The Alcyonaria of Bikini and Other Atolls in the Marshall Group. Part I: The Gorgonacea[1]

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THIS REPORT COVERS the alcyonarian corals collected during two expeditions to the Marshall Islands conducted by the United States Navy and other agencies. The Gorgonacea are considered in the present part, and the lesser groups (Stolonifera and Alcyonacea) will be taken up in Part II.

I wish to acknowledge my indebtedness to the Project Officer of the Bikini Scientific Resurvey Expedition (1947), Captain Christian L. Engleman, U. S. N.; to Dr. John W. Wells, United States Geological Survey, with whom I worked often in the field; to Dr. L. P. Schultz and Dr. J. P. E. Morrison, my colleagues of the U. S. National Museum, who extended every assistance possible; and last, but certainly not least, to Fred C. Zimmerman, Seaman 2/c, of the *Chilton's* crew, whose services were assigned me during a part of the expedition.

THE ALCYONARIA

The Alcyonaria inhabiting the coral reefs of the Pacific Ocean are a much less conspicuous element of the fauna than those of the tropical Atlantic. The reef-dwelling forms of the Pacific are the inconspicuous Alcyonacea and the stoloniferan, *Tubipora musica.* The only alcyonarian of real importance to reef formation is the blue coral, *Heliopora.* The holaxonian Gorgonacea occur only in the deeper waters of the lagoons and surrounding ocean and must be taken by dredge.

During "Operation Crossroads," the first expedition to the Marshalls, collecting was concentrated upon the reefs, and therefore few Alcyonaria, none of which were Gorgonacea, were obtained. However, on the second trip the LCI 615 was fitted for deep-water dredging, and under the direction of Dr. R. Dana Russell many hauls, which accounted for all but one of the gorgonacean species collected during the entire operation, were made in the waters surrounding Bikini Atoll. The alcyonaceans taken in the dredge, along with the littoral forms collected on the reefs of Bikini and Rongerik by the author and Fred Zimmerman, will be discussed in Part II of this report.

The classification of the Alcyonaria is not, in certain respects, entirely satisfactory. A case in point is the questionable scope of the family Muriceidae, whose species constitute the major portion of this paper. However, since the present report is in no sense revisionary, this aspect of the problem must await treatment in more comprehensive studies.

Since the literature concerning these animals has in the past been typified by inadequate and imperfect illustration of the species, it has been of primary concern to figure adequately, both microscopically and macroscopically, all the species herein discussed.

Gorgonacea were taken at four stations:

STATION 9. Off Bikini Atoll, 11° 29′ 16″ N., 165° 20′ 45″ E.; depth 50–96 fathoms. August 6, 1947.

STATION 12. Off the seaward shore of Bikini Island, Bikini Atoll, 11° 28′ 23″(?) N., 165° 31′ 35″(?) E.; depth 58–90 fathoms. August 7, 1947.

STATION 23. Bikini Lagoon, east end, Bikini Atoll, 11° 31′ 51″ N., 165° 32′ 53″ E.; depth 5–12 fathoms. August 15, 1947.

STATION 30. Off Enyu Pass, Bikini Atoll, 11° 29′ 28″ N., 165° 31′ 40″ E.; depth 116–120 fathoms. August 22, 1947.

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A list of the species collected by the Bikini Scientific Resurvey is given here:

Order GORGONACEA
Sub-order SCLERAXONIA

SUBEROGORGIIDAE

1. **Suberogorgia mollis** (Nutting)

Sub-order HOLAXONIA

KEROEIDIDAE

2. **Keroeides koreni** Wright and Studer

MURICEIDAE

3. **Paracis squamata** (Nutting)
4. **Paracis orientalis** (Ridley)
5. **Muricella englemani** new species
6. **Echinogorgia russelli** new species
7. **Villogorgia zimmermani** new species
8. **Villogorgia zimmermani** form **pallida** new
9. **Villogorgia compressa** Hiles

PRIMNOIDAE

10. **Caligorgia pseudoflabellum** new species

GORGONELLIDAE

11. **Scirpearia erythraea** Kükenthal
12. **Toeplitzella laevis** (Verrill)

Genus SUBEROGORGIA Gray

Suberogorgia mollis (Nutting)

Figs. 1*f*, 2 *g-h*; Pl. 4, fig. 1

Euplexaura mollis Nutting 1910*b*: 13, pl. 3, figs. 4, 4a; pl. 4, fig. 8.
Euplexaura mollis Kükenthal 1919: 224.
Euplexaura mollis Kükenthal 1924: 94.
Suberogorgia mollis Stiasny 1937: 98, text fig. FF; pl. 8, fig. 47.
Suberogorgia mollis Stiasny 1940*a*: 203.

Diagnosis: Colony erect, flabellate, branched in one plane; branching with frequent anastomosis forming a network with elongate rectangular meshes. Largest branches and the end twigs round in cross section, the intermediate ones flattened at right angles to the plane of branching. Twigs 1.5 to 2.0 mm. in diameter, flat branches about 7.0 by 10.0 mm. in diameter, large main branches 30 mm. and probably more. Anthocodiae retractile into very low verrucae scarcely separable from surrounding coenenchyma; aperture with eight distinct lobes. Verrucae on all sides of the branches, mostly 0.75 to 1.0 mm. apart. Anthocodial armature of eight points of spindles in converging rows and collaret of short spindles transversely arranged. Axis composed of smooth, irregularly branched spicules and horny substance. Color, in life, bright orange; in dry condition, dirty brown. Sclerites of deep layers of coenenchyma blunt spindles with prominent belts of warts; in superficial layers double clubs or double wheels with smooth, sharply constricted shaft; those at surface with heads unilaterally produced into a pair of granular lobes.

Spicule measurements:

Spindles: 0.1 × 0.04 mm.; 0.08 × 0.045 mm.
Symmetrical double clubs: 0.05 × 0.034 mm.; 0.026 × 0.02 mm.
Asymmetrical double clubs: 0.03 × 0.03 mm.; 0.045 × 0.035 mm.

Locality: Enyu Island, Bikini Atoll, on edge of a large coral knoll in about 45 feet of water, August, 1947.

Specimen: Dry fragments, U.S.N.M. No. 44074.

Remarks: This specimen, of which the U. S. National Museum possesses only fragments, was about 8 feet high when complete, and so large that only one of the branches could be collected. Dr. Robert W. Hiatt, of the University of Hawaii, found it while diving on a submerged reef off Enyu Island. When alive the colony was a bright orange color, according to Dr. Hiatt, but after a few hours in the air it assumed the brownish hue which it still retains. The greater part of the specimen is in the collection of the University of Hawaii.

Stiasny first recognized that Nutting had erred in calling this scleraxonian a plexaurid. However, the calcareous deposits of the axis take a definite spicule form, unlike those of the Plexauridae. In its cortical spiculation it is similar to *S. verriculata,* although the asymmetrical double wheels of the surface layers are not identical with those figured by Aurivillius

