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# Glacidorbidae (Gastropoda: Heterobranchia) in South America: revision and description of a new genus and three new species from Patagonia

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The Glacidorbidae, a family restricted to the Gondwanan realm (Tasmania, southeastern and southwestern Australia, and southern Argentina and Chile), previously included five genera with 20 identified species; 19 of them are Australian, with one genus and species, *Gondwanorbis magallanicus* (Meier-Brook & Smith, 1976), from South America. Here we describe two new species of *Gondwanorbis*: *Gondwanorbis fueguensis* n. sp. from the freshwater gastropods province of Southern Patagonia (Argentina) and *Gondwanorbis tricarinatus* n. sp. from Chile, and a new genus and species from the freshwater gastropods province of northern Patagonia (Argentina), *Patagonorbis nahuelhuapensis* n. sp and n. gen.

http://www./zoobank.org/urn:lsid:zoobank.org:pub:62EA0972-3AEF-4188-8E6D-F10895CE2BEF

**Keywords:** Argentina; Chile; freshwater molluscs; Gondwana



## Introduction

The freshwater gastropod fauna from Australasia and South America is related by the presence of Tateidae, Chilinoidea and Glacidorbidae. Tateidae comprise various genera in Australasia and one recognised genus in South America, *Potamolithus* Pilsbry & Rush, 1896 (Wilke *et al*. 2013). The Chilinoidea comprise genus *Chilina* Gray, 1828 (Chilinidae) found only in South America and *Latia* Gray, 1828 (Latiidae) of New Zealand, which constitute a basal group from the Hygrophila (Dayrat *et al*. 2001). The systematic position of Glacidorbidae is well explained by Ponder and Avern (2000), who related them to the Pulmonata. Meier-Brook and Smith (1976) considered this taxon to be a 'prosobranch', Ponder (1986) and Healy (1995) considered it a lower pulmonate ('Basommatophora'), while Haszprunar (1988), Haszprunar and Huber (1990), Huber (1993), Bandel (1997), Dayrat and Tillier (2002), Bouchet and Rocroi (2005) and Strong *et al*. (2008) considered it a member of the lower Heterobranchia. However, recent molecular studies link the family with the basal 'Pulmonata' (Dinapoli and Klussmann-Kolb 2010; Holznagel *et al*. 2010; Dayrat *et al*. 2011; Golding 2012), as also suggested by anatomy (Ponder 1986) and sperm ultrastructure (Healy 1995).

The Glacidorbidae is restricted so far to the Gondwanan realm (Tasmania; southeastern and southwestern Australia; southern Chile) (Ponder and Avern 2000). Ponder (1986) studied the anatomy of the southeast Australian *Glacidorbis hedleyi* (Iredale, 1943) and classified the group as operculate basommatophoran pulmonates. He proposed the family Glacidorbidae and superfamily Glacidorbacea to include *Glacidorbis* Iredale, 1943 and its relatives; all of which are freshwater taxa. Ponder (1986) proposed two subgenera, *Gondwanorbis* Ponder, 1986 from South America and *Glacidorbis s.s.* from Tasmania and temperate mainland Australia. Starobogatov (1988) placed this family in the new order Glacidorbiformes, and elevated *Gondwanorbis* to generic rank. Ponder and Avern (2000) revised the Australian members of the group and proposed three new Australian genera (*Benthodorbis* Ponder & Avern, 2000, *Striadorbis* Ponder & Avern, 2000 and *Tasmadorbis* Ponder & Avern, 2000). In total there are 20 described species for the family (American and Australian).

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Only one species is currently known from South America, *Gondwanorbis magallanicus* (Meier-Brook & Smith, 1976), which was named by those authors as *Glacidorbis magallanicus*, based on five specimens collected from a small creek near Pehoé Lake, southern Chile. Rumi *et al.* (2006, 2008) and Núñez *et al*. (2010) included *G. magallanicus* in their revision of Argentinean freshwater molluscs based on records reported by Landoni *et al*. (1999) in the province of Tierra del Fuego (southern Patagonia, Gondwanan realm).

Here *Gondwanorbis fueguensis* n. sp., *Gondwanorbis tricarinatus* n. sp. and *Patagonorbis nahuelhuapensis* n. sp. and n. gen. are described for southern South America, bringing the total number of described glacidorbids to 23.

## Materials and methods

The material described here comes from the malacology collection of Museo de La Plata (MLP-Ma). Six shell measurements were taken: dmax—maximum diameter; dmin—minimum diameter; aph—aperture height; apw—aperture width; mdht—height at midpoint of shell; whl—total number of whorls. Shell and operculum morphology and ornamentation were observed on the better preserved specimens using a scanning electron microscope (JEOL100) in the Museo de La Plata. Dry individuals were hydrated by the protocol described by Holznagel (1998), to obtain radula and embryo shells inside the adult.

## Systematics

**Superfamily Glacidorboidea Ponder, 1986**
**Family Glacidorbidae Ponder, 1986**
**Genus *Gondwanorbis* Ponder, 1986**

### *Type species*

*Gondwanorbis magallanicus* (Meier-Brook & Smith, 1976)

### *Diagnosis*

Peripheral keel on shell. Base of central radular teeth about twice as wide as mesocone; radula with or without pair of vestigial lateral teeth. Circular, paucispiral operculum with central nucleus.

