Zoological Studies **60**:28 (2021)
doi:10.6620/ZS.2021.60-28

Zoological Studies

Open Access

Taxonomic Revision of Living Boring Bivalves Belonging to the Family Pholadidae Lamarck, 1809, (Bivalvia: Myida) from the Southwestern Atlantic

Marina Delfino[1,2] and Javier H. Signorelli[1,*]

[1]*Instituto de Biología de Organismos Marinos (IBIOMAR, CCT CONICET-CENPAT). Bvd. Brown 2915, U9120ACD Puerto Madryn, Chubut, Argentina. E-mail: mai_delfino@hotmail.com (Delfino)*
[2]*Universidad Nacional de la Patagonia San Juan Bosco (UNPSJB), Puerto Madryn, Chubut, Argentina.*
**Correspondence: E-mail: jsignorelli@cenpat-conicet.gob.ar (Signorelli)*

Received 1 October 2020 / Accepted 7 March 2021 / Published 24 June 2021
Communicated by James D. Reimer

Boring bivalves of the family Pholadidae Lamarck, 1809 living in Argentinean and Uruguayan waters are herein revised. The literature research revealed twelve nominal species of Pholadidae mentioned as living in the study area. Type material of all nominal taxa were examined when it was possible. Additional specimens from field works and malacological collections were studied, illustrated and re-described. Details of type localities, repositories, and distribution range are provided for each valid taxa. This work revealed the presence of five native and one introduced species belonging to Pholadidae in Argentinean and Uruguayan waters. *Barnea* (*Anchomasa*) *lamellosa*, *Cyrtopleura* (*Scobinopholas*) *lanceolata*, *Pholas* (*Thovana*) *campechiensis* and *Martesia fragilis* belonging to the Argentine biogeographical province; *Netastoma darwinii* from Magellan province; and *Barnea* (*Anchomasa*) *truncata* introduced in the Bahía Blanca estuary. Finally, morphological comparison with congeneric species distributed in American seas are provided.

Key words: *Pholas*, *Barnea*, *Martesia*, *Cyrtopleura*, *Nettastoma*, Argentina, Taxonomy, Boring bivalves.

BACKGROUND

The classification of the superfamily Pholadoidea Lamarck, 1809 has been modified over the years. Several authors recognized the families Pholadidae Lamarck, 1809 and Teredinidae Rafinesque, 1815 (Turner 1954 1955 1969 2002; Monari 2009; Bieler et al. 2010; Huber 2010). Within Pholadidae the subfamilies Pholadinae, Martesiinae, Jouannetiinae and Xylophagainae were historically grouped (Hoagland and Turner 1981; Bernard 1983; Harvey 1996; Turner 2002; Mikkelsen and Bieler 2007; Bieler et al. 2010; Huber 2010). However, Xylophagaidae Purchon, 1941 was considered as separate from the Pholadoidean family (Harvey 1996; Haga and Kase 2008 2013; Coan and Valentich-Scott 2012; Paredes et al. 2016; Coan et al. 2017). Some works elevated Jouannetiidaea to the family level (Coan and Valentich-Scott 2012; Valentich-Scott et al. 2020). In this work the classification of Bieler et al. (2010) is followed.

The members of the family Pholadidae are specialized to bore different types of substrates that affect the morphology of the shell and soft parts (Turner 1969). In general terms, they are characterized by an aragonitic fragile, ovate to elongate and widely gaping shell; dorso-anterior area with umbonal reflection; external surface very sculptured with reticulate or imbricated spines and separated by a radial sulcus to

Citation: Delfino M, Signorelli JH. 2021. Taxonomic revision of living boring bivalves belonging to the family Pholadidae Lamarck, 1809, (Bivalvia: Myida) from the southwestern Atlantic. Zool Stud **60**:28. doi:10.6620/ZS.2021.60-28.

© 2021 Academia Sinica, Taiwan

define distinct zones. The hinge is simple, without teeth and external ligament mainly absent. Some species are trimyarian with the ventral adductor muscle; siphons totally fused, usually covered by a periostracum; pedal muscle subject by the apophysis; foot truncate with discoid extremity; valves with accessory plates along the dorsal margin called protoplax, mesoplax and metaplax; anterior pedal gape closed by a callum in adults.

Five species belonging to the family Pholadidae were cited as living in the southwestern Atlantic Ocean from Uruguay to Argentina (Carcelles 1944; Carcelles and Williamson 1951; Castellanos 1970; Rios 1994 2009; Scarabino 2003; Scarabino et al. 2006 2016; Zelaya 2016). They are *Barnea lamellosa* (d'Orbigy, 1841 in 1834–1847), *Cyrtopleura lanceolata* (d'Orbigy, 1841 in 1834–1847), *Pholas campechiensis* Gmelin, 1791, *Martesia fragilis* Verril and Bush 1898 and *Netastoma darwinii* (G. B. Sowerby II, 1849). Nevertheless, twelve nominal species were mentioned in the literature related to the study area. During an ongoing revision of different groups of boring bivalves, it became necessary to revise the taxonomy of the species belonging to the family Pholadidae living in the Argentinean and Uruguayan waters.

MATERIALS AND METHODS

A total of 260 lots were examined from malacological collections. In addition, field works on several localities of Argentine Patagonian coast were carried out. However, only specimens of *Barnea* (*Anchomasa*) *lamellosa* and *Netastoma darwini* with soft parts were found. The sampled specimens were removed mechanically from the substrate with a geologist hammer. Digital pictures were taken with a Nikon D5000 with a 60 mm Nikkor micro lens. All specimens were cleaned and studied under stereoscopic microscope. Diagnostic characters and mantle cavity organs, when it was possible, were revised and re-described. All dissections were done after Magnesium chloride relaxing method. The type locality and recording sites of revised species are illustrated in the figure 1. Type material and additional specimens studied in this work are deposited in the following institutions: ANSP, Academy of Natural Sciences of Philadelphia; IBIOMAR - CNP-INV, Instituto de Biología de Organismos Marinos; LSL, Linnean Society of London; MACN, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"; MLP, Museo de La Plata; NHMUK, Natural History Museum, London; USNM, United States National Museum.

The following abbreviations are used: aam: anterior adductor muscle; ap: apophysis; cm: collecting mass; es: excurrent siphon; f: foot; fg: food groove; ild: inner left demibranch; illp: inner left labial palp; ird: inner right demibranch; irlp: inner right labial palp; is: incurrent siphon; llp: left labial palp; old: outer left demibranch; ollp: outer left labial palp; ord: outer right demibranch; orlp: outer right labial palp; pam: posterior adductor muscle; pg: pedal gape; pt: Protoplax; rlp: right labial palp; s: siphons; ur: umbonal reflection; vam: ventral adductor muscle; vm: visceral mass; z1: zone 1; z2: zone 2; z3: zone 3.

RESULTS

Family Pholadidae Lamarck, 1809
Subfamily Pholadinae Lamarck, 1809
Genus *Barnea* Risso, 1826 (ex Leach MS)

[= *Barnia* Gray, 1840: 150 (error pro *Barnea*); *Holopholas* Fischer, 1887 in 1880–1887: 1133 (objective)].

Type species: *Barnea spinosa* Risso, 1826 (= *Pholas candida* Linnaeus, 1758), by monotypy.

Distribution: Cosmopolite.

Remarks: *Barnea* includes sixteen valid species widely distributed (Monari 2009; Huber 2010). It differs from other genera within Pholadinae by having only a single lanceolate protoplax. In addition to that, the umbonal reflection is not septate, as in *Pholas*, and the valves are not divided by an umbonal-ventral sulcus as in *Zirfaea* (Kennedy 1974). Fischer (1887) introduced *Holopholas* as a subgenus of *Pholas* and included *Barnea* as a subsection of *Holopholas*, for this reason *Barnea* and *Holopholas* are objective synonyms. *Barnea* has two subgenera: *Barnea s. s.* and *Anchomasa*. *Barnea s. s.* does not occur in the southwestern Atlantic Ocean (Kennedy 1974; Huber 2010). Species included into the subgenus *Anchomasa* have shells anteriorly beaked, wide posterior end and large pedal gape (Kennedy 1974; Huber 2010).

Subgenus *Anchomasa* Leach, 1852

Type species: *Anchomasa pennantiana* Leach, 1852 (= *Pholas parva* Pennant, 1777), by monotypy.

Distribution: Widely distributed, south and west coast of Africa, Japan and Indian seas, South Australia and New Zealand, Europe, west and east coast of America.

Remarks: Currently the subgenus *Anchomasa* includes eleven valid species (Huber, 2010). They are: *Barnea* (*Anchomasa*) *alfredensis* (Bartsch, 1915), *B.* (*A.*) *davidi* (Deshayes, 1874 [1873]), *B.* (*A.*) *fragilis* (G.

© 2021 Academia Sinica, Taiwan

B. Sowerby II, 1849), *B*. (*A*.) *ghanaensis* Huber, 2018 (in Cosel and Gofas, 2018), *B*. (*A*.) *lamellosa* (d'Orbigy, 1841 in 1834–1847), *B*. (*A*.) *manilensis* (Philippi, 1847 [1847-1848]), *B*. (*A*.) *obturamentum* (C. Hedley 1893), *B*. (*A*.) *parva* (T. Pennant 1777), *B*. (*A*.) *similis* (Gray in Yate 1835), *B*. (*A*.) *subtruncata* (G. B. Sowerby I 1834), *B*. (*A*.) *truncata* (T. Say 1822). Future genetic works will clarify the sub-generic status of the mentioned species.

Barnea (*Anchomasa*) *lamellosa* (d'Orbigy, 1841 in 1834–1847)

(Figs. 2A–C, 3)

Pholas lamellosa – d'Orbigny 1841 in 1834–1847: 498, pl. 77, figs. 20, 21; Dall 1908: 289.

Barnea lamellosa – Ihering 1907: 329; Castellanos 1970: 258, pl. 26, figs. 1–2; Figueiras and Sicardi 1970: 412, pl. 5, fig. 80; Scarabino 1977: 215; Bernard 1983: 60; Scarabino 2003: 242; Dias Passos and Magalhães 2011: 148; Scarabino et al. 2016: 10.

Barnea (*Anchomasa*) *subtruncata lamellosa* – Lamy 1925: 82; Carcelles 1944: 295, pl. 14, figs. 108–109; Carcelles 1950: 82.

Barnea subtruncata lamellosa – Barattini 1951: 256; Barattini and Ureta 1961: 184.

Barnea (*Anchomasa*) *lamellosa* – Turner 1954: 25, pl. 8 and 10; Figueiras 1962: 64; Olazarri 1962: 51; Klappenbach 1967: 164;

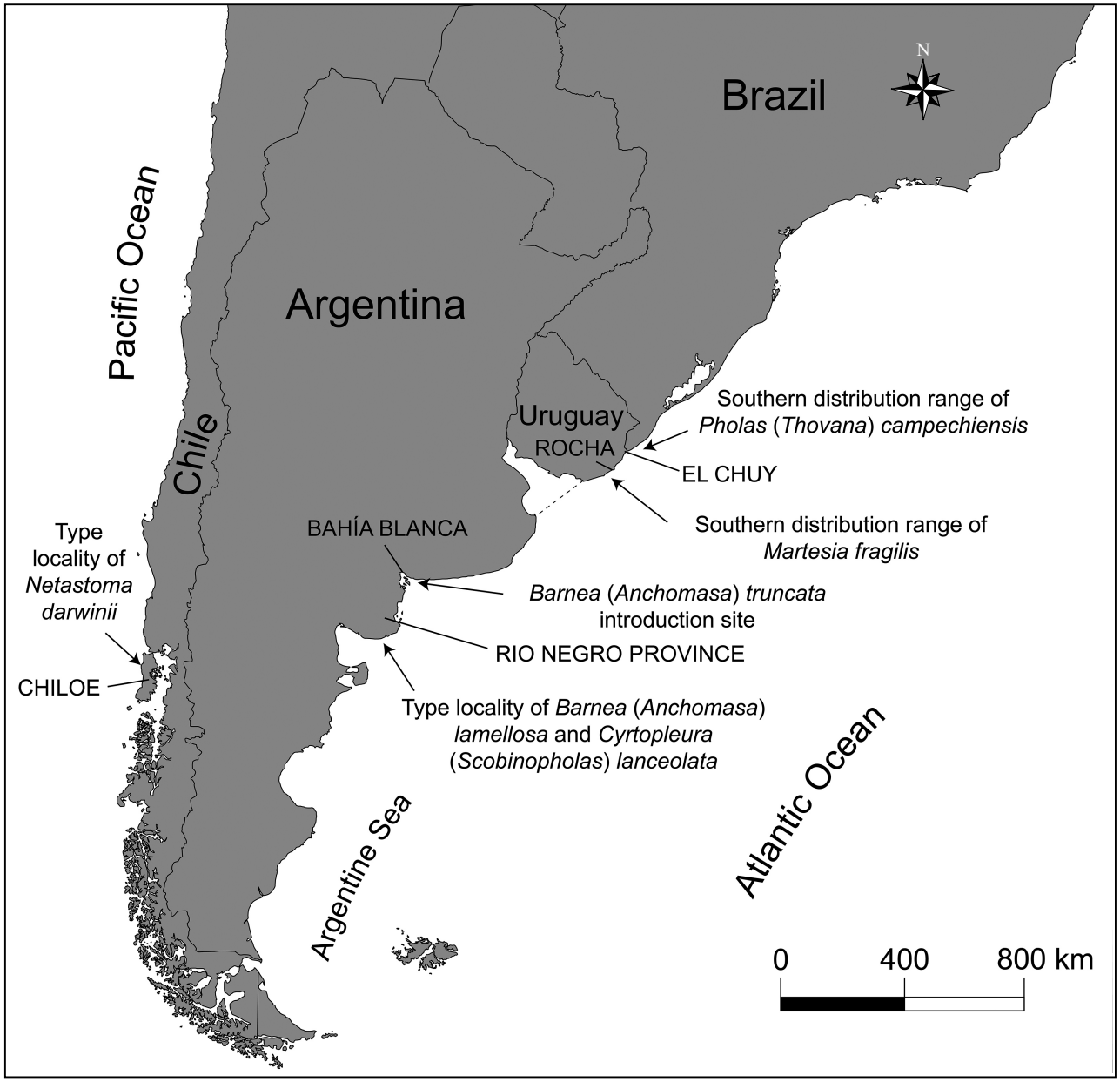


Fig. 1. Map of the study area showing the type locality and the recording sites of the species herein revised.

