

***Pisidium chilense* (d'Orbigny, 1846) and new species of *Pisidium* C. Pfeiffer, 1821 from southern Chile (Bivalvia, Sphaeriidae)**

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ABSTRACT

Pisidium chilense (d'Orbigny, 1846), a species only known from a rather poor original description, is here fully redescribed and figured. *Pisidium huillichum* n. sp. and *Pisidium llanquihuense* n. sp. respectively from Llanquihue Lake, Chiloé Island and Yelcho Lake, southern Chile, are described. Both new species share as common features the presence of only one demibranch, one siphonal aperture and brood pouches developing from the upper and posterior part of inner demibranchs. As it was described for other Patagonian species, the ligament in both new species is internal, however, in *Pisidium llanquihuense* n. sp. the ligament is slightly visible from the exterior.

KEY WORDS

Bivalvia,
Sphaeriidae,
Pisidium,
new species,
South America,
Chile.

RÉSUMÉ

Pisidium chilense (d'Orbigny, 1846) et nouvelles espèces du genre *Pisidium* C. Pfeiffer, 1821 du sud du Chili (Bivalvia, Sphaeriidae).

Pisidium chilense (d'Orbigny, 1846), espèce connue seulement par une description originale brève et peu précise, est ici décrite et illustrée. Deux nouvelles espèces de bivalves de la famille Sphaeriidae, *Pisidium huillichum* n. sp. et *Pisidium llanquihuense* n. sp., provenant respectivement du lac Llanquihue, île de Chiloé et du lac Yelcho, au sud du Chili, sont décrites. Les nouvelles espèces ont comme caractères communs la présence d'une seule paire de lames branchiales, interne (dans lesquelles les poches incubatrices se développent vers le haut et en arrière) et une seule ouverture siphonale. De plus, comme il a déjà été décrit pour d'autres espèces de Patagonie, le ligament est interne, bien que, dans le cas de *Pisidium llanquihuense* n. sp., il soit faiblement visible du dehors.

MOTS CLÉS

Bivalves,
Sphaeriidae,
Pisidium,
nouvelles espèces,
Amérique du Sud,
Chili.

INTRODUCTION

There are a few contributions dealing with *Pisidium* C. Pfeiffer, 1821 species from Chile. D'Orbigny (1846) described *Pisidium chilense* (d'Orbigny, 1846) from Concepción, Mabille (1884) described *Pisidium lebruni* (Mabille, 1884) from Punta Arenas and long afterwards,

Ituarte (1995) reported for the first time *Pisidium observationis* Pilsbry, 1911 from Cabeza de Mar, 48 km north Punta Arenas, southern Chile. The remaining reports on Sphaeriidae distributed in Chile correspond to the genus *Sphaerium* Scopoli, 1777: *Sphaerium lauricochae* (Philippi, 1869) was reported from Ojos de Ascotan, Antofagasta Province (Kuiper & Hinz 1984) and *Sphaerium forbesi* (Philippi, 1869) has been reported from Cota Cotani (Ituarte 1995), both records being from northern Chile.

Knowledge on other geographically close sphaeriid faunas from southern South America east Andes mountain range (mainly from Argentine Patagonia) comes from the work of Pilsbry (1911), Ituarte & Gordillo (1991) and Ituarte (1996).

In the present paper, *Pisidium chilense* is redescribed and properly figured. Moreover *Pisidium huillichum* n. sp. and *Pisidium llanquihuense* n. sp. from southern Chile, are described.

MATERIALS AND METHODS

Samples were collected by the author during a field trip to southern Chile, between December 1996 and January 1997 (Fig. 1). After collection, the specimens were immediately relaxed and killed by immersion in warm water (50 °C approx.) for a few minutes and then fixed and preserved in ethanol 80°. Length measurements [shell length (SL), shell height (SH), shell width (SW) and pre-siphonal suture (PSS)], shape indices and morphometric ratios [height index ($I\ SH/SL$), convexity index ($Ci = SW/SH$), ratio hinge length (distance between cusps of left anterior lateral and left posterior lateral): shell length (HiL/SL)], were calculated according to the criteria followed by Ituarte (1996).

For comparative purposes, 15 syntypes of *Pisidium lebruni* Mabille, 1884, lodged at Muséum national d'Histoire naturelle (MNHN), Paris, and photographs of two syntypes of *Pisidium chilense* (d'Orbigny, 1846) lodged at the Natural History Museum (NHM), London, were also used.

