

No. 7. — *Ophiuridæ and Astrophytidæ of the Exploring Voyage of H.M.S. "Challenger," under PROF. SIR WYVILLE THOMSON, F.R.S.*  
By THEODORE LYMAN.

PART I.

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IN order that persons who are interested in Echinodermata may get early information, and to secure a just priority of discovery to the "Challenger" expedition, this Prodrôme is printed.

It will be in two parts, and will contain descriptions of all new genera and species of Ophiuridæ and Astrophytidæ, with a simple outline figure of each. Part I. contains thirteen new genera and ninety-six new species, to wit: *Ophioceten*, 4 species; *Ophioglypha*, 35; *Ophiomastus*, 1; *Ophioplinthus*, 2; *Ophiomusium*, 12; *Ophiopyrgus*, 1; *Ophiernus*, 1; *Ophioceramis* (?), 2; *Ophiozona*, 4; *Ophiotrochus*, 1; *Ophiophyllum*, 1; *Ophiobyrsa*, 1; *Ophiochiton*, 1; *Ophiopyren*, 2; *Ophiacantha*, 16; *Ophiothamnus*, 1; *Ophiomitra*, 4; *Ophiocamax*, 1; *Ophiolebes*, 2; *Ophioscisma*, 1; *Ophiogeron*, 1; *Ophioscolex*, 2.

Part II. will contain the remaining Ophiuridæ and the Astrophytidæ. All matters beyond those of description will be reserved for the more important work to be published by the British Government.

The following courses will give a general notion of the position of the dredging stations:—

- Stations 1– 24, Canaries to West Indies.
- " 25– 53, West Indies to Halifax.
- " 59– 83, Bermuda to Madeira.
- " 84–123, Madeira to Brazil.
- " 129–140, Brazil to Cape of Good Hope.
- " 141–161, Cape of Good Hope to South Australia by Antarctic Circle.
- " 162–237, Australia, by Philippines, to Japan.
- " 238–260, Japan to Sandwich Islands.
- " 261–304, Sandwich Islands to Patagonia.
- " 305–321, Patagonia to Buenos Ayres.
- " 322–354, Buenos Ayres to the Azores.

## OPHIOGLYPHA.

## TABLE OF SPECIES HEREIN DESCRIBED.

NOTE. Following these descriptions will be found the species previously known and brought back by the "Challenger," namely, *O. Sarsii*, *O. acerrata*, *O. sinensis*, *O. falcoifera*, *O. hexactis*, *O. multiciliata*, *O. Lymani*.

- |   |   |                                      |
|---|---|--------------------------------------|
| Disk rather flat, and covered with imbricated scales. Under arm-plates small, widely separated; much wider than long beyond the second plate, and thereafter constantly diminishing in size. Arm-comb of more or less needle-like papillae. Arm slightly flattened, with spines about as long as a joint. Tentacle-scales few beyond the second pair of pores. (This is the typical form of the genus based on <i>O. ciliata</i> .) | } <i>O. ferruginea</i> .  |                                      |
| Disk covered with smooth skin, through which the very small scales are scarcely or not at all visible. Arm-spines long, broad, and flat.  | } <i>O. flagellata</i> .  |                                      |
| Disk-scales thin and smooth. Under arm-plates, within disk, large and touching each other. Arm-comb of sharp needle-like papillae, with a well-marked under comb on the arm itself.   | } <i>O. palliata</i> .  |                                      |
|   | { Four arm-spines; one long and high up, three short and low down. Radial shields touching without; disk-scales angular.  | } <i>O. lepida</i> .                 |
| Disk thin, with rather delicate scales, arms slender, with small spines. Papillae of arm-comb sharp and cylindrical.  | { Three arm-spines; one long and high up, two short and low down. Radial shields separated; disk-scales small and curved.   | } <i>O. Ijungmani</i> .              |
|   | { Four very short, peg-like arm-spines equally spaced.  | } <i>O. aequalis</i> .               |
|   | { Three slender, equally spaced arm-spines. Mouth-shield trefoil, with a long lobe inward.  | } <i>O. imbecillis</i> .             |
|   | { Three very short, small, sharp arm-spines, low down. Mouth-shield wider than long, with a point within. Radial shields long and separated.                        | } <i>O. irrorata</i> .               |
|   | { Three very short, small, sharp arm-spines, low down. Mouth-shield as broad as long. Radial shields short, rounded, and separated by the fine scaling of the disk. | } <i>O. orbiculata</i> .             |
| Disk covered with smooth, moderately thick scales. Arm-spines small and short. Second under arm-plate about as long as broad, those farther out much broader than long. Papillae of arm-comb close-set, flat, and with rounded ends.  | { Three very short conical arm-spines, standing on middle of edge of plate. Disk-scales coarse and rather thick. Radial shields broader than long and joined.       | } <i>O. undulata</i> .               |
|   | { Three very short, blunt, peg-like arm-spines, evenly spaced. Disk-scales few and large. Radial shields long and separated.  | } <i>O. costata</i> .                |
|   | { Six short, blunt, peg-like, evenly spaced arm-spines. Arms narrow. Radial shields short and separated by one or two large rounded plates.                         | } <i>O. albata</i> .                 |
|   | { Three slender pointed arm-spines, about two thirds as long as a joint. Disk-scales few and mostly large. Radial shields large and joined.                         | } <i>O. jejuna</i> .                 |
| Disk-scales of moderate size, thick, and swollen. Very small, narrow side mouth-shields. Arm-spines short. Tentacle-scales numerous. Under arm-plates within disk about as broad as long, and separating the side arm-plates.   | { Three short, blunt, peg-like arm-spines evenly spaced. Papillae of arm-comb short, close-set, and sharp.  | } <i>O. brevispina?</i><br>E. A. Sm. |
|   | { Four short, blunt, peg-like arm-spines, three together, low down, and one higher up. Papillae of arm-comb short, close-set, and squarish.                         | } <i>O. ambigua</i> .                |
| Disk smooth and flat, with scales, radial shields, and mouth-shields all small. Arm-spines few and small. Mouth-papillae and tentacle-scales similar, numerous, even, and close-set.  | { Three to five short, sharp arm-spines, about half as long as a joint.   | } <i>O. Loveni</i> .                 |
|   | { Five very minute, blunt arm-spines, which often are rubbed off or naturally wanting.  | } <i>O. fraterna</i> .               |
| Disk high and arched. Arms short and thick. Each under arm-plate having a median, elongated, bead-like swelling. (Type of <i>O. Stuwitzii</i> .)  | } <i>O. elevata</i> .   |                                      |

<p>Disk high. Basal under arm-plates about as long as broad. Arms high and rounded, with very short spines. Side arm-plates not meeting below within disk. Side mouth-shields small, and at inner point of mouth-shield. Many tentacle-scales. (Type of <i>O. bullata</i>.)</p>	<p>Interbrachial space, below, covered almost entirely by the large mouth-shields and genital scales.</p>	<p>Three minute, evenly spaced arm-spines. Disk-scales above rounded and of various sizes, with large marginal plates.</p> <p>Three small tapering arm-spines. Disk covered above by a rosette of large angular primary plates, radial shields, and a few large interbrachial plates.</p>	<p><i>O. bullata</i> Wyv. Thom.</p> <p><i>O. convexa</i>.</p>
	<p>Mouth-shield and genital scales large and conspicuous, but not covering the central margin of the interbrachial space.</p>	<p>Six minute arm-spines. First under arm-plate broader than long; those beyond longer than broad. Radial shields separated within by a cluster of large scales.</p>	<p><i>O. sculptilis</i>.</p>
<p>Basal under arm-plates, beyond the second, about as long as broad, squarish, and with water-pores between them. Arms high, with swollen upper arm-plates and very small spines. Upper disk covered in great part by a rosette of primary plates and by radial shields.</p> <p>Disk covered with much-swollen lumpy plates. Genital scales wide, thick, and in a single piece. Basal under arm-plates longer than wide. Papillae of arm-comb short, flat, close-set, and with rounded ends.</p> <p>Disk-plates high and excessively swollen. Upper arm-plates rising in a high sharp ridge. Arm-spines minute, close-set, and like little blocks.</p> <p>Interbrachial space below covered by only one or two plates besides the genital scales. Upper arm-plates rudimentary or wanting. Tentacle-pores of arm with only one rounded scale.</p> <p>Disk thick, and covered with thin smooth scales. No arm-comb, nor papillae along genital openings. Basal under arm-plates, beyond the second, short and wide.</p>	<p>Four or five minute arm-spines. Under arm-plates longer than broad. Radial shields separated at inner ends by a single scale.</p>	<p>Three or four minute, widely spaced arm-spines. Mouth-shield trefoil, with a pointed lobe inward.</p>	<p><i>O. variabilis</i>.</p> <p><i>O. ornata</i>.</p>
	<p>Three minute arm-spines, high up. Radial shields rounded, separated by one scale within. One large marginal plate with small scales about it.</p>	<p>Three minute arm-spines, high up. Radial shields rounded, separated by one scale within. One large marginal plate with small scales about it.</p>	<p><i>O. Lacazei</i>.</p>
	<p>Three minute arm-spines. Disk covered by small irregular scales, small separated radial shields, and very large mouth-shields.</p>	<p>Two minute arm-spines. Mouth-shield trefoil. Under arm-plates axe-shape. Radial shields small and rounded.</p>	<p><i>O. lienosa</i>.</p> <p><i>O. radiata</i>.</p>
	<p>Four minute, blunt arm-spines. Disk-plates rough and lumpy, with rosette of large primaries. Under arm-plates pentagonal.</p>	<p>Eleven short, pointed, close-set arm-spines. Mouth-shields trefoil. Under arm-plates squarish. About eight tentacle-scales to each pore within the disk.</p>	<p><i>O. undata</i>.</p> <p><i>O. lapidaria</i>.</p>
	<p>Basal under arm-plates, beyond the second, about as long as broad, squarish, and with water-pores between them. Arms high, with swollen upper arm-plates and very small spines. Upper disk covered in great part by a rosette of primary plates and by radial shields.</p>	<p>No true arm-comb.</p>	<p>Side mouth-shields large and ovoid. Radial shields and primary plates circular and similar.</p> <p>Side mouth-shields small. Mouth-shield broader than long, with a peak inward.</p> <p>Disk-plates irregular and lumpy. A group of papillae near the arm, on margin of interbrachial space.</p>
<p>Disk and arm-plates thick, swollen, and closely soldered. Mouth-papillae and scales of mouth-tentacles thick, squarish, irregular, and crowded. Arm-spines minute, with tentacle-scales similar in form, and standing only on side arm-plate, inside the pore.</p>	<p>A small arm-comb. Side mouth-shields very narrow.</p>	<p>Side mouth-shields very narrow.</p>	<p><i>O. inorta</i>.</p>

**Ophioglypha ferruginea** sp. nov.**Plate III. Fig. 76.**

*Special Marks.*—Disk rather flat and covered with imbricated scales. Under arm-plates small, widely separated; much wider than long beyond the second plate, and thereafter constantly diminishing in size. Arm-comb of papillæ more or less needle-like. Arm slightly flattened with spines about as long as a joint.

*Description of an Individual* (Station 162).—Diameter of disk 6.5 mm. Length of arm about 22 mm.; width of arm close to disk without spines 1.5 mm. Three or four short, pointed, widely separated papillæ on each side, and one or two, somewhat longer, at apex of jaw. Mouth-shields longer than wide, pentagonal, with an angle inward, lateral sides straight, outer edge rounding, length to breadth 1.7 : 1. Side mouth-shields nearly straight and narrow, slightly tapering inward, where they meet. First under arm-plate triangular, with an angle inward and outer edge curved; second one with lateral sides curved; those beyond are much broader than long, with curved outer edge and a small peak within. Side arm-plates slightly swollen, meeting broadly below, separated above by upper arm-plates, four-sided, with outer edge rounded, lateral sides straight, and inner side shorter than outer. Disk covered with closely joined, rounded scales of several sizes; radial shields short pear-seed shape, swollen, nearly meeting without, but separated their entire length by a wedge of one large and three or four smaller scales; space within the radial shields occupied by a central cluster of six primary plates, separated by minute scales, one or two larger plates in the brachial and interbrachial spaces, with other smaller ones irregularly disposed. Genital scales long and narrow; along their free edge is a line of very fine bead-like papillæ, becoming short regular spines as they pass to the upper surface to form the arm-comb, where the genital scales are much broader; interbrachial spaces below covered with rows of semicircular swollen plates, varying in size; at the margin is a large, much swollen plate, broader than long, on either side of which is a smaller oval one. Three long tapering arm-spines, the upper one being slightly longer than the others, and nearly as long as a joint. Tentacle-scales thin, and quite round, — on the large pores of the mouth-tentacles four or five on each side; on the second three on each side; third and fourth two on each side; those beyond have usually one large scale. Color in alcohol, below, white; above, mottled yellowish brown, and arms barred with the same.

*O. ferruginea* is of the strictly typical *Ophioglypha*. It is distinguished from *O. sinensis* by different mouth-shields and thicker disk-scales, and by wanting the water-pores between the basal under arm-plates.

Station 162, Bass Straits, 38 fathoms, 3 specimens. Port Jackson, 2–10 fathoms, 12 specimens. Station 161, 38 fathoms, 1 specimen. Station 188, 23 fathoms, 1 specimen.

**Ophioglypha flagellata** sp. nov.

Plate II. Figs. 49-51.

*Special Marks.* — Disk covered with smooth skin, through which the very small scales are scarcely or not at all visible. Arm-spines long, broad, and flat.

*Description of an Individual* (Station 232). — Diameter of disk 18 mm. Width of arm without spines 4 mm. Mouth-papillæ four or five on each side, small, tooth-like, separated, growing larger towards the apex of the jaw, where there is one large and club-shaped resembling the teeth above it. Mouth-shield small, short heart-shape, with projecting corners and angle inward; length to breadth 2.7 : 3. Side mouth-shields long and narrow, wider without than within, where they do not quite meet. First under arm-plate broader than long, triangular or rudely hexagonal, with angles much rounded; the plates beyond are much wider than long, bounded within by a blunt angle and without by a curve having a little peak at its apex. Side arm-plates rather thin, not meeting till some way beyond disk, widely separated above by upper arm-plates, which are hexagonal, much broader than long, very flat and thin, with outer and inner edges straight, and ill-marked lateral angles. Disk flat, covered with a thick skin, under which the thin small scales are scarcely, or not at all, distinguishable. Radial shields very small, rounded, and widely separated; length to breadth 1 : 1.5. Interbrachial spaces below covered by regular rows of very fine, minute scales, extending quite to the margin. Genital scales long and very narrow, almost concealed by the disk-scales; along the free edge is a row of very fine, delicately pointed papillæ, which grow longer as they pass upward to make a short arm-comb. Arm-spines longer than the joints, flat spatula-shape, arranged in a cluster of three just outside the tentacle-pores; of which those of the mouth-tentacles are very large, and have six or seven thin, flat scales on each side; the next three have three long thin flat scales on the inner side, and one or two very small slender ones on the outer side, beyond this three only, on the inner side. Color in alcohol, disk gray, upper arms yellow brown.

Station 232, 340 fathoms, 2 specimens.

**Ophioglypha palliata** sp. nov.

Plate IV. Figs. 98-100.

*Special Marks.* — Disk-scales thin and smooth. Under arm-plates, within disk, large and touching each other. Arm-comb of sharp needle-like papillæ, with a well-marked under comb on the arm itself.

*Description of an Individual* (Station 164 a). — Diameter of disk 10.5 mm. Width of arm close to disk 2.5 mm. Five or six small mouth-papillæ on each side, the two outermost being short and blunt, the next three or four sharply pointed, while the one at the apex of the jaw is large and rounded at the end. Mouth-shield pentagonal with a blunt angle inward, and outer

corners rounded. Length to breadth 2.5 : 2. Side mouth-shields long and narrow, meeting within ; broadest at their outer end, where they join the side arm-plates. First under arm-plates irregular, transverse oval ; the second similar, but larger ; those immediately beyond are transverse diamond-shape, with much rounded angles. Side arm-plates broad and thin, not meeting below till beyond the disk, widely separated above by the upper arm-plates, of which the first one is small and triangular, the second quadrangular, with the outer edge widest and curved, and inner edge straight. Upper surface of disk, which is smooth and even, covered with thin, fine, ill-defined curved scales ; the radial shields are longer than wide, with edge much rounded, separated their entire length by small scales. Under surface covered by rows of scales somewhat larger than the scales above. Genital scales wholly covered by the scaling, except above, where they support an arm-comb of sharp, slender papillæ ; their free edge below carries a row of small conical papillæ. Three tapering arm-spines, upper one longest, second and third about equal. Three or four small rounded tentacle-scales on each side of the mouth-tentacles, second and third pores having three on each side ; those just beyond with four short sharp scales on the inner side. Color in alcohol, gray.

