

No. 11. — *Some Japanese and East Indian Echinoderms.* By
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THE Museum of Comparative Zoölogy received in the autumn of 1907 a collection of Echinoderms made by Mr. Thomas Barbour at Amboina and several other islands in the Dutch East Indies, including Dutch New Guinea. There are 362 specimens in this collection, representing thirty-two species, and while none of them is new to science, some are new to the Museum collection and many are of interest because of the localities where they were collected. The value of these specimens is greatly enhanced by Mr. Barbour's notes on their color, habitat, and appearance in life.

From Mr. Alan Owston the Museum has purchased an interesting lot of Echinoderms, consisting of 153 specimens, representing forty species, of which eight are new to science. The following pages give an annotated list of the seventy species contained in these collections and indicated as the Barbour collection and the Owston collection respectively, arranged systematically, with descriptions of the new forms.

CRINOIDEA.

Tropiometra macrodiscus.

Antedon macrodiscus Hara, 1895. Zoöl. Mag., Tokyo, 7, p. 115.

Tropiometra macrodiscus A. H. Clark, 1907. Smiths. Misc. Coll., 50, p. 349.

1 specimen, in excellent condition, about 450 mm. in diameter. Color in alcohol uniform deep yellow. Misaki, Sagami Bay, Japan. Owston collection. Kindly identified by Mr. A. H. Clark.

Cyllometra manca.

Antedon manca P. H. Carpenter, 1888. Challenger Reports, 26, p. 226.

Cyllometra manca A. H. Clark, 1907. Smiths. Misc. Coll., 50, p. 357.

1 specimen, about 90 mm. in diameter. Color in alcohol pale purple; arms banded with whitish. Uruga Channel, Gulf of Tokyo, Japan; 20-30 fathoms. Owston collection.

ASTEROIDEA.

Archaster typicus.

Müller & Troschël, 1840. Monatsb. Akad. Wiss., Berlin, p. 104.

60 specimens, 60–125 mm. in diameter. Saonek, Waigiou Island, New Guinea. — 45 specimens, 50–120 mm. in diameter. Amboina. Barbour collection.

According to Mr. Barbour's notes, these specimens were taken in very shallow water on a bottom of white sand. The color in life was orange-red, but in drying the specimens nearly all trace of this color was lost, and they became pale yellowish, with only here and there patches of orange-red. One of the specimens from Amboina has 6 rays, while two of those from Saonek have only 4 rays each.

Oreaster nodosus.

Asterias nodosa Linné, 1758. Syst. Nat., ed. 10, p. 661.

Oreaster nodosus Bell, 1884. Proc. Zoöl. Soc. London, p. 70.

18 specimens, Humboldt Bay, New Guinea. — 5 specimens, Sorong, New Guinea. — 3 specimens, Ausus, Jappen Island, New Guinea (135° 44' E. × 1° 47' S'). — 1 specimen, Amboina. Barbour collection.

These specimens range from 80 to 300 mm. in diameter and exhibit the greatest diversity in the development of the great tubercles so characteristic of this species. In the youngest specimen there are present 15 tubercles, one at each radial corner of the disc and two on the ridge of each ray; those on the disc are largest and most nearly pointed, while those nearest the tips of the rays are small and nearly spherical. In specimens a trifle older there are 20 or 25 tubercles, one or two more having developed on each ray. The pair of tubercles which are found in large specimens at the proximal end of the rays, one on each side of the ridge, are first seen in an individual 165 mm. in diameter, but are quite small and rounded, and it is only in much larger specimens that they are fully developed. The tubercle at the centre of the disc is present in only six specimens, and none of these is under 200 mm. in diameter. In the largest individual it is wanting, but there are 72 tubercles, arranged as follows: one large one, with two or even three points, at each radial angle of the disc; one rather small but pointed one in each interradius not far from the margin, and in one interradius there are two such tubercles; eight on the ridge of each ray, with a ninth on two of the rays; the usual pair at the base of each ray; and one, two, or even three extra tubercles on the sides of the rays near the base. No less than 20 of the tubercles terminate in two, three, or even four sharp, bare points. — In life, the color of this species shows considerable diversity, ranging from clay-color with the large tubercles muddy brown, or with the large tubercles deep red-brown, becoming vermilion at the base, or with the large tubercles black, with their bases, the tips of the

arms, and the centre of disc claret-red, to a nearly uniform vermilion-red all over. Most of the dried specimens were dirty yellowish, but on being washed with alcohol the vermilion-red color returned to a greater or less degree in different individuals and has not been lost by subsequent drying. The largest specimen (300 mm.) from Amboina is the most uniform and the brightest vermilion. — This species was found chiefly on bottoms where there was more or less vegetation or in open places about coral reefs.

Culcita novae-guineae.

Müller & Troschel, 1842. *Sys. Ast.*, p. 38. *Goniodiscus sebae* Müller & Troschel, 1842. *Sys. Ast.*, p. 58.

3 specimens, 80–130 mm. in diameter. Sorong, New Guinea. — 1 specimen, 75 mm. in diameter. Amboina. Barbour collection.

The small series of *Culcitas* brought home by Mr. Barbour is of great interest because they prove that the starfish hitherto known as *Goniodiscus sebae* is the young of *Culcita novae-guineae* and not a distinct species closely related to the ancestral stock from which *Culcita* has sprung, as Döderlein has so ably argued (Semon's *Zool. Forsch. Aust.*, 5, lf. 4, p. 489–504). The specimen from Amboina is clearly *Goniodiscus sebae*, agreeing not only with Müller and Troschel's description, but with de Loriol's (1885. *Mém. Soc. Phys., Genève*, 29, p. 48; Plate 15, figs. 6–6e) description and figures, and with specimens in the Museum of Comparative Zoölogy collection from the Gilbert and Marshall Islands. It cannot, however, be separated in any way from the slightly larger young *Culcita* from Sorong, which is certainly identical with the other two specimens. On the actual side the latter are exactly like Döderlein's (1896. Semon's *Zool. Forsch. Aust.*, 5, lf. 3, p. 301–322) figures (Plate 20, fig. 9) of *C. novae-guineae*, but abactinally one is like *C. n. plana* (Plate 19, fig. 1), while the other (the largest of all) is like *C. n. arenosa* (Plate 19, fig. 5). Judging from the 54 *Culcitas* accessible to me, it seems doubtful whether the varieties (or subspecies) of *C. novae-guineae*, so carefully worked out by Döderlein, are really sufficiently distinct to warrant their recognition. — Mr. Barbour's specimens were collected about the reefs and were of a yellowish-brown color, with something of an olive tint when alive. They were all flat and more or less discoidal in life and showed no tendency to the spherical form characteristic of many adult *Culcitas*.

Gymnasteria carinifera.

Asterias carinifera Lamarck, 1816. *Anim. s. Vert.*, 2, p. 556.

Gymnasterias carinifera v. Martens, 1866. *Arch. f. Naturg.*, 32 (1), p. 74.

1 specimen, 130 mm. in diameter. Yellowish brown (dried). Sorong, New Guinea. Barbour collection.

Asterina cepheus.

Asteriscus cepheus Müller & Troschel, 1842. Sys. Ast., p. 41.

Asterina cepheus v. Martens, 1866. Arch. f. Naturg., **32** (1), p. 85.

2 specimens, 33 mm. in diameter. Amboina. Barbour collection.

In life these specimens were bluish green above, pale yellowish beneath, and these colors were little changed by drying. But on being washed with alcohol, the blue-green color was changed to orange-red, which faded to reddish-yellow on drying.

Asterina exigua.

Asterias exigua Lamareck, 1816. Anim. s. Vert., **2**, p. 554.

Asterina exigua Perrier, 1876. Arch. Zoöl. Exp., **5**, p. 222.

1 specimen, 30 mm. in diameter. In life dark fawn-color; pale in dried specimen. Under a stone, Tifu Bay, Buru Island, Moluccas. Barbour collection.

Asterina pectinifera.

Asteriscus pectinifer Müller & Troschel, 1842. Sys. Ast., p. 40.

Asterina pectinifera v. Martens, 1865. Arch. f. Naturg., **31** (1), p. 352.

2 specimens, Misaki, Sagami Bay, Japan. — 3 specimens, Tokyo, Japan. Owston collection.

These specimens are 68–90 mm. in diameter, and the color in alcohol is a more or less indistinct orange-red, which becomes paler on drying.

Linckia laevigata.

Asterias laevigata Linné, 1758. Syst. Nat., ed. 10, p. 662.

Linckia laevigata Lütken, 1871. Vid. Med., p. 265.

32 specimens, Amboina. — 6 specimens, Sorong, New Guinea. — 3 specimens, Gani, Halmahera Island. — 2 specimens, Manokwari, New Guinea. — 1 specimen, Pom, Jappen Island, New Guinea. Barbour collection.

These specimens were all collected on sandy bottoms and were blue, ranging from bright cobalt to brownish blue, with the papular areas more or less distinctly yellow. They were taken directly from the salt water and dried by artificial heat, so that in most cases there has been little change in form or color. They range from 85 to 265 mm. in diameter. Three of those from Amboina have only four rays each. The specimen from Pom has two madreporites but is not otherwise peculiar in any way. Examination of a very large series of specimens (343) in the Museum collection, from twenty stations between the Persian Gulf and Zanzibar on the west, and Samoa and Hawaii on

the cast, has satisfied me that it is futile to attempt to separate *L. multifora* from *laevigata* by any constant characters, although typical examples of the two forms are so easily distinguished. Specimens under 75 mm. in diameter usually show the characters of *multifora*, but in fully grown specimens all intergradations occur between the broad-rayed *laevigata* and the slender-rayed *multifora*. Unfortunately the number of madreporites is worthless as a character, for broad-rayed specimens occasionally have two, while slender-rayed specimens very often have only one. Most specimens from the western part of the Indo-Pacific region seem to have the rays long and slender, while most of those from Australia and the Pacific Islands have the rays short and broad, but this is far from being invariably true. On the whole I think we may retain *multifora* only as a form or variety of *laevigata*. The specimens in the Barbour collection showed a most extraordinary change in color when washed with alcohol. A few were placed in a jar of alcohol, which had been previously used, and their blue tints immediately became vivid orange-red. Thinking the change might be caused by impurities in the alcohol, further experiments were made, which showed that the effect is produced by the alcohol itself, and the mere application of perfectly pure alcohol for a few seconds is sufficient to change a bright blue color to bright orange-red. Subsequent application of an alkali had no visible effect. Continued immersion in alcohol results in the gradual loss of red, the specimens becoming brownish-yellow. On drying, the red specimens seem to retain the color quite well. In the lot of specimens from Amboina there are now to be seen brownish-blue, blue, orange-red, reddish-yellow, and brownish-yellow individuals. These facts emphasize the rule that little importance can be attached to differences in color shown by museum specimens of starfish.—One of the specimens from Amboina and one of those from Manokwari, each bore a specimen of the peculiar gasteropod, *Thyca pellucida*, described by Kükenthal in 1897 as found by him on specimens of *Linckia* at Ternate (see his "Parasitische Schnecken," Abh. Senck. Nat. Ges., 24 (1), p. 7; Plate 2, figs. 7-9).

