31 December 1987

PROC. BIOL. SOC. WASH.
100(4), 1987, pp. 937–991

NEW AND PREVIOUSLY KNOWN TAXA OF ISIDID OCTOCORALS (COELENTERATA: GORGONACEA), PARTLY FROM ANTARCTIC WATERS

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Abstract.—The classification and taxonomic characters of the gorgonacean family Isididae are discussed, and a revised key to world genera is presented. The Austral genus *Primnoisis* Studer [and Wright] and its type species *P. antarctica* (Studer) are discussed on the basis of material taken by HMS *Challenger* and by R/V *Hero,* and a new species, *P. mimas,* is described from South Georgia. The genus *Echinisis* Thomson and Rennet and its type species *E. spicata* (Hickson) are discussed on the basis of material taken by USARP, and three new species, *E. eltanin, E. vema,* and *E. persephone* are described. The genus *Sclerisis* Studer is discussed and its type species, *S. pulchella* Studer, is redescribed on the basis of a specimen obtained by USARP. *Ceratoisis ramosa* Hickson is redescribed and the species reassigned to the genus *Chathamisis* Grant. A new genus, *Stenisis,* is established for the Caribbean *Primnoisis humilis* Deichmann, and the species is redescribed on the basis of recently collected specimens. A new genus and species, *Australisis sarmentosa,* are established for abundant sub-Antarctic material obtained by USARP. Five new finds of *Ceratoisis microspiculata* Molander are reported from Antarctic localities, variation among the specimens described, and the species assigned to a new genus *Tenuisis.* The genus *Chelidonisis* Studer, heretofore known only from eastern Atlantic localities, is reported from the Gulf of Mexico and the Philippine Islands. A new subspecies, *C. aurantiaca mexicana,* and a new species, *C. philippinensis,* are described.

In the course of describing a collection of isidid octocorals from New Caledonia (Bayer and Stefani, 1987), it was necessary to examine a wide range of specimens, both identified and unidentified, belonging to that family. Among these were detected six undescribed species that were not pertinent to the New Caledonian fauna and consequently were omitted from that paper. In addition, two incorrect generic allocations were discovered which require new genus-level taxa, and two records of *Chelidonisis* from the collections of the National Museum of Natural History, Smithsonian Institution, that substantially widen the range of that genus are recorded as a new subspecies and a new species respectively. These species are the subject of the present paper.

Abbreviations

BM(NH) = British Museum (Natural History)
USARP = United States Antarctic Research Program
USNM = National Museum of Natural History, Smithsonian Institution

Classification

The currently accepted subdivision of the family Isididae into subfamilies was pro-

posed by Kükenthal (1915, 1919, 1924) and modified by Grant (1976). Although that system is open to some criticism, it is not the purpose of this paper to revise the subfamilies. Grant's characterization of subfamilies and allocation of genera, here reduced to key form, is as follows:

1 (4). Polyps retractile.
2 (3). Sclerites of polyps are thorny spindles. Muricellisidinae (*Muricellisis*).
3 (2). Sclerites of polyps are small rods with tubercles. Isidinae (*Isis, Chelidonisis*).
4 (1). Polyps non-rectractile.
5 (6). Sclerites of polyps include needles, spindles or rods. Keratoisidinae (*Keratoisis, Lepidisis, Acanella, Isidella*).
6 (5). Sclerites of polyps are exclusively scales.
7 (8). Polyps with operculum. Peltastisidinae (*Peltastisis, Chathamisis, Minuisis*).
8 (7). Polyps without operculum.
9(10). Scales of polyps cycloid, with smooth margin, irregularly arranged. Circinisidinae (*Circinisis*).
10 (9). Scales of polyps crescentic, with dentate or serrate margin, transversely placed. Mopseinae (*Mopsea, Primnoisis*).

Taxonomic Characters

Classification and identification of isidid octocorals has traditionally been based upon (1) retractability of the polyps, (2) growth form of the colonies, (3) details of the articulated axial skeleton, (4) shape and size of the calcareous sclerites, and (5) arrangement of sclerites on the individual polyps. To this character array Grant (1976) has added (6) the presence or absence of sclerites specially differentiated as opercular scales protecting the oral region of the polyps.

1. Retractility.—The distinction between retractility (line 1 in the key plan above) and non-retractility (line 4) directly involves the anatomical concepts of anthocodia and anthostele (Bourne 1900) and is often blurred, both here and elsewhere in the Gorgonacea. In the case of the sole genus, *Muricellisis* of the Muricellisidinae, the polyps consist of a distal part (anthocodia) armed with sclerites that form a crown and points, which is completely retractile within a proximal, calicular part (anthostele) stiffened by sclerites, which projects above the general coenenchymal surface. The tentacles fold inward over the mouth and are enclosed within the crown and points, just as is the case in *Paramuricea.*

In the case of *Isis,* the polyps are nearly or quite devoid of sclerites and have no proximal calicular part filled with sclerites; they are completely retractile within a thick, common coenenchyme. Consequently, the polyps of *Isis,* although completely retractile, are not composed of anthocodia and anthostele.

In the case of *Keratoisis* and other genera attributed to Keratoisidinae, the polyps usually are armed with numerous sclerites that fill the body wall and extend into the tentacles. The polyps are proportionally very tall and the spiculation of the distal part is continuous with that of the proximal part. As there is no division into anthocodia and anthostele, the polyps cannot withdraw the entire distal part within the proximal body wall, but can only fold the tentacles over the mouth. Because of their height and the thinness of the common coenenchyme, retraction is impossible.

The polyps of *Chelidonisis,* which have been considered retractile because they form conspicuous hemispherical or bluntly conical calyces (Kükenthal 1919:599, 631; 1924: 414, 445), demonstrate an intermediate condition. The spiculation of the body wall is continuous with that of the tentacles, which merely fold inward over the mouth; the projecting "calyx" is actually the sclerite-filled body wall of the polyp. The polyps are not retractile in the same way that those

of either *Muricellisis* or *Isis* are retractile, and in this sense they differ from the polyps of *Keratoisis* only in relative height and in form of the sclerites.

Terminology: The term "calyx," equivalent to Kükenthal's "Polypenkelch," is correct for the anthostele of *Muricellisis* but is not appropriate for the different structure formed by the polyps of *Chelidonisis, Mopsea, Acanthoisis* and other isidids, primnoids and ellisellids that are unable to withdraw the distal part of the polyp into a specialized proximal part (Bayer et al. 1983: 6). The term "verruca" was used by Verrill, Deichmann and others not only for this kind of structure, but for the true "calyx" as well. Verseveldt (1940:5) employed "verruca" for the wart-like anthostele when the anthocodia is retracted. As it is useful to distinguish between an anthostelar calyx and the "calyx" of polyps that are incapable of retraction, and Bayer et al. (1983) recommended no term for the latter, it might now be appropriate to restrict the term "calyx" to the former condition and revive "verruca" for the latter. The adjectival form "verrucal" should be used in preference to Deichmann's "verrucinal" (probably falsely analogous to "calicinal").

2. Growth form.—The manner of branching and colonial form developed in the subfamily Mopseinae (+Peltastisidinae and Circinisidinae Grant) are (1) filiform, unbranched, (2) planar, dichotomous or pinnate, and (3) branched in all directions, bushy or bottle-brush shaped. These colonial types were the main characteristics distinguishing genera until *Echinisis* was established by Thomson and Rennet (1931) for bottle-brush colonies with strongly spinose polyp-sclerites. Subsequently, Grant (1976) employed the development of a distinctly differentiated operculum of 8 plates to establish the genera *Chathamisis* and *Minuisis* for species not otherwise different from *Primnoisis.*

The shape of isidid colonies ranges from simple, unbranched whips to densely branched, bushy or arborescent forms, comparable to the range of form present in other families. Recurrent patterns of branching are pinnate, dichotomous, and bottle-brush forms that correspond exactly with the growth forms of primnoid colonies.

3. Axial skeleton.—Although the overall aspect of isidid colonies depends upon the diverse form of the supporting axis, the articulated nature of the axis is consistent. Branching may take place from the horny nodes or from the calcareous internodes. The internodes may be long or short, hollow or solid, longitudinally grooved or not, smooth or sculptured with granules, thorns or spines.

4. Sclerites.—The distinction between spindles (or rods or needles) and scales is by no means sharp, as spindles can be more or less flattened depending, at least in part, upon the space in which they occur. The larger sclerites of the polyps of all Keratoisidinae are cylindrical rods or tapered spindles, but the small sclerites may be thin scales even though their thickness is not limited by space. In *Tenuisis exilis* described below, the sclerites of the polyp body are elongated and tapered, but are flat and scale-like even though they seem not to be limited by space. They are, in fact, scales, not spindles, thus excluding *Tenuisis* from Keratoisidinae.

5. The arrangement and number of sclerites in the body of the polyp influences its mobility. The polyps of *Isis* are essentially devoid of sclerites, hence can withdraw completely into the thick common coenenchyme that invests the supporting axis. Long sclerites placed longitudinally, as in *Keratoisis,* preclude any appreciable shortening of the body during contraction, whereas smaller sclerites transversely placed, as in *Mopsea,* permit the body to be shortened to a greater or lesser extent. Added protection is gained by turning the oral end of the polyp inward toward the axis during contraction, a motion possible if the sclerites along the adaxial side of the body are smaller or fewer than those along the abaxial side.

6. *Operculum.*—The differentiation of the distal body scales and the proximal tentacle scales as protective structures for the contracted polyp is so inconsistent that its use as a character at the subfamily level is suspect. Among species of *Mopsea* alone, there are species with (1) a well-differentiated operculum of eight triangular scales (*Mopsea plumacea* Briggs), (2) a series of triangular to crescentic scales transversely arranged along the base of the tentacles (*Mopsea whiteleggei*), and (3) narrow scales set en chevron on the base of the tentacles (*Mopsea encrinula*). In Grant's system, *Mopsea whiteleggei* and *M. encrinula* fall in the Mopseinae, but *Mopsea plumacea* would fall in the Peltastisidinae.

In *Echinisis spicata,* the scales of the two distalmost circles of body sclerites project spine-like around the bases of the tentacles. Within these marginal scales eight acutely triangular scales of the tentacle bases fold inward over the infolded tentacles, which bear smaller triangular scales decreasing in size distad along the tentacle backs, followed by transversely set crescentic scales. If the eight triangular scales are treated as an "operculum," as Grant (1976) did, *E. spicata* should fit without difficulty in the subfamily Peltastisidinae, as the polyp sclerites are exclusively scales, even though they have deeply incised margins.

In the three new species here ascribed to *Echinisis,* the distalmost circle of body scales (i.e., "marginals") can fold inward over the bases of the tentacles in complete contraction, forming an apparent operculum, but these scales are poorly differentiated from those on the base of the tentacles making it difficult to distinguish "opercular" scales from those following.

From this it can only be concluded that the degree of differentiation of the sclerites to form an "operculum" is variable, ranging from narrow scales set en chevron on the bases of the tentacles, through a series of imbricating crescentic scales transversely arranged, to a single large triangular or triradiate scale on the base of each tentacle, followed distally by smaller scales. In speciose genera such as *Mopsea,* all of these conditions and intergrades occur. It therefore appears that this character is more important at the species level than at the generic level. However, until more material is available for evaluation, the genera *Chathamisis* Grant and *Minuisis* Grant are maintained as distinct from *Primnoisis* Wright and Studer.

Family Isididae Lamouroux, 1812, sensu lato

The continuing increase in collections and discovery of new species obscures some of the taxonomic boundaries that have become accepted over the past century, making the allocation of species to genera, and of genera to subfamilies, increasingly problematical. Material both old and new now at our disposal requires the establishment of four new genera of Isididae in addition to the revalidation of two others suggested in a separate paper (Bayer and Stefani 1987), bringing to 20 the number of genera in this family. As the relationship of the various genera is unclear and the boundaries of the subfamilies are blurred, no attempt is made here to propose a "natural" arrangement. Accordingly, we offer the following artificial key for the differentiation of the genera of Isididae here recognized.

1(2). Polyps unarmed or with only a few tiny rods in tentacles, contractile within thick coenenchyme. Sclerites of coenenchyme are small clubs in surface layer, with capstans and tuberculate spindles in the deeper layers, sometimes developing as double heads or coarse pebbles .... *Isis* Linnaeus, 1758

2(1). Polyps armed with numerous sclerites, conspicuously pro-

jecting above the thin coenenchyme.

3(4). Sclerites of polyps organized as crown and points in anthocodiae fully retractile within prominent calycular anthosteles. Sclerites are thorny spindles ....*Muricellisis* Kükenthal, 1915

4(2). Sclerites of polyps not organized as crown and points, polyps not divided into anthocodial and anthostelar portions; tentacles fold inward at summit of prominent verrucae, but upper part of polyp does not retract into lower.

5(6). Coenenchymal sclerites are 6-radiates ....*Chelidonisis* Studer, 1890

6(5). Coenenchymal sclerites if present never 6-radiate.

7(8). Sclerites of polyps are cycloid scales with smooth margins .....*Circinisis* Grant, 1976

8(22). Sclerites of polyps are transversely arranged plates.

9(16). Eight large scales at bases of tentacles are differentiated as a distinct operculum.

10(11). Colonies unbranched, filiform .....*Peltastisis* Nutting, 1910

11(10). Colonies branched.

12(13). Opercular scales triangular .. .. *Minuisis* Grant, 1976

13(12). Opercular scales triradiate.

14(15). Polyp sclerites of distalmost 1–3 whorls below tentacles furnished with a strong projecting spike ..... *Echinisis* Thomson and Rennet, 1931

15(14). Polyp sclerites of distalmost 1–3 whorls without projecting spike ..*Chathamisis* Grant, 1976

16(9). No well-differentiated operculum of eight scales; bases of tentacles covered by several transverse, oblique, or converging scales.

17(21). Polyps tall, clavate, often recurved toward axis.

18(19). Colonies bushy, often bottlebrush shaped ..... *Primnoisis* Studer [and Wright], 1887

19(20). Colonies pinnate, dichotomous, or openly irregular; internodes of axis longitudinally fluted, often but not always with small spines or denticles on the ribs ....*Mopsea* Lamouroux, 1816

20(18). Colonies planar, distantly pinnate; internodes of axis not fluted, covered with low, blunt prickles .....*Stenisis,* n. gen.

21(17). Polyps short, not recurved toward axis ..... *Acanthoisis* Studer [and Wright], 1887

22(7). Sclerites of polyps are not transversely set plates but spindles, rods, or slender flat scales arranged longitudinally or obliquely.

23(26). Colonies unbranched.

24(25). Colonies tall, polyps all around; internodes of axis usually hollow, sometimes longitudinally fluted, surface smooth ...*Lepidisis* Verrill, 1883

25(26). Colonies small, polyps biserial; internodes of axis solid, not longitudinally fluted, covered with low, sharp prickles ....*Caribisis,* n. gen.

26(29). Colonies branched from the nodes.

27(28). Branches arranged in whorls, growth form bushy .... *Acanella* Gray, 1870

28(27). Branches not in whorls, growth form approximately planar .. .. *Isidella* Gray, 1857

29(23). Colonies branched from the internodes.

30(31). Sclerites of polyps are minute

flat scales never projecting between the tentacle bases .... *Tenuisis,* n. gen.

31(30). Sclerites of polyps are spindles or rods.

32(33). Polyps filled with slender, sharp spindles arranged conspicuously en chevron; no strong spindles projecting spine-like between bases of tentacles; colonies abundantly bushy; axis with numerous horny nodes throughout, internodes not longitudinally ribbed or fluted, covered with small sharp prickles most conspicuous on distal internodes ..... *Australisis,* n. gen.

33(32). Polyps with strong, longitudinally or obliquely arranged spindles not en chevron.

34(35). Colonies pinnate or bottle-brush shaped, of small or moderate size, main axis with few nodes joining long internodes expanded as runway for commensal polychaete worm. Spike-like sclerites around oral end of polyp, if present, aligned on the bases of tentacles, between the mesenterial insertions ..... *Sclerisis* Studer, 1878

35(34). Colonies not bottle-brush shaped, large and robust, axis with numerous nodes throughout, joining internodes not expanded as runway for commensal worms. Oral end of polyps with strong spindles or needles projecting spine-like between bases of tentacles .. .. *Keratoisis* Wright, 1869

Primnoisis Studer [and Wright], 1887

Primnoisis Studer [and Wright], 1887:46.—Wright and Studer, 1889:34.—Kükenthal, 1912:339; 1919:611; 1924:432.—Gravier, 1913:456.—Deichmann, 1936: 250.—Bayer, 1956:F222; 1981:942.—Grant, 1976:10, 35.

Ceratoisis (part).—Hickson, 1907:7.

Type species.—*Isis antarctica* Studer, 1879; by monotypy.

Diagnosis.—Isidids branched from the internodes, in several planes or on all sides in the form of a bottle-brush; polyps cylindrical or clavate, standing straight or inclined from the axis, sometimes recurved toward the axis, scattered on all sides of the branches; sclerites in the form of serrated scales or plates, sometimes narrow and fusiform, transversely placed in the polyps; bases of tentacles armed with converging scales.

Remarks.—As originally constituted, *Primnoisis* contained a single species, *Isis antarctica* Studer; the original specimen taken northwest of Kerguelen by the *Gazelle* was a denuded axis of bottle-brush growth form. The characters of the polyps and their spiculation remained unknown until the *Challenger* Expedition obtained living specimens of strikingly similar habitus in 310 fathoms off Prince Edward Island. Because of its distinctive growth-form (now known to be shared by several species of *Primnoisis* and *Echinisis*), Studer in collaboration with E. P. Wright identified the *Challenger* material with that from Kerguelen taken by the *Gazelle* cruise, briefly described the polyps and spiculation, and established the genus *Primnoisis* (Studer [and Wright], 1887:45). However, the bare axis of the type specimen of *Isis antarctica* could belong to any of several species in at least two genera, so the generic characters of *Primnoisis* are based upon the *Challenger* specimen so identified and described in detail in the *Challenger* report, not upon the type of *Isis antarctica,* its nominal type species.

Comparison of our drawing (Fig. 3a) with Wright and Studer's illustration of the same

material (1889:pl. 8, fig. 2a) immediately reveals a discrepancy in the shape of the polyps. Although we at first suspected that either the *Challenger* specimens are a composite of more than one species, or the illustrations of the polyps of *P. rigida* (1889: pl. 8, fig. 3a) and *antarctica* (pl. 8, fig. 2a) were transposed, we are informed by Mr. Simon J. Moore (British Museum [Nat. Hist.]) that neither is the case. His examination of all the *Challenger* specimens labeled as *P. antarctica* shows them to be homogeneous and in agreement with our drawing. His comparison of *antarctica* with *P. rigida* shows that the polyps of the latter are distinctly recurved, in conformity with pl. 8, fig. 3a, whereas the polyps of *antarctica* are bent inward little, if at all. Consequently, the discrepancy probably can be attributed to inaccuracy of drawing introduced by the commercial lithographer who prepared the plates for the *Challenger* report.

Three new species also of profusely bushy, if not strictly bottle-brush, growth form were added to *Primnoisis* by Wright and Studer (1889:34–40). This dense branching has been accepted as a generic character distinguishing *Primnoisis* from *Mopsea,* in which branching is "always" planar (either pinnate or dichotomous), and on the basis of it several more species have been added to the genus over the years. These include *Ceratoisis spicata* Hickson and *Primnoisis armata* Kükenthal (both now included in *Echinisis* on the strength of spicular characters of the polyps), *P. formosa* Gravier and *P. fragilis* Kükenthal.

Primnoisis delicatula Hickson, *Ceratoisis ramosa* Hickson (transferred to *Primnoisis* by Kükenthal 1919), and *Primnoisis humilis* Deichmann, although abundantly branched, depart from the "characteristic" growth form of *Primnoisis* and differ in other characters as well, hence cannot justifiably be retained in *Primnoisis.*

The branchlets of *P. ramosa* have a very strong tendency to remain in one plane, and the polyps have a kind of operculum formed by a single large triradiate scale resting upon one or more crescentic scales at the base of each tentacle. These scales, particularly mentioned by Hickson (1904:224), consist of a crescentic or bifurcate base and strong apical spike. Owing to the stylization of the drawing, the disposition of the opercular scales is not clearly shown in Hickson's figure of the polyps (pl. 8, fig. 12); each octant ordinarily includes only one large triradiate scale, the base of which rests upon one or two crescentic "circum-opercular" scales. Considering these features, *Ceratoisis ramosa* Hickson, 1904, falls in Grant's genus *Chathamisis* rather than in *Primnoisis.*

Primnoisis humilis Deichmann (1936: 251) was described only from the fragmentary type specimen from off the Dry Tortugas and has never been illustrated. Three finds taken by the University of Miami Deep-sea Expeditions consist of several specimens in good condition, which provide additional morphological information as well as distributional data, are now placed on record. These specimens show that the species has consistently planar colonies branched in an openly pinnate or "lateral" manner, *Mopsea*-like polyps with transverse sclerites, and ungrooved internodes covered with low prickles, characters incompatible with *Mopsea, Primnoisis,* and all other genera of Isididae. *Primnoisis humilis* Deichmann is therefore assigned to a new genus *Stenisis,* described below.

Kükenthal (1924) recognized eight valid and four doubtful species in the genus *Primnoisis* Studer and Wright, 1887. Two of the species he considered valid, *P. spicata* (Hickson) and *P. armata* Kükenthal, are at present assigned to a genus of their own, *Echinisis* Thomson and Rennet, 1931. Of the species considered doubtful by Kükenthal, *P. pulchella* (Studer) is the type species of the distinct genus *Sclerisis* Studer, 1879; *P. ramosa* (Hickson, 1905), originally de-

scribed in *Ceratoisis* [sic], can be reassigned to the genus *Chathamisis* Grant as demonstrated in this paper; *P. ramosa* Thomson and Ritchie, 1906 (not Hickson, 1905) was based upon denuded axis and is insufficiently characterized for subsequent recognition; *P. formosa* Gravier, 1913, is possibly a valid species but is not clearly differentiated from certain of those species recognized as valid by Kükenthal. Subsequent to Kükenthal's summary in 1924, Deichmann (1936:251) described *Primnoisis humilis,* a new species taken off Florida by the U.S. Coast Survey steamer *Blake,* the first record of the genus in the northern hemisphere. Study of material more extensive than that available to Deichmann now demonstrates that *P. humilis* cannot be retained in *Primnoisis* as now constituted, so a new genus is proposed for it in these pages.

The nominal species attributable to *Primnoisis* are as follows:

1. *Primnoisis antarctica* (Studer), from Prince Edward Island.
2. *Primnoisis sparsa* Wright and Studer, from Prince Edward Island.
3. *Primnoisis ambigua* Wright and Studer, from Kerguelen Island.
4. *Primnoisis rigida* Wright and Studer, from off Rio de la Plata.
5. *Primnoisis fragilis* Kükenthal, from Gauss Station, Antarctic.
6. *Primnoisis mimas* n. sp., from off South Georgia.

As the polyps of *Primnoisis* do not materially differ in spiculation from those of *Mopsea,* these genera are distinguished chiefly by colonial form. On the basis of this criterion, *P. delicatula* Hickson is more appropriately assigned to the genus *Mopsea* and appears to be close to *M. gracilis* Gravier, although not branched strictly in one plane.

Primnoisis fragilis Kükenthal (1912:342) has the bottle-brush form of *P. antarctica* and polyps not much different in size. The marginal scales were depicted as roughly triangular with their apices projecting as points around the distal end of the polyp. The transverse body scales as originally illustrated (Kükenthal 1912:342; 1924:436, fig. 206) are unusually large, but this large size may be more apparent than real, because it is notoriously difficult to discern the shape and edges of all the scales covering the polyps.

As the shape and armature of the polyps and the general form of the sclerites in the subfamily Mopseinae Gray (+ Peltastisidinae and Circinisidinae Grant) are so uniform, generic distinctions are with few exceptions based mainly on colonial form and pattern of branching. Unbranched, filiform or flagelliform colonies comprise *Peltastisis* and *Circinisis,* planar colonies branched either pinnately or dichotomously have been assigned to *Mopsea* and *Acanthoisis* (with the recent addition of *Circinisis*), and colonies abundantly branched in all direction comprise the genera *Primnoisis* and *Echinisis.* The recently established genera *Chathamisis* and *Minuisis* (Grant, 1976) have essentially *Primnoisis* growth form but were distinguished on the basis of opercular development.

Primnoisis antarctica (Studer, 1879)
Figs. 1a, 2, 3a, b, 4

?*Isis antarctica* Studer, 1879:661, pl. 5, fig. 32.

Primnoisis antarctica.—Wright and Studer, 1889:35, pl. 8, figs. 2, 2a, 2b; pl. 9, fig. 6.

Material examined.—Branchlet from one colony from off Marion Island, Prince Edward Islands: 46°41′00″S, 38°10′00″E, 310 fathoms; HMS *Challenger* sta 145A, 27 Dec 1873, BM(NH) 1889.7.5.24.

