

Deep-water Drilliinae, Cochlespirinae and Oenopotinae (Mollusca: Gastropoda: Turridae) from the Campos Basin, southeast Brazil

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SUMMARY: Samples of a soft-bottom community from the continental slope of Campos Basin, off southeast Brazil, were obtained between 2001 and 2003 by the Research Vessel "Astro-Garoupa" with a 0.25 m² box corer or by dredging with a Charcot dredge. A total of 177 samples were taken at depths ranging from 700 to 1950 m. Mollusks were present at all of the stations and among Gastropoda the Turridae showed the highest diversity. Within the family Cochlespirinae we found: *Leucosyrinx tenoceras* (Dall, 1889), *L. verrillii* (Dall, 1881), expanding the known distribution of the latter species farther south, and *L.? subgrundifera* (Dall, 1888), which is the first record of this species for the South Atlantic and the shallowest depth at which it has ever been found. Within the family Drilliinae we found *Splendrillia centimata* (Dall, 1889), also the first record of this species for the South Atlantic and its shallowest depth. Within the subfamily Oenopotinae we describe here three new species in the genus *Oenopota* Mörch, 1852: *O. seraphina* n. sp., *O. diabula* n. sp. and *O. carioca* n. sp.

Keywords: deep-water, Turridae, *Leucosyrinx*, *Splendrillia*, *Oenopota*, Southwestern Atlantic, Brazil.

RESUMEN: DRILLIINAE, COCHLESPIRINAE Y OENOPOTINAE (MOLLUSCA: GASTROPODA: TURRIDAE) DE AGUAS PROFUNDAS DE LA CUENCA DE CAMPOS, SUDESTE DEL BRASIL. – Se estudiaron muestras de sustratos sedimentarios procedentes de 117 estaciones del talud continental de la Cuenca de Campos (sudeste de Brasil), obtenidas entre 2001 y 2003 por el Buque de Investigación Astro-Garoupa, con un "box-corer" de 0.25 m² o con draga de Charcot a profundidades comprendidas entre 700 y 1950 m. Los moluscos estuvieron presentes en todas las estaciones y, entre los gasterópodos, la familia Turridae presentó la máxima diversidad. Se encontraron tres especies pertenecientes a la subfamilia Cochlespirinae: *Leucosyrinx tenoceras* (Dall, 1889), *L. verrillii* (Dall, 1881), extendiendo su rango de distribución conocido hacia el sur, y *L.? subgrundifera* (Dall, 1888), que se cita por primera vez en el Atlántico sur y en el rango batimétrico menos profundo conocido hasta la fecha. Otra de las especies encontradas pertenece a la subfamilia Drilliinae: *Splendrillia centimata* (Dall, 1889), que se cita, asimismo, por primera vez en el Atlántico sur y en el rango batimétrico más superficial conocido. Dentro de la subfamilia Oenopotinae, describimos tres nuevas especies del género *Oenopota* Mörch, 1852: *O. seraphina* n. sp., *O. diabula* n. sp. y *O. carioca* n. sp.

Palabras clave: batial, Turridae, *Leucosyrinx*, *Splendrillia*, *Oenopota*, Atlántico suroeste, Brasil.

INTRODUCTION

Turridae Swainson, 1840 is one of the most significant families of marine gastropods in number of species, with over 670 genera (Bouchet, 1990). According to the traditional classification of gastropods, Turridae constitutes the superfamily Conoidea Rafinesque, 1815, together with the families Conidae and Terebridae. Traditionally, Turridae is seen as one of

the most taxonomically disconcerting families, and most of the proposed classifications for it are based entirely on characters of the shell and radula (Powell, 1966; Bouchet and Warén, 1980). More recently, Taylor *et al.* (1993) suggested a new classification for the Conoidea, with a substantial rearrangement of the taxa, based on characters of the shell, operculum and foregut anatomy. Thus, these authors transferred most of the turrid genera to the family Conidae, restricting

TABLE 1. – Geographical data for stations sampled with a box-corer. N° specimens refers to those belonging to the studied subfamilies.

Station	Coordinates	Depth	Date	No. specimens
OP I # 44	22°10'43"S, 39°54'46"W	750 m	10/12/2002	842
OP I # 45	22°10'54"S, 39°52'19"W	1050 m	10/12/2002	30
OP I # 49	22°04'34"S, 39°54'05"W	750 m	24/11/2002	63
OP I # 50	22°04'33"S, 39°52'04"W	1050 m	24/11/2002	1
OP I # 54	21°57'17"S, 39°56'01"W	750 m	12/12/2002	21
OP I # 59	21°52'59"S, 39°55'30"W	750 m	12/12/2002	311
OP I # 60	21°52'50"S, 39°51'42"W	1050 m	12/12/2002	13
OP I # 61	21°52'51"S, 39°48'11"W	1350 m	12/12/2002	15
OP I # 64	22°36'03"S, 40°21'45"W	750 m	22/11/2002	12
OP I # 74	22°27'31"S, 40°09'23"W	750 m	21/11/2002	54
OP I # 75	22°31'28"S, 40°03'50"W	1050 m	19/11/2002	42
OP I # 80	22°24'31"S, 39°57'28"W	1050 m	20/11/2002	15
OP I # 84	22°26'27"S, 39°58'51"W	1050 m	20/11/2002	1
OP I # 85	22°29'33"S, 39°56'17"W	1350 m	19/11/2002	6
OP II # 44	22°10'43"S, 39°54'45"W	750 m	01/07/2003	32
OP II # 45	22°10'53"S, 39°52'18"W	1039 m	01/07/2003	106
OP II # 49	22°04'32"S, 39°54'11"W	722 m	30/06/2003	25
OP II # 54	21°57'11"S, 39°56'04"W	698 m	29/06/2003	40
OP II # 58	21°57'26"S, 39°40'34"W	1942 m	27/06/2003	2
OP II # 59	21°52'59"S, 39°55'32"W	751 m	29/06/2003	23
OP II # 60	21°52'49"S, 39°51'40"W	1055 m	28/06/2003	13
OP II # 61	21°52'51"S, 39°48'12"W	1372 m	26/06/2003	5
OP II # 63	21°52'43"S, 39°40'41"W	1941 m	26/06/2003	1
OP II # 69	22°31'11"S, 40°15'12"W	743 m	18/06/2003	7
OP II # 74	22°27'31"S, 40°09'23"W	749 m	18/06/2003	88
OP II # 75	22°31'28"S, 40°03'49"W	1043 m	18/06/2003	29
OP II # 79	22°20'22"S, 40°01'24"W	755 m	21/06/2003	8
OP II # 80	22°24'30"S, 39°57'28"W	1044 m	20/06/2003	22
OP II # 81	22°26'28"S, 39°54'08"W	1345 m	21/06/2003	1
OP II # 84	22°26'28"S, 39°58'53"W	1046 m	20/06/2003	25
OP II # 85	22°30'21"S, 39°56'53"W	1353 m	21/06/2003	1
OP II # 86	22°31'37"S, 39°55'14"W	1630 m	16/06/2003	2
B # 32M	22°38'01"S, 40°17'26"W	900 m	18/05/2002	5

TABLE 2. – Geographical data for stations sampled with a Charcot dredge. N° specimens refers to those belonging to the studied subfamilies.