### *Remarks*

Only species of *Gondwanorbis* to have a peripheral keel on shell (Ponder and Avern 2000), but its level of development is a specific character (see descriptions below). Punctures on inner shell surface have been observed in the two species described below but have yet to be confirmed in the type species.


Figure 1. Species distribution of Glacidorbidae in South America. ■ *Gondwanorbis magallanicus*; ♦ *Gondwanorbis fueguensis* n. sp.; ▲ *Gondwanorbis tricarinatus* n. sp.; ● *Patagonorbis nahuelhuapensis* n. gen and n. sp.

### *Gondwanorbis magallanicus* (Meier-Brook & Smith, 1976)

*Glacidorbis magallanicus*.—Meier-Brook and Smith 1976: 193, Figs 1–6.
*Glacidorbis (Gondwanorbis) magallanicus*.—Ponder 1986: 82.
*Gondwanorbis magallanicus* Starobogatov 1988: 84; Ponder and Avern 2000: 348.
*Type material and type locality*: Pehoé Lake in Torres del Paine National Park, Chile (50°57′S, 73°03′W), coll. Karsten Reise, February 1971.
*Holotype*. Senckenberg Museum, Frankfurt, (SMF) 239465.
*Paratypes*. SMF 239466 (two specimens), same data.

### *Diagnosis*

'A species of *Glacidorbis* with short mesocone on the central bearing 4 to 5 denticles on each side; shell smooth, almost glossy with weak carination' (from Meir-Brook and Smith 1976: 193).

### *Original description*

> Shell planspiral, 2–2.8 mm wide, 0.8–1.0 mm high, with 2½ to 2¾ whorls. Periphery with one keel situated centrally between upper and under side. Last whorl loosely touching the penultimate whorl. Aperture round. Growth rings straight. Periostracum brown, surface smooth, almost glossy. Operculum thin, corneus with the same number of the whorls as the shell. The radula consists of 28 rows of teeth consisting either of the centrals only or accompanied by vestiges of the lateral tooth. The dimensions of the central teeth are: 42 µm wide and 27 µm long.

