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

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A new species of *Scutalus* Albers, 1850 (Gastropoda: Bulimulidae), *Scutalus chango* sp. n. is described from a coastal area of northern Chile. Empty shells of this new species were found buried in sand and under boulders and rocks in the foothills of the Chilean Coastal Range at Paposo, Región de Antofagasta. This new species is distinguished from all 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 *Scutalus* in Chile, and the southernmost record for this endemic South American bulimulid genus. The presence of this species in Paposo highlights the need for further research and for conservation guidelines in coastal areas of northern Chile, which have comparatively high levels of biodiversity and endemism.

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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. Empty shells of this new species were found

22 buried in sand and under boulders and rocks in the foothills of the Chilean Coastal Range at

23 Paposo, Región de Antofagasta. This new species is distinguished from all 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 *Scutalus* in Chile, and the southernmost record for this

26 endemic South American bulimulid genus. The presence of this species in Paposo highlights the

27 need for further research and for conservation guidelines in coastal areas of northern Chile,

28 which have comparatively high levels of biodiversity and endemism.

29

30

31 **INTRODUCTION**

32 Terrestrial mollusks are one of the least well known invertebrate groups in Chile; knowledge of
33 their diversity is based on comparatively few works, most of them from the 19th century, with a
34 single, more comprehensive recent work (Stuardo & Vega, 1985), which lists 154 species in 14
35 families for all Chilean territories, including the Juan Fernández and Desventuradas
36 Archipelagos as well as Easter Island. The Chilean terrestrial molluscs are mostly represented by
37 species of the families Charopidae, Bulimulidae and Bothriembryontidae, most of them with
38 very narrow distributions; these families show, in Chilean territories, high levels of endemism.
39 Works which have reviewed terrestrial snails from the northern part of the country (characterized
40 by its arid to hyper-arid landscapes) only include the studies done by Philippi (1860), Gigoux
41 (1932), Rehder (1945), Breure (1978), Stuardo & Valdovinos (1985), Valdovinos & Stuardo
42 (1988), Miquel & Araya (2013), Araya & Catalán (2014), Araya (2015a) and Araya et al. (2016).

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

52

53 **MATERIAL AND METHODS**

54 *Material collection*

55 Sixteen specimens, all of them empty shells, were collected buried in humus and under boulders
56 and fallen rocks north of Paposo (24°55' S; 70°30' W, altitude 150 to 170 m; precise locality
57 data available from first author on request), Región de Antofagasta, northern Chile (Figures 1, 2).
58 The dimensions of the shells, measured with Vernier calipers (± 0.1 mm) are depicted in Figure
59 3; measurements are given in mm and include, when appropriate, the additional thickness of the
60 lip. Type specimens are deposited in the collections of the Museo Paleontológico de Caldera
61 (MPCCL), in Caldera, Chile and in the Santa Barbara Museum of Natural History (SBMNH) at
62 Santa Barbara, USA. Field study permits were not required for this study and none of the species

63 studied herein are currently under legal protection. Abbreviations used are: H: height (maximum

64 dimension parallel to axis of coiling); HA: height of aperture; HS: height of spire; LW: height of

65 last whorl; SA: spire angle; W: width (maximum dimension perpendicular to H); and width of

66 aperture (WA). The distribution map (Figure 1) was prepared using SimpleMappr (Shorthouse

67 2010).

68 *Nomenclature*

69 The electronic edition of this article conforms to the requirements of the amended International

70 Code of Zoological Nomenclature, and hence the new name contained herein is available under

71 that Code from the electronic edition of this article (ICZN, 1999; ICZN, 2008). This published

72 work and the nomenclatural acts it contains have been registered in ZooBank, under the LSID

73 urn:lsid:zoobank.org:pub:C9BE441E-6159-4973-888D-74660B2C25F3. The electronic edition

74 of this work is available from the following digital repositories: PubMed Central, LOCKSS.

75

76 **RESULTS**

77 **Systematic Account**

78 **Superfamily Orthalicoidea Martens, 1860**

79 **Family Bulimulidae Tryon, 1867**

80 **Genus *Scutalus* Albers, 1850**

81 **Diagnosis (Modified from Breure, 1979):** Shell elongate-ovate to rather globose or depressed

82 conical; (broadly) perforate; solid. Whitish to brownish in color, often with darker spiral bands,

83 with axial streaks or coalescent spots in some species. Surface granulate or with incrassate

84 growth striae. Protoconch pit-reticulate. Whorls slightly convex. Aperture (sub) ovate. Peristome

85 more or less expanded. Columella in some species with a fold within the last whorl.