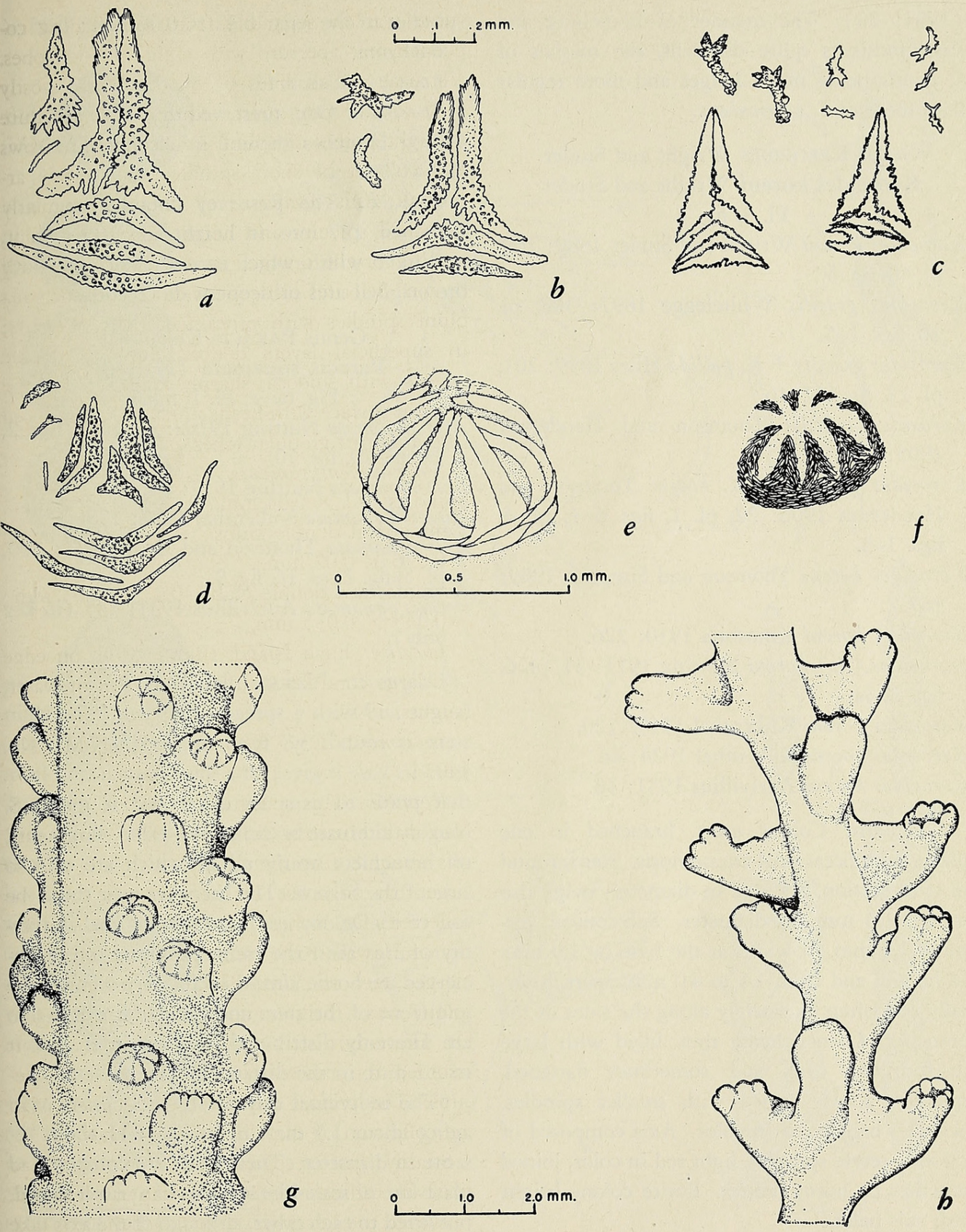


Fig. 1. *a, Villogorgia zimmermani:* Spicules of the opercular point, collaret, tentacles, and pinnules. *b, Villogorgia zimmermani* form *pallida:* Spicules of the opercular point, collaret, tentacles, and pinnules. *c, Villogorgia compressa:* Spicules of the opercular point, collaret, tentacles, and pinnules. *d, Echinogorgia russelli:* Spicules of the opercular point, collaret, tentacles, and pinnules. *e, Paracis orientalis:* Oblique view of retracted zooid with its armature. *f, Suberogorgia mollis:* Oblique view of retracted zooid with its armature. *g, Toeplitzella laevis:* Part of branch, enlarged, showing arrangement of verrucae. *h, Scirpearia erythraea:* Part of the stem, enlarged, showing arrangement of verrucae.

(1931: 20). The manner of branching and anastomosis is quite different, the meshes of *S. mollis* being much longer and more regular than those of *S. verriculata.*

Genus KEROEIDES Wright and Studer

Keroeides koreni Wright and Studer

Pl. 3, fig. 3

Keroeides koreni Wright and Studer 1889: 169, pl. 40, fig. 3.
Keroeides gracilis Whitelegge 1897: 308, pl. 16, figs. 1–5.
Keroeides gracilis + *K. pallida* Hiles 1899: 201, pl. 22, figs. 12–16.
Keroeides gracilis Thomson and Henderson 1905: 287.
Keroeides gracilis + *K. koreni* Thomson and Henderson 1906: 22, pl. 1, figs. 6–7; pl. 4, figs. 1–3.
Keroeides koreni Thomson and Simpson 1909: 167.
Keroeides koreni Kinoshita 1910: 226.
Koroeides [*sic*] *koreni* Nutting 1911: 31, pl. 6, figs. 3, 3a.
Keroeides koreni Kükenthal 1919: 120.
Keroeides koreni Kükenthal 1924: 46.
Keroeides koreni Aurivillius 1931: 38.

Diagnosis: Colony erect, branched in one plane, with occasional anastomosis. Stems round in cross section, 2.5 mm. in diameter; twigs also round, 1.0 mm. in diameter. Sub-conical verrucae 1.0 mm. in width at the base by 1.0 mm. in height, and from 1.5 to 4.0 mm. apart, biserially and often alternately along the sides of the branches. Coenenchyma thin, filled with large fusiform to oval, and sometimes flattened, spicules; zooids armed with smaller spindles. Sclerites bright red in color. Axis composed of smooth, terete spindles, light red in color, joined together by horny matter. Entire colony bright red, axis paler.

Spicule measurements:

Spindles: 1.05 × 0.25 mm.; 0.47 × 0.14 mm.; 0.39 × 0.11 mm.
Ovals: 0.54 × 0.21 mm.
Spindles of the zooids: 0.15 × 0.03 mm.
Spindles of the axis: 0.32 × 0.06 mm.; 0.25 × 0.04 mm.

Locality: Station 12.

Specimen: One, preserved dry, U.S.N.M. No. 44075; branches thereof in alcohol, U.S.N.M. No. 44076.

Remarks: The Resurvey obtained one fine specimen, 127 mm. in height and 105 mm. in maximum width, which agrees very closely with the original and subsequent descriptions.

Genus PARACIS Kükenthal

Paracis squamata (Nutting)

Fig. 6*a–e*; Pl. 1, fig. 1

Acis squamata Nutting 1910*a*: 42, pl. 7, figs. 2, 2a; pl. 20, fig. 50.
Acis squamata Nutting 1912: 81.
Paracis squamata Kükenthal 1924: 158.
Acis squamata Thomson and Dean 1931: 200, pl. 5, fig. 2; pl. 16, fig. 9.
Paracis squamata Aurivillius 1931: 145 (in key only).

Diagnosis: "Colony flabellate, 14.3 cm. in height and with a spread of 4.9 cm. The main stem is round, 3.8 mm. in diameter. 1.6 cm. from its base it gives off a short branch, and from that point to near its distal end it gives off roughly alternate branches, several of which give off branchlets nearly all of which are on one side of the branch. The branches near the distal end of the colony are more symmetrical in their branchings than the more proximal ones. The calyces are borne almost exclusively on the sides and front of the stem and branches, where they are unevenly distributed, varying from .5 mm. to 2.2 mm. in the distance between them.

"The individual calyces are short tubes averaging about 1.5 mm. in height, and about the same in diameter. Their walls are composed of plate-like or scale-like spicules of various shapes; but fitted to each other, although they sometimes overlap somewhat. The ends, or edges, of the distal row form a scalloped border around the calyx margin. There seems to be no regularity whatever in the disposition of these calyx spicules. They are also exceedingly irregular in

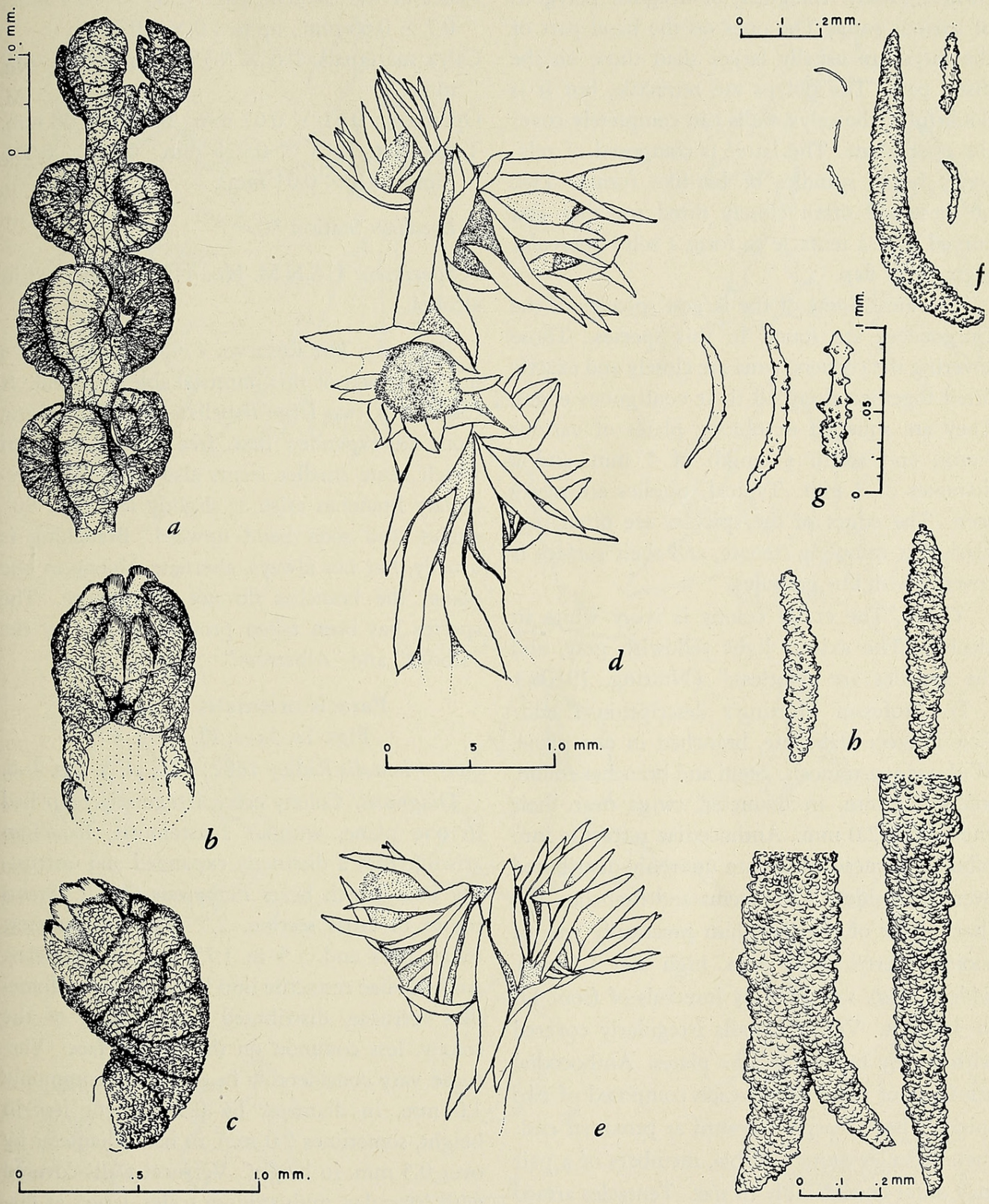


Fig. 2. *a–c, Caligorgia pseudoflabellum: a,* part of twig, enlarged, showing arrangement of the whorls of zooids; *b,* adaxial view of zooid; *c,* lateral view of zooid. *d–h, Muricella englemani: d, e,* parts of twigs, enlarged, showing calyces; *f,* spicules of calyx and tentacles; *g,* spicules of tentacles; *h,* spicules of the coenenchyma.

shape, being squarish oblong with rounded corners, rudely triangular, or irregular polygons of various sorts. The ones on the basal part of the calyx are usually larger than those on the distal part. The polyps are retractile, but it is doubtful if the calyx walls can completely cover the operculum. The latter is composed of relatively heavy spindles or bar-like forms. Two of these are often closely fitted together and curved over a tentacle to form a solid opercular segment or flap.