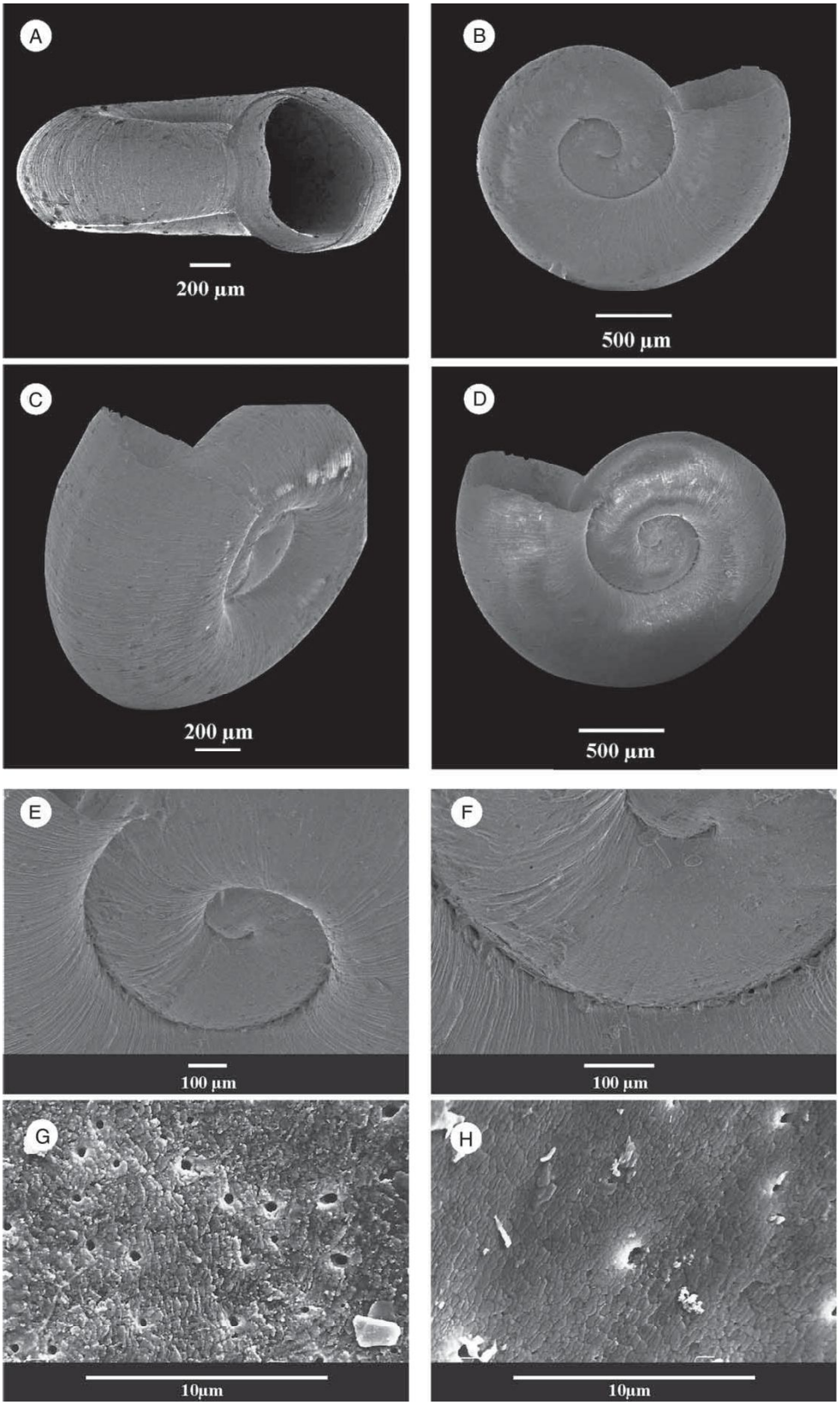


Figure 2. *Gondwanorbis fueguensis* n. sp. from Yehuin Lake. **A,** Lateral view; **B,** ventral view; **C,** partial oblique dorsal view; **D,** dorsal view; **E, F,** dorsal view of protoconch; **G,H,** punctures on inner surface of shell.

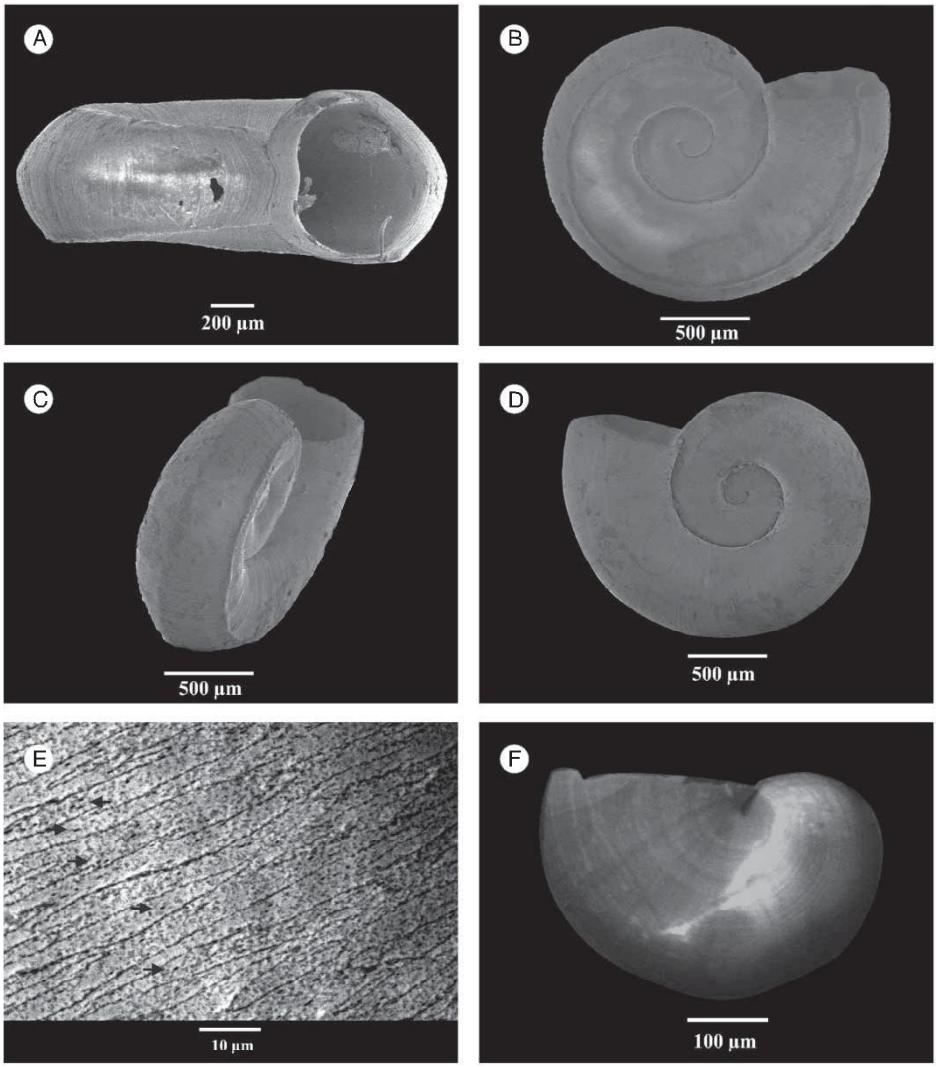


Figure 3. *Gondwanorbis tricarinatus* n. sp. from Cisnes Lake, Chile. **A,** Lateral view; **B,** ventral view; **C,** oblique ventral view; **D,** dorsal view; **E,** punctures on inner surface of shell, arrows show location of punctures; **F,** dorsal view of an embryonic shell from inside adult specimen from Torres del Paine (MLP-Ma 13659).



> The mesocone is armed with 4 to 5 denticles on each side; no basal denticles occur. The vestiges of the lateral teeth, if present, are reduced, 6 to 7 µm wide and 15 to 16 µm long, rhombic in shape and lacking denticles. No ctenidia. (from Meir-Brook and Smith 1976: 193)

### *Distribution*

Only known from the type locality, a small creek near Pehoé Lake, Chile (Fig. 1).

