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A New Species of Whip-Like Gorgonian Coral in the Genus *Swiftia* from the Gulf of the Farallones in Central California, with a Key to Eastern Pacific Species in California (Cnidaria, Octocorallia, Plexauridae)

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A new species of plexaurid gorgonian coral in the genus *Swiftia*, collected by Remotely Operated Underwater Vehicle, is described from the Greater Farallones National Marine Sanctuary near the Farallon Islands off the coast of central California. The species is unlike other species of *Swiftia* in that it is whip-like and unbranched or Y-shaped with two terminal branches. The genus *Swiftia* has a wide geographic distribution – not associated with coral reefs — it is known from the eastern Pacific and the western and eastern Atlantic, as well as parts of the Indo-West Pacific, from mesophotic depths and in deeper water.

KEYWORDS: Alcyonacea, *Swiftia*, plexaurid gorgonian, central California, Farallon Islands, outer continental shelf, taxonomic key to local species.

A previously undescribed species of the gorgonian genus *Swiftia* was recently encountered during an exploratory survey by Remotely Operated Underwater Vehicle (ROV) on board the National Oceanic and Atmospheric Administration (NOAA) ship R/V *Fulmar* in the then proposed expansion area of the Gulf of the Farallones National Marine Sanctuary (now known as the Greater Farallones National Marine Sanctuary) off the Sonoma County coast of northern California, USA. A single whole colony was collected by ROV, which is here designated as the holotype specimen.

The gorgoniid genus *Swiftia* Duchassaing & Michelotti, 1864 is comprised of 15 currently recognized species, widely-distributed in the eastern Pacific — the western Atlantic, the northeastern Atlantic, the northern Pacific, and the Indo-Pacific (Ofwegen 2015; Breedy et al. 2015). The new species described here makes a total of 16 species currently recognized as valid that comprise the genus.

Most species of *Swiftia* vary in depth from approximately 70–732 m with a few species recorded from as shallow as 18–30 m (Breedy et al. 2015) and as deep as at least 1829 m (Goldberg 2001; and CASIZ collections data base).

MATERIALS AND METHODS

The material examined in this study is housed in the collections of the Department of Invertebrate Zoology and Geology at the California Academy of Sciences (CASIZ), San Francisco. *In situ* photographs were taken by Peter Etnoyer during the NOAA ROV cruise on board RV *Fulmar* in the Greater Farallones NMS (National Oceanic and Atmospheric Administration 2014), approximately 70 miles NW of the Farallon Islands (Fig. 1), on 6 September 2014. Photographs of preserved material were taken by the authors at the California Academy of Sciences in September of 2015. The holotype was collected by ROV at 182 m in depth. Abbreviations used in the text are: CASIZ (California Academy of Sciences, Department of Invertebrate Zoology), GFNMS (Gulf of the Farallones National Marine Sanctuary), NOAA (National Oceanic and Atmospheric Administration), and ROV (Remote Operational Vehicle).

Definitions recognized in this paper for depth zones of benthic faunal communities are as follows: shallow-water (< 40 m), mesophotic (40–150 m), and deep-water (> 150 m).



FIGURE 1. The Farallon Islands, approximately 40 miles west of San Francisco, California, and 70 miles southeast of the type locality of *Swiftia farallonesica* sp. nov., in the Greater Farallones National Marine Sanctuary.

SYSTEMATIC ACCOUNT

Subclass Octocorallia

Order Alcyonacea Lamouroux, 1812

Family Plexauridae Gray, 1859

Swiftia Duchassaing and Michelotti, 1864

Swiftia Duchassaing and Michelotti, 1864:13; Kükenthal, 1924:236; Deichmann, 1936:185–186; Bayer, 1956:F206; Bayer, 1981:945; Harden, 1979:109–110; Breedy, et al., 2015:329.

Stenogorgia Verrill, 1883:29 (see Kükenthal, 1924:347 for *Stenogorgia* synonymy).

Platycaulos Wright and Studer, 1889:61; Bayer, 1981:945.

Callistephanus Wright and Studer, 1889:62; Bayer, 1981:945.

Allogorgia Verill, 1928:7; Bayer, 1981:945.

GENERIC DIAGNOSIS.— Colonies unbranched, or sparsely to copiously branched. Branches mostly free or with some anastomoses. Polyp mounds conical, prominent, or slightly raised, scattered or crowded, usually biserial or present on all sides of polyp-bearing branches. Anthocodiae with points arrangements of straight to curved bar-like rods, or frequently elongate tuberculated spindles.

TYPE SPECIES.— *Swiftia exserta* (Ellis and Solander, 1786)

***Swiftia farallonesica* Williams and Breedy, sp. nov.**

Figures 1–9.

Leptogorgia, National Oceanic and Atmospheric Administration, 2014:1–2.

HOLOTYPE.— CASIZ 196930.

TYPE LOCALITY (Figs. 8–9).— Deep-sea rocky substrata at Football Shoal, Greater Farallones National Marine Sanctuary, off Bodega Bay, California, USA (38.00°26.33'N 123.00°34.19'W); 182 m depth; 06 September 2014; Gary Williams and Peter Etnoyer; one entire specimen collected by ROV.

