

**The Genus *Grasshoffia* with the Description of a
New Deep-water Species from the Northern Philippines
(Octocorallia: Pennatulacea: Virgulariidae)**

Gary C. Williams

*Department of Invertebrate Zoology and Geology, California Academy of Sciences,
55 Music Concourse Drive, San Francisco, California 94118, USA; E-mail: gwilliams@calacademy.org*

A new species of the recently described pennatulacean genus *Grasshoffia*, collected by beam trawl, is described from deep-water off southern Luzon in the Philippines. The new species is here allocated to the genus *Grasshoffia* based on the presence of numerous minute rod-like sclerites in the polyp walls and polyp leaves. The sclerites in the new species are distinctive in that they are more-or-less rectangular in shape with truncate apices, unlike the type species of the genus, as well as other species of pennatulaceans. The two species of *Grasshoffia* are known only from widely disparate regions of the world – the Gulf of Guinea in eastern Atlantic and the Philippine Archipelago in the western Pacific.

KEYWORDS: Pennatulacea, virgulariid sea pen, *Grasshoffia*, northern Philippines, deep-sea, synopsis and key to species of the genus.

During the deep-water component of the 2011 Hearst Philippine Biodiversity Expedition of the California Academy of Sciences and various agencies in the Philippines (Williams & Gosliner, 2014), deep-water collecting was conducted in the Verde Island Passage from Batangas Bay to the northwest of the Lubang Islands, primarily utilizing either beam or otter trawling nets, and ranged in depth from 63–2350 m (Iwamoto and McCosker, 2014; Williams, 2014).

MATERIALS AND METHODS

In the period between 28 May and 4 June 2011, thirty-one deep-water bottom trawl stations were explored on board the Philippine research ship *M/V DA-BFAR* in the Verde Island Passage of the Philippines — the region between southwestern Luzon, northern Mindoro, and the Lubang Islands. One such deep-water collecting station was in the eastern part of Balayan Bay (Figs. 1 and 2), which yielded (among other benthic fauna) two colonies of a new species of pennatulacean octocoral, which is here described. Scanning electron micrographs were made using a Hitachi SU3500 Scanning Electron Microscope and a Cressington 108 Auto Sputter Coater. An abbreviation used in the text is CASIZ (California Academy of Sciences, Invertebrate Zoology collection).