Station 164 a, 400 - 1200 fathoms, 1 specimen.

### *Ophioglypha lepida* sp. nov.

Plate III. Figs. 71 - 73.

*Special Marks.* — Four arm-spines ; one long and high up, three short and low down. Radial shields touching without ; disk-scales angular. Disk thin, with rather delicate scales. Arms slender.

*Description of an Individual* (Station 46). — Diameter of disk 9 mm. Width of arm close to disk 1.5 mm. Mouth-papillæ three to four on each side, short and square, with a larger pointed one at apex of jaw. Mouth-shield wide pentagonal, with an obtuse angle inward, outer edge slightly curved, and outer corners rounded ; length to breadth 1 : 1. Side mouth-shields long narrow, wider without, tapering inward where they meet. First under arm-plate broad triangular, those beyond pentagonal, with obtuse angle inward, lateral sides re-enteringly curved and outer edge slightly curved ; beyond the disk they gradually acquire the shape of a transverse oval, with a little peak without and within. Side arm-plates even, giving a tubular figure to the arm, meeting below, but separated above by the upper arm-plates, which are as long as broad, and in shape long hexagonal, with the three outer angles almost blended in a curve. Disk smooth, covered with small, delicate, irregular, ill-defined, closely soldered scales ; radial shields long pear-seed shape, overlapped along their edges by the surrounding scales, diverging inward and separated their entire length by a wedge of smaller and larger scales ; in centre of disk one large round primary plate, and another in each brachial space, lying close to inner ends of radial shields. Disk, below, covered with very fine irregularly shaped

scales. Genital openings edged with fine, closely set papillæ, growing larger as they pass upwards along the outer edge of genital scale, which is long, narrow within, broad without, and divided in several pieces. Three short and blunt arm-spines, situated low on the side arm-plates, close to the tentacle-pores, and one long tapering spine, just below the junction of the upper arm-plate. Tentacle-scales short and rounded; to each mouth-tentacle seven on the interbrachial side, and three longer and tapering on the brachial edge; beyond there are at first five on the interbrachial and four on the brachial edge, after which they diminish rapidly in number and size. Color in alcohol, gray.

*O. lepida* and its kindred species form an intermediate type between the shallower, like *O. albida*, and the deep-sea, of which *O. bullata* is the extreme.

Station 46, 1350 fathoms, 5 specimens. Off Bermuda, 750 fathoms, 2 specimens. Station 76, 900 fathoms, 4 specimens. Station 45, 1240 fathoms, 1 specimen. Station 343, 420 fathoms, 1 specimen.

### *Ophioglypha Ljungmani* sp. nov.

#### Plate III. Fig. 77.

*Special Marks.* — Three arm-spines; one long and high up, two short and low down. Radial shields separated; disk-scales small and curved. Disk thin, with rather delicate scales. Arms slender.

*Description of an Individual* (Station 122). — Diameter of disk 8.5 mm. Length of arm about 45 mm.; width of arm without spines close to disk 2 mm. Four or five short flat mouth-papillæ on each side, and one or two longer pointed papillæ at apex of jaw. Mouth-shield rounded triangular, or inclining to rounded pentagonal, with an angle inward, longer than broad, outer edge curved. Side mouth-shields very narrow, wider without, tapering within, where they nearly or quite meet. First under arm-plate broad triangular, with lateral corners truncated and outer edge curved; second, third, and fourth plates widely pentagonal, with an angle inward; beyond these they are small, broader than long, with an obtuse angle inward and a curved outer edge. Side arm-plates slightly projecting at their outer edge, meeting broadly below beyond the disk; separated above by the upper arm-plates, which are hexagonal, with lateral sides straight and two outer angles nearly blended in a curve. Disk smooth, covered with small irregular plates, but little swollen. Radial shields pear-seed shape, somewhat overlapped by adjoining scales, just touching without, diverging within, where they are separated by two or three small plates. The rest of the upper disk is occupied by numerous scales, among, and separated by which, appears a central cluster of primary plates; in the interbrachial spaces are usually one or more larger plates near the margin of the disk. Genital scales very broad above and without, where they carry an arm-comb of fine spines, but buried by disk-scales below near the mouth-shield; along their lower free edge is a row of minute tooth-like papillæ, between the genital plates and outside the mouth-shield. Interbrachial space

below covered by irregular overlapping scales. Three slender arm-spines, the longest one nearly as long as a joint, and situated near the junction of the side arm-plate with the upper, and two others similar but shorter near the junction of the side with the under arm-plate. Tentacle-scales small, short, pointed, four or five on each side of mouth-tentacle pore, whence they diminish in number, till just beyond the disk, where there are two on the inner side of each pore. Color in alcohol, gray.

Station 122, 350 fathoms, 12 specimens.

### *Ophioglypha æqualis* sp. nov.

Plate III. Figs. 74, 75.

*Special Marks.* — Four very short, peg-like arm-spines, equally spaced. Disk thin, with rather delicate scales. Arms slender.

*Description of an Individual* (Station 218). — Diameter of disk 10 mm. Width of arm close to disk without spines 1.7 mm. Four or five short, square, separated mouth-papillæ on each side, with one much larger and pointed at apex of jaw. Mouth-shields broader than long, with outer edge curved, a blunt angle inward and a slight notch in the lateral sides; length to breadth 1.3 : 2. Side mouth-shields short and narrow, meeting within. First under arm-plate broad triangular, with outer edge curved and a blunt angle inward; second plate broader without than within, pentagonal, with an angle inward, outer edge slightly curved, and lateral sides re-enteringly curved; the rest are broader than long, rapidly becoming smaller in size beyond the disk, where they acquire the shape of a transverse oval, with a little peak within and a curve without. Side arm-plates even and of a tubular figure, slightly projecting at their outer edge, meeting widely below, separated above at the basal joints by the upper arm-plates, of which the first and second form a wedge with a curved outer edge, filling the notch formed by the arm-combs, and bearing on their lateral sides a row of minute, sharp papillæ; the rest are long, triangular, with the outer edge curved, and a sharp angle inward, which on the second and third plate is truncated. Disk flat and delicate, covered with very thin, small, closely overlapping scales; in the centre is a circular primary plate, surrounded by fine irregular scales, then a circle of five primary plates, one in each brachial space, and separating the inner ends of the radial shields, which are long pear-seed shape, and separated the rest of their length by small scales; in the interbrachial space there is a row of larger rounded plates, of which the outer one is marginal. Interbrachial spaces below covered with thin overlapping scales. Genital scales long and very narrow where next the mouth-shield, but gradually growing wider above the arm, where they make a long arm-comb carrying delicate spine-like papillæ; on the free edge of the genital scale below there is a row of very short, minute, rounded papillæ. Four or five minute, blunt arm-spines, equally spaced along the edge of the side arm-plate. The pores of the mouth-tentacles and the two pairs beyond



are long and large, and have from four to six small tentacle-scales on each side. Those a little beyond the disk have only one scale on the inner side and none on the outer. Color in alcohol, white.

Station 218, 1070 fathoms, 6 specimens.

### *Ophioglypha imbecilis* sp. nov.

Plate III. Figs. 63, 64.

*Special Marks.*—Three slender, equally spaced arm-spines. Mouth-shield trefoil, with a long lobe inward. Disk thin, with rather delicate scales. Arms slender.

*Description of an Individual* (Station 232).—Diameter of disk 6.5 mm. Length of arm 20 mm. Width of arm near disk 1 mm. Mouth-papillæ four or five on each side, square, short, and closely set, with a pointed one at apex of jaw. Mouth-shields trefoil-shaped, with a lobe inward; length to breadth 1.5 : 1.5. Side mouth-shields curved, long, and narrow, of nearly even width, and meeting within. First arm-plate triangular, with angle inward, and outer side curved; second plate, which is largest of all, axe-shaped, with lateral sides re-enteringly curved; the rest are triangular, with outer side curved, and diminish constantly in size. Side arm-plates straight and rather delicate, meeting broadly above and below, beyond the second upper arm-plate. Upper arm-plates triangular, with acute angle inward, and outer edge curved. Upper surface of disk covered with irregular, rather thin plates. Radial shields longer than broad; outer edges curved, meeting broadly without, diverging inward, where they are separated by a smaller and larger plate. On the interbrachial margin of the disk is a large oval plate, broader than long, connecting the radial shields; in the centre a circular primary plate, surrounded by numerous others, irregularly shaped. Genital scales long and broad, bearing three or four papillæ near their outer end. Outside the mouth-shield and between the genital scales are two large semicircular plates, whose outer edges reach the margin of the disk. Three arm-spines, tapering, very delicate, situated half-way up on the side arm-plate, near base of arm; they are about half as long as a joint. Tentacle-scales minute and semicircular, two on either side of first two pores; at the third, two on the outer and one on the inner side; for the rest only one. Color in alcohol, gray.

Station 232, off Enosima, 340 fathoms, 5 specimens.

### *Ophioglypha irrorata* sp. nov.

Plate IV. Figs. 106-108.

*Special Marks.*—Three very short, small, sharp arm-spines, low down. Mouth-shield wider than long, with a point within. Radial shields long and separated. Papillæ of arm-comb close-set, flat, and with rounded ends.

*Description of an Individual* (Station 143).—Diameter of disk 8.5 mm.

Width of arm close to disk, without spines, 1.7 mm. Six square, close-set mouth-papillæ on each side, and one large diamond-shaped at apex of jaw. Mouth-shield much broader than long, with outer edge much rounded and an obtuse angle inward; length to breadth 1.7 : 2. Side mouth-shields long and narrow, just meeting within and with a swelling at the outer end. First under arm-plate triangular, transverse oval, or wide rounded hexagonal; second plate pentagonal, with inner angle truncated, outer edge rounded and wider than inner one, lateral sides re-enteringly curved; beyond this they are rounded triangular, with a broad curve without, and a peak inward. Side arm-plates wide, flat, even; meeting broadly below, beyond third plate separated above by the upper arm-plates, which are four-sided, with inner side shorter than outer, which is curved. Disk flat and thin, covered with fine, closely overlapping scales; there are six large round primary plates, one in the centre and one to each brachial space, widely separated by the disk-scales; on the surface of the disk are a few scattered, very minute spines. Radial shields irregular rhomboidal, broad without and with a blunt angle inward, separated their entire length by a wedge of larger and smaller disk-scales; length to breadth 2 : 1. Interbrachial surface on the under side covered with the same fine overlapping scales as above. Genital scales small, narrow within, widening a little without as they appear above the disk. Along their free edge, which extends from outer edge of mouth-shield to margin of disk, there is a close row of minute, squarish, tooth-like papillæ, which become short and rounded on the arm-comb. Three small pointed arm-spines, situated low on the edge of the side arm-plate close to tentacle-scales. On the pores of the mouth-tentacles five large rounded scales similar to mouth-papillæ, on either side; on the second set six on the interbrachial side and four on the brachial; immediately beyond the disk there are only one or two on the inner and none on the outer side. Color in alcohol, white.

Station 143, 1900 fathoms, 1 specimen. Station 164, (young of this species?) 410 fathoms, 6 specimens.

### **Ophioglypha orbiculata** sp. nov.

#### **Plate IV. Figs. 103-105.**

*Special Marks.* — Three very short, small, sharp arm-spines, low down. Mouth-shield as broad as long. Radial shields short, rounded, and separated by the fine scaling of the disk. Papillæ of arm-comb close-set, flat, and with rounded ends.

*Description of an Individual* (Station 237). — Diameter of disk 15.5 mm. Width of arm close to disk 2.7 mm. Six or seven mouth-papillæ on each side, small, irregular, and tooth-like, with three longer and more pointed at apex of jaw. Mouth-shield broader than long, five-sided, having a broad angle within, with outer lateral corners rounded; length to breadth 2.5 : 2.3. Side mouth-shields, following inner angle of mouth-shield, narrow, pointed without, and

broader within, where they meet. First under arm-plate transverse oval, broader than long, often with lateral ends pointed; second arm-plate four-sided, with corners much rounded; the next three are pentagonal, with an angle inward, and outer edge curved; beyond these the lateral sides become shorter, so that soon the form changes to very wide triangular, with a broad curved outer edge, and an obtuse angle inward. Side arm-plates broad, little swollen, meeting below beyond the disk, separated above by upper arm-plates, of which the first is oval, with pointed lateral ends; those beyond four-sided, broader without than within, outer side curved, lateral sides nearly straight. Disk flat, smooth, and very thin; upper surface covered with small, irregular, closely overlapping scales, with a row of larger scales along the margin. Radial shields broad triangular, with edges rounded, separated widely by a group of disk-scales; length to breadth 2.3 : 2. On the under surface the scales are more uniform, and are arranged in irregular transverse rows, four to six in each row. The genital plate, except at its outer end, appears only as a narrow line, bearing a close row of short, square papillæ, which become larger and more rounded where they form the arm-comb. Three short, bluntly pointed arm-spines, situated near the junction of the side with the under arm-plate. Seven square, close-set scales on each side of mouth-tentacle pores; the next two pairs have four on each side; the next one usually three on the inside and two on the other; beyond the disk only one on the inner side. Color in alcohol, white.

Station 237, 1875 fathoms, 10 specimens.

### *Ophioglypha undulata* sp. nov.

Plate III. Figs. 61, 62.

*Special Marks.* — Three very short, conical arm-spines, standing on middle of edge of plate. Disk-scales coarse and rather thick. Radial shields broader than long, and joined. Papillæ of arm-comb close-set, flat, and with rounded ends.

*Description of an Individual* (Station 224). — Diameter of disk 12 mm. Width of arm close to disk, without spines, 2.3 mm. Mouth-papillæ four on each side, short and square and closely set, the outer one widest; at angle of the jaw usually a cluster of three conical papillæ. Mouth-shield rounded triangular, much broader than long, with an obtuse angle within, and outer side slightly curved; length to breadth 2.3 : 2.3. Side mouth-shields nearly straight, rather long, and meeting fully within. First under arm-plate oval or rounded hexagonal, and wider than long; the next longer than any other, axe-shaped, with long lateral sides re-enteringly curved and outer side curved; those beyond grow rapidly shorter, and beyond the fourth are separated by the side arm-plates, which are regular and scarcely swollen, and meet above and below beyond the fourth upper arm-plate. First upper arm-plate wide, semicircular; the rest diamond-shaped, with inner angle truncated and the outer more or less

curved. Disk high, covered with rather thin, irregular, curved plates, among which may be seen a central five-sided primary, and a large wide plate on the margin of the disk, much broader than long. Radial shields rudely semi-circular, and meeting only at their outer points, diverging inward, where they are separated by a small triangular plate. The interbrachial space on the under surface is covered by the rather long and narrow genital scales, which are broken in two, and bear no papillæ, and by two large irregularly curved plates, between which and the mouth-shield are from one to three little scales. Arm-spines three, short, very small, conical, situated half-way on the outer edge of the side arm-plate. Tentacle-pores, except the first pair, small and narrow. The first bears about three scales on each side †; the second, the same; the third, two; and the fourth, one minute scale on the outer and two on the inner side. Color in alcohol, disk pale gray, arms white.

Station 224, 1850 fathoms, 1 specimen.

### *Ophioglypha costata* sp. nov.

Plate IV. Figs. 92-94.

*Special Marks.* — Three very short, blunt, peg-like arm-spines, evenly spaced. Disk-scales few and large. Radial shields long and separated. Papillæ of arm-comb close-set, flat, and with rounded ends.

*Description of an Individual* (Station 142). — Diameter of disk 6.5 mm. Width of arm close to disk 1.3 mm. Mouth-papillæ five or six on each side, short, square, close-set, with one larger, diamond-shaped, at apex of jaw. Mouth-shield five-sided, with outer edge curved, lateral sides nearly straight, and an obtuse angle within; length to breadth 1:1. Side mouth-shields rather short, lying along inner angle of mouth-shield, meeting within. First under arm-plate broad triangular, with an angle within and curved outer edge; the rest are pentagonal, broader than long, with an obtuse angle within, short lateral sides, and a long curved outer edge. Side arm-plates a little swollen and constricted at their inner end, meeting below; separated above for the first three joints by the upper arm-plates, of which the first is transverse oval; the second four-sided, with a curved outer edge much wider than the inner; and the rest triangular, with an angle within and curved outer edge. Disk rather flat, and covered by angular plates and a few small rounded scales, closely overlapping; in centre a five-sided rosette of primary plates, which are rounded and partly separated by minute scales; in the interbrachial spaces a single or double row of larger and smaller plates. Radial shields rhomboidal, with the angles slightly rounded; length to breadth 2:1; separated without by a large diamond-shaped plate, with its outer and inner angles truncated. The lower interbrachial spaces have a large marginal plate and four or five smaller ones; genital scales wide, bearing on their free edge a close-set row of fine papillæ, which grow somewhat larger and more rounded above to form the arm-comb. Three arm-spines, minute, blunt, and equally spaced. Tentacle-scales short and squarish, five on one side and three on the other of the pores

of the mouth-tentacles ; the second pores have three on each side, and those beyond not so many. Beyond the disk there are no tentacle-scales, and the tentacles are very minute. Color in alcohol, white.