Antarctic Peninsula, Palmer Archipelago, Graham Land: 64°49.4′S to 64°49.5′S, 62°51.9′W, 120–148 m, *Hero* cruise 721, sta 730, 27 Dec 1971. Three nearly complete

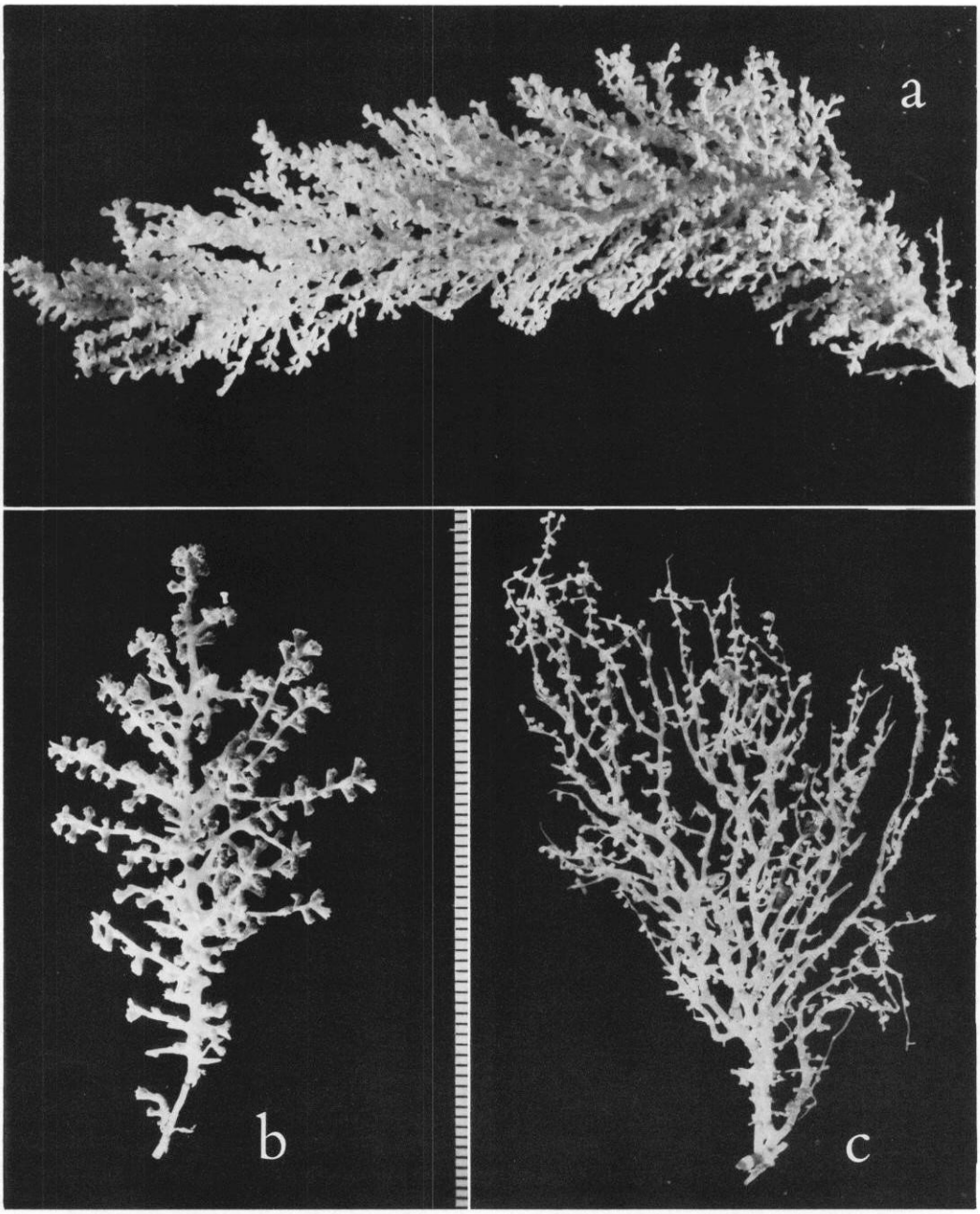


Fig. 1. a, *Primnoisis antarctica* (Studer), USNM 78355; b, *Echinisis spicata* (Hickson), USNM 75222; c, *Chathamisis ramosa* (Hickson), USNM 43071. Vertical scale divided in mm applies to all three specimens.

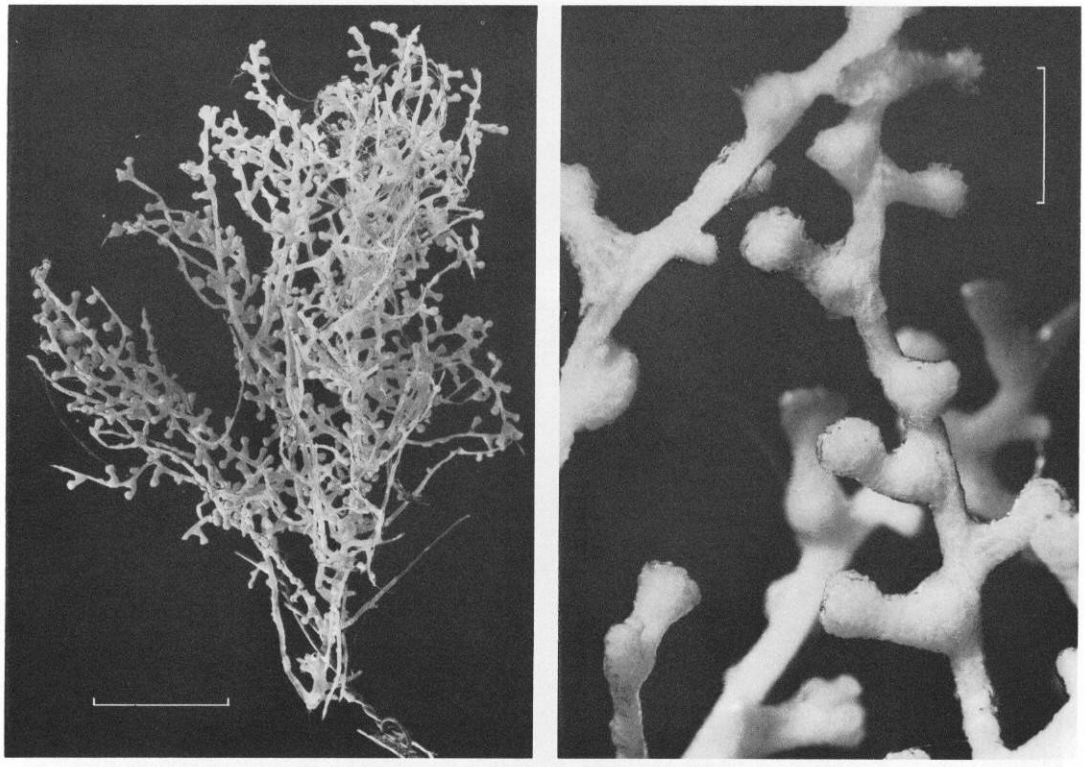


Fig. 2. *Primnoisis antarctica* (Studer), BM(NH) 1889.7.5.24: Left, colony, scale = 1 cm; right, detail of same, scale = 1 mm. Photographs courtesy of the Trustees of the British Museum (Nat. Hist.).

colonies, and branches, alcohol, USNM 78355.

Discussion.—Although described and illustrated by Wright and Studer (1889) in considerable detail, essential information about the size, distribution, and spiculation of the polyps was not presented. Consequently, we have examined the polyps and sclerites of a fragment from one of the *Challenger* specimens through the kindness of Dr. P. F. S. Cornelius, and here present illustrations (Figs. 2, 3a, 4) to supplement the description.

Neither Hickson (1907:6), Thomson and Rennet (1931:11), nor Broch (1965:20) provided enough information to confirm their reports of the species. The drawings given by Kükenthal (1912:340, figs. 55–57) are sufficient to demonstrate that his specimen probably was not the species taken by the *Challenger*.

One lot of specimens of bottle-brush form (USNM 78355) discovered among the Antarctic collections of the National Museum of Natural History can be referred to *P. antarctica* as represented by the *Challenger* specimen now examined. Although the latter was dredged near Prince Edward Island, the present lot from the Palmer Archipelago along the west coast of the Antarctic Peninsula is at least from the same general sector of the Antarctic even if not remotely topotypic. The polyps (Fig. 3b) are for the most part similar to those of the *Challenger* specimens (Fig. 3a) in size and shape and spiculation, but the fully developed polyps (as opposed to obviously young individuals) show considerable variation in size from one twig to another even on the same branch. Moreover, many polyps are misshapen owing to the presence of 1–4 large eggs, a condition not observed by Wright and Studer.

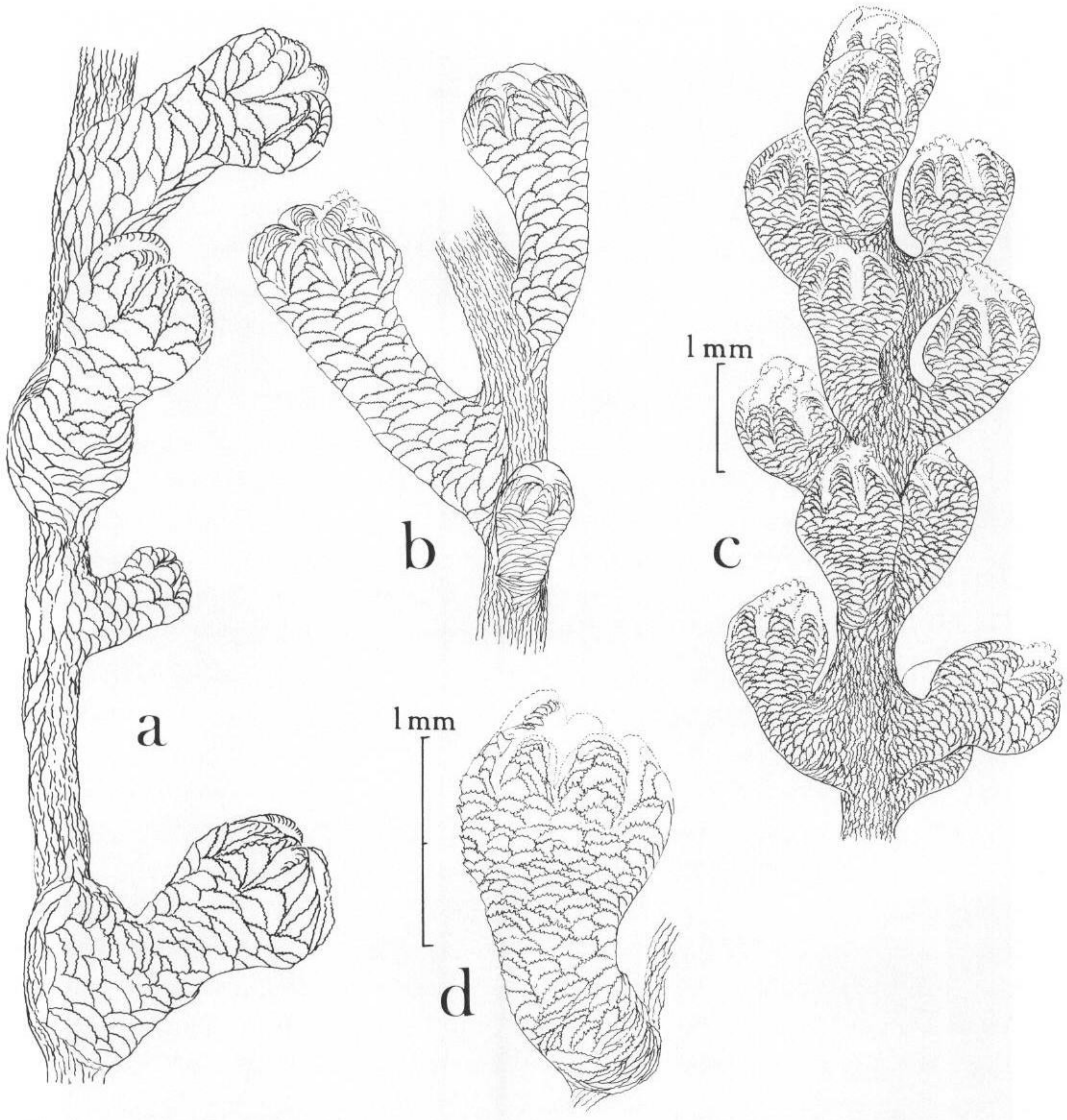


Fig. 3. a, *Primnoisis antarctica* (Studer) from *Challenger* sta 145A, BM(NH) 1889.7.5.24; b, *Primnoisis antarctica* from *Hero* sta 730, USNM 78355; c, d, *Primnoisis mimas* n. sp., USNM 78356. Scale at c applies to c only; that at d applies to a, b, d.

Primnoisis mimas, new species
Figs. 3c, d, 5, 6

Material examined.—Vicinity of South Georgia: 54°14.1′S., 37°54.2′W, depth 164–183 m. USARP, R/V *Islas Orcadas,* cruise 575, sta 101, 10 Jun 1975; 2 colonies without holdfast, USNM 78356 (holotype), USNM 78357 (paratype).

Vicinity of South Georgia: 53°51′–53°52′S, 37°38′–37°36′W, depth 97–101 m. USARP, USNS *Eltanin,* cruise 22, sta 1535, 7 Feb 1966; 1 colony without holdfast, USNM 78358 (paratype) and 1 small colony possibly juvenile or representing a different species (USNM 78359).

Diagnosis.—Bottlebrush-shaped *Primnoisis* with closely crowded clavate polyps

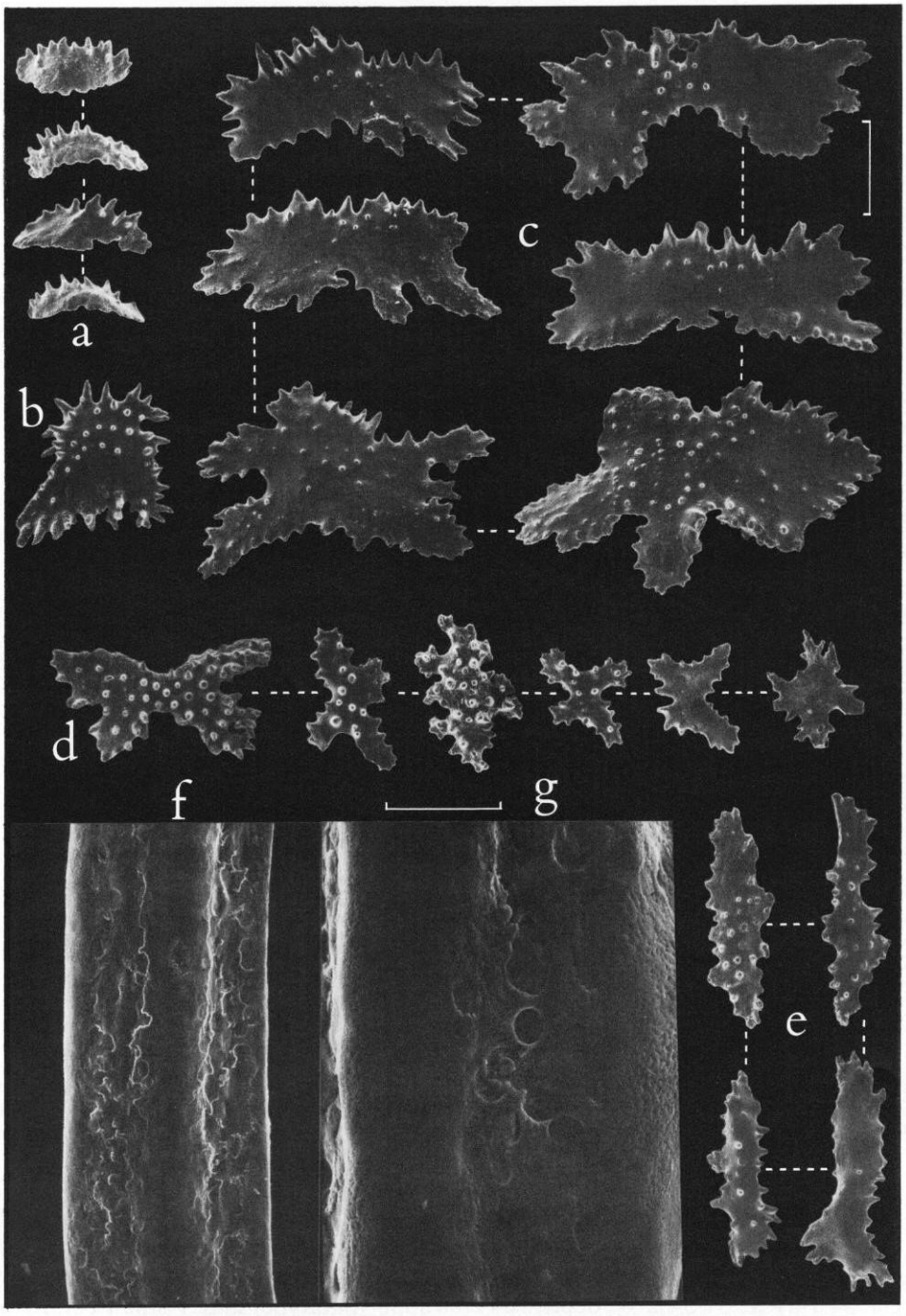


Fig. 4. *Primnoisis antarctica* (Studer) from *Challenger* sta 145A, BM(NH) 1889.7.5.24. a–e, sclerites: a, From tentacles; b, From base of tentacle; c, From body of polyp; d, e, From coenenchyme; f, g, Part of axial internode. 0.1 mm scale bar at c applies to a–f; 0.05 mm bar at g applies to g only.

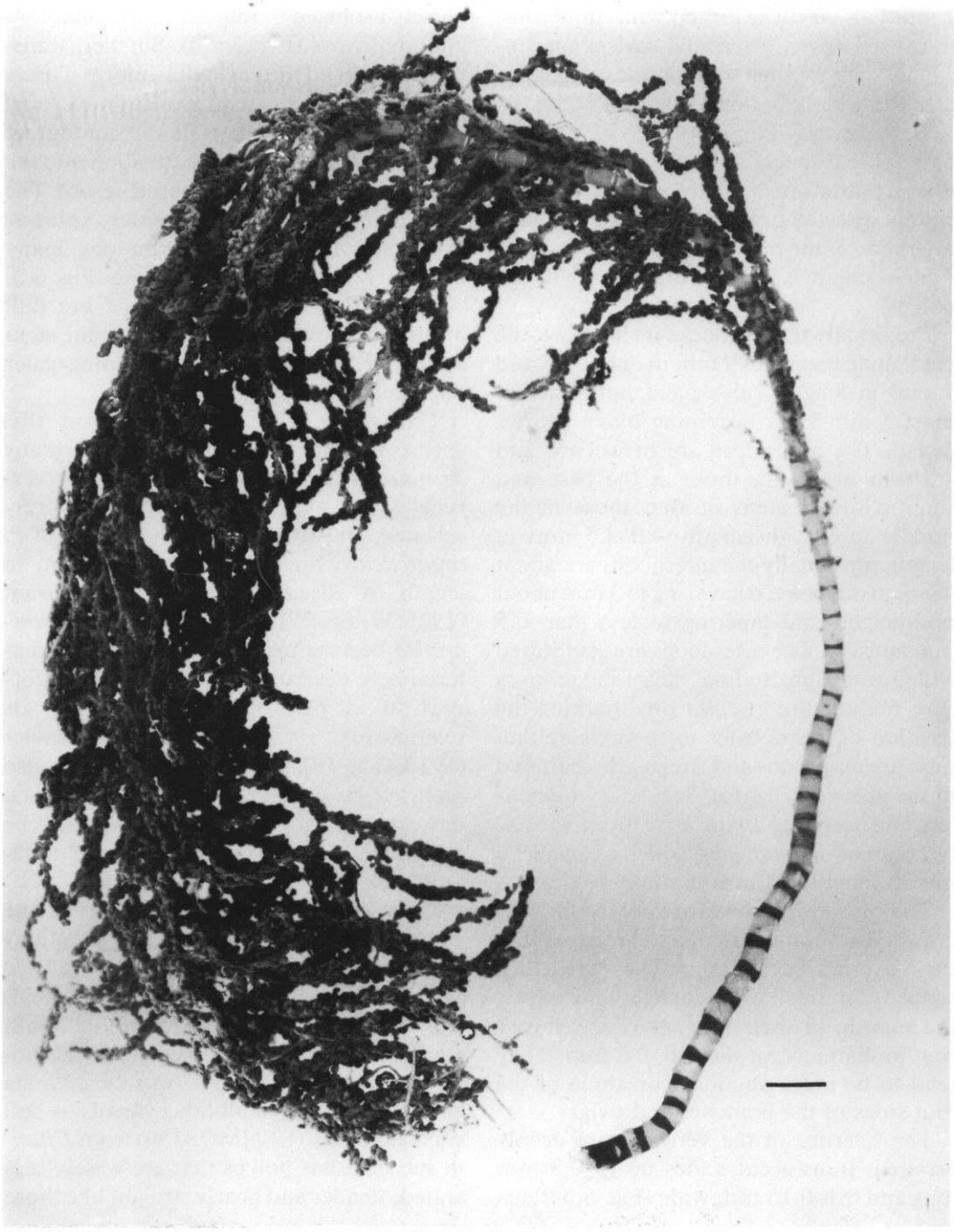


Fig. 5. *Primnoisis mimas* n. sp., holotype colony, USNM 78356. Scale bar = 1 cm.

2 mm tall; verrucae armed with numerous, transverse, deeply serrated scales; coenenchyme with slender spinous rods and spindles commonly flattened and scale-like.

Description.—The holotype colony (Fig. 5) is approximately 43 cm high. It is shaped like a bottle-brush, with up to three upwardly directed branches arising from each internode of the main axis, measuring up to 7 cm in length, 0.7 mm in diameter (without polyps).

Proximally the axis lacks its holdfast; the basal node measures 4 mm in diameter, and 7 mm in length; subsequent nodes are at most 3 mm long, becoming much shorter distad. The internodes are between 2 and 4.5 mm in length, those at the base and summit of the stem shorter, those in the middle more consistently 4.0–4.5 mm in length; proximally the internodes are about 4 mm in diameter, decreasing to 3 mm about mid-height, and tapering to less than 0.5 mm apically. The internodes are sculptured with distinct longitudinal ridges and grooves (Fig. 6e); oval or circular pits marking the location of desmocytes in the axis epithelium are numerous and irregularly scattered in the grooves (Fig. 6f). Secondary branchlets and terminal twigs arise from the internodes of the branches, which average 2.5 mm in length, 0.7 mm in diameter.

The upwardly directed polyps are so crowded around the stem and branches that they overlap each other. They are club-shaped, 2 mm tall with tentacles folded over the mouth; at their base, they measure 1 mm in diameter, at the top, 0.6 mm. They tend to be more abundant on three of the four sides of the branches and twigs.

The sclerites of the verrucae are deeply serrated, translucent scales up to 0.3 mm long and 0.1–0.15 mm wide (Fig. 6c) transversely arranged in numerous irregular longitudinal rows (Fig. 3c, d). Smaller, transversely placed scales with more closely serrated margins extend along the backs of the tentacles, curved to fit the contour of the rachis (Fig. 6a); those extending into the pinnules show a peculiar twist (Fig. 6b). The coenenchyme contains slender, spinous spindles and rods 0.25–0.3 mm long, many distinctly flattened and scale-like (Fig. 6d).

The polyps and coenenchyme are dull brown; the lower nodes of the main stem are a rich reddish brown, becoming paler distad. The internodes are white.

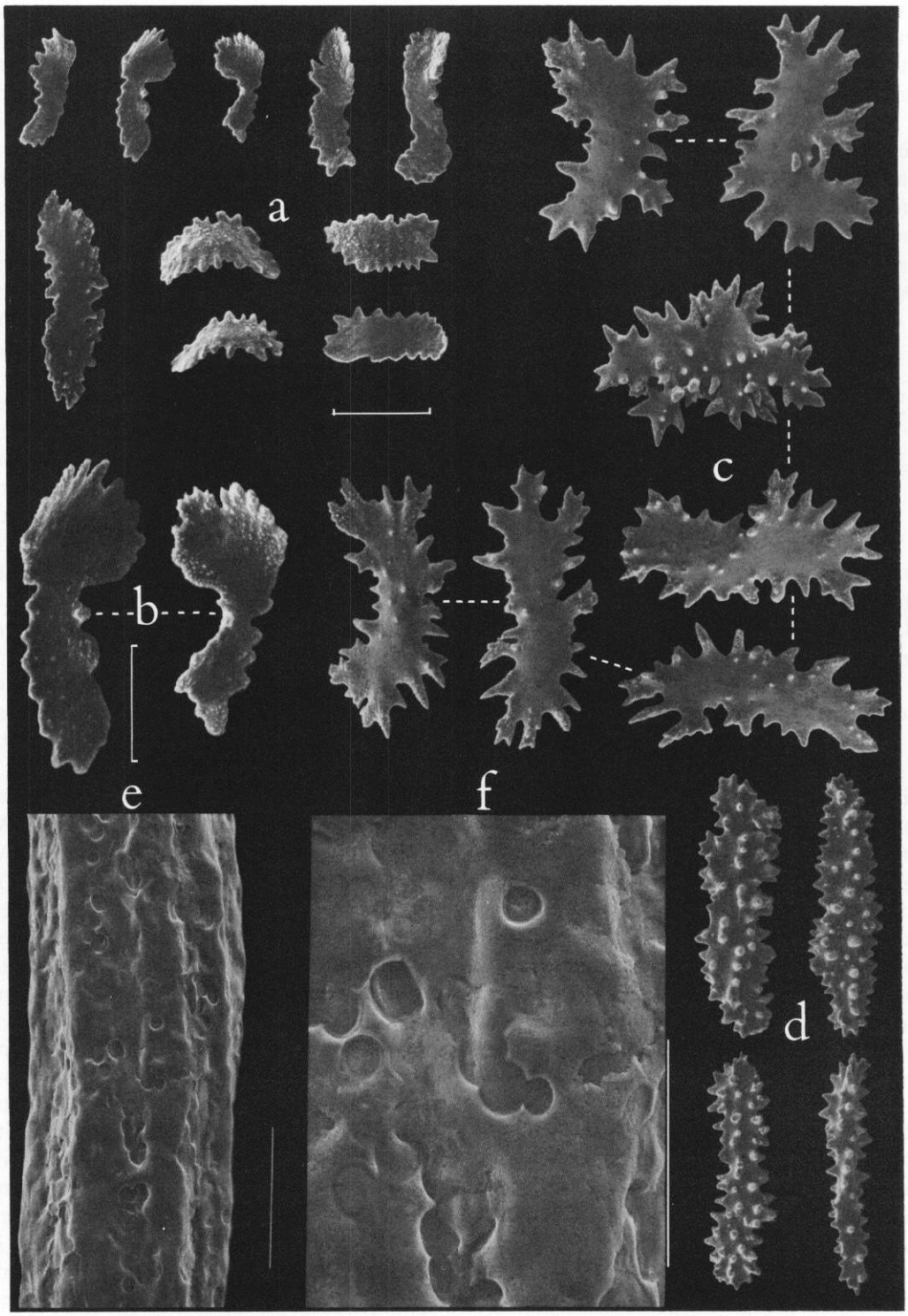
Comparisons.—In growth form this species is stouter and more robust than any *Primnoisis* heretofore described. The verrucal scales are more deeply and sharply serrated, and smaller than than those of *P. antarctica,* which may exceed 0.4 mm in length. A specimen illustrated by Grant (1976:37, fig. 32) and attributed to *P. antarctica* bears some resemblance to the material here described, but insufficient information is provided to determine its relationship. *Primnoisis formosa* Gravier (1913:453; 1914:31, pl. 1, figs. 3–5), also reported by Grant (1976:38), has a much more delicate growth form, and seems to be closer to *antarctica* than to the present material.