Nardoa tuberculata.

Gray, 1840. Ann. Mag. Nat. Hist., 6, p. 287.

5 specimens, 130-215 mm. in diameter. Sorong, New Guinea. Barbour collection.

These specimens were found on sandy patches among the reefs and in life were a fawn-brown, which in dried specimens has become deep tawny brown, more or less blotched with blackish abactinally on the rays. They agree with de Loriol's (1893) specimens from Amboina in the entire absence of the dusky cross-bands on the rays shown in Herklot's (1868) figure. One of the specimens has only a very few of the characteristic tubercles developed.

Pteraster obesus, sp. nov.

Rays 5. $R = 22$ mm., $r = 16$ mm., $R = 1.4 r$. Breadth of ray at base, 16 mm. Interbraehial arcs shallow. Disc high, vertical diameter, 16 mm.; rays

not clearly marked off. Abactinal surface of rays high, rounded; actinal surface somewhat flat. Distal end of ray upturned, so that ambulacral furrows terminate on abactinal surface. Supradorsal membrane rather thin with no sign of reticulations. Spiracula small but very abundant all over abactinal surface. Paxillae high with numerous spines (8-10 or more) of approximately equal size. About 30 of the paxillae have the spines longer and stouter than the others, and these push the membrane up into more or less conspicuous points or ridges, which are irregularly scattered and give the abactinal surface a rough, almost warty appearance. Apparently there are no other calcareous particles in the membrane. Osculum large, surrounded by about 50 closely webbed long spines, which nearly close it. Ambulacra of moderate width; feet in two rows. Adambulacral plates, each with six (near the mouth there may be seven) spines, the innermost much the smallest, the outermost longest; as the innermost is situated on the inner aboral corner of the plate and the others are on its adoral side, the series is distinctly curved, with the concavity away from the mouth; all the spines are united to each other and to the actino-lateral spine by a membrane which reaches nearly to their free ends, but from which they project distinctly. Actino-lateral spines short, only about half as long again as the outermost adambulacral spine; as they are approximately equal except at tip of ray, the actino-lateral "fringe" is narrow and nearly parallel-sided, and is thus completely concealed from above; aperture-papilla small, free only along its aboral edge. Mouth-plates large, decidedly elevated at their aboral ends, where they terminate in a conspicuous point; the points of the adjacent plates are closely appressed, so there is only one point for the two plates. Each plate bears on its margin 5-7 (usually 6) spines, of which the first is about as long as the plate, flat, about one-fourth as wide as long, and square-cut at the end; the second is about two-thirds as long and, although flat, is somewhat more tapering; the remaining 3-5 spines are very slender, pointed, and about half as long as the first; the spines are all free, no membrane being developed between them. On the surface of each mouth-plate, at about the centre, is a very conspicuous superoral spine; it is longer and much stouter than the first mouth-spine, and terminates in a heavy, sharp, triangular point. — Color of alcoholic specimen, purplish pink, lightest on the ambulacra.

1 specimen from Sagami Bay, Japan; 35° N. × 138° 48' E., 75 fathoms. Owston collection.

Pteraster multiporus, sp. nov.

Rays 5. $R = 16$ mm., $r = 10$ mm., $R = 1.6 r$. Breadth of ray at base 11 mm. Interbrachial arcs rather deep and angular. Disc moderately high, vertical diameter 8.5 mm.; rays not well marked off. Abactinal surface of rays rather high, rounded; actinal surface flat. Distal end of ray upturned so that ambulacral furrows terminate on abactinal surface. Supradorsal membrane thin, very indistinctly reticulated. Spiracula small but exceedingly numerous all over the abactinal surface. Paxillae low, with numerous spines (8-10 or more), which are

much longer than the stalk that bears them; these spines are slender and approximately equal, so that the entire abactinal surface is relatively smooth. Aside from the tips of these spines there do not appear to be any calcareous particles in supradorsal membrane. Osculum rather small, surrounded by 30-40 rather short, closely webbed spines. Ambulacra rather narrow; feet in two rows. Adambulacral plates each with five (sometimes six) spines, the innermost much the smallest, the outermost longest; as the innermost is situated on the inner aboral corner of the plate and the others are on its adoral side, the series is distinctly curved, with the concavity away from the mouth; all the spines are united to each other and to the actino-lateral spine by a membrane which reaches nearly to their free ends, but from which they project distinctly. Actino-lateral spines short, little longer than outermost adambulacral spine, flattened and widened at the bluntly-rounded tip; they are subequal and the actino-lateral "fringe" is accordingly narrow and nearly parallel-sided. Aperture-papilla small, free only along aboral edge. Mouth-plates moderate, each with six slender, nearly cylindrical but pointed spines along the margin, the innermost largest, outermost smallest; the entire group of twelve spines is completely united by a thin but conspicuous membrane; superoral spines moderately stout, cylindrical but pointed, slightly exceeding the longest oral spines. — Color of alcoholic specimen, purplish pink.

1 specimen from Sagami Bay, Japan; 35° N. × 138° 48' E., 75 fathoms. Owston collection. Although taken at the same station with *obesus*, it is an entirely distinct species. It is closely allied to *reticulatus* from the Hawaiian Islands, but differs in having webbed oral spines, short, broad, actino-lateral spines, and low paxillae.

List of the species of *Pteraster*.

- militaris* O. F. Müller, 1776. Zool. Dan. Prod., p. 234. North Atlantic and Arctic Oceans, 10-618 fathoms.
- pulvillus* M. Sars, 1861. Overs. Norg. Ech., p. 62. North Atlantic and Arctic Oceans, 20-80 fathoms.
- danae* Verrill, 1869. Proc. Bost. Soc. Nat. Hist., 12, p. 386. Atlantic Ocean off east coast of South America, 30(?)—55 fathoms.
- affinis* Smith, 1876. Ann. Mag. Nat. Hist., (4) 17, p. 108. Royal Sound, Kerguelen Island, 5-28 fathoms.
- caribbaeus* Perrier, 1883. Stell. du "Blake," p. 216. Subtropical western Atlantic Ocean, 151-422 fathoms.
- aporus* Ludwig, 1886. Zool. Jahrb., 1, p. 293. Behring Sea.
- rugatus* Sladen, 1889. Challenger Report, 30, p. 473. Antarctic Ocean, vicinity of Heard Island, 150 fathoms.
- semireticulatus* Sladen, 1889. Challenger Report, 30, p. 475. Antarctic Ocean, near Marion Island, 69 fathoms.
- stellifer* Sladen, 1889. Challenger Report, 30, p. 474. Antarctic Ocean, near Cape Horn, 245 fathoms.

- personatus* Sladen, 1891. Proc. Roy. Irish Acad., (3) 1, p. 694. Atlantic Ocean, off Irish coast, 750 fathoms.
- ingoufi* Perrier, 1891. Ech. Cap Horn, p. K 144. Antarctic Ocean, near Cape Horn, 150 fathoms.
- lebruni* Perrier, 1891. Ech. Cap Horn, p. K 145. Antarctic Ocean, near Cape Horn and further south, 45-250 fathoms.
- alveolatus* Perrier, 1894. Tal. et Trav. Ech.: Stell., p. 183. Atlantic Ocean, near Azores, 2256 fathoms.
- sordidus* Perrier, 1894. Tal. et Trav. Ech.: Stell., p. 182. Atlantic Ocean, off Morocco, 633 fathoms.
- multispinus* Clark, 1901. Proc. Bost. Soc. Nat. Hist., 29, p. 326. Puget Sound.
- jordani* Fisher, 1905. Bull. Bur. Fish., 24, p. 314. Eastern Pacific Ocean, off San Diego, Cal., 642-650 fathoms.
- reticulatus* Fisher, 1906. Starfishes Haw. Isl., p. 1098. Pacific Ocean, near Hawaiian Islands, 284-298 fathoms.
- obesus* Clark, supra.
- multiporus* Clark, supra.

Key to the species of *Pteraster*.

Form more or less stellate, $R > 1.8 r$, usually 2-3.5 r .

A stout spine (superoral) present on surface of each oral plate.

A more or less conspicuous opening (osculum) present in centre of abactinal surface.

Adambulacral comb with more than 5 spines.

Stalk of paxilla short, not much higher than thick; oral spines 6, similar, none so large as superoral *militaris*.

Stalk of paxilla high and slender; oral spines 5, innermost much the largest, larger than superoral *caribbaeus*.

Adambulacral comb with 3-5 spines.

Oral spines 6; supradorsal membrane thick and smooth . . . *lebruni*.

Oral spines 4; supradorsal membrane thin.

Paxillae with numerous (5-10) spinelets; superoral spine shorter and stouter than innermost oral; 4 well-developed adambulacral spines
affinis.

Paxillae with few (1-3) spinelets, of which one is very long; superoral spine long, equalling innermost oral; innermost of 4 adambulacral spines very small or wanting *jordani*.

No osculum present *aporus*.

No superoral spine present.

Adambulacral spines 5, in curved series; oral spines 5 *personatus*.

Adambulacral spines 4, in straight series; oral spines 6 *sordidus*.

Form more or less pentagonal, $R < 1.8 r$, usually 1.3-1.7 r ; superoral spine present.

Adambulacral armature of 6-7 spines; paxillae spinelets 8-15.

Abactinal surface more or less swollen and rough or warty in adult; oral spines 6 (5-7).

Oral spines rather slender, all united by membrane; superoral spine not stout and triangular-pointed; actino-lateral spines much longer near middle of ray than near tip *pulvillus*.