This species is pretty near *O. Lymani*, but is readily distinguished by its flat upper arm-plates, those of *O. Lymani* being high and more or less ridged.

Station 141, 93 fathoms, 6 specimens (young). Station 142, 150 fathoms, 6 specimens.

### *Ophioglypha albata* sp. nov.

Plate IV. Figs. 95-97.

*Special Marks.* — Six short, blunt, peg-like, evenly spaced arm-spines. Arms narrow. Radial shields short, and separated by one or two large rounded plates. Papillæ of arm-comb close-set, flat, and with rounded ends.

*Description of an Individual* (Station 236). — Diameter of disk 10 mm. Length of arm about 40 mm. Width of arm close to disk 2 mm. Three short, crowded mouth-papillæ on each side, with one (or sometimes three) conical at apex of jaw. Mouth-shield pentagonal, having a blunt angle within and outer corners curved ; length to breadth 1.5 : 1.3. Side mouth-shields narrow, meeting within ; running along inner angle of mouth-shield, and passing beyond to join first under arm-plate, where they are widest. First under arm-plate irregular transverse oval ; second plate short, bell-shaped, wider without than within ; those immediately beyond are five-sided, wider without than within, with outer edge curved, a blunt angle inward, and inner lateral sides a little re-enteringly curved ; about half-way out on the arm they become nearly triangular, broader than long, with outer angles much curved. Side arm-plates broad, but little swollen, not meeting below within the disk, widely separated above by the upper arm-plates, of which the second and third are hexagonal, while those beyond are lengthened, their two outer angles blended in a curve, and the inner side very short. Disk smooth and slightly arched, covered with thin, rounded or angular, closely soldered scales, the six primaries being a little larger and separated by one or two rows of scales ; there is a transverse row of three large angular plates extending along the margin and connecting the radial shields, which are longer than wide, angular, widely separated by two or three large scales ; their outer points may or may not meet : under surface covered by rows of thin, ill-defined plates, similar to those above. Genital scales hidden by the disk-scales ; along their free edge is a close row of short, bead-like papillæ : they become larger and more rounded where they pass upward to make the arm-comb, which is attached to the radial shield. Six short, blunt, conical arm-spines, arranged along the entire margin of the side arm-plate. The pores of the mouth-tentacles are large, and have four short close-set scales on either side ; the two next have three small rounded scales on the inner side ; those beyond have two. There are also minute and not easily seen scales on the outer side of the second and third pores. Color in alcohol, white.

Station 236, 775 fathoms, 1 specimen.

**Ophioglypha jejuna** sp. nov.

Plate II. Figs. 55, 56.

*Special Marks.* — Three slender, pointed arm-spines, about two thirds as long as a joint. Disk-scales few and mostly large. Radial shields large and joined. Papillæ of arm-comb close-set, flat, and with rounded ends.

*Description of an Individual* (off Tristan d'Acunha). — Diameter of disk 5 mm. Width of arm 1 mm. Mouth-papillæ small, tooth-like, and close-set, five on each side, with long pointed one at apex of jaw; those near the outer angle of the jaw broader than long, growing longer as they near the inner angle. Mouth-shield pentagonal, length and breadth about equal, the outer and lateral sides curved, with corners rounded and a very blunt angle inward. Side mouth-shields long and narrow, curved, with club-like outer ends; narrower within, where they barely meet. First under arm-plate large triangular, with outer end curved and a blunt angle inward; second and third plate five-sided, with lateral sides nearly straight and outer corners rounded. Side arm-plates broad, slightly swollen, meeting below, but separated above on first two joints by upper arm-plates, which are wedge-shaped, with outer side curved and a long sharp angle within; those beyond are similar, but separated by side arm-plate. Disk flat and smooth, covered with thin rounded plates or scales; in centre of upper surface is a close rosette of five round primary plates, with three small ones in their midst; in each interbrachial space are two large rounded plates, of which the outer is marginal, with some small scales on either side. Radial shields rudely triangular, with an angle inward, joined, except at their inner points, where they are separated by a small wedge-scale; length to breadth 1 : .7. Genital scales long and narrow, wider without than within, bearing on their free edge a row of fine, close-set, tooth-like papillæ, extending to base of upper arm-plate, where they become scale-like and form the arm-comb. Interbrachial spaces below covered by half a dozen rounded plates or scales of several sizes, whereof the largest lies on the margin. Arm-spines three, delicately tapering, about two thirds as long as a joint, equally spaced on the side arm-plate. Scales of mouth-tentacles small and tooth-like; four on the brachial side and five on the other; on the next three pores are only two pointed, spine-like scales. Color in alcohol, brown.

Station 135, off Tristan d'Acunha, 500 fathoms, 2 specimens. Station 164 a, 410 fathoms, 1 specimen.

**Ophioglypha brevispina** (?) E. A. SMITH.

*Ophioglypha brevispina* E. A. SMITH, Ann. and Mag. N. H., XVII. p. 112, Feb., 1876. Transit of Venus Expedition, p. 11, Pl. XVII., Figs. 5, a-c.

Plate II. Figs. 44-46.

*Special Marks.* — Three short, blunt, peg-like arm-spines, evenly spaced. Papillæ of arm-comb short, close-set, and sharp. Disk-scales of moderate size, thick and swollen. Very small, narrow side mouth-shields.

*Description of an Individual* (Royal Sound).—Diameter of disk 11 mm. Length of arm 45 mm. Width of arm 2.5 mm. Mouth-papillæ short, blunt, close-set, four or five on each side, and two longer at apex of jaw. Mouth-shield pentagonal, with a blunt angle inward, outer edge curved, lateral sides notched; length to breadth, 2.3 : 2. Side mouth-shields extending along inner angle of mouth-shield, narrow, of about even width, meeting within. First under arm-plate very large, broader than long, transverse oval in shape; next three plates wider without than within, their sides straight, except the outer, which is curved; the rest are triangular, with outer edge curved, and an angle within. Side arm-plates short, slightly swollen, just meeting below, beyond the disk; widely separated above by the upper arm-plates, which are large, arched, much broader than long, wider without than within, with outer side curved and inner side re-enteringly curved. The upper surface of disk has numerous rounded, much swollen plates, closely soldered together, with a cluster of six primaries in the centre separated by one or two rows of smaller plates; outside this cluster in each interbrachial space is another large rounded plate. Radial shields longer than broad, much rounded, the inner end slightly smaller than outer, their inner ends widely separated by a large rounded triangular plate within and smaller scales without; length to breadth 2 : 1.5. Interbrachial space below evenly covered by small thick scales. The genital scale is nearly or quite covered, except at its outer portion, whose free edge carries a row of very fine saw-like papillæ, which become a little longer above, where they make the arm-comb. Three small blunt arm-spines, equally spaced, and standing low on the outer edge of side arm-plate. The pores of the mouth-tentacles have four or five close-set, small, tooth-like scales on each side; the second and third set have four or five on the interbrachial side, and three on the brachial; beyond this they diminish till a short distance beyond the disk, where there is on the inner side a small scale, similar to and continuous with the arm-spines, and on the outer side a little ridge. Color in alcohol, light gray.

Mr. Smith, who kindly compared a "Challenger" specimen with his originals, reports that the latter are smaller, and differ from the former in having disk-scales coarser, radial shields that converge and touch each other, upper arm-plates narrower inward, etc. As these differences may depend on age, I have retained the name with a query.

Royal Sound, Kerguelen Islands, 25–28 fathoms, 12 + specimens. Balfour Bay, Kerguelen Islands, 20–60 fathoms, 2 specimens. Off Christmas Harbor, Kerguelen Islands, 120 fathoms, 1 specimen.

### *Ophioglypha ambigua* sp. nov.

Plate II. Figs. 47, 48.

*Special Marks.*—Four short, blunt, peg-like arm-spines, three together, low down, and one higher up. Papillæ of arm-comb short, close-set, and squarish. Disk-scales of moderate size, thick and swollen. Very small, narrow side mouth-shields.

*Description of an Individual* (Royal Sound). — Diameter of disk 13.5 mm. Width of the arm close to disk 2.5 mm. Mouth-papillæ short, blunt, tooth-like, and close-set, five on each side, similar to and continuous with the tentacle-scales of the mouth-tentacles, with a larger, longer, and pointed one at angle of jaw. Mouth-shield pentagonal, with outer edge rounded, lateral sides notched, and a blunt angle inward; length to breadth 3 : 2. Side mouth-shields short, just meeting within and slightly wider at their outer end. First under arm-plate large, rudely diamond-shaped, with outer and inner angles rounded; the next two or three plates four-sided, wider without than within, with outer side curved and re-entering curves on lateral sides; further out they become pentagonal, much broader than long, with an angle inward. Side arm-plates short and thick, not meeting below till some distance from the disk; widely separated above by upper arm-plates, much broader than long, arched, wider without than within, outer edge curved, inner edge re-enteringly curved. Disk thick and angular, covered with thick, closely soldered, irregularly shaped plates, among which the primaries may be distinguished, but not very clearly. Radial shields small, irregularly triangular, with angles rounded, widely separated by one large and two or three small scales; length to breadth 2 : 1.5. Genital plates short, beginning opposite fourth under arm-plate and widening rapidly outward; along the free edge is a row of fine, short, square, close-set papillæ, extending as an unbroken line upward to form the arm-comb. Four short, blunt, and tooth-like arm-spines, three in a cluster, close to edge of tentacle-pores, and one a little separated above; farther out the four make a continuous group. Tentacle-pores large; those of the mouth-tentacles have five short, rounded scales on the interbrachial side and four on the other; the next pair, six on one side and five on the other; thence they diminish till some distance beyond the disk, where there is but one tentacle-scale, similar to and continuous with the arm-spines. Color in alcohol, light gray.

Royal Sound, Kerguelen Islands, 25–28 fathoms, 12 + specimens. Off Christmas Harbor, Kerguelen Islands, 120 fathoms, 12 + specimens.

### **Ophioglypha Loveni** sp. nov.

Plate IV. Figs. 109–111.

*Special Marks.* — Three to five short, sharp arm-spines, about half as long as a joint. Disk smooth and flat, with scales, radial shields, and mouth-shields all small.

*Description of an Individual* (Station 157). — Diameter of disk 21 mm. Width of arm close to disk 3.7 mm. Six or seven small rounded mouth-papillæ on each side, the outer three being closely soldered together; at apex of jaw a clump of three larger papillæ. Mouth-shields triangular, with an obtuse angle within, and the outer edge much rounded; length to breadth 3.5 : 4. Side mouth-shields following inner angle of the mouth-shield, rather narrow without, where the mouth-tentacle pores encroach, wider within, where



they scarcely meet. First under arm-plate broad triangular, or broad rounded hexagonal, with outer edge much curved, and a very blunt angle inward; second plate nearly square, with rounded corners; the next two rudely semi-circular, with outer edge straight, or broad much rounded pentagonal, with an ill-marked angle inward; the rest are transverse oval, with a peak inward. Side arm-plates wide, a little swollen, meeting below beyond the disk, separated above by the upper arm-plates, which are much broader than long, with outer edge broken in three angles or curved, and the lateral sides forming an angle. Disk arched, but not thick, covered above and below with small, thin, closely soldered scales, the six primaries being small, circular, widely separated plates. Radial shields much longer than wide, with a sharp angle inward, separated by a wedge of disk-scales; length to breadth 4.5:2. Genital scales very narrow, covered by fine scaling, bearing on their free edge a close row of very fine, square papillæ, which increase a little in size as they appear above to form the arm-comb. Three tapering arm-spines, about half as long as a joint; the upper one the longest. Larger specimens have five or more spines. On the mouth-tentacle pores there are seven or eight close-set, tooth-like scales on either side; the next two pairs have six or seven on each side, just beyond the disk; there are four scales on the inner side, and the same number of smaller ones on the outer. Color in alcohol, gray.

Station 146, 1375 fathoms, 12 + specimens. Station 147, 1600 fathoms, 12 + specimens. Station 157, 1950 fathoms, 12 + specimens. Station 153, (same species?) 1800 fathoms, 1 very large specimen. Station 160, 2600 fathoms, 1 specimen.

### *Ophioglypha fraterna* sp. nov.

#### Plate IV. Fig. 112.

*Special Marks.*—Five very minute, blunt arm-spines, which often are rubbed off or naturally wanting. Disk smooth and flat, with scales, radial shields, and mouth-shields all small, and obscured by skin. No arm-comb.

*Description of an Individual* (Station 157).—Diameter of disk 23.5 mm. Width of arm close to disk 3.7 mm. Mouth-papillæ short, squarish, closely joined together, seven or eight on each side, diminishing in size inward, with three pointed and longer at apex of jaw. Mouth-shield small, broader than long, pentagonal, with outer edge rounded and obtuse angle within; length to breadth 3:3. Side mouth-shields occupying the inner angle of the mouth-shield, and passing beyond it; narrower without than within, where they meet. First under arm-plate much broader than long, with outer edge curved; second plate six-sided, with inner laterals longest; beyond the disk they are very broad, triangular, with long sharp lateral angles, an obtuse angle inward, and the outer side curved. Often the lateral corners are broken off, and form separate pieces. Side arm-plates broad, not swollen, meeting below beyond the disk; separated above by the upper arm-plates, which are broader than long, and broader without than within, having the outer edge wavy. Disk high and

irregularly arched, covered above and below with a thick skin, which almost entirely obscures the fine disk-scales and the radial shields, which may be recognized as small, oval, smooth patches near the disk margin, on either side of the arm. Along the edge of the genital opening is a row of minute, closely joined squarish papillæ, which extend only to the margin of the disk, the arm-comb being absent. Five very minute, blunt arm-spines, three situated low on the edge of side arm-plate and two above. Often they are rubbed off, and there seem to be none. Tentacle-scales of the mouth-tentacles similar to mouth-papillæ and on one side, closely continuous with them; on the first pair there are four or five scales on each side; on the second five or six on each side; just outside the disk there are four scales on the inner side and none on the other; and a short distance beyond there are no scales. Color in alcohol, light gray.

Station 157, 1950 fathoms, 4 specimens.

### *Ophioglypha elevata* sp. nov.

Plate IV. Figs. 87-89.

*Special Marks.*—Disk high and arched. Arms short and thick. Each under arm-plate has a median, elongated, bead-like swelling.

*Description of an Individual* (Station 145).—Diameter of disk 6 mm. Length of arm about 11mm. Width of arm close to disk, without spines, 1.3 mm. Five short, square, closely joined mouth-papillæ on each side, and one longer diamond-shaped at apex of jaw. Mouth-shield longer than wide, broader without than within, deeply constricted at the sides, and curved at both ends; length to breadth 1 : .7. Side mouth-shields narrow, of even width, curving round the inner lobe of the mouth-shield and meeting within. First under arm-plate triangular, with angle inward and outer side curved; second, third, and fourth plates four-sided, with outer edge, which is wider than inner, curved, and lateral sides re-enteringly curved. There is a longitudinal swelling on the under arm-plates which forms a continuous ridge within the disk. Side arm-plates wide, little swollen, constricted within, not meeting below on basal joints; separated above by the upper arm-plates, which are four-sided, much broader than long, wider without than within, with outer and inner edges straight, and lateral sides re-enteringly curved. Disk thick and arched, covered with small, swollen, irregular scales, with one large pentagonal primary plate in centre. Radial shields small, as wide as long, irregularly triangular, joined their entire length; length to breadth .7 : .7. Lower interbrachial space filled with small rounded scales; along the free edge of the genital scale is a row of very minute pointed papillæ, which suddenly become long and spine-like as they pass upward to make the arm-comb. Five short blunt arm-spines, three well up on the edge of the side arm-plate, and two somewhat shorter close to tentacle-pores. On the mouth-tentacle pores there are two large scales on either side; the other pores within the disk have three long rounded scales on the inner side, and one very wide, thick, erect scale on the

outer side, the latter being sometimes in two pieces ; beyond the disk there are on each pore a larger and a smaller short curved scale. Color in alcohol, light brown. .

Station 145, 310 fathoms, 1 specimen.

### *Ophioglypha bullata* WYV. THOM.

*Ophioglypha bullata* WYV. THOM., Nature, Vol. VIII. p. 400, Sep., 1873, with figure. Voyage of the "Challenger." The Atlantic, I. p. 400, with figures.