HABITAT AND DISTRIBUTION.— Found on hard, rugose, horizontal substrata composed of relatively dense congregations of detritus-covered rounded boulders between 181 and 190 m depth, at the type locality and vicinity (Figs. 8–9). Pink and white ophiuroids (species unidentified) were observed (on the holotype and by underwater video and still imagery) attached along portions of the lengths of several colonies (Figs. 2A & D, 3A & E). Approximately 15–20 colonies were observed in total by underwater video and still photography.

ETYMOLOGY.— The specific epithet is derived from the Spanish *farallón* (steep rock, cliff, headland, outcrop), and the Latin *-icus* (suffix meaning belonging to); referring to the region of the discovery of the new species — the Greater Farallones National Marine Sanctuary.

Description of the Holotype

EXTERNAL MORPHOLOGY (Figs. 2–3).— The proximal-most surface of the holdfast that adheres to the substratum is circular, approximately 10 mm in diameter and 2 mm in height. The colony is unbranched and whip-like, 378 mm in length by 3–4 mm in width. The external surface of the colony is pustular in appearance with retracted polyps forming low mounds on all sides of the branches, from the holdfast to the apex of the colony. Each protuberance is approximately 2.0

mm in diameter at their bases and 0.8–1.0 mm in height. There are approximately 25–30 polyps per every 10 mm along the length of the colony. Many of the polyps throughout the colony are entirely retracted, while others are preserved in varying states of partial retraction.

SCLERITES (Figs. 4–7).— The sclerites of the polyp mounds and coenenchyme are predominantly double discs and disc spindles 0.05–0.08 mm in length (Fig. 4), eight-radiates 0.04–0.12 mm long (Fig. 5), and spindles and girdled spindles (0.08–0.20 mm in length). Some girdled spindles are wider toward one end compared to the opposite end, and thus appear somewhat club-shaped in overall appearance (Fig. 6). Sclerites of the anthocodiae are mostly elongated rods with parallel sides and are variably tuberculated, 0.09–0.21 mm long (Fig. 7). All sclerites in the colony are colorless.

COLOR (Figs. 2–3).— The color of the holotype is white throughout, both in life and wet-preserved.

REMARKS (Figs. 2–3).— All colonies observed are whip-like and unbranched, except for one colony that was recorded by underwater still imagery and is Y-shaped with a single lateral branch (Fig. 3C). All colonies that were observed by underwater video or still imagery are also uniformly white in color (Fig 3A–E).

DISCUSSION AND CONCLUSION

Key to *Swiftia* species in California

- 1a. Colonies multiply-branched 2
- 1b. Colonies unbranched (flagelliform, whip-like), or Y-shaped with a single branch; with low polyp mounds distributed on all sides of branches; colonies pure white in color.
 *Swiftia farallonesica* Williams and Breedy, sp. nov.
- 2a. Colonies mostly dichotomously branched, somewhat fan-shaped; with low polyp mounds distributed on all sides of branches; colonies pink to bright coral red in color
 *Swiftia spauldingi* (Nutting, 1909)
- 2b. Colonies densely branched with prominent polyp mounds distributed biserially along branches; colonies red with deep red polyp mounds *Swiftia kofoidi* (Nutting, 1909)

Taxonomic Assessment

Swiftia is one of 43 currently recognized genera in the gorgonian family Plexauridae (Williams and Cairns 2015). Plexaurids are characterized by a darkly colored axis (black or brown), which is composed of a cortex of proteinaceous material (gorgonin) with spaces (loculi) that are sometimes filled with lighter calcified material. The central core of the axis is hollow and cross-chambered (Fabricius and Alderslade 2001:59; Williams 2005:54, Fig. 1).

The genus *Swiftia* is distinguished by the following combined set of characters: coenenchymal sclerites are largely capstans, many of which are modified to a lesser or greater degree as discs; polyp mounds low-rounded to cylindrical or conical, slightly raised to prominent; anthocodiae contain relatively large, conspicuously tuberculated rods (based on Bayer 1981:932).