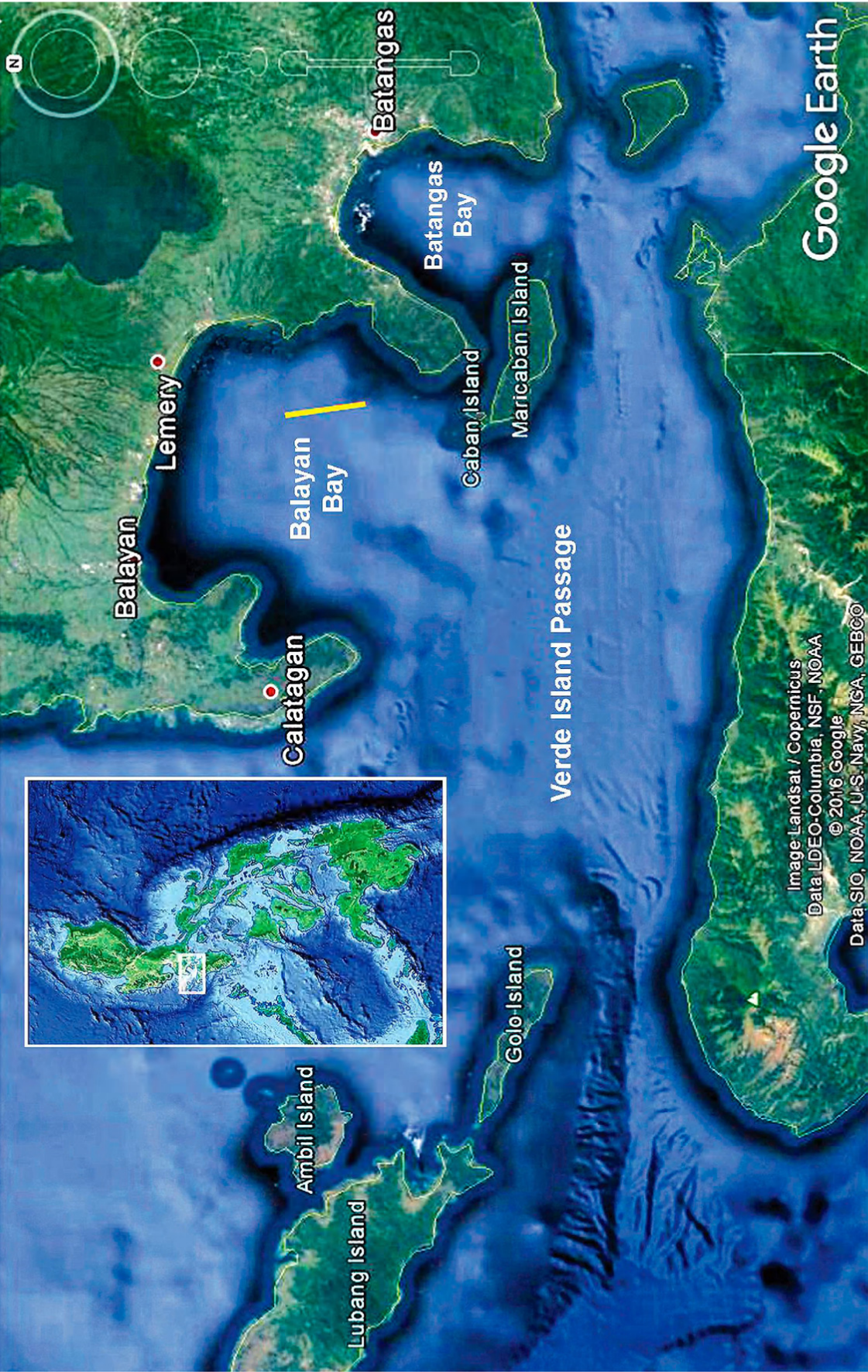


FIGURE 1. Map of the Philippine Archipelago (inset), boxed region of inset is enlarged below with the type locality of *Grasshoffia profunda* n. sp. shown in yellow as a trawling line.



FIGURE 2. Late afternoon view from the eastern shore of Balayan Bay, southern Luzon, Philippines – the eastern part of the bay shown here is the type locality of *Grasshoffia profundica* sp. nov.

SYSTEMATIC ACCOUNT

Subclass Pennatulacea Verrill, 1865

Family Virgulariidae Verrill, 1868

***Grasshoffia* Williams, 2015**

Grasshoffia Williams, 2015:41.

GENERIC DIAGNOSIS (modified from Williams, 2015:41).— Virgulariid sea pens; polyp leaves funnel-shaped and rolled or ovate and flattened; 10–26 autozooids per polyp leaf; sclerites of polyp leaves slightly three-flanged rods with parallel lateral sides and ends triangular or truncate, 0.02–0.08 mm in length (modified from Williams, 2015:41).

TYPE SPECIES.— *Grasshoffia virgularioides* Williams, 2015.

***Grasshoffia profundica* Williams, sp. nov.**

Figures 3–7.

HOLOTYPE.— CASIZ 207514.

PARATYPE.— CASIZ 207515.

TYPE LOCALITY (Fig. 1).— Balayan Bay, southwestern Luzon, Philippines (13.77283°N, 120.8507°E to 13.764167°N, 120.85167°E); station number HEPD-010; 318–333 m depth; 30

May 2011; G.C. Williams on board the research ship of the Philippine Bureau of Fisheries and Aquatic Resources, *M/V DA-BFAR*, during the 2011 CAS Hearst Philippine Biodiversity Expedition; two partial specimens collected by beam trawl.

HABITAT AND DISTRIBUTION.— Collected from muddy sea bottom in a north to south linear transect in the eastern part of Balayan Bay (Fig. 1), which represents the only known occurrence of the species.

ETYMOLOGY.— The specific epithet is derived from the Latin *profundus* (deep or of the depths), and the suffix *-icus* (belonging to), referring to the deep-sea habitat of the holotype.

Description

EXTERNAL MORPHOLOGY (Fig. 3).— Both the holotype and the paratype are partial in the distal and proximal ends of each of the colonies are missing. In the holotype (which is 238 mm long), the portion of the peduncle that is remaining is 70 mm in length and up to 2 mm in width and the portion of the rachis that remains is 168 mm in length. The length of the partial paratype is 143 mm. The colonies are filiform – elongate and very thin. The coenenchyme of the rachis is extremely thin to indiscernible.