#### Plate III. Figs. 85, 86.

*Special Marks.* — Three minute, evenly spaced arm-spines. Disk-scales above rounded, and of various sizes, with large marginal plates. Disk high. Basal under arm-plates about as long as broad. Arms high and rounded.

*Description of an Individual* (Station 61). — Diameter of disk 11 mm. Length of arm 23 mm. Width of arm close to disk 2 mm. Four or five small, conical, widely separated mouth-papillæ on each side, and three larger at apex of jaw. Mouth-shield very large, long pentagonal, with an obtuse angle inward much wider without than within ; outer lateral corners rounded ; length to breadth 2.7 : 2.3. Side mouth-shields pointed oval, small, meeting widely within. First under arm-plate triangular, with sharp angle inward and outer edge curved ; the rest within the disk four-sided, with inner edge slightly wider than outer, and lateral side a little re-enteringly curved ; beyond they gradually become wide hexagonal. Side arm-plates swollen, not meeting below till half a dozen joints beyond the disk ; separated above by upper arm-plates, which are much swollen, forming a high ridge ; the first two or three nearly square with rounded corners ; those just beyond rounded hexagonal ; and only near the middle of the arm do they become triangular, with an angle within and outer edge curved. Disk thick and arched ; in centre of upper surface a cluster of six large, round primary plates, separated by an irregular row of smaller ; between inner ends of radial shields and in each interbrachial space a conspicuous round plate ; on the margin are two plates connecting outer ends of genital scales, and within these a large plate connecting outer ends of radial shields ; rest of upper surface covered with small, swollen, rounded scales. Radial shields longer than broad, rounded pear-seed shape, forming a well-marked notch over arm ; separated their entire length by a single or double row of rounded scales ; length to breadth 2.7 : 2. The under interbrachial space is occupied by the large mouth-shield, the lower edges of the two small marginal plates, and the large genital scales, which are very narrow within, widening without, as they extend upward over the arm, bearing on the free edge a close row of square, flat papillæ, which begin at the third arm-plate and maintain the same shape in the arm-comb. Three minute pointed arm-spines, evenly spaced ; the lowest next the tentacle-scales. Tentacle-pores oval and very large ; four short rounded scales on each side of mouth-tentacles ; the rest, within and well beyond the disk, have four or more on the inner side, and

one or two on the outer side. The entire surface is microscopically tuberculous. Color in alcohol, straw.

Station 45, 1240 fathoms, (young.) Station 54, 2650 fathoms, 8 specimens. Station 61, 2850 fathoms, 12 + specimens. Station 133, 1900 fathoms, 5 specimens.

### *Ophioglypha convexa* sp. nov.

Plate III. Figs. 83, 84.

*Special Marks.* — Three small tapering arm-spines. Disk covered above by a rosette of large angular primary plates, radial shields, and a few large inter-brachial plates.

*Description of an Individual* (Station 241). — Diameter of disk 12 mm. Length of arm 30 mm. Width of arm close to disk, without spines, 3 mm. Mouth-papillæ small, conical, four to six on each side, and three larger at angle of jaw. Mouth-shield large, much longer than wide, five-sided, with an angle inward, and outer edge, which is wider than inner, much curved; length to breadth 4 : 3.5. Side mouth-shields short, wider within than without, meeting broadly and occupying only the inner angle of the mouth-shield. First under arm-plate three-sided, with truncated angles; beyond they are nearly square, with truncated corners and their lateral sides re-enteringly curved; those farther out are octagonal, and afterwards hexagonal. Side arm-plates thick, swollen, meeting neither above nor below, except at end of arm. Upper arm-plates much broader than long, hexagonal, arched. Disk thick, covered above with a few stout plates. Radial shields angular, pear-seed shape, somewhat sunken, joined without but diverging inward, where they are separated by a thick wedge-like scale; length to breadth 3 : 2. In the interbrachial spaces are five large plates, two on margin of disk, connecting the outer ends of the genital scales; one quadrangular, connecting the radial shields; and two smaller, which lie between inner ends of radial shields. The central space is covered by six regular, stout primary plates, elevated above the rest, the central one pentagonal, the others hexagonal. The genital scales fill the lower inter-brachial space between mouth-shield and arm, and bear on their free edge a close row of square papillæ, which become peg-like on the arm-comb. Beyond the mouth-shield is a row of three small rounded marginal plates. Three short, delicate, tapering arm-spines, equally spaced. Tentacle-pores within the disk have two or three scales on the inner side, and one or more on the outer. Color in alcohol, yellowish-gray.

Station 241, 2300 fathoms, 2 specimens (young). Station 246, 2050 fathoms, 6 specimens. Station 346, 2350 fathoms, 4 specimens.

### *Ophioglypha sculptilis* sp. nov.

Plate IV. Figs. 115, 116.

*Special Marks.* — Six minute arm-spines. First under arm-plate broader than long; those beyond longer than broad. Radial shields separated within

by a cluster of large scales. Disk high. Basal under arm-plates about as long as broad. Arms high and rounded.

*Description of an Individual* (Station 237). — Diameter of disk 12.5 mm. Width of arm close to disk 3 mm. Mouth-papillæ five on each side, broader than long, shaped like blunt saw-teeth, with two blunt pointed papillæ at apex of jaw. Mouth-shield much rounded, pentagonal, with an angle inward, and two outer angles almost blended in a wide curve; length to breadth 3.5 : 2.5. Side mouth-shields narrow, curved, pointed within, where they broadly meet. The first under arm-plate broad triangular, with outer edge curved, and a blunt angle within; the next three long axe-shape, with outer edge, which is wider than inner, slightly curved, and lateral sides re-enteringly curved; beyond the disk they are similar, but present an angle inward. Side arm-plates minutely tuberculous, broad, and swollen, meeting below at some distance beyond the disk; separated above by upper arm-plates, of which the first is much wider than long; the second wide semicircular, with outer edge curved; the third narrower, with outer edge curved, and wider than the inner; the rest rounded diamond-shape, with the inner angle longer than the outer. Disk thick, covered with thin flat plates; in the centre is a large round primary plate, surrounded by five smaller, separated by two or three rows of fine scales; in the interbrachial spaces are three large plates in a line, of which the outer is marginal and has usually a round plate on either side. Radial shields irregular blunt pear-seed shape, touching without, diverging inward, where they are separated by a wedge of three or four small rounded scales. Genital scales narrow within, growing much wider without; bearing on their free edge a close row of squarish papillæ, which become spiniform where they pass upward to form the arm-comb. Six minute blunt arm-spines, equally spaced along the side arm-plate. Four or five small blunt tentacle-scales on each side of pores within the disk; beyond the disk they soon diminish to two standing inside of pore. Color in alcohol, light gray.

Station 237, 1875 fathoms, 2 specimens.

### **Ophioglypha variabilis.**

**Plate III. Figs. 70, 78, 79.**

*Special Marks.* — Four or five minute arm-spines. Under arm-plates longer than broad. Radial shields separated at inner ends by a single scale. Disk high. Basal under arm-plates about as long as broad. Arms high and rounded.

*Description of an Individual* (Station 195). — Diameter of disk 11.5 mm. Length of arm about 40 mm. Width of arm close to disk 2.7 mm. Mouth-papillæ six on each side, of which three are square and three pointed and one larger and diamond-shaped at apex of jaw; they are all low and somewhat irregular. Mouth-shield blunt pear-seed shape with an angle within, or of a much rounded pentagonal form with an angle within and a curve without;

length to breadth 3.3 : 2.7. Side mouth-shields narrow, meeting within and there forming a sharp angle. First under arm-plate triangular, outer edge curved, inner angle blunt; the next three plates are long axe-shaped, with outer edge, which is wider than inner, curved, and re-entering curves on the lateral sides; those beyond are separated by side arm-plates, and are pentagonal, with an angle inward, and outer side curved. Side arm-plates broad, somewhat swollen, meeting below beyond the fourth under arm-plate, and above beyond the fourth upper arm-plate, where they form almost the entire covering of the arm, having an angle inward and a curve without; the first three are broader and have the inner angle truncated. Disk thick, rather flat, covered above with thin, closely overlapping scales; a cluster in the centre of one large rounded primary plate and one smaller to each brachial space, separated by two or three rows of much smaller scales; in the interbrachial spaces are three large plates, — an oval marginal, connecting the outer ends of the genital scales; a second inside, joining the radial shields by a line of small scales; and a third, smaller and more rounded, which lies between the inner ends of the radial shields. Radial shields three-sided, with corners much rounded and a blunt angle inward, touching without, diverging inward, where they are separated by a small rounded scale; length to breadth 2.5 : 2. The under surface is occupied by the large mouth-shield; three to five small plates, just outside, and the broad genital scales, which, starting very narrow from the lateral side of the mouth-shield, increase in width as they curve upward over the arm; along their free edge, on the under surface, is a close row of large square papillæ, which become spiniform on the arm-comb. Four or five minute, round, pointed arm-spines, evenly spaced along edge of side arm-plate. Tentacle-pores very large, the basal ones oval, the rest round; those of the mouth-tentacles have three or four scales on each side; the next two sets, three on either side, those next the arm-plate being larger than the others; just beyond the disk they have two small scales on the inner edge, and one larger one next the arm-plate, and further out there are no scales. Color in alcohol, gray.

Station 195, 1425 fathoms, 5 specimens. Station 24, (same species?) 390 fathoms, 2 specimens (young).

### *Ophioglypha ornata* sp. nov.

Plate IV. Figs. 113, 114.

*Special Marks.* — Three or four minute, widely spaced arm-spines. Mouth-shield trefoil, with a pointed lobe inward. Disk high. Basal under arm-plates about as long as broad. Arms high and rounded.

*Description of an Individual* (Station 216). — Diameter of disk 10 mm. Width of arm close to disk 3 mm. Five or six short, square, close-set mouth-papillæ on each side, the outer ones wider than the inner, with two pointed ones at apex of jaw. Mouth-shield large, much rounded triangular, with a

lateral constriction which makes a pointed lobe inward; length to breadth 2.7 : 2.5. Side mouth-shields long, crooked, and very narrow, meeting within. First and second under arm-plates larger than those beyond, axe-shaped, with outer edge wide and curved, and lateral sides re-enteringly curved; those beyond are similar, but present an angle inward. Side arm-plates swollen, broad, minutely tuberculated, meeting below, outside the disk; separated above by upper arm-plates, which are narrow, four-sided, much swollen, with curved lateral and straight outer and inner sides; towards the middle of the arm they become longitudinal oval. Disk thick, smooth, and angular, covered in the centre by small, thin, irregular, overlapping scales, in the midst of which are the six primary plates, which are rounded and rather small. In each interbrachial space, and connecting the radial shields, is a large rounded angular plate. Outside of this are two large marginal plates, which extend below nearly or quite to the outer edge of the mouth-shield. Radial shields much rounded triangular, broadly meeting without, separated within by two or three disk-scales; length to breadth 2 : 1.7. Interbrachial spaces below covered by the two great marginal plates, between which and the mouth-shield there are sometimes two or three small scales. Genital scales rather wide, and carrying on the free edge a row of large, square, close-set papillæ, which become spiniform where they form the arm-comb. Usually three, rarely four, very minute arm-spines, one at the top, one near the middle, and one at the lower edge of the side arm-plate. Three or four small rounded tentacle-scales on each side of first three sets of tentacle-pores; those just beyond the disk have two or three scales on the inner, and two on the outer side. Color in alcohol, light gray.

Station 216, 2000 fathoms, 2 specimens.

### **Ophioglypha Lacazei** sp. nov.

Plate III. Figs. 58-60.

*Special Marks.*—Three minute arm-spines, high up. Radial shields rounded, separated by one scale within. One large marginal plate, with small scales about it. Disk high. Basal under arm-plates about as long as broad. Arms high and rounded.

*Description of an Individual* (Station 160).—Diameter of disk 11 mm. Length of arm about 30 mm. Width of arm close to disk 2.3 mm. Mouth-papillæ very small and widely separated; eleven to thirteen to each angle; one large at apex of jaw. Mouth-shield large, much rounded pentagonal, with obtuse angle inward, and outer side curved; length to breadth 2.5 : 2.5. Side mouth-shields rather short and wide, meeting within, where they are broader than without. First under arm-plate long, wedge-shaped, with outer edge curved; the rest axe-shaped, with outer edge curved, and lateral sides re-enteringly curved. Side arm-plates regular and scarcely swollen. Upper arm-plates large, broader than long, hexagonal, with outer angles much rounded; length to breadth 1 : 1.3. Farther out they become nearly semi-

circular, with the curve inward. Disk covered with rounded, flat, thin, closely joined plates, among which may be seen a central rosette of primaries, and two larger plates in each interbrachial space. Radial shields short, wide, rudely semicircular, touching along part of their length, separated within by small wedge-like scales. The interbrachial space on the under surface is nearly covered by the large mouth-shield. The genital scales are broad and slightly curved, and bear rather stout tooth-like papillæ. Outside the mouth-shield are two rows of small thin semicircular scales. The papillæ of the arm-comb are flat, squarish, and separated, and are borne by a semicircular plate about as broad as long. Three minute arm-spines, pointed and standing well up on the outer edge of the side arm-plate. Tentacle-scales of the innermost pair of pores small, semicircular, usually two on either side. The rest of the tentacle-pores have usually one large on the outer side, and three or four smaller on the inner side. Color in alcohol, nearly white.

Station 160, 2600 fathoms, 5 specimens. Station 299, 2160 fathoms, 3 specimens.

### **Ophioglypha lienosa** sp. nov.

Plate III. Figs. 80-82.

*Special Marks.* — Three minute arm-spines. Disk covered by small irregular scales, small separated radial shields, and very large mouth-shields. Disk high. Basal under arm-plates about as long as broad. Arms high and rounded.

*Description of an Individual* (Station 157). — Diameter of disk 15 mm. Length of arm about 37 mm. Width of arm, without spines, close to disk 3.5 mm. Mouth-papillæ small, conical, widely spaced, diminishing in size from within outward; about five on each side and a group of three larger ones at apex of jaw. Mouth-shields very long, pentagonal, with an obtuse angle inward, lateral sides re-enteringly curved, and outer edge rounded; length to breadth 3.5:3. Side mouth-shields short, meeting broadly within, where they are wider than without; occupying only the inner end of the mouth-shields. First under arm-plate triangular, with an angle inward, and outer edge curved; beyond, the plates are four-sided, thick, with outer and inner edges nearly straight, and lateral sides re-enteringly curved; beyond the disk they become hexagonal; their surface has a minutely crystalline appearance. Side arm-plates swollen, and not meeting below for some distance beyond disk. Upper arm-plates broader than long, thick and swollen, with outer side curved and longer than the inner, which is nearly straight; lateral sides re-enteringly curved. Beyond, they are bounded by a long curve within and a peak without. Disk smooth, arched, and very thick, covered above with small thin plates, having a minutely tuberculous or crystalline appearance; in the centre are six circular primary plates, separated by others irregularly shaped and angular, which also fill the interbrachial spaces. Radial shields small, short, and thick, rounded triangular, with an angle outward, separated their entire



length by a round plate without and several smaller plates within. Inter-brachial space below chiefly covered by the great mouth-shields, outside which are three or four rows of small scales, and on either side a genital scale, bearing on the free edge broad, square, close-set papillæ, which become narrower where they form the arm-comb, on the broadened outer end of the genital scale. Three small sharp arm-spines, one situated in a notch well up on the outer edge of the side arm-plate, the other two lower, near junction of side with under arm-plate. Tentacle-pores very large, transverse oval in shape; on those of the mouth-tentacles four rounded scales on the under arm-plate, and three on the other side; the other pores within disk have usually four on the inner side, and one wide scale on the outer. Color in alcohol, body gray, arms straw-color.

Station 157, 1950 fathoms, 4 specimens.

### **Ophioglypha radiata** sp. nov.

**Plate III. Figs. 65, 66.**

*Special Marks.* — Two minute arm-spines. Mouth-shield trefoil. Under arm-plates axe-shape. Radial shields small and rounded. Disk high. Basal under arm-plates about as long as broad. Arms high and rounded.