Sample	Coordinates	depth	date	No. specimens
OP I # 1	22°45'S, 40°10'W - 22°42'S, 40°07'W	1322-1326 m	10/02/2003	3
OP I # 2	22°30'S, 40°00'W - 22°28'S, 39°58'W	1122-1147 m	08/02/2003	31 (1 live)
OP I # 3	22°35'S, 39°58'W - 22°32'S, 39°56'W	1620-1623 m	11/02/2003	5
OP I # 4	22°24'S, 39°55'W - 22°21'S, 39°53'W	1128-1135 m	07/02/2003	2
OP I # 5	22°27'S, 39°54'W - 22°24'S, 39°52'W	1320-1299 m	08/02/2003	2
OP I # 7	22°45'S, 40°19'W - 22°44'S, 40°16'W	1118-1130 m	09/02/2003	10
OP I # 8	22°48'S, 40°15'W - 22°47'S, 40°13'W	1324-1321 m	11/02/2003	5 (1 live)
OP I # 9	22°41'S, 40°02'W - 22°39'S, 40°01'W	1609-1621 m	10/02/2003	7
OP I # 10	22°11'S, 39°51'W - 22°08'S, 39°51'W	1144-1127 m	12/02/2003	8
OP I # 11	22°11'S, 39°49'W - 22°09'S, 39°48'W	1334-1327 m	13/02/2003	5 (1 live)
OP I # 12	22°11'S, 39°47'W - 22°08'S, 39°46'W	1632-1620 m	12/02/2003	4
OP I # 13	21°53'S, 39°51'W - 21°50'S, 39°52'W	1120-1060 m	14/02/2003	38
OP I # 14	21°50'S, 39°49'W - 21°47'S, 39°50'W	1358-1498 m	14/02/2003	7
OP I # 15	21°48'S, 39°48'W - 21°45'S, 39°48'W	1620-1598 m	13/02/2003	5
OP I # 16	22°15'S, 39°53'W - 22°12'S, 39°52'W	1071-1250 m	13/02/2003	26 (1 live)
OP I # 18	22°16'S, 39°47'W - 22°13'S, 39°47'W	1628-1622 m	12/02/2003	19 (1 live)
OP II # 1	22°41'S, 40°07'W - 22°44'S, 40°10'W	1318-1305 m	27/08/2003	1
OP II # 2	22°30'S, 40°00'W - 22°28'S, 39°58'W	1107-1141 m	27/08/2003	4 (1 live)
OP II # 3	22°32'S, 39°56'W - 22°35'S, 39°57'W	1605-1605 m	27/08/2003	4 (1 live)
OP II # 5	22°27'S, 39°54'W - 22°24'S, 39°52'W	1325-1290 m	25/08/2003	7
OP II # 7	22°46'S, 40°20'W - 22°44'S, 40°17'W	1107-1114 m	28/08/2003	2
OP II # 8	22°49'S, 40°16'W - 22°47'S, 40°13'W	1305-1303 m	28/08/2003	5
OP II # 10	22°11'S, 39°51'W - 22°08'S, 39°51'W	1157-1128 m	22/08/2003	13
OP II # 11	22°11'S, 39°49'W - 22°08'S, 39°48'W	1332-1325 m	22/08/2003	8 (3 live)
OP II # 12	22°12'S, 39°47'W - 22°08'S, 39°46'W	1532-1640 m	24/08/2003	6 (1 live)
OP II # 13-1	21°53'S, 39°51'W - 21°47'S, 39°52'W	1064-1114 m	20/08/2003	23 (5 live)
OP II # 13-2	21°53'S, 39°51'W - 21°49'S, 39°52'W	1077-1082 m	20/08/2003	31 (5 live)
OP II # 14	21°50'S, 39°48'W - 21°47'S, 39°50'W	1360-1346 m	21/08/2003	4
OP II # 15	21°50'S, 39°47'W - 21°46'S, 39°48'W	1664-1577 m	21/08/2003	1
OP II # 16	22°16'S, 39°53'W - 22°13'S, 39°52'W	1059-1110 m	22/08/2003	107 (16 live)
OP II # 17-1	22°15'S, 39°51'W - 22°12'S, 39°49'W	1332-1300 m	23/08/2003	3
OP II # 17-2	22°16'S, 39°51'W - 22°12'S, 39°49'W	1332-1264 m	24/08/2003	2
OP II # 18	22°15'S, 39°47'W - 22°12'S, 39°47'W	1620-1618 m	23/08/2003	4 (1 live)

Turridae to only a few of them. This taxonomic suggestion was followed by Bouchet and Rocroi (2005); however, Rosenberg (1998) noted several misinterpretations in that analysis and recommended that the more traditional classification should not be abandoned just yet. Recently, Puillandre *et al.* (2008) provided a molecular phylogeny of the “turrids”. However, we prefer to follow Rosenberg and the “traditional” taxonomic arrangement of Turridae until a more definitive taxonomic framework is established. Tucker (2004) organized a list of turrids of the world, but did not discuss generic or specific allocations.

The family Turridae was first divided into three subfamilies (Turritinae, Clavatulinae and Defranciinae) by H. and A. Adams (1858). Since then this subdivision has been revised and discussed repeatedly, and many other subfamilies have been proposed. Rosenberg (2005) mentioned 12 subfamilies within Turridae, Powell (1966) recognized only 9, and Bouchet and Warén (1980) disregarded this separation altogether. Although the classification of the Turridae at the subfamily level is still very much debated and some of the taxa may be artificial, we agree with Kilburn (1983) that “in a family as large and complex as Turridae, virtually any practical subdivision is better than none”.

There are few records of the deep-water species from the Brazilian coast, and only after the second half of the twentieth century have they begun to increase slowly: e.g. Leal and Bouchet (1989, 1991), Leal and Rios (1990), and Leal and Simone (1998, 2000). Other reports have appeared, such as Absalão *et al.* (2001, 2005), Absalão and Pimenta (2003), Absalão and Santos (2004), Zelaya *et al.* (2006), Simone (1999, 2002, 2003), Simone and Birman (2006), Simone and Cunha (2006), Barros *et al.* (2007), Lima and Barros (2007), and Lima *et al.* (2007). However, only Absalão *et al.* (2005) dealt with Turridae.

The goal of the present study was to revise the Brazilian deep-water Drilliinae, Cochlespirinae and Oenopotinae from the Campos Basin in the state of Rio de Janeiro, the main oil production region in Brazil. The study is part of a large project on Brazilian deep-water mollusks.

