REPORT ON THE HEXACTINELLID SPONGES COLLECTED BY THE UNITED STATES FISHERIES STEAMER "ALBATROSS" IN THE NORTHWESTERN PACIFIC DURING THE SUMMER OF 1906

By Yaichiro Okada

Zoological Institute, Tokyo University of Science and Arts, Tokyo, Japan

The large number of hexactinellid sponges collected by the United States Fisheries steamer *Albatross* during her cruise in the northwestern Pacific Ocean in 1906 were originally assigned for study and report to the late Professor Ijima by the United States Bureau of Fisheries. Two years before his death, in March, 1920, the specimens were placed in my hands for joint report with Doctor Ijima, at which time the material had been practically untouched. With the permission of the Bureau of Fisheries, I have worked up this valuable collection and prepared this report upon it. To that bureau I tender my best thanks. I also extend my thanks to the late Professors Ijima and Watasé and to Professor Yatsu, who have kindly given me a table in the Zoological Institute; to Dr. S. Hôzawa for his many valuable suggestions; and to two American colleagues, Dr. Waldo L. Schmitt, of the United States National Museum, and Dr. Carl L. Hubbs, of the University of Michigan, for assistance in seeing the manuscript through the press.

The specimens are referable to 42 species and 7 subspecies belonging to 17 genera and 3 subgenera. Owing to the imperfectness of the specimens the following material, mentioned elsewhere herein, could not be specifically determined: Hyalonematids, *Farrea* sp., *Aphrocallistes* sp., *Bathydorus* species? α and β.

Twenty-nine species and subspecies, as follows, are new to science:

The stations where the hexactinellids reported upon were obtained are listed in Table 1:

TABLE 1.—*Stations in northwestern Pacific where hexactinellids were obtained*

Station No.	Date	Approximate location	Latitude and longitude	Depth	Temperature	Nature of bottom	Species collected
	1906			*Fathoms.*	° *F.*		
4768	June 3	"Bowers Bank," Bering Sea.	54° 20′ 30″ N., 179° 09′ 30″ E. (approx.).	764	36.5	Greenish-brown mud, fine black sand.	Indeterminable Farrea.
4769	do	do	54° 30′ 40″ N., 179° 14′ E. (approx.).	244	38.5	Gray sand, green mud	Aulosaccus tuberculatus, A. fissuratus, Rhabdocalyptus borealis, Bathydorus β sp.
4770	do	do	54° 31′ N., 179° 15′ E. (approx.)	247			Rhabdocalyptus heteraster, Bathydorus β sp.
4771	June 4	do	54° 30′ N., 179° 17′ E	426		Broken shells	Staurocalyptus rugocruciatus.
4772	do	do	54° 30′ 30″ N., 179° 14′ E	344	38.1	Greenish brown sand	Rhabdocalyptus australis, R. borealis.
4775	do	do	54° 33′ 30″ N., 179° 44′ E	584		Green mud, black specks, foraminifera.	Aulosaccus fissuratus.
4780	June 7	Near western extremity of Aleutian Islands.	52° 01′ N., 174° 39′ E	1,046	35.9	Gray mud, sand, pebbles.	Aphrocallistes aleutiana.
4781	do	do	52° 14′ 30″ N., 174° 13′ E	482	38.6	Fine gray sand, pebbles	Aphrocallistes yatsui, Aulosaccus fissuratus, Rhabdocalyptus unguiculatus.
4790	June 14	Near Bering Islands, Bering Sea.	54° 38′ 45″ N., 167° 11′ 45″ E	64	41	Pebbles	Farrea beringiana, Hyalascus attenuatus, Aulosaccus pinularis.
4797	June 20	Near Petropavlovsk, Staritschkof Island.	52° 37′ 30″ N., 158° 50′ E	682	36.6	Green mud, coarse black sand, broken shells.	Farrea watasei, Aulosaccus albatrossi.
4803	June 24	SE. of Shimushir Island, Kuriles.	46° 42′ N., 151° 44′ E	229	35.9	Coarse pebbles, black sand.	Aphrocallistes intermedia, Aulosaccus schulzei, A. fissuratus shimushirensis, Acanthascus pachyderma.
4804	do	do	46° 42′ N., 151° 47′ E	229	35.9	do	Farrea kurilensis, Aphrocallistes intermedia, Aulosaccus solaster, Hyalascus attenuatus.
4876	Aug. 2	Eastern channel of Korea Strait, vicinity of Oki Islands.	34° 20′ N., 130° 10′ E	59	62.1	Fine gray sand, broken shells.	Euplectella oweni.
4878	do	do	34° 18′ 30″ N., 130° 14′ 30″ E	59		do	Do.
4890	Aug. 9	10 to 20 miles SW. of Gotô Islands, Ôsezaki.	32° 26′ 30″ N., 128° 36′ 30″ E	135	52.3	Rocks	Eurete farreopsis, E. sacculiformis, Aphrocallistes beatrix orientalis.
4893	do	do	32° 32′ N., 128° 32′ 50″ E	106	55.9	Gray sand, broken shells, pebbles.	Pheronema ijimai, Eurete nipponica.

TABLE 1.—*Stations in northwestern Pacific where hexactinellids were obtained*—Continued

Station No.	Date	Approximate location	Latitude and longitude	Depth	Temperature	Nature of bottom	Species collected
				Fathoms.	° *F.*		
4894	Aug. 9	10 to 20 miles SW. of Gotô Islands, Ôsezaki.	32° 33′ N., 128° 32′ 10″ E.	95	------	Green sand, broken shells, pebbles.	Aphrocallistes beatrix orientalis.
4895	---do----	-----do-----	32° 33′ 10″ N., 128° 33′ 20″ E.	95	------	-----do-----	Do.
4900	Aug. 10	-----do-----	32° 28′ 50″ N., 128° 34′ 40″ E.	139	52.9	Gray sand, broken shells.	Semperella schulzei.
4903	---do----	-----do-----	32° 31′ 10″ N., 128° 33′ 20″ E.	139	------	-----do-----	Do.
4911	Aug. 12	10 to 20 miles SW. of Koshiki Islands, Tsurikake Saki.	31° 38′ 30″ N., 129° 19′ E.	391	41.9	Gray globigerina ooze---	Indeterminable Hyalonema.
4915	---do----	-----do-----	31° 31′ N., 129° 25′ 30″ E.	427	------	-----do-----	H. (Cyliconema) apertum.
4917	Aug. 13	About 90 miles WSW. of Kagoshima Gulf.	30° 34′ N., 129° 06′ E.	361	------	Gray sand, globigerina, broken shells.	Sericolophus reflexus, Bathydorus a sp.
4919	---do----	Kusakaki Jima-----	30° 34′ N., 129° 19′ 30″ E.	440	41.8	Globigerina ooze-----	Hyalonema (Cyliconema) apertum solidum, Sericolophus reflexus.
4920	---do----	-----do-----	30° 34′ N., 129° 22′ E.	440	41.8	-----do-----	Sericolophus reflexus.
4924	Aug. 14	18 miles SW. of Yakushima, Nagada Saki.	30° 5′ N., 130° 21′ 22″ E.	159	55.8	Rocks-----	Farrea sollasii yakushimensis.
4929	Aug. 15	10 miles S. of Yakushima----	30° 12′ 30″ N., 130° 43′ E.	84	74.8	Broken shells, coral, pebbles.	Do.
4933	Aug. 16	Sata Misaki, off Kagoshima Gulf.	30° 59′ N., 130° 29′ 50″ E.	152	56	Rocks-----	Pheronema giganteum.
4934	---do----	-----do-----	30° 58′ 30″ N., 130° 32′ E.	103	------	Rocks-----	Pheronema ijimai, Semperella schulzei, Aphrocallistes beatrix orientalis, Eurete farreopsis, Lanuginella pupa.
4936	---do----	-----do-----	30° 54′ 40″ N., 130° 37′ 30″ E.	103	------	Stones-----	Pheronema globosum kagoshimensis, Crateromorpha meyeri rugosa.
4937	---do----	In Kagoshima Gulf, Chirin Jima.	31° 13′ N., 130° 43′ 10″ E.	58	64.8	Mud, lava, pebbles----	Aphrocallistes beatrix orientalis.
4948	Aug. 21	East of Hiuga, Ôshima----	31° 19′ N., 131° 23′ E.	65	62.6	Dark gray volcanic sand, broken shells, pebbles.	Euplectella oweni.
4956	Aug. 23	Off entrance to Bungo Channel, Mizunoko Jima.	32° 32′ N., 132° 23′ E.	720	37.5	Greenish-brown mud, fine gray sand, foraminifera.	Hyalonema (Coscinonema) kirkpatricki globosum, H. (Cyliconema) hozawai.

4957	---do----	Off east coast of Kyûshû	32° 36′ N., 132° 23′ E	437	39. 8	---- do	Hyalonema (Cyliconema) apertum solidum, Hyalonema (Coscinonema) kirkpatricki globosum.
4958	---do----	-----do	32° 36′ 20″ N., 132° 21′ 30″ E	405	40. 1	----do	Hyalonema (Corynonema) owstoni.
4959	---do----	-----do	32° 36′ 30″ N., 132° 21′ 30″ E	---do----	------	-----do	Hyalonema (Cyliconema) apertum solidum.
4976	Aug. 30	SW. of Shiomisaki in Kii	33° 22′ 50″ N., 135° 38′ 30″ E	545	38. 7	Brown mud, small stones.	Hyalonema (Corynonema) owstoni.
5030	Sept. 29	About midway between south end of Sagkalin and Eturup Island.	46′ 29′ 30″ N., 145° 46′ E	1, 800	35. 4	Brown mud	Eurete irregularis.
5069	Oct. 15	Entrance to Enoura, Suruga Gulf, Isezaki.	35° 03′ 10″ N., 138° 47′ E	131	55. 8	Mud, sand, broken shells.	Indeterminable Hyalonema, Eurete schmidtii, Crateromorpha corrugata.
5070	---do----	-----do	35° 03′ 25″ N., 138° 47′ 40″ E	108	57. 6	-----do	Eurete schmidtii.
5083	Oct. 20	34.5 miles nearly SSW. of Omaizaki.	34° 04′ 20″ N., 137° 57′ 30″ E	624	38. 1	Fine gray sand, globigerina.	Serieolophus reflexus.
5084	---do----	-----do	34° N., 137° 49′ 40″ E	918	36. 8	Green mud, fine sand, globigerina.	Pheronema surugensis, Hyalonema (Coscinonema) ovatum.
5085	Oct. 23	Sagami Bay, Jôgashima	35° 06 45″ N., 139° 19′ 05″ E	622	37. 8	Green mud, fine black sand.	Chaunoplectella spinifera.
5087	---do----	-----do	35° 09′ 40″ N., 139° 19′ 05″ E	614	37. 5	Green mud	Rhabdocalyptus bidentatus.
5088	Oct. 25	-----do	35° 11′ 25″ N., 139° 28′ 20″ E	369	41. 8	-----do	Periphragella elisae, Acanthascus cactus.
5090	Oct. 26	Entrance to Uraga Strait, between Jôgashima and Okinosé.	35° 03′ 50″ N., 139° 37′ 30″ E	200	47. 6	Pebbles, black sand	Indeterminable Aphrocallistes?, Rhabdocalyptus victor.
5091	---do----	-----do	35° 04′ 10″ N., 139° 38′ 12″ E	197	47. 6	Green mud, coarse sand, pebbles.	Farrea sollasii.
5092	---do----	-----do	35° 04′ 50″ N., 139° 38′ 18″ E	70	56. 3	Coarse black sand	Aphrocallistes beatrix orientalis.

Suborder AMPHIDISCOPHORA F. E. Schulze, 1899

Family PHERONEMATIDAE J. E. Gray, 1870

Genus PHERONEMA Leidy, 1868

PHERONEMA GIGANTEUM F. E. Schulze

Pheronema giganteum F. E. Schulze, Rep. Voy. *Challenger*, vol. 21, pp. 250–254, pl. 45, figs. 1–11, pl. 46, figs. 1–11, 1887; Sitzber. kon. preuss. Akad. Wiss. Berlin, 1893, p. 563.—Ijima, *Siboga*-Expeditie, vol. 6, pp. 10–17, pl. 5, figs. 1–7, 1927.

Two specimens of this species were obtained from the same station, No. 4933, off Kagoshima Gulf, at a depth of 152 fathoms. Of these, one is of a complete, large globular form and is beset with numerous prominently protruded bundles of cuspidates, which attain a length of 45 mm beyond the sponge dermal surface. The sponge body measures 80 mm in height and 68 mm in maximum diameter. The external surface of the skin, as seen between the laterally projecting tufts of spicules, appears to the naked eye very uniform and even. The osculum is nearly circular and measures 9 mm in diameter; its margin is not raised and it is entirely free from such marginalia as seen in the *Challenger* specimen. The gastral cavity, which attains a depth of 30 mm, is narrow, nearly smooth, and even on the surface.

The smaller specimen is incomplete, the upper half or more having entirely fallen off. The barrel-shaped mesamphidisk, as observed in the specimen of *Challenger* collection, seems to be entirely absent over the body of the sponge in hand.

A cuspidate, larger than any described for this species by previous authors, occurs more rarely, intermixed with the other cuspidates. It measures 2 mm long or more and 40μ to 50μ broad at the middle, attenuating gradually toward the distal end protruding from the sponge body. The surface of the spicule is covered with prominent short spines projected directly toward both lateral sides. Their sizes increase toward the distal end of the spicule, which is beset with two prominent distally directed spines on each side, and diminish toward the proximal end, imbedded in the spongy body.

In most particulars of the spiculation, the present specimens are quite similar to those of the *Siboga* expedition and show features somewhat different from the *Challenger* specimen.

PHERONEMA GLOBOSUM KAGOSHIMENSIS, new subspecies

Plate 1, Figure 4

A large complete specimen (holotype, U.S.N.M. No. 22026), for which I establish this new form, was collected from a spot off

Kagoshima Gulf, at a depth of 103 fathoms (Station 4936). It is closely allied to the type of the species in essential characters but differs from it chiefly by having an ovoid mesamphidisk and a different kind of large uncinate. The sponge has the shape of a radish, its maximum transverse diameter at the upper end much exceeding its height; it measures 51 mm, becoming somewhat attenuated below and measuring 33 mm at the base. The oscular margin is nearly circular, with an axis of 35 mm. The upper surface is occupied by a concave sieve plate, the margin of which forms a slightly raised and sharpened edge, from which the short and weak marginal cuspidates protrude in a single row. The lateral cuspidates, which project radially from several points on the sides of the sponge, form small bundles each of several spicules. Most of these are stout and, grouped together, form a small strand protruding several centimeters from the body surface.

The root tuft is about 35 mm long. The basalia composing it are arranged in a large bundle 23 mm thick. The upper ends of these spicules, which are smooth and gradually drawn to a point, are imbedded in the sponge for a length of several centimeters. Their much longer free part extends more or less obliquely downward. The basalia have two teeth rising from the gently bow-shaped, rounded, and thickened terminal portion, and end in simple conical points. The distance between these two terminal points—that is, the total breadth of the anchor—is 0.35 mm to 5 mm. The shaft becomes gradually narrower to within a certain distance of the end of the anchor, and then increases in thickness on the anchor itself.

In the present specimen the distal ray of the dermal pinules on the lateral side attains a length of 200μ, and that on the sieve plate, though similar to the dermal in shape, may be much longer than it. The four basal rays are longer than those of the type of the species, measuring 100μ. On some parts of the oscular sieve plate much shorter pinules, measuring 85μ, are found. In these the distal unpaired pinular ray is covered with moderately stout, conically pointed, and widely diverging spines, 52μ in breadth. The basal rays, which form a rectangular cross, are much longer, measuring 180μ to 200μ. They are stout and straight, and are often nearly covered distally with short spines. A slight curvature of the basal rays may sometimes appear on these pinules. The proximal ray is represented by a vestige in the form of a terminally pointed short tubercle.

As to the amphidisk, I have found moderately broad, nearly ovoid mesamphidisks, which are sparsely developed among the hypodermalia and parenchymalia. Among the latter they occur much more abundantly than among the former. Each spicule usually measures 80μ to 120μ in length and bears on each end 12 sharply pointed

umbel rays forming a distinct broad bell-shaped terminal disk, almost meeting the opposite one and attaining a breadth of 40μ to 56μ. The shaft is 4μ to 6μ thick and fairly rich in rounded tubercles on all surfaces. Macramphidisks sometimes attain a length of 190μ in the present specimen and have a bell-shaped terminal disk 45μ long and 56μ broad.

The large uncinates in the type of the species are not abundant; besides these, there is another form of large uncinates, similar to those seen in many members of Dictyonina. On these the spines are short, straight, and very oblique, nearly parallel, and closely applied to the shaft.

TABLE 2.—*Comparison of* Pheronema globosum *Schulze and* P. g. kagoshimensis, *new subspecies*

Form	Collected	Pinules on dermal lateral wall		Pinules on sieve plate	
		Distal ray	Basal ray	Distal ray	Basal ray
		Length in μ	*Length in* μ	*Length in* μ	*Length in* μ
Pheronema globosum (type)	Little Kii Islands by Challenger	150	60	-------	-------
P. g. kagoshimensis	Off Kagoshima Gulf, 103 fathoms, by Albatross.	160–200	60–100	(1)	(2)

Form	Collected	Macramphidisk		Mesamphidisk		Uncinates	
		Length in μ	Width in μ	Length in μ	Width in μ	Large	Small
							μ
Pheronema globosum (type)	Little Kii Islands by Challenger.	60	40	-------	-------	------	120
P. g. kagoshimensis	Off Kagoshima Gulf, 103 fathoms, by Albatross.	160–185	55–65	80–120	40	------	120–280

[1] Mostly 180–240, infrequently 85. [2] Mostly 80–100, infrequently 200.

PHERONEMA IJIMAI, new species

FIGURE 1; PLATE 2, FIGURE 1

The four complete specimens for which I establish this new species are nearly allied in outer configuration. The largest one, which I shall designate with the letter A (holotype, U.S.N.M. No. 22027), was collected from a spot 10 to 20 miles southwest of the Gotô Islands, at a depth of 106 fathoms (Station 4893). The remaining three specimens (B–D) were found off Kagoshima Gulf at 103 fathoms (Station 4934). Specimen A is a circular ball-like mass, abruptly narrowed terminally, 43 mm high, and 37 mm broad at the center. The nearly elliptical osculum measures 5 mm by 3.5 mm.

The sieve plate is entirely lacking. The gastral chamber is very shallow and small, measuring only 8 mm in depth. The root tuft projecting from the basal surface is curled. The prostal marginalia

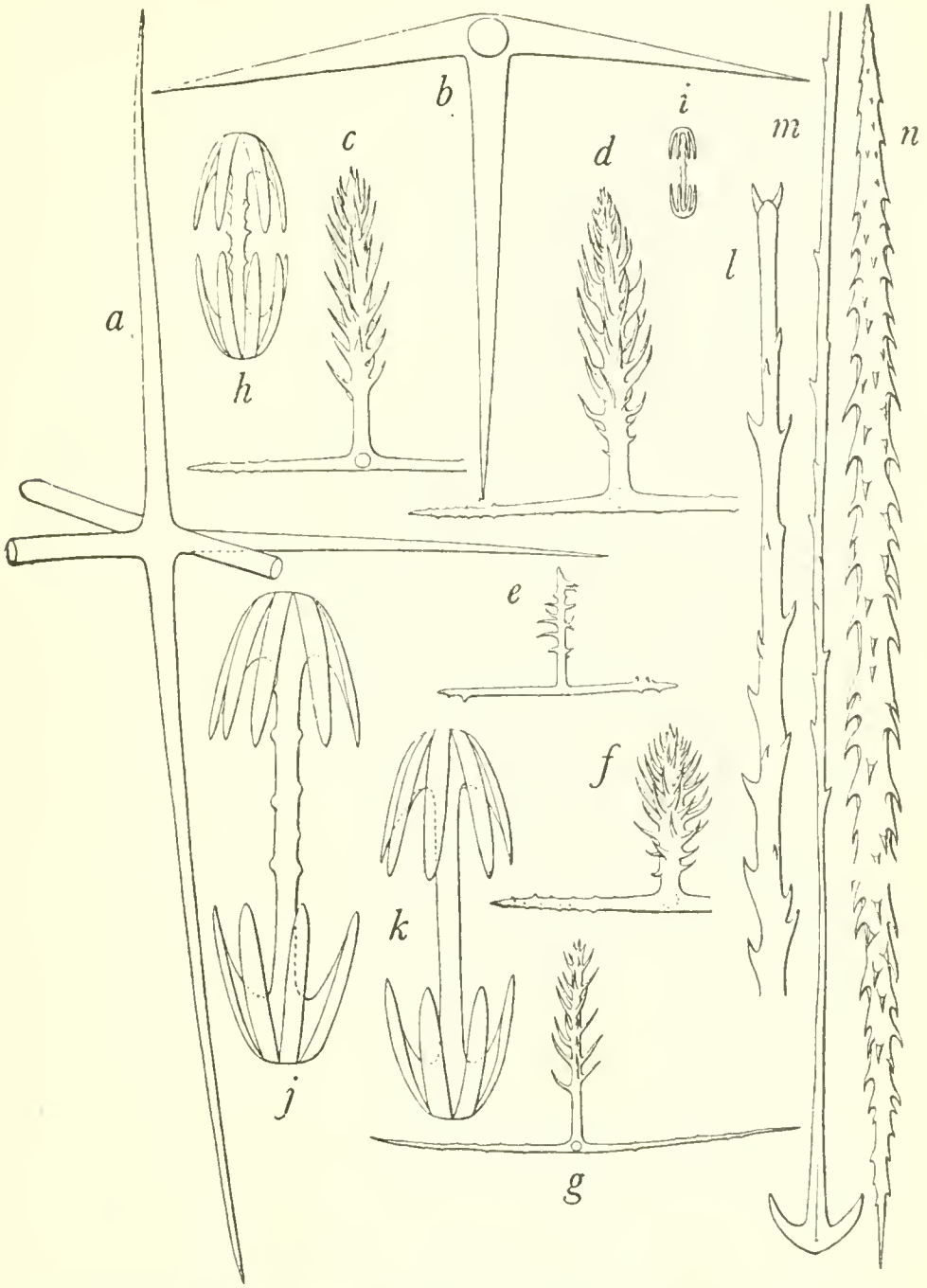


FIGURE 1.—*Pheronema ijimai*, new species: *a*, Parenchymal hexactin, × 125; *b*, hypodermal pentactin, × 125; *c*, dermal pentactinic pinule, × 250; *d*, dermal pentactinic pinule, × 250; *e*, young pentactinic pinule, × 250; *f*, gastral pentactinic pinule, × 250; *g*, gastral pentactinic pinule, × 250; *h*, mesamphidisk, × 250; *i*, micramphidisk, × 250; *j*, macramphidisk, × 250; *k*, mesamphidisk, × 250; *l*, cuspidate, × 250; *m*, basalia, × 250; *n*, macrouncinate, × 250

are very inconspicuous. Specimen B, the smallest of all, has a nearly egglike form and is 26 mm in breadth and 16.5 mm in height. The circular osculum measures 2 mm in diameter. Specimen C represents an entire ball-like body, having at its apical end a nearly oval

osculum, measuring 3 mm in diameter. Specimen D is a compound body potatolike in form and provided with three circular oscular apertures measuring 2 mm on the top, two of which open close together, while the third one is situated somewhat apart from the others.

All the specimens labeled B to D have numerous weak, short, prostal lateralia protruding from the entire surface of the body, and the basal tuft is not prominently formed. The basal anchor spicules project separately from the basal surface.

Spiculation.—The numerous radial cuspidates (fig. 1, *l*), projecting a very short distance beyond the surface of the sponge, are long spicules, thickly covered with pointed microspines on the proximal surface imbedded in the sponge wall and becoming gradually sparser and larger toward the apex. They occur on all surfaces, especially at the basal regions of the body and are always radially disposed, so that the pointed ends of the bars are directed inward and the anterior point of the whole spicule outward. The distal end, somewhat expanded to a globular form, is provided laterally with two short spines projecting slightly outward. I have found only one specimen (D) in which these protruding spicules are much stouter, longer, and arranged in a bundle; they usually project singly.

The root spicules (fig. 1, *m*) do not form a tuft; they protrude singly from the basal surface of the sponge body, infrequently making a small curled bundle. These long, strongly developed spicules end internally in the body in a simple point; while, toward the lower and outer end, they first decrease gradually in thickness and then finally form a double-toothed, gently curved anchor. Two anchorlike teeth stand out almost at right angles from the shaft; are only slightly bent, and end in a somewhat blunt point. In specimens B to D, 25–37 mm in diameter, the basalia project singly; and, as the sponge grows, the spicules composing the basal tuft increase in number and in size.

The hypodermalia (fig. 1, *b*) are composed of the large pentactins supporting the dermal membrane; the four paratangentials lie mostly in a plane and extend tangentially to the radially arranged rays of starlike texture on the dermal surface, measuring 320μ to 1,700μ in length. The spicules vary greatly in size; the larger ones measure 105μ to 1,200μ along the proximal ray and 320μ to 1,700μ across the paratangential rays. The rays are quite smooth, and usually taper toward the sharp-pointed end, with a breadth of 16μ to 160μ at the base.

In certain parts of the dermal and gastral membranes, uncinates 1 mm to 3 mm or more in length and up to 16μ thick occur, some-

times forming a large bundle. These macrouncinates (fig. 1, *n*) are covered with spines, which protrude very obliquely and extend nearly parallel close to the surface of the shaft of spicules.

Pinules are found on the dermal and gastral membranes, much more sparsely on the latter. They usually stand close together, their basal rays extending parallel for considerable distances and forming a very irregular network. The dermal pinules (fig. 1, *c*, *d*) are 60μ to 80μ high, usually 65μ. The four basal rays are nearly always quite straight and form a regular cross with beams intersecting vertically. They vary from 100μ to 200μ long, averaging 140μ, and are 4μ thick, proximally smooth for a very short distance, and distally covered sparsely or thickly with either vertical or oblique spines, which are sharply pointed. The distal ray is vertical to the plane of the basal rays and consists of a smooth proximal part, 6μ thick and 10μ or more long, and a bushy, distal, nearly conical part covered with curved stout spines. This distal part is usually 50μ or more long and covered with stout, lateral spines, terminally only slightly curved and extended obliquely upward, proximally projecting almost transversely.

The gastral pinules (fig. 1, *f*, *g*) are somewhat different from those on the dermalia. The basal rays, measuring 180μ on an average, are a little longer than the distal ray, which measures 120μ to 160μ in length. Most of the pinules have a prominent, stout, terminal spine and lateral spines obliquely extended upward on both sides, so that the distal ray makes a distally expanded bushy tuft.

Besides these pentactinic pinules, there are infrequently hexactinic pinules on the dermalia. They have a sparsely spined and somewhat shorter distal pinular ray, which, as a whole, is narrow and feather-shaped, measuring 56μ on an average. The proximal ray is slightly shorter than the paratangential rays of the same pinule, measuring 68μ long and 4μ thick at the base, with sharply pointed end. It is beset with small, generally erect prickles, sparingly present or entirely absent at the base but more numerous at the end.

Among these pinules there are found much more delicate pinules, which may be younger or abnormal forms. These spicules may occur in ectosome and endosome as well as in choanosome; in the hexactinic pinules, the six rays are unequal, beset with several sharply pointed, echinated spines near the distal ends. The paratangentials are the longest of all, 100μ to 140μ in length, and 4μ thick at the base, gradually attenuating toward the sharply or conically pointed and somewhat curved end. The distal ray is the shortest and is covered with weak lateral spines on the distal part. The pentactinic pinules (fig. 1, *e*), which may occur together with the hexactinic ones, are nearly the same size. The distal unpaired ray usually measures 92μ long

and is echinated prominently, while the paratangential rays are somewhat curved and spined only distally, measuring 100μ to 140μ in length. The distal ray is represented by a vestige in the form of very short, terminally pointed spines.

Canalaria pinules are in this, as in other members of *Pheronema*, nearly entirely absent.

Amphidisks of three kinds—macramphidisks, mesamphidisks, and micramphidisks—are found in the dermalia and in the parenchymalia.

The macramphidisks (fig. 1, *j*) are 160μ to 220μ long and have bell-shaped terminal disks that attain a diameter of 68μ and a height of 63μ. The shaft is 8μ thick and roughened by a few round tubercles on the surface. Each disk has eight broad, spade-shaped, terminally slightly pointed marginal rays.

The mesamphidisks (fig. 1, *h*, *k*) are mostly distributed sparsely in the parenchymalia, and are beset with 8 to 12 slender terminally pointed marginal rays on the broad bell-shaped terminal disk, which attains a length of 90μ to 125μ and is 52μ in diameter. The shaft also has round tubercles on the surface and measures 8μ in breadth at the center.

The numerous micramphidisks (fig. 1, *i*) occur everywhere, and are especially abundant in the gastralia. They are 20μ to 40μ, rarely as much as 48μ, long. Their terminal disks are bell-shaped, about 10μ long and 8μ broad, and have 8 to 12 marginal teeth, which sometimes are not easy to observe distinctly. The shaft is rough and is beset with numerous sharply pointed microspines.

The microuncinates are very abundant in the parenchymalia and vary in length from 140μ to 230μ, becoming extremely attenuated toward the posterior end and covered with short stout spines, the basal part of which is nearly perpendicular to the shaft on the anterior part of the same spicule, and the distal part of which is strongly or weakly bent and hooklike in appearance.

Besides this microuncinate, there occur the other small uncinates, which are entirely similar to the above-mentioned large uncinates in shape and which vary considerably in size. It is therefore evident that the large and small uncinates of these forms are connected by transitional forms and do not seem essentially different from one another.

In the parenchymalia, the large robust hexactins and pentactins are found. The hexactinic parenchymalia (fig. 1, *a*) are seemingly of quite variable dimensions. Many rays are about 0.5 mm to 1.7 mm long and 80μ broad near the spicular center. They are usually smooth throughout the entire surface and taper gradually toward the sharply pointed end.

The pentactinic parenchymalia play a comparatively less important part in the composition of the parenchyme, as they are sparse. They occur mostly in loose strands running in company with the rays of hexactinic parenchymalia. They are also smooth on the surface and gradually or suddenly attenuated toward the sharply pointed end.

TABLE 3.—*Measurements of four specimens of* Pheronema ijimai

Specimen and condition	Collected at—	Dermal pinules		Gastral pinules		Macramphidisk	Mesamphidisk	Micramphidisk	Uncinates	
		Distal ray	Basal ray	Distal ray	Basal ray				Large	Small
		μ	μ	μ	μ	μ	μ	μ	*Mm*	μ
A (large, complete).	Station 4893, off Gotô Islands, 106 fathoms.	60–80	100–180	160	120–180	160–200	104	20–40	1. 3–2. 3	160–240
B (small, complete).	Station 4934, off Kagoshima Gulf, 103 fathoms.	60–70	140–170	120	128–195	180–200	90–104	20–48	1. 4–2. 2	140–240
C (small, complete).	do	60–80	130–180	140	160–180	180–220	125	20–48	1. 3–2. 4	140–230
D (small, complete).	do	60–80	160–200	(?)	(?)	160–200	(?)	20–46	1. 4–2. 2	(?)

PHERONEMA SURUGENSIS, new species

Two large fragments (U.S.N.M. No. 22028), very badly macerated and injured, which may be two parts of a tolerably large sponge body, were collected at Station 5084, nearly south by southwest of Omaizaki, Suruga Bay, at a depth of 918 fathoms.

Spiculation.—The prostal marginalia protruding from the oscular margin, the large and tolerably small uncinates with oblique spines, and the oxypentactins, supporting the interior of the sponge body, are to be considered as macroscleres.

The prostal marginalia, which are protruded from the oscular margin, are long cuspidates, straight or slightly curved, 10 mm to 20 mm or longer (protruding parts about 5 mm to 10 mm long), and 40μ thick at the center. Their distal parts, though most of them are broken off, are slenderer than the proximal parts and are covered with distinct spines. These spines are directed obliquely near the distal end of the spicule and gradually come to project perpendicularly to the shaft, near the base of the protruded parts of the same spicule. The proximal third, which is imbedded in the body of the sponge, has quite a smooth surface. The distal end is probably somewhat inflated, beset laterally with a pair of pointed spines, since such cuspidates usually occur in members of this genus. The proximal end is simply sharply pointed.

The supporting spicules of the interior are exclusively stout oxypentactins. Their four paratangential rays are somewhat shorter

than the proximal unpaired ray, which measures 3 mm to 5 mm in length. Their rays are quite smooth and taper gradually toward the conically pointed end, measuring 30μ to 50μ thick at the base.

In the parenchymalia and hypodermalia, there are greater or smaller numbers of macrouncinates, 6μ to 7 mm or more long and up to 10μ thick. They are quite similar to the macrouncinates occurring in species of *Farrea* and are covered with spines situated very obliquely and extending nearly parallel, close to the shaft of the spicule. They are arranged radially or irregularly, the thicker distal end lying in the outer surface of the sponge. Frequently the macrouncinates show a heteropole form, having a sharply pointed distal end and a spherically expanded proximal end whose surface is nearly smooth or slightly rough. The entire surface of the spicule, except the proximal end, is also covered with obliquely directed spines.

I will not describe the microscleres. Pinules are found in the dermal membranes, where they generally stand close together, forming a quadratic network because the basal rays extend side by side for considerable lengths, while in the gastral membrane they are sparsely distributed, not forming a network.

The dermal pinules are somewhat smaller than the gastral ones. They are about 160μ to 230μ high; their basal rays, which form a rectangular cross, are about 180μ to 240μ long, gradually attenuated toward the conically pointed end, and slightly spined on all parts, most distinctly so on the distal part. The unpaired distal rays have a prominent terminal spine and numerous long and somewhat stout lateral spines, terminally only slightly curved, extending obliquely upward. It consists of a smooth proximal part 8μ to 12μ thick and 12μ or more long, and a somewhat bushy, conically shaped distal part 28μ in breadth, covered with obliquely curved spines proximal to it, with vertically directed spines.

The gastral pinules have a considerably longer distal unpaired ray measuring 300μ to 360μ in length, with the basal rays 210μ to 230μ long, but otherwise nearly similar to the dermal pinules. In these pinules, the distal ray shows a somewhat whiplike appearance, covered with tolerably short spines, obliquely directed upward.

I have not been able to find any macramphidisks. I do not wish to assert, however, that such spicules are entirely absent. Mesamphidisks are very sparsely scattered in the parenchymalia. They measure about 125μ in length and have bell-shaped terminal disks 25μ high and 36μ broad, with 8 to 12 marginal teeth, pointed at the ends. Micramphidisks are of the usual shape, with hemispherical terminal disks 10μ broad and 12 to 18 marginal teeth. They measure about 28μ in length.

Microhexactins are numerous in the parenchyme of the entire sponge body. Their rays are frequently of a medium thickness of 6μ

and sometimes much slenderer, and are covered with numerous microspines irregularly distributed on the surface.

The microuncinates, which are nearly similar to those occurring in *Sericolophus reflexus* Ijima, are fairly abundant, are 4μ broad at the center, and are spindle-shaped, with both ends sharply pointed and the surface quite smooth.

Genus SERICOLOPHUS Ijima, 1901

SERICOLOPHUS REFLEXUS (Ijima)

Hyalonema reflexum IJIMA, Zool. Anz., vol. 17, p. 336, 1894.
Sericolophus reflexus IJIMA, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 15, p. 128, 1901; *Siboga*-Expeditie, vol. 6, pp. 26–28, 1927.

There are 13 specimens of *S. reflexus* in the collection. The difference between the dermal and gastral pinules is not only in the state of the spines on the distal ray, as described by Ijima from the specimens from Sagami Sea, but also from my observation it is found in the dimensions of corresponding parts of the spicules. The distal ray of the gastral pinule averages 160μ to 260μ in length, 14μ broad at its base, and the basal crossing rays attain a length of 240μ and are 8μ broad at the base. The dermal pinules, though somewhat smaller than those of the type specimen, have a distal ray 120μ to 160μ in length and basal rays 70μ to 100μ long. The hexactinic dermal pinules are infrequently found in the ectosome of several specimens. The paratangential ray is 70μ to 90μ long and terminally pointed. The proximal ray is 90μ long and the distal pinular ray 136μ long.

The parenchymal microxyhexactins are much slenderer and their prickles are not so prominently developed as those of *Siboga* specimens of this species. From my observations of the preparations of the *Siboga* specimens and those from the Sagami Sea it is evidently exhibited that the parenchymal oxyhexactins may vary considerably in size and shape. The *Siboga* specimens have more robust and larger rays, beset with prominent prickles on the surface, while the present specimens have distinctly slenderer rays and very slightly developed prickles. The Sagami Sea specimens have the spicules intermediate in size.

Besides the microxyhexacts, which occur abundantly in the type specimen as well as in the present ones, there exist other micropentacts, which are mostly distributed in the wall of the excurrent canals and in the parenchyme, intermixed with the microxyhexacts. The spicule is provided with an unpaired distal ray 100μ to 180μ long and with a paratangential basal ray 190μ to 320μ long, the surface of which is slightly roughened. Frequently the basal rays are curved to certain directions near the distal ends.

An uncinate with one end thickened, 12μ in breadth, the other sharply pointed and with a wholly echinated surface, is frequently present in the dermal membrane. It measures 200μ to 310μ long and 6μ broad at the center.

A monact measuring 300μ in length and 25μ in breadth at the center, with conical ends, occurs infrequently in the parenchyma. This spicule somewhat resembles the microuncinate described by Ijima in Japanese specimens, though it has much larger dimensions in length and breadth; but it seems to me to show in shape and constitution some similarity to the microuncinate.

TABLE 4.—*Measurements of 13 specimens of* Sericolophus reflexus

Specimen	Collected at—	Body		Breadth of reflected portion	Root-tuft		Breadth of basal portion	Size of exhalent aperture
		Length	Breadth		Length	Thickness		
		Mm	*Mm*	*Mm*	*Mm*	*Mm*	*Mm*	*Mm*
A	Station 4917, off Kagoshima Gulf, 361 fathoms.	33	15	3.2	31	2	4	1
B	Station 4919, off Kagoshima Gulf, 440 fathoms.	37	28	6	70	2	3	1×2
C	do	41	26	9	60?	2	5	1
D	do	64	37	18	90	4	9	2-2.5
E	do	75	46?	16	97	5	8.5	1.5-3
F	do	110	------	25	140	8	------	--------
G	do	80	40	20	------	------	------	1×3-2.5
H [1]	do	80?	45?	19?	------	------	------	1-2.5
I	Station 4920, off Kagoshima Gulf	103?	53	25	------	------	------	3-2
J	do	115	57	33	------	------	------	3×5.5-4
K	do	105	55	28	------	------	------	3×4-3
L	do	------	74	40	------	------	------	3×5.5 2×3
M	Station 5083, off Onmaizaki, Suruga Bay	21	8	3	30	1	1.5	1-1.8

[1] Two other fragments not measured.

Genus SEMPERELLA J. E. Gray, 1868

SEMPERELLA SCHULZEI Semper

Semperella schulzei SEMPER, Verh. phys. med. Ges. Würzburg, vol. 1, p. 272, 1868.—MARSHALL, Zeit. Wiss. Zool., vol. 25, suppl., p. 212, pl. 12, fig. E, 16, 17, 1875.—MARSHALL and MEYER, Mitth. Zool. Mus. Dresden, vol. 2, p. 276, pls. 14, 15, figs. 18, 19, 1877.—F. E. SCHULZE, Abh. kön. preuss. Akad. Wiss. Berlin, 1886, p. 67; Rep. Voy. *Challenger*, vol. 21, p. 261, pls. 51, 52, 1887.—BLACKBURN, Trans. Manchester Micr. Soc., 1896, pp. 57–61, pl. 1.

I have examined eight specimens of this species (Table 5). The three complete and the two fragmental specimens exhibit nearly the same outer configuration, but specimen H shows a somewhat different outer appearance and mode of spiculation.

Specimen A is a complete, medium-sized, and well-preserved specimen, 71 mm high, and, exclusive of the basal tuft, 25 mm long. The broadest part of the body measures 16 mm. The distinct, beveled longitudinal edges, which form a regular hexagonal-shaped sponge body, are four in number. Specimen B shows a nearly complete body and appears to be the youngest specimen of all. It was superficially injured and considerably macerated on the dermal network, only the parenchymal supporting-skeleton and here and there small parts of the dermal membrane being preserved. Specimen C is a fragment of the superior regions of the sponge body.