Voucher specimens were deposited in the malacological collections of the Museo de La Plata

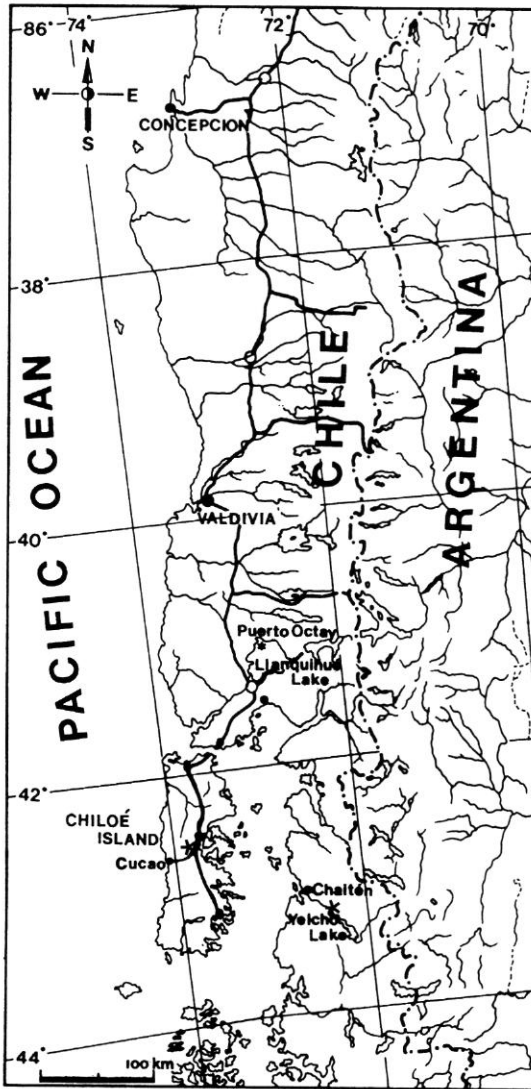


FIG. 1. — Location map, collecting sites are indicated with an asterisk.

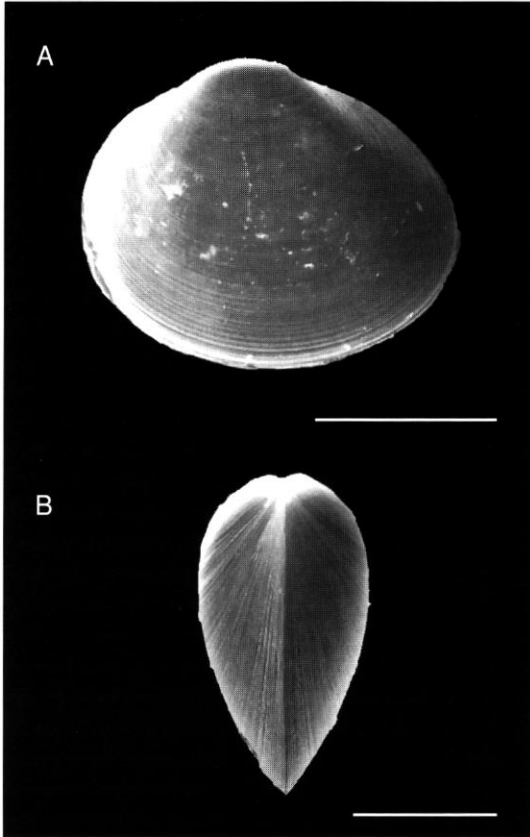


FIG. 2. — *Pisidium chilense* (d'Orbigny, 1846) (MLP 5345); **A**, right external view; **B**, posterior view of a shell. Scale bars: 2 mm.

(MLP), Museo Argentino de Ciencias Naturales, Buenos Aires (MACN) and MNHN, Paris.

SYSTEMATICS

Pisidium chilense (d'Orbigny, 1846)
(Figs 2-4)

Cyclas chilense d'Orbigny, 1846: 568, pl. 83, figs 11-13.

Pisidium chiliense – Pilsbry 1911: 604.

TYPE LOCALITY. — According to the original description by d'Orbigny (1846), the type locality of *Pisidium chilense* is Concepción (36°50'S, 72°50'W), Chile. However, some confusion exists due to the fact that the original label of the two syntypes deposited in

the NHM, London reads: "Valdivia, Chile" (39°49'S; 73°16'W) (a place approximately 450 km south of Concepción), as the origin of those specimens (Fig. 1). The registration book of the NHM, London malacological collection and Gray's (1855) list are coincident and report Valdivia as the type locality for *P. chilense*.

MATERIAL EXAMINED. — **Southern Chile.** (Fig. 1) Región de los Lagos, Yelcho Lake, Puerto Cárdenas 46 km south of Chaitén (MLP 5345). — Outskirts of Chaitén, unnamed brook on the Carretera Austral, [Austral Road] (MLP 5381).