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

87

88 ***Scutalus chango* new species**

89 **(Figs. 4A–Q, 5A–D)**

90 **Diagnosis:** A species with a medium sized thick and elongated shell (H to 25.5 mm),whitish or

91 variegated in color, sculptured by growth lines and sometimes presenting shallow varices. The

92 shell is mainly characterized by the subovate peristome with an expanded and reflexed outer lip,

93 a narrow and deep umbilicus and by the presence of a columellar fold.

Description: Shell solid, of medium size (H up to 25.5 mm), elongated, fusiform; around 2.3 times as long as wide, rimate; upper whorls conic. Surface slightly shining; color white, corneous, or white with brownish axial streaks; sculptured by faint prosocline growth lines, crossed by minute and irregular spiral lines, forming a minutely reticulated surface in some areas. Irregular, longitudinal varices formed by old peristomes are occasionally found on the shell. Protoconch one and a half whorls, white to reddish-brown in color; smooth to the naked eye but actually sculptured with many small nodules and striations visible under microscope. Protoconch-teleoconch boundary well defined; teleoconch sculptured with fine growth lines and minor spiral lines better visible on earlier whorls; sculpture more distinct toward the umbilical area. Six and a half flat to slightly convex whorls; last whorl convex and slightly angulated, about 0.66-0.68 of total height. Sutures impressed but shallow. Aperture large (HA about 0.44-0.48 of H), subovate (around 1.50-1.54 times as long as wide), slightly oblique and prosocline (about 27° with columellar axis). Columellar margin short, dilated above, minutely rugose, with a columellar fold in the interior of its upper part. Terminations of peristome joined by a moderately thin, oblique, parietal callus. Outer lip expanded and reflexed, sharp, often with the internal margin thickened. Umbilicus narrow and very deep. Soft parts unknown.

Type material: Holotype MPCCL 020617 (Figs. 4A–H): H: 24.8, HA: 10.6, LW: 16.6, NW: 7.5, SA: 47.5°, W: 10.7, WA: 7.3; paratype 1 MPCCL 030617A (Figs. 4J–K): H: 25.3, HA: 12.4, LW: 16.8, NW: 7.5, SA: 50°, W: 11.2, WA: 8.1; paratype 2 (juvenile) MPCCL 030617B (Figs. 4L–N): H: 18.1, HA: 9.4, LW: 12.9, NW: 7.0, SA: 59°, W: 9.2, WA: 6.2; paratype 3 (juvenile) MPCCL 030617C (Figs. 4O–Q): H: 15.3, HA: 8.1, LW: 10.6, NW: 6.5, SA: 57°, W: 8.3, WA: 5.0; paratype 4 (juvenile) SBMNH 460094 (Figs. 5A–D): H: 15.7, HA: 7.3, LW: 10.5, NW: 6.75, SA: 54°, W: 8.6, WA: 4.9; paratype 5 MPCCL 030617D (Fig. 4I): H: 25.4, HA: 12.6, LW: 17.2, NW: 7.5, SA: 47.67°, W: 11.2, WA: 8.1. All the specimens collected by M. Araya and J. F. Araya, January 17, 2016.

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

Distribution and habitat: Only known from type locality; shells found in humus under boulders and fallen rocks, usually near communities of the arborescent cacti *Eulychnia iquiquensis*, the large succulent shrub *Euphorbia lactiflua* and other small vegetation in the foothills of the

124   Chilean Coastal Range. Many old shells and shell fragments were found buried in sediments in

125   creeks and gullies, but no live specimens were recovered.

126   **Etymology:** A patronym (noun in apposition) in honor of the Chango people (now extinct) who

127   inhabited coastal areas of northern Chile, having their last communities at Paposo, the type

128   locality of the new species.

129   **Remarks:** Juvenile specimens have an obtusely angulated to almost carinated last whorl (Figs.

