbilicus; anterior fasciole slightly convex; columellar plaits 3. Siphonal notch lip and anterior end of fasciole not upturned. Aperture cream to peach, inner surface of outer lip cream to orange but paler on the posterior extension. Periostracum thin and grey-brown. Animal: foot and siphon orange (fresh animal), pale pink-orange (formalin preserved paratype QMMO86417).

Other material examined

Queensland. Great Barrier Reef. trawled off Pith Reef, 150–250 m on muddy sand (ex E.H.Brown coll.). trawled N of Pith Reef (E of Tully) [18°S, 146°59'E], 150–250 m [recorded as 80–100 fathoms] on muddy sand, Jan 1986, F.Williams et al., F.V.*Apollo VII* (ARF3049, A.R.Field coll.). deepwater NE of Townsville (2 unnumbered subadult specimens, ex E.H.Brown coll.). trawled 50 km N of Pith Reef, Oct 2001 (2 unnumbered adult specimens, ex G.Rowse coll.).

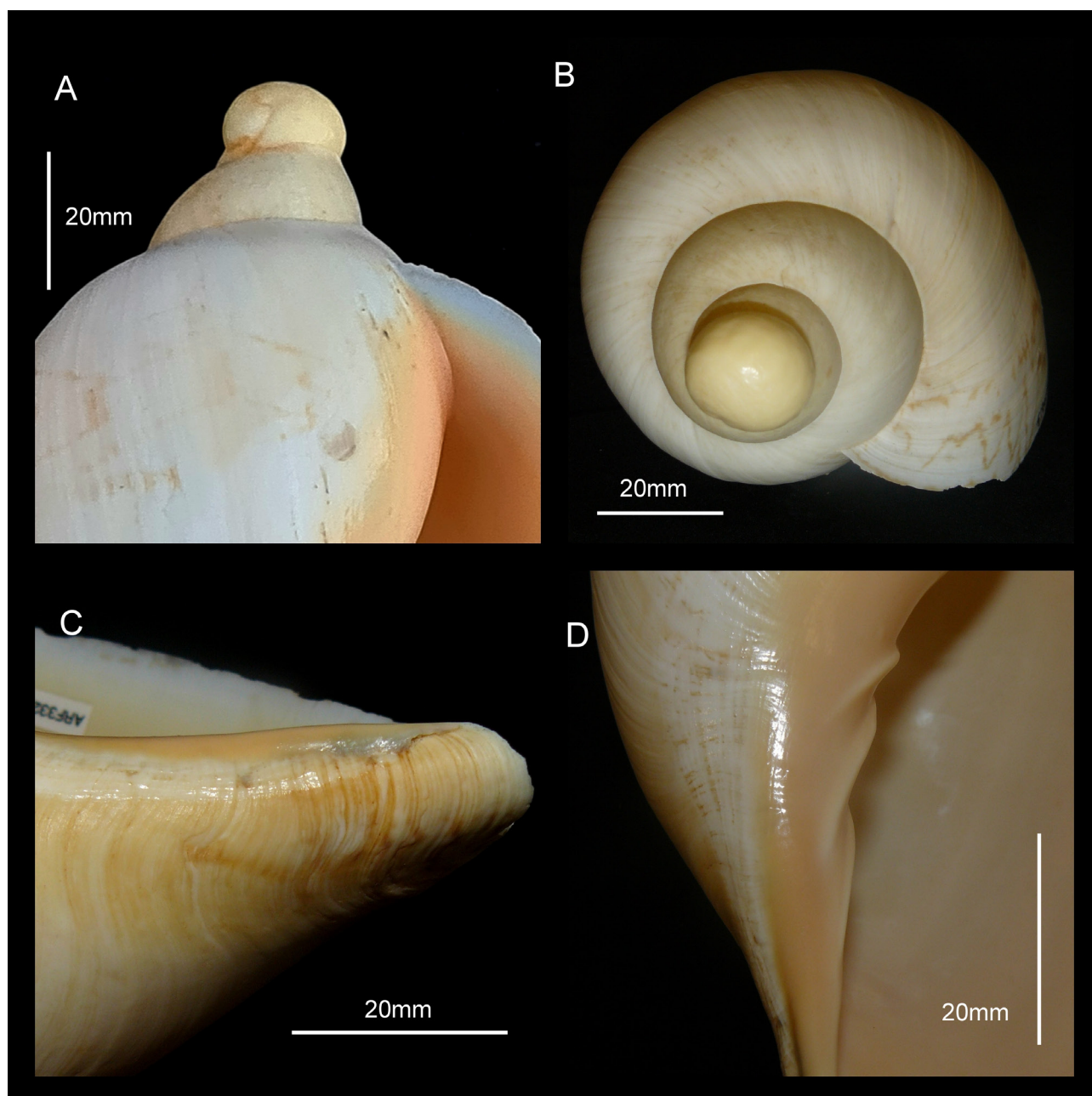


Figure 10 *Livonia pithensis* sp. nov. holotype QMMO86413 shell details. **A.** Side view of protoconch (exserted, uniformly cream) and initial region of teleoconch. **B.** Protoconch and entire spire; absence of spiral sculpture on tall spire. **C.** Anterior fasciole lacking fasciolar (inner lip) plate and false umbilicus. **D.** Columella showing three plaits.

Remarks

Livonia pithensis sp. nov. differs from *L. mammilla* by its smaller shell size (193–217 mm long versus 244–330 mm long), lack of subsutural spiral sculpture, smaller and more exserted protoconch (15.6–20 mm diam. versus 22.8–27.4 mm diam.), its cream nucleus, extended anterior lip and its absence of a false umbilicus. It differs from *L. mooloolaba* sp. nov. by its smaller size, taller spire, smaller and more exserted protoconch, cream nucleus, and axial colour pattern limited to the body whorl and outer lip. It differs from *L. capricornia* sp. nov. by its taller spire, more exserted protoconch, cream nucleus and less developed patterning. It differs from *L.*

hydrographica sp. nov. by its larger size, greater posterior extension of lip and the presence of brown axial zig-zag pattern on the body whorl. See Figures 1, 2, 9 & 10.

