

Charopatagonia, a new genus of Charopidae from meridional America, with description of two new species

(Mollusca, Eupulmonata, Punctoidea)

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A new genus, *Charopatagonia*, and two new extant species, *C. fragilis* and *C. delicatissima*, are described from Patagonia. *Charopatagonia* is classified as Charopidae, Charopinae on shell structure and radula dentition, with the diagnostic characters: shell discoidal to planispiral; protoconch whorls almost flat, sculptured with spiral cords; umbilicus narrow; teleoconch with radial ribs and microradials bearing elevated peristrial lamellae; radula with formula M7–L3–C–L3–M7, central tooth and lateral teeth tricuspid, marginal teeth primarily bicuspid with elongate cusps. Also assigned to the new genus are the extant species *Radiodiscus villarricensis* from southern Chile, and – tentatively – the fossil taxa *Punctum patagonicum* and *Radiodiscus sanrafaelensis* from Argentine Mio-Pliocene.

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Introduction

The superfamily Punctoidea constitutes a significant component of the land snail fauna of Patagonia, in the austral area of South America, with numerous genera and species. Several genus-group taxa have long been known as endemic to the region, including *Payenia* Rochebrune & Mabilie, 1889 and *Austrodiscus* Parodiz, 1957 (see synopsis in Annex 2). Nonetheless, knowledge of the punctoidean diversity in Patagonia is still far from complete, as illustrated by the recognition on morphological grounds in recent years of a number of additional taxa in the region, including the regional endemic genera *Araucocharopa* Miquel & Cádiz Lorca, 2008 and *Neoparyphantopsis* Miquel & Araya, 2015. Shape and sculptural characters of teleoconch and protoconch, and in some cases along with radular dentition, have been the common currency in

erecting punctoidean genus-group taxa (e.g., Solem 1976, 1983). Nonetheless, recent studies continue to elucidate unique combinations of conchological characters that are ascribed to new genera among South America Punctoidea, suggesting a significant component of South America Punctoidea diversity remains to be discovered. In this paper, we describe one such discovery, erecting a new genus and two new species from southern Chile. Two Argentine fossil species are also considered to belong to this new genus-group taxon.

Materials and methods

The samples were collected from rain forest leaf litter in Patagonian Chile. Specimens were processed by drowning in water, and fixed and stored in 70% ethanol. Stereomicroscopic examination of shells was supple-

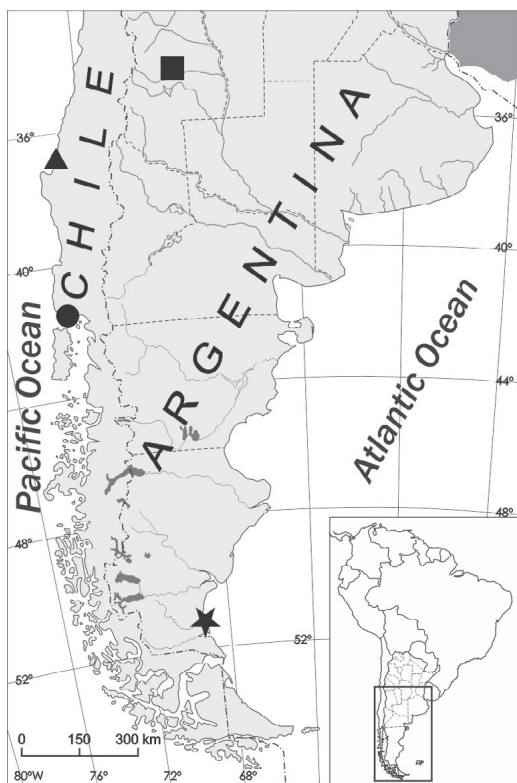


Fig. 1. Distribution of *Charopatagonia* gen. nov. in South America. ▲ *Charopatagonia fragilis* sp. nov. and *Radiodiscus villarricensis* Miquel & Barker, 2009: Botanical Park Hualpén and Fundo El Manzano, Concepción, Chile. ● *Charopatagonia delicatissima* sp. nov.: Maullín, Chile (41°39'12"S, 73°35'18"W). ■ †*Radiodiscus sanrafaelensis* Turazzini & Miquel, 2014: San Rafael city, Mendoza, Argentina. ★ †*Punctum patagonicum* Miquel & Rodríguez, 2015: "Puesto de la Estancia La Costa" (=Corriguen Aike; 51°12'8.2"S, 69°03'35.6"W), between the Coyle and Gallegos Inlets, Argentina.

mented by scanning electron microscopy utilizing specimens coated with gold-palladium to elucidate features of teleoconch and protoconch sculpture. Two specimens containing soft parts were processed by critical point drying in an attempt to avoid the collapse of the shell walls under the vacuum of the scanning electron microscope.

In addition to the new taxa described herein, we studied other specimen material for comparative purposes. These are listed in Annex 1.

Abbreviations. ANSP, Academy of Natural Sciences of Philadelphia; MACN-In, Invertebrates Division, Museo Argentino de Ciencias Naturales, Buenos Aires.

Results

Superfamily Punctoidea Hutton, 1884

Family Charopidae Hutton, 1884

Subfamily Charopinae Hutton, 1884

Charopatagonia gen. nov.

Diagnosis. Shell minute, often thin and fragile; discoidal to planispiral as spire weakly elevated; perforate, umbilicus narrow, scarcely perspective; embryonic and adult whorls well differentiated by distinct sculptures, protoconch with numerous closely-spaced spiral cords or lirae, but lacking any radial sculpture; teleoconch ornamented by radial ribs, running almost straight to sigmoidal over periphery, with radial riblets and finer spiral cords occupying intercostal spaces, often somewhat nodular at their intersection; radial ribs and riblets calcareous, summited by elevated periostracal lamellae.