### *Remarks*

Ponder and Avern (2000) added to the original description the circular, paucispiral operculum with a central nucleus. The absence of a ctenidium is a feature of all Heterobranchia. Attempts to find this species in and around the type locality in November 2008 were unsuccessful (W. Ponder, pers. comm. Feb. 2015).

## ***Gondwanorbis fueguensis* Rumi & Gutiérrez Gregoric n. sp.**

(Fig. 2)

### *Synonymy*

*Glacidorbis* sp.—Landoni *et al*. 1999.

*Gondwanorbis magallanicus*.—Rumi *et al*. 2006: 199–200 in part, 206; Rumi *et al*. 2008: 81 in part; Núñez *et al*. 2010: 51, 56, 58 in part.

*Type material and type locality*. Western shore of Yehuin Lake, Tierra del Fuego province, Argentina (54°26′S, 67°44′W), coll. Sandra Gordillo, April 1996.

*Holotype*. MLP-Ma 13552.

*Paratypes*. MLP-Ma 13553 (one specimen) and MLP-Ma 5503 (nine specimens), same data.

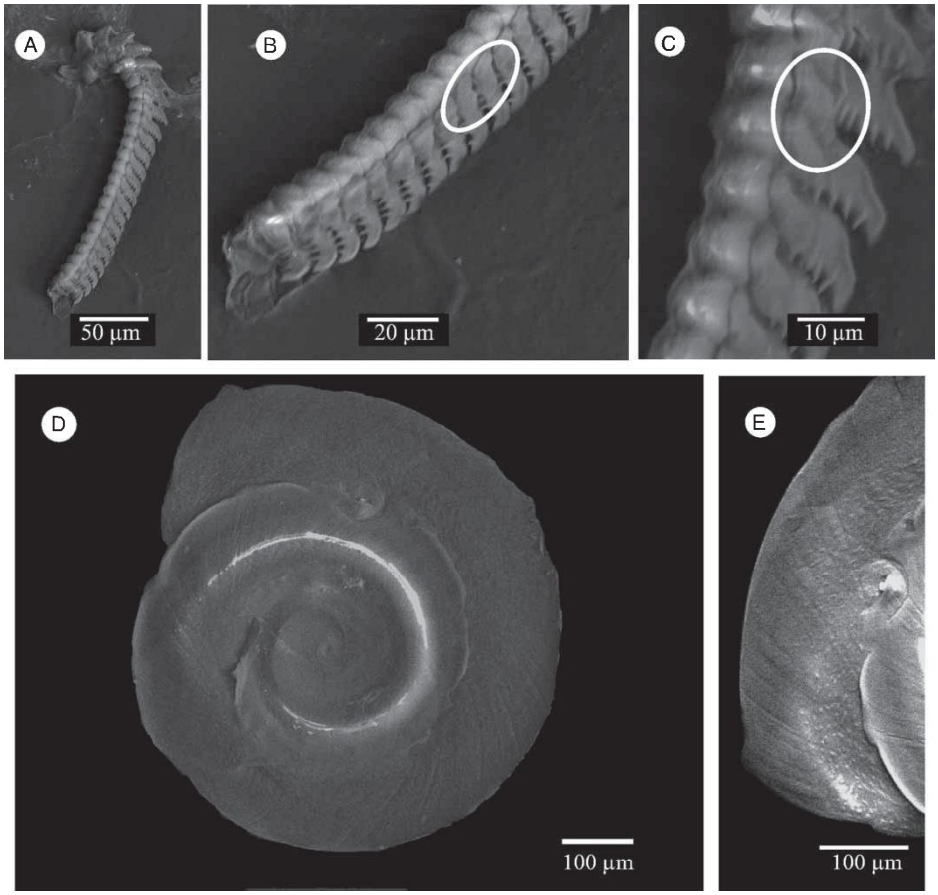


Figure 4. *Gondwanorbis tricarinatus* n. sp. from Torres del Paine (MLP-Ma 13659), Chile. **A–C,** Radula; B and C: circle indicates the vestigial lateral tooth; **D,** operculum; **E,** detail of outer surface ornament of operculum.



### *Diagnosis*

Protoconch with apical and secondary sculpture with spiral lines. Teleoconch sculpture with fine, orthocline growth lines. Periphery of last whorl evenly convex; periphery with weak angulation.

### *Description*

Shell (Fig. 2, Table 1): small (up to 2.08 mm in maximum diameter observed), planispiral, up to 2.30 total convex whorls (holotype 2.25 whorls). Protoconch of 0.90 of whorl, immersed; apical sculpture with thin axial lines crossed by concentric slightly high lines giving reticulated aspect; secondary sculpture with spiral lines. Teleoconch sculpture with fine, orthocline growth lines. Dorsal surface of whorls convex near suture, sutures impressed; periphery of last whorl evenly convex; whorl rounded, peripheral keel present as weak angulation. Aperture near circular. Some punctures present on inner surface of shell.

### *Distribution and habitat* (Fig. 1)

The sample from Yehuin Lake was obtained by collection of sediments on the shores of the lake. This large lake is 53 km$^2$, and centrally located in the province of Tierra del Fuego at 241 m above sea level. It has a half moon shape where the western shore is the longest and receives small creeks from the surrounding hills. According to Mariazzi *et al*. (1987), the water is cold and clear, with low salt concentration, a pH of 7.6, with a predominance of bicarbonate and calcium ions. It is an oligotrophic lake, very poor in nutrients and with low primary production.