Etymology.—Greek Μίμασ, one of the giants, slain by Zeus (or perhaps Ares) during the war with the gods.

Remarks.—A specimen (USNM 78358) collected at *Eltanin* sta 1535, off South Georgia, is smaller and paler than the holotype and paratype from *Islas Orcadas* sta 101, but it agrees in all other details. A still smaller colony (USNM 78359) from *Eltanin* sta 1535 has polyps that are widely separated, slender and nearly straight like those

→

Fig. 6. *Primnoisis mimas* n. sp. a–d, sclerites: a, From tentacles; b, From pinnules; c, From body of polyp; d, From coenenchyme; e, f, Part of axial internodes. 0.1 mm bar at a applies to a, c, d; 0.05 mm bar at b applies to b only; 0.2 mm bar at e applies to e only; 0.1 mm bar at f applies to f only.


a
b
c
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of *P. antarctica* on its lower branches, but on the upper branches and apex of the main stem clavate, recurved polyps are crowded as in the type material of *P. mimas.*

The variation among specimens from different stations and among colonies from the same haul suggests that intensive study of more abundant material will be necessary before Antarctic species of gorgonians can be adequately delimited and reliably recognized.

Echinisis Thomson and Rennet, 1931

Ceratoisis (part).—Hickson, 1907:5.
Primnoisis (part).—Kükenthal, 1915:122; 1919:611; 1924:432.
Echinisis Thomson and Rennet, 1931:15.—Grant, 1976:47.

Diagnosis.—Isididae with polyps covered by conspicuously lobed or branched scales having deeply serrate margins, those of 1 to 3 distal transverse rows bearing a strong projecting spine.

Type species.—*Ceratoisis spicata* Hickson, 1907, by subsequent designation.

Remarks.—This genus was established for colonies of essentially *Primnoisis* growth form, but in which the body sclerites of the polyps are irregularly stellate plates, those of the distalmost transverse rows below the tentacles having one ray developed as a strong projecting spike (Thomson and Rennet 1931). In one species (*E. spicata*), scales of the uppermost 2–3 rows develop such a spine; in the other (*E. armata*), only one row has the spines. Observations on variation of this character suggest that it is not wholly consistent (Thomson and Rennet 1931; Grant 1976). The three new species described herein, while clearly showing projecting spinous polyp scales as in *Echinisis,* depart from the bottle-brush growth form of the two species of that genus known heretofore. As we consider it undesirable to erect yet another genus, solely on the basis of growth form, we here place the new forms in *Echinisis* with a suitably emended diagnosis.

The recognition of *Echinisis spicata,* the type species of *Echinisis* Thomson and Rennet, 1931, on the basis of published data about the two species included in it is problematical. Kükenthal (1912) considered his *Primnoisis armata* to be close to, if not identical with, Hickson's *Ceratoisis spicata* (Hickson, 1907:7) but maintained the two as distinct species on the basis of the number of transverse rows of polyp sclerites bearing projecting spines and the different appearance of the body scales; the polyps of *spicata* also were considerably larger (2 mm) than those of *armata* (1.3 mm).

The species have subsequently been reported only infrequently, *armata* once when the genus *Echinisis* was established (Thomson and Rennet 1931), *spicata* once by Grant (1976) from six stations off New Zealand. Thomson and Rennet (1931) reported variation in the number of transverse distal scale rows developing strong spines and suggested intergradation between *spicata* and *armata* but retained both species as valid. Grant (1976:49) reported similar variation among his specimens, referring all to *spicata* while echoing Thomson and Rennet's doubt about the distinctness of the species.

We have examined specimens from Bahía Grande, Sta. Cruz, Argentina (USNM 77367), the South Shetland Islands (USNM 75651), Palmer Peninsula (USNM 58161, 76913, *Hero* 1022, *Hero* 26-1), Ross Sea (USNM 75222, *Eltanin* 2110), and off Cape Adare (USNM 77355), ranging in depth from 173 m to 2350 m. They show conspicuous differences in growth form, size of polyps, spiculation, and color of the polyps resulting from pigmentation of the mesenterial filaments, making unequivocal identification with either *spicata* or *armata* difficult. In no case is the circlet of spines of the polyps confined to the single distalmost row as reported by Kükenthal for *armata.*

The type locality of *Echinisis spicata* is McMurdo Bay in the Ross Sea, 175–218 m (96–120 fathoms), Scott Coast, Antarctica. Among the specimens that we have studied, three are from the Ross Sea, one from the

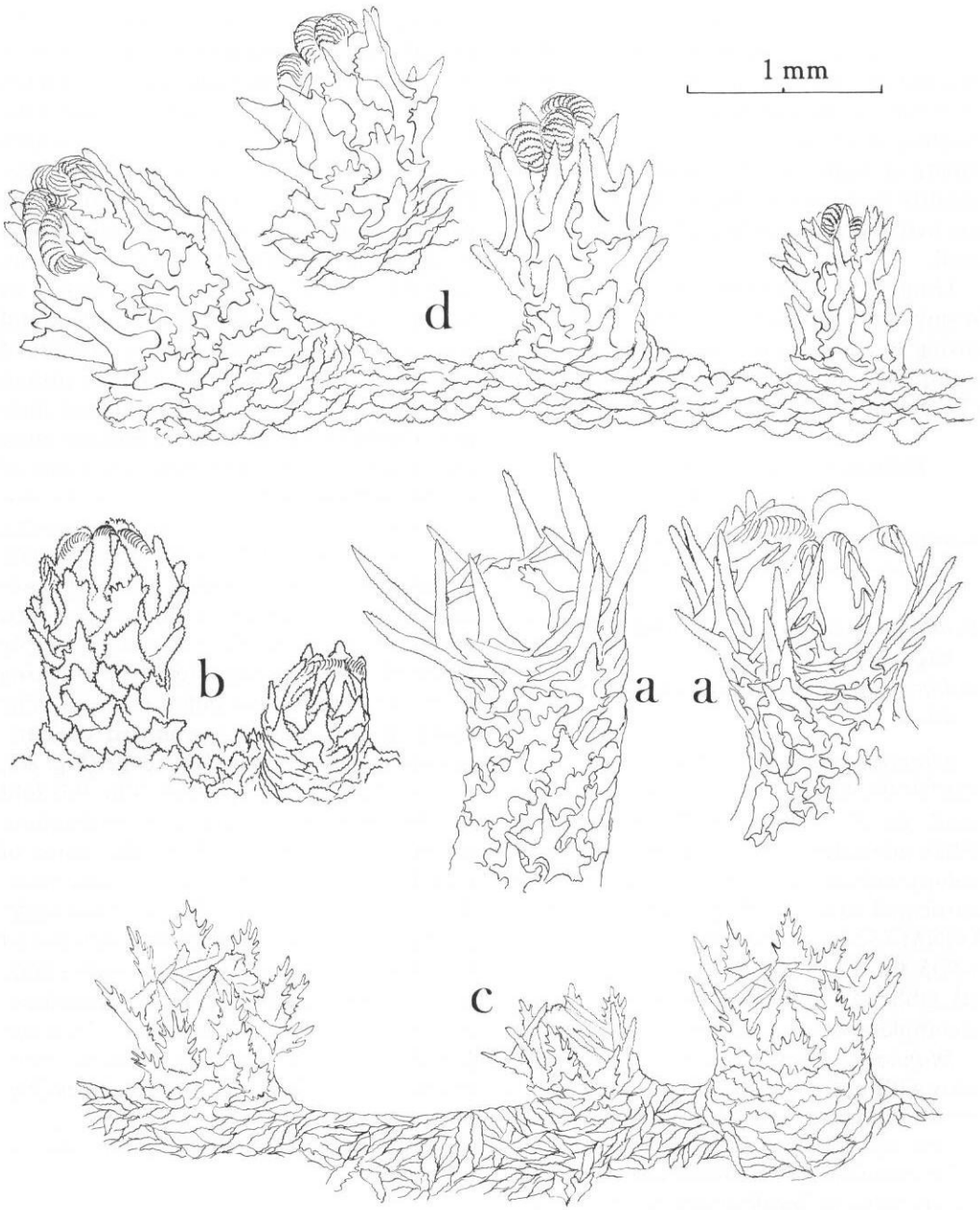


Fig. 7. a, *Echinisis spicata* (Hickson), two polyps; b, *Echinisis eltanin,* n.sp., two polyps; c, *Echinisis vema,* n. sp., three polyps; d, *Echinisis persephone,* n. sp., isolated polyp and twig tip wtih three polyps. Scale applies to all figures.

eastern part of the sea off Saunders Coast, depth unrecorded (USNM 75222), one from the middle part of the sea in 2350 m of water (USNM 78379), and one from the vicinity of Cape Hallett in 392 m (USNM 77355). In attempting to recognize *E. armata* with reasonable confidence the sample from 2350 m has been excluded on the basis of depth

as well as size of the spines of the distal body scales. Those from the other two Ross Sea stations are in close agreement and they conform in all essentials with Hickson's original description; the station off Cape Adare is some 700 km north of the type locality in a similar depth. These two lots are here taken to represent *E. spicata* (Hickson).

Grant (1976) did not include this genus in any of the subfamilies that he recognized, owing to the presence of an "operculum" composed of eight triradiate sclerites (Thomson and Rennet 1931:12, 16).

Echinisis spicata (Hickson, 1907)
Figs. 1b, 7a, 8

Ceratoisis spicata Hickson, 1907:7, pl. 2, figs. 16–18.—Thomson and Rennet, 1931: 15.

Primnoisis spicata.—Kükenthal, 1919:613; 1924:433.

Echinisis spicata.—Grant, 1976:47, figs. 48, 49.

Material examined.—Ross Sea: 76°30′S, 156°19′W, Deepfreeze II, USS *Staten Island,* sta 21, coll. J. Q. Tierney, 26 Dec 1960; one colony with holdfast, one smaller colony without holdfast, one completely decorticated axis, and fragments; in alcohol. USNM 75222.—Ross Sea: off Cape Hallett, 72°05.8′S, 172°15.2′E, 392 m, Deep Freeze III, USS *Atka* sta 23, 12 Jan 1958; two small incomplete colonies, alcohol. USNM 77355.

Diagnosis.—Bottle-brush shaped *Echinisis* with body sclerites of the three distalmost transverse rows each prolonged into a strong, echinulate spike.

Description.—The colonies are branched on all sides in bottle-brush form, but the lateral branches tend to bend in such a way that the growth form becomes almost flabellate (Fig. 1b), as Hickson (1907:7) mentioned. The internodes of the principal axis are from 10 to 17 mm long, their length being rather consistent in any one colony; they give rise on all sides to about 10 to 13 lateral branches, which do not originate with a node. The first node of the lateral branches occurs at about 1 cm from the main axis, before which several secondary branchlets may be produced without articulating nodes. In the completely denuded axis from the eastern part of the Ross Sea, one lateral branch from the first main internode is developed as a secondary branch almost as long as the main axis, but less robust and with fewer branchlets. The fully developed polyps are up to 2 mm tall and 0.75 mm in diameter, mostly separated by at least their own diameter but tending to become more crowded toward the twig tips. The scales of the distalmost three circlets below the tentacles are produced as a stout spine arising from a bifurcated, lobed base (Figs. 7a, 8e); the sclerites of the proximal part of the polyps are stellate plates with elaborately lobed rays, often with one of the rays more sharply serrated and inconspicuously projecting from the body of the polyp (Fig. 8f). The bases of the tentacles are armed with triradiate scales of inverted Y-shape (Fig. 8c), the most proximal of which (Fig. 8d) fold inward over the tentacles in contraction, forming an "operculum" in the sense of Grant (1976). One or more smaller triradiate scales may follow the opercular scale, giving way distad to small flat rodlets and then transversely set crescentic scales (Fig. 8a, b) of the type that is of widespread occurrence also in *Primnoisis, Mopsea, Chathamisis* and *Sclerisis.* The coenenchyme is thin, filled with stellate plates (Fig. 8g).

The color is pale tan with darker brownish polyps.

Echinisis eltanin, new species
Figs. 7b, 9b, 10

Material examined.—Campbell Plateau south of New Zealand: 49°51′S, 178°35′E, 2010–2100 m, USNS *Eltanin*, sta 2143, 26

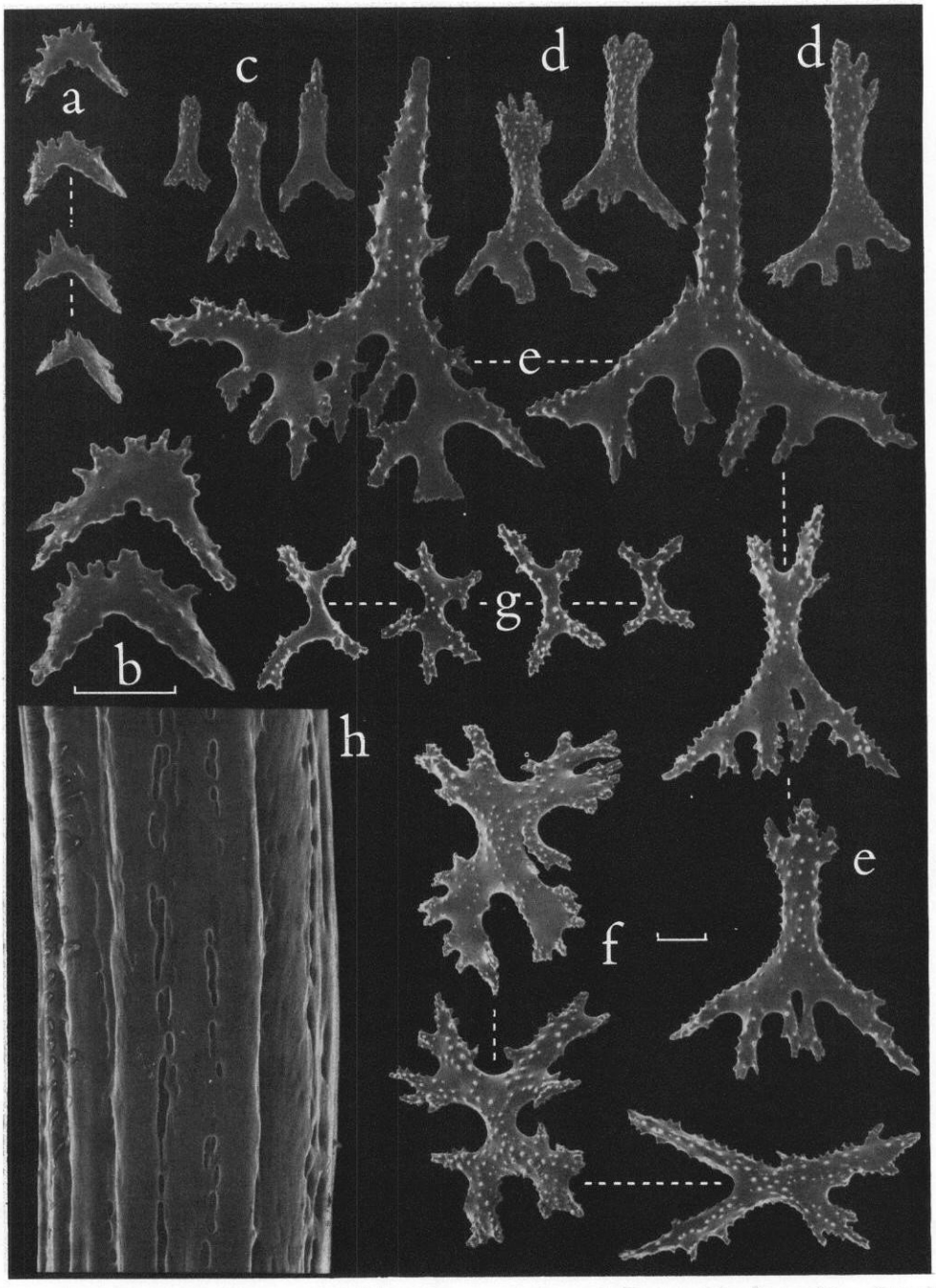


Fig. 8. *Echinisis spicata* (Hickson), USNM 77355. a–g, sclerites: a, b, From rachis of tentacles; c, From base of tentacles; d, Opercular sclerites from beneath tentacles; e, Thorn-stars from distal part of polyp; f, Stellate plates from body of polyp; g, From coenenchyme; h, Part of axial internode. 0.1 mm scale bar at b applies only to b; 0.1 mm bar at f applies to all others.

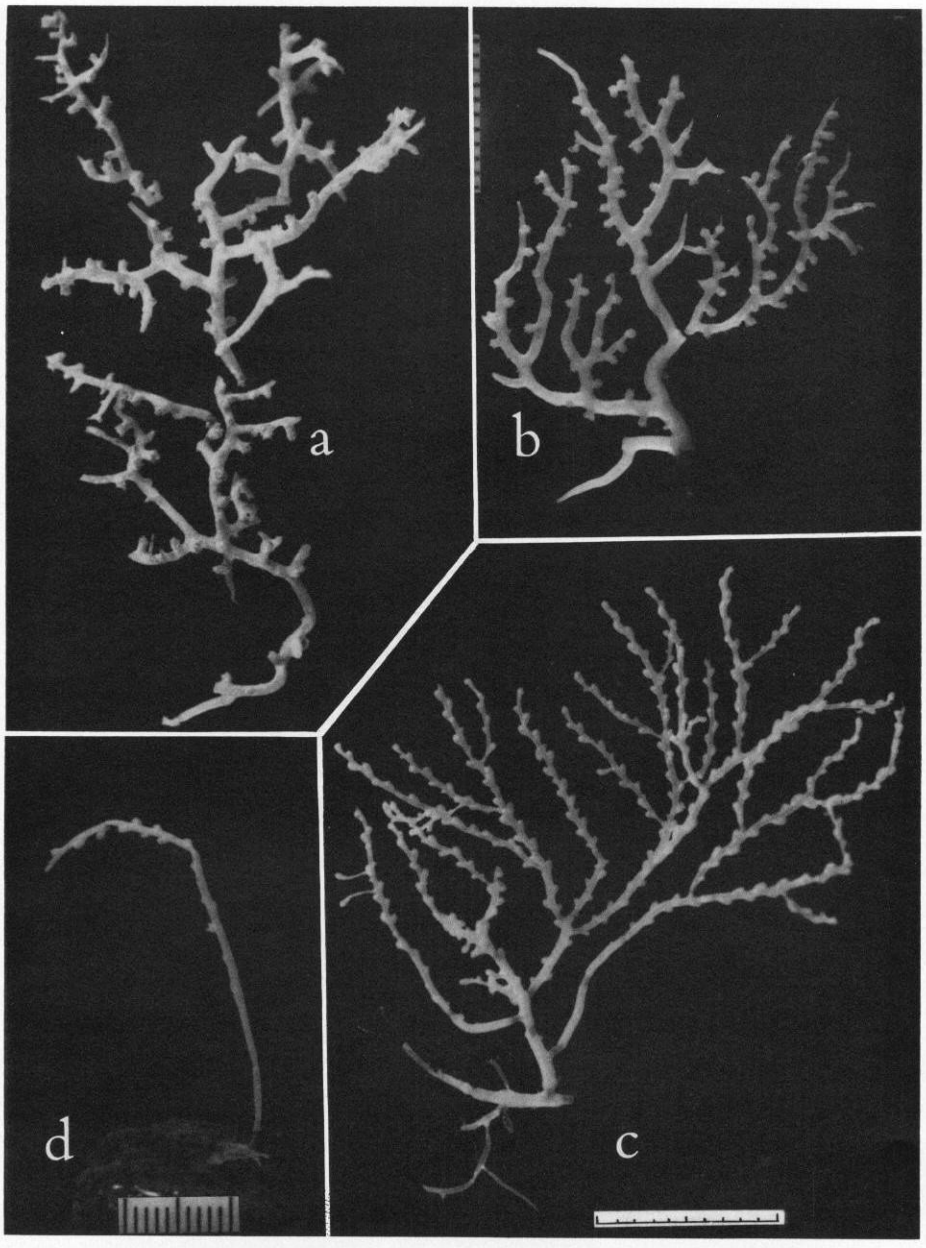


Fig. 9. a, *Echinisis vema,* n. sp., syntypic branches, USNM 78362; b, *Echinisis eltanin,* n. sp., holotype, USNM 78361; c, *Stenisis humilis* (Deichmann), n. gen., USNM 57287; d, *Caribisis simplex,* n. gen., n. sp., holotype colony USNM 57290. All scales = 1 cm; that at top applies to a and b.

Feb 1968; branch (of a larger colony?), now broken in two pieces; alcohol; holotype, USNM 78361.

Diagnosis.—*Echinisis* with branching planar, irregularly pinnate or lateral, without anastomoses. Internodes unusually long, forming tapering branches without nodes. Verrucae with sclerites of distalmost 2 or 3 transverse rows prolonged into a stout, echinulate, often 3-lobed projection.

Description.—Though the general growth-form is unknown because the colony is not

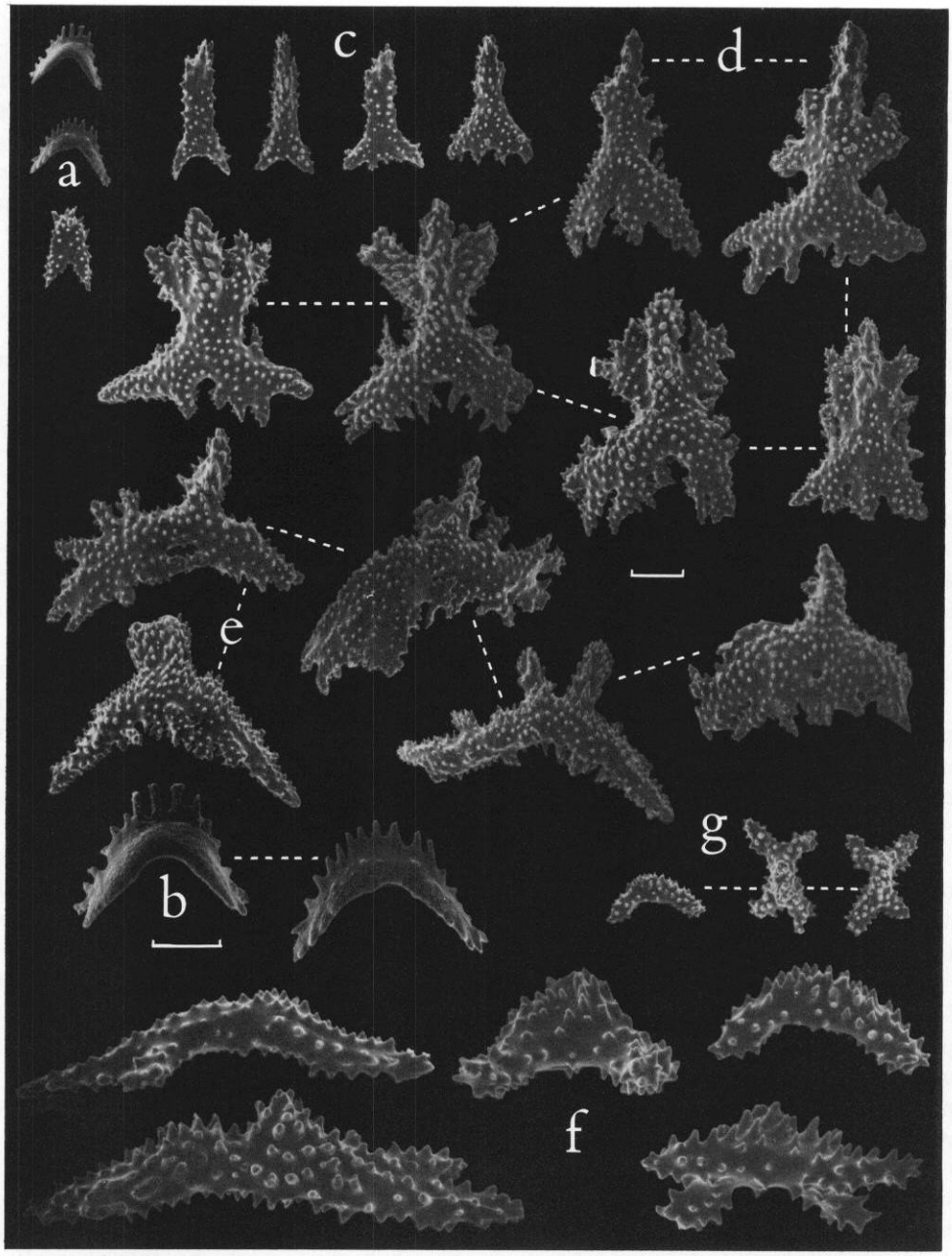


Fig. 10. *Echinisis eltanin,* n. sp., sclerites: a, b, From rachis of tentacles; c, From base of tentacle; d, Prickly thorn-stars from distal part of polyp; e, Prickly thornscales from proximal part of polyp; f, g, From coenenchyme. Scale bar at b = 0.05 mm applies to b only; bar between d and e = 0.1 mm, applies to all others.

complete, the specimen is in one plane (Fig. 9b) and suggests that the complete colony probably was planar. Long, stout branches curve toward the top of the colony. Branches occur laterally, mainly on one side of the colony. Terminal branchlets taper to a point, and are unbranched.