TABLE 5.—*Measurements of 8 specimens of* Semperella schulzei

Specimen	Collected at—	Description	Lateral pentact pinules	Basal rays of lateral pentact pinules	Pinules on ridges		Macramphidisk	Mesamphidisk	Micramphidisk
					Distal ray	Basal rays			
			μ	μ	μ	μ	μ	μ	μ
A	Station 4900, 10 to 20 miles SW. of Gotô Islands, 139 fathoms.	Small, complete	90–120	72–90	280	72–80	220	80–110	20
B	do	do	80–140	70–80	?	?	180	100	20
C	do	Large fragments of superior parts of sponge body.	80–120	70–100	?	?	180–220	80	20
D	Station 4903, 10 to 20 miles SW. of Gotô Islands, 139 fathoms.	Complete	90–120	65–100	240–360	70–80	230	90	20
E	do	Small fragment	90–120	70–100	240–300	70–80	230–320	70–85	20
F	Station 4934, off Kagoshima Gulf, 103 fathoms.	Large fragment of superior regions.	80–100	90–100	240–360	70–80	210–340	80–108	20
G	do	do	90–120	70–105	230–300	70–80	230–300	80–110	20
H	do	do	96–120	104	240–360	70–85	240–280	90–100	16–20

A beautiful specimen (D), 109 mm in length and 11 mm to 27 mm in thickness, was taken near the Gotô Islands at Station 4903. Another (E) has been well preserved and remains almost uninjured. The club-shaped body measures 74 mm in length, exclusive of the basal tuft. Inferiorly it has a cylindrical form, gradually widening upward and forming an irregular pentagonal prism with conically pointed ends. At its broadest part the body measures 27 mm and the lateral wall between the two projecting longitudinal ridges 10 to 12 mm. These ridges somewhat anastomose by means of cross processes.

Specimens F and G are two similarly shaped large fragments of the superior regions of the sponge body but of much larger specimens. Their breadth is 35 mm to 39 mm at the broadest part. Among the other specimens from Station 4934 there was a much larger fragment (H), which agrees in many points with the present

species, though it has a somewhat different appearance. It has a cucumber-shaped body, slightly curved at the middle, and beset with a slightly irregular truncate tip. In these points it somewhat resembles *Semperella cucumis* Schulze. There are indeed some differences as above mentioned, but these may be explained as individual variations. The specimen has a total length of 167 mm. The basal regions are much injured and have fallen off.

In the specimens of this species hitherto known the diactinic marginalia, which project from near the peak of the sponge body, are not present, while in the present specimens (except H) they always show a distinct, short, brushlike appearance. These diacts are arranged nearly in one series, projecting from the elevated ridges near the conically pointed tip of the sponge body. They measure 10 mm to 20 mm in length, projecting from the surface of the ridge about half or more of the entire length, and 8 mm to 12 mm in breadth at the center. Frequently among these diacts, there occur spicules beset with prickles, bent very slightly obliquely upward and outward, and disposed in two opposite rows along the distal part of the external portion. This spicule slightly resembles that represented in the younger specimen of the *Challenger* collection but it is doubtful whether it represents the remains of those projecting from the top of the beveled longitudinal edges or whether it belongs entirely to a different category.

In the large specimens from Station 4934 I find a larger isolated form of amphidisks about 280μ long, provided with 8 to 12 paddle-like and terminally slightly pointed or only rounded rays. Besides these, though nearly absent or very rarely present in the smaller specimens (A to E), I find a sparsely distributed, similar form of medium-sized amphidisks present in the larger specimens (F to H). The slender middle-sized amphidisk occurring in the *Challenger* specimens may be lacking in all the specimens of this species in the collection.

Among the ectodermal pentact pinules, there occur also fairly abundant pinules that have big, long, straight paratangentials, measuring 12μ broad and 105μ long and beset with prominent hooklike lateral spines.

The heteropole uncinate, which is nearly allied to the uncinatum-like oxydiact in the *Challenger* specimen of this species, occurs rarely in the hypoderm of specimen H.

The anchorlike spicule of the basal tuft frequently forms a strongly developed trifurcate anchor at its lower end, measuring 140μ in width. This spicule in large bundles is intermixed with the ordinary basal spicule, which ends in an anchorlike structure, beset with two long recurved opposite teeth in the same plane. The shaft is biseriate with alternately disposed barbules.

Family HYALONEMATIDAE J. E. Gray, 1857

Genus HYALONEMA J. E. Gray, 1832

HYALONEMA (CYLICONEMA) APERTUM F. E. Schulze

Stylocalyx apertus F. E. SCHULZE, Abh. kön. preuss. Akad. Wiss. Berlin, 1886, p. 59.
Hyalonema (Stylocalyx) apertum F. E. SCHULZE, Rep. Voy. *Challenger*, vol. 21, p. 214, pls. 37, 38, 1887; Abh. kön. preuss. Akad. Wiss. Berlin, 1894, p. 39, pl. 8, figs. 1–6.
Hyalonema affine MARSHALL, Zeit. Wiss. Zool., vol. 25, suppl., p. 225, 1875.
Hyalonema affine japonicum F. E. SCHULZE, Sitz-ber. Ges. Naturf. Freunde Berlin, 1899, pp. 112–129.
Hyalonema affine reticulum F. E. SCHULZE, Sitz-ber. Ges. Naturf. Freunde Berlin, 1899, pp. 112–129.
Hyalonema maehrenthelli F. E. SCHULZE, Abh. kön. preuss. Akad. Wiss. Berlin, 1894, p. 41, pl. 8, figs. 7–11.

From a depth of 472 fathoms in the vicinity of Koshiki Island, four specimens of *Cyliconema* were dredged (Table 6). In all the body is still well preserved, though the basal tuft remains in only two. Specimens A to C show the cup-shaped sponge body, which is characteristic of this species in Japan, while specimen D exhibits a somewhat different outer configuration forming a transversely extended thick-walled calyx, the lower end of which is somewhat torn off but otherwise well preserved. The superior terminal surface is nearly flat, somewhat fallen in at the center, and forms a horizontally extending rim 50 mm broad, providing a sharp-angled projecting marginal fringe, which thins out toward the margin and flares outward and backward. From the central sunken portion, a markedly pointed and fairly long cone projects. An irregularly formed large pore (incurrent canalar aperture) opens widely on one side of the cone at its base, while near the base several fairly large and nearly circular pores (incurrent canalar apertures) open. The whole lateral surface shows distinctly, even to the naked eye, the rectangular latticework of the dermal membrane.

TABLE 6.—*Measurements of 4 specimens of* Hyalonema (Cyliconema) apertum

Specimen	Collected at—	Description	Dermalia	Gastralia	Microhexactin		Macramphidisk	Mesamphidisk	Micramphidisk
					Curved rays	Straight rays			
			μ	μ	μ	μ	μ	μ	μ
A	Station 4915, Koshiki Island, 472 fathoms.	Complete	200–250	70–140	60–80	60–70	180–260	40–100	16–20
B	do	do	210–280	100–160	70–90	40–80	160–205	40–60	16–24
C	do	do	340–400	100–140	70–80	50–75	230–340	60–80	16–20
D	do	do	180–250	120–160	80–100	60	180–360	60–100	12–16

It is doubtful whether a specimen (E) from Bungo Channel here assigned to *H.* (*Cyliconema*) *apertum* really represents this species or another. I consider it better for the present to place it with *H.*

(*Cyliconema*) *apertum* than to make it a new species, even though it is distinguished from the type of the species by the quite different outer configuration.

It is tulip-shaped, abruptly truncated terminally, 4 cm long, and 2.7 cm broad above. The gastral area is flatly exposed without being depressed, entirely lacking the central cone, which is usually present in the typical specimens, and somewhat flared out upward and outward as a free edge. The excurrent apertures open externally directly on the gastral area and are fairly numerous and somewhat circular, and 1 mm to 4 mm in diameter. The dermal, lateral, and gastral surfaces appear quite smooth and even.

In this form the macramphidisks appear to be of two kinds. One is common on the dermal membrane, measuring 220μ to 312μ in length and 108μ to 116μ broad at the semicircular terminal disk, which may be quite similarly shaped to that of *H.* (*Cyliconema*) *apertum solidum;* while the other, in the parenchyma, usually exhibits a smaller size, 140μ in length, with the shaft only particularly tuberculous in its central part, not over the entire part as in the dermal larger macramphidisk.

Acanthophores of this specimen consist of fairly large stauractins, which exhibit a nearly straight and quite smooth surface except on the terminal ends, the surfaces of which are roughened and somewhat inflated.

Table 7 may serve to show the relative proportions of various spicules represented by specimens A to D from Koshiki Island, and specimen E from Bungo Channel.

TABLE 7.—*Comparison of specimens of* Hyalonema (Cyliconema) apertum *from Koshiki Island and Bungo Channel*

Specimen	Collected at—	Dermal pinule	Amphidisks		
			Macra-	Mesa-	Micra-
A, B, C, D	Station 4915, Koshiki Island, 472 fathoms	μ 200–250	μ 160–360	μ 40–100	μ 12–24
E	Station 4959, entrance to Bungo Channel, 405 fathoms.	200–240	a—220–312 b—140	60–80	20–30

Specimen	Collected at—	Microxyhexact		Tignule	Gastral surface	Central core on gastral surface
		Curved rays	Straight rays			
A, B, C, D	Station 4915, Koshiki Island, 472 fathoms.	μ 60–100	μ 40–80	3 mm–4 mm by 200μ.	Depressed-	Present.
E	Station 4959, entrance to Bungo Channel, 405 fathoms.	85–100	80	4 mm–5 mm by 160μ.	Flat	Absent.

HYALONEMA (CYLICONEMA) APERTUM SOLIDUM, new subspecies

PLATE 1, FIGURES 1, 2

In the collection are three specimens representing a new form. They were found at three stations not far apart.

TABLE 8.—*Measurements of 3 specimens of* Hyalonema (Cyliconema) apertum solidum

Specimen	Collected at—	Description	Dermalia	Gastralia	Microhexactin	
					Curved rays	Straight rays
			μ	μ	μ	μ
A	Station 4957, Bungo channel, 437 fathoms.	Complete, cuplike	80–140	60–150	50–70	40–45
B	Station 4919, about 90 miles WSW. of Kagoshima Gulf.	do	80–180	80–120	60–80	45–55
C	Station 4959, Bungo Channel, 405 fathoms.	Complete, dishlike	90–120	80–120	60–70	45–65

Specimen	Collected at—	Macramphidisk	Mesamphidisk	Micramphidisk
		μ		μ
A	Station 4957, Bungo channel, 437 fathoms.	145–210	Very rare, 30μ–45μ	18–20
B	Station 4919, about 90 miles WSW. of Kagoshima Gulf.	160–245	Probably wanting.	20–26
C	Station 4959, Bungo Channel, 405 fathoms.	140–200	Very rare, 36μ–40μ	16–28

Specimens A (holotype, U.S.N.M. No. 22054) and B are tulip-shaped and have a deeply concave gastral cavity, the surface of which is perforated with few excurrent apertures; while specimen C shows an entirely different outer configuration, forming a shallow transversely expanded body like the fruit of a lotus. The gastral surface is nearly flat, showing the irregular lozenge form with a thin-edged outer margin.

The difference between the external appearances of these specimens originally induced me to contemplate the establishment of two distinct species, but microscopic observation shows agreement in their spiculation to such an extent that I have decided to consider all one form.

One of the chief characters separating *H.* (*Cyliconema*) *apertum solidum* from *apertum* proper is to be found in the shape of the macramphidisk, which presents a constant form as follows: The terminal disk of this amphidisk is somewhat semicircular, contracting inward on either side at the base, and curved inward at the ends, with the proportion of the breadth and the height in the marginal teeth nearly always 1 : 1.5.

The microxyhexactins of this subspecies have a much more robust appearance than those of the typical form but are otherwise very similar.

Another difference between this and the typical form is in the length of the distal ray in the dermal pinules. In the present subspecies it averages 100μ to 150μ in length, while that of the typical form is usually 200μ to 250μ.

HYALONEMA (CYLICONEMA) HOZAWAI, new species

FIGURE 2; PLATE 1, FIGURES 3, 5

The two specimens (Table 9) for which I establish this species are entirely different in shape and of totally different size. The extreme differences between the two specimens originally led me to consider the establishment of two distinct species, but microscopic examination shows them to agree in the spiculation to such an extent that I have concluded to place both in one species.

Specimen A is tulip-shaped, abruptly truncated terminally, 85 mm long and 62 mm broad above, 30 mm broad below. The oscular sieve plate is nearly circular, deeply concave, and raised toward the margin. The pores of the sieve plate are tolerably numerous, more or less circular, and vary in size from 3 mm to 5 mm. The sponge body in alcohol is light grayish.

Specimen B (holotype, U.S.N.M. No. 22030) has a spindlelike form. The upper end is not transversely truncated, but extends to a somewhat pointed apex, in the form of a projecting fez, 35 mm in height, which part may constitute the gastral surface, being directed straight forward. The conelike gastral surface is even and smooth, the excurrent canalar apertures being concealed by the thickened gastral membrane. The basal tuft, except for an encrustation near the lower end, is free of *Palythoa*. It measures 70 cm in length.

TABLE 9.—*Record of specimens of* Hyalonema (Cyliconema) hozawai

Specimen	Collected at—	Description
A	Station 4956, off entrance of Bungo Channel, 720 fathoms	Complete, large.
B	do	Complete, small.

Spiculation.—The most numerous parenchymal macroscleres are oxydiactins. Those of the common type are very slender and smooth over the entire surface, and make up a small, strongly curved strand. They vary from 1 mm to 2 mm in length and from 12μ to 16μ thick at the center. The other type, sparsely scattered in the ectosome and in the choanosome, is also smooth over the entire surface and straight.

It frequently has a clearly defined central inflation, which usually bears two knobs arranged on each side. The size of the oxydiactin is fairly variable, generally 0.5 mm to 1.5 mm long and 20μ to 25μ thick.

Oxyhexactins occur much less frequently. Their rays are nearly the same length, smooth, 30μ thick, and gradually attenuated toward

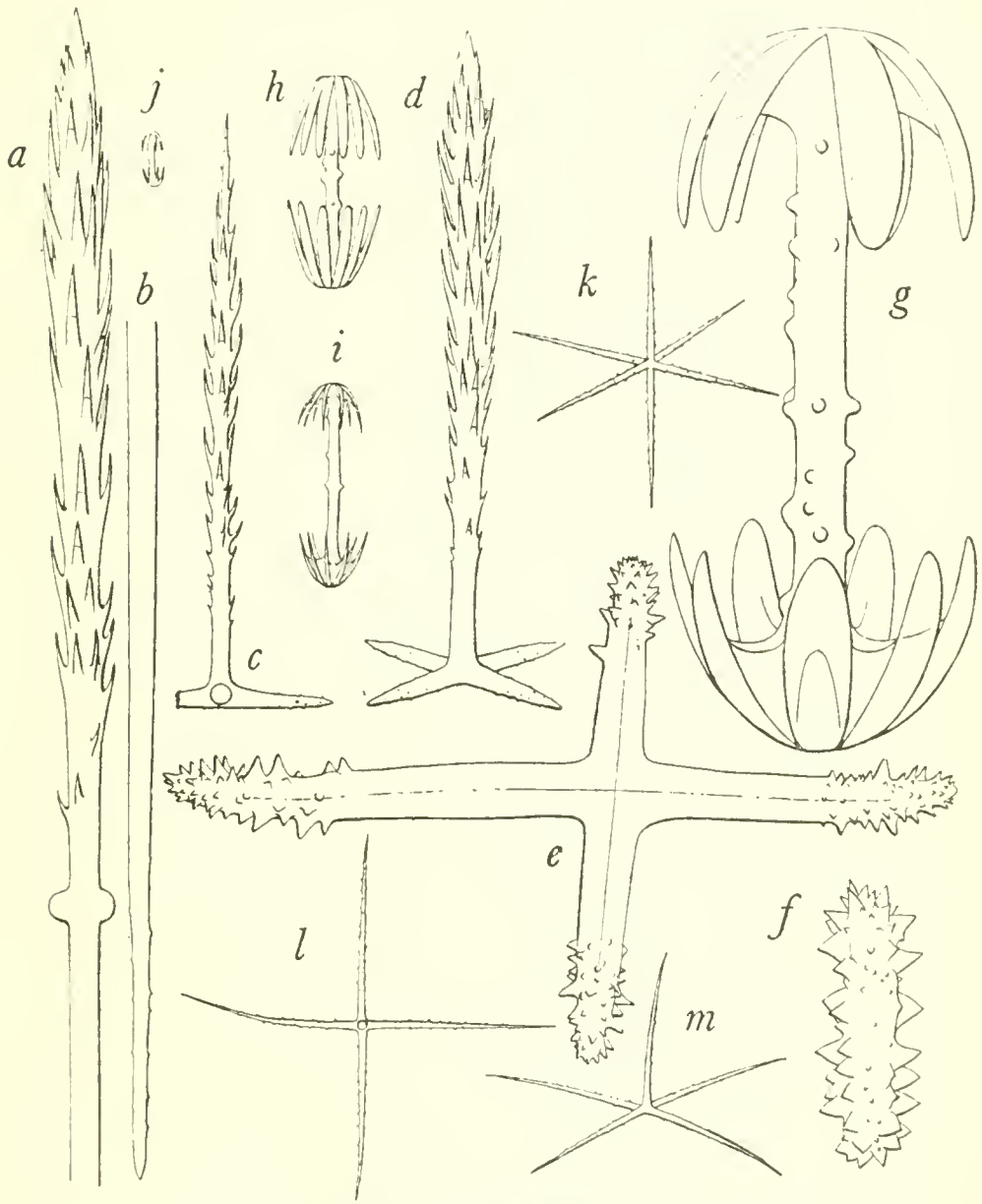


FIGURE 2.—*Hyalonema* (*Cyliconema*) *hozawai*, new species: *a*, Distal part of diactinic marginalia; *b*, proximal part of diactinic marginalia; *c*, dermal pinule; *d*, gastral pinule; *e*, acanthophore; *f*, acanthophore; *g*, macramphidisk; *h*, mesamphidisk; *i*, young macramphidisk in basal regions; *j*, micramphidisk; *k*, microxyhexactin; *l*, microstauractin; *m*, micropentactin. All × 250

the pointed end. The paratangential rays are sometimes curved, measuring 50μ to 600μ long. The distal ray is 510μ long and the proximal ray 680μ, and usually straight.

In the subdermal oxypentactins, which form an important part of the supporting skeleton, the paratangential basal rays are con-

siderably shorter than the radial ray, which measures 0.4 mm to 0.7 mm or more in length. All the rays are smooth over the entire surface and attenuated gradually toward the pointed ends.

In both specimens the acanthophores (fig. 2, *e*, *f*) near the lower end of the body are clearly chiefly composed of cross-shaped tetractins and large straight diactins. In specimen A, the diactinic acanthophores are most numerous, with a few tetractinic ones mixed in; while in specimen B, the latter are the more numerous. All the superficial diactinic acanthophores are covered with uniformly developed, robust, short spines and have the appearance of being covered with crystallized sugar. The basal parts of the tetractinic acanthophore are mostly smooth, frequently straight, and bear spines on the somewhat inflated, terminal parts of the rays only.

The diactinic marginalia (fig. 2, *a*, *b*) forming the fringe of the oscular margin and the margin of pores on the sieve plate are not more than 600μ to 850μ long. The proximal ray of these spicules, which is imbedded in the body of the sponge, is perfectly smooth; the distal free ray, resembling a Lombardy poplar in shape, measures 30μ to 40μ broad, is covered with oblique spines, and has a distinct distal spine. The center of the spicule bears four rounded protuberances arranged crosswise and containing rudiments of axial canals.

The dermal oxypentactinic pinules (fig. 2, *c*) sparsely cover the strands of the external network. Their four basal rays, which form a rectangular cross, are 10μ in thickness, 35μ to 50μ long, terminally pointed and finely granular. Their free radial ray varies from 240μ to 280μ in length, is smooth on the proximal third, uniformly attenuated toward the sharp-pointed end, and covered with obliquely directed spines on the distal two-thirds. The spines attain the greatest length near the lower end of the distal spined part of the ray; upward they gradually decrease in size.

The canalar pinules are nearly similar, a little shorter, not more than 200μ long, and slenderer and covered with fewer spines. They occupy the walls of the larger incurrent canals but do not stand nearly so close together as the dermal pinules on the external surface.

The pinules of the oscular sieve plate are a little shorter in the distal radial ray, measuring 200μ long and 20μ to 30μ broad; they also resemble a Lombardy poplar. The basal cross measures 80μ to 110μ in length and is finely roughened by the presence of microspines. These spicules are distributed much more closely together.

The dermal macramphidisks (fig. 2, *g*) vary in length from 200μ to 320μ. The shaft is 2μ to 20μ broad and usually bears rounded

tubercles sparsely and irregularly scattered over the surface. The rather flat terminal disks are 70μ to 125μ high, 104μ to 120μ broad, on an average, and have eight broad, spadelike marginal teeth. These amphidisks are scattered sparsely in the derm over the superior regions of specimen A, while on the inferior regions and on all parts of specimen B they are found abundantly.

Ellipsoidal mesamphidisks (fig. 2, *h*) of varying size, 60μ to 80μ long on an average, are abundant. The shaft is slender, 4μ broad, and covered with numerous sharp spines. The high, bell-shaped terminal disks, 24μ in breadth, usually have 10 to 12 narrow marginal teeth. On the basal regions of both specimens A and B there exist much larger mesamphidisks, which measure 100μ to 145μ in length. These have also 10 to 12 marginal teeth, 48μ in length at the bell-shaped terminal disk, which measures 40μ broad.

The micramphidisks (fig. 2, *j*) are most numerous and lie scattered irregularly in the dermal and gastral membrane. In fewer numbers they are found in the parenchyme. They are 16μ to 20μ long and have hemispherical terminal disks with numerous marginal teeth.

Microxyhexactins (fig. 2, *k*) are abundant in the parenchyme. Their rays are 60μ to 80μ long, 4μ thick at the base, straight, and covered throughout with small tubercles, making the surface appear rough. The curved, rayed microxyhexactins are totally absent. Occasionally similar-sized pentactins (fig. 2, *m*) and stauractins (fig. 2, *l*) are found. In the pentactins the distal unpaired ray is much shorter than the paratangential rays, measuring 40μ long.

The present new species somewhat resembles *H. indicum andamanense* F. E. Schulze, but differs from it by having differently shaped gastral pinules and the poplar-tree-shaped diactinic marginalia.

HYALONEMA (COSCINONEMA) KIRKPATRICKI GLOBOSUM, new subspecies

PLATE 2, FIGURE 3

Stations 4956 and 4957, where the two specimens of this subspecies were captured, are not far apart. The best preserved specimen (designated holotype, U.S.N.M. No. 22031) has a nearly truncated cone and is 135 mm long. Its root tuft, however, has been entirely torn off. The broader upper end has a diameter of 85 mm. The lateral dermal surface of the sponge body is more or less crushed and injured, but in most of it the quadrate dermal latticework is well preserved. The sieve plate is deeply depressed in the center and raised toward the margin to form a low ring wall with a somewhat sharp edge. The surface is perforated by more or less circular, irregularly scattered apertures, 1 mm to 4 mm wide. The

openings of the other specimen, evidently a large fragment of the superior regions of the sponge body consisting of a strongly compressed lamella, are poorly preserved. (Table 10.)

TABLE 10.—*Record of specimens of* Hyalonema (Coscinonema) kirkpatricki globosum

Specimen	Collected at—	Description
A	Station 4956, off entrance of Bungo Channel, 720 fathoms	Large, complete.
B	Station 4957, off entrance of Bungo Channel, 437 fathoms	Large fragment.

The chief differences between the typical form and the new subspecies are in the type of macramphidisk and in the much longer dermal pinules. In the present form, the macramphidisk seems somewhat smaller, measuring 200μ to 260μ long, and bearing on its shaft numerous tubercles, not only on the shaft center, as in the typical form, but also on the entire surface. In this spicule, the comparative dimensions of the length and breadth of the terminal disks and the entire length of the spicule are somewhat different from those of the typical form. This fact may account for the complete dissimilitude of the configuration of the two.

The distal ray of the pinules, varying from 180μ to 560μ in length, is longer than in typical *kirkpatricki*.

Because of these differences, I consider the present specimens as representing a distinct form of *H.* (*Coscinonema*) *kirkpatricki* Ijima.

HYALONEMA (COSCINONEMA) OVATUM, new species

FIGURE 3; PLATE 2, FIGURE 2

The fairly large and completely preserved specimen of this new species (holotype, U.S.N.M. No. 22032) was taken from a depth of 918 fathoms, SSW. of Omaizaki (Station 5084). The body of the sponge is oval, 86 mm long, 45 mm broad, and dorsoventrally or posteroanteriorly slightly compressed. It is difficult to say whether this compression and rugosity were present in the living sponge or whether they were produced post mortem by pressure. The anterior oscular depression is very narrow and shallow, measuring about 30 mm in width. The root tuft where it arises from the lower end of the sponge body has entirely fallen off, but the point of attachment is indicated by the destruction of the dermal membrane. Through the compact and somewhat transparent quadratic dermal reticulation of the outer surface one can not see the subdermal cavities and the openings of the incurrent canals.

Spiculation.—The important macrosclere parenchymalia are the oxydiactins. These are mostly isolated, more rarely aggregated in bundles, and appear abundantly throughout the interior. They are

slender, straight, or sometimes slightly curved, and 1.7 mm to 2.5 mm or more long, terminating with a somewhat expanded roughened point at either end. Beside these, are frequently found the shorter oxydiactins, quite smooth on the surface, with two or four central well-defined protuberances in the middle, and measuring 1.2 mm to 2 mm in length and 20μ broad at the center.

Between these spicules, sparsely scattered smooth oxyhexactins of varying size, 1 mm to 1.2 mm in axial length, are found. The para-

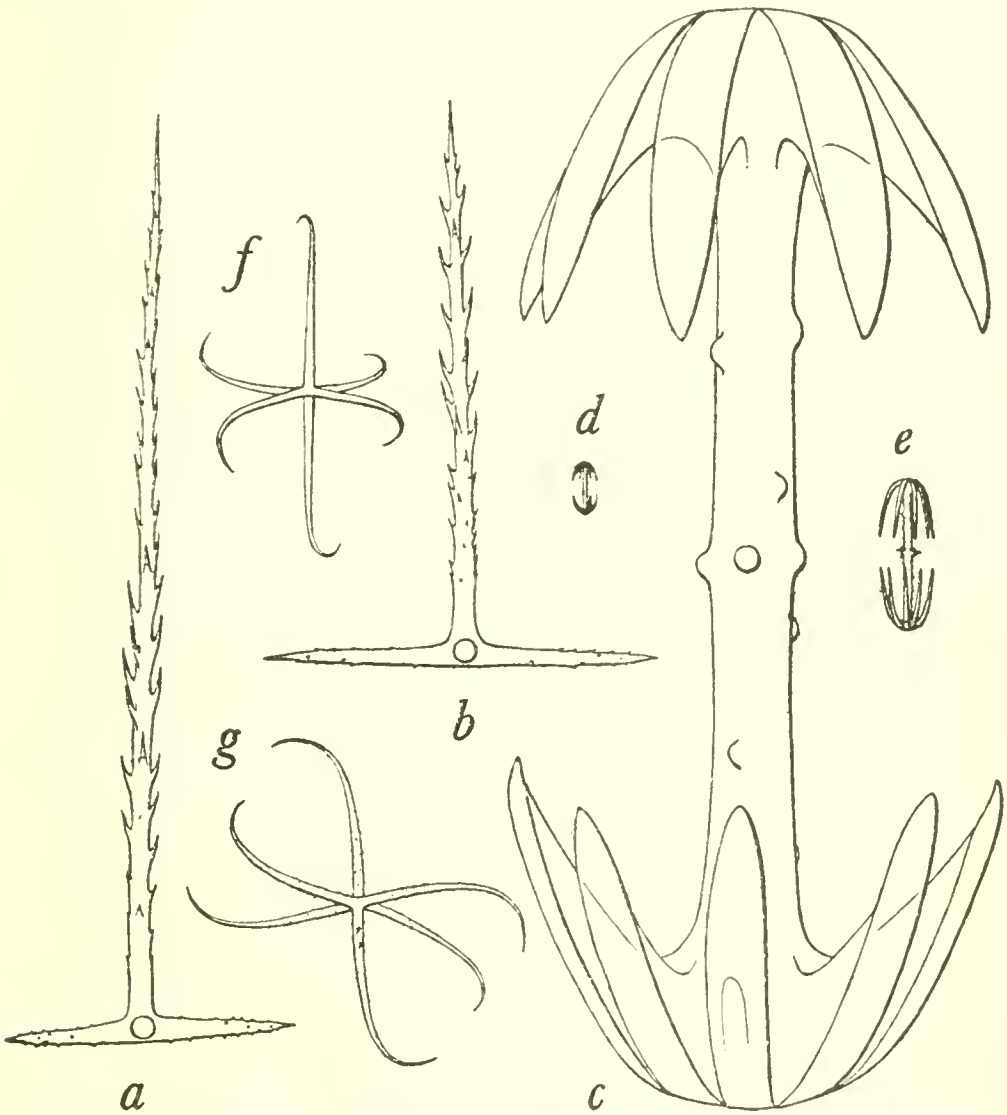


FIGURE 3.—*Hyalonema (Coscinonema) ovatum*, new species: *a*, Dermal pinule; *b*, canalar pinule; *c*, macramphidisk; *d*, micramphidisk; *e*, mesamphidisk; *f*, oxyhexactin; *g*, oxyhexactin. All × 300

tangential and distal rays are usually shorter than the proximal ray, and all the rays measure 28μ broad at the base, being gradually attenuated toward the pointed ends.

The oxypentactins appear as regularly arranged hypodermalia, lying below the outer surface and supporting the dermal membrane. Under the gastral membrane there are probably no such spicules. In these spicules the paratangential rays are mostly shorter than the proximal unpaired ray, measuring 200μ to 850μ in length, while the

breadth at the base is nearly the same in all, 20μ to 40μ. All the rays are smooth on the surface and gradually attenuated toward the conically pointed end.

Of the microsclere parenchymalia I shall first describe the oxyhexactins (fig. 3, *f*, *g*). These occur abundantly in varying numbers in different regions of the sponge and measure 120μ to 150μ in diameter. Their rays are fairly stout, quite smooth, sharply pointed, and extremely curved at the end. Of the curved tangential rays, I have found two kinds: Some are curved away from their fellow at the end, while others are directed toward one another on one side. I have found the former condition much commoner than the latter. In the subdermal regions, these oxyhexactins are frequently arranged in lines and groups of several. Other than in these regions, I found these spicules also in the subgastral region and in the parenchyme, as well as in the wall of the excurrent canals, where they were distributed both in groups and separately. Besides these oxyhexactins, oxypentactins of the same features are found infrequently intermixing with the former.

Oxypentactinic dermal pinules (fig. 3, *a*) cover the external surface in great numbers. Their four basal rays, which form a rectangular cross, are of medium thickness and measure 6μ at the base and 45μ in length; terminally they are pointed and irregularly roughened. The free radial ray is on the average 200μ long, smooth in the proximal third, uniformly attenuated toward the pointed end, and in the distal two-thirds irregularly covered with rather short, slightly divergent spines. The spines attain their greatest length at the middle or somewhat below the distal spined parts of the ray; above and below they gradually decrease in size.

The canalar pinules (fig. 3, *b*) are nearly similar; the distal ray being a little shorter than that of the dermal pinules, instead of having a longer paratangential ray, measuring 60μ in length. They occupy the walls of the larger incurrent canals but do not stand nearly so close together as the dermal pinules on the external surface.

The gastral pinules (fig. 3, *a*) are entirely similar to those of the derm.

Macramphidisks (fig. 3, *c*) are found infrequently on the dermal membrane itself and are entirely absent in the hypodermalia and in the internal parenchyme. They attain a considerable size, 350μ or more in length. The shaft is either smooth or covered with a few irregularly distributed small tubercles, and measures 30μ in width at the center. The terminal disks are 100μ long and 160μ broad, nearly semicircular, and somewhat expanded proximally and narrowed distally at the flattened ends. They have 8 to 9 marginal teeth, 100μ long, which terminate with somewhat lancet-shaped points.

Mesamphidisks (fig. 3, *e*), which vary in size considerably and measure 30μ to 90μ long, occur chiefly on the walls of larger excurrent canals as a layer and are scattered in the parenchymalia. The narrower incurrent canals are destitute of such a layer or coating of mesamphidisks, being instead occupied by pentactinic pinules. The shaft is slender and covered with sharp spines. In the center there is a ring of longer spines. The high, bell-shaped terminal disks have 10 to 12 marginal teeth, usually narrow, measuring 20μ to 30μ in length and 20μ to 25μ broad.

Micramphidisks (fig. 3, *d*), which are much fewer than the former, lie scattered irregularly in the dermal and gastral membrane; still fewer are found in the choanosome. They are 15μ to 20μ long and have hemispherical terminal disks with several marginal teeth.

Although I find the outer features of this sponge peculiar, the facts stated above enable me to place it systematically. At first doubting whether it should be placed in the present genus or in some other genus of the Hyalonematidae, or whether a new genus should be established for it, I have come to the conclusion that the entire spiculation, particularly the dermal pinules and the parenchymal oxyhexactins with their curved rays, is in complete accordance with what I find in the other representatives of *Hyalonema*.

HYALONEMA (CORYNONEMA) OWSTONI Ijima

Hyalonema owstoni IJIMA, Zool. Anz., no. 459, p. 367, 1894.
Hyalonema clathratum IJIMA, Zool. Anz., no. 459, p. 368, 1894.

In the collection I discovered a complete specimen and two fragments referable to the present species, obtained from Station 4958. The first, specimen A, represents a complete, tolerably large, slightly inflated cup. It is 46 mm high and has, at the upper free margin of the cup, where broadest, a transverse diameter of 55 mm. The outer dermal surface is composed of a fine and nearly uniform smooth and even network. The inner surface is perforated by numerous more or less circular apertures, 1 mm to 6 mm wide, which are the openings of the excurrent canals into the cup cavity, which is the gastral cavity of the sponge. These canal mouths are irregularly distributed and decrease in size toward the upper, free margin of the funnel wall. There is no trace of an oscular sieve plate.

TABLE 11.—*Record of specimens of* Hyalonema (Corynonema) owstoni

Specimen	Collected at—	Description
A	Station 4958, off entrance of Bungo Channel, 405 fathoms	Complete.
B	do	Large fragment.
C	Station 4976, SW. of Shiomisaki in Kii, 545 fathoms	Do.

The second specimen (B) is a fragment of large sponge body, having small parts of perforated gastral wall.

Another tolerably large fragment (C), which I am inclined to refer to the same species, has come under my observation. It was obtained from Station 4976 (southwest of Shiomisaki, Kii). It is a portion representing the greater part of the upper section of an individual probably similarly shaped, but somewhat smaller than the second specimen. The gastral cavity of the sponge has also, here and there, large openings of the excurrent canals, measuring 3 mm to 7 mm in diameter.

The outer dermal surface seems much macerated and its membrane probably has fallen off.

In the first and second specimens the barrel-shaped mesamphidisks are much more numerous than another kind that are present abundantly in the third specimen, in which the barrel-shaped ones are also sparingly represented.

The essential difference between *H.* (*C.*) *owstoni* and *H.* (*C.*) *clathratum* is the presence of the barrel-shaped mesamphidisk, but from the observation of the three specimens in question, such a specific difference is perhaps unsatisfactory. Though *owstoni* may not prove specifically separable from *clathratum*, it has a different gastral aspect. I have also found much larger dermal pentactinic pinules, which attain a length of 280μ and a breadth of 68μ in the distal ray.

INDETERMINABLE HYALONEMATIDS

The collection includes several fragmentary macerated specimens that are probably referable to *Hyalonema*, but that can not be more definitely identified on account of their incomplete state:

Station 4911 (10 to 20 miles southwest of Koshiki Islands); a macerated specimen with a very long, beautiful root tuft.

Station 5069 (entrance to Enoura, Suruga Gulf); macerated fragments.

Suborder HEXASTEROPHORA F. E. Schulze, 1899

Tribe HEXACTINOSA Schrammen, 1910–12

Subtribe CLAVULARIA F. E. Schulze, 1886

Family FARREIDAE F. E. Schulze, 1886

Genus FARREA Bowerbank, 1862

FARREA KURILENSIS, new species

FIGURE 4; PLATE 3, FIGURE 2

This new species is represented by a large colony (holotype, U.S.N.M. No. 22034) attached to a plate of large cirripeds. It was

obtained from a depth of 229 fathoms, southeast of Shimushir Island, Kuriles, at Station 4804. The irregular, largely expanded colony attains a height of 18 mm; its greatest width is about 75 mm. Unfortunately the outermost ends of the tubes are broken off for a greater or lesser distance. The diameter of imperfect tubes is usually 8 mm; the outer margin seems somewhat flared outward and backward in forming an approximately circular oscular opening with a diameter of

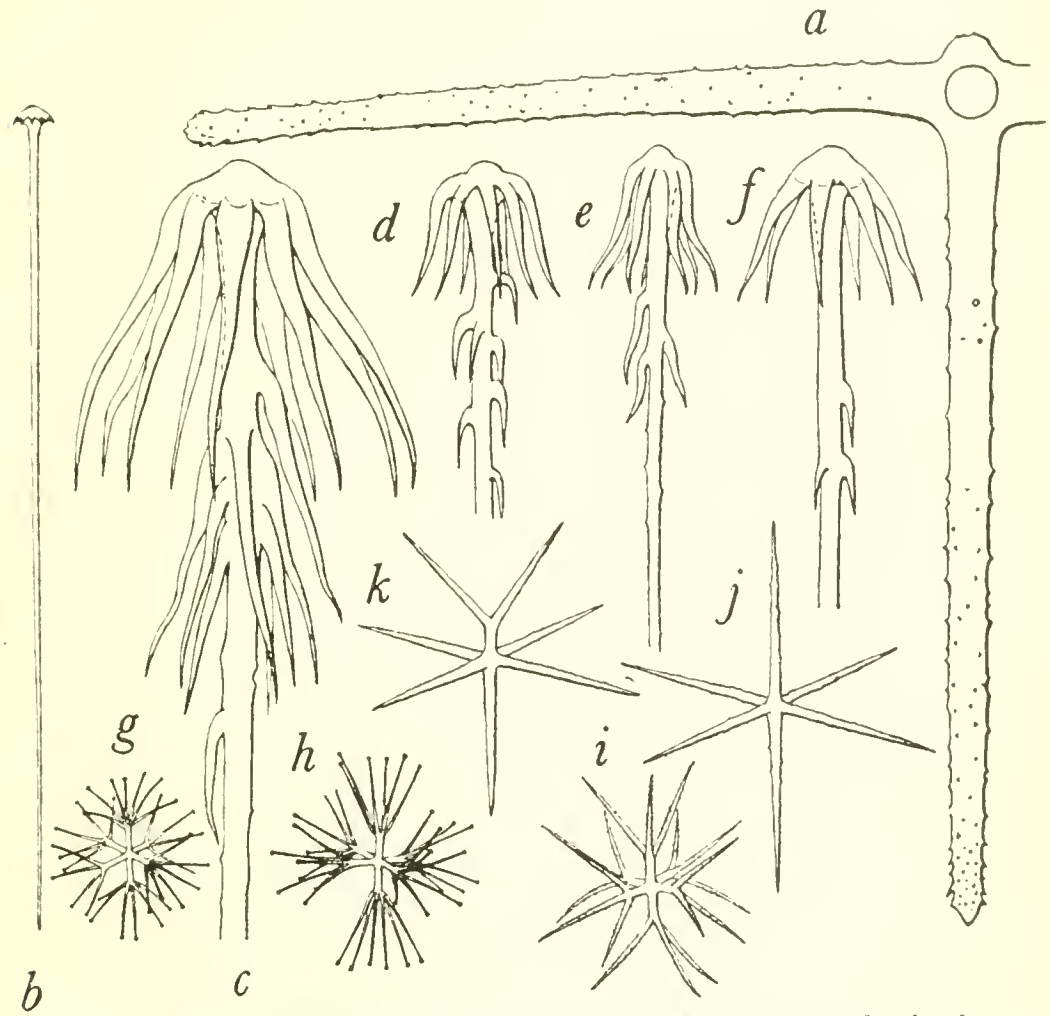


FIGURE 4.—*Farrea kurilensis*, new species: *a*, Dermal pentactin; *b*, circular umbellate clavulae; *c*, anchorate hooked clavulae (form A); *d*, anchorate hooked clavulae (form B); *e*, anchorate hooked clavulae (form A); *f*, anchorate hooked clavulae (form B); *g*, discohexaster; *h*, discohexaster, *i*, oxyhexaster; *j*, oxyhexactin; *k*, oxyhexactin. All × 250

about 10 mm. The entire extended colony was attached on a plate of cirripeds by the entire base and not predominantly erect nor attached by special short or long peduncles as are other members of this genus. Whether the dichotomous division of the single tubular ends takes place is doubtful, as the outer margins of the tubes are damaged and imperfectly preserved. The dichotomous ramification begins at a very early stage at irregular intervals, resulting not in a long straight main trunk, but in an irregular twisted system of tubes, spreading in all directions, especially transversely.

