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A new species of *Chrysogorgia* (Anthozoa: Octocorallia) from the Antarctic

Stephen D. Cairns

Department of Systematic Biology—Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560-0163, U.S.A.

Abstract.—A new species of *Chrysogorgia, C. antarctica,* is described from the Ross Sea, Antarctica, representing the first chrysogorgiid described from south of 50°S. It is distinguished by having only scales in its body wall and tentacles (Group C), a dichotomously branching main stem with a 1/4R branching sequence, and uniquely shaped tentacular sclerites. Based on an extrapolation of the height (and thus age) of the colony and the number of concentric axial lamellae, it was determined that one lamella is secreted approximately every 43 days, not on an annual basis as in tropical species that have been examined.

Chrysogorgiids are widespread in the world oceans at depths of 10–3375 m (see Cairns 2001), but none of the approximately 91 species has ever been reported from the Antarctic (Keller & Pasternak 2001). The farthest south any chrysogorgiid has been reported is *Chrysogorgia flexilis* (Wright & Studer, 1889) from off Isla Wellington in the fjord region of southern Chile at 49°24′S, 74°23′W. Thus, the discovery of a robust specimen of an undescribed species of *Chrysogorgia* from the Ross Sea considerably extends the known range of both the genus and family. Also, the large size of the specimen allowed for an estimation of its age and the periodicity of the production of its concentric axial lamellae.

Methods

The SEM photomicrographs were taken by the author using an AMRAY 1810 scanning electron microscope in the SEM Laboratory of the National Museum of Natural History. Mineralogical analysis of the axis and sclerites was done by standard X-ray diffraction techniques using a Scintag X-Ray Diffractometer with CuKα radiation, a Peltier detector, and zero-background quartz mounting plates.

The cross-section of the axis was prepared for SEM by sanding with very fine paper and then immersing the polished face in Surgipath Decalcifier I Solution for 45 seconds.

Subclass Octocorallia
Order Alcyonacea
Suborder Calcaxonia
Family Chrysogorgiidae Verrill, 1883

Chrysogorgia antarctica, new species
Figs. 1–3

Description.—The type material consists of a large colony and several dozen smaller branches, presumably fragments of the same colony. The colony consists of a main stem 23 cm in height and 5.94 × 5.41 mm in diameter at its broken base, the holdfast not being present. A cross-section through the base reveals approximately 277 smooth, concentric lamellae, occurring at an average distance of every 10.7 μm. These smooth lamellae become slightly undulating near the surface of the axis, resulting in shallow longitudinal grooves on the surface of the axis. At a height of 7 cm the main stem