Description

Shell minute, not exceeding 2.75 mm width at 4.25 whorls; discoidal to almost planispiral as spire very weakly elevated; shell height to width ratio 0.38 to 0.56; aperture broad, rounded; perforate, umbilicus narrow at about 0.20 shell width, scarcely perspective. Protoconch ~500 µm diameter, of about 1.75 whorls, with about 15 continuous, crowded, rounded spiral cords or lirae; sharply differentiated from teleoconch in lacking radial sculpture. Teleoconch ornamented with primary radial ribs, weakly prosocline, almost straight or sigmoid in running over periphery, and each surmounted by single or double blade-like periostracal lamella; region between ribs with 4 to 9 closely spaced riblets or microradials, each of which have elevated periostracal lamella, and variably nodular at intersection with very fine spiral cords. Aperture little descendent, broadly rounded, rim simple, thin, not expanded or reflected; aperture lacking barriers. Periostracum cream or golden yellow, with or without darker flammulations. Type species, *radula* dentition M7–L3–C–M3–L7; central tooth and lateral teeth tricuspid, marginal teeth primarily bicuspid with elongate cusps.

Etymology. Combination of 'Charo' from *Charopa* Hutton, 1884 (type genus of the family Charopidae) and Patagonia, the southern American region from which extant members of the new taxon are endemic.

Type species. *Charopatagonia fragilis* sp. nov.

Other members of the genus. *Charopatagonia delicatissima* sp. nov. and *Radiodiscus villarricensis* Miquel & Barker, 2009 from southern Chile. The extinct species *Radiodiscus sanrafaelensis* Turazzini & Miquel,

2014 from Early Pliocene of Mendoza, Argentina and *Punctum patagonicum* Miquel & Rodríguez, 2015 from Early Miocene of Santa Cruz Province, Argentina are tentatively also assigned.

Distribution. The three known extant species inhabit southern Chile (Fig. 1).

Grammatical gender. Feminine.

Charopatagonia fragilis sp. nov.

Figs 1, 2A–B, 3A–C, Table 1

Description

Shell of minute, up to 2.75 mm width, discoidal, spire very weakly elevated, body whorl descending slightly more rapidly, height to width ratio 0.38; with 4.25 convex whorls regularly increasing in width; walls very thin, pliable and fragile, rather translucent; ornamented with conspicuous radial ribs; aperture 0.76 shell height, broad, rounded, little descendant; umbilicus narrow at 0.20 shell width. Protoconch essentially discoidal, with 1.75 whorls, first nuclear part bulbous, without sculpture, subsequently with ~15 rounded spiral cords or lirae that become obsolete just before commencement of teleoconch; radial sculpture entirely lacking. Teleoconch up to 2.5 whorls, with radial ribs somewhat irregularly spaced, running more or less straight to weakly and broadly sigmoidal over shell periphery, each surmounted by elevated double blade-like periostracal lamellae; region between ribs with 4 to 9 closely spaced riblets or microradials, each bearing elevated

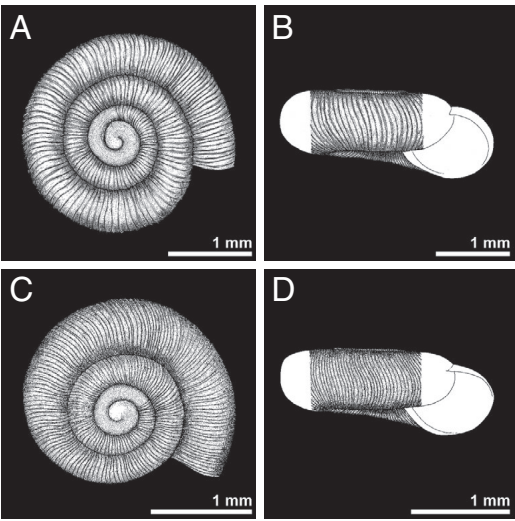


Fig. 2. A–B. *Charopatagonia fragilis* sp. nov., holotype MACN-In 44061. A. Apical view. B. Apertural view. C–D. *Charopatagonia delicatissima* sp. nov., holotype MACN-In 44063. C. Apical view. D. Apertural view.

periostracal blade of variable height, and very fine spiral cords occasionally nodular at intersection with riblets. Holotype with 105 radial ribs on last whorl. Suture deeply impressed. Periostracum pale cream, translucent, with traces of reddish flammulations; shell colouration in live material strongly influenced by underlying animal tissues (especially red-brown of digestive gland and cream-brown ovotestis). The measurements are indicated in Table 1.

Table 1. Measurements of shells for species included in *Charopatagonia* gen. nov. * = Specimens damaged, details obscured by partially extended animal, † = fossil material.

Taxon (original names)	Width (mm)	Height (mm)	Aperature dimensions (mm)	Umbilicus width (mm)	Whorls: Protoconch + Teleoconch	Ribs on last whorl
<i>Charopatagonia fragilis</i> gen. et. sp. nov. Holotype MACN-In 44061	2.75*	1.05	~0.80×0.80	0.55*	4.25: 1.75+2.50	125
<i>Charopatagonia delicatissima</i> gen. et. sp. nov. Holotype MACN-In 44063	2.35*	0.95*	0.80×0.80*	0.40*	4: 1.75+2.25	135
<i>Radiodiscus villarricensis</i> Miquel & Barker, 2009 Holotype	2.27	1.27	0.60×1.00	0.53	3.75: 1.75+2.00	65
† <i>Punctum patagonicum</i> Miquel & Rodríguez, 2016 Holotype	1.70	1.45	–	–	+3.5: 1.5+2.00	75
† <i>Radiodiscus sanrafaelensis</i> Turazzini & Miquel, 2014 Holotype	1.56	0.78	–	–	4: 1.75+2.25	180–190

