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Three new species of the genus *Adeuomphalus* (Gastropoda: Seguenzioidea) from deep water of Cuba

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Keywords: GASTROPODA, SEGUENZIOIDEA, *Adeuomphalus,* Cuba, new species.

Abstract: Three new species of the genus *Adeuomphalus* Seguenza, 1876 from deep waters of the north of Cuba are described and compared with the previously known species.

Introduction: *Adeuomphalus* Seguenza, 1876 is a genus of very small skeneimorph vetigastropods from bathyal depths, with 'miniature ammonites'-appearance, characterised by a minute shell with almost perfectly planispiral whorls, an orthocline aperture, distinct radial ribs and a deeply concave apex and base.

Phylogenetic analysis carried out by Kano, Chikyu & Warén (2009) revealed six monophyletic groups in **Seguenzioidea: Seguenziidae, Chilodontidae, Calliotropidae, Cataegidae, Spinicalliotropis** and skeneimorph seguenzioids. The three included skeneimorphs in the analysis (*Adeuomphalus elegans* n. sp., *Xyloskenea* sp. and *Ventsia tricarinata*) were ambiguously grouped, possibly suggesting a vast, undiscovered phylogenetic diversity of the group.

The genus currently includes nine previously named species in the Atlantic, Mediterranean, Pacific and Indian Ocean:

(1) *A. ammoniformis* Seguenza, 1876 from Plio-Pleistocene deposits in Italy and in the Mediterranean.
(2) *A. densicostatus* (Jeffreys, 1884) from northeastern Atlantic and fossil in the Mediterranean.
(3) *A. sinuosus* (Sykes, 1925) from northeastern Atlantic.
(4) *A. bandeli* (Schröder, 1995) from the Early Cretaceous of Poland.
(5) *A. trochanter* Warén & Bouchet, 2001 from a hydrothermal vent site on Juan de Fuca Ridge in northeastern Pacific.
(6) *A. elegans* Kano, Chikyu & Warén (2009) from a vent site in Lau Basin off Tonga.
(7) *A. collinsi* Kano, Chikyu & Warén (2009) from a vent in Manus Basin off New Guinea.
(8) *A. guillei* Kano, Chikyu & Warén (2009) from off Reunion Island, Indian Ocean.
(9) *A. xerente* Absalao, 2009 from the Campos Basin off Brazil.

All the previously known species were originally described in the genus *Adeuomphalus*, except *A. densicostata* and *A. sinuosa,* which were described in the genus *Omalogyra* Jeffreys, 1860 and *A. bandeli*, which was described in the genus *Discohelix* Dunker, 1847.

In the Expedition in Cuban waters organised by the USA ship Weatherbird II between 10 and 25 May 2017, three species of this genus were found and they are described in the present work.

Abbreviations:

ANC:	Acuario Nacional, La Habana, Cuba
CACTI:	Centro de Apoyo Científico y Tecnológico of the University of Vigo, Spain
CEAC:	Centro de Estudios Ambientales, Cienfuegos, Cuba
CIM-UH:	Centro de Investigaciones Marinas, University of La Habana, Cuba
USF:	University of South Florida, USA

SYSTEMATICS

VETIGASTROPODA Salvini-Plawen, 1980
Superfamily **Seguenzioidea** Verrill, 1884
Family [unassigned]
Genus ***Adeuomphalus*** Seguenza, 1876

Adeuomphalus Seguenza, 1876: 10 (type species *Adeuomphalus ammoniformis* Seguenza, 1876, by monotypy; Upper Pliocene to Lower Pleistocene, Sicily, Italy; Recent in Mediterranean).
Transomalogyra Palazzi & Gaglini, 1979: 33 (type species *Ammonicerina simplex* sensu Palazzi & Gaglini, 1979, not Costa, 1861 = *Homalogyra densicostata* Jeffreys, 1884).