*Description of an Individual* (Station 205). — Diameter of disk 8.5 mm. Length of arm 35.5 mm. Width of arm close to disk 3 mm. Four or five wide, rectangular, closely set mouth-papillæ on either side, with three long and pointed at apex of jaw. Mouth-shields large, trefoil-shape, with a pointed lobe inward. Side mouth-shields very narrow, of even width and meeting within. First under arm-plate largest of all, triangular, with an angle within and outer edge much curved; the other plates are axe-shaped, with re-entering lateral sides and curved outer side; the first three touch each other. Side arm-plates thick, swollen, and minutely tuberculous, meeting on the under surface beyond the third plate. Upper arm-plates much swollen, the first two rounded hexagonal, those beyond rounded triangular. Disk high and rounded, covered with fine overlapping scales, of which the marginal are the larger. Radial shields small, broader than long, four-sided, with rounded corners, outer edges straight, touching nearly their whole length, diverging inward, where they are separated by a small triangular plate. There are small round primary plates, widely separated by the finer disk-scales. Genital scales short, wider without than within, bearing along their entire margin long, flat, and closely set papillæ, about fourteen in number; those towards upper surface much narrower than the under ones. Two very minute arm-spines, one situated low on the edge of the side arm-plate, next the tentacle-pore, the other half-way up the arm. Tentacle-scales curved; from three to four on either side of the large pores on the basal joints. Color in alcohol, pale yellow.

Station 205, 1050 fathoms, 6 specimens.

**Ophioglypha undata** sp. nov.

Plate IV. Figs. 101, 102.

*Special Marks.* — Four minute blunt arm-spines. Disk-plates rough and lumpy, with rosette of large primaries. Under arm-plates pentagonal. Disk high. Basal under arm-plates about as long as broad. Arms high and rounded.

*Description of an Individual* (Station 176). — Diameter of disk 3.5 mm. Width of arm close to disk 1 mm. Five mouth-papillæ on either side, of which the three outer ones are squarish, and the two innermost pointed and similar to the large one at apex of jaw. Mouth-shields five-sided, with outer lateral corners curved and a blunt angle within; length-to breadth .7 : .5. Side mouth-shields rather large, longer than wide; wider without than within, where they meet. First under arm-plate long, three-sided, with angles much rounded and lateral sides re-enteringly curved; second and third five-sided, with outer corners rounded, an angle inward, and lateral sides re-enteringly curved; those beyond grow rapidly smaller, but have the same general form. Side arm-plates much swollen, but constricted at their inner margin, meeting widely above and below beyond the disk. The first upper arm-plate is triangular, with outer edge curved; the second diamond-shaped, having the inner angle slightly truncated; beyond this they become rapidly smaller and are diamond-shaped. Disk-plates above thick, and overlapping like tiles; in the centre is a rosette of the six primary plates, the middle one being pentagonal, and those surrounding it transverse oval; on the outer edge of each of these latter plates are one large and two smaller semicircular plates; in the interbrachial spaces are two large rounded plates, the outer one extending quite to the margin of the disk. Radial shields about as broad as long, angular, closely soldered together. On the under surface the plates are rounded, and so much swollen as to form knobs with furrows between, the three along the margin being larger than the others. Genital scales narrow, with a row of seven or eight pointed papillæ on the free edge, while the papillæ of the arm-comb are longer and more slender. Four minute blunt arm-spines on the basal joints. The pores of the mouth-tentacles do not open into the mouth-slit: they have three rounded scales on either side; the next two have two scales on either side, and beyond two on the inner and one on the outer side. Color in alcohol, gray.

Station 176, 1450 fathoms, 1 specimen.

**Ophioglypha lapidaria** sp. nov.

Plate III. Figs. 67-69.

*Special Marks.* — Eleven short, pointed, close-set arm-spines. Mouth-shields trefoil. Under arm-plates squarish. About eight tentacle-scales to each pore within the disk. Disk high. Basal under arm-plates about as long as broad.

*Description of an Individual* (Station 235). — Diameter of disk 11 mm. Width of arm close to disk 2.5 mm. Five or six short square mouth-papillæ on each side, and a cluster of two or three larger at apex of jaw. Mouth-

shields longer than broad; wider without than within, where they present a rounded angle; outer corners also rounded; on the lateral sides a constriction which gives them a three-lobed aspect; length to breadth 2.5:2.3. Side mouth-shields small, long, very narrow; outer end slightly broader than the inner, where they meet. First under arm-plate triangular, with truncated angle inward and outer edge curved; the next four are four-sided, with curved outer edge; beyond the disk they are pentagonal, with an obtuse angle inward, short lateral sides, and a long curved outer side. Side arm-plates thick, deeply constricted at their inner end; not meeting below till some distance beyond the disk, separated above by upper arm-plates, which are broader than long, wider without than within, the outer edge being curved. Disk thick, covered with large, closely soldered plates and scales. Radial shields pear-seed shape, longer than wide, with an angle within and outer edges rounded; touching without, separated within by a single wedge-like plate; in the centre above is a close rosette, consisting of a pentagonal primary plate, surrounded by five others, smaller and of an irregular shape; the remaining interbrachial space on the upper surface is occupied by rows of semicircular plates. Lower interbrachial space, covered by small curved, overlapping plates. Genital scales very narrow, except without, where they broaden into a wide radial scale, bearing a comb of short spines, which continue below as minute papillæ on the margin of the genital opening. Ten or twelve fine, short, blunt arm-spines, extending in a close continuous row along outer edge of side arm-plate. Tentacle-scales short, square, large, and thin. The pores of the mouth-tentacles carry five or six on each side; the pores immediately beyond are very large, and have about four on each side; beyond the disk they have three or four on the inner side, and one spiniform on the under arm-plate. Color in alcohol, light gray.

Station 235, 565 fathoms, 1 specimen.

### *Ophioglypha solida* sp. nov.

Plate V. Figs. 120 - 122.

*Special Marks.* — Basal under arm-plates, beyond the second, about as long as broad, squarish, and with water-pores between them. Arms high, with swollen upper arm-plates and very small spines. Upper disk covered in great part by a rosette of primary plates and by radial shields.

*Description of an Individual* (Station 192). — Diameter of disk 10.5 mm. Width of arm close to disk, without spines, 3 mm. Eight minute, widely separated, pointed mouth-papillæ on each side of angle, with a cluster of three bluntly pointed at apex of jaw. Mouth-shields narrow, pear-seed shaped, with sharp angle inward, and outer edge much rounded; length to breadth 2:1.5. Side mouth-shields longer than broad, much wider without than within, where they meet, extending nearly two thirds of the distance on sides of mouth-shield. First under arm-plate three-sided, longer than wide, with rounded angle inward, and a slight re-entering curve on all three sides; the next six or

seven plates are broader than long, octagonal, and separated by wide pores or depressions; the remainder of the under arm-plates are quadrangular, with an angle within and without. Side arm-plates broad and somewhat swollen, meeting below only towards the tip of the arm; separated above by the upper arm-plates, which are broader than long, and four-sided, with lateral sides straight, and outer edge much wider than inner, and curved; towards the tip of the arm they are diamond-shape, with truncated angles without and within. Disk round and high, covered with large, much swollen plates, the central primary being pentagonal, surrounded by five others, large and more or less rounded; in the upper interbrachial space are two plates, the inner one rounded; the outer marginal one much broader than long, and somewhat swollen. Radial shields joined, small, and irregular in shape, curved without. Lower interbrachial space covered by two much swollen plates, longer than wide, extending from the outer edge of the mouth-shield to the marginal plate. Genital scales much longer than wide, wider without, tapering inward, carrying along their free edge, from the outer edge of the mouth-shield to the edge of the arm-comb, a row of minute papillæ, which become somewhat longer as they appear above the arm to form the comb. Two, and sometimes three, small, delicately tapering arm-spines, about half as long as a joint. Tentacle-scales on first pair of pores, three on either side; on the second, three or four on the interbrachial side, and two on the brachial; third pair the same, but only one on the brachial; beyond there are three long blunt scales on the interbrachial side. Color in alcohol, white.

Although from only 129 fathoms, this species has the look of a deep-sea inhabitant.

Station 192, 129 fathoms, 1 specimen.

### **Ophioglypha rugosa** sp. nov.

Plate IV. Figs. 90, 91.

*Special Marks.* — Disk covered with much swollen, lumpy plates. Genital scales wide, thick, and in a single piece. Basal under arm-plates longer than wide. Papillæ of arm-comb short, flat, close-set, and with rounded ends.

*Description of an Individual* (Station 169). — Diameter of disk 7 mm. Width of arm close to disk 1.5 mm. Four short tooth-like mouth-papillæ on each side, with one larger at apex of jaw. Mouth-shields pentagonal; outer and lateral sides straight, with very blunt angle within; outer corners rounded; length to breadth 1.3:1. Side mouth-shields narrow, with a wavy outline, meeting within. First under arm-plate triangular, with an angle within and outer side curved; second plate longer, with inner angle truncated; beyond this they are pentagonal, with outer side curved, lateral sides re-enteringly curved, and an angle within. Side arm-plates broad, meeting below, but separated above, near base of arm, by the upper arm-plates, which are long wedge-shape, with outer edge curved, and an angle within, except the first two, which have the inner angle truncated. Disk angular, covered with large,

much swollen plates, having deep furrows between them ; in centre a group of six primary plates, separated by a row of irregular smaller plates ; outside of these is another circle of ten equally large plates, of which the brachial ones separate the inner ends of the radial shields. In each interbrachial space there is also a large marginal plate. Radial shields longer than broad, outer edge much wider than inner, joined without, but widely separated within by a large rounded plate. Length to breadth 2 : 1. On the under surface the plates are not so much swollen, and more regular ; in each interbrachial space are about three concentric rows, of from three to five plates each. Genital plates long and rather wide, with outer end wider than inner ; along the free edge is a close row of fine, even, tooth-like papillæ, which become somewhat longer and wider as they pass upward to form the arm-comb. Three arm-spines short, blunt, and equally distant from each other. On first two sets of pores four tentacle-scales on each side ; the third has three on each side ; the fourth, one on the outside and three on the inside ; a little beyond the disk there is only one on the inside. Color in alcohol, white.

Station 169, 700 fathoms, 4 specimens.

### *Ophioglypha ponderosa* sp. nov.

Plate II. Figs. 52-54.

*Special Marks.* — Disk-plates high and excessively swollen. Upper arm-plates rising in a high sharp ridge. Arm-spines minute, close-set, and like little blocks.

*Description of an Individual* (Station 232). — Diameter of disk 32 mm. Width of arm at disk 6 mm. Mouth-papillæ square, flat, crowded, forming a continuous row with the scales of the mouth-tentacles, four or five on each side, with three or four longer and pointed papillæ at angle of jaw. Mouth-shield long and narrow, with outer end much rounded, lateral sides having a slightly re-entering curve, and a short blunt angle within ; length to breadth 5.7 : 3. Side mouth-shields long triangular, outer edges broader ; inner ends tapering, where they meet. Under arm-plates broad hexagonal, with outer and inner ends straight, and short angles on the sides ; the first plate is similar, but not so large as the others ; farther out on the arm they become diamond-shaped. Side arm-plates swollen, with outer edge curved, not meeting either above or below. Upper arm-plates narrow, very highly arched, forming a sharp ridge ; length to breadth about equal, wider without than within, four-sided, with sides nearly straight. The upper surface of disk is covered by angular plates, excessively swollen and lumpy, and compactly soldered ; the plates in centre being smallest. Radial shields longer than wide, with edges irregularly curved, meeting without, diverging inward, where they are separated by a large plate of about the same size and shape ; in the interbrachial space, besides numerous smaller plates, is one roughly triangular, with one angle inward ; on the lower interbrachial space the scales are not so much swollen ; there are about half a

dozen, besides the genital plates, which are composed of three pieces, the outer one being the largest and thickest; along their entire edge from the mouth-shield to the outer edges of the radial shields is a row of fine, square, short papillæ, those nearest the mouth-shield being broader than long, while towards the radial shields they become very fine, much narrower than long; there is a group of similar papillæ on the free outer end of the side mouth-shield. The arm-spines are so short, thin, square, and closely soldered together as to look like a continuous narrow border to the side arm-plate; in shape they resemble the arm-comb, and are about eight in number. The pores of the mouth-tentacles have four or five scales on each side, similar to the mouth-papillæ; the second has seven similar scales on the interbrachial side, and four on the other; the third five and four; the fourth four and three; beyond this three only on the inner or interbrachial side. Color in alcohol, brownish-yellow.

Station 232, 340 fathoms, 1 specimen.

### *Ophioglypha minuta* sp. nov.

Plate V. Figs. 117-119.

*Special Marks.*—Interbrachial space below covered by only one or two plates besides the genital scales. Upper arm-plates rudimentary or wanting. Tentacle-pores of arm with only one rounded scale.

*Description of an Individual* (Station 158).—Diameter of disk 5.5 mm. Length of arm about 12 mm. Width of arm close to disk, without spines, 1 mm. Six short, squarish, closely set, longer than wide mouth-papillæ on sides of angle, and three short and bluntly pointed at apex of jaw. Mouth-shield as long as broad, having a slight constriction towards the inner end, which is an obtuse angle, outer side widely curved; length to breadth 1:1. Side mouth-shields longer than wide, meeting within, and there forming a long angle inward; outer edges narrower than inner. First under arm-plate triangular, with rounded angle inward, lateral sides having a slight re-entering curve, and outer edge gently curved. Second under arm-plate pentagonal, length and breadth about equal, having deep re-entering curves on the lateral sides, a narrow obtuse angle within, and outer side curved; beyond the second the plates are triangular in shape, having an angle inward and outer side curved, and they become rapidly less in size. Side arm-plates long and thick, beyond the second under arm-plate forming almost the entire covering of the arm, as there are no upper arm-plates. Disk flat and round, with a central group of six primary plates, whereof the middle one is pentagonal, while the five surrounding it are transverse oval; connecting these plates are minute triangular scales; the interbrachial spaces above are filled by two large plates, the inner one broader than long, with outer edge straight, and inner edge broader than outer; the marginal plate has the inner edge straight, and the outer curved; on either side of the marginal plate are two minute semicircular scales. Radial shields three-sided, longer than broad, joined their entire length; outer edges with a

slight re-entering curve; interbrachial edges curved; length to breadth 1.5 : 1.3. Interbrachial space below filled by a large slightly swollen plate, which is sometimes divided in two by a median line, and by the large, thick, longer than broad genital scales, along the free edge of which are eight or more very minute, short, blunt papillæ, extending to upper margin of disk, where they bear an arm-comb of two or three papillæ. Three short delicate arm-spines about two thirds the length of a joint, two low on the under surface of the arm, and one well up on its side. Tentacle-scales on the first set of pores, two on the interbrachial side and one on the brachial; beyond this there is only one large scale on the inner side. Color in alcohol, white.

The proportionate size of the side arm-plates and small number of those of the disk show this to be a young specimen, but its characters are so well marked as to warrant a description, and its great depth gives it importance.

Station 158, 1800 fathoms, 1 specimen.

{ *Ophioglypha inermis* sp. nov.

Plate V. Figs. 123-125.

*Special Marks.*—No arm-comb, and only a feeble row of grains along the genital opening. Disk covered with thin overlapping scales and very small radial shields.

*Description of an Individual* (off Tristan d'Acunha).—Diameter of disk 14 mm. Length of arm about 70 mm. Width of arm close to disk, without spines, 2.5 mm. Mouth-papillæ small, short, pointed, and close-set, similar to and continuous with the tentacle-scales of the second pair of mouth-tentacles. If true mouth-papillæ be those that stand on the mouth-frames, there are eight or ten on either side and a cluster of three somewhat larger on the jaw-plate. Mouth-shield broader than long, with very blunt angle inward and outer edge curved; length to breadth 2 : 2.7. Side mouth-shields longer than broad, of nearly equal width, nearly or quite meeting within. First under arm-plate small, longer than broad, hexagonal; second plate broader than long, rounded quadrangular; beyond this the plates become much broader than long, with sharp angles at the lateral sides, a small peak within, and a rounded angle without. Side arm-plates thin, not swollen, just meeting below beyond the fourth under arm-plate; separated above by the large upper arm-plates, which are much broader than long, and wider without than within, with lateral sides straight, and outer corners rounded. Disk high and round, covered above and below with very thin, closely overlapping scales, with one minute circular primary plate in centre of disk. Radial shields small, nearly round, separated by a large angular plate; length to breadth 1.3 : 1. Genital scales hidden; along their free edge is a row of very minute, bead-like papillæ; three slim, flat, pointed, nearly equal arm-spines, somewhat longer than an arm-joint, and equally spaced along the outer edge of the side arm-plate. The first pair of tentacle-pores, which open into the mouth-slit, have six or seven minute tentacle-scales, exactly like the mouth-papillæ, and arranged in an ox-bow

figure. The first arm-pores have three minute papillæ on either side; those beyond have only two long and rounded scales on the inner side of each pore. Color in alcohol, white.

It will be noted that *O. inermis* stands on the limit of *Ophioglypha*; while it has the general look and structure of the genus, it lacks wholly the arm-comb, and has only a trace of the papillæ along the genital scale below. It seems to go better here than with *Ophioceten*.