Oral spines not united by membrane; first two (innermost) very flat and truncate; superoral spine very stout and triangular-pointed; actino-lateral spines of approximately equal length except at very tip of ray . . . *obesus*.

Abactinal surface not much elevated and not at all warty.

Oral spines 3, united by membrane; $R = 1.5 r \pm$ *multispinus*.

Oral spines 6 or 7, not united by membrane; $R = 1.7 r \pm$. . . *reticulatus*.

Adambulacral armature of 3-5 (rarely 6) spines.

Oral spines 6.

2 innermost spines long, 4 lateral short, each group united by a web; thus 4 groups to each mouth angle; adambulacral spines usually 4; no spiracula *alveolatus*.

Oral spines of each mouth angle all (12) united by a common membrane into a single group; adambulacral spines usually 5; spiracula very abundant *multiporus*.

Oral spines 3-5.

Oral spines not united by a web.

Adambulacral spines short, scarcely projecting beyond web . . . *stellifer*.

Adambulacral spines slender, projecting far beyond web . . . *danae*.

Oral spines united together by a web.

Adambulacral spines usually 3, sometimes 4, short, scarcely projecting beyond web *rugatus*.

Adambulacral spines 3-5, usually 4, projecting far beyond web.

$R = 1.75 r \pm$; dorsal membrane thin, evidently reticulated
semireticulatus.

$R = 1.4 r \pm$; dorsal membrane thick, not at all reticulate . . . *ingoufi*.

Echinaster eridanella.

Müller & Troschel, 1842. Sys. Ast., p. 24.

1 specimen, with six rays, 110 mm. in diameter. Very deep crimson-red in life. Manokwari, New Guinea. — 1 specimen, with six rays, 60 mm, in diameter. Red in life. Makassar, South Celebes. Barbour collection.

Asterias rollestoni.

Bell, 1881. Proc. Zool. Soc. London, p. 514.

1 young specimen, 50 mm. in diameter. Nearly white, more or less mottled with deep gray abactinally. Tokyo Bay, Japan, five fathoms. Owston collection.

Although this specimen does not correspond perfectly to either Bell's or Döderlein's (Zool. Anz., 25, p. 333) description, I think there can be little doubt that it belongs to this species.

Asterias similispinis, sp. nov.

Rays 5. $R=25$ mm., $r=5$ mm., $R=5$ r. Interbrachial arcs acute. Rays little flattened, upper surface somewhat convex, sides scarcely vertical, and actinal surface not sharply marked off. Breadth of ray at base 5.5 mm. Disc moderate; vertical diameter 5 mm. Whole abactinal surface quite closely and very irregularly covered with low stout spines, which though blunt are not capitate; there are three or four of these spines to each square millimeter; a median radial line is seldom well marked. Papular areas very variable in size, with from one to five papulae each. Among the spines are scattered small, rather stout and blunt (less commonly, acute) pedicellariae. On sides of ray can be distinguished a dorso-marginal and a ventro-marginal series of spines; space between these distinct but narrow; dorso-marginal series consists of a single (occasionally double near base of ray) longitudinal row of spines similar to and only a little larger than those on abactinal surface; ventro-marginal series made up of two rows which are quite separate at base of ray but become very closely appressed as tip of ray is approached, the lower spine of each pair being placed aboral to the upper; these spines are little longer than those of the dorso-marginal series, are nearly cylindrical, and blunt; near base of ray there may be two spines placed side by side on each infero-marginal plate, in the lower row of the ventro-marginal series. Most of the marginal spines of both series have a group of small pedicellariae at the base, which, however, do not form a surrounding wreath. Adambulacral armature consists of one or two large blunt cylindrical spines, very similar in appearance to the marginals; near base of ray every other plate bears two spines, the outer one nearer the mouth, but at middle of ray and beyond, most of the plates carry only a single spine; all of the adambulacral spines carry small pedicellariae, and there are similar pedicellariae on the plates within the ambulacral groove. There are no spines between the ventro-marginals and the adambulacrals, but no bare space is visible there, as the entire actinal surface is covered by those spines. Oral plates each with two marginal spines at the inner end, the innermost decidedly the larger; a still larger superoral spine is present on the surface of the plate near the middle. Madrepore plate free from spines, small, 1.5 mm. in diameter, situated about half-way between margin and centre of disc. — Color entirely bleached by alcohol.

6 specimens, 23–45 mm. in diameter. Taraku Island, near Nemuro, Hokkaido, Japan. Owston collection.

It is only with the greatest hesitation that I venture to describe a new *Asterias*, in the face of the large number of imperfectly described or little known species which now make that genus a source of so much difficulty. But as the six specimens before me agree in all essentials and differ in important particulars from any of the species known to me, and most decidedly from any of the species hitherto known from Japan (see Döderlein's key to the Japanese species of *Asterias*, Zool. Anz., 25, p. 331), I have felt justified in giving them a new name, based on the remarkable similarity between the adambulacral and marginal spines.

Although the reproductive organs are fairly well developed, I do not feel confident that these specimens are full grown.

OPHIUROIDEA.

Pectinura gorgonia.

Ophiarachna gorgonia Müller & Troschel, 1842. Sys. Ast., p. 105.

Pectinura gorgonia Lütken, 1869. Add. Hist. Oph., pt. 3, p. 33.

4 specimens. Diameter of disc, 10–11 mm. Green above, more or less blotched with yellowish white; arms conspicuously banded with same colors (dry). Sorong, New Guinea. Barbour collection.

Pectinura infernalis.

Ophiarachna infernalis Müller & Troschel, 1842. Sys. Ast., p. 105.

Pectinura infernalis Lütken, 1869. Add. Hist. Oph., pt. 3, p. 33.

34 specimens. Diameter of disc, 7–11 mm. Light gray to yellow-brown above, more or less variegated; arms distinctly banded with light and dark gray (dry). Sorong, New Guinea. Barbour collection.

Ophiolepis annulosa.

Ophiura annulosa de Blainville, 1834. Man. d'Act., p. 244.

Ophiolepis annulosa Müller & Troschel, 1840. Arch. f. Naturg., 6 (1), p. 328.

3 specimens. Diameter of disc, 15–18 mm. Deep purplish brown above, with large spot at centre of disc, one equally large at base of each arm, and from five to eight bands on each arm, dark buff (dry). Sorong, New Guinea. Barbour collection.

Ophiolepis cincta.

Müller & Troschel, 1842. Sys. Ast., p. 90.

2 specimens. Diameter of disc, 10 mm. Dull olive or brownish above; one specimen with arms indistinctly banded with lighter (dry). Amboina. Barbour collection.

Ophioplocus imbricatus.

Ophiolepis imbricata Müller & Troschel, 1842. Sys. Ast., p. 93.

Ophioplocus imbricatus Lyman, 1865. Illust. Catal., p. 69.

1 specimen. Diameter of disc, 14 mm. Dull brownish above on disc; light olive, with nine or ten narrow dark bands on arms. Amboina. Barbour collection.

Ophiozona longispina, sp. nov.

Diameter of disc, 7-10 mm.; length of arm, 15-25 mm. Disc flat, covered by about 60-75 plates, among which the central dorsal plate, the five radial primary plates, and ten radial shields are conspicuous. Radial shields oval, much larger than centro-dorsal, distinctly longer than wide, separated from each other by a longitudinal series of three or four radial plates. (Relative size and arrangement of other dorsal plates decidedly variable.)—Dorsal arm-plates more or less diamond-shape, two outer sides shorter than inner, with angles rounded (especially distal) or proximal truncate; first three or more (even out to the seventh sometimes) distinctly in contact.—Ventral surface of disc with interbrachial spaces covered by 15-25 plates. Oral shields large (about 1 mm. each way), pentagonal, with an inner angle, and outer side curved; lateral sides nearly as long as inner. Adoral plates somewhat variable, approximately quadrilateral but either broad or narrow; distinctly in contact within. Genital plates moderately large and plainly visible. Oral papillae four on each side, variable in relative size. No "infra-dental" papilla.—Ventral arm plates more or less quadrilateral, at least at base of arm, but becoming indistinctly pentagonal, hexagonal, or even heptagonal further out; first three or four wider than long, fourth or fifth about as long as wide, remainder rapidly becoming much longer than wide: first 4-8 distinctly in contact.—Side arm-plates rather small, coming in contact with each other dorsally at from fourth to eighth arm-joint and ventrally at from fifth to ninth joint; each one carries two (rarely three) long, slender, acute, well-spaced spines, which are usually longer than arm-joint and near base of arm, upper spine, which is longer than lower, may equal two arm-joints.—Tentacle-scale single, of moderate size.—Color (in alcohol) nearly white.

3 specimens. Uraga Channel, Gulf of Tokyo, Japan; 70 fathoms. Owston collection.

List of the species of *Ophiozona*.

- pacifica* Lütken, 1856. Vid. Med., p. 22. Pacific Ocean, off Mexico and Central America, littoral.
- impressa* Lütken, 1859. Add. Hist. Oph., pt. 2, p. 101. Atlantic Ocean off Florida, West Indies, and Brazil, 0-300 fathoms.
- nivea* Lyman, 1875. Illust. Catal., 8, p. 9. Atlantic Ocean, off Florida and West Indies, 56-424 fathoms.
- antillarum* Lyman, 1878. Bull. Mus. Comp. Zoöl., 5, p. 127. Atlantic Ocean, off West Indies, 450 fathoms.
- depressa* Lyman, 1878. Bull. Mus. Comp. Zoöl., 5, p. 128. Pacific Ocean, off Meangis Islands, 500 fathoms.
- dubia* Lyman, 1878. Bull. Mus. Comp. Zoöl., 5, p. 224. Atlantic Ocean, off West Indies, 539 fathoms.
- insularia* Lyman, 1878. Bull. Mus. Comp. Zoöl., 5, p. 126. Pacific Ocean, off Fiji Islands. 310 fathoms.