© 2021 Academia Sinica, Taiwan

Rios 2009: 591, fig. 1630; Huber 2010: 474.

Type material: NHMUK 1854.12.4.655, two syntypes, an articulated specimen and a single valve.

Type locality: "Patagonie, au sud du Rio Negro", Rio Negro Province, Argentina.

Description: Shell: fragile, pellucid, equivalve, moderately elongated, inequilateral; shell length up to 50 mm; anterior end pointed, forward projected; posterior end rounded (Fig. 3A–B); umbos prosogyrate, subcentral; umbonal reflection totally free, well developed on the anterior side of the umbo; apophysis prominent, long, narrow, curved and ventrally projected inside each valve, dorso-posterior margin curved; ventral margin almost straight, slightly rounded; external surface with concentric sculpture defined by spines, more conspicuous on the anterior side of the shell (Fig. 3A); internal surface white; hinge plate rudimentary; pallial sinus broad and deep; adductor muscle scars moderately marked (Fig. 3B). Dorso-anterior area with a calcareous protoplax, strongly keeled, rhomboid and narrow (Fig. 3E); valves not completely closed over the ventral edge; pedal gape rounded.

Mantle cavity organs: siphons totally fused, very elongated, twice shell length, with mud and sand particles attached to the external surface (Fig. 3C, F–G); incurrent siphon wider than excurrent, with a ring of white and single tentacles, equal in size and length; space between tentacles brownish; excurrent siphon without tentacles; two demibranchs at each sides of the body, equal in length, food groove present over the ventral edge of inner and outer demibranch (Fig. 3H–I); labial palps trigonal with the outer surface smooth and inner plicate (Fig. 3J); visceral mass white; on the posterior area with a collecting membrane, trigonal, inflate, well developed; foot large, tubular; pedal gape disc-like; dimyarian, adductor muscles lenticular.

Material examined: Uruguay ─ Departamento de Rocha (MACN 14790); Argentina ─ Santa Clara del Mar (MLP 7781), Mar del Plata (MACN 10745, MACN 11991), Miramar (MACN 15636), Monte Hermoso (MACN 6619, MLP 7780), Bahía Blanca (MACN 38385), Punta Alta (MACN 11171), San Blas Bay (MACN 20213), Rio Negro mouth (MLP 2510), San José gulf, Punta Tehuelche (CNP-INV 2910, 2911, 2912), Puerto San Julián (CNP-INV 2908, 2909).

Distribution: Santa Catarina, Brazil to the Malvinas/Falkland Islands (Rios 2009). In this work specimens from Rocha, Uruguay, to Puerto San Julián in Santa Cruz province were revised.

Remarks: *Barnea lamellosa* has been recorded boring horizontal consolidated mud substrates in the intertidal zone, usually covered with a layer of sand. The sampled specimens were found in a very low density. Although Tryon (1868) and Carcelles (1944) mentioned *Barnea* (*Anchomasa*) *lamellosa* (d'Orbigy, 1841 in 1834–1847) as synonym of *B.* (*Anchomasa*) *subtruncata*, type material examination confirmed that both species are valid. *Barnea subtruncata* (Fig. 2G–J) is distributed along the Pacific coasts of America, from USA to northern Chile, whereas *B. lamellosa* (Fig. 2A–C) inhabits the coasts of Argentina and Uruguay (Coan and Valentich-Scott 2012; Scarabino et al. 2016; Zelaya 2016). No additional synonym of *B. lamellosa* were found in the literature. *Barnea lamellosa* differs from the eastern Pacific *B. subtruncata* in being shorter, with a less elongated posterior end and by having a shallowest pallial sinus. Kellog (1915) described the collecting membrane for *B. costata* and *B. subtruncata* (as *B. pacifica*). The morphology of this character has taxonomic value. Atkins (1937) and Purchon (1955) described this membrane in other Pholadidae highlighting size differences between species. In *B. lamellosa* the collecting membrane is wider than in *B. costata* and *B. subtruncata* (Fig. 3H). The collecting membrane of the visceral mass, is posteriorly oriented and projected to the mantle cavity. It is a retractile and ciliated organ related to cleaning functions that prevent the entrance of sediment into the mantle cavity at low tide (Kellog 1915).

***Barnea* (*Anchomasa*) *truncata* (Say, 1822)**

(Fig. 2D–F)

Synonyms [for complete list see Turner, 1954; here, only the selected combinations found in the most important literature are listed]

Pholas truncata – Say 1822: 321; G.B. Sowerby II 1849: 488, pl. 104, figs. 29–30.

Pholas (*Cyrtopleura*) *truncata* – Tryon 1862: 202; Lamy 1925: 87.

Barnea truncata – Dall 1889: 72, 1898: 816; Perry 1940: 88; Nicklès 1950: 232, fig. 454; Abbott 1954: 461; Moore 1961: 16; Barnard 1964: 565; Kilburn and Rippey 1982: 203; Kensley and Pether 1986: 209, fig. 14; Mikkelsen and Bieler 2004: 609; Ardovini and Cossignani 2004: 54, 292; Turgeon et al. 2009: 736; Velásquez et al. 2017: 254, figs. 12–13.

Barnea (*Anchomasa*) *truncata* – Turner 1954: 27, pl. 8, figs. 11–13; Huber 2010: 474; Cosel and Gofas 2019: 982–983.

Type locality: "southern coast of the United States", it was restricted to Charleston, South Carolina by Turner (1954).

Type material: Types was not found in ANSP cabinets. The specimen was deposited at the ANSP by Say itself. A probable syntype (ANSP 50775) was illustrated by Turner (1954).

Description: Shell: medium to large, length up to 5 cm, thin, elongated, gaped at both ends, beaked anteriorly; external surface with radial ribs declining gradually, strong on the anterior slope, but almost smooth on the posterior side of the shell; dorsal margin

© 2021 Academia Sinica, Taiwan

slightly curved; umbonal reflection almost in touch with the umbos but anteriorly free; internally white, hinge plate without teeth, but with an apophysis, long, narrow, curved and ventrally projected inside each valve; dorso-anterior area covered by a thin protoplax, with parallel sides, not attached to the anterior adductor muscle.

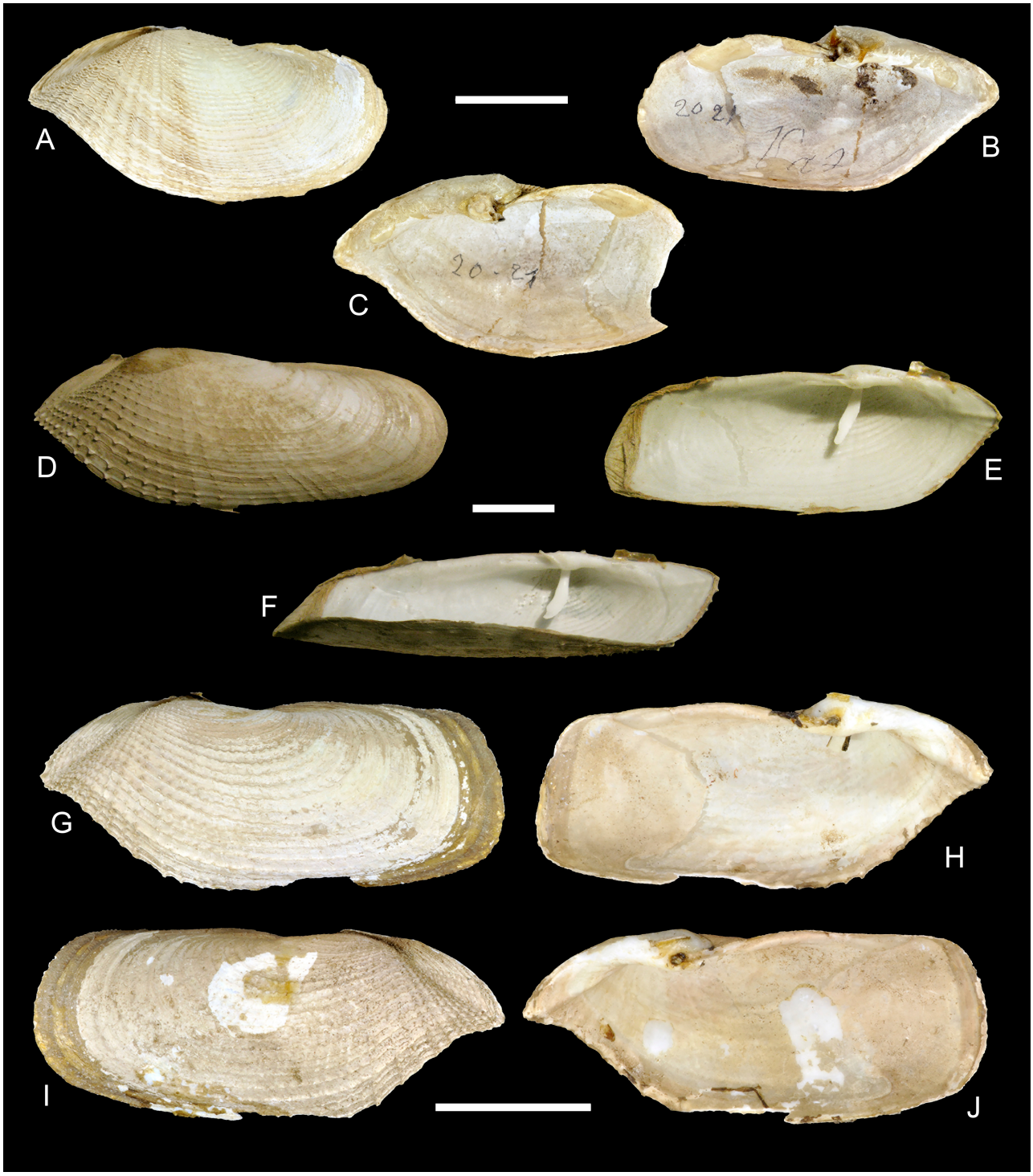


Fig. 2. A–C, *Barnea* (*Anchomasa*) *lamellosa* (d'Orbigy, 1841 in 1834–1847), NHMUK 1854.12.4.655, syntypes. D–F, *Barnea* (*Anchomasa*) *truncata* (Say, 1822), MACN 38385 from Bahía Blanca. G–J, *Barnea* (*Anchomasa*) *subtruncata* (G. B. Sowerby I, 1834, in 1821–1834), material collected by d'Orbigny in Payta, Perú, NHMUK 1854.12.4.656. The specimens of *B*. (*A*.) *lamellosa* and *B*. (*A*.) *subtruncata* with the apophysis broken. Scale bar = 1 cm.

© 2021 Academia Sinica, Taiwan

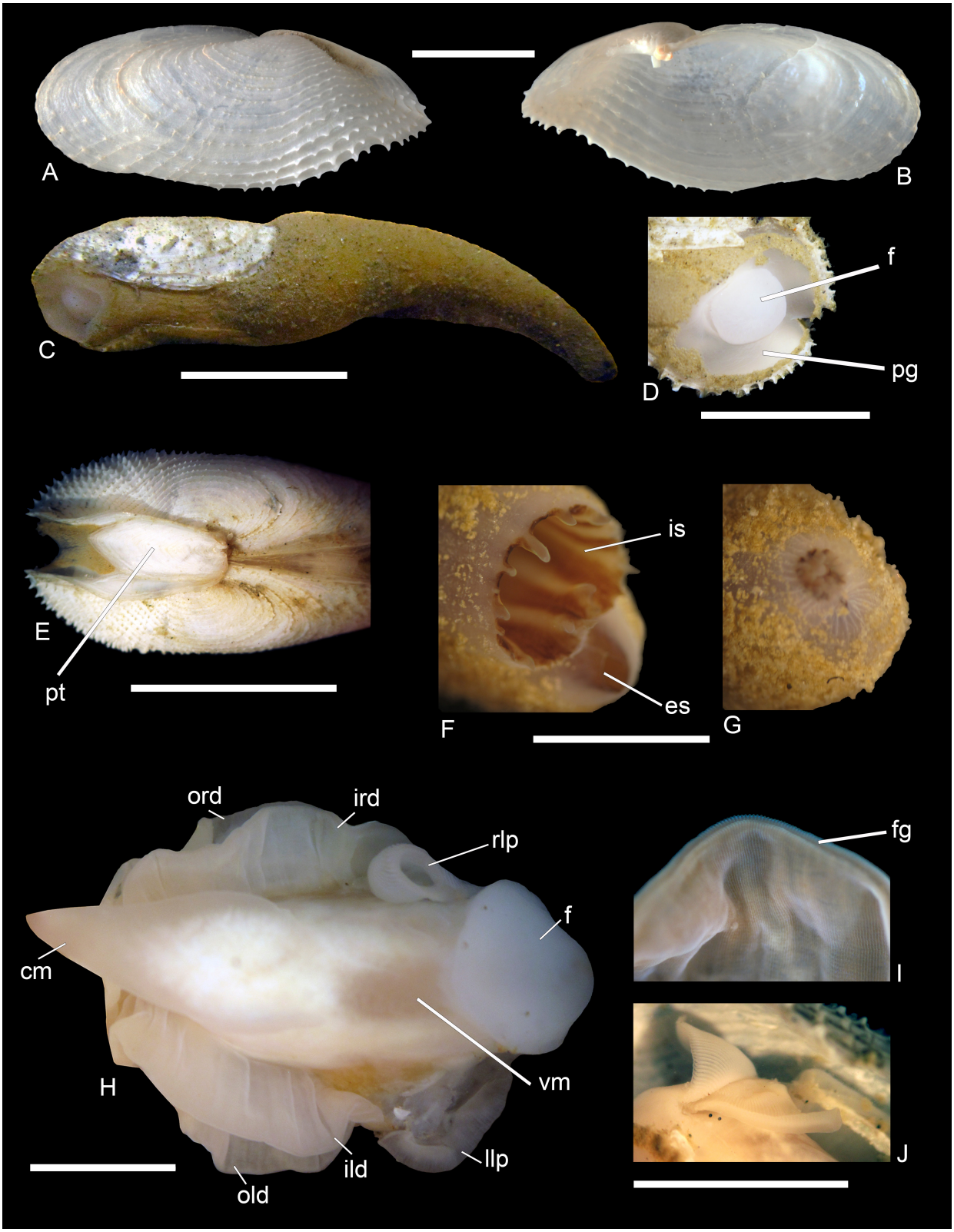


Fig. 3. *Barnea* (*Anchomasa*) *lamellosa*. A, external view right valve. B, internal view right valve. C, external view of living specimen. D, anterior view showing pedal gape and foot. E, detail of calcareous protoplax. F−G, detail of siphons. H, general aspect of mantle cavity organs. I, detail of food groove over the distal edge of the outer demibranch. J, detail of left labial palps and apophysis. Scale bars: A−B, D−E, H−J = 5 mm; C = 1 cm; F−G: 2.5 mm.