Two specimens, (also two young, this species?) off Tristan d'Acunha, 500 fathoms.

### *Ophioglypha Deshayesi* sp. nov.

Plate II. Figs. 35 - 37.

*Special Marks.* — Side mouth-shields large and ovoid. Radial shields and primary plates circular and similar. Disk and arm plates thick, swollen, and closely soldered. Mouth-papillæ and scales of mouth-tentacles thick, squarish, irregular, and crowded.

*Description of an Individual* (Station 51). — Diameter of disk 18 mm. Length of arm 80 mm. Width of arm close to disk 4 mm. Mouth-papillæ irregular, crowded, angular, closely soldered, five or six on each side and usually one or two at apex of jaw. Mouth-shields small, with long, acute angle inward, and outer edge cleanly curved; length to breadth 3 : 2. Side mouth-shields large, narrow pear-seed shape, with the rounded ends inward, where they meet at one point. Inside the junction of the side mouth-shields is a small diamond-shaped supplementary plate, which makes the apex of an angle. First under arm-plate semicircular or transverse oval, with outer edge nearly straight; the plates beyond are wide triangular, with a truncated angle inward, and outer side a little curved. Side arm-plates swollen, nearly meeting below within the disk; separated above by the upper arm-plates, which are broader than long, arched, wider without than within, hexagonal, having outer angles more or less rounded. Disk very thick, covered with rounded plates somewhat obscured by a thick skin; in the centre above are six large primary plates separated by one or two rows of smaller ones, and in the interbrachial spaces are two larger plates, one marginal and the other inside it. Radial shields very nearly round, separated usually by three plates in a line; length to breadth 3 : 3; along their inner margin is a row of small irregular-shaped scales. Genital plates formed of two or more pieces, wider without, tapering inward; along the outer portion of their free edge is a row of small shapeless pieces, which become more numerous above, and there form a sort of arm-comb. One minute papilla-like arm-spine situated near the junction with the upper arm-plate. Pores of mouth-tentacles enclosed on one side by the two outer mouth-papillæ, with some other minute pieces; and on the other side by four or five similar parts, which correspond to tentacle-scales: the rest of the pores stand near the lateral corners of the under arm-plates, and have three small peg-like tentacle-scales. Color in alcohol, yellowish-brown or gray.



Station 150, 150 fathoms, 2 specimens. Station 151, 75 fathoms, 8 specimens. Christmas Harbor, Kerguelen Islands, 120 fathoms, 12 + specimens. Royal Sound, Kerguelen Islands, 28 fathoms, 12.+ specimens.

**Ophioglypha inornata** sp. nov.

Plate II. Figs. 26, 27.

*Special Marks.*—Side mouth-shields small. Mouth-shield broader than long, with a peak inward. Disk and arm plates thick, swollen, and closely soldered. Mouth-papillæ and scales of mouth-tentacles thick, squarish, irregular, and crowded.

*Description of an Individual* (Station 106).—Diameter of disk 10 mm. Length of arm about 23 mm. Width of arm close to disk, without spines, 2 mm. Five or six short, bead-like, closely soldered mouth-papillæ on each side, with one much longer at apex of jaw. Mouth-shields broader than long, small, rounded triangular, with angle inward, and outer edge curved. Side mouth-shields short, pointed oval, occupying inner sides of the mouth-shield and meeting broadly within. First under arm-plate rounded, with a long curve within and an obtuse angle without; second pentagonal, with an angle inward, outer side wide, and laterals re-enteringly curved; beyond these the plates become broader than long, with an angle within and a curve without. Side arm-plates thick, slightly swollen, meeting broadly below; separated above by upper arm-plates, which are thick, rather small, of a rounded diamond-shape, and as long as broad. Disk rather thick, swollen, covered with thick, minutely tuberculous plates. Radial shields irregular in form, inner edges nearly circular or oval, diverging inward, where they are separated by a single row of three scales; in each interbrachial space is a marginal plate connecting the radial shields. In centre of disk above are six round, well-marked primary plates, separated from each other and from the radial shield by single lines of much smaller plates. Interbrachial space below covered chiefly by a large marginal plate, and two smaller between it and the mouth-shield. Genital plates short, thick, broader within, tapering outward, where they bear small, irregularly placed papillæ, which make above a sort of arm-comb. Arm-spines minute and hard to see, one near upper arm-plate and two or three near the under. Tentacle-scales minute; on the pores of the mouth-tentacles are four on one side and three on the other; the second pore, which is near the inner end of the arm-plate, has only three; and the third two. Color in alcohol, gray.

Station 106, 1850 fathoms, 3 specimens.

**Ophioglypha confragosa** sp. nov.

Plate II. Figs. 38, 39 - 57

*Special Marks.*—Disk-plates irregular and humpy. A group of papillæ near the arm, on margin of interbrachial space. Disk and arm plates thick,

swollen, and closely soldered. Mouth-papillæ and scales of mouth-tentacles thick, squarish, irregular, and crowded.

*Description of an Individual* (Station 320).—Diameter of disk 14 mm. Width of arm close to disk 2.3 mm. Mouth-papillæ angular, closely soldered, four or five on each side, and one, diamond-shaped, at angle of jaw. Mouth-shield large, five-sided, with blunt angle inward, and outer edge slightly curved; length to breadth 2.3 : 2. Side mouth-shields narrow, of about even width, running along inner angle of mouth-shield and meeting within. First under arm-plate three-sided, with inner sides much curved and outer edge nearly straight; second and third also three-sided, having two re-entering curves on the lateral sides; beyond this they become broader than long, with outer edge so much curved as to give them a diamond-shaped appearance. Side arm-plates swollen, just meeting below and separated above by upper arm-plates, which are rounded, with outer and inner edges slightly flattened; farther out they become long hexagonal, with corners much rounded. Disk flat, covered with rounded raised plates, separated by deep furrows; in the centre are six primary plates surrounded by a row of smaller and more angular. In each interbrachial space above are two large plates, one on the margin. Radial shields blunt pear-seed shape, with the rounded end outward, separated widely by one large and one small plate. Genital plates composed of two or three pieces, the outer and principal piece long and narrow, tapering at each end, of which the outer is covered by a clump of small soldered papillæ, which pass upward and form a sort of arm-comb. The rest of the lower interbrachial space is covered by five large and as many small plates. Arm-spines minute and peg-like, one half-way up the side arm-plate, and one near the junction of the upper arm-plate with the side arm-plate. Three large, square, close-set tentacle-scales on either side of pores of mouth-tentacles; on the second pair one peg-like scale, and on the rest two similar scales. Color in alcohol, white. Station 320, 600 fathoms, 12 + specimens.

### **Ophioglypha intorta** sp. nov.

Plate II. Figs. 41 - 43.

*Special Marks.*—Side mouth-shields very narrow. A small arm-comb. Disk and arm plates thick, swollen, and closely soldered. Mouth-papillæ and scales of mouth-tentacles thick, squarish, irregular, and crowded.

*Description of an Individual* (off Marion Island).—Diameter of disk 9 mm. Length of arm 23 mm. Width of arm at disk 1.5 mm. Mouth-papillæ angular, closely soldered, five or six on each side, and a larger, diamond-shaped, at angle of jaw. Mouth-shield large, pentagonal, with a long angle within and outer edge rounded. Side mouth-shields long, narrow, curved, and tapering towards either end, scarcely meeting within. First under arm-plate triangular, with one angle inward, outer edge straight, and lateral sides curved; those beyond are wide pentagonal, with an angle within, and outer side a little curved. Side

arm-plates short and stout, scarcely meeting below within the disk, and separated above by the upper arm-plates, which are swollen, broader than long, broader without than within, with a curved outer edge. Disk flat, covered with raised, irregular-shaped, angular plates, having deep furrows between them. Radial shields ovoid in outline, with the smaller end inward, separated by a wedge of three or four plates. Genital plates long and narrow, much wider without than within; along their free edge is a row of fine, short, upright papillæ, which pass upward and form an arm-comb. Two short, thick, and blunt arm-spines, one at centre of edge of the side arm-plate, and another near junction of the upper arm-plate. The pores of the mouth-tentacles have three or four scales like mouth-papillæ on each side; beyond there are two scales shaped like the arm-spines. Color in alcohol, light gray.

Off Marion Island, 50 - 75 fathoms, 12 + specimens.

#### **Ophioglypha Sarsii** LYMAN.

*Ophiura Sarsii*, LTK. Vid. Meddel. Nov. 1854. p. 7.

*Ophioglypha Sarsii*, Ill. Catal. Mus. C. Zoöl. p. 41, Figs. 2, 3.

Station 49, 83 fathoms, 12 + specimens.

#### **Ophioglypha acervata** LYMAN.

*Ophioglypha acervata*, Bull. Mus. C. Zoöl. I. No. 10, p. 316. 1869.

Station 122, 350 fathoms, 3 specimens.

#### **Ophioglypha sinensis** LYMAN.

*Ophioglypha sinensis*, Ill. Catal. Mus. C. Zoöl. No. VI. p. 12, Pl. I. Figs. 1, 2. 1871.

Off Yokohama, Japan, 8 - 14 fathoms, 7 specimens. Station 233 b, 15 fathoms, 8 specimens.

#### **Ophioglypha falcifera** LYMAN.

*Ophioglypha falcifera*, Bull. Mus. C. Zoöl. I. No. 10, p. 319. 1869.

Station 24, 390 fathoms, 1 specimen.

#### **Ophioglypha hexactis** E. A. SMITH.

*Ophioglypha hexactis*, Ann. & Mag. of N. H. 1876, Feb. XVII. p. 3.

Balfour Bay, 20 - 60 fathoms, 1 specimen. Betsey Cove, 20 - 25 fathoms, 12 + specimens. Royal Sound, 25 fathoms, 12 + specimens. All localities in Kerguelen Islands. Also off Marion Island, 50 - 75 fathoms, 12 + specimens.

#### **Ophioglypha multispina** L.J.N.

*Ophioglypha multispina*, Ophiuroidea Viventia. Öf. Kong. Akad. p. 307. 1866.

Port Jackson, 30 - 35 fathoms, 11 specimens.

**Ophioglypha Lymani** Ljn.

*Ophioglypha Lymani*, Om trånne nya arter. Öf. Kong. Akad. No. 5, p. 472. 1870.

Station 304, 45 fathoms, 2 specimens. Station 305, 120 fathoms, 12 specimens. Station 307, 147 fathoms, 12 + specimens. Station 308, 175 fathoms, 1 specimen. Station 309, 40-140 fathoms, 3 specimens. Station 311, 245 fathoms, 1 specimen. Station 313, 50 fathoms, 12 + specimens.

**OPHIOCTEN** LTK.**Ophiecten amitinum** sp. nov.

**Plate V. Figs. 129, 130.**

*Special Marks.*—Primary and marginal disk-plates large and conspicuous. Arm-comb and papillæ on first two upper arm-plates well marked. Two minute tentacle-scales.

*Description of an Individual* (Kerguelen Islands).—Diameter of disk 7 mm. Length of arm about 35 mm. Width of arm without spines 1.5 mm. Four short blunt mouth-papillæ on each side, and one longer and pointed at apex of jaw. Mouth-shield large, pentagonal, broader within than without, having a wide angle within, and outer corners curved; length to breadth 1.3 : 1.4. Side mouth-shields small, broader without than within, where they meet and are often somewhat separated from the mouth-shield. First under arm-plate large, rounded triangular, with outer edge straight; the remaining plates small and three-sided, much wider than long, with outer edges strongly curved and inner laterals re-enteringly curved, the whole presenting almost a crescent shape; they become very small towards tip of arm. Side arm-plates broad, flaring somewhat outward, meeting broadly below; separated above by the upper arm-plates, which are broader than long, with lateral sides straight, and outer edge, which is wider than inner, curved. Disk round, flat, and rather thick, covered with thin flat scales and plates of various sizes, among which are six rounded primaries, separated by single lines of small scales; in the brachial space, just inside the radial shields, there is a transverse row of larger rounded scales; in each interbrachial space are two separated plates similar to the primaries, and outside these, along margin of disk, is a row of four connected plates. Radial shields conspicuous, pear-seed shaped, widely separated by disk-scales. Outside the radial shields is an arm-comb of small, short-pointed papillæ, part carried on outer point of genital scale and part on outer edge of radial shield and on the scale between the radial shields; besides these there is on the outer edge of the first three upper arm-plates a row of from three to five papillæ. Lower interbrachial space covered by regular rows of small, semicircular, overlapping scales, and by the genital scales, which are longer than broad, and slightly wider without than within, and sometimes carry on their free edge an irregular row of minute papillæ. First pair of tentacle-pores have two very small scales on the outer edge, the rest have one

on each side. Three long, slender, cylindrical, sharp, tapering arm-spines, situated close together low on the outer edge of the side arm-plates; lengths to that of an arm-joint 1.2, .8, .6 : .6. Color in alcohol, white.

A young, with a disk of 3 mm., differed in having the upper disk covered almost entirely by the primary and the other large plates; the intermediate disk-scales were just beginning to form. The radial shields were shorter, and the papillæ above the arm fewer.

Kerguelen Islands, 120 fathoms, 12 + specimens. Prince Edward's Island, 85 - 150 fathoms, 7 specimens (same species?). Station 152, 1260 fathoms, 4 specimens.

### **Ophiocten umbraticum** sp. nov.

Plate V. Figs. 131, 132.

*Special Marks.* — Primary and marginal disk-plates small, and the former widely separated. Arm-comb feeble. Tentacle-scales single and minute, or quite wanting.

*Description of an Individual* (Station 325). — Diameter of disk 9.5 mm. Width of arm close to disk, without spines, 1.3 mm. Four rather wide, closely joined mouth-papillæ, with one larger, diamond-shaped, at apex of the jaw. Mouth-shield very thin, triangular, broader than long, with blunt angle inward and corners rounded; length to breadth 1 : 1.5. Side mouth-shields long and narrow, tapering inward, where they nearly or quite meet. First under arm-plate large, four-sided, the inner side being very short like a truncated angle, with corners rounded; the rest of the under arm-plates are very small, nearly or quite semicircular, with a little peak inward. Side arm-plates slightly flaring outward, meeting broadly below, where they form most of the under surface of the arm; separated above by upper arm-plates, which are four-sided, with outer edge wider than inner, and curved; lateral sides slightly re-enteringly curved. Disk flat and thin, covered with small, transparent, delicate scales; six small, rounded, widely separated primaries, one in the centre and one to each brachial space; outside these there are two similar plates in each interbrachial space, one towards the centre and one near the margin; along the margin there are two irregular rows of small plates, somewhat broader than long. Radial shields triangular, with a rounded angle inward, widely separated by the disk scaling; length to breadth 1.5 : .8. Lower interbrachial space covered by delicate, nearly transparent scaling, which also hides the genital scales, except their outer tips, just outside the radial shields, which bear an arm-comb of three or four minute papillæ. Genital opening quite long, extending from the outer end of side mouth-shields to edge of disk. There are large tentacle-pores, but no scales on any of the pores. Near base of arm there are three small, delicately tapering arm-spines, situated on the outer edge of the side arm-plate; the upper is about two thirds the length of an arm-joint and the lowest about half as long; farther out there are but two spines. Color in alcohol, white.

On the above specimen no tentacle-scales could be seen, but on others some pores, at any rate, are furnished with a single minute one.

Station 325, 2650 fathoms, 7 specimens.

**Ophiocten pallidum** sp. nov.

Plate V. Figs. 126-128.

*Special Marks.* — Disk covered with minute thin scales, among which appear very small, widely separated primary plates. One minute tentacle-scale. Three short, equal, slender arm-spines.

*Description of an Individual* (Station 160). — Diameter of disk 14.5 mm. Length of arm about 70 mm. Width of arm close to disk, without spines, 1.7 mm. Five short, blunt, ill-defined mouth-papillæ on the side, and one larger at apex of jaw, like the three or four teeth that stand immediately above it. Mouth-shields much broader than long, bounded on the outer edge by a wide curve and by a very wide angle within; length to breadth 1.2: 2.6. Side mouth-shields long and narrow, extending along the inner angle of the mouth-shield, and just meeting within, where they broaden slightly, becoming narrower at the outer end where attached to the side arm-plate. First under arm-plate much larger than the others, four-sided, with outer edge straight, lateral sides re-enteringly curved, and a short side, like a truncated angle within; the rest of the under arm-plates are very small, with a curved outer side, and are nearly semicircular in form, but have a slight peak inward at the junction of the side arm-plates, which are thin and wide, flaring slightly outward, meeting broadly below, and separated above by the upper arm-plates, which are four-sided, with outer edge nearly straight and wider than inner. Disk round, smooth, and flat, covered with minute, very thin, overlapping scales, four or five in the length of a mm. on upper surface, and more below; among them may be distinguished small, round, widely separated primary plates. Radial shields longer than broad, three-sided, with all three angles much rounded, widely separated their entire length by the disk scaling; length to breadth 2.6: 1.5. Genital scales hidden, except the outer tip, which shows outside the radial shield, and bears no papillæ, or only one or two rudimentary. Three sharp, slender, tapering arm-spines, situated close to each other on the middle edge of the side arm-plate. Only one very minute, rounded tentacle-scale on the outer edge of some of the tentacle-pores; a little way out on the arm there usually is a minute scale on the inside of the pore, and none on the outer side. Color in alcohol, pale straw.

