

## First records of actual and fossil *Stephadiscus* outside Patagonia, and description of a new Amazonian species

(Mollusca: Pulmonata: Charopidae)

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### Abstract

An extension of both temporal and spatial range of *Stephadiscus* is provided, together with the description of the first Amazonian species (recorded from Peru) and the first Holocene fossils (found in Chile). The new species, *S. madreñosensis*, was recorded in the Peruvian department Madre de Dios. The first Chilean fossils of the genus, which would have lived in more humid environmental conditions than at present, are recorded from the region of Los Vilos (Choapa province), for the late Holocene. Both findings show that the genus *Stephadiscus* has been distributed in the past and at present beyond the limits of the Patagonian area.

**Key words:** *Stephadiscus*, Perú, Amazon basin, Chile, recent new species, fossil records.

### Introduction

The genus *Stephadiscus* HYLTON SCOTT 1981 was introduced for recent South American “Endodontidae” species, currently known as Charopidae, characterized by a microsculptured protoconch, with axial ribs only (HYLTON SCOTT 1981). Originally, the genus included species known previously as *Stephanoda* ALBERS 1860: *S. lyratus* (COUTHOUY in GOULD 1846) (type species of *Stephadiscus*), *S. celinae* (HYLTON SCOTT 1969), *S. perversus* (HYLTON SCOTT 1969), *S. distinctus* (HYLTON SCOTT 1970), *S. testalbus* (HYLTON SCOTT 1970), *S. rumbolli* (HYLTON SCOTT 1973a), and *S. antarctica* (HYLTON SCOTT 1973b), all of them found in Patagonia and the Falkland Islands (Islas Malvinas), south of 36° SL.

In the same paper, HYLTON SCOTT (1981) described *S. striatus* as well as two subspecies: *S. s. striatus*, from northwest Argentina, and *S. s. caribeus* from Venezuela; recently, *S. stuardoi* MIQUEL & BARKER 2009 was added from northern Chilean Patagonia. However, *S. s.*

*striatus* and *S. s. caribeus* show the teleoconch with an embryonic microsculpture similar to the Punctidae species *Paralaoma servilis* (SHUTTLEWORTH 1852), so both subspecies could be synonymous of this exotic species (MIQUEL, in prep.). The first fossil records of *Stephadiscus*, which correspond to middle-late Eocene, were from Chubut (Argentina), where *S. sp. aff. S. lyratus* were described (BELLOSI et al. 2002).

In this paper, a new species from the Peruvian Amazon and the first Holocene records of the genus from central Chile are described, being the first non-Patagonian taxa of *Stephadiscus*.

### Material and methods

The Peruvian specimens were collected in four localities of Madre de Dios department, located on the

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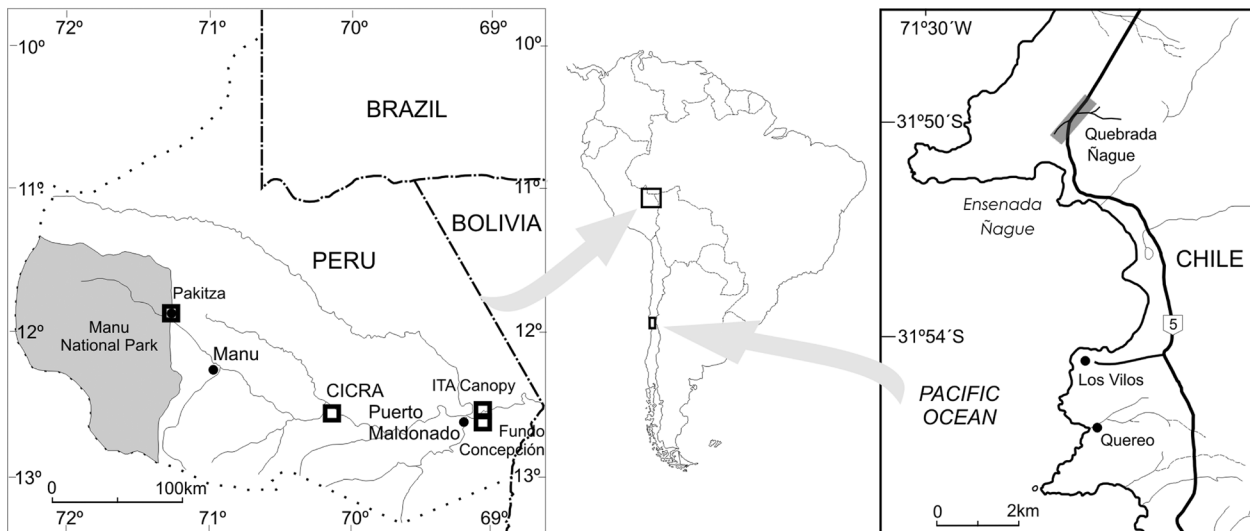


Fig. 1: Location map of distribution area of *Stephadiscus madreiosensis* MIQUEL & RAMÍREZ n. sp. in Peru and Chilean fossil *Stephadiscus*.

