

A conspicuous new terrestrial snail species (Gastropoda: Bulimulidae) from the Región de Antofagasta, northern Chile

Juan Francisco Araya ^{Corresp., 1,2}, Abraham S.H. Breure ^{3,4}

¹ Programa de Doctorado en Sistemática y Biodiversidad, Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción, Chile

² Universidad de Atacama, Copayapu 485, Copiapó, Región de Atacama, Chile

³ Royal Belgian Institute of Natural Sciences, Vautierstraat 29, 1000 Brussels, Belgium

⁴ Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, the Netherlands

Corresponding Author: Juan Francisco Araya

Email address: jfaraya@u.uchile.cl

A new species of *Scutalus* Albers, 1850 (Gastropoda: Bulimulidae), *Scutalus chango* sp. n. is described from a coastal area of northern Chile. Shells of this new species were collected buried in sand and from under boulders and rocks in the foothills of the Chilean Coastal Range at Paposo, Región de Antofagasta. The new species is distinguished from all the other Chilean terrestrial snails by its slender shell with a flared and reflected aperture, and by the presence of a columellar fold. This is the first record of the genus *Scutalus* in Chile, and the southernmost record for this endemic South American bulimulid genus. The presence of this species at Paposo highlights the need for further research and for conservation guidelines in coastal areas of northern Chile, which have a comparatively high biodiversity and endemism.

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2 **Antofagasta, northern Chile**

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4 Juan Francisco Araya^{1,2*}, Abraham S. H. Breure^{3,4}

5

6 ¹*Programa de Doctorado en Sistemática y Biodiversidad, Universidad de Concepción,*
7 *Concepción, Chile.*

8 ²*Universidad de Atacama, Copiapó, Región de Atacama, Chile.*

9 *E-mail: juan.araya@uda.cl*

10 *orcid.org/0000-0002-4087-9641*

11 *[urn:lsid:zoobank.org:author:443B4F42-FB13-42A6-B92B-1B0F835698A9](https://zoobank.org/urn:lsid:zoobank.org:author:443B4F42-FB13-42A6-B92B-1B0F835698A9)*

12 ³*Royal Belgian Institute of Natural Sciences, Brussels, Belgium.*

13 ⁴*Naturalis Biodiversity Center, Leiden, the Netherlands.*

14 *orcid.org/0000-0001-9357-0501*

15

16 Corresponding author Juan Francisco Araya

17 *E-mail: juan.araya@uda.cl*

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19 **ABSTRACT**

20 A new species of *Scutalus* Albers, 1850 (Gastropoda: Bulimulidae), *Scutalus chango* sp. n. is
21 described from a coastal area of northern Chile. Shells of this new species were collected buried
22 in sand and from under boulders and rocks in the foothills of the Chilean Coastal Range at
23 Paposo, Región de Antofagasta. The new species is distinguished from all the other Chilean
24 terrestrial snails by its slender shell with a flared and reflected aperture, and by the presence of a
25 columellar fold. This is the first record of the genus *Scutalus* in Chile, and the southernmost
26 record for this endemic South American bulimulid genus. The presence of this species at Paposo
27 highlights the need for further research and for conservation guidelines in coastal areas of
28 northern Chile, which have a comparatively high biodiversity and endemism.

29

30 **Keywords** *Scutalus*, Chilean Coastal Range, Stylommatophora, Orthalicoidea, South America,
31 Peru, Bolivia, land mollusc, Pulmonata

32

33 **INTRODUCTION**

34 Terrestrial molluscs are one of the least researched invertebrate groups in Chile; the knowledge
35 on its diversity is based in comparatively few works, most of them studies from the XIX century,
36 with a single recent comprehensive work (Stuardo & Vega 1985) which listed 154 species in 14
37 families for the entire Chilean territories, including the Juan Fernández and Desventuradas
38 Archipelagos and Easter Island. The Chilean terrestrial molluscs are mostly represented by
39 species of the families Charopidae, Bulimulidae and Bothriembryontidae, most of them with
40 very small distributions and high levels of endemism. Works which have reviewed terrestrial
41 snails from the northern part of the country (characterized by its arid to hyper-arid landscape)
42 only include the studies done by Philippi (1860), Gigoux (1932), Rehder (1945), Breure (1978),
43 Stuardo & Valdovinos (1985), Valdovinos & Stuardo (1988), Miquel & Araya (2013), Araya &
44 Catalán (2014), Araya (2015a) and Araya et al. (2016).