MATERIALS AND METHODS

The mollusks were taken from the southern coast of Brazil (700-1950 m depth). The sampling stations were in the Bacia de Campos (Campos Basin) and were visited as part of the program “Environmental Characterization of Campos Basin, RJ, Brazil”. Samples were obtained by the Research Vessel “Astro-Garoupa” belonging to Petrobras S.A. (a public Brazilian oil company) with a 0.25 m² box core or by dredging with a Charcot dredge. A total of 117 samples were taken in this region. Each sample was washed in running seawater through a mesh of 300 µm, and the residue placed in 70% ethanol. In the laboratory, this residue was sorted under magnification and the Turridae picked out. The

analysis was based only on shell characters, since most of the material obtained consisted of empty shells. Types were not examined when the original illustration (and/or description) was sufficient to identify the taxon. All material is deposited in the Molluscan Collection of the Departamento de Zoologia, Instituto de Biologia of the Universidade Federal do Rio de Janeiro (IBUFRJ). Of the species described as new, additional paratypes were sent to the following institutions: Museu de Zoologia da Universidade de São Paulo (MZSP) in São Paulo, Brazil; Museu Nacional (MNRJ) in Rio de Janeiro, Brazil; Muséum National d’Histoire Naturelle (MNHN) in Paris, France; and Museum of Comparative Zoology (MCZ) of the Harvard University, Massachusetts, United States.

Locations and data of the sampled stations are shown in Tables 1 and 2.

RESULTS

Family TURRIDAE Swainson, 1840

Subfamily OENOPOTINAE

Genus *Oenopota* Mörch, 1852

Type species: Fusus pleurotomarius Couthouy, 1838 by subsequent designation Dall, 1918.

Oenopota seraphina n. sp.

(Fig. 1A, B, C)

Type material: Holotype IBUFRJ 18299 OP II # 84 (22°26'28"S, 39°58'53"W), 1046 m (Fig. 1A, C), 4.60 mm. Paratypes MNRJ 13552 [5], 3.64 mm, 3.66 mm, 3.80 mm, 4.02 mm and 4.46 mm, Paratypes MZSP 90704 [5], 3.72 mm, 3.98 mm, 4.16 mm, 4.18 mm and 4.72 mm, Paratypes MNHN [5], 3.86 mm, 3.96 mm, 4.12 mm, 4.16 mm and 5.36 mm, Paratype MCZ 362494 [2], 3.96 mm (Fig. 1B) and 4.42 mm, all from OP I # 44 (22°10'43"S, 39°54'46"W), 750 m. Paratypes MNRJ 13553 [4], 3.62 mm, 3.64 mm, 3.84 mm and 4.34 mm, Paratypes MZUSP 90705 [4], 3.18 mm, 3.84 mm, 4.12 mm and 4.32 mm, Paratypes MCZ 362495 [4], 4.06 mm, 4.12 mm, 4.60 mm and 5.34 mm, all from OP I # 59 (21°52'59"S, 39°55'30"W), 750 m.

Type locality: 22°26'28"S, 39°58'53"W, Campos Basin, southeast Brazil, southwestern Atlantic, 1046 m.

Material examined: Type material and 17213 [756] OP I # 44; 18286 [8] OP I # 45; 15033 [48] OP I # 49; 14965 [21] OP I # 54; 17047 [286] OP I # 59; 18287 [1] OP I # 60; 18288 [3] OP I # 61; 16090 [11] OP I # 64; 15351 [35] OP I # 74; 18289 [13] OP I # 75; 18290 [12] OP I # 80; 18291 [1] OP I # 84; 18292 [1] OP I # 85; 18388 [179] OP II # 44; 16962 [89] OP II # 45; 18389 [46] OP II # 49; 15569 [35] OP II # 54; 18390 [248] OP II # 59; 18293 [5] OP II # 60; 15541 [3] OP II # 69; 17273 [68] OP II # 74; 18294 [10] OP II # 75; 16806 [8] OP II # 79; 18295 [19] OP II # 80; 18296 [7] OP II # 84; 18297 [1] OP II # 85; 18298 [5] B # 32M.

Description: Shell short, plump, white, with up to 5.3 mm (3 whorls) (Fig. 1A, B). Protoconch with about 1 1/2 whorls, white, smooth, dome-shaped, with faint axial riblets on the last 1/2 whorl (Fig. 1C). Teleoconch whorls with a concave region below the suture, forming an acute shoulder. Axial sculpture consists of about 16 orthocline ribs, forming small blunt nodules where they cross the shoulder and the area immediately below