REDESCRIPTION

(BASED UPON EXAMINED MATERIAL)

Shell ovate somewhat high (I SH/SL about 76-80%), not inflated [convexity index (Ci) is less than 50%]. Maximum observed SL = 5.1 mm. Anterior end moderately protruded, posterior end evenly curved. Dorsal margin evenly arcuate, however, depressed immediately below beaks (Fig. 3A-C); ventral margin evenly arcuate. The point of junction of dorsal and anterior margin faintly marked by an angle. Beaks wide, low, not exceeding dorsal shell margin, slightly visible above dorsal margin, somewhat displaced posteriorly (located at about 60% of shell length). Surface rather smooth, sulcated by low and fine concentric ribs and very slightly marked radial stripes (Fig. 2B), periostracum straw-yellowish, dull shining.

Hinge plate rather solid, hinge line representing about 64% of shell length. Hinge: in right valve one club-shaped cardinal tooth (Fig. 3A, B), the surface of enlarged posterior end sculptured by multiple small shallow pits (Fig. 4A). Lateral teeth well-developed, anterior inner lateral tooth (A_1) long with nearly central cusp, posterior inner lateral tooth (P_1) shorter with posteriorly displaced cusp. Anterior and posterior outer teeth shorter with distal cusps. In left valve, two cardinal teeth, the outer (C_4) longer, slender and evenly arcuate, the inner (C_2) wider and shorter, almost completely overlapped by C_4 . Anterior lateral tooth (A_2) robust, with nearly central cusp, posterior lateral tooth (P_2) shorter, straight with distal cusp.

Ligament-pit deep, with S-shaped ventral margin, slender at anterior end, broadened and markedly arcuate at the posterior two thirds (Figs 3A-D; 4A). Escutcheon moderately mark-

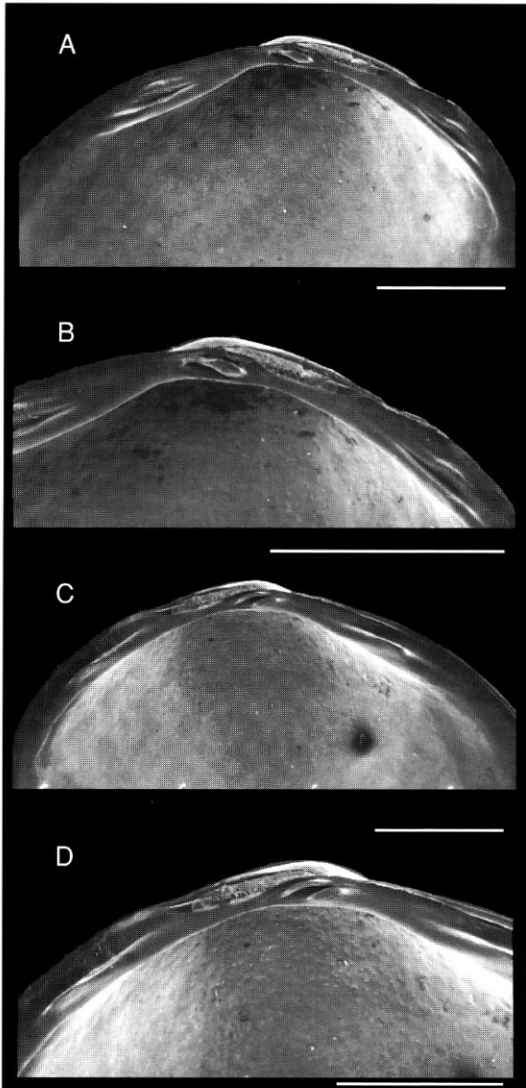


FIG. 3. — *Pisidium chilense* (d'Orbigny, 1846) (MLP 5345); **A**, hinge of the right valve; **B**, detail of right cardinal tooth, ligament and right lateral teeth; **C**, hinge of the left valve; **D**, detail of the left cardinal teeth, ligament and posterior lateral tooth. Scale bars: 1 mm.

ed. Ligament robust, internal, however slightly visible from outside as a slender stripe, never protruded (Fig. 4B). Ligament length represents about 21% of shell length.

Five pairs of muscle scars, corresponding to the inner radial mantle muscles, almost coalescent

with the mantle line, except for the anterior pair which is slightly apart.

ANATOMY

Only inner demibranch present; ascending lamella shorter, representing less than 50% of the descending one. Dorsal loop of the nephridia cleft. Brood sacs developing in the upper part of the posterior half of the descendent lamellae of each inner demibranch. Anal aperture present only; pre-siphonal suture short (representing about 15% of SL), as long or slightly shorter than siphonal diameter.