Station 160, 2600 fathoms, 12 + specimens. Station 156, 1975 fathoms, 4 specimens.

**Ophiocten sericeum?** Ljn.*Ophiura sericea* FBS.*Ophiocten Krøyeri* LTK.*Ophioglypha gracilis?* (young) G. O. Sars.

*Ophiocten sericeum* seems not to differ essentially from *Ophioglypha gracilis*, except in having a comb of fine papillæ along the outer edges of the basal upper arm-plates; but this comb is wanting in the young, and not regular in the adult.

A young *O. sericeum* (disk 7.5 mm.) was very like a still smaller *O. gracilis* (disk 6.8 mm.), which had the arm-comb less marked; but other specimens had it just the same. A number of specimens marked as *O. sericeum* (young) and *O. gracilis* showed variations in number of papillæ along the genital openings, coarseness of disk-scales, more or less pointed tentacle-scales, and length of spines; but all these variations seem common to both, in a greater or less degree. The two specimens of the "Challenger" Expedition showed no valid difference with the half-grown *O. sericeum*, except in absence of papillæ along the genital opening; but two specimens from George's Bank, off Massachusetts, were in this respect intermediate, and had hardly any papillæ in that region.

Off Marion Island, 50 - 75 fathoms, 2 specimens.

### *Ophiocten hastatum* sp. nov.

Plate V. Figs. 133, 134.

*Special Marks.* — Disk with minute thin scales, among which appear well-marked primary plates. Three tapering arm-spines, the upper much the longest and largest. One minute tentacle-scale.

*Description of an Individual* (Station 146.) — Diameter of disk 9 mm. Width of arm close to disk 2 mm. Four or five short, squarish, close-set mouth-papillæ on each side, with one much larger at apex of jaw, having two small bead-like ones at its base. Mouth-shield rounded pentagonal, having a broad angle within. Side mouth-shields long and narrow, of about equal width, nearly or quite meeting within. First under arm-plate larger than any of the others, four-sided, with inner side much narrower than the outer, which is slightly rounded; the remainder of the under arm-plates are much wider than long, and nearly semicircular, with a slight peak inward, and outer side deeply curved. Side arm-plates somewhat swollen and flaring outward, meeting broadly below; separated above by the upper arm-plates, which are somewhat arched, with the inner side narrower than the outer, which is curved. Disk round, smooth, and flat, covered, above and below, with minute thin scales; in the centre are several rounded primary plates, and one of nearly equal size in each interbrachial space. Radial shields pear-seed shape, with inner angle blunt, and outer corners rounded; separated their entire length by fine overlapping scales. Genital scales hidden, except their tips, outside the radial shields, which bear an arm-comb of a few minute papillæ, as does sometimes the first upper arm-plate. Three slender, cylindrical, tapering, pointed arm-spines, the upper one being much longer and larger than the two lower; lengths to that of an arm-joint 3.4, 1, .8 : 1. Tentacle-scales minute and rounded; there are two or three to each of the second mouth-tentacles; usually one on the outside of the basal pores, and one on the inside of the pores farther out on the arm. Color in alcohol, disk nearly white; arms above pale gray.

Station 78, 1000 fathoms, 2 specimens. Station 146, 1375 fathoms, 12 + specimens. Station 163, 1100 fathoms, 12 + specimens.

## OPHIOMASTUS \* gen. nov.

Disk arched and extremely high, covered with a few large thick plates, among which the primaries are conspicuous for superior size. Arms short, with large thick side arm-plates. First under arm-plate similar to and nearly as large as those beyond. Mouth-papillæ arranged in a narrow close-set line; teeth rather slender; no tooth-papillæ. Small smooth arm-spines arranged along outer edge of side arm-plates. Two narrow genital openings in each interbrachial space.

**Ophiomastus tegulitius** sp. nov.

Plate VI. Figs. 167-169.

*Special Marks.*—Two very short, stout arm-spines. Disk-plates swollen and microscopically tuberculous. Side mouth-shield of a pointed ovoid shape.

*Description of an Individual* (Station 165).—Diameter of disk 4 mm. Length of arm about 6 mm. Width of arm close to disk, without spines, 1 mm. Mouth-papillæ so closely soldered as to form an almost continuous narrow line from side mouth-shields to apex; on either side is a long curved one, followed by two shorter, and by a narrow spine-like one at apex of angle. Mouth-shield pentagonal, with an angle inward, longer than wide; inner lateral sides straight, outer lateral corners rounded; length to breadth .7 : .5. Side mouth-shields large, swollen; broadest and rounded within, where they meet, then tapering outward along the inner lateral sides of the mouth-shields. Under arm-plates long pentagonal, with an angle inward, lateral sides re-enteringly curved, outer side slightly curved. Side arm-plates large, thick, and swollen, meeting below and above; upper arm-plates small, first one diamond-shaped, and second triangular with sharp angle inward and outer edge straight; the rest are similar, but grow rapidly smaller. Disk highly arched and rounded; in the centre a large hexagonal primary plate, surrounded by six others, much swollen, with inner and lateral sides nearly straight and outer edges rounded; these seven plates cover almost the entire upper surface of the disk; in the upper interbrachial space there is a rounded, much swollen marginal plate, and over the arm two small, joined, scale-like radial shields. On the under surface, outside the mouth-shield, there are two large plates, the outer and larger one connecting with the large marginal plate. Genital scale long and wide, and composed of three pieces. Tentacle-scales long, narrow, and curved, the one on the interbrachial side being semicircular, while the other on the lateral side of the under arm-plate is small and lip-like. Two very short, blunt arm-spines, placed low on the outer edge of the side arm-plate. Color in alcohol, pale straw.

A smaller specimen, with a disk of 2 mm., showed no special variations, except that the radial shields were relatively larger and there were only six primary plates, which is doubtless the normal number.

\* ὄφις, a snake : μαστός, a breast.



Station 164, 950 fathoms, 1 specimen. Station 165, 2600 fathoms, 1 specimen. Station 166, 275 fathoms, 1 specimen. Station 218, 1070 fathoms, 2 specimens.

### OPHIOLINTHUS\* gen. nov.

Disk smooth and covered by a thin skin bearing irregular delicate scales and radial shields. Genital scales wide and divided in several pieces. Small, blunt, close-set mouth-papillæ; no tooth-papillæ; short angular teeth; very minute, peg-like arm-spines on outer edges of side arm-plates. Second pair of mouth-tentacles and first two pairs of arm-tentacles rising from round pores near the inner end of the under arm-plates; those beyond are smaller, and stand close to the under arm-spine. Arms narrow, cylindrical, and gradually tapering. Two genital openings, running only a part of the way toward the margin. Mouth-frames seen from above, after removing the top of the disk, long and rising in a ridge, so that in the interbrachial space is a wide angle, and in the brachial space a deep trough. Arm-bones long and cylindrical, with only a faint upper furrow. Genital scales long, slender, and cylindrical.

This genus by its large first under arm-plate has a slight relation to *Ophioglypha*, and by its large tentacle-pores at base of arm, an appearance like *Ophiomusium*, but its structure is really quite peculiar.

### *Ophiolinthus medusa* sp. nov.

Plate II. Figs. 30, 31, 40.

*Special Marks.*—Sealing of lower interbrachial space coarse (four or five scales in a transverse row). No scales on arm-tentacles. Usually three very minute, peg-like arm-spines, equally spaced.

*Description of an Individual* (Station 156).—Diameter of disk 16 mm. Width of arm 2 mm. Mouth-papillæ short, square, closely soldered, four or five on each side, with one, diamond-shaped, at apex of the jaw. Mouth-shields rounded triangular, with an angle inward, sides curved, and often a re-entering curve without; they are frequently furrowed or cracked. Side mouth-shields irregularly rhomboidal, sometimes broader within, where they touch. First under arm-plate rounded triangular, with a blunt angle inward, and a long curved outer edge; second plate five-sided, with an obtuse angle within, and a curved outer edge; beyond this they are broader than long, with a blunt angle within and a wavy curve without. Side arm-plates thick and smooth, meeting broadly below and touching above beyond the sixth plate. Upper arm-plates rounded diamond-shaped, with a longer angle within; they often are cracked or grooved. Disk high, covered with thin, irregular, overlapping plates; the central primary one about 2 mm. in diameter and conspicuously the largest, and in each brachial space is a primary plate larger than the rest. Radial shields irregular, four-sided, with rounded corners, broader on the outer edge,

\* ὄφις, snake; πλινθος, tile.

separated their entire length by a broad wedge of small scales. On the under surface of the disk are numerous irregular plates between the genital scales, which are thick, with a wavy outline. The genital opening runs less than half-way to the margin. Three very short, blunt arm-spines, situated low on the outer edge of the side arm-plate. A pair of small tentacle-pores, each surrounded by a raised burr, situated near the inner angle of the second under arm-plate, on its edge; and a similar but minute pair on the third plate. Beyond this the pores are difficult to see and lie near the base of the under arm-spine. The second pair of mouth-tentacles protrude from an oval rim, having on each side a couple of ill-defined tentacle-scales. Color in alcohol, gray.

The disk and arms had clinging to them small polyp-like creatures, about 2 mm. high, and which seemed unquestionably the *Scyphostoma* stage of some medusa, like *Cyanea*. It is not easy to guess what they were doing 12,000 feet below the surface of the ocean.

Station 156, 1975 fathoms, 11 specimens.

### **Ophioplinthus grisea** sp. nov.

Plate II. Figs. 33, 34.

*Special Marks.* — Scaling of lower interbrachial space fine (ten or twelve in a transverse row). Very small, bead-like scales on first two pairs of arm-tentacles. Two or three very minute, peg-like arm-spines, situated low down.

*Description of an Individual* (Station 156). — Diameter of disk 20 mm. Width of arm close to disk, without spines, 2 mm. Mouth-papillæ short, thick, closely soldered together, about six on each side, with two longer blunt papillæ at apex of jaw. Mouth-shields small, very broad heart-shape, with a peak within, often cracked in two or more pieces. Side mouth-shields small, narrow, not meeting within, and so covered by the skin as to be seen with difficulty. First under arm-plate large, three-sided, with inner angle much rounded and outer edge slightly curved; second and third pentagonal, with sharp angle inward, lateral sides re-enteringly curved, outer edge slightly rounded; those beyond are rounded diamond-shape, and much broader than long. Side arm-plates smooth, meeting broadly below, slightly swollen along their outer edge. The basal upper arm-plates are as wide as long, of a general oval form, wider without than within, and having a deep median groove. Disk covered with thin, rounded, irregular plates and scales, having six large rounded primary plates, one in the centre and one to each brachial space. Radial shields very irregular, rudely triangular or quadrangular, with rounded corners, separated their entire length by three or more rows of disk-scales; length to breadth 3:3. On the under surface of the disk the scales are small and very thin; the genital scales are long and narrow, with an irregular wavy outline and often broken in three pieces. The genital opening extends less than half-way to the margin. The minute blunt arm-spines, of which the under one is largest, stand low, on the side arm-plate. The second pair of mouth-tentacles issue from large

pores, surrounded by a rim of minute, ill-defined papillæ ; the tentacles of the second and third under arm-plates issue in like manner from smaller pores ; beyond this the small tentacle issues near the base of the under arm-spine, and is covered, except at base of arm, by a very small, spine-like scale. The skin of the disk and base of arms is thick, and obscures the finer lines. Color in alcohol, gray.

Station 156, 1975 fathoms, 5 specimens.

## OPHIOMUSIUM.

## TABLE OF KNOWN SPECIES.

	{ Disk-scales numerous and rather flat, with a large one on the margin. Two or three short stout arm-spines. Side mouth-shields long and large.	} <i>O. eburneum</i> Lym.
	{ Interbrachial space between radial shields occupied by two large plates. Papillæ along genital openings extending upward as a small arm-comb. Four or five small arm-spines.	} <i>O. serratum.</i>
	{ Papillæ on genital openings extending upward as a small arm-comb. Side mouth-shields small and short. Upper arm-plates comparatively large, some of the basal ones inclining to hexagonal. Three or four small arm-spines.	} <i>O. armigerum.</i>
Arms rather slender and tapering; cylindrical, or but slightly wavy from the gentle swelling of the side arm-plates. Upper and under arm-plates persisting nearly to end of arm; but no tentacles beyond third or fourth under plate. Mouth-shields small. Genital opening bounded by small close-set papillæ.	{ Disk thick. Side mouth-shields and under arm-plates much swollen. Outer mouth-papillæ much larger than inner. Genital papillæ large and bead-like. Six or seven small arm-spines.	} <i>O. corticosum.</i>
	{ Disk flat, covered with small imbricated scales, which are nearly equal, except the marginal, which are larger. Upper arm-plates large, the basal ones long hexagonal.	} <i>O. cancellatum.</i>
	{ Disk covered by thick skin; its upper surface occupied chiefly (and in half-grown specimens almost entirely) by radial shields and large primary plates, with small scales between. Arms even and cylindrical. Four minute rudimentary arm-spines.	} <i>O. archaster</i> Wyv. Thom. MS.
Several flat angular plates in lower interbrachial space besides the large one joining the mouth-shield. Genital scales wide. No under arm-plates beyond the second or third.		} <i>O. Lymani</i> Wyv. Thom.
Upper disk covered by large swollen radial shields, with minute imbricated scaling in centre. Arms wide and thick, with side arm-plates much swollen and rounded. Upper arm-plates broad diamond-shape.		} <i>O. laqueatum.</i>
Disk covered by large angular swollen plates, of which the interbrachial marginal is largest. Arms wide and thick, with side arm-plates much swollen and rounded, and bearing a spine on their upper surface.	{ Upper disk-plates bearing large tubercles.	} <i>O. aciferum</i> Lym.
	{ Upper disk-plates smooth.	} <i>O. Lütkeni.</i>
Most of the lower interbrachial space outside the mouth-shield is occupied by broad genital scales and a great central plate. No under arm-plates beyond the third.	{ Four small, equally spaced arm-spines. Small upper arm-plates. The great lower interbrachial plate has usually two much smaller at its outer corners.	} <i>O. validum</i> Ljn.
	{ Two minute arm-spines set low down. Besides the great interbrachial plate below, there are three others along the margin.	} <i>O. simplex.</i>
	{ Two minute arm-spines set back from edge of plate. Only one lower interbrachial plate. No upper arm-plates.	} <i>O. lunare.</i>
	{ Three short, stout, well-defined arm-spines. Disk-plates thick, separated by narrow grooves, and arranged above like steps. Side arm-plates flaring a little outward.	} <i>O. scalare.</i>
	{ Two or three minute arm-spines. Disk-plates coarse, swollen, and irregular. Two or three marginal plates besides the central one in the lower interbrachial space.	} <i>O. testudo</i> Lym.
	{ Five short, sharp, well-marked arm-spines. The great lower interbrachial plate is separated by a square one from the mouth-shield. Margin of disk set with small points.	} <i>O. granosum.</i>
Basal side arm-plates very flat and wide, encroaching much on the interbrachial space, and bearing stout spines on their outer edge. First under arm-plate similar to those beyond, and furnished with a tentacle-scale.	{ Genital scales meeting on median line of lower interbrachial space.	} <i>O. pulchellum</i> Wyv. Thom.
	{ First side arm-plates meeting in median line of lower interbrachial space.	} <i>O. flabellum.</i>

**Ophiomusium serratum** sp. nov.

Plate I. Figs. 23, 24, 25.

*Special Marks.* — Arms rather slender and tapering, cylindrical or but slightly wavy. Upper and under arm-plates persisting nearly to end of arm, but no tentacles beyond third or fourth under plate. Genital opening bounded by small close-set papillæ. Interbrachial space between radial shields occupied by two large plates. Papillæ along genital openings extending upward as a small arm-comb. Four or five small arm-spines.