Madre de Dios basin (Fig. 1): 1) BIOLAT Biodiversity Station, Pakitza Guard Station, 65 km above the mouth of Manu river, 356 m, 11°56'47"S 71°17'00"W (ERWIN 1991); 2) CICRA Biological Station, at the south end of "Los Amigos Conservation Concession" (LACC), 268 m, 12°34'07"S 70°05'57"W (PITMAN 2008); and two localities at the lower Río Madre de Dios 3) Inkaterrea Reserva Amazónica (ex "Cuzco Amazónico") (DUELLMAN & KOEHLIN 1991; DUELLMAN 2005) and 4) Fundo Concepción through the NGO Inkaterrea Association (ITA). The specimens were obtained by sieving samples of soil and litter (1 m<sup>2</sup> surface and 5 cm depth).

The Chilean specimens were obtained by sieving samples of sediment (3 cm<sup>3</sup>) of a stratigraphic column (intervals between 2 and 5 cm) and picking them with a stereomicroscope (MALDONADO & VILLAGRÁN 2002).

For comparison, the following specimens were used:

- S. antarctica*: Holotype. MACN-In 27.820. Falkland Islands (Islas Malvinas), collected by M. RUMBOLL, 1971.  
*S. celinae*: Holotype. MACN-In 27.275. Villa La Angostura, Nahuel Huapí National Park, Neuquén, Argentina, collected by C. MATTERI, XI-1968. FMNH 308.201. Pudeto, Chiloé Islands, Chiloé province, Chile, collected by T. CEKALOVIC, 21-II-1989. 1 spec.  
*S. distinctus*: Holotype. MACN-In 27.332. Forest area of Foyel river, Río Negro, Argentina. FMNH 308.199. Chepu, Chiloé Island, Chiloé province, Chile, collected by T. CEKALOVIC, 14-I-2002. 1 spec.  
*S. lyratus*: MACN-In 27.462. Isla de los Estados, Alexander bay, Argentina, collected by C. MATTERI, 21-XI-1971. 2 specs.  
*S. perversus*: MACN-In 36.121. Puerto Blest, Nahuel Huapí National Park, Río Negro, Argentina, collected by G.M. BARKER & S.E. MIQUEL, 18-X-1996. 2 specs.  
*S. rumbolli*: MACN-In 27.815-1. 40 km at Río Gallegos, Santa Cruz, Argentina, collected by C. MATTERI and G. HÄSSEL de MENÉNDEZ, 4-I-1976. 1 spec.  
*S. striatus striatus*: Paratype. MLP 11487. Pocitos, Salta, Argentina, collected by M. BIRABÉN, 20-III-1964.

*S. striatus caribeus*: Syntype. MACN-In 31.132. La Castellana, Venezuela, collected by E. MARTÍNEZ FONTES, 20-XII-1960.

*S. stuardoi*: Holotype. MNHNCL 6655. Hualpén Botanical Park, Concepción, Chile, collected by G.M. BARKER and S.E. MIQUEL, 13-X-1996. MACN-In 36.130. Hualpén Botanical Park, Concepción, Chile. Col. G.M. BARKER and S.E. MIQUEL, 13-X-1996. 3 specs.

*S. testalbus*: Holotype. MLP 10.511. Mascardi lake area, Nahuel Huapí National Park Río Negro, Argentina, collected by M. BIRABÉN, 1942. MACN-In 36.113. Gutiérrez lake, Nahuel Huapí National Park, Argentina, collected by G.M. BARKER and S.E. MIQUEL, 16-X-1996. 1 spec. FMNH 308.230. Estero Nonguen, Concepción province, Chile, collected by T. CEKALOVIC, 8-XII-1993. 7 specs.

For morphometric analysis of the shell, the holotype and 4 paratypes of the new species, and only one specimen of each other species and subspecies were used. The Principal Components Analysis was applied to the transformed log<sub>10</sub> data, using the SPSS Statistics 17.0 software.

The abbreviations used are:

D	Maximum Diameter
DUMB	Diameter of umbilicus
FMNH	Field Museum of Natural History, Chicago, USA
H	Height
IML	Instituto Miguel Lillo, San Miguel de Tucumán, Argentina
L	Length of the aperture
MACN-In	Invertebrates Division of Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina
MACN-Pi	Paleoinvertebrates Division of Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina

MLP	Museo de La Plata, La Plata, Argentina	RLW	number of ribs on the last whorl
MNRJ	Museu Nacional, Rio de Janeiro, Brazil	RMM	number of ribs per mm
MNHNCL	Malacological Collection of Museo Nacional de Historia Natural, Santiago, Chile	SMF	Natur-Museum Senckenberg, Frankfurt am Main, Germany
MUSM	Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, Perú	W	Width of the aperture
		WN	Number of whorls

## Systematic account

Family Charopidae HUTTON 1884

Genus *Stephadiscus* HYLTON SCOTT 1981

Type species: *Helix (Pyramidula) lyrata* COUTHOUY in GOULD 1846, by original designation.

Type locality: Near Orange bay, Hardy peninsula, Hoste island, Chile.

