Reprinted from PCAS 56(5):53–65 (29 April 2005)

PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES

Volume 56, No. 5, pp. 53-65, 10 figs. April 29, 2005

New Taxa of Octocorals (Anthozoa: Octocorallia) from the Northeastern Pacific Ocean

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The octocorallian fauna of the Alaskan region is poorly known. Recently, several research projects have been initiated to explore the faunal elements of the continental shelf in the Gulf of Alaska. A wealth of material, including octocorals (mostly gorgonians with some pennatulaceans), has been collected by trawl nets during field research conducted by agencies such as the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA). A new genus of gorgonian has recently been described from the Aleutian Islands as *Alaskagorgia* Sanchez and Cairns, 2004. The present paper reports the discovery of an additional plexaurid gorgonian from the same region, and provides a description of it as a new genus and species. Additionally, an unusual new species of sea pen, genus *Cavernularia* (Family Veretillidae), is described from the central Aleutian island chain. The geographically nearest veretillid taxa outside of the type locality occur in the northwestern and eastern Pacific — Japan and Panama.

According to Wing and Barnard (2004), approximately 64 species of octocorals are presently known to occur in Alaskan waters. The authors also provide a key to the known octocoral taxa and color figures for twenty species. Other kinds of coral also included are scleractinians, stylasterine hydrocorals, and antipatharians.

The gorgonian family Plexauridae Gray, 1859 has relatively recently had a plethora of genera allocated to it along with the amalgamation of several groups at the ranks of family and subfamily. Included here are the Muriceidae, Paramuriceidae, Plexaurinae, and Stenogorgiinae (= Paramuriceinae) (Bayer 1981). The tropical western Atlantic genera were treated by Bayer (1961). Recent works have compiled previously described taxa and have added new generic names making a total of approximately 38 genera that are presently considered to comprise the family. These works include Grasshoff (1977) for the northern Atlantic Ocean and Mediterranean Sea, Grasshoff and Barbigant (2001) and Frabricius and Alderslade (2001) for the tropical western Pacific, and Sanchez and Cairns (2004) for Alaskan waters. The present paper describes an additional new genus and species from the Alaskan Aleutian Islands, making a total of 39 worldwide genera in the family Plexauridae. The new taxon does not closely resemble other plexaurid taxa.

In addition, a new species of the veretillid pennatulacean genus *Cavernularia* is described, also from the Aleutian Archipelago. The only other known taxa of vertetillid pennatulaceans from the northwestern and eastern Pacific Ocean include several species from Japan, Panama, and the Galápagos Islands (López-González, Gili, and Williams 2000; Kükenthal 1915; Hickson 1921; and Williams 1989, 1995).

METHODS

Material was collected on board a research vessel (the F/V "Vesteraalen" or the M/V "Sea Storm") using trawling gear, and was preserved in 75% ethanol. Sclerites were isolated from surrounding tissues by the use of sodium hypochlorite (household bleach). Micrographs were made using a Nikon Coolpix 990 digital camera, sometimes in combination with a Nikon SMZ-10 dissecting microscope or an Olympus CH-2 compound microscope. Original drawings of sclerites were made with an Olympus CH-2 compound microscope and an Olympus drawing tube. Scanning electron micrographs were taken using a LEO 1400 series scanning electron microscope. Digital images for the making of plates were manipulated using Adobe Photoshop software. Abbreviations used in the text are CAS (California Academy of Sciences, San Francisco), NMFS (National Marine Fisheries Service), and NOAA (National Oceanic and Atmospheric Administration — of the United States Department of Commerce).

SYSTEMATIC ACCOUNT

Order Alcyonacea Lamouroux, 1816
Family Plexauridae Gray, 1859

REMARKS.— Most of the taxa allocated to this family have relatively large sclerites, over 0.3 mm long (up to a maximum length of approximately 5 mm), with tubercular sculpture rarely arranged in whorls. In addition, both Bayer (1981:924) and Fabricius and Alderslade (2001:59) use the following axial characteristics to describe the family. The plexaurid axis often appears woody and fibrous, often brown or darker. The central core is wide, hollow, and cross-chambered. The surrounding axial cortex is soft, usually with hollow spaces called loculi that are sometimes filled with a fibrous substance or non-spicular calcite. In contrast, the family Gorgoniidae usually has small scerites, less than 0.3 mm long, with tubercles arranged in whorls. The axis is often dark brown or black. It has a narrow core and the cortex is very dense with few or no locules.

The new taxon described here is somewhat enigmatic in that it has small scerites, less than or equal to 0.15 mm in length, which is characteristic of the Gorgoniidae. Additionally, the tubercles of the spindles and radiates are sometimes arranged in whorls, but often they are not. Regardless of the problematic nature of these features, the new taxon is here placed in the family Plexauridae because the axis has a woody or fibrous appearance and wide and hollow central core, whereas the surrounding axial cortex is soft with easily observable amounts of non-spicular calcite (Fig. 1).