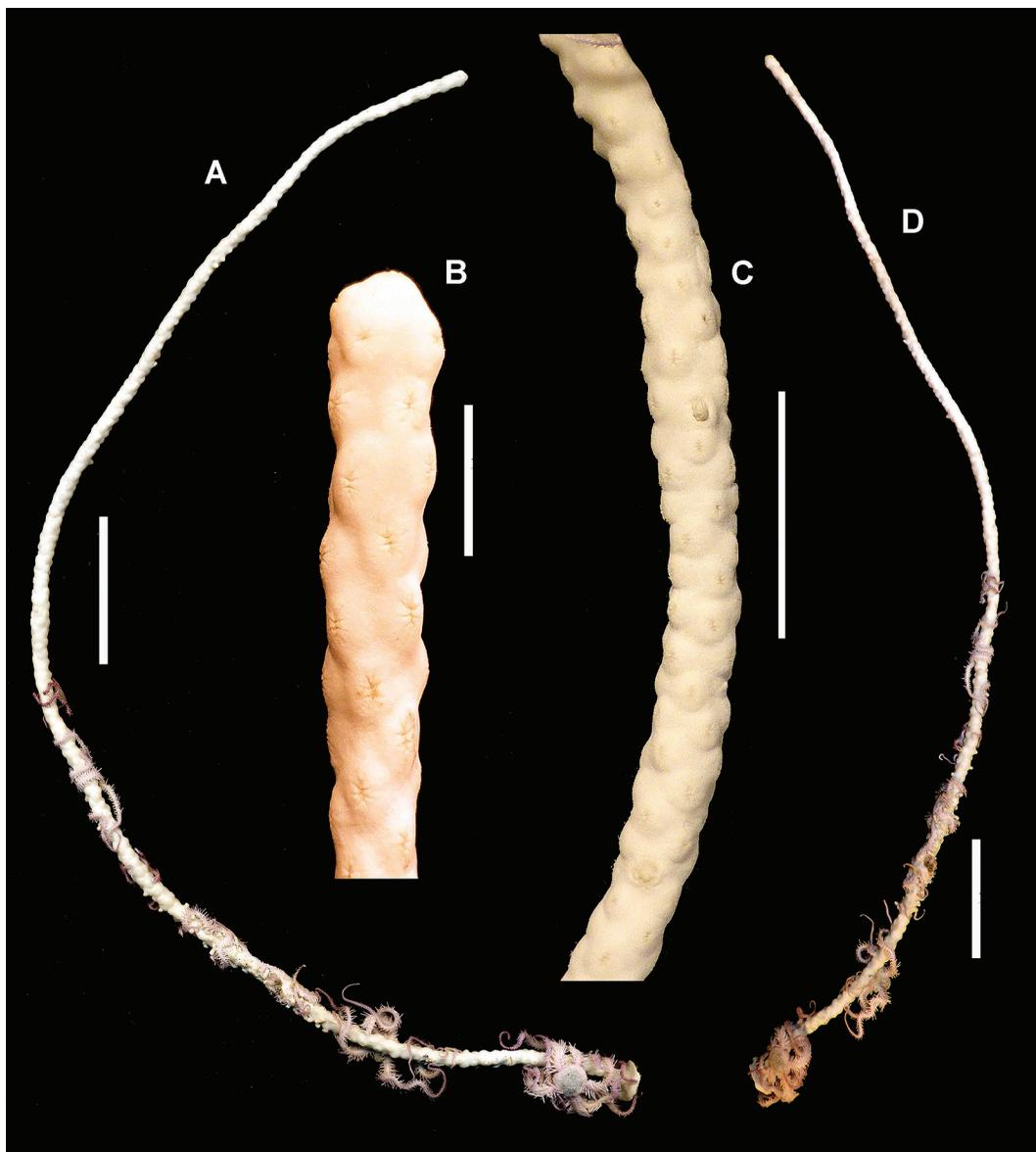


FIGURE 2. *Swiftia farallonesica* sp. nov. Wet-preserved holotype. A, D. Entire colony, scale bars = 10 mm. B. Distal apex region, scale bar = 5 mm. C. Middle portion of colony, scale bar = 10 mm.