AXIS (Figs. 3B, 4).— The cylindrical axis extends virtually throughout the entire length of the colony and is approximately 0.86 mm in diameter (Fig. 3B). In transverse section, the axis is conspicuously circular in shape (Fig. 4A). A typical pennatulacean morphology is evident in that it displays radiating wedges of calcareous material outward from the central core, and a central area that is composed of densely concentrated proteinaceous material (Figs. 4A–B). The external longitudinal surface of the axis is smooth, not lined or striated (Fig. 4C). However, under higher magnification, very fine longitudinal striations are evident along with small slit-like openings that vary in length from approximately 5–12 micrometers (Fig. 4D).

POLYP LEAVES (Figs. 3C–F).— The polyp leaves are mostly flattened and oblong-ovate in shape, approximately 1.8–2.0 mm long by 1.0 mm wide (Fig. 3F). Each polyp leaf is attached to the rachis by a short and narrow proximal neck (Figs. 3C, F). Polyp leaf pairs are oppositely or sub-oppositely placed along the length of the rachis (Fig. 3A, C–D). They are sometimes disposed obliquely to the longitudinal plane of the axis such that the free, distal ends are higher up on the rachis than the opposite end adjacent to the proximal point of attachment (Figs. 3C–F). Approximately 1.5–3.0 mm of bare rachis separates many adjacent polyp pairs (Figs. 3C–D, F).

POLYPS (Fig. 3F–G).— There are usually 10–12 autozooids per polyp leaf (Fig. 3F). The autozooids are cylindrical, approximately 1.0–1.2 mm in length. The tentacles were preserved mostly exserted in both the holotype and paratype and are approximately 0.3 mm in length. Both the polyp walls and the tentacles are densely-set with minute spicules. Siphonozooids were not detected by observation through a dissecting microscope in either the holotype or paratype.

SCLERITES (Figs. 5–7).— The sclerites of the polyp leaves and polyp walls are numerous, minute, quadrilateral rods, more-or-less rectangular in shape with truncate ends, and vary in length from 0.040–0.085 mm. Sclerites were not observed and apparently are not present in the tissues of the peduncle.

COLOR (Fig. 3).— In the wet-preserved holotype and paratype, the axes are white, while the polyp leaves and polyps are tan to brownish in color, and all sclerites are colorless. The appearance and color of the colonies in life was not noted.

DISCUSSION

Williams (2015:48) provided a definition of the family Virgulariidae, as well as a key to the six currently-recognized genera. See Williams (1995:122–125) for diagnoses of five of the six genera (*Acanthoptilum*, *Scytaliopsis*, *Scytalium*, *Stylatula*, and *Virgularia*). For a taxonomic diagnosis of the genus *Grasshoffia*, see Williams (2015:41).

Revised key to the genera of Virgulariidae Verrill. 1868

- 1A Sclerites are present in the polyp leaves 2
- 1B Sclerites are absent in the polyp leaves. 5
- 2A Sclerites in the polyp leaves are conspicuous spindles and/or needles, ≤ 1.50 mm in length. Sclerites are colorless. 3
- 2B Sclerites in the polyp leaves are small to minute ovals or somewhat three-flanged rods, ≤ 0.08 mm in length. 4
- 3A Robust spindles form a conspicuous fan-like armature at the bases of the polyp leaves. Sclerites are colorless. Eleven species of the east and west coasts of North and South America, Japan, New Zealand *Stylatula*
- 3B Spindles and ovoid sclerites may form a weak cluster at the bases of the polyp leaves (but not in a fan-like arrangement), or they are scattered in the polyps leaves. Sclerites are colorless. Seven species of the west coast of North America, Gulf of Mexico, New Zealand *Acanthoptilum*
- 4A Densely-set ovoid sclerites are present in the rachis and polyp leaves. Sclerites are noticeably red to red-violet. Two or three species of Indo-West Pacific distribution (Red Sea to Palau) *Scytalium*
- 4B Indistinctly-three-flanged rod-like sclerites are numerous in the polyp leaves and polyp walls. Sclerites are colorless. Two species (West Africa and Philippines) *Grasshoffia*
- 5A The polyps contained on a single polyp leaf are of equal size. Number of polyps per polyp leaf highly variable (few to 100 or more). Fifty-six described species, perhaps twenty of which are valid, worldwide in temperate and tropical latitudes *Virgularia*
- 5B The polyps on the inner-most part of a single polyp leaf are smaller in size than those on the outer margin of the leaf. One species, *Scytaliopsis djiboutiensis* (East Africa). . . *Scytaliopsis*