130   4L–Q) and a rather narrow and slanted aperture (Figs. 4L, 5A), slightly semilunar in some

131   specimens (Fig. 4O); the external lip becomes reflexed and expanded, and the columellar lip

132   widens in more mature specimens (Fig. 4L), while in fully mature shells the peristome is almost

133   continuous, with a large, expanded and reflexed outer lip and a thin columellar fold (Figs. 4A

134   and 4J). Evidence of episodic growth is seen in the irregular varices found in several specimens;

135   this characteristic is unseen in any other Chilean terrestrial mollusk.

136   **Comparisons with related taxa:** This species differs from all other species of Chilean terrestrial

137   snails by its slender shell, a flared and reflected apertural lip and by the presence of a columellar

138   fold, a feature so far unique among Chilean terrestrial species. At first glance, this new taxon

139   resembles *Scutalus latecolumellaris* Preston, 1909, which was reported by Weyrauch (1967)

140   from northern Peru at an elevation of 1700 m. However, the size difference (25 vs. 54 mm)

141   immediately distinguishes both species. All other *Scutalus* species are decidedly stouter and

142   cannot be confused with the new species. The protoconch of the type specimen of *S.*

143   *latecolumellaris* (see Breure & Ablett, 2014: 106) differs slightly from this new species: "the

144   sculpture [of *S. latecolumellaris*] looks more pitted than the wave like sculpture [in *S. chango*]"

145   (J. Ablett, pers. comm. 3 January 2017). Also, the protoconch of specimens of *S. proteus*

146   Broderip, 1832 in the Leiden museum are slightly more pitted than in the new species. *Scutalus*

147   *chango* sp. n. corresponds with the *Scutalus* species from northern-central Peru in the ecology

148   and the occurrence in the low-altitude coastal area. We have also compared this new species to

149   members of *Kuschelenia* Hylton Scott, 1951, found in high-altitude Andean areas in Argentina,

150   Bolivia, Ecuador and Peru (Hylton-Scott, 1951; Weyrauch, 1967; Breure, 1978, 1979; Miquel

151   1998; Cuezzo et al. 2013). The protoconch in *Kuschelenia* species has (anastomosing) axial

152   wrinkles (Breure, 1979: 87), which are more prominent than in *S. chango* sp. n. The whorls of

153   the new species are more convex, and the peristome more expanded than those in *Kuschelenia*

154   species. The gap in distribution between *S. chango* sp. n. and other *Scutalus* species (northern

155   Chile versus central and northern Peru; Weyrauch, 1967, Breure, 1979) is larger than the
156   distribution gap between the new species and the nearest *Kuschelenia* species (northern Chile
157   versus the altiplano of Bolivia). It cannot be excluded a priori that the new species may turn out
158   to be a low-altitude representative of this genus. Although this remains somewhat puzzling, this
159   can only be resolved in the future with anatomical and molecular data. For the time being, we
160   prefer to consider the new species as a member of *Scutalus*. Finally, the shell shape of *S. chango*
161   sp. n. is reminiscent of some *Drymaeus* species; however, the lattice sculpture of the protoconch,
162   with axial riblets and spiral sculpture in the latter genus is clearly different from the protoconch
163   sculpture in this new species. Type localities and records housed at the Leiden Museum of
164   *Scutalus* and *Kuschelenia* species are shown in Figure 1.

165

166   **DISCUSSION**

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

184   This fragile ecosystem is in peril due to urbanization and industrialization in the area,
185   where a thermoelectric industry has already been established. Land snails are currently not taken

186 into account in local governmental planning policies; a thorough evaluation proper knowledge of

187 the species present in northern Chile and of their distributions is essential for future conservation

188 efforts, especially in hotspots of biodiversity like Paposo.

189

190 **CONCLUSIONS**

191 A new terrestrial bulimulid species (Gastropoda: Orthalicoidea), *Scutalus chango* sp. n., is

192 described from Paposo, Región de Antofagasta, northern Chile, being the first record of the

193 genus *Scutalus* in Chile and the southernmost record for this endemic South American genus.

194 The new species may represent part of a relict fauna at the coastal area of northern Chile, with

195 close relationship with species from central-northern Peru.