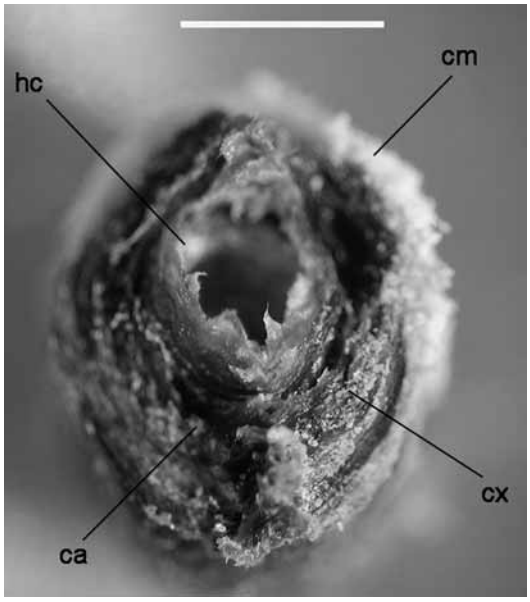

FIGURE 1. Non-type specimen (CAS 164584) of *Cryogorgia koolsae* gen. and sp. nov. Transverse section of a branch near the apical end showing the axis and thin coenenchyme; scale bar = 3.8 mm; **ca** – calcitic material, **cm** – coenenchyme, **cx** – axial cortex, **hc** – hollow core.

Genus *Cryogorgia* Williams, gen. nov.

TYPE SPECIES: *Cryogorgia koolsae* Williams, sp. nov., by monotypy

DIAGNOSIS.— Branching relatively sparse, mostly lateral but rarely dichotomous, planar, anastomosis absent. Terminal branches elongate, somewhat clavate. Azooxanthellate. Axis proteinaceous, flexible with wide hollow core, brown to dark brown, cylindrical near holdfast, slightly compressed in higher branches. Polyps monomorphic, retractile into polyp mounds or completely into coenenchyme, calyces absent. Coenenchymal sclerites leaf clubs, coarsely-tuberculated spindles, radiates, modified and often clavate radiates (some approaching wart clubs), and crosses. Sclerites colorless. Wet-preserved coenenchyme tan-white.

ETYMOLOGY.— The new generic name is derived from the Greek, *Kryos* (cold or chilly) and the commonly used suffix for a gorgonian octocoral, *-gorgia*; in reference to the cold nature of the type locality of this gorgonian.

Cryogorgia koolsae Williams, sp. nov.

Figs. 1–8

MATERIAL EXAMINED.— HOLOTYPE: CAS 151364, Northeastern Pacific Ocean, United States, Alaska, Aleutian Islands, 52.25ºN 171.70ºW, 406 m depth, Haul 79, 11 June 2000, collected by E.J. Kools aboard F/V "Vesteraalen," NMFS Aleutian Survey 2000, one whole colony wet preserved in 75% ethanol. PARATYPE: CAS 150650, Northeastern Pacific Ocean, United States, Alaska, Aleutian Islands, 52.07º N 177.25º W, 86 m depth, Haul 146, 26 June 2000, collected by E.J. Kools aboard F/V "Vesteraalen," NMFS Aleutian Survery 2000, one whole colony wet preserved in 75% ethanol. OTHER MATERIAL: CAS 164584, Northeastern Pacific Ocean, United States, Alaska, Aleutian Islands, 51.75ºN 175.67ºW, 83 m depth, Haul 101, 7 July 2002, collected by R.J. Van Syoc aboard M/V "Sea Storm," three whole colonies wet preserved in 95% ethanol. CAS 168893, Northeastern Pacific Ocean, United States, Alaska, Aleutian Islands, 52.31ºN 173.65ºW, 402 m depth, Haul 144, collected by R.J. Van Syoc aboard M/V "Sea Storm," one whole colony wet preserved in ethanol.

DESCRIPTION OF HOLOTYPE.— Growth form and size (Figs. 2–3): The holotype measures 370 mm long by 150 mm wide. The basal trunk is 115 mm in length before the first side branch arises. It averages approximately 10 wide and 8 mm deep, as it is slightly compressed. The branching is irregular (lateral) and sparse. The terminal branches are 30–100 mm in length.