The axis is solid, with unusually long,

branched calcareous white internodes (3.5 cm high) tapering to the tips of the branches. Slight ribbing is visible along the entire internode, but the surface of the axis is quite smooth. The single horny node present in this specimen measures 1 mm in diameter, 0.5 mm in length.

The polyps (Fig. 7b) are prominent, cylindrical, non-retractile, perpendicular to the axis, when contracted forming verrucae that measure 1 mm in height, 0.6 mm in diameter. They are alternate, at intervals of about 0.75 mm, occurring only on one colonial face. The 8 triangular scales form a distinct operculum only when the tentacles are completely infolded.

In the polyps, the tentacles have elongated triradiate scales (Fig. 10c) proximally, measuring up to 0.2 mm, and sharply curved scales distally, the concave margins of which are smooth, while the convex margins are prominently serrated. These measure up to 0.2 mm in length. The body sclerites of the polyps include thorn-scales (Fig. 10d) measuring 0.35 mm in height, 0.5 mm in width, placed around the base of the tentacles in circular rows. In the body wall below this, the transversal thorn scales (Fig. 10e) become more complex, with their basic crescent shape becoming more apparent, finally assuming the shape of curved spindles in the coenenchyme at the base of the polyp.

The coenenchyme contains a thin layer of pale yellow sclerites (Fig. 10f), and appears bumpy owing to the presence of short spindles and 4-rayed bodies with a prominent blunt projection, and longer, more or less bent spindles measuring up to 0.4 mm in length, covered with conical spines, also often with a median hump or blunt projection, serrated along the edges, and 4-armed sclerites measuring 0.25 mm in length, also with blunt projections and serrated edges.

The colony in alcohol is pale yellow in color.

Etymology.—Named after USNS *Eltanin,* which operated in Antarctic waters under the U.S. Antarctic Research Program between July 1962 and December 1972.

Remarks.—The planar branching of the present material indicates that the colony could hardly have been in the bottle-brush shape of the previously described species of *Echinisis.* Assignment of this new species to that genus is made on the basis of the spinous development of the verrucal sclerites.

Echinisis vema, new species
Figs. 7c, 9a, 11

Material examined.—South Atlantic Ocean, Falkland Plateau: 54°44′S, 55°39′W, 1814–1919 m, R/V *Vema* sta 17-61, 11 May 1961; four branches (of a larger colony?). Syntypic branches, USNM 78362. Dry.

Diagnosis.—Irregularly branched *Echinisis* with repeatedly branched internodes infrequently interrupted by horny nodes; distal scales of verrucae prolonged into multiple serrated spikes.

Description.—The overall growth form is unknown because the colony is not complete. The specimen consists of 4 fragments irregularly branched, not planar and neither pinnate nor dichotomous (Fig. 9a). The axis consists of calcareous internodal material showing evidence of only 2 nodal articulations; examination by strong transmitted illumination fails to reveal nodes overgrown by internodal substance. The internodes are repeatedly branched, tapered toward the twig tips where longitudinal grooving becomes evident; elsewhere the surface is macroscopically smooth.

The contracted polyps (Fig. 7c) form short, cylindrical verrucae attaining about 1.75 mm in diameter; the tallest are about 2.5 mm tall, but most are less and some are only 1 mm tall. The body of the polyps is covered proximally by transversely arranged, irregularly lobed plates up to 0.7 mm long, curved in conformity with the body contours (Fig. 11f). The sclerites surrounding the oral end of the verrucae are basically triradiate scales about 0.7–0.8 mm in length, but with elaborately lobed margins. Those of the distalmost 2 or 3 transverse rows are prolonged as a strongly ser-

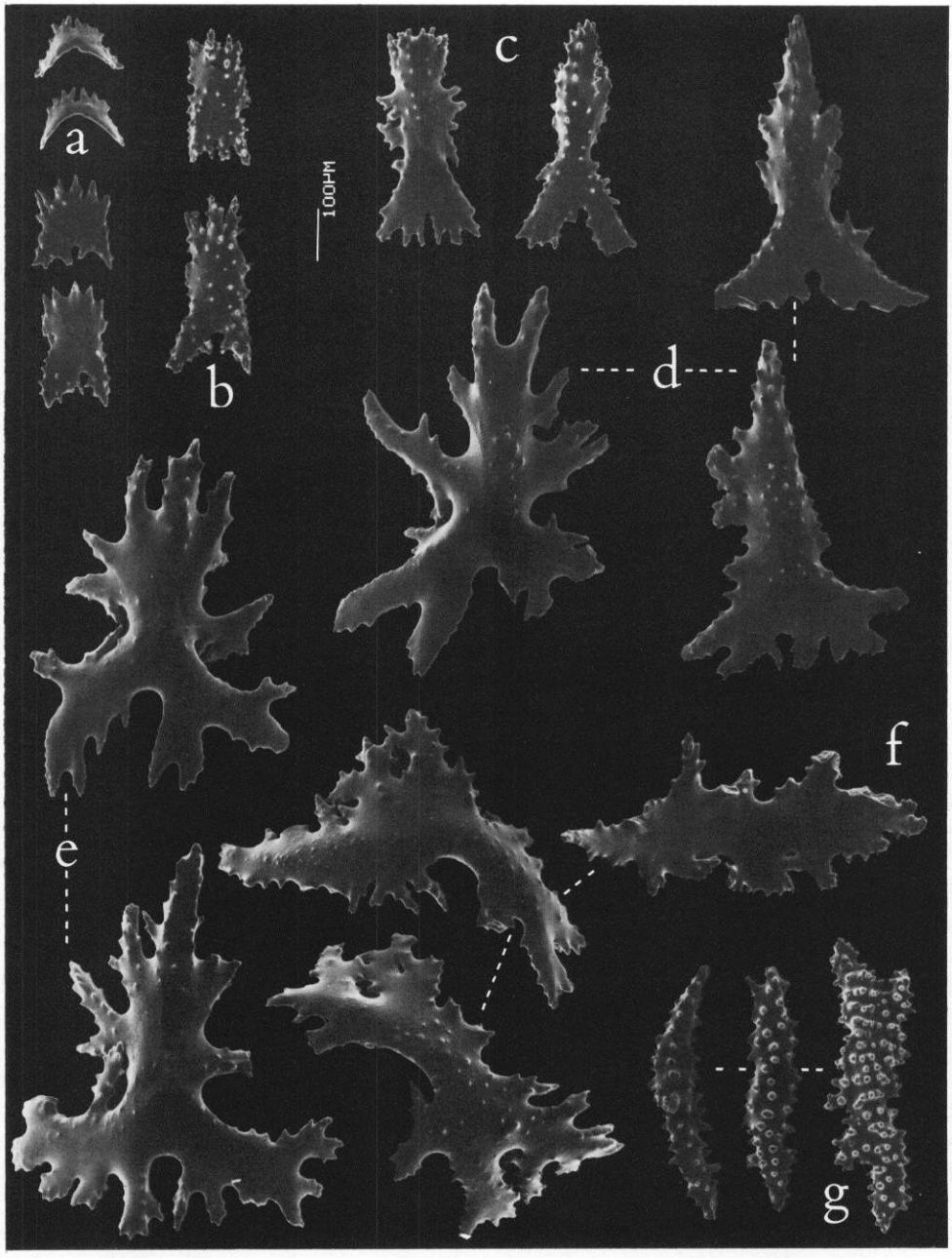


Fig. 11. *Echinisis vema,* n. sp., sclerites: a, b, From tentacles; c, From base of tentacle; d, Opercular scales from beneath tentacles; e, Thorn-stars from distal part of polyp; f, Lobate scales from proximal part of polyp; g, From coenenchyme. Scale applies to all figures.

rated spike; those of the sclerites immediately surrounding the tentacle bases may have on one or both sides one or more low, serrated lobes (Fig. 11d). In the sclerites of the lower transverse rows the lateral lobes of the central spike become prolonged as accessory spikes (Fig. 11e). The scales of the tentacles (Fig. 11a) progressively diminish in size distad, changing in shape from roughly triradiate scales at their bases, which

fold over the oral region as an "operculum" (Fig. 11c), to curved, crescentic scales transversely placed along the distal part of the tentacle rachis (Fig. 11a). The coenenchyme contains a thin layer of irregularly oriented flattened spindles 0.5–0.6 mm long, ornamented with prominent tubercles (Fig. 11g).

The colony in dried condition is white; the sclerites are colorless, translucent.

Etymology.—Named after R/V *Vema* of Lamont Geophysical Observatory.

Remarks.—While adequate to demonstrate the distinctness of this species, the material is insufficient to permit conjecture about the overall branching of the colony. The irregular, crooked branchlets do not indicate the bottle-brush form assumed by *Echinisis spicata* and *E. armata,* so assignment to *Echinisis* is made on the basis of the spinous development of the distal sclerites of the verrucae.

Echinisis persephone, new species
Figs. 7d, 12, 13

Material examined.—Southwest Pacific Basin: 42°01′ to 41°57′S, 130°02′ to 130°01′W, 4831–4851 m, USNS *Eltanin* sta 1775, 14 Aug 1966; many fragments, alcohol, USNM 78363, syntypic branchlets.

Diagnosis.—*Echinisis* of unknown colonial form. Distal part of verrucae surrounded by 3 whorls of thornscales with a claw-like spine projecting obliquely from a divaricate or flattened lobate base; proximal part encircled by transverse, curved, flattened spindles sculptured by scattered conical projections. Coenenchyme with small, irregular spindles, many developing an outwardly directed hump.

Description.—The specimen is broken into many fragments, none longer than about 1.5 cm, some bifurcated or producing 1 or 2 short branchlets (Fig. 12a); the calcareous axis shows no trace of horny nodes among the numerous fragments, hence seems to consist solely of internodal material devoid of longitudinal grooves. The polyps form prominent cylindrical verrucae about 1 mm tall and 0.5 mm in diameter when fully developed (Fig. 7d), placed uniserially along the branchlets, mostly 1–2 mm apart but occasionally a little more or less. The distal part of the verrucae is surrounded by 3 (sometimes 2) whorls of thornscales with an obliquely projecting claw-like, serrated spike; the base of the verrucae is encircled by transversely placed, curved, rather flattened spindles (Figs. 7d, 12b); the tentacles of most polyps are loosely folded over the oral region. The coenenchyme has a pebbly appearance (Fig. 7d) resulting from a single layer of short spindles mostly with a prominent hump.

The verrucal thornscales, aligned in 8 vertical rows, are composed of a claw-like serrated spike projecting obliquely from a bifurcated or lobed, flattened base (Fig. 13d); in many cases the spike is apically enlarged and furnished with several strong diverging thorns (Fig. 13e). The spike is 0.3–0.4 mm long and the base 0.3–0.45 in width. Similar thornscales of smaller size (Fig. 13c) are present on the bases of the tentacles and are capable of folding over the inturned tentacles; distally on the tentacles they give way to transversely placed narrow scales curved to fit the contour of the rachis; these have a smooth concave margin and a convex margin with tall thorns (Fig. 13a, b) that project along the backs of the tentacles. The largest measure about 0.2–0.25 mm, decreasing in size distad along the tentacle. The curved spindles surrounding the base of the polyps are about 0.45 mm long, those merging with the coenenchyme as much as 0.7 mm and not so strongly curved. The coenenchymal sclerites (Fig. 13g) include irregular spindles mostly with a strongly humped projecting surface, sometimes reduced to a roughly hemispherical thorny body, sometimes distinctly fusiform and with or without a thorny projecting process. The stubby, humped bodies are 0.2–0.3 mm long, the narrower spindles up to about 0.5 mm.

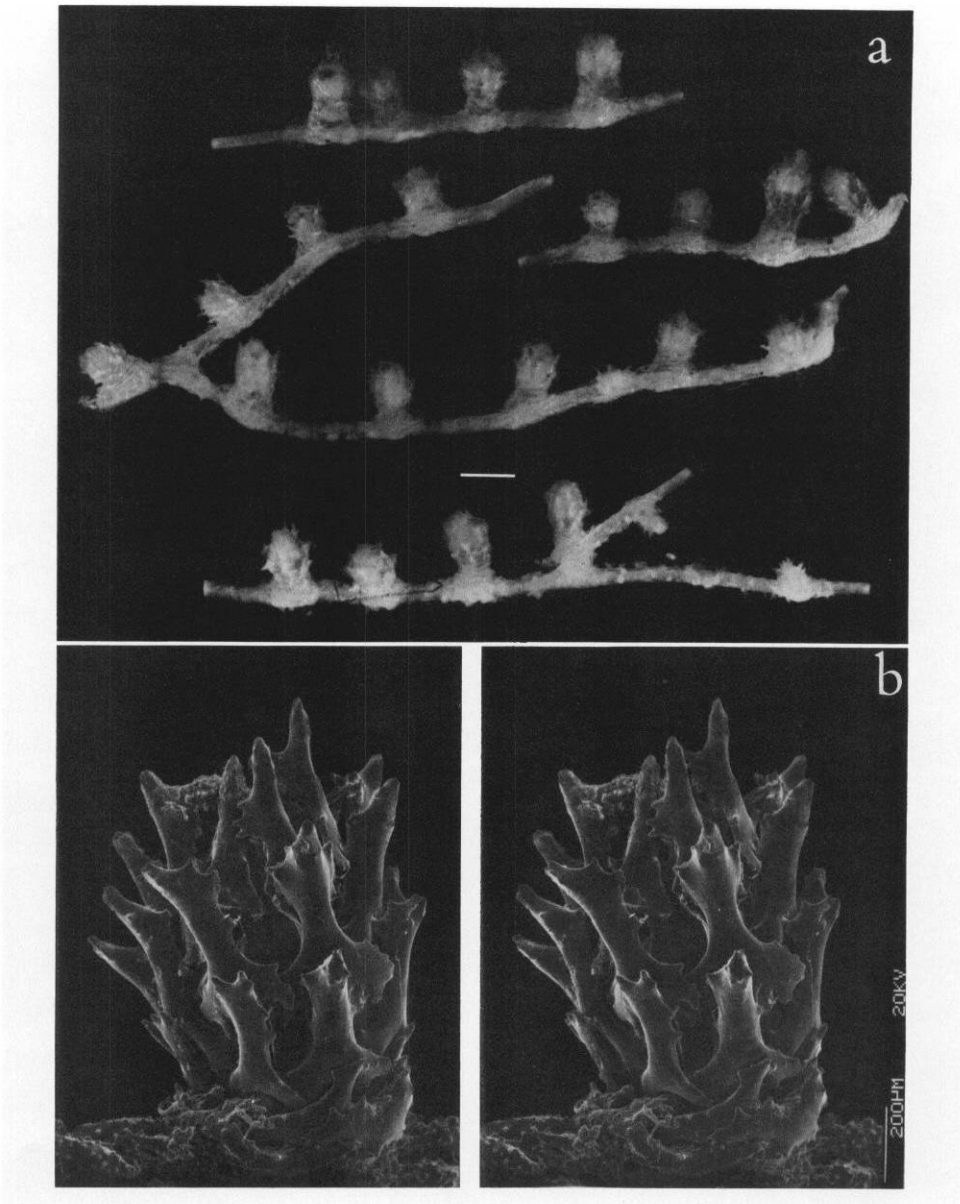


Fig. 12. *Echinisis persephone,* n. sp.: a, Broken branchlets; b, Profile of contracted polyp (stereoscopic view). Scale at a = 1 mm; that at b = 0.2 mm.

The axis is not longitudinally grooved but has faint short surficial striations (Fig. 13h); desmocyte pits are absent except near the extreme tips of the branchlets.

Comparisons.—In general shape the verrucal thornscales of *Echinisis persephone* are similar to those of both *Echinisis vema* and *E. eltanin,* the spike often having lateral lobes or accessory projections. At first sight, they are conspicuously different from the thornscales of *Echinisis spicata* and might be considered indicative of a distinct genus. However, it is by no means rare for the thornscales of *E. spicata* to be apically lobed,

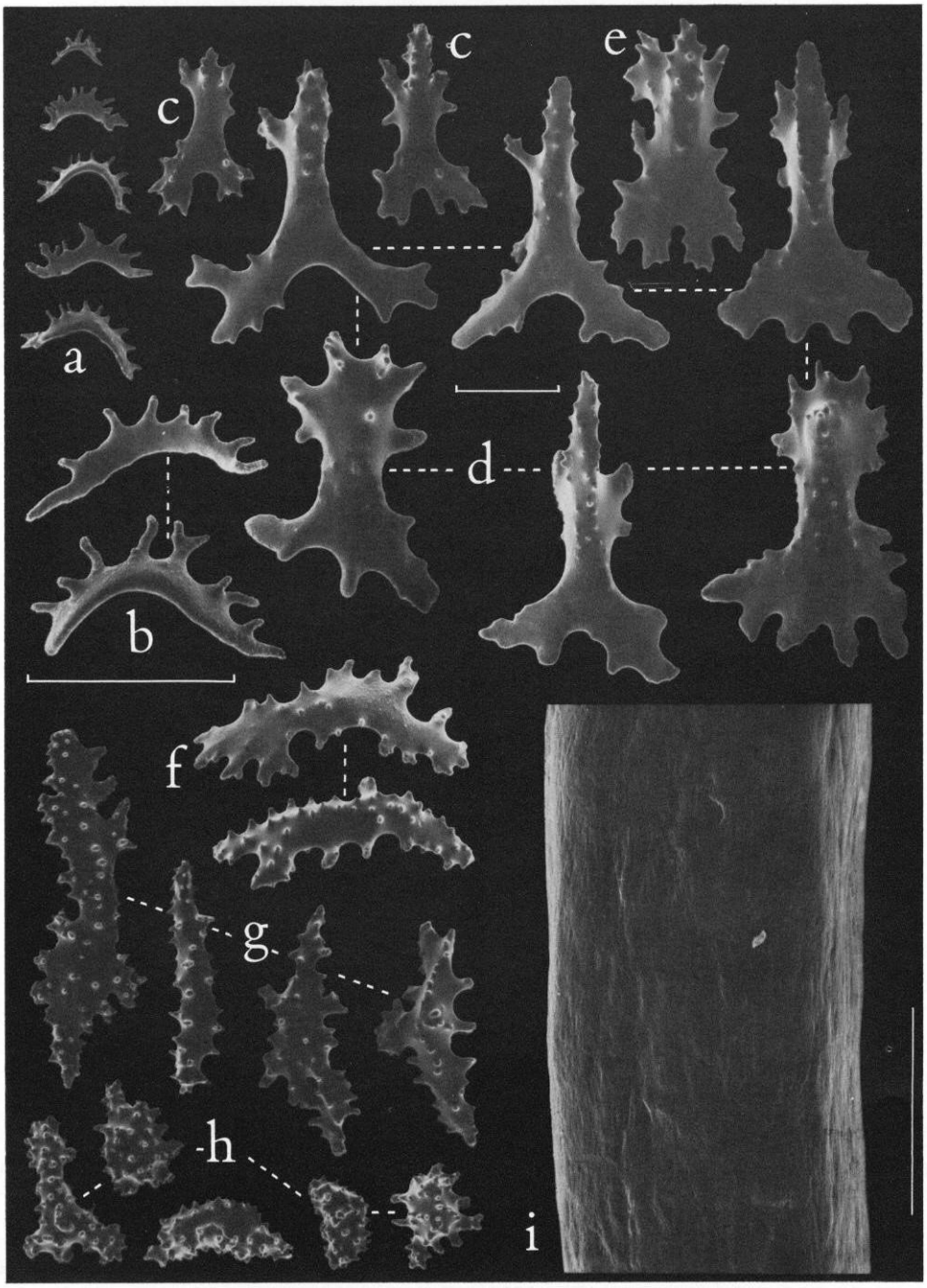


Fig. 13. *Echinisis persephone,* n. sp., sclerites: a, b, From rachis of tentacles; c, From base of tentacles; d, e, Thornscales form verrucal wall; f, Transverse scales from verrucal base; g, Coenenchymal scales transitional to verrucae; h, From coenenchyme; i, Part of axial internode. Bar scales at b and i apply to b and i only; scale at d applies to all others. All bars = 0.2 mm.

and the spike may have distinct, even strong, lateral spikes. Therefore, until more material is available to provide information about colonial characters, it seems preferable to treat all of the *Primnoisis*-like forms with verrucal thornscales or thornstars as a single genus *Echinisis*.

Etymology.—Persephone, mythological character, daughter of Zeus, wife of Hades and Queen of the lower world.

Remarks.—As numbers of sponge spicules were found on these fragments, it is possible that the colony was associated with a sponge, as was observed in *Primnoisis delicatula* by Hickson (1907:5). If the gorgonian was embedded in, or largely covered by, sponge tissue, this could account for the fragmentary condition of the sample obtained.

Sclerisis Studer, 1879

Sclerisis Studer, 1879:661.—Kükenthal, 1915:124.

Primnoisis.—Kükenthal, 1924:432 (part).

Since our reestablishment of this genus and description of *Sclerisis macquariana* were written (Bayer and Stefani 1987), we have located another specimen from Antarctic waters which provides additional information about this little-known genus. We interpret the specimen as conforming with all the salient characters mentioned by Studer (1879) in his brief original description of the genus *Sclerisis* and its sole species *Sclerisis pulchella.*

Sclerisis pulchella Studer, 1879
Figs. 13, 14c, 15

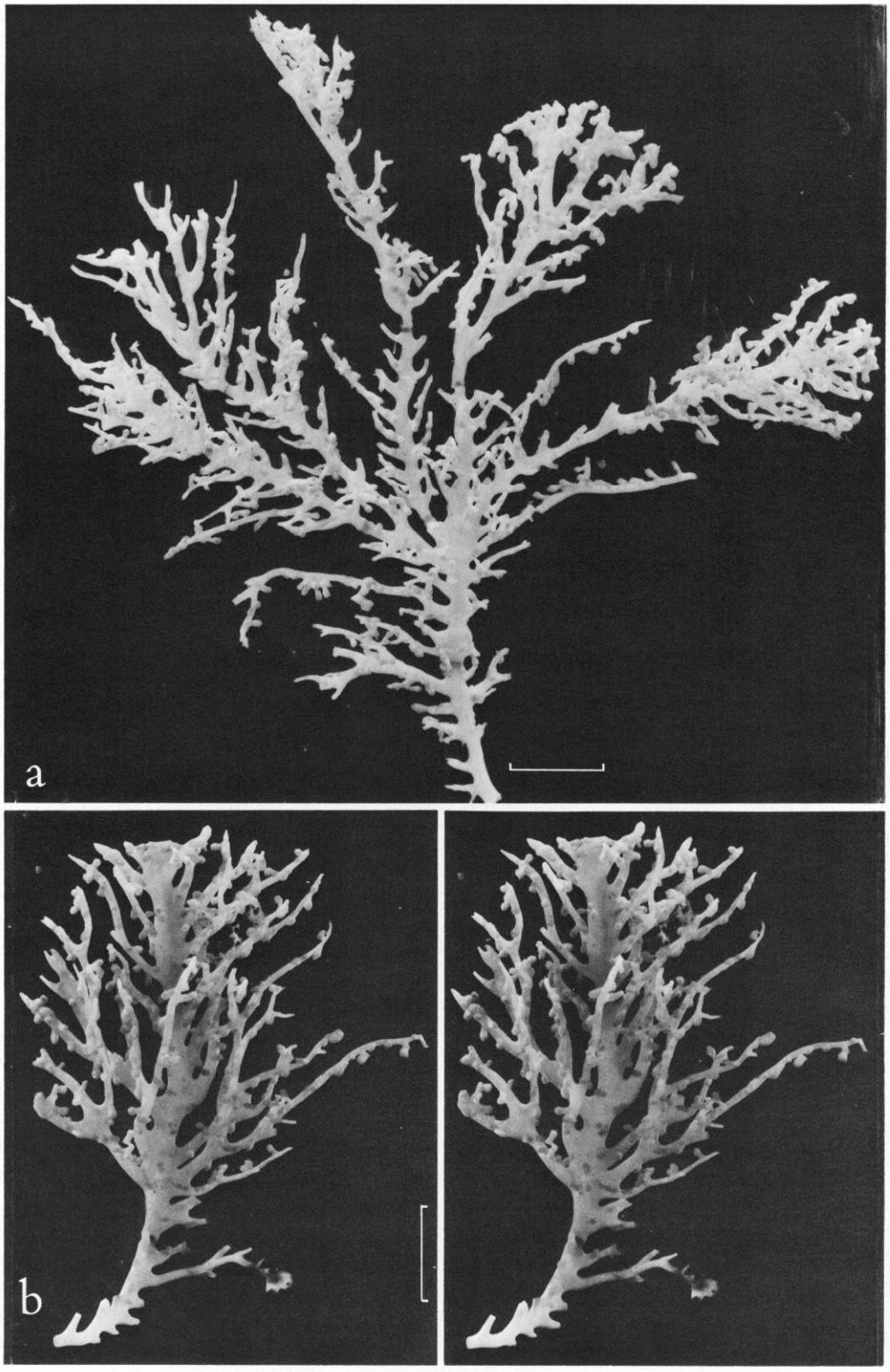
Sclerisis pulchella Studer, 1879:662, pl. 5, fig. 33 a, b, c.