Livonia pithensis sp. nov. is presently known only from the deepwater research surveys of the James Cook University RV *Cidarid I* and a limited number of specimens obtained as bycatch by experimental deepwater commercial trawl fishing for barking crays (*Linuparus trigonus*). The first two known specimens were trawled in 1986, and each remained an enigma, one in the James Cook University collection (later in the QM wet collection – paratype QMMO86417) and one in the private collection of trawlerman E.H.Brown of Oonoonba (later in

A.R.Field collection). Further specimens were trawled between 1998 and 2001 which showed the consistent features of the population. It has been recorded from the largest depth range, from about 140–500 m on muddy-sands in the area outside the Great Barrier Reef north of Pith Reef off Townsville.

The presence of *Livonia* on the E coast of Australia ENE of Innisfail (17°34') places the genus well into the tropics and approaching the northern range known in NW Western Australia (15°). How far north and east *Livonia* occur in Queensland, or the Coral Sea remains unknown due to limited deepwater benthic exploration. Outside the Great Barrier Reef from about Channel Reef northwards the continental slope is very steep and unviable for commercial trawling (E.H.Brown pers. comm. to A.R.Field).

The formalin preserved *Cidaris I* specimen has lost part of its colour, being pale pink-orange, which is consistent with field observations that *L. pithensis* sp. nov. has an orange-tinged foot and siphon (G.Rowse pers. comm. to A.R.Field). Field samples contained a substantially larger number of juvenile individuals than adult individuals (E.H.Brown pers. comm. to A.R.Field).

Etymology: named for Pith Reef, north of which the holotype was trawled.

Livonia mooloolaba sp. nov.

urn:lsid:zoobank.org:act:12AC8A74-8EA5-4FE9-9325-088E2113AB24

Synonymy and misapplied names

Livonia mammilla - non *Livonia mammilla* (Sowerby I, 1844), Abbottsmith (1969, p. 56).

Livonia (Livonia) mamilla (Sowerby, I 1844) - non *Livonia mamilla* (Sowerby I, 1844), Poppe & Goto (1992, p.156 pl.59, figs 4,5)

Livonia mamilla (Sowerby, 1844) - non *Livonia mammilla* (Sowerby I, 1844), Robin (2008, p. 361, fig. 7).