- stellata* Lyman, 1878. Bull. Mus. Comp. Zoöl., **5**, p. 125. Pacific Ocean, off New Zealand, 700-1100 fathoms.
- tessellata* Lyman, 1878. Bull. Mus. Comp. Zoöl., **5**, p. 223. Atlantic Ocean, off West Indies, 242 fathoms.
- clypeata* Lyman, 1883. Bull. Mus. Comp. Zoöl., **10**, p. 234. Atlantic Ocean, off West Indies, 151-232 fathoms.
- marmorea* Lyman, 1883. Bull. Mus. Comp. Zoöl. **10**, p. 233. Atlantic Ocean, off West Indies, 114-250 fathoms.
- bispinosa* Koehler, 1897. Ann. Sci. Nat., (8) **4**, p. 319. Indian Ocean, off Andaman Islands, 112 fathoms.
- alba* Lütken & Mortensen, 1899. Mem. Mus. Comp. Zoöl., **23**, p. 102. Pacific Ocean, off Cocos and Galapagos Islands, 770-1360 fathoms.
- contigua* Lütken & Mortensen, 1899. Mem. Mus. Comp. Zoöl., **23**, p. 101. Pacific Ocean, off Galapagos Islands, 1322-1360 fathoms.
- inermis* Bell, 1902. Rep. Nat. Hist. "Southern Cross," p. 217. Antarctic Ocean, off Cape Adare, South Victoria Land, 26 fathoms.
- casta* Koehler, 1904. Oph. Exp. "Siboga," pt. 1, p. 22. Arafura Sea, 312 fathoms.
- molesta* Koehler, 1904. Oph. Exp. "Siboga," pt. 1, p. 23. Sulu Sea, 705 fathoms; Atlantic Ocean, near Canary Islands, 1175 fathoms.
- capensis* Bell, 1905. Mar. Iuv. South Africa, **3**, p. 256. Indian Ocean, off Cape Colony, 25-900 fathoms.
- projecta* Koehler, 1905. Oph. Exp. "Siboga," pt. 2, p. 19. Banda Sea, etc., among Dutch East Indies, 8-63 fathoms.
- sincera* Koehler, 1906. Mém. Soc. Zoöl. France, **19**, p. 12. Atlantic Ocean, off Spain, 679-889 fathoms.
- longispina* Clark, supra.

Key to the species of Ophiozona.

Tentacle pores not restricted to base of arm; tentacle scales present at least at base of arm.

Tentacle scales present on all tentacle pores.

Tentacle scales 2

Arm-spines 2.

Arm-spines short, equal; radial shields small, separate or touching *molesta*.

Arm-spines as long as side arm-plates, upper longer; radial shields large, separate *bispinosa*.

Arm-spines 3-5.

Surface of disc smooth.

Disk high but flat, margin raised above arms, with a short spine or knob at outer end of each radial shield *tessellata*.

Disc-margin raised little, or not at all, above arms; no spine or knob at outer ends of radial shields.

Oral shields very small, little or not at all larger than one of the swollen adoral plates; arms short, 3-4 times diameter of disc
marmorea.

- Oral shields normal; arms 4-6 times diameter of disc.
- Arms about 4 times diameter of disc; lower interbrachial space with less than 30 plates *nivea*.
- Arms about 6 times diameter of disc; lower interbrachial space with more than 50 plates *clypeata*.
- Surface of disc lumpy and irregular, due to numerous, more or less swollen, small plates.
- Arms 3 or 4 times diameter of disc; arm-spines nearly or quite equal to joint, rather stout *impressa*.
- Arms 4 or 5 times diameter of disc; arm-spines minute, about half as long as joint *pacifica*.
- Tentacle scale single, though the basal pores may have an extra small scale on the inner side.
- Arm-spines 4 *insularia*.
- Arm-spines 2-3.
- First side arm-plates of adjacent arms meeting in interbrachial space *dubia*.
- First side arm-plates not meeting.
- Arm-spines short and peg-like, not exceeding half the arm-joint.
- Radial shields well separated.
- Most of the disc plates with one or more small but conspicuous tubercles *projecta*.
- Disc plates without tubercles or at most only a single large low tubercle on some of the primary plates.
- Upper arm-spine much the shorter; radial shield smaller than central primary plate *stellata*.
- Upper arm-spine the longer; radial shield larger than central primary plate *depressa*.
- Radial shields more or less in contact, or rarely slightly separated.
- Arm-spines 3 equal; mouth shield wide, touching first side arm-plate on each side *casta*.
- Arm spines 2, lower longer; mouth shield longer than wide, not in contact with first side arm-plate *sincera*.
- Arm-spines two-thirds as long as arm-joint or longer, radial shields separated.
- Side arm-plates meeting above, beyond first upper arm-plate *antillarum*.
- Side arm-plates not meeting above, before third upper arm-plate at least.
- Side arm-plates entirely separate above, at least on basal half of arm; radial shields small, about as broad as long; upper arm-spine not longer than lower *contigua*.
- Side arm-plates meeting beyond third to eighth upper arm-plate; radial shields large, longer than wide; upper arm-spine the longer.
- Basal under arm-plates longer than wide; arm spine not exceeding joint; mouth shield scarcely pentagonal, lateral sides much shorter than inner *alba*.

- 3 or 4 basal under arm-plates wider than long; upper arm-spine exceeding joint; mouth shield pentagonal, lateral sides nearly equal to inner *longispina*,
 Tentacle scales wanting on all except basal pores, where there are 2; arm-spines 3, short and peg-like *inermis*.
 Tentacle pores restricted to 3 basal joints of arm; no tentacle scales present; 3 minute arm-spines *capensis*.

Ophioglypha sterea, sp. nov.

Diameter of disc 7-8.5 mm.; length of arm 15-20 mm. Disc flat but high (vertical diameter about 2 mm.), covered by rather more than 100 plates, among which the centro-dorsal is conspicuous; relative size and arrangement of dorsal plates variable. Radial shields small, not much larger than centro-dorsal, about as wide as long, broadly in contact; inner ends separated very slightly by a radial plate, outer ends distinctly separated by first upper arm-plate. — Arms high and compressed at base, becoming nearly cylindrical towards tip. First upper arm-plate nearly pentagonal with an angle between radial shields, about half as large as one of them; second plate quadrilateral, about twice as wide as long; these two plates are included in the disc notch; third plate quadrilateral with rounded corners, two or three times as wide as long; next three or four plates more or less hexagonal but wider than long and broadly in contact with each other; succeeding plates longer than wide, gradually becoming diamond-shaped with distal angle rounded; somewhere between fifteenth and twentieth arm-joint, these dorsal plates cease to be in contact with each other. — Upper ends of genital plates conspicuous dorsally on each side of base of arm, rounded, flattened, and as wide as second dorsal arm-plate plus half of first; each plate bears an "arm-comb" of about a dozen spinelets, which are minute, flat, and truncate ventrally, but become longer, cylindrical, and acute dorsally; beneath this comb (and naturally concealed by it) on margin of side arm-plate is a delicate fringe of much more minute spinelets. — Ventral surface of disc with each interbrachial space covered by oral shield and about a dozen small plates. Oral shields very large (about 2 mm. long by 1.5 mm. wide), oval with narrow end inwards. Adoral plates very small, with parallel sides. Oral plates larger than adoral, somewhat swollen at inner end, and so forming a slight projection where they meet. Oral papillae four or five on each side; outermost widest and very flat, next two or three short and blunt, innermost longer and pointed; at apex of jaw is an unpaired, pointed papilla, the longest of all. — First ventral arm-plate nearly triangular with base and outer angle rounded; next three or four plates a trifle larger, more nearly square and broadly in contact; next five or six are longer than wide, more or less octagonal, and still in contact with each other; succeeding plates are hexagonal, pentagonal, and finally nearly circular, and are widely separated from each other. — Side arm-plates large; high, broad, and flat near base of arm where they meet neither above nor below; they meet each other dorsally somewhere after the fifteenth joint and ventrally two or three joints sooner.

Each one carries four minute, well-spaced, pointed spines, about one-third as long as plate, nearly equal or uppermost shortest.—Tentacle pores conspicuous, first six or eight with scales on both sides, but further out tentacle-scales are confined to margin of side arm-plates and resemble so closely the arm-spines that it is not easy to distinguish between them; first pore entirely distinct from mouth-slit, with five scales on outer side and five on inner; second pore has six scales on outer (proximal) side and four on inner; third has six and four respectively; fourth, seven and four; fifth, seven and three; tenth, sixth and none.—Color in alcohol white.

4 specimens, Uruga Channel, near Tokyo, Japan. 70 fathoms. Owston collection.

When Lyman published his key to Ophioglypha (Challenger Report, 1882), he included 58 species as valid. Since then more than 40 additional species have been described, chiefly from the collections of the "Siboga," "Albatross," "Blake," and "Investigator," so that it is with some hesitation that I add another to this already unwieldy group. The genus, however, is not so homogeneous but that it can be separated into subordinate divisions which at some future time it may be desirable to recognize as genera. One of these groups, of which *O. variabilis* Lyman is a good representative, has the following characters:—

Disc and arms high, latter rounded, with very short spines; basal under arm-plates about as broad as long; side arm-plates not meeting below within disc; oral shield large and conspicuous, covering a considerable part (sometimes nearly all) of ventral interbrachial space; adoral plates (usually small) at inner point of oral shield; first pair of tentacle pores not opening into mouth-slit; tentacle scales usually numerous. The following species belong in this group:—

- bullata* Wyville Thomson, 1873. *Nature*, **8**, p. 400. South Atlantic Ocean, 1240–2850 fathoms.
- convexa* Lyman, 1878. *Bull. Mus. Comp. Zoöl.*, **5**, p. 84. North Pacific, 2050–2350 fathoms (tropical Atlantic, 114–270 fathoms?).
- sculptilis* Lyman, 1878. *Bull. Mus. Comp. Zoöl.*, **5**, p. 84. Pacific Ocean, off Japan, 1875 fathoms.
- variabilis* Lyman, 1878. *Bull. Mus. Comp. Zoöl.*, **5**, p. 85. Dutch East Indies, 1425 fathoms (West Indies, 175–955 fathoms).
- ornata* Lyman, 1878. *Bull. Mus. Comp. Zoöl.*, **5**, p. 86. Tropical Pacific, north of Dutch New Guinea, 2000 fathoms.
- laczai* Lyman, 1878. *Bull. Mus. Comp. Zoöl.*, **5**, p. 87. South Pacific Ocean, south of Australia; coast of Chili, 2160–2600 fathoms.
- lienosa* Lyman, 1878. *Bull. Mus. Comp. Zoöl.*, **5**, p. 88. Antarctic Ocean, southwest of Australia, 1950 fathoms.
- radiata* Lyman, 1878. *Bull. Mus. Comp. Zoöl.*, **5**, p. 89. Pacific Ocean, off west coast of Luzon, Philippine Islands, 1050 fathoms.
- undata* Lyman, 1878. *Bull. Mus. Comp. Zoöl.*, **5**, p. 90. Pacific Ocean, west of Fiji Islands, 1450 fathoms.