Material examined.—South Atlantic Ocean: 61°04'S to 61°07'S, 39°55'W to 39°42'W, 2355–2897 m, USARP, USS *Eltanin* sta 1545, 11 Feb 1966; three large branches, possibly of a single colony; alcohol. USNM 78364.

Apart from being a much larger colony in better state of preservation (Fig. 13), the present specimen agrees with all important points in Studer's description: "Aufrecht verzweigt, die Kalkglieder sehr lang, fein gestreift, die hornigen Glieder kurz, scheibenförmig. Die Äste entspringen von den kalkigen Gliedern. Die Rinde, sehr dünn, entbehrt der Spicula. Die Kelche sind glockenförmig, mit eingeschnürter Basis und bedeckt mit grossen gebogenen, dornigen Spindeln, welche in Sklerenchym dicht aneinander liegen und sich mannigfach kreuzen und um die Kelchmündung, senkrecht stehend, einen achtklappigen Deckel bilden." (1879:661.) "Der Stamm ist gerade, und besteht aus einem kurzen, scheibenförmigen Hornglied und einem 35 mm. langen Kalkgliede. Das Kalkglied ist eigenthümlich missgestaltet durch die Anwesenheit einer Annelide, welche an dem Stamm lebt. Derselbe ist lamellenartig abgeplattet, die Ränder zusammengebogen, so dass eine tiefe Hohlrinne entsteht, in welcher der Wurm, eine Eunicide, lebt . . . Vom Stamme entspringen nach drei Seiten feine, dünne Zweige von höchstens 1 mm. Dicke an der Basis und bis 10 mm. Länge aus abwechselnd kurzen hornigen und langen kalkigen Gliedern. Die Kalkglieder sind fein längsgestreift. Die glockenförmigen Kelche sitzen vereinzelt an den dünnen Ästchen. Die Spicula, welche die Kelchmündung schliessen, sind lange, dornige, an der Basis am meisten verbreiterte Schuppen. Farbe weiss." (1879:662.)

In our specimen, the polyps are campanulate and basally constricted, directed downward, covered with large, bent, thorny spindles, which lie close together and variously cross one another, placed vertically at the distal end of the calyces to form an 8-lobed "operculum" (Fig. 15c).

The stem is straight and consists of short, discoidal horny nodes and long calcareous internodes that are about 35 mm long. The internodes of the principal branches are characteristically expanded to form con-


a
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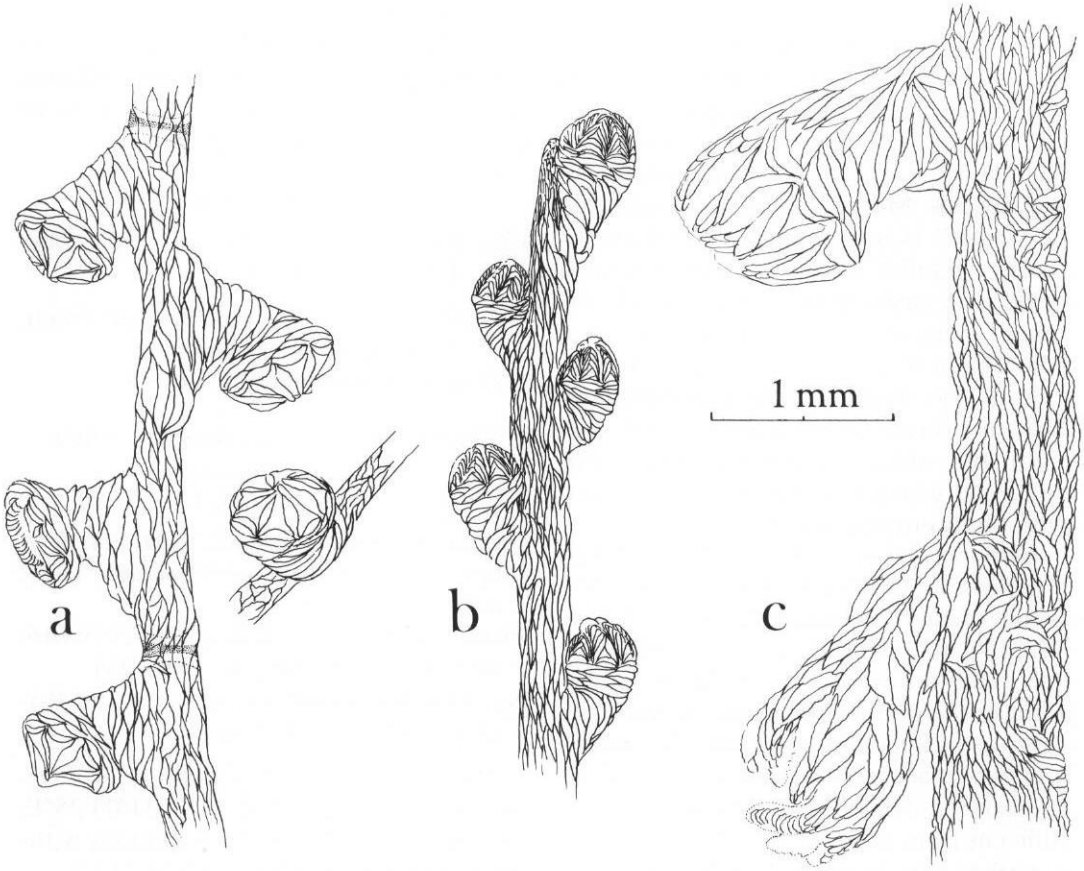

Fig. 15. a, *Chathamisis ramosa* (Hickson); b, *Stenisis humilis* (Deichmann); c, *Sclerisis pulchella* Studer.

cave, gutterlike structures from the upturned edges of which the lateral branchlets arise (Fig. 14b).

The slender lateral twigs, which leave one face of the colony free, contain horny nodes and calcareous internodes as described by Studer, but the nodes are infrequent and the internodes long, commonly branching repeatedly without intervention of horny nodes, so they are not composed of short nodes "alternating" with long internodes, but rather of long, branching calcareous internodes infrequently interrupted by horny nodes. Here it can be mentioned that Studer's figure (1879:pl. 5, fig. 33) illustrates rather few nodes in the branchlets, but it is unclear whether or not the internodes branch without intervening nodes.

The principal discrepancy between Studer's description and the specimen before us is Studer's statement that the spicules that close the calicular aperture are long, thorny scales mostly expanded toward the base. Strictly interpreted, this condition applies more closely to *Sclerisis macquariana* Bayer and Stefani than to the specimen at hand. However, the verrucal sclerites of this specimen (Fig. 16d) definitely are long,

←

Fig. 14. *Sclerisis pulchella* Studer, USNM 78364: a, Broken colony; b, Branch (stereoscopic view). Scale bars = 1 cm.

thorny, distinctly flattened and commonly expanded at one end. Studer's drawing of the polyps of *pulchella* (1879:pl. 5, fig. 33b) does not suggest the strong projecting spines of *S. macquariana,* as it certainly would have had the spines been as conspicuous as in that species. Moreover, Studer's definition of "scales" is not clear, but the flattened thorny spindles of the present specimen could very easily qualify. Transversely arranged crescentic scales with serrated convex margin (Fig. 16a) extend along the rachis of the tentacles, the proximal ones becoming more or less asymmetrical (Fig. 16b) and obliquely placed. The coenenchymal sclerites are stubby rods covered with blunt projections (Fig. 16e).

Remarks.—Two pieces of denuded axis (USNM 78365) from *Eltanin* sta 1991 (south of New Zealand: 54°39′S to 54°44′S, 170°22′E to 170°25′E, in 1862–1940 m, 2 Jan 1968) are strikingly similar in growth form to the present specimen attributed to *Sclerisis pulchella.* A small piece of branch and two intact but dissociated polyps from the same haul (USNM 78366) are distinctly different from those of *S. pulchella* as here described. On the strength of the possibility that these polyps are conspecific with the axial fragments, we do not assign the latter to *S. pulchella.* If the polyps and axial fragments are not conspecific, the possibility remains that the latter are *S. pulchella,* so we here record that the largest, expanded, gutterlike internode, broken at both ends, is 65 mm long and 5 mm wide; from both edges it produces lateral branchlets, some of which are further branched, all without horny nodes. It is highly probable that the intact colony would have been closely similar in growth form to the colony of *pulchella* here reported.

It must be mentioned that the type locality of *Sclerisis pulchella* is northeast of New Zealand in 597 fathoms (1092 m), whereas the specimen from *Eltanin* sta 1545 is from the South Atlantic. Therefore, there is a possibility that the denuded axis from sta 1991 south of New Zealand is the real *pulchella,* regardless of whether it is or is not conspecific with the South Atlantic specimen. Studer's type specimen must be examined to resolve the question.

Chathamisis Grant, 1976

Chathamisis Grant, 1976:9, 10, 43.—Bayer, 1981:941 (in key).

Type species.—*Chathamisis bayeri* Grant, 1976: by original designation.

Diagnosis.—See Grant 1976:43.

Chathamisis ramosa (Hickson, 1904), new combination
Figs. 1c, 15a, 17

Ceratoisis ramosa Hickson, 1904:224, pl. 7, figs. 3, 4; pl. 8, fig. 12.—Thomson, 1911: 877, pl. 43, fig. 1.

Primnoisis ramosa.—Kükenthal, 1919:616; 1924:436.—Deichmann, 1936:251.

Not *Primnoisis ramosa* Thomson and Ritchie, 1906:851, pl. 1, fig. 2.

Material examined.—Vicinity of Durban, South Africa: 30°02′45″S, 31°03′25″E, 112 fathoms, 30 Jun 1930; one colony without holdfast, in alcohol, USNM 43071.

Description.—The original description (Hickson 1904) requires some amplification. Although the colony (Fig. 1c) is profusely bushy, the smaller branches strongly tend to ramify in one plane; some scattered anastomosis occurs. The calcareous internodes have several shallow longitudinal furrows separated by low ridges; the slender distal internodes are triangular or quadrangular in cross section, having 3 or 4 rounded ridges separating the shallow furrows that form the sides.

Many of the polyps have the squat, chalicelike aspect shown in Hickson's drawing (1904: pl. 8, fig. 12); for the most part, the polyps are strongly curved downward, away from the tips of the branches (Fig. 15a). The 8 large scales of the tentacle bases form a low conical operculum over the infolded tentacles, often lying almost flat. The tri-

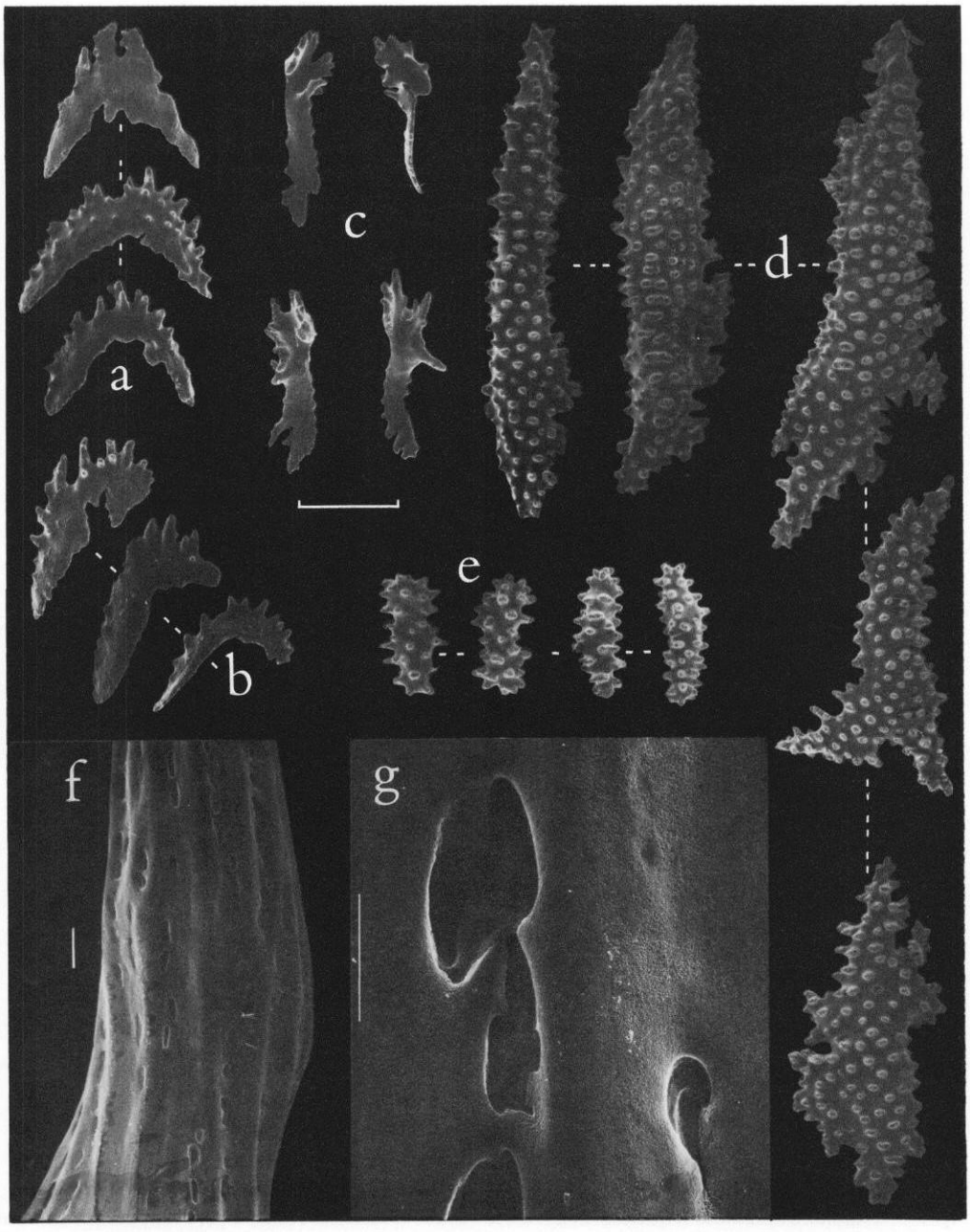

Fig. 16. *Sclerisis pulchella* Studer, a–e, sclerites: a, b, From rachis of tentacles; c, From pinnules; d, From verrucal walls; e, From coenenchyme; f, g, Part of axial internode. Upper scale = 0.1 mm, applies to all sclerites; scale at f = 1 mm; scale at g = 0.05 mm.

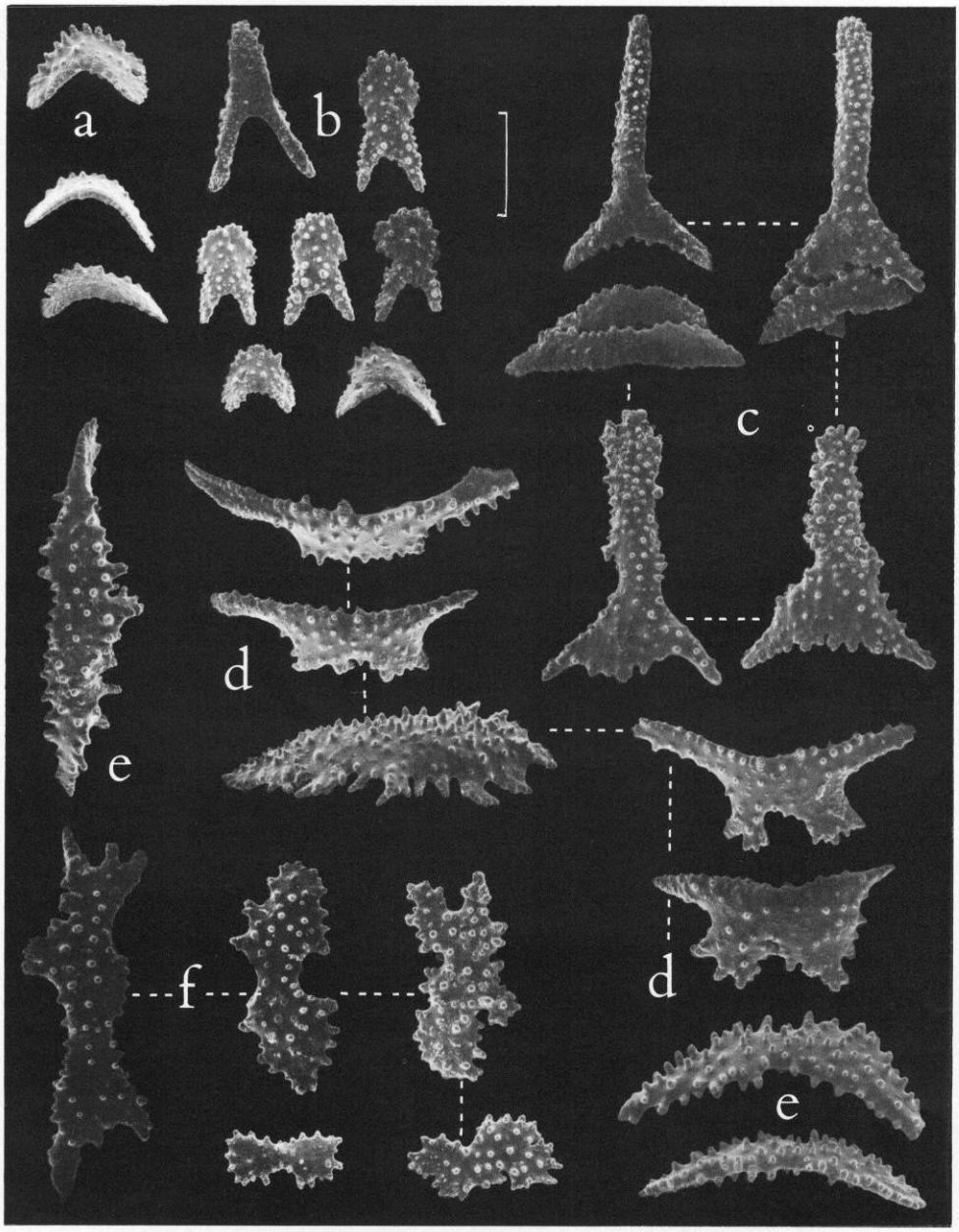

Fig. 17. *Chathamisis ramosa* (Hickson), a–f, sclerites: a, From rachis of tentacles; b, From base of tentacles; c, From opercular sectors; d, e, From verrucal wall; f, From coenenchyme. 0.1 mm scale bar at c applies to all figures.

radiate opercular scales typically rest upon a transverse lunate scale that occupies the basal concavity (Fig. 17c); non-fatal breakage and repair of the scales in one or more octant may result in an opercular segment with an irregular number of scales, and occasionally a narrow accessory sclerite lies along one or both sides of the apical spike

of the opercular scales, but the opercular valves do not typically consist of several scales as depicted in Hickson's stylized drawing. The tentacles, which occasionally are preserved outside the opercular scales, have a series of small scales transversely placed along the back of the rachis (Fig. 17a). The more proximally placed of these have a bifurcated base that partially surrounds the tentacular rachis, resulting in forms intermediate between opercular and distal tentacular scales (Fig. 17b). A similar condition occurs in *Echinisis spicata* (see Fig. 8c). The body sclerites are transversely placed crescentic plates about 0.3 mm long, some with 2 broad diverging lobes on the proximal edge, others with several narrow lobes (Fig. 17d). The coenenchymal sclerites are elongated scales up to 0.35 mm long, the smaller individuals often with a median constriction (Fig. 17f).

Distribution.—South Africa.

Remarks.—There is no question but that the eight triradiate scales of the tentacle bases form an operculum in the sense of Grant (1976). However, the transverse scales immediately beneath each opercular scale tend to fold inward farther and farther with stronger degrees of contraction, the end result of which is a condition not unlike that seen in some species of *Mopsea*; the chief difference is that the uppermost scale is the largest and forms an opercular scale, whereas in *Mopsea* the scales become progressively smaller distad on the tentacles.

Stenisis, new genus

Primnoisis (part).—Deichmann, 1936:250 (not Studer [and Wright], 1887).

Type species.—*Primnoisis humilis* Deichmann, 1936.

Diagnosis.—Small, planar colonies branched from the internodes in a distantly pinnate manner, internodes without longitudinal grooves and ribs, covered with low, pointed thorns; polyps biserial, forming upturned verrucae weakly recurved toward axis, not retractile, tentacles folding over mouth; verrucal sclerites narrow, curved, spindlelike plates transversely arranged below tentacles.

Etymology.—Greek στένος = narrow + Isis, Egyptian goddess of the earth and the moon, whose name was applied to jointed octocorals by Linnaeus (1758).

Remarks.—The new species described by Deichmann (1936) as *Primnoisis humilis* was described and illustrated by Verrill in the unpublished manuscript on the *Blake* collection later rewritten and published by Miss Deichmann. Unfortunately, Verrill's original manuscript is no longer extant, but the surviving plates show that he recognized two species that he placed in a new genus *Stenisis,* one of them the *Primnoisis humilis* of Deichmann. Without access to Verrill's text it is impossible to say how the two species differed, but the illustrations reveal nothing significant. All of the specimens in the present collection can be attributed to one species, identical with Deichmann's *Primnoisis humilis.* The colonies branched in one plane, with biserial polyps armed with very narrow transverse plates of almost spindle-like form, are characters so at variance with *Primnoisis* that a separate genus is required, as recognized by Verrill a century ago. For this genus we here use the name *Stenisis* originally proposed for it by Verrill.

Stenisis humilis (Deichmann, 1936)
Figs. 9c, 15b, 18

Primnoisis humilis Deichmann, 1936:251.

Material examined.—Northwest Providence Channel, Bahamas: 26°32′N, 78°55′W, 183–549 m, R/V *Gerda*, sta G-493, 3 Feb 1965; one profusely subdivided branch, possibly a complete colony lacking holdfast, USNM 57287.—Yucatan Channel: 20°55′N, 86°28′W, 97–120 fathoms, R/V *Gerda* sta G-889, 10 Sep 1967; two profusely subdivided branches, possibly colonies without holdfasts; one exten-

sively decorticated, USNM 57288.—Yucatan Channel: 21°04′N, 86°19′W, 185–200 fathoms, R/V *Gerda* sta G-898, 10 Sep 1967; ten more or less complete colonies and several broken branches, some partially decorticated and overgrown by epizoans, USNM 57289.

Diagnosis.—As for the genus.

Description.—The present specimens conform in all respects to Deichmann's description of the dried type specimen, but their better condition and greater number permit some minor amplification. The several colonies, some of which are complete (though partly decorticated and overgrown by epizoans), range from 2 to 5 cm in height, branched in a loosely pinnate or lateral manner chiefly in one plane and about as wide as high (Fig. 9c). The colonies are articulated to a discoidal holdfast by a basal horny node 1.5–4.5 mm long but only 0.4–0.5 mm wide. The first internode, which may or may not bear one or two lateral branches, is 3–4 mm long and 0.5–0.6 mm in diameter. The following nodes are 1–1.5 mm long, those of the smaller branches about 0.5 mm, and about 0.25 mm in diameter. In the finest terminal branchlets, the nodes may be only 0.15 mm in diameter and 0.5–0.6 mm long; the internodes vary in length from 0.5 mm to 3 mm or more. The internodes are not longitudinally furrowed but are covered by small, conical spinules (Fig. 18e).

The polyps (Fig. 15b) are 0.7–0.9 mm tall, somewhat larger than reported by Deichmann, but this may be explained by a difference in method of measurement. For the most part they are directed upward, although downward-pointing individuals are not rare. They are covered proximally by transversely and obliquely placed narrow, fusiform plates 0.2–0.25 mm long, sculptured externally by simple, blunt spines (Fig. 18c); these sclerites are more accurately described as curved spindles, flattened and smooth internally, sculptured externally by crowded, blunt spines. The bases of the tentacles are covered by smaller, straight spindles set en chevron (Fig. 18a); small, twisted, claw-like scales (Fig. 18b) occur distally in the tentacles, probably in the pinnules, but their exact position could not be determined.

The coenenchyme contains a layer of spindles (Fig. 18d) similar to those of the polyps but not strongly curved, up to 0.2 mm long.

Remarks.—The planar branching, spindle-like sclerites, and unfurrowed prickly internodes preclude assignment of this species to the genus *Primnoisis.*

The exceptional length of the basal node suggests that conditions of the habitat call for greater flexibility of the axis than would be afforded by the short, disk-like nodes more usual in small isidids.

Deichmann's assertion that this species is closely related to *Primnoisis rigida* Wright and Studer (1889:37) and might be nothing more than a shallow-water form of it is without justification. *Primnoisis rigida* is a densely bushy form that appears to be a true *Primnoisis.*

Australisis, new genus

Type species.—*Australisis sarmentosa,* n. sp.

Diagnosis.—Bushy isidids branched from the internodes; internodes round in cross-section, tapered, not longitudinally grooved, but covered with low prickles or thorns; polyps on all sides, not retractile but forming prominent cylindrical verrucae; verrucal walls filled with thorny spindles arranged distinctly en chevron in eight longitudinal tracts.

Etymology.—Latin *australis* = southern + *Isis,* in allusion to the geographic range of the type species.