Diagnosis: In Kano, Chikyu & Warén (2009): "Shell minute, up to 2.95 mm in diameter, colourless, almost perfectly planispiral with deeply concave apex and base. Protoconch paucispiral, of about 0.2 mm in diameter. Teleoconch whorls ornamented with straight or slightly flexuous axial ribs, often keeled at both apical and basal sides; suture deeply impressed; aperture simple, nearly or perfectly orthocline, trapezoidal to horseshoe-shaped to nearly round with a thin edge. Operculum transparent, multispiral with a central nucleus. Animal colourless, cephalic and epipodial tentacles with sensory papillae, simple right neck lobe present, gill small and monopectinate, foot anteriorly bifurcated with a pair of epipodial sense organs (ESOs) and epipodial tentacles. Pigmented eyes, eye lobes, cephalic lappets and subocular peduncles all lacking. Radula absent or 3–2–1–2–3 in formula".

Habitat: Indo-Pacific, Atlantic and Mediterranean in upper to lower bathyal zone (300–2000 m) (Kano, Chikyu & Warén, 2009); Early Cretaceous to Recent (Kaim, 2004).

Remarks: Kano, Chikyu & Warén (2009) confirm that at least three of the known species have no radula (*A. densicostatus, A. trochanter* and *A. collinsi*), while *A. guillei* has a simplified (3–2–1–2–3) rhipidoglossate radula. Anatomical investigations of *A. collinsi* and *A. trochanter* revealed the features described above.

The species of *Adeuomphalus* closely resemble those of *Eudaronia* Cotton, 1945 and *Palazzia* Warén, 1991 in having an almost perfectly planispiral shell with a deeply concave apex and base and a perfectly or nearly orthocline aperture.

Adeuomphalus, Eudaronia and *Palazzia* are probably closely related genera. All of them are also rare inhabitants of the deep sea of unknown familial placement (Warén, 1991; Rex, 2002; Kano, 2008).

Adeuomphalus diegoalejandroi n. sp.
Fig. 1A-F

Type material: Holotype (Figs 1A-B) in ANC (ANC.06.3.162).

Material examined: Only the holotype.

Type locality: North of Cuba, SL42-750, 23.0984 N, 82.9843 W, 1455 m.

Description: Shell minute (<1.5 mm), semitransparent, thin, formed by a little more than 2 whorls. The protoconch has 0.6 whorls, with a diameter of 210 µm and its surface is covered by an irregular net-like sculpture of irregularly fused elevations around the smooth base with rounded profiles. Protoconch/teleoconch boundary simple without a lamellate section. Teleoconch with 1.6 whorls, no apical or basal spiral keels and up to 42 flexuous axial ribs of which 14 are present on first 0.6 whorls and 28 on the last one. The interspaces between the prominent lamellae are only sculptured with faint, fine and a little irregular spiral cordlets, equidistantly separated, which go up a little on the lateral wall of the lamellae. Aperture orthocline, simple, of roughly circular cross-section, except in the area of contact of the aperture with the previous whorl, where the curve disappears; size 0.36 mm in width, 0.44 mm in height; peristome wide, formed by the last lamella, not continuous, very slightly curved by the previous whorl.

Dimensions: the holotype's size is 1.2 mm in diameter and 0.6 mm in height.

Habitat: Bathyal species collected at a depth of 1455 m.

Distribution: Only known from type locality.

Etymology: The species' name is after Diego Alejandro Fernández Artíles, grandson of the first author.

Remarks: *A. diegoalenjandroi* n. sp. is characterised by the lack of an apical and basal keel, by its sinuous axial ribs, which are rather prominent and with a regular distance between them and fundamentally by having all the surface of the teleoconch between the ribs covered with microgranules and fine spiral cordlets.

A. collinsi Kano, Chikyu & Warén, 2009 is the species with an apparent great resemblance, but this species may be differentiated by the different shape of the aperture, its

fine peristoma and by having a very fine, discontinuous microsculpture between the lamellae on the teleoconch.

A. guillei Kano, Chikyu & Warén, 2009 has a protoconch with different microsculpture, an angled prominence in the middle of the surface in adapical and abapical parts, and lacks prominent spiral cordlets.

See below for the differences with *Adeuomphalus valentinae* n. sp. and *Adeuomphalus misaeli* n. sp.

It can be differentiated from most of the known species (*A. densicostatus, A. ammoniformis, A. trochanter, A. elegans* and *A. guillei*) because all of these have apical and basal keels.

Adeuomphalus valentinae n. sp.
Fig. 2A-F

Type material: Holotype (Figs. 2A-B) in ANC (ANC.06.03.164).