- lapidaria Lyman, 1878. Bull. Mus. Comp. Zoöl, **5**, p. 90. Pacific Ocean, off Japan, 565 fathoms.
- fasciculata Lyman, 1883. Bull. Mus. Comp. Zoöl., **10**, p. 237. Atlantic Ocean, off Barbados, 288 fathoms.
- saurura Verrill, 1894. Proc. U. S. Nat. Mus., **17**, p. 288. Atlantic Ocean, off northeast coast of United States, 471-677 fathoms.
- obtecta Lütken & Mortensen, 1899. Mem. Mus. Comp. Zoöl., **23**, p. 119. Pacific Ocean, between Panama and Galapagos; vicinity of Galapagos Islands, 1201-1360 fathoms.
- sterea Clark, supra.

Key to variabilis group of Ophioglypha.¹

Arm-spines 2 or 3 (rarely 4 near base of arm).

Radial shields in contact for more or less of their length.²

Arm-comb present; basal upper arm-plates not ridged.

Lower arm-plates separated by side arm-plates, beyond third joint.

Arm-spines only 2 *radiata*.

Arm-spines more than 2.

Radial shield clearly longer than broad; interradial margin of disc not nearly filled by a single plate *obtecta*.

Radial shield about as wide as long; interradial margin of disc filled by a single plate *ornata*.

Lower arm-plates in contact at least to sixth joint.

Primary plates, radial shield, and two large plates in each interradius practically covering disc; oral shield very large, covering nearly entire interbrachial space beneath *convexa*.

Disc covered by more than 100 plates; oral shield covering about two-thirds of the interbrachial space *lacazei*.

Arm-comb wanting; basal upper arm-plates transversely ridged . . . *saurura*.

Radial shields completely separated by small plates.

Primary plates large; a single big interradial marginal plate . . . *bullata*.

Primary plates small; no large interradial plate on margin . . . *lienosa*.

Arm-spines 4 or more; radial plates more or less in contact.

Arm-spines 4 or 5.

¹ The species *abdita* Koehler, 1901, and *mundata* Koehler, 1906, very possibly belong in this group, but Koehler does not say whether the first pair of tentacle pores opens into the mouth-slit or not, and I am unable to satisfy myself on this point from the figures. Another species (*insolita* Koehler, 1904) I should certainly have placed here, judging from Koehler's description and figure, but Koehler himself places it in the group in which the first tentacle pores open into the mouth-slit; I cannot reconcile his figure with such a grouping.

² The figure of *O. lacazei* given by Lyman in the "Challenger" Report (Plate 6, fig. 5) shows the radial shields widely separated, in direct contradiction to the earlier figure (Bull. Mus. Comp. Zoöl., **5**, Plate 3, fig. 59) and to both of Lyman's descriptions.

Under arm-plates separated beyond third or fourth.

Basal upper arm-plates broadly in contact *variabilis*.

Basal upper arm-plates separated beyond second *undata*.

Under arm-plates not separated until at least the sixth.¹

Disc covered chiefly by 6 primary plates, 10 radial shields, and 5 large interradials; a large interradial plate just outside oral shield ventrally
fasciculata.

Disc covered by numerous small plates, among which primary plates are not conspicuous; no large interradial plate outside oral shield *sterea*.

Arm-spines 6 (rarely 5?) or more.

Arm-spines not more than 7 *sculptilis*.

Arm-spines not less than 9 *lapidaria*.

Ophiocoma brevipes.

Peters, 1852. Arch. f. Naturg., 18 (1), p. 85.

6 specimens. Diameter of disc, 9–17 mm. Color of disk yellowish-brown, with more or fewer dark spots; arms variegated olive and yellowish with narrow dark cross-bands. Amboina.—3 specimens. Diameter of disc 10–12 mm. Color of disc variegated light and dark brown; arms as in Amboina specimens. Sorong, New Guinea. Barbour collection.

Ophiocoma erinaceus.

Müller & Troschel, 1842. Sys. Ast., p. 98.

1 specimen. Diameter of disc, 8 mm. Color above and below deep purplish-brown, the spines strongly tinged with red. Amboina. Barbour collection.

This specimen is so easily distinguished from the other Ophiocomas in the collection that I am loath to accept the view held by Koehler and others that *erinaceus* is only a variety of *scolopendrina*.

Ophiocoma schoenleinii.

Müller & Troschel, 1842. Sys. Ast., p. 99.

3 specimens. Diameter of disc, 9–15 mm. Color above and below deep purplish-brown, almost black; proximal margin of under arm-plates whitish; as tip of arm is approached, the light color becomes more extensive, especially laterally, passing up on the side arm-plates to the upper surface, until at the extreme tip the arm is prettily banded with white and brown. This peculiar type of coloration is occasionally seen in specimens of *erinaceus*. Amboina. Barbour collection.

¹ Lyman says in his description of *fasciculata*, side arm-plates "meeting neither above nor below," but his figure shows them apparently in contact beyond the sixth under arm-plate.

The re-discovery of this lost species, which Lyman was inclined to regard as identical with *O. wendtii*, while he held both to be of doubtful validity, is a matter of real interest. Koehler (1905, "Siboga" Oph., pt. 2, p. 63; 1907, Bull. Sci. France et Belg., 41, p. 327) has ably defended the validity of *wendtii*, while the specimens which Mr. Barbour has brought from Amboina show that *schoenleinii* is equally recognizable. It may be distinguished at once from *erinaceus*, which it superficially resembles closely, by the presence of a single large tentacle scale on all the arm-joints beyond the disc; there are usually two on the first arm-joint, sometimes on one side of the second, and very rarely on one side of the third or fourth. The arm-spines are shorter and the oral shields a trifle wider than in specimens of *erinaceus* of the same size. The color also appears to be darker and without any trace of reddish. From *wendtii*, these specimens are easily separated by the short, broad oral shields, nearly as wide at the inner as at the outer end, by the basal under arm-plates which are wider than long, and by the absence of long club-shaped dorsal arm-spines on every third or fourth joint; the color also appears to be a deeper, more blackish brown, and more uniformly dark on the arms. In spite of the fact that it seems to be not only possible but quite easy to divide our Museum specimens of *Ophiocoma* from the East Indies into these various species, I shall not be surprised if more extended observations, carried on at the shore, prove that *erinaceus*, *schoenleinii*, *scolopendrina*, and *wendtii* are merely intergrading forms of a single variable species.

Ophiocoma scolopendrina.

Ophiura scolopendrina Lamarck, 1816. Anim. s. Vert., 2, p. 544.

Ophiocoma scolopendrina Agassiz, 1835. Mém. Soc. Sci. Neuchâtel, 1, p. 192.

47 specimens. Diameter of disc, 6-22 mm. Color dorsally very variable, ranging from uniform deep purplish brown to light yellowish brown, more or less marked with darker and on the arms finely spotted with white; but on the ventral side the under arm-plates and oral shields are always more or less clear yellowish. Sorong, New Guinea.—3 specimens, similar to above. Amboina. Barbour collection.

Ophiarthrum elegans.

Peters, 1851. Monats. K. Akad. Berlin, p. 464.

1 specimen. Diameter of disc, 12 mm. Color: centre of disc nearly black; margin of disc, arms, and interbrachial spaces yellowish or whitish finely spotted with brown; indistinct cross-bands of brown occur on the arms, especially near tip. Sorong, New Guinea. Barbour collection.

Ophiomastix annulosa.

Ophiura annulosa Lamarek, 1816. Anim. s. Vert., 2, p. 543.

Ophiomastix annulosa Müller & Troschel, 1842. Sys. Ast., p. 107.

8 specimens. Diameter of disc, 12-26 mm. Color brown, beautifully marked with yellowish white, each upper arm-plate sharply outlined therewith; spines whitish, spotted, or ringed with blackish. Amboina. Barbour collection.

Ophiarachna incrassata.

Ophiura incrassata Lamarck, 1816. Anim. s. Vert., 2, p. 542.

Ophiarachna incrassata Müller & Troschel, 1842. Sys. Ast., p. 104.

1 specimen. Diameter of disc, 24 mm. Color: disc greenish, centre, and areas over radial shields, light brownish (*not* in marked contrast) spotted with yellow; arms reddish buff; arm-spines light yellow, each with from two to four rings of brownish red; oral shields reddish buff, each with a round yellow spot. Amboina. Barbour collection.

This very handsome specimen, though dry, is nearly perfect. It is of interest because the color agrees fairly well with Müller and Troschel's original description, whereas the "Siboga" specimens seem to have been deep green; at least Koehler says (1905, Oph. "Siboga," pt. 2, p. 65) that Herklot's (1868) colored figure, which is very rich green, variegated on the disc with whitish, is "suffisamment exact."

Ophiothrix longipeda.

Ophiura longipeda Lamarck, 1816. Anim. s. Vert., 2, p. 544.

Ophiothrix longipeda Müller & Troschel, 1842. Sys. Ast., p. 113.

2 specimens. Diameter of disc, 15 mm. Color purple variegated with whitish; spines and spinelets white or nearly colorless. Amboina.—2 specimens. Diameter of disc 12 mm. Color similar to those from Amboina but lighter. Sorong, New Guinea. Barbour collection.

Ophiocreas papillatus, sp. nov.