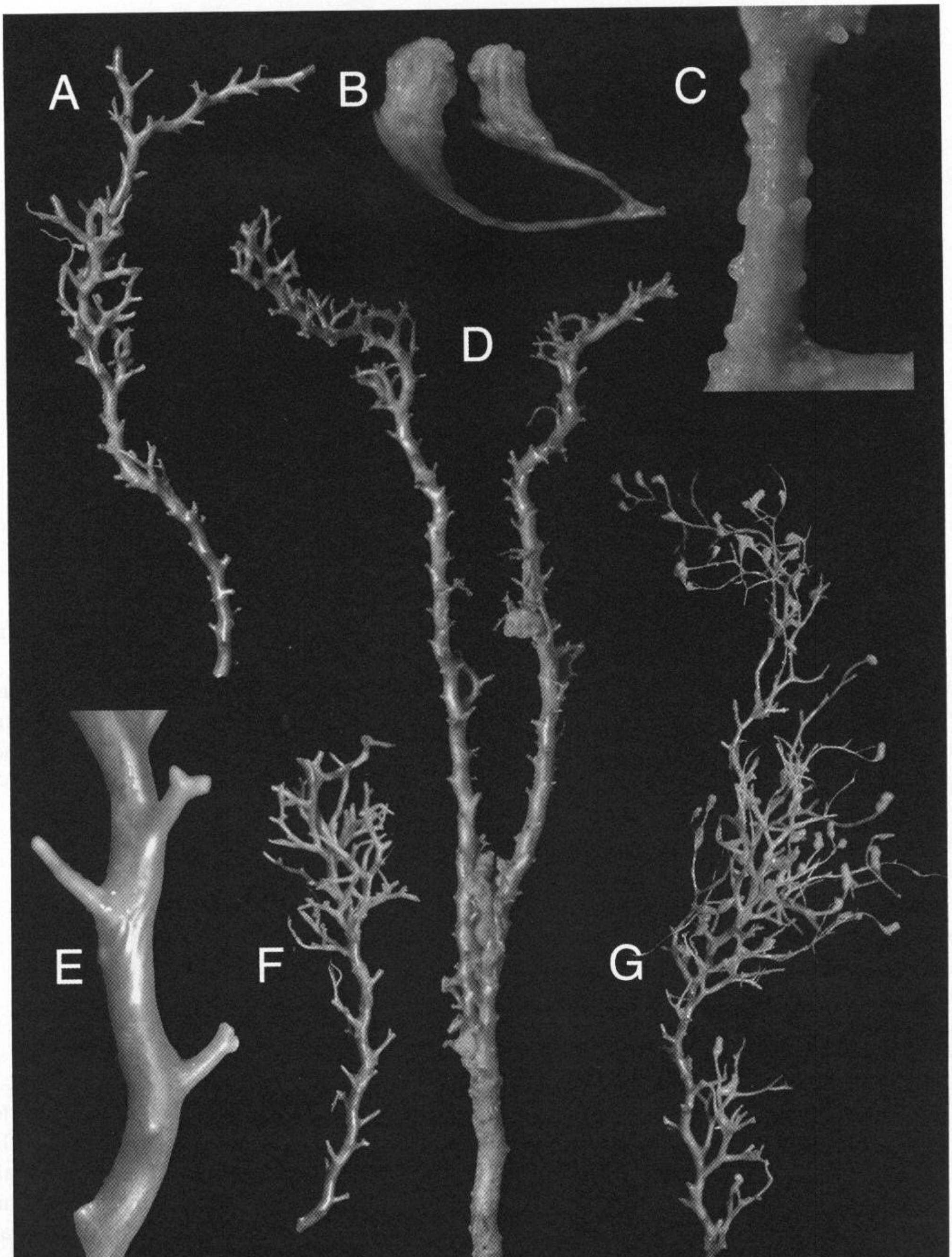

Fig. 1. *Chrysogorgia antarctica,* holotype, USNM 82103. A, F, G, distal branches, the base of Fig. F showing the spiral (1/4R) branching sequence, ×0.91, 1.25, 1.20, respectively; B, two polyps, ×5.8; C, distal branch bearing nematozooids, ×19; D, the main stem, ×0.71; E, smaller-diameter stem, ×4.4.

bifurcates, the angle between the two resulting secondary stems being only 20°; at a colony height of 19 cm (and stem diameter of 3.1 mm) both of these stems also bifurcate, resulting in four stems. Based on the numerous broken branches it would appear that another two or three generations of dichotomous stem branching occurs. The thick, lower stems are straight (not corkscrew or spiral in shape, as in most chrysogorgiids), bearing short, often broken, dichotomously branching side branches that are rarely more than 1 cm (or two internodes) in length. These short side branches do not bear polyps, and those in the vicinity of the first stem bifurcation anastomose with the other secondary stem, producing a semi-enclosed cavity for a polychaete worm tube. The branching sequence of these short branches from the thick main stems is not clear. However, the upper, more slender stems, near and above the second stem bifurcation, ascend in a spiral corkscrew manner which is more typical of the genus, and the branching sequence is predominantly 1/4R, each successive branch originating from the stem being offset by 90° to the right (viewed from above) from the preceding, resulting in roughly four longitudinal rows of branches. The 1/4R branching sequence is not as clear-cur as in most other congenerics, but is the predominant pattern. The distance between branches is 2.0–2.5 mm, resulting in an orthostiche interval between aligned branches of 7–10 mm. The dichotomously branched side branches in the distal portion of the colony are bushy and often anastomose with one another, have up to 17 nodes, and are up to 60–65 mm in length. The internodes are 1–3 mm in length, but the slender (0.1 mm in diameter) terminal twigs may be up to 10 mm in length. Branching is highly asymmetric, usually only one internode of each dichotomy continuing to branch again. The stems and branches have a golden-yellow luster. Polyps are sparse, occurring predominantly on the terminal twigs: usually one occurs at the tip of each terminal twig, sometimes two occur on the terminal twig, and rarely three polyps will occur on a long terminal twig. Rarely a polyp will also occur at the node that leads to a terminal twig.