Material examined: Only the holotype.

Type locality: North of Cuba, SL42-750, 23.0984 N, 82.9843, 1455 m.

Description: Shell minute (<2.0 mm), semitransparent, thin, formed by 2.6 whorls. Protoconch with ¾ whorl, with a diameter of 200 µm and its surface covered with an irregular net-like sculpture, which agglomerates in irregular spiral lines. Protoconch/teleoconch boundary simple, without a lamellate section. Teleoconch with 2 whorls, without any trace of spiral keels and up to 50 strong axial ribs of which 19 present on first whorl and 31 on last one. Surface totally covered with micro-granules; from the first ¾ whorl, fine, equidistantly separated spiral cordlets are distributed in the interspaces of the ribs. Aperture orthocline, simple, nearly circular; peristome not continuous, scarcely indented by the preceding whorl.

Dimensions: the holotype's size is 1.70 mm in diameter and 0.74 mm in height.

Habitat: Bathyal species dredged at 1455 m depth.

Distribution: Only known from type locality.

Etymology: The specific name is after Valentina Calzadilla Nápoles great-grandaughter of the first author.

Remarks: *A. valentinae* n. sp. is characterised by lacking any apical and basal keels, by its radial axial ribs with regular distances between them and fundamentally by having all the surface of the interspaces of the axial ribs in the teleoconch covered by microgranules and fine spiral cordlets.

A. sinuosus (Sykes, 1925) is the species with most resemblance, but differentiated from this by having straight instead of sinuous axial ribs.

A. diegoalejandroi n. sp. is differentiated by the different ornamentation of the teleoconch, with more prominent, slightly undulous axial ribs, a different microsculpture of the protoconch and having the aperture a little curved where touching the previous whorl.

See differences with *Adeuomphalus misaeli* n. sp. in the remarks on this species (see below).

It can be differentiated from most known species (*A. densicostatus, A. ammoniformis, A. trochanter, A. elegans* and *A. guillei*) because all these have adapical or basal keels.

Adeuomphalus misaeli n. sp.
Fig. 3A-F

Type material: Holotype (Figs 3A-B) in ANC (ANC.06.3.164).

Material examined: Only the holotype.

Type locality: North of Cuba, SL42-750, 23.0984 N, 82.9843, 1455 m.

Description: Shell minute (<1.5 mm), semitransparent, thin, fragile, formed by 1 ½ whorls. Protoconch with 3/4 whorls, about 0.6 mm, having its surface covered with an irregular net-like sculpture. Protoconch/teleoconch without any kind of separation. Teleoconch of about 1.6 whorls, ornamented with 39-40 flexuous axial ribs (8-9 in first half whorl and about 32 in the last whorl); there are no apical nor basal spiral keels; surface covered with a very fine sculpture with irregular microperforations and granules. Axial ribs thin, but strong, higher near sutures than in the periphery and very irregularly distributed in the last half whorl; first 8-9 ribs nearly straight while later

ones strongly curved backward near sutures; last 20 ribs faint towards periphery. Aperture orthocline; peristome complete, not modified by the previous whorl, of roughly circular cross-section, 0.36 mm in width, 0.44 mm in height.

Dimensions: Holotype size 1.12 mm in diameter and 0.56 mm in height.

Habitat: Bathyal species dredged at 1455 m deep.

Distribution: Only known from the type locality.

Etymology: The species is named is after Dr. Misael Díaz Asencio, Centro de Estudios Ambientales de Cienfuegos (CEAC), who collected the sample.

Remarks: *Adeuomphalus misaeli* n. sp. is characterised by the lack of apical and basal keels; by the number, the irregular size and flexuous variable shape of the axial ribs between them; fundamentally, by having all the surface of the teleoconch covered with microperforations in a rough, irregular sculpture.

A. densicostatus, A. ammoniformis, A. trochanter, A. elegans and *A. guillei* all differ because they have basal and apical keels.

A. sinuosus (Sykes, 1925) is different in having the surface of the teleoconch covered with fine, irregularly shaped granules.

A. diegoalejandroi n. sp. is different in its ornamentation of the teleoconch with prominent, regular and uniform distribution of the axial ribs, which are a little undulant. Also by the spiral cordlets between the axial ribs and by its larger aperture.