Diameter of disc, 15 mm.; length of arm, about 250 mm.; width of arm at base, 4 mm.; height of arm at base, 4 mm. Disc flattened, not higher than arms, concave at centre, covered by a thin skin, which is thickly dotted in radial areas and near margin with minute roundish calcareous granules; of these there are, where thickest, about 75 to a square millimeter. Radial shields long, narrow, and flattened especially towards centre, where they approximately meet; no two are elsewhere in contact. They appear to be made up of several thin, flat, superposed, overlapping plates. Extending from outer end of radial shield at right angles to it, on margin of disc, is a small but very distinct plate, about a millimeter long; it appears to limit upper border of genital slit. Arms approximately cylindrical but flattened ventrally, tapering very gradually, not at all enlarged at base. No upper arm-plates. Skin at base of arm thickly sprinkled with minute calcareous granules like those on disc. Genital plates nearly as large, but not so long, as radial shields; genital slits 4 mm. long, nearly vertical, and parallel. Oral shield wholly invisible. Adoral plates large but indistinctly outlined. Oral plates two, projecting and rather conspicuous. Oral papillae small, rounded, of unequal size, very variable, from five to nine on each side of mouth-slit, situated

far up on sides of slit. Teeth papillae four to six, first or second much larger and more acute than others. Teeth few, apparently only five or six, thick, rounded triangular. — Ventral arm-plates small, separated by rather stout side arm-plates which meet in midline. Tentacle pores very large, diameter equal to or exceeding distance between two consecutive pores; buccal pair without scales but surrounded by a sprinkling of minute granules; first pair on arm much smaller than others and with no tentacle scale; second pair with one tentacle scale; succeeding pores each with a pair of scales. Tentacle scales tapering, rather acute, and more or less spinulose at tip; outer one somewhat shorter than inner, but difference between them is not great on any part of arm; inner one, where longest, is not equal to two arm-joints. Above outer tentacle scale, on each side of every joint until nearly at tip of arm, is a low, rounded tubercle. — Color pale reddish.

1 specimen (dry). Sea of Idzu, Hondo, Japan. Owston collection.

In the large size of the tentacle pores as well as in general appearance, this species is very similar to *O. japonicus* Koehler, but the presence of oral papillae and of granules on the disc, as well as the short nearly parallel genital slits, are such important differences that it does not seem possible that the two can be identical. It must be granted, however, that specific differences in the genus are very slight, and it is by no means certain that the species now recognized are all valid. It seems to be useless to lay any stress on relative proportions of disc and arms, for, as Lyman long ago pointed out, these vary greatly with age. Moreover, the enlargement at the base of the arm, supposed to be characteristic of *oedipus*, appears to be essentially dependent on the condition of the reproductive organs and therefore of very uncertain value. Bearing these facts in mind, I have prepared the following list of, and key to, the species of *Ophiocreas*. The key shows not only the relationships of the new form herein described, but reveals the remarkably slight differences by which the various species are distinguished from each other.

List of the species of *Ophiocreas*.

- lumbricus* Lyman, 1869. Bull. Mus. Comp. Zoöl., **1**, p. 347. Atlantic Ocean, off West Indies, 60–580 fathoms.
- abyssicola* Lyman, 1879. Bull. Mus. Comp. Zoöl., **6**, p. 64. Pacific Ocean, east of Japan, 2300 fathoms.
- oedipus* Lyman, 1879. Bull. Mus. Comp. Zoöl., **6**, p. 65. Pacific Ocean, west of Philippine Islands, 500 fathoms; northwest of Halmahera, 1108 fathoms; and Atlantic Ocean, off Ascension Island, 420–425 fathoms.
- carneus* Lyman, 1879. Bull. Mus. Comp. Zoöl., **6**, p. 63. Pacific Ocean, off west coast of Patagonia, 175 fathoms.
- caudatus* Lyman, 1879. Bull. Mus. Comp. Zoöl., **6**, p. 64. Pacific Ocean, off Enosima, Japan, 345 fathoms.
- spinulosus* Lyman, 1883. Bull. Mus. Comp. Zoöl., **10**, p. 281. Atlantic Ocean, off West Indies, 116–288 fathoms.

- adhaerens Studer, 1884. Abh. K. Pr. Akad. Wiss. Berlin, p. 54. Indian Ocean, off west Australia, 45 fathoms.
- constrictus Farquhar, 1900. Trans. N. Z. Inst., 32, p. 405. Pacific Ocean, off New Zealand.
- sibogae Koehler, 1904. Oph. "Siboga," pt. 1, p. 165. Pacific Ocean, off Halmahera, Kei and Rotti Islands, Dutch East Indies, 113-605 fathoms.
- japonicus Koehler, 1907. Bull. Sci. France et Belg., 41, p. 346. Pacific Ocean, off Japan.
- papillatus Clark, supra.

Key to the species of Ophiocreas.

Radial shields and upper arm-plates free from spines.

Skin of disc and bases of arms free from numerous pits and pores.

Oral shields very small, concealed; arms 5; 1 or 2 tentacle scales present on third and commonly on second pair of pores.¹

Tentacle pores small, their diameter much less than distance between 2 consecutive pores.

Radial shield long, narrow, thick; genital slits long, exceeding one-eighth of diameter of disc.

First 5 or more (rarely only 4) tentacle pores with only 1 scale or none.

Skin thick, soft, and smooth; radial shields long, meeting at centre of disc.

Skin very thick, wrinkled; no oral papillae or calcareous granules on mouth angles *carnosus*.

Skin thick and minutely tuberculated; small oral papillae or calcareous granules on sides of mouth angles *caudatus*.

Skin thin, provided on disc with minute granules; radial shields short, not quite meeting at centre *oedipus*.

First 2 or 3 (rarely 4) tentacle pores with 1 tentacle scale or none.

Oral papillae present, 9 or 10 to each mouth angle; skin of disc with numerous minute calcareous granules *lumbricus*.

Oral papillae wanting; skin of disc perfectly smooth *sibogae*.

Radial shields short, broad, thin, and flat; genital slits very short, less than one-tenth the diameter of disc² *abyssicola*.

Tentacle pores very large, their diameter about equalling distance between 2 consecutive pores.

No oral papillae; skin of disc smooth; genital slits long, converging
japonicus.

5-9 small rounded oral papillae on each side of mouth-slit; skin of disc and bases of arms rough with numerous small calcareous granules; genital slits short and nearly parallel *papillatus*.

¹ Not counting the buccal pair.

² In both the original description (1879) and the Challenger Report (1882) it is said that the genital slits are "5 mm. long," an obvious misprint for 0.5 mm., as shown both by context and figures.

Oral shields large and conspicuous; arms 5-7; no tentacle scales on first 3 pairs of pores, but 2 on each succeeding pore *adhaerens*.
 Skin of disc and bases of arms with numerous minute pits and pores *constrictus*.
 Radial shields and upper arm-plates with more or less numerous spines. *spinulosus*.

ECHINOIDEA.

Cidaris metularia.

Cidarites metularia Lamarck, 1816. Anim. s. Vert., **3**, p. 56.

Cidaris metularia Blainville, 1830. Zoöphytes: Dict. Sci. Nat., **60**, p. 212.

1 specimen, 18 mm. in diameter. Guam, Ladrone Islands. Owston collection.

Phyllacanthus baculosa.

Cidarites baculosa Lamarck, 1816. Anim. s. Vert., **3**, p. 55.

Phyllacanthus baculosa A. Agassiz, 1872. Rev. Ech., pt. 1, p. 150.

4 specimens, 24-38 mm. in diameter. Amboina. Barbour collection.

Goniocidaris biserialis.

Stephanocidaris biserialis Döderlein, 1885. Arch. f. Naturg., **51** (1), p. 79.

Goniocidaris biserialis Döderlein, 1887. Jap. Seeigel, p. 10.

3 specimens, 25-32 mm. in diameter. Uruga Channel, Gulf of Tokyo, Japan, 20-30 fathoms. — 1 specimen, 25 mm. in diameter. Sagami Bay (34° 58' N. × 138° 45' E.), Japan, 77 fathoms. Owston collection.

Goniocidaris mikado.

Discocidaris (Cidaris) mikado Döderlein, 1885. Arch. f. Naturg., **51** (1), p. 80.

Goniocidaris mikado Döderlein, 1887. Jap. Seeigel, p. 15.

3 specimens, 20 mm. in diameter. Sagami Bay (34° 58' N. × 138° 45' E.), 77 fathoms. Owston collection.

Diadema setosum.

Cidaris diadema var. *β setosa* Leske, 1778. Add. Klein, p. xvii (nomen nudum).

Echinometra setosa Leske, 1778. Add. Klein, p. 36; Plate 37, fig. 1, 2.

Diadema setosa Gray, 1825. Ann. Phil., p. 4.

10 specimens, 33-55 mm. in diameter. Amboina. Barbour collection. — 1 specimen, 15 mm. in diameter. Sagami Bay, Japan, 2 fathoms. Owston collection.

The specimens from Amboina are of special interest because they leave no doubt as to what species of *Diadema* Rumphius (1705) called *Echinometra setosa*. His specimens were the common *Diadema* of Amboina, and there can be no question that the specimens brought by Mr. Barbour from the same place are the same species. These ten specimens all agree in having the straight, slender pedicellariae, which Mortensen (1904, Dan. Exp. Siam: Ech., p. 11) has pointed out as characteristic of the commonest Indo-Pacific species of *Diadema*. Dr. Mortensen follows Lovén (1887, Ech. des. by Linn., p. 124) in attaching Linné's name *saxatilis* to this species, but Lovén's argument seems very weak. It is only by altering Linné's description and entirely ignoring his references to figures and to geographical distribution that his *saxatilis* can be applied to any *Diadema*, and even if all that were done, it would be absolutely impossible to tell to which of the five species recognized by Mortensen, Linné's name should rightly belong. On the other hand, Leske's figures, combined with Rumphius's good description, leave no doubt that a *Diadema* is the basis of the name *setosa*, and since the type-locality is definitely stated to be Amboina, examination of specimens from that place is bound to show to what particular *Diadema* the name should be attached. Of course it is quite possible that two or more species may occur at Amboina, but there is no evidence that such is the case, and even if it should prove to be so, the common species is evidently the one which Rumphius describes. It seems, therefore, beyond doubt that *Diadema saxatile* Mortensen, 1904, is the true *Diadema setosum*; whether Lovén's (1887) *saxatile* is the same appears to be indeterminable, while *saxatilis* Linné is almost certainly not a *Diadema* at all.

The young *Diadema* from Japan, in the Owston collection, is a very remarkable looking specimen, and I shall not be surprised if it proves to belong to an undescribed species. It differs from all other young *Diademas* which I have ever seen, or of which I can find records, in coloration. Instead of the usual black (or brown) and white (or whitish) cross-banded primaries, this specimen has the large spines light green with three or four cross-bands of purple. Unfortunately no large tridentate pedicellariae are to be found, although the specimen is perfectly preserved; presumably none have been developed. There are only eight or nine coronal plates in each column, and the number of primary spines in the ambulacra does not exceed ten in each vertical series. Consequently primary spines are not numerous, and secondaries and miliaries are also noticeably few. The longest spines do not exceed 20 mm. — In view of the fact that only a single specimen of this handsome young Echinoid is available, it seems best to record it under the name of the *Diadema* which is most likely to occur in Sagami Bay, although none is as yet known from there.