Spiculation.—The dictyonal framework is supported by a single-layered network in most parts and occasionally by a two or more layered irregular network. The framework is always quadrangular in those portions near outer margins of the tubes and becomes irregular in the lower portions. The beams of the framework are microtuberculated on the surface. From the center of the crossing point of the beams, a prominent, fairly long, rough-surfaced, and nearly conical boss projects.

The dermal and gastral pentactins (fig. 4, *a*) of this species measure commonly 430μ to 460μ in length of the paratangential rays. The proximally directed, unpaired ray is usually the same as the paratangentials of the same spicule, except that they are slightly shorter. Near the center the rays are 12μ to 16μ thick. All the rays gradually attenuate toward the more or less conically pointed end. The surface is roughened except for a short distance near the center, the roughness becoming gradually more pronounced toward the ends.

The clavulae are, broadly speaking, of two kinds, namely, circular umbellate clavulae and anchorate hooked clavulae. The circular umbellate clavulae (fig. 4, *b*) are fairly abundant here and there, penetrating vertically to the surface, and form small bundles around the unpaired proximal ray of the dermal pentactin. There is no swelling on the shaft, except just below the umbel, which measures about 16μ in width and has 16 to 18 minute teeth on the periphery. The shaft is very slender and attenuated gradually to the pointed end, usually about 300μ long. The surface is sparsely roughened, the roughness being most pronounced on the swelling of the shaft, just below the umbel.

Several variations of the anchorate hooked clavulae occur in different regions of the same sponge. This variation is, on the one hand, associated with the shape of the terminal disk, and on the other, with its terminal spines. I distinguish two forms or varieties which are designated by the letters A and B.

Form A (fig. 4, *c*, *c*) is represented chiefly in the dermal layer and is arranged vertically to the dermal surface. It is large and strong and is provided with long curved spines, 48μ to 95μ long, forming a disk 64μ to 105μ broad across tips of spines, and 30μ to 40μ broad across the club-shaped basal swelling, which is externally roofed over by a hemispherically arched umbel, raised on the center into a projecting boss, or infrequently with a nearly smooth convex umbel. The shaft is generally simple, straight, 590μ to 680μ long, 8μ to 12μ broad at the base, and gradually attenuated toward the conically pointed end and covered with sparsely scattered spines on the distal end, while the proximal end near the terminal disk is covered with numerous strong, long, curved spines, projecting obliquely from the shaft.

Form B (fig. 4, *d*, *f*) appears chiefly in the gastral layer, occasionally intermixing with form A, arranged obliquely to the dermal surface. It is somewhat smaller and shorter, about 400μ to 450μ long. Its most striking characters are the shape of the terminal spines projecting from the periphery of the terminal disk and the shape of the lateral spines covering the proximal surface of the shaft. The terminal disk of this form is usually 25μ to 30μ broad, and its summit shows a generally hemispherically arched umbel, being raised in the center into a weak external projecting boss or rarely a simply smooth convexed surface. The spines on the periphery of the terminal disk are usually much shorter and nearly straight, not so curved as those of the preceding type. They are 30μ to 50μ long and 36μ to 75μ broad at the distal extension. The lateral spines on the proximal surface of the shaft are also much shorter; projecting perpendicularly at first, they are distally curved downward, instead of simply projecting obliquely as those of form A.

The uncinate is arranged perpendicularly or obliquely to the dermal surface. It usually penetrates the whole thickness of the body wall. It is acerate and nearly straight; the outer half, nearer the dermal surface, is always much thicker than the inner, narrowed and sharply pointed end, and is spined at short intervals throughout. These spines, which are all bent backward, are very short, slender, and smooth. They are supported by small, weak, bracketlike processes arranged around the shaft in a spiral. The uncinate measures about 1.3 mm long and exhibits some variability in length, though this depends to some extent on the age of the individual spicule and on the region of the sponge in which it occurs.

Discohexasters of this species are probably found in two forms. The common one (fig. 4, *h*), present in large numbers everywhere in the sponge, is 60μ to 80μ in diameter and is provided with rather strong principals crossing one another at the center, measuring 16μ in length. From these arise 6 to 8 thin, nearly straight, and weakly divergent terminals 20μ long and terminating with pinheadlike disks at the ends.

The other form (fig. 4, *g*) may be present occasionally in the parenchyme, intermingled with the former. It is somewhat smaller in size, measuring about 55μ in diameter. Each short principal is supplied with a bell-shaped, outwardly extending tuft of four to six terminals, differentiating it from the preceding. These are somewhat stronger, thicker, and fewer than those of the former form, and each terminates in a small circular pinheadlike disk.

The oxyhexaster (fig. 4, *i*) occurs more frequently than the discohexaster above mentioned, appearing chiefly on the dermal membrane and sparsely in the parenchyme. It measures on the average about

90μ in diameter. Its short, smooth, principal ray (8μ long as measured from the axial center) divides into 3 to 4 widely diverging, straight terminals, two or three times the length of the principal ray. These terminals have sharply pointed ends. Of the spicules irregularly scattered throughout the parenchyme, I will describe the oxyhexactin (fig. 4, *j*) and oxypentactin in addition to the above-mentioned spicules; the former seems to be more numerous than the latter. They are very numerous everywhere, in the choanosome, ectosome, and in the endosome. The oxyhexactin measures 130μ to 140μ in axial length and 6μ broad at the base. The rays are gradually attenuated to the sharply pointed ends, and the surface is sparsely roughened. The oxypentactin is of nearly the same size and has the same features as the former spicule.

FARREA WATASEI, new species

FIGURE 5; PLATE 3, FIGURE 1

There is but a single specimen (holotype, U.S.N.M. No. 22035) of this new species. It is fairly large and was obtained from a depth of 682 fathoms near Petropavlovsk in Bering Sea (Station 4797). The sponge is of a somewhat large, thick-walled, irregular, tubular configuration measuring 2 mm to 3 mm in the middle and becoming gradually more or less thinner toward edges. The characteristic dictyonal framework, which appears commonly in all members of the genus *Farrea*, is distinctly present in this specimen and is densely filled up by microscleres. The incurrent and excurrent canalar apertures are of nearly the same size and shape: mostly small and circular, 0.3 mm to 0.5 mm in diameter.

Spiculation.—The dictyonal framework of *F. watasei* for the most part consists of two or more layers. Infrequently it is in one layer, as in many other species of *Farrea*. In the many-layered dictyonal framework, the radial beams extend between the layers, which lie irregularly or parallel to one another. These radial beams somewhat resemble tangential beams in their cylindrical shape, though they are frequently roughened on the surface. The prominences, which project from the outer and inner surface of the whole latticework, measure 500μ to 600μ. They are always tuberculous. The length of these freely projecting conical prominences varies as much as their form within fairly wide limits. They are generally straight or somewhat curved terminally, slender and shorter in the younger portions, and longer on the surface of the many-layered framework of the older regions. The breadth of the beams varies considerably, from 60μ to 90μ.

Of the spicules in the loose parenchyme, which lies between the dictyonal framework, the uncinate is first described. It exhibits an

extraordinary variability in length, but is usually 3.5 mm long and 12μ broad at the middle. It is disposed obliquely or perpendicularly to the surface, traversing the wall of the tube in a radial direction, the proximal two-thirds imbedded in the body of the sponge. Though the tip does not usually penetrate the dermal membrane, it occasionally does for a third of its length. The inner weaker and pointed ends remain at some distance from the gastral membrane or reach it. The spines arranged around the shaft are very slender and short, supported on very weak bracketlike processes.

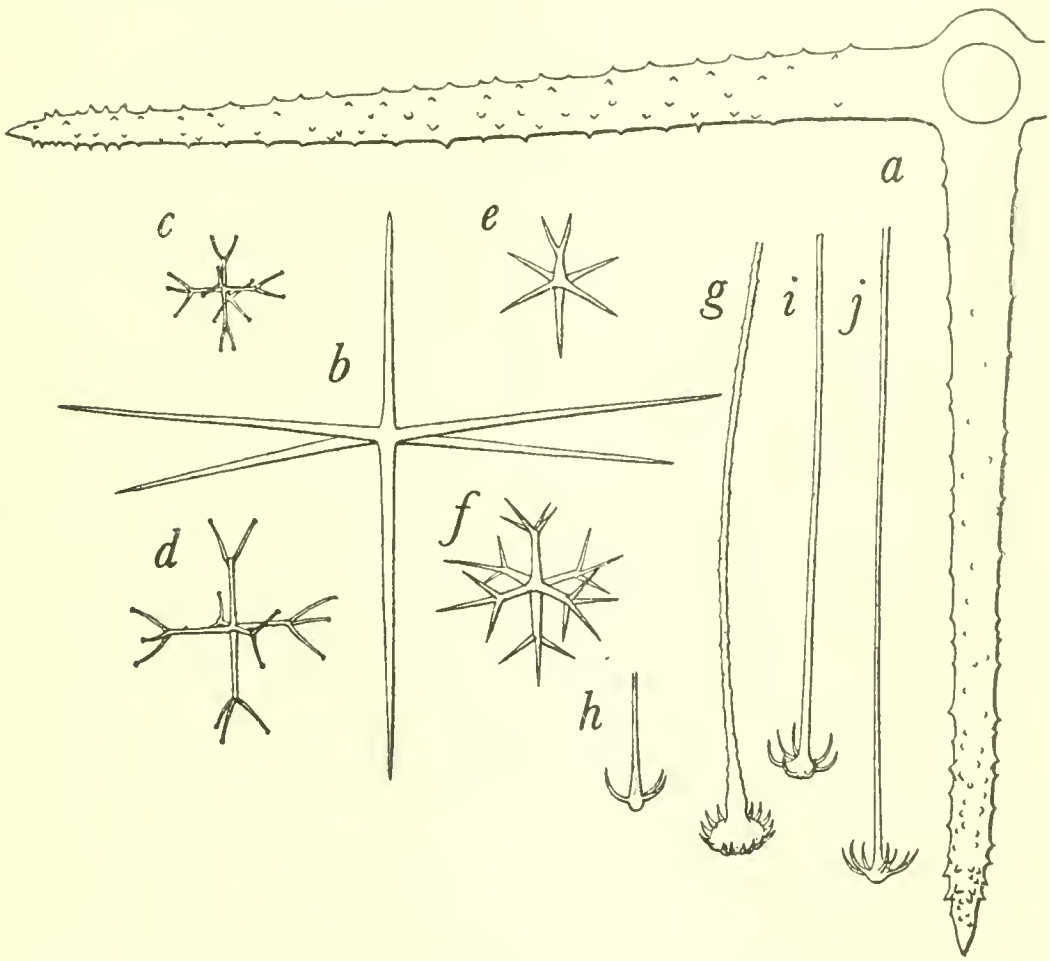


FIGURE 5.—*Farrea watasei,* new species: *a,* Dermal pentactin; *b,* hexactin; *c,* discohexaster (form A); *d,* discohexaster (form B); *e,* oxyhexaster; *f,* oxyhexaster; *g,* circular umbellate clavulae; *h,* anchorate hooked clavulae; *i,* anchorate hooked clavulae; *j,* anchorate hooked clavulae. All × 250

Besides the uncinates, parenchymalia are represented by simple oxyhexasters (fig. 5, *f*) in abundance, though they frequently occur in subdermal or subgastral regions, intermingled with discoctasters. In these the principal rays, which are long, smooth, and somewhat attenuated to the end, divide into two to three widely diverging, straight, short, smooth terminals, half as long as the principals. Terminals arising infrequently from the principals are reduced to only one in number (fig. 5, *e*). In certain cases one of the six rays

of the same spicule may be divided into two short terminals while the other principals are not divided at the end. From this form, I can ascertain that the oxyhexaster of the present species may be derived from the small hexactin, though the latter is not found in this sponge. Oxyhexasters measure 40μ to 70μ in diameter; the terminals are 8μ to 12μ long, and the principals are twice as long as the terminals.

Besides the uncinates and the oxyhexasters, the parenchymalia of the present species contain many simple hexactins and pentactins of much larger size, though they occur abundantly on subdermal regions and are sometimes nearly absent in the parenchyme.

Most of the hexactins (fig. 5, *b*) measure 160μ to 240μ in axial length; their rays are gradually attentuated to sharply pointed ends. The surface of the rays is slightly roughened. These spicules are sparsely distributed in the parenchyme, though much more abundantly in regions between the dermal pentactins. The pentactinic form appears rarely, intermingling with the former, and exhibits nearly the same structure as the hexactins.

The dermal membrane is supported by the four rectangularly intersecting tangential rays of the pentactins (fig. 5, *a*), whose unpaired proximal ray penetrates into the parenchyme vertically. Though the proximal ray is always perfectly straight and gradually narrowed into a conical form toward the pointed end, the four paratangential rays are frequently bent gently inward. Infrequently they are straight and end in a conical point. All the surfaces are roughened; and toward the ends of the rays the microspines increase in height and are more densely placed. The proximal ray usually does not exceed the tangential in length, measuring 200μ to 350μ in length and 30μ broad at the base. It is always cylindrical and somewhat smooth at a short distance from the base, with the exception of a strongly roughened end. The tangential rays are also cylindrical and usually somewhat longer, measuring 230μ to 380μ in length. The roughness of the surface is quite similar to that of the proximal ray.

The opposed tangential rays of these pentacts in the dermal membrane form a nearly quadratic framework. Frequently, also, they are irregularly arranged.

The gastral pentactins agree essentially with the dermal; so that I may simply refer to the above description of the latter and note only that the principal deviations are a somewhat smaller size and a somewhat less regular arrangement.

Discohexasters seem to be of two kinds, which are designated by the letters A and B. Form A (fig. 5, *c*) appears commonly in subdermal and in subgastral regions, and infrequently in the

parenchyme, while form B (fig. 5, *d*) is rarely found in subdermal regions. Much preparation and special research will be necessary to find it.

Form A measures 70μ to 80μ in diameter, and is provided with tolerably long, smooth principals, measuring about 20μ, which are divided into 2 to 3 short, straight, narrowly divergent terminals tipped with a small pinhead knob. Form B, which is found very rarely in subdermal regions, measures 90μ to 95μ in diameter and is characterized by fairly long S-shaped terminals, disposed in a perianthlike whorl tipped with a small knob.

Clavulae are of two kinds, namely, circular umbellate and delicate anchorate hooked; both occur in the dermal layer.

The circular umbellate clavulae (fig. 5, *g*) represent a common type that appears in many members of this genus. They occur rarely on the surface of the dermal layer, penetrating perpendicularly to the surface, close to the unpaired proximal rays of the dermal pentactins. The umbel is provided with minute teeth on the margin and is 20μ broad. The shaft is 200μ long, somewhat broadened just below the umbel, and gradually attenuated toward the conically pointed end. The surface is sparsely roughened, the roughness being somewhat pronounced on the proximal parts of the shaft.

Of the anchorate hooked clavulae two kinds of small forms are found. In one form (fig. 5, *i*, *j*) the shaft shows toward its upper end at most a gentle thickening, which bears terminally 6 to 8 delicate, slender, markedly recurved hooks, or teeth, producing a certain resemblance to an anchor. The so-called head frequently shows an external slightly raised swelling at the center which occasionally is entirely absent, then being represented merely by a convex surface. The shaft is 200μ long, and 3μ broad proximally. The head, at least, and the greater part of the shaft, are partly destitute of the roughness so frequent in the circular umbellate clavulae.

In the other form (fig. 5, *h*) the end of the shaft makes a prominent conical swelling, from which 3 or 4 slender curved hooks project. This form occurs infrequently in the dermal layer, intermixed with the former, and measures 200μ in length. The shaft is entirely smooth and totally devoid of lateral spines.

FARREA SOLLASII F. E. Schulze

Farrea sollasii F. E. SCHULZE, Rep. Voy. *Challenger*, vol. 21, p. 281, pl. 74, figs. 1–6, 1887.

There is a single specimen in the collection that may be identified as *F. sollasii*. It was collected from a depth of 197 fathoms at the entrance to Uraga Strait, between Jôgashima and Okinosé in Sagami Sea (Station 5091). I wish to call attention here to the numerous larvae of this species that were found in the maternal sponge body.

Ijima in his Contribution III, page 42, speaks of the spherical larva of *Leucopsacus orthodicus*, and in his Contribution IV, page 46, of the spindle-shaped ones of *Vitrollula fertilis*. The present larvae are also spindle shaped, and I consider them larvae in an early stage of development.

Our spindle-shaped larvae measure 100μ to 105μ in breadth and 220μ to 250μ in height. It was not possible to give a detailed account of them, as my preparations were not sectioned and the specimens were poorly preserved. The macrosclere, which first makes its appearance in the larva, is a minute and delicate-rayed oxystauractin. The spicule is situated on the surface, with the plane of the four rays disposed paratangentially to the surface of the larva. The longer distal and proximal rays cross or join each other at both ends of the other oxystauractins on both peripheral ends of the larva. Their smooth, greatly tapering longer proximal and distal rays with the sharply pointed or somewhat inflated ends may be 95μ to 100μ long, and the shorter paratangential rays measure 60μ in length. The epithelial covering is entirely concealed from view.

FARREA SOLLASII YAKUSHIMENSIS, new subspecies

Specimen A (holotype, U.S.N.M. No. 22036) is much branched, forming composite masses, and measures 25 mm in height and 50 mm in breadth. It exhibits a somewhat narrow-meshed tubular framework, which was fixed to a substratum by means of a few compact pedicles. In inferior regions of the sponge body in parts near the pedicles, most of the soft parts are macerated, and only the dictyonal frameworks are complete. The constituent tubes are 2 mm to 3 mm in breadth and open out by means of short projecting terminal branches. In external appearance this specimen seems to be allied to the members of *Eurete*.

TABLE 12.—*Record of specimens of* Farrea sollasii yakushimensis

Specimen	Collected at—	Description
A	Station 4924, 18 miles SW. of Yakushima, 159 fathoms	Large.
B	do	Small.
C	Station 4929, 10 miles S. of Yakushima, 84 fathoms	Do.

Specimen B is much smaller and poorly preserved; nearly all the soft parts are macerated. The body is attached to a stone by a short pedicle. The height of the specimen is 25 mm, and the broadest part, which is at the distal end of the sponge body, measures 23 mm.

Specimen C, preserved in alcohol, is attached to a stone by the broad base measuring 8 mm. Although the greater part of it is so completely macerated that only the dictyonal net is left, the soft

parts are sufficiently preserved to make it possible to study the isolated spicules. It is 11 mm in height and 13 mm in breadth.

The chief difference from typical *sollasii* lies in the total absense of large onychasters and oxyhexasters, as well as in the presence of the much smaller circular umbellate clavulae. The discohexaster of the present subspecies is much smaller, measuring 40μ to 45μ in diameter, and has a somewhat stronger and much shorter terminal. Of the circular umbellate clavulae, some deviations occur in different regions of the same sponge. This variation is chiefly associated with the swelling on the shaft, just below the umbel. In many cases the swelling is conspicuous; occasionally it is totally lacking or is inconspicuous. The roughness of the surface is much pronounced on the swelling or on parts just below the terminal umbel. The anchorate hooked clavulae are quite delicate. They have 8 to 10 weakly developed, slender, hooklike spines, widely diverged externally, and 55μ to 57μ in breadth at the lower extension. The shaft is slender, smooth on the surface, gradually attenuated to the pointed end, and 450μ long and 8μ broad just below the umbel. The four tangential rays of the dermal pentactins are much more distinctly tuberculous and somewhat broader than those of the typical form.

FARREA BERINGIANA, new species

FIGURE 6; PLATE 3, FIGURE 5

Several large and small fragments (U.S.N.M. No. 22037) which may represent parts of the lateral wall of a sponge body, were collected from a depth of 64 fathoms, off Bering Island, Bering Sea (Station 4790).

Though both the shape of the sponge and its spiculation might warrant establishing a new genus for this material, and indeed I find that the entire spiculation, particularly the dictyonal framework and total absence of umbel clavulae, is completely different from what we find in other species of *Farrea*, I venture to retain it in the present genus. Instead of the network and tubular sponge body, which occur in many species of *Farrea*, there is here the moderately soft, fairly thick, compact wall of a large cup. The sponge body was broken into several fragments 30 mm to 34 mm broad, and accordingly the complete outer configuration could not be studied. Yet I believe that the body does not form the framework of a slender tube, as in many species of *Farrea;* it rather seems to form a somewhat larger cup or tube.

The gastral membrane, which is quite clearly visible in alcoholic specimens, extends over the whole inner surface in the form of a delicate skin. A quadrate, latticelike network, formed of opposed dermalia or gastralia, is entirely absent on all sides of both mem-

branes, which have an irregular streaky appearance, though the dictyonal framework is visible from the outside.

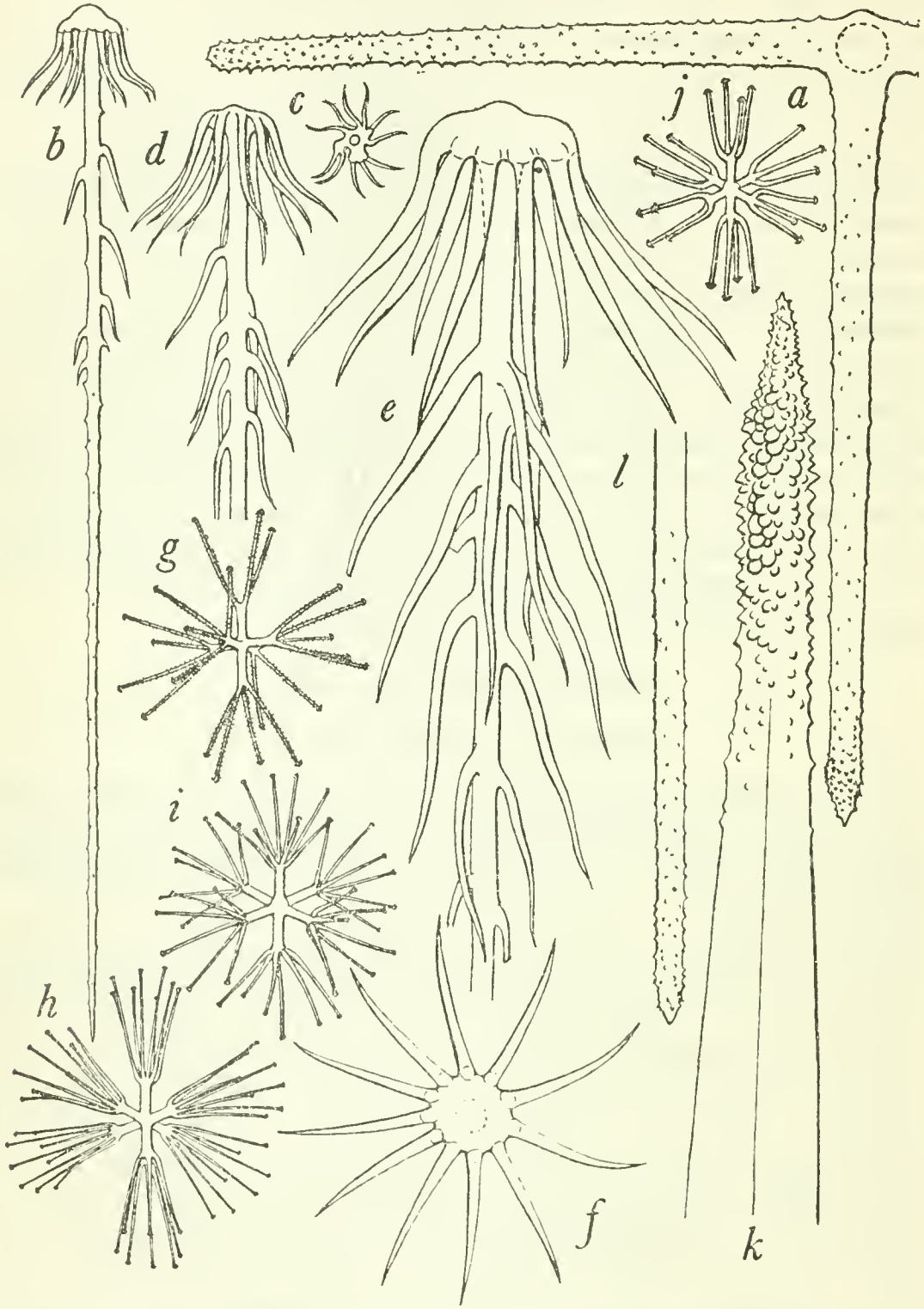


FIGURE 6.—*Farrea beringiana*, new species: *a*, Dermal pentactin; *b*, small clavula; *c*, upper view of head of small clavula; *d*, small clavula; *e*, large clavula; *f*, upper view of head of large clavula; *g*, tylohexaster; *h*, tylohexaster; *i*, tylohexaster; *j*, discohexaster; *k*, large extremity of diactin; *l*, small extremity of diactin. All × 250

Spiculation.—The dictyonal framework exhibits notable variations in the different regions of the plate, but chiefly forms perfectly square or rectangular meshes of variable sizes. Most of the beams

of the framework are smooth on the surface. They are frequently beset with tubercles on the longitudinal beams and are fairly slender, measuring 34μ to 50μ in width, and are curved. The moderately long and curved, free-projecting prongs, or conical pegs, are 4 mm to 1.7 mm long, rough and tubercled on the surface, and project from the inner or outer side, frequently laterally from the median beams.

The dermal membrane is supported by the four rectangularly intersecting tangential rays of pentactins (fig. 6, *a*), whose unpaired proximal ray penetrates into the parenchyme vertically. Though the proximal ray is always perfectly straight and slightly roughened on the surface, the tangential rays are somewhat curved inward and more roughened on the surface, with the roughness much more pronounced toward the end of the rays. The proximal ray, which is usually much longer than the tangential, measuring 340μ to 510μ in length and 16μ to 24μ broad near the center, is somewhat smooth at a short distance from the center. The tangential rays are usually more or less shorter, 280μ to 320μ long, and slightly curved inward. These pentactins on the dermal membrane are very irregularly arranged, though sometimes they form a quadratic framework. The gastral pentactins agree essentially with the dermal.

The clavulae are a kind of hooked anchorate. Their size variation is considerable in different regions of the same sponge. This, on the one hand, is chiefly associated with the total sizes of the spicule and, on the other, is partly associated with the number of the protruding teeth on the periphery of the head. These deviations merge into one another through forms of intermediate size and shape.

The larger clavulae (fig. 6, *c*, *f*), which occur mostly on the dermal layer and occasionally on the gastral layer, penetrating obliquely or lying on the surface, are 1 mm to 1.7 mm long. The head, 50μ to 70μ in width, shows a convex, smooth surface with an external, slightly raised swelling at its center. It is usually provided with 10 to 14 strong, externally curved or nearly straight teeth 140μ long, forming a large bunch 200μ broad at the distal expansion. The shaft is gradually attenuated to the conically pointed end, measuring 12μ to 16μ broad on parts just below the head and 8μ broad near the end. The curved or nearly straight lateral spines project from the proximal parts of the shaft. They are 80μ to 105μ long, their length gradually decreasing downward.

The smaller form (fig. 6, *b*, *c*, *d*), measuring 760μ to 850μ long, is much more abundant on the gastral and dermal layers, penetrating vertically to the surface, exposing only its head from the surface or being immersed entirely into the body wall. The head is much smaller, measuring 20μ in diameter, and its surface is quite smooth and convex or weakly raised at the center. In some of these forms the spines projecting from the periphery of the

terminal disk are arranged in a spiral manner and are not so regular as in those of the larger ones.

In the hypodermal and hypogastral layers, the prominent tylohexasters (fig. 6, *g*, *h*, *i*) are abundant but are not so numerous in the parenchyme, being sparsely distributed, intermingled with discohexasters derived by reduction and stoutness of terminals from the former. The tylohexaster of large rosettes, which possess terminal rays bearing pinheadlike disks at the ends, exhibits the typical number of principal rays, since as a rule six are present. At the slightly expanded outer end they divide into 6 to 15 straight or somewhat S-shaped terminals, which diverge slightly in a tuft and attain a length about double that of the principals. Each terminal, smoothed on the surface, bears at its extremity a small pinheadlike disk. The tylohexasters vary considerably in size, measuring 80μ to 150μ in diameter; the larger ones occur mostly in the ectosome, while the smaller ones are present in the choanosome. Two other kinds of spicules, which are considered derivatives of the normal tylohexaster above mentioned, are found rarely in the parenchyme. I therefore do not give special descriptions of them.

Frequently I have found a discohexaster (fig. 6, *j*) intermingled with the tylohexasters, mostly in the ectosome, with 3 to 4 robust gently curved terminal rays. The curvature of the terminal rays usually assumes an S-shaped form and results in the formation of strong, three or four rayed perianthlike whorls at the end of the principal rays.

Uncinates of *beringiana* usually penetrate the dermal surface obliquely, though they are sometimes perpendicular to it. They vary in length and thickness, measuring 1 mm to 1.5 mm long and 8μ broad at the center, and are surrounded by fine barbs.

The large diactins (fig. 6, *k*, *l*) in the hypodermal regions show a character peculiarly different from those of other members of the genus. They may attain a length of 9 mm, measuring 70μ broad at the center and gradually attenuating to a conically pointed end. The entire surface of the spicule is nearly smooth, except at both ends where the surface is sparsely roughened by microspines, though that of the larger one is distinguished by larger and more densely distributed microtubercles.

INDETERMINABLE FARREA

There is in the collection a small colony of specimens of *Farrea* collected by the *Albatross* and not determinable specifically. It is completely macerated and as it would be futile to describe it in detail, I merely give the following record of it:

Station 4768 ("Bowers Bank," Bering Sea). Small macerated colony.

Subtribe SCOPULARIA F. E. Schulze, s. ext.

Family EURETIDAE F. E. Schulze, s. ext.

Genus EURETE Semper, 1868

EURETE NIPPONICA, new species

PLATE 3, FIGURE 3

Among the specimens of *Eurete* collected, a single small injured specimen (holotype, U.S.N.M. No. 22038) appears to represent a new species. It was obtained at Station 4893 (10 to 20 miles southwest of the Gotô Islands, 106 fathoms). This small and erect sponge arising from the slender tubular basal region measures 25 mm in height and about 24 mm in breadth. At the upper end there are irregular, radial tubes about 5 mm in diameter, most of which are injured at the apertural margin. The soft parts are sufficiently preserved in places to enable one to recognize the microscleres.

In spicular characters *Eurete nipponica* closely resembles *E. marshalli*, differing from it in the thickened spinose nodes at the intersections of the dictyonal beams and in having onychasters in the parenchyme. The onychaster may be considered as a derivative of the discohexaster, though, as I have demonstrated, this form may be derived from an oxyhexaster.

The dictyonal net forms a regular to irregular triangular or quadrangular honeycomb. The beams composing it are nearly covered with conically pointed small tubercles on the entire surface. Everywhere in the lower, older regions of the specimen the dictyonal network forms a thicker layer. It is stronger and is covered entirely with many more, stout tubercles. At the dermal and gastral margins, on the surfaces bounding the honeycomb cavities, most of the nodes appear distinct, round, and thickened, showing a strawberrylike form, though much more prominently formed on the dermal than on the gastral regions.

The dermal membrane is supported by pentactins with paratangential rays 160μ to 200μ long, which are nearly straight or bent inward, gradually attenuated toward the conically pointed or round ends, and covered with microtubercles on the surface, being somewhat pronounced at the ends. The proximal radial ray is somewhat shorter in length, is gradually attenuated to the slightly roughened, conically pointed end, and usually bears densely distributed, small pointed tubercles.

The gastralia are also pentactins, which show nearly the same features as the dermalia, though they have more inwardly curved tangential rays.

The scopules are numerous and arranged perpendicularly or obliquely to both surfaces; they are rather abundant in the dermal layer and are variable in shape. They usually have four branches, which lie close to the center of the pentactins, where the proximal unpaired ray is given off, and which nearly reach the surface. The shaft is generally simple, smooth, straight, 20μ to 210μ long, and gradually attenuated toward the pointed, roughened end. It is always rough terminally, but for the rest of its length nearly smooth. Though the number of branches is subject to considerable variation, they are most commonly 4 in number. They arise from a comparatively short thickening at the distal end of the shaft. The basal part of each branch is thin, about 52μ long, and extends upward, bending slightly outward. Toward the end it is thickened in a club-shaped manner and is sparsely covered with spines, small and indistinct at the base, larger toward the distal end, and directed backward.

Uncinates, varying in length and thickness, are quite frequently found close to the dictyonal honeycomb. They are arranged perpendicularly, occasionally obliquely, to the surface and usually penetrate the whole thickness of the sponge wall. The outer half of the spicule, nearer the dermal surface, is always thicker than the inner half (nearer the gastral surface), which is gradually attenuated to a pointed end. They are mostly 85μ long and 8μ to 15μ broad at the thickest part of the outer half of the spicule. The spines projecting from the entire surface of the spicule are arranged densely but irregularly.

Much more peculiar and worthy of interest are the hexasters scattered in varying numbers irregularly through the parenchyme. Their shapes and sizes differ in different regions of the same individual.

The onychasters are 45μ to 55μ in diameter. From each short principal there arise three or four thin, tapering, nearly straight, considerably divergent terminals. The terminations of the branch ray bear a verticil of fine claws, usually four in number. These are of small size, and subject to little variation. The claws are horizontal to the branch ray or extend obliquely downward, and are slightly recurved. Sometimes, perhaps less often, they extend obliquely upward at the end of the terminals. These probably are not senile structures, as they are produced in all hexasters of the present species and are undoubtedly derived from the oxyhexaster by the transformation of the extremities of the terminals.

True oxyhexasters occur more abundantly than the former onychasters, and the latter may be easily overlooked unless a special search be made for them. Sometimes it was difficult to find even a single onychaster between the numerous oxyhexasters; sometimes

both were present in nearly equal numbers. The onychasters are only occasionally present in parenchymal regions. In the oxyhexasters, the diameter is usually 50μ to 75μ. The principals are of moderate length and relatively slender, being about 8μ to 10μ long, as measured from the central point of the axial cross. The slightly swollen end of the principals bears 3 to 5 terminals in a diverging tuft, smooth, tapering, generally nearly straight, but frequently curved outwardly near the end. These spicules mostly occur on the subdermal regions and closely resemble in general appearance those occurring in *E. marshalli*.

EURETE SACCULIFORMIS, new species

PLATE 3, FIGURES 6, 7

Five complete colonies (cotypes, U.S.N.M. No. 22039) and two other fragments of *E. sacculiformis* are in the collection. They were obtained 10 to 20 miles southwest of the Gotô Island (Station 4890), at a depth of 135 fathoms, together with *Aphrocallistes beatrix orientalis* Ijima.

One entire specimen forms a hemispheroidal mass, which has a diameter of 30 mm to 40 mm and a height of 24 mm to 35 mm. It is attached at the base. The surface is plainly flattened by short inferiorly expanded peduncles. The lobes are usually about 5 mm thick, and the sponge appears as if it had been produced by a continued branching and anastomosing growth that started from centers of the lower regions. The oscula are about 3 mm in diameter and are bounded by a thick wall, not thinned out at the margin as is usual in members of the present genus. (It is difficult to ascertain the true features in greatly broken specimens.)

The surface of the sponge appears slightly porous, owing to the numerous afferent canals. In spots, especially in the oscular margin of the tubes, the afferent canals are nearly closed, and the surface has a heterogeneous appearance.

Spiculation.—The dictyonal net forms an irregular and nearly uniform honeycomb. The hexactinic dictyonalia, which are joined in a regular manner, form a net or latticework with irregular triangular or quadrangular meshes. Fairly long, tuberculous, cylindrical processes protrude from the dermal and gastral surfaces. Those protruding from the dermal surface are distally expanded in a knob-like swelling and are quite densely tuberculous, while those protruding from the gastral surface are conically pointed and sparsely roughened. The beams composing the dictyonal net are sparsely covered with small pointed tubercles. They are 100μ to 120μ broad at the middle, becoming broader at their intersections.

The dermalia are nearly smooth pentactins. The rays vary from 160μ to 190μ in length, as measured from the center, and are 16μ thick at the middle. They taper outward slightly, or not at all, and end somewhat rounded or expanded. The paratangential cross is usually—but not always—slightly convex, as the rays themselves. On the surface, the dermal latticework presents irregular meshes, though in places these show a tendency toward an irregular quadrate arrangement. All the rays are nearly smooth on the surface, except on the thickened, rounded end, which is covered with densely distributed tubercles.

The gastralia are also pentactins, though they are somewhat different in shape and size from those of the dermalia. The paratangentials measure 180μ to 200μ in length, while the proximal unpaired ray is somewhat longer, measuring 200μ to 250μ. All the rays are quite straight, not arched convexly as in the dermalia, and gradually attenuated toward the conically pointed and roughened ends.

Scopulae are represented by two kinds, one being a larger, robuster, and much more abundant form than the other. It has four terminal branches, which lie between the proximal radial rays of the dermal hexactins and nearly reach the surface, arising from an inconspicuous, short thickening at the distal end of the shaft. The basal part of each branch is uniformly thick, sparsely covered with microspines and slightly divergent outward. Toward the end, branches are thickened in a spherical knob-shaped manner. It is also densely covered with spines, large and distinct at the base, directed backward, and smaller toward the distal convexed surface. The shaft is generally simple, straight, 300μ to 400μ long, and gradually attenuated toward the pointed and roughened end.

Of the other kind of scopulae, two to four branches also project at the tip of the shaft; but they are different from the scopulae described above, as follows: The distal thickening of the shaft is very prominent, nearly spherical, and the two to four branched rays arise from its margin and diverge somewhat prominently outward. They are nearly cylindrical, measuring 30μ to 40μ in length, somewhat thin at the base, and gradually thickened at the end. They terminate in a small spherical knoblike swelling densely covered with microspines which are larger at the base and directed backward.

The onychasters are fairly numerous in the choanosome. They are slender rayed and rather small, 40μ to 70μ in diameter. Each short principal bears two or three, sometimes four, terminals, which are widely divergent, quite straight, thickest at the base, and gradually thinned out toward the end. They are quite smooth on the surface. The tip carries two fine prongs. Unlike the claws in a true onychaster, these are generally directed obliquely forward and outward.

The small circular nodule from which the very short principals arise is not formed as in most cases, the onychasters merely intersecting at the center.

Uncinates show the usual features common to members of the present genus. They measure 2.5 mm in length and 8μ broad at the center.

EURETE SCHMIDTII F. E. Schulze

Eurete schmidtii F. E. Schulze, Rep. Voy. *Challenger*, vol. 21, p. 293, pl. 78, figs. 1–6, 1887.

Of *E. schmidtii* there are four nearly complete small colonies and single small fragments, which are somewhat macerated and injured at the extremities of the tubes. They were obtained from two stations not far apart near the entrance to Enoura, Suruga Gulf (Table 13).

Table 13.—*Record of specimens of* Eurete schmidtii

Lot	Collected at—	Number and description
A	Station 5069, entrance to Enoura, Suruga Gulf, 131 fathoms.	Two, nearly complete, small.
B	Station 5070, entrance to Enoura, Suruga Gulf, 108 fathoms.	Two, nearly complete, but macerated; one small fragment.

The outer configuration of our specimens closely resembles that of the type specimens. Unfortunately the basal portion supporting the entire colony, described for a Japanese specimen by F. E. Schulze in his *Challenger* report, is entirely absent here. On some of the specimens there were numerous small Actiniae irregularly scattered about as already recorded for the present and other species by other authors.

Besides the common typical oxyhexaster of this species two other kinds of spicules are found intermingled with the former; the one is nearly similar to that occurring in the *Challenger* type, being somewhat different in the number of terminals and in the manner of their curvature. Of less frequent occurrence is the other kind of oxyhexaster of nearly the same size, which differs from the first in having a distinct central knob and widely divergent terminals, which are not curved outwardly at the ends. Of more frequent occurrence are the medium-sized oxyhexasters with simple principal rays of medium length, and with 2 to 3 outwardly bent or nearly straight medium-sized terminals, as in the type specimens. The terminal rays are usually twice as long as the principals of the same spicule. The oxyhexaster in question is entirely similar to that occurring in *Periphragella elisae* Marshall. (*Challenger* Rep., pl. 81, fig. 5.)

The 2 to 4 terminal barbs of the much more numerous scopulae are somewhat different from those of the type specimens. They are rather weakly developed at the base, but gradually increase in diameter at the middle and again decrease, being extremely attenuated toward the sharpened spinous end.

EURETE IRREGULARIS, new species

PLATE 3, FIGURE 4

At Station 5030, two small sponges (cotypes, U.S.N.M. No. 22040) were taken. Owing to the fact that the microscleres had not been totally lost, the specimens are fairly well preserved. One of the bodies is an irregularly shaped tube 28 mm long with a greatest transverse diameter of 16 mm. The wall is about 3 mm thick, slightly thinning out above to an opening of the tube. The other sponge is also tubular in form but variously divided. There is no basal plate. In neither specimen is the upper end of the sponge preserved, and it may be seen that the axis is not dichotomously prolonged into branches, but remains single. Parts of the edge of cup may be flared out or may simply project toward one another.