Remarks.—This genus cannot be accommodated in any of the subfamilies as now defined. The polyps are not retractile into the coenenchyme as those of *Isis* are, but form prominent cylindrical verrucae. The

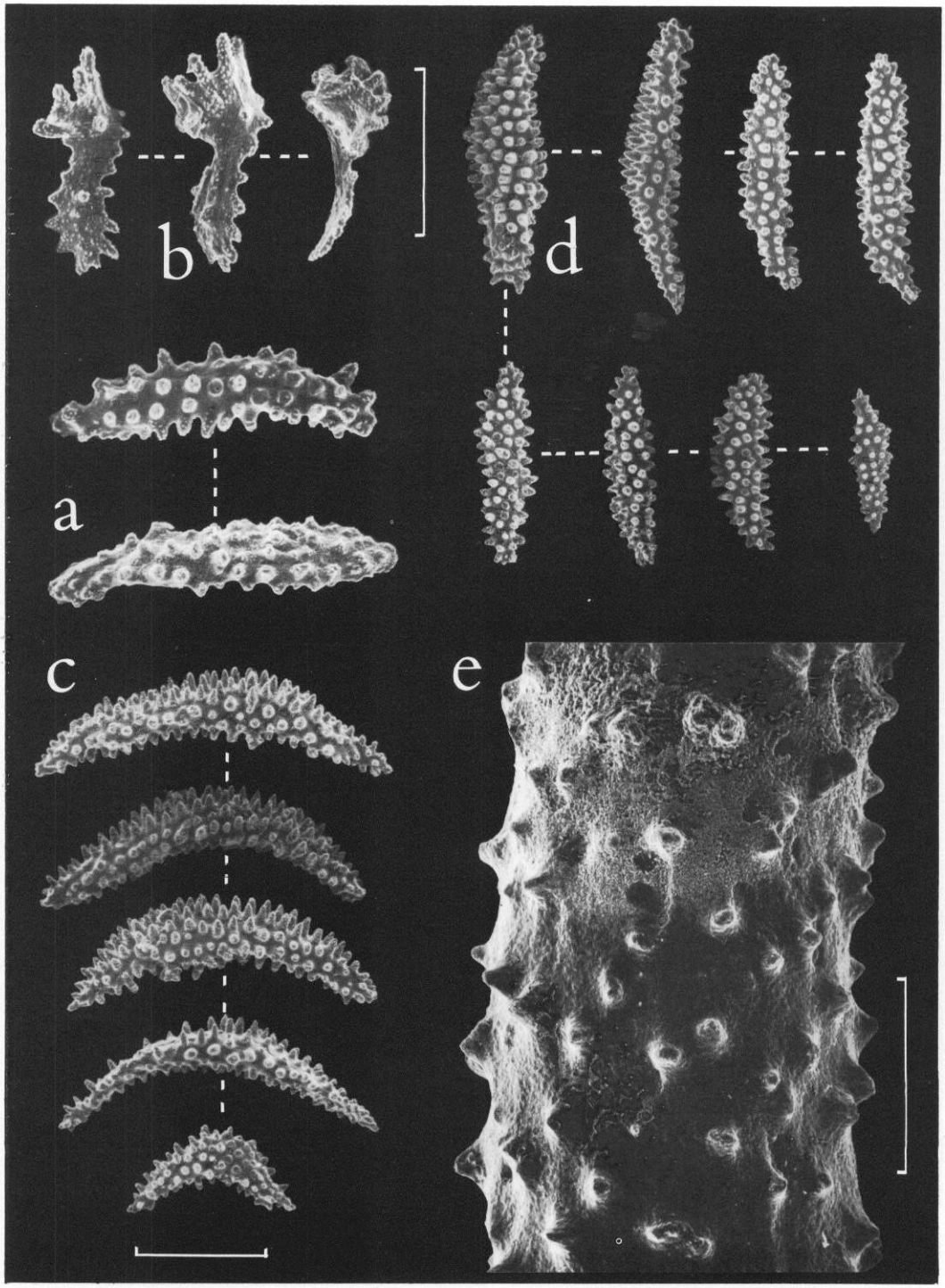

Fig. 18. *Stenisis humilis* (Deichmann), a–d, sclerites: a, From base of tentacles; b, From pinnules; c, From verrucal wall; d, From coenenchyme; e, Part of axial internode. 0.05 mm bar at b applies to a and b; 0.1 mm bar below c applies to c and d; 0.1 mm bar at e applies to e only.

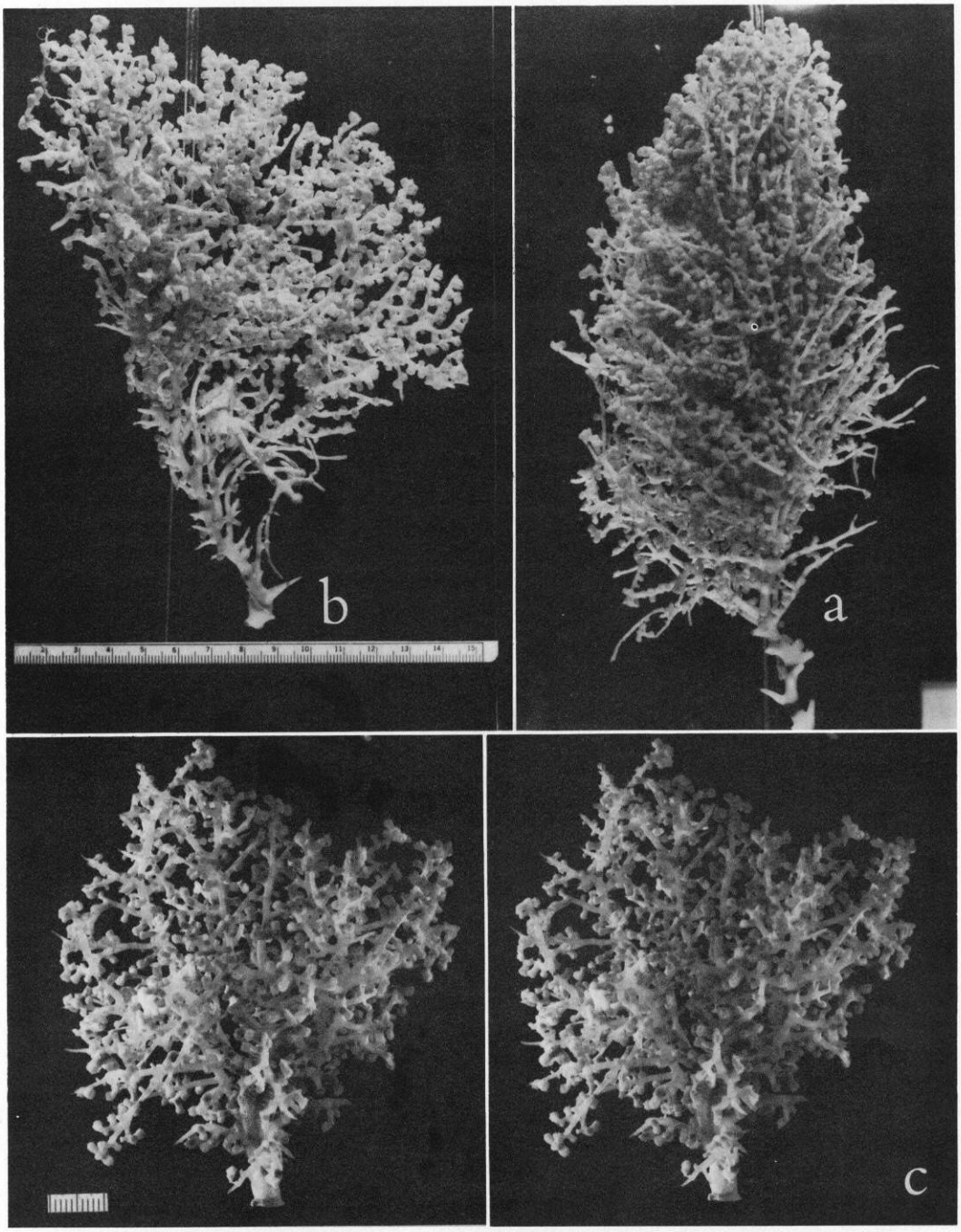

Fig. 19. *Australisis sarmentosa,* n. gen., n. sp.: a, Paratype, USNM 78370; b, Holotype, USNM 78368; c, Paratype, USNM 78371, stereoscopic pair. Scale at b applies to a and b.

verrucal sclerites are distributed without interruption from base to tentacles, so the polyps are not divided into an anthostelar and an anthocodial part as in *Muricellisis,* and therefore lack crown and points. The verrucal sclerites are exclusively spindles arranged conspicuously en chevron.

Australisis sarmentosa, new species
Figs. 19, 20, 21d–i

Material examined.—South Shetland Islands: 61°19′ to 61°21′S, 56°28′ to 56°27′W, 403 m, 5′ Blake Trawl, USNS *Eltanin* sta 992, 13 Mar 1964; fragments, USNM 78367.—Off South Georgia: 54°29′S, 39°22′W, 659–686 m, 5′ Blake Trawl, USNS *Eltanin* sta 1536, 8 Feb 1966; one colony, holotype, USNM 78368; 4+ colonies, paratypes, USNM 78369.—Off South Georgia: 55°00.6′S, 37°42.6′W, 494–501 m, USARP, R/V *Islas Orcadas,* cruise 575, sta 91, 7 Jun 1975; one colony complete except for holdfast, paratype, USNM 78370.—Off South Georgia: 53°27.1′S, 41°39.2′W, 371–424 m, USARP, R/V *Islas Orcadas,* cruise 575, sta 102, 11 Jun 1975; one complete colony and several partly denuded branches, paratypes, USNM 78371.

Diagnosis.—As for the genus.

Description.—The colony branches abundantly in all directions from the internodes to form a dense, upright bush (Fig. 19). Most internodes produce 1, often 2 or 3 lateral branches that diverge in various directions but rarely if ever coalescing, even when they come in close proximity; the few internodes that fail to branch are usually terminal or subterminal. The lateral branches arise from the parent internode without a nodal articulation, and the branch may itself branch again before producing a horny node. The internodes are round in cross-section except in the immediate vicinity of branch origins, where some flattening may occur; when branches originate at an angle of 45° or less, the axils may be extensively filled in to produce even greater flattening. The internodes are not longitudinally grooved, but are covered with small, sharp prickles (Fig. 21i), most conspicuous on the more distal internodes, becoming lower and obscure on the larger, proximal internodes. The minute pits marking the position of desmocytes in the axis epithelium are irregularly scattered over the surface (Fig. 21h).

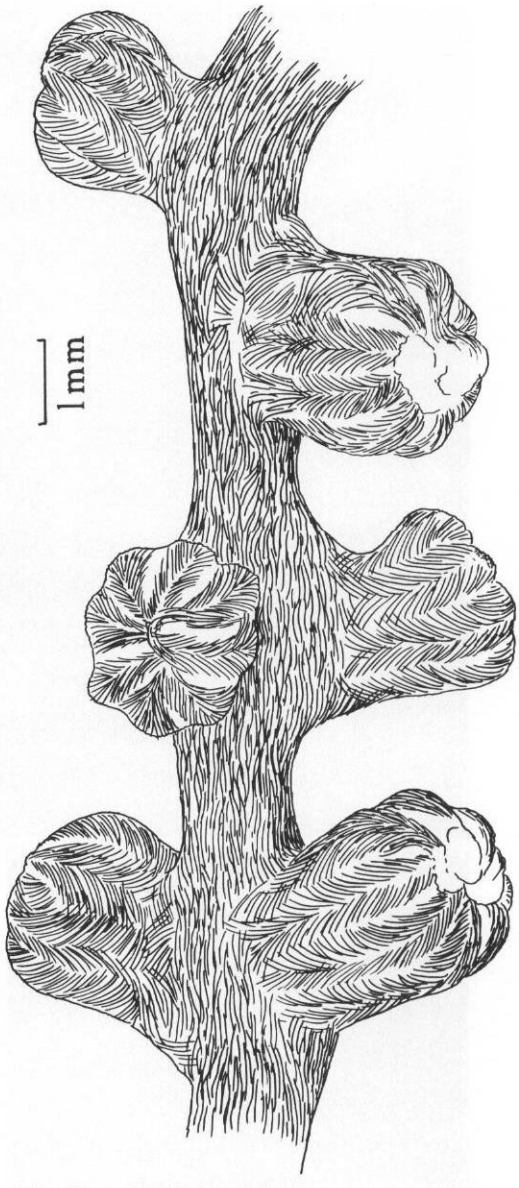

Fig. 20. *Australisis sarmentosa,* n. gen., n. sp. Part of branchlet with contracted verrucae.

Most of the specimens have been de-

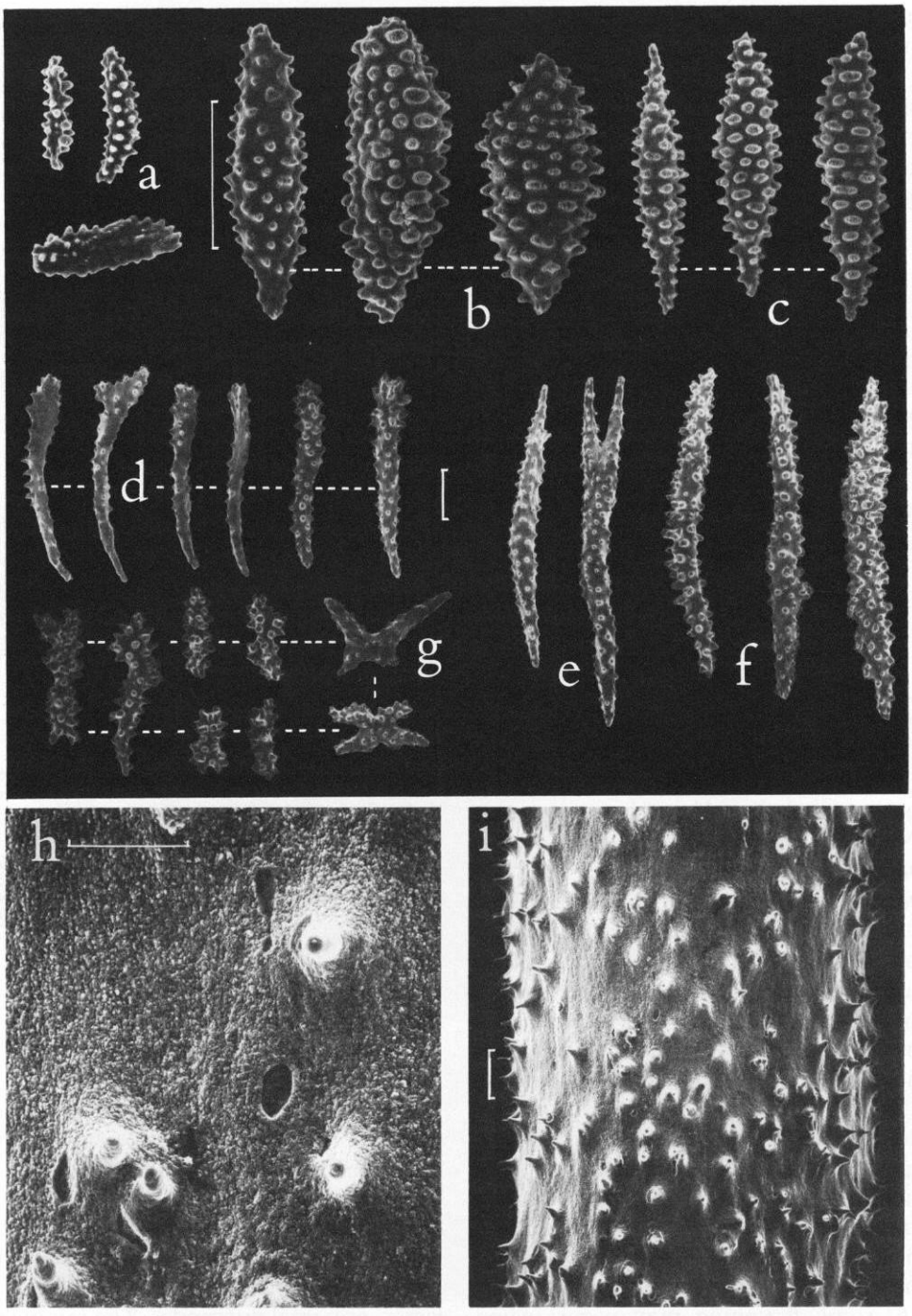

Fig. 21a–c, *Caribisis simplex*, n. gen., n. sp., sclerites: a, From tentacles; b, From verrucal wall; c, From coenenchyme. d–i, *Australisis sarmentosa* n. gen., n. sp., a–g, sclerites: d, From pinnules; e, From base of tentacles; f, From verrucal wall; g, From coenenchyme; h, Surface of axial internode; i, Part of axial internode. Upper scale bar = 0.1 mm, applies to a–c; scale at d = 0.1 mm, applies to d–g; scale at h = 0.05 mm; scale at i = 1 mm.

tached from their holdfast at the basal articulation, but one small colony attached to a pebble, and another to a fragment of dead scleractinian coral, show that the holdfast is a thin calcareous disk from which the colony arises by way of a basal node.

The contracted polyps (Fig. 20) are prominent, cylindrical, and sometimes slightly enlarged distally, 2–3 mm tall depending upon the degree of contraction. They are situated on all sides of the branches, 2–4 mm apart but with a tendency to occur in opposite pairs; often they are more closely placed near twig tips, and twigs commonly end with an opposed pair. The tentacles are folded over the mouth and may be turned inward to a greater or lesser extent.

The sclerites of the body wall are narrow, pointed spindles up to about 0.65 mm long, usually curved or bent, ornamented with low, sharp thorns (Fig. 21f); they are arranged in closely crowded chevrons converging on the bases of the tentacles. The spindles on the base of the tentacles are less sharply sculptured (Fig. 21e) and decrease in size distally, assuming a longitudinal direction; smaller, slender spindles about 0.3 mm long, somewhat twisted and more or less distinctly expanded at one end (Fig. 21d) extend into the pinnules, expanded end outermost. The coenenchyme contains shorter, thorny spindles about 0.45 mm long, whose thorns are somewhat stronger on one side, and rather flattened, irregular forms of smaller size (Fig. 21g).

The colonies are pale tan or dark cream-colored, the nodes light brown and the internodes white.

Etymology.—Latin *sarmentosus* = full of twigs, in allusion to the bushy growth form.

Remarks.—The densely branched, compact growth form, the prominent cylindrical verrucae with sclerites conspicuously en chevron, and the prickly cylindrical internodes without longitudinal fluting of *Australisis sarmentosa* are features unlike those of any isidid heretofore reported. The character of the internodes is shared with *Caribisis simplex* n. gen., n. sp. and *Primnoisis humilis* Deichmann (now reassigned to a new genus *Stenisis*). Although the former is further similar in having only spindle-shaped sclerites, these are only indistinctly arranged in chevrons in verrucae that are distinctly up-turned and recurved toward the axis as in several species of *Mopsea,* and the unique type colony is unbranched. The internodes of *Stenisis humilis* (Deichmann) are similarly prickly and ungrooved, but the colonies are small and planar, and the up-turned and recurved verrucae are armed with narrow, transverse plates similar to those of some species of *Mopsea* and *Acanthoisis.*

Caribisis, new genus

Diagnosis.—Unbranched isidids with non-retractile polyps biserially placed, directed upward and recurved toward the axis. Sclerites exclusively spindles, those of verrucae longitudinally arranged in eight tracts irregularly en chevron. Internodes not longitudinally grooved, covered with low prickles.

Type species.—*Caribisis simplex,* n. sp.

Caribisis simplex, new species
Figs. 9d, 21a–c, 22

Material examined.—Windward Islands, Lesser Antilles; off St. Vincent: 13°20.8′N, 61°02.5′W, 576–842 m, 5′ Blake Trawl, R/V *John Elliott Pillsbury* sta P-881, 6 Jul 1969; one colony, holotype, USNM 57290.

Diagnosis.—Unbranched colonies with biserial polyps directed upward and recurved toward the axis; sclerites exclusively tuberculate spindles, in the verrucae arranged indistinctly en chevron in 8 longitudinal tracts.

Description.—The holotype (Fig. 9d) is an unbranched colony 4.5 cm in height consisting of 4 internodes articulated by horny nodes, arising from a conical, calcareous holdfast. The polyps are biserial and variably alternate (Fig. 21a), directed obliquely upward, and measuring 1.1 mm in height,

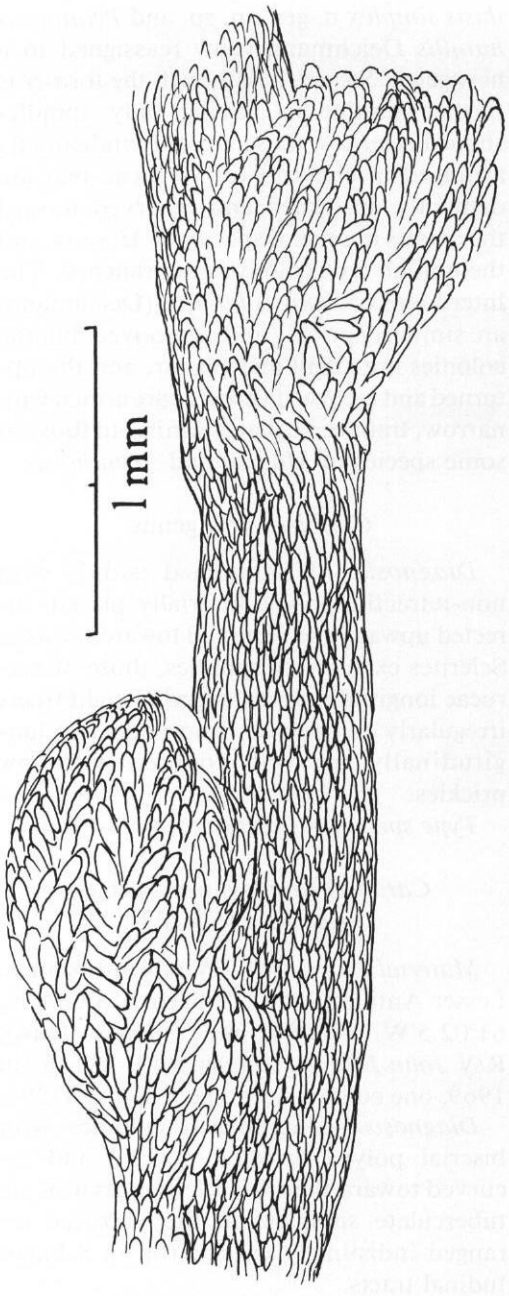

Fig. 22. *Caribisis simplex,* n. gen., n. sp. Part of colony with two contracted verrucae.

0.6 mm in width, placed at intervals of 3 mm proximad, 2 mm distad. There is no distinct operculum at the top of the verrucae. The first polyp occurs 1.4 cm from the base, although tissue is missing from the base of the colony.

The axis consists of calcareous internodes measuring between 0.7 and 1.95 cm in length, and 0.7 mm in diameter, alternating with horny nodes the most proximal of which measures 3 mm in length, compared to 1 mm for the others. The terminal internode tapers a little, but the end is broken off. The internodes are cylindrical, not longitudinally ribbed, the surface covered by scattered sharp granules or low prickles.

The coenenchymal sclerites are tapered, slender spindles (Fig. 21c), those of the verrucae mostly stouter and blunt (Fig. 21b), with complex tubercles arranged in irregular rows; some tubercles may fuse together transversely, but they are not arranged in regular girdles around the sclerite. Both verrucal and coenenchymal spindles measure up to 0.2 mm in length, but the calicular spindles are consistently narrower than their coenenchymal counterparts. Smaller sclerites, about 0.1 mm in length, extend onto the tentacles, those of the tentacle backs slightly curved, with prominent blunt projections, some becoming distinctly flattened, with the projections forming a serrated margin (Fig. 21a).

In alcohol the colony is pure white, including the internodes; the long basal node is light yellowish brown but the subsequent nodes are only faintly yellowish.

Etymology.—Latin *simplex* = simple, uncompounded; in allusion to the unbranched colonial form.