Echinothrix calamaris.

Echinus calamaris Pallas, 1774. Spic. Zool., 1, fasc. 10, p. 31.

Echinothrix calamaris A. Agassiz, 1872. Rev. Ech., pt. 1, p. 119.

2 specimens, 33–57 mm. in diameter. Amboina. Barbour collection.

Asthenosoma owstoni.

Araeosoma owstoni Mortensen, 1904. Ann. Mag. Nat. Hist., (7) **14**, p. 82.

Asthenosoma owstoni A. Agassiz and Clark, 1907. Bull. Mus. Comp. Zool., **51**, p. 117.

1 specimen, 160 mm. in diameter. Koajiro, Sagami Bay, Japan. Depth not given.—1 specimen, 130 mm. in diameter. Yenoshima, Sagami Bay, Japan. Depth not given. Owston collection

Asthenosoma ijimai.

Yoshiwara, 1897. Ann. Zool. Jap., **1**, p. 8.

2 specimens, 95–115 mm. in diameter. Sagami Bay, Japan. Depth not given. Owston collection.

Heterocentrotus trigonarius.

Echinus trigonarius Lamarck, 1816. Anim. s. Vert., **3**, p. 51.

Heterocentrotus trigonarius Brandt, 1835. Prod. Anim., p. 66.

6 specimens, 52–76 mm. in long diameter. Djamna, New Guinea.—1 specimen, 60 mm. in long diameter. Sorong, New Guinea. Barbour collection.

Echinometra mathaei.

Echinus mathaei de Blainville, 1825. Dict. Sci. Nat., **37**, p. 94.

Echinometra mathaei de Blainville, 1830. Dict. Sci. Nat., **60**, p. 206.

14 specimens, 20–37 mm. in long diameter. Amboina.—6 specimens, 28–38 mm. in long diameter. Sorong, New Guinea. Barbour collection.—1 specimen, 38 mm. in long diameter. Guam, Ladrone Islands. Owston collection.

Stomopneustes variolaris.

Echinus variolaris Lamarck, 1816. Anim. s. Vert., **3**, p. 47.

Stomopneustes variolaris Agassiz, 1841. Mon. d'Ech.: Obs. Prog. Rec. Hist. Nat. Ech., p. 7.

2 specimens, 45–50 mm. in diameter, remarkable for their deep but distinct green color. Sorong, New Guinea. Barbour collection.

Strongylocentrotus depressus.

Toxocidaris depressa A. Agassiz, 1863. Proc. Acad. Nat. Sci. Phil., p. 356.

Strongylocentrotus depressus A. Agassiz, 1872. Rev. Ech., pt. 1, p. 162.

12 specimens, Yenoshima, Sagami Bay, Japan.—4 specimens, Yemura, Uruga Gulf, Japan, half a fathom.—4 specimens, Sagami Bay, Japan. Owston collection.

This series of specimens, ranging in diameter from 14 to 67 mm., shows remarkable diversity in the color of the primary spines, which may be deep purple, purplish red, reddish, or white. All the primaries of any one individual are practically of the same color, consequently the specimens appear at first sight to belong to quite different species. I fail to find any other character, however, associated with this color difference.

Strongylocentrotus pulcherrimus.

Psammechinus pulcherrimus A. Agassiz, 1863. Proc. Acad. Nat. Sci. Phil., p. 357.
Strongylocentrotus pulcherrimus Mortensen, 1903. Ing. Ech., pt. 1, p. 121.

21 specimens, 16–33 mm. in diameter. Sagami Bay (34° 59' N. × 139° 50' E.), Japan. — 6 specimens, 25–30 mm. in diameter. Negishi, near Yokohama, Japan. Owston collection.

Strongylocentrotus purpureus.

Toxocidaris purpurea v. Martens, 1866. Arch. f., Naturg., 32 (1), p. 137.

3 specimens, 14–17 mm. in diameter. Yenoshina, Sagami Bay, Japan. — 1 specimen, 47 mm. in diameter. Sagami Bay, Japan. Owston collection.

Temnopleurus hardwickii.

Toreumatica hardwickii Gray, 1855. Proc. Zool. Soc. London, p. 39.
Temnopleurus hardwickii A. Agassiz, 1872. Rev. Ech., pt. 1, p. 166.

1 specimen, 42 mm. in diameter. Uruga Channel, Gulf of Tokyo, Japan. Owston collection.

Temnopleurus reynaudi.

Agassiz & Desor, 1846. Ann. Sci. Nat., 6, p. 360.

1 specimen, 17 mm. in diameter. Sagami Bay, Japan, 30–40 fathoms. Owston collection.

Temnopleurus toreumaticus.

Cidaris toreumatica Leske, 1778. Add. Klein, p. 91.
Temnopleurus toreumaticus Agassiz, 1841. Mon. d'Ech., Obs. Prog. Rec. Hist. Nat. Ech., p. 7.

5 specimens, 46–52 mm. in diameter. Uruga Channel, Gulf of Tokyo, Japan. — 1 specimen, 33 mm. in diameter. Sagami Bay (34° 59' N. × 139° 50' E.), Japan. Owston collection.

These specimens show great diversity in the height of the test, the vertical diameter varying from less than .50 to more than .65 of the horizontal diameter.

Salmacis sphaeroides.*Echinus sphaeroides* Linné, 1758. Sys. Nat., ed. 10, p. 664.*Salmacis sphaeroides* Lovén, 1887. Ech. Linn., p. 69.

2 specimens, 55 and 63 mm. in diameter. Amboina. Barbour collection.

Mespilia globulus.*Echinus globulus* Linné, 1758. Sys. Nat., ed. 10, p. 664.*Mespilia globulus* Agassiz & Desor, 1846. Ann. Sci. Nat., 6, p. 358.

5 specimens, about 20 mm. in diameter. Yenoshima, Sagami Bay, Japan.—1 specimen, 27 mm. in diameter. Aburatsubo, Sagami Bay, Japan. Owston collection.

In the specimen from Aburatsubo the spines are very bright red, in striking contrast to the dark green, bare interambulacral spaces, but in the specimens from Yenoshima the colors are more yellowish and not nearly so bright.

Salmacopsis olivacea.

Döderlein, 1885. Arch. f. Naturg., 51 (1), p. 93.

3 specimens, about 18 mm. in diameter. Sagami Bay (33° 9' N. × 138° 42' E.), Japan, 30–40 fathoms.—2 specimens, about 20 mm. in diameter. Uraga Channel, Gulf of Tokyo, Japan, 40 fathoms.—1 specimen, 24 mm. in diameter. Uraga Channel, Gulf of Tokyo, Japan, 20–30 fathoms.—1 specimen, 14 mm. in diameter. Aburatsubo, Sagami Bay, Japan. Owston collection.

The specimen from Aburatsubo is remarkable for the very bright green color of the interambulacra, contrasting sharply with the white ambulacra. The others are all olive-brown with more or less evident traces of greenish but with little contrast between interambulacra and ambulacra; the genital and ocular plates are blackish.

Prionechinus agassizii.

Wood-Mason & Alcock, 1891. Ann. Mag. Nat. Hist., (6) 8, p. 441.

2 specimens, 4.5 and 9 mm. in diameter. Nearly white but with a pink tinge. Sagami Bay (35° 32' 14" N. × 139° 31' E.), Japan, 400 fathoms. Owston collection.

Toxopneustes pileolus.*Echinus pileolus* Lamarck, 1816. Anim. s. Vert., 3, p. 45.*Toxopneustes pileolus* Agassiz, 1841. Mon. d'Ech., Obs. Prog. Rec. Hist. Nat. Ech., p. 7.

4 specimens, 62–114 mm. in diameter. Sagami Bay (35° 2' N. × 138° 52' E.), Japan. Owston collection.

Clypeaster japonicus.

Döderlein, 1885. Arch. f. Naturg., **51** (1), p. 100.

2 specimens, 87 and 100 mm. in long diameter. Sagami Bay, Japan. — 1 specimen, 54 mm. in long diameter. Sagami Bay (35° 2' × N. 138° 50' E.), Japan; 55 fathoms. — 2 specimens, 15 mm. in long diameter. Misaki, Sagami Bay, Japan. Owston collection.

The young ones from Misaki are too small to show specific characters plainly, but the ventral surface is so concave that I think there is little doubt that they are *japonicus*. The specimen 54 mm. long is very different from the larger adults, but its peculiarities may be due to immaturity. The primary spines are relatively few dorsally, only about one-third to one-half as many per square centimeter as in typical *japonicus* (20–25 as against 50–75), and instead of being greenish-white with a broad reddish or brownish band around the middle, they are glassy white; some, however, do show a faint brown band.

Clypeaster scutiformis.

Echinus scutiformis Gmelin, 1788. Linn. Sys. Nat., p. 3184.

Clypeaster scutiformis Lamarek, 1816. Anim. s. Vert., **3**, p. 14.

1 specimen, a broken, bare test, 23.5 mm. in long diameter. Buleleng, Bali, Dutch East Indies. Barbour collection.

Laganum laganum.

Echinodiscus laganum Leske, 1778. Add. Klein, p. 140.

Lagana laganum de Blainville, 1830. Dict. Sci. Nat., **60**, p. 196.

4 specimens, including 3 bare tests, 24–32 mm. long. Saonek, Waigiou, New Guinea. Barbour collection.

According to our now generally accepted codes, the name *bonani* cannot be retained for this species, as it is one of Klein's (1734) names re-introduced by Agassiz in 1841.

Laganum pellucidum.

Peronella (Laganum) pellucida Döderlein, 1885. Arch. f. Naturg., **51** (1), p. 104.

Laganum pellucidum A. Agassiz & Clark, 1907. Bull. Mus. Comp. Zoöl., **51**, p. 128.

2 specimens, about 22 mm. long. Misaki, Sagami Bay, Japan. Owston collection.

Arachnoides placenta.

Echinus placenta Linné, 1758. Sys. Nat., ed. 10, p. 666.

Arachnoides placenta Agassiz, 1841. Mon. d'Ech. Scut., p. 94.

1 specimen, a broken, bare test. Ampenan, Lombok Island, Dutch East Indies. Barbour collection.