196

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205

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Figure 1

Figure 1. Location map

Geographical location of *Scutalus chango* sp. n. (red star: type locality), Peruvian *Scutalus*
species (yellow circles), and *Kuschelenia* species (black squares).
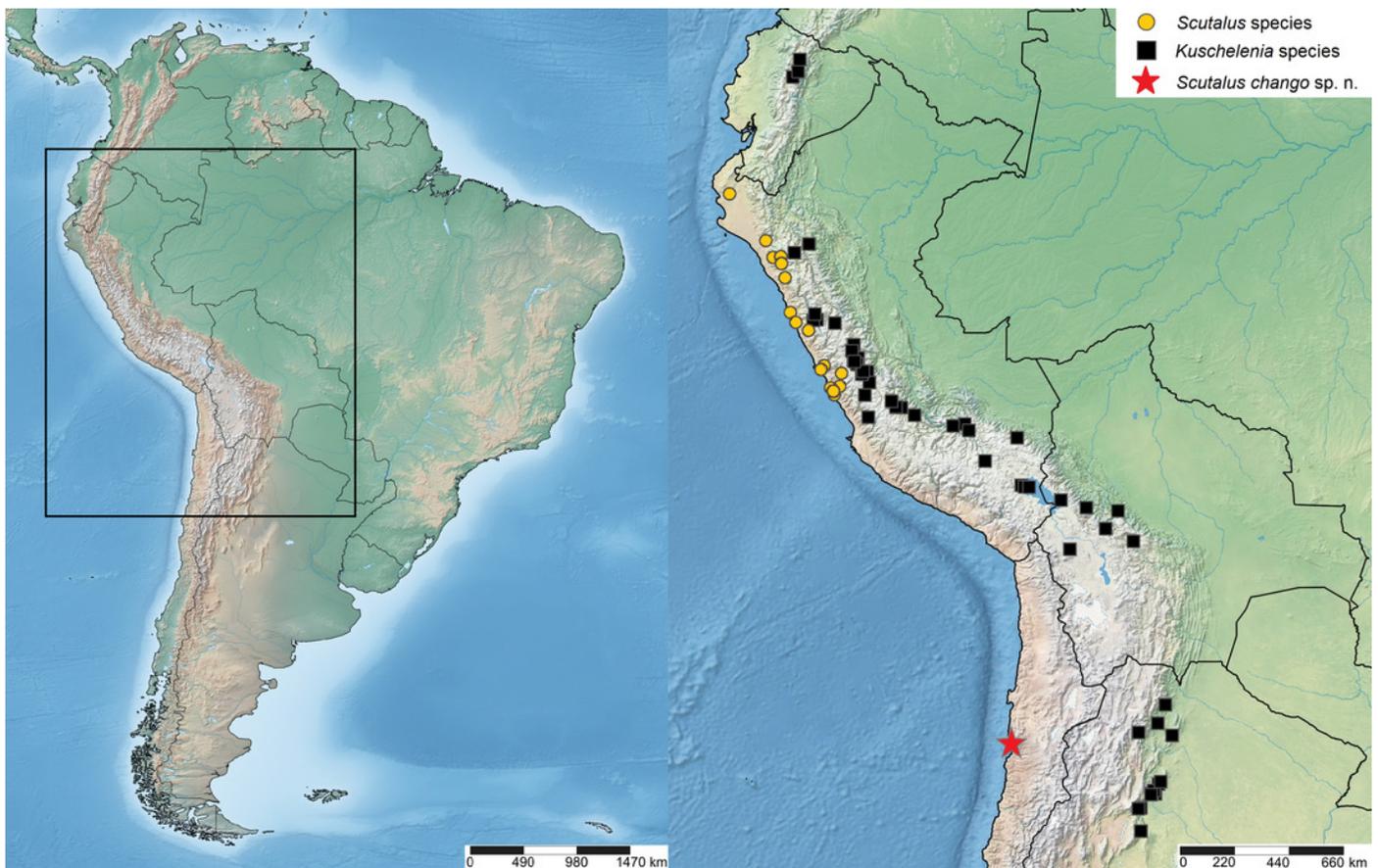
Figure 2