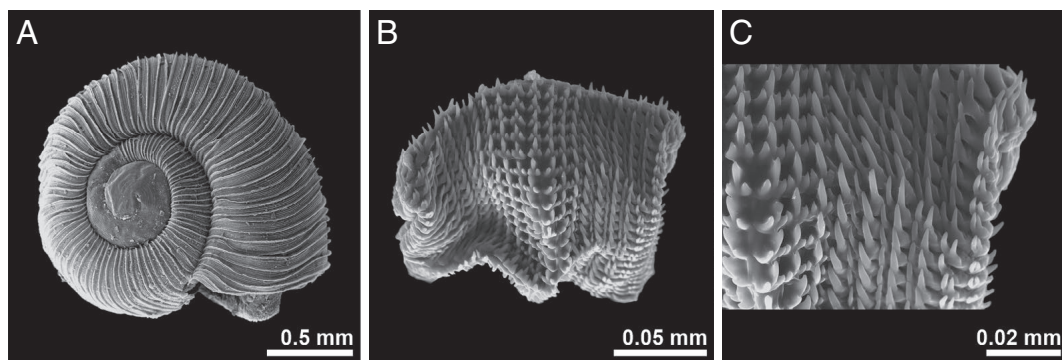


Fig. 3. *Charopatagonia fragilis* sp. nov., paratype MACN-In 44062. A. Apical view. Topotype. MACN-In 44062/1. B. General view of the radula. C. Details of marginal teeth.

Radula dentition (Fig. 3B–C) $\frac{M7}{2-(3)} + \frac{I3}{3} + \frac{C}{3} + \frac{I3}{3} + \frac{M7}{2-(3)}$; central tooth tricuspid, with short pointed ectocones set at higher plain with respect to larger, more elongate mesocone; lateral teeth similarly tricuspid; marginal teeth bicuspid, each with more or less equally elongated endocone and mesocone, diminishing in size towards radula margin and with additional small nodular cusp.

Other aspects of anatomy not known.

Etymology. Species named for the fragility of the shell.

Type locality. Parque Botánico Hualpén, Concepción, Chile (36°47'35" S, 73°09'33" W, ~30 m altitude). In forest of angiosperms, adjacent to lake.

Studied materials. In ethanol: Holotype MACN-In 44061. – Paratypes (5 specimens) MACN-In 44062. MACN-In 44062/1, topotype (1 radula) employed for imaging by scanning electron microscopy. Types and topotype collected by G. M. Barker and S. E. Miquel, 13-X-1996.

Distribution. Known only from the type locality in southern Chile.

Comparative remarks. *Charopatagonia fragilis* sp. nov. and *Charopatagonia villarricensis* (new combination) are similar in that the radial ribs are surmounted by two periostracal lamella blades. *Charopatagonia fragilis* sp. nov. differs from *C. villarricensis* however, in the number of primary radial ribs (105 vs 65 on last whorl), the much weaker nodulation at the intersection of radial riblets with the fine spiral cords, and in the fragility of its shell. The fossil taxa *Charopatagonia patagonicum* (new combination) and *Charopatagonia sanrafaelensis* (new combination) are smaller and have different numbers in ribs on last whorl (75 and 180–190, respectively) (Table 1).

Charopatagonia delicatissima sp. nov.

Figs 1, 2C–D, Table 1

Description

Shell minute, 2.35 mm width, discoidal, spire very weakly elevated, body whorl descending slightly more rapidly, height to width ratio 0.40; with 4 convex whorls regularly and rather rapidly increasing in width; walls very thin, translucent; profusely ornamented with low, radial ribs; aperture 0.84 shell height, rounded and a little descendent; umbilicus narrow at 0.17 shell width. Protoconch discoidal, with 1.75 whorls, first nuclear part bulbous, without sculpture, subsequently with ~15 rounded spiral cords or lirae that become obsolete just before commencement of teleoconch; radial sculpture entirely lacking. Teleoconch 2.25 whorls, with closely spaced, prosocline delicate radial ribs, running broadly sigmoidal over shell periphery, each surmounted by elevated blade-like periostracal lamella; region between ribs with closely spaced riblets or micro-radials, each bearing an elevated periostracal blade of variable height, and very fine spiral cords which are occasionally nodular at intersection with riblets. Holotype with 135 radial ribs on body whorl. Suture deeply impressed. Periostracum golden yellow, translucent, without darker flammulations or other markings; shell colouration in live material strongly influenced by underlying animal tissues (especially red-brown of digestive gland and cream-brown ovotestis). The measurements are indicated in Table 1.

Anatomy not known.

Etymology. In reference to the shell, which is scarcely calcareous.

Type locality. Maullín, Chile (41°39'12" S, 73°35'18" W, about 6 m altitude).

Studied materials. In ethanol: Holotype MACN-In 44063. – Paratype (juv.) MACN-In 44064. Maullín, Route 5, Chile. In mixed forest of *Nothofagus* and other angiosperms. Collected by G. M. Barker & S. E. Miquel, 20-X-1996.

Distribution. Southern Chile.

Comparative remarks. *Charopatagonia delicatissima* sp. nov. differs from *C. fragilis* sp. nov. and *C. villarricensis* in the greater number of radial ribs, their periostracal lamellae being single rather than double, distinctly sigmoid path over the periphery, and more delicate nature; and the golden colour of the periostracum without any trace of flammulations or other markings. The much greater numbers in teleoconch ribs and smaller shell size differentiate *C. sanrafaelensis* from *C. delicatissima* sp. nov. (Table 1).