A. valentinae n. sp. is different in having more regular axial ribs and by the different ornamentation of the surface of the teleoconch.

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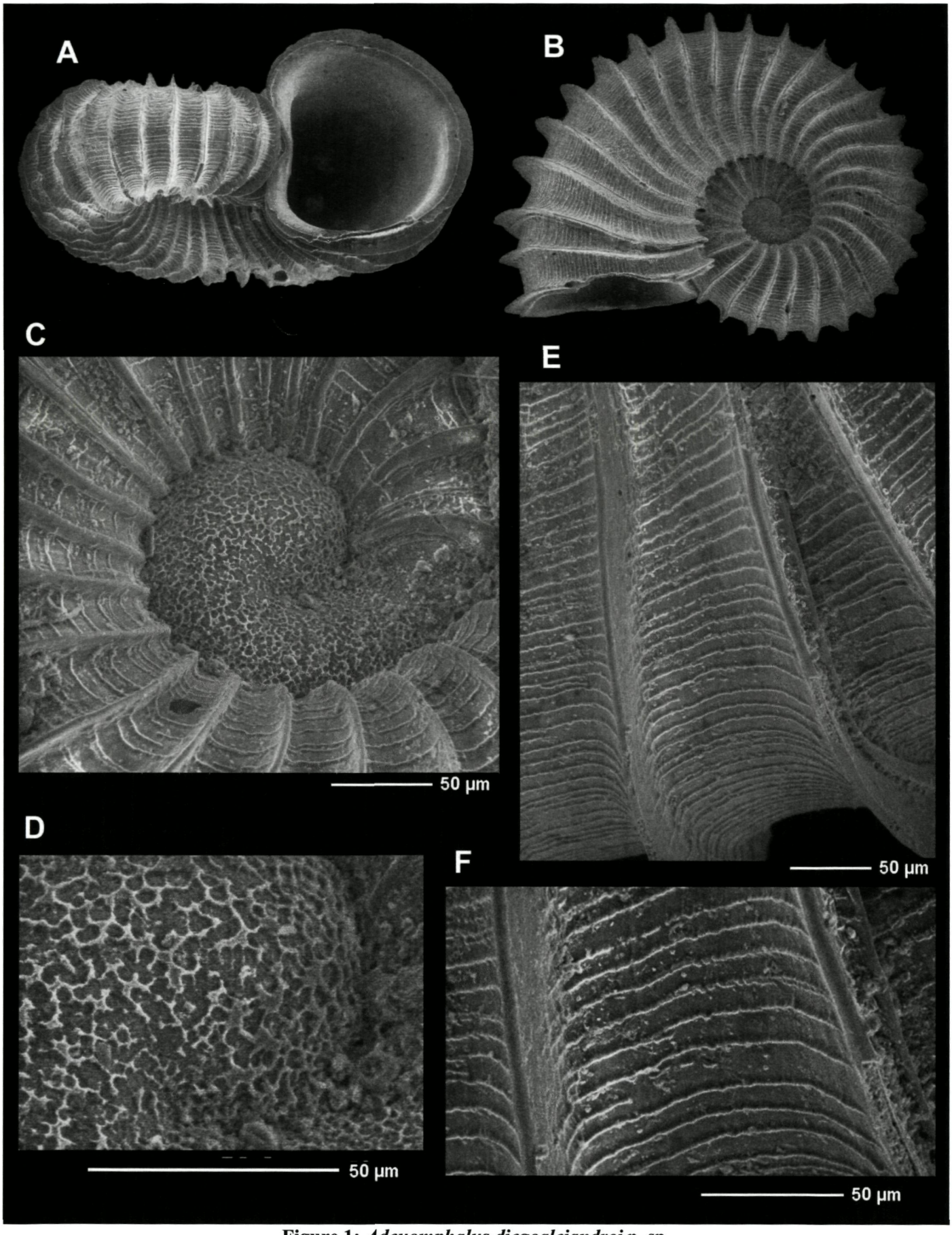

Figure 1: ***Adeuomphalus diegoalejandroi*** n. sp.
A-B: holotype, 1.2 mm in diameter, N of Cuba, SL42, 1455 m (CIM-UH).
C-D: protoconch and microsculpture of the protoconch.
E-F: microsculpture of the teleoconch and detail.