*Description of an Individual* (Station 23). — Diameter of disk 10 mm. Width of arm near disk, without spines, 2.5 mm. Mouth-papillæ six on each side, with one at angle of jaw, all in close contact. Mouth-shields heart or rounded-diamond shape, with an angle inward; length to breadth 1.5 : 1. Side mouth-shields long triangular, extending farther out than the mouth-shield; wider without than within, where they just meet. The first four under arm-plates bearing tentacle-scales are pentagonal, with an obtuse angle inward, outer edge slightly curved, lateral sides re-enteringly curved; length to breadth, second arm-plate, 1 : .7. Side arm-plates thick, constricted within, meeting below, even within the disk, and above beyond the second upper arm-plate; those beyond are also pentagonal, but small, broad, and widely separated. Upper arm-plates triangular, with an acute angle inward, and outer edge curved; length to breadth 1 : .7. Disk covered with flat plates closely soldered; in the central space within the radial shields are six rounded primary plates, separated by a circular row of small ones; the interbrachial space is occupied by two angular plates, the outer one much larger. Radial shields long triangular, separated their entire length by one small and two large scales. In the interbrachial space below are two large circular plates, extending from the mouth-shield to margin of disk, on either side of which are smaller circular scales. Genital scales long and very narrow, extending from the edge of the mouth-shield to margin of disk, on the free edge of which are fine tooth-like papillæ, corresponding to similar papillæ along the side mouth-shields, giving a resemblance to *Ophioglypha*. At the base of the arm above are short blunt papillæ on either side of first upper arm-plate. Arm-spines four or five, delicate, pointed, nearly equally placed; middle one longest and nearly half as long as a side arm-plate. A single circular tentacle-scale on second, third, and fourth under arm-plates, situated near the inner angle. The entire surface of the animal is microscopically tuberculated. Color in alcohol, white.

Station 23, 450 fathoms, 1 specimen.

**Ophiomusium armigerum** sp. nov.

Plate I. Figs. 21, 22.

*Special Marks.* — Arms rather slender and tapering, cylindrical or but slightly wavy. Upper and under arm-plates persisting nearly to end of arm,

but no tentacles beyond third or fourth under plate. Genital opening bounded by small close-set papillæ, which extend upward as a small arm-comb. Side mouth-shields small and short. Upper arm-plates comparatively large, some of the basal ones inclining to hexagonal. Three or four small arm-spines.

*Description of an Individual* (Station 332).—Diameter of disk 11 mm. Length of arm 47 mm. Width of arm near the disk 2.5 mm. Mouth-papillæ six on each side, forming a close line, and one larger one at apex of jaw. Mouth-frames long triangular, quite large. Mouth-shields rounded triangular, with an angle inward; length to breadth 1.5 : 1.5. Side mouth-shields short triangular, touching by their narrow ends within. First under arm-plate circular, very small; the next three are furnished with tentacle-scales, and are three-sided, with an angle inward, and outer side curved; the others are smaller and roughly triangular, with an angle inward, and lateral sides curved. Side arm-plates thick, and meeting broadly below beyond the disk, but just touching above on the basal joints. Upper arm-plates long, diamond-shaped, except at base of arm, where the outer and inner angles are truncated. Genital scales very narrow, and so closely soldered to surrounding parts as to be hardly distinguishable. Near inner end of genital opening they bear a few square close-set papillæ, as in *Ophioglypha*. Interbrachial space below covered by ten or a dozen circular plates of irregular outline. Upper surface of disk covered by long, rudely triangular, somewhat sunken radial shields, widely separated their entire length by two or three large and several minute rounded plates; the interbrachial space covered by a large circular marginal plate, with various smaller ones within; the central space within the radial shields by six rounded, sunken primary plates, separated by about three rows of small scales. The entire surface is microscopically tuberculous. Three or four small cylindrical arm-spines, situated well up on the outer edge of the side arm-plate; they stand out from the arm, and the two middle ones are largest. The second, third, and fourth under arm-plates have, near their inner end, small oval tentacle-scales, one to each pore. Color in alcohol, white.

Station 83, 1650 fathoms, 2 specimens. Station 106, 1850 fathoms, 5 specimens. Station 299, 2160 fathoms, (same species?) 1 specimen. Station 332, 2200 fathoms, 1 specimen.

### ***Ophiomusium corticosum* sp. nov.**

**Plate I. Figs. 19, 20.**

*Special Marks.*—Arms rather slender and tapering, cylindrical or but slightly wavy. Upper and under arm-plates persisting nearly to end of arm, but no tentacles beyond third or fourth under plate. Genital opening bounded by small close-set papillæ. Disk thick. Side mouth-shields and under arm-plates much swollen. Outer mouth-papillæ much larger than inner. Genital papillæ large and bead-like. Six or seven small arm-spines.

*Description of an Individual* (Station 224).—Diameter of disk 12 mm.

Width of arm, without spines, close to disk 2 mm. Mouth-papillæ seven on each side, three basal ones considerably largest; all forming a close line. Mouth-shields small, triangular, with acute angle inward, and outer edge much rounded. Side mouth-shields large, much longer than broad, wider without, meeting within; length to breadth 1.7 : 1. Under arm-plates from the second to the fourth or fifth furnished with tentacles; they are axe-shaped, with an angle inward, lateral sides re-enteringly curved and outer side curved; beyond, the plates are rudimentary and diamond-shaped. Side arm-plates thick, meeting above and below beyond the disk. Upper arm-plates diamond-shaped, with an angle without and within; length to breadth .7 : .7. Genital scales long and narrow, bearing a row of papillæ on the free edge. Lower inter-brachial space covered by thin curved plates, of which five form a transverse row along the disk margin; upper surface of disk pentagonal. Radial shields triangular, separated their entire length by a row of small plates; and there is a similar row in each interbrachial space; the central space within the radial shields is covered by six circular primary plates separated by small ones. Arm-spines six or seven in number, very short and blunt, situated on the outer edge of the side arm-plate. No scales beyond the fourth or fifth under arm-plate: they are large, oval, and situated near the inner angle of the plate, one to each pore. Color in alcohol, gray.

Station 224, 1850 fathoms, 3 specimens.

### **Ophiomusium cancellatum** sp. nov.

Plate I. Figs. 17, 18.

*Special Marks.* — Arms rather slender and tapering, cylindrical or but slightly wavy. Upper and under arm-plates persisting nearly to end of arm, but no tentacles beyond third or fourth under plate. Genital openings bounded by small close-set papillæ. Disk flat, covered with small imbricated scales, which are nearly equal, except the marginal, which are larger. Upper arm-plates large; the basal ones long hexagonal.

*Description of an Individual* (Station 236). — Diameter of disk 8.5 mm. Width of arm, without spines, 1.5 mm. Length of arm 28 mm. Mouth-papillæ forming a close line, six on each side, with one, diamond-shaped, at angle of jaw. Mouth-shields triangular, with an angle inward, sides equal and curved; length to breadth 1 : 1. Side mouth-shields long triangular; much wider without than within, where they do not quite meet. Genital scales concealed under fine, closely set disk-scales. Under arm-plates pentagonal near base of arm, farther out quadrangular, with an angle inward; one tentacle-scale, which is round, and situated on inner angle of the second and third under arm-plates. Side arm-plates thick, minutely tuberculous, meeting below, but not above, near base of arm. Upper arm-plates near base of arm hexagonal, with outer and inner sides very short. Disk covered above and below by thin, rounded, minutely tuberculous scales; on the margin are larger

angular plates of the same character. Radial shields small, minutely tuberculous, rounded triangular; length to breadth 1.5 : .7; widely separated by a group of half a dozen plates, of which the outer ones are much wider than long. Two or three minute peg-like arm-spines situated in a notch low on the side arm-plate. Color in alcohol, pale gray.

Station 236, 420-470 fathoms, 1 specimen. Station 33, 300 fathoms, (same species?) 1 specimen.

**Ophiomusium archaster** WYV. THOM. MS. sp. nov.

**Plate II. Figs. 28, 29, 32.**

*Special Marks.*—Arms rather slender and tapering, cylindrical, or but slightly wavy. Upper and under arm-plates persisting nearly to end of arm, but no tentacles beyond third or fourth under plate. Genital opening bounded by small close-set papillæ. Disk covered by thick skin, its upper surface occupied chiefly (and in half-grown specimens almost entirely) by radial shields and large primary plates, with small scales between. Arms even and cylindrical. Four minute rudimentary arm-spines.

*Description of an Individual* (Station 323).—Diameter of disk 10 mm. Width of arm close to disk, without spines, 2.5 mm. Five mouth-papillæ on each side, short, pointed, closely joined, with one large, diamond-shaped, at angle of jaw. Mouth-shields broad heart-shaped, with a peak within; length to breadth 1.3 : 1.5. Side mouth-shields long triangular, very broad without; tapering and curved inward, where they meet. First under arm-plate very small, triangular, with angle inward; the three next bear tentacle-scales, and are three-sided, with lateral sides a little re-enteringly curved and outer side slightly curved; the rest are small, triangular, with outer side curved. Side arm-plates thick, slightly swollen, somewhat constricted within, meeting below throughout, and above beyond the third upper arm-plate. First two upper arm-plates rounded and much wider than those beyond, which are triangular, with an angle inward, lateral sides straight, outer edge much curved. Disk flat, covered with thick, minutely tuberculous plates and scales. Radial shields sunken, of irregular rhomboidal shape, with corners rounded; length to breadth 1.7 : 1.3. Central primary plate smaller than the others, circular, sunken, separated by a double row of small circular scales from five large sunken, nearly round plates which surround it; the rest of the upper surface is covered with small rounded scales, with a larger one on the margin. Under surface covered with small rounded plates, irregularly disposed; genital scales long and very narrow, on the free edge of which are fine, short, square papillæ, corresponding to similar ones on the side arm-plates. One small rounded tentacle-scale, situated near inner angle of plate. Three or four minute, slender, rounded arm-spines standing low down on arm-plate; upper one longest. Color in alcohol, straw.

Station 323, 1900 fathoms, 5 specimens.



**Ophiomusium Lymani** WYV. THOM.

*Ophiomusium Lymani*, Depths of the Sea, p. 172, Figs. 32, 33. 1873.

The specimens from the following widely separated stations showed certain minor differences. For example, those from Station 235 had more arm-spines and rather more numerous lower disk-plates, and the tentacle-scales were entire, instead of divided. I have deemed it best to keep the varieties together for the present.

Station 45, 1245 fathoms, 1 specimen. Station 50, 1250 fathoms, 12 specimens. Station 76, 900 fathoms, 1 specimen. Off Tristan d'Acunha, 1100 fathoms, 7 specimens. Station 169, 700 fathoms, 1 specimen. Station 191, 800 fathoms, 4 specimens. Station 235, 565 fathoms, 5 specimens. Station 296, 1825 fathoms, (only arms.)

**Ophiomusium laqueatum** sp. nov.

Plate I. Figs. 14-16.

*Special Marks.* — Upper disk covered by large swollen radial shields, with minute imbricated scaling in centre, arms wide and thick, with side arm-plates much swollen and rounded. Upper arm-plates broad, diamond-shape.

*Description of an Individual* (Station 192). — Diameter of disk 14 mm. Width of arm 3.5 mm. Mouth-papillæ six or seven on each side, and one, diamond-shaped, at angle of jaw. Mouth-shields ovoid, slightly pointed within; length to breadth 2 : 1.3. Side mouth-shields long, narrow, having curved sides, wider without than within, where they nearly or quite meet; length 2.3 mm. Genital scales very long and narrow, extending from mouth-shield to margin of disk, and bearing on their free edge an irregular row of close-set oblong papillæ. Under arm-plates triangular, with an angle inward; in the first two plates the angle is blunt, becoming more acute in those beyond; outer edge somewhat curved. Tentacle-scales only on the first three plates; they are minute, circular, two in number, set close together and situated very near the inner angle. Side arm-plates thick, swollen, barely meeting above and below at the inner angle of the upper and under arm-plates. Upper arm-plates near base of arm quadrangular, wider than long; length to breadth 1.3 : 2; towards end of arm they are three-sided. Disk covered in centre with fine delicate scales, among which appear six larger rounded primary plates, which are widely separated, one in the centre, and one in each brachial space. Radial shields oval, swollen, a little wider without than within, separated from each other their entire length by two or three long oval scales mingled with finer. Interbrachial spaces on upper surface occupied by two or three rounded scales, bordered by smaller, and of which the largest is on the margin of disk. Under interbrachial space covered by about a dozen thick, rounded, swollen scales, almost concealing the genital scale; the three largest stand on or near the margin. Four minute peg-shaped arm-spines; three standing together, low on the edge of the plate; the fourth placed much above them. Color in alcohol, white.

Station 192, 129 fathoms, 1 specimen.

**Ophiomusium Lütkeni** sp. nov.

Plate V. Figs. 138-140.

*Special Marks.* — Disk covered by large, angular, smooth, swollen plates, of which the interbrachial marginal is largest. Arms wide and thick, with side arm-plates much swollen and rounded, and bearing a spine on their upper surface.

*Description of an Individual* (Station 192). — Diameter of disk 13 mm. Length of arm about 45 mm. Width of arm close to disk, without spines, 2.5 mm. Four or five large square mouth-papillæ on each side, with one, small and slender, at apex of jaw, all closely joined, those without being deeper than those within. Mouth-shields rudely three-sided, having a blunt angle within and a curved outer edge broken by angles. Length to breadth 2.5 : 2.7. Side mouth-shields longer than broad, and thick, meeting well within, where they are slightly narrower than without. First under arm-plate small, nearly square, with all four angles rounded; the next two larger, pentagonal, with an angle inward, outer lateral corners rounded, and deep re-entering curves on the lateral sides, where the tentacle-scales stand; the under arm-plates beyond these are minute and triangular, having an angle inward and the outer edge slightly curved. Side arm-plates large, swelling without into a rounded ridge and forming the greater part of the covering of the arm. Upper arm-plates triangular, with an angle inward, and all three sides slightly curved. Disk massive and flat, covered with thick, slightly swollen plates, one pentagonal primary in the centre, surrounded by five rudely hexagonal plates; interbrachial spaces filled by one hexagonal plate within, and a smaller quadrangular extending to the very large marginal plate, which is much swollen and has a constriction on the outer edge. Radial shields large and angular, wider without than within, with outer angles rounded, separated their entire length within by an hour-glass-shaped wedge of three small plates. Lower interbrachial space covered by the great marginal plate, the broad genital scales extending from the mouth-shield to the marginal plate, and by three intermediate plates. There are two short blunt arm-spines, besides a supplementary spine on the top of the side arm-plate. Tentacle-pores at the second and third under arm-plates only, with one small round scale on each pore. Color in alcohol, grayish.

By its general shape, and by the extra spines on top of the arm, this species approaches *O. acuferum*, but is distinguished by form and arrangement of disk-plates.

Station 192, 129 fathoms, 3 specimens.

**Ophiomusium validum** Ljn.

*Ophiomusium validum* DR. GOËS, Vestindisk. Oph. Öf. Kong. Akad. p. 618. 1871.

Plate I. Figs. 7-9.

*Special Marks.* — Most of the lower interbrachial space outside the mouth-shield is occupied by broad genital scales and a great central plate. No under

arm-plates beyond the third. Four small, equally spaced arm-spines. Small upper arm-plates. The great lower interbrachial plate has usually two much smaller at its outer corners.

*Description of an Individual* (Station 24). — Diameter of disk 8.5 mm. Width of arm, without spines, close to disk 2 mm. Mouth-papillæ five on each side, with a large diamond-shaped one at angle of jaw, all forming a close line. Mouth-shields large, irregularly pentagonal, with an acute angle inward and outer edge straight; length to breadth 2 : 1.7. Side mouth-shields longer than broad, wider without than within; outer ends curved, touching by their narrow ends within. Genital scales large, semicircular, stretching from mouth-shield to margin of disk. There are only three under arm-plates, the first small and diamond-shaped, lying at outer end of mouth-slit; second and third pentagonal, with an angle inward, and lateral and outer sides nearly straight. Side arm-plates thick, slightly swollen, and beyond the third under arm-plate forming the entire covering of the arm, with the exception of rudimentary triangular upper arm-plates, which do not extend to the tip of the arm. Disk rather flat, and covered by closely soldered plates; the upper surface is occupied by six primary plates, separated by many smaller ones; radial shields rounded triangular, with acute angle within; outer edges curved, strongly diverging inward, and separated by a triangular scale. In interbrachial space are two angular plates, the outer one wide quadrangular and closely soldered to a great marginal plate, which, with the genital scales, covers the interbrachial space on the under surface of the disk. At base of arm above are four little plates, two central and two lateral. Four short, blunt, and thick arm-spines, situated low on the outer edge of the side arm-plate. Tentacle-scales minute, rounded, situated on the inner angle of second and third under arm-plates. Color in alcohol, pale gray.

In presence of the many new species of *Ophiomusium*, it has been thought well to give figures and a full description of this one.

Station 24, off St. Thomas, 390 fathoms, 2 specimens. Station 23, close to Sombrero, 450 fathoms, 3 specimens.