Discussion and conclusions

The shells of *C. fragilis* sp. nov. and *C. delicatissima* sp. nov. are weakly calcified, very thin, pliable and fragile. This is a natural feature, but may have been accentuated by some decalcification during storage in 70 % ethanol since 1996. Because of the specimen fragility and rarity, we were unable to obtain high quality photographic images of the shell. The respective holotype shells are illustrated by inked drawings (Fig. 2). Details of the protoconch and teleoconch sculptures were successfully obtained for topotype specimen material of *C. fragilis* sp. nov. processed by the critical point method to avoid collapse of the shell under vacuum during scanning electron microscopy (Fig. 3A). The shell of *C. villarricensis* is more heavily calcified and more robust, and the shell form along with protoconch and teleoconch sculpture were illustrated via scanning electron microscopy by Miquel & Barker (2009: figs 4–7).

In gross features, the shell of *Charopatagonia* gen. nov. has similarities to several South American Charopidae, including *Radiodiscus* Pilsbry, 1906; *Rotadiscus* Pilsbry, 1927; *Zilchogyra* Weyrauch, 1965; and *Stephacharopa* Miquel & Araya, 2013. However, close examination shows *Charopatagonia* to be distinctive, with a unique combination of protoconch and teleoconch sculpture.

There is considerable diversity among charopids in the sculpturing of the protoconch and teleoconch (Solem 1976, 1983). Qualitative differences in protoconch sculpture have generally been afforded importance in charopid taxonomy, albeit only properly elucidated by scanning elec-

tronic microscopy. This taxonomy operates with little understanding of dispersion of protoconch characters amongst phylogenetic clades, genes encoding different sculptural forms, epigenetics of expression, and the functional importance (if any) in the embryonic life of these snails. The protoconch ornamentation in *Charopatagonia* comprises crowded, continuous spiral cords or lirae. Spiral cords are a very common type of sculpture on the protoconch of charopids (e.g., Solem 1983, Goulstone & Mayhill 1998, Pawłowska-Banasiak 2008, Marshall & Barker 2008, Holcroft 2018), and in several extralimital taxa closely approach those of *Charopatagonia*. Among South American charopids with a spirally sculptured protoconch, several *Radiodiscus* species occur in the same distributional area as *Charopatagonia*, including *R. coppingeri* (E. A. Smith, 1881), *R. magellanicus* (E. A. Smith, 1881), *R. patagonicus* (Suter, 1900), and *R. riochicoensis* Crawford, 1939 (Annex 2). The original description of *Radiodiscus* (Pilsbry & Ferriss 1906: p. 154) did not define any diagnostic character of the genus. However, redescription with new images of its type species, *R. millecostatus* Pilsbry & Ferriss, 1906 from North America (Solem 1977: figs 7, 8; Miquel & Cádiz Lorca 2008: figs 19, 20), has shown the presence of radial incisurae of the protoconch that interrupt the otherwise continuous spiral cords or lirae (and highlight the similarities between this taxon and a monotypic genus *Retidiscus* Fonseca & Thomé, 1993 from southern Brazil). Our examination of *R. riochicoensis* confirm the same phenomenon. Thus, *Radiodiscus* differs from *Charopatagonia* in protoconch sculpture and can be considered taxonomically distinct. This forms the basis for assigning *Charopatagonia* to Charopinae, following the schema of Solem (1983). Nonetheless, as with the spiral ornamentation, the combination of spiral lirae and interrupting radial undulations or incisurae occur widely in geographically and seemingly phylogenetically distant charopid lineages (e.g., Solem 1983, Marshall & Barker 2008, Holcroft 2018). Phylogenetic studies are urgently needed to determine the systematic value of protoconch sculpture in Charopidae and underpin a classification scheme based on evolutionary relationships.

The postapical ornamentation of the shell in *Charopatagonia* – comprising major radial ribs and a microsculpture of radial riblets and secondary spiral elements – is not remarkable within the context of the diverse pattern seen in Charopidae (Solem 1976) and not dissimilar to South American *Radiodiscus* Pilsbry, 1906; *Lilloiconcha* Weyrauch, 1965; *Zilchogyra* Weyrauch, 1965; *Stephadiscus* Hylton Scott, 1981; and *Stephacharopa* Miquel & Araya, 2013 (Annex 2). In the type species *C. fragilis* sp. nov. and in *C. villarricensis*, the radial ribs in *Charopatagonia* are each surmounted

by two periostracal lamellae – similar to that seen in the Fijian *Microcharopa mimula* Solem, 1983 (Solem 1983: fig. 4a, although not described as such in the original description) – most clearly elucidated in scanning electron micrographs. *Charopatagonia delicatissima* sp. nov. exhibits the more typical charopid pattern with the radial ribs surmounted by a single periostracal lamella. In all three *Charopatagonia* species the microradial riblets are surmounted by a single periostracal lamella, but the elevation of the lamellae is variable. In *C. fragilis* sp. nov. particularly, the lamellae are most elevated on the riblets adjacent to the primary ribs – a morphology seen widely in the family. The spiral microsculpture is present in *C. fragilis* sp. nov., *C. villarricensis* and *C. delicatissima* sp. nov., but most strongly developed in the latter where the reticulation with the riblets and occasionally nodular at their intersection can be seen even under the stereomicroscope, particularly on the dorsal subsutural and ventral umbilical aspects of the teleoconch.

Charopatagonia lacks any calcareous “teeth” or barriers on the internal walls of the shell, and thus differs from the Recent *Zilchogyra paulistana* Hylton Scott, 1973; *Lilloiconcha superba* Thiele, 1927; *Radioconus pleurophora* (Moricand, 1846) from tropical South America (Miquel et al. 2004, Miquel et al. 2007: 223, fig. 35); and *Patagocharopa enigmatica* Miquel & Rodríguez, 2015 an extinct species from southern Argentina (Miquel & Rodríguez 2015).