Polyps (Figs. 3A–E): The polyps of the holotype exhibit various states of retractility. Some are preserved totally retracted and flush with the surrounding coenenchyme — especially those along the main stem and along the thicker branches, whereas others are preserved in various stages of exsertion. The length of the exserted polyps is usually less than 2 mm. They vary in shape from mound-like and hemispherical to cone-shaped or somewhat cylindrical (Fig. 3E). These mounds or cones are thickly set with coenenchymal sclerites (Fig. 5). In all cases, the anthocodiae are at least partly retracted or hidden. Examination of dissected polyps has not shown the anthocodiae to contain sclerites.

Sclerites (Figs. 2C, 4–7): Coenenchymal sclerites of the polyp-bearing branchs, branch tips, and polyp mounds are of several different forms: foliates or leaf clubs (0.07–0.12 mm in length); seven- and eight-radiates (0.07–0.10 mm long); clavate forms (0.08–0.15 mm in length); crosses (0.10–0.11 mm long); and modified radiates, cylinders, and spindles (0.07–0.15 mm in length). Anthocodial sclerites are apparently absent.

Color (Figs. 2–3): The axis is dark brown to black. The coenenchyme and retracted polyps are grayish white to tan-white. The sclerites are colorless.

FIGURE 2. A–B. Holotype of *Cryogorgia koolsae* gen. and sp. nov.; scale bars = 65 mm. C. Three leaf club sclerites from the surface coenenchyme of a terminal branch; scale bar = 0.05 mm.