Livonia mammilla (Sowerby I, 1844) - non *Livonia mamilla* (Sowerby I, 1844), Abbottsmith (1983, p. 12, pl. 8). Coucom (2010, p. 5 and colour supplement 1, Fig. 9); Robin et al., (2024, p.136, Fig. 3).

Type material examined

HOLOTYPE: QMMO86408 (adult, 248 × 158 mm), East of Mooloolaba [26°45'S, 153°35'E] (South East Queensland), 140 m (ex K.Lamprell coll.)(Figures 1B, 11A,B, 12).

PARATYPE 1: QMMO65353 (adult, 300 × 179 mm), trawled E of Mooloolaba [26°45'S, 153°35'E] (South East Queensland) (ex K. Lamprell coll.)

PARATYPE 2: QMMO65387 (adult, 286 × 179 mm), trawled E of Mooloolaba [26°45'S, 153°35'E] (South East Queensland) (ex K. Lamprell coll.).

PARATYPE 3: QMMO86409 (adult, 280 × 171 mm), trawled E of Mooloolaba [26°45'S, 153°35'E] (ex K. Lamprell coll.)(Figures 11C,D).

PARATYPE 4: QMMO86410 (adult, 288 × 173 mm), trawled NE of Cape Moreton [26°55'S, 153°35'E] (ex T. Whitehead coll.)(Figures 11E,F).

PARATYPE 5: QMMO DM 1184763001 (adult, 261 × 158 mm), east of Moreton Bay, [27°S, 153°30'E] (ex D. Mellinger coll.).

PARATYPE 6: QMMO86174 (juvenile, 105 × 59 mm), E. of North Stradbroke Island, [27°30'S, 153°44'24"E], 143 m, CSIRO Southern Surveyor bottom trawl (SSBT) 17 Oct 2023.

PARATYPE 7: QMMO3272:1 (juvenile, 109 × 59 mm), trawled off Cape Moreton [27°S, 153°30'E], 117–128 m (B. Beutel).

PARATYPE 8: QMMO3272:2 (juvenile, 147 × 82 mm), trawled off Cape Moreton [27°S, 153°30'E], 117–128 m (B. Beutel).

PARATYPE 9: QMMO3272:3 (juvenile, 79 × 38 mm), trawled E of Cape Moreton [27°S, 153°30'E], 117–128 m (B. Beutel).

PARATYPE 10: QMMO60425 (juvenile 79 × 38 mm), trawled E of Brisbane [27°24'S, 153°51'E] (Iron Summer Survey) , 260 m, 25 Sept 1982, (G. Smith).

Diagnosis

Shell fusiform, very broad and inflated; light-weight and thin-shelled; protoconch partly embedded, bright orange with large purple-brown blotch on nucleus; teleoconch spire low and lacking subsutural spiral sculpture; anterior fasciole straight, lacking fasciolar (inner lip) plate and false umbilicus; teleoconch almost completely covered by two very broad, brown bands featuring numerous pale tents; outer lip thin and moderately extended posteriorly.

Description

Shell 248–295 mm long × 158–185 mm wide. Protoconch low, embedded at its widest circumference, pale cream to bright orange with a large and somewhat irregularly-shaped, purple-brown blotch on nucleus, 24.4–25.5 mm wide × 13–13.8 mm high. Teleoconch of 2.7–2.8 whorls, with a mean spire-to-body whorl ratio of 0.57. Spire low compared to the size of the large ovate body whorl. All whorls smooth without subsutural spiral sculpture, background colour pale cream-white, overlain with two very broad, brown bands featuring numerous pale tents. Outer lip thin and flanged posteriorly approximately halfway to the suture of the spire whorl. Inner (columellar) lip thin and closely adpressed to the anterior fasciole, not developing a fasciolar plate or false umbilicus; columellar plaits 3–4 (predominantly 4); anterior fasciole slightly convex. Siphonal notch well developed and wide. Siphonal notch lip and anterior end of fasciole slightly upturned. Aperture pale whitish or peach cream with pale peach-yellow on the inside of the outer lip and columellar and a white anterior extension of the outer lip. Periostracum very thin and olive-brown. Animal: foot, head and siphon mottled red.