"Spicules. Some of the largest spicules of the Gorgonacea are found in this species. Those covering the coenenchyma are closely and exactly fitted together along all their contiguous edges. They are squarish or oblong plates of various forms, and attain a length of 5 mm. and a diameter of 2 mm. Typical spindles are rarely seen. The edges of the spicules are often regularly but minutely ctenate, and their surface is covered with fine granules.

"Color. The entire colony is ivory white in alcohol. The axis is light yellowish gray, and the spicules are colorless." (Nutting, 1910*a*.)

To Professor Nutting's description I add: Colony erect, flabellate, branched in one plane. Without anastomosis. Stem and branches round, stems 2.5 mm. in diameter, twigs near their ends about 2.0 mm. Anthocodiae retractile into tubular verrucae which are unevenly distributed over three sides of the stems and branches, i.e., "back" face of the flabellum practically free of zooids. Verrucae 1.5 mm. high and 1.5 mm. wide at base, separated by intervals of from 1.0 to 3.0 mm. Verrucal walls irregularly covered with closely fitted scale-like plates. Anthocodial armature of eight points each composed of two spindles bent sharply outward at proximal end; these spicules quite variable, members of a pair may differ considerably in size. Tentacles armed with small spindles and curved forms furnished with prominent conical processes. Spicules of the coenenchyma oblong or squarish thick plates, closely fitted together. Anthocodial spicules colorless, plates of cortex white.

Spicule measurements:

Plates of the coenenchyma: 2.85 × 1.25 mm.; 0.7 × 0.65 mm.; up to 5.0 × 2.0 mm.

Calyx marginals: 0.6 × 0.35 mm.; 0.69 × 0.49 mm.

Opercular: 0.61 × 0.07 mm.; 0.64 × 0.08 mm.

Tentacular: 0.15 × 0.025 mm.; 0.15 × 0.035 mm.; 0.18 × 0.03 mm.

Locality: Station 30.

Specimen: U.S.N.M. No. 44077, preserved in alcohol.

Remarks: The Resurvey Collection contains a fine specimen of this unmistakable muriceid. It consists of two large flabellate portions arising from an expanded base free of zooids, from which some smaller stems also arise. The secondary branches arise at slightly less than 90° angles, and soon bend upward. Branching is usually, but not always, alternate, chiefly in one plane; the branches do not anastomose. The species has been taken previously only by the "Siboga" and "Albatross."

Paracis orientalis (Ridley)

Figs. 1*e*, 5*a–e*; Pl. 1, fig. 4

Acis orientalis Ridley 1882: 126, pl. 5, figs. 1–6.

Diagnosis: Colony erect, irregularly branched in one plane, without anastomosis; flabellum arising from a distinctly expanded and encrusting base which bears numerous zooids. Stems round in cross section, 2.5 mm. in diameter; twigs, near end, 1.5 to 1.75 mm. in diameter. Anthocodiae retractile into low, tubular to dome-like verrucae, distributed on all sides of the colony, less common on the "back" face. Verrucae vary considerably in size, most commonly 1.0 mm. in diameter by 0.5 mm. or less in height, sometimes 2.0 mm. in basal diameter by over 0.5 mm. in height. Verrucal walls covered with irregular, multispinose scales, latter, at distal margin, reduced to simple spine with flattened, tubercular base. Anthocodial armature consisting of eight points, each formed of two contiguous bent spindles, and two curved spindles placed transversely beneath each point, to-

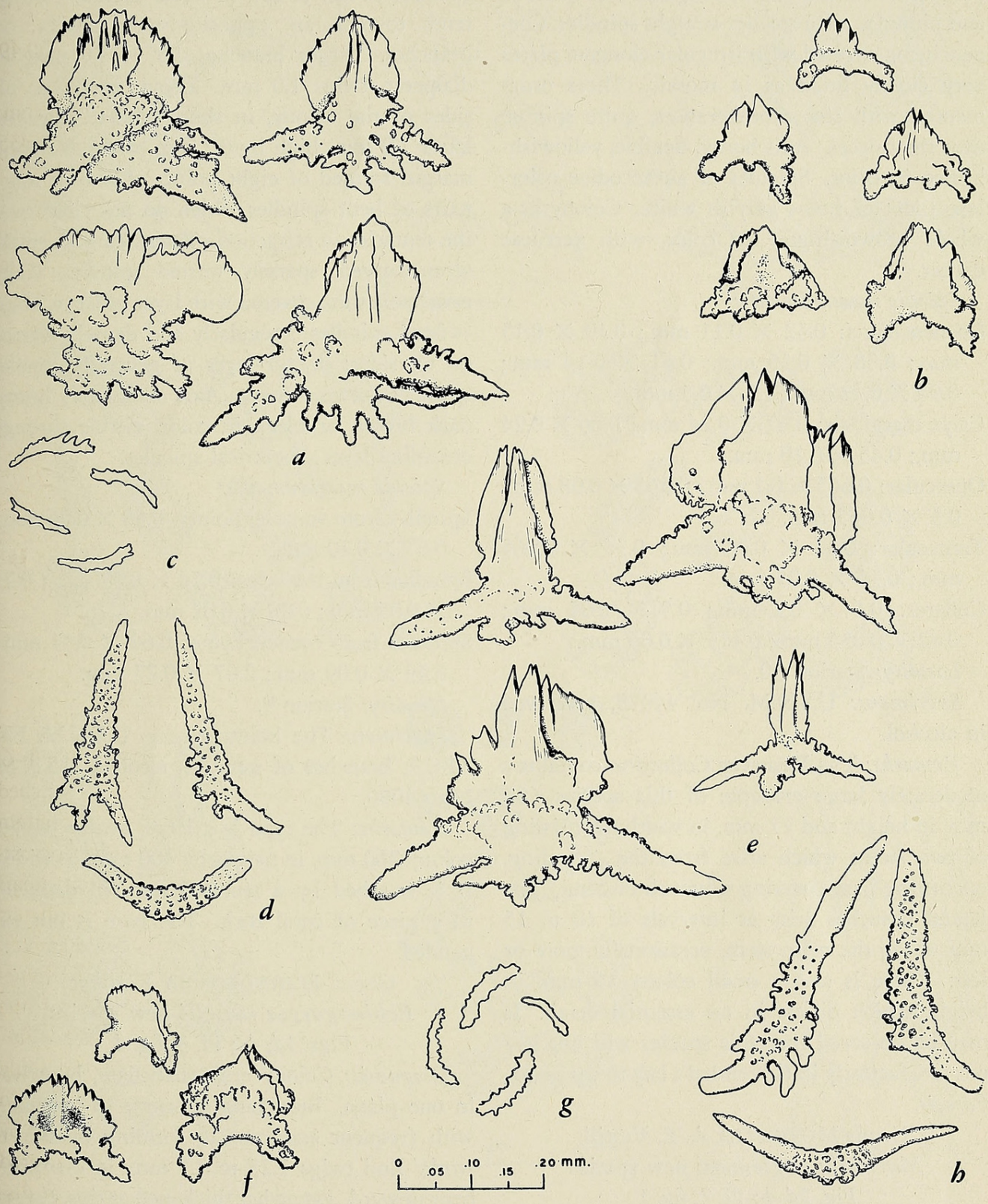


Fig. 3. *a–d, Villogorgia zimmermani* form *pallida: a,* spicules of the calyces; *b,* of the coenenchyma; *c,* of the tentacles; *d,* operculum and collaret. *e–h, Villogorgia zimmermani: e,* spicules of the calyces; *f,* of the coenenchyma; *g,* of the tentacles; *h,* operculum and collaret.

gether forming collaret ring. Tentacles further provided with curved, spinose, club-like spicules, and pinnulae with smaller straight spindles. Coenenchyma covered with irregular elongate plates very closely fitted as in mosaic. These ornamented with low protuberances, quite spinose near the calyces. Axis horny, flexible, yellowish-brown in color. Spicules of anthocodiae colorless, those of stems grayish white. Colony as a whole brownish-gray in color, with verrucae darker.

Spicule measurements:

Coenenchyma: 0.32 × 0.11 mm.; 0.39 × 0.15 mm.; 0.38 × 0.15 mm.; 0.41 × 0.14 mm.; 0.94 × 0.42 mm.; 1.5 × 0.5 mm.

Calyx marginals: 0.67 × 0.24 mm.; 0.66 × 0.24 mm.; 0.45 × 0.10 mm.

Opercular: 0.665 × 0.1 mm.; 0.565 × 0.08 mm.; 0.3 × 0.065 mm.