Spiculation.—The dictyonal net forms a regular elongated quadrangular honeycomb. The beams composing it are quite smooth and approximately of the same breadth (70μ to 90μ) throughout the entire length. The rather slender processes, which become gradually attenuated toward the ends of the conically pointed beams, protrude from the dictyonal net toward the dermal and gastral surfaces.

The dermalia are pentactins, which are commonly supplied with a bosslike rudiment of the distal sixth ray. The rays are rather strong, 220μ to 250μ in length (as measured from the center), especially the proximal, unpaired ray, which is twice as long as the paratangentials, and 12μ in thickness at the base. Their surface is beset throughout with obsolete microspines growing more prominent toward the end and thinner toward the base of the rays and the central node. They taper perceptibly from the base toward the conically pointed or rounded end. The paratangential cross is usually much more convex on the inward surface, which is due to the curvature of the rays themselves.

The gastralia are also pentactins, resembling the dermalia. The rays are similar to those of the dermalia, except that the paratangentials are usually not so curved convexly, being nearly straight.

Much more peculiar and worthy of interest are the onychasters scattered abundantly in the parenchyme. Their shape and size differ in different regions of the same individual.

The onychasters themselves vary greatly in the length and the number of rays. The normal onychaster usually measures 70μ to 80μ

in axial length. The short principals are 12μ long and generally bear three widely divergent terminals, which are 24μ in length, nearly straight or slightly bent, and thickest at the base, thinning out to a very fine caliber toward the end. They are quite smooth on the surface. In the same spicule all the claws are similar in shape and of nearly equal size.

Transitional forms connect them with the normal onychaster, and they all occur in the parenchyme. Sometimes all the principals are supplied with two, occasionally three, terminals, and at other times they are either hemihexactinic or quite hexactinic forms, showing an increase in diameter (65μ to 95μ in diameter) over normal forms. The tip of the terminal branches is without a trace of a disklike expansion but bears a whorl of two or three short and exceedingly fine prongs, directed obliquely backward.

Scopulae are of one kind, forming delicate spicules 300μ to 350μ long in the entire length. They are arranged perpendicularly to the surface, forming a bundle around the proximal ray of dermal pentactins, their terminal branches protruding forward from the sponge wall. The shaft is generally simple, straight, 280μ to 300μ long, and gradually attenuated toward the conically pointed end. All the surfaces are quite smooth. The number and shape of the terminal branches are subject to considerable variation. They are slender, 4 to 8 in number, 30μ to 45μ long, nearly the same breadth throughout, and quite smooth on the surface. They arise from a prominent thickening at the distal end of the shaft, which is provided with three or four weak protuberances on the surface, 8μ in breadth. They run nearly parallel or slightly divergent on the whole. The most characteristic feature of the spicule is the distal thickening of the shaft, which has several protuberances on the surface.

A most peculiar feature of the species is the total absence of uncinates. I have searched particularly for them in all the preparations, but I must confess that I am still in doubt regarding them.

EURETE FARREOPSIS Carter

Eurete farreopsis CARTER, Ann. Mag. Nat. Hist., ser. 4, vol. 19, p. 122, pl. 9, figs. 1–7, 1877.—F. E. SCHULZE, *Challenger* Rep., vol. 21, p. 295, pl. 79, figs. 5–8, 1887.

A single small, almost completely preserved, specimen and several fragments of *E. farreopsis* were collected from two stations. (Table 14.) The species resembles *Pararete carteri* in essential spiculations, except for the curved terminal branches of scopulae and for the much more delicate discohexaster. The specimens in question deviate from the type specimens as follows, but these variations are deemed too slight to warrant the establishment of a new species:

TABLE 14.—*Record of specimens of* Eurete farreopsis

Lot	Collected at—	Number and description
A	Station 4890, 10–20 miles SW. of Gotô Islands, 135 fathoms	Several fragments.
B	Station 4934, off Kagoshima Gulf, 103 fathoms	One, nearly complete.

Of the scopulae the sharp brakelike bend of the terminal branches, which characterizes the spicules of the species, does not constantly occur, some scopulae being occasionally found with straight terminal branches, as in *P. carteri*. In addition to the common discohexaster like that in the typical species, another with widely divergent terminals is occasionally found scattered in the parenchyme as well as in the hypoderm.

The greatest variations of the spicules of this sponge are to be found in the free hexactins, which are abundant in the parenchyme, but these variations in spiculation are correlated with the parts or regions of the sponge body where they enter into the formation of the dictyonal framework.

Genus PERIPHRAGELLA Marshall, 1875

PERIPHRAGELLA ELISAE Marshall

Periphragella elisae MARSHALL, Zeit. Wiss. Zool., vol. 25, suppl., pp. 177–180, pl. 12, fig. B, 1875; Zeit. Wiss. Zool., vol. 27, p. 123, 1876.

A large nearly complete specimen, resembling in outer configuration the *Challenger* specimen brought from Enoshima, Japan, by Döderlein, was obtained from a depth of 369 fathoms in Sagami Bay, near Jôgashima (Station 5088). It has the form of a nearly straight cup, or funnel, 137 mm in length, and rises, with a round hollow stalk of 16 mm diameter, from an irregularly formed basal plate 40 mm broad, and gradually expands upward toward the round terminal opening, which is 40 mm in diameter. Most of the narrow tubular branches, which project externally from all the surface, are injured toward the ends of the tubes.

The discohexaster in the parenchyme differs slightly from that of the type specimens in having broad, long principals. From these arise five or six short but strong terminals, which are half as long as the principal. Distally they are weakly bent outward, becoming perianthlike in shape. On the form of the discohexaster the *P. elisae* from Japanese waters, described by Schulze in the *Challenger* report, ought to be separated from the typical species, as it has long, slender, widely divergent terminals, nearly twice as long as the principals.

Family APHROCALLISTIDAE J. E. Gray, 1858

Genus APHROCALLISTES J. E. Gray, 1858

APHROCALLISTES BEATRIX ORIENTALIS Ijima

PLATE 4, FIGURE 1

Aphrocallistes beatrix orientalis IJIMA, Annot. Zool. Japon., vol. 9, pt. 2, pp. 173–182, 1916.

Many complete colonies and fragments that may be identified as *A. b. orientalis* Ijima were obtained from the several stations mentioned in Table 14, all of which, except Station 5092, are close together. In these specimens I have found certain differences in spiculation from the type specimens. In specimens D, the macroscleres and microscleres show a comparatively much more delicate form than those of the typical species. The distal ray of the dermal pinules, especially, is slender and is provided with weak lateral spines. Furthermore, the oxyhexasters also have much slenderer terminals. In the parenchymal regions of these sponges I have occasionally found hexactins of variable sizes, which may be of some consequence in the formation of the dictyonal framework.

TABLE 14.—*Record of specimens of* Aphrocallistes beatrix orientalis

Specimens	Collected at—	Number and description
A	Station 4890, 10–12 miles SW. of Gotô Islands, 135 fathoms	Three, nearly complete; seven fragments.
B	Station 4894, 10–12 miles SW. of Gotô Islands, 95 fathoms	Small macerated dry fragments.
C	Station 4895, 10–12 miles SW. of Gotô Islands, 95 fathoms	Two, macerated.
D	Station 4934, off Kagoshima Gulf, 153 fathoms	Two, macerated and injured.
E	Station 4937, in Kagoshima Gulf, 58 fathoms	Four, macerated and injured.
F	Station 5092, entrance of Uraga Channel, 70 fathoms	One, macerated.

Specimens A are fine and uninjured. The fully developed form is a tube gradually widening upward, with numerous radial glove-fingerlike swellings on the lateral walls. The axis of the entire tube, which may attain a length of 87 mm or more, as a rule has a slight curvature. The inferior extremity, which is firmly attached to the substratum, has the form of short peduncles, which are 5 mm to 7 mm in breadth. The length of these diverticula, which always end in a small circular osculum, as measured on the outer end of the tube, is in most cases 9 mm, but gradually decreases in the middle and upper parts to a length varying from 3 mm to 5 mm. Very frequently much elongated diverticula occur here and there at a distance above the base. These are bent obliquely downward, occasionally

reaching the firm substratum as if they were used for supporting the entire sponge. I have found many cases in which the diverticula are arranged in more or less longitudinal rows usually nine in number, which in inferior parts of the entire tube are arranged in a cruciate manner. Above, this arrangement becomes indistinct and irregular. Where the upper terminal opening with its natural margin is present and uninjured, it is closed by a transversely stretched narrow-meshed latticelike plate. The latter is somewhat concavely incurved, or occasionally not curved, and united to the honeycomblike lateral wall. In a few cases this latticelike transverse partition occurs in the interior of the tube, as already reported by Schmidt and Marshall. I agree with Schulze's opinion regarding its formation and significance, as mentioned in his *Challenger* report. There is some doubt in regard to the onychaster of specimens described by other authors. In the specimens of the *Challenger* expedition, Schulze does not describe the onychaster, while in the specimen from Andamans in the Indian Ocean, he reports it for this species. On the other hand, the discoctaster was mentioned by him in the former specimen and not in the latter. At any rate the spicules in question are present in all the specimens before me.

APHROCALLISTES INTERMEDIA, new species

Three fairly large, macerated fragments and several well-preserved fragments (cotypes, U.S.N.M. No. 22121) of this species were collected from two stations (Table 15).

TABLE 15.—*Record of specimens of* Aphrocallistes intermedia

Specimens	Collected at—	Number and description
A	Station 4803, about southeast of Shimushir Island, Kuriles, 229 fathoms.	Three, fairly large, macerated fragments.
B	Station 4804, about southeast of Shimushir Island, Kuriles, 229 fathoms.	Several well-preserved fragments, including the sieve plate.

I have some doubt as to whether *intermedia* should be placed under *Aphrocallistes* or whether a distinct genus should be erected for it. The characters distinguishing it from *Aphrocallistes* are found in the presence of scopulae on the gastral regions and in the existence of a peculiar gastral oxyhexaster. The species is generically associated with *Aphrocallistes* rather than with *Chonelasma*, because it has diactins in the subgastral regions.

Spiculation.—The dictyonal net forms a regular and nearly uniform hexagonal honeycomb. The hexactinic dictyonalia are joined in a regular manner to form a net or latticework with nearly quadrangular meshes. Slender, faintly tuberculous, short, cylindrical

processes protrude from the dermal and gastral surface. The beams composing the net are nearly smooth and measure 20μ to 40μ broad. The nodes are very slightly or not at all thickened, and are only sparsely covered with small tubercles.

The dermalia are strong hexactins, with a free distal ray 180μ to 200μ long. They are terminally thickened in a club-shaped manner with stout spines, or thorns, of medium length, which diverge obliquely and are curved toward the end of the ray like the branches of a Lombardy poplar. The tangential rays are simple, straight, strongly tuberculous at the conically pointed ends, and much shorter than the distal ray, measuring 130μ to 150μ in length. The proximal ray is similar in shape but generally somewhat shorter. These hexactins are arranged regularly in quadratic meshwork, formed by the paratangential rays of the spicule.

The gastralia are stout, straight, occasionally slightly curved, somewhat flattened diactins, with a defined swelling at the center. Their ends are conically pointed or infrequently rounded and covered densely with small pointed tubercles. The spicule is always covered with such protuberances in its entire remaining length. The length of spicule varies considerably, measuring from 0.8 mm to 1.2 mm or more in length. The spicules are irregularly scattered on the gastral layer.

Scopulae are numerous, arranged perpendicularly to the surface or scattered irregularly in the parenchyme and sometimes distributed perpendicularly to the wall of the incurrent canals. The four to six branches of the scopulae perpendicular to the surface of the sponge lie between the proximal rays of the dermal hexactins and do not reach the sponge surface, except the extremity of the proximal ray. Elsewhere in the sponge they have no definite arrangement. The shaft is generally simple, straight, 160μ to 210μ long, and gradually tapering toward the pointed end. It is always slightly rough on the surface except at the end, which is frequently smooth. The number and shape of the branches are subject to considerable variation. Usually four stout or slender diverging dermal branches are observed. They arise from a comparatively short thickening at the distal end of the shaft and extend upward toward the distal ends, being nearly parallel to one another. They are nearly cylindrical, slightly thickened in a knot-shaped manner at the distal end, and uniformly densely covered in their entire length with very minute spines directed obliquely backward. The terminal thickening is covered with similar but slightly stouter spines.

The other kinds of scopulae occasionally found on both layers differ mainly in length from the one described above. They are about two or three times as long as the former scopulae, measuring 340μ long in shaft and 80μ long in dermal branch.

Transitional scopular forms, connecting the smallest one to the largest, here described, are quite frequent. Scopulae with fewer than four branches are not found in *intermedia*.

Uncinates, varying in length and thickness, quite frequently occur close to the dictyonal honeycomb. They are arranged perpendicularly to the dermal and mostly obliquely to the gastral surfaces and usually reach only to the inner two-thirds of the whole thickness of the body wall. The outer half of the spicule, nearer the dermal surface, is always slightly thicker than the inner half, nearer the inner regions of the parenchyme. The inner half tapers quite gradually to the pointed end. The weak barbs around the shaft are not so numerous.

Of the spicules irregularly scattered throughout the parenchyme, I will first describe those simple hexactins that measure 140μ to 160μ in axial length and seem to play so important a part in the growth of the dictyonal network. Their rays are fairly stout, straight, gradually tapered, bluntly pointed, and irregularly covered with small, more or less numerous tubercles.

The peculiar oxyhexasters are scattered abundantly in the hypogastral regions and are not found in the parenchyme or in the dermal regions. They measure 24μ to 28μ in diameter and have stout principals 3μ broad near the base, being somewhat thicker toward the distal end, from which numerous outwardly curved terminals arise. These terminals vary in number from 10 to 13 on each principal and are very short, about half as long as the principals.

Much more peculiar and worthy of interest are the hexactins, hemihexactins, oxyhexasters, and onychasters, irregularly scattered in varying numbers through the parenchyme. They are subject to considerable variation; their shape and size vary in different regions of the same individual. They are frequently found in the same place intermixing with one another. Four kinds of intermediary parenchymalia, except the onychaster, are to be distinguished: Stout-rayed microxyhexactins, microhexactinic and microhemihexactinic forms, the rays of which show a tendency to bifurcation so that they pass into oxyhexasters.

The regular oxyhexasters with six equal main rays, which are nearly the same thickness as the terminals, form right angles with one another. They are terminally crowned with groups of 3 or 4 nearly straight branch rays of uniform thickness, shape, number, and degree of divergence. The main rays, measuring 8μ at the base, are generally short. The spicules usually have a diameter of not more than 80μ.

The microhexactins and hemihexactins have more or less the same features, measuring 80μ to 100μ in diameter. Their rays are strong

and broad at the base, measuring 8μ, attenuating gradually toward the pointed ends. The surface is faintly rough.

The more robust onychasters, measuring about 50μ to 70μ in diameter, are also found together with the spicules on the upper side, but more numerous in the subgastral or in the subdermal regions. All the rays are somewhat slender and inconspicuously roughened near the ends. The terminations of the branch rays bear a verticil of fine claws, usually four in number. These are perpendicular to the branch ray and slightly recurved.

Small onychasters are present in the parenchyme layer, intermixed sparsely with larger onychasters. They are more abundant in the subgastral regions. They measure 30μ to 40μ in diameter and have two or four widely diverged terminals, the surface of which is quite smooth.

In the compact, thickened regions of the sponge wall near the sieve plate, the dermal hexactins occur more densely than in other parts of the entire sponge body. The proximal ray of the hexactins is much longer, attaining a length of 680μ to 750μ, while the distal poplarlike ray is somewhat slenderer and shorter, measuring 160μ to 200μ in length. The tubercles of the proximal ray are very pronounced toward the end of the ray. In general, the distal poplarlike ray of the spicule is much broader and stouter, being much longer than that of the ordinal hexactins distributed in other regions of the sponge body. In the parenchyme of this region, the microscleres are rarely found; especially lacking are the hexactinic and hemihexactinic forms and the onychaster.

The diactinic gastralia are thickly accumulated and irregularly distributed, being many times as thick as the ordinary ones of the subgastral regions, and measuring 0.8 mm to 1.7 mm thick. (It is somewhat interesting to note that a dictyonal framework is not found in the parenchyme of this region.)

Uncinates, when they occur, are also found in fewer numbers. They penetrate vertically to the surface, nearly approaching the gastral surface.

The peculiar oxyhexasters occurring on the gastral membrane are practically absent, and when they do occur they are sparsely scattered.

The so-called latticelike plate of this species differs somewhat from that occurring in *Aphrocallistes beatrix* Gray in several particulars. The meshes are nearly circular, being 2.5 mm to 3.5 mm across; their beams are tolerably thick and composed of diactins, which are entirely similar to those occurring in the gastral membrane. Many previous authors, as Schmidt, Marshall, and Schulze, who discussed some points of distinction between the internal diaphragms and that of the terminal sieve plate in *Aphrocallistes beatrix* Gray, came virtually to the same conclusion regarding this point. In the present

specimen, the narrow-meshed terminal sieve plate is united all around to the thinner body wall and is not separated by several openings of new additional zooecial tubes, as in *Aphrocallistes bocagei* P. Wright.

APHROCALLISTES YATSUI, new species

PLATE 4, FIGURES 2, 3

A nearly complete specimen (holotype, U.S.N.M. No. 22108) of *A. yatsui* was collected from Station 4781 (near the western extremity of the Aleutian Islands at 482 fathoms). The body shows a somewhat dorsoventrally compressed, cuplike form, gradually narrowed toward the stalklike basal regions, and expanded toward the nearly truncated oscular edges. The surface of the sponge is very porous, owing to the great numbers of large and small afferent canals, the outer ends of which are generally rounded and vary in size up to 1 mm in diameter. Nearly all of them are large enough to be noted macroscopically. The surface has a very homogeneous appearance.

It is generally difficult to trace the distinction between a dermal surface and a gastral surface in this sponge. On the gastral surface the larger and smaller efferent canals make their appearance, arranged somewhat regularly and much more visible than on the dermal surface. The outer edges of the efferent canals are usually raised to a slight degree by the thickening of the gastral surface.

Spiculation.—The arrangement of the constituent beams of the dictyonal framework has a certain regularity. Beams directed radially to the surface of the sponge may be distinguished. Between these lie the connectives, which are frequently transverse, thus giving rise to rectangular meshes. The superficial ends of the radial beams form tapering spines of varying lengths, sometimes very short, frequently long, often slightly irregular, and as a rule thickly covered with microtubercles. The beams in general are sparsely covered with similar tubercles. Usually they are 80μ thick.

Slender, sharp, tuberculated spines generally project from the nodes of the skeletal reticulum, on the free surfaces and edges of the plate. Some of the very delicate connecting bars that extend between the adjoining skeletal plates give the impression of having arisen through the fusion of such spines.

The dermalia are exclusively hexactinic pinules, so far as those of the body proper is concerned. The pinular ray as a whole is nearly spindle shaped, 160μ to 200μ long and 30μ to 50μ broad in the middle, which is about the broadest part. In this part, the obliquely upwardly directed, conical spines are closely distributed. The rhachis is smooth for a short distance at the base, which is about 12μ thick; its conically pointed outer end forms the tip of the pinular ray. The remaining five rays are somewhat slender, and

gradually taper toward the conically or bluntly pointed end. They are beset with small, generally erect prickles, on the end. The proximal ray though occasionally nearly as long as, is usually much shorter than the paratangentials of the same spicule, measuring 100μ in length. The paratangentials usually measure 160μ in length and when subequal to the proximal ray the latter will be found to measure between 120μ and 140μ long.

The gastralia include both pentactinic and diactinic forms. The diactins in most regions are much the more abundant, and the pentactins are scarcely anywhere more numerous than the diactins. In the pentactins, the distal ray is not represented by a boss; the tangential rays measure 120μ to 230μ in length. They have blunt or rounded tubercles on the distal end and are quite straight and not curved inwardly. The proximal ray as a rule is longer than the tangentials, about 200μ to 300μ long, is of about the same thickness as the tangentials, and tapers evenly to a point above, where it is prominently roughened. Elsewhere it is smooth or has a few scattered, weak, minute prickles. Nearly all the rays taper evenly toward the end, which is blunt or rounded.

The diactins are stout, straight, varying in length from 200μ to 400μ, and gradually tapering toward the conically pointed ends. They are usually provided with two to eight defined swellings at the center, measuring 20μ in width, while the ray near the center measures 8μ in breadth. In some of the diactins, mostly those up to 450μ in length and 12μ broad, the distinct central knobs are not seen. These closely resemble those occurring commonly in other species of *Aphrocallistes*. The roughness of the surface is commonly much more pronounced at the distal ends and sparsely scattered on the central knobs and other parts. Occasionally variously developed, prominent microspines cover the entire surface.

The uncinates show the usual shape, vary considerably in size, extend radially or obliquely, and are usually immersed in the sponge wall without penetrating it.

The hexasters are of the discohexaster, tylohexaster, and hemidiscohexaster types, as well as of the stout peculiar oxyhexaster type. They are scantily or only fairly abundant, intermixed with one another. The discohexasters are most abundant in the parenchyme, being nearly spherical, with a diameter of 30μ to 40μ. Each principal, which is not very short, bears a bunch of two to four or more terminals, which are smooth-surfaced, slightly thickened toward the outer end, and capped by a minute disk, which is divided into two or three clawlike teeth directed backward.

Occasionally the hexactinic forms may be present in the parenchyme. In hexactinic forms the axial length may reach 70μ, showing an increase in diameter over the normal form. The rays

taper considerably toward the end, which is supplied with two or three backwardly diverging, slender, short claws. Beside these forms, there is a microdiscohexaster, nearly resembling that commonly occurring in the Acanthascinae and measuring 20μ in diameter. They are scattered in the gastralia as well as in the parenchyme, though much more sparsely in the latter. In parenchymal regions scattered large hexactins with slender rays are rather more numerous than in the subgastral regions. The axial length of the rays is 120μ to 200μ; breadth at base, 6μ. All the six rays in the same spicule in general are subequal, though in some cases the distal ray is somewhat shorter than the paratangential rays. Occasionally also the free proximal ray may be longer than the paratangentials. All the rays are gradually tapered to the sharply pointed end. The microtubercles may be slightly more pronounced on the distal ends than on any other, but in any case the differentiation is never carried out to any considerable degree.

The stout oxyhexasters are present in the subdermal regions in small numbers, being sparsely scattered. They measure mostly 75μ to 85μ in diameter and have remarkably thick, conic rays, measuring 8μ on the base near the center of the spicules. The rays are usually divided into two terminals. Occasionally they are not divided, the principal being prolonged into one terminal ray. They are nearly smooth over the entire surface.

Scopulae fall into only one class, having four or six distal rays, measuring 35μ to 60μ long, being cylindrical and covered with sparse and minute tubercles, and terminating in very small round enlargements. The shaft at its upper end has a definitely circumscribed enlargement on which the rays rest; tapering thence to the conically shaped point, above which it is sparsely roughened. Elsewhere it is nearly smooth. The shaft is 200μ to 250μ over all and 4μ thick just below the upper enlargement. Scopulae occur only on the dermal surface, penetrating obliquely or horizontally to the sponge wall, close and nearly parallel to the proximal rays of the pinularlike hexactins.

APHROCALLISTES ALEUTIANA, new species

Several small colonies and fragments of *A. aleutiana* were collected from Station 4780 (near the western extremity of the Aleutian Islands). They are all nearly macerated or washed out, and can not be described in any great detail.

Spiculation.—The dermalia are slender hexactins, with free distal rays 50μ to 60μ long, terminally sometimes thickened in a nearly circular pear-shaped manner. They are covered with short slender thorns, which diverge slightly obliquely, and are curved toward the end of the ray, showing a rounded or angularlike boss, which is 50μ

to 60μ long. The tangential rays are simple, straight, prominently tuberculous at the weakly blunt or conically pointed ends, and twice or four times as long as the distal ray, measuring 130μ to 200μ in length. The proximal unpaired ray is nearly similar in shape and generally much longer than the paratangentials.

The gastralia are stout, straight diactins with a more or less clearly defined swelling at the center, measuring 20μ in breadth. Their ends are conically pointed and are always covered more or less densely with small pointed tubercles. The spicule is usually very sparsely covered with such protuberances throughout its entire length. The length of these spicules varies considerably, from about 1.2 mm to 1.5 mm or more. Besides this diactin in the gastral layer, there are frequently pinularlike hexactins, which are nearly similar to those of the dermalia. The presence of the latter spicule, the hexactin, is quite distinctive of the members of *Aphrocallistes;* but *aleutiana* is seemingly more similar to *Hexactinella* than to *Aphrocallistes* in dermal and gastral spiculations.

The scopulae are numerous, are arranged horizontally to the surface, and are of two kinds. One is small, measuring 250μ to 300μ in length, and the other is larger, 400μ to 500μ long. In the larger type, the dermal branches usually number 4 or 5 and are uniformly bent outward in a club-shaped manner. The branches, which arise from a comparatively short thickening at the distal end of the shaft, measure 130μ to 150μ in length. They are nearly cylindrical, either of nearly uniform thickness throughout or basally slightly thin and terminally thickened in a knot-shaped manner at the distal end and uniformly and densely covered on the entire length with minute spines, directed obliquely backward. The shaft usually measures 400μ in length, becoming gradually tapered toward the conically pointed end. In a small one, the terminal branches usually number four, running nearly parallel toward the thickened club-shaped ends. They are covered with small, slender, oblique spines, which are directed backward, the spines on the distal knot-shaped thickening being slightly stouter. The shaft is generally simple, straight, 200μ to 250μ long, and gradually tapered toward the pointed end. It is rough at the end, but for the remainder of its length is entirely smooth. The chief characters aside from the one just described include the following: The distal thickening of the shaft is indistinct and the branches arising from the margin extend upward, being nearly parallel to each other, and uniformly thickened throughout toward the small club-shaped thickening.

Uncinates, varying in length and thickness, are found close to the dictyonal honeycomb. They are arranged horizontally or obliquely to the surface and usually penetrate the whole thickness of the body wall. The outer half of the spicule, nearer to the dermal surface, is

always much thicker than the inner half, nearer the gastral surface, which is quite gradually attenuated to a pointed end. The spines are projected first in horizontal transverse directions and then are bent backward.

Besides this distinct uncinate, there occasionally occurs a small uncinatelike spicule. It is usually 300μ long. The distal end is somewhat extended in a lobelike manner, measuring 25μ in breadth and is then gradually tapered toward the conically pointed end, which is 8μ in breadth. The surface is roughened by densely distributed microtubercles at the end of the spicule but elsewhere is quite sparsely roughened by microtubercles.

Of the spicules irregularly scattered throughout the parenchyme I have found only one kind of onychaster. It is 40μ to 80μ in diameter. From each short principal (6μ long as measured from the axial center) there arise two or three fairly thick, nearly straight, and strongly divergent terminals. The finely attenuated end of these bears a whorl of two or three fine backwardly arched minute claws. The surface of the terminals is sparsely covered all over with minute pointed microspines directed backward.

The chief distinguishing characters of this species are: (1) The uncinate is very robust in form, with large, short barbs; (2) the small uncinate is distributed irregularly and is rarely found in the dermal layer; (3) microscleres usually consist of one kind of onychaster, measuring 40μ to 80μ in diameter and rarely of a normal oxyhexaster.

The present species is somewhat allied to the members of the *Aphrocallistes* group but differs from them by the existence of the gastral hexactinic pinules together with the diactins.

INDETERMINABLE APHROCALLISTES

There is in the collection a fragmentary specimen, probably referable to *Aphrocallistes*. Since it is badly macerated, it can not be more fully determined. It was taken at Station 5090 (entrance to Uraga Strait between Jôgashima and Okinosé), and consisted of small fragments of a thin-walled skeletal tube.

Tribe LYSSACINOSA Ijima, 1927

Family LEUCOPSACASIDAE Ijima, 1903

Genus CHAUNOPLECTELLA Ijima, 1903

CHAUNOPLECTELLA SPINIFERA Ijima

Chaunoplectella spinifera IJIMA, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 18, art. 1, pp. 71–77, pl. 5, figs. 14–17; pl. 6, figs. 1–8, 1903.

I have discovered in the collection a fairly large colony that is unfortunately incomplete, lacking parts of the lateral wall. Though

it differs in some respects from the type, I am strongly inclined to refer it to *C. spinifera*. It comes from Sagami Bay (Station 5085), where it was taken at a depth of 622 fathoms.

Although the sponge has come to maturity, I have, unfortunately, not found the spines on the paratangentials of the dermal oxypentactins, which constitute a characteristic feature of the species. As to the forms or varieties of discohexasters, I have also met with nearly the same forms as those occurring in the type specimens, but their dimensions seem to be different from those of the latter. Of the discohexasters, the commonest form, corresponding in outer appearance to that which Ijima (loc. cit. p. 76) called the first variety in the typical species, has somewhat larger dimensions, attaining 108μ in diameter. The second variety (loc cit. p. 75) in the typical species often appears and varies from 120μ to 180μ in diameter. In outer appearance it is to be considered as represented by two forms. One has a widely expanding bunch of terminals and is 160μ to 180μ in diameter. while the other forms somewhat slender terminals, grouped separately, narrow at the middle and outwardly expanding into tufts, usually measuring 140μ in diameter. The largest variety, which Ijima called form *c* in the type specimens, appears occasionally. Its diameter falls short of the 230μ of the type specimens, measuring only 210μ in the present specimen. The fourth variety of discohexaster seems to be wanting here, but perhaps it is to be considered as represented by the much more delicate form that I have just mentioned above in the case of the second variety. The discohexasters thus far indicated have specific features somewhat different from those of the type specimens. I identify the present specimen as *Chaunoplectella spinifera*, regarding the spicular differences to be a matter of individual variation.

Family EUPLECTELLIDAE (Gray) Ijima, 1903

Subfamily EUPLECTELLINAE Ijima, 1903

Genus EUPLECTELLA Ijima, 1903

EUPLECTELLA OWENI Kerklots and Marshall

Euplectella M. J. S. SCHULTZE, Ein Beitrag zur Naturgeschichte der Spongien, Bonn, p. 39, 1860.

Euplectella oweni KERKLOTS and MARSHALL, Arch. Néerland. Sci. Exact. et Nat., vol. 3, p. 435, 1868.—MARSHALL, Zeit. Wiss. Zool., vol. 25, suppl., p. 189, figs. in pls., 1875; vol. 27, p. 128, 1876.—F. E. SCHULZE, Abh. kön. preuss. Akad. Wiss. Berlin, 1886, p. 38; Rep. Voy. *Challenger*, vol. 21, p. 78, pl. 6, figs. 1, 2, 1887; Abh. kön. preuss. Akad. Wiss. Berlin, 1895, pp. 29, 48.—IJIMA, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 15, p. 202, pl. 6, figs. 1–10, 1901.

There are five specimens of *E. oweni* in the collection, which were taken as indicated in Table 16.

TABLE 16.—*Record of specimens of* Euplectella oweni

Specimen	Collected at—	Number and description
A	Station 4876, eastern channel of Korea Strait, vicinity of Oki Islands, Japan Sea, 59 fathoms.	1, small, lacking parts of sieve-plate and lower parts.
B (1, 2, and 3)	Station 4878, eastern channel of Korea Strait, vicinity of Oki Islands, 59 fathoms.	3, large, complete.
C	Station 4948, east of Hiuga Province, 65 fathoms	1, small, complete.

Specimen A is the smallest one in the collection. It measures 113 mm in length, excluding sieve plate,[1] and the broadest part [2] (ledges included) is 24 mm in diameter. The compressed lower end of body measures 13 mm in diameter, and the part immediately below the sieve plate is about 8.5 mm in diameter. This specimen is rather delicate in form, with thin walls and inconspicuous parietal ledges, which frequently form irregular ribbonlike masses or protuberances. It somewhat differs from typical *E. oweni* in the presence of a lophocome, in the number of transverse and longitudinal beams relative to the size of entire stock, and in having weakly developed parietal ledges. Nevertheless, I think it advisable to identify this form with the present species.

First, the lophocome (though somewhat different from that of *E. marshalli* in its dimensions) scarcely deserves to be considered a character of such systematic significance as to warrant establishing a new name. The lophocome may possibly exist in *E. oweni*, even though it has not yet been described in the hitherto known specimens.

Secondly, the proportional number of transverse and longitudinal beams is not a constant character in these sponges, especially in young specimens, thus also losing its importance as a distinctive specific character. The numbers of transverse and longitudinal beams in this specimen are as follows: Circular beams, 52; longitudinal beams at upper end, 25; longitudinal beams at middle, 34; longitudinal beams at lower end, 19.

The above-mentioned characters seem to indicate some relationship with *E. marshalli.* The lophocome occurs quite rarely and singly. The diameter is 61μ. The principal rays are 4μ to 6μ in length. The terminals are 22μ to 24μ long and exceedingly fine. They are pointed at the outer end and arise close together from all parts of the outer disk surface. The peripherally situated terminals in each tuft are slightly but distinctly flaring, so that the tuft may be said to be campanulate.

[1] The sieve plate is damaged and therefore is excluded in measuring the total length of the body.

[2] Breadth measured after restoring compressed body wall to a cylindrical form.

The dermal swordlike hexactin is somewhat larger than that in the typical species but is smaller than those of the specimens from other stations. The length of the hilt ray is 120μ to 160μ. The blade ray is generally more than three times as long, up to 550μ. Guard rays are somewhat shorter than the hilt ray, measuring 88μ to 145μ in length.

Specimens B (1, 2, and 3) are beautifully preserved. Measurements and numbers of transverse and longitudinal beams are given in Table 17.

TABLE 17.—*Measurements and numbers of transverse and longitudinal beams of 3 specimens (B, 1, 2, and 3) of* Euplectella oweni

Specimen (B)	Body length [1]	Diameter of sieve plate	Body diameter		Diameter immediately below sieve plate	Number of beams			
			At broadest part [2]	At compressed lower end		Circular	Longitudinal at upper end	Longitudinal at middle	Longitudinal at lower end
	Mm	*Mm*	*Mm*	*Mm*	*Mm*				
1	220	29	36	21	34	40	24	27	19
2	210	22	40	20	20	46	23	33	24
3	247	32	45	28	35	40	22	28	23

[1] Exclusive of basal tuft. [2] Ledges included.

In specimen B, 1, the diameter of the parietal pores is large, measuring 1.5 mm. The parietal ledges are prominently developed, being 5 mm high. The broadest part of the body is usually situated far below the middle of the entire stock. The wall of the body is thick, attaining 4 mm in the thickest part of the entire stock (excluding the height of parietal ledges).

Spiculation.—It is a prominent fact that the blade ray of the dermal hexactin and the distal ray of the gastral pentactin are very long, compared with those of the specimens from Stations 4948 and 4876. This character seems to indicate some relation to the thickness of the sponge body. The dermal hexactin has a very long blade ray, measuring from 0.8 mm to 2.1 mm in length, while the hilt ray and the guard ray are comparatively short, measuring 110μ to 187μ in length.

I distinguish two forms of floricome, which I shall designate with the letters *a* and *b*. They seem to represent different quantitative proportions and to show certain differences in the manner of distribution within the sponge. Form *a*, the larger floricome, occurs commonly and measures 80μ to 100μ in diameter. It has 6 to 9 terminals (mostly 7) provided with 5 or 6 marginal teeth on the terminal plate. It is abundant, both subdermally and at the apex of the

dermal hilt rays. Form *b* is smaller than form *a*, measuring 68μ to 80μ in diameter. The number of terminals in a perianth varies from 9 to 12. The marginal teeth of the terminal plate are 3 or 4 in number and seem to occur frequently among the parenchymalia or subgastralia of the basal parts of the entire stock.

Oxyhexasters occur abundantly both in the subdermal and subgastral layers, being more numerous within the former layer, and least numerous in the middle parts of the parenchyme layer. Each principal ray usually bears four or five, sometimes only two, diverging terminals. The principals and terminals of the oxyhexaster of *E. oweni* are somewhat slenderer than in either *E. imperialis* or *E. marshalli*, but observation of the specimens, which may be referable to *E. oweni* in this collection, shows that the principals are frequently thick or that they occasionally have small knoblike swellings. In general, the principals that are provided with four or five terminals seem thicker than those beset with only two or three terminals.

The lophocome is probably absent.

The thin and rather short diactins do not exist in the strands of the comitalia which are provided with four tubercles at the center.

The oscularia consist mainly of the common diactins, with either two oppositely or four cruciately disposed central knobs. Frequently they are intermingled with many more pentactins, tetractins, and stauractins. Generally speaking the diactins are commonly located near the edge of the oscular membrane, and the other forms stand outside or in among them in mode of occurrence. The state of the oscularia mentioned above nearly resembles that occurring in *E. marshalli*.

The sieve plate shows parenchymalia consisting mainly of tetractins and diactins. The latter seem to occur more abundantly among the parenchymalia than do the former. Frequently diactins, which are provided with one to four short tubercles at the center, occur among the parenchymalia.

The small and large gastral pentactins are thinly beset with small prickles near their distal ends. Paratangential rays measure 100μ to 160μ long and 6μ to 8μ thick near the center. The distal ray measures 440μ to 528μ in length. Besides these pentactins, large triradiates and quadriradiates frequently occur. These are also tuberculated at the ends of the rays. The former have a smooth, straight basal ray, ending in a small, distinctly tuberculated protuberance, measuring about 715μ long and 22μ thick at the center. Paired rays are 45μ long, strongly diverging, slightly curved inward, and also tuberculated at the ends.

The basalia have a very broad, miter-shaped anchorhead, measuring 72μ across from tip to tip of opposed teeth. The latter are weakly

developed, measuring 24μ to 28μ in length, and are four, sometimes six, in number. They differ somewhat from those of the other specimens in having a strongly rounded apex at the head; not pointed as a gothic arch as in the other specimens from same locality.

In specimen B, 2, the diameter of the parietal pore is usually 1 mm and seems not to exceed this size. The parietal ledges are prominently developed, frequently measuring 5 mm in height, especially those of the oscular margin close to the outer margin of the sieve plate, which approach 6 mm in height. The wall of the body is also thick, as in specimen B, 1, measuring 4 mm at the middle of the body, and becoming gradually thinner toward the upper and lower ends, measuring 2.3 mm.

Spiculation.—The hexactin of the dermalia is not so large as that of specimen B, 1, usually having the blade ray 830μ to 1,370μ long. The paratangential rays are proportionally very short, measuring 66μ to 121μ in length.

Form *b* of the floricome in specimen B, 1, is probably not present in this specimen. The basalia do not differ from those of the type specimens, except in being slightly robuster and in having a perceptibly thicker shaft. The anchor teeth, of which there are five to eight in each head (usually six or seven) are strong and about 60μ long. The distance from tip to tip of any two oppositely situated anchor teeth is 80μ to 88μ. The shaft is 24μ thick close to its origin from the head.

Specimen B, 3, is the smallest specimen obtained from the same location. It does not have such prominent parietal ledges as specimens B, 1 and 2. They measure 2 to 3 mm in height, and have sharp edges.

Spiculation.—Among the basalia, there is occasionally found a much smaller form of anchor-toothed spicule than in the typical form. The apex of its head is rather pointed as in a Gothic arch. The anchor teeth vary in length from 12μ to 24μ, and their numbers are constantly 4. The distance from tip to tip of any two opposed anchor teeth is 32μ to 56μ. The shaft close to the head is 8μ to 12μ thick. The spines on the shaft are not so conspicuous as those of the typical form and become more degenerate in number and length. Especially in the smallest one (basalia?), the spines are very short and are projected at wide intervals. These forms seem to be intermediate and probably grade over into the common anchor-toothed basalia and the pentactin basalia of these varieties.

An abnormality, like that occurring in the specimen from station 4948, is shown by three short tubercular spines projected sideways

from one of the anchor teeth near the apex of the head and another smaller protuberance near the end of a certain spine.

Specimen C is beautifully preserved, and its sponge body is nearly straight, phalluslike, and quite similar to the outer configuration of various specimens obtained from the southern part of Japan (especially to the specimen photographed on Plate 6, figure 1, of Ijima's Contribution I).

Parietal ledges are present but not so prominently developed. They run irregularly in places, and may approach 1 mm in height. Their free edge is fairly even, frequently being either blunt or sharp. The numbers of beams are as follows: Circular, 39; longitudinal at upper end, 31; longitudinal at middle, 28; longitudinal at lower end, 23.

Spiculation.—The oxea of the oscular margin are prominent, being usually slightly curved compass-needlelike spicules with two very weak oppositely placed tubercles at their center and sharply pointed at both ends. They occur in tufts or projecting singly from the dermal surface of the oscular margin and with the inner one-third to one-fourth of their length embedded in the oscular margin. They measure about 715μ to 780μ long and 8μ thick at their center.