Key to species of the genus *Grasshoffia* Williams, 2015

- 1A. Polyp leaves rolled, convoluted, or semicircular in shape. Polyp leaves appear densely congested along the rachis. Sclerites of polyp leaves and peduncle are rods with parallel sides and triangular ends, 0.02–0.06 mm long. Type locality Niger River Delta, Gulf of Guinea. *Grasshoffia virgularioides*
- 1B. Polyp leaves flattened and broadly ovate in shape. Polyp leaf pairs are separated by bare portions of the rachis. Sclerites of polyp leaves are rods, more-or-less rectangular in shape, 0.04–0.08 mm long. Sclerites of peduncle are apparently absent. Type locality northern Philippines *Grasshoffia profundica* sp. nov.

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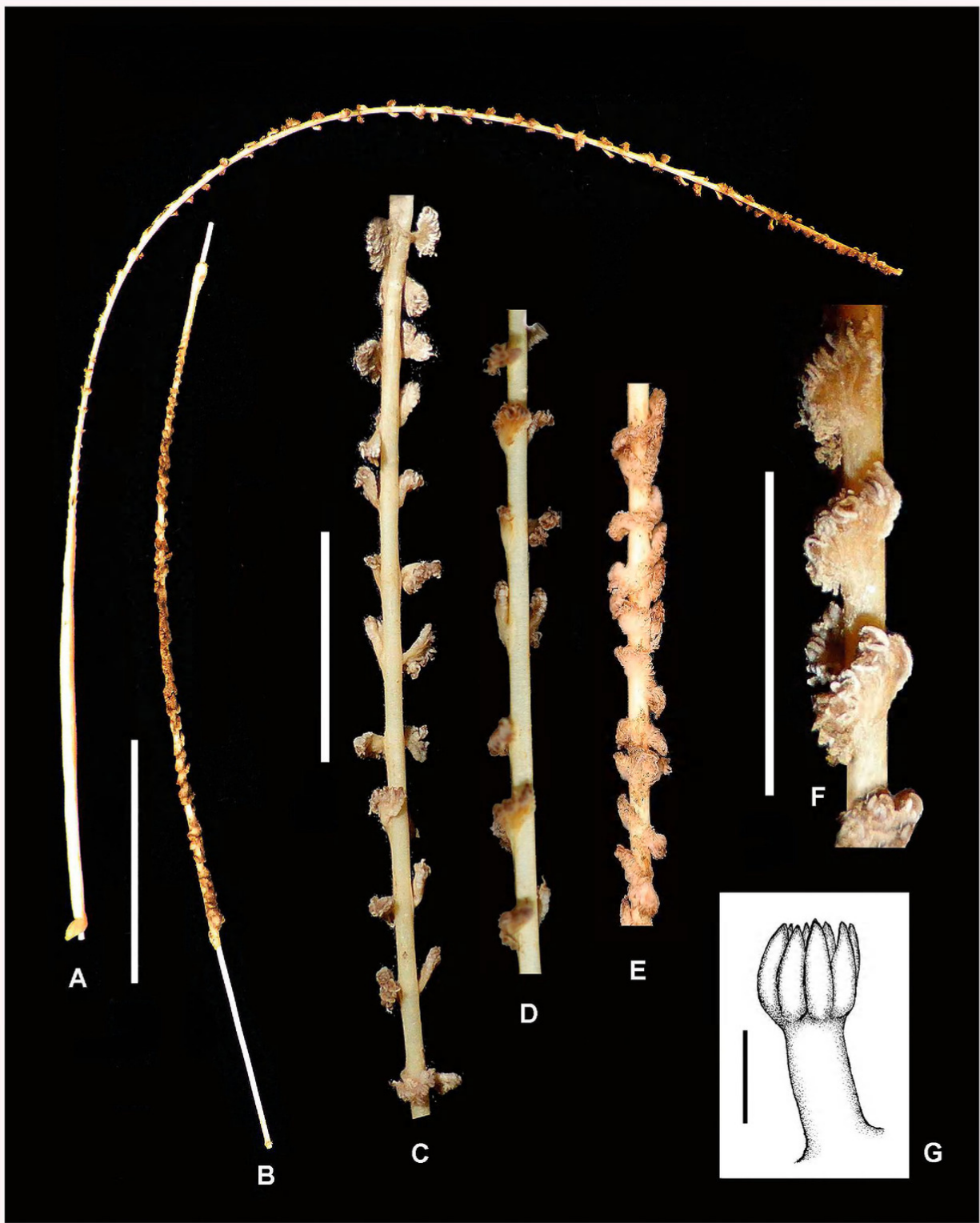