### *Etymology*

The use of *fueguensis* refers to the Tierra del Fuego province, Argentina, where this species was found.

### *Remarks*

Material deposited in MLP-Ma consists of dry shells without any trace of animal tissue or operculum. Peripheral keel of *G. fueguensis* much weaker compared with *G. magallanicus*. Also, for equivalent size, number of whorls of *G. fueguensis* is less. Mean of maximum diameter/ height ratio (mean = 2.511; $n = 5$) differs from that of *G. fueguensis* (mean = 3.63; $n = 11$), showing that

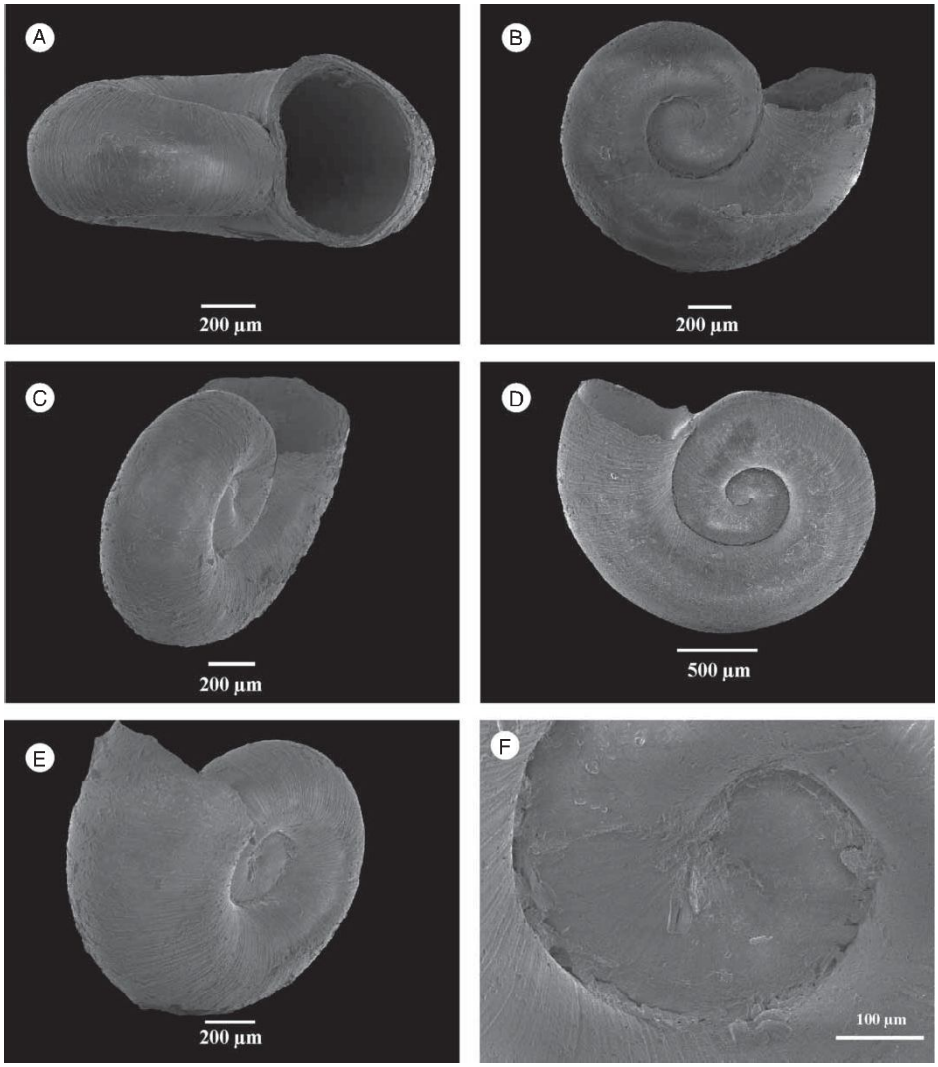


Figure 5. *Patagonorbis nahuelhuapensis* n. gen and n. sp. from Nahuel Huapi Lake, Argentina. **A,** Lateral view; **B,** ventral view; **C,** oblique ventral view; **D,** dorsal view; **E,** oblique dorsal view; **F,** ventral view of protoconch.



shell height of specimens of *G. fueguensis* is relatively less than that of *G. magallanicus*.

### *Gondwanorbis tricarinatus* Rumi & Gutiérrez Gregoric n. sp.

(Figs 3, 4)

*Type material and type locality*. Cisnes Lake, Chile (47°06′49″S, 72°26′57″W, coll. D. Alvarez), January 2010.

*Holotype*. MLP-Ma 13657.

*Paratypes*. MLP-Ma 13658 (three specimens), same data.

*Other material*. MLP-Ma 13659 collected in the stomach contents of fish, *Galaxias platei* Steindachner, 1898 in Pehoé Lake, Torres del Paine National Park, Chile (51°03′42″S, 72°59′26″W), coll. J. González, one specimen and a broken one, January 2009.