The shells of *Charopatagonia* are similar in protoconch and teleoconch characters of several New Zealand Charopinae, including species of *Climocella* Goulstone, 1996 (Goulstone & Mayhill 1998: 276, fig. 2) and various species assigned to *Allodiscus* Pilsbry, 1892 by Marshall & Barker (2008: 79, fig. 8F–J; 88, fig. 11K–O; 95, fig. 14F–J; 100, fig. 18F–J; 131, fig. 28K–O).

The radula dentition of *C. fragilis* sp. nov. does not conform fully to the ‘standard pattern of structure’ described for charopid snails by Solem (1976: 93 and 1983: 34) based principally on Pacific and Australian–New Zealand species. In the diagnosis of Charopinae, Solem (1983: 70) noted that the tricuspid laterals and marginals typical of the taxon may be modified to bicuspid or unicuspid laterals and sometimes with ectoconal splitting on the marginals. In *C. fragilis* sp. nov. the marginal teeth are primarily bicuspid – with retained and elongated endocone and mesocone, rather than tricuspid, and thus exhibit an alternative form of modification. Elongated cusps in early marginal teeth that are well exhibited in the radula of *Charopatagonia* are not uncommon in Charopinae, especially in the Australia–New Zealand region – e.g. *Chaureopa titirangiensis* (Suter, 1896) [as *Charopa ochra*

(Webster, 1904)], *Paracharopa chrysaugaia* (Webster, 1904) and *Charopa coma* (Gray, 1843) (see Climo 1970: p. 346, figs I, J, K); *Cavellia reeftonensis* (Suter, 1892) (see Climo 1969: 245, fig. Cii), *Coricudgia wollemiana* Hyman & Stanisic, 2005 and *Marilyniropa jenolanensis* Hyman & Stanisic, 2005 (see Hyman & Stanisic 2005: 258, fig. 19B and 19E, respectively).

The radula of *Charopatagonia* differs from that presently known for other South American charopids. In *Radiodiscus* the central tooth is smaller relative to the early lateral teeth, and the marginal teeth are squat, quadrangular and multicuspid; while in *Radiodomus* H. B. Barker, 1930 the radula has more teeth, with the lateral teeth bicuspid and the marginal teeth low and very weakly serrate (Pilsbry 1948). In the South American charopids *Payenia saxatilis* (Gould, 1846), *Stephacharopa testalba* (Hylton Scott, 1970), *Stephadiscus lyratus* (Gould, 1846), *Stephanoda mirabilis* Hylton Scott, 1968, *Zilchogyra costellata* (d’Orbigny, 1835) and *Zilchogyra leptotera* (Mabille, 1886) the radulae have greater number of teeth, with the central tooth small relative to the first lateral teeth, and the marginal teeth quadrangular and tricuspid to multicuspid (Hylton Scott 1964, 1968, 1970).

The radula and shell characters perhaps point to a closer phylogenetic affinity of *Charopatagonia* with Charopinae of the Pacific–Australian–New Zealand region than to other charopine snails presently known from South America. Definitive evidence for this must await molecular phylogenetic studies of Punctoidea, which are in their infancy (Salvador et al. 2020).

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References

- Cádiz, F. J. & Gallardo, C. S. 2008. Morphological and anatomical features of *Flammulina festiva* Scott, 1970 (Stylommatophora: Charopidae) from southern Chile, with notes on its natural history. *Gayana* 72: 1–8.
- Climo, F. M. 1969. Classification of New Zealand Arionacea (Mollusca Pulmonata), Part II. Records of the Dominion Museum of Wellington 6(13): 175–258.
- 1970. Classification of New Zealand Arionacea (Mollusca Pulmonata), Part III. Records of the Dominion Museum of Wellington 6(18): 285–366, pls 1–9, 22 figs.