© 2021 Academia Sinica, Taiwan

Mantle cavity organs: Siphons totally fused, covered by the periostracum, extended almost ten times shell length, papillose tentacles surrounding both siphons; incurrent siphon with a row of single tentacles, excurrent siphon without tentacles; brownish pigmentation between tentacles, extended along the inner wall of the siphons; foot white and oval.

Material examined: United States of America ─ South Carolina (ANSP 50775); Argentina ─ Bahia Blanca (MACN 38385).

Distribution: Northwestern Atlantic Ocean, from Canada to Florida (Bousfield 1960; Hebda 2011; Mikkelsen and Bieler 2007; Turgeon et al. 2009), Brazilian coast (Rios 2009), Senegal to Congo (Barnard 1964; Cosel and Gofas 2019), Bahía Blanca, Argentina (Fiori et al. 2012, reported as introduced).

Remarks: *Barnea truncata* was widely found boring in wood, clay, and soft rocks (Barnard 1964; Rios 2009; Díaz Merlano and Puyana Hegedus 1994). No synonyms of this species were found in the literature. It was recently reported as introduced in Bahía Blanca (Fiori et al. 2012; Schwindt et al. 2020). *Barnea* (*A.*) *truncata* differs from *B.* (*A*) *lamellosa* in having a more anteriorly placed umbo, a posterior end more truncate and anterior margin slightly pronounced (Fiori et al. 2012). This species was widely reported from eastern and western Atlantic Ocean. Genetic studies on specimens of Canadian (Bousfield 1960; Hebda 2011; Mikkelsen and Bieler 2007; Turgeon et al. 2009; Turner 1954), African (Barnard 1964; Cosel and Gofas 2019) and Argentine waters (Fiori et al. 2012; Schwindt et al. 2020) will clarify this wide distribution range.

Genus *Cyrtopleura* Tryon, 1862

[= *Leuconyx* H. Adams and A. Adams, 1863 (name rejected by Turner (1969) as a forgotten name (*nomen oblitum*) because it was not used as a valid name for 50 years (ICZN 1999, Article 23b)].

Type species: *Pholas cruciger* G.B. Sowerby I, 1834 by subsequent designation (Stoliczka 1870, 1871).

Distribution: Atlantic coast of North America from Massachusetts to Gulf of Mexico, South America from Venezuela to Argentina and Pacific coast of Central America from Panama to Ecuador.

Remarks: *Cyrtopleura* currently includes two subgenera, *Cyrtopleura s. s.* and *Scobinopholas* Grant and Gale, 1931, and three living species. The type species *Cyrtopleura* (*C.*) *crucigera* (G. B. Sowerby I, 1834) from the Pacific coast of Central America and northern South America; *Cyrtopleura* (*Scobinopholas*) *costata* (Linnaeus, 1758) and *C.* (*S.*) *lanceolata* (d'Orbigy, 1841 in 1834–1847) (Huber 2010; Coan and Valentich-Scott 2012). *Cyrtopleura* differs from the genus *Pholas* in the simple umbonal reflection, not septated, and from *Barnea* in shell outline, anterior end more rounded and umbonal reflection more developed. *Scobinopholas* differs from *Cyrtopleura s. s.* in the rounded anterior end, narrow pedal gape and more conspicuous sculpture.

Subgenus *Scobinopholas* Grant and Gale, 1931

Type species: *Pholas costatus* Linnaeus, 1758, by original designation.

Distribution: East coast of America.

Remarks: *Scobinopholas* currently includes two valid species. *Cyrtopleura* (*Scobinopholas*) *costata* (Linnaeus 1758) and *C.* (*S.*) *lanceolata* (d'Orbigy, 1841 in 1834–1847). The former distributed along the east coast of North and Central America, and the latter living along the southeastern coast of South America. The species included into this subgenus are characterized by a lanceolate protoplax.

Cyrtopleura (*Scobinopholas*) *lanceolata* (d'Orbigy, 1841 in 1834–1847)

(Fig. 4)

Pholas lanceolata d'Orbigy, 1841 in 1834–1847, 1841: 497, pl. 77, figs. 18–19.

Barnea lanceolata – Tryon 1862: 208; Ihering 1907: 329; Lamy 1925: 43; Carcelles 1944: 295, pl. 16, fig. 110; Barattini 1951: 256; Barattini and Ureta 1961: 184.

Barnea (*Scobinopholas*) *lanceolata* – Lange de Morretes 1949: 49; Gofferjé 1950: 279.

Cyrtopleura (*Scobinopholas*) *lanceolata* – Lange de Morretes 1949: 49; Goffergé 1950: 279; Turner 1954: 39–41, pl. 19, figs. 1–3; Olazarri 1962: 51; Figueiras 1962: 64; Rios 1966: 36; Klappenbach 1967: 165; Huber 2010: 475.

Cyrtopleura lanceolata – Turner 1954: 39–41, pl. 19, figs. 1–3; Castellanos 1970: 257; Scarabino 1977: 215; Hoagland and Turner 1981: 130; Scarabino 2003: 242; Scarabino et al. 2006: 396, 2016: 7; Rios 2009: 592, fig. 1633; Dias Passos and Magalhães 2011: 148; Zelaya 2016: 254.

Type locality: Ensenada de Ros, Rio Negro province, Argentina.

Type material: NHMUK 1854.12.4.654, paralectotypes, 3 specimens; MNHN-IM, unnumbered, probable lectotypes, 4 valves (Fig. 4A–K).

Description: *Shell*: lanceolate, fragile, elongated, equivalve, inequilateral, length up to 70 mm, both ends rounded but with the anterior end slightly angled (Fig. 4A–D); umbos well developed sub central but near the anterior third of the shell; umbonal reflections separated from the umbos (Fig. 4A, C); pedal gape narrow and elongated; external surface with a weak radial sculpture, usually absent on the posterior slope in adults, in juvenile specimens radial sculpture observed over the

© 2021 Academia Sinica, Taiwan

entire length; concentric sculpture well developed (Fig. 4A, C, E, G); internal surface white; pallial sinus deep and broad, about 60% of shell length (Fig. 4B, D, F); pallial line and adductor muscle scar well marked; apophysis short but broad, fragile and flattened at the distal end (Fig. 4N); protoplax T-shaped, thin, chitinous, slightly downward curved at its posterior area, closely attached to the muscles; mesoplax calcareous, transverse, composed by two parts, the anterior part inserted into the socket of the umbonal reflection; periostracum yellowish and deciduous.

Mantle cavity organs (Based on Turner, 1954 and museum material): siphons totally fused, protected by a light-brown, papillose, chitinous cover; incurrent siphon with a row of single tentacles surrounding the aperture; excurrent siphon without tentacles; pedal gape and foot elliptical in outline.

Material examined: Uruguay ─ Punta del Este (MLP 8448, 8449); Argentina ─ Punta Médanos (MLP 16084, 16900), Ostende (MACN 20096), Villa Gesell (MACN 5377), Mar Chiquita (MACN 26529, 29384), Santa Clara del Mar (MLP 7781-2), Mar del Plata (MACN 9361-39, 10234, 10746, 11990), Chapadmalal (MACN 26246), Miramar (MACN 1888, 2329, 2387, 15635, MLP 1443), Puerto Quequén (MLP 2311, 12037), Monte Hermoso (MACN 1421, 1885, 6619-14, 9210-13, 11169, 14818), Arroyo Chocorí (MACN 19950), Puerto Belgrano (MACN 11168), Bahía Blanca (MACN 4497), Arroyo Parejas (MACN 11167), Caleta Brightman (MACN-INV 16143), Río Colorado (MLP 1386), Villarino (MLP 40815), San Blas bay (MACN 20212), Río Negro mouth (MACN 20547, MLP 1886, 2709, 4894).

Distribution: From Sao Paulo state, Brazil to San Matías gulf, Argentina (Turner 1954; Ruhland and Saalfeld 1967; Rios 1994 2009; Scarabino 1977). In this work, specimens from Punta del Este, Uruguay, to Rio Negro mouth were studied. In addition, this taxa had been reported to quaternary deposits of Puerto Belgrano and Mar del Plata (Figueiras 1962).

Remarks: *Cyrtopleura* (*Scobinopholas*) *lanceolata* has been reported from calcareous rocks and soft substrates (Rios 1966). No synonyms of this taxa were found in the literature. Although several authors included this species in other genera, such as *Pholas* and *Barnea*, the morphology of its shell places it within the genus *Cyrtopleura* and the subgenus *Scobinopholas*. *Cyrtopleura* (*S.*) *lanceolata* differ from *C. crucigera* in showing a more rounded anterior end, lanceolate shell outline, much weaker sculpture and mesoplax in two parts, and from *C.* (*S.*) *costata* by its weak radial sculpture, not observed on the posterior slope, flat apophysis, longer anterior slope and mesoplax in two parts.

Genus *Pholas* Linnaeus, 1758

[= *Hypogaea* Poli, 1791: 29, objective (*partim*); *Hypogaeoderma* Poli, 1795: 251, 257, objective, type species: *Pholas dactylus* Linnaeus, 1758, by subsequent designation (Turner, 1954); *Phloas* Turton, 1802: 172 (error pro *Pholas*); *Pholadiarius* Duméril, 1806: 310, unnecessary emendation of *Pholas* Linnaeus; *Pholax* Renier, 1807: vii (error pro *Pholas*); *Pholadites* Schlotheim, 1813: 105, invalid, ICZN 1999, art. 20; *Pholalites* Schläpfer, 1821: 278 (error pro *Pholaldites*); *Xylotrya* Menke, 1830: 121, objective, type species: *Pholas dactylus* Linnaeus, 1758, by subsequent designation (Clench and Turner, 1946); *Dactylina* Gray, 1847, type species: *Pholas dactylus* Linnaeus, 1758, by original designation; *Pholadarius* Herrmannsen, 1852: 105 (error pro *Pholadiarius*); *Pholalithes* Paetel, 1875: 160 (error pro *Pholalites*); *Pragmopholas* Fischer, 1887: 1133, type species: *Pholas dactylus* Linnaeus, 1758, by by subsequent designation (Turner, 1954)].

Type species: *Pholas dactylus* Linnaeus, 1758, by subsequent designation (Children 1822).

Distribution: Eastern and Western Atlantic, Southeastern Pacific, China Seas.

Remarks: The genera *Pholadites*, *Dactylina*, *Xylotrya* and *Pragmopholas* are objective synonyms of *Pholas* due to their type species is *Pholas dactylus*. The genus level names *Hypogaea*, *Hypogaeoderma*, *Phloas* and *Pholadarius* are considered invalid names. Five valid species are currently included into the genus *Pholas* (Bernard et al. 1993; Huber 2010; Coan and Valentich-Scott 2012; Cosel and Gofas 2018). *Pholas dactylus* Linnaeus, 1758 from Northeastern Atlantic and *P. orientalis* Gmelin, 1791 from China Seas belong to *Pholas s. s.*, whereas the other three species are included in the subgenus *Thovana* Gray, 1847.

Subgenus *Thovana* Gray, 1847 (ex Leach MS)

Type species: *Pholas oblongata* Say, 1822 (= *Pholas campechiensis* Gmelin, 1791), by monotypy.

Distribution: Western Atlantic.

Remarks: This subgenus includes *Pholas chiloensis* Molina, 1782 from southeastern Pacific; *P. bissauensis* Cosel and Haga, in Cosel and Gofas, 2018 from West Africa and *P. campechiensis* Gmelin, 1791 from western Atlantic. *Thovana* differs from *Pholas s. s.* by having a more rounded anterior end and nuclei of the two halves of the protoplax more anterocentrally located (Coan and Valentich-Scott 2012).

Pholas (*Thovana*) *campechiensis* Gmelin, 1791
(Fig. 5)

Pholas campechiensis – Gmelin, 1791: 3216; Hanley 1842–1856: 6, pl. 9, fig. 44; Abbott 1954: 461; Díaz Merlano and Puyana Hegedus 1994: 101; Scarabino 2003: 242; Scarabino et al. 2006: 396, 2016: 7; Turgeon et al. 2009: 737; Dias Passos and

© 2021 Academia Sinica, Taiwan

Magalhães 2011: 148; Capelo et al. 2014: 34; Velásquez et al. 2017: 254; De Vasconcellos et al. 2018: 52.
Pholas oblongata – Say, 1822: 320; Hanley 1842–1856: 5; De Kay 1843: 248; Dall 1898: 815.
Pholas candeana – d'Orbigy, 1847 in 1834–1847: 215, pl. 25, figs. 18–19; Dall 1898: 815.
Thovana oblongata – Gray 1847: 187.
Dactylina campechensis – Adams and Adams 1856 in 1853–1856: 326; Fischer 1858: 49; Carpenter 1864: 635.
Dactylina candeana – Chenu 1862 in 1859–1862: 4, fig. 12.