45 In the present study —part of ongoing work reviewing terrestrial molluscs from northern
46 and central Chile (Araya & Aliaga 2015; Araya, 2015b) — we report an unusual new terrestrial
47 snail species, characterized by having a shell with an expanded aperture and a columellar fold,
48 collected buried in humus and sand, among communities of arborescent cacti (*Eulychnia*
49 *iquiquensis*) and large succulent shrubs (*Euphorbia lactiflua*) and other xerophytic plants, in a
50 narrow area in the foothills of the Chilean Coastal Range north of Paposo, Región de
51 Antofagasta, in northern Chile. This new species represents the southernmost record of the genus
52 *Scutalus* Albers, 1850, a South American genus belonging to the family Bulimulidae, a family
53 which was formerly represented in Chile solely by the genus *Bostryx* Troschel, 1847.

54

55 **MATERIAL AND METHODS**56 *Material collection*

57 Sixteen specimens, all of them empty shells, were collected buried in humus and under boulders
58 and fallen rocks north of Paposo (24°55' S; 70°30' W, altitude 150 to 170 m), Región de
59 Antofagasta, northern Chile (Figures 1, 2). The dimensions of the shells, measured with Vernier
60 calipers (± 0.1 mm) are depicted in Figure 3; measurements are given in mm and they include,
61 when appropriate, the additional thickness of the lip. Type specimens are deposited in the
62 collections of the Museo Paleontológico de Caldera (MPCCL), in Caldera, Chile and in the Santa

63 Barbara Museum of Natural History (SBMNH) at Santa Barbara, USA. Field study permits were
64 not required for this study and none of the species studied herein are currently under legal
65 protection. Abbreviations used are: H: height (maximum dimension parallel to axis of coiling);
66 HA: height of aperture; HS: height of spire; LW: height of last whorl; SA: spire angle; W: width
67 (maximum dimension perpendicular to H); and width of aperture (WA). The distribution map
68 (Figure 1) was prepared using SimpleMapp (Shorthouse 2010).

69 *Nomenclature*

70 The electronic edition of this article conforms to the requirements of the amended International
71 Code of Zoological Nomenclature, and hence the new names contained herein are available
72 under that Code from the electronic edition of this article. This published work and the
73 nomenclatural acts it contains have been registered in ZooBank, the online registration system
74 for the ICZN. The ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated
75 information viewed through any standard web browser by appending the LSID to the prefix
76 “<http://zoobank.org/>”. The LSID for this publication is: urn:lsid:zoobank.org:pub:C9BE441E-
77 6159-4973-888D-74660B2C25F3. The electronic edition of this work was published in a journal
78 with an ISSN and has been archived and is available from the following digital repositories:
79 PubMed Central, LOCKSS.

80

81 **RESULTS**

82 **Systematic Account**

83 **Superfamily Orthalicoidea Martens in Albers, 1860**

84 **Family Bulimulidae Tryon, 1867**

85 **Genus *Scutalus* Albers, 1850**

86 **Type species** *Bulinus proteus* Broderip, 1832

87

88 ***Scutalus chango* new species**

89 **(Figs. 4A–O, 5A–D)**

90 **Diagnosis:** A species with a medium sized (H up to 25.5 mm) elongated whitish or variegated
91 thick shell, sculptured by growth lines and sometimes presenting shallow varices. The shell is
92 most characterized by the subovate peristome with an expanded and reflexed outer lip, a narrow
93 and deep umbilicus narrow and by the presence of a columellar fold.

94 **Description:** Shell solid, of medium size (H up to 25.5 mm), elongated, fusiform; around 2.3
95 times as long as wide, rimate; the upper whorls conic. Surface slightly shining; color white,
96 corneous, or white with brownish axial streaks; sculptured by faint prosocline growth lines,
97 crossed by minute and irregular spiral lines, giving a minutely reticulated surface in some areas.
98 Irregular, longitudinal varices formed by old peristomes are occasionally found on the shell.
99 Protoconch one and a half whorls, white to reddish-brown in color; smooth to the naked eye but
100 in magnification sculptured entirely by many small nodules and striations. Protoconch-
101 teleoconch boundary well defined; the teleoconch sculptured with fine growth lines and minor
102 spiral lines most visible in earlier whorls; sculpture more marked toward the umbilical area. Six
103 and a half flat to slightly convex whorls; last whorl convex and slightly angulated, about 0.66-
104 0.68 of total height. Sutures impressed but shallow. Aperture large (AH about 0.44-0.48 H),
105 subovate (around 1.50-1.54 times as long as wide), slightly oblique and prosocline (about 27°
106 with columellar axis). Columellar margin concave, short, dilated above, minutely rugose, with a
107 columellar fold in the interior of its upper side. The terminations of the peristome joined by an
108 oblique parietal callus. Outer lip expanded and reflexed, sharp, often with the internal margin
109 thickened. Umbilicus narrow and very deep. Soft parts unknown.