REMARKS

The solid hinge plate of *Pisidium chilense* is a characteristic shared with the remaining known species from southern Chile and Patagonia, such as *Pisidium magellanicum* (Dall, 1908), *Pisidium patagonicum* Pilsbry, 1911, *Pisidium observationis* Pilsbry, 1911, *Pisidium plenilunium* (Melvill & Standen, 1907), *Pisidium inacayali* Ituarte, 1996 and *Pisidium lebruni* Mabille, 1884 (Ituarte 1995, 1996). The ligament could be considered neither strictly external nor internal, tending very slightly to be external but never protruding. It can be seen from outside as a narrow line between valves (Fig. 4B) as it has been described by Meier-Brook (1967) for *Pisidium forense* Meier-Brook, 1967 from Minas Gerais, Brazil, and also observed in two new *Pisidium* species from Corrientes and Misiones provinces, northeastern Argentina, still unpublished (Ituarte in press). The specimens of *Pisidium chilense* from Yelcho Lake, here studied, show slightly lower shells and beaks faintly more centrally located when compared to the photographs of syntypes at MNH, London. When *Pisidium chilense* is compared with the syntypes of *Pisidium lebruni* (MNHN, Paris) from Punta Arenas, Chile, the latter proved to have higher and more inflated shells, with posterior end shorter and more abruptly truncated, and the anterior margin sloping markedly. Kuiper & Hinz (1984) have wrongly included (with a question mark) *P. chilense* in the synonymy list of *Pisidium casertanum* (Poli, 1791) (a species currently known as cosmopolitan) which shows striking differences such as two siphonal apertures, both, inner and outer, demibranchs, and ligament decidedly internal.

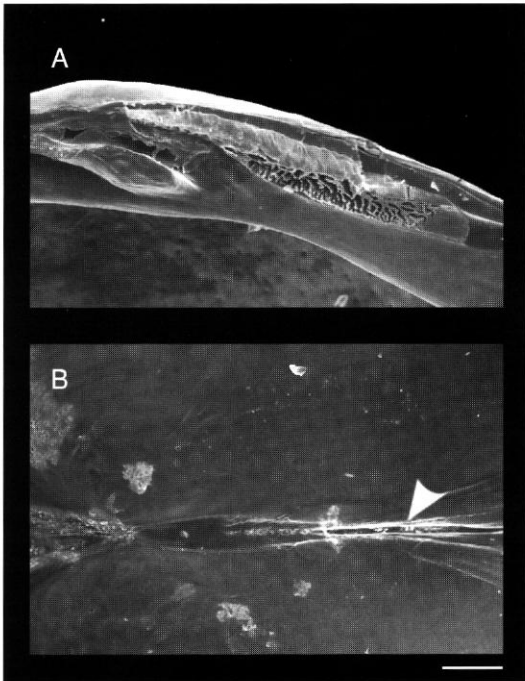


FIG. 4. — *Pisidium chilense* (d'Orbigny, 1846) (MLP 5345); **A**, detail of a lateral view of the ligament; **B**, dorsal view showing the narrow portion of the ligament exposed (arrow). Scale bar: 100 μ m.

***Pisidium huillichum* n. sp.**
(Figs 5-7)

MATERIAL EXAMINED. — **Southern Chile.** (Fig. 1) Región de los Lagos, Yelcho Lake, Puerto Cárdenas 70 m altitude, 46 km south of Chaitén, 1.I.1997, col. Ituarte, holotype (MLP 5358), 2 paratypes (MLP 5358, MNHN, Paris), 2 paratypes (MACN, Buenos Aires). — Llanquihue Lake, between 40°38'S, 72°31'W and 41°20'S, 73°0'W, Puerto Octay, 26.XII.1996, col. Ituarte, paratypes (MLP 5350).

ETYMOLOGY. — The specific name refers to Huilliches (Indian word that means "southern people"), a tribe of the Mapuches Indian people, who were the ancient inhabitants of southern lands in Chile.