- 1989. The panbiogeography of New Zealand as illuminated by the genus *Fectola* Iredale, 1915 and subfamily Rotadiscinae Pilsbry, 1927 (Mollusca: Pulmonata: Punctoidea: Charopidae). *New Zealand Journal of Zoology* 16: 587-649.
- Fonseca, Á. L. M. da & Thomé, J. W. 1993. Descrição de *Glabrogrya* subgen. n., recaracterização de *Austrodiscus twomeyi* (Parodiz, 1954) e reclassificação das espécies sulamericanas dos gêneros *Austrodiscus* Parodiz, 1957, *Radioconus* Baker, 1927, *Radiodomus* Baker, 1930 e *Trochogrya* Weyrauch, 1965 (Charopidae) e *Zilchogrya* Weyrauch, 1965 (Helicodiscidae) (Gastropoda, Stylommatophora, Endodontoidea). *Iheringia (Zoologia)* 75: 97-105.
- Goulstone, J. F. & Mayhill, P. C. 1998. Three new species of *Climocella* (Gastropoda: Punctoidea: Charopidae) from northern New Zealand, and transfer/assignment of *Charopa* (*Mocella*) *accelerata* Climo, 1970 to the genus *Flammocharopa* Climo, 1970. *New Zealand Journal of Zoology* 25(3): 273-285.
- Holcroft, L. 2018. Protoconch sculpture as a taxonomic tool in Australian charopid systematics (Gastropoda: Eupulmonata: Charopidae). *Molluscan Research* 38: 258-273.
- Hylton Scott, M. I. 1963. Tres nuevos endodóntidos de Tucumán. *Neotropica* 9(29): 49-54.
- 1964. *Helix costellata* d'Orbigny, a la luz de su anatomía (Gastrop. Endodontidea). *Neotropica* 10(31): 15-19.
- 1968. Endodóntidos neotropicales III (Moll. Pulm.). *Neotropica* 14(45): 99-102.
- 1970. Endodóntidos de la región austral cordillerana (Gastropoda-Pulm.). *Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"*, *Zoología* 10(18): 267-296.
- 1973. Endodóntidos neotropicales IV (sic) (Gastropoda Pulmonata). *Neotropica* 19(59): 104-109.
- 1981. Referencia al género *Stephanoda* Albers, 1860 y la creación del género *Stephadiscus* n. gen. (Mollusca Endodontidae). *Neotropica* 27(78): 123-126.
- Hyman, I. T. & Stanisic, J. 2005. New charopid land snails chiefly from limestone outcrops in eastern New South Wales (Eupulmonata: Charopidae). *Memoirs of the Queensland Museum* 50(2): 219-302.
- Mabille, J. 1886. Diagnoses testarum novarum. *Bulletin de la Société Philomathique de Paris Sér. 7*, 10: 123-135.
- Marshall, B. A. & Barker, G. M. 2008. A revision of the New Zealand landsnails referred to *Allodiscus* Pilsbry, 1892 and *Pseudallodiscus* Climo, 1971, with the introduction of three new genera (Mollusca: Gastropoda: Charopidae). *Tuhinga, Records of the Museum of New Zealand Te Papa Tongarewa* 19: 57-167.
- Miquel, S. E. & Aguirre, M. L. 2011. Taxonomía de los gasterópodos terrestres del Cuaternario de Argentina. *Revista Española de Paleontología* 26(2): 101-133.
- & Araya, J. F. 2013. A new Charopidae from Chile and Argentina, *Stephacharopa calderaensis* gen. et sp. nov., with remarks on the taxonomy of the genus *Stephadiscus* Hylton Scott 1981 (Mollusca: Gastropoda Pulmonata). *Archiv für Molluskenkunde* 142(2): 227-235.
- & Araya, J. F. 2015. New records of terrestrial molluscs of the Juan Fernández Archipelago (Chile), with the description of a new genus and species of Charopidae (Gastropoda: Stylommatophora). *Archiv für Molluskenkunde* 144(2): 155-167.
- & Barker, G. M. 2009. New Charopidae from Chilean-Argentine Patagonia (Mollusca: Gastropoda: Stylommatophora). *Archiv für Molluskenkunde* 138(1): 1-9.
- & Bellosi, E. S. 2010. Middle Eocene-Oligocene gastropods of the Sarmiento Formation. Pp.61-68 in: Madden, R. H., Carlini, A. A., Vucetich, M. G. & Kay, R. F. (eds). *The paleontology of Gran Barranca: evolution and environmental change through the Middle Cenozoic of Patagonia*. New York (Cambridge University Press).
- & Cádiz Lorca, J. F. 2008. *Araucocharopa gallardoi* gen. et sp. n. de Charopidae (Mollusca: Gastropoda: Stylommatophora) del sur de Chile. *Revista del Museo Argentino de Ciencias Naturales, N.S.* 10(2): 329-340.
- & Rodríguez, P. E. 2015. A novel late Early Miocene assemblage of terrestrial gastropods from Santa Cruz (Patagonia, Argentina). *Journal of Paleontology* 89(5): 748-761.
- , Ramírez, R. & Thomé, J. W. 2004. Lista preliminar de los Punctoideos de Rio Grande do Sul, Brasil, con descripción de dos especies nuevas (Mollusca, Gastropoda, Stylommatophora). *Revista Brasileira de Zoologia*, 21(4): 925-935.
- , Ramírez, R. & Thomé, J. W. 2007. Biodiversidad y taxonomía de micromoluscos Punctoidea del sur de Brasil, con la descripción de una nueva especie de *Radiodiscus* de la Mata Atlántica (Mollusca, Gastropoda, Pulmonata). *Revista del Museo Argentino de Ciencias Naturales, Nueva Serie* 9(2): 205-230.
- Pawłowska-Banasia, E. 2008. *Andrefrancia* Solem, 1960 (Gastropoda: Pulmonata: Charopidae) – a systematic revision. *Folia Malacologica* 16(3): 101-195.
- Pilsbry, H. A. 1948. Land Mollusca of North America (north of Mexico), Vol. 2, Part 2. 1113 pp., Philadelphia (The Academy of Natural Sciences of Philadelphia).
- & Ferriss, J. H. 1906. Mollusca of the Southwestern States. II. Proceedings of the Academy of Natural Sciences of Philadelphia. 58: 123-160 [20 June 1906], 161-175, pls 5-9 [24 July 1906].
- Salvador, R. B., Brook, F. J., Shepherd, L. D. & Kennedy, M. 2020. Molecular phylogenetic analysis of Punctoidea (Gastropoda, Stylommatophora). *Zoosystematics and Evolution* 96(2): 397-410.
- , Cabrera, F., Martínez, S., Miquel, S. E., Simone, L. R. L. & Cunha, C. M. 2018. Annotated catalogue of the fossil Hygrophila and Eupulmonata (Mollusca: Gastropoda) from South America (Cretaceous – Neogene). *Neues Jahrbuch für Geologie und Paläontologie – Abhandlungen* 289(3): 249-280.