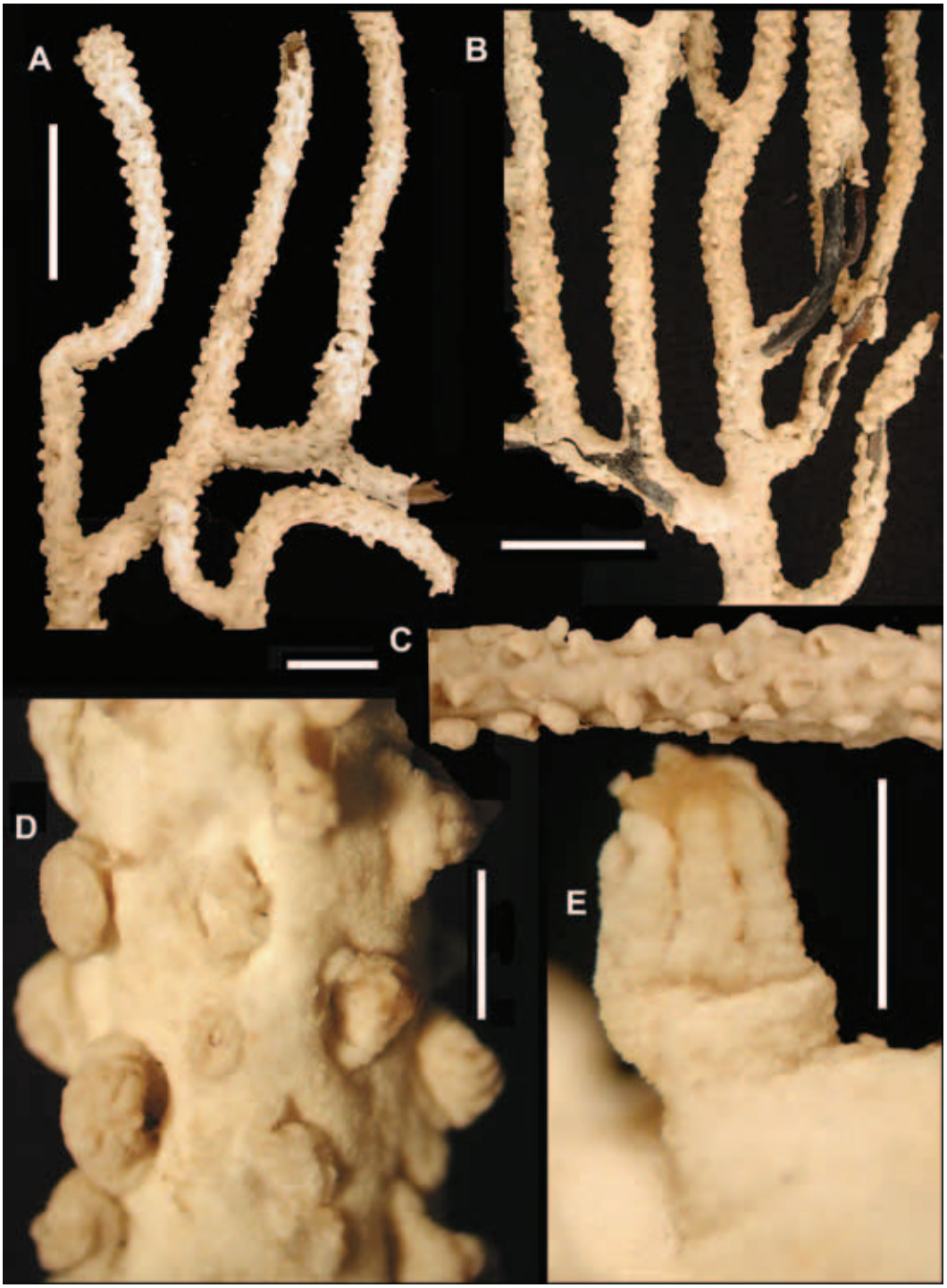

FIGURE 3. Holotype of *Cryogorgia koolsae* gen. and sp. nov.; details of branches and polyps. A–B. Details of branching patterns. C–D. Details of a single branch and polyps. E. Detail of a single polyp. Scale bars: A = 25 mm, B = 25 mm, C = 5 mm, D = 2 mm, E = 1 mm.

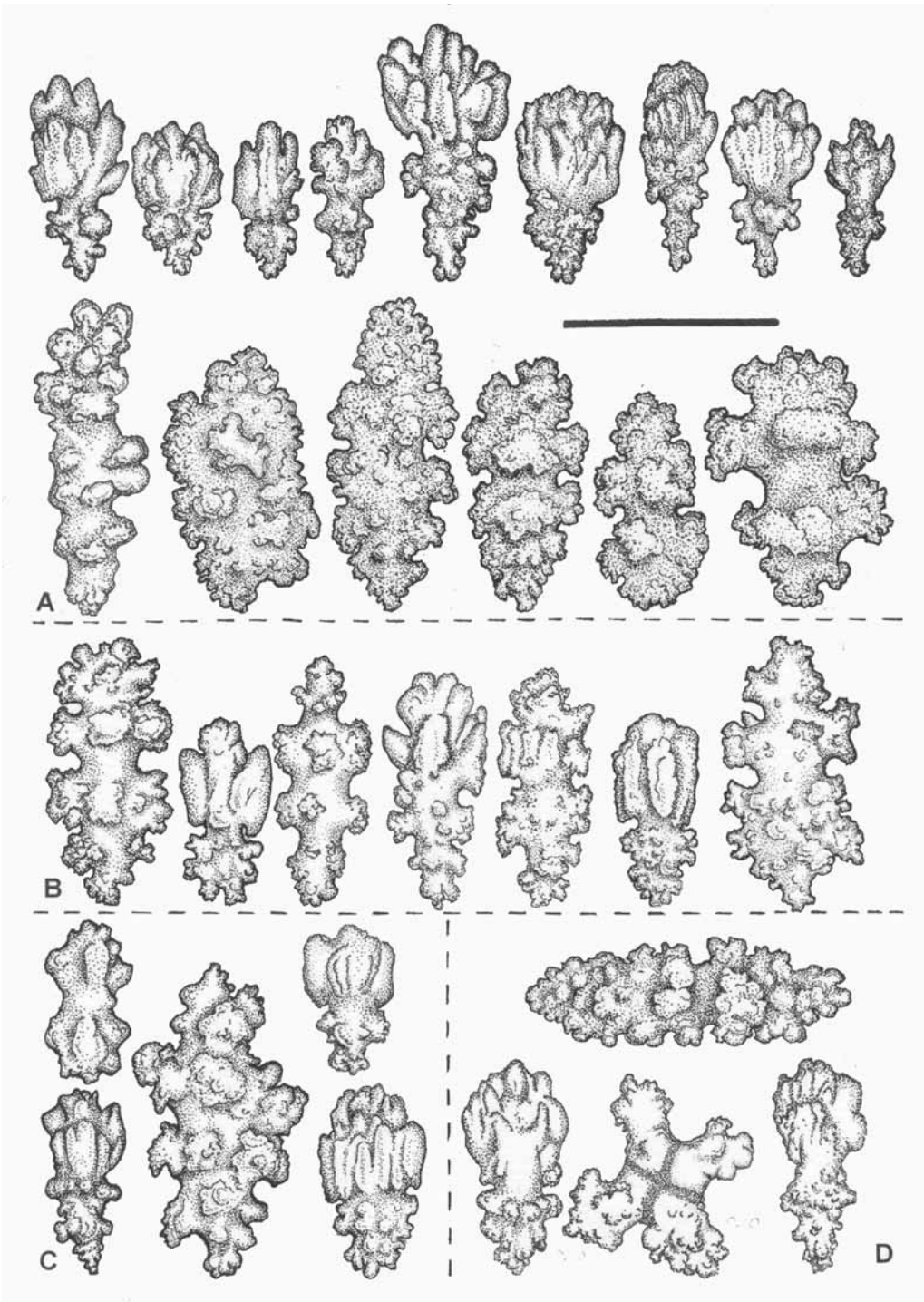

FIGURE 4. *Cryogorgia koolsae* gen. and sp. nov. Coenenchymal sclerites from a polyp-bearing branch; scale bar = 0.10 mm. A. Holotype (CAS 151364). B. Paratype (CAS 150650). C. Non-type specimen (CAS 164584). D. Non-type specimen (CAS 168893). Scale bar = 0.10 mm.