Polyps are elongate and cylindrical, the distalmost polyp on a twig up to 2.7 mm in height and 1.2 mm in diameter, whereas more proximal polyps are usually smaller, about half this size. The base of some polyps is slightly enlarged into a brood chamber, containing 6–8 yellow developing oocytes, each about 0.35 mm in diameter.

All sclerites are unornamented (smooth) scales with extremely finely serrated edges, their size and shape differing slightly within the colony. The edge serration is more of a pleating than a true serration, each small ridge being oriented perpendicular to the sclerite edge and only 2.5–3.0 μm apart (Fig. 2A, right). Coenenchymal sclerites consist of small, elliptical scales 0.10–0.13 mm in length and 0.025–0.040 mm in width, the smaller value of the width corresponding to the medial constriction. The coenenchyme of both stems and branches is covered by numerous, closely-spaced cnidal papillae (nematozooids), each 0.15–0.20 mm in diameter and height. The sclerites of the brood chamber and/or polyp wall are larger and broader scales, 0.27–0.37 mm in length and 0.07–0.12 mm in width, also usually slightly medially constricted, the lower value of the width corresponding to the constriction. They are transversely to obliquely arranged on the body wall and slightly overlapping. The base of each of the eight tentacles contains a conspicuous, elongate, biconvex region devoid of sclerites, about 0.5 mm long and 0.1 mm wide, which allows for unimpeded outfolding of tentacles when expanded (Bayer & Stefani 1988). Each naked region is flanked by a pair of elongate, longitudinally-arranged scales up to 0.48 mm in length, one end being slender (0.05 mm) and rounded, the other end wider (up to 0.12 mm), thicker, and angular in shape (Fig. 2E). There is no edge serration on these sclerites. The narrow portion of these sclerites is quite thin