Age: Middle-late Eocene–Recent (MIQUEL & BELLOSI 2007; 2010).

Comment: The first record of this genus in Perú was published recently (RAMÍREZ *et al.* 2007).

*Stephadiscus madreiosensis* n. sp.

Figs 2–6

**Diagnosis:** Shell minute, orbicular, with 3.50 whorls, subcircular aperture, umbilicus perspective, teleoconch with 110–120 axial ribs on the last whorl, and 10–12 spiral costulae, protoconch with 1.75 whorls, and nearly 30 axial ribs, translucent white color.

**Description:** Shell minute (diameter: 1 mm), orbicular, with 3.50 whorls; moderately elevated spire, apex scarcely protruding; subcircular descendent aperture; convex whorls; marked suture; umbilicus perspective (about 1/3 shell diameter); teleoconch with 110–120 axial ribs on the body whorl (53–57 per mm), and 10–12 irregular, spiral costulae (lirae), marked on umbilical view; protoconch with 1.75 whorls, costulated with nearly 30 heavy axial ribs; irregularly protoconch ends; translucent white color.

**Measurements** of illustrated specimens: see Table 1.

**Type locality:** Peru, Madre de Dios department, Manu province, Los Amigos Conservation Concession (LACC), Los Amigos Biological Station (CICRA) (12°34'07"S 70°05'57"W, 268 m).

**Distribution:** Peru, Madre de Dios department; 200–360 m.

**Derivation of name:** of Madre de Dios, department and basin name where the new species was found.

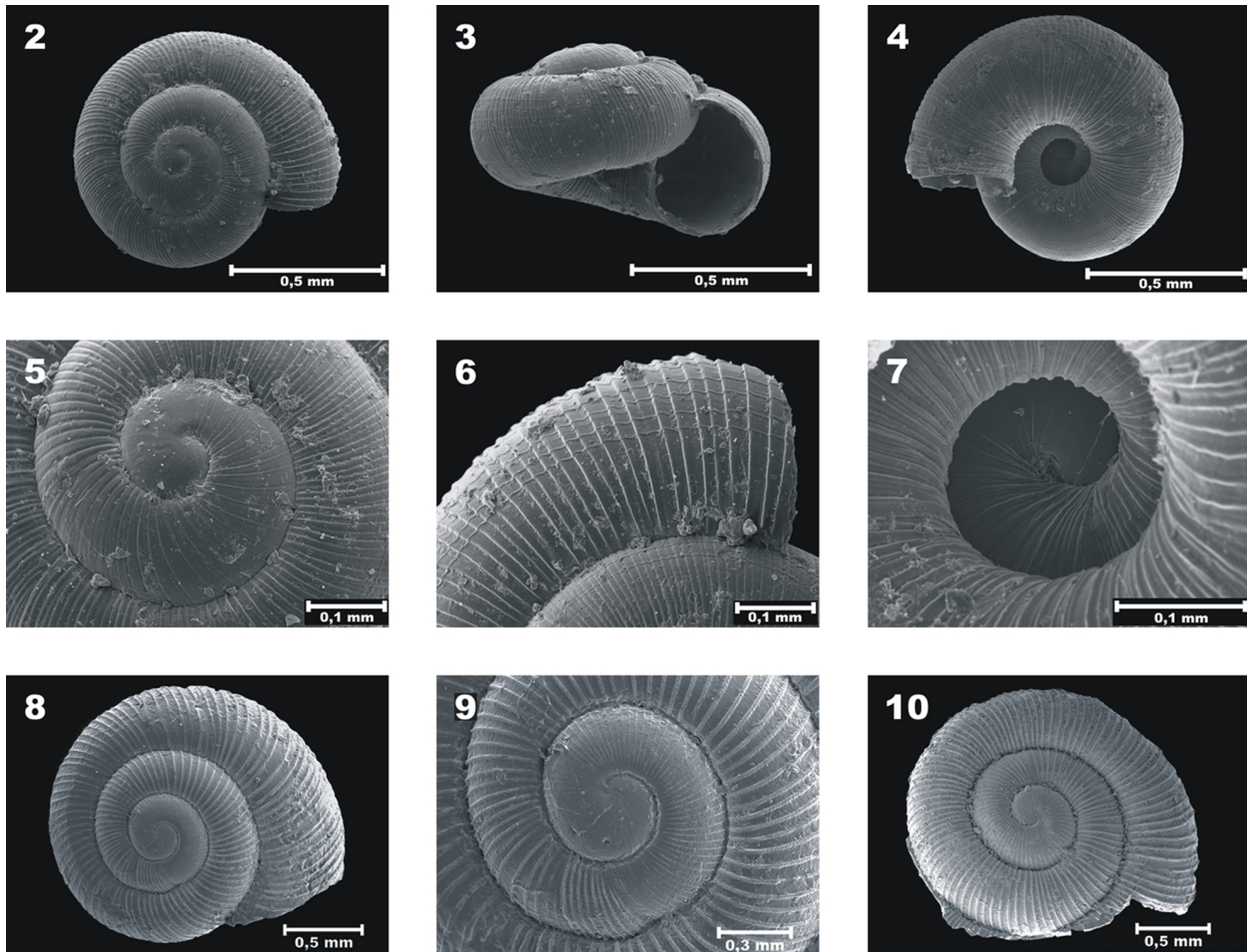
**Material examined:** Holotype: MUSM 4238a. — Paratypes: MUSM 4238b/4. Los Amigos Conservation Concession (LACC), Los Amigos Biological Station (CICRA) (12°34'07"S 70°05'57"W, 268 m: between Trail 14 (Cocha Lobo) and 11 (Bajío), between Trees 123 and 127, Manu province, Madre de Dios department, Peru, coll. R. RAMÍREZ, 21-VI-2006; MACN-In 37716/2 (ex MUSM 4238); IML 15.343/2 (ex MUSM 4238/2); MUSM 5000/2; MACN-In 37.721/1 (ex MUSM 5000/1). Reserved Zone of Manu National Park, Pakitza Guard Station, BIOLAT Biodiversity Station, 356 m, (11°56'47"S 71°17'00"W): Zone 02, Plot 13, Quad 08, Tree 13, Manu River, Manu prov., Madre de Dios dept. Peru, coll. by R. RAMÍREZ, IX-1988; MUSM 4239/3. Los Amigos Biological Station (CICRA) (12°34'07"S 70°05'57"W, 268 m: Trail 15 (Carretera), landmark 700 m, Los Amigos Conservation Concession (LACC), Manu prov., Madre de Dios dept. Peru, coll. R. RAMÍREZ & P. ROMERO, 21-III-2007; MUSM 4240/1. Los Amigos Biological Station (CICRA) (12°34'07"S 70°05'57"W, 268 m: Trail 13 (Playa), Los Amigos Conservation Concession (LACC), Manu prov., Madre de Dios dept. Peru, coll. by R. RAMÍREZ and P. ROMERO, 19-III-2007; MUSM 5001/1, MACN-In 37720/2 (ex MUSM 5001/2), MNRJ 15.467/2 (ex MUSM 5001/2); IML 15.452/1 (ex MUSM 5001/1). Inkaterra Reserva Amazónica, Canopy station: Tower 1 near Platform 1 (12°31'53.71"S 69°02'47.76"W), Lower Madre de Dios River, Tambopata prov., Madre de Dios dept. Peru, coll. R. RAMÍREZ, V. BORDA & H. MÉNDEZ, 18-III-2009; MUSM 5002/3, MACN-In 37823/1 (ex MUSM 5002/1), SMF 336146/2 (ex MUSM 5002/2), FMNH 312493/2 (ex MUSM 5002/2). Fundo Concepción (ITA): Ubos trail (12°36'24.48"S 69°04'56.64"W), Lower Madre de Dios River, Tambopata prov., Madre de Dios dept., Peru, coll. R. RAMÍREZ, V. BORDA & H. MÉNDEZ, 19-III-2009.