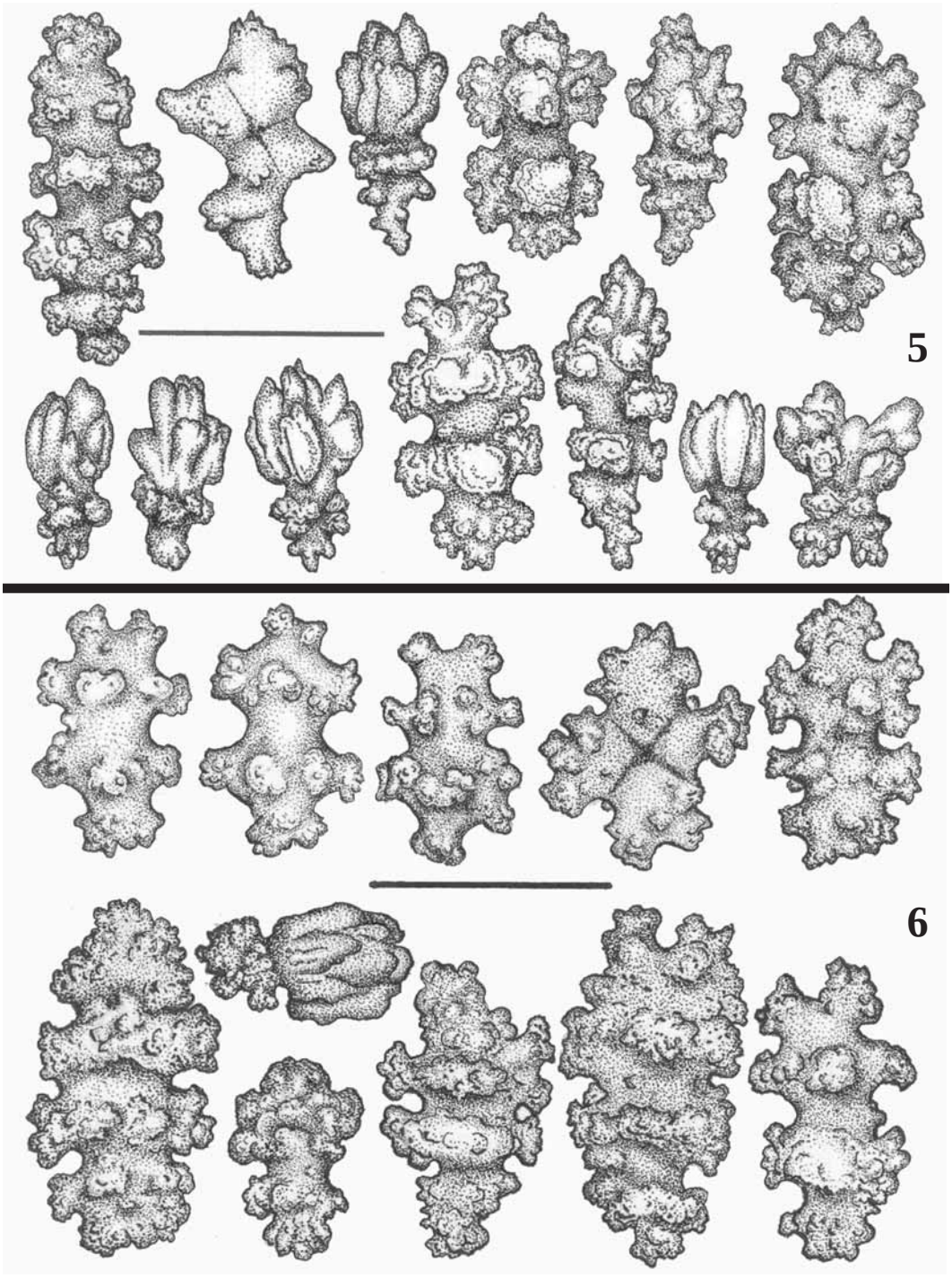

FIGURE 5 (above) *Cryogorgia koolsae* gen. and sp. nov. Coenenchymal sclerites from a mound formed by a retracted polyp; scale bar = 0.10 mm. FIGURE 6 (below). Holotype of *Cryogorgia koolsae* gen. and sp. nov. Coenenchymal sclerites from the base of the holdfast; scale bar = 0.10 mm.