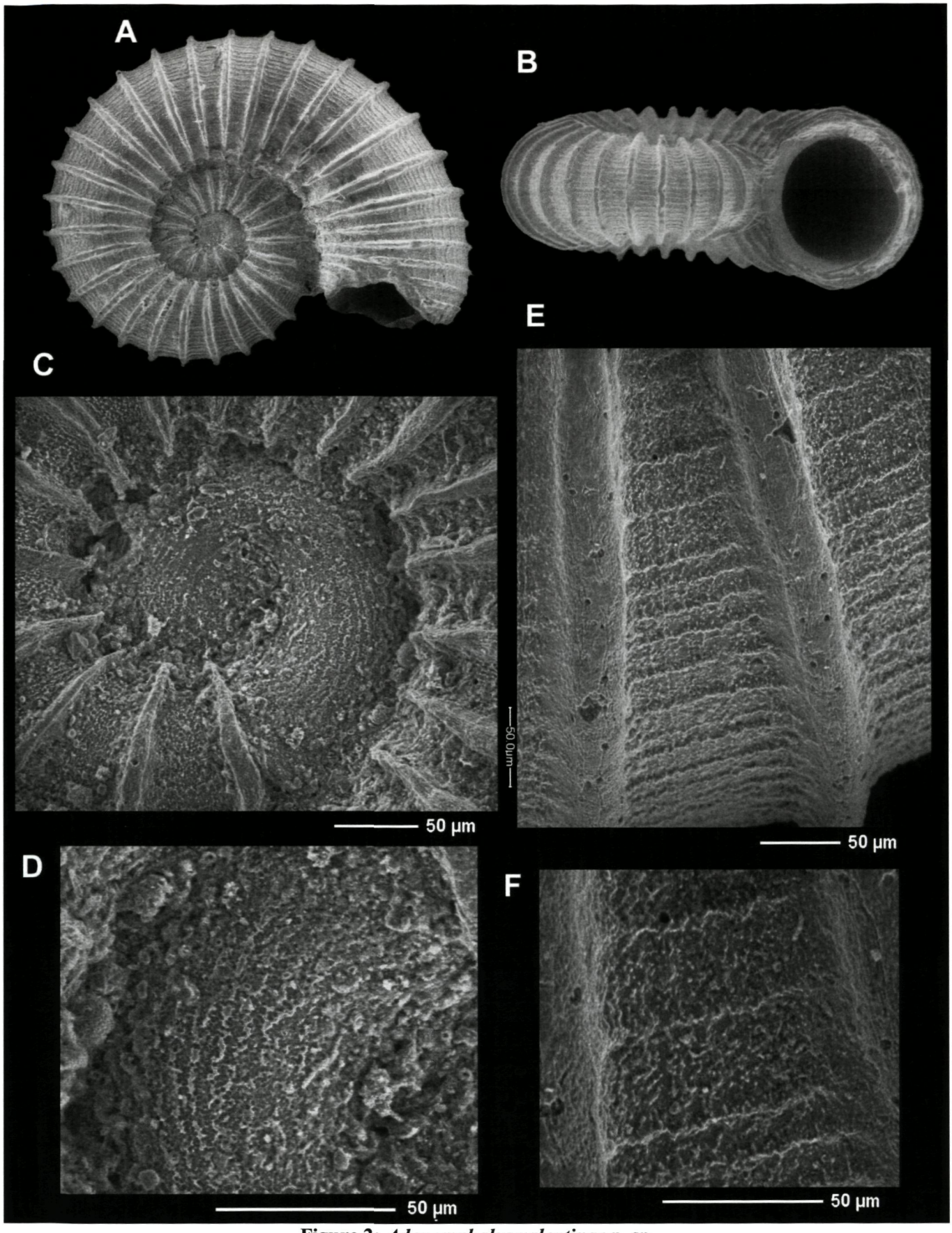

Figure 2: ***Adeuomphalus valentinae*** n. sp.
A-B: holotype, 1.7 mm, N of Cuba, SL42, 1455 m (CIM-UH).
C-D: protoconch and microsculpture of the protoconch.
E-F: microsculpture of the teleoconch and detail.