**Other material examined:** MUSM 4242. Los Amigos Biological Station (CICRA) (12°34'07"S 70°05'57"W, 268 m: head of trail 14 (Cocha Lobo), Los Amigos Conservation Concession (LACC), Manu prov., Madre de Dios dept., Peru, coll. R. RAMÍREZ & P. ROMERO, 19-III-2007, 1 spec. living in rotting logs.

**Comparisons:** Differs to *S. lyratus*, type species of the genus, by its very small size, umbilicus more open, and less axial ribs in the teleoconch and protoconch (130–140 on body whorl of *S. lyratus*). *S. testalbus* is larger (3 times approximately), has more axial ribs and lacks spiral lirae in the teleoconch, *S. distinctus* has

Table 1: Measurements of *S. madreiesense* n. sp. (mm).

	D	H	L × w	dum	wn	rlw
Holotype (MUSM 4238a)	0.93	0.50	0.43 × 0.27	0.27	3.25	100
Paratype (MUSM 4238b-1)	1.03	0.60	0.47 × 0.27	0.30	3.50	115
Paratype (MUSM 4238b-2)	1.00	0.53	0.47 × 0.30	0.23	3.25	96
Paratype (MUSM 4238b-3)	0.87	0.53	0.43 × 0.27	0.23	3.25	110
Paratype (MUSM 4238b-4)	0.87	0.53	0.40 × 0.27	0.27	3.25	95