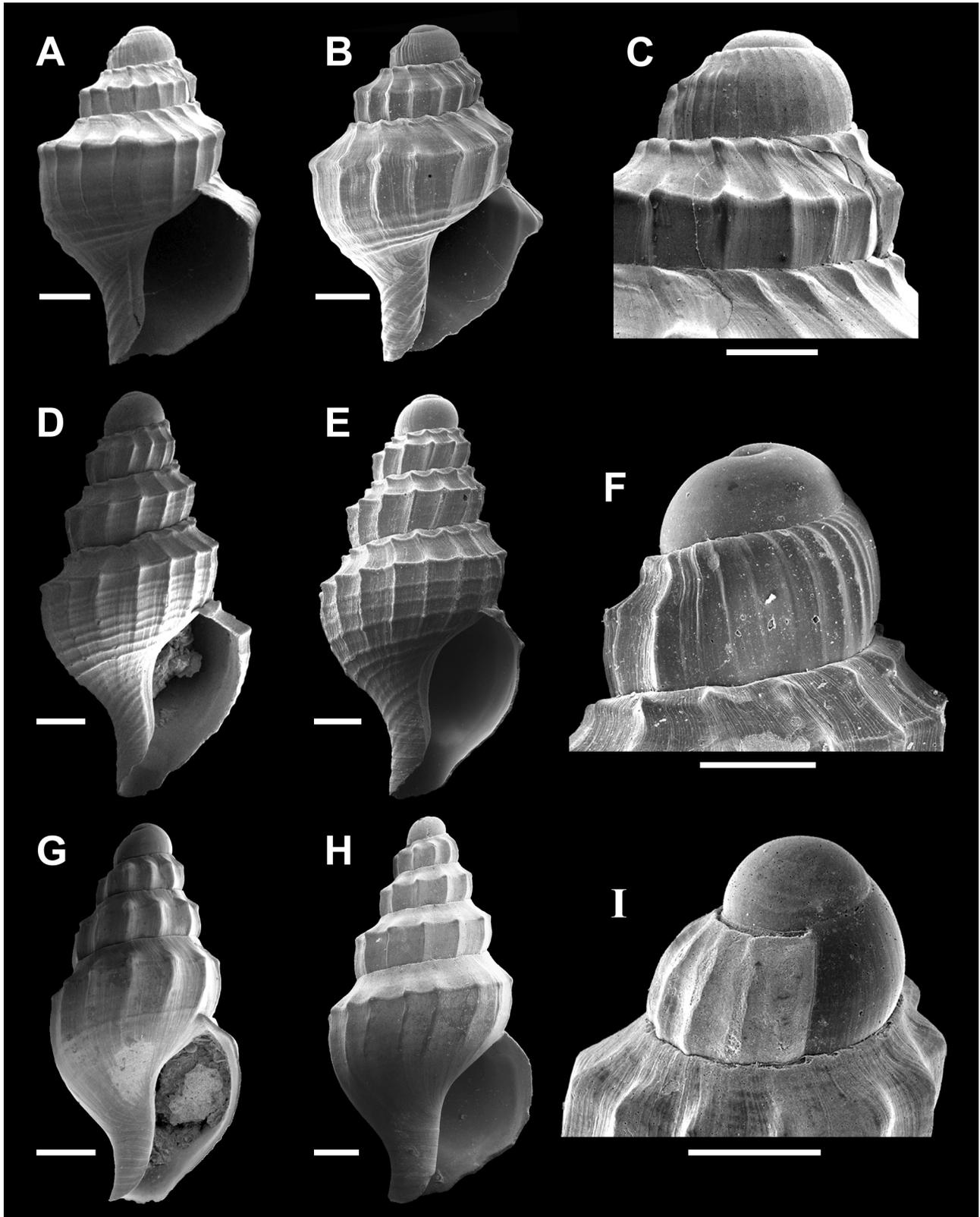


FIG. 1. – A, B, C, *Oenopota seraphina* n. sp.: A, C, holotype, IBUFRJ 18299, 4.6 mm; A, whole shell; C, protoconch; B, paratype, MCZ 362494, 3.96 mm, whole shell. D, E, F, *O. diabula* n. sp.: D, holotype, IBUFRJ 18300, 5.4 mm, whole shell; E, paratype, MCZ 362496, 5.54 mm, whole shell; F, paratype, IBUFRJ 18301, protoconch. G, H, I, *O. carioca* n. sp.: G, holotype, IBUFRJ 18303, 4.3 mm, whole shell; H, paratype, MNRJ 13556, 5 mm, whole shell; I, paratype, IBUFRJ 18304, protoconch. Scale bars: A, B, D, E, G and H, 600 μ m; C, F and I, 400 μ m.

the suture, and extend over the base, vanishing towards the inner lip. Suture moderately shallow. Base short, convex, inflecting to form a fasciolar region, sculptured with about 4 spiral cords. Fasciolar region with 6 oblique cords. No labial sinus. Inner lip reflected over parietal wall. Outer lip thin. Siphonal canal broad and short. Aperture ovoid-elliptical.

Etymology: *seraphina* refers to a kind of angel.

Geographic distribution: Only known from Campos Basin, off Rio de Janeiro, 698-1353 m.

Discussion: Bouchet and Warén (1980) considered *Oenopota* in a broad sense, including as synonyms 11 other generic names, admitting a wide range of variation both in the protoconch and in teleoconch sculpture and shape. Although Lundberg *et al.* (1996) provided cladistic results that indicate that *Oenopota* is a paraphyletic group, we will adopt the *Oenopota* concept of Bouchet and Warén (1980) until anatomical and/or molecular data become available.

There are five species of *Oenopota* assigned to the southwestern Atlantic region (Rosenberg, 2005; Forcelli, 2000): *O. magellanica* (Martens, 1881), *O. profunda* (Castellanos and Landoni, 1993), *O. anomalapex* (Powell, 1951), *O. lateplicata* (Strebel, 1905) and *O. cunninghami* (E.A. Smith, 1881).

Oenopota magellanica occurs in the south of Brazil at 32°S and geographically it is the closest species to *Oenopota seraphina* n. sp., but it is very distinct from it. *Oenopota seraphina* n. sp. can be differed by its plump and shouldered profile, wide aperture, short anterior canal and spiral ornamentation restricted to the base. *Oenopota profunda* has a type locality at 60°S and 600 m depth, *O. seraphina* n. sp. is quite different in its form and stronger axial ribs, spiral ornamentation restricted to the base, larger body whorl and strongly shouldered whorls. *Oenopota anomalapex*, another species from southern Argentinean Patagonia, can be distinguished from *O. seraphina* n. sp. because the latter species has a nodulose subsutural cord, an angled shoulder and an inner lip reflected over the parietal wall. Finally, *Oenopota lateplicata*, a littoral species, has no trace of a sub-sutural cord, and the axial ribs are devoid of nodules at the whorl shoulder; both the shell and aperture are more slender, and there is a conspicuous anal sinus. *Oenopota cunninghami* is somewhat similar to *O. seraphina* n. sp. in the plump and shouldered profile and short anterior canal, but it has much more numerous spiral threads covering the entire whorl, a narrower aperture, the axial ribs are more sinuous and it is found in shallow water (110 – 165 m).

This species resembles *Oenopota graphica* (Locard, 1897) from Morocco and Spain, illustrated by Bouchet and Warén (1980, Figs. 152, 153), in the plump and shouldered profile, but *O. seraphina* n. sp. has the spiral ornamentation restricted to the base and a longer siphonal canal and protoconch with fine spiral

threads according to the photograph of Bouchet and Warén 1980, p. 104, Fig. 269. *Oenopota seraphina* n. sp. also shows a superficial similarity to *Benthomangelia decapitata* Bouchet and Warén (1980, p. 47, Figs. 107-108). However, *O. seraphina* n. sp. has more numerous axial ribs, spiral ornamentation restricted to the base and a very different protoconch.

***Oenopota diabula* n. sp.**
(Fig. 1D, E, F)

Type material: Holotype IBUFRJ 18300 OP I # 44 (22°10'43"S, 39°54'46"W), 750 m, 5.40 mm (Fig. 1D). Paratype IBUFRJ 18301 [1] OP II # 45 (22°10'53"S, 39°52'18"W), 1039 m, 3.54 mm (Fig. 1F). Paratype MCZ 362496 [3] OP II # 59, 4.70 mm, 4.88 mm and 5.54 mm (Fig. 1E), Paratype MNRJ 13554 [1], 4.08 mm, OP II # 75. Paratype MNRJ 13555 [2], 3.58 mm and 7.20 mm, Paratype MZSP 90707 [2], 3.24 mm and 5.52 mm, Paratype MNHN [2], 3.90 mm and 5.18 mm, all from OP II # 84. Paratype MZSP 90706 [1], 4.90 mm, Paratype MNHN [1], 4.46 mm, all from OP I # 75.

Type locality: 22°10'43"S, 39°54'46"W, Campos Basin, southeast Brazil, southwestern Atlantic, 750 m.

Material examined: Type material and 17203 [12] OP I # 44; 18272 [20] OP I # 45; 15035 [1] OP I # 49; 18273 [1] OP I # 50; 17048 [19] OP I # 59; 18274 [12] OP I # 60; 18275 [12] OP I # 61; 15353 [2] OP I # 74; 18276 [25] OP I # 75; 18277 [3] OP I # 80; 18278 [5] OP I # 85; 18386 [6] OP II # 44; 16961 [11] OP II # 45; 18387 [5] OP II # 59; 18279 [7] OP II # 60; 18280 [5] OP II # 61; 18281 [17] OP II # 75; 18282 [3] OP II # 80; 18283 [1] OP II # 81; 18284 [11] OP II # 84; 18285 [2] OP II # 86.

Description: Shell short, white, with up to 7.2 mm (3 1/2 whorls) (Fig. 1D, E). Protoconch with one whorl, white, smooth, dome-shaped, with faint axial riblets on the last ¼ whorl (Fig. 1F). Teleoconch whorls with a slightly concave region between the suture and the shoulder. Spirally sculptured by a prominent thin cord on the shoulder, a weaker subsutural cord, and several thin threads on the lower portion of the whorls. From the whorl shoulder to the fasciolar region, the body whorl is sculptured with about 16-20 spiral threads. Axial sculpture consists of about 16 thin orthocline ribs forming small pointed sharp nodules where they cross the shoulder spiral cord and the subsutural one, and extend over the base, vanishing towards the inner lip. Suture moderately deep. Base short, convex, inflecting to form the fasciolar region. No labial sinus. Inner lip thin, reflected over the parietal wall. Outer lip thin. Siphonal canal broad and moderately short. Aperture elliptical.