DESCRIPTION

Shell small (maximum SL = 2.45 mm), solid, rounded oval outline, high (mean I SH/SL = 83 ± 2), inflated (average Ci = 73 ± 6). Beaks

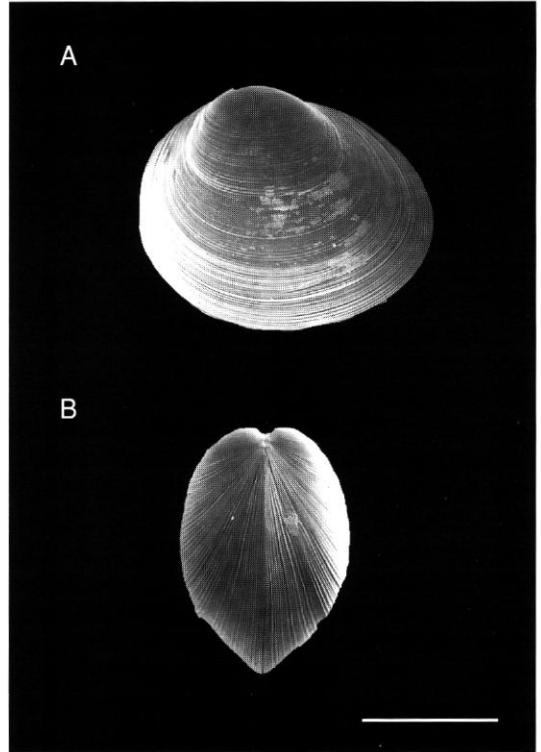


FIG. 5. — *Pisidium huillichum* n. sp. (MLP 5358); **A**, right external view; **B**, posterior view of a shell. Scale bar: 1 mm.

wide, inflated, well visible above dorsal margin, posteriorly displaced (beak position: 58-63% of SL). Anterior end protruded in a sharp curve, posterior end truncate, widely arcuate. Anterior half of dorsal margin faintly curved, posterior half forming a markedly descendant curve. Ventral margin evenly and strongly arcuate. Shell translucent. Surface glossy, straw-yellowish, sculptured with well-marked, evenly spaced, fine striae (Fig. 5A, B).

Hinge plate somewhat solid, hinge line rather short, representing about 50% of SL. Hinge: in right valve one cardinal tooth (C_3) slightly curved, slender at anterior half, broadened at posterior end, forming a rounded sulcated small head. Lateral teeth very strong, short, with markedly rugose inner surfaces. Inner anterior lateral tooth (A_1) very large, with inner margin markedly curved. Outer anterior lateral (A_3) minuscule

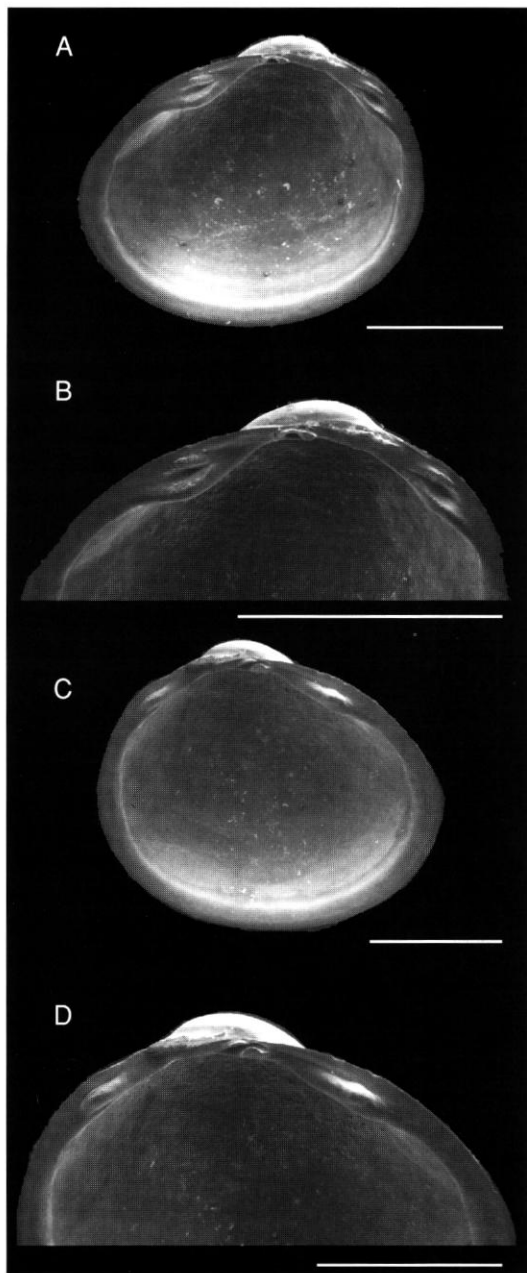


FIG. 6. — *Pisidium huillichum* n. sp. (MLP 5350); **A**, internal view of a right valve; **B**, detail of the hinge of right valve; **C**, internal view of a left valve; **D**, detail of the hinge of left valve. Scale bars: 1 mm.