110 **Type material:** Holotype MPCCL XXX1 (Figs. 4A–G): H: 24.8, HA: 10.6, LW: 16.6, NW: 7.5,
111 SA: 47.5°, W: 10.7, WA: 7.3; paratype 1 MPCCL XXX2 (Figs. 4H–I): H: 25.3, HA: 12.4, LW:
112 16.8, NW: 7.5, SA: 50°, W: 11.2, WA: 8.1; paratype 2 (juvenile) MPCCL XXX3 (Figs. 4J–L):
113 H: 18.1, HA: 9.4, LW: 12.9, NW: 7.0, SA: 59°, W: 9.2, WA: 6.2; paratype 3 (juvenile) MPCCL
114 XXX4 (Figs. 4M–O): H: 15.3, HA: 8.1, LW: 10.6, NW: 6.5, SA: 57°, W: 8.3, WA: 5.0; paratype
115 4 (juvenile) SBMNH 460094 (Figs. 5A–D): H: 15.7, HA: 7.3, LW: 10.5, NW: 6.75, SA: 54°, W:
116 8.6, WA: 4.9; paratype 5 MPCCL XXX5: H: 25.4, HA: 12.6, LW: 17.2, NW: 7.5, SA: 47.67°,
117 W: 11.2, WA: 8.1. All the specimens collected by M. Araya and J. F. Araya, January 17, 2016.

118 **Type locality:** Foothills of the Chilean Coastal Range, north of Paposo (24°55' S; 70°30' W,
119 altitude 150 to 170 m), Comuna de Taltal, Región de Antofagasta, northern Chile.

120 **Distribution and habitat:** Only known from the type locality; the shells were found in humus
121 under boulders and fallen rocks, usually near communities of the arborescent cacti *Eulychnia*
122 *iquiquensis*, the large succulent shrub *Euphorbia lactiflua* and other small vegetation in the
123 foothills of the Chilean Coastal Range. Many old shells and shell fragments were found buried in
124 sediments in creeks and gullies, but no live specimens were recovered.

125 **Etymology:** A patronym (used as a noun in apposition) in honor of the Changos, local
126 indigenous people (now extinct) who inhabited in the coastal areas of northern Chile, having
127 their last communities at Paposo, the type locality of the new species.

128 **Remarks:** Juvenile specimens have an obtusely angulated to almost carinated last whorl (Figs.
129 4J–O) and a rather narrow and slanted aperture (Figs. 4J, 5A), slightly semilunar in some
130 specimens (Fig. 4M); the external lip becomes reflexed and expanded, and the columellar lip
131 widens in more mature specimens (Fig. 4J), while in fully mature shells the peristome is almost
132 continuous, with a large, expanded and reflexed outer lip and a thin columellar fold (Figs. 4A
133 and 4H). Evidence of episodic growth is seen in the irregular varices found in several specimens;
134 this characteristic is unseen in any other Chilean terrestrial mollusc.