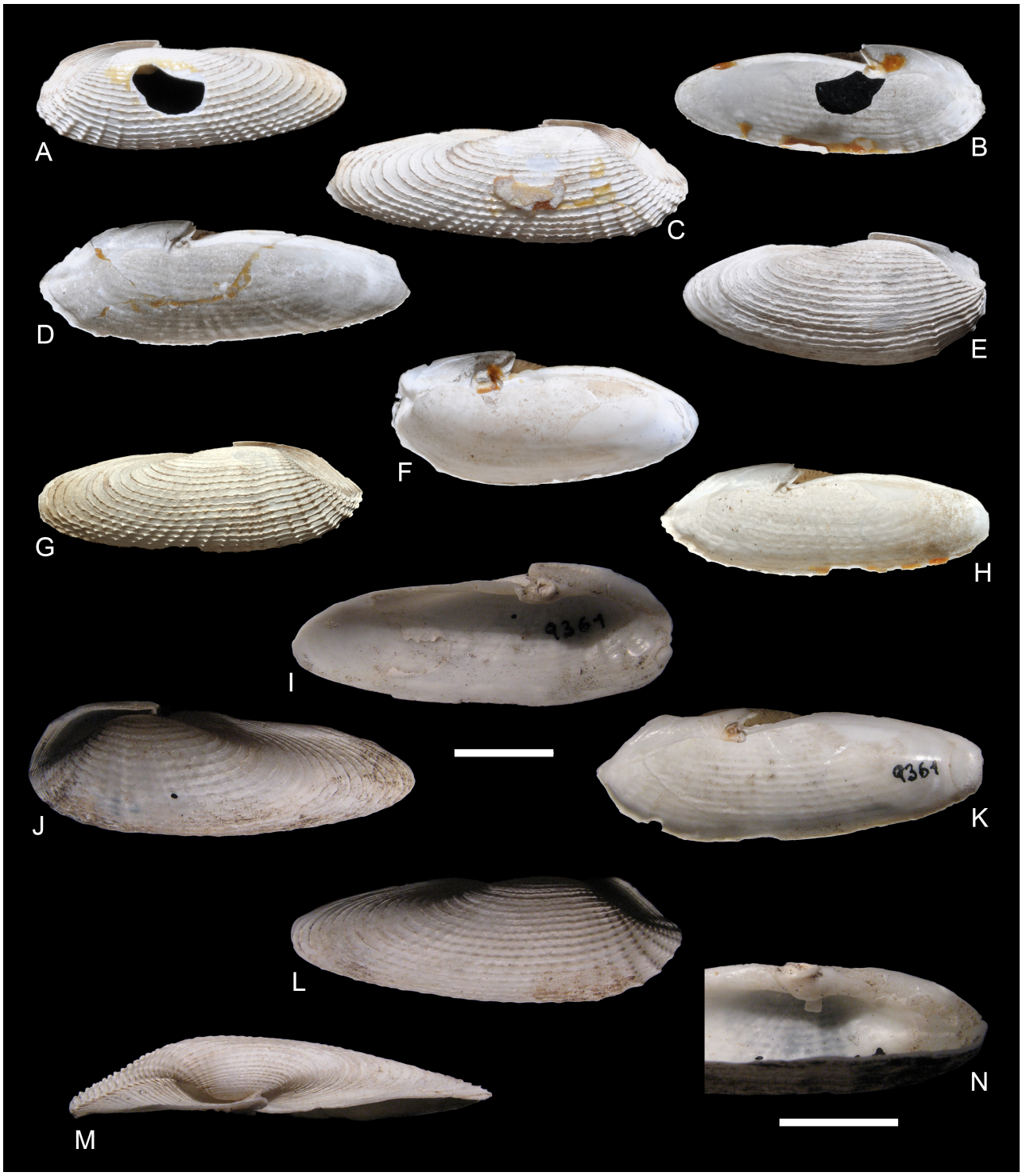


Fig. 4. *Cyrtopleura lanceolata.* A–H, probable lectotypes, MNHN-IM unnumbered. I–N, examined material, MACN 9361-39. Scale bars: A–M = 1 cm; N = 1 cm.

© 2021 Academia Sinica, Taiwan

Dactylina (*Gitocentrum*) *campechensis* – Tryon 1862: 204.
Pragmopholas (*Gitocentrum*) *campechiensis* – Fischer 1887: 1133.
Pholas (*Thovana*) *campechiensis* – Dall 1898: 815; Lamy 1925: 31–32; Lange de Morretes 1949: 49; Gofferjé 1950: 279; Turner 1954: 48, pl. 24, figs. 1–4; Olazarri 1962: 51; Klappenbach 1967: 166; Huber 2010: 473.

Type locality: "Sinu Campechiensi", Gulf of Campeche, Mexico.

Type material: *Pholas campechiensis*: not found, species based on the illustration of Lister (1685−1695, pl. 432, fig. 275, invalid) (Fig. 5H); *Pholas oblongata*: not found; *Pholas candeana*: NHMUK 1854.10.4.493, syntypes (Fig. 5A–G).

Description: Shell: Large, ovate-cylindrical, length up to 110 mm, sub-elliptical, very elongate, fragile, moderately gaped at both ends; anterior and posterior ends rounded (Fig. 5A–F); umbos well developed, sub central, placed on the anterior fourth of the valves; umbonal reflection double, the inferior one free at the anterior side of the umbos, the upper reflection septated (Fig. 5A, C, E, G), umbonal reflection usually eroded at the contact point with the complement valve (Fig. 5B, D, F); external surface with radial ribs almost covering the entire shell, only absent in the anterior part; concentric sculpture well defined, strong on the anterior slope, but weaker near the umbo; imbricated scales are observed where the radial ribs cross the concentric ridges (Fig. 5A, C, E); internally white; external sculpture usually visible from inside the shell; muscle scars and pallial line visible; pallial sinus broad and deep, about 60% of shell length; apophysis fragile, short but broad, posteriorly projected; three accessory plates observed; protoplax rectangular, longitudinally divided, posteriorly truncated; mesoplax transverse, trigonal, small, but broad; metaplax thin elongate, narrow.

Material examined: Brazil ─ Cananeia, Sao Paulo State (MACN 11444); Uruguay ─ El Chuy, Rocha (MACN 25711).

Distribution: From North Carolina to Texas, USA and throughout the Caribbean, in South America from Colombia, Venezuela, Suriname, Brazil and Uruguay (Díaz Merlano and Puyana Hegedus 1994; Rios 1994 2009), eastern Atlantic from Senegal to Angola (Díaz Merlano and Puyana Hegedus 1994; Cosel and Gofas 2019).

Remarks: Only two lots of *Pholas* (*Thovana*) *campechiensis* have been found deposited in the Argentine national collections (MACN 11444, Cananeia, Brazil; MACN 25711, Chuy, Uruguay). *Pholas* (*Thovana*) *campechiensis* has been sampled deeply burrowed into compacted clay, wood, or soft rocks (Díaz Merlano and Puyana Hegedus 1994; Rios 2009). Gmelin (1791) based the description of *Pholas* (*T.*) *campechiensis* on the illustration of Lister (1685–1695, pl. 432, fig. 275). Although no type material was found, this illustration confirms its generic position. The type material of *Pholas oblongata* could not be located into the cabinets of the Philadelphia Academy of Natural Sciences. According to Turner (1954), it is probably lost. However, this species was cited by several authors as junior synonym of *P.* (*T.*) *campechiensis* (Turner 1954, Díaz Merlano and Puyana Hegedus 1994, Huber 2010, Velásquez et al. 2017) and even Say (1822) mentioned the morphological similarities with the Gmelin's species. The analysis of type material of *Pholas candeana* (NHMUK 1854.10.4.493, syntypes) confirmed its status as a junior synonym of *P.* (*T.*) *campechiensis*. *Pholas* (*T.*) *campechiensis* differs from the West African species *P.* (*T.*) *bissauensis* in its larger size and elongated and less compact shell, in the outer radial sculpture with widely spaced corrugations and in the less prominent umbonal reflection. The eastern Pacific species *P.* (*T.*) *chiloensis* has a larger and heavier shell, a higher umbonal reflection and a less sculpted posterior end than the observed in *P.* (*T.*) *campechiensis*.

Subfamily Jouannetiinae Tryon, 1862

Genus *Netastoma* Carpenter, 1864

[= *Netastomella* Paetel, 1875 (error pro *Nettastomella* Carpenter, 1865); *Nettastoma* Lamy, 1926 (error pro *Netastoma* Carpenter, 1864); *Nettastomella* Carpenter, 1865; *Nettostomella* Habe, 1952: 244 (error pro *Nettastomella* Carpenter, 1865)].

Type species: *Pholas darwinii* G. B. Sowerby II, 1849, by monotypy.

Distribution: Japan and east Pacific coast from USA to southern Chile and Southwestern Atlantic Ocean.

Remarks: The genus *Netastoma* was described by Carpenter (1864) who proposed as a type species *Pholas darwinii*. A year later Carpenter (1865) proposed *Nettastomella* as replacement name of *Netastoma* to emend the homonymy with *Nettastoma* Rafinesque, 1810 (Pisces, Anguiliformes). In this way, the name *Nettastomella* has been used by several authors (Turner 1969; Kennedy 1974 among others). Turner (1955) examined Carpenter's collection and confirmed that type species designation was based on a misidentification of *N. rostratum*. Additionally, Carpenter diagnosis and locality fit more adequately to *N. rostratum* than to *N. darwinii*. Coan and Kennedy (1980) elevated to the ICZN the revision of *Nettastomella* and the designation of the type species. Finally, the ICZN (Opinion 1296 1985) concluded that the generic name *Netastoma* must be considered as valid with type species *Pholas darwinii* G. B. Sowerby II, 1849, by monotypy. Currently, the genus *Netastoma* includes three species: *Netastoma*

© 2021 Academia Sinica, Taiwan

darwinii (GB Sowerby II, 1849), *Netastoma rostratum* (Valenciennes, 1846) and *Netastoma japonicum* (Yokoyama, 1920).

***Netastoma darwinii* (G. B. Sowerby II, 1849)**
(Fig. 6)

Pholas darwinii G.B. Sowerby II, 1849: 490, pl. 107, figs. 76–77.

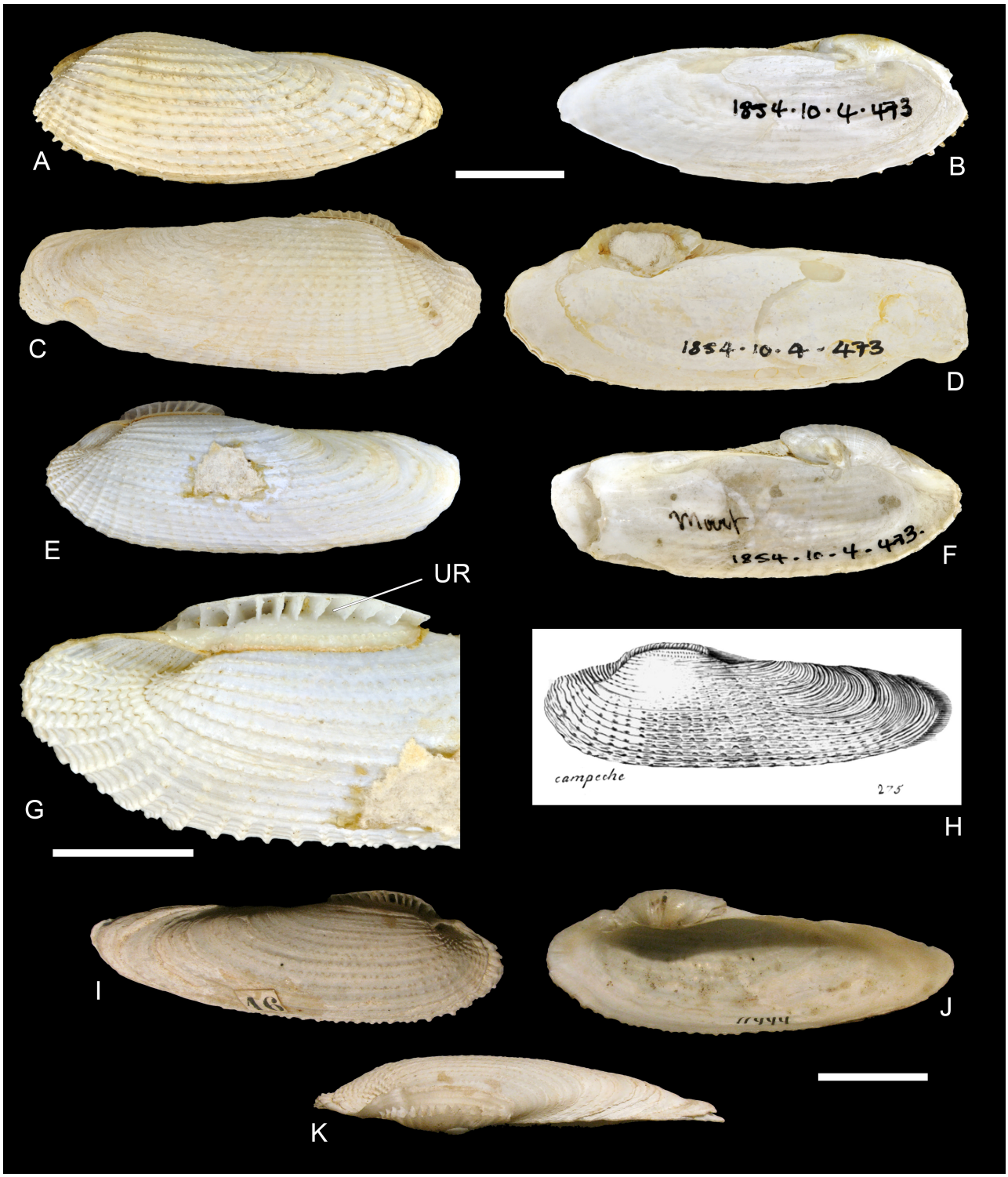


Fig. 5. *Pholas campechiensis*. A–G, *Pholas candeana* d'Orbigny 1853 (in 1841, 1842, 1846, 1853), NHMUK 1854.10.4.493, syntypes. H, original description of *Pholas campechiensis* from Lister, 1685–1695. I–K, examined material, MACN 11444. Scale bars: A–F, H, I–J = 1 cm; G = 5 mm.

© 2021 Academia Sinica, Taiwan

Pholas macrostoma Philippi, 1858: 23.
Netastoma darwinii – Bernard 1983: 61; Pastorino 1995: 17, pl. 8, fig. 36; Scarabino 2003: 242; Rios 2009: 594, fig. 1637; Huber 2010: 479; Dias Passos and Magalhães 2011: 148; Scarabino et al. 2016: 7.
Pholadidea (*Nettastomella*) *darwini* – Dall 1909: 276; Carcelles 1950: 82, pl. 5, fig. 93; Carcelles and Williamson 1951: 348.
Pholadidea darwini – Lamy 1926: 155; Castellanos 1970: 259, pl. 25, fig. 5.
Nettastomella darwinii – Turner 1955: 142, pl. 85, figs. 1–3, pl. 86, figs. 1–4; Rios 1966: 37; Klappenbach 1967: 167; Scarabino 1977: 215; Aldea and Valdovinos 2005: 379, 396, fig. 11J.