Etymology: *diabula* refers to the feminine of "diabo" which is a spiritual entity from the Afro-Brazilian culture.

Geographical distribution: Only known from Campos Basin, off Rio de Janeiro, 750-1630 m.

Discussion: *Oenopota diabula* n. sp. can be distinguished from *O. profunda*, *O. anomalapex*, *O. lateplicata* and *O. magellanica* by its nodulose subsutural

spiral cord and the presence of nodules on the whorl shoulder, both of which are lacking in the previously known species; and the weaker spiral ornamentation. It can also be distinguished from *O. cunninghami* by the nodulose subsutural spiral cord, longer siphonal canal and narrower aperture. *Oenopota diabula* n. sp. has a narrower shell than *O. seraphina* n. sp., spiral threads on the anterior part of the whorls, and a narrower reflected inner lip. *Oenopota diabula* n. sp. resembles *Oenopota graphica* (Locard, 1897) from Morocco and Spain, illustrated by Bouchet and Warén (1980, Figs. 152, 153), but it has a much longer siphonal canal and more numerous and weaker spiral threads. It is also similar to *Oenopota rugulata* (Troschel, 1866), from the Bering Sea and Norway, illustrated in Dall (1919, p. 50, pl. 13, Fig. 6), in the shouldered profile and longer siphonal canal, but it can be distinguished by its narrower reflected inner lip, the presence of a nodulose sub-sutural spiral cord, and the absence of any other spiral ornamentation above the whorl shoulder.

Oenopota diabula n. sp. is superficially similar to *Benthomangelia decapitata* (Bouchet and Warén 1980, p. 47, Figs. 107-108), but it can be distinguished by its nodulose subsutural cord, absence of spiral threads above the shoulder, fewer spiral threads below the shoulder, slightly softer axial ribs and a very different protoconch.

***Oenopota carioca* n. sp.**
(Fig. 1G, H, I)

Type material: Holotype IBUFRJ 18303 OP I # 74 (22°27'31"S, 40°09'23"W), 750 m, 4.03 mm (Fig. 1G). Paratype MCZ 362497 [3], 3.42 mm, 3.6 mm and 3.96 mm, Paratype MZSP 90708 [3], 2.72 mm, 3.92 mm and 4.48 mm, Paratype MNHN [4], 2.36 mm, 3.60 mm, 4.02 mm and 4.76 mm, all from type locality. Paratype IBUFRJ 18304 [2], OP I # 59 (21°52'59"S, 39°55'30"W), 750 m, 2.2 mm (Fig. 1I) and 4.29 mm. Paratype MNRJ 13556 [2] OP I # 49, 2.56 mm and 5 mm (Fig. 1H).

Type locality: 22°27'31"S, 40°09'23"W, Campos Basin, southeast Brazil, southwestern Atlantic, 750 m.

Material examined: Type material and 17199 [62] OP I # 44; 18269 [2] OP I # 45; 15036 [12] OP I # 49; 17044 [14] OP I # 59; 16091 [1] OP I # 64; 15354 [13] OP I # 74; 18270 [3] OP I # 75; 18383 [25] OP II # 44; 18384 [25] OP II # 49; 15570 [5] OP II # 54; 18385 [14] OP II # 59; 15543 [4] OP II # 69; 17280 [19] OP II # 74; 18271 [2] OP II # 75.

Description: Shell short, slender, white, with up to 5 mm (4 1/2 whorls) (Fig. 1G, H). Protoconch with one whorl, white, smooth. Clear-cut proto-teleoconch boundary (Fig. 1I). Teleoconch whorls with a very slightly concave region between the suture and the shoulder. Shoulder marked by a very faint spiral thread and another faint suprasutural thread is visible on the third whorl. Axial sculpture consists of about 14 ribs (on the third whorl), forming small gentle nodules on the shoulder and fading away above it, never reaching the suture. Growth scars over entire shell. Suture moderately shallow. Base smooth, short, convex gently inflecting to form the short fasciolar region. No labial

sinus. Inner and outer lips thin. Siphonal canal broad, moderately short and slightly bent upward. Aperture elongated.

Etymology: *carioca* is the name for all those born in Rio de Janeiro.

Geographical distribution: Only known from Campos Basin, off Rio de Janeiro, 698-1050 m.

Discussion: *Oenopota carioca* n. sp. can be distinguished from *O. magellanica* by the presence of only two faint spiral threads, stronger shoulder and shorter siphonal canal. It can be differed from *O. profunda* by its narrower profile, stronger and fewer axial ribs, and the presence of only two faint spiral threads. *Oenopota carioca* n. sp. can be distinguished from *O. anomala-pex* by its narrower shell, its orthocone axial ribs, and the presence of only two faint spiral threads. *Oenopota carioca* n. sp. shares its shell profile with *O. lateplicata*, but can be distinguished from it by its larger protoconch, the slight nodules where axial ribs cross the shoulder, and the presence of only two faint spiral threads. *Oenopota cunninghami* has the same profile, but *O. carioca* n. sp. has only two faint spiral threads and a slightly inflected siphonal canal.

Oenopota carioca n. sp. can be distinguished from *O. seraphina* by its narrower profile, fewer axial ribs, and the presence of two faint spiral threads on the whorls and smooth base. *Oenopota carioca* n. sp. shares with *Oenopota diabula* n. sp. the same general shell shape, but whereas *Oenopota carioca* n. sp. has gentle axial ribs and a rounded shoulder, *Oenopota diabula* n. sp. has more acute axial ribs and small pointed sharp nodules on the shell shoulder. Also, *Oenopota carioca* n. sp. has only two faint spiral threads

Subfamily COCHLESPIRINAE
Genus *Leucosyrinx* Dall, 1889

Type-species: *Pleurotoma verrilli* Dall, 1881

***Leucosyrinx verrillii* (Dall, 1881)**
(Fig. 2A, B, C)

- Pleurotoma (Pleurotomella) verrillii* Dall, 1881: 57.
Pleurotoma (Pleurotomella?) sigsbeii Dall, 1881: 57; Abbott (1974: 263, Fig. 2899).
Pleurotoma (Leucosyrinx) verrillii: Dall (1889: 75, pl. X, Fig. 5); Dall (1890: 302).
Pleurotoma talismani Locard, 1897; Dautzenberg (1927: 28, pl. II, Fig. 1); Dautzenberg and Fischer (1906: 10).
Surcula gradata Thiele, 1925: 211 [177], pl. XXXV [XXXIII], Fig. 13-15.
Leucosyrinx janetae Bartsch, 1934: 11, pl. 3, Fig. 3, 11, 12; Powell (1966: pl. 2, Fig. 7)
Leucosyrinx sigsbeii error pro sigsbeii: Dall (1903: 96) Powell (1966: 30).
Leucosyrinx verrillii: Mendiskaya (1999: 175, Fig. 2); Thiele (1931: 358); Powell (1966: 30, pl. 2, Fig. 6); Abbott (1974: 263, Fig. 2898); Bouchet and Warén (1980: 23, Figs. 8, 68, 69, 197, 202); Rios (1975: 128, pl. 39, Fig. 565; 1985: 133, pl. 45, Fig. 601; 1994: 166, pl. 55, Fig. 754).