FIGURE 3. *Grasshoffia profundica* n. sp. External morphology. A. Holotype (CAS 207514). B. Paratype (CAS 207515); scale bar for A and B = 40 mm. C. Detail of holotype rachis. D. Detail of holotype rachis. E. Detail of paratype rachis; scale bar for C-E = 10 mm. F. Detail of rachis of paratype showing broadly ovate polyp leaves with narrow proximal region attached to the rachis; scale bar = 5.0 mm. G. Diagram of a single autozoid, pinnules not shown; scale bar = 0.5 mm.

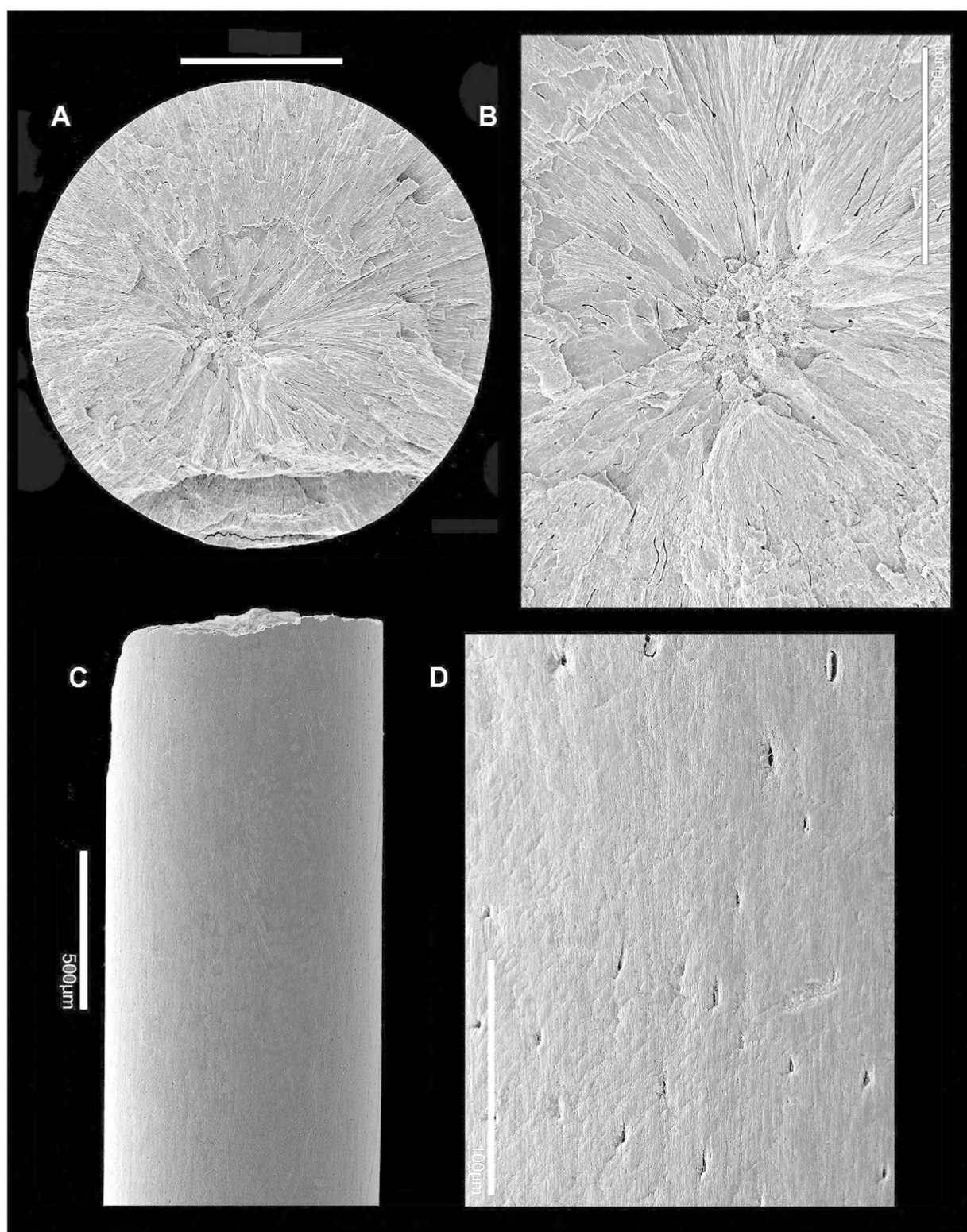


FIGURE 4. *Grasshoffia profundica* n. sp. Scanning electron micrographs of axial morphology. A. Transverse section of axis from the distal region of the rachis showing arrangement of wedge-shaped