The oxyhexaster is represented in greater numbers, as compared with the other specimens. It is especially abundant in the parenchyme, differing from the specimens from Station 4878, which have fewer oxyhexasters among the parencyhmalia than in the subdermalia and subgastralia. The same abnormality of the basalia occurring in the specimen from Station 4878 is also found in this specimen.

Family ROSSELLIDAE (F. E. Schulze) Ijima, 1903

Subfamily ROSSELLINAE F. E. Schulze, 1897

Genus CRATEROMORPHA J. E. Gray, 1872

CRATEROMORPHA MEYERI RUGOSA Ijima

Crateromorpha meyeri var. *rugosa* IJIMA, Annot. Zool. Japon., vol. 2, p. 49, 1898.

Crateromorpha meyeri rugosa IJIMA, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 18, art. 7, pp. 71–74, pl. 4, figs. 10, 11, pl. 5, figs. 14, 15, 1904.

Two large specimens of *C. m. rugosa* were trawled up from a depth of 103 fathoms off Kagoshima Gulf (Station 4936). Both are badly macerated. One, a large fragment, is probably all the body proper of a large sponge, and the other is a nearly complete colony with a distinct large stalk, which during preservation was broken from the body. The stalk expands somewhat abruptly

at its upper end, is laterally compressed, and measures 22 mm by 15 mm at the middle, and is nearly as long as the body, 75 mm. It is compact looking throughout, being entirely covered by a dense coating of dermal and hypodermal spicules, which seem to have fallen from the Sagami Sea specimens preserved in the University of Tokyo. Internally it is traversed by a system of anastomosing excurrent canals. The conspicuous features of this subspecies mentioned by Ijima I have found also in these specimens. They show the irregularities of the external surface, which result from a pronounced thickening of the wall into protuberances in the lower part of the body, and occasionally numerous wrinklelike ridges in the general superior surface. But the agreement does not extend into the spiculation, since these specimens lack hexactins among the parenchymalia. In the first specimen, the breadth of the paratangential rays of the hypodermal pentactins is usually 50μ to 60μ at the base. They occasionally attain a thickness of 140μ. In most of the oxyhexasters, the ends of the terminals are somewhat curved inward at the tip, and I have observed this feature in the preparations from the Sagami Sea specimens. (I have occasionally found the onychasterlike hexaster in the preparations of the latter. I consider the onychasterlike hexaster to be a variation of the oxyhexaster with terminals curved at their ends because I have found a complete series of intergrading forms from one to the other.)

A thorough examination of slide preparations revealed a single case of a smaller microdiscohexaster, which is nearly like that of the common form of this spicule included in the tissues of other rossellids. The occurrence of this solitary microdiscohexaster in the slide preparations I believe is due to the contamination of the sponges either in the dredge or by other species that may have been placed in the same bottle at the time of collection. I have observed the presence of this spicule with the same size and shape in preparations of *C. meyeri* from the Sagami Sea, in the tissues of the basal region of the entire stock.

The second specimen that I refer to this species has essentially the same spiculation but with some points of deviation. Few of the terminals of the oxyhexaster show a curved end. This, however, I consider to be due to individual variation. The hypodermal pentactins are fewer in number and distributed sparsely and irregularly on the superior region of the entire stock. But among the dermalia of the stalk region, there are numerous short and robust-rayed spicules irregularly oriented. The paratangentials usually measure

but do not exceed 20μ to 200μ in length, and the proximal ray is 100μ to 120μ long.

CRATEROMORPHA CORRUGATA Ijima

Crateromorpha corrugata IJIMA, Annot. Zool. Japon., vol. 2, p. 49, 1898; Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 18, art. 7, pp. 78–86, pl. 6, figs. 1–8, 1904.

A small fragment of *C. corrugata* was collected from a depth of 131 fathoms at the entrance to Enoura, Suruga Gulf (Station 5069).

The peculiar structure described by Ijima for *Scyphidium longispina* can be plainly seen in the present specimen. It also has very delicate filaments, arranged irregularly, in brushlike bunches.

Subfamily LANUGINELLINAE F. E. Schulze, 1897

Genus LANUGINELLA O. Schmidt, 1870

LANUGINELLA PUPA O. Schmidt

PLATE 5, FIGURE 2

Lanuginella pupa SCHMIDT, Grundzüge einer Spongien-Fauna des atlantischen Gebietes, p. 13, pl. 2, figs. 1, 3, 1870.—KENT, Monthly Micr. Journ., vol. 4, p. 247, pl. 65, figs. 1–6, 1870.—SCHULZE, Abh. kön. preuss. Akad. Wiss. Berlin, 1886, p. 47; Rep. Voy. *Challenger*, vol. 21, p. 130, pl. 53, figs 3–5, 1887; Sitz-ber. kön. preuss. Akad., vol. 26, p. 548, 1897.—IJIMA, Zool. Jap., vol. 2, p. 44, 1898; Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 18, art. 7, pp. 3–16, pl. 1, figs. 1–13, 1904.

There is a single specimen in the collection that may be identified as *L. pupa*. It was collected from a depth of 153 fathoms in Kagoshima Gulf (Station 4934), and seems to be the largest of the species hitherto recorded. It is cup shaped in form, 51 mm in height, and 35 mm in breadth at the widest part of the entire stock. It has also a short stalklike basal region measuring 8 mm in breadth at the middle. The dermal surface is quite smooth and not covered by a veil, as in the Sagami Sea specimens recorded by Ijima.

Spiculation.—Toward the stalklike base of specimens from the Sagami Sea the hypodermal lattice becomes unnoticeable. In the present specimen it is irregularly distributed, and has somewhat stronger-rayed pentactins with a shorter proximal ray. The pentactins of this specimen do not protrude through the dermal layer, so that the surface of their paratangentials is quite smooth. Occasionally there occur in the hypodermalia stronger and larger diactins, which measure 3.5 mm long and 100μ thick at the middle. In the stalklike basal region of the sponge they attain a length of about 5 mm.

The parenchymal oxyhexactins supporting the skeleton of the sponge may attain larger dimensions; the axial length frequently

measures 3 mm; and the thickness of the rays reaches 60μ near the central node.

As described by Ijima, the discohexaster shows considerable variations in both size and appearance in the same specimen. This condition is also found in the present specimen. In it I have discovered three forms of discohexasters, which are seen in the Tokyo University Faculty of Science specimen No. 436 of this species, which was taken outside of Okinosé in the Sagami Sea. The largest one, which measures 80μ in diameter, has three terminals, similarly thickened throughout; the intermediate one, which measures 60μ in diameter, is provided with four to five terminals; while the smallest one, 45μ in diameter, has more numerous delicate terminals, nearly resembling the so-called microdiscohexasters of certain other rossellids in appearance. In general, the number of terminals varies with different sizes of rosette, the smaller the rosette the fewer the terminals are in number.

Identical oxyhexactins, as well as canalaria and parenchymalia, occur in great abundance.

The strongiloplumicome of the present specimen usually measures 50μ in diameter and occurs abundantly in the subgastral region, as well as in the choanosome.

Genus HYALASCUS Ijima, 1896

HYALASCUS ATTENUATUS, new species

FIGURE 7; PLATE 6, FIGURE 5

This new species is represented by two specimens. In specimen A (holotype, U.S.N.M. No. 22044), the body shows a vaselike, or somewhat barrellike, appearance. The height is 48 mm and the breadth 45 mm near the basal region (the attachment base is torn off, so that it can not be measured), and 40 mm above just under the oscular edge. The wall is moderately thick, 3 mm to 4 mm in the middle of the entire stock, and becomes gradually thinner toward the oscular margin. The osculum is comparatively large and circular, measuring 30 mm in diameter. The diactinic prostalia are confined to the oscular edge and to the superior regions of the entire stock. The marginalia generally project straight upward to a length of 5 mm to 10 mm.

TABLE 18.—*Record of specimens of* Hyalascus attenuatus

Specimen	Collected at—	Number and description
A	Station 4790, near Bering Islands, Bering Sea, 64 fathoms	One, large, basal regions torn off.
B	Station 4804, SE. of Shimushir Island, Kuriles, 229 fathoms	One, small, complete.

Specimen B is barrellike in shape and measures only 30 mm in height, with a roundish osculum 10 mm in diameter. It was directly and firmly attached to stones with the basal surface. The wall is 2 mm thick at the base and gradually becomes thinner toward the oscular margin, which is 0.8 mm thick.

Spiculation.—The following description applies to the first and larger specimen (A), unless otherwise indicated:

The parenchymalia are all slender diactins of variable thickness, measuring 10μ to 30μ broad and 1 mm to 2 mm long. Both ends of

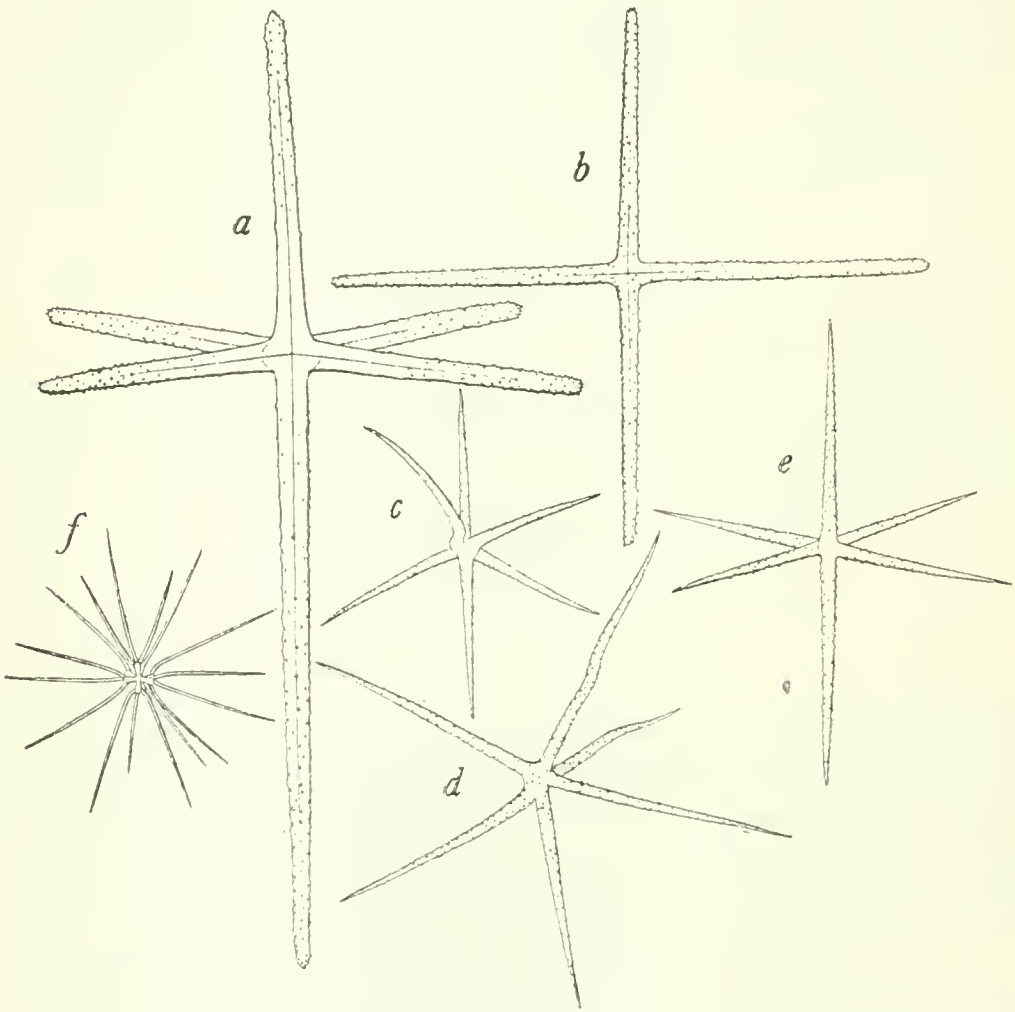


FIGURE 7.—*Hyalascus attenuatus*, new species: *a*, Gastral hexactin, × 175+; *b*, dermal stauractin, × 175+; *c*, hemihexactinic oxyhexaster, × 375; *d*, hemihexactinic oxyhexaster, × 375; *e*, hexactinic oxyhexaster, × 375; *f*, oxyhexaster, × 375

the diactins usually are conically pointed and beset with microtubercles on the surface. Sometimes each is spherically expanded, showing a moderately large knoblike swelling. The diactins occur either individually or are combined into long bundles. Besides this spicule, shorter and slenderer diactins, which are almost entirely smooth on the surface, frequently occur in the parenchyme. Very strong and large diactins are only occasionally found among the foregoing. They are more commonly present in the lower regions of

the sponge body. The diactins measure 3 mm long and 170μ broad at the center. They are of nearly the same breadth throughout, but taper suddenly near the sharply pointed ends, which have the surface roughened. Except the ends, the entire surface is quite smooth and completely covered with numerous striations. Single spicules occur irregularly.

The comitalia are only 12μ thick or sometimes less, showing as usual the same breadth for the greater part of their length.

The prostal marginalia are long diactins of variable sizes, projecting from the oscular edge and measuring 15 mm to 40 mm in length. They taper gradually toward the conically pointed ends, of which the distal one is smooth, while the proximal is rough. Furthermore, the prostal marginalia project from the surface of the superior regions of the entire stock. Most of the hypodermalia are moderately large oxypentactins with smooth, tapering rays, except at the end. The straight, unpaired proximal ray tapers strongly toward the sharply pointed and microtuberculated end and is 3 mm long. The paratangential rays are shorter or nearly the same length as the proximal ray, usually 1 mm to 1.5 mm. They are always either more or less curved or nearly straight, tapering gradually toward the conically pointed and sparsely tuberculated ends. These spicules may occur singly or grouped together. The paratangentials constitute the beams of the irregularly meshed hypodermal latticework.

The dermalia are mostly stauractins and pentactins, occasionally hexactins.

The pentactins are commonly supplied with a bosslike rudiment of the distal sixth ray. The paratangentials measure 80μ to 100μ in length (measured from the center) and 8μ in thickness at the base. The proximal rays are in general nearly as long as, or longer than, the paratangentials, measuring 100μ to 200μ. They taper perceptibly from the base toward the conically pointed end. The surface is beset throughout with microspines, which grow considerably weaker and thinner toward the base of rays and central node. In the stauractins (fig. 7, *b*) the bosslike rudiment is usually not present. The axial rays are 190μ to 240μ in length and roughened all over. The microspines on the surface are more pronounced on the conically pointed ends. In the hexactinic form, the proximally directed ray is not so long as in the gastral hexactins, and is nearly as long as the paratangentials of the same spicule.

The gastralia (fig. 7, *a*) are all rough hexactins in which the free proximal ray is usually much longer than the other rays. In length the paratangentials measure 140μ to 160μ. The distal ray is frequently shorter than, though occasionally as long as, the paratangentials. The proximal ray is 210μ to 280μ long and 12μ broad at base

of rays. All the rays taper gradually or strongly toward the sharply or conically pointed ends. Except at the base of the rays and on the central node, both of which parts are usually smooth or occasionally thinly microtuberculated, the surface of the rays is beset with numerous microspines similar to those on the dermalia.

Oxyhexasters, represented by normal, hemihexactinic, and somewhat less frequently by hexactinic, forms, are numerous in the choanosome and in the ectosome, as well as in the endosome. Normally developed oxyhexasters (fig. 7, *f*) are present frequently in the ectosome and in the choanosome. In them the center is swollen to a globular node, and the principals are exceedingly short or frequently almost obsolete. Two or three slender terminals, which are about half as broad as the principals, are attached to each principal. They are apt to be broken off near the base, as the fragments are found in abundance in the soft parts. In diameter, or axial length, the normal oxyhexasters measure 120μ to 140μ. The hexactinic forms (fig. 7, *e*) (axial length 160μ) are rarely found and are for the most part appreciably larger than those of the hemihexactinic form. The terminals are moderately strong, on the average about 10μ thick at the base and slightly rough. In the hemihexactinic form (fig. 7, *c*, *d*), 1 to 3 of the 12 extremely short or almost entirely atrophied principals each bear two diverging terminals. These are fairly strong and nearly straight. All the terminals of the oxyhexasters mentioned above are rough on the surface, and in those of the endosome the roughness of surface usually becomes more pronounced toward the base of the terminals, distinctly on account of reverted microtubercles.

There is but one kind of microdiscohexaster. This is fairly common near the gastral surface. It is probably not altogether lacking among the parenchymalia. It is rather small and is spherical in shape, with a diameter of 40μ to 45μ. The six principals are fairly long, about 14μ in length; their outer ends are somewhat expanded, forming a disklike expansion. There are usually 14 terminals; frequently 10 to each principal. The terminal disks are rather small.

As regards the spiculation of the smaller specimen (B) herein provisionally referred to *H. attenuatus:*

Here the paratangentials of the hypodermal pentactins attain a maximum length of 0.85 mm to 1.4 mm, while the proximal unpaired ray may be 1.7 mm long and 25μ broad. They are shorter and decidedly slenderer than in the larger specimen; and further the paratangential is nearly straight to the ends which have an entirely smooth surface.

Among the dermalia the pentactins occur infrequently and the hexactins very rarely, while they are fairly abundant in the larger specimen.

Oxyhexasters are represented by normal hemihexactinic and hexactinic forms. The first are abundant and exhibit a distinct knoblike center and very short principals.

The distinct parenchymal diactins which become very much attenuated toward both ends seem not to be represented in the smaller specimen. Instead are found large diactins, which measure 5 mm to 6 mm long and 85μ to 150μ broad.

The basidictyonal plate is not completely formed, being represented by large individual or compound stauractins with ends bifurcated or multifurcated, connecting with those of other approaching stauractins. The surface is nearly smooth, except near the ends, which have scattered microspines.

Genus AULOSACCUS Ijima, 1896

This genus was originally established by Ijima because it differs from *Scyphidium* and *Rossella* in having no pentactinic hypodermalia, though otherwise it shows great affinity to both genera. If certain species of *Aulosaccus* described by him were only provided with pentactinic hypodermalia, there would have been no hesitation in including it in *Scyphidium* at that time. But in the various specimens in the collection before me, I have always found a pentactinic hypodermalia. The spicule in question easily drops from the dermal surface of the sponge and is not observed in poorly preserved specimens. Although Ijima mentioned the absence of hypodermal pentactins as the most important character of the genus, I maintain that it may be regarded as distinct from the genera *Rossella* and *Scyphidium* in having the macrodiscohexaster as well as the hypodermal pentactin.

AULOSACCUS FISSURATUS, new species

FIGURE 8

Both of the complete specimens are very similar in appearance, being large and vaselike in shape, attached by a somewhat narrowed base, and having at the broad upper end a large circular osculum. The larger specimen, which I make the type of the species (U.S.N.M. No. 22114), is nearly 175 mm long and 100 mm broad at the broadest part. The circular osculum measures 80 mm in diameter.

TABLE 19.—*Record of specimens of* Aulosaccus fissuratus

Specimen	Collected at—	Number and description
A	Station 4769, Bowers Bank, Bering Sea, 244 fathoms	Several macerated fragments.
B	Station 4775, Bowers Bank, Bering Sea, 584 fathoms	One, large, complete.
C	Station 4781, near western extremity of Aleutian Islands, 482 fathoms.	One, complete; about same size as Specimen B.

Spiculation.—The parenchymalia are mainly diactins, which are as usual of varied dimensions, ranging from filamentous comitalia to principalia of 5 mm or more in length and 10μ in thickness in the middle. The larger diactins are oftener found in the deeper

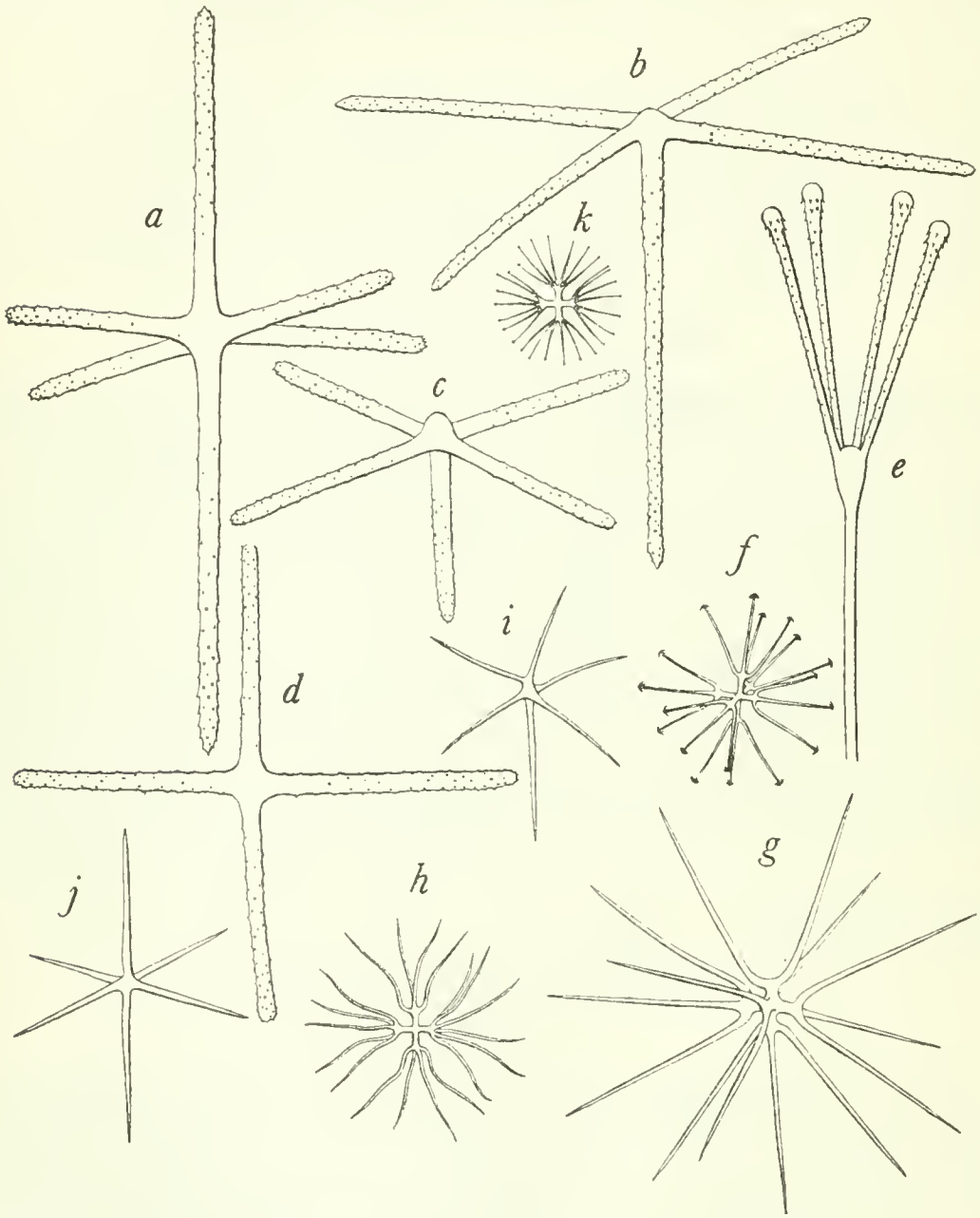


FIGURE 8.—*Aulosaccus fissuratus*, new species: *a*, Gastral hexactin, × 200; *b*, hypodermal oxypentactin, × 200; *c*, dermal pentactin, × 200; *d*, dermal stauractin, × 200; *e*, scopula, × 400; *f*, macrodiscohexaster, × 400; *g*, oxyhexaster, × 400; *h*, oxyhexaster, × 400; *i*, hemihexactinic oxyhexaster, × 200; *j*, hexactinic oxyhexaster, × 200; *k*, microdiscohexaster, × 400

parts of the body. They are bowlike and of nearly the same breadth throughout, with conically pointed and microtuberculated ends and without central swellings or knobs. The shorter and broader diactins, which are mostly isolated, are smooth at the center or, at most, with an annular swelling there; their ends are always roughened and rounded or conically pointed.

The hypodermalia are mainly large oxypentactins (fig. 8, *b*) with rather strong rays, among which the diactinic forms are intermixed. The former spicules vary somewhat in size. The paratangentials may be 180μ to 1,320μ or more long, and the straight unpaired proximal ray is always much longer than the paratangentials in the same spicule, measuring 490μ to 2,000μ in length. The rays at the base may attain a thickness of 70μ. The pointed ends of the rays usually are rough on the surface at a short distance from the end. Sometimes the surface is roughened all over, caused by their being densely covered with tiny microtubercles and lined with a few distinct straight striations. These pentactinic hypodermalia occur singly at the centers of the starlike texturings of the sponge surface. The radiating texture of the surface is formed by the paratangentials and by the slender diactins, described below, which help to support the dermal layer. The diactins, which occur either singly or together with the paratangentials of the oxypentactins forming the small bundles, are distinguished by two forms. One, less frequently found, is the shorter and broader diactin and is smooth at the center or, at most, with an annular swelling; its ends are always roughened and conically tapered or rounded to a point.

The dermalia are slightly rough pentactins (fig. 8, *c*), occasionally stauractins (fig. 8, *d*). The rays, measured from the center, average 150μ long and 12μ thick. The unpaired ray is somewhat shorter, measuring 75μ to 145μ in length. If they taper outward, it is only slightly. The ends are rounded or conically pointed. Not infrequently the pentactinic form, in which the unpaired ray is always directed proximad, shows an indication of the sixth distal ray in the form of a knob. The paratangential cross is usually straight and not convex. Seen from the surface, the delicate dermal latticework presents irregular meshes, though in places these tend to assume a regular quadrate arrangement. Near the oscular margin the latticework may be disturbed, forming a very irregular arrangement.

The gastralia are rough hexactins (fig. 8, *a*) with six long and more sharply pointed rays. The paratangential ray is 165μ to 220μ long; breadth at base, 20μ. All the six rays in the same spicule may occasionally be nearly uniform in length, though usually the distal ray is much shorter, measuring 120μ to 210μ, and the free proximal ray much longer, measuring 300μ to 340μ. The microtubercles are more pronounced on the distal parts of the six rays. They are sometimes entirely absent on the basal parts and on the central node of the rays. All the six rays are very gradually tapered distally and sharply pointed at the ends. Frequently the proximal ray (in the case of its ray measuring twice the length of the distal ray) is slightly curved laterally toward the proximal end.

Oxyhexasters of normal, hemihexactinic (fig. 8, *i*), and hexactinic (fig. 8, *j*) forms are found; the two latter most commonly in the choanosome and in the ectosome, as well as in the endosome. The normally developed oxyhexasters (fig. 8, *g*, *h*) are frequently met within the hypoderm and occasionally in the parenchyme layer. They measure 90μ to 150μ in diameter. From the slender and short principals arise the two slender terminals, moderately widely diverged. In the present species I have not seen the robuster larger oxyhexasters that occur in *A. albatrossi*, but I believe that some might have been discovered, had a more extensive search been made. Frequently, among the gastralia, the somewhat robuster oxyhexasters, mentioned above, are to be found. This oxyhexaster has the same dimensions, but it differs in having broader terminals and a distinctly microtuberculated surface. The hemihexactinic and hexactinic forms, being quite similar to those of *A. albatrossi*, are not described.

The macrodiscohexaster (fig. 8, *f*) is very much like that of *A. albatrossi*, except that it is perceptibly smaller in diameter. It averages 450μ in diameter and is provided with a round central sphere measuring 40μ to 45μ in diameter.

The microdiscohexaster (fig. 8, *k*) is of two forms. The larger one is rare in the dermal layer, while the smaller one is usually present in the choanosome and in the ectosome, as well as in the endosome. The former is essentially similar to the macrodiscohexaster known to occur in *A. mitsukurii*, but has a somewhat shorter diameter. It measures 75μ to 80μ and is fairly well supplied with terminals, which are generally straight and uniformily thick throughout their length. The terminal disks are small, and each is furnished with six or more minute marginal teeth.

The smaller microdiscohexaster measures 32μ in diameter. I have found this form on the whole sparsely distributed in the ectosome and in the endosome as well as in the choanosome, though exceedingly rare in the latter. The principals are slender and form a cross, measuring about 8μ in axial length. The terminals number six to eight and measure 12μ to 13μ in length. In the endosome, this microdiscohexaster usually attains a diameter of 36μ to 40μ. The terminals are also longer, measuring 16μ in length.

I have always found the structure of the basidictyonal plate of this species to be thick. The beams of this plate are entirely smooth and look quite different from those of *A. albatrossi*, and the meshes are much longer than in the latter.

Remarks.—The other smaller specimen is a vaselike form with a somewhat narrower inferior part of the body. The height and the

broadest part of the body are nearly the same as those of the type, but the osculum is somewhat oval in form, measuring 67 mm by 45 mm.

The species here described as new is unquestionably a very near relative of *A. schulzei* Ijima and *A. albatrossi*, new species. It can scarcely be said to differ from these species so far as the categorical forms of the spicular elements are concerned; but in the details of the characters I find in all individuals referred to it certain constant peculiarities that I think may be considered to be of sufficient specific value.

AULOSACCUS FISSURATUS SHIMUSHIRENSIS, new subspecies

A tolerably large fragment (holotype, U.S.N.M. No. 22046) was obtained from a depth of 229 fathoms southeast of Shimushir Island, Kuriles (Station 4803).

Spiculation.—The hypodermalia and hypogastralia are pentactins and diactins. The pentactinic forms appear frequently and are not so great in size. They are provided with paratangentials 130μ in length and with an unpaired proximal ray 680μ to 2,500μ long. The surface of the rays is sparsely microtuberculated all over. The rays taper slightly toward the rounded or conically pointed ends, the surface of which is not so prominently tubercled as that occurring in other members of the genus. The diactins are generally 20μ in breadth and are less than 180μ to 300μ in length. They taper very slightly toward both conically pointed ends; the surface is sparsely tubercled. The center of this spicule is frequently marked externally by a conspicuous swelling.

The parenchymalia are all slender diactins in loose, feltlike arrangement or grouped together into moderately thickened bundles. The principalia may attain a length of 9 mm or more and a breadth of 45μ at the middle; they taper gradually toward the rough and sharply pointed ends.

The dermalia are predominantly stauractins in which the atrophied fifth ray is frequently indicated by a gentle swelling on the distal side of the paratangential cross. The axial length measures 170μ to 200μ and is 8μ to 12μ thick at the base. For the greater part of their length they maintain a nearly uniform thickness. Besides this form, occasionally they are represented by pentactinic forms. The paratangential rays, as measured from the spicular center, are 75μ to 100μ long, and an unpaired proximal ray measures 92μ long and 5μ broad at the base. The thickness of all the rays is nearly the same, but decreases very slightly toward the rounded tips. Their

surface is entirely rough, the roughness being uniformly distributed on the entire surface.

The gastralia consist chiefly of rough hexactins. The paratangentials mostly measure 70μ long from the spicular center and 8μ thick at the base. The distal ray is nearly as long as, or somewhat longer than, the paratangential of the same spicule, while the proximal ray is usually longer, 105μ to 120μ in length. The rays taper perceptibly toward the conically pointed end; their entire surface is quite uniformly rough.

The hexaster, the oxyhexaster, and hemihexactinic forms are of frequent occurrence in all parts of the entire stock. Their axial length varies from 60μ to 80μ. The very thin and delicate terminals of the normal oxyhexaster are about 1μ thick at the base and diverge widely; the principals are distinct and thick. The hemihexactinic form is robuster, measuring 100μ in diameter; and the terminals are stronger and the roughness is more pronounced. It occurs mostly in the parenchyme, intermingled with the normal oxyhexaster and is more numerous than the latter.

The macrodiscohexaster shows a sunlike appearance, nearly like that occurring in other members of this genus. It varies in diameter from 680μ to 850μ. The axis of the central sphere measures 34μ.

The microdiscohexaster shows two kinds; the larger one is nearly similar to that occurring in *A. mitsukurii* Ijima and measures 80μ in diameter, with straight, strong terminals and with distinct principals 10μ long. The smaller one shows a delicate structure with a diameter of 40μ to 50μ, nearly the half of the former. It occurs chiefly in the dermal layer.

Remarks.—Our new subspecies closely resembles *A. fissuratus* in general spiculation, but differs from it in having a larger macrodiscohexaster and in the appearance of the microdiscohexaster.

AULOSACCUS ALBATROSSI, new species

FIGURE 9; PLATE 5, FIGURE 3

The larger, complete specimen A (holotype, U.S.N.M. No. 22111), upon which I base this description, is exquisitely vaselike, being broadest in the upper fourth of its length and gradually narrowing. The total length is 182 mm; greatest breadth, about 120 mm. The osculum is nearly circular, with a diameter of approximately 45 mm. The wall in the middle of the entire body is 12 mm thick; in the oscular margin, 2 mm. The greater part of the dermal skeleton has fallen off. Where it is preserved it shows a delicate dermal layer, of which the latticework is perceptible with the naked eye. The parenchymal mass, exposed to the eye on the ouside, presents as the re-

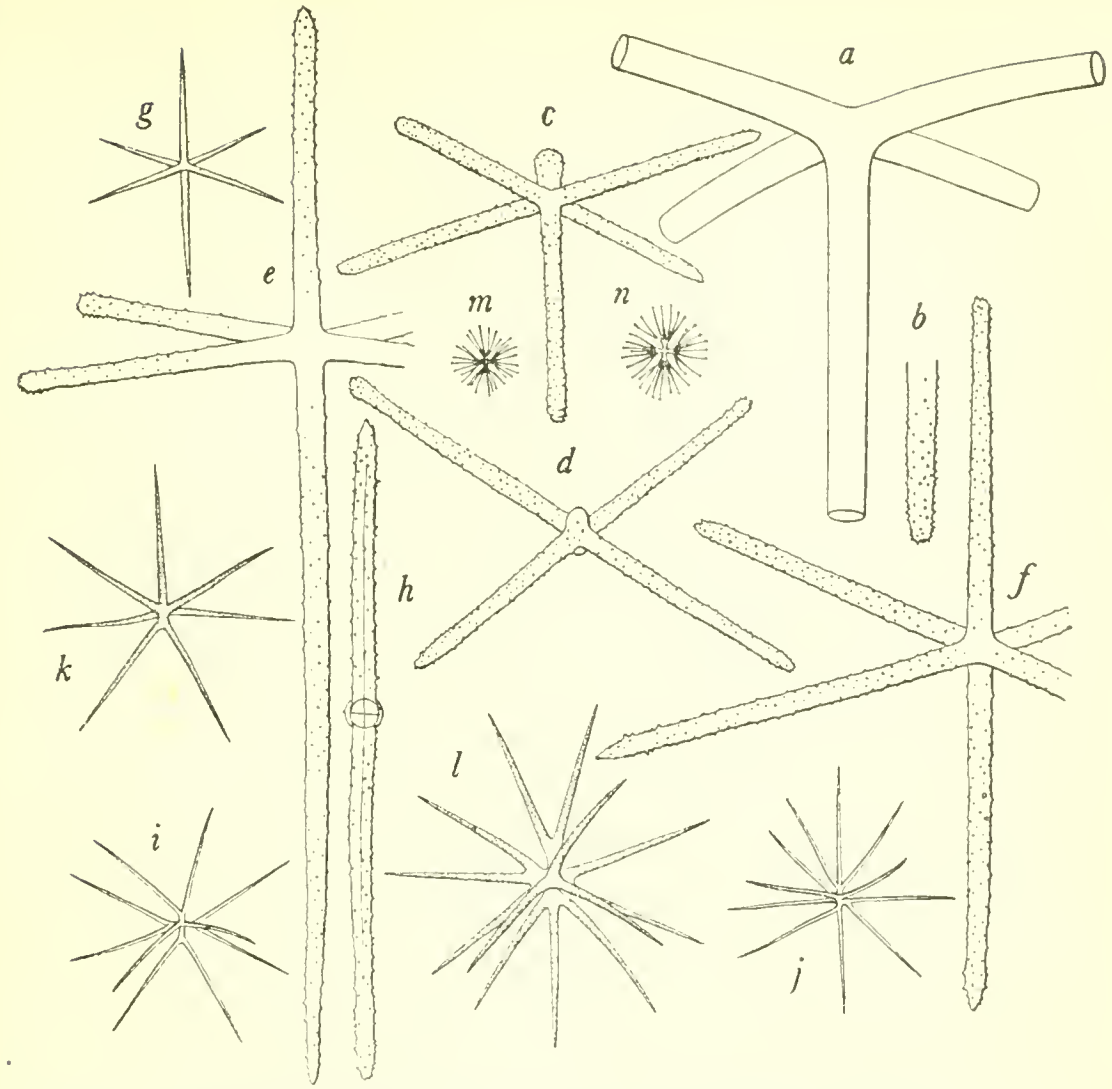


FIGURE 9.—*Aulosaccus albatrossi*, new species: *a*, Hypodermal pentactin, × 100; *b*, proximal part of hypodermal pentactin, × 100; *c*, dermal pentactin, × 200; *d*, dermal stauractin, × 200; *e*, gastral hexactin, × 200; *f*, gastral hexactin, × 200; *g*, small gastral hexactin, × 200; *h*, dermal diactin, × 200; *i*, small oxyhexaster, × 250; *j*, small oxyhexaster, × 320; *k*, hemihexactinic oxyhexaster, × 320; *l*, large oxyhexaster, × 320; *m*, microdiscohexaster, × 320; *n*, larger microdiscohexaster, × 320

sult of abrasion a curly appearance. The gastral surface is well preserved. It is lined all over with a continuous layer of the delicate endosomal skeleton.

TABLE 20.—*Record of specimens of* Aulosaccus albatrossi

Specimen	Collected at—	Number and description
A	Station 4797, near Petropavlovsk, 682 fathoms	One, large, complete.
B	do	One, small, represented by large pieces broken from superior region.

Spiculation.—The hypodermalia are pentactins (fig. 9, *a*, *b*) and diactins. The former show essentially the same character and ar-

rangement as in *A. fissuratus*. In general they occur singly and not in groups, the manner of arrangement being typically as described below. The starlike texture of the sponge surface is mainly formed by this pentactin, situated centrally with the diactins running along its paratangentials and entering with them into the support of the dermal layer. The pentactins are comparatively large, with rather strong rays. They are infrequently supplied with a bosslike rudiment of the distal ray, the end of which is strongly beset with sharply pointed microspines. The paratangentials may be 180μ to 1,045μ long and the unpaired proximal ray 500μ to 1,700μ long. The rays at the base may attain a thickness of 45μ. The conically pointed ends usually show a tuberculated surface. The diactins are generally 20μ to 30μ in breadth at the center and less than 3½ mm in length. They quite agree in appearance with the similarly sized hypogastralia, except for the fact that the spicular center is often, but not always, externally marked by an inconspicuous annular swelling.

The parenchymalia are all slenderer and longer diactins than those of the hypodermal and hypogastral layers. They are usually grouped together into curled, ill-defined bundles. The principalia may attain a length of 3 mm or more and a breadth of 30μ at the middle; they are of nearly the same breadth throughout and smooth on the surface except for the conical, tuberculated ends.

The dermalia are nearly the same as those of *A. fissuratus*. They are predominantly pentactins and occasionally stauractins. The rays of the pentactins (fig. 9, *c*), as measured from the spicular center, are 110μ to 165μ long and 8μ to 12μ broad at the base. Their surface is completely rough, the roughness being most pronounced near the conically pointed end. They are also commonly furnished with a bosslike rudiment of the distal ray. Stauractins (fig. 9, *d*) are only slightly rough all over. Their axial length is from 280μ to 450μ. The rays taper perceptibly toward the rounded or conically pointed tip and are almost uniformly thick; at the middle they are 8μ to 12μ thick. The meshes of the dermal latticework, which may be composed of pentactins and stauractins, are fairly regularly quadrate, averaging 143μ in length of sides. Seen under the microscope the dermal latticework is not regularly meshed throughout, especially on the dermal membrane of the oscular margin.

The gastralia are predominantly rough hexactins (fig. 9, *e*, *f*). The paratangentials usually measure 155μ to 190μ in length and 15μ to 18μ in thickness at the base. The distal ray is nearly as long as, or somewhat shorter than, the paratangential in the same spicule, while the proximal ray is generally much longer; it may be 330μ in length. Sometimes in the same spicule these rays are subequal, but often there is a high degree of variation in the length of the

distal or proximal ray. The rays are nearly uniformly broad through their length toward the conically pointed and microtuberculated end. These hexactins, being single or two or three in a group, also form a regular quadrate latticework, the length of which is nearly the same as those of the dermal layers or 110μ to 145μ. Besides these large hexactins, there occasionally occur small and delicate hexactins (fig. 9, *g*), which may be younger or not fully developed, with lengthened paratangentials, 80μ; distal ray, 75μ; and proximal ray, 90μ.

In this specimen I have occasionally found paratangentially disposed, diactinic dermalia (fig. 9, *h*) and diactinic gastralia. The manner of their occurrence in company with the stauractinic or pentactinic form in the ectosome and with the hexactins in the endosome leaves no doubt as to the legitimacy of considering them to be dermalia and gastralia. They seem to be linked to the hypodermalia and the hypogastralia by means of intermediate forms. Their presence in the species seems to be nearly constant.