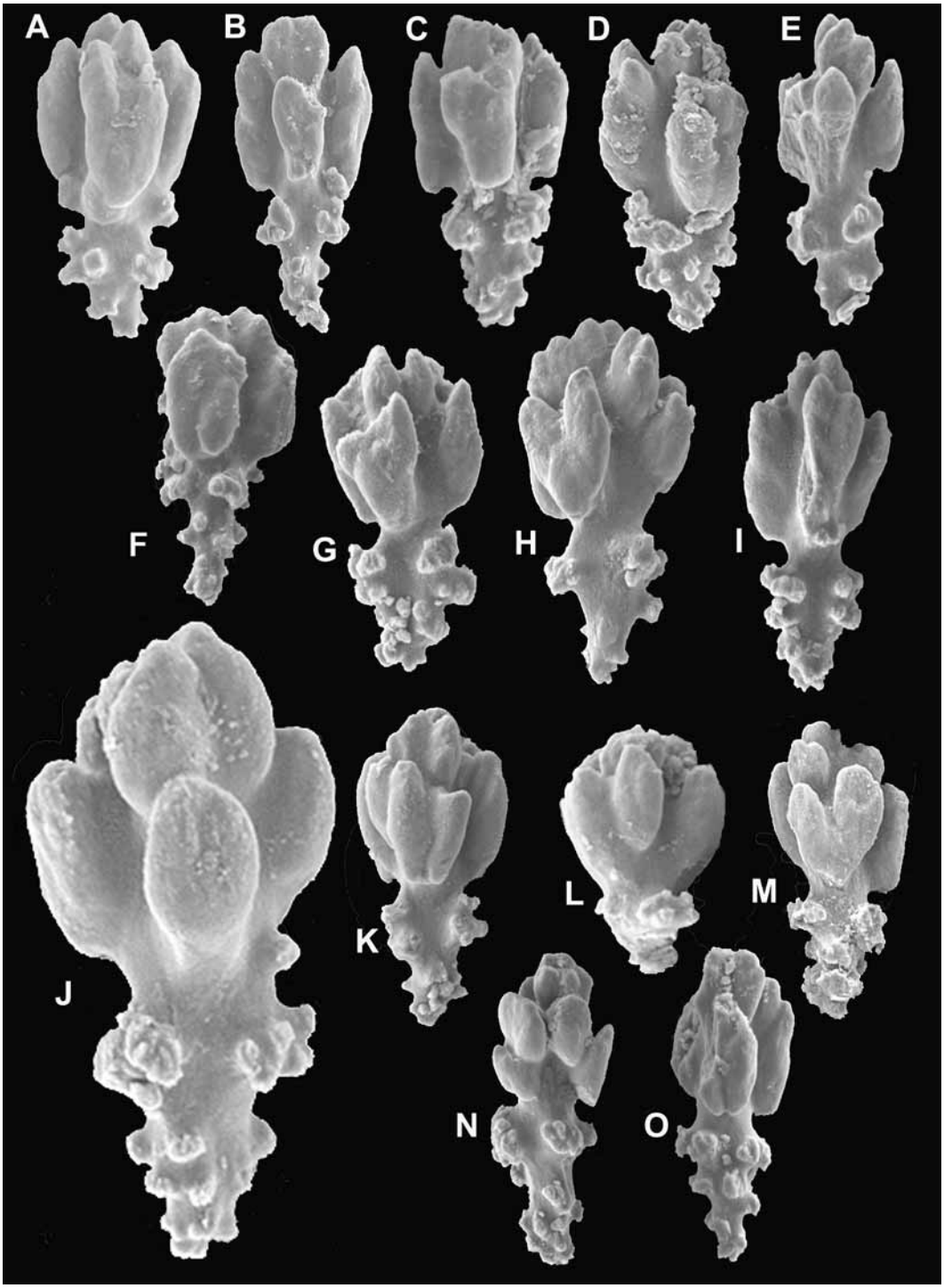

FIGURE 7. Holotype of *Cryogorgla koolsae* gen. and sp. nov. Scanning electron micrographs of leaf clubs from the coenenchyme of a terminal branch. A. 0.08 mm. B. 0.11 mm. C. 0.08 mm. D. 0.08 mm. E. 0.09 mm. F. 0.08 mm. G. 0.07 mm. H. 0.09 mm. I. 0.08 mm. J. 0.10 mm. K. 0.08 mm. L. 0.06 mm. M. 0.10 mm. N. 0.12 mm. O. 0.10 mm.

Etymology.— This species is named for its discoverer, Elizabeth J. Kools, (Department of Invertebrate Zoology and Geology, California Academy of Sciences, San Francisco).

Distribution.— This new taxon is presently known from four localities in the central Aleutian Archipelago of Alaska, northern Pacific; 83–406 m depth (Fig. 8).