sections of calcareous material radiating outward from the central core; scale bar = 0.3 mm. B. Enlarged detail of the central region from Fig. 2A showing concentration of organic matter in the central core and several elongated, tadpole-shaped channels surrounding the core; scale bar = 0.2 mm. C. Longitudinal external view of portion of axis from the distal region of the rachis showing uniformly smooth surface; scale bar = 0.5 mm. D. Enlarged detail of axial surface (from Fig. 2C) showing short, slit-shaped orifices; scale bar = 0.1 mm.

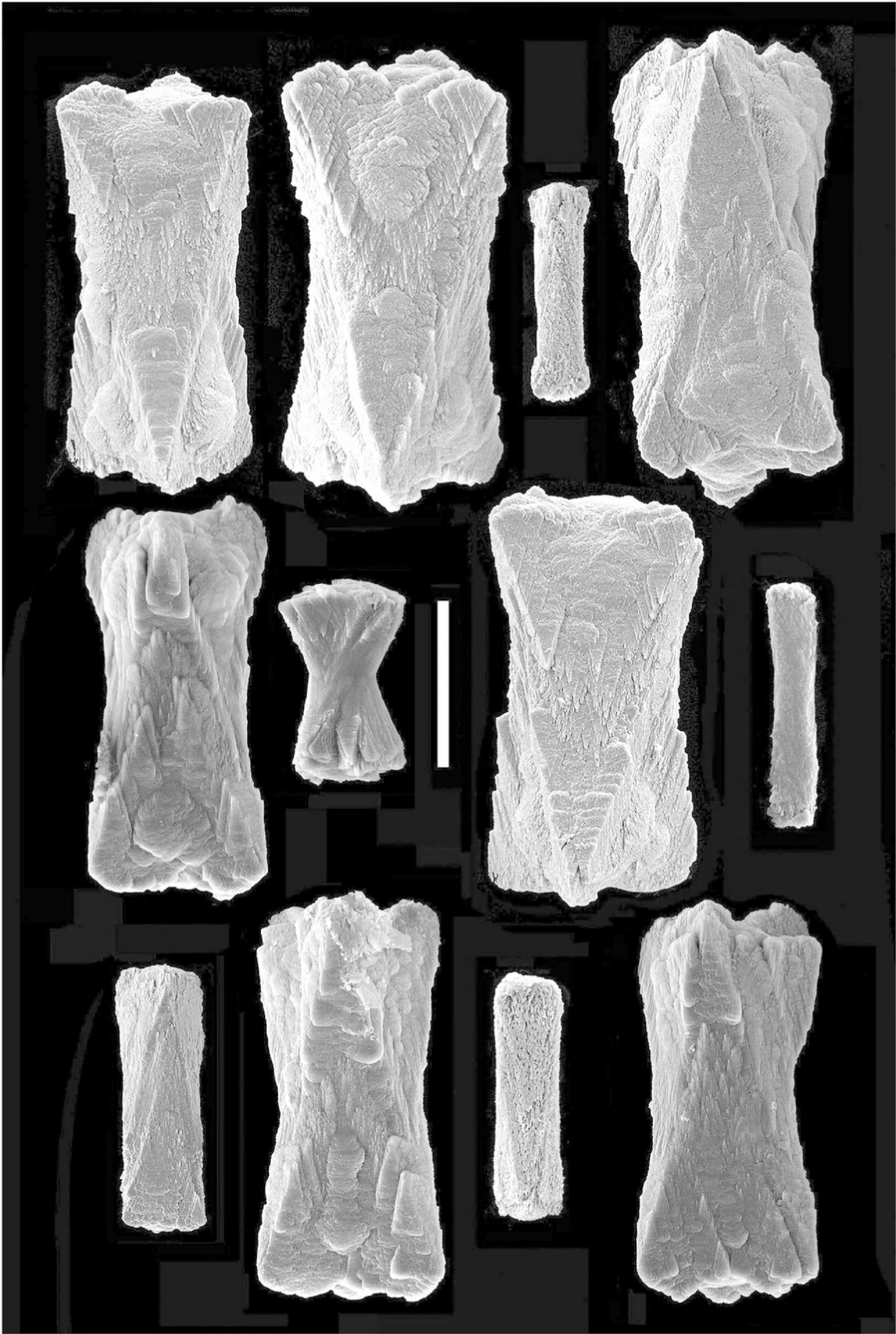


FIGURE 5. *Grasshoffia profunda* n. sp. Scanning electron micrographs of sclerites from polyps and polyp leaves. Scale bar = 0.03 mm.