Type material: *Pholas darwinii*: NHMUK unnumbered, holotype, articulated specimen without soft parts; *Pholas macrostoma*: not found.

Type locality: Chiloé Island, Chile, collected by Charles Darwin.

Description: Shell: white fragile, equivalve, inequilateral and triangular; anterior end open and back closed; shell length up to 38 mm; umbo prosogyrate, in some specimens the umbos are found displaced from each other; umbonal reflection located in the anterior third of the shell (Fig. 6A–D); dorsal and ventral margin straight ; posterior margin extended outward, forming a calcareous siphonoplax (Fig. 6G); external surface white with differentiated concentric ornamentation in three zones (Fig. 6E–F): zone 1 with continuous marked growth lines without crests or radial ribs (z1), zone 2 with growth lines also marked, but with weak radial ribs formed by small crests (z2), zone 3 with marked growth lines without crests or radial ribs (z3); mesoplax small and rudimentary; protoplax (pt) not calcareous, present on the dorso-anterior margin covering the adductor muscle anterior (Fig. 6G–H); periostracum not observed; inner surface white; pallial sinus wide, although not very visible; adductor muscle scar poorly visible; hinge plate rudimentary with a single cardinal tooth in each valve (Fig. 6C–D).

Mantle cavity organs: mantle only exposed at the pedal gape (Fig. 6I); siphons of equal size, totally fused, with a row of simple tentacles surrounding both apertures; incurrent siphon with a single row of tentacles; excurrent siphon without tentacle (Fig. 6J–L); two pairs of gills arranged along the antero-posterior axis; inner demibranchs wider than outer (Fig. 6M); food groove observed over the distal margin of both demibranchs; two pairs of labial palps longer than wide, triangular in shape, with external surface smooth and internal surfaces with plicate folds (Fig. 6M); trimyarian with a ventral adductor muscle (Fig. 6O).

Material examined: Argentina ─ Mar del Plata (MACN 11974), Bahía Blanca (MACN 24482), Punta Norte (MACN 11509), San José gulf (MACN 9175-25), Puerto Madryn (MACN 9172-30), Punta Este (CNP-INV 2901), Punta Ninfas (CNP-INV 2898, 2899, 2900, 2903), Puerto Deseado (MACN 9237), Puerto San Julián, Playa La Mina (CNP-INV 2902, 2904, 2905, 2906, 2907).

Distribution: From southern Chile to Rio Grande do Sul, Brazil (Kennedy 1974; Scarabino 2003; Aldea and Valdovinos 2005; Ríos 2009; Scarabino et al. 2016). Specimens from Mar del Plata, Buenos Aires province, to Puerto San Julián, Santa Cruz province were examined in this work.

Remarks: The specimens of *N. darwinii* were mostly sampled on the vertical walls of soft rocks at low tide. The species was widely reported along the western Atlantic ocean (Rios 2009; Scarabino et al. 2016; Zelaya 2016, and literature therein). The type material of *Pholas macrostoma* described by Philippi (1858) from Chonos Archipelago was not found. Nevertheless, the author reported characters compatible with *N. darwinii* such as an oval to cuneiform shell, with two sculptured areas, the anterior one with radial ribs and concentric lamella, and the posterior one with only concentric ornamentation. This synonymy was also suggested by Coan and Valentich-Scott (2012). *Netastoma darwinii* differs from the Eastern Pacific *Netastoma rostratum* and Japanese *Netastoma japonicum* in having a larger shell, with a relatively smoother posterior end and callum, and with a more diverging siphonoplax.

Subfamily Martesiinae Grant and Gale, 1931

Genus Martesia (ex Leach MS) G.B. Sowerby I, 1824 (in 1821–1834)

[*Mactresia* Gray, 1840: 150; *Mactesia* Paetel, 1875: 119 (nom. null.); *Martesiella* Verrill and Bush, 1898: 777, type species *Martesiella fragilis*, by monotypy; *Hiata* Zetek and Mclean, 1936: 110, objective, type species *H. infelix* (= *Pholas striatus* Linnaeus), by original designation; *Mesopholas* Taki and Habe, 1945: 109, objective, type species: *Mesopholas intusgranosa* (= *Pholas striatus* Linnaeus), by original designation; *Diploplax* Bartsch and Rehder, 1945: 10, objective, type species: *Martesia* (*Diploplax*) *americana* (= *Pholas striatus* Linnaeus), by original designation].

Type species: *Pholas clavata* Lamarck, 1818: 446 (= *Pholas striatus* Linnaeus, 1758: 669) by monotypy.

Distribution: Western Atlantic, Eastern Pacific, United Kingdom, Indo-Pacific and Australia.

Remarks: Species included in *Martesia* show two different sculptured areas on the external surface of the shell. Both valves are closed by a callum placed in the anterior part of the shell. The anterior area is sculptured by radial ridges whereas the posterior area by concentric ridges. Shell outline, sculpture and mesoplax and hypoplax morphology have taxonomic value to identify species within *Martesia* (Holmes et al. 2015). Bartsch and Rehder (1945) revised the genera *Martesia* and

© 2021 Academia Sinica, Taiwan

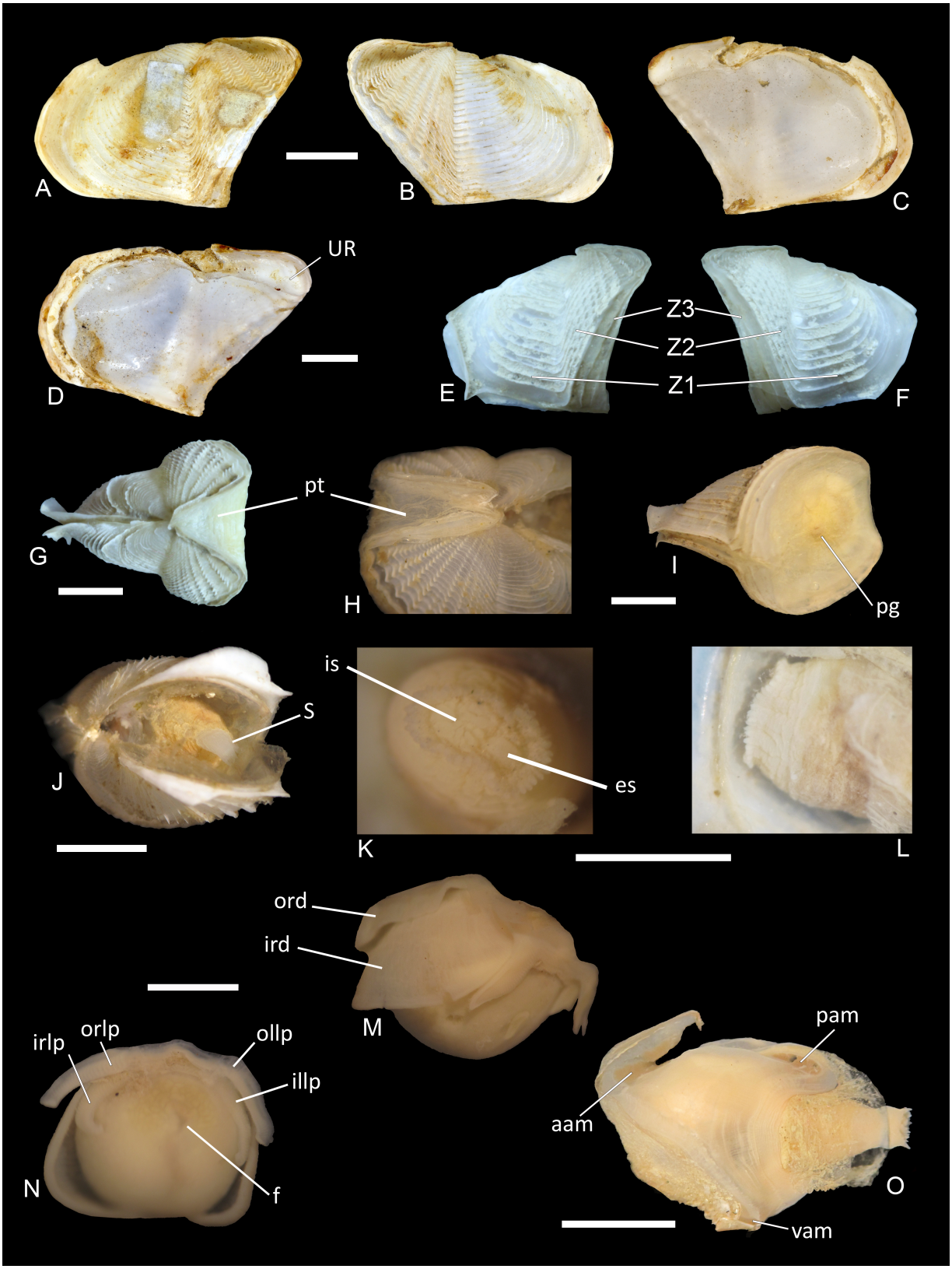


Fig. 6. *Netastoma darwinii.* A–D, NHMUK without numeration, holotype. E–F, external sculpture showing the three differentiated zones. G, detail of calcareous siphonoplax. H, detail of protoplax. I, pedal gape. J–L, general view of the siphons. M–O, general aspect of visceral mass. Scale bars: A–F, J = 5 mm; G–I = 2.5 mm; K–L = 1 µm; MN = 2 mm; O = 4 mm.

© 2021 Academia Sinica, Taiwan

considered necessary to establish 4 subgenera. Later, Turner (1955) revealed that juveniles do not develop a callum yet which is a character of adults and therefore synonymized the subgenera *Martesia* (*Martesia*) with *Martesia* (*Diploplax*). On the other hand, *Diplothyra* was elevated to a genus level based on callum and mesoplax morphology, leaving only two valid subgenera within *Martesia* (Turner 1955). Currently, six valid species are included in *Martesia* (Srinivasan 1959; Rios 1994 2009; Huber 2010). *Martesia striata* (Linnaeus, 1758), *Martesia cuneiformis* (Say, 1822) and *Martesia fragilis* Verrill and Bush, 1898 have been reported as widely distributed but commonly registered along the western Atlantic Ocean. Other described species are: *Martesia multistriata* (G. B. Sowerby II, 1849) from Australian seas, *Martesia nairi* Turner and Santhakumaran, 1989 from India, and *Martesia pygmaea* Tchang et al. 1960 from Chinese seas.

Martesia fragilis Verril and Bush 1898

(Fig. 7)

Martesia (*Martesiella*) *fragilis* Verrill and Bush, 1898: 777, pl. 79, fig. 10.

Pholadidea (*Penitella*) *minuscula* Dall, 1908: 425.

Martesia (*Diploplax*) *exquisita* Bartsch and Rehder, 1945: 10.

Martesia (*Diploplax*) *bahamensis* Bartsch and Rehder, 1945: 11.

Martesia (*Martesia*) *fragilis* – Turner 1955: 111, pl. 65–66, figs. 1–9; Daniel and Srinivasan 1956: 59; Srinivasan 1959: 107; Klappenbach 1967: 167; Bernard 1983: 60; Turner and Santhakumaran 1989: 161, fig. 4; Rios 1994: 296: pl. 100, fig. 1440; 2009: 593, fig. 1635; Huber 2010: 476; Coan and Valentich-Scott 2012: 894, pl. 279.

Martesia fragilis – Olsson 1961: 446; Keen 1971: 276; Hoagland and Turner 1981: 130; Díaz Merlano and Puyana Hegedus 1994: 101, pl. 30, fig. 288; Scarabino 2003: 242; Turgeon et al. 2009: 737; Dias Passos and Magalhães 2011: 148; Scarabino et al. 2016: 7; Velásquez et al. 2017: 252, figs. 9–10.

Type locality: 360 miles Off Charles cape, Virginia, United States, Station N° 2566 R/V Albatross in a floating piece of wood, lat. 37°23'N, long. 68°8'W.

Type material: *Martesia fragilis*: USNM 614180, lectotype, two valves; *Martesia* (*Diploplax*) *bahamensis*: USNM 573549, holotype, collected at Est side of Hudros Island, Andros Light, South Bight, Bahamas; *Martesia* (*Diploplax*) *exquisita*: USNM 573548, holotype, collected at Stony Cove, St. Mary Parish, Jamaica; *Pholadidea* (*Penitella*) *minuscula*: USNM 122946, syntypes, seven valves, collected at Azuero Peninsula, Punta Mala, SE of Gulf of Panama, Panama in 1891.

Description: Shell: small, fragile, thin, equivalve, inequilateral; length up to 10 mm; anterior end rounded and short; pedal aperture closed by the callum in adults; dorso-anterior margin rounded toward the umbos; posterior end elongated, rounded, less developed in juveniles, laterally compressed in adult specimens; external surface with a deep sulcus that goes from the umbos to the ventral margin dividing the external sculpture in two areas; thin and concentric imbricate ribs over the anterior side of the sulcus; sculpture curved downward and form a distinct angle in line with the antero-ventral margin; concentric ribs crossed by fine radial lines; irregular growth lines on the posterior side of the sulcus; mesoplax thick, relatively large, and usually heart-shaped, ovate-elongate with a dorsal depression and concentric sculpture; metaplax long, narrow, placed above the dorsal margin, with free edges under the posterior end of mesoplax and the anterior end narrow.

Distribution: *Martesia fragilis* was recorded from floating woods in the Northwestern Atlantic, USA (Turner 1955), in the southwestern Atlantic (Klappenbach 1967, Díaz Merlano and Puyana Hegedus 1994; Rios 2009), in the Eastern Pacific from Mexico to Panama (Díaz Merlano and Puyana Hegedus 1994), in the Indian and eastern Pacific Oceans (Daniel and Srinivasan 1956; Srinivasan 1959); and in the United Kingdom (Holmes et al. 2015).