135 **Comparisons with related taxa:** This species differs from all the other species of Chilean
136 terrestrial snails by its slender shell with a flared and reflected apertural lip and by the presence
137 of a columellar fold, a feature so far unique among Chilean terrestrial species. This new taxon
138 resembles at first face *Scutalus latecolumellaris* Preston, 1909, which was reported by Weyrauch
139 (1967) from northern Peru at an elevation of 1700 m. However, the size difference (25 vs. 54
140 mm) immediately distinguishes the new taxon from *S. latecolumellaris*. All other *Scutalus*
141 species are decidedly stouter and cannot be confused with this novelty. The protoconch of this
142 new species, sculptured with nodules and striations, has been compared to other *Scutalus*
143 species; these latter are described as “pit-reticulate” (Breure 1979: 80). Although the protoconch
144 of this novelty is slightly different, the characteristics of the shell morphology, and the ecology
145 and low altitude of the locality of this new species all point more towards the inclusion within
146 *Scutalus* —with a coastal distribution in northern-central Peru and now in northern Chile— than
147 the high-altitude genus *Kuschelenia* Hylton Scott, 1951, found in Andean areas in Argentina,
148 Bolivia, Ecuador and Peru (Hylton-Scott, 1951; Weyrauch, 1967; Breure, 1978, 1979; Miquel
149 1998; Cuezco et al. 2013); type localities, and records housed at the Leiden Museum, of *Scutalus*
150 and *Kuschelenia* species are shown in Figure 1. There is a remarkable gap in distribution
151 between this novelty and other *Scutalus* species which do occur in the coastal area of central and
152 northern Peru (Weyrauch 1967, Breure 1979). Future study of the anatomy and molecular data
153 should provide further evidence on its possible relationships with species from neighbouring
154 countries.

155

156 DISCUSSION

157 The coastal areas of the Atacama Desert in northern Chile have been found to harbor a
158 surprisingly rich diversity of land snails, almost matching the species richness of the much more
159 humid Juan Fernandez Archipelago, off central Chile (Miquel & Araya, 2013; Araya & Catalan
160 2014; Araya 2015b, Miquel & Araya, 2015). The areas near and around Paposo have already
161 yielded a relatively rich snail harvest in early explorations, e.g. by Cuming (Broderip & Sowerby
162 1832a,b) and the ‘Comisión Científica del Pacífico’ (Hidalgo 1872); the latter collection recently
163 revised by Breure & Araujo (2017). In contrast with the much more arid inland areas of northern
164 Chile, these coastal lowlands receive periodic fogs from the sea, which helps to sustain unique
165 communities of plants in ravines and gullies in the West side of the Chilean Coastal Range.
166 Taltal-Paposo in particular has a very rich diversity of endemic plant species, including some
167 relict species with micro-ranges, acting as a local biodiversity island (Ricardi, 1957; Dillon,
168 1991; Pizarro-Araya & Jerez, 2004). The particular habitat of *S. chango* sp. n., living among and
169 under large boulders, may provide a microclimatic condition similar to humid areas; this rock
170 habitat is also relatively stable and buffered from climatic change. These litho-refugia have
171 already been documented for Australian territories (Couper and Hoskin 2008), and they may also
172 explain the presence of charopid species in northern Chile, which require humid environments to
173 thrive.

174 This fragile ecosystem is in peril due to urbanization and industrialization in the area,
175 where a thermoelectric industry has already been built. Land snails are currently not taken into
176 account in local governmental policies; a proper knowledge of the species present in northern
177 Chile and of their distributions is essential for future conservation efforts, especially in hotspots
178 of biodiversity like Paposo.

179

180 CONCLUSIONS

181 A new terrestrial bulimulid species (Gastropoda: Orthalicoidea), *Scutalus chango* sp. n., is
182 described from Paposo, Región de Antofagasta, northern Chile, being the first record of the
183 genus *Scutalus* in Chile and the southernmost record for this endemic South American genus.
184 The new species may represent part of a relict fauna at the coastal area of northern Chile, with
185 close relationship with species from central-northern Peru.

186

187 **ACKNOWLEDGMENTS**

188 We are thankful to Daniel Geiger and Vanessa Delnavaz (SBMNH, Santa Barbara, USA) for
189 their help with SEM images and to Marta Araya (Caldera, Chile) for her help in the field
190 collection at Paposó.

191

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Figure 1

Location map

Figure 1. Geographical location of *Scutalus chango* sp. n. (red star: type locality), Peruvian *Scutalus* species (yellow circles), and *Kuschelenia* species (black squares).