Of the hexasters, the oxyhexaster (fig. 9, *i*, *j*, *k*) is of frequent occurrence in the endosome and the ectosome, as well as in the choanosome. The oxyhexaster exhibits the normal oxyhexaster as well as hemihexactinic and hexactinic forms. The normal oxyhexasters may be distinguished as of two kinds, the smaller one (fig. 9, *i*, *j*) is usually present in the ectosome and in the endosome of the superior region of the entire stock, while the larger one (fig. 9, *k*) seems to occur in the parenchyme of the inferior basal regions. They differ in respect to both size and general appearance. The former is comparatively small and of a delicate appearance, with a diameter of 120μ to 130μ. From each exceedingly short and slender principal arise two or three thin, straight terminals, the surface of which is rather sparsely tuberculated. The latter oxyhexaster is larger, with much stronger terminals, measuring 76μ in length. The principals are usually fairly long and broad, 8μ at the base. The number of terminals to a principal is usually two or three. The diameter is 150μ to 160μ. Its entire surface is strongly tuberculated.

Hemihexactinic and hexactinic forms (fig. 9, *k*) are of frequent occurrence. In shape and size they quite agree with those of *A. schulzei*.

The macrodiscohexaster in this species is somewhat smaller than that of *A. schulzei*, usually measuring 250μ to 650μ in diameter, about half that of the latter species. The central sphere measures 35μ to 48μ in diameter. The terminals are delicate, slender, rodlike, and quite smooth-surfaced. The terminal disk is somewhat conically convex on the outer side. The margin shows a row of numerous small teeth. This spicule occurs usually in the hypoderm and in the dermal membrane, as well as occasionally in the parenchyme.

Microdiscohexasters (fig. 9, *m*, *n*) are of two kinds, namely, the larger, which usually occurs in the hypodermal region, and the smaller, which is found commonly everywhere, in the endosome, ectosome, and choanosome. The larger one measures 50μ to 56μ in diameter and is frequently somewhat better supplied with terminals (8 to 12) than the smaller. Terminals measure 16μ to 20μ long, are generally slightly curved inward distally, and are nearly uniformly thick throughout. The terminal disks are small and are furnished with minute marginal teeth. The principals are perceptibly broad and form a cross 10μ to 12μ in axial length. The common, smaller microdiscohexaster is comparatively small, measuring 32μ to 40μ in diameter. It is a very delicate form and usually occurs everywhere, except on the ectodermal region. In some places in the basal region of the entire stock it is more abundant than elsewhere. The principals are slender and form a cross 8μ to 10μ in axial length. Their outer end shows a disklike expansion from which slender terminals arise, 12μ to 16μ in length.

I have always found the basidictyonal plate to be fairly thick and very uneven. The irregularly contoured beams are sparsely microtubercled. The meshes are very small and roundish, oval, or irregular in shape.

AULOSACCUS SCHULZEI Ijima

Aulosaccus schulzei IJIMA, Zool. Anz., 1886, p. 252; Annot. Zool. Japon., vol. 2, p. 51, 1898; Journ. Sci. Coll. Imp. Univ. Tokyo, vol. 18, art. 7, pp. 110–117, pl. 8, figs. 26–28, pl. 9, figs. 1–12, 1904.

A single fairly large specimen of *A. schulzei* was collected southeast of Shimushir Island, Kuriles, at a depth of 229 fathoms (Station 4803). It is exquisitely vasiform, and 87 mm broad at the lower end. The greatest breadth is about 57 mm. Above the broadest part of the body the wall curves in more or less to terminate in the thin oscular margin, which in this specimen is much injured. The osculum is irregularly circular, with a diameter of approximately 34 mm. The thickness of the wall in the middle of the upper half of the sponge is 5 mm; in the middle of the lower half, about 18 mm. The greater part of the dermal skeleton has fallen off; the parenchymal mass exposed by abrasion presents a curly appearance. The gastral surface is quite well preserved, but most of the delicate endosomal skeleton has also fallen off.

The normal oxyhexaster, which is absent in the type specimens, appears intermingled with the hemihexactinic and hexactinic forms. It measures 135μ in diameter and its center is swollen to form a globular node. The terminals, generally two or occasionally three in number, arising from each principal are slender and rough. They seem to be rather brittle near the base, as their fragments are found in abundance in the soft parts.

The gastral hexactins, though somewhat shorter, are much more robust than those of the type specimens, measuring mostly 12μ to 15μ broad at the base. The roughness of the surface, caused by the existence of microspines, is also much more pronounced.

Remarks.—The present species somewhat resembles *A. fissuratus shimushirensis* from the same station in the essential characters of spiculation; but differs from it by the entire absence of the larger microdiscohexaster and by the structure of the normal oxyhexaster, which has the central knob well developed in the present species, while absent in the latter.

AULOSACCUS TUBERCULATUS, new species

FIGURE 10

This species is represented by three fragments (cotypes, U.S.N.M. No. 22122), which may belong to the upper portion of the same sponge (two fragments preserved in the same bottle are larger than

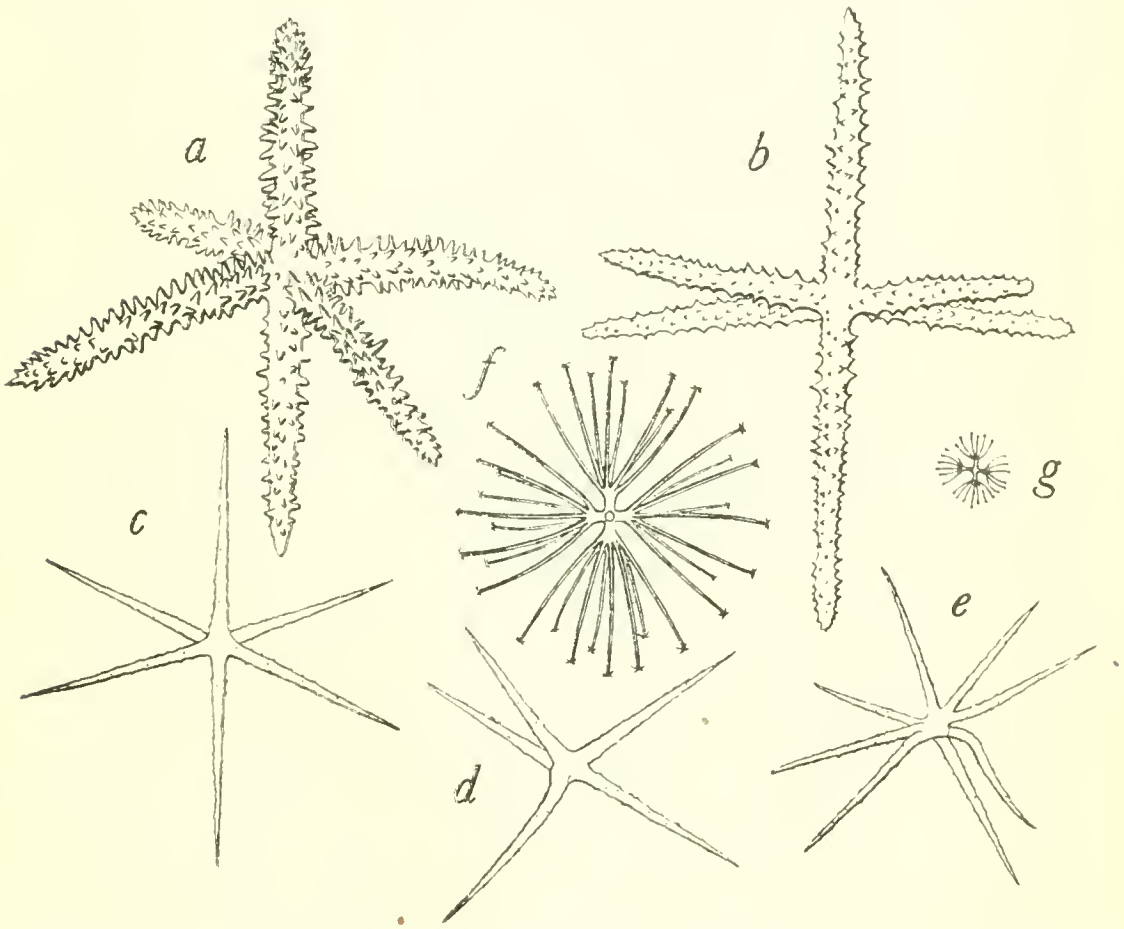


FIGURE 10.—*Aulosaccus tuberculatus*, new species: *a*, Dermal hexactin, × 250; *b*, gastral hexactin, × 250; *c*, hexactinic form, × 500; *d*, hemihexactinic form, × 500; *e*, hemihexactinic form, × 500; *f*, macrodiscohexaster, × 500; *g*, microdiscohexaster, × 500

the third in another bottle). They were all obtained from a depth of 244 fathoms, off Bowers Bank, Bering Sea (Station 4769). The greater part of the dermal delicate latticework has fallen off, some

remaining near the marginal parts of the osculum. The incurrent apertures vary considerably in size, measuring 1 mm to 5 mm in diameter, and sparsely scattered with small and large ones intermingling. The excurrent ones are like the former in size and shape. The wall is about 9 mm thick in the middle, becoming gradually thinner toward the oscular margin, where it measures 1 mm.

Spiculation.—The parenchymalia are mainly slender diactins of widely varying sizes, reaching 7 mm in length and 20μ in thickness at the middle. They are sparsely distributed and are infrequently present singly or forming small bundles. The gradually tapering rays are provided with microspines at the end. The slenderer parenchymalia present no features worthy of special mention.

The hypodermalia and hypogastralia are predominantly diactins, which are much stronger and longer than those of the parenchyme, measuring 6 mm in length and 30μ to 50μ in thickness at the center. These spicules usually occur singly, rarely forming bundles, and are more densely distributed than in the parenchyme layer. They are nearly the same breadth throughout, with conically pointed, occasionally distinctly circular, expanded ends, the surface of which is usually microspined. Comitalia are slender diactins, smooth, but with roughened conically pointed ends. The length may reach 3 mm or more and the thickness at the middle 12μ.

The dermalia are rather thick-rayed pentactins, the paratangential rays of which are strongly arched on the dermal plane. Occasionally hexactins (fig. 10, *a*), stauractins, and tauractins are found. In the pentactins, the paratangential, as measured from the central point, is 90μ to 100μ long; the thickness at the base averages 12μ. The rays are very slightly narrowed outward; the tip is rounded or somewhat conically pointed. Their surface is thickly beset all over with well-developed, erect, and conical, or tubercular, prickles, which constitute one of the most striking characteristics of the species, as it does of *A. mitsukurii.* The hexactins and stauractins need no special mention. The quadrate meshes formed by apposed rays of the dermalia measure 100μ to 120μ in length of sides.

The gastralia are prominently stronger and larger hexactins (fig. 10, *b*) than those of the dermal layer, and are rarely pentactins. The rays are somewhat tapering toward the ends; the prickles on the surface are not so strongly and conspicuously developed as those of the dermalia. The proximal ray is the longest of the rays, measuring 120μ to 210μ in length while the distal ray measures 112μ to 128μ. The paratangentials are nearly straight and measure 108μ to 132μ; the thickness at the base averages 10μ. The quadrate meshes formed by the paratangentials of the gastralia usually measure 120μ in length of sides.

The pentactins are much like those in the dermal layer, but the prickles over their surface are not so prominently developed. They rarely occur in this layer. The prominent sixth ray knob is usually found in these spicules, though absent in the dermal pentactins.

The oxyhexaster consists of normally developed oxyhexaster, hemihexactinic (fig. 10, *d*, *e*), and hexactinic (fig. 10, *c*) forms. The former oxyhexasters are not so numerous. They occasionally occur in the ectosome and in the endosome, and far more rarely in the parenchyme. They measure 108μ in diameter. From each exceedingly short principal, there diverge usually two, thin, often slightly strong, obsoletely rough-surfaced, and nearly straight terminals. Frequently the last two forms are found throughout the sponge, being especially abundant in the choanosome. No special mention is made of the hemihexactinic and hexactinic forms. Generally speaking, the central nodes of these spicules are distinct, and the surface of all the rays is rough.

The macrodiscohexaster (fig. 10, *f*) is somewhat smaller than that of *A. mitsukurii*, is nearly spherical in shape, and measures 90μ in diameter. It is not so well supplied with terminals; these are very thin and generally not straight. No more than five terminals arise, not in a circle but promiscuously from the disklike expansion of each very short broad principal. The terminal disks are very small and are furnished with three or four sharply pointed claws. This macrodiscohexaster is found chiefly in the dermal and gastral layers, and frequently quite abundantly in the choanosome.

The microdiscohexaster (fig. 10, *g*) is small, only 28μ in diameter, and spherical in shape. I have found it fairly numerous in the gastral and dermal membranes, but in the parenchyme it is exceedingly rare.

AULOSACCUS SOLASTER, new species

FIGURE 11

This species is represented in the collection by a large fragment (holotype, U.S.N.M. No. 22109) that seems to be the superior part of an entire stock. It was obtained southeast of Shimushir Island, Kuriles, at a depth of 229 fathoms (Station 4804). The osculum may attain 140 mm in size. The body wall is very thick, measuring 30 mm at the inferior region, and becomes thinner toward the oscular margin. It has a yellowish-white color in alcohol.

Spiculation.—The parenchymalia are all slender diactins of variable thickness. Their ends are usually beset with microtubercles and are mostly conically rounded. The diactins occur either singly or combined into long threadlike bundles. In the latter case, they are curled strongly among the parenchymalia, commonly about 1.5 mm thick. These diactins are long, attaining a length of 4.25 mm to

6 mm or more, and are nearly uniformly broad throughout the entire length, measuring 8μ to 20μ at the center.

The hypodermalia and hypogastralia are mainly diactins; pentactins are not found. These hypogastral diactins are broader but shorter than those of the hypoderm. They measure 16μ to 40μ thick at the center and attain a length of 1.37 mm to 2 mm. Sometimes their spicular center shows a gentle annular swelling.

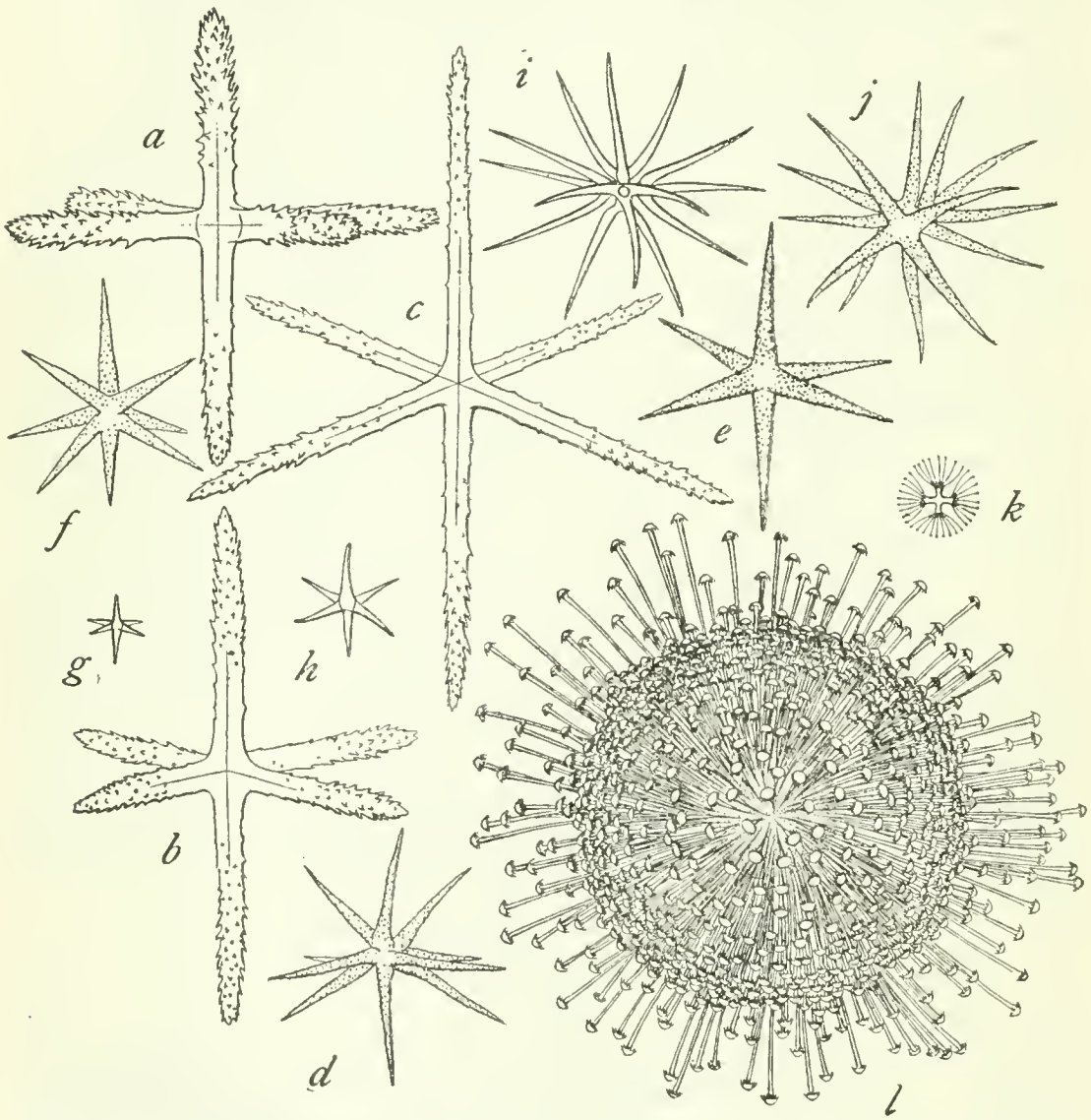


FIGURE 11.—*Aulosaccus solaster*, new species: *a*, *b*, Dermal hexactins; *c*, gastral hexactin; *d*, hemihexactinic form; *e*, hexactinic form; *f*, hemihexactinic form; *g*, *h*, small hexactinic form; *i*, *j*, oxyhexaster; *k*, microdiscohexaster; *l*, macrodiscohexaster. All × 225

The dermalia are all hexactins (fig. 11, *a*, *b*) in which the proximal ray is always longer than any of the other rays. They are of two forms, one being occasionally intermingled with the others. In the first kind, the length of the paratangentials is 100μ to 132μ; distal ray is as long as the paratangentials or somewhat longer; length of proximal ray, 121μ to 154μ; breadth at base of rays, 20μ. The length of paratangentials in the smaller one is 68μ to 73μ; the distal ray is also as long as the paratangentials or somewhat longer; length of

proximal ray, 75μ to 80μ. All the rays taper very perceptibly toward the conically pointed ends. Their surface throughout is beset with conical, erect, or nearly erect microspines, which are sometimes absent on the base of the rays and on the central node. Both of these parts are smooth. The microspines on all rays are strongly directed toward their ends. The meshes of the latticework for the greater part appear quadrate, measuring 110μ to 143μ in length of sides.

The gastralia are also hexactins (fig. 11, *c*), of nearly the same shape as those of the dermal layer, but on the whole much larger. The length of the rays, as measured from the spicular center, is usually 155μ to 180μ. The six rays are nearly the same length, but often the distal ray is shorter than the others, measuring 120μ to 165μ in length. Except at the base of the rays and on the central node, both of which parts are generally smooth, the surface is also beset with numerous microspines similar to or somewhat more weakly developed than those on the dermalia. Stauractins are rough near the ends and either nearly plane or slightly arched. They are of rare occurrence among the gastralia. The rays, perceptibly tapering toward the rounded tip, are nearly all uniformly thick, though sometimes slightly swollen at the center.

Oxyhexasters are commonly represented by hexactinic forms, and somewhat less frequently by hemihexactinic and normal forms. The former two are abundantly present in the hypodermal, hypogastral, and parenchymal layers, especially the hexactinic form, which is much commoner everywhere. Two forms of normally developed oxyhexasters are occasionally found in the endosome and in the choanosome. In the endosome, the delicate oxyhexasters (fig. 11, *i*) are rarely intermingled with common robuster forms. These robuster normal oxyhexasters (fig. 11, *j*) measure 90μ to 110μ in diameter. Two to four stouter terminals with slightly rough surface, measuring 52μ in length and widely diverged, are attached to the broad principals which measure 6μ in breadth. Hexactinic forms (fig. 11, *e*) are very abundant throughout. They have six broad, strong rays, 45μ to 60μ long, which taper strongly toward the sharply pointed end, measuring 4μ to 8μ at the base. The entire surface is slightly rough and tuberculated, except at the base. Besides this form much smaller hexactinic forms (fig. 11, *g*, *h*) with the surface entirely smooth, occasionally occur, in all probability a partly developed, or younger, form. The hemihexactinic form (fig. 11, *d*, *f*) may be present together with the hexactinic form. They show nearly the same features, with big rays, as those occurring in other members of the genus, measuring 90μ to 100μ in diameter.

The macrodiscohexaster (fig. 11, *l*) shows a regularly spherical form, measuring 230μ to 320μ in diameter. From a central sphere 55μ to 75μ across, there arise numerous straight, smooth-surfaced

terminals, radiating uniformly in all directions. They have a minute terminal disk, the margin of which shows a row of 2 to 14 small teeth. The terminals always appear to have been regularly arranged in their positions and not situated promiscuously as those of *A. schulzei;* they usually radiate uniformly in all directions, forming two circles; the inner circle is always composed of shorter terminals, which stick densely together in great numbers. The longer terminals are arranged sparsely on the outer circle. This spicule is very common in the gastral membrane and fairly so in the endosome and the choanosome, but is not found on the dermal membrane. This can easily be verified with a hand lens.

The microdiscohexaster (fig. 11, *k*), of a delicate nature and with a diameter of 40μ to 45μ, is common in the parenchyme, hypoderm, and hypogastral layers. It is spherical in shape and provided with exceedingly fine terminals 10μ to 12μ long. The principals are noticeably broad and form a cross about 18μ in axial length. Their outer ends do not show a distinct disklike expansion but become somewhat broader than the middle of the principals, and in the central part they are weakly spherically swollen.

AULOSACCUS PINULARIS, new species

A single specimen in the collection (Station 4790) has served as the type of this new species (U.S.N.M. No. 22112). In general appearance, this sponge resembles *A. schulzei* Ijima from Sagami Sea. It is exquisitely vaselike, broadest in the upper third of its length, and gradually narrowed below. The total length of the stock is 135 mm; greatest breadth, about 85 mm. Above the broadest portion, the wall curves in more or less to terminate in a much-injured, thin, oscular margin, which may have flared out slightly. The osculum is nearly circular, with a diameter of approximately 55 mm. The wall in the middle of the upper half is 10 mm thick; in the middle of the lower half, 19 mm. The greater part of the dermal skeleton has fallen off. Where preserved it shows an exceedingly delicate dermal layer supported below by fine hypodermal strands that intersect one another at various angles. The parenchymal mass, exposed by abrasion, presents a somewhat curly appearance. The apertures to the incurrent canals are medium sized or smaller.

The gastral surface is well preserved. It is lined throughout with a continuous layer of the delicate endosomal skeleton. This consists of a small and irregularly meshed latticework of thin hypogastral strands bearing gastralia, which, without forming a continuous layer by themselves, leave the hypogastral meshes more or less freely open. The surface features of *pinularis* are largely common to all species of the genus. The excurrent canalar apertures are

all small in the upper part of the gastral cavity. Lower down, larger ones become interspersed. The openings of all are covered by the sievelike layer of the gastral skeleton.

Spiculation.—The parenchymalia are all slender diactins either in a loose feltlike arrangement or grouped together into moderately thick, ill-defined bundles. The principal may attain a length of 6 mm or more and a breadth of 52μ at the middle; it tapers gradually toward both ends, which are rough and conically pointed. All sizes down to comitalia only 12μ in thickness are to be found. All the smaller diactins have roughened ends, which taper very slightly to a conical tip, measuring 8μ broad.

The hypodermalia and hypogastralia are likewise diactins; pentactins are not present. They are generally 20μ in breadth and less than 1.5 mm in length. They quite agree in appearance with similar-sized parenchymalia, except in the fact that the spicular center is often, but not always, externally marked by an inconspicuous annular swelling.

The dermalia are hexactinic pinules, so far as those of the body proper are concerned. The pinular distal ray as a whole is spindle-shaped; it is 110μ to 160μ long and 14μ to 18μ broad in the middle, which is about the broadest part. In this part the obliquely upwardly directed, elongate, conical spines may be as long as 8μ. The rhachis is smooth for a short distance at the base, which is about 8μ thick; its conically pointed, outer end forms the tip of the pinular ray. The remaining five rays are somewhat slender and bluntly pointed at the end. They are beset with small, usually erect prickles, sparingly at the base but more pronounced at the end; length, 110μ to 120μ. The proximal ray is usually slightly shorter than the paratangentials of the same pinule, measuring 105μ to 130μ in length. The fine quadratic-meshed dermal latticework is formed by two to six paratangentials of two to six adjoining pinules lying side by side for nearly their entire length. Here and there, among the dermalia, I have found such forms as may appropriately be regarded as early stages in their development. They are much smaller, slender-rayed hexactins, in which either there is no distally directed ray or it is but little differentiated from the other rays, being nearly as prickly as these.

The gastralia are pinularlike hexactins. The free ray is much longer, 260μ to 300μ long and 8μ to 12μ broad at the base, beset with strong prickles, which are projected obliquely upward and pronounced at the extremity. The remaining five rays are all slenderer and gradually taper toward the conically or sharply pointed end. But frequently one of the paratangentials shows a somewhat pinular-like appearance and is provided with strong prickles at the end.

The distal ray is the smallest and shortest of all, measuring 180μ to 220μ in length and sharply pointed at the end, while the paratangentials are usually somewhat longer and bigger than the distal ray, 200μ to 240μ long.

The oxyhexaster consists of normal oxyhexaster and hemihexactinic and hexactinic forms. The normal oxyhexaster is abundant, measuring 125μ to 160μ in diameter. Two varieties of this spicule can be distinguished from the characters of the ray; both seem to occur together promiscuously. In the one the center is swollen to a globular shape, and the very short principals are somewhat rounded in a knoblike manner. Terminals are slender, mostly rough but occasionally smooth, usually three or four arising from each principal. It seems that this is the more abundant of the two oxyhexaster varieties.

In the other form the terminals are usually two in number and slightly stronger, while the principals are much less distinctly indicated, being in fact quite abortive. Insignificant microtubercles are sometimes seen on the surface of the terminals. They measure usually 110μ to 115μ in diameter.

Hemihexactinic and hexactinic forms are also intermixed with the normally developed oxyhexaster in the choanosome of the sponge body. They measure 120μ to 160μ in diameter. The terminals, which look moderately strong, are about 10μ thick at the base, and their surface is obsoletely rough. The latter occurs usually much more abundantly than the former.

The macrodiscohexaster resembles that occurring in *A. ijimai* (Schulze). It is sunlike in appearance, measures nearly 200μ to 430μ at the axis of the rosette, and is present mostly in the choanosome.

From the end of the principals, which are separated by six hemispherical bosses measuring 45μ to 55μ across, there arise numerous very long and slender terminals, radiating uniformly outward. Terminals are filamentlike, obscurely rough-surfaced, and furnished with a disk at the end, which is somewhat conically convex on the outer side. It measures about 12μ in diameter. The margin shows a row of numerous small teeth.

Microdiscohexasters of spherical shape and 40μ in diameter are not uncommon in or near the endosomal layer. They were occasionally observed in the ectosome also. From a nearly spherical node arise comparatively thick principals, which in length are about one-third the radius of the rosette, each of which carries at the outer end a small disk, usually provided with a central tubercular prominence on the external side. The terminals are very fine and difficult to count, but there are probably not more than 10 to each principal.

Remarks.—This new species resembles *A. ijimai* in essential mode of spiculation but differs from it in the shapes of the dermal and gastral hexactins and the outer feature of the parenchymal oxyhexaster.

BATHYDORUS UNDETERMINED

Here are mentioned three specimens that I have studied but which I prefer to leave unnamed. I provisionally place them in the genus *Bathydorus*. One of them is very small and probably a young specimen in which the characters have not been fully developed. The other two are broken into several fragments, which were preserved in a badly macerated condition.

BATHYDORUS, α species

PLATE 6, FIGURE 2

This is a little specimen collected at Station 4917, about 90 miles west by southwest of Kagoshima Gulf at a depth of 361 fathoms, together with *Sericolophus reflexus* (Ijima). The body is barrel-like in shape, measures 14.5 mm high and 7 mm broad, and is attached to a mass of pebbles. From the body proper arise fine prostal needles of a considerable length, mostly directed obliquely upward and outward. The dermal surface is smooth. The parenchymalia are chiefly diactins less than 12μ thick. Nearly all the surface is smooth; occasionally it is rough at both ends.

The dermalia are predominantly stauractins, the plane of which is usually slightly convex on the outer side. The length of their rays varies from 65μ to 80μ. They are 4μ in breadth at their base.

The relatively strong and slightly tapering rays are entirely rough with distinct but sparse microtubercles. The atrophied rays are entirely absent in the present spicule.

The gastralia are hexactins found in dense but irregular distribution. They do not form a regular latticework. The surfaces of the rays are much more prominently microspined. The paratangentials usually measure 70μ to 80μ in length; the distal ray is shortest of all, while the proximal is 120μ to 180μ long, tapering toward the pointed and curved ends.

The hypodermalia are moderately large pentactins, with their rays gradually tapered toward the conically pointed ends. The paratangentials measure 360μ to 400μ in length and 12μ to 16μ in breadth near the spicular center. The proximal fifth ray is always longer than the paratangential in the same spicule and at times is nearly twice as long. Seen in surface-view preparations, the paratangential crosses are situated for the most part without any regular or "mutual" arrangement, though at places they approach the formation of a quadrate-meshed latticework.

The oxyhexasters are common, but not abundant, in the choanosome, as well as in the subdermal and in the subgastral spaces. They are characterized by rather longer terminals, as compared with the principals, and are slender, quite smooth on the surface, and, though bent at the base, are nearly straight for the rest of their length, and so diverge from one another as to give a spherical shape to the entire spicule. This measures 110μ to 120μ in diameter. Principals bearing less than two terminals probably never occur; there are two or three in most cases.

The only kind of discohexaster present is comparable to the microdiscohexaster of certain other rossellids. It measures only 3.04 mm in diameter. The convex disk at the outer end of each fairly strong principal bears a bunch of numerous and exceedingly fine divergent terminals, each of which ends in a minute terminal knob. The shape of the entire rosette is spherical. In some parts the discohexasters in question were found only occasionally; in other parts of the same specimen they were quite common, occurring near the subdermal or subgastral regions, where they seem to be present in nearly equal numbers to, or are somewhat more numerous than, the oxyhexasters.

The described spiculation seems to come nearest to, and indeed closely resembles, that of *Vitrollula fertilis*. But, as the parenchymal hexactins are lacking, I should prefer not to make a definite specific determination.

An interesting fact regarding the specimen is the presence of certain peculiar small bodies lodged in large numbers among the tissues of the choanosome. Ijima has already noted these in *Staurocalyptus glaber*. To the naked eye they appear as whitish spots of various sizes of about or less than 0.5 mm diameter. Under the microscope the body is found to be a reticular mass of no definite shape, consisting of an irregular rigid framework of microtuberculate beams. The mass is always completely transversed by a few parenchymal diactins of the sponge. These reticular bodies treated of are also like those described by F. E. Schulze from the buds borne on the prostal lateralia of *Rhabdocalyptus mirabilis*.

BATHYDORUS, β species

Several poorly preserved fragments were obtained from two stations: No. 4769 (Bowers Bank, Bering Sea, depth 244 fathoms), and No. 4770 (Bowers Bank, Bering Sea, depth 247 fathoms). As the specimens are macerated and broken into several fragments, it is impossible definitely to determine whether they are identical.

The principal parenchymalia are the rather numerous and elongated bowlike diactins, 160μ to 200μ long, the middles of which are not always externally marked by a swelling. They are practically smooth on the surface, gradually tapering toward both ends.

The smaller parenchymalia down to comitalia only 10μ in thickness are of the usual description. The tips are acuminate, rounded, conical, or mucronate; infrequently they are swollen to a clublike or even a bulbous shape.

Hypodermal pentactins are well developed and show essentially the same characters and arrangements as in common members of *Staurocalyptus*, being isolated or sometimes standing out in small loose groups. Paratangentials do not exceed 4 mm in length; the shaft is longer, measuring up to 7 mm. They are either paratropal or almost regularly cruciate. The surfaces of all rays are quite smooth except at the ends, the surface of which is roughened by densely distributed microtubercles. All the rays are gradually attenuated toward the conically or sharply pointed ends.

The dermalia are rather thick-rayed pentactins, with the unpaired ray directed proximally. Their paratangential rays are in a plane slightly arched on the inside. Occasionally stauractins are found, intermingled here and there with the former spicules. The paratangentials, from the central point, measure 90μ to 100μ, while the proximal unpaired rays are 100μ to 110μ in length. The thickness at base averages 12μ. The rays are slightly narrowed outward; the tip is rounded or somewhat conically pointed. Their surface is thickly beset nearly all over with distinct microspines, which are much more pronounced at the ends. In the stauractins, the rays are somewhat longer, 120μ to 135μ long, also in a plane, slightly arched on the inside. The aborted rays of both spicules are at most represented by vestigial bosses.

The gastralia are strong and long hexactins, for the most part fully twice as long as the dermalia. The rays are somewhat more tapering toward their ends; the microspines or microtubercles on the surface are in like manner moderately developed. Length of rays: Paratangentials, 130μ to 180μ; distal ray, 130μ to 160μ; proximal, 180μ to 210μ. The rays at the base are somewhat slender, averaging 8μ thick.

The oxyhexasters consist of three kinds, namely, normal oxyhexaster, hemihexactinic, and hexactinic. The normally developed oxyhexaster occurs less abundantly in all parts, but it is especially plentiful near the ectosome. Its diameter is 90μ to 135μ. There is no appreciable difference in appearance between those in the periphery and others situated more deeply in the wall. From each exceedingly short principal two or three rather thin, obscurely rough-surfaced, and nearly straight terminals diverge. Occasionally the principals appear distinctly circular-knoblike in shape, measuring 10μ in size. Oftener the oxyhexasters seem to be hemihexactinic and occasionally quite hexactinic forms. In the hemihexactins, the diameter meas-

ures 80μ to 110μ, while in the latter it is 150μ to 210μ across. Of the hemihexactinic forms, the total number of terminals to the entire rosette may vary from 5 to 11, indicative in each case of the number of the principals that remain biterminal and of those that become uniterminal.

Much less numerous than the oxyhexasters are the microdiscohexasters, which vary considerably in size, measuring 30μ to 60μ in diameter. They are thinly distributed both subdermally and subgastrally, though they seem to be much commoner in the gastral regions. The shape is spherical; the terminal disk is minute, not pinheadlike, but is a small laterally expanded disk.

Genus ACANTHASCUS F. E. Schulze, 1886

ACANTHASCUS PACHYDERMA, new species

FIGURE 12; PLATE 5, FIGURE 1

This species is based on a single complete specimen (holotype, U.S.N.M. No. 22123) collected from a depth of 229 fathoms southeast of Shimushir Island, Kuriles (Station 4803). It has an elongated barrel shape. The lower end is somewhat contracted into a stalklike base, 27 mm broad, gradually becoming broader toward the upper end. The total height is 88 mm; the greatest breadth near the anterior end of the body is 39 mm. The osculum at the superior end of the stock is elliptical in form, the greater diameter being 18 mm and the smaller 11 mm. The deep gastral cavity extends almost into the stalklike base. The body wall in the middle is as thick as 10 mm and is of nearly the same thickness toward the simple-edged oscular margin.

The external surface is quite smooth, but shows indications of a number of small and large tubercles, measuring 1 mm to 3 mm across in the lateral side of the entire stock. The more prominent of these tubercles may have been 2 mm in height. The wall is firm, on account of the closely interwoven state of the hypodermal spicules as well as of the small size of the canals. Nearly all the irregularly quadrate-meshed dermal latticework is torn off. It partly covers the incurrent apertures, which are less than 2 mm in diameter. Their apertures are irregularly placed and are indistinctly visible through the latticework. The gastral surface appears smooth, but the excurrent apertures may be distinctly observed, 2 mm to 3 mm in diameter, distributed irregularly.

Spiculation.—Principal parenchymalia are fairly long diactins, 4.5 mm or more in length and up to 20μ in thickness at the middle. They taper gradually toward the conically pointed or rounded ends, the surface of which is much less strongly roughened than that of

the middle part of the spicule. There are frequently much slenderer, curved diactins, forming small bundles close together. At any rate the parenchymal diactins are somewhat slender in form and are

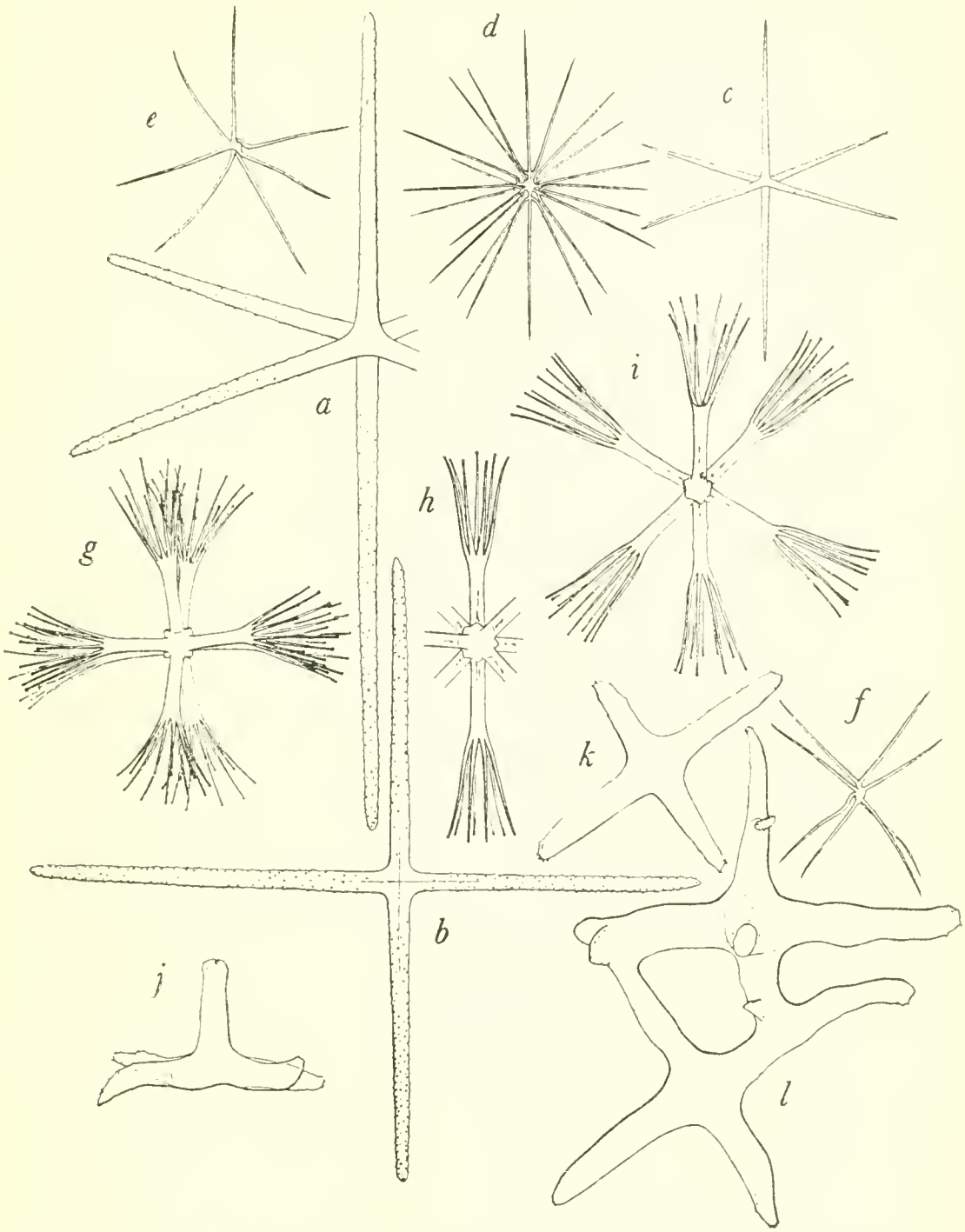


FIGURE 12.—*Acanthascus pachyderma*, new species: *a*, Gastral hexactin, × 225; *b*, dermal stauractin, × 1,875; *e*, hexactinic form, × 225; *d*, oxyhexaster, × 375; *e*, oxyhexaster (form A), × 375; *f*, oxyhexaster (form B), × 375; *g–i*, discoctasters, × 375; *j–l*, basalia, × 225

distributed much more irregularly and sparsely than those of the hypogastral layer.