#### *Diagnosis*

Shell with three keels, two strong (peripheral and ventral), and one weak (dorsal). Apical and secondary protoconch sculpture with fine spiral lines. Radula: central with five or six cusps of similar size, strong, long and pointed, positioned laterally to mesocone. Vestigial lateral teeth simple and short (40% height of central teeth).

#### *Description*

Shell (Fig. 3, Table 1): small (up to 2.18 mm in maximum diameter), planispiral, of about 2.25 convex whorls in total. Protoconch of near one whorl; apical sculpture with spiral threads; secondary sculpture with spiral threads. Teleoconch with orthocline growth lines with three keels; dorsal keel weak in middle of whorl; ventral keel strong in middle of whorl; peripheral keel strong. Aperture polygonal. Punctures on inner surface of shell.

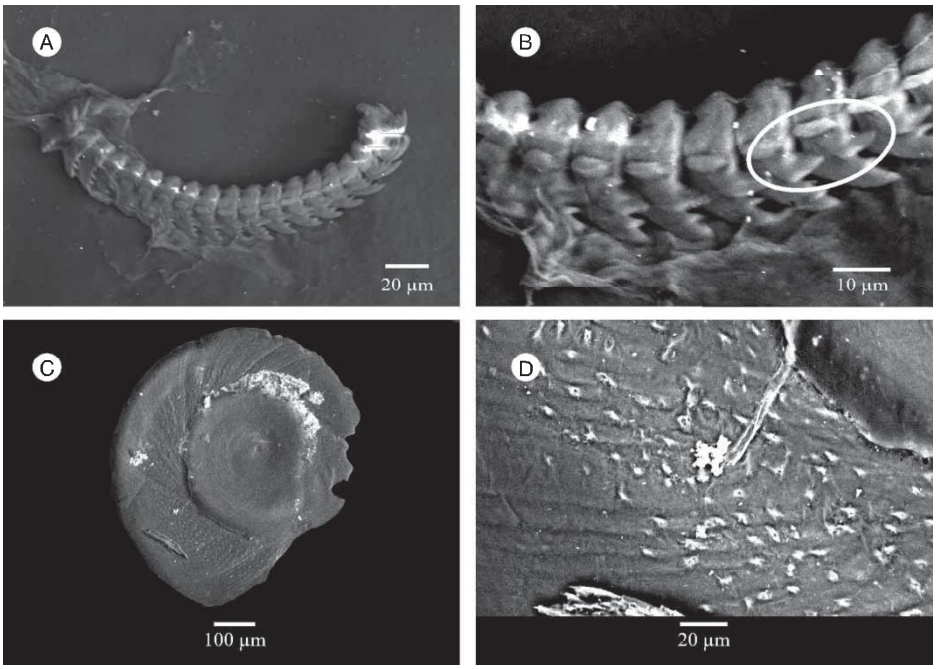


Figure 6. *Patagonorbis nahuelhuapensis n*. gen and n. sp. from Nahuel Huapi Lake, Argentina. **A,B,** radula; B: circle indicates the vestigial lateral tooth; **C,** operculum; **D,** detail of outer surface ornament of operculum.

Operculum (Fig. 4): oval with nucleus eccentric to subcentral (width 0.59 mm, length 0.69 mm; $n = 1$), slightly concave, of 2.5 whorls with little or no overlap. Opercular sculpture on outer surface with granules.

Radula (Fig. 4): of 24 rows with a length of 0.25 mm. Central teeth triangular, mesocone curved with five or six cusps of uniform size, strong, long, pointed, positioned laterally on mesocone. Angle with regard to base: 46°. Vestigial lateral tooth short (40% of central), triangular, directed forward.

### *Distribution and habitat*

*Gondwanorbis tricarinatus* is only known in the two localities mentioned here, Cisnes and Pehoé lakes (Chile) (Fig. 1). The samples from Cisnes Lake were taken from a sediment core of 147 cm long, which was obtained from the deepest part of the lake (18 m). Unpublished data (D. Alvarez, pers. com. 2012) suggest that specimens of this species are present throughout the core, much of which is about 6000 years old, except for the uppermost part (20 years).

### *Etymology*

The use of *tricarinatus* is indicative of the three keels on the shell.

### *Remarks*

This new species is placed in *Gondwanorbis* because of the presence of a peripheral keel that is thought to be diagnostic of this genus. *Gondwanorbis tricarinatus* differs from *G. magallanicus* and *G. fueguensis* mainly by the presence of a strong peripheral keel, as well as two additional keels, one weak dorsal and one strong ventral, both of which are lacking in *G. magallanicus* and *G. fueguensis*. Figure 3F is an embryonic shell extracted from inside an adult, suggesting that this species may brood in the mantle cavity as seen in some Australian species.

## Genus *Patagonorbis* Rumi & Gutiérrez Gregoric n. gen.

### *Type species*

*Patagonorbis nahuelhuapensis* Rumi & Gutiérrez Gregoric.

### *Diagnosis*

Shell without keels, with fine growth lines, slightly hyperstrophic. Secondary protoconch with spiral lines. Operculum oval with pustules on exterior edges. Radula with medium-sized but semi-vestigial lateral teeth. No punctures on shell interior.