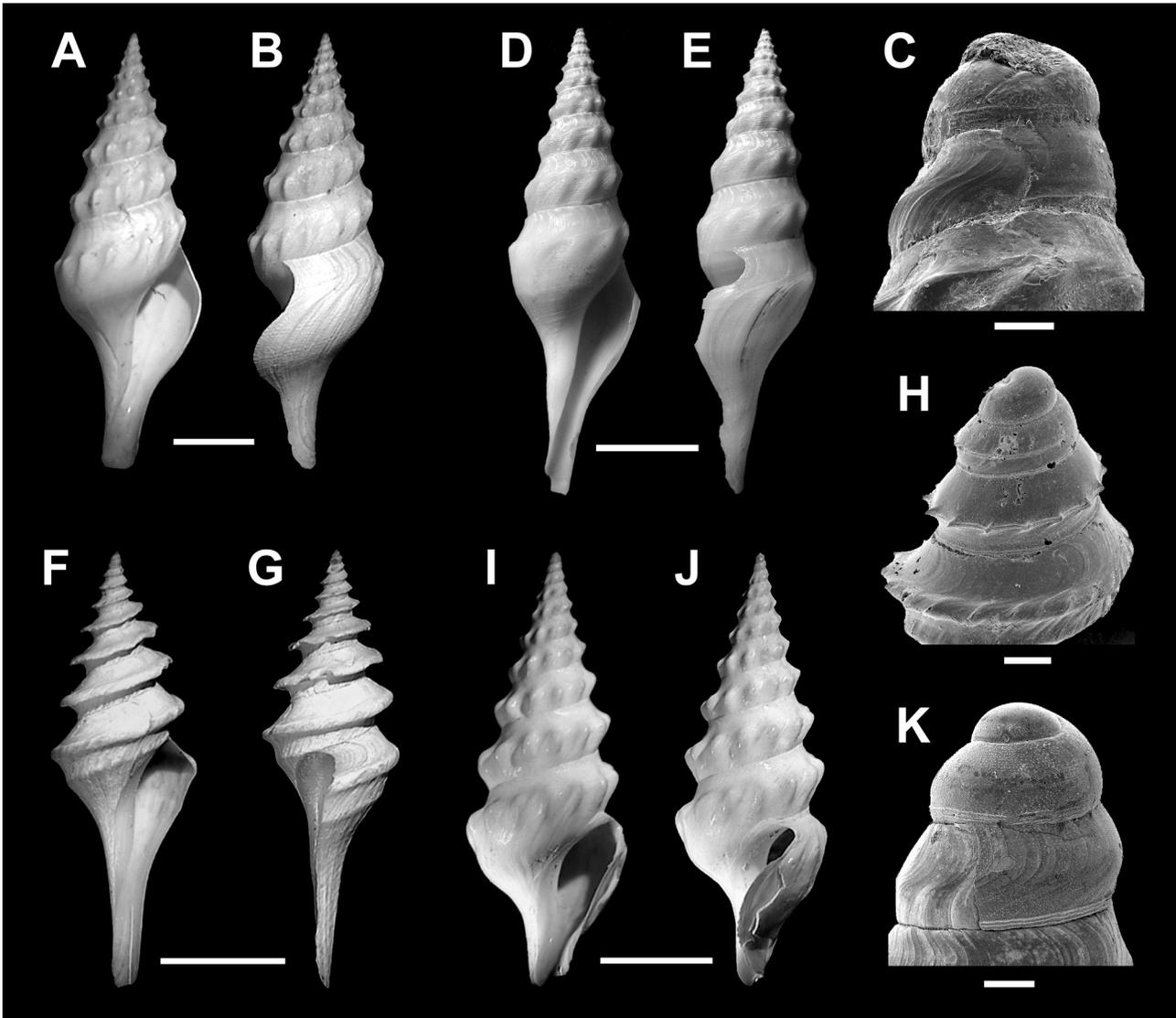


FIG. 2. – A, B, C, *Leucosyrinx verrillii* (Dall, 1881): A, B, IBUFRJ 16527, 30.16 mm, whole shell; C, IBUFRJ 16681, protoconch. D, E, *L. tenoceras* (Dall, 1889), IBUFRJ 16422, 52.01 mm, whole shell. F, G, H, *L. ? subgrundifera* (Dall, 1888): F, G, IBUFRJ 16705, 19.82 mm, whole shell; H, IBUFRJ 18267, protoconch. I, J, K, *Splendrillia centimata* (Dall, 1889): I, J, IBUFRJ 18263, 21.83 mm; K, IBUFRJ 18262, protoconch. Scale bars: A, B, F, G, I and J, 5 mm; D and E, 10 μ m; C, H and K, 200 μ m.

Type material: Holotype MCZ 007032, Blake sta 41 (23°N, 83°W), off Bahia Honda, Cuba, 1572 m. (not examined).

Material examined: 16401 [1] OP I # 1; 16420 [26] OP I # 2; 16435 [1] OP I # 2; 16398 [5] OP I # 3; 16444 [2] OP I # 4; 16412 [10] OP I # 7; 16452 [1] OP I # 9; 16425 [2] OP I # 10; 16443 [6] OP I # 10; 16515 [36] OP I # 13; 16465 [3] OP I # 14; 16468 [1] OP I # 15; 16510 [24] OP I # 16; 16442 [1] OP I # 18; 16669 [1] OP II # 1; 16578 [2] OP II # 2; 16524 [6] OP II # 5; 16527 [2] OP II # 7; 16384 [3] OP II # 8; 16530 [13] OP II # 10; 16549 [6, 2 live] OP II # 11; 16518 [2] OP II # 13-1; 16522 [21, 5 live] OP II # 13-1; 16612 [16] OP II # 13-2; 16548 [14, 5 live] OP II # 13-2; 16390 [2] OP II # 14; 16587 [1] OP II # 15; 16520 [93, 16 live] OP II # 16; 16681 [3] OP II # 16; 16650 [1] OP II # 17-1; 16533 [1] OP II # 17-2; 18261 [1] OP II # 60.

Description: Shell high, slender, whitish, with 9 whorls (Fig. 2A, B). Protoconch with three whorls, dark yellow, smooth except for very fine supra-sutural spi-

ral threads (Fig. 2C). Teleoconch whorls pagoda-like, showing a slightly concave region between the suture and the shoulder. Whorls sculptured with large, blunt, axially elongated nodules, beginning on their shoulder and continuing towards the inferior suture, about 14 on the 7th whorl, and numerous fine spiral threads over the entire shell. Suture shallow. Base concave, with spiral threads on its upper half and smooth on its lower half. Labial sinus broad and moderately shallow. Inner lip reflected. Outer lip projecting forward. Siphonal canal long and wide. Aperture elliptical.

Geographical distribution: Northwest Atlantic: North Carolina, Florida, Gulf of Mexico, West Indies (Dall, 1889; Dall, 1903); West Indies (Dall, 1890; Medinskaya, 1999; Bartsch, 1934). Southwest At-

lantic: Bahia (Dall, 1890); Campos Basin, southeast Brazil (this paper). Northeast Atlantic: Azores and Morocco (Dautzenberg, 1927); Morocco and Canary Islands (Dautzenberg and Fischer, 1906); Côte d'Ivoire (Thiele, 1925); Spain, Portugal, Morocco, Mauritania, Azores, Madeira, Canary Islands, Cape Verde (Bouchet and Warén, 1980).

Bathymetry: from 274 m (Dall, 1889) to 3030 m (Bouchet and Warén, 1980).

Discussion: *Leucosyrinx* was described by Dall (1889: 75), as a subgenus of *Pleurotoma* Lamarck, 1799, to include the operculated species characteristic of the archibenthic zone. According to Dall, these species differ from all others by their thin, white, delicately sculptured shells, lack of a subtubular projection of the anal notch, lack of a thick varix to mark their maturity, generally large size, long siphonal canal and wide rounded anal sinus close to the suture.

Our material matches with the original illustration (Dall, 1889, pl. X, Fig. 5) and description (Dall, 1881, p. 57). *Leucosyrinx verrillii* as figured by Bouchet and Warén (1980: 24, Fig. 68) seems to be the same. Our material differs from these by its narrower posterior part of the aperture. Gracia *et al.* (2004, p. 65, Fig. 53) also illustrated the same species from the Colombian continental slope, but the teleoconch and the aperture are narrower and the siphonal canal is longer than both our and Bouchet and Warén's (1980) material. In fact, Gracia's material is more similar to *L. tenoceras* (Dall, 1889) (see below).

***Leucosyrinx tenoceras* (Dall, 1889)**
(Fig. 2D, E)

Pleurotoma (Leucosyrinx) tenoceras Dall, 1889: 76, pl. XXXVI, Fig. 5; Dall (1890: 302).

Leucosyrinx tenoceras: Powell (1966: 30); Abbott (1974: 263, Fig. 2897); Rios (1975: 128, pl. 39, Fig. 564; 1985: 132, pl. 45, Fig. 600; 1994: 166, pl. 55, Fig. 753).

Leucosyrinx verrillii: Gracia *et al.* (2004: 66, Fig. 53).

Type material: Syntype MCZ 007036, Blake sta 161, near Guadalupe, 1066m. Syntype MCZ 007037, Blake sta 265, near Grenada, 1053 m. (not examined).

Material examined: 16432 [1] OP I # 2; 16422 [1 live] OP I # 8; 16428 [1] OP I # 11; 16543 [1] OP II # 16; 16544 [1] OP II # 17-2.

Description: Shell high, slender, whitish, with 10 whorls (Fig. 2D, E). Protoconch with three dark-yellow whorls with fine spiral threads. Teleoconch whorls pagoda-like, with a slightly concave region between the suture and the shoulder. Whorls sculptured on their shoulder with large, axially elongated nodules that extend towards the lower suture, about 14 on the 8th whorl, and numerous axial threads, stronger on the earlier whorls. Just below the suture there are many short curved axial riblets that do not reach the whorl shoulder. Suture moderately deep.

Base entirely sculptured with spiral threads. Labial sinus broad and moderately deep. Inner lip thin. Outer lip projecting forward. Siphonal canal very long and wide. Aperture elliptical.

Geographical distribution: Northwest Atlantic: North Carolina, Florida, West Indies (Dall, 1889; Dall, 1890), Colombian continental slope (Gracia *et al.*, 2004, as *L. verrilli*). Southwest Atlantic: Rio de Janeiro (Dall, 1890; this paper).

Bathymetry: from 874 m (Dall, 1889) to 1609 m (Dall, 1890).

Discussion: Our material matches perfectly with the original illustration (Dall, 1889, pl. XXXVI, Fig. 5) and description (Dall, 1889, p. 76), though none of our specimens had a full protoconch to be illustrated here. This species can be distinguished from other species of *Leucosyrinx* by the extremely long siphonal canal and the short axial riblets below the suture.

***Leucosyrinx ? subgrundifera* (Dall, 1888)**
(Fig. 2F, G, H)

Pleurotoma (Leucosyrinx) subgrundifera Dall in Agassiz, 1888: 66, Fig. 283; Dall (1889: 77, pl. XXXVIII, Fig. 1).

Leucosyrinx subgrundifera: Powell (1966: 30); Abbott (1974: 263, Fig. 2900).

Type material: Syntype MCZ 007038, off Yucatan Strait, 1170 m (not examined).

Material examined: 16728 [2] OP I # 13; 16705 [1] OP II # 13-2; 18266 [1] OP I # 75; 18267 [2] OP II # 45; 18268 [2] OP II # 59; 17270 [1] OP II # 74.

Description: Shell high, slender, whitish, with 8 whorls (Fig. 2F, G). Protoconch with three whorls, dark yellow, first whorl smooth, subsequent whorls with a middle keel ornamented with pointed nodules, both gradually increasing in prominence (Fig. 2H). This keel continues into the teleoconch where it becomes a large drooping flap on each whorl, forming a relatively extensive, almost straight region between the suture and the keel. The distal end of the keel is rounded, with vanishing nodules towards the body whorl. On the body whorl, the keel is a bit less prominent, and no longer points downwards but rather horizontally. Suture shallow. A rounded spiral cord marks the beginning of the base, which is smooth. Inner lip reflected. Labial sinus broad and deep. Siphonal canal narrow, very long. Aperture triangular-elongated.

Geographical distribution: Northwest Atlantic: North Carolina, Florida, West Indies (Dall, 1889). Southwest Atlantic: Campos Basin, southeast Brazil (this paper).

Bathymetry: from 749 m (this paper) to 1324 m (Dall, 1889).

Discussion: Our material fits quite well with the original description of this species, but our shells have a larger profile compared with the original illustration by Dall (1889, pl. XXXVIII, Fig. 1).

Dall (1889, p. 75) created the genus *Leucosyrinx* and stated that “peripheral keel if present not recurved”. In the same paper (Dall, 1889, p. 77), he described *L. subgrundifera*, which does not agree with his own genus concept, “in some cases having its edge actually curved forward and overhanging”. In addition, *Leucosyrinx* is characterized by its spiral threads and the presence of nodules on the whorl shoulder. None of these characters is present in *L. subgrundifera*.

A few other turrid genera have an equally prominent keel as this species, such as *Spirotropis* Sars, 1878 and *Cochlespira* Conrad, 1865. However, although *Spirotropis monterosatoi* (Locard, 1897), the type species of *Spirotropis* (see Bouchet and Warén, 1980, p. 18, Fig. 57), has a high spire, narrow aperture, deep labial sinus, and the characteristic spiral keel, *L. subgrundifera* is distinguished by a longer siphonal canal and a blunt and slightly drooping keel, whereas in *Spirotropis* the siphonal canal is shorter and the keel is thinner and pointed upwards. *Cochlespira* has the keel, the elongated profile and the long siphonal canal, but the keel is also thin and pointed upwards, and it is ornamented with spines. In contrast, in *L. subgrundifera* the keel has barely perceptible small rounded nodules.

Ancistrosyrinx clytotropis (Sykes, 1906) as illustrated by Bouchet and Warén (1980, p. 24, Fig. 67) is probably congeneric with *L. subgrundifera*, because both share the same shell profile and type of keel. The genus *Ancistrosyrinx*, however, is very similar to *Cochlespira*, and is sometimes even regarded as its junior synonym (Abbott, 1974). *Ancistrosyrinx elegans* Dall, 1881 (illustrated in Dall, 1889, pl. 38, Fig. 3) is the type species of the genus and it has a sharp keel, pointed upwards and ornamented with spines, a feature that is quite different from what is observed both in our material and the shell illustrated as *A. clytotropis* by Bouchet and Warén (1980: p. 24, Fig. 67).

Powell (1942; 1966) illustrated some genera that have a keel somewhat similar to that of *L. subgrundifera*, but not recurved, and either smooth (*Tahusyrinx*, *Lirasyrinx*) or moniliform (*Cosmasyrinx*). All of these genera, however, have spiral striation on the teleoconch, whereas *L. subgrundifera*, aside from the keel, has no sculpture at all. The genus *Tatcherina* Vera-Peláez, 1998 has a keeled teleoconch, but this keel is not nearly as projected, especially on the earlier whorls, and it also has spiral striation on the teleoconch. In addition, the protoconch is diagonally cancelled (Gracia and Vera-Peláez, 2004).

Although we do not agree with the assignment of *subgrundifera* to *Leucosyrinx*, we were unable to find a better generic allocation for it. Therefore, we have left it provisionally in the genus *Leucosyrinx* for now, simply to avoid the useless multiplication of synonyms, but a definitive generic allocation is pending on additional studies of soft parts.

Subfamily DRILLIINAE Morrison, 1966
Genus *Splendrillia* Hedley, 1922

Type-species: *Drillia woodsi* Beddome, 1883 by original designation.

Splendrillia centimata (Dall, 1889)
(Fig. 2I, J, K)

Drillia ? (*Cymatosyrinx*) *centimata* Dall, 1889: 95, pl. XXXVI, Fig. 9.

Pleurotoma centimata: Dautzenberg and Fischer (1906: 10).

Pleurotoma (Cymatosyrinx) centimata: Dautzenberg (1927: 31, pl. II, Fig. 10, 11).

Cymatosyrinx centimata: Powell (1966: 900).

Spirotropis centimata: Bouchet and Warén (1980: 20, Figs. 2, 54, 191, 203).

Type material: Syntype MCZ 007094, Blake sta 31, Gulf of Mexico (24°33'N, 84°23'W), 3511 m. (not examined).

Material examined: 16491 [1] OP I # 1; 18265 [2, 1 live] OP I # 2; 16737 [1] OP I # 5; 16454 [2] OP I # 8; 16486 [3] OP I # 9; 16713 [2, 1 live] OP I # 11; 16496 [2] OP I # 12; 16502 [2] OP I # 14; 16485 [2] OP I # 15; 16404 [1] OP I # 16; 16740 [9, 1 live] OP I # 18; 16558 [1 live] OP II # 2; 16556 [2, 1 live] OP II # 3; 18264 [1] OP II # 5; 16385 [1] OP II # 8; 16632 [1 live] OP II # 11; 16624 [3, 1 live] OP II # 12; 16654 [1] OP II # 14; 16561 [5] OP II # 16; 16648 [2] OP II # 17-1; 16607 [2, 1 live] OP II # 18; 18262 [2] OP II #58; 18263 [1] OP II #63.

Description: Shell high, slender, white, with 9 whorls (Fig. 2I, J). Protoconch with two whorls, yellow, smooth except for very fine suprasutural spiral threads (Fig. 2K). Teleoconch whorls pagoda-like, with a relatively short concave region between the suture and the shoulder. Whorls sculptured on their shoulders, with large, blunt and very prominent, axially elongated nodules on their lower half, about 14 on the 8th whorl. Surface of the shell completely smooth aside from extremely faint growth lines. Suture shallow. Labial sinus broad, deep, and slightly tubular. Inner lip reflected. Outer lip projecting forward. Siphonal canal wide and short. Aperture elliptical.

Geographical distribution: Northwest Atlantic: North Carolina, Florida, Gulf of Mexico (Dall, 1889). Southwest Atlantic: Campos Basin, southeast Brazil (this paper). Northeast Atlantic: Azores and Morocco (Dautzenberg, 1927); Morocco (Dautzenberg and Fischer, 1906); Portugal, Morocco, Azores and Madeira (Bouchet and Warén, 1980)

Bathymetry: from 1122 m (this paper) to 3511 m (Dall, 1889).

Discussion: Hedley (1922) described *Splendrillia* as a subgenus of *Melatoma* Swainson, 1840, to include species with a “particularly glossy surface, and absence of the usual spirals”. The genus *Melatoma*, originally considered a fluvial taxon, was transferred to Turridae by Dall (1918), and *Clionella* Gray, 1847 was considered as its synonym. These decisions, however, have not been generally accepted, and some authors

(Powell, 1942; Iredale, 1918) have chosen to consider *Clionella* the valid name for the group until the matter is resolved. Either way, *Splendrillia* is very different from these genera, with a generally smaller size and a smooth protoconch with fine suprasutural spiral threads (Wells, 1990).

Splendrillia woodsi, the type species of *Splendrillia* (illustrated in Powell, 1966, pl. 12, Fig. 19), is quite similar to *Cymatosyrinx lunatus* (Lea, 1843) the type species of *Cymatosyrinx* (illustrated in Powell, 1966, pl. 13, Figs. 16-17) but differs from it by having a smooth protoconch, a very weak stromboid notch, and a fasciole that is not ridge-margined; whereas *C. lunatus* has a carinated protoconch, a deep stromboid notch, a nodulose subsutural cord and a prominent ridge edging the anterior fasciole (Powell, 1966).

Although it is very similar to *Leucosyrinx verrilli* (Dall, 1881) (illustrated in Dall, 1889, pl. X, Fig. 5), the type species of *Leucosyrinx*, since both share the macroscopically smooth protoconch and general outline of the shell, *L. verrilli* can be distinguished by a delicate sculpture of spiral keels or threads over the entire shell and usually a long anterior canal (Dall, 1889); whereas in *S. woodsi* the spiral sculpture is absent (some species of *Splendrillia* have such sculpturing restricted to the rostrum) and the anterior canal is short (Kilburn, 1988).

Dall (1889) described *S. centimata* in the genus *Cymatosyrinx*, which is characterized by several traits that are clearly absent in this species, such as a carinated protoconch, a deep stromboid notch, a nodulose subsutural cord and a prominent ridge edging the anterior fasciole. Bouchet and Warén (1980) transferred this species to the genus *Spirotropis*, but the genus *Spirotropis* (see Bouchet and Warén, 1980, p. 18, Fig. 57) has a completely smooth peripheral carina, aside from a very weak nodulation only on the earlier whorls; and *S. centimata* has very large blunt nodules on every whorl of the teleoconch. As such, this species seems to be better allocated to the genus *Splendrillia*, because it shows the typical smooth glossy surface, short siphonal canal, subtubular labial sinus, and strong, axially oriented nodules below the shoulder. Therefore, this fit with the concept of *Splendrillia* suggests that it is a better generic placement than *Cymatosyrinx* or *Spirotropis*.

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