- Smith, E. A. 1881. Account of the Mollusca and Molluscoida collected during the survey of H.M.S. 'Alert' in the Straits of Magellan and on the coast of Patagonia. Proceeding of the Zoological Society of London 1881: 22–276, pls 3–5.
- Solem, A. 1976. Endodontoid land snails from Pacific islands (Mollusca: Pulmonata: Sigmurethra). Part 1: Family Endodontidae. XII+508 pp., Chicago (Field Museum of Natural History).
- 1977. Shell microsculpture in *Striatura*, *Punctum*, *Radiodiscus* and *Planogyra* (Pulmonata). The Nautilus 91 (4): 149–155.
- 1983. Endodontoid land snails from Pacific islands (Mollusca: Pulmonata: Sigmurethra). Part 2: Families Punctidae and Charopidae, zoogeography. IX+336 pp., Chicago (Field Museum of Natural History).
- Suter, H. 1900. Observações sobre alguns caracões terrestres do Brazil. Revista do Museu Paulista 4: 329–337.
- Turazzini, G. F. & Miquel, S. E. 2014. A terrestrial gastropod community from the Early Pliocene (Neogene) of Mendoza, Argentina, with description of a new species of *Radiodiscus* (Mollusca: Pulmonata: Charopidae). Ameghiniana 51 (5): 396–404.
- Virgillito, M. & Miquel, S. E. 2013. New records of exotic land snails and slugs in Argentina. Revista del Museo Argentino de Ciencias Naturales, Nueva Serie 15 (2): 295–303.

Annex 1: Other studied materials for comparative purposes

***Radiodiscus coppingeri* (Smith, 1881):** MACN-In 31752, 51°25' S, 73°06' W, coll. C. Matteri, 1983 (12 specs). – MACN-In 36085, Redonda Island, Beagle Channel, Argentina, coll. S.E. Miquel, XII-1999 (3 specs). – MACN-In 36086, Dos Lagos, near Fagnano Lake, Tierra del Fuego, coll. C. Matteri, 1992 (4 specs). – MACN-In 36087, Tolhuin, Tierra del Fuego, coll. C. Matteri (1 spec.). – MACN-In 36092, Alférez Joffré Island, Isla de los Estados, coll. C. Matteri, 20-X-1971 (5 specs). – MACN-In 36700, Buen Suceso Bay, Tierra del Fuego, coll. C. Matteri, 1986 (1 spec.).

***Radiodiscus riochicoensis* Crawford, 1939:** Holotype ANSP 88807, Rio Chico, 50 miles above Sierra Oveja, Patagonia, Argentina, on a dry stone near the water, coll. J.B. Hatcher, 22-XII-1899. – MACN-In 36098, Futalaufquen Lake, Chubut, coll. S. E. Miquel, 1994 (2 specs). – MACN-In 36133, Nahuel Huapi National Park, route 258, Mascardi Lake, *Nothofagus–Austrocedrus* forest, coll. G. M. Barker and S. E. Miquel 16-X-1996 (3 specs). – MACN-In 36134, Nahuel Huapi National Park, route 258, Mascardi Lake, *Nothofagus–Austrocedrus* forest, coll. G. M. Barker and S. E. Miquel, 16-X-1996 (3 specs). – MACN-In 36135, Nahuel Huapi National Park, route 258, Cañadón de la Mosca. *Nothofagus–Austrocedrus* forest, coll. G. M. Barker and S. E. Miquel, 16-X-1996

(1 spec.). – MACN-In 36136, Nahuel Huapi National Park, route 258, Gutiérrez Lake, *Nothofagus* forest, coll. G. M. Barker and S. E. Miquel, 16-X-1996 (2 specs). – MACN-In 36137, Nahuel Huapi National Park, route 258, Gutiérrez Lake, *Nothofagus* forest, coll. G. M. Barker and S. E. Miquel, 16-X-1996 (4 specs). – MACN-In 36138, Nahuel Huapi National Park, route 258, Mascardi Lake, *Nothofagus* forest, coll. G. M. Barker and S. E. Miquel, 16-X-1996 (7 specs). – MACN-In 36139, Lanín National Park, route 63, dry, open scrubland, coll. G. M. Barker and S. E. Miquel, 17-X-1996 (9 specs). – MACN-In 36140, Nahuel Huapi National Park, route 231, Las Flores, old growth *Nothofagus* forest, coll. G. M. Barker and S. E. Miquel, 17-X-1996 (2 specs). – MACN-In 36141, Lanín National Park, route 63, dry, open scrubland, coll. G. M. Barker and S. E. Miquel, 17-X-1996 (3 specs).

Annex 2: Synopsis for generic identification of extant and fossil Punctoidea recorded for austral South America († = fossil, ? = uncertain)

A. Smooth teleoconch and protoconch

1. Shell nautiloid: *Flammulina* Martens, 1873 (Recent, New Zealand–Chilean Patagonia).
Type species: *Vitrina zebra* Le Guillou, 1842 (Recent, New Zealand).
Updated references: Miquel & Cádiz Lorca (2008), Cádiz & Gallardo (2008).
2. Shell subglobose: *Payenia* Mabilie & Rochebrune in Rochebrune & Mabilie, 1889 (Recent, Chilean and Argentinian Patagonia).
Type species: *Helix saxatilis* Couthouy in Gould, 1846 (Recent, Chilean Patagonia).
Updated reference: Miquel & Cádiz Lorca (2008).
3. Shell lenticular, with numerous semi-internal barriers: † *Patagocharopa* Miquel & Rodríguez, 2015 (Miocene, Argentina).
Type species: *Patagocharopa enigmatica* Miquel & Rodríguez, 2015 (Miocene, Santa Cruz, Argentina).

B. Smooth teleoconch and spiral sculpture in the protoconch

Glabrogrya Fonseca & Thomé, 1993 (? introduced, Chile).
Type species: *Radiodiscus kuscheli* Hylton Scott, 1957 (? introduced, Chilean Patagonia).
Updated reference: Miquel & Cádiz Lorca (2008).

C. Smooth teleoconch and reticular sculpture in the protoconch

Stephanoda Albers, 1860 (Eocene, Argentina; Recent, Chile–Argentina).
Type species: *Helix dissimilis* d'Orbigny, 1835 (Recent, Chile).
Updated references: Miquel & Cádiz Lorca (2008), Miquel & Bellosi (2010).