Tentacular: 0.36 × 0.06 mm.; 0.36 × 0.065 mm.; 0.36 × 0.05 mm.

Collaret: 0.6 × 0.1 mm.; 0.5 × 0.05 mm.; 0.42 × 0.035 mm.; 0.415 × 0.06 mm.

Locality: Station 30.

Specimens: U.S.N.M. No. 44078, preserved in alcohol.

Remarks: The Resurvey Collection contains a moderately large example of this species (85 mm. in height and 77 mm. in width) consisting of two stems which arise from the spreading, encrusting base covering a branch of coral. The lateral branches arise at intervals of 10 to 15 mm. along the main stem, occasionally more or less. There is also a small colony 35 mm. in height which differs in no essential detail. It may be observed that this species will not key out satisfactorily in Kükenthal's key to the genus *Paracis.*

Genus MURICELLA A. E. Verrill

Muricella englemani new species

Fig. 2*d–h*; Pl. 2, fig. 1

Diagnosis: Colony erect, spreading, flabellate, branched in one plane. Anastomosis frequent and irregular. Branches sinuous, knotty in places, with tendency to flatten at almost any angle to the plane of branching, varying with position in the colony. Main stem, before dividing, and smallest twigs, round in cross section. Twigs tend toward an opposite arrangement on branches. Larger branches 1.5 × 3.0 mm. in diameter, twigs 1.0 mm. Zooids small, on all sides of the colony, in short tubular verrucae, latter 1.0 mm. high by 0.7 mm. wide. Verrucal margin formed of eight points of one or more pairs of bent spindles which do not close over the tentacles in retraction. Tentacles with small, often curved, sparsely warted spindles. Coenenchyma thin, covered with layer of large, often twisted spindles, irregularly and densely warted on all sides; deeper layer of generally smaller spindles between them. Axis completely horny, dark brown or black in color, visible through crust-like layer of cortical spicules.

Spicule measurements:

Spindles from verrucal points: 0.58 × 0.06 mm.; 0.87 × 0.10 mm.

Spindles from tentacles: 0.16 × 0.02 mm.; 0.21 × 0.05 mm.; 0.08 × 0.02 mm.

Spindles from coenenchyma: 0.60 × 0.11 mm.; 0.49 × 0.09 mm.; 2.07 × 0.27 mm.

Locality: Station 9.

Specimen: The holotype, dry, U.S.N.M. No. 44079; branches of same, in alcohol, U.S.N.M. No. 44080.

Remarks: The type is a large, nearly perfect colony 260 mm. in height by 400 mm. in width. It is attached by a trunk 5 mm. in diameter to a piece of coral rock. The base is not expanded.

Genus ECHINOGORGIA Kölliker

Echinogorgia russelli new species

Figs. 1*d*, 4*c*; Pl. 3, fig. 4

Diagnosis: Colony erect, flabellate, branched in one plane. Branching alternate to irregular, with frequent anastomosis, forming open network. End twigs 1.25 to 1.5 mm. in diameter, bent upward, somewhat thickened at tips. Larger branches 2.0 to 2.5 mm. in diameter, flattened at right angles to plane of branching. Anthocodiae retractile into low, dome-like verrucae, 1 mm. in diameter by 0.5 mm. or less in height, closely placed on all sides of branches and twigs,

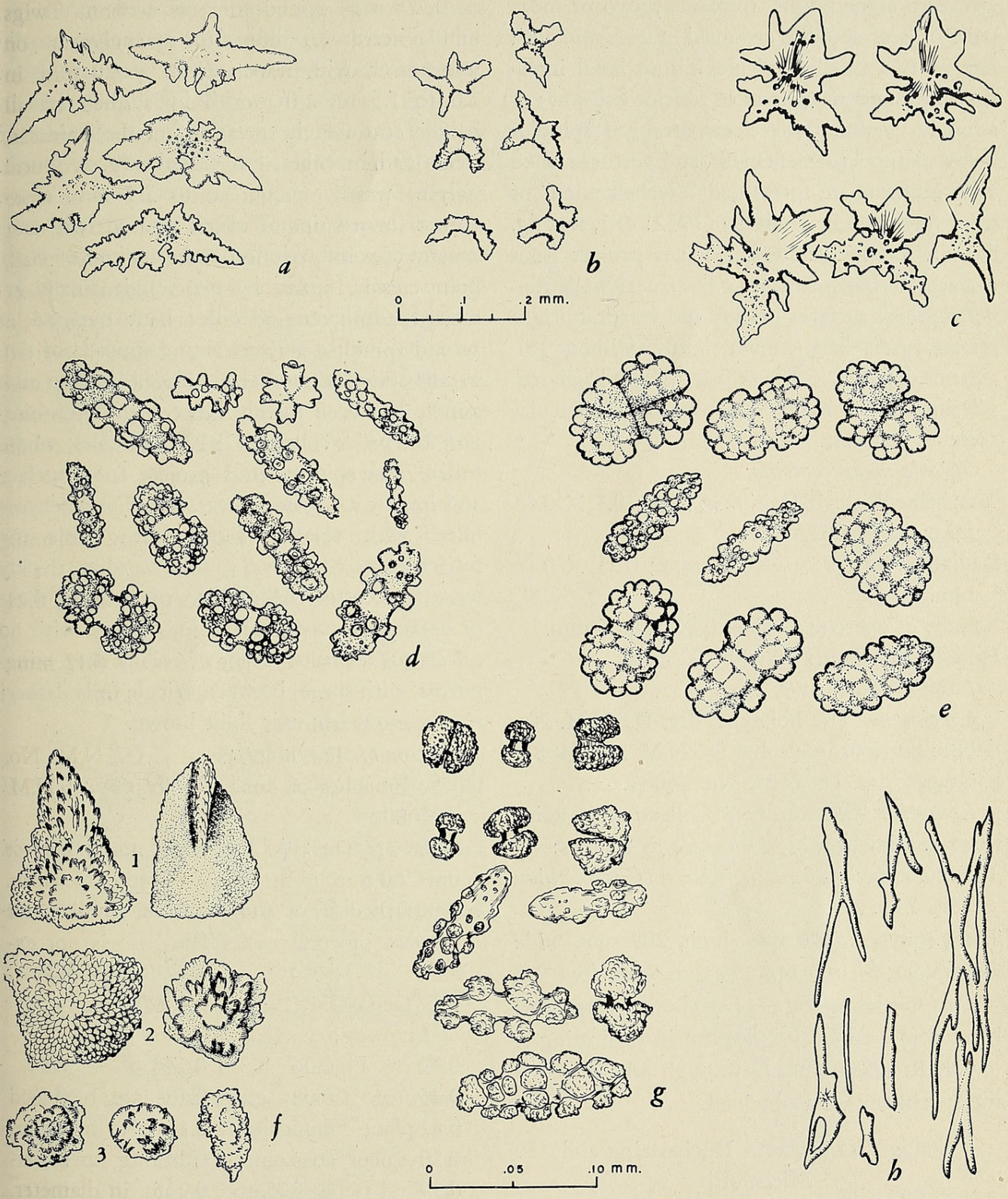


FIG. 4. *a, b, Villogorgia compressa: a,* spicules of the calyces; *b,* of the coenenchyma. *c, Echinogorgia russelli:* Spicules of the calyces. *d, Scirpearia erythraea:* Spicules. *e, Toeplitzella laevis:* Spicules. *f, Caligorgia pseudoflabellum:* f_1, spicules of the operculum; f_2, of the marginal row; f_3, the coenenchyma. *g, h, Suberogorgia mollis: g,* spicules of the coenenchyma, the double clubs from the surface, and the warted spindles from the deeper layer; *h,* spicules of the axis. (Upper scale applies to *a, b, c, f, h;* lower to *d, e.*)

commonly in spiral arrangement. Anthocodial armature eight points, formed by two or more pairs of bent spindles arranged *en chevron,* with one or two smaller spicules filling basal interspace; prominent collaret of four or five rows of strongly curved, transversely arranged spindles below points. Coenenchyma and verrucae filled with multiradiate forms and "Stachelkeulen" of the type shown by Hickson (1932: 481, text fig. 6a, b). Leaves of these spicules project from surface of coenenchyma and verrucal walls rendering these surfaces prickly and verrucal orifice serrate. Axis dark brown, horny, without calcareous deposits. Color of colony light brick-red, sclerites light reddish or orange; opercular spindles colorless.

Spicule measurements:

"Stachelkeulen": 0.21 × 0.19 mm.; 0.3 × 0.15 mm.; 0.2 × 0.175 mm.

Radiate forms: 0.24 × 0.15 mm.; 0.21 × 0.16 mm.

Spindle of opercular point: 0.25 × 0.05 mm.

Spindle of collaret: 0.31 × 0.02 mm.

Locality: Stations 9, 23.

Specimens: The holotype, dry, U.S.N.M. No. 44082; portions in alcohol U.S.N.M. No. 44083; paratypes, dry, U.S.N.M. No. 44081.

Remarks: The Resurvey Collection contains three specimens which measure as follows:

The holotype: 190 mm. high, 114 mm. wide (Sta. 23).

The paratypes: 190 mm. high, 207 mm. wide (Sta. 9); 86 mm. high, 36 mm. wide (Sta. 9).

This species appears to have been undescribed heretofore, and I take pleasure in dedicating it to Dr. R. Dana Russell, through whose efforts the specimens were obtained.