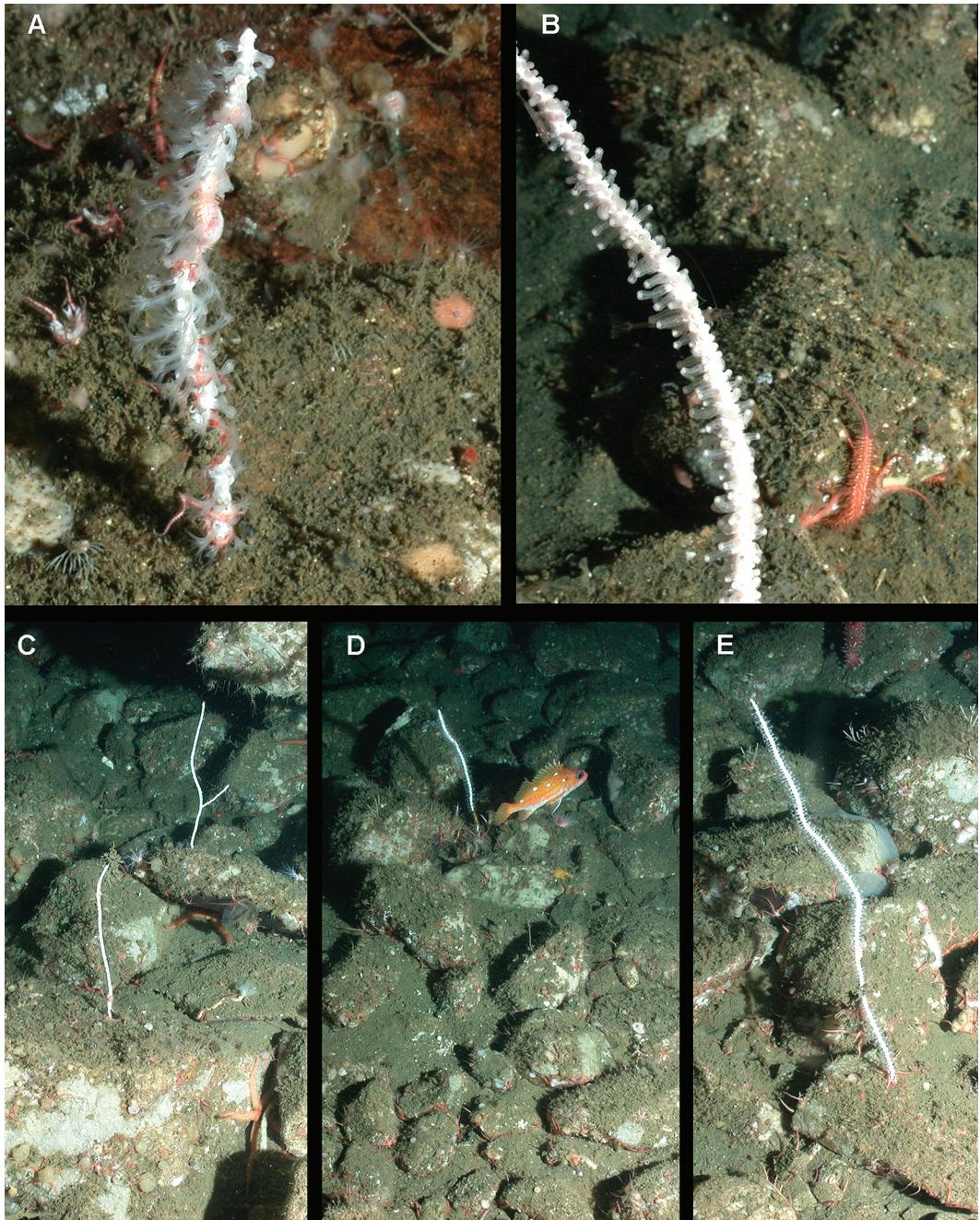


FIGURE 3. *Swiftia farallonesica* sp. nov. Underwater photographs taken *in situ* by ROV, between 181 and 190 m in depth, 6 September 2014.