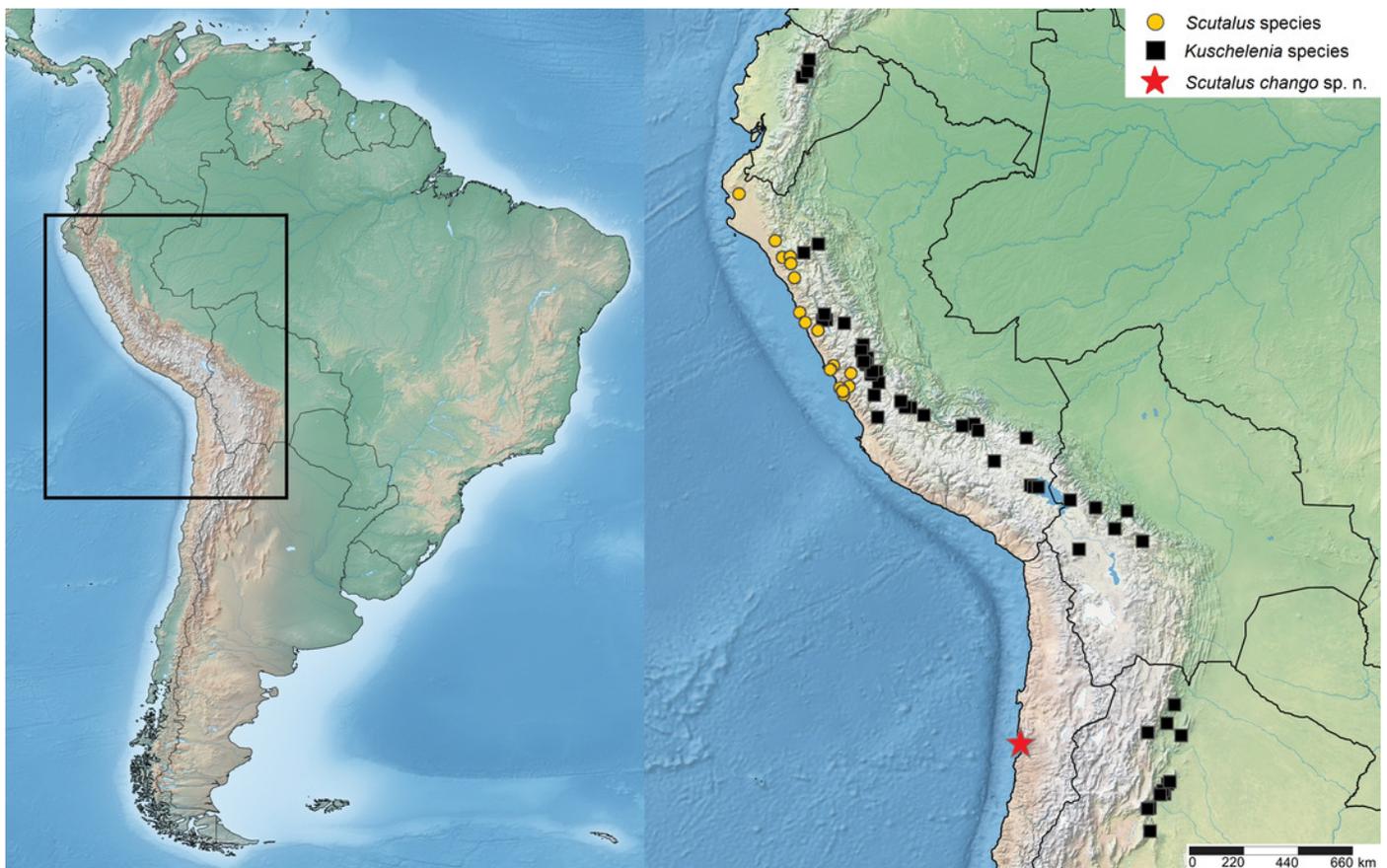


Figure 2

Type locality

Figure 2. Type locality and habitat of *Scutalus chango* sp. n.: under boulders at foothills of the Chilean Coastal Range (SE view), north of Paposo, Región de Antofagasta, northern Chile.



Figure 3

Measurements performed on shells

Figure 3. Measurements taken on specimens and counting of whorls. Abbreviations are: diameter (D: maximum dimension perpendicular to H); height (H: maximum dimension parallel to axis of coiling); height of aperture (HA); height of last whorl (LW); height of aperture (HA); spire angle (SA), and width of aperture (WA).