Genus VILLOGORGIA Duchassaing and Michelotti

Villogorgia zimmermani new species

Figs. 1*a*, 3*e–h*; Pl. 3, fig. 1

Diagnosis: Colony erect, flabellate, branched in one plane; without anastomosis. Branching alternate, opposite, and sometimes unilateral for considerable distances. Stems round, 3.0 mm. in diameter; branches 1.5 mm.; twigs, near the ends, 1.0 mm. Anthocodiae retractile into short, tubular verrucae, points of the operculum usually not entirely withdrawn into it. Verrucae, from 1.0 to 1.5 mm. in width by slightly less in height, scattered irregularly over three sides of stems and branches, less abundantly on fourth. Calyces usually about 2.0 to 2.5 mm. apart, closest toward tips of twigs; two on twig ends usually opposed. Anthocodial armature of eight points, each formed by two longitudinally arranged contiguous spindles bent outward at proximal end; a collaret ring composed of two curved spindles transversely placed beneath each point. Verrucae thickly beset with "*Acamptogorgia*-type" (Nutting, 1910*a*) spicules, whose foliate and spinose ends project from surface and impart a rugose appearance. Coenenchyma filled with smaller forms with projecting foliaceous part, and two to four root-like, thickly warted processes. All sclerites rose-purple, those of operculum much paler. Axis horny, with no calcareous deposits. Color of colony deep wine-purple, with spaces between spicule folia darker; zooids brownish; axis light brown.

Spicule measurements:

Opercular spindles: 0.35 × 0.09 mm.; 0.33 × 0.06 mm.

Collaret spindles: 0.27 × 0.055 mm.; 0.25 × 0.04 mm.

Foliate spicules of the verrucae and coenenchyma:

Width across roots	Diameter of roots at base	Height of folia	Width of folia
	VERRUCAE		
0.32	0.06	0.145	0.09
0.45	0.08	0.12	0.17
0.41	0.05	0.15	0.15
0.30	0.06	0.145	0.19
0.39	0.05	0.215	0.10
0.63	0.12	0.23	0.13
0.45	0.10	0.29	0.16
	COENENCHYMA		
0.18	0.04	0.10	0.16
0.19	0.06	0.11	0.175
0.13	0.35	0.06	0.09

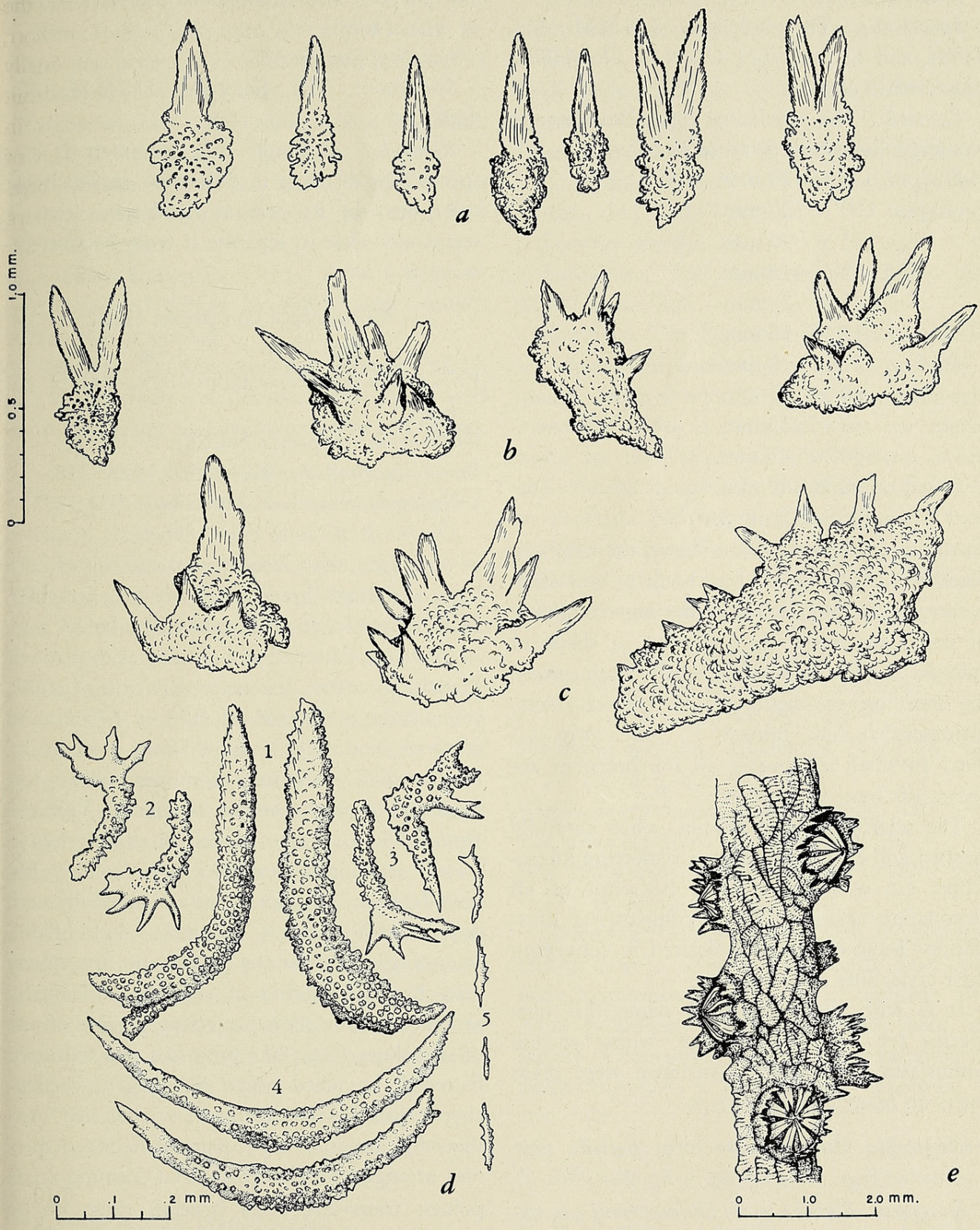


FIG. 5. *a–e, Paracis orientalis: a,* spicules of the calicular margin; *b,* of the verrucal wall; *c,* of the verrucal base and adjacent cortex; *d,* of the anthocodial armature, including one of the points (1), clubs from the tentacles (2 and 3), curved spindles of the collaret (4), and spindles of the pinnules (5); *e,* part of a twig enlarged to show the arrangement of verrucae.

Locality: Station 30.

Specimens: The holotype, U.S.N.M. No. 44084, and 11 paratypes, U.S.N.M. No. 44085, preserved in alcohol.

Remarks: The specimens represented in the Resurvey Collection measure as follows:

Holotype: 145 × 120 mm.
Paratypes: 150 × 120 mm.
125 × 90 mm.
75 × 115 mm.
45 × 22 mm.
12 × 18 mm.
21 × 8 mm.
80 × 57 mm.
47 × 45 mm.
70 × 45 mm.
50 × 42 mm.
40 × 25 mm.

In the measurements given above, the height is listed first. The third, fourth, fifth, and sixth paratypes are all attached to the same fragment of coral, and show the variation in shape of colonies at different ages. In a fully adult colony, the stem measurements are as follows: Stem, diameter 3.0 mm.; branch, 1.5 mm.; twig, 1.0 mm. In small specimens, all the branches are about 1.0 mm. in diameter.

The sclerites of this species, when carefully cleaned and examined under a dissecting microscope, are among the most beautiful of all alcyonarian spicules. The accompanying illustrations leave much to be desired in conveying their crystalline appearance.

It is with pleasure that I name this new species for Fred Zimmerman, whose sincere enthusiasm and faithful assistance were great assets on many collecting trips.

Villogorgia zimmermani form ***pallida*** new

Figs. 1*b*, 3*a-d*; Pl. 3, fig. 2

Diagnosis: Similar to *V. zimmermani* s.s., except: color, pale yellowish-brown, with colorless spicules; colony less robust, stems measuring 2.5 mm. in diameter, branches 1.25, and twigs 0.75; verrucae also somewhat smaller. Spicules same size as in typical form, but completely without rose-purple color. Operculum identical to that of typical form.

Locality: Station 30.

Specimen: The holotype, U.S.N.M. No. 44086.

Remarks: Although this specimen is not specifically distinct, it differs so markedly in color, and in its general slenderness, that it seems advisable to separate it from *V. zimmermani* as a form.

Villogorgia compressa Hiles

Figs. 1*c*, 4*a–b*; Pl. 2, fig. 2

Villogorgia compressa Hiles 1899: 200, pl. 22, fig. 7.
Villogorgia compressa Nutting 1910*a*: 71.
Brandella compressa Kükenthal 1924: 218.
Villogorgia compressa Aurivillius 1931: 225.

Diagnosis: Colony erect, flabellate, branched in one plane, with frequent anastomosis of both large and small branches. Branching irregular. Main stem oval in cross section, 1.0 by 2.0 mm. in diameter, flattened at right angles to plane of branching. After first major division of trunk, stems strongly compressed, 0.75 by 1.75 mm. in diameter; end twigs round, 0.5 mm. in diameter. Anthocodiae retract into prominent tubular verrucae set at right angles to stems. Verrucae from 0.75 to 1.0 mm. in height, slightly less in width, irregularly scattered over colony, less abundant on "rear face." End twigs usually with opposed pair of zooids. Axis horny, light brown, becoming paler distally. Color of dry colony dirty brown. Sclerites of verrucae horizontally arranged, with a short projecting portion of one or two short, finger-like processes, and with two flattened, branched roots. Sclerites of coenenchyma quadriradiate forms of smaller size. Anthocodial armature eight pairs of flattened spicules arranged longitudinally and forming eight points; transverse rows beneath these merge with transverse verrucal spicules, hence collaret without well-defined proximal boundary.