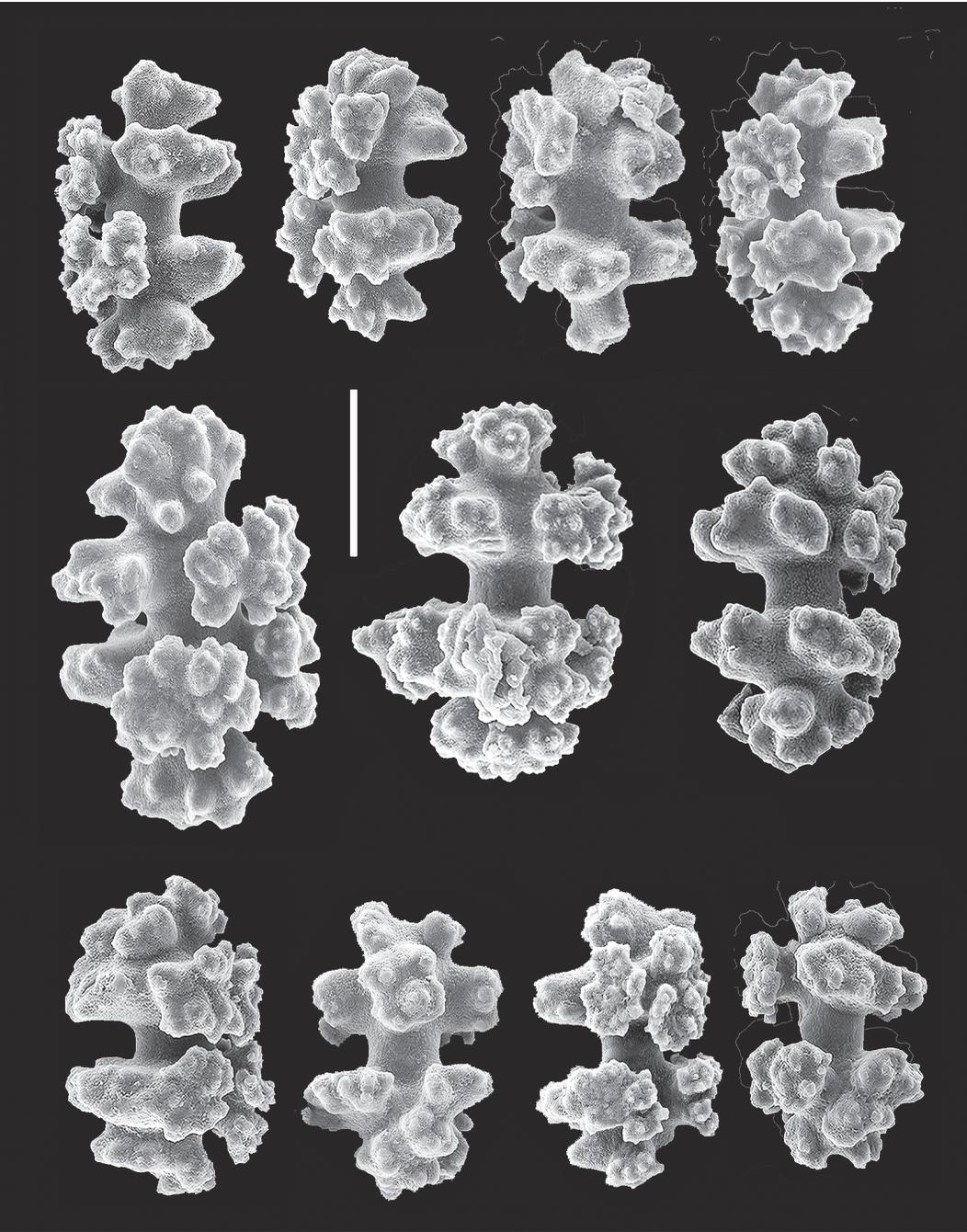


FIGURE 4. *Swiftia farallonesica* sp. nov. Scanning electron micrographs of coenenchymal sclerites — double discs and disc-spindles. Scale bar = 0.03 mm.

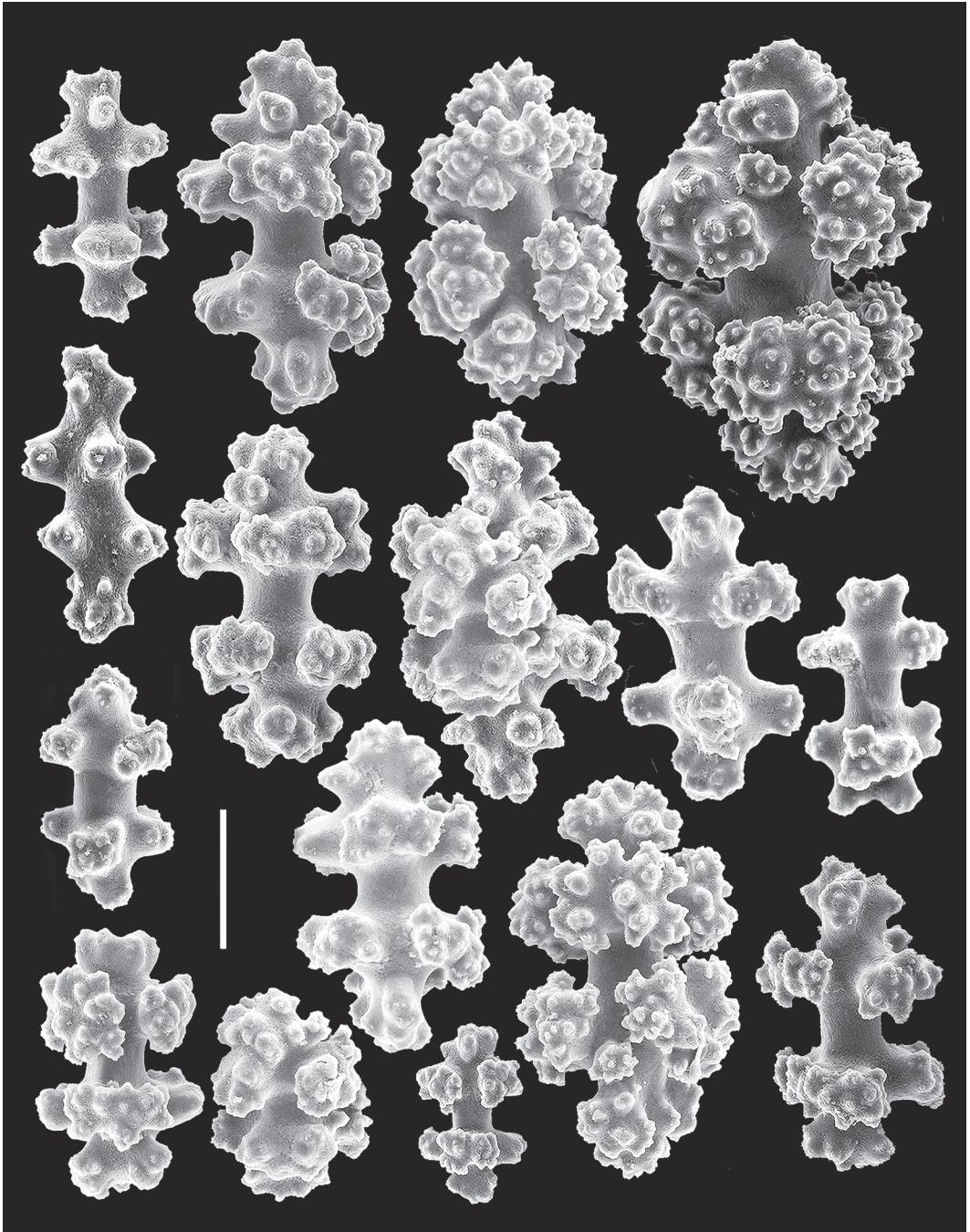


FIGURE 5. *Swiftia farallonesica* sp. nov. Scanning electron micrographs of coenenchymal sclerites — eight radiates. Scale bar = 0.03 mm.