(Fig. 6A, B). In right valve, two short cardinal teeth, the outer (C_4) a slender lamellae, overlapping C_2 at posterior half or a little more. Lateral

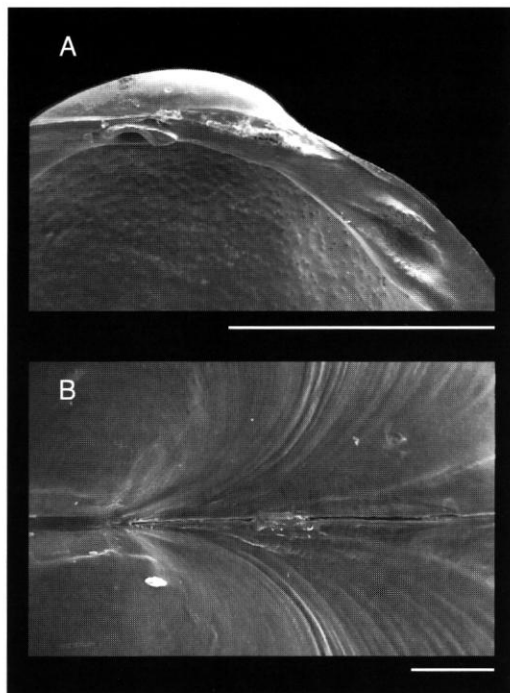


FIG. 7. — *Pisidium huillichum* n. sp. (A, MLP 5350; B, MLP 5358); **A**, detail of right cardinal tooth, ligament and ligament-pit; **B**, dorsal view showing the included ligamental pit. Scale bars: A, 1 mm; B, 100 μ m.

teeth very robust, short, high, with pointed cusps, almost central in A_2 , displaced backwards in P_2 (Fig. 6C, D).

Ligament-pit enclosed, deep, with ventral margin evenly curved (Fig. 7A). Escutcheon well-marked (Fig. 7B). Ligament internal, relatively short, representing about 19% of SL (Fig. 7).

ANATOMY

Only inner demibranch present; short ascending lamellae not much longer than one fourth to one third of length of descending one. Brood sacs developing in the upper part of the posterior half of the descendent lamellae of inner demibranchs, occupying more than three quarters of the demi-branch length, maximum number of incubated embryos found: 12 shelled larvae, measuring about 0.5×0.7 mm (minimum and maximum diameters). Only anal opening present. Presiphonal suture short to somewhat long (average PSS $18 \pm 2\%$ of SL), representing one to

one and a half fold the diameter of the anal opening. Dorsal loop of the nephridia, cleft. Posterior adductor muscle scars small, posterior foot retractors powerful. Inner radial mantle muscles weak, five to six not well-defined muscular bundles (except for the siphonal one), attached almost onto the mantle line.

REMARKS

Pisidium huillichum n. sp. can be easily distinguished from the remaining Chilean known species by the small-sized, relatively high and inflated shell. The general shell shape and the strongly marked surface striation are also quite distinctive characters. The high number of embryos in the brood sacs is also a peculiar feature. The presence of the internal ligament and strong surface sculpture chiefly distinguishes *P. huillichum* n. sp. from other similar small-sized South American *Pisidium* species such as *Pisidium vile* Pilsbry, 1897 and *Pisidium punctiferum* (Guppy, 1867). The latter also differs in having higher and less inflated shell, and smaller, lower and more centrally located beaks.

***Pisidium llanquihuense* n. sp.**
(Figs 8-10)

MATERIAL EXAMINED. — **Southern Chile.** (Fig. 1) Puerto Octay, north of Llanquihue Lake, 70 m altitude, between 40°38'S, 72°31'W and 41°20'S, 73°0'W, 26.XII.1996, col. Ituarte, holotype (MLP 5349), 2 paratypes (MLP 5349, MNHN, Paris), 2 paratypes (MACN, Buenos Aires). — Chiloé Island, a small water course at Notuco Bridge, on the national route No. 5, immediately before the branch road to Cucao (on the Pacific coast), 26.XII.1996, col. Ituarte, paratypes (MLP 5344).

ETYMOLOGY. — The name refers to Llanquihue Lake, the type locality.

DESCRIPTION

Shell of medium size (maximum observed size: 5.2 mm), ovate, tending to be sub-quadrangular, rather high (mean I SH/SL = 85 ± 1), somewhat compressed (mean Ci = 62 ± 3), nearly equilateral. Beaks slightly displaced backwards (located at about 56% of the shell length), wide, low, faintly visible above dorsal margin (Figs 8; 9). Surface finely striated, white-yellowish, silky-glossy.