Other material examined

QUEENSLAND. South East Queensland. E of Mooloolaba, 200–250 m, trawled on muddy sand, 1998 (ARF4945, A.R.Field coll.). Off Cape Moreton E of Mooloolaba, 200

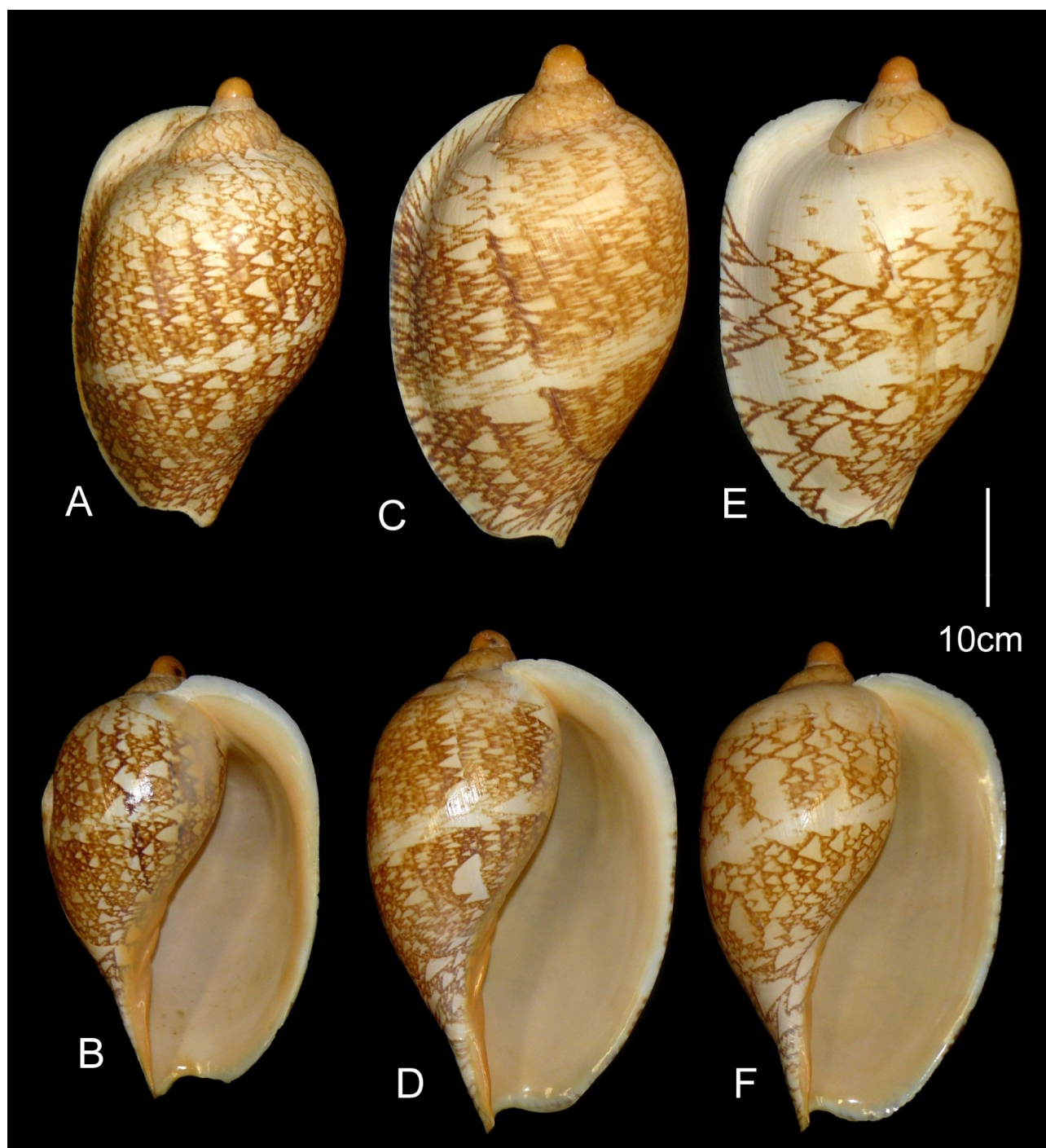


Figure 11 *Livonia mooloolaba* sp. nov. Dorsal view (top row) and apertural view (bottom row). **A,B.** holotype QMMO86408, East of Mooloolaba [26°45'S, 153°35'E] (South East Queensland), 140 m (248 × 158 mm). **C,D.** Paratype 3, QMMO86409, trawled E of Mooloolaba (280 × 171 mm). **E,F.** paratype 4, QMMO86410, trawled NE of Cape Moreton (288 × 173 mm).