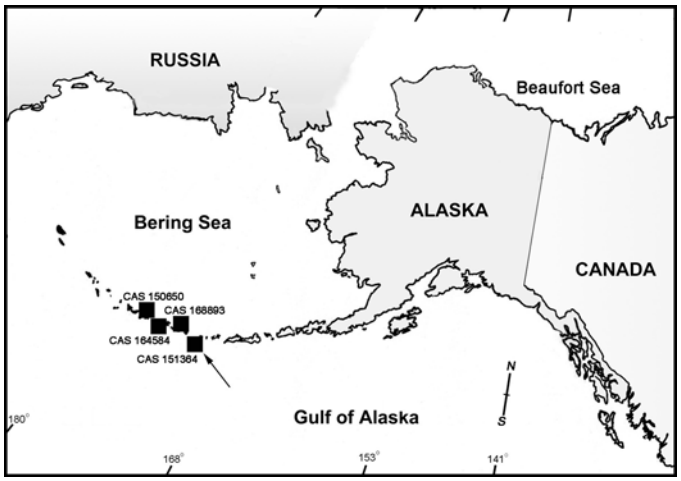

Figure 8. Map of the Aleutian Island Chain showing collecting stations (with collection numbers) for *Cryogorglia koolsae* gen. and sp. nov. (■); arrow shows type locality.

Order Pennatulacea Verrill, 1865
Family Veretillidae Herklots, 1858

Genus *Cavernularia* Valenciennes in Milne-Edwards and Haime, 1850

Cavernularia vansyoci **Williams, sp. nov.**
Figs. 9–10

Material Examined.— Holotype: CAS 168894, Northeastern Pacific Ocean, United States, Alaska, Aleutian Islands, 52.0663° to 52.07043ºN; 175.30231° to 175.2824ºW, 86–93 m depth, Haul Number 66, 13 June 2002, collected by Robert Van Syoc on board M/V "Sea Storm," NMFS Aleutian Survey 2002, one whole colony cut longitudinally into two halves and wet preserved in 75% ethanol.

Description of holotype.— Growth form and size (Figs. 9A–B, 10A): The colony is clavate, 33 mm in total length.

Polyps (Figs. 9A–D, 10A): The polyps of the holotype are all preserved completely retracted. They are flush with the surface of the rachis and nowhere do they extend past the surface. Calyces are absent. The polyps and polyp walls contain minute sclerites, similar to the sclerites of the surperficial coenenchyme and peduncular interior. As in the coenchymal tissues, these sclerites can only accurately be detected at microscope magnifications at 400× or higher.

Internal Anatomy (Figs. 9C–D): The specimen was cut longitudinally into two halves to reveal internal structures. Gastric cavities are approximately 1 mm wide and 4–5 mm long. Numerous ova can be concentrated in interior-most parts of some of the cavities. In the center of the colony, several vertical canals can be seen. A calcified axis is absent altogether.

Sclerites (Figs. 9E, 10B–C). The sclerite complement is composed entirely of very small ovals

FIGURE 9. *Cavernularia vansyoci* sp. nov. A–B. External views of both halves of the longitudinally sectioned holotype. C–D. Internal views of both halves of the longitudinally sectioned holotype. E. Photomicrographs of three sclerites from the superficial coenenchyme taken from the region of juncture between the rachis and peduncle of the holotype; the sclerites are actually colorless, color shown here is due to properties of the light microscope at high power. Scale bar for A-D = 16 mm; scale bar for E = 0.005 mm.