Remarks.—The growth form, spiculation, and axial characters as combined in *Caribisis simplex* are unlike those of any isidid described heretofore. The shape and arrangement of the verrucal spindles are unique and attributable to no known genus; the axial internodes resemble those of *Australisis* and *Stenisis,* both of which have quite different verrucae, arrangement and shape of sclerites, and colonial form. It is impossible to state whether older colonies develop branches as they grow larger but, if so, it is

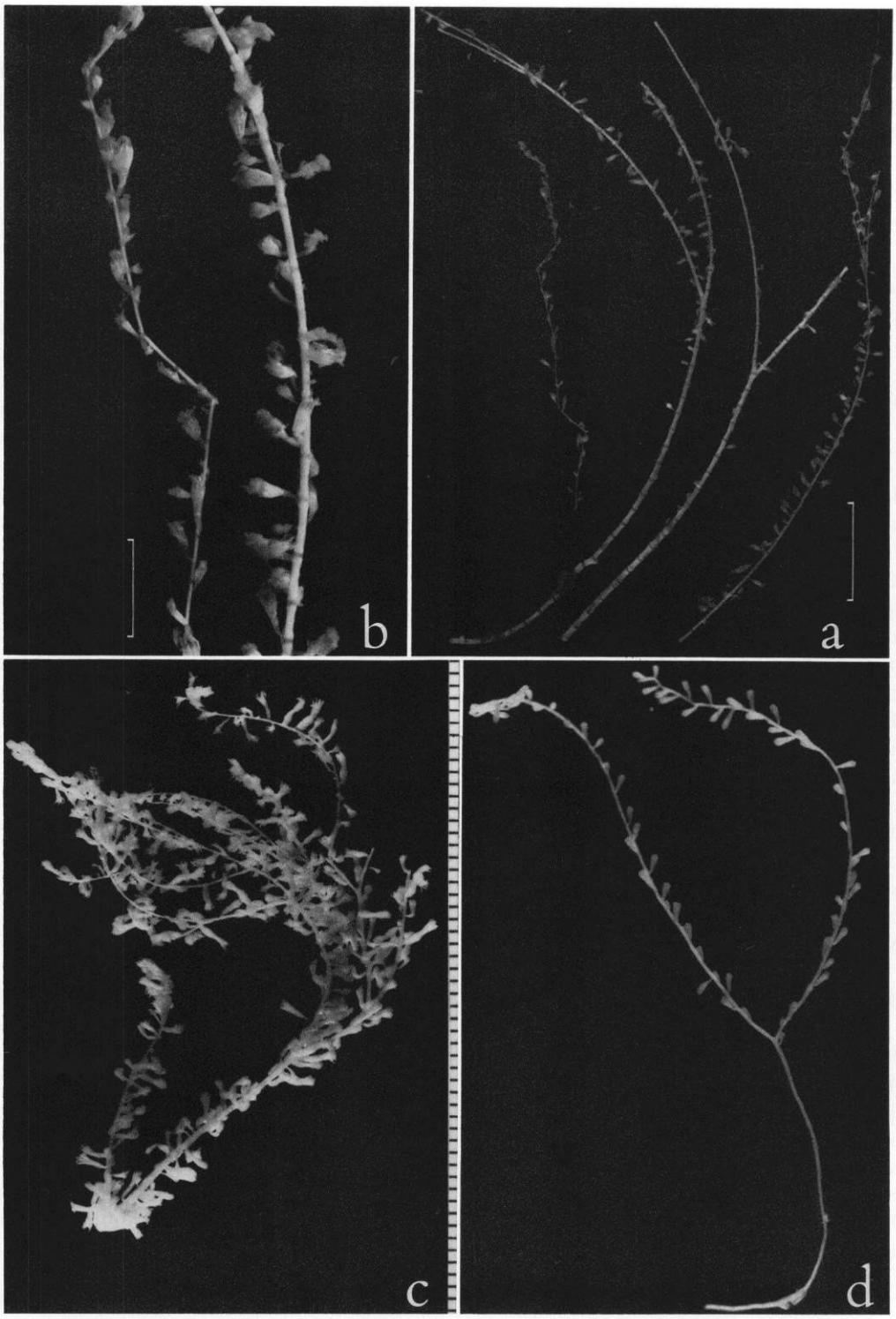

Fig. 23. *Tenuisis microspiculata* (Molander), n. gen.: a, Branches of USNM 78373; b, Detail of same; c, Nearly complete colony USNM 78375; d, Almost complete young colony with part of holdfast, USNM 78374. Vertical scale in mm applies to c and d; scale bar at a = 1 cm; bar at b = 5 mm.

strange that no larger, branched specimens have been taken by any of the hundreds of trawling stations occupied in the same general vicinity during the past century of exploration.

Tenuisis, new genus

Ceratoisis.—Molander, 1929:78.

not *Ceratoisis.*—Verrill, 1883:10.—Wright and Studer, 1889:26.—Kükenthal, 1915: 120; 1919:585; 1924:423.

not *Keratoisis* Wright, 1869:23.—Bayer, 1956:222; 1981:941.—Grant, 1976:15.

Diagnosis.—Very slender isidids sparsely dichotomously branched chiefly from the internodes, occasionally from the nodes; internodes cylindrical, solid, slightly enlarged at each end, smooth or with only faint longitudinal striation confined to the larger branches and main stem. Polyps tall, narrowly campanulate, usually 1 or 2 per internode. Sclerites exclusively scales, those of the polyps narrow, more or less tapered, marginally serrated, longitudinally placed in the body wall; tentacles with crescentic scales transversely placed and curved to fit the rachis, and delicate, narrow scales or rodlets extending into the pinnules. When present, sclerites of the coenenchyme are small, thin scales with dentate margins, many with a median constriction.

Type species.—*Ceratoisis microspiculata* Molander, 1929, here designated.

Remarks.—In his report on the octocorals of the Swedish Antarctic Expedition, Molander (1929:78) described a new species of isidid, *Ceratoisis* [sic] *microspiculata.* Six samples from Antarctic waters in the collections of the National Museum of Natural History, one of which was reported by E. Deichmann (1945:294) as *C. microspiculata,* can now be attributed to that species. However, the material at hand differs from *Keratoisis* in many respects and clearly cannot be accommodated in that genus. Colonies of *Keratoisis* are large and robust, even very large—sometimes exceeding a meter in height (Verrill 1922:43). The characteristic sclerites are stout, cylindrical rods or tapered spindles, longitudinally arranged in the polyps and more or less strongly projecting around the oral end, sometimes with an admixture of smaller scales; the pharyngeal walls contain small double stars or thorny rods.

The specimens at hand agree with *Keratoisis* only in their sparse dichotomous branching. The sclerites are exclusively scales, not spindles or rods, do not project around the distal end of the polyps, and may be wholly absent from the coenenchyme; the pharyngeal walls are devoid of sclerites. Molander's description of the sclerites as "short, flat spindles, cylinders and clubs" must in part reflect faulty observation, as no sclerites in the present material can be described as cylindrical; some are tapered and could be called flat spindles, and some have one end expanded and might be described as clubs, but they are scales without exception. Consequently, this material is here treated as a distinct new genus, for which we propose the name *Tenuisis.*

Tenuisis microspiculata (Molander, 1929)
Figs. 23–27

Ceratoisis microspiculata Molander, 1929: 78, fig. 26; pl. 5, fig. 8.—Deichmann, 1945: 294.

Material examined.—South Shetland Islands: Discovery Bay, at Anchorage off Greenwich Island, 62°28′S, 59°37′W; 31 fathoms, dredge, W. L. Schmitt coll., sta 62–63, 26 Feb 1963; one colony now broken into several pieces, USNM 78373.—South Shetland Islands: 62°05.00′S, 58°23.7′W; 58 m, Petersen grab, R/V *Hero* cruise 721, sta 806, 15 Jan 1972; one colony with holdfast, alcohol, USNM 78374.—Antarctic Peninsula, Graham Land: Palmer Archipelago, 64°49.4′ to 64°49.5′S, 62°51.9′W, 120–148 m, R/V *Hero* cruise 721, sta 730, 27 Dec 1971; several terminal branches, in alcohol, USNM 78375.—Antarctic Penin-

sula, Palmer Land: Neny Fjord, 68°16′S, 66°50′W, 15 fathoms, dredge, 20 Mar 1940; one colony much broken, USNM 51279.—Knox Coast, Antarctica: Vincennes Bay, 66°55.5′S, 110°58.5′E, 120 m, USS *Glacier,* sta G1.-1, dredge, 18 Mar 1956; two colonies, somewhat broken; in alcohol, USNM 78376.—Wilkes Land, Antarctica: off Wilkes Station, 66°16′38″–66°16′20″S, 110°30′48″–110°31′24″E, 128–146 m USARP, VIMS sta AZ, 12 Feb 1961; trawl, many broken branches; in alcohol, USNM 78377.

Diagnosis.—As for the genus.

Remarks.—The specimens in hand agree in the main with Molander's original description, but differ in some particulars. The specimen from Schmitt sta 62–63 (Fig. 23a, b) bears a strong resemblance to the material from South Georgia described by Molander (1929:78, pl. 5, fig. 8). The polyps as described by Molander are of similar size but the scale of his illustration (1929:plate 5, fig. 8), given as 1:1, must be wrong if the measurements are correct as given in the text. The polyps are shown at least 5 mm tall and the specimen 15 cm, but the largest fragment was stated in the text to be 7 cm tall and the polyps 1–1.5 mm tall. The internodes (Fig. 27) are similar in size to those described by Molander, but in his material they were sculptured by "fünf deutlichen Rippen" which are not present here. The polyp sclerites of *microspiculata* were reported to be short, flat spindles, cylinders and clubs, sparsely thorned, 0.15 to 0.25 mm long, but in this specimen they are narrow scales up to 0.4 mm long. The polyps (Fig. 24c, d, e) are tall, trumpet-shaped, 1.5–1.8 mm in height, about 0.3 mm in diameter proximally and 0.5 mm distally, usually one or occasionally two per internode, all around the branches. The intact individuals are covered by a thin layer of epidermal tissue probably overlain by cuticle (Fig. 24d, e), but in many cases this was torn off during collection so most polyps are flayed. The distal half of the polyp body, beneath the tentacles, contains a single layer of flat, elongated scales longitudinally arranged, the distalmost sclerites weakly converging in 8 indistinct points. The sclerites of the body are not continuous with those of the tentacles, the backs of which are filled with narrow, flat scales transversely arranged and curved to fit the rachis (Fig. 26a, b). The large scales of the polyp body (Fig. 26c) are as long as 0.4 mm and about 0.05 mm wide, not uncommonly wider and marginally lobed at one end, tapering to a narrower blunt point at the other; they are sparsely ornamented with low, rather sharp granules, those along the edge more prominent and producing a toothed or serrated margin. A few smaller scales, sometimes twinned, occur among the large body scales. The tentacular scales (Fig. 26a) are mostly small, transversely placed crescents, but a few are flat, bilobed, with a distinct median waist, resembling the scales of some chrysogorgiids; all are nearly smooth. They diminish in size toward the tip of the tentacles; the pinnules contain minute rodlets about 0.03–0.04 mm in length, the larger ones flattened and marginally lobate (Fig. 26d). The nature of the holdfast is not known as the base of the colony was not collected. However, the lowest part of the axis obtained is denuded and overgrown by epizoans, so it probably constitutes the main trunk just above the holdfast. A species of diatom found attached to the denuded trunk (Fig. 27e) was also observed in whole mounts on the axis of distal twig tips with coenenchyme intact.

The specimen taken by the U.S. Antarctic Service Expedition at Neny Fjord in Palmer Land, reported by Deichmann (1945), agrees with that from the South Shetland Islands in all respects except that the body scales of the polyps are somewhat smaller, more nearly in accord with the measurements given by Molander (1929) for *microspiculata.* The branches are conspicuously thickened in several places by elongated swellings containing a parasitic copepod. The tissue over these galls contains sclerites present no-

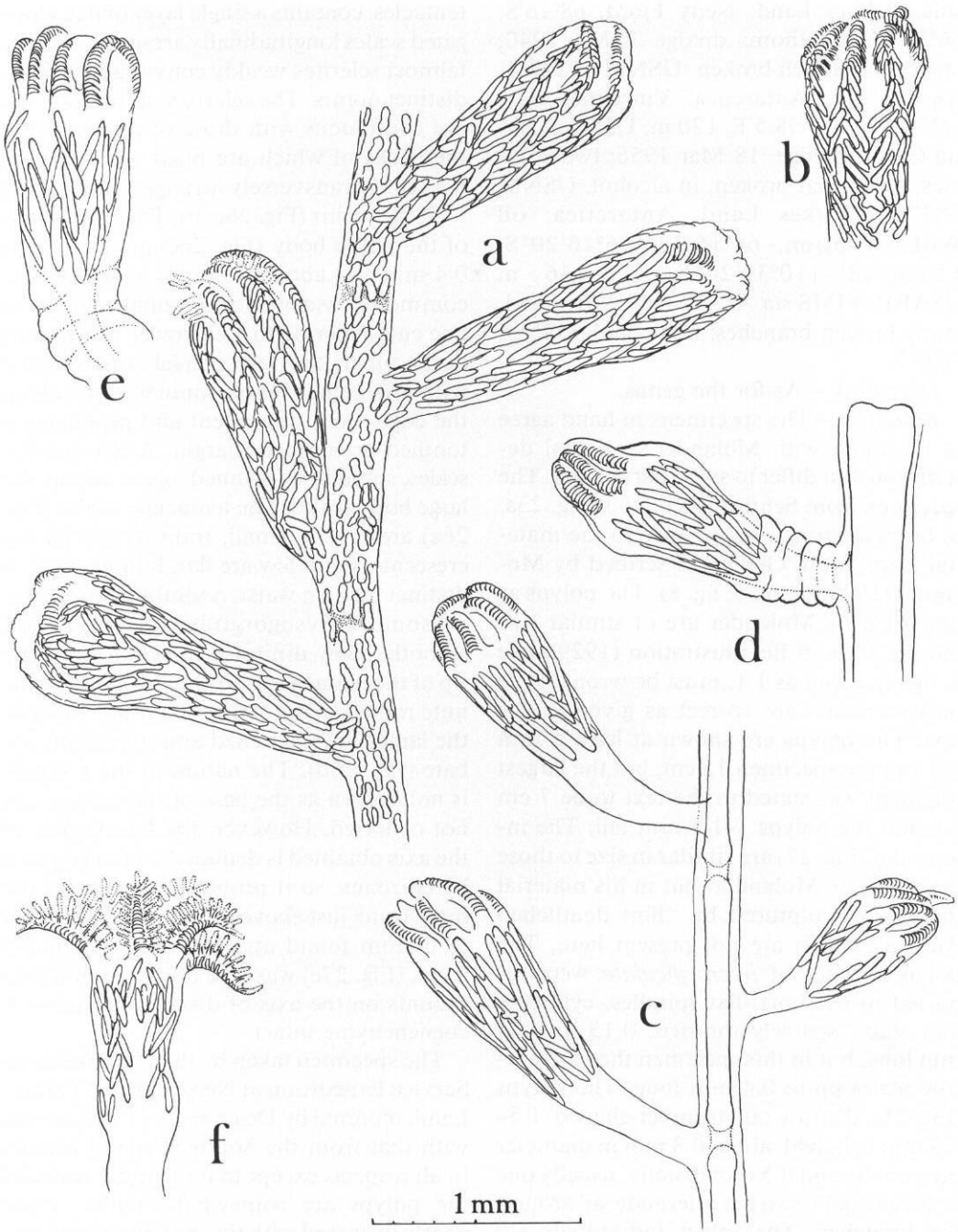

Fig. 24. *Tenuisis microspiculata* (Molander), n. gen.: a, b, USNM 78376, part of branch and polyp; c–e, USNM 78373, part of branch and two polyps; f, USNM 51279, polyp.

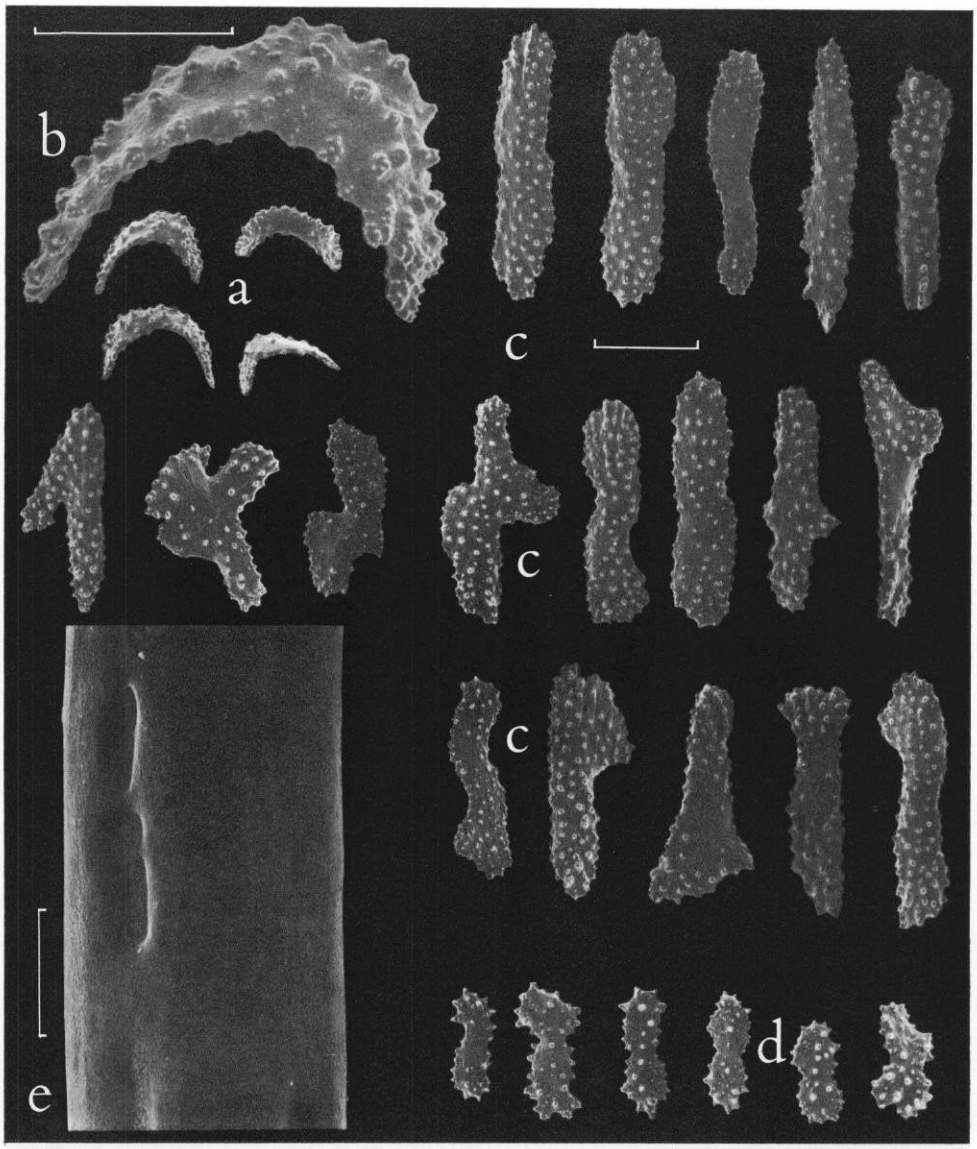

Fig. 25. *Tenuisis microspiculata* (Molander), n. gen. USNM 78376: a–d, Sclerites: a, b, From tentacles; c, From verrucal wall; d, From coenenchyme; e, Part of axial internode. Scale bar at b = 0.05 mm, applies to b only; bar at c = 0.1 mm, applies to a, c, d; bar at e = 0.05 mm, applies to e only.

where else in the coenenchyme. As the entry of the copepod into the gorgonian tissue is most likely through the polyp that ingested it in larval stage, this condition is not surprising. Owing to differences in preservation, many polyps of this specimen are preserved with tentacles extended (Fig. 24f).

The taller colony from *Glacier* sta 1 at Vincennes Bay, Knox Coast, somewhat broken and lacking the proximal parts and holdfast, is more than 10 cm in height. Reaching a length of slightly more than 0.2 mm, the scales of the polyps (Fig. 25c) are similar in size to those reported by Molander, but the coenenchymal scales (Fig. 25d) are much smaller, about 0.1–0.13 mm long,

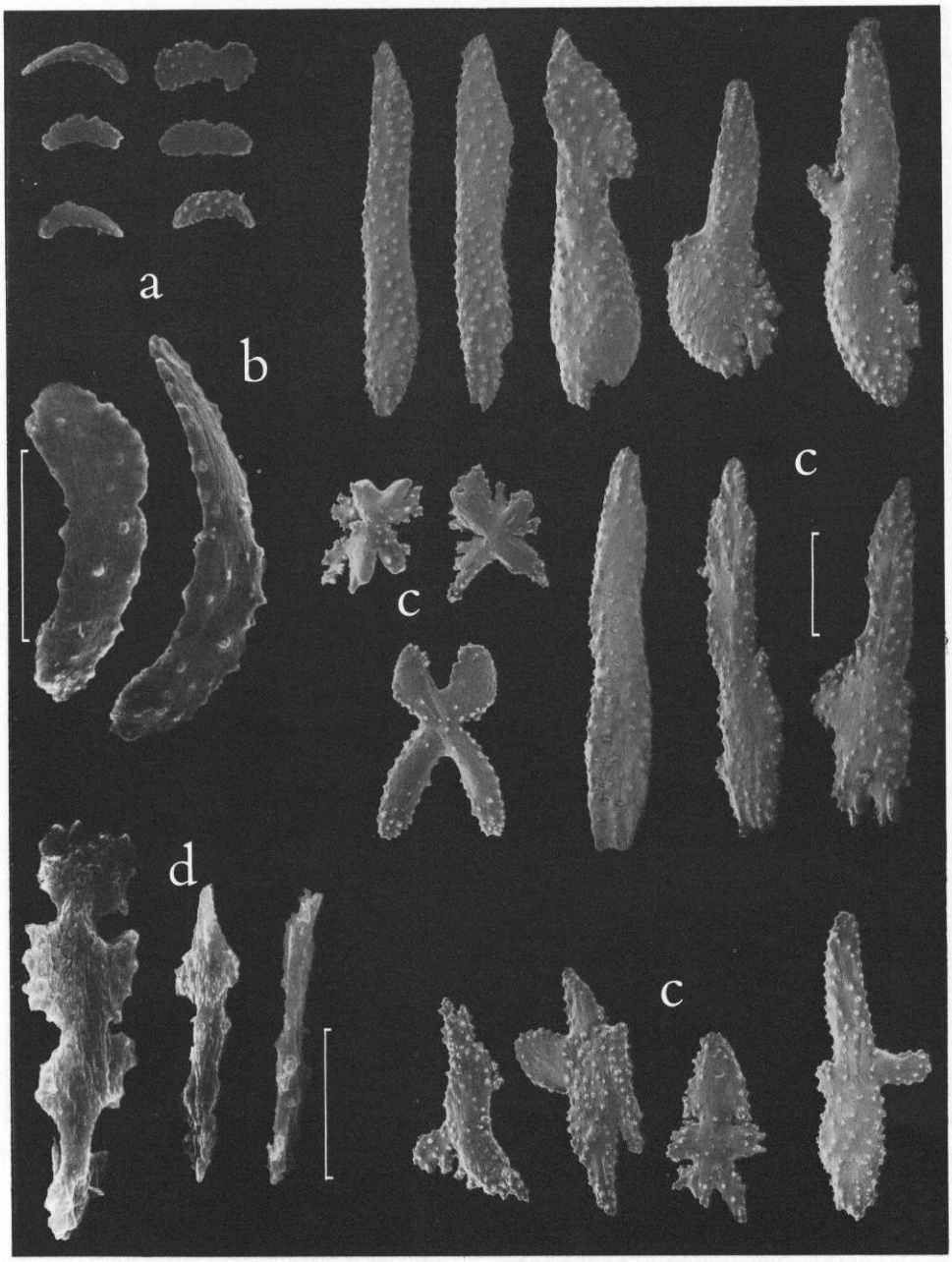

Fig. 26. *Tenuisis microspiculata* (Molander), n. gen., USNM 78373, a–d, sclerites: a, b, From tentacles; c, From verrucal wall; d, From pinnules. Scale bar at b = 0.05 mm; scale bar at c = 0.1 mm, applies to a and c; scale bar at d = 0.02 mm.

never as much as 0.21 as recorded by Molander. The body scales are longitudinally arranged in interseptal tracts irregularly converging toward the bases of the tentacles (Fig. 24a, b), where somewhat smaller scales converge toward the tips; these are followed by transversely placed crescentic scales (Fig. 25a, b) curved to fit the rachis of the ten-

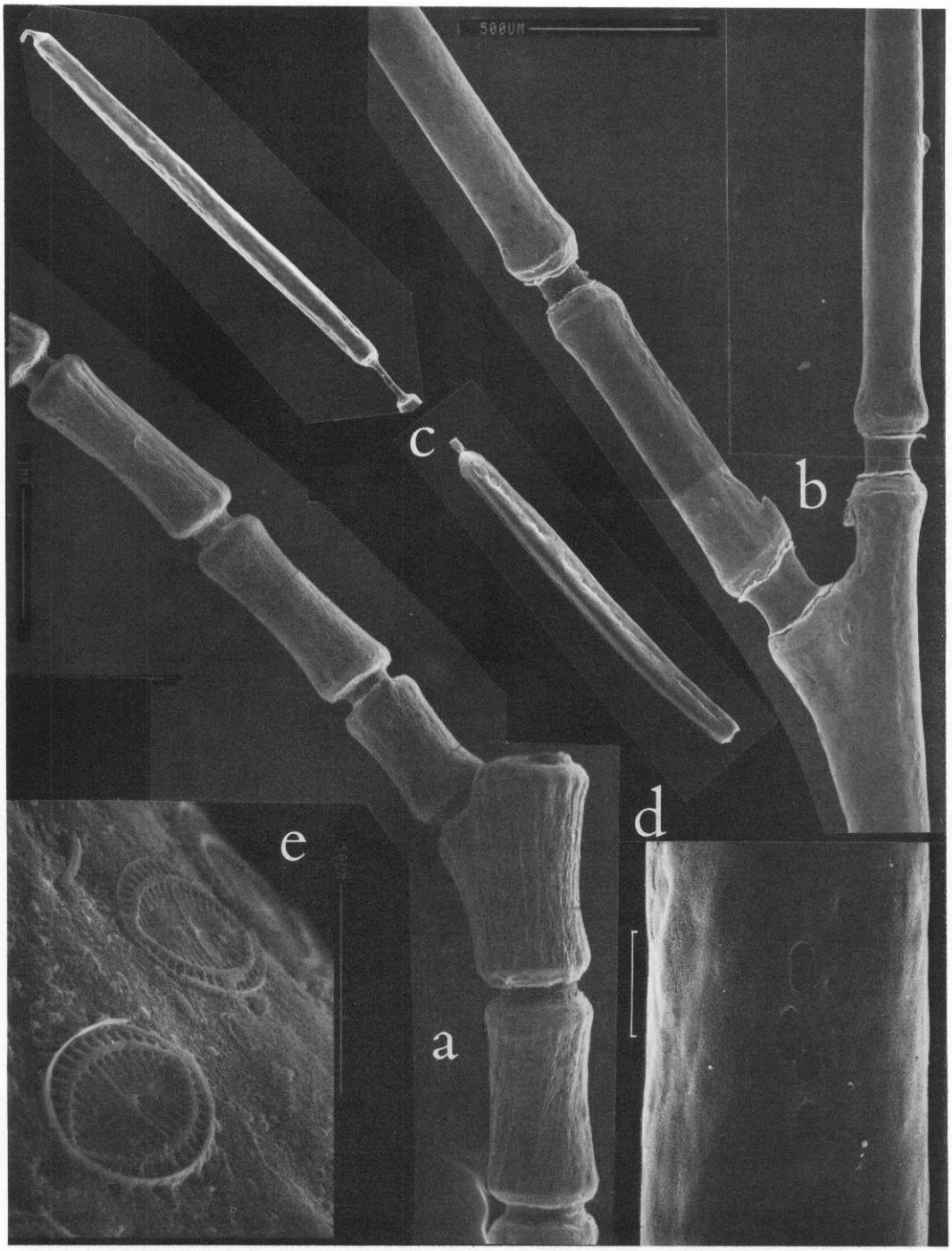

Fig. 27. *Tenuisis microspiculata* (Molander), n. gen., USNM 78373: a, Proximal, b, Intermediate, and c, Distal segments of axis; d, Surface of internode; e, Surface of denuded proximal internode showing attached diatoms. 1 mm, scale at a applies to a only; 0.5 mm scale at b applies also to c; scale at d = 0.05 mm.

tacles. Groups of minute, narrow rods extend into the pinnules. The axis is without conspicuous longitudinal fluting (Fig. 25e).