### *Remarks*

*Patagonorbis* is similar to *Gondwanorbis* but differs in at least three features: lack of a peripheral keel, shell slightly hyperstrophic, and more developed lateral teeth. Moreover, both genera are recorded in different and distant river basins.

Table 1. New Glacidorbidae species from South America.

| | dmax | dmin | aph | apw | mdht | whl |
|---|---|---|---|---|---|---|
| *Gondwanorbis magallanicus* Pehoe Lake | | | | | | |
| Holotype SMF 239465 | 2.85 | | | | 1.0 | 2.75 |
| Paratype SMF 239466 | 2.7 | | | | 0.95 | |
| Paratype SMF 239466 | 2.0 | | | | 0.8 | |
| Ind. 2° | 2.8 | | | | 1.05 | 2.75 |
| Ind. 3° | 2.5 | | | | 1.0 | |
| *Gondwanorbis fueguensis* Yehuin Lake | | | | | | |
| Holotype MLP-Ma 13552 | 1.90 | 1.53 | 0.67 | 0.49 | 0.68 | 2.25 |
| Paratype MLP-Ma 13553 | 2.08 | 1.60 | 0.83 | 0.61 | 0.52 | 2.30 |
| MLP-Ma 5503 | 1.13 | 0.88 | 0.53 | 0.45 | 0.38 | 1.50 |
| MLP-Ma 5503 | 1.43 | 1.10 | 0.68 | 0.55 | 0.43 | 1.75 |
| MLP-Ma 5503 | 1.65 | 1.33 | 0.73 | 0.63 | 0.43 | 2.00 |
| MLP-Ma 5503 | 1.70 | 1.40 | 0.75 | 0.55 | 0.45 | 2.00 |
| MLP-Ma 5503 | 1.95 | 1.60 | w/d | w/d | 0.48 | 2.25 |
| MLP-Ma 5503 | 1.90 | 1.58 | 0.68 | 0.65 | 0.50 | 2.20 |
| MLP-Ma 5503 | 1.93 | 1.63 | 0.80 | 0.83 | 0.55 | 2.25 |
| MLP-Ma 5503 | 2.00 | 1.63 | 0.80 | 0.73 | 0.53 | 2.25 |
| MLP-Ma 5503 | 2.05 | 1.65 | 0.80 | 0.73 | 0.50 | 2.25 |
| *Gondwanorbis tricarinatus* Cisnes Lake | | | | | | |
| Holotype MLP-Ma 13657 | 1.93 | 1.35 | 0.73 | 0.58 | 0.38 | 2.00 |
| Paratype MLP-Ma 13658 | 2.10 | 1.63 | 0.88 | 0.73 | 0.55 | 2.25 |
| Paratype MLP-Ma 13658 | 0.78 | 0.60 | 0.45 | 0.33 | 0.30 | 1.125 |
| Paratype MLP-Ma 13658 | 2.18 | 1.83 | 0.83 | 0.75 | 0.55 | 2.25 |
| *Gondwanorbis tricarinatus* Torres del Paine | | | | | | |
| MLP-Ma 13659 | 2.13 | 1.63 | 0.93 | 0.70 | 0.55 | 2.25 |
| *Patagonorbis nahuelhuapensis* Nahuel Huapi Lake | | | | | | |
| Holotype MLP-Ma 13655 | 1.63 | 1.30 | 0.75 | 0.58 | 0.50 | 2.125 |
| Paratype MLP-Ma 13656 | 1.50 | 1.13 | 0.75 | 0.60 | 0.43 | 2.125 |
| *Patagonorbis nahuelhuapensis* Gutiérrez Lake | | | | | | |
| MLP-Ma 5504 | 2.13 | 1.73 | 0.90 | 0.78 | 0.60 | 2.25 |
| MLP-Ma 5504 | 2.15 | 1.73 | 0.88 | 0.60 | 0.63 | 2.25 |
| MLP-Ma 5504 | 2.03 | 1.60 | 0.83 | 0.63 | 0.48 | 2.25 |

Measurements of shell (millimetres).
Abbreviations: aph—aperture height; apw—aperture width; dmax—maximum diameter; dmin—minimum diameter; mdht—height (at midpoint of shell); whl—total number of whorls; w/d—without data.



With respect to Australasian species, the hyperstrophic coiling pattern is only present in the following species: *Glacidorbis troglodytes* Ponder & Avern, 2000 (some specimens), *Benthodorbis* spp. (*Benthodorbis pawpela* (Smith, 1979) and *Benthodorbis fultoni* Ponder & Avern, 2000) and some specimens of *Tasmadorbis punctatus* Ponder & Avern, 2000. But comparing these genera with *Patagonorbis*, *Glacidorbis troglodytes* is smooth; *Benthodorbis* spp. have weak spiral threads on the periphery, prosocline growth lines and the opercular whorls overlap. Finally, the operculum of *T. punctatus* is circular with a central nucleus, seven overlapping whorls (similar to *Striadorbis*) and smooth surface, and the radula has one cusp much larger (autapomorphy of *Tasmadorbis*).

### *Etymology*

*Patagonorbis* is named in reference to the Patagonia Region of Argentina.