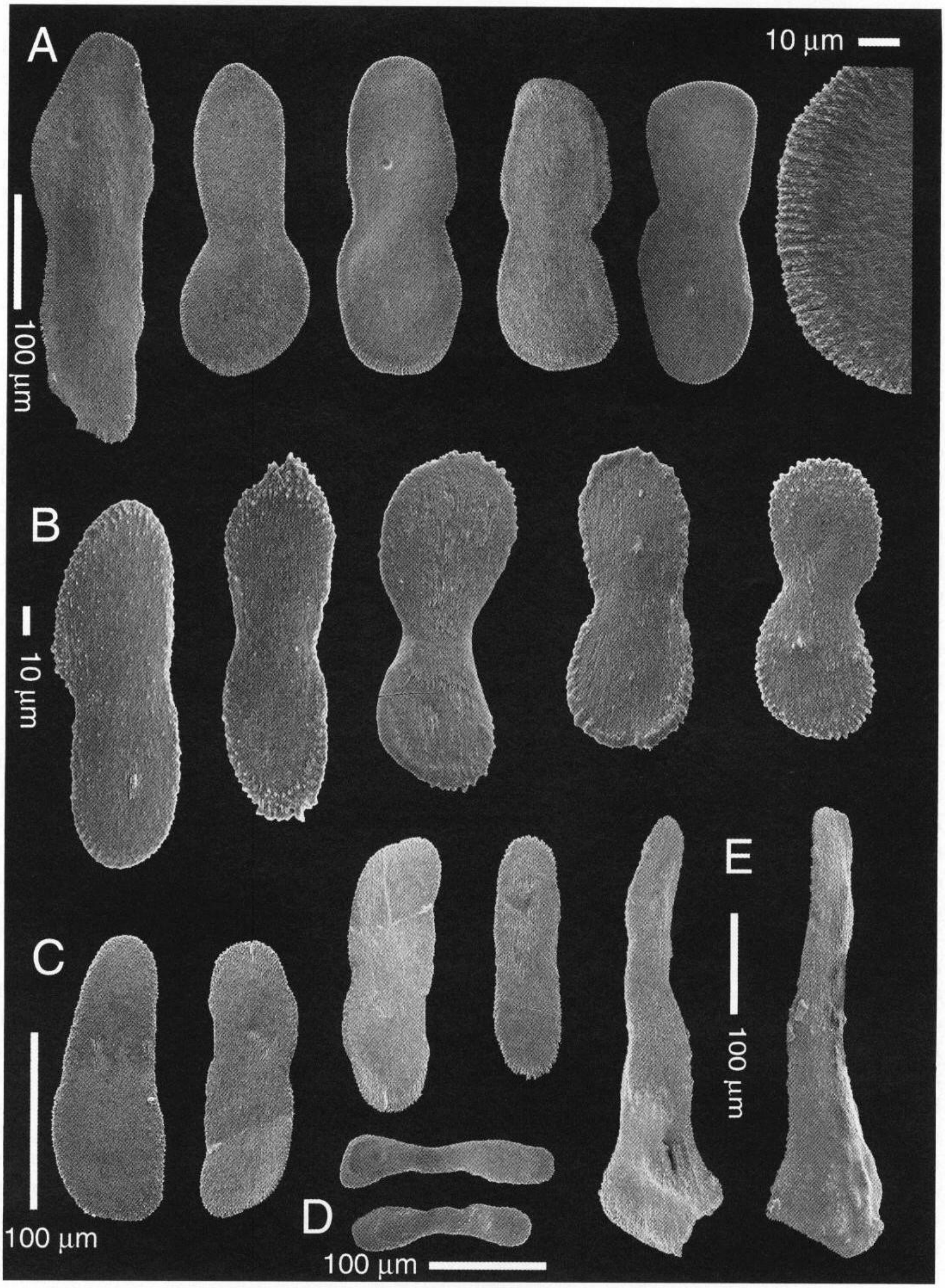

Fig. 2. *Chrysogorgia antarctica,* sclerites from holotype. A, five scales from body wall, and enlargement of pleated edge (at right), B, five coenenchymal scales; C, four scales from distal tentacles; D, two pinnular scales; E, inner and outer views (left and right images, respectively) of a pair of scales adjacent to naked region at base of each tentacle.

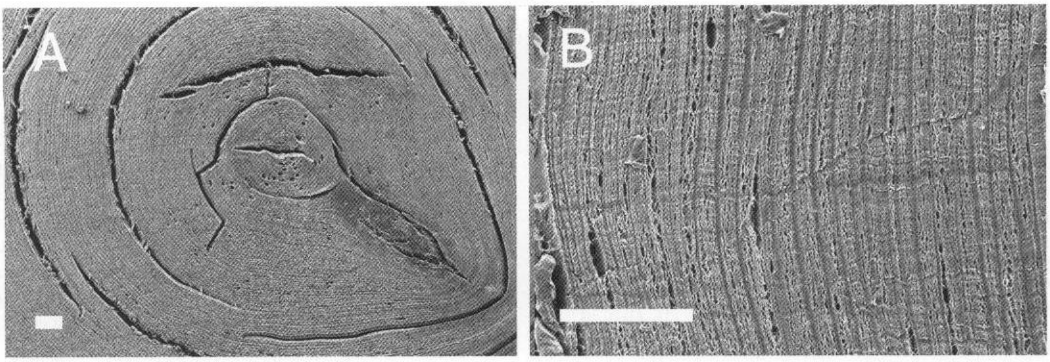

Fig. 3. *Chrysogorgia antarctica,* holotype. A, B, cross-section of base of large stem, showing concentric banding of axial lamellae. Scale bar in both images is 100 μm.