Spicule measurements:

Spicules of verrucae: 0.25 × 0.01 mm.; 0.24 × 0.01 mm.; 0.26 × 0.125 mm.

Quadriradiates of coenenchyma: 0.15 × 0.09 mm.; 0.10 × 0.06 mm.; 0.158 × 0.1 mm.
Opercular points: 0.33 × 0.06 mm.; 0.36 × 0.07 mm.; 0.30 × 0.055 mm.
Transverse: 0.20 × 0.04 mm.; 0.20 × 0.07 mm.; 0.25 × 0.05 mm.
Spinose clubs of tentacles: 0.16 (length) × 0.10 (across spines) mm; 0.155 × 0.09 mm.; 0.10 × 0.055 mm.

Locality: Station 9.

Specimen: U.S.N.M. No. 44087 (dry), 44088 (branches in alcohol).

Remarks: The one specimen obtained, which is 145 mm. high and 193 mm. wide, agrees well with Miss Hiles' original description and figures.

Genus CALIGORGIA J. E. Gray

Caligorgia pseudoflabellum new species

Figs. 2*a–c*, 4*f*; Pl. 4, fig. 2

Caligorgia flabellum Nutting 1912: 60.
Not *Prymnoa flabellum* Ehrenberg 1834: 358.
Not *Primnoa flabellum* Kölliker 1865: 135, pl. 17, fig. 11.

Diagnosis: Colony erect, alternate-pinnately branched in one plane. Zooids in whorls of 3 or 4, rarely 5, on twigs; 28–32 whorls in 4 cm. twig length. Individual zooids ± 1.25 mm. high, clavate, bent inward, covered with closely fitted spicules heavily warted on outer surfaces. Abaxial rows with eight scales; outer lateral rows reduced to two; adaxial rows two, very small. Operculum of eight scales, adaxials smallest; rather elongate, with single broadly rounded, crenulate distal projection. Coenenchyma with irregular scales. Color creamy white. Axis calcareous, finely striate longitudinally, with metallic golden luster.

Spicule measurements:
Opercular scales: 0.32 × 0.23 mm.; 0.29 × 0.19 mm.
Body scales: 0.27 × 0.20 mm.; 0.20 × 0.18 mm.
Coenenchyma scales: 0.13 × 0.15 mm.; 0.20 × 0.15 mm.; 0.11 × 0.13 mm.; 0.17 × 0.09 mm.; 0.11 × 0.17 mm.

Locality: Station 30.

Specimen: The holotype, U.S.N.M. No. 44089, in alcohol.

Remarks: The Resurvey Collection includes an incomplete specimen which is probably a branch from a very large colony. *Caligorgia pseudoflabellum* is identical with the species taken by the "Albatross" in Japanese waters and referred erroneously to *Caligorgia flabellum* by Professor Nutting. It differs markedly from the specimens of *C. flabellum* which Kinoshita (1908: 35) described, as can be seen from the tabulated comparison on this page.

Genus SCIRPEARIA G. Cuvier

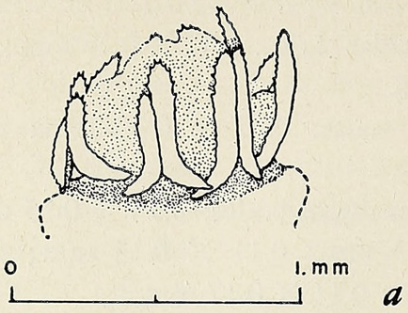
Scirpearia erythraea Kükenthal

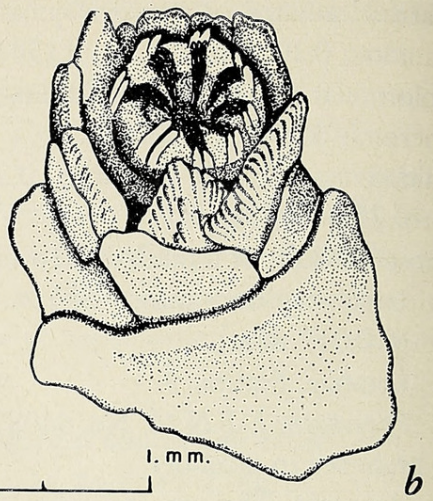
Figs. 1*h*, 4*d*; Pl. 1, fig. 3

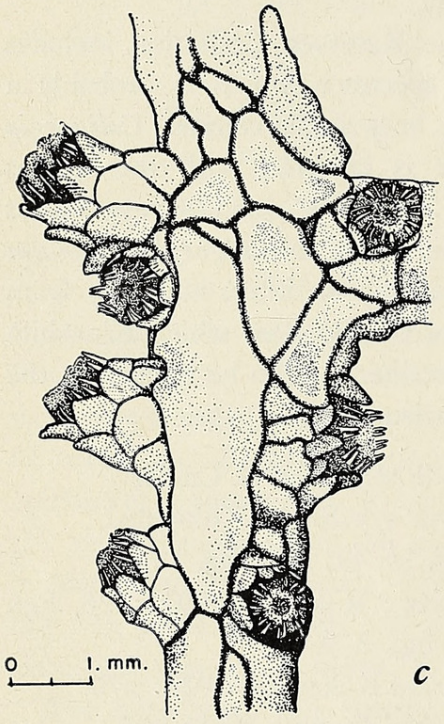
Scirpearia erythraea Kükenthal 1913: 26, figs. 21, 22; pl. 3, figs. 8–9.
Scirpearia erythraea Kükenthal 1924: 370.
Scirpearia erythraea Toeplitz 1929: 302.
Not *Scirpearia erythraea* Stiasny 1940*b*: 158, 171, pl. 1, fig. 5.

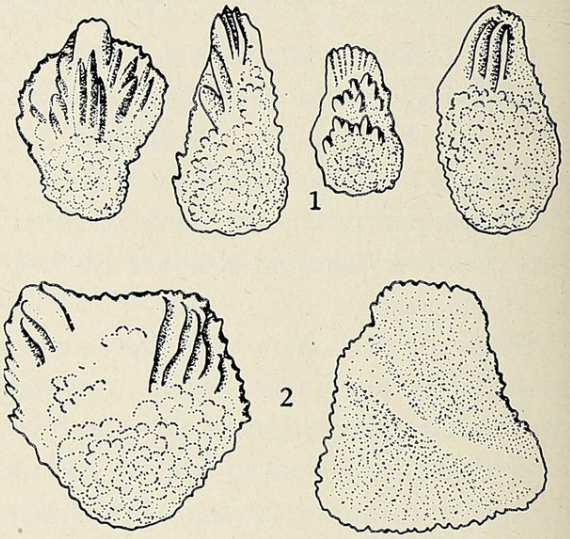
Diagnosis: Colony unbranched, flagelliform, arising from a somewhat spreading base. Primary longitudinal canals two in number. Verrucae prominent, usually somewhat bent, arranged in two series, each of two approximately alternating rows of zooids; series separated by

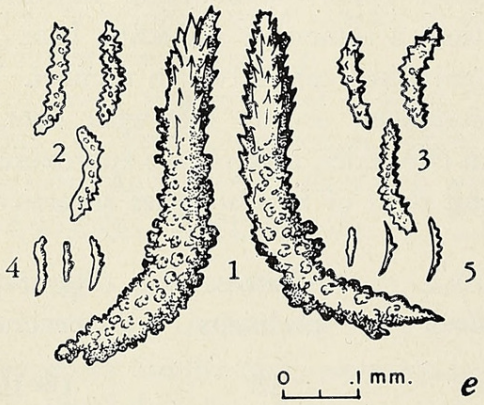
	C. flabellum	"Albatross" specimens	Resurvey specimen
No. twigs per cm. branch length	8–18	18	14–16
Angle of origin of twigs	30°–40°	30°–40°	30°–40°
Length of twigs	10–20 cm.	2.5–5.0 cm.	2.5–5.0 cm.
No. whorls per 4 cm. twig length	15–20	28–32	28–32
No. polyps per whorl	3–8	3–5	3–5
Length of polyps	1.5–2.0 mm.	2.0 mm.	1.25 mm.











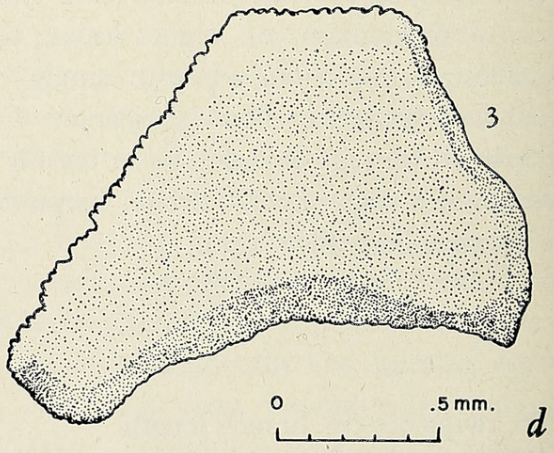


FIG. 6. *a–e, Paracis squamata: a,* side view of retracted zooid removed from calyx to show anthocodial armature; *b,* single calyx with retracted zooid; *c,* a twig enlarged to show arrangement of calyces; *d,* spicules, including spicules of the calicular margin (1), of the verrucal wall (2), and of the verrucal base (3); *e,* spicules, including one of the opercular points (1), spindles of the tentacles (2 and 3), and spindles of the pinnules (4 and 5).

barren areas corresponding to two primary canals. Verrucae absent from lower part of colony. Proximal zooids on colony very low, increasing in height distally, 2 mm. tall near middle of colony. Axis slender, calcified, with prominent concentric rings. Sclerites of verrucae mostly rather long, fairly stout, double spindles with low warts and more or less pronounced smooth girdle. Sclerites of coenenchyma symmetrical double clubs with prominent belts of warts. Color orange-ochraceous, tips of verrucae darker.