Hypodermal diactins are loosely arranged and do not form strands, as do those occurring in the hypogastral layer. They are wider but

usually shorter than hypogastral diactins. They may attain a length of 170μ and are 16μ wide at the middle. The width is nearly the same throughout, slightly tapering toward the rounded ends, the surface of which is roughened by microspines. The diactins are distributed densely, forming a thickened firm layer 1 mm in thickness. Occasionally diactins that have a central protuberance appear. They are 550μ in length and 20μ to 24μ wide at the center. The surface, except that of the central protuberance, is roughened sparsely.

Hypogastralia also consist of diactins, which are arranged in loose or compact bundles of variable length, distributed much more sparsely and irregularly. They are generally slenderer than those on the hypodermalia but much longer than the latter. They taper very gradually toward both ends, the tip being either simply acuminate or conically pointed. Subterminally the surface is sparsely roughened by microspines. Occasionally in the diactins the center shows a gentle swelling, but more frequently four protuberances, like those occurring in the hypogastralia.

Dermalia are predominantly stauractins (fig. 12, *b*), sparsely rough all over, nearly plane, not arched; axial length, 280μ to 360μ. The rays taper perceptibly toward the conically pointed or rounded tip, or are nearly uniformly thick. They are sometimes provided with a central prominence. The thickness at the middle averages 8μ. Occasionally among the dermalia there are found pentactinic forms in which the proximally directed, unpaired ray is somewhat shorter or longer than the paratangentials, 140μ to 200μ in length. The surface is also sparsely roughened. Besides these common stauractins and pentactins, a smaller and very slender stauractin occasionally occurs. Its rays are very slender, measuring 2μ to 4μ wide at the middle, and are sharply pointed at the ends.

Gastralia are rough large hexactins (fig. 12, *a*), irregularly scattered. The rays taper slightly outward. The microtubercles on their surface are neither numerous nor strongly developed, so that the roughness on the surface is not prominent. The proximal ray measures 212μ in length; the distal ray 190μ, and the paratangentials 175μ.

Oxyhexasters consist of normal oxyhexaster (fig. 12, *d*), hemihexactinic, and hexactinic forms, the last of which is rarely found in the parenchyme. The normal oxyhexaster may be present in two forms, designated A and B, differing in total size, in the slenderness of the terminals and in the shape of the principals. The variety B (fig. 12, *f*) frequently occurs in the dermal and gastral layers, as well as abundantly in the parenchyme, intermingled with the other variety. It measures 140μ to 155μ in diameter and has a distinct globular node and short principals, rounded in a knoblike man-

ner at the ends. Slender, sparsely roughened terminals, generally two or three in number, arise from each principal. They are apt to be broken off near the base. It seems that this form is the more abundant of the two varieties.

In variety A (fig. 12, *e*) the terminals are considerably stronger, being nearly 5μ in thickness at the base, while the principals are much less distinctly indicated, being in fact quite abortive. They are obscurely rough all over. There are generally two terminals to each principal, never more, rarely only one. The principal measures 172μ in diameter. The hexactinic form (fig. 12, *e*) is somewhat larger, measuring 190μ in diameter and having roughly surfaced terminals which are pointed at the ends. The hemihexactinic forms are somewhat smaller, measuring about 150μ across, and are provided with delicate and slender terminals. These two forms are distributed fairly abundantly, intermixing with the normal oxyhexasters in the parenchyme.

Discoctasters (fig. 12, *g*, *h*, *i*) are common in all parts, being especially abundant near the ectosome and the endosome. They measure 180μ to 220μ in diameter. The principals are 8μ thick at the base, fairly slender, and 40μ long. The number of principals projecting from the spicular center varies from 6 to 8; in most cases 6 and less often 8, of which 6 protrude laterally and the remaining 2 forward and backward. In other cases, the pairs protrude from the spicular center in all directions. The number of terminals in a tuft is 5 to 12, each with a minute terminal disk. They are usually somewhat longer than the principals, measuring 56μ in length, with their tuft narrow at the base and slightly expanded distally. This discoctaster has a distinct quadrangular humplike prominence measuring 20μ in diameter on the central node. The terminal disk is very small and pinheadlike. The microdiscohexaster is found abundantly in the parenchyme. Spherical in shape, it is similar in appearance and in structure to that of all members of the genus, so that a special description appears unnecessary. It measures 40μ in diameter.

The basidictyonal plate (fig. 12, *j*, *k*) is represented by a fairly large-meshed siliceous reticulum, the beams of which may measure 20μ broad at the widest part and have a smooth surface. In isolated instances much more robust pentactins are found (14μ to 18μ in breadth, and paratangentials 32μ to 48μ in length), and oftener stauractins having nearly the same or a greater axial length. It is not difficult to make out that the foundation of this plate is formed of the stauractins and pentactins above mentioned, which are directly as well as synaptically fused together.

ACANTHASCUS CACTUS F. E. Schulze

Acanthascus cactus F. E. Schulze, Abh. kön. preuss. Akad. Wiss. Berlin, 1886, p. 49; Rep. Voy. *Challenger*, vol. 21, p. 148, pl. 57, figs. 1–7, 1887.—Ijima, Annot. Zool. Japon., vol. 1, p. 48, 1897.—F. E. Schulze, Sitz-ber. kön. preuss. Akad. Wiss. Berlin, vol. 26, p. 551, 1897.—Ijima, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 18, art. 7, pp. 140–158, 296, pl. 11, figs. 16–22, pl. 12, figs. 23–37, 1904.

Specimen A expands somewhat superiorly in such a manner as to take on a funnellike shape, as shown in Ijima's Contribution IV, page 142, Figure 6, D. Height, 140 mm. Broadest part of sponge body, 70 mm. Near the basal end it measures 45 mm. As the preserved sponge is extremely compressed laterally, the exact size of the osculum can not be ascertained. It probably measured 45 mm to 65 mm. The wall of this specimen is thicker than in specimen B, measuring up to 6 mm in the middle of the entire stock. The body is nearly completely preserved, lacking a basal attachment and even a basal plate. The sharply apexed conical elevation of the external surface occurs at various but rather wide intervals, measuring about 17 mm high. On the oscular edge there may occur very fine prostal marginalia, which always project singly, without forming small tufts.

In the smaller specimen (B) the lower parts of the entire stock are much more dilapidated. It measures 76 mm high and 60 mm wide at the broadest part of the sponge. The wall in the middle is about 2 mm thick. There are no numerous conical elevations, as in specimen A.

Table 21.—*Record of specimens of* Acanthascus cactus

Specimen	Collected at—	Number and description
A	Station 5088, Sagami Bay, 369 fathoms	One, large, nearly complete.
B	do	One, small, lacking inferior parts of body.

Spiculation.—The prostal marginalia are not distinct, projecting simply from the thin edge of the osculum. They are very fine diactins, measuring about 2 mm long and 0.5 mm thick in the middle, being smooth on the surface with the exception of both ends.

Although the simple hexactins in the parenchyme were not seen by previous observers, they were found occasionally in both specimens. Paratangentials are of nearly uniform length, being 48μ long, and the distal and proximal rays 56μ long, and tuberculated on the entire surface.

As noted by previous authors, the gastralia usually consist of rough pentactins and occasionally of stauractins, but besides these I have

occasionally found rough hexactins having paratangentials of nearly equal length, 90μ to 115μ long and 8μ to 10μ broad at the base, with proximal and distal rays measuring 120μ to 134μ in length.

As regards the occurrence of the abnormality of the oxyhexaster of this species described by Ijima, I have met with a discoctaster in these specimens that represents what seems to be a case of abnormal development. This occurs occasionally in the dermal membrane of both specimens. It measures 72μ in diameter with an irregularly shaped central node 14μ broad, with no indications of the normal principals dividing into more than 30 terminals. Each terminal ends in a very small pinhead.

Genus STAUROCALYPTUS Ijima, 1897

STAUROCALYPTUS RUGOCRUCIATUS, new species

FIGURE 13; PLATE 6, FIGURE 4

A single small specimen of this species (holotype, U.S.N.M. No. 22051) was obtained from a depth of 426 fathoms off Bowers Bank, Bering Sea (Station 4771). The sponge body is a pair of elongated, thick-walled, pear-shaped sacs. From the base the breadth increases somewhat gradually until over mid-height is reached when it decreases rapidly toward the oscular opening. The total height is 46 mm. Near the lower parts it is irregularly shaped and bent inward; the maximum breadth at mid-height is 25 mm. The osculum, which is elliptical in outline, measures 5 mm by 15 mm. The margin is fairly thick and simple-edged. The body wall is thick, decreasing gradually from 8 mm near the base to 2 mm near the oscular margin. Projecting from all parts of the outer surface of the sponge are many long, robust prostalia, forming a definite and distinct fringe at the oscular margin. They are more abundant in the lower portion of the sponge than in the upper. Those projecting directly outward from the oscular margin measure 10 mm to 15 mm in length. The gastral surface is smooth and has numerous evenly distributed circular openings about 0.5 mm in diameter. The diactinic prostals are somewhat weaker needles of various lengths. They project to a free length of 5 mm to 15 mm or more, being directed on the whole obliquely and outward. The pentactinic prostals are of a moderately large size, and may form a gossamer-like covering over the dermal surface. They generally protrude in groups of two or more, but sometimes stand out singly.

Spiculation.—The prostal diactins, which are primarily to be regarded as enormously developed parenchymal principalia, are of various sizes. A small one may measure 10 mm in length, while the larger measure 35 mm long and 170μ thick at the middle. These

spicules are straight and taper perceptibly toward both ends. The outer and inner ends are acutely or bluntly pointed, the entire surface being smooth and not beset with microtubercles.

Comitalia are slender diactins, measuring 20μ, with a smooth surface, except at both ends, where they are roughened by microtubercles. They are broad at the middle and nearly as long as half of the entire length of the prostal diactins.

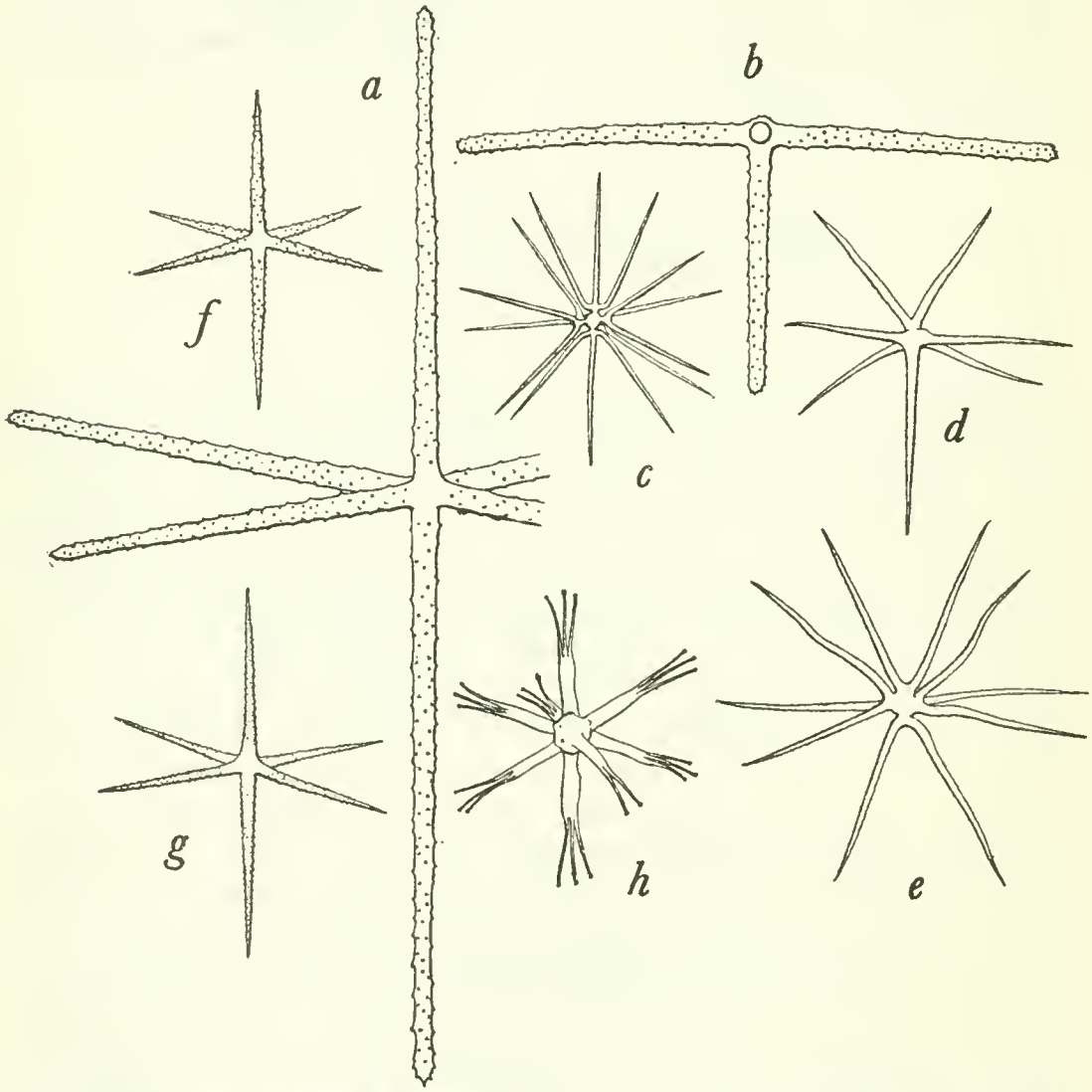


FIGURE 13.—*Staurocalyptus rugocruciatus*, new species: *a*, Gastral hexactin; *b*, dermal pentactin; *c*, oxyhexaster; *d*, *e*, hemihexactinic forms; *f*, *g*, hexactinic forms; *h*, discoctaster. All × 250+

The parenchymalia are composed of large and small oxydiactins, either nearly straight or gently bent in a bowlike manner. They may attain 5 mm in length and 170μ in breadth at the middle. The ends are usually prominently microspined in varying degrees. In some of these diactins, one end is slightly rounded, but most of them are acutely pointed at both ends. The smaller diactinic parenchymalia with 2 or 4 knobs at the middle and 300μ to 400μ in length,

occur in the hypodermal and hypogastral layers. They are microspined on the entire surface, most pronouncedly so at the end. They are frequently smooth near the center.

The hypodermal pentactins are somewhat variable in size, the larger ones usually occurring lower down on the sponge, while the small ones, measuring not more than half the size of the larger ones, are situated near the oscular margin. I have found that the small pentactins are generally arranged in the form of a regular cross. This cruciate arrangement of the paratangentials also occurs rather rarely in the larger pentactins lower down on the sponge. The larger pentactins are usually protruded singly from the lower parts of the sponge surface. The paratangentials, which are generally not quite straight but rather wavy, are 4 mm or more long. The straight shaft or the unpaired proximal ray is always much longer than the paratangential in the same spicule. All the rays of the pentactins are at first smooth or very sparsely rough except near the ends, which are minutely rough. They are so in most of the spicules in the hypodermal situation or in the oscular margin; while the older pentactins present a finely shagreenlike surface throughout the lower parts of the entire stock. The roughness is caused by minute, erect, and sharply pointed processes. The fine shagreenlike surface is caused by the same minute and thickly set processes. The microspines remind one of those on the prostal pentactins of *Staurocalyptus dowlingii* (Lambe). In general, the surface of the rays in the pentactins is more thickly microspined on the paratangentials and more sparsely so on the proximal unpaired ray.

The dermalia are mainly rough pentactins. Exceptionally they may be stauractins, rarely hexactins. The pentactins (fig. 13, *b*) measure 150μ along both the paratangential rays and the unpaired proximal ray, which is somewhat shorter than, or nearly equally as long as, the paratangentials. The thickness at the middle is 8μ. They are straight and taper very slightly toward the rounded or conically pointed ends. All the surfaces of the rays are sparsely roughened. The stauractins are nearly straight on the outside and almost the same size as the pentactins in axial length. The rays are 140μ to 170μ long and 8μ broad at the base. They are entirely rough, and the microtubercles on their surface are more or less prominent. The hexactins are nearly the same as those occurring in the gastralia but are smaller in size.

The gastralia are fairly large hexactins (fig. 13, *a*). All six rays in one spicule may sometimes be of nearly equal length, but more frequently the proximal free ray is the longest and the distal the shortest. The length of proximal ray is 100μ to 250μ; of paratan-

gential rays 80μ to 240μ; and of the distal rays 70μ to 200μ. At the base the thickness averages about 10μ. The rays taper gradually toward the pointed ends and may all be nearly equally rough, on account of microspines, but more pronouncedly so at the distal ends. These hexactins are generally arranged irregularly, and do not form a continuous quadrate-meshed latticework.

The oxyhexasters, occurring in moderate abundance in all parts, are partly normal and partly hemihexactinic and hexactinic forms. In most normal oxyhexasters (fig. 13, *c*) the principals each bear 2 or 3 terminals, so that the total number of terminal points is 12 to 16. Their diameter measures 110μ to 140μ. The terminals are rather strong, measuring about 2μ across at the base, and are straight or wavy and sparsely rough on the surface. The principals are extremely short and often obsolescent. Throughout the parenchyme there are numerous oxyhexasters and hemihexactinic (fig. 13, *d*, *e*) and hexactinic (fig. 13, *f*, *g*) forms, which are seen to be sparsely rough or occasionally densely rough, having numerous microtubercles on the surface and measuring 112μ in axial length. Any one of the principal rays of hemihexactinic form may bear two long, straight or wavy, divergent, sharply pointed terminal rays, thus giving rise to the oxyhexasters, so that all gradations between the 6 and 12 rayed spicules are seen. These several forms are entirely similar to those occurring in *Staurocalyptus dowlingii* (Lambe).

The discoctasters (fig. 13, *h*) are not abundant. They are slender rayed and on the whole small. The diameter is usually 80μ. The central node is plain and very weakly tubercled. The principals are slender, nearly as long as, or much longer than, the terminals. The number of terminals to a principal is frequently three and probably never more than four. They form a very slightly diverging tuft and are nearly straight. On the minute terminal disks the marginal serration is wanting.

Malformed discoctasters, in which one or more primary terminals stand free without fusing with any of the secondary principals, are of occasional occurrence.

The microdiscohexasters are of usual appearance and 50μ in diameter. They are found, mostly in the ectosome and in the endosome, in fairly large numbers though scattered.

The new species, as before mentioned, resembles *Staurocalyptus dowlingii* in outer configuration and in some essential points of spiculation, but differs from it in having a smaller discoctaster and a larger microdiscohexaster.

Genus RHABDOCALYPTUS F. E. Schulze, 1886

RHABDOCALYPTUS BOREALIS, new species

FIGURE 14; PLATE 6, FIGURE 3

As can be seen, this species has passed through my hands in no small numbers. With one exception, all were obtained from the same station. Some were not well preserved, the oscular margin and other parts being damaged. Though these specimens all differ in external appearance, they do show an essential or almost complete agreement in spiculation.

TABLE 22.—*Record of specimens of* Rhabdocalyptus borealis

Specimen	Collected at—	Number and description
A	Station 4772, Bowers Bank, Bering Sea, 344 fathoms.	One, large, lacking parts of oscular margin.
B	do	One, large, broken upper parts of entire stock.
C	do	One, large, complete.
D	do	One, fairly large, complete.
E	do	Do.
F	do	Do.
G	do	One, small, lacking the greater upper part of one side of entire stock.
H	Station 4769, Bowers Bank, Bering Sea, 244 fathoms.	One, small, complete.

Specimen A represents a belt-purselike form, totally closed at the entire lower end and lacking a special attachment of the entire stock. The specimen is not well preserved, being somewhat dilapidated in parts on the oscular edge. It is expanded outward, all around, and is bent backward. The major and minor diameters of the osculum are 70 mm (exclusive of the flaring rim of about 15 mm in breadth and measured on the inner margin of the osculum). The thin oscular edge is of a finely granular or densely feltlike appearance. The height is 75 mm. The broadest part measures 90 mm and is located below the middle of the sponge body. The wall is 1 mm thick in the middle of the body; lower down it is as much as 1.5 mm thick, and at the margin of the oscular rim as little as 0.8 mm.

Specimen B is very different. It represents a vaselike, or funnellike, form; total height, 145 mm; size of the oval-shaped osculum, 55 mm; breadth of body, 50 mm near the upper end, near the middle 42 mm, and farther below 30 mm. The narrowest part of the entire stock—the basal region—measures only 22 mm from side to side. The thickness of the wall at the middle of the body is 2.5 mm; farther below, near the base of the body, it is 2 mm. The wall gradu-

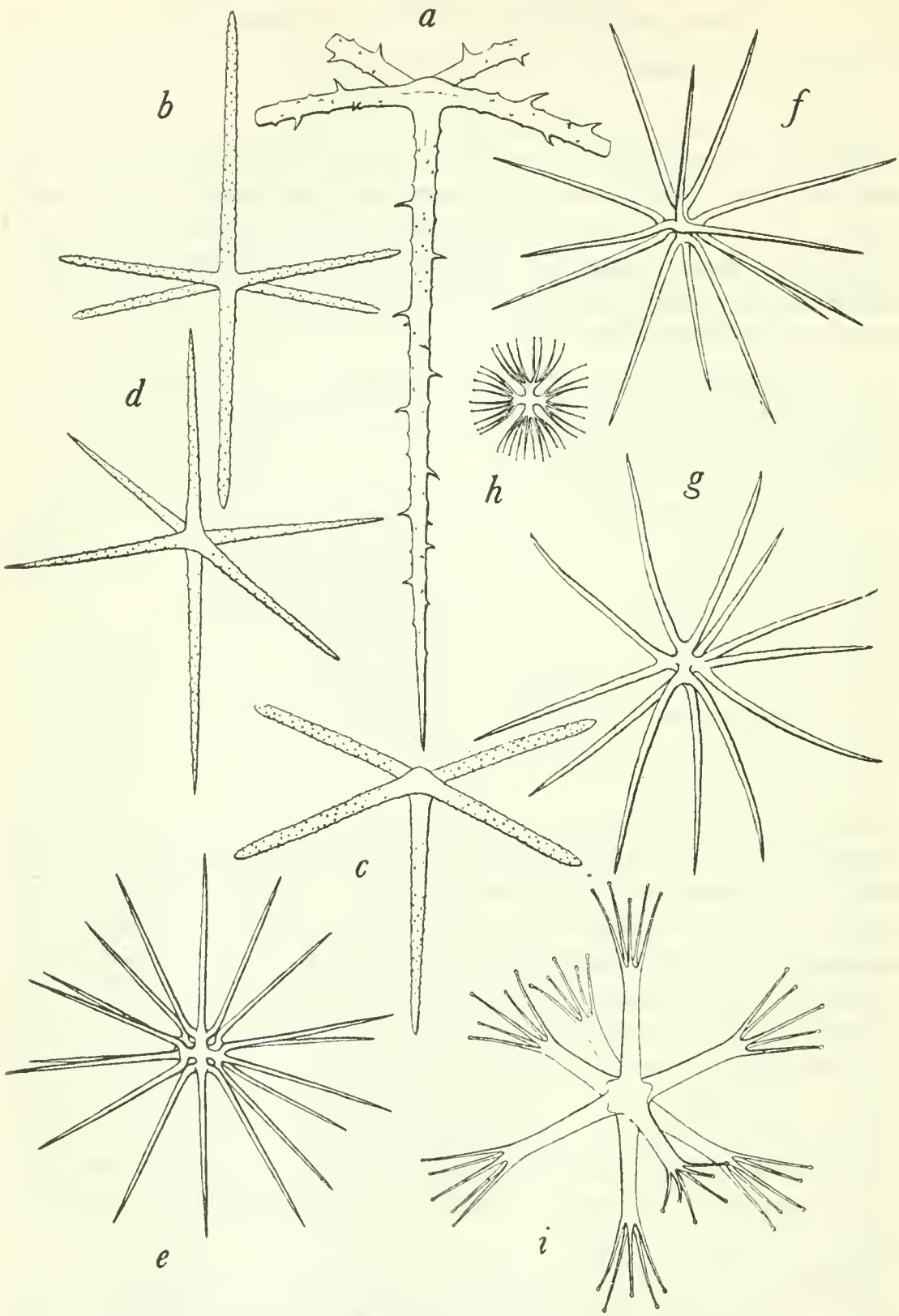


FIGURE 14.—*Rhabdocalyptus borealis*, new species: *a*, Hypodermal pentactin, × 80+; *b*, gastral hexactin, × 225−; *c*, dermal pentactin, × 225−; *d*, parenchymal oxyhexact, × 425+; *e*, oxyhexaster (form C), × 425+; *f*, oxyhexaster (form B), × 425+; *g*, oxyhexaster (form A), × 425+; *h*, microdiscohexaster, × 425−; *i*, discoctaster, × 250

ally thins out at the oscular margin, which does not flare out. The base can not be said to be solid, since the gastral cavity extends almost to the attachment surface.

Specimen C is elongate-sacciform, 95 mm high, with an oval oscular opening. The broadest part of the body is situated below the middle of the stock and measures 38 mm; the basal part measures only 14 mm. The thickness of the wall is nearly the same as in specimen B, measuring 2 mm in the middle and 1 mm in the lower part.

Specimens D and E are similarly shaped and have bent bodies (at the base) 75 mm in height. The diameters of the oval-shaped osculum are 13 mm and 20 mm, respectively. The broadest part of the entire stock measures 26 mm to 30 mm, and the extremely narrowed stalklike basal region, which is bent toward one side, measures 2 mm to 5 mm in breadth. The thickness of the wall is 2 mm at the thickest part of the entire stock. Both specimens are well preserved, except at their basal ends. The gastral cavity seems not to extend into the extreme end of the basal stalk region but appears close to it.

Specimen F is the smallest of all, and is tubular or vaselike in form, about 30 mm in height and not less than 8 mm in diameter. The wall is 1 mm thick in the thickest part and becomes gradually thinner toward the outer oscular margin, where it measures 0.8 mm. The circular osculum measures 4 mm to 5 mm in diameter. The prostal marginalia measure 15 mm to 20 mm in length.

The greater part of the entire stock of specimen G is broken, the remaining part measuring about 35 mm high and 15 mm broad.

Specimen H (holotype, U.S.N.M. No. 22161) is a cup-shaped sponge, 65 mm in height; the wall at the middle of the entire stock measures 2 mm thick. The greatest breadth of the sponge appears in the superior region; near the lower part of the oscular margin it measures 40 mm.

Spiculation.—The parenchymal principalia are bowlike oxydiactins with tapering or straight rays, which subterminally are occasionally smooth. They may attain a length of 6 mm and a thickness of 102μ in the middle, but are usually smaller. The middle is not externally marked by a swelling. There are no points worth special mention regarding the slender parenchymalia.

The prostal marginalia present on some specimens are needlelike oxydiactins, which may be 10 mm to 17 mm or more long and 12μ to 77μ thick. The rays gradually taper toward the end and are subterminally minutely tuberculated.

The prostal basalia are represented in some specimens. They are nearly the same length as the prostal marginalia but are rather strongly tuberculated at the ends and not extremely narrowed or pointed.

The large prostal pentactins are present usually in the upper two-thirds of the entire stock; they seem to become lost as somehow they are shed off in the lower parts. Diactinic prostalia were not ob-

served in specimens A–C, either at the rim of the oscular margin or in the lateral wall of the entire stock. But in the remaining specimens, long, diactinic prostalia project beyond all parts of the outer surfaces. They do not occur in large numbers nor do they form a definite fringe at the oscular margin (except in specimen F), though they are more abundant in the upper portion of the sponge than elsewhere. These marginal and pleural prostalia are smooth on the surface, frequently reach a length of 20 mm and have a maximum thickness of about 180μ.

The hypodermalia are strongly developed diactins, oxypentactins with paratropal paratangentials and pentactins. There are usually in each group one or two pentactins that have entirely smooth paratangentials, except at the ends; they may be the youngest of all in the group. The older pentactins (fig. 14, *a*) usually are situated at a higher level than the younger (this is characteristic of all *Rhabdocalyptus* species) and have the paratangentials armed from base to tip with strong, straight or slightly curved, and sharply pointed prongs, arranged in two series along the lateral sides of the rays. The prongs are placed at fairly regular intervals, those of the two sides alternating with one another. In the basal parts of the rays, the strongest prongs may be 119μ long; there they all spring out vertically, frequently bend forward away from the dermal surface. Toward the tip of the rays and along with the gradual tapering of these, the prongs grow continually smaller. Apart from the above prongs, the surface of the paratangentials is perfectly smooth, except at the microtuberculated end. The unpaired shaft ray is occasionally pronged, but then not so numerously as in other rays. The paratangentials of the older pentactins are 20 mm to 50 mm long, and the shafts 40 mm to 90 mm. The rays are not more than 85μ thick at the base.

The dermalia are predominantly pentactins (fig. 14, *c*), which have short, rough, microtuberculated tangential rays 90μ to 100μ long; proximal ray 75μ to 85μ long. Less often, among the dermalia, stauractins are found lying with their rays in the dermal plane and still more rarely hexactins somewhat smaller than those in the gastral layer.

The gastralia are rough hexactins (fig. 14, *b*) with rays exactly like those of the dermalia; length of rays, 152μ to 190μ; breadth at base, 12μ. Occasionally all six rays in the same spicule are subequal, though in most cases the proximal ray is somewhat longer than the paratangential and the distal rays. They measure 152μ to 176μ in length. The microtubercles are slightly more pronounced on the proximal ray than on any other.

The oxyhexasters occur in abundance in all parts of the sponge wall and are of three slightly differing forms, designated herein by

the letters A, B, and C. Forms A and C are chiefly in the ectosome or endosome, and form B is common everywhere, intermixed with other forms, though less numerous in the endosome.

The A oxyhexasters (fig. 14, *g*) are distinguished by having very slender, slightly wavy and slightly roughened terminals. Each very short principal usually carries two slightly curved terminals. The diameter of the oxyhexaster, 112μ, seems to be greater than in form B. Form A is not so numerous as the remaining forms.

Form B (fig. 14, *f*) is 88μ to 100μ in diameter and occurs everywhere. It is by far the best represented of the three forms, occurring in greatest abundance of all these spicules. It is distinguished by having nearly straight and rough terminals, which seem not to be so fragile as those in the form A. Each very short principal is provided with two, occasionally three, straight, slightly rough terminals. This roughness becomes more or less pronounced toward the base, but not so prominent as to form microspines or barbs. The terminals measure 48μ to 52μ long.

Form C (fig. 14, *e*) resembles form B in shape and size. It is distinguished from the other forms by having very broad, strong principals, to each of which are attached widely diverged strong terminals. These principals are of a perceptible length, 4μ; and there are usually two, sometimes three, terminals to a principal. They usually measure 49μ to 52μ long and have a smooth surface. This oxyhexaster is represented in nearly the same numbers as form B, but is more abundant in the endosome of the sponge. Throughout the parenchymalia are a few oxyhexacts (fig. 14, *d*), which are rough on the surface. The proximal and distal rays are 48μ long and the tangential rays 40μ.

Discoctasters (fig. 14, *i*) commonly occur among the parenchymalia and are occasionally found in the ectosome, as well as in the endosome. The six prominent bosses present on the central node frequently form a large tuberculated mass, measuring 12μ by 18μ across. The principals are slender, at most 4μ thick; about one-half or more the length of the entire ray, measuring 20μ to 32μ long. The fine terminals are four to six in number, in a gently expanding tuft measuring 16μ to 30μ in length, and have very minute terminal disks shaped like a pinhead. The diameter of the spicule is 80μ to 120μ.

The microdiscohexaster (fig. 14, *i*) is relatively small, measuring 25μ in diameter. I have found it sparsely distributed everywhere, though it is most frequently in the dermal and gastral membranes. The principals are slender and form a cross measuring about 8μ in axial length. The number of terminals may reach 10 to 12, measuring 5μ long.

This new species seems to agree closely with *Rhabdocalyptus australis* Topsent in outer appearance and in essential characters of spiculation, but differs from it in three respects: In our species (1) the surface of the prostal paratropal pentactins is smooth, except at the end, instead of microtuberculated over the surface; (2) oxyhexasters consist of three kinds and usually have smooth or slightly rough terminals; (3) the discoctaster has four to six terminals to each principal, instead of three to four.

RHABDOCALYPTUS HETERASTER, new species

FIGURE 15; PLATE 6, FIGURE 6

The two complete specimens of this species were collected from the Station 4770 (Bowers Bank, Bering Sea, 247 fathoms). Both of

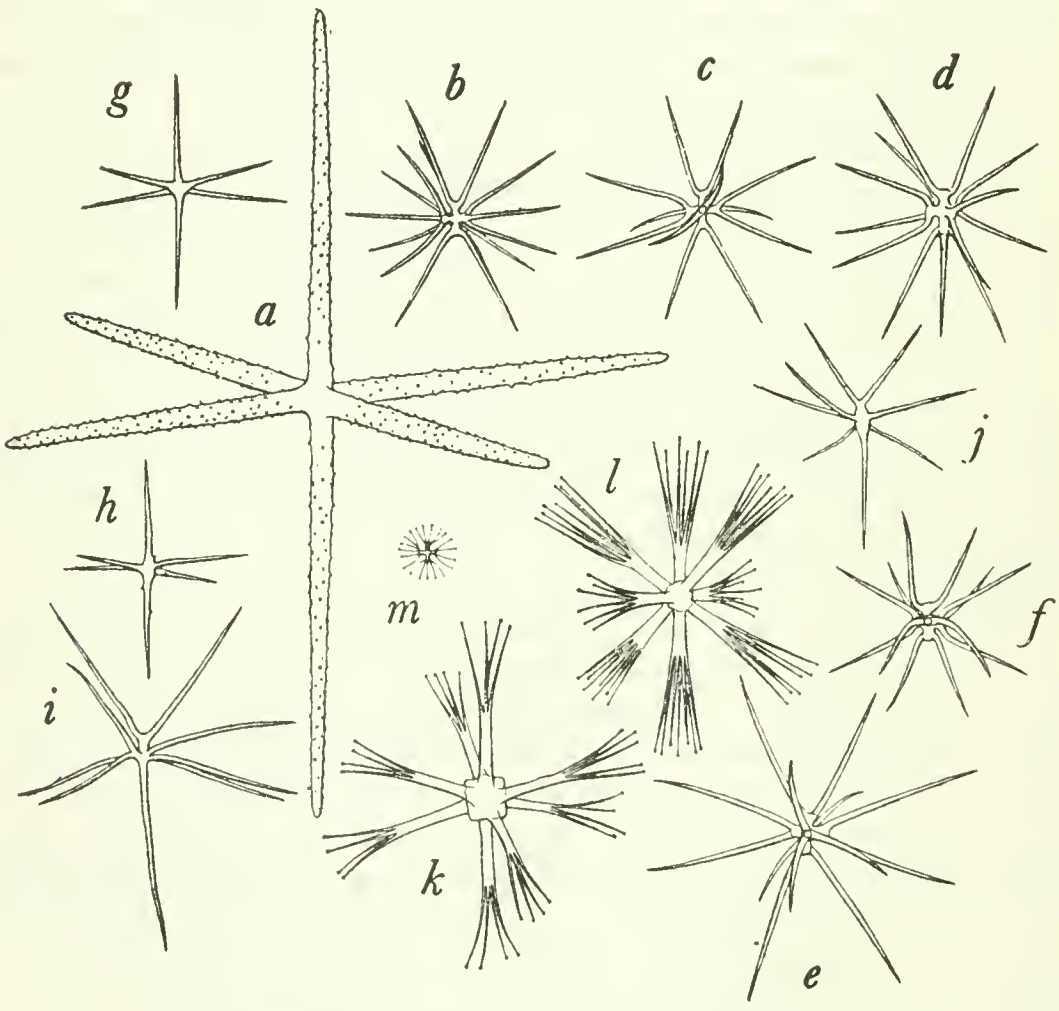


FIGURE 15.—*Rhabdocalyptus heteraster,* new species: *a,* Gastral hexactin, × 225; *b,* oxyhexaster (form B), × 270; *c,* oxyhexaster (form B), × 270; *d,* oxyhexaster (form C), × 270; *e,* oxyhexaster (form A), × 270; *f,* oxyhexaster (form C); × 270; *g,* hexactinic form, × 270; *h,* hexactinic form, × 270; *i,* hemihexactinic form, × 270; *j,* hemihexactinic form, × 270; *k,* discoctaster, × 270; *l,* discoctaster, × 180; *m,* microdiscohexaster, × 270

them are fairly thin-walled, subglobular, and purselike in form, and are without a specially formed attachment at the base. In the larger one (holotype, U.S.N.M. No. 22052) the total height is 85 mm

and the breadth 57 mm measured at the broadest part, which is just above the middle of the entire stock. The smaller one is 20 mm in height and 12 mm in breadth. The dermal surface is rough and is covered with pentactinic pleuralia on the inferior parts of the sponge body. The oscular margin is much injured, only a part remains of one side and it seems not to flare out. The orifice is subcircular, with a thin edge. The incurrent canalar apertures are very small, attaining a size of nearly 0.5 mm and becoming smaller toward the upper region of the sponge; they are numerous and distributed closely together. The excurrent canalar apertures are also small, nearly the same size as those of the incurrent canalar apertures, covered by the thin gastral layer. The thickness of the wall near the basal region is 3 mm to 4 mm, which becomes thinner toward the oscular edge.

Spiculation.—Parenchymalia are long diactins, wholly smooth on the center and roughened or microspined toward the ends, with sharply pointed or conically pointed ends. The slenderer ones are in bundles, and the thicker are isolated.

Hypodermal oxypentactins with the paratangential rays are paratropal, more or less curved, smooth, and provided with nearly regularly distributed, sharply pointed thorns.

Dermalia are rough pentactins, occasionally hexactins, or rarely stauractins. The rays average 115μ long, measured from the center, and 12μ thick. They taper outward to a slight degree; the ends are rounded or conically pointed. The paratangential cross is usually not convex on the outside and measures 220μ to 240μ in length. Seen surface on, the delicate dermal latticework presents irregular meshes, though in places these show a tendency to assume a regular quadrate arrangement, measuring 130μ in length of sides. The hexactins and stauractins are of usual appearance and have nearly the same length of ray, 100μ to 150μ long. The latter spicules seem to be more abundant than the former.

The gastralia are chiefly hexactins (fig. 15, *a*). The rays are similar to those of the dermalia; only they are usually of a much greater dimension. The paratangentials are somewhat longer than the distal ray, measuring 120μ to 135μ in length, though they are much shorter than the proximal ray, which may attain a length of 170μ. The rays are 10μ thick at the base and taper somewhat strongly outward to sharply or conically pointed ends. Except for the central node, all surfaces of the rays are microspined, though more sparsely proximally.

Three varieties of oxyhexasters may be distinguished, designated by letters A, B, and C.

The first oxyhexaster, form A (fig. 15, *e*), occurs mostly in the ectosome and occasionally intermixed with form C in the choano-

some; diameter, 105μ. The principal is exceedingly short and slender and to it two slender terminals (occasionally three) are usually attached. They are nearly straight, narrowly diverged, and slightly rough, or nearly smooth on the surface.

The second variety, form B (fig. 15, *b*, *c*), is nearly the same size as form A, but is frequently smaller. It occurs mostly in the choanosome, rarely intermixed with the form A in the dermal layer. It is distinguished by slender principals and by weakly bifurcated slender terminals. (The degree of divergence is about intermediate between forms A and C.) Each short, slender, principal is provided with two straight, smooth terminals, and does not form a central node, as in form A.

The last oxyhexaster, C (fig. 15, *d*, *f*), occurring only in the gastral layer, measures 76μ in diameter. It is distinguished by having very broad principals, forming a distinct central node, and widely diverging terminals. Each broad principal in a spicule usually carries two of these widely diverging, smooth terminals.

Besides these normal oxyhexasters, there are hemihexactinic (fig. 15, *i*, *j*) and hexactinic (fig. 15, *g*, *h*) forms in the parenchymal, subdermal, and subgastral layers. They measure about 80μ in axial length and have smooth-surfaced rays.

The microdiscohexaster (fig. 15, *m*) is present sparsely in the gastral layer and near the hypogastral layer. It measures 20μ in diameter and is provided with very delicate terminals. As its features are common to the microdiscohexaster, which occurs in many members of the present genus, a detailed description here is unnecessary.

Discoctasters occur in abundance everywhere in the entire body. Of them I also distinguish two varieties. They occur in different quantities and show also certain differences in the manner of distribution and in shape. The one variety (fig. 15, *l*) usually occurs in the subdermal space and is much larger than the other. In diameter the spicule in question varies from 190μ to 290μ. The central node frequently has six more or less distinct hillocklike prominences. The principals take up about one-third or less of the entire ray length, measuring 32μ long, while the terminals are nearly twice as long as the principals. There are five to eight terminals in a tuft; occasionally as few as three. The tuft is very gently expanded distally, the terminals composing it being each slightly bent outward, or are sometimes nearly straight. The surface of the terminals and principals is smooth or microtuberculated. The terminal disks are very small and pinheadlike.