D. Teleoconch with radial sculpture and protoconch with reticular sculpture

Austrodiscus Parodiz, 1957 (?Paleocene, Brazil; Recent, Chile).

Type species: *Araucania twomeyi* Parodiz, 1954 (Recent, Chile).

Updated reference: Miquel & Cádiz Lorca (2008).

E. Teleoconch and protoconch with similar radial sculpture

1. *Amphidoxa* Albers, 1850 (Recent, Chile).

Type species: *Helix marmorella* L. Pfeiffer, 1845 (Recent, Juan Fernandez Archipelago, Chile).

Updated reference: Miquel & Araya (2013).

2. *Stephadiscus* Hylton Scott, 1981 (Eocene, Argentina; Recent Argentina, Chile, Peru).

Type species: *Helix (Pyramidula) lyrata* Couthouy in Gould, 1846 (Recent, Chile).

Updated references: Miquel & Bellosi (2010), Miquel & Araya (2013).

F. Teleoconch and protoconch with dissimilar radial sculpture

1. Main radial ribs without elevated periostracal lamellae: *Stephacharopa* Miquel & Araya, 2013 (Recent, Chile-Argentina).

Type species: *Stephacharopa calderaensis* Miquel & Araya, 2013 (Recent, Chile).

2. Main radial ribs with elevated periostracal lamellae: *Neoparyphantopsis* Miquel & Araya, 2015 (Recent, Chile).

Type species: *Neoparyphantopsis crusoena* Miquel & Araya, 2015 (Recent, Juan Fernández Archipelago, Chile).

G. Teleoconch with radial sculpture and smooth protoconch

1. Shell discoid, medium height, retractive ribs: *Zilchogyra* Weyrauch, 1965 (Eocene, Argentina; Recent, South America).

Type species: *Helix costellata* d'Orbigny, 1835 (Recent, Argentina).

Updated references: Miquel & Cádiz Lorca (2008), Miquel & Bellosi (2010).

2. Shell trochoid, very small, retractive ribs: †*Colhueconus* Miquel & Bellosi, 2010 (Eocene, Patagonia).

Type species: †*Colhueconus simpsoni* Miquel & Bellosi, 2010 (Eocene, Patagonia).

3. Shell trochoid, medium height, straight ribs: *Lilloiconcha* Weyrauch, 1965 (Eocene, Argentina; Recent, South America).

Type species: *Austrodiscus superbus tucumana* Hylton Scott, 1963 (Recent, Tucumán, Argentina). = *Zilchogyra (Trochogyra)* Weyrauch, 1965 (Recent, Brazil).

Type species: *Endodonta superba* Thiele, 1927 (Recent, Brazil).

Updated references: Fonseca & Thomé (1993), Miquel & Cádiz Lorca (2008), Miquel & Bellosi (2010).

4. Shell pyramidal: *Chellius* Vargas-Almonacid & Stuardo, 2007 (Recent, Chile).

Type species: *Chellius pyramidalis* Vargas-Almonacid & Stuardo, 2007 (?introduced, Chile). = *Phrignathus* sp. Hutton, 1883 (Recent, New Zealand).

Type species: *Phrignathus celia* Hutton, 1883 (Recent, New Zealand).

Updated reference: Miquel & Barker (2009).

5. Shell planorboid, straight ribs: *Rotadiscus* Pilsbry, 1926 (Eocene, Argentina; Recent, Central and South America).

Type species: *Helix hermanni* Pfeiffer, 1866 (Recent, Mexico). = *Ptychodon (Unilamellatus)* Weyrauch, 1958 (Recent, Peru).

Type species: *Ptychodon (Unilamellatus) unilamellatus* Weyrauch, 1958 (Recent, Peru).

Updated references: Climo (1989), Miquel & Cádiz Lorca (2008), Miquel & Bellosi (2010).

H. Teleoconch with radial sculpture and protoconch with spiral sculpture

1. Spire elevated, adult radial ribs curved: *Paralaoma* Iredale, 1913 (introduced, Argentina).

Type species: *Paralaoma raoulensis* Iredale, 1913 (Recent, New Zealand). = *Pichikadi* Vargas Almonacid & Stuardo, 2007 (introduced, Chile).

Type species: *Pichikadi hualpensis* Vargas Almonacid & Stuardo, 2007 (introduced, Chile).

Updated references: Miquel & Barker (2009), Virgil-lito & Miquel (2013).

2. Spire flat, adult radial ribs almost straight to sigmoidal: *Charopatagonia* gen. nov. (Mio-Pliocene, Argentina; Recent, Chile).

Type species: *Charopatagonia fragilis* gen. et sp. nov. (Mio-Pliocene, Argentina; Recent, Chile).

I. Teleoconch with radial sculpture and protoconch with spiral sculpture and axial incisurae

Radiodiscus Pilsbry, 1906 (?Cretaceous, Argentina; Eocene, Argentina; Recent, America).

Type species: *Radiodiscus millicostatus* Pilsbry & Ferriss, 1906 (Recent, United States of America).

Updated references: Miquel & Cádiz Lorca (2008), Miquel & Bellosi (2010), Salvador et al. (2018). = *Retidiscus* Fonseca & Thomé, 1995 (Holocene, Argentina; Recent, Brazil).

Type species: *Retidiscus reticulatus* Fonseca & Thomé, 1995 (Holocene, Argentina; Recent, Brazil) syn. nov.

Updated references: Miquel & Cádiz Lorca (2008), Miquel & Aguirre (2011).

J. Teleoconch with radial sculpture and protoconch with spiral ringed costulae

Araucocharopa Miquel & Cádiz Lorca, 2008 (Recent, Chile).

Type species: *Araucocharopa gallardoi* Miquel & Cádiz Lorca, 2008 (Recent, Chilean Patagonia).

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