Figure 2. Type locality

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

Figure 3. Measurements performed on shells

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).
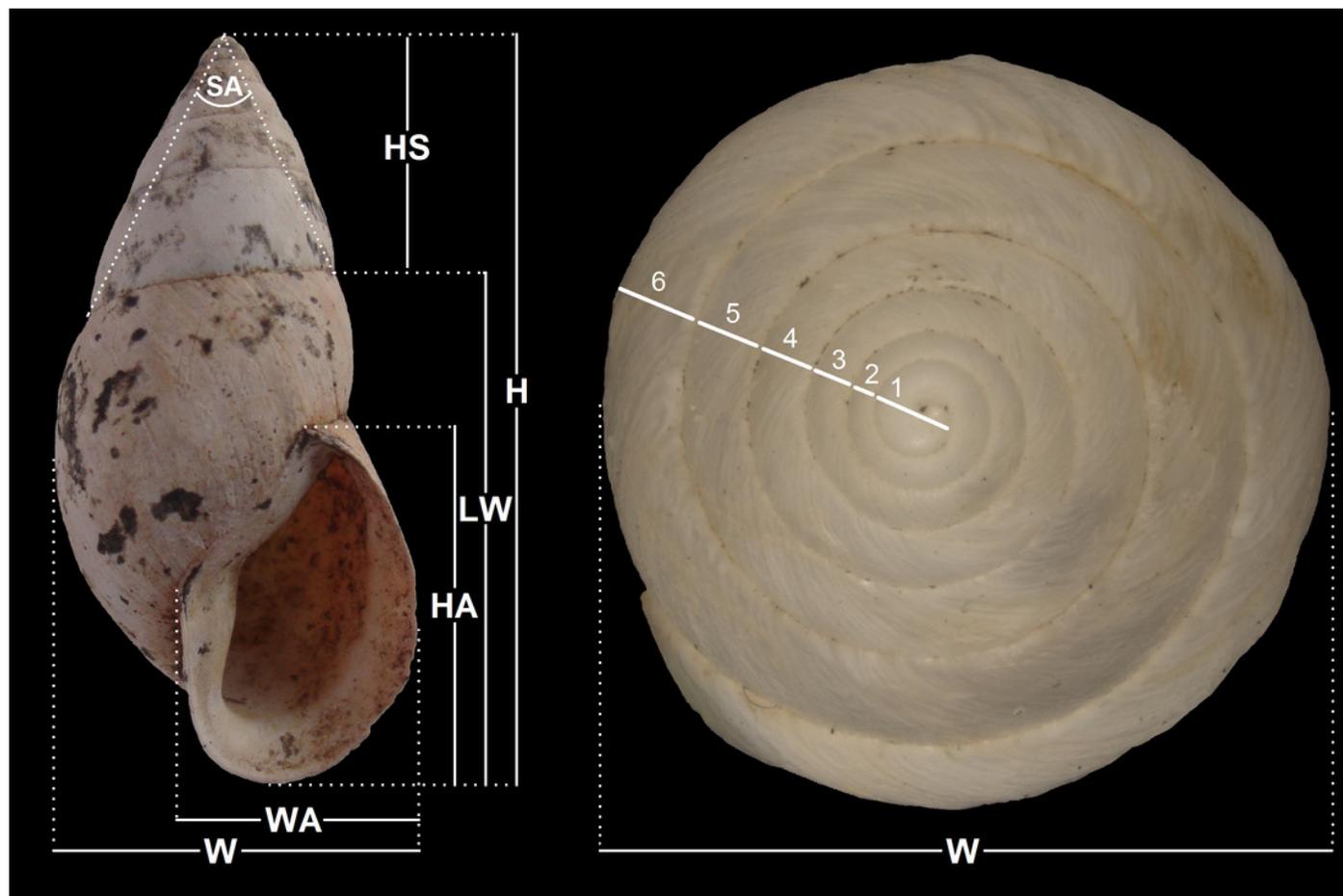
Figure 4

Figure 4. *Scutalus chango* n. sp.

Scutalus chango n. sp. Holotype MPCCL 020617, A: apertural view, B: side view (external lip view), C: abapertural view, D: side view (umbilical view), E: detail of sculpture and sutures, F: detail of umbilicus and columellar lip, G: detail of columellar fold, H: basal view; Paratype 5 MPCCL 030617D, I: detail of columellar fold; Paratype 1 MPCCL 030617A, J: apertural view, K: abapertural view; Paratype 2 MPCCL 030617B (juvenile specimen), L: apertural view, M: side view (external lip view), N: abapertural view; Paratype 3 MPCCL 030617C (juvenile specimen), O: apertural view, P: side view (external lip view), Q: abapertural view. Scale bars are 10 mm for A–D, G–H, J–K, L–Q, and 5 mm for E–F and I.