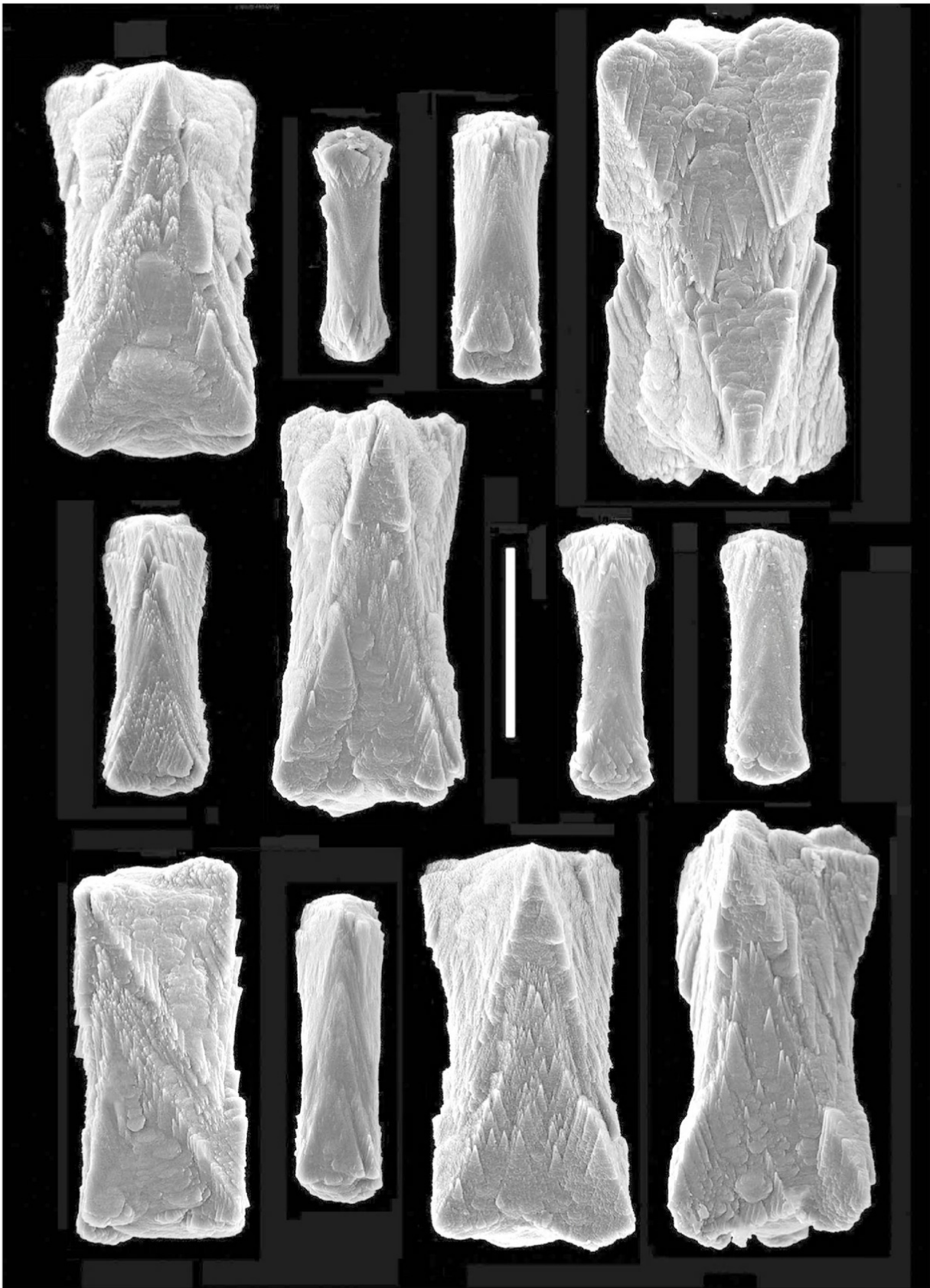


FIGURE 6. *Grasshoffia profundica* n. sp. Scanning electron micrographs of sclerites from polyps and polyp leaves. Scale bar = 0.03 mm.