m, trawled on muddy sand, 2001 (ARF4938, A.R.Field coll.). Off Cape Moreton (E.H.Brown coll.). Cape Moreton, 2001 (G.Rowse coll.).

Specimen images examined

QUEENSLAND. N of Cape Moreton S. Qld, 128–183 m, pres. T.A.Garrard (AM C. 64625).

Remarks

Livonia mooloolaba sp. nov. differs from all species examined by its lightweight and highly inflated (rounded) shell: from *L. mammilla* it further differs by its more embedded protoconch (with large nuclear colour blotch) and absence of both a fasciolar (inner lip) plate and false umbilicus. It further differs from *L. capricornia* sp. nov., *L. hydrographica* sp. nov. and *L. pithensis* sp. nov. by its low (embedded) protoconch, much larger shell (>248 mm versus <217 mm) and more extensive

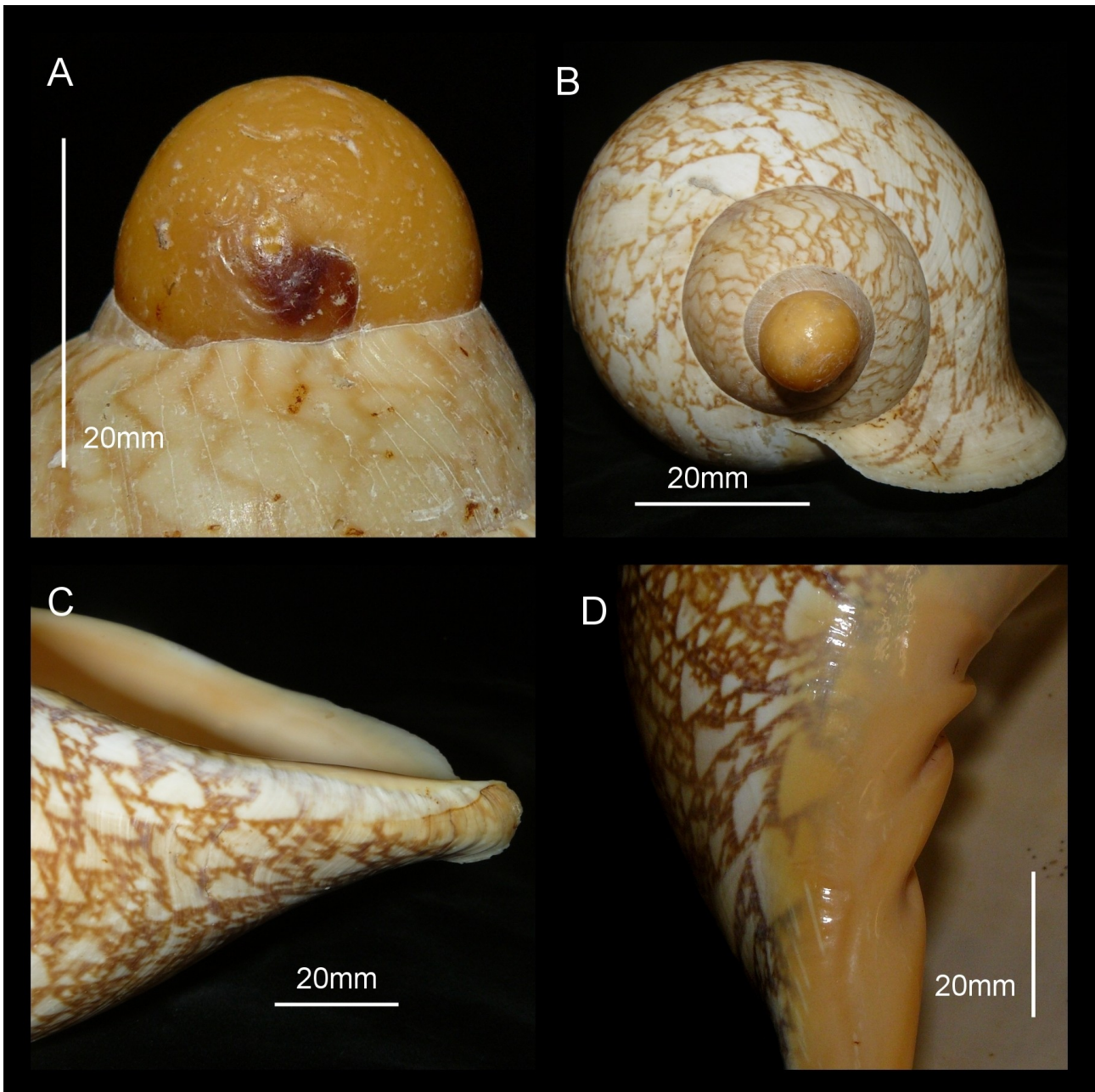


Figure 12 *Livonia mooloolaba* sp. nov. Holotype QMMO86408 shell details. **A.** Side view of protoconch (half embedded, orange with prominent purple-coloured nucleus) and initial region of teleoconch. **B.** Protoconch and entire spire (lacking spiral sculpture): note flare of outer lip in relation to spire. **C.** Anterior fasciole showing absence of inner lip plate and false umbilicus. **D.** Columella showing three plaits.

colour patterning. It also differs from *L. hydrographica* sp. nov. and *L. pithensis* sp. nov. by its lower spire, and protoconch nucleus colouration. See Figures 1, 2, 11 & 12.

Livonia mooloolaba sp. nov. is known primarily from numerous specimens obtained as bycatch of deepwater commercial prawn trawl operations in Southeastern Queensland, with paratypes 7-9 being the earliest institutional record known to us (all accessioned in QM collection, 27th July 1967). Additionally, a few dead, juvenile shells have been collected by research expedition vessels (paratypes 6 and 10) which at least helps to corroborate