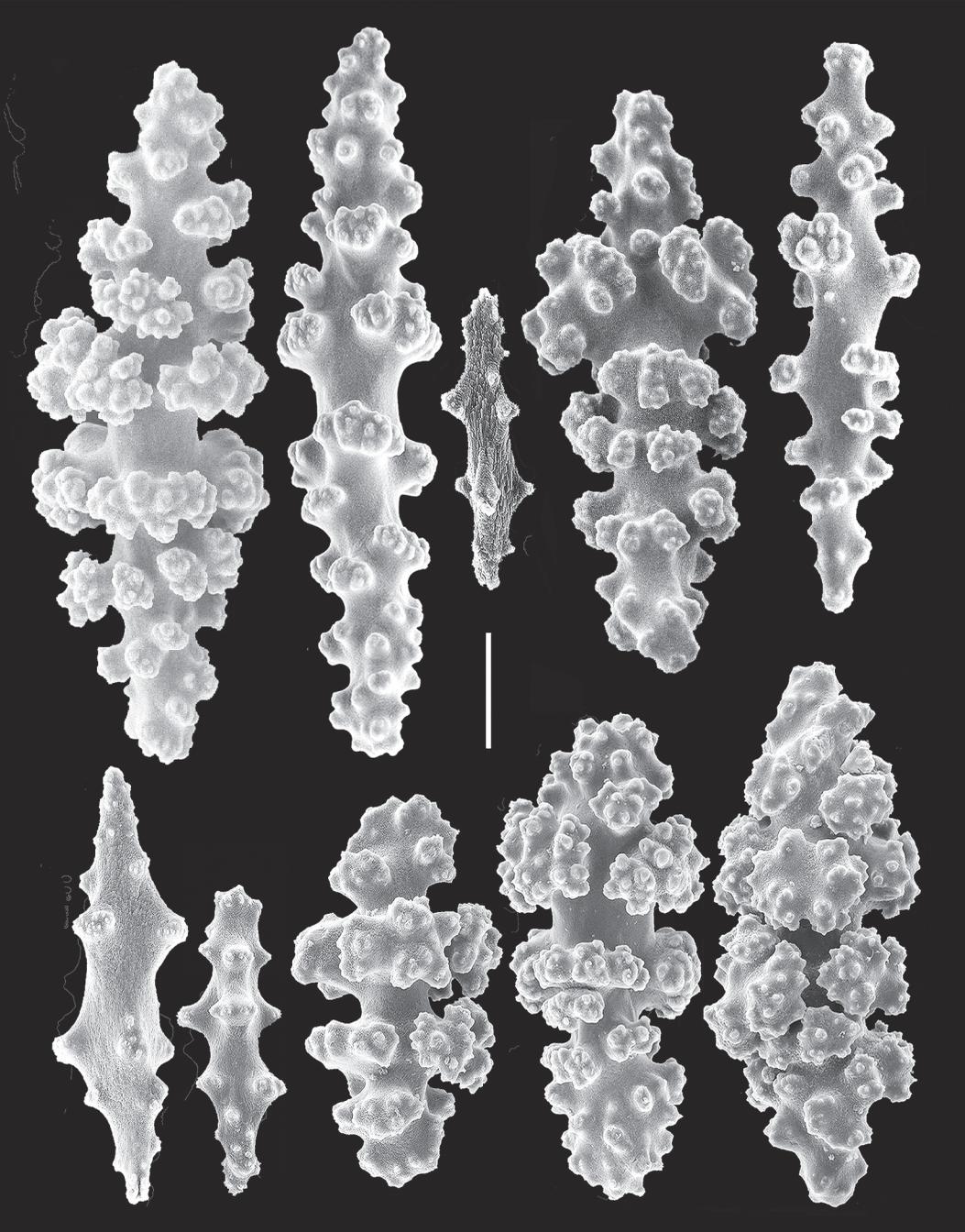


FIGURE 6. *Swiftia farallonesica* sp. nov. Scanning electron micrographs of coenenchymal sclerites — spindles. Scale bar = 0.03 mm.