***Astriclypeus manni*.**

Verrill, 1867. Trans. Conn. Acad., 1, p. 311.

3 specimens, 100–125 mm. in diameter. Sagami Bay, Japan. Owston collection.

***Spatangus pallidus* sp. nov.**

Test broad and flattened; width (47 mm.) nearly equal to length (49 mm.), but height little more than half as much; greatest width just back of abactinal system; greatest height (30 mm.) a trifle further back; at labrum, height only 26 mm. Cordate form of test not conspicuous as anterior ambulacral furrow is shallow, only about 2 mm. deep at ambitus. Anterior petals a trifle sunken, about 15 mm. long by 5 wide; there are about 15 pairs of pores in anterior series, and 18 in posterior. Posterior petals longer (17 mm.) and narrower (4 mm.), scarcely sunken; there are about 18 pairs of pores in anterior series, and 19 in posterior. Posterior end of test truncate, a trifle oblique, with slope downwards and forwards; periproct 8 mm. broad and 6 mm. high, covered by 60–70 plates, of which ten are much larger than others and form an outer marginal ring. Ventral surface of test flat on each side of sternum, but latter conspicuously keeled; keel about 11 mm. broad, 3 mm. high, and extending from labrum backward 27 mm. to a point about 15 mm. from lower margin of periproct, which we may call its posterior end; keel is highest, 9 mm. in front of this posterior end; seen from side, therefore, in natural position of test, keel slopes downward markedly from labrum for 18 mm., then slopes upward slightly for 9 mm., to its posterior end, whence test curves abruptly upward 10 mm., to a point on upper margin of subanal fasciole, about 5 mm. below periproct. Labrum slightly curved, but little projecting, 13 mm. from ambitus in furrow. Actinostome little sunken, about 8 mm. wide by 4 mm. long, covered by 30–40 plates, of which most anterior are largest. Bare ambulacral spaces on each side of sternum, about 6 mm. wide. Remainder of test quite closely covered with tubercles, except around actinostome; most of ventral surface is covered by primary tubercles which, however, pass into secondaries posteriorly, laterally, and on crest of keel. On dorsal surface, primaries few and inconspicuous; there are about fifteen small ones in posterior interradius arranged in half a dozen groups of two or three each; there are about ten slightly larger ones in each lateral interradius; and in each anterior interradius there are from twenty to thirty along margin of furrow, gradually passing into secondaries near ambitus. Sutural lines on dorsal surface, especially posteriorly, are slightly sunken and very distinct. Subanal fasciole consists of a broad band (varying from 1.5 to 2 mm.), enclosing an oblong space with rounded corners, about 13 mm. wide and about 8 mm. high (outside limits of fasciole, therefore, 17 × 12 mm.). Uppermost point of fasciole is about 3 mm. below periproct, while its lowest (or most anterior) point includes posterior end of sternum. — Genital pores 4, close together, practically at centre of dorsal surface. Whole test (except around mouth and on bare ventral ambulacra) thickly

covered with very slender, hair-like spines; secondaries and miliaries 1-3 mm. long and primaries up to 9 or 10 mm. in length; primaries, however, not conspicuously different or sharply distinguishable from secondaries. — Color of test pale purple, almost a grayish lavender, darkest in posterior dorsal interambulacrum and in band of subanal fasciole; spines silvery white.

2 specimens, Sagami Bay (35° 11' N. × 139° 45' E.), Japan, 50 fathoms. —
1 specimen, Sagami Bay (35° 3' N. × 138° 48' E.), Japan. Owston collection.

List of the species of *Spatangus*

- purpureus* O. F. Müller, 1776. Zool. Dan., p. 236. Norway to Azores, and in Mediterranean, 5-458 fathoms.
raschi Lovén, 1869. Öfv. Vet. Akad. Förh. Stockholm, p. 733. Norway to Azores, 100-805 fathoms.
lütkeni A. Agassiz, 1872. Bull. Mus. Comp. Zoöl., 3, p. 57. Japan, littoral (?)—107 fathoms; Moluccas (Sluiter).
capensis Döderlein, 1905. Zool. Anz., 28, p. 624. South Africa, 40-280 fathoms.
pauचितuberculatus A. Agassiz & Clark, 1907. Bull. Mus. Comp. Zoöl., 50, p. 253. Hawaii, 127-286 fathoms.
altus Mortensen, 1907. "Ingolf" Ech., pt. 2, p. 131. "China Seas."

Key to the species of *Spatangus*.

- Primary tubercles of dorsal side numerous, 150 or more in lateral and posterior interambulacra together.
Subanal fascioled area more than twice as wide as high with a reëntering angle on upper side *purpureus*.
Subanal fascioled area not nearly twice as wide as high, with no reëntering angle.
Only 2 pairs of ambulacral pores included within subanal fasciole on each side; anterior petals tapering towards ends, more or less decidedly so proximally.
Primary tubercles present in ambulacra between end of petals and ambitus; width of posterior petals less than one-fourth length *raschi*.
Primary tubercles wanting in ambulacra; width of posterior petals more than one-fourth length *capensis*.
3 pairs of ambulacral pores included within subanal fasciole on each side; anterior petals broad, not tapering towards ends, even proximally *altus*.
Primary tubercles of dorsal side few, less than 50 in lateral and posterior interambulacra together.
Lateral ambulacra with two, one, or no primary tubercles; test very broad and flat, vertical diameter about equal to one-half length or less *pauचितuberculatus*.
Lateral ambulacra with from six to twelve primary tubercles; vertical diameter usually more than half the length.
Plastron with little or no keel; subanal fasciole 1-1.5 mm. broad; color deep purple *lütkeni*.
Plastron with conspicuous keel; subanal fasciole 1.5-2 mm. broad; color grayish lavender *pallidus*.

Maretia planulata.

Spatangus planulatus Lamarck, 1816. Anim. s. Vert., 3, p. 31.

Meretia planulata Gray, 1855. Cat. Rec. Ech. Brit. Mus., p. 48.

3 specimens, about 45 mm. in length; Sagami Bay ($35^{\circ} 10' N. \times 139^{\circ} 48' E.$), Japan. Owston collection.

Lovenia gregalis?

Alcock, 1893. Journ. Asiat. Soc. Bengal, 62, p. 175.

1 specimen, 26 mm. long. Sagami Bay ($35^{\circ} 12' N. \times 139^{\circ} 44' E.$), Japan, 60 fathoms. Owston collection.

Although there can be little question that this young spatangoid is a *Lovenia*, there is abundant room for doubt as to its being *gregalis*, for the specific characters are not yet evident.

Brissus carinatus.

Spatangus carinatus Lamarck, 1816. Anim. s. Vert., 3, p. 30.

Brissus carinatus Gray, 1825. Ann. Phil., p. 9.

4 specimens, 56-93 mm. long. Sagami Bay, Japan. Owston collection.

Metalia spatagus.

Echinus spatagus Linné, 1758. Sys. Nat., ed. 10, p. 665 (= *E. maculosus* Gmel.).

Metalia spatagus Lovén, 1887. Ech. des. Linn., p. 162.

1 specimen, 28 mm. long. Sagami Bay ($35^{\circ} N. \times 138^{\circ} 41' E.$), Japan, 25 fathoms. Owston collection.

Schizaster japonicus.

A. Agassiz, 1879. Proc. Amer. Acad., 14, p. 212.

4 specimens, about 50 mm. long. Sagami Bay ($35^{\circ} 22' N. \times 139^{\circ} 40' E.$), Japan. — 1 specimen, Sagami Bay ($35^{\circ} 12' N. \times 139^{\circ} 44' E.$), Japan. — 1 specimen, Uraga Channel, Gulf of Tokyo, Japan, 20-30 fathoms. Owston collection.

All but two of these specimens are badly crushed.

Schizaster ventricosus.

Gray, 1851. Ann. Mag. Nat. Hist., (2) 7, p. 133.

4 specimens, about 30 mm. long. Sagami Bay, Japan. — 2 specimens, Tokyo Bay, Japan, 10 fathoms. Owston collection.

All but one of these specimens are badly crushed.

HOLOTHURIOIDEA.

Thyone anomala ?

Östergren, 1898. Zool. Anz., 21 p. 110.

1 specimen, about 75 mm. long by 13 in diameter. Sagami Bay (35° 3' N. × 135° 47' E.), Japan, 110 fathoms. Owston collection.

The specimen is contracted, and having been preserved in formalin, the calcareous particles in the skin are entirely wanting, except a few perforated and somewhat corroded plates in the tentacles. The general anatomy agrees well with *anomala*, except that I found only a single stone-canal. Of course, without the calcareous particles of the skin, actual identification of a *Thyone* is impossible.

Holothuria monacaria ?

Lesson, 1830. Cent. Zool., p. 225.

1 specimen, about 140 mm. long. Okinose, Sagami Bay, Japan. Owston collection.

This specimen is also strongly contracted, and the outer layer of calcareous particles appears to be nearly all dissolved; at least tables are very rare, while buttons with three pairs of holes are exceedingly common. The general appearance of the animal is very much like a *Stichopus*, for there is a series of large warts along each side and others are scattered over the back, while the ventral surface is thickly covered with pedicels. The deposits, however, seem to agree perfectly in form with those of *monacaria*, and I therefore refer the specimen to that species, although its condition is such as to leave room for doubt.

Molpadia rosacea, sp. nov.

Body stout, 100 mm. long by about 50 mm. in diameter; oral disc 15 mm. in diameter; caudal appendage very small, only 5 mm. long, and apparently without any anal papillae. Skin thin and smooth. Tentacles fifteen, of uniform size; each one is about 4 mm. long and 1 mm. in diameter; nearly a millimeter from the tip on each side is a very slender digit only a quarter of a millimeter long; no other digits are present. No evident genital papilla. Calcareous ring not very stout; radial projections posteriorly rather small and delicate. Polian vessel single. Stone-canal single, spirally wound in dorsal mesentery. Respiratory-trees well developed but slender; right one extending forward so far as to lie against calcareous ring. Calcareous deposits in body wall very scarce, consisting of irregular perforated plates, which have the appearance of having been discs of small tables; they are only 80–100 μ across and have from two to six holes; most of them are colored and apparently becoming transformed into phosphatic bodies; these latter are exceedingly abundant but extraordinarily small, scarcely any exceeding 40 μ in diameter; they are arranged in small groups which appear as