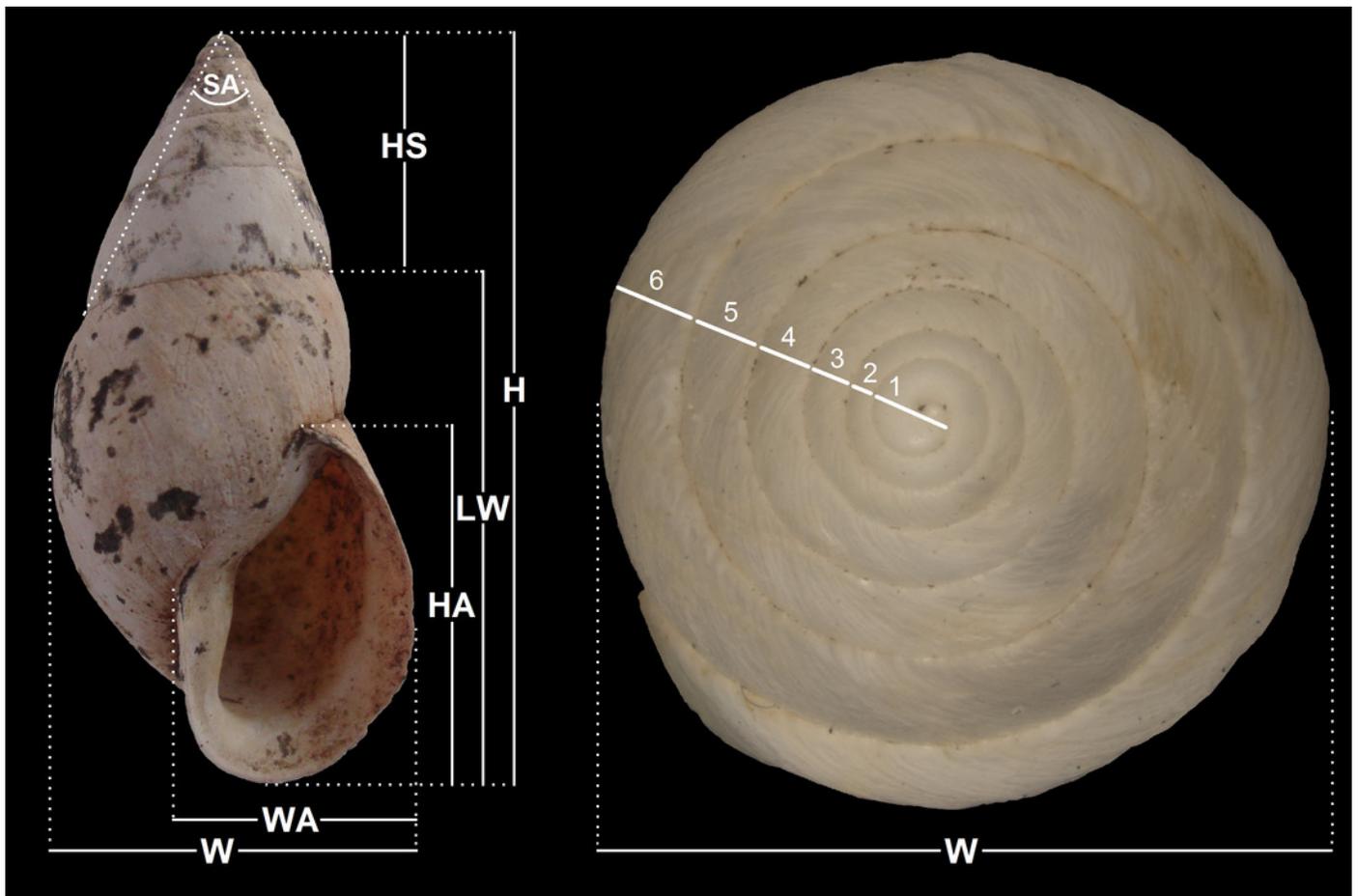


Figure 4

Scutalus chango n. sp.:

Figure 4. *Scutalus chango* n. sp. A-G: Holotype MPCCL XXX1, A: apertural view, B: side view (external lip view), C: abapertural view, D: side view (umbilical view), E: basal view, F: detail of umbilicus and columellar lip, G: detail of sculpture and sutures; H-I: Paratype 1 MPCCL XXX2, H: apertural view, I: abapertural view; J-L: Paratype 2 MPCCL XXX3 (juvenile specimen), J: apertural view, K: side view (external lip view), L: abapertural view; M-O: Paratype 3 MPCCL XXX4 (juvenile specimen), M: apertural view, N: side view (external lip view), O: abapertural view. Scale bars are 10 mm for A - E, 5 mm for F-G, and 10 mm for J-O.