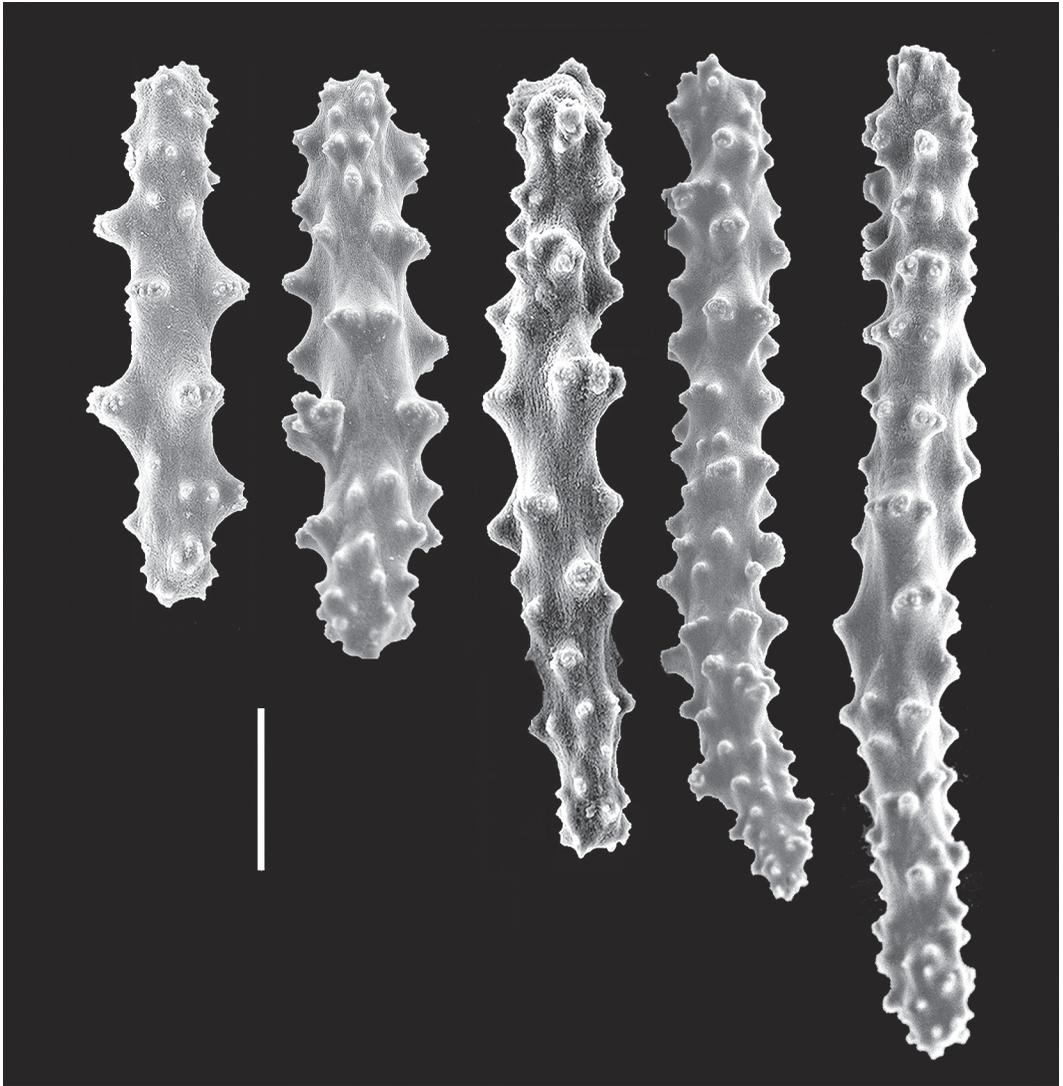


FIGURE 7. *Swiftia farallonesica* sp. nov. Scanning electron micrographs of anthocodial sclerites. Scale bar = 0.03 mm.