(about 0.012 mm), the wider end, which is arranged in the proximal position of the tentacle, is thicker, and is slightly convex on its outer surface and slightly concave on its inner surface. The remainder of each tentacle is covered with roughly rectangular to ellipsoidal scales 0.12–0.17 mm in length and 0.04–0.05 mm in width; pinnular scales are equal in length, but medially constricted, reduced to a medial width of 0.022–0.025 mm.

The mineralogical composition of the axis is Mg-calcite (9.7 mole % MgCO3), which is similar to values obtained for two other chrysogorgiids by Bayer & MacIntrye (2001). There was no holdfast available to analyze, but the composition of the sclerites was also Mg-calcite (9.1 mole % MgCO3), which is consistent with the polymorph found in all octocoral sclerites samples to date (Bayer & Macintrye 2001).

Discussion.—*Chrysogorgia* is one of the most speciose of the approximately 280 alcyonacean genera, its 60 species (see Cairns 2001) ranking it as seventh or eighth in species richness. Versluys (1902) facilitated comparison among species by dividing the genera into three groups based on the type of sclerites in the body wall and tentacles. *C. antarctica* clearly falls within Group C, also called the "Squamosae typicae," its 15 species being characterized by having only scales (no rods or spindles) in both body wall and tentacles. Versluys further subdivided this group into subgroupings based on branching sequence, i.e., 1/3L, 1/4L, and 2/5L. *C. antarctica* has a branching sequence of 1/4R, which distinguishes it from all other species in its group. Several species in Group B have a 1/4R branching sequence (see Cairns 2001), but species in that group are characterized by having rods and/or spindles in their tentacles. *C. antarctica* also appears to be unique in the repeated dichotomous branching of its main stem, and in the unique shape of the tentacular scales that border the naked region. And, although not unique to *C. antarctica,* the presence of branch nematozooids is rare in this genus.

The concentric axial lamellae are assumed to be laid down with temporal regularity, but the time interval between each lamella can only be speculated. The growth rate of only one chrysogorgiid, *C. agassizii,* has been measured by repeated in situ observations (Vinogradova 2000). He found its annual growth in height to be about one cm. The holotype of *C. antarctica* is 23 cm in height but was probably at least another 10 cm taller if its distal branches were intact, resulting in an estimated height of 33 cm and a hypothetical age of 33 years. SEM of a polished and partially decalcified cross-section through the base of the axis (Fig. 3) shows that the width of a calcified growth band between lamellae varies from 5.2 to 15.5 μm, averaging 10.74 μm (σ = 2.92).

If the greater radius of the axial stem is 2.97 mm, then approximately 277 growth bands could be expected to be present; these bands and thinner darker lamellae are visible even with a dissecting microscope at ×50. Using these approximations, this number of growth bands laid down over 33 years would yield an average increment of one band every 43.5 days, or a range of 31.8 to 55.5 days if the range of the standard deviation is used. This roughly lunar periodicity is quite different from the annual banding found in shallow-water plexaurid species (Grigg 1974, Opresko 1974).

Etymology.—Named for the general region from which the type was collected.

Material examined.—One colony in numerous fragments (holotype), *Eltanin* 27-1901, USNM 82103. Type locality: 76°30′S, 174°54′E (off Cape Crozier, western Ross Sea, Antarctica), 445–448 m, 20 Jan 1967.

Distribution.—Known only from the type-locality.

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