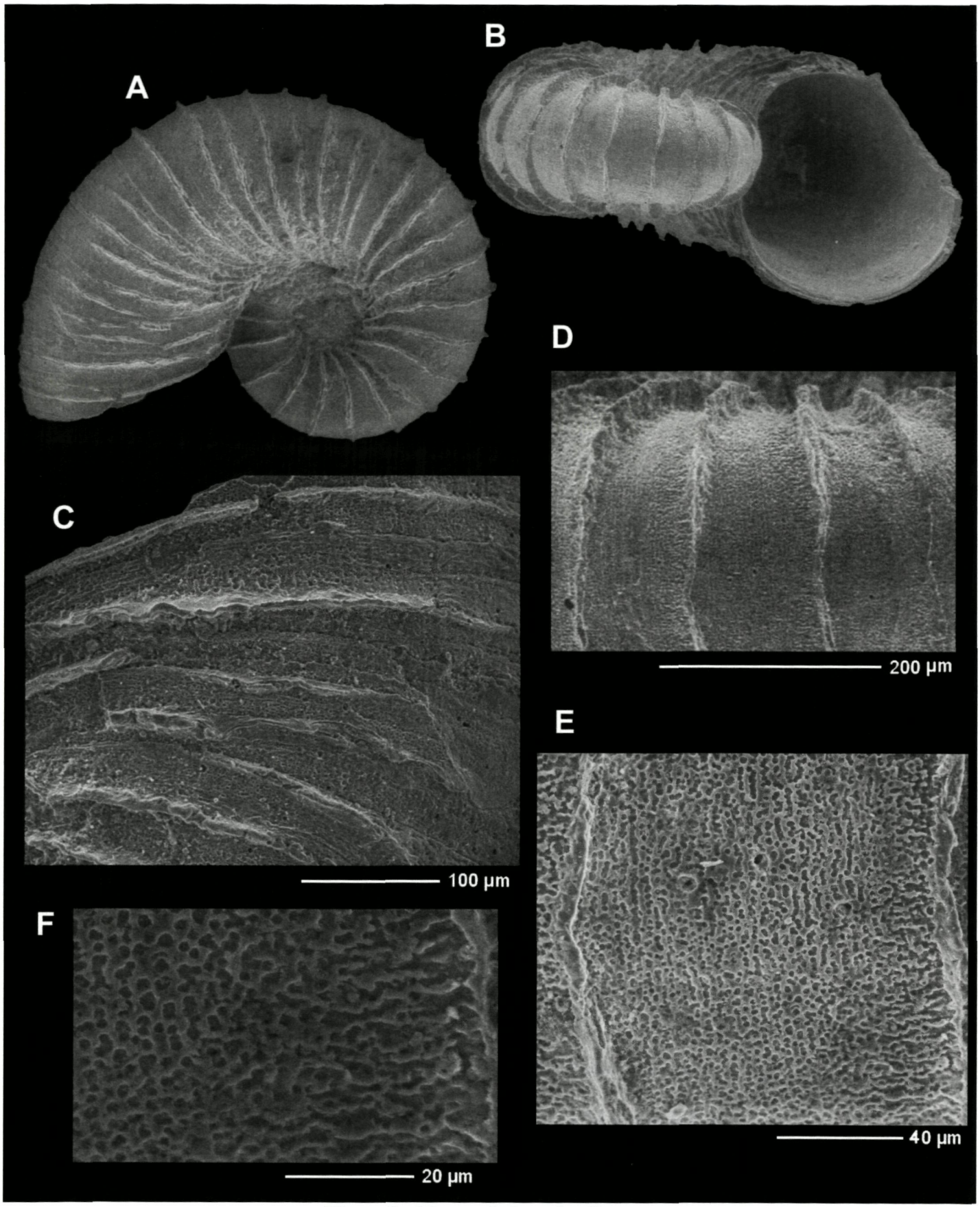

Figure 3: ***Adeuomphalus misaeli*** n. sp.
A-B: holotype, 1.12 mm, N of Cuba, SL42, 1455 m (CIM-UH).
C-D: sculpture of the teleoconch.
E-F: microsculpture of the teleoconch and detail.