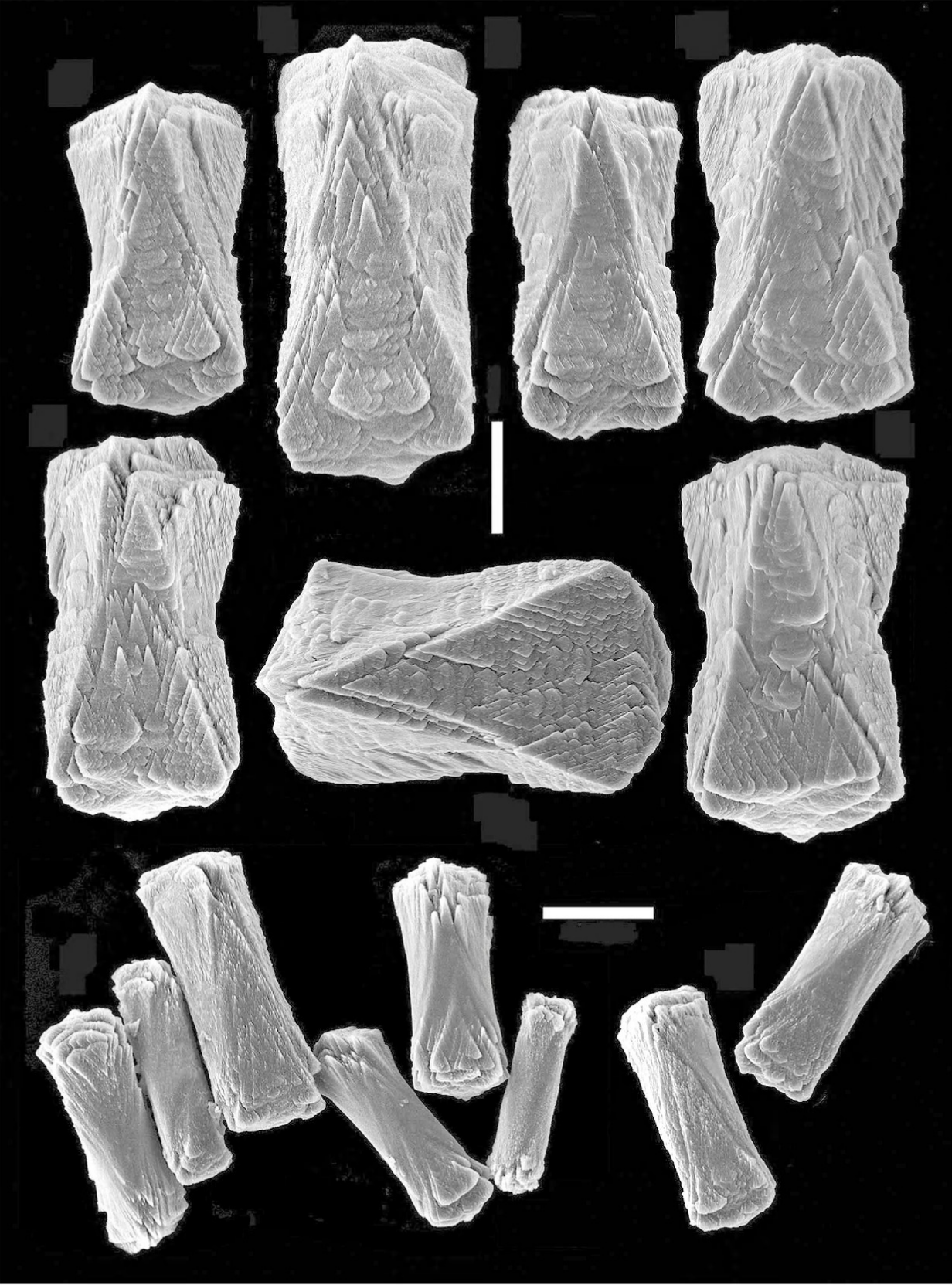


FIGURE 7. *Grasshoffia profunda* n. sp. Scanning electron micrographs of polyp sclerites from polyps and polyp leaves. Scale bars = 0.02 mm.



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