Remarks: *Martesia fragilis* had been occasionally recorded in fixed wooden substrates. It was first reported by Klappenbach (1967) for Uruguayan waters (Natural History National Museum, Montevideo, N° 1313). Nevertheless, it was widely registered in floating pieces of wood of different trees such as *Myristica fragrans* and *Mangifera indica* in the Indo Pacific; coconuts in the United Kingdom or the cork *Quercus suber* in the western Atlantic (Turner 1955; Srinivasan 1959; Klappenbach 1967; Holmes et al. 2015). It is considered a pelagic species (Turner 1955) with a wide geographical distribution suggesting the presence of an ocean traveler. However, more studies must be carried out to understand this process. Three species have been mentioned as synonym of *Martesia fragilis* in the literature. They are and *Pholadidea* (*Penitella*) *minuscula* (USNM 122946) (Fig. 7D–H), *Martesia* (*Diploplax*) *bahamensis* (USNM 573549) (Fig. 7I–L), *Martesia* (*Diploplax*) *exquisita* (USNM 573548) (Fig. 7M–P). The description of these three nominal species were based on very small specimens, juveniles (Fig. 7D–P) with equal external sculpture in comparison with the types of *M. fragilis.* The synonyms listed above were described from the Caribbean Sea. The morphology of *M. fragilis* was studied by Holmes et al. (2015) who distinguished it from *M. striata* and *M. cuneiformis* by mesoplax morphology. The type species has a mesoplax large, circular with irregular wrinkles and without concentric sculpture as in *M. fragilis* and without a longitudinal groove and growth lines as in

© 2021 Academia Sinica, Taiwan

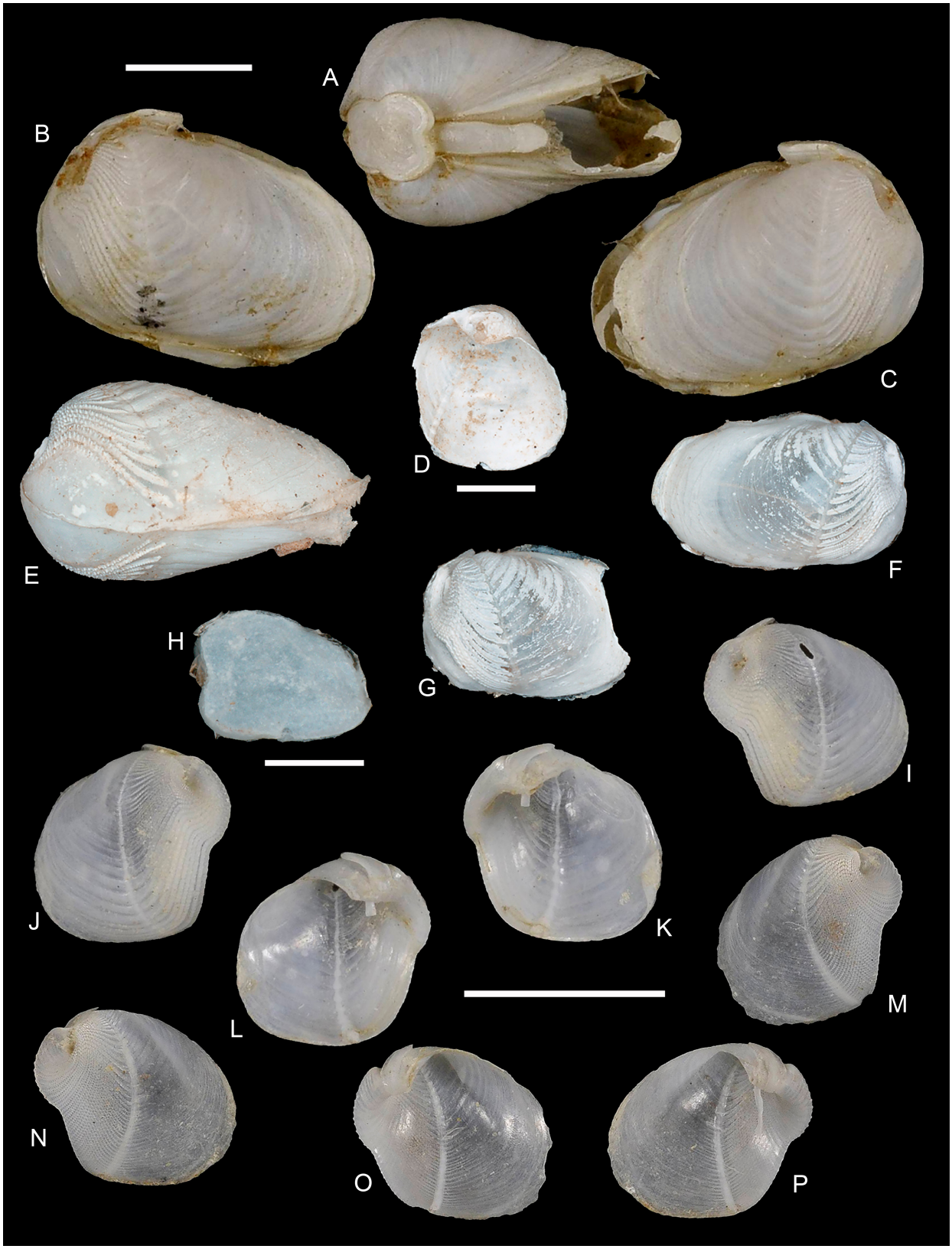


Fig. 7. *Martesia fragilis*. A−C, USNM 614180, lectoype. D−H, *Pholadidea minuscula* Dall, 1908, USNM 122946, syntypes. I−L, *Martesia* (*Diploplax*) *bahamensis* Bartsch and Rehder, 1945, USNM 573549, holotype. M−P, *Martesia* (*Diploplax*) *exquisita* Bartsch and Rehder, 1945, USNM 573548, holotype. Scale bars: A−C, E = 2 mm; D = 1 mm; F−G, I−P = 5 mm; H = 500 µm.

© 2021 Academia Sinica, Taiwan

M. cuneiformis. In addition, *Martesia fragilis* can be distinguished from *M. striata* by the thinnest umbonal reflection, most elongated anterior adductor muscle, longest anterior part of the shell, lanceolate hypoplax and largest metaplax (Srinivasan 1959).

DISCUSSION

The presence of six valid species belonging to the family Pholadidae living in Argentina and Uruguay were confirmed in this study. In a global context 76 valid species are recognized as valid. However, the biodiversity of this group along the southern tip of South America is relatively low. Rios (2009) reported the same genera, but three additional pholadids from Brazil. A similar scenario is observed in tropical East America where the same genera plus *Lignopholas* in which each species was reported once (Mikkelsen and Bieler 2007; Huber 2010). In European waters five genera (*Pholas*, *Barnea*, *Martesia*, *Pholadidea* and *Zirfaea*) and seven valid species were mentioned in the literature (Poppe and Gotto 1993; Gofas et al. 2001; Holmes et al. 2015), and along the Atlantic coast of Africa this group is represented by seven genera (*Barnea*, *Jouannetia*, *Martesia*, *Parapholas*, *Pholas*, *Pholadidea* and *Talona*) and thirteen taxa (Huber 2010; Cosel and Gofas 2019). Nevertheless, a greater biodiversity of Pholadidae is observed along the Pacific Ocean. In this way, six genera (*Barnea*, *Chaceia*, *Netastoma*, *Parapholas*, *Penitella* and *Zirfaea*) and twelve species were reported in the literature from western North America (Coan et al. 2000). And ten genera (*Barnea*, *Cyrtopleura*, *Diplothyra*, *Jouannetia*, *Martesia*, *Parapholas*, *Penitella*, *Pholadidea*, *Pholas*, and *Zirfaea*) and seventeen taxa were mentioned from Tropical West America (Coan and Valentich-Scott 2012). Finally, from the Indo-Pacific region ten genera (*Pholas*, *Aspidopholas*, *Barnea*, *Jouannetia*, *Lignopholas*, *Martesia*, *Nipponopholas*, *Parapholas*, *Penitella* and *Pholadidea*) and twenty four species were mentioned (Bernard et al. 1993; Huber 2010; Sanpanich 2011). And from southern Australian and New Zealand waters seven genera (*Pholas*, *Aspidopholas*, *Barnea*, *Martesia* and *Jouannetia*) and fourteen species from are recognized as valid in the literature (Lamprell and Healy 1998; Huber 2010). In general term, the generic biodiversity of the group is similar along the different regions, being the Tropical West America and the Indo Pacific the most diverse in number of genera and species. This first taxonomic approach focused on living Pholadidae from Argentinean and Uruguayan waters and makes up the nomenclatorial basis for future works.

CONCLUSIONS

The systematic arrangement of valid species herein confirmed have been modified during the years (Carcelles 1944; Carcelles and Williamson 1951; Castellanos 1970; Rios 1994 2009; Scarabino 2003; Scarabino et al. 2006 2016; Zelaya 2016). Five of the six valid species were originally described as *Pholas*. Only *Martesia fragilis* was described in a different genus. This work presents valid species by revising type material of all nominal species. *Netastoma darwinii* and *Pholas* (*T.*) *campechensis*, type species of its genus and subgenus respectively, are generically stable. Nevertheless, genetic studies of this family will clarify the generic placement of other revised species and the existence of new generic entities.

In a biogeographical context, *Pholas* (*Thovana*) *campechiensis*, *Barnea* (*Anchomasa*) *lamellosa* and *Cyrtopleura* (*Scobinopholas*) *lanceolata* belong to the Argentine province, distributed from Brazil to Uruguay and northern Argentina. *Martesia fragilis* is an ocean traveler widely reported from different regions. *Netastoma darwinii* is the only Jouannetiinae species present in the study area that extends its distribution to Rio Grande do Sul. The sixth valid species herein confirmed is *Barnea* (*Anchomasa*) *truncata.* In our opinion, the identity of Canadian, west African and Argentinean records of this species must be genetically tested. However, the observed characters of the specimens reported by Fiori et al. (2012) as introduced in the Bahía Blanca coincide with those observed in specimens of *B. truncata* from north western Atlantic (MACN 38385, Fig. 2D–F).

Acknowledgments: Special thanks to Alejandro Tablado and Mariela Romanelli (MACN), to Gustavo Darrigran and Cristina Damborenea (MLP), to Gary Rosenberg and Paul Callomon (ANSP), to Andreia Salvador and Tom White (NHMUK and LSL) and to Ellen Strong and John Pfeiffer (USNM) for their assistance in the revision of type material and additional examined specimens. We are grateful to the Secretaría de Ciencia, Tecnología e innovación productiva de la Provincia de Chubut. This is the contribution #146 of the LARBIM.

Authors' contributions: JHS and MD wrote the manuscript, sampled the specimens, analyze the types and edited the illustrations. MD separated the specimens and examined the museum collections.

Competing interests: The authors declare that they have no conflict of interests.

© 2021 Academia Sinica, Taiwan

Availability of data and materials: All the studied material is deposited in either museums or public institutions.

Consent for publication: Not applicable.

Ethics approval consent to participate: Not applicable.

REFERENCES

Abbott RT. 1954. American Seashells 1st edition, 2nd printing. Van Nostrand Reinhold Co, Toronto, Canada.

Adams H, Adams A. 1853–1858. The genera of Recent mollusca; arranged according to their organization. John van Voorst, Paternoster Row, London, 2 vols.

Adams H, Adams A. 1863. Descriptions of five new genera of Mollusca. An Mag Nat Hist, Zoology, Botany, and Geology Series **3(11):**18–20.

Aldea C, Valdovinos C. 2005. Moluscos del intermareal rocoso del centro-sur de Chile (36°–38°S): taxonomía y clave de identificación. Gayana **69(2):**364–396. doi:10.4067/S0717-65382005000200014.

Ardovini R, Cossignani T. 2004. West African seashells (including Azores, Madeira and Canary Is) = Conchiglie dell'Africa Occidentale (incluse Azzorre, Madeira e Canarie) English-Italian edition L'Informatore Piceno: Ancona, Italy.

Atkins D. 1937. On the ciliary mechanisms and interrelationships of Lamellibranchs Part II Sorting devices on the gills. Q J Microsc Sci **79, Part III:**339–373.

Barattini LP. 1951. Malacología uruguaya. Enumeración sistemática y sinonímica de los moluscos del Uruguay. Pub Cient SOYP **6:**179–293.

Barattini LP, Ureta EH. 1961. La fauna de las costas uruguayas del este (Invertebrados). Publicaciones de Divulgación Científica, Museo "Dámaso Antonio Larrañaga", Montevideo.

Barnard KH. 1964. Contributions to the knowledge of South African marine Mollusca Part V Lamellibranchiata. A S Afr Mus **47(3):**361–593.

Bartsch P. 1915. Report on the Turton collection of South African marine mollusks, with additional notes on other South African shells contained in the U. S. National Museum. Bull U S Nat Mus **91:**1–305. doi:10.5479/si.03629236.91.i.

Bartsch P, Rehder HA. 1945. The west Atlantic boring mollusks of the genus *Martesia*. Smith Misc Coll **104(11)[3804]:**1–16.

Bernard FR. 1983. Catalogue of the living Bivalvia of the eastern Pacific Ocean: Bering Strait to Cape Horn Can Spec Publ Fish Aq Sc **61:**1–102.

Bernard FR, Cai YY, Morton B. 1993. A catalogue of the living marine bivalve molluscs of China Hong Kong University Press, Hong Kong.

Bieler R, Carter J, Coan EV. 2010. Classification of bivalve families. *In*: Bouchet P, Rocroi JP (eds) Nomenclator of bivalve families Malacol **52:**1–184. doi:10.4002/040.052.0201.

Bousfield EL. 1960. Canadian Atlantic Sea shells National Museum of Canada, Ottawa, Canada.

Capelo JC, Rada M, Sole M, Buitrago J, Grune Loffler S, Narvaez J. 2014. Los moluscos marinos litorales del norte de la península de Macanao, isla de Margarita, Venezuela. Amici Moll **22:**29–44.

Carcelles A. 1944. Catálogo de los moluscos marinos de Puerto Quequén Rev Mus La Plata, **3 sección Zool:**233–309.

Carcelles A. 1950. Catálogo de los moluscos marinos de Patagonia An Mus Nahuel Huapi 2 extra nueva serie **8:**41–100.