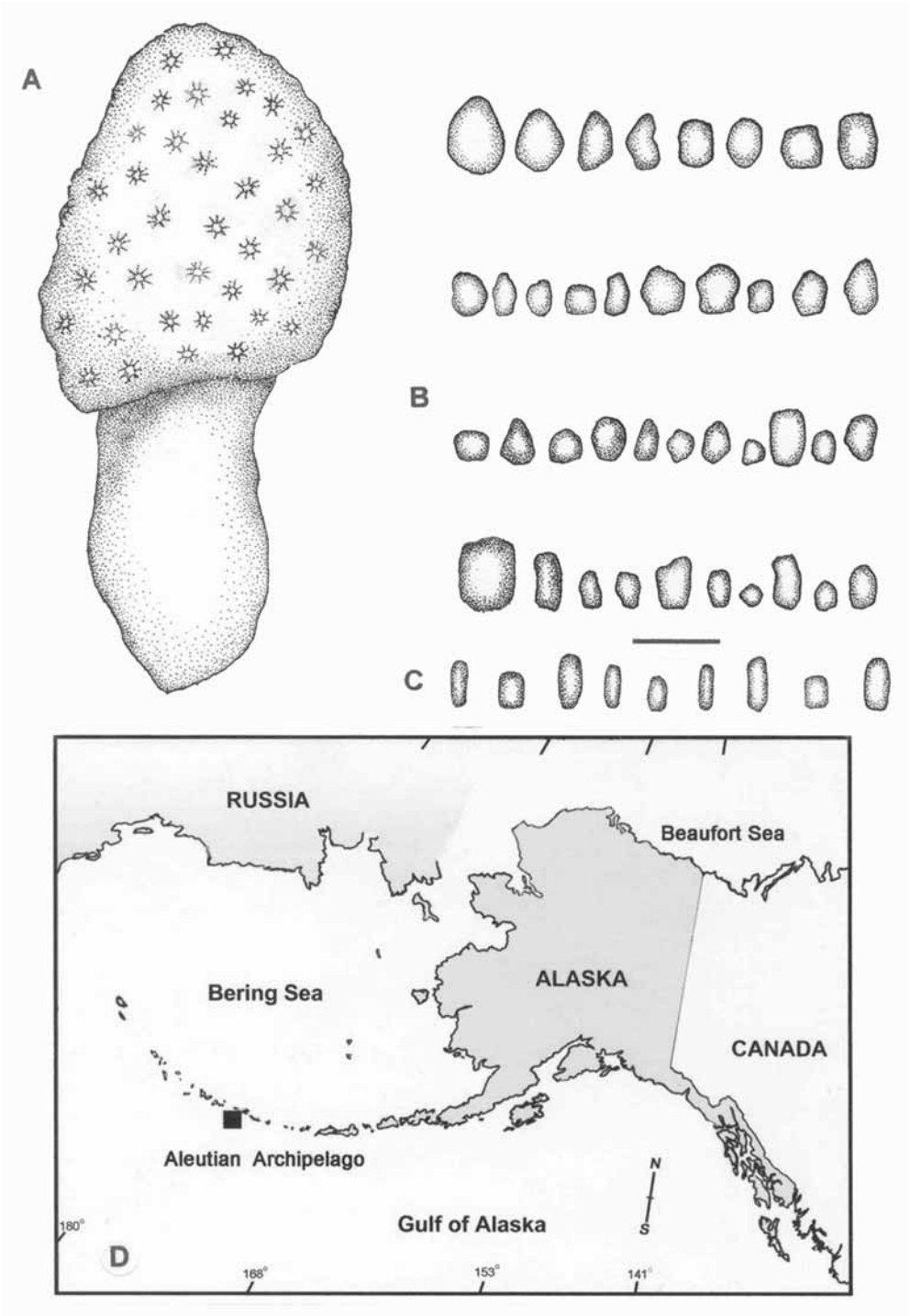

FIGURE 10. *Cavernularia vansyoci*, sp. nov. A. Whole wet-preserved holotype, 33 mm in length. B. Coenenchymal sclerites from the surface of the junction between the rachis and the peduncle. C. Sclerites from the interior of the peduncle. Scale bar for B and C = 0.01 mm. D. Map showing locality of the holotype (■ = collecting station).

(0.003–0.007 mm in length). The shape of these sclerites is only accurately discernable at microscopic magnifications of 400x or more. They vary in shape from rounded-rectilinear to oval, more-or-less round, or elliptical. Some sclerites are irregular in shape. These minute sclerites are relatively dense is all parts of the colony examined, including the coenenchyme of the surface of the rachis and peduncle, as well as the interior of the colony, but seem to be less densely distributed in the anthocodiae and polyp walls.

Color (Figs. 9A–D). The color of the preserved holotype is grayish white throughout. The sclerites are colorless.

ETYMOLOGY.— This species is named for its discoverer, Robert Van Syoc, Department of Invertebrate Zoology and Geology, California Academy of Sciences, San Francisco.

DISTRIBUTION.— The new species is known only from the type locality in the Aleutian Islands of Alaska; 86–93 m depth (Fig. 10D).

DISCUSSION

The most recent compendium of Alaskan corals is that of Wing and Barnard (2004), which includes a listing of twelve species of plexaurid octocorals and twelve species of pennatulaceans. Of these, three plexaurids and three pennatulaceans are figured with color photographs. The taxa figured are identified as belonging to five genera — *Muriceides*, *Swiftia*, *Protoptilum*, *Ptilosarcus*, and *Halipteris*. The present paper describes a new genus and species of plexaurid gorgonian and a new species of the pennatulacean genus *Cavernularia* — these are newly recorded taxa to the Alaskan octocoral fauna.

ACKNOWLEDGMENTS

I gratefully appreciate the contributions and services of Elizabeth Kools and Robert Van Syoc (Department of Invertebrate Zoology and Geology, California Academy of Sciences), and the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA), for making this project possible.

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