Spicule measurements:

Verrucae: 0.08 × 0.025 mm.; 0.075 × 0.025 mm.; 0.095 × 0.031 mm.

Coenenchyma: 0.06 × 0.035 mm.; 0.061 × 0.037 mm.; 0.062 × 0.04 mm.

Locality: Station 9.

Specimens: One perfect, one damaged, U.S.N.M. No. 44090.

Remarks: The collection contains two specimens of this gorgonellid which agree satisfactorily with Kükenthal's diagnosis and figures. The largest, broken at the tip, is 235 mm. long, with a diameter of 2.5 mm. at the base and 1.0 mm. at the upper end. The smaller, and complete, colony is 175 mm. high with a stem diameter of 1.5 mm. at the base tapering to about 0.5 mm. at the tip. Both are attached to fragments of rocks by slightly spreading bases. In the large colony, the verrucae are directed upward, especially toward the tip, as shown in Figure 1*h*, whereas in the smaller, they are bent downward. Although Kükenthal's species was described from the Red Sea, the Bikini examples agree so well with his description that there seems to be no need for separation.

Genus TOEPLITZELLA Deichmann

Toeplitzella laevis (Verrill)

Figs. 1*g*, 4*e*; Pl. 1, fig. 2

Juncella laevis A. E. Verrill 1866: 189.

Juncella laevis + *Scirpearia furcata* + *Scirpearia furcata* var. *robusta* + *Scirpearia robusta* (part) J. J. Simpson 1910: 306, 339, 357.

Ellisella laevis Stiasny 1940*b*: 170.

For detailed list of references, see Kükenthal 1924: 366.

Diagnosis: Colony sparsely branched. End twigs long and whip-like, 2.5 mm. in diameter near base. Anthocodiae retractile into dome-like, upturned verrucae as much as 0.5 mm. in height, arranged in two series along stems, each series of three or four alternating rows of zooids. Series separated by bare tracts corresponding to primary longitudinal canals. Coenenchyma comparatively thick, filled with double clubs whose heads have rather smooth warts. Axis gray-brown, longitudinally striate, highly calcareous, with conspicuous concentric rings. Color plain orange-red, spicules light orange.

Spicule measurements:

Double clubs: 0.07 × 0.025 mm.; 0.075 × 0.048 mm.; 0.07 × 0.044 mm.

Double spindles: 0.07 × 0.025 mm.; 0.071 × 0.026 mm.

Locality: Station 9.

Specimen: U.S.N.M. No. 44091, in alcohol.

Remarks: The Resurvey Collection contains a damaged specimen which was probably more than 18 inches in height when complete. The colony is simply forked; zooids are absent below the fork, and most of the coenenchyma is missing on the trunk.

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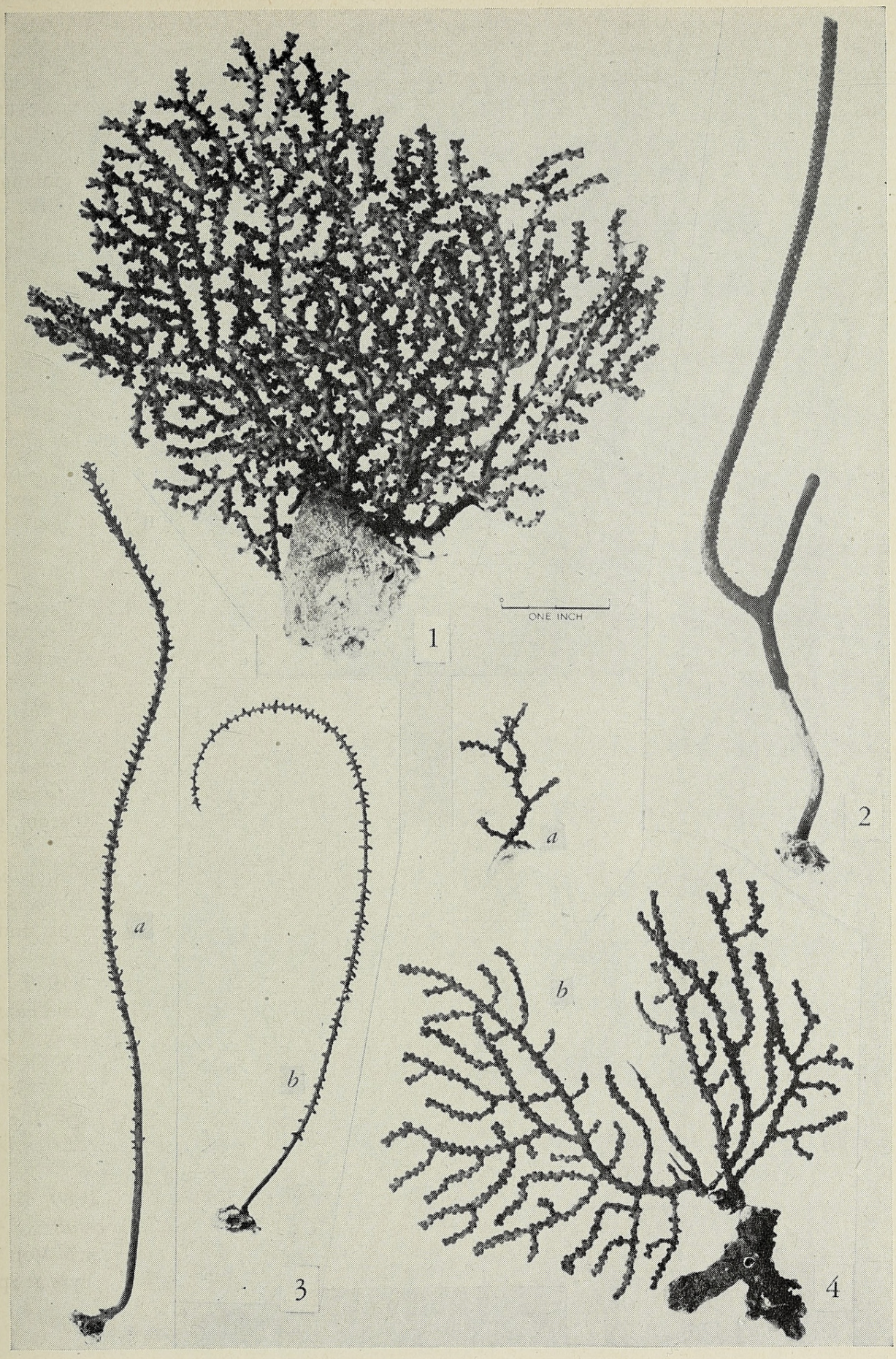

ALCYONARIA PLATE 1.

FIG. 1. *Paracis squamata.*
FIG. 2. *Toeplitzella laevis.*
FIG. 3. *Scirpearia erythraea.* Two colonies.
FIG. 4. *Paracis orientalis.* Two colonies.

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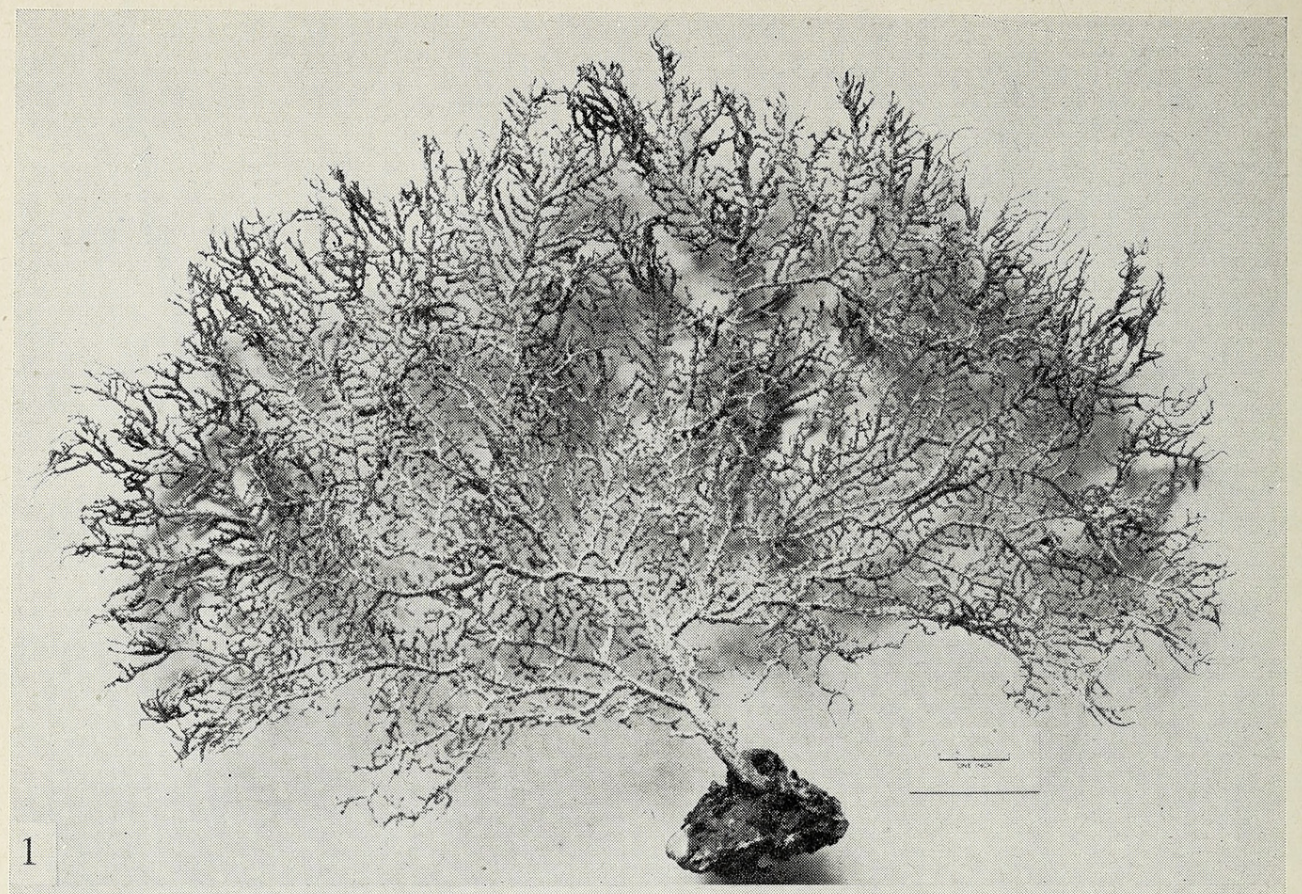