Carcelles A, Williamson S. 1951. Catálogo de los moluscos marinos de la provincia magallánica Rev Inst Nac Investig Cienc Nat, 2 Ciencias Zoológicas **(5):**225–383.

Carpenter PP. 1864. Supplementary report on the present state of our knowledge with regard to the Mollusca of the west coast of North America. Rep Brit Assoc Adv Sci **1863:**517–686.

Carpenter PP. 1865. Diagnoses of new forms of Mollusca from the Vancouver district. J Nat Hist **15(85):**28–32.

Castellanos ZJAd. 1970. Catálogo de los moluscos marinos bonaerenses An Com Investig Cient prov Buenos Aires **8:**9–365.

Chenu JC. 1859–1862. Manuel de Conchyliologie et de Paléontologie conchyliologique Paris, 2 vols.

Children JG. 1822. Art VI - Lamarck's genera of shells translated from French by J G Children, F R S andc andc andc With plates from original drawings, by Miss Anna Children. Quart J Sci Lit Arts **14(27):**64–86.

Clench W, Turner RD. 1946. The genus *Bankia* in the western Atlantic. Johnsonia **2(19):**1–28.

Coan EV, Carlton JT, Evenhuis NL. 2017. Case 3717—Xylophagidae Purchon, 1941 (Mollusca: Bivalvia): proposed emendation of the spelling to Xylophagaidae to remove homonymy with Xylophagidae Fallén, 1810 (Insecta: Diptera). Bull Zool Nom **73(2–4):**103–105. doi:10.21805/bzn.v73i2.a4.

Coan EV, Kennedy GL. 1980. *Nettastomella* Carpenter, 1865 (Mollusca: Bivalvia: Pholadidae): proposed conservation under the plenary powers ZN (S) 1054. Bull Zool Nom **37:**114–116.

Coan EV, Valentich-Scott P. 2012. Bivalve Seashells of Tropical West America Marine Bivalve Mollusks from Baja California to Perú Santa Barbara, Santa Barbara Museum of Natural History Monographs Number 6, Studies in Biodiversity Number 4.

Coan EV, Valentich-Scott P, Bernard FR. 2000. Bivalve Seashells of Western North America. Marine Bivalve Mollusks from Arctic Alaska to Baja California. Studies in Biodiversity No. 2. Santa Barbara Museum of Natural History Monographs 2, Studies in Biodiversity Number 2.

Cosel R, Gofas S. 2018. Description of a new genus and twelve new species of marine bivalves from tropical West Africa, with comments on other taxa from the area. Iberus **36(1):**1–54.

Cosel R, Gofas S. 2019. Marine bivalves of tropical West Africa: from Rio de Oro to southern Angola Faune et Flore Tropicales **48:**1–1104.

Dall WH. 1889. A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States, with illustrations of many of the species. Bull U S Nat Mus **37:**1–121.

Dall WH. 1898. I Prionodesmacea: *Nucula* to *Julia* II Teleodesmacea: *Teredo* to *Ervilia* Wagner Free Institute of Science of Philadelphia, Transactions, vol. 3, Tertiary Mollusks of Florida Contributions to the Tertiary fauna of Florida, with especial reference to the Miocene silex-beds of Tampa and the Pliocene beds of the Caloosahatchie River, including in many cases a complete revision of the generic groups treated and of their American Tertiary Species Part IV.

Dall WH. 1908. XIV Reports on the dredging operations off the west coast of America to the Galapagos To the West coast of Mexico, and in the Gulf of California, in charge of Alexander Agassiz, carried on by the U S fish Commission steamer "Albatross," during 1891, Lieut Commander Z L Tanner, USN, commanding XIV The Mollusca and the Brachiopoda Reports on the scientific results of the expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, carried on by other U S fish Commission steamer "Albatross", from October 1904 to March, 1905 Lieut

© 2021 Academia Sinica, Taiwan

Commander L M Garret, USN, commanding XXXVII. Bull Mus Comp Zool **43(6):**205–487.

Dall WH. 1909. Report on a collection of shells from Peru, with a summary of the littoral marine Mollusca of the Peruvian zoological province. Proc U S Nat Mus **37(1704):**147–294. doi:10.5479/si.00963801.37-1704.147.

Daniel A, Srinivasan VV. 1956. Occurrence of two wood-boring Pholads at Madras. Curr. Sci **25(2):**59–60.

De Kay JE. 1843. Zoology of New York, or the New York Fauna; comprising detailed descriptions of all the animals hitherto observed within the state of New York; with brief notices of those occasionally found near its borders: and accompanied by appropriate illustrations. Part 5. Mollusca. Carroll and Cook, Printers to the Assembly, Albany, New York, USA.

De Vasconcellos Gernet M, Colley E, Da Veiga Santos E, Birckolz CJ. 2018. Diversity and community composition of marine mollusks fauna on a mainland island of the coast of Paraná, southern Brazil. Pesq Ens Ciênc Ex Nat **2(1):**48–59. doi:10.29215/pecen.v2i1.580.

Deshayes GP. 1874 [1873]. Description de quelques espèces de mollusques nouveaux, ou peu connus envoyés de la Chine par M. l´Abbé A. David. Bull Nou Arch Mus **9:**1–14.

Dias Passos F, Magalhães FT. 2011. A comparative study of the Bivalvia (Mollusca) from the continental shelves of Antarctica and Brazil. Biota Neot **11(1):**143–155. doi:10.1590/S1676-06032011000100014.

Díaz Merlano JM, Puyana Hegedus M. 1994. Moluscos del Caribe Colombiano Un Catálogo ilustrado Fundación Natura, Bogotá.

d'Orbigny A. 1834–1847. Mollusques. *In*: Bertrand CP (ed) Voyage dans l'Amerique Meridionale (Le Bresil, La Republique Orientale de L'Uruguay, La Republique Argentine, La Patagonie, La Republique du Chili, La Republique de Bolivia, La Republique du Perou), execute pendant les annees 1826, 1827, 1828, 1829, 1830, 1831, 1832 et 1833 Paris: Chez Ve Levrault.

d'Orbigny A. 1841, 1842, 1846, 1853. Mollusques. *In*: Ramon de la Sagra, Alcide D. d'Orbigny, J. T. Cocteau, G. Bibron, A. Guichenot, F.-E. Guérin-Méneville, J. F. C. Montagne, and A. Richard, 1838-1857, Histoire Physique, Politique, et Naturelle de l'Ile de Cuba, 12 vols. + maps. Issued as of 1853, but published in parts. French ed., 2 vols. and atlas: vol 1, parts 1–14, p. 1–208, 1841; parts 15–17, p. 209–264, 28 pls., 1842; vol 2, parts 1–7, p. 1–112, 1842; parts 8–24, p. 113–380, 1853.

Duméril AMC. 1806. Zoologie analytique ou méthode naturelle de classification des animaux, rendue plus facile à l'aide de tableaux synoptiques Allais, Paris, France.

Figueiras A. 1962. Sobre nuevos hallazgos de moluscos subfósiles de la Transgresión Querandina. Com Soc Malac Urug **1(3):**53–68.

Figueiras A, Sicardi OE. 1970. Catálogo de los moluscos marinos del Uruguay Adiciones y correcciones a la clase Pelecypoda. Com Soc Malac Urug **3(1):**15–22.

Fiori SM, Simonetti P, Dos Santos EP. 2012. First record of Atlantic mud piddock, *Barnea* (*Anchomasa*) *truncata* (Bivalvia, Pholadidae) in Argentina. Aq Inv **7(2):**283–286. doi:10.3391/ai.2012.7.2.015.

Fischer PH. 1858. Études sur les pholades. J Conchyl **7[(2)3](1):**47–58.

Fischer PH. 1880–1887. Manuel de conchyliologie et de paleontology conchyliologique ou Histoire naturelle des mollusques vivants ou fossiles suivi d'un Appendice sur les Brachiopodes par DP Oehlert Avec 23 planches contenant 600 figures dessinées par S P Woodward et 1158 gravures dans le texte F Savy, Paris (Published in 11 parts).

Gmelin JF. 1791. Caroli a Linné, Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum characteribus, differentiis, synonymis, locis Editio decima tertia, aucta, reformata, cura J F Gmelin Georg Emanuel Beer, Lipsiae, 1, part 6 Vermes.

Gofas S, Le Renard, J, Bouchet P. 2001. Mollusca. *In*: Costello, M. J., Emblow, C. and White, R. (eds). European register of marine species: a check-list of the marine species in Europe and a bibliography of guides to their identification. Collection Patrimoines Naturels 50, pp. 180–213.

Gofferjé CN. 1950. Contribuigáo a Zoogeografia da Malacofauna do Litoral do Estado do Paraná. Arq Mus Paranaense **8:**221–282.

Grant US, Gale HR. 1931. Catalogue of the marine Pliocene and Pleistocene mollusca of California. Mem San Diego Soc Nat Hist **1:**1–1036.

Gray JE. 1835. Catalogue of shells collected on the east coast of New Zealand, by the Rev. W. Yate. Pp. 307–310, Appendix, *In*: W. Yate, An account of New Zealand; and of the formation and progress of the Church Missionary Society's mission in the Northern Island, 2nd ed. Seeley & Burnside, London, UK.

Gray JE. 1840. Shells of molluscous animals. *In*: Synopsis of the contents of the British Museum, 42nd edition. G. Woodfall & Son, London, UK.

Gray JE. 1847. A list of the genera of Recent Mollusca, their synonymy and types. Proc Zool Soc London **15:**129–219.

Habe T. 1952. Genera of Japanese shells. Pelecypoda, Nro. 3. Molluscan literature publishing committee. Kyoto, Kairui-bunken-kanko-kai, Japan.

Haga T, Kase T. 2008. Redescription of the deep-sea wood borer *Neoxylophaga teramachii* Taki and Habe, 1950 and its assignment of the genus *Xyloredo* (Bivalvia: Myoida: Pholadoidea) with comments on fossil Pholadoidae. Veliger **50:**107–119.

Haga T, Kase T. 2013. Progenetic dwarf males in the deep-sea wood-boring genus *Xylophaga* (Bivalvia: Pholadoidea). J Molluscan Stud **79(1):**90–94. doi:10.1093/mollus/eys037.

Hanley SCT. 1842–1856. An illustratted and descriptive catalogue of recent Bivalve shells, London.

Harvey R. 1996. Deep water Xylophagaidae (Pelecypoda: Pholadacea) from the North Atlantic with descriptions of three new species. J Conch **35:**473.

Hebda A. 2011. Information in Support of a Recovery Potential Assessment of Atlantic Mudpiddock *Barnea truncata* in Canada DFO. Can Sci Advis Sec Res Doc **2010/117:**vi + 30 pp.

Hedley C. 1893. *Pholas obturamentum*; an undescribed bivalve from Sydney harbour. Rec Aust Mus **2(5):**55–57.

Herrmannsen AN. 1852. Indicis Generum Malacozoorum Primordia Nomina Subgenerum, Generum, Familiarum, Tribucm, Ordinum, Classium; Adjectis Auctoribus, Temporibus, Locis Systematicis, Atque Literariis, Etymis, Synonymis Praetermittuntur Cirripedia, Tunicata et Rhizopoda Theodori Fischer, Cassel 2 vols Supplementa et Corrigenda.

Hoagland KE, Turner RD. 1981. Evolution and adaptive radiation of wood-boring bivalves (Pholadacea). Malacol **21:**111–148.

Holmes A, Fenwick D, Gainey P, Williams T. 2015. *Martesia fragilis* Verrill and Bush, 1898 in the North-East Atlantic Overlooked and a Recent new discovery. J Conch **42(2):**183–187.

Huber M. 2010. Compendium of bivalves A full-color guide to 3,300 of the World's Marine Bivalves A status on Bivalvia after 250 years of research ConchBooks, Hackenheim, Germany.

ICZN (International Commission on Zoological Nomenclature). 1985. Opinion 1296. Request for the use of the Plenary Powers to conserve *Nettastomella* Carpenter, 1865 (Bivalvia) refused. Bull Zool Nom **42(1):**37–38.

ICZN (International Commission on Zoological Nomenclature). 1999. International Code of Zoological Nomenclature Fourth edition.