Note: Auto Gamma Correction was used for the image. This only affects the reviewing manuscript. See original source image if needed for review.
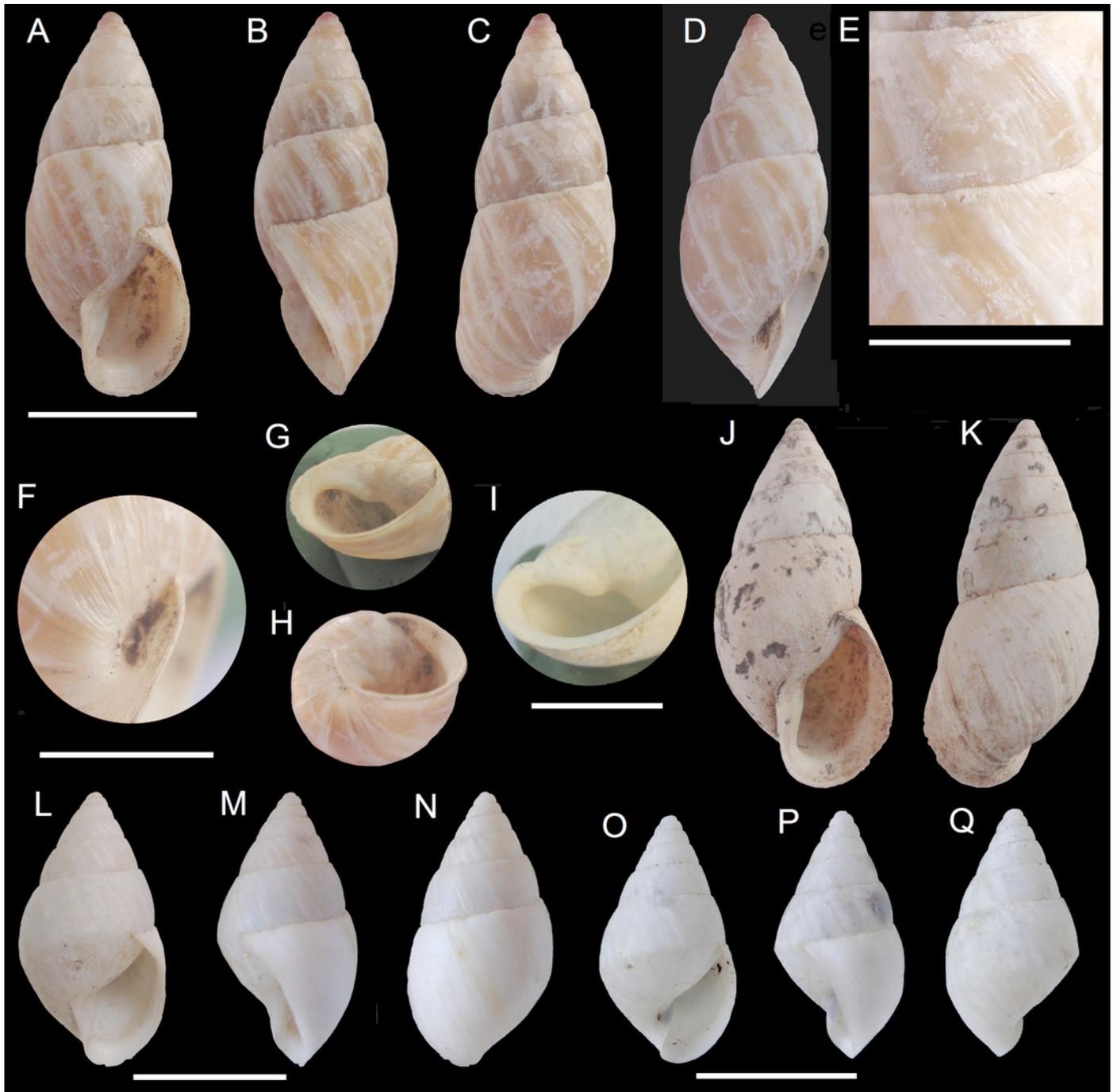
Figure 5

Figure 5. *Scutalus chango* n. sp.

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.