The other form (fig. 15, *k*) resembles that occurring in *Rhabdocalyptus dawsonii*. It is usually present in the subgastral and parenchymal regions; frequently in the subdermal space intermingled with the former variety. It is much smaller, averaging 90μ in

diameter, with a distinct, quadrangular central node, which is 8μ to 10μ across.

The principals are slender and smooth on the surface. They are much shorter, about half or more of the length of the terminals, which measure about 16μ long. There are two to four terminals to each principal. The tuft is also gently curved near the end. The terminal disks are also much smaller and are pinheadlike in shape.

Remarks.—The distinguishing characters of the present species are: (1) Two kinds of discoctaster are present; the larger one measures 190μ to 210μ in diameter and is not provided with a distinct quadrangular central node, while the smaller one measures 90μ and has a very regular, quadrangular central node. (2) There are three kinds of normal oxyhexasters, differing in dimensions, in degree of divergence of the terminals, and in the development of the principals.

RHABDOCALYPTUS AUSTRALIS Topsent

Rhabdocalyptus australis TOPSENT, Result. Voy. S. Y. *Belgica*, Zoologie, Spongiaires, p. 37, pl. 2, figs. 5, 6, pl. 4, figs. 14–21, pl. 5, fig. 1, 1901.

Two complete specimens were obtained from the same station, together with *Rhabdocalyptus borealis*. Specimen A is larger than B, and is an elongate, tubular, or vaselike sponge, slightly and irregularly compressed laterally. It is about 68 mm long, 19 mm broad in the middle, and considerably tapered at the lower end, which measures 13 mm broad. The upper truncated end of the body is occupied by an oval-shaped osculum, measuring 10 mm in diameter. The wall is about 2 mm thick in the middle, gradually becoming thinner toward the oscular edge, and is thinner than that of the second specimen. Over the entire external surface, except near the inferior part of the stock, there arise pentactinic prostal pleuralia. In the upper part of the body they are finer and much shorter than those situated lower down. Along the oscular edge the diactinic prostal marginalia project straight upward, the exposed portion attaining a length of 7 mm.

Specimen B is very small, measuring about 13 mm in diameter. It retains a barrellike shape, a cross-section of the body being approximately circular. It possesses a small circular osculum 4 mm in diameter. The body wall is very thick, attaining a thickness of 4 mm at the thickest part of the body. Both the prostal marginalia and

TABLE 23.—*Record of specimens of* Rhabdocalyptus australis

Specimen	Collected at—	Number and description
A	Station 4772, Bowers Bank, Bering Sea, 344 fathoms	One, large, completely preserved.
B	do	One, small, complete.

the prostal pleuralia have increased in number. The latter are abundant over the entire stock.

Spiculation.—The diactinic prostal marginalia are very long, measuring 15 mm to 20 mm, and are inserted over half or more of the entire length. They measure 132μ to 176μ in diameter in the middle and are gradually tapered at both ends. They are smooth on the surface, except at both ends, which are usually minutely tuberculated, although occasionally not tuberculated in the larger specimen. Prostal basalia have a shape somewhat different from the other prostal marginalia and prostal pleuralia. They measure 0.132 mm to 4.79 mm in length and 22μ diameter in the middle. They are slightly narrowed proximally, but become broad distally, usually forming a distinct knob-shaped swelling. Both ends are strongly tuberculated.

The discoctaster is rare. The microdiscohexaster may be lacking.

RHABDOCALYPTUS UNGUICULATUS Ijima

Rhabdocalyptus unguiculatus IJIMA, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 18, art. 7, pp. 268–276, pl. 21, figs. 1–12, 1904.

This species is represented by two specimens obtained from a depth of 482 fathoms near the western extremity of the Aleutian Islands (Station 4781). It has hitherto been recorded from the Sagami Sea in Japan, and this is the first time it has been collected so far north. The smaller specimen (A) differs a little from *R. unguiculatus*, but I am nevertheless inclined to identify it with that species. It is almost completely preserved, lacking only the basal parts of the stock. It is vaselike in form, 125 mm in height and 50 mm broad in the middle. The thickness of the wall at this point is 6 mm to 7 mm. The osculum is smaller than that of the type species, measuring 11 mm in size. The gastral latticework, however, is discontinuous. Its meshes are not vaulted, and, being filled with the choanosome, are not visible to the eye.

Spiculation of specimen A.—The discoctasters have much smaller dimensions, in diameter measuring 108μ to 140μ. I have even seen a few of them outside of the dermal layer. One point of difference from the type specimens is that they probably occur in two very slightly differing sizes, the one chiefly in the hypodermal and hypogastral layers and the other in the parenchymal space. The hypodermal and hypogastral discoctasters are slightly larger than the latter, measuring 135μ to 140μ in diameter. The central node arising from the principals is very prominent. The parenchymal discoctasters measure 108μ to 112μ in diameter and infrequently the central node is indistinct. In general, the terminals of the oxyhexaster are much more fragile and slightly more wavy than those of the type specimens.

Specimen B is not so well preserved as specimen A; several parts of the entire stock are torn off. The hypodermal pentactins are more numerously veiled on the surface of the sponge. In this specimen, the prostal marginalia are better developed and can be distinctly observed. Along the oscular edge the diactinic prostal marginalia project straight upward, the exposed portion attaining a length of 30 mm. This spicule is very long, and is inserted for half or more of its entire length in the sponge body. They are smooth on the surface except the proximal ends, which are minutely tuberculated and taper gradually toward the tips. In the discoctasters, the humplike prominences of the central node usually appear and are distinctly recognizable. The terminals of the oxyhexasters are not so fragile as those occurring in specimen A and are very nearly like those of the type specimens.

RHABDOCALYPTUS BIDENTATUS, new species

FIGURE 16

This new species is based on a single holotype specimen (United States National Museum No. 22053). It is a fairly large, solitary individual, obtained at Station 5087 in Sagami Bay (614 fathoms). The body is cuplike in shape, truncated at the upper end and gradually narrowed toward the base. The height is 195 mm. The body is only slightly laterally compressed. At the superior region of the body the breadth is 95 mm; near the base it is 45 mm. The oscular edge is not so thin as in some other members of the genus and may not be provided with distinct prostal marginalia. The base is solid, as the gastral cavity does not extend to the attachment surface. The thickness of wall at the middle of the body is 10 mm; farther below it measures up to 2 mm and near the oscular margin it measures 7 mm. The dermal surface may be fairly smooth, when in a good state of preservation. On the whole, it forms a delicate lacework, judged from the remains of the meshes of latticework seen under the microscope. Pentactinic hypodermalia are mostly preserved in inferior parts of the stock. On the inner side of the wall, the endosome shows a continuous delicate gastral lacework, the quadrate meshes of which are visible to the naked eye.

The incurrent canalar apertures are of about the same size as the excurrent on the external side but are somewhat more closely set together. They usually show an oval, sometimes elliptical, shape and measure 2 mm to 7 mm.

Our species closely resembles *R. unguiculatus* Ijima but differs from it chiefly in the dermal spiculation and in the character of the terminal disk of the discoctaster, which has two distinct sharply pointed claws on its edge. The species also agrees with *R. mirabilis*

Schulze in essential characters, but differs from it in the character of the gastral hexactins and of the discoctasters, the latter differing in the same manner as those of *R. unguiculatus* just mentioned.

Spiculation.—The principal parenchymalia are mainly slender oxydiactins (fig. 16, *d*), attaining a length of 6 mm and a thickness of 8μ to 20μ at the middle. They usually form slender bundles,

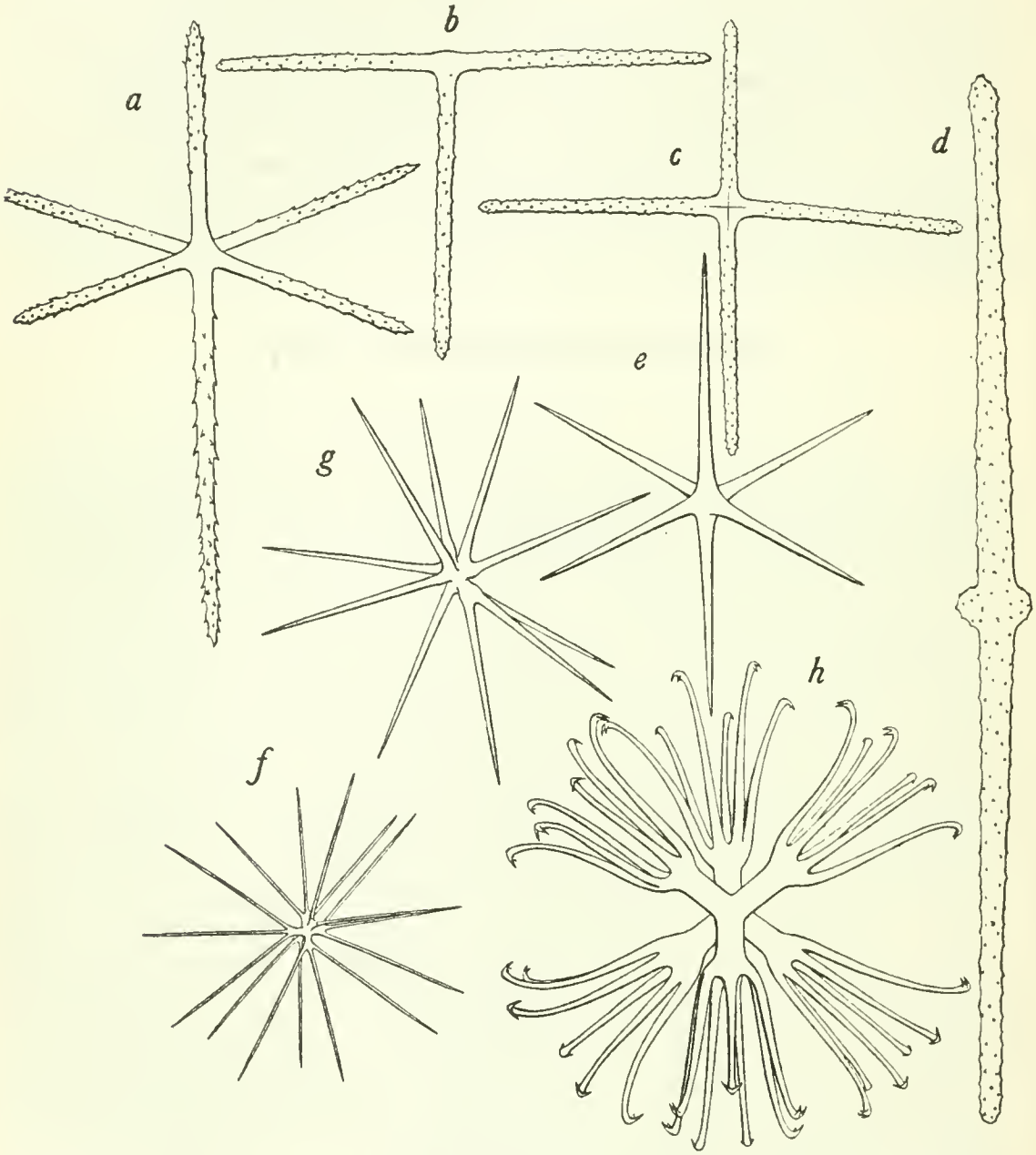


FIGURE 16.—*Rhabdocalyptus bidentatus*, new species: *a*, Gastral oxyhexactin, × 175+; *b*, dermal tauractin, × 157+; *c*, dermal stauractin, × 175+; *d*, parenchymal diactin, × 375; *e*, hexactinic form, × 375; *f*, oxyhexaster, × 375; *g*, hemihexactinic form, × 375; *h*, discoctaster, × 375

although they occasionally appear singly. The gradually tapering rays are subterminally more or less rough. There are no points worth special mention regarding the slenderer parenchymalia.

The hypodermalia consist of large oxypentactins with paratropal paratangentials, which are 5 mm to 6 mm in length and about 80μ

in thickness at the base. The shaft, up to 6.5 mm to 7 mm in length, is always the longest of the rays; it is smooth except at the roughened end and is not provided with spines. The paratangentials are also nearly smooth on the surface. The stout conical spines occur in a rather regular distribution—in two lateral rows. Those situated on the basal parts of the rays spring vertically, become more or less bent forward near the end of the ray, and bend more strongly toward the extremity. These hypodermal pentactinic spicules may occur singly and not in close groups of two or more, as in some other members of this genus. Occasionally they occur fairly close together. Diactins do not seem to associate with the hypodermal paratangentials in forming the support to the dermal layer.

The dermalia are mostly stauractins (fig. 16, *c*), but frequently rough diactins and rarely pentactins, as well as stauractins. The common stauractins appear abundantly in the entire stock. The center of these is generally plain but occasionally shows a gentle swelling on either the external or the internal side or both. The axial length of the spicule may measure 260μ to 320μ and 10μ thick at the center. The entire surface is slightly roughened, being more pronounced at the conically pointed ends. In the diactins the suppressed rays are indicated by three knobs in a cruciate arrangement on the center. The rays are rough all over and taper slightly toward the rounded or obtusely conical end. They measure 320μ to 480μ in total length and 12μ in thickness near the middle. In the tauractins (fig. 16, *b*) the atrophied paratangential usually leaves a knoblike relic, while the radial rays may or may not be similarly represented. The meshes of the dermalia, which are composed of stauractins, diactins, and pentactins, are more irregular in shape than those of the gastralia.

The gastralia are rough oxyhexactins (fig. 16, *a*) of great axial length. The length of the free proximal ray in the most prominent part is 320μ; that of the distal ray, 160μ; that of the paratangentials, 180μ; thickness of rays near the base, about 10μ on the average. The microtubercles on all rays are sparsely and uniformly developed but are somewhat strongly pronounced on all the ends. The gastral lacework shows a regular quadrangular shape, measuring about 140μ by 190μ in length of sides.

The discoctasters (fig. 16, *h*) resemble in shape and size those of *R. unguiculatus*. They are found more abundantly in the ectosome, as well as directly under the dermalia, than in deeper parts. Their diameter is 150μ to 160μ. The principals are entirely smooth on the surface and 16μ long as measured from the spicular center; in any case they are much longer than in *R. unguiculatus*. The terminals number 6 to 8 to each principal and form a rather broad, lilylike tuft, expanded at the outer end. Each terminal disk distinctly shows

strongly recurved and sharply pointed marginal claws, usually numbering two, occasionally three or more, on the external side of the disk.

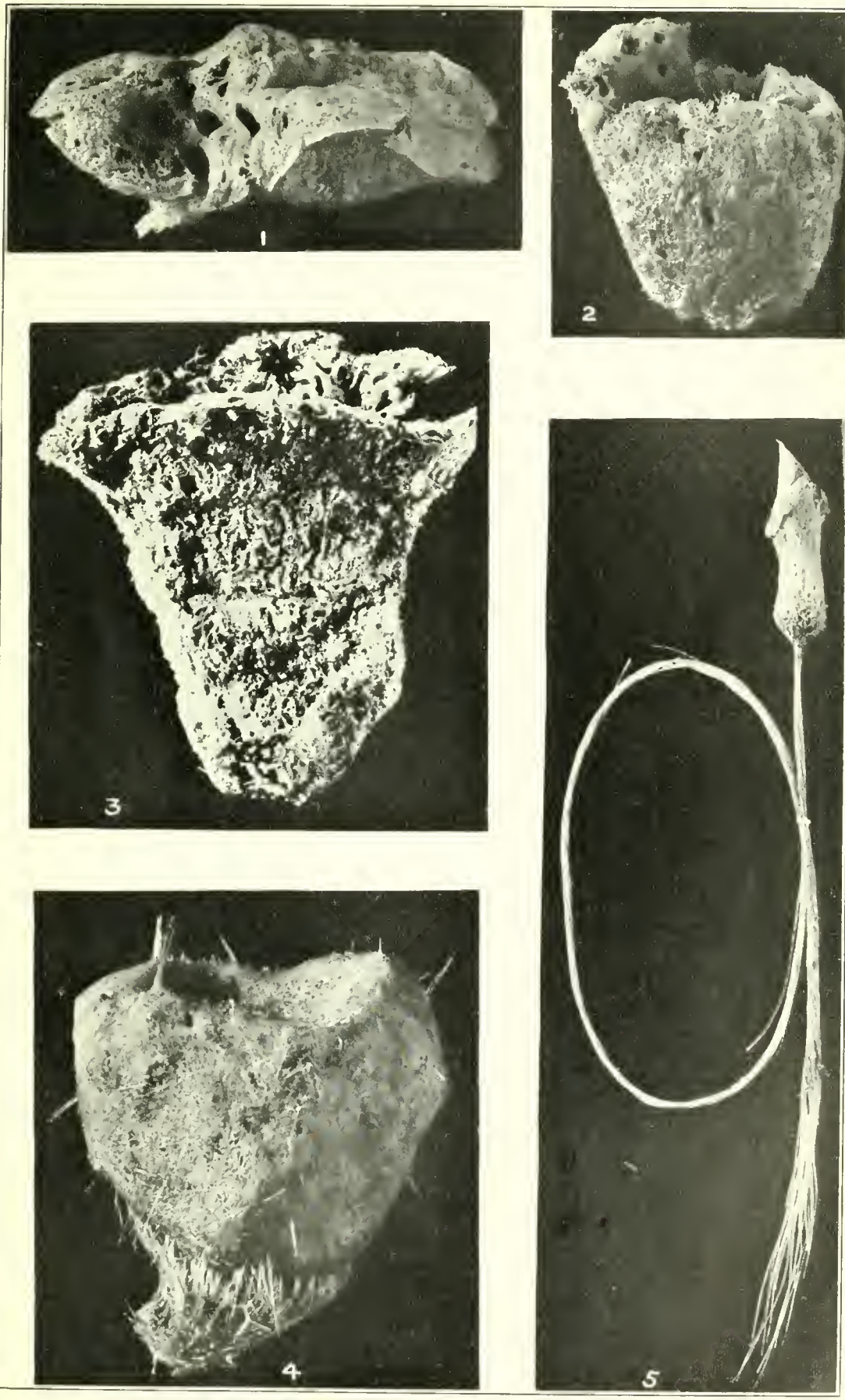
Oxyhexasters represented by hemihexactinic and somewhat less frequently by hexactinic forms, are abundantly present in the choanosome as well as in the gastral layer. Normally developed oxyhexasters (fig. 16, *f*) may frequently appear in the choanosome, measuring 130μ to 140μ in diameter. From each exceedingly short principal there diverge two, occasionally three, slightly rough-surfaced and nearly straight terminals. Hexactinic forms (fig. 16, *e*) (axial length 120μ) are for the most part appreciably smaller than the hemihexactinic. It seems to be the general rule that the oxyhexasters show a tendency to take the hexactinic form. The terminals appear to be moderately thin and are generally nearly straight. In the hemihexactinic forms (fig. 16, *g*) usually five, but sometimes one, of the six principals are uniterminal; the rest of the principals are biterminal, in which case the entire ray is either straight or else is bent at the base. A case of a principal bearing more than two terminals has not been observed.

Microdiscohexasters of 30μ and 40μ in diameter are sparsely distributed in the dermal membrane as well as in the choanosome. They are quite similar to those occurring in *R. unguiculatus*, except in having a greater diameter.

RHABDOCALYPTUS VICTOR Ijima

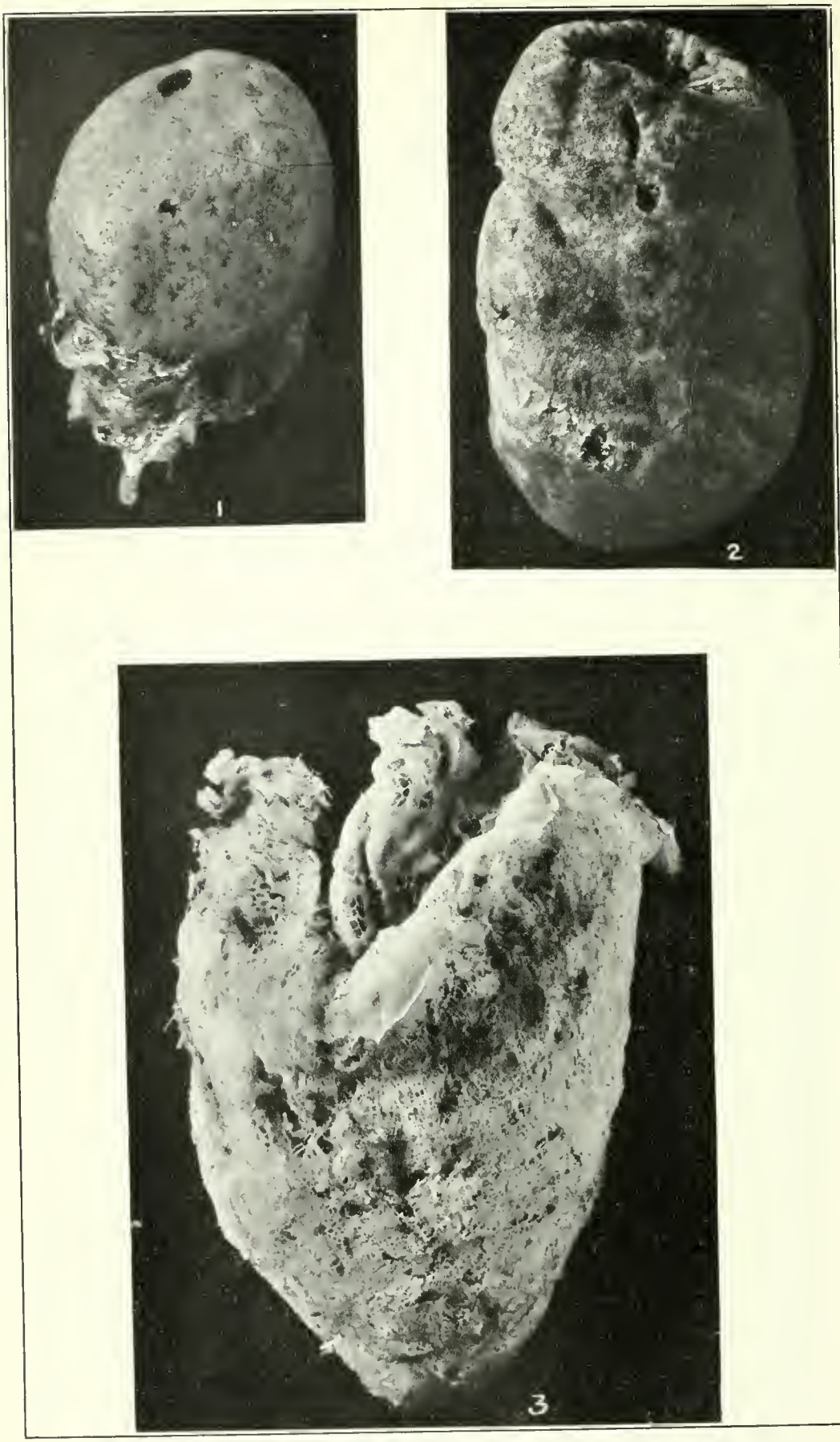
Rhabdocalyptus victor IJIMA, Annot. Zool. Japon., vol. 1, p. 52, 1897.—CH. GRAVIER, Bull. Mus. d'Hist. Nat. Paris, vol. 5, no. 8, p. 421, 1899.—IJIMA, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 18, art. 7, pp. 238–253, pls. 18, 19, figs. 1–23, 1904.

Two small fragments in this collection, which probably belong to the same colony, were obtained at the entrance of the Uraga Channel, at a depth of 200 fathoms (Station 5090). In these specimens I found much larger and stronger parenchymal prostalia than any hitherto recorded, attaining a length of 30 mm to 40 mm and a width of 170μ at the middle. The discoctaster usually measures 180μ in diameter, and frequently larger ones, measuring 220μ in diameter, are found on the gastral layer intermingled with the smaller. It may be somewhat worth while to mention that the meshed siliceous reticulum, which seems to be homologous to that of basidictyonal plate in its contitution and formation, is occasionally present on the surface of the large parenchymal diactins to which it is attached. The foundation of this network is made up of certain stauractins, hexactins, and pentactins, synapticularly fused together.



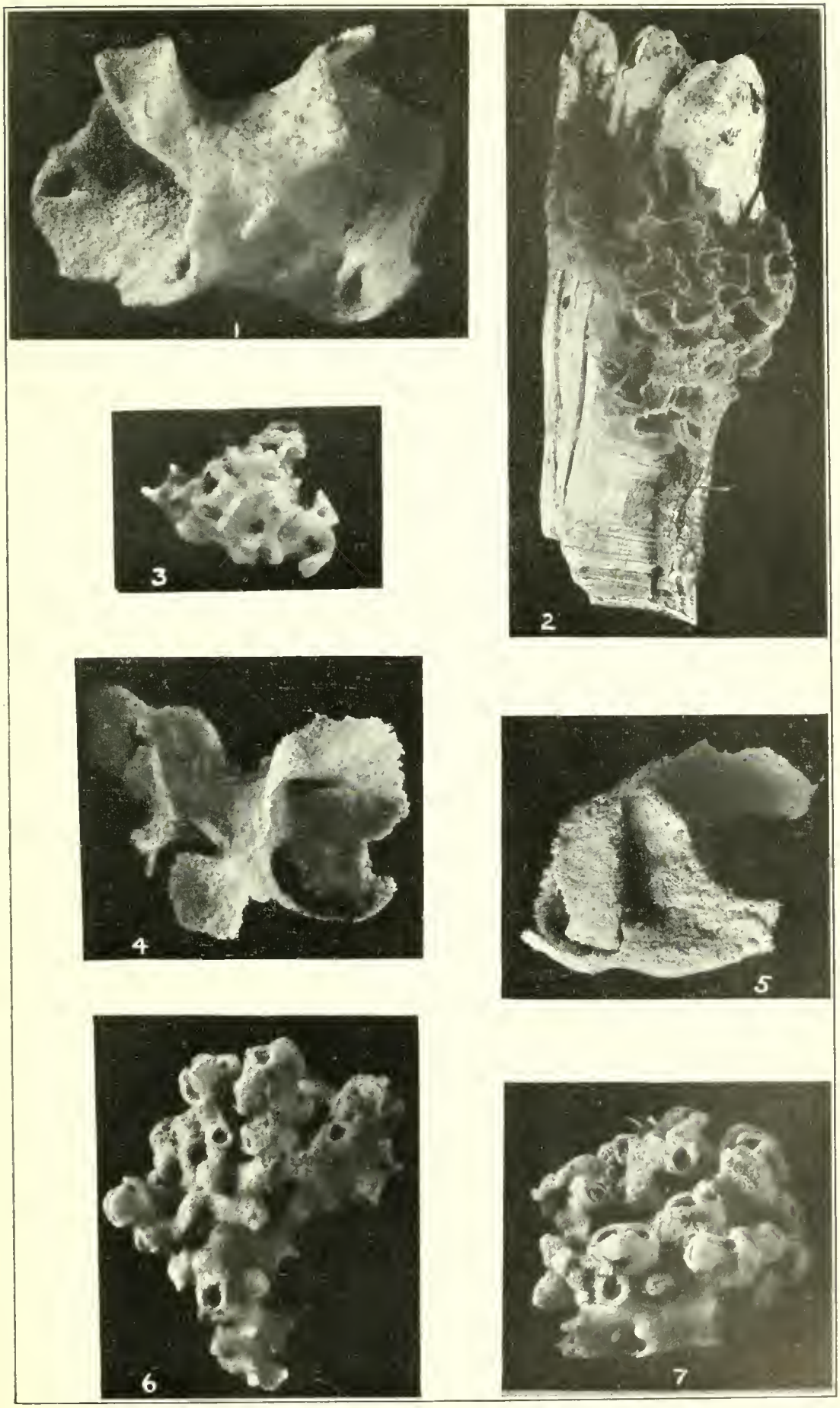
NEW SPECIES AND SUBSPECIES OF HYALONEMA AND PHERONEMA

1, 2, *Hyalonema (Cyliconema) apertum solidum;* 3, 5, *H. (C.) hozawai;* 4, *Pheronema globosum kagoshimensis.* All about natural size except 5, which is $\times \frac{2}{3}$.



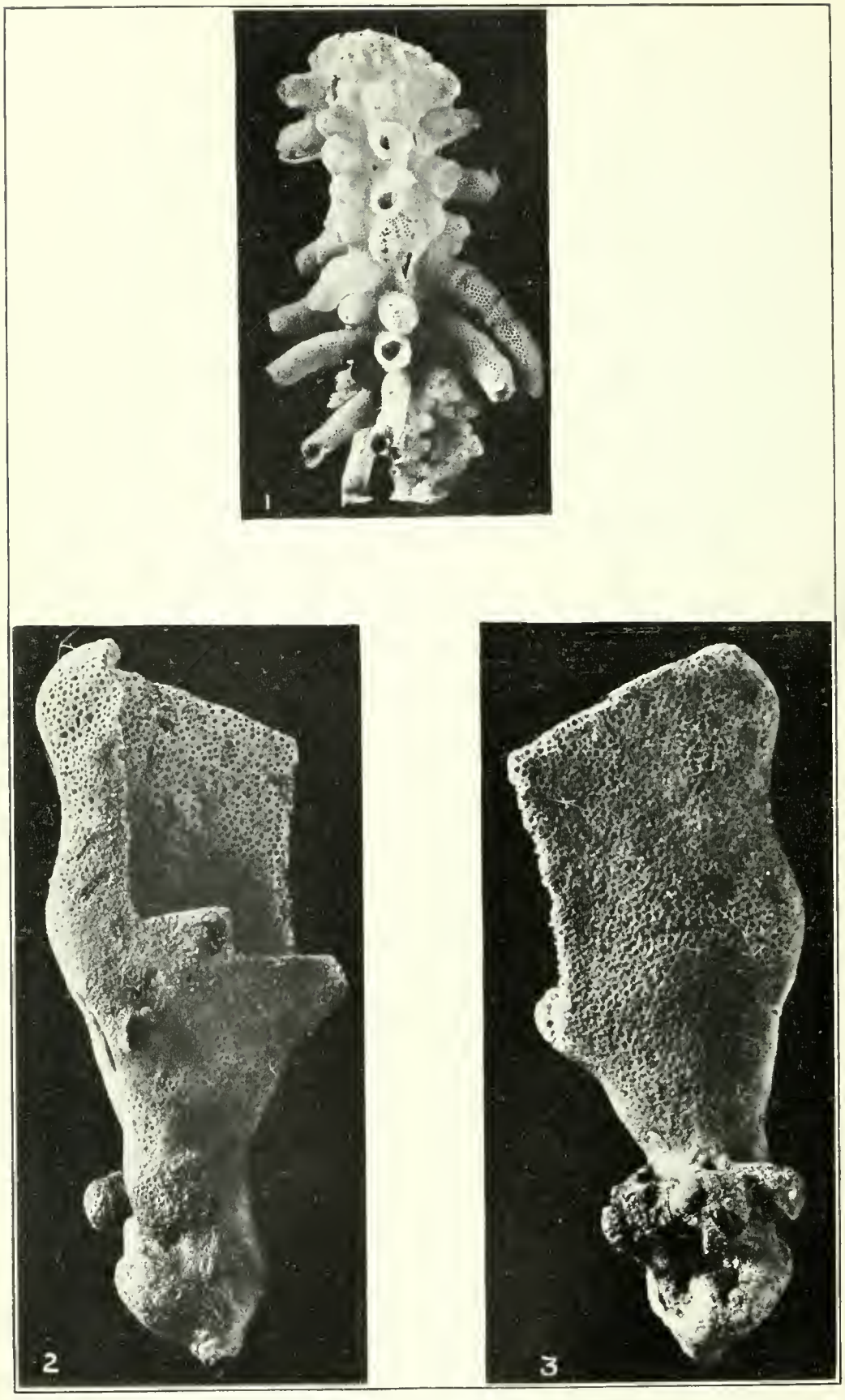
NEW SPECIES AND SUBSPECIES OF HYALONEMA AND PHERONEMA

1, *Pheronema ijimai;* 2, *Hyalonema* (*Coscinonema*) *ovatum;* 3, *H.* (*C.*) *kirkpatricki globosum.* All natural size except 3, which is × ⅔.



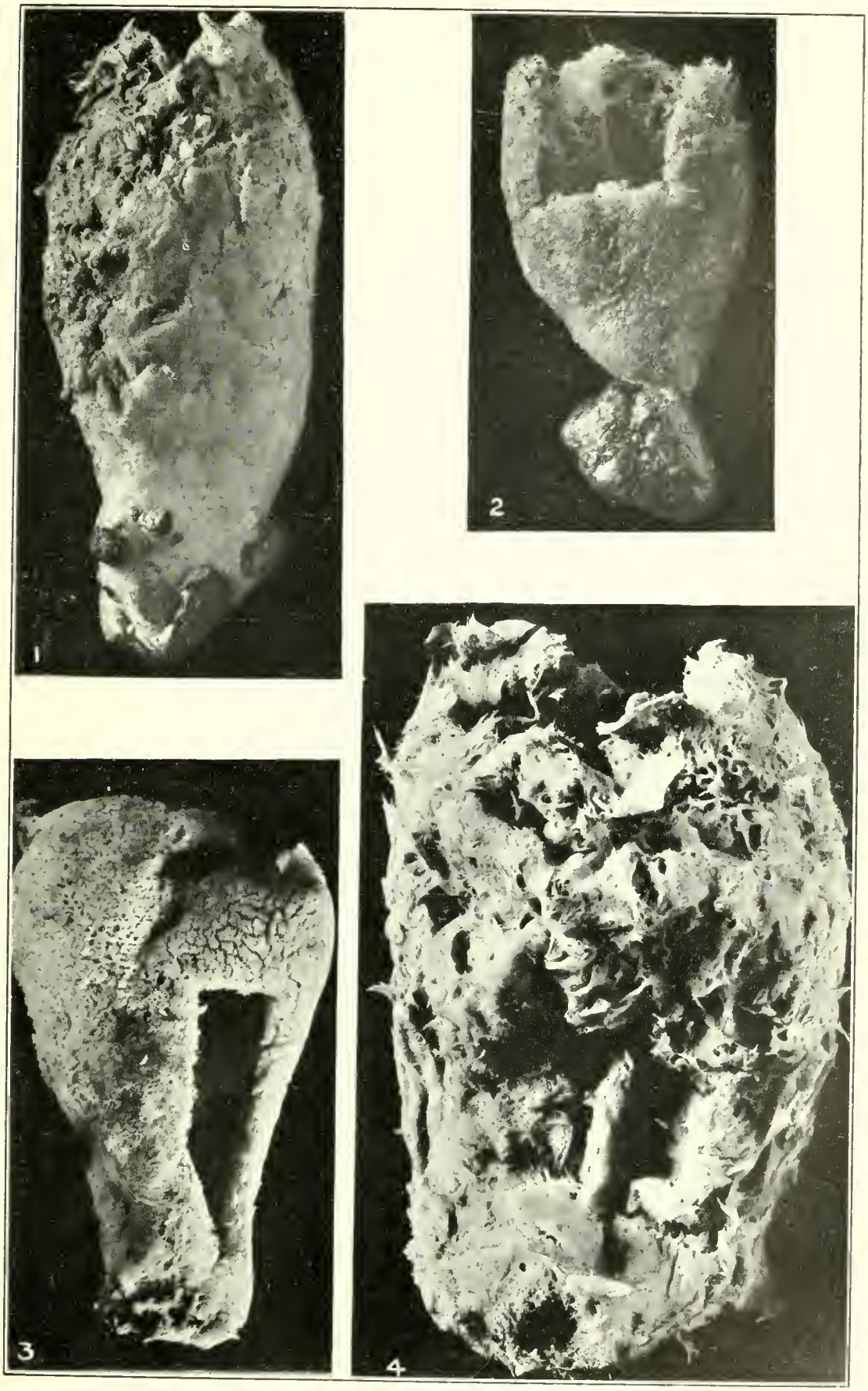
NEW SPECIES OF FARREA AND EURETE

1, *Farrea watasei;* 2, *F. kurilensis;* 3, *Eurete nipponica;* 4, *E. irregularis;* 5, *Farrea beringiana;* 6, 7, *Eurete sacculiformis.* All about natural size except 2, which is × ½.



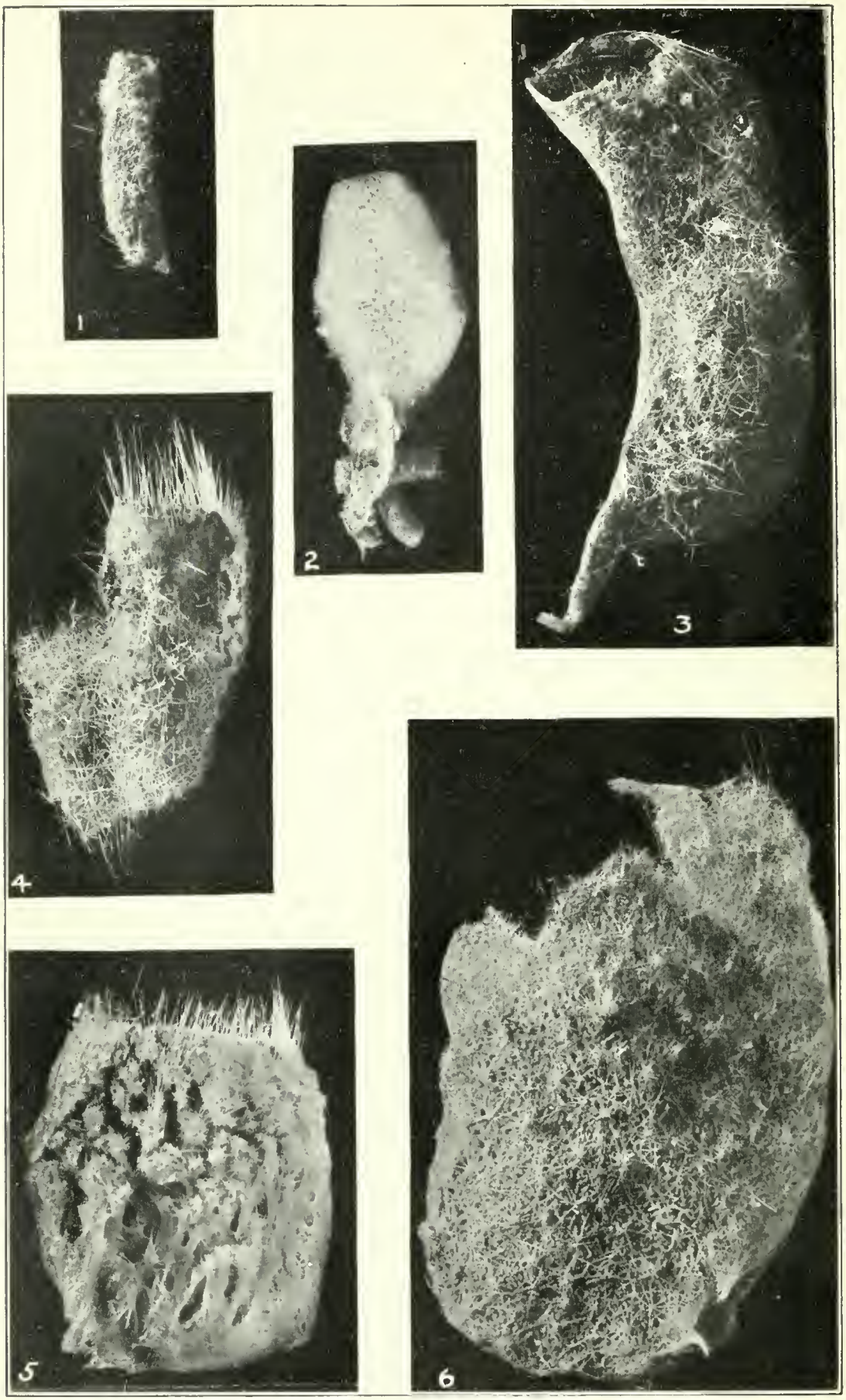
APHROCALLISTES

1, *Aphrocallistes beatrix orientalis* Ijima; 2, 3, *A. yatsui*, new species. All natural size.



ACANTHASCUS, LANUGINELLA, AND AULOSACCUS

1, *Acanthascus pachyderma*, new species, × 1; 2, *Lanuginella pupa* Schmidt, × 1; 3, *Aulosaccus albatrossi*, new species, × ⅓; 4, *A. pinularis*, new species, × ⅔.



NEW SPECIES OF RHABDOCALYPTUS, BATHYDORUS, STAUROCALYPTUS, AND HYALASCUS

1, *Rhabdocalyptus bidentatus;* 2, *Bathydorus* a species; 3, *Rhabdocalyptus borealis;* 4, *Staurocalyptus rugocruciatus;* 5, *Hyalascus attenuatus;* 6, *Rhabdocalyptus heteraster.* All about natural size except 2, which is × 3.

INDEX

(Synonyms are given in *italics*)