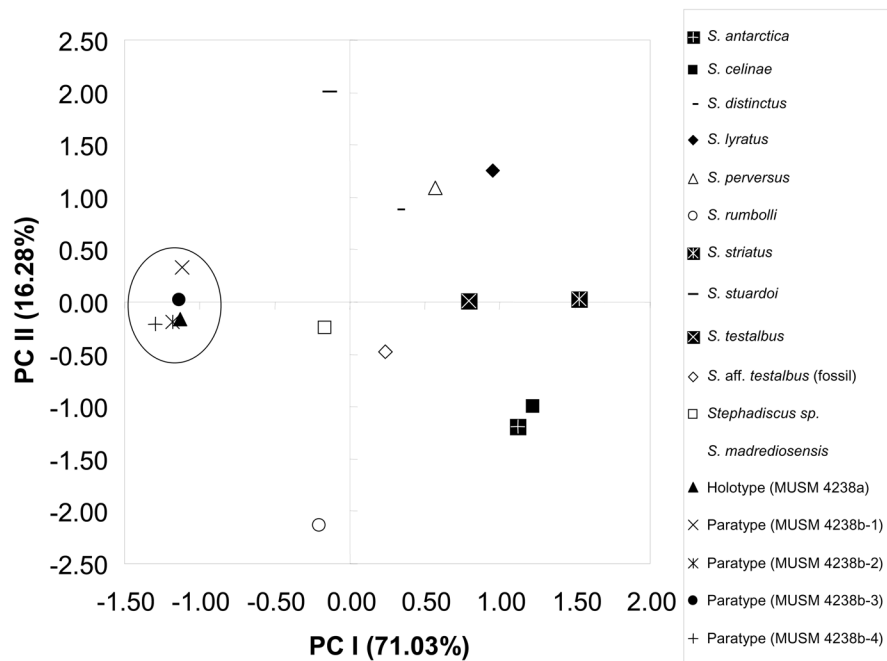


Figs 2–10. Species of *Stephadiscus*. Figs 2–7: *S. madreiesensis*. Fig. 2, Holotype MUSM 4238a, apical view; Fig. 3, paratype MUSM 4238b, frontal view; Fig. 4, paratype MUSM 4238b, umbilical view; Fig. 5, holotype MUSM 4238a, detail of protoconch; Fig. 6, holotype MUSM 4238a, detail of ribs on last whorl; Fig. 7, *S. madreiesensis*, paratype MUSM 4238b, umbilical view. — Figs. 8–9: *Stephadiscus* sp. aff. *S. testalbus*. Fig. 8, MACN-Pi 4.918, apical view; Fig. 9, MACN-Pi 4.918, detail of protoconch. — Fig. 10: *Stephadiscus* sp., MACN-Pi 4.917, apical view.

a more delicate appearance, with more costulae on the protoconch, is more discoid, its aperture is reniform (not subcircular), and the periostracum is yellowish, white in *S. madreiesensis*. *S. stuardoi* is planispiral, the sculpture of the protoconch and teleoconch is similar, and has more axial ribs on the last whorl (approximately 190); *S. celinae* is larger (3.0 × 1.7 mm), has a more open

umbilicus and less ribs in the adult stage (40–45), *S. per-versus* is sinistral, larger and its umbilicus is narrower, *S. rumbolli* and *S. antactica* are similar, respectively, to *S. lyratus* and *S. celinae*, but they do not seem to be adults, fossil *Stephadiscus* spp. from Chile are larger with more open umbilicus and less axial ribs in the adult stage (Table 2; Fig. 11).

Fig. 11. Discrimination of *Stephadiscus madreiosensis* MIQUEL & RAMÍREZ n. sp. from the Principal Components Analysis (PCA) of variation for 8 quantitative shell characters among 11 species of *Stephadiscus*. The percentage of variation accounted for by each Principal Component (PC) is given in parentheses.



Principal Components Analysis (PCA) (Fig. 11): *Stephadiscus madreiosensis* was clearly discriminated among the species of the genus, based on the shells. In the PCA of shells of *Stephadiscus*, the first principal component (PCI) was responsible for 71.03% of the total variation, shell height (H) and the diameter of umbilicus (Dumb) being the variables that more contributed to such variation, followed by diameter (D). Regarding the second principal component (PCII), that was responsible for 16.28% of the total variation, the variable that most contributed was number of ribs on the last whorl (rlw), followed by number of whorls (wn) and number of ribs per mm (rmm). The PCI discriminated the new species by its tiny shell and narrower umbilicus; *S. stuardoi*, *S. rumbolli* and *Stephadiscus* sp. are more related to the new species regarding these characteristics; on the contrary, *S. striatus* is the most divergent, with the highest shell and widest umbilicus. If the number of ribs per mm is considered (PCII), the new species takes a position between *S. stuardoi* (most abundant) and *S. rumbolli* (most scarce), while *S. testalbus*, *S. striatus* and *Stephadiscus* sp. are within the range of variation of ribs per mm of *Stephadiscus madreiosensis* (Tables 3 and 4).

*Stephadiscus* sp. aff. *Stephadiscus testalbus* (HYLTON SCOTT 1970)

Figs 8–9

aff. *Stephanoda testalbus* HYLTON SCOTT 1970: 284, fig. 4 (1, 2).

aff. *Stephadiscus testalbus*, – (así lo pide la revista) HYLTON SCOTT 1981: 125.

*Radiodiscus* sp. MALDONADO & JACKSON 2001: 64; MALDONADO & VILLAGRÁN 2002: 137.

Description: Shell minute (diameter: 1.87 mm), discoidal, costulated, spire low, umbilicus perspective, 3.75 convex whorls, gradually increasing, suture marked, aperture large and subcircular; protoconch with 1.50 whorls with axial ribs more closely set than those of the teleoconch.