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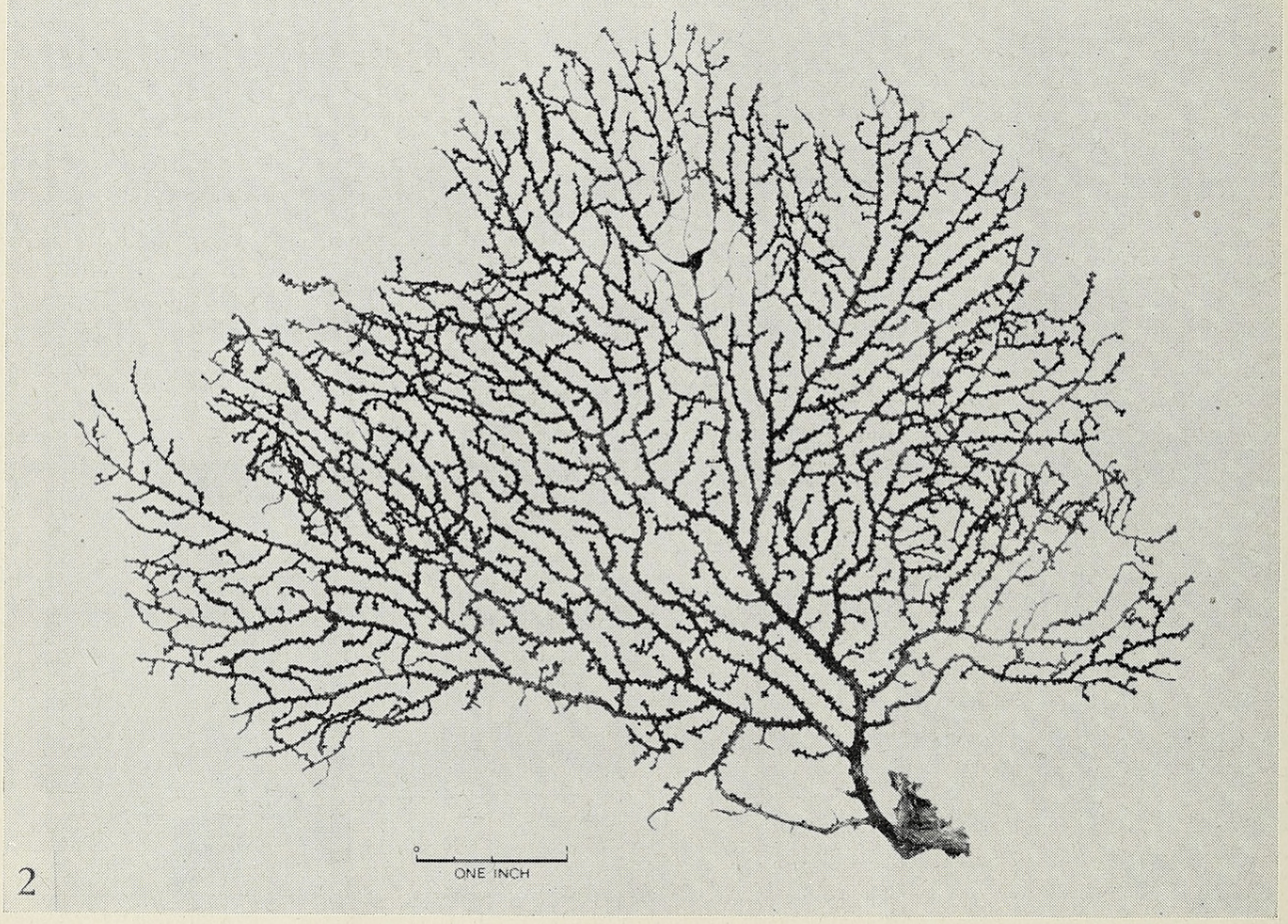

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ALCYONARIA PLATE 2.

FIG. 1. *Muricella englemani.* The holotype. FIG. 2. *Villogorgia compressa.*

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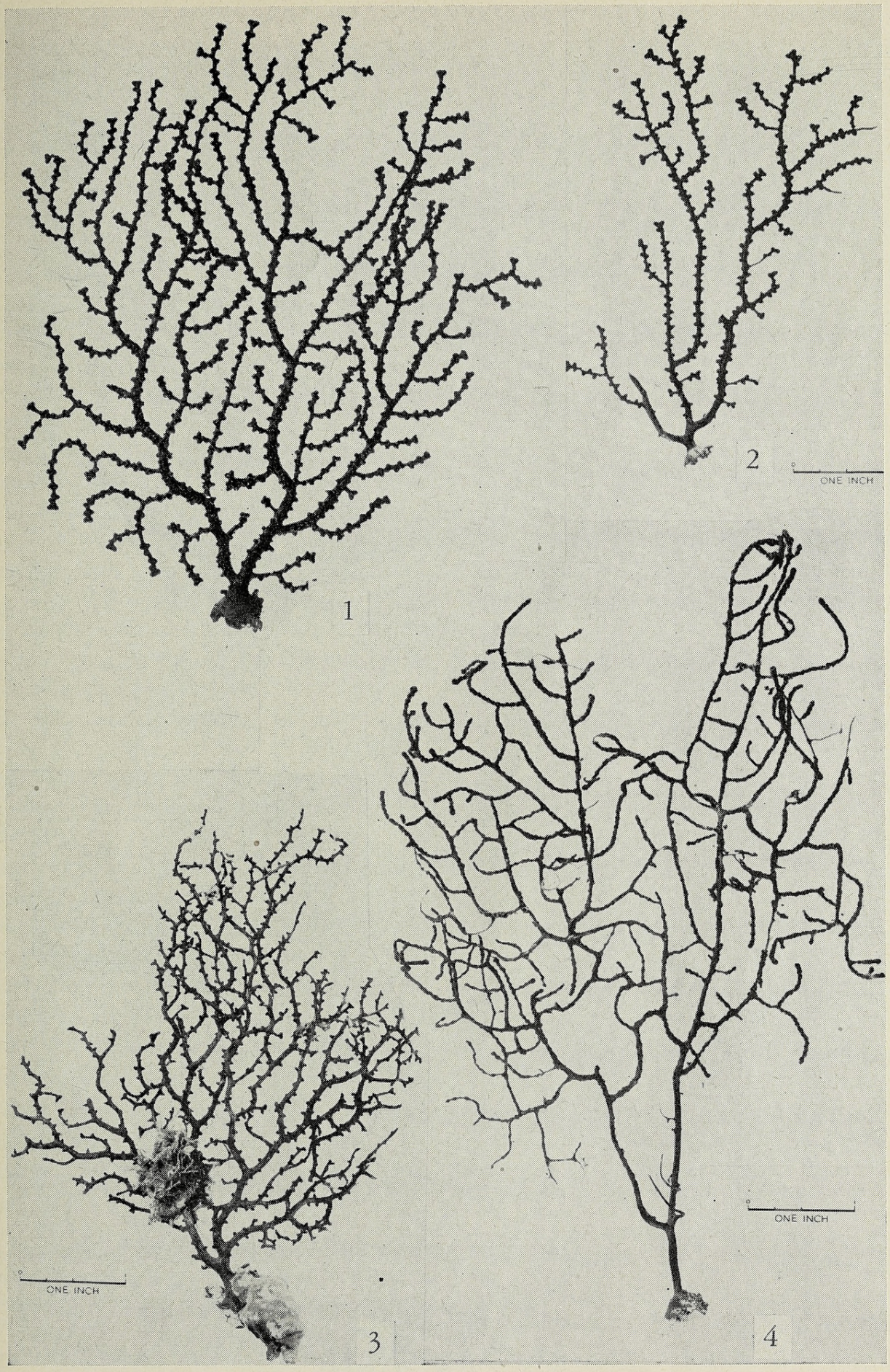

ALCYONARIA PLATE 3.

FIG. 1. *Villogorgia zimmermani.* The holotype.
FIG. 2. *Villogorgia zimmermani* form *pallida.* The holotype.
FIG. 3. *Keroeides koreni.*
FIG. 4. *Echinogorgia russelli.* The holotype.

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