Description of a new species of *Calliostoma* (Gastropoda, Vetigastropoda: Calliostomatidae) from the Cape Verde Islands

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Key words: Gastropoda, Calliostomatidae, *Calliostoma*, Atlantic Ocean, West Africa, taxonomy, new species.

Calliostoma cancapae sp. nov. is described from the Cape Verde Islands. Empty shells of the new species were collected from 41 sites in the depth range 35-3250 m during the CANCAP-VI (1982) and CANCAP-VII (1986) expeditions.

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INTRODUCTION

The CANCAP expeditions explored the subtropical areas of the NE Atlantic Ocean between 1976 and 1986 (van der Land, 1987). Mollusca collected during these expeditions are retained in the systematic collection at Naturalis Biodiversity Centre (NBC) in Leiden, the Netherlands. Groups of molluscs have already been reviewed: Polyplacophora (Kaas, 1991), Pectinidae (Dijkstra & Goud, 2002), Rissoidae (Hoenselaar & Goud, 1998), Pyramidellidae (van Aartsen et al., 1998, 2000), and Philinidae (van der Linden, 1995). Many families were only partly studied and undescribed species were left for future reviews. The second author currently reviews the gastropod families with many undetermined species. A new species of Calliostomatidae is described here.

Species in Calliostomatidae live in all oceans from the littoral and shelf to bathyal depths. Most species are carnivorous (Hoffman et al., 2019), although littoral species may partially feed on algae (Fretter et al., 2019; de Bruyne et al., 2013). A significant inventory of NW African molluscs was completed by Locard (1897-1898) from the material collected during the Travailleur and Talisman expeditions; five species in the genus *Calliostoma* Swainson, 1840 were originally described in the genus *Zizyphinus* J. E. Gray, 1842. Recent reviews of the NE Atlantic / Azorean seamounts species of *Calliostoma* include Hoffman et al. (2019) and Gofas & Hoffman (2020). Juvenile specimens of an unidentified calliostomatid were reported by Rolán (2005) in his compilation of the molluscan fauna of the Cape Verde archipelago. Important reviews of fossil calliostomatids from the NE Atlantic include those by Millet (1865) on the Maine and Loire Basins and by Landau et al. (2017) on Upper Miocene species from NW France.