The colony from *Hero* sta 806 (USNM 78374) has most of its discoidal calcareous holdfast, detached from the substrate. The basalmost three internodes are overgrown by horny nodal material, above which the next six or seven internodes show irregular longitudinal ridges. The internodes of the upper part of the colony are not ribbed.

The specimen from *Hero* sta 730 (USNM 78375) has the polyps more closely placed than in the other specimens examined (Fig. 23c).

Distribution.—Molander's original material was collected in the vicinity of South Georgia in the South Atlantic. Four of the lots now recorded, including that reported by Deichmann (1945), are from the Antarctic Peninsula in the same Antarctic sector. Two of the lots (USNM 78376 and 78377) are from the diametrically opposite side of the Antarctic continent, indicating a widespread Antarctic distribution for this species.

Chelidonisis Studer, 1890

Chelidonisis Studer, 1890:553; 1901:38.—Kükenthal, 1915:118, 124; 1919:631; 1924:444.—Deichmann, 1936:252.—Bayer, 1956:F224; 1981:941.—Tixier-Durivault and d'Hondt, 1974:1415.—Grant, 1976:10.

Type species.—*Chelidonisis aurantiaca* Studer, 1890; by monotypy.

Diagnosis.—Isidids dichotomously branched in one plane, occasionally anastomosing; branching from the distal end of the internodes; internodes longitudinally grooved, the ridges serrated. Polyps forming hemispherical or bluntly conical verrucae distributed mostly on 2 sides of the branches in the plane of ramification. Coenenchyme thin. Sclerites predominantly in the form of 6-radiates.

Remarks.—The 6-radiate sclerites of *Chelidonisis* (Fig. 29b) are unique in the family. Studer's statement that the sclerites "ont tout-à-fait la forme de celle du genre *Isis* proprement dit" is clearly incorrect. Tuberculate spindles and clubs do not occur in *Chelidonisis.*

The ornamentation of the axial internodes (Fig. 29a) also is unique in the family. Although longitudinal fluting by ridges and furrows occurs in several genera, as do prickles or thorns aligned or scattered on the ridges, and pits marking the location of desmocytes are present in all, the internodal sculpture of *Chelidonisis* is distinct from that of all other genera.

Studer's observation (1890:553) that the upper part of the polyp with its tentacles can be withdrawn within the verrucae must be based upon a misinterpretation of the verrucal structure. In contraction the tentacles are merely folded inward over the oral region and enclosed by the eight verrucal lobes—actually the bases of the tentacles.

The specimens from the Gulf of Mexico and the Philippines are so similar to the eastern Atlantic material that there can be no doubt about their identification. However, among these geographically scattered specimens there are subtle differences in the form of the sclerites and the distribution of the polyps that defy adequate description and quantification. Although it is possible that populations on opposite sides of the North Atlantic could maintain a continuous gene pool, it seems highly improbable that an interbreeding population could include colonies as geographically remote as the Philippines. Consequently, we are here considering the population in the Gulf of Mexico to be a geographical subspecies of the eastern Atlantic *aurantiaca,* and are treating that in the Philippines as a distinct species.

Distribution.—Heretofore this genus has been known only from isolated records in the eastern North Atlantic (Studer 1890; Stephens 1909; Tixier-Durivault and d'Hondt 1974; Grasshoff 1982, 1986), although Deichmann (1936:252) stated that

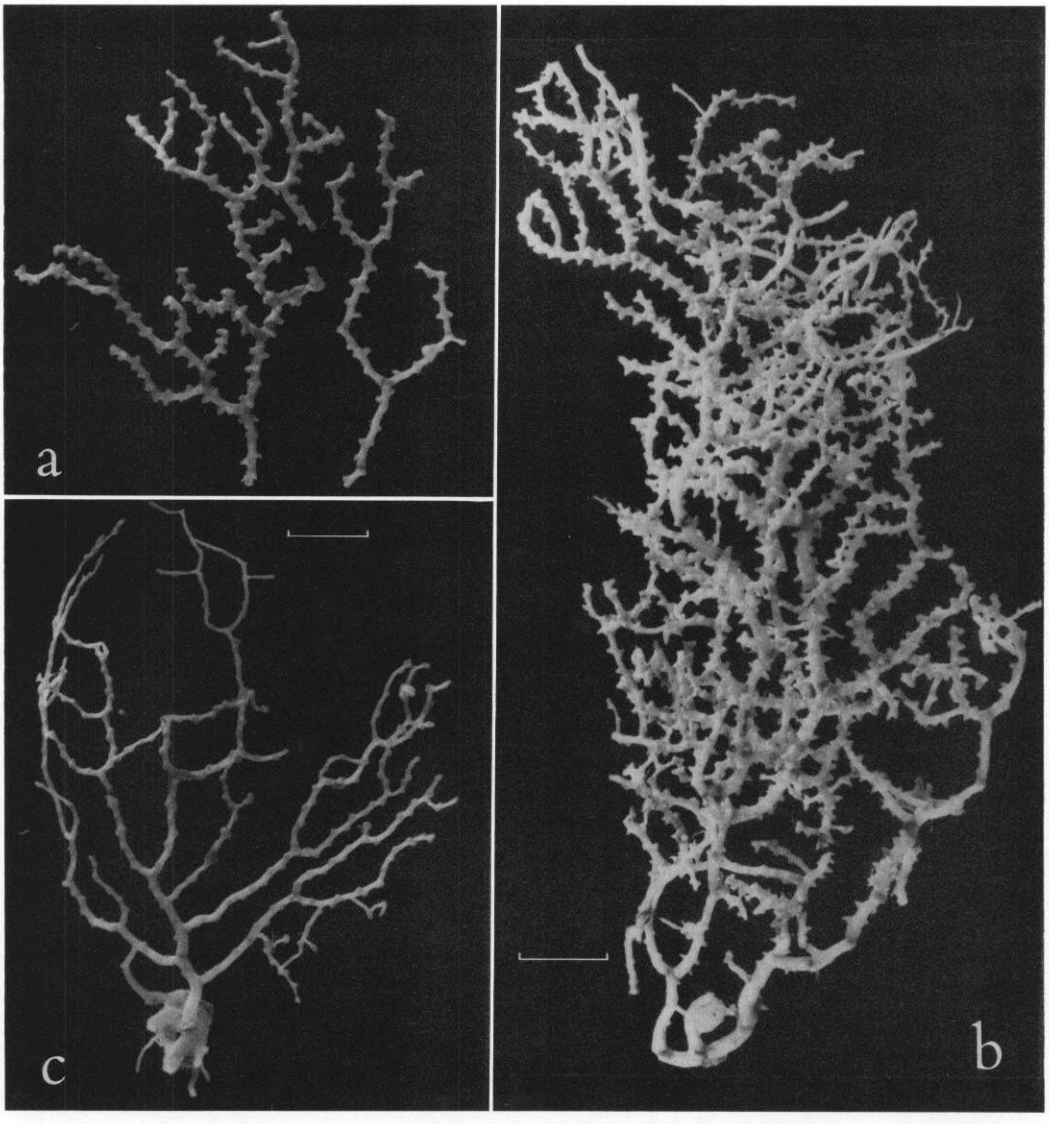

Fig. 28. a, *Chelidonisis aurantiaca aurantiaca* Studer, USNM 28238; b, *Chelidonisis aurantiaca mexicana,* n. subsp., USNM 56564, holotype; c, *Chelidonisis philippinensis,* n. sp., USNM 60389, holotype. Scale bars = 1 cm; that at b applies also to a.

Verrill, in his unpublished report on the "Blake" alcyonarians, described a specimen, now lost, of *Chelidonisis aurantiaca* taken by the University of Iowa Bahamas Expedition off Sand Key, Florida. No illustration of it is to be found among the surviving unpublished plates from Verrill's report, and his original manuscript describing it seems no longer to be extant. While it is strange that none of the many trawling and dredging stations occupied in that area by research vessels of the University of Miami obtained it, a specimen trawled by M/V *Oregon* at sta 4708 in the Gulf of Mexico lends credibility to Verrill's record from the Florida Keys.

The specimen obtained by the U.S. Fish Commission steamer *Albatross* at sta

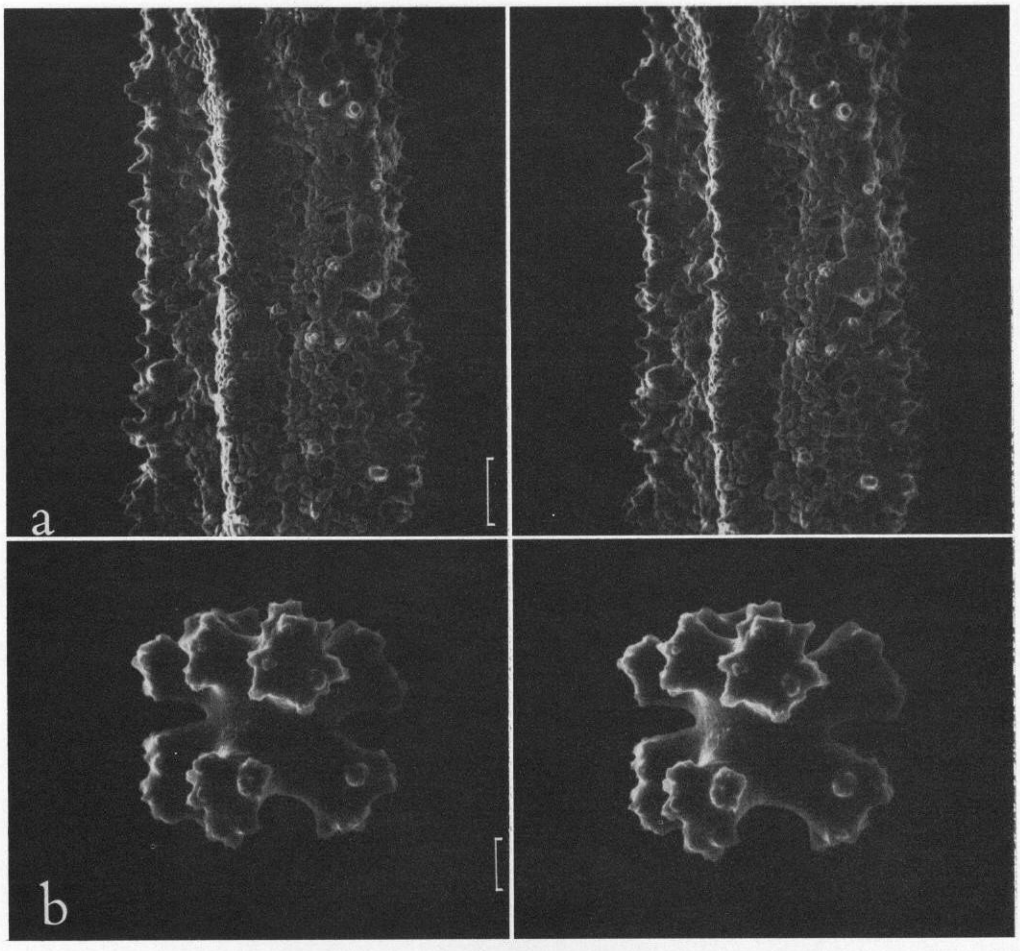

Fig. 29. *Chelidonisis aurantiaca* Studer: a, Part of axial internode, stereo pair, scale bar = 0.1 mm; b, Sclerite, stereo pair, scale bar = 0.01 mm.

D-5423 in the Philippine Islands is the first and only known record of *Chelidonisis* from the Indo-Pacific.

Kükenthal's (1915:124; 1919:637; 1924: 445) contention that *Isidella capensis* Studer, 1878, belongs to this genus is not convincing and is completely refuted by Stiasny's (1941:87, fig. 11) illustrations of sclerites from Studer's type specimen. Even though the axis is not described, the sclerites are those of a melithaeid, probably *Acabaria.* Hickson's (1900:86, pl. 6, figs. A, A') specimen identified as *Primnoisis capensis* (Studer) appears from the illustrations to be some melithaeid rather than an isidid, and may be Studer's species.

Chelidonisis aurantiaca aurantiaca
Studer, 1890
Figs. 28a, 29, 30a, 31a

Chelidonisis aurantiaca Studer, 1890:553; 1901:38.—Stephens, 1909:9.—Kükenthal, 1919:631; 1924:444.—Deichmann, 1936:253.—Tixier-Durivault and d'Hondt, 1974:1415.—Grasshoff, 1982: 965; 1986:35.

Material examined.—Southwest of Ireland: 50°42′N, 11°18′W, 627–728 fathoms,

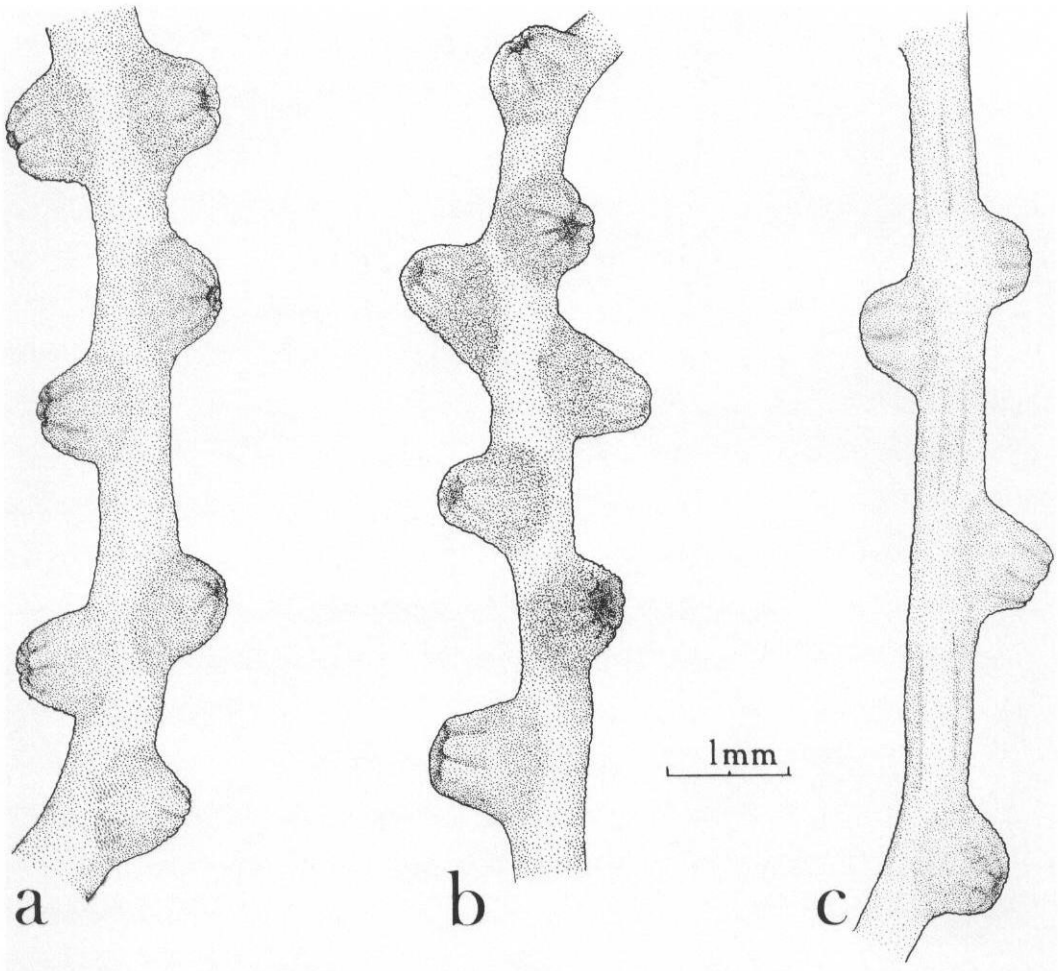

Fig. 30. a, *Chelidonisis aurantiaca aurantiaca* Studer; b, *C. aurantiaca mexicana,* n. subsp.; c, *C. philippinensis,* n. sp.

Fisheries of Ireland, Scientific Investigation S.R. 504, 12 Sep 1907; several branches without holdfast, USNM 28238, received from the National Museum of Dublin.

Diagnosis.—As for the genus.

Remarks.—The present material (Figs. 28a, 30a), part of that recorded by Stephens (1909:9), agrees in every respect with the original description so its authenticity is not open to question. Examination of the sclerites by scanning electron microscope shows that some of the 6-radiates are asymmetrically developed (Fig. 31a) in a way similar to that occurring in *Corallium* and *Paragorgia.* Such asymmetrical forms were illustrated, although not very clearly, by Studer (1901:pl. 4, fig. 9).

Chelidonisis aurantiaca mexicana, new subspecies
Figs. 28b, 30b, 31b

Material examined.—Gulf of Mexico, south of the Mississippi Delta: 27°45′N, 91°12.5′W, 230 fathoms; R/V *Oregon* sta 4708, 23 Feb 1964; one colony, USNM 56564.

Diagnosis.—*Chelidonisis* having colonies

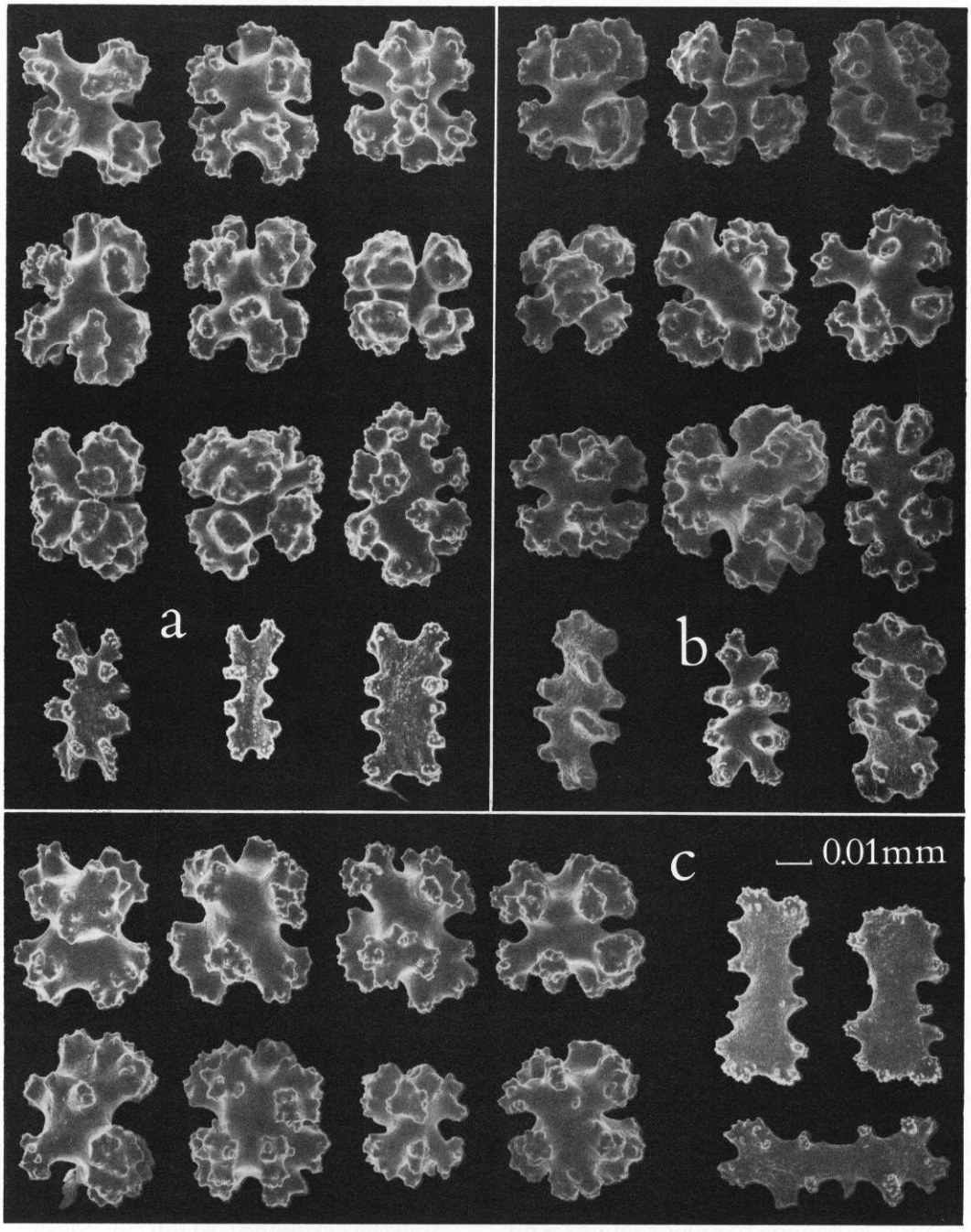

Fig. 31. Sclerites of a, *Chelidonisis aurantiaca aurantiaca* Studer; b, *Chelidonisis aurantiaca mexicana,* n. subsp.; c, *Chelidonisis philippinensis,* n. sp.

abundantly branched, with occasional anastomosis; polyps commonly less than 2 mm apart.

Description.—The holotype (Fig. 28b) as preserved is a colony, probably incomplete, about 11.5 cm tall and 5 cm wide, in the form of a profusely branched compressed bush produced by a combination of dichotomous and lateral branching with occasional anastomosis. In many cases, an internode gives rise to 2 branches, each beginning with a horny node, so close to its distal end that they seem to arise from a single node. Between such bifurcations, one or both internodes may give rise laterally to one or more side branches in approximately the same plane, each commencing with a horny node. These branches may in turn bifurcate or produce further lateral branchlets, resulting in an irregular multiplanar thicket. The middle of the colony is traversed by a vague principal axis formed by the dominance of one branch of successive bifurcations; the thickest internodes are about 2 mm in diameter, whereas those of the smaller branches are only 0.2 mm wide, or even less. The longest internodes are about 1 cm long between dichotomies, and the side branches from them are 3–5 mm apart.

The polyps tend to a biserial arrangement, rather widely separated, on the smaller branches; some incline toward one face of the colony, and on the older branches they occupy 2 sides and one face of the branches, leaving one side of the colony almost free of polyps. They contract to form obtusely conical verrucae 0.2–0.35 mm tall and 0.5–0.6 mm wide at the base; the infolded tentacles produce a blunt, obscurely 8-lobed apex (Fig. 30b).

The sclerites (Fig. 31b) are similar to those of eastern Atlantic material.

Chelidonisis philippinensis, new species
Figs. 28c, 30c, 31c

Material examined.—Philippine Islands, off Cagayan Island: 9°38′30″N, 121°11′E, 508 fathoms; USFC steamer *Albatross* sta D-5423, 31 Mar 1909; one nearly complete colony with holdfast and some detached branchlets; holotype, USNM 60389; one colony lacking holdfast, and detached branchlets; paratype, USNM 78378.

Diagnosis.—*Chelidonisis* with flabellate colonies openly branched, polyps widely spaced, commonly 2.5 mm or more apart.

Description.—The holotype (fig. 28c) is a nearly complete colony about 6 cm in height and width, arising from a multilobed holdfast adapted for anchoring the colony in soft substrate. The colony is essentially uniplanar but the flabellum is distinctly convex. Branching is chiefly dichotomous, each internode giving rise at its distal end to 2 branches each arising from a short horny node; a few internodes produce 1 or 2 side branches articulated by a horny node, and a few fail to bifurcate, instead producing only a single new internode in its own direction of growth. Anastomosis may occur fortuitously where the courses of 2 branches coincide, but does not appear to be a consistent feature of ramification. Most internodes are 1 cm in length, but a few may be as long as 1.2 cm or as short as 0.7 cm. The basal internodes of the main stem are 1.5 mm in diameter, those of the principal branches 1 mm, and of the terminal branches only 0.2–0.5 mm.

The polyps are biserially arranged, widely spaced and often in pairs, probably owing to the fact that branchlets always end with an opposed pair of polyps. Distance between polyps is usually 3–4 mm, but somewhat greater or lesser distances are not uncommon. In most parts of the colony the contracted polyps form hemispherical verrucae 0.25–0.3 mm in height, with blunt, indistinctly 8-lobed apices formed by the bases of the infolded tentacles (Fig. 30c); near the tips of branches, the verrucae may be scarcely raised above the coenenchymal surface.

The sclerites (Fig. 31c) differ from those of Atlantic material in no significant way.

Acknowledgments

We are grateful to Mr. Phil Alderslade, Northern Territory Museum of Arts and Sciences, Darwin, Australia, Dr. Manfred Grasshoff, Natur-Museum Senckenberg, West Germany, and Dr. David Pawson, Smithsonian Institution, Washington, D.C., for critical reading of the manuscript. The scanning electron micrographs were taken by Mr. Walter R. Brown, Chief of the S.E.M. Laboratory, National Museum of Natural History.

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