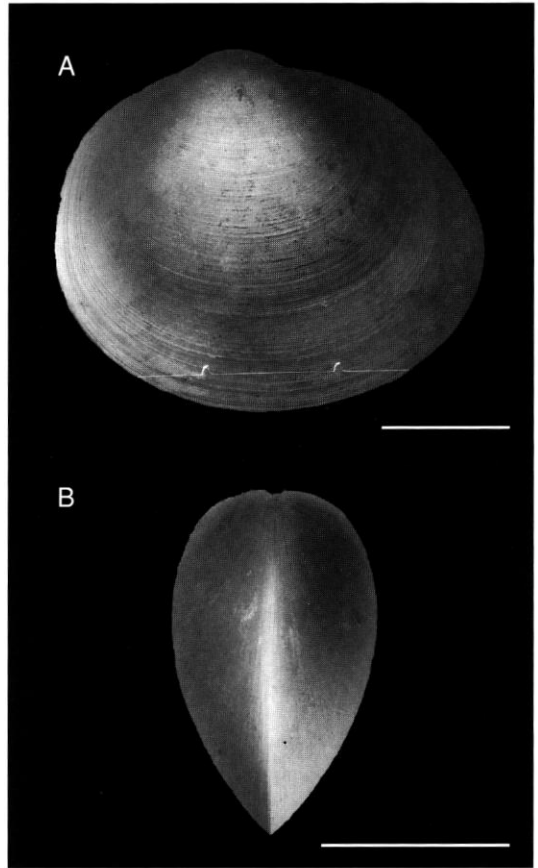


FIG. 8. — *Pisidium llanquihuense* n. sp. (MLP 5349); **A**, right external view; **B**, posterior view of a shell. Scale bars: 2 mm.

Hinge line evenly arcuate, sunken at the median point, just below central point of beaks, relatively short (representing about 57-60% of SL), rather solid. Hinge: in right valve an Y-shaped cardinal tooth (C₃) with very short anterior end, curved and enlarged at posterior end forming a deeply sulcate triangular head; anterior and posterior lateral teeth relatively short and robust, markedly rugose (Figs 9A, B; 10A). In left valve, outer cardinal tooth long, oblique, almost straight, overlapping C₂ at posterior half or slightly more, inner cardinal tooth short, curve at anterior end, diverging strikingly from C₄ (Fig. 9C, D). Anterior and posterior lateral teeth (A₂ and P₂) robust, cusps distal. Ligament-pit deep, its ventral margin open S-

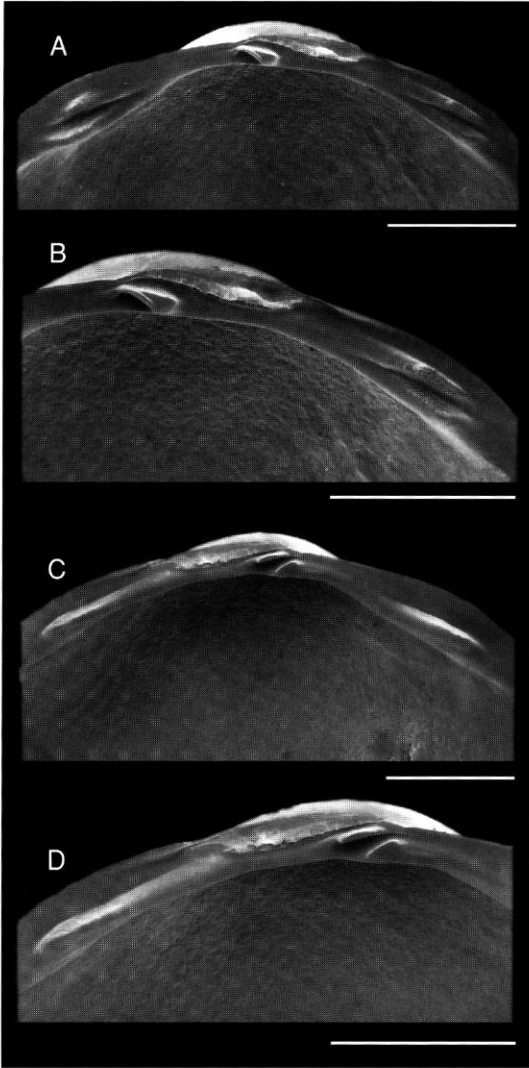


FIG. 9. — *Pisidium llanquihuense* n. sp. (MLP 5344); **A**, hinge of the right valve; **B**, detail of right cardinal tooth, ligament and posterior lateral teeth; **C**, hinge of the left valve; **D**, detail of left cardinal teeth, ligament and posterior lateral tooth. Scale bars: 1 mm.

shaped, its dorsal wall is a thin calcareous layer which in dried specimens can fracture in several small plates (Fig. 10C). Ligament internal, however it is slightly exposed to the exterior through a narrow slit (Fig. 10B-D). In larger specimens, the ligament might be protruding, but it is always covered by the calcic plates which form the roof of the ligament-pit (Fig. 10D).