### ***Patagonorbis nahuelhuapensis* Rumi & Gutiérrez Gregoric n. sp.**

(Figs 5, 6)

### *Synonymy*

*Gondwanorbis magallanicus*.—Rumi *et al*. 2006: 199–200 in part, 206; Rumi *et al*. 2008: 81 in part; Núñez *et al*. 2010: 51, 56, 58 in part.

*Type material and type locality*. Nahuel Huapi Lake, San Carlos de Bariloche, Río Negro province, Argentina (41°09′S, 71°18′W), collected in the stomach contents of catfish, *Diplomystes viedmensis*, by V. Flores.

*Holotype*. MLP-Ma 13655.

*Paratype*. MLP-Ma 13656 (one specimen), same data.

*Other material*. MLP-Ma 5504 Gutiérrez Lake, San Carlos de Bariloche, Río Negro province, Argentina (41°08′S, 71°17′W), September 1994; three complete specimens and a few broken ones.

### *Diagnosis*

Shell without keels, with fine growth lines. Secondary protoconch sculpture with spiral lines. Shell slightly hyperstrophic. Operculum oval with granules on exterior edges. Opercular whorls with little or no overlap. Radula: central teeth with three cusps on each side of mesocone with even cusp pattern. Semi-vestigial lateral teeth curved forward and medium-sized (49% of the central).

### *Description*

Shell (Fig. 5, Table 1): small (up to 2.15 mm in maximum diameter), light brown. Coiling pattern shell slightly hyperstrophic of about 2.25 total convex whorls. Protoconch with initial part distinctly inclined downwards, secondary protoconch sculpture with spiral lines. Teleoconch with fine and irregular growth lines (orthocline). Without keel. Aperture circular.

Operculum (Fig. 6): oval (width 0.59 mm, length 0.69 mm; $n = 1$), slightly concave, with 2.5 whorls with little or no overlap; nucleus subcentral. Exterior with numerous rather irregular rows of partly spirally arranged granules on last whorl.

Radula (Fig. 6): of 20 rows with a length of 0.17 mm. Central teeth triangular, curved, with three strong, long, pointed cusps of similar length positioned laterally to the mesocone. Angle with regard to the base: 24°. Semi-vestigial lateral teeth medium (49% of the central), triangular aspect, and directed forward.

### *Distribution and habitat*

Known only from two localities of West Andean Patagonia: Nahuel Huapi and Gutiérrez lakes, San Carlos de Bariloche, Río Negro province (Fig. 1). Nahuel Huapi Lake is 557 $km^2$ and is located approximately 700 m above sea level. It is notable for its depth (464 m) and its seven arms. Water comes from snowmelt, and other less extensive lakes, such as Gutiérrez, Moreno, Espejo and Correntoso. Gutiérrez Lake has an area of about 17 $km^2$, is up to 111 m deep and is at 800 m above sea level. It is situated in an Atlantic watershed and empties through the Gutiérrez Stream, into Nahuel Huapi Lake. The water is relatively temperate, as its main contribution is not the thawing of winter snows, but winter–spring rain.

### *Etymology*

The use of *nahuelhuapensis* is in reference to the Nahuel Huapi Lake from Patagonia were this species was found.

### *Remarks*

We had only one specimen containing an animal to observe both the operculum and radula, so we are unable to discuss variation. In Rumi *et al*. (2006, 2008) and Núñez *et al*. (2010), Gutiérrez Lake material was determined as *G. magallanicus*. *Patagonorbis nauelhuapensis* is readily distinguished from other glacidorbids in South America (*Gondwanorbis* spp.) by absence of an angulation or keels on the periphery, the hyperstrophic coiling pattern and the protoconch with the initial part distinctly inclined downwards.

## Discussion

Shell punctures are present on the inner surface of the two new species of *Gondwanorbis* shells. These have only previously been observed in the Tasmanian genus *Tasmadorbis*, and this character is now shared with *Gondwanorbis*. *Tasmadorbis*, however, differs from *Gondwanorbis* in having one much larger cusp on the central teeth. *Patagonorbis* and *Gondwanorbis* have spiral threads on the protoconch, like *Striadorbis* and *Tasmadorbis*; *Benthodorbis* is the only representative glacidorbid without this feature (Ponder and Avern 2000).

*Gondwanorbis* shares with *Tasmadorbis* and *Striadorbis* the presence of a circular operculum with a central nucleus (Ponder and Avern 2000). The analysed material of *G. tricarinatus* shows that the operculum on *Gondwanorbis* may also be oval—the partial image of the operculum published by Meier-Brook and Smith (1976) may misinterpret its appearance. In contrast, *Patagonorbis* has an oval operculum with a subcentral nucleus as in *Glacidorbis* and *Benthodorbis* (Ponder and Avern 2000).

These records extend the distribution and diversity of this family in South America. The shortage of records may be due to the small size of samples or to possibly erroneous determination in some instances, as glacidorbids can be confused with juvenile shells of planate Planorbidae, which are represented in southern South America by three genera, *Antillorbis* Harry & Hubendick, 1963, *Drepanotrema* Fischer & Crosse, 1880 and *Biomphalaria* Preston, 1910. More intensive field work in Patagonian lakes, swamps and small streams would allow us to confirm the real distribution, diversity and abundance in this family in South America.

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