locality information accompanying shells obtained via commercial fishing sources. The species has been recorded on muddy-sand and rubble on the continental slope from 125–280 m. It appears to be restricted to the Central Eastern Shelf Transition (=Tweed-Moreton Bioregion) with most specimens known from offshore of Cape Moreton and Mooloolaba (Sunshine Coast). The known northern limit is off Sandy Cape (K'gari / Fraser Island) (see Poppe & Goto, 1992, Pl. 59, Figs 4,5) but this may require further collection to substantiate. Although the southern limits of *L. mooloolaba* sp. nov. and the northern limits of *L. mammilla* are closer than for all the preceding new species, we have not found any inter-

grading specimens. Robin et al (2024, Fig. 3), in their visual documentation of the volute collection of the late Patrice Bail, illustrate an adult specimen said to be from “Lakes Entrance, South Australia”. Unquestionably this is a captioning or labelling error, *Livonia mooloolaba* sp. nov. only being recorded from south east Queensland (additionally, Lakes Entrance is in Victoria and not South Australia). The shell of *L. mooloolaba* sp. nov. is densely patterned with white tent marks formed by reticulating brown lines, and no unpatterned specimens are known to us. Compared to all other *Livonia*, *L. mooloolaba* sp. nov. has the most inflated, light-weight and thin-walled shell for its size. The shell is frequently marred by boring sponges and/or damaged by trawling and presumed crab attacks. No animals were available for anatomical examination, but prior observations by one of us (A.R.Field pers. obs. Nov 2000) indicate that the colour of the foot, head and siphon are mottled orange and therefore similar to *L. mammilla*.

Etymology: Named for Mooloolaba, east of which the holotype and three paratypes were trawled. Mooloolaba is considered to be a place name adapted from Kabi origin, referring to either place of Red-Bellied Snakes or Snapper Fish (Steele, 1984).

Disclosures

We declare that there are no conflicts of interest.

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