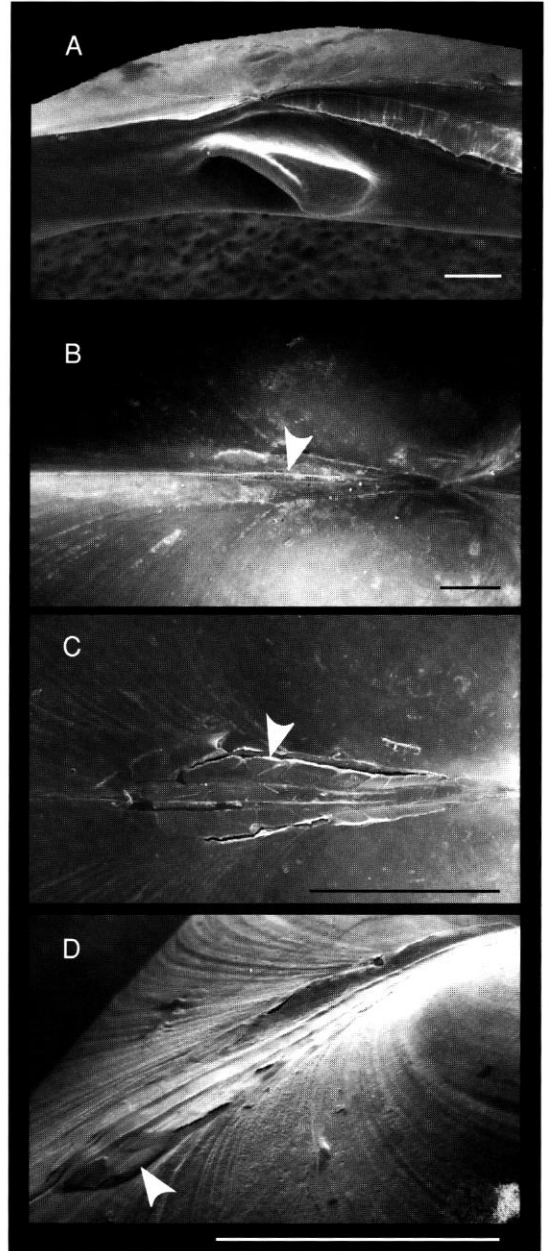


FIG. 10. — *Pisidium llanquihuense* n. sp. (A, B, MLP 5344; C, D, MLP 5349); **A**, detail of the right cardinal tooth; **B**, dorsal view showing a narrow portion of the ligament visible (arrow); **C**, dorsal view of a shell showing the small plates which form the dorsal wall of the ligament-pit (arrow); **D**, dorso-lateral view of the escutcheon, showing a strong ligament elevating the dorsal wall of the ligament-pit (arrow). Scale bars: A, 100 μ m; B, 200 μ m; C, 0,5 mm; D, 1 mm.

ANATOMY

Only the anal siphon present. Pre-siphonal suture short (representing about 13% of shell length), approximately as long as the siphonal diameter. Dorsal loop of the nephridia deeply cleft. Only one (the inner) pair of demibranchs present, ascending lamellae shorter, representing about one-third of the descending one. Brood sacs developing postero-dorsally, maximum number of incubated embryos found: eight shelled larvae (1.2 mm length) in an adult of 5.2 mm of shell length. Multiple (12-13) weak inner radial mantle muscles, besides a powerful siphonal retractor, inserting not apart from the mantle line (however, in paratypes of the lot MLP 5344, inner radial muscles are well-developed and muscle scars very well-marked, but always lying just above or in close contact with the mantle line).

REMARKS

Pisidium llanquihuense n. sp. may be easily distinguished from other pisidia from southern Chile and Patagonia by its high ovate, tending to sub-quadrangular, shell shape. The type of ligament, internal but very slightly exposed and the presence of one demibranch and one siphonal aperture, place this species in the vicinity of those from the Paraná, Uruguay and Río de La Plata drainages such as *Pisidium forense* Meier-Brook, 1967 and two yet unpublished new species from Corrientes and Misiones provinces (northeastern Argentina). However, the solidness of shell and particularly that of the hinge plate agrees with the pattern which is characteristic for Patagonian species. The short pre-siphonal suture and the reduced litter size, are also distinctive. The type of nephridia, the siphonal arrangement, the number of demibranchs and position of brood sacs, reminds one of those species included in the subgenus *Afropisidium*, however, the characteristics of the ligament-pit and the peculiar position of the ligament are discordant characters.

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