**Note: Auto Gamma Correction was used for the image. This only affects the reviewing manuscript. See original source image if needed for review.*

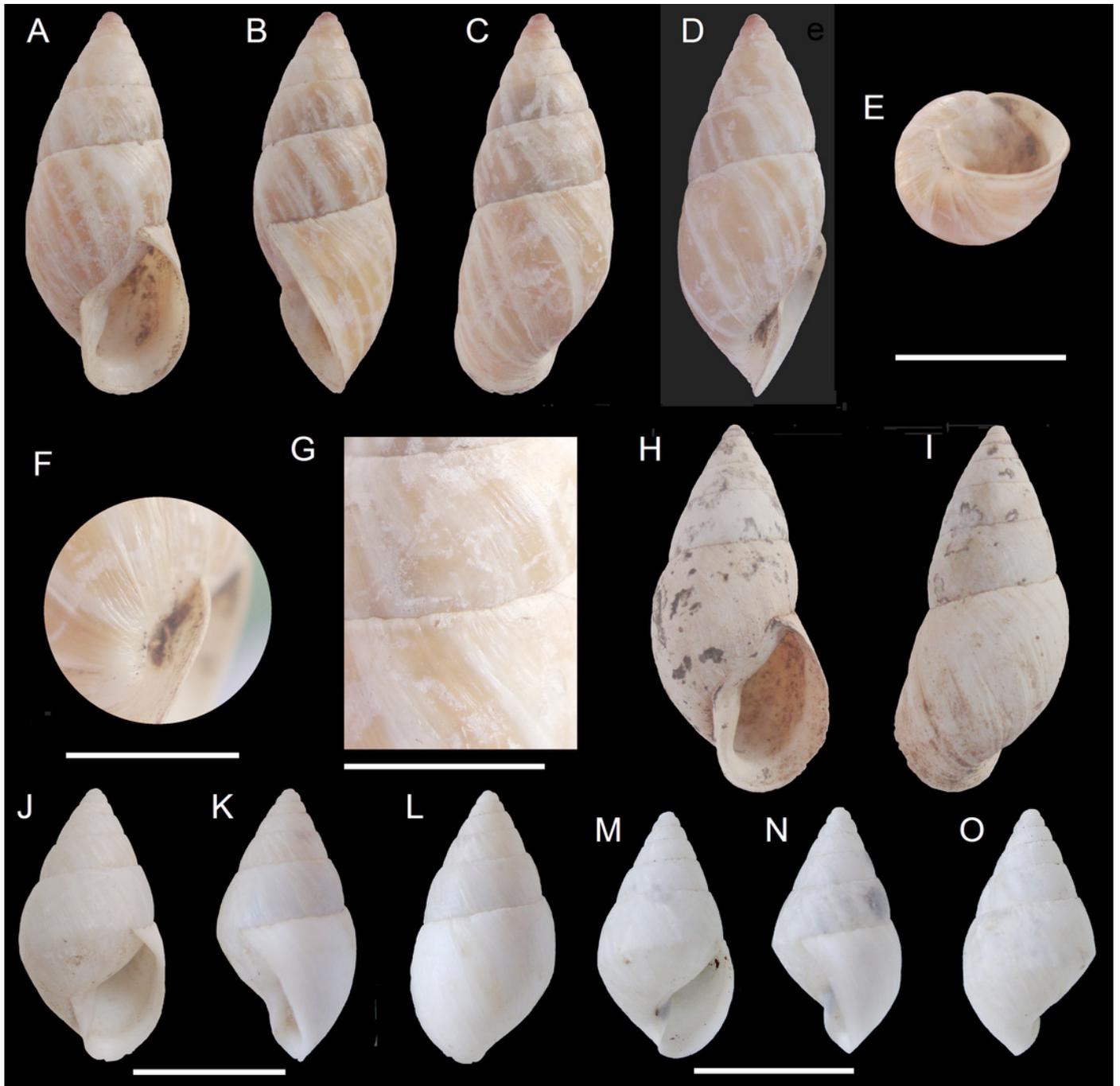


Figure 5

Scutalus chango n. sp.

Figure 5. *Scutalus chango* n. sp. A-D: Paratype 4 SBMNH 460094, A: apertural view, B: apical view, C: SEM side view of protoconch, E: SEM apical view of protoconch. Scale bars are 5 mm for A and B, and 1 mm for C and D.