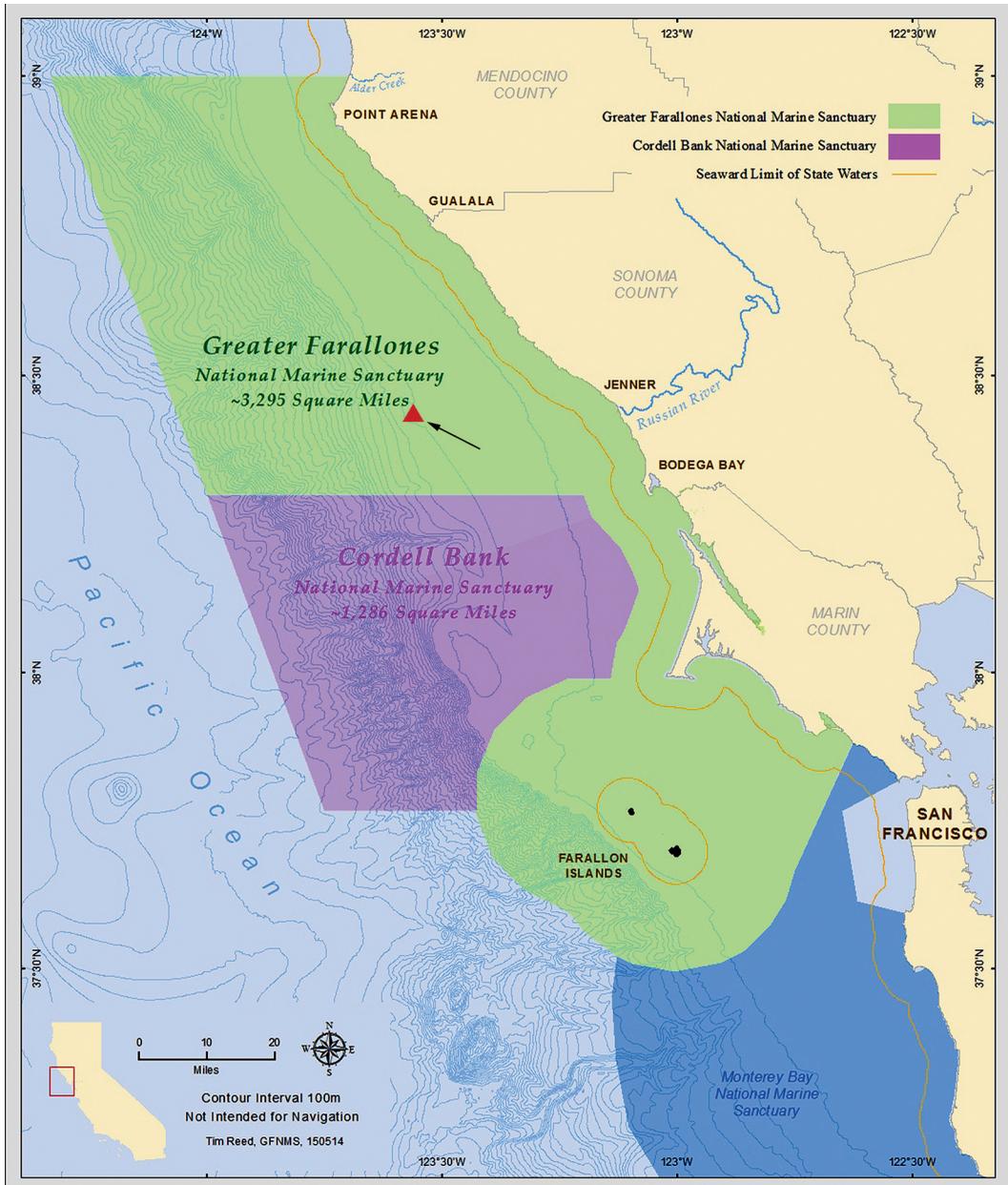


FIGURE 8. Map of the Greater Farallones National Marine Sanctuary (central California, USA), showing type locality of *Swiftia farallonesica* sp. nov. (represented by red triangle). Map modified from National Oceanic and Atmospheric Administration (2014).

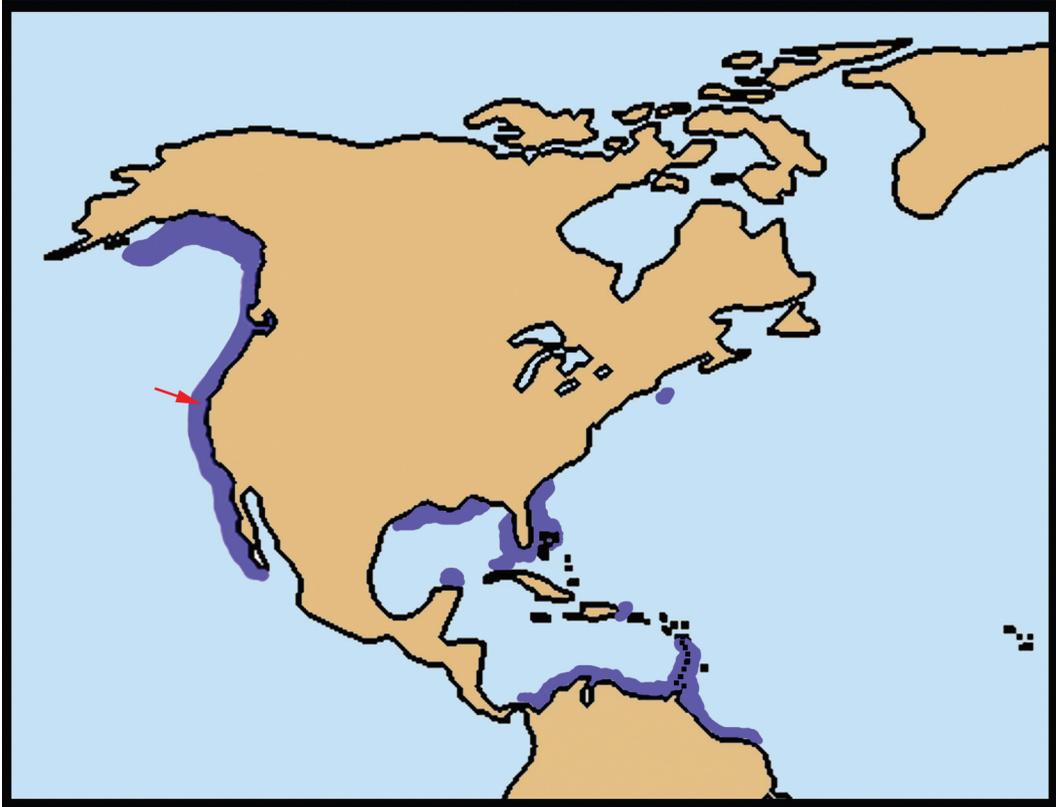


FIGURE 9. Map showing the known distribution of the genus *Swiftia* in North America and northern South America. Arrow shows type locality of *Swiftia farallonesica* sp. nov.

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