© 2021 Academia Sinica, Taiwan

International Trust for Zoological Nomenclature, London, UK.
Ihering Hv. 1907. Les Mollusques fossiles du Tertiaire et du Cretace superieur de l'Argentine. An Mus Nac Bs As **Serie III:**1–611.
Keen M. 1971. Seashells of Tropical West American Marine mollusks from Baja California to Peru. Stanford University Press, Stanford, California, USA.
Kellogg JL. 1915. Ciliary mechanisms of lamellibranchs with descriptions of anatomy J Morph **26(4):**625–701. doi:10.1002/jmor.1050260403.
Kennedy GL. 1974. West American Cenozoic Pholadidae (Mollusca: Bivalvia). Mem San Diego Soc Nat Hist **8:**2–127.
Kensley B, Pether J. 1986. Late tertiary and early quaternary fossil mollusca of the Hondeklip area, Cape Province, South Africa. An South African Mus **97(6):**141–225.
Kilburn RN, Rippey E. 1982. Sea Shells of Southern Africa Macmillan South Africa, Johannesburg, South Africa.
Klappenbach M. 1967. La familia Pholadidae en aguas uruguayas, con mención de *Martesia* (*Martesia*) *fragilis* (Verrill and Bush 1890) para la malacofauna de nuestro país. Rev Inst Invest Pesq **2(1):**163–168.
Lamarck JBPAdM. 1809. Philosophie zoologique, ou Exposition des considerations relatives à l'histoire naturelle des animaux; à la diversité de leur organisation et des facultés qu'ils on obtiennent; aux causes physiques qui maintiennent en eux la vie et donnent lieu aux mouvemens qu'ils exécutent; enfin, à celles qui produisent les unes le sentiment et les autres l'intelligence de ceux qui en sont doués. Paris, Dentu, 2 volumes.
Lamarck JBPAdM. 1818. Histoire Naturelle des Animaux sans Vertèbres, Présentant les Caractères Généraux et Particuliers de ces Animaux, leur distribution, leurs Classes, leurs Familles, leurs Genres, et la Citation des principales Espèces qui s'y Rapportent; Précédée d'une Introduction Offrant la Détermination des Caractères Essentiels de l'Animal, sa Distinction du Végétal et des Autres Corps Naturels; enfin, l'Exposition des Principes Fondamentaux de la ZoologieVerdière, Paris, France.
Lamprell K, Healy J. 1998. Bivalves of Australia, Volume 2. Backhuys Publushers, Leiden, Netherlands.
Lamy E. 1925. Révision des Pholadidae vivants du Muséum national d'histoire naturelle de Paris. J Conchyl **69:**79–103.
Lamy E. 1926. Révision des Pholadidae vivants du Muséum National d'Histoire Naturelle de Paris. J Conchyl **69:**136–168.
Lange De Morretes F. 1949. Ensaio de Catalogo dos Moluscos do Brasil. Arq Mus Paranaense **7:**1–216.
Leach WE. 1852. Molluscorum Britanniae Synopsis: a Synopsis of the Mollusca of Great Britain Arranged According to their Natural Affinities and Anatomical Structure. J Van Voorst, London, UK.
Linnaeus CA. 1758. Caroli Linnaei, Equitis de Stella Polari, Archiatri Regii, Med. and Botan. Profess. Upsal.; Acad. Upsal. Holmens. Petropol. Berol. Imper. Lond. Monspel. Tolos. Florent. Soc. Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis. Editio Decima, reformata, 2 vols., paged continuously. Tomus I, Regnum Animale. Impensis Laurentii Salvii, Holmiae, Lipsiae, Stockholm, Sweden.
Lister M. 1685–1695. Historiae Conchyliorum Privately printed, London, UK.
Menke KT. 1830. Synopsis Methodica Molluscorum Generum Omnium et Specierum Earum, quae in Museo Menkeano Adservantur; Cum Synonymia Critica et Novarum Specierum Diagnosibus Georgi Uslar, Pyrmonti Editio altera, auctior et emendatior.
Mikkelsen PM, Bieler R. 2004. Critical catalog and annotated bibliography of marine bivalve records for the Florida Keys. Malacol **46(2):**545–623.
Mikkelsen PM, Bieler R. 2007. Seashells of Southern Florida - Living Marine Mollusks of the Florida Keys and Adjacent Regions: Bivalves Princeton University Press, Princeton, New Jersey, USA.
Molina JI. 1782. Saggio sulla storia naturale del Chile, del Signor Abate Giovanni Ignazio Molina Bologna.
Monari S. 2009. Phylogeny and biogeography of pholadid bivalve *Barnea* (*Anchomasa*) with considerations on the phylogeny of Pholadoidea. Acta Pal Polonica **54(2):**315–335. doi:10.4202/app.2008.0068.
Moore DR. 1961. The marine and brackish water Mollusca of the State of Mississippi Gulf Coast Research Laboratory. Gulf Res Rep **1(1):**1–58.
Nicklès M. 1950. Mollusques Testacés Marins de la Côte Occidentale d'Afrique. Manuels Ouest-Africains Vol 2 Lechevalier, Paris, France.
Olazarri J. 1962. Ampliación de la distribución de *Pholas campechiensis* Gmelin Com Soc Malac Urug **1(3):**51–52.
Olsson AA. 1961. Mollusks of the Tropical Eastern Pacific - Panamic Pacific Pelecypoda, Ithaca, New York, USA.
Paetel F. 1875. Die bisher veröffentlichten Familien und Gattungsnamen der Mollusken, Berlin, Germany.
Paredes C, Cardoso F, Santamaría J, Esplana J, Llaja L. 2016. Lista anotada de los bivalvos marinos del Perú. Rev Peruana Biol **23(2):**127–150. doi:10.15381/rpb.v23i2.12397.
Pastorino G. 1995. Moluscos costeros recientes de Puerto Pirámide, Chubut, Argentina. Acad Nac Cienc, Córdoba **(93):**1–30.
Pennant T. 1777. [Anonymous] British Zoology. Cymmorodorion Society, London, 4th edition, Vol. 4, Crustacea, Mollusca, Testacea. B, White, London, UK.
Perry LM. 1940. Marine shells of the southwest coast of Florida. Bull Am Paleontol **26:**1–260.
Philippi RA. 1847 [1847–1848]. Testaceorum novorum centuria. Zeit Malak **4(5):**71–77.
Philippi RA. 1858. Breves descriptiones molluscorum quorundam terrestrium et marinorum Chilensium Ab Nat Gesell Halle **4:**21–24.
Poli GS. 1791, 1795. Testacea Utriusque Siciliae Eorumque Historia et Anatome Tabulis Aeneis Illustrata. Rusconi, Parma; Chiaje, Neapoli.
Poppe G, Goto Y. 1993. European Seashells. Vol. II (Scaphopoda, Bivalvia, Cephalopoda). Christa Hemmen, Wiesbaden, Germany.
Purchon RD. 1941. On the biology and relationships of the lamellibranch *Xylophaga dorsalis* (Turton). J Mar Biol Ass UK **25(1):**1–39. doi:10.1017/S0025315400014259.
Purchon RD. 1955. The structure and function of the British Pholadidae (Rockboring Lamellibranchia). Proc Zool Soc London **124(4):**859–911. doi:10.1111/j.1469-7998.1955.tb07821.x.
Rafinesque CS. 1810. Indice d'ittiologia siciliana ossia catalogo metodico dei nomi latini, italiani, e siciliani, e siciliani dei pesci, che si rinvengono in Sicilia disposti secondo un metodo naturale eseguito da un appendice che contiene la descrizione di alcuni nuovi pesci siciliani. Ill Opuscolo del signore C.S. Rafinesque Schmaltz. Giovanni del Nobolo, Messina, Italy.
Rafinesque CS. 1815. Analyse de la Nature ou Tableau de l'University et des Corps Organisés, etc. C. S. Rafinesque. Jean Barravecchia, Palermo, Italy.
Renier SA. 1807. Tavole per Servire alla Classificazione e Connoscenza degli Animali, Padua, Italy.
Rios EC. 1966. Provisional list of Rio Grande do Sul marine mollusks Escola de Geologia. Notas e Estudos **1(2):**15–40.
Rios EC. 1994. Seashells of Brazil Editora da Fundaçao Universidade do Rio Grande, Rio Grande do Sul, Brazil.

© 2021 Academia Sinica, Taiwan

Rios EC. 2009. Compendium of Brazilian Sea Shells Evangraf, Rio Grande, Brazil.

Risso A. 1826. Histoire Naturelle des Principales Productions de l'Europe Méridionale et Particulièrement de celles des Environs de Nice et des Alpes Maritimes. 5 vols. F.-G. Levrault, Paris, Strasbourg. Vol. 4, Mollusques. AnnélidesParis, F.G. Levrault. 3(XVI): 1–480, 14 pls. [copepods 160–163]. doi:10.5962/bhl.title.58984.

Ruhland J, Saalfeel K. 1967. Ocorrencia e distribuicao de algunas espécies de moluscos marinhos da Ilha de Santa Catarina, SC Brasil (Gastropoda, Bivalvia). Iheringia **66:**83–94.

Sanpanich K. 2011. Marine bivalves occurring on the east coast of the Gulf of Thailand. Sci Asia **37:**195–204. doi:10.2306/scienceasia1513-1874.2011.37.195.

Say T. 1822. An account of the marine shells of the United States. J Acad Nat Sci Phila **2:**221–227.

Scarabino F. 2003. Lista sistemática de los Bivalvia marinos y estuarinos de Uruguay Com Soc Malacol Urug **8(80-81):**229–259.

Scarabino F, Zaffaroni JC, Clavijo C, Carranza A, Nin M. 2006. Bivalvos marinos y estuarinos de la costa uruguaya: faunística, distribución, taxonomía y conservación. *In*: Menafra, R, Rodríguez Gallego, L, Scarabino, F y Conde, D, (eds) Bases para la conservación y el manejo de la costa uruguaya Vida Silvestre (Sociedad Uruguaya para la Conservación de la Naturaleza), Montevideo, Uruguay.

Scarabino F, Zelaya DG, Orensanz JM, Ortega L, Defeo O et al. 2016. Cold, warm, temperate and brackish: bivalve biodiversity in a complex oceanographic scenario (Uruguay, southwestern Atlantic). Am Malacol Bull **33(2):**284–301. doi:10.4003/006.033.0219.

Scarabino V. 1977. Moluscos del Golfo San Matías (Provincia de Río Negro, República Argentina Inventario y Claves para su identificación Com Soc Malacol Urug **4:**177–285.

Schläpfer JG. 1821. VIII Über die, bei St Gallen befindlichen Bersteinetungen Neue Alpina: eine Schrift der Schweizerischen Naturgeschichte. Alp Landwirth Gew **1:**268−287.

Schlotheim EFFV. 1813. Beiträge zur Naturgeschichte der Versteinerungen in geognostischer. H Tasch Min **7:**3−134.

Schwindt E, Carlton J, Orensanz JM, Scarabino F, Bortolus A. 2020. Past and future of the marine bioinvasions along the Southwestern Atlantic. Aq Inv **15:**11–29. doi:10.3391/ai.2020.15.1.02.

Sowerby GBI. 1821–1834. The genera of recent and fossil shells, for the use of students, in conchology and geology London, UK.

Sowerby GBI. 1834. Characters of new species of shells contained in the collection formed by Mr Cuming, chiefly on the western coast of South America and among the islands of the South Pacific Ocean Proc Zool Soc London **1834:**68–72.

Sowerby GBII. 1849. Monograph of the genus *Pholas* in Sowerby, GB II ed, Thesaurus Conclyliorum; Or monographs of genera of Shells **2(10):**485–500.

Srinivasan VV. 1959. Two species of wood-boring pholads of Madras. Proc Indian Acad Sci, Section B **50(2):**105–111.

Stoliczka F. 1870, 1871. The Pelecypoda, with a review of all known genera of this class, fossil and Recent in Thomas Oldham, Cretaceous Fauna of Southern India Vol 3, Palaeontologia Indica, Being Figures and Descriptions of the Organic Remains Procured During the Progress of the Geological Survey of India Trübner and Co Memoirs of the Geological Survey of India, Calcutta (series 1), no 3, issued in 13 parts.

Taki I, Habe T. 1945. Taxonomy of Pholadacea in Japan. Venus **14(1–4):**108–123.

Tchang S, Tsi C, Li K. 1960. Étude sur les pholads de la Chine et description d'expèces nouvelles. Acta Zool Sinica **12(1):**63–87.

Tryon GW. 1862. On the classification and synonymy of the Recent species of Pholadidae. Proc Acad Nat Sci Phila **14(5):**191–221.

Tryon GW. 1868. Catalogue of the recent Mollusca belonging to the order Pholadacea. Am J Conch **3(3):**1–21.

Turgeon DD, Lyons WG, Mikkelsen PM, Rosenberg G, Moretzsohn F. 2009. Bivalvia (Mollusca) of the Gulf of Mexico. *In*: Felder DL, Camp DK (eds) Gulf of Mexico - Origins, Waters, and Biota Biodiversity Texas A and M Press, College Station, Texas, USA.

Turner RD. 1954. The family Pholadidae in the western Atlantic and the eastern Pacific part I-Pholadinae. Johnsonia **3(33):**1–63.

Turner RD. 1955. The family Pholadidae in the western Atlantic and the eastern Pacific part II-Martesiinae, Jouannetiinae and Xylophaginae. Johnsonia **3(34):**65–160.

Turner RD. 1969. Superfamily Pholadacea. *In*: Moore RC (ed) Treatise on invertebrate paleontology, Part N (Mollusca), 6 (Bivalvia) (2). Geological Society of America and the University of Kansas Lawrence, Kansas, USA.

Turner RD. 2002. On the subfamily Xylophagainae (Family Pholadidae, Bivalvia, Mollusca). Bull Mus Comp Zool **157(4):**223–308.

Turner RD, Santhakumaran LN. 1989. The genera *Martesia* and *Lignopholas* in the Indo-Pacific (Mollusca: Bivalvia: Pholadidae). Ophelia **30(3):**155–186. doi:10.1080/00785326.1989.10430842.

Turton W. 1802, 1806. A General System of Nature through the Three Grand Kingdoms of Animals, Vegetables, and Minerals, Systematically Divided into their Several Classes, Orders, Genera, Species and Varieties, with their Habitations, Manners, Economy, Structure, and Peculiarities. Sir Charles Linné: Translated from Gmelin, Fabricius, Willdenow, &c Together with Various Modern Arrangements and Corrections, Derived from the Transactions of the Linnean and other Societies, as well as from the Classical Works of Shaw, Thornton, Abbot, Donovan, Sowerby, Latham, Dillwyn, Lewin, Martyn, Andrews, Lambert, etc., etc. With a Life of Linné, Appropriate Copper-plates, and a Dictionary Explanatory of the Terms which occur in the Several Departments of Natural History, by William Turton, M. D. Lackington, Allen and Co., London, UK.

Valentich-Scott P, Coan EV, Zelaya DG. 2020. Bivalve Seashells of western South America. Marine bivalves mollusks from Northern Peru to Southern Chile. Santa Barbara Museum of Natural History Monographs Number 8, Studies in Biodiversity Number 6.

Valenciennes A. 1846. Atlas de Zoologie, Mollusques. *In*: DuPetit-Thouars AA (ed) Voyage Autour du Monde sur la Frégate La Vénus, Pendant les Années 1836−1839, Gide, Paris, France.

Velásquez M, Valentich-Scott P, Capelo JC. 2017. Marine boring bivalve mollusks from Isla Margarita, Venezuela. Festivus **49(3):**247–269.

Verrill AE, Bush KJ. 1898. Revision of the Deep-water Mollusca of the Atlantic Coast of North America, with Descriptions of New Genera and Species: Part 1. Bivalvia. Proc U S Nat Mus **20:**775–901. doi:10.5479/si.00963801.20-1139.775.

Yokoyama M. 1920. Fossils from the Miura Peninsula and its immediate north Tokyo, J Imperial Univ College Sci **39(6):**1−193.

Zelaya DG. 2016. Marine bivalves from the Argentine coast and continental shelf: Species diversity and assessment of the historical knowledge Am Malacol Bull **33:**245–262. doi:10.4003/006.033.0204.

Zetek J, Mclean RA. 1936. *Hiata* a new genus of the family Pholadidae from the Pacific at Panama with description of a new species. Nautilus **49(4):**110−111.

© 2021 Academia Sinica, Taiwan