Stratigraphical and geographical occurrence: Sites Ñague and Chungos peak, Ñague gully, Los Vilos, Choapa province, Chile (31°50'S 71°28'W) (Fig. 1); Late Holocene (4200–3200 cal years B.P.) (MALDONADO & VILLAGRÁN 2002).

Measurements of illustrated specimen: D: 1.87 mm; H: 0.90 mm; l: 0.73; w: 0.50 mm; 3.50 whorls.

Repository: MACN-Pi 4.918. 4 specs., coll. D. JACKSON.

Comment: It is different from *S. madreiosensis* because it is larger and lacks spiral costulae crossing the radial ribs of the teleoconch.

*Stephadiscus* sp.

Fig 10

*Radiodiscus* sp. MALDONADO & JACKSON 2001: 64; MALDONADO & VILLAGRÁN 2002: 137.

Description: Shell minute, discoidal, costulated, with low spire, umbilicus perspective, 3.75 convex gradually increasing whorls, marked suture, large and subcircular aperture; protoconch with 1.50 whorls with axial ribs more closely set than those of the teleoconch, radial ribs are crossed by delicate spiral costulae.

Stratigraphical and geographical occurrence: Site Ñague, Ñague gully, Los Vilos, Cho-

Table 2: Comparative features of the species of *Stephadiscus* (disc. = discoid; hel. = helicoidal; ind. = indifferiated; orb. = orbicular; sin. = sinistral).

	Shape	Size D vs. H	Whorls	Aperture t vs. w	Ribs rmm vs. rlw	Umbilicus mm vs. %	Proto- conch	Obs.
<i>S. lyratus</i> MACN-In 27462	orb. to disc.	3.6 vs. 2.0	3.75	1.3 vs. 1.5	25 vs. 180	0.7 vs. 20	ind.	
<i>S. celinae</i> MACN-In 27275	vaulted orb.	3 vs. 1.7	4	1.1 vs. 1.1	9 vs. 38	0.8 vs. 37	1.75	
<i>S. perversus</i> MACN-In 36121	sin. disc.	2.2 vs. 1.3	4.25	1.2 vs. 0.7	20 vs. 120	0.6 vs. 27	2	
<i>S. distinctus</i> MACN-In 27332	vaulted orb.	2.1 vs. 1.3	4	1.1 vs. 0.5	22 vs. 120	0.5 vs. 25	1.50	
<i>S. testalbus</i> MACN-In 36113	vaulted orb.	2.6 vs. 1.6	3.25	1.1 vs. 0.9	14 vs. 100	0.8 vs. 30	1.75	
<i>S. rumbolli</i> MACN-In 27815-1	low orb.	1.7 vs. 1.0	2.25	0.9 vs. 0.4	21 vs. 50	0.4 vs. 22	1.75	Juv
<i>S. antarctica</i> MACN-In 27820	low hel.	2.8 vs. 1.6	4	0.8 vs. 0.9	6 vs. 40	0.9 vs. 31	1.75	
<i>S. striatus striatus</i> MLP 11487	Conical	2.5 vs. 1.8	3.25	1.1 vs. 1.2	8 vs. 60	0.3 vs. 12	ind.	
<i>S. striatus caribeus</i> MACN-In 31132	Conical	4.0 vs. 2.5	4	1.3 vs. 1.5	9 vs. 70	1.1 vs. 27	ind.	
<i>S. stuardoi</i> MNHNCL 6655	Planispiral	2.0 vs. 0.8	4.25	0.8 vs. 0.5	55 vs. 190	0.6 vs. 33	ind.	
<i>S. aff. testalbus</i> MACN-Pi 4918	orb.	1.9 vs. 1.1	3.50	0.7 vs. 0.7	14 vs. 75	0.5 vs. 38	1.75	
<i>S. sp.</i> MACN-Pi 4917	orb.	1.5 vs. 0.8	3.50	0.7 vs. 0.5	16 vs. 90	0.4 vs. 37	ind.	
<i>S. madrediosense</i> 2 PT F4	vaulted orb.	1.0 vs. 0.6	3.50	0.5 vs. 0.3	55 vs. 115	0.3 vs. 33	1.75	

apa province, Chile (31°50'S 71°28'W) (fig. 1); Late Holocene (4200–3200 cal years B.P.) (MALDONADO & VILLAGRÁN 2002).

Measurements: D: 1,5 mm; H: 0,90 mm; l: 0,67; w: 0,50 mm; 3.50 whorls.

Repository: MACN-Pi 4.917. 1 spec. fragm., collected by D. JACKSON.

Comment: The specimen could represent a new species, but its fragmentary condition does not allow the description of a new taxon.

## Discussion

At present, *Stephadiscus* shows a distribution on both sides of the “Cordillera de los Andes”, from 36° SL to southernmost continental as well as insular areas of South America (MIQUEL *et al.* 2003; MIQUEL & BARKER 2009; 2010).

The Peruvian fauna includes published records of 13 Charopidae species (RAMÍREZ *et al.* 2003). These records and the information obtained from the samples housed in the Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos collection show the following distribution by departments: *Radiodiscus* PILSBRY in PILSBRY & FERRIS 1906 in Ancash, Cuzco, Junín, Pasco and Puno; *Rotadiscus* PILSBRY 1927 (and “*Ptychodon*” ANCEY 1888) in Cuzco, Junín and Lima; *Lilloiconcha* WEYRAUCH 1965 in Pasco; *Zilchogyra* WEYRAUCH 1965 in Ancash, Apurímac, Cuzco and Piura, and the invasive species *Paralaoma* IREDALE 1913, in Cuzco and Puno. Madre de Dios has no records of Charopidae. The localities where *S. madrediosensis* was found belong to the biogeographic region Subtropical Amazon, that is characterized by a rainy season between November to April (2 m per year) and 24° C (with a minimum of 8° C during

“frijas” (cold air fronts from south) between June and August (RODRÍGUEZ 1996). The life zone that characterizes the area is transitional tropical to subtropical rainforest (bh–T/S) (INRENA 1995; VEGA *et al.* 2006), located in a plain forest (“Llanura Baja” or “Bajío”), characterized by heavy rains that flood the area, and high levels of decaying organic matter (DUELLMAN & KOEHLIN 1991; ERWIN 1991; VEGA *et al.* 2006).

The present northernmost Chilean Charopidae live between 30° and 37° SL (STUARDO & VEGA 1985; VALDOVINOS ZARGES 1999), where *Austrodiscus* (*Zilchogyra*) *solemi* VALDOVINOS & STUARDO 1989 (probably a *Rotadiscus* sp.) lives at 30° SL. In Los Vilos area the terrestrial malacofauna is diverse, particularly in medium-sized molluscs: Pupillidae, Succineidae, Strophocheilidae, Orthalicidae and less representative groups (VALDOVINOS ZARGES 1999), but has no Charopidae records. The specimens of *Stephadiscus* described in this paper are the first fossil Charopidae from Chile, they would have lived in more humid environments than at present, according to pollen analysis; this climatic characteristics would be related to changes in position and / or intensity of westerly

winds and, probably, to the frequency of the El Niño/Southern Oscillation events (MALDONADO & JACKSON 2001; MALDONADO & VILLAGRÁN 2002). At present, the only known fossils of *Stephadiscus* occur in the Eocene of Chubut (Argentina) (MIQUEL & BELLOSI 2007; 2010), being the most ancient records of the genus.

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### References

- ALBERS, J. C. (1860): Die Heliceen, nach natürlicher Verwandtschaft systematischgeordnet von Johann Christian ALBERS. 2. — Ausgabe, herausgegeben von E. von Martens: i–xviii, 1–359. Leipzig.
- ANCEY, C. F. (1888): Nouvelles contributions malacologiques, IX. Catalogue raisonné des mollusques Néo-Calédoniens publiés jusqu’à ce jour, et compris par les autres dans les genres *Hyalinia*, *Helix*, *Diplomphalus*, etc. — Bulletin de la Société malacologique de France, **5**: 357–376.
- BELLOSI, E. S., MIQUEL, S. E., KAY, R. F. & MADDEN, R. H. (2002): Un paleosuelo mustersense con microgasterópodos terrestres (Charopidae) de la Formación Sarmiento, Eoceno de Patagonia central: significado paleoclimático. — *Ameghiniana*, **39**: 465–477.
- DUELLMAN, W. E. (2005): Cusco Amazónico: the lives of amphibians and reptiles in an Amazonian rainforest. — 433 pp.; Ithaca (Cornell University Press).
- DUELLMAN, W. E. & KOEHLIN, J. E. (1991): The Reserva Cuzco Amazónico, Peru: biological investigations, conservation, and ecotourism. — *Occasional Papers of the Museum of Natural History*, **142**: 1–38.
- ERWIN, T. L. (1991): Natural history of the carabid beetles at the BIOLAT Biological Station, Rio Manu, Pakitza, Perú. — *Revista Peruana de Entomología*, **33**: 1–85.
- GOULD, A. A., (1846): Descriptions of the shells collected by the United States Exploring Expedition under Captain WILKES. — *Proceeding of the Boston Society of natural History*, **2**: 165–167; 170–173.
- HYLTON SCOTT, M. I. (1969): Endodóntidos neotropicales IV (Moll. Pulm.). — *Neotropica*, **15** (47): 59–63.
- — — (1970): Endodóntidos de la región austral cordillerana (Gastropoda-Pulm.). — *Revista del Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”*, *Zoología*, **10**: 267–296.
- — — (1973a): Endodóntidos neotropicales IV (*sic*) (Gastropoda Pulmonata). — *Neotropica*, **19** (59): 104–109.
- — — (1973b): Endodóntidos neotropicales V (Gastropoda Pulmonata). — *Neotropica*, **19** (60): 126–131.
- — — (1981): Referencia al género *Stephanoda* Albers, 1860 y la creación del género *Stephadiscus* n. gen. (Mollusca Endodontidae). — *Neotropica*, **27** (78): 123–126.
- IREDALE, T. (1913): The land mollusca of the Kermadec Islands. — *Proceeding of the Malacological Society of London*, **10**: 364–388, pl. 18.
- MALDONADO, A. & JACKSON, D. (2001): Cambios ambientales y ocupaciones humanas en la costa de Los Vilos (31° 55'S) durante el Holoceno. — *Gayana*, **58**: 64.
- MALDONADO, A. & Villagrán, C. (2002): Paleoenvironmental Changes in the Semiarid Coast of Chile (32° S) during the Last 6200 cal Years Inferred from a Swamp-Forest Pollen Record. — *Quaternary Research*, **58**: 130–138.
- MIQUEL, S. E. & BARKER, G. M. (2009): New Charopidae from Chilean – Argentine Patagonia (Mollusca: Gastropoda: Stylommatophora). — *Archiv für Molluskenkunde*, **138** (1): 1–9.
- MIQUEL, S. E. & BELLOSI, E. S. (2007): Microgasterópodos terrestres (Charopidae) del Eoceno medio de Gran Barranca (Patagonia Central, Argentina). — *Ameghiniana*, **44** (1): 121–131.
- & — (2010): Middle Eocene-oligocene gastropods of the Sarmiento Formation. The Paleontology of Gran

- Barranca: Evolution and Environmental Change through the Middle Cenozoic of Patagonia. 5: 61–68. Ed. R.H. MADDEN, A.A. CARLINI, M.G. VUCETICH & R.F. KAY. Cambridge University Press. New York. v + ix; 1–448 pp.
- MIQUEL, S. E., RAMÍREZ, R. & THOMÉ, J. W. (2003): Análisis cualitativo de la distribución de Punctoidea en áreas de forestas de América del Sur. — 18° Encontro Brasileiro de Malacologia. Livro de Resumos: 236. Sociedade Brasileira de Malacologia. Rio de Janeiro, 21–25/07/03.
- PILSBRY, H. A. (1927): Costa Rican Land Shells collected by A. A. Olsson. — Proceeding of the Academy of natural Sciences of Philadelphia, 78: 127–133, pl. 11.
- PILSBRY, H. A. & FERRIS, J. H. (1906): Mollusca of the Southwestern States. II. Proceeding of the Academy of natural Sciences of Philadelphia, 58: 123–175, pls. 5–9.
- PITMAN, N. C. A. (2008): An overview of the Los Amigos Watershed, Madre de Dios, southeastern Peru. [http://cicra.acca.org.pe/espanol/paisaje\\_biodiversidad/los-amigos-overview9.pdf](http://cicra.acca.org.pe/espanol/paisaje_biodiversidad/los-amigos-overview9.pdf) [26 octubre 2008].
- RAMÍREZ, R., PAREDES, C. & ARENAS, J. (2003): Moluscos del Perú. — Revista de Biología Tropical, 51 (Supl. 3): 225–284.
- RAMÍREZ, R., MIQUEL, S. [E.], MEDINA, N., ROMERO, P., BORDA, V., PECEROS, F., CHUMBE, A. & RAMÍREZ, J. (2007): Micromoluscos de la reserva Los Amigos y el primer registro de *Stephadiscus* fuera del extremo sur de América. — XVI Reunión Científica ICBAR. Instituto de Investigación de Ciencias Biológicas Antonio Raimondi, Facultad de Ciencias Biológicas, Universidad Nacional Mayor de San Marcos. Resúmenes: 173. 27–29/VIII/2007. Lima.
- RODRÍGUEZ, L. (1996): Diversidad Biológica del Perú. Zonas Prioritarias para su Conservación. — República del Perú, Ministerio de Agricultura. INRENA, GTZ. Lima. 191 pp.
- SHUTTLEWORTH, R. J. (1852): Diagnosen einiger neuen Mollusken aus den Canarischen Inseln. — Mittheilungen Naturforschenden Gesellschaft Bern, 241/242: 137–146.
- STUARDO, J. & VEGA, R. (1985): Synopsis of the Land Mollusca of Chile. With Remarks on Distribution. — Studies on Neotropical Fauna and Environment, 20: 125–146.
- VALDOVINOS, C. & STUARDO, J. (1989): *Austrodiscus (Zilchogyra) solemi* spec. nov. (Pulmonata: Endodontidae). — Boletín de la Sociedad de Biología de Concepción, 60: 239–245.
- VALDOVINOS ZARGES, C. (1999): Biodiversidad de moluscos chilenos: base de datos taxonómica y distribucional. — Gayana, 63: 111–164.
- VEGA, M.S., CERONI, A. & REYNEL, C. (2006): Observaciones ecológicas y taxonomía del género *Codonanthe* (Mart.) Hanst. (Gesneriaceae) en la cuenca del Río Los Amigos, Madre de Dios, Perú. — Ecología Aplicada, 5 (1–2): 37–43.
- WEYRAUCH, W. K. (1965): Neue und verkannte Endodontiden aus Südamerika. — Archiv für Molluskenkunde, 94 (3/4): 121–134.

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