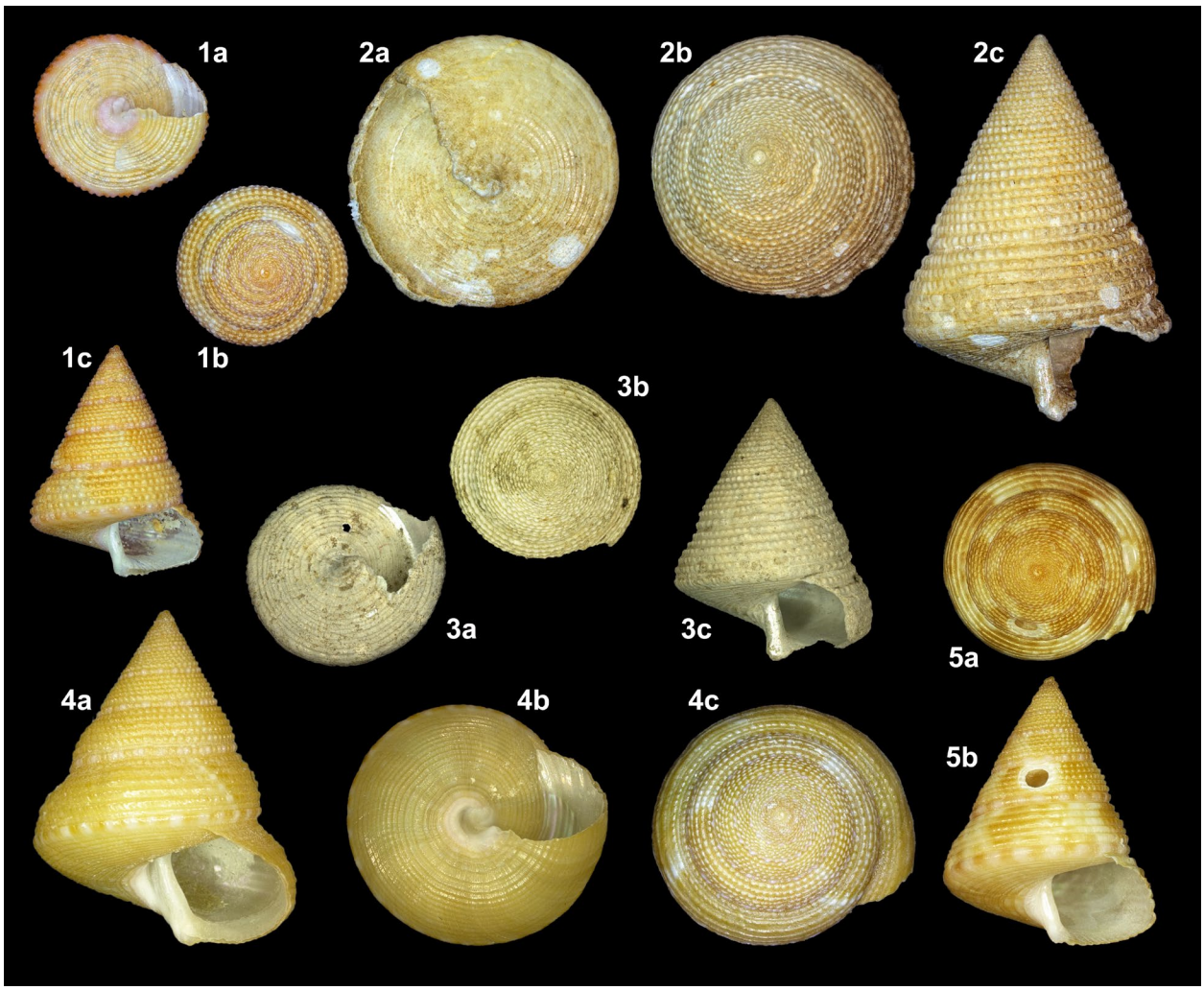
Abbreviations: CANCAP = acronym for Canarian Cape Verdean region; H = height of shell; Ha = height of aperture; RMNH.MOL = Rijksmuseum voor Natuurlijke Historie Mollusca collection, currently Naturalis Biodiversity Center, Leiden, The Netherlands; SEM = scanning electron microscope; W = width of shell.

SYSTEMATICS

Class Gastropoda Cuvier, 1795
Subclass Vetigastropoda Salvini-Plawen, 1980
Superfamily Trochoidea Rafinesque, 1815
Family Calliostomatidae Thiele, 1924

Genus *Calliostoma* Swainson, 1840

Type species (designated by Herrmannsen, 1846, Indicis generum malacozoorum primordia, 1: 154): *Trochus conulus* Linnaeus, 1758.



Figs 1-5. *Calliostoma cancapae* spec. nov., Cape Verde Islands. **1a-c.** Paratype, RMNH.MOL.138892, station unknown, H 8.1 mm, W 6.9 mm, Ha 2.8 mm. **2a-c.** Paratype, RMNH.MOL.138798, S of Soa Nicolau, CANCAP 6.029, 3000-3250 m, H 13.6 mm, W 9.3 mm. **3a-c.** Paratype, RMNH.MOL.138495, S of São Tiago, CANCAP 7.004, 320 m, H 9.0 mm, W 7.3 mm. **4a-c.** Holotype, RMNH.MOL.28290, SW of Boa Vista, CANCAP 6.069, 76-90 m, H 11.8 mm, W 9.0 mm, Ha 4.2 mm. **5a-b.** Paratype, RMNH.MOL.139070, SE of Cima, CANCAP 7.033, 40 m, H 9.3 mm, W 7.2 mm, Ha 3.1 mm.

***Calliostoma cancapae* spec. nov.**

Figs 1-12

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Type material (total 5 empty shells), Cape Verde Islands. — Holotype: • SW of Boa Vista, 15°43'N 23°00'W, depth 76-90 m, 13.vi.1982, CANCAP 6.069, in calcareous algae, 1.2 m Agassiz trawl, RMNH.MOL.28290 (Figs 4a-c). Paratypes (4 shells): • 1 shell, Cape Verde Islands (unknown locality), 1982, CANCAP-VI, RMNH.MOL.138892, (Figs 1a-c). • 1 shell, S of São Nicolau, 16°23'N, 24°37'W, depth 3000-3250 m, 14/15.vi.1982, CANCAP 6.092, 3.5 m Agassiz trawl, RMNH.MOL.138798 (Figs 2a-c). • 1 shell, S of São Tiago, 14°54'N, 23°38'W, depth 320 m, 20.viii.1986, CANCAP 7.004, sandy dark grey mud with tubeworms, few living animals, few shells, van Veen grab, RMNH.MOL.138495 (Figs 3a-c). • 1 shell, SE of Cima, 14°58'N, 24°39'W, depth 40 m, 23.viii.1986, CANCAP 7.033, dark grey Foraminifera sand with calcareous red algae, van Veen grab, RMNH.MOL.139070 (Figs 5a-b).

Other material examined (79 juvenile empty shells). — 1 shell (SEM, Fig. 9), S of São Tiago, 14°54'N 23°30'W, depth 75-68 m, sand and shell gravel, van Veen grab, 5.vi.1982, CANCAP 6.005. • 4 shells, S of São Tiago, 14°53'N 23°30'W, depth 310 m, sandy mud and shell gravel, van Veen grab, 5.vi.1982, CANCAP 6.010. • 3 shells (1 SEM, Fig. 11), W of São Tiago, 15°01'N 23°44'W, depth 466 m, volcanic sand and calcareous gravel, van Veen grab, 6.vi.1982, CANCAP 6.019. • 8 shells (2 SEM, Fig. 10), Cape Verde Islands, bay on W coast of São Tiago, 15°00'N 23°44'W, depth 540 m, muddy volcanic

sand, van Veen grab, 7.vi.1982, CANCAP 6.024. • 1 shell (SEM), bay on W coast of São Tiago, 15°00'N 23°45'W, depth 920-970 m, muddy volcanic sand and calcareous nodules, van Veen grab, 7.vi.1982, CANCAP 6.027. • 1 shell (SEM), S of São Nicolau, 16°34'N 24°22'W, depth 35 m, lava sand and calcareous algae, van Veen grab 4x, 14.vi.1982, CANCAP 6.082. • 6 shells (2 SEM, Fig. 8), S of São Nicolau, 16°34'N 24°22'W, depth 100 m, coarse yellow Foraminifera sand, van Veen grab, 14.vi.1982, CANCAP 6.085. • 2 shells, SW of Razo, 16°36'N 24°37'W, depth 400-430 m, sand and shell gravel, van Veen grab, 15.vi.1982, CANCAP 6.093. • 2 shells, SW of Santa Luzia, 16°43'N 24°46'W, depth 102 m, fine sand, shell gravel and calcareous algae, van Veen grab, 16.vi.1982, CANCAP 6.103. • 1 shell, SSW of Santa Luzia, 16°43'N 24°47'W, depth 150-300 m, coarse sand with calcareous algae, rectangular dredge, 16.vi.1982, CANCAP 6.106. • 1 shell, SW of Santa Luzia, 16°44'N 24°46'W, depth 50 m, sand, van Veen grab, 16.vi.1982, CANCAP 6.107. • 1 shell, S of São Vicente, 16°45'N 25°02'W, depth 110-120 m, coarse sand and shell gravel, van Veen grab, 19.vi.1982, CANCAP 6.134. • 1 shell, SW of São Vicente, 16°48'N 25°06'W, depth 99 m, Foraminifera sand, shells and calcareous algae, van Veen grab, 20.vi.1982, CANCAP 6.147. • 1 shell, SW of São Vicente, 16°47'N 25°06'W, depth 293 m, muddy Foraminifera sand, van Veen grab, 20.vi.1982, CANCAP 6.149. • 1 shell, SW of São Tiago, 14°54'N 23°38'W, depth 510 m, muddy sand with pteropods, large gorgonid caught in wire, van Veen grab, 20.viii.1986, CANCAP 7.003. • 1 shell, SW of São Tiago, Ponta Grande da Cidade, 14°54'N 23°38'W, depth 700 m, sandy mud, van Veen grab, 20.viii.1986, CANCAP 7.008. • 1 shell, S of São Tiago, Ponta Grande da Cidade; 14°54'N 23°38'W, depth 450-600 m, grey clay, van Veen grab, 21.viii.1986, CANCAP 7.015. • 2 shells, SE of Cima, 14°57'N 24°39'W, depth 165 m, hard bottom with some yellow calcareous sand, van Veen grab, 23.viii.1986, CANCAP 7.030. • 3 shells (1 SEM), SE of Cima, 14°57'N 24°38'W, depth 65 m, calcareous nodules and yellow sand, van Veen grab, 23.viii.1986, CANCAP 7.032. • 1 shell, SE of Cima, 14°57'N 24°38'W, depth 285-350 m, muddy calcareous sand and shell gravel, van Veen grab, 24.viii.1986, CANCAP 7.037. • 1 shell, SW of Maio, Ponta Inglez/Ponta Preta, 15°06'N 23°14'W, depth 166 m, muddy, yellow-grey Foraminifera sand with some shells, a sponge and several polychaetes (mainly tube worms), van Veen grab, 25.viii.1986, CANCAP 7.049. • 1 shell, W of Sal, off Palmeira, 16°45'N 23°01'W, depth 354 m, volcanic and calcareous mud, sand and gravel with polychaet tubes, van Veen grab, 30.viii.1986, CANCAP 7.100. • 1 shell, W of Sal, off Palmeira, 16°45'N 23°01'W, depth 123-142 m, calcareous and volcanic sand, nodules and stones with serpulids and Foraminifera, van Veen grab, 30.viii.1986, CANCAP 7.105. • 4 shells (3 SEM, Figs 6a-b, 7a-b), S of Razo, 16°36'N 24°36'W, depth 80 m, calcareous sand, gravel and nodules with Foraminifera, van Veen grab, 1.ix.1986, CANCAP 7.115. • 3 shells (3 SEM), S of Razo, 16°36'N 24°36'W, depth 75 m, calcareous sand and gravel, van Veen grab, 1.ix.1986, CANCAP 7.116. • 4 shells, S of Razo, 16°36'N 24°37'W, depth 208 m, muddy calcareous sand, van Veen grab, 1.ix.1986, CANCAP 7.120. • 10 shells (2 SEM), S of Razo, 16°36'N 24°36'W, depth 140-160 m, coarse calcareous sand, gravel and stones with Foraminifera, van Veen grab, 1.ix.1986, CANCAP 7.119. • 5 shells (1 SEM), S of Razo, 16°36'N 24°37'W, depth 200-230 m, muddy calcareous sand, van Veen grab, 1.ix.1986, CANCAP 7.121. • 3 shells, S of São Nicolau, S. Jorge Bay, 16°33'N 24°17'W, depth 400 m, muddy Foraminifera sand, some shell gravel and some volcanic gravel, van Veen grab, 2.ix.1986, CANCAP 7.128. • 3 shells, S of Branco, 16°38'N 24°41'W, depth 35 m, calcareous sand and gravel with calcareous algae, Foraminifera, shells and algae, van Veen grab, 4.ix.1986, CANCAP 7.141. • 1 shell, S of Branco, 16°38'N 24°41'W, depth 56 m, yellow calcareous sand with calcareous red algae and bryozoans, van Veen grab, 4.ix.1986, CANCAP 7.142. • 2 shells, S of Branco, 16°40'N 24°42'W, depth 64 m, calcareous nodules with bryozoans, rectangular dredge, 4.ix.1986, CANCAP 7.146.

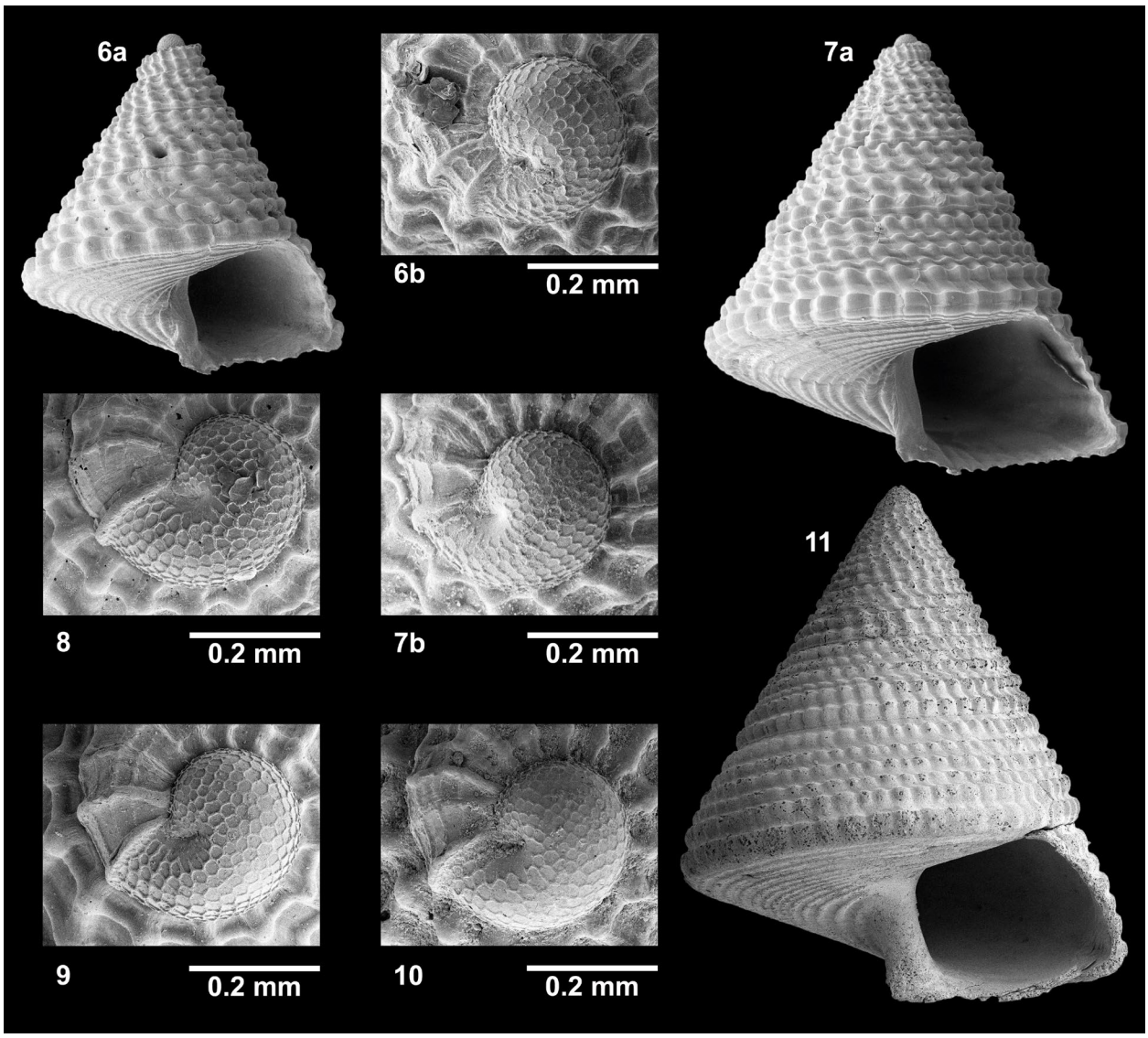
Type locality. — Cape Verde Islands, SW of Boa Vista, 15°43'N 23°00'W, depth 76-90 m, CANCAP 6.069, in calcareous algae, 1.2 m, Agassiz trawl.

Etymology. — The name refers to the CANCAP expeditions.

Description. — Solid, conical shell with beaded spiral cords; maximum height 14 mm, width 10 mm. Small rounded tip, initial whorl with shoulder and steep periphery, subsequent whorls sloping, straight outline. Colour light orange-brown blotches on cream background.

Protoconch. — One whorl with raised dome of nucleus and with convex rim at the lip; sculpture with flattened net-pattern with shallow, smooth, hexagonal or pentagonal pits, diameter pits approximately 25 µm, width net approximately 4 µm; maximum diameter 310-330 µm; light orange-brown. Transition to teleoconch clear by change in sculpture.

Teleoconch. — Seven to eight whorls with conical outline, apical angle 56°. First whorl with two varices at start, subsequent four whorls with a flattened profile; last and penultimate whorls increasingly convex. First whorl with four spiral cords with 15 axial columns with regular beads, first spiral at suture, second on flat shoulder, two on steep periphery. Number of cords increases from five on the second whorl to six on penultimate and last whorls, axial columns of beads increase from 17 on second whorl to 33 on penultimate whorl; supra-sutural cord strongest; beads fade on last whorl leaving smooth cords. Weak regular growth stages, prosocline at 35°–40° to spire axis. Suture shallowly impressed. Base last whorl weakly convex with about 15 slightly irregular cordlets with weaker interspaces. Umbilicus closed by white callus; umbilical imprint. Aperture 30% of height, trapezoidal, outer lip sharp, corrugated edge,



Figs 6-11. *Calliostoma cancapae* spec. nov., Cape Verde Islands. **6a-b.** S of Razo, 80 m, CANCAP 7.115, 80 m. **6A.** Ventral view, H 2.4 mm, W 2.3 mm, Ha 0.9 mm. **6b.** Protoconch W 0.32 mm. **7a.** Same locality, H 3.3 mm, W 3.2 mm, Ha 1.3 mm. **7b.** Protoconch W 0.31 mm. **8.** S of São Nicolau, CANCAP 6.085, 100 m, protoconch W 0.33 mm. **9.** S of São Tiago, CANCAP 6.005, 75 m, protoconch W 0.31 mm. **10.** W of São Tiago, CANCAP 6.024, 540 m, protoconch W 0.32 mm. **11.** W of São Tiago, CANCAP 6.019, 466 m, H 5.6 mm, W 4.8 mm, Ha 1.8 mm.

prosocline; columella curved with thick callus; parietal callus absent; internally nacreous with spiral imprint of external sculpture, imprint strongest in upper half and base. External background colour cream white with light brown patches in the interspaces between the cords and regular light brown or lilac patches on the supra-sutural cord.

Variability. — The degree of convexity on penultimate and last whorls varies; adult shells from depths exceeding 100 m have a flattened profile wheras shells from the upper shelf show a swollen profile of the last whorls. The broad brown patches are weak in the holotype and darker in two fresh paratypes. Most shells from deep water are worn and lost their colour.

Differential diagnosis. — The new species is similar to *Calliostoma heugteni* Vilvens & Swinnen, 2003 from the Azorean seamounts but this species is smaller, up to 7 mm, it has more convex whorls, a narrow open umbilicus and is uniformly white (Vilvens & Swinnen, 2003; Gofas & Hoffman, 2020). *Calliostoma freiwaldi* Gofas & Hoffman, 2020 from the Azorean seamounts has a similar size but it has more convex whorls, an open umbilicus and a uniform white shell (Gofas & Hoffman, 2020). *Calliostoma cleopatra* (Locard, 1898) from off NW Africa also has a closed umbilicus, but is larger (up to 24 mm), with convex whorls and a uniform cream colour (Locard, 1898). *Calliostoma lithocolletum* Dautzenberg, 1925 has been described from the Bay

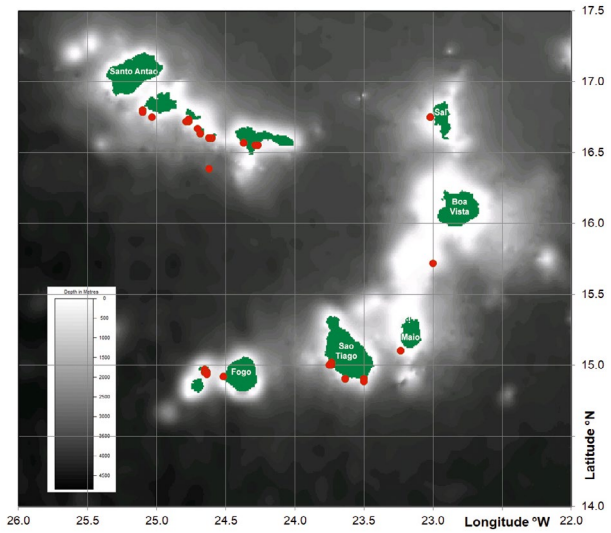


Fig. 12. Locations of *Calliostoma cancapae* spec. nov. in the Cape Verde Archipelago as found during the CANCAP VI and CANCAP VII expeditions are indicated by red dots. Bathymetric data from GEBCO.

of Biscay; it is a white species with a darker obtuse apex. It has been confused with the more southern *C. simulatum* Nolf & Hubrecht, 2022 described from the Canary Islands. *Calliostoma simulatum* Nolf & Hubrecht, 2022 has more spiral cords with fine beads and it lacks axial sculpture (Nolf & Hubrecht 2022a); *C. cancapae* spec. nov. has fewer cords and axially aligned beads. Nolf & Hubrecht (2022b) also described *Calliostoma coeneyi* and *C. schoenherri* from Angola; both species are characterised by beaded spirals without axial sculpture and with beaded cords at the base. Landau et al. (2017) described similar species from the Upper Miocene: *Calliostoma spinosum* Landau, Van Dingenen & Ceulemans, 2017 is smaller and has a cyrtoconoid outline; *C. michaeli* has finer and sharper cords and a stronger shell; *C. alternatum* Millet, 1865 is smaller and has a protruding peripheral cord; C. *baccatum* Millet, 1865 has fine irregular spiral cords.

Distribution. — Only empty shells off the Cape Verde Islands in 35-3250 m. The depth range of live populations needs to be confirmed.

Remarks. — Rolán (2005: 43) reported on juveniles of a *Calliostoma* sp. from off Branco, Cape Verde Islands in 50 m bathymetric depth. His species is described as cream-coloured with a tuberculate sculpture and similar to *Clelandella milliaris* (Brocchi, 1814); it is possible that his species is the new species described herein.

The morphology of the protoconch and initial teleoconch was extensively tested using SEM images of 17 juveniles from both upper shelf and deep water as well as from populations from different islands: Razo (80-200 m), Sao Tiago (75-920 m), Cima (65 m) and Sao Nicolau (35-100 m). No significant morphological differences were found between protoconchs and initial teleoconchs from either shallow- and deep-water shells or between populations from different islands. We therefore assume that we deal with a single species over the full Cape Verde Archipelago. Note that no soft tissue was available for physiological or genetic studies.

The type specimens and ancillary material are kept at the Naturalis Biodiversity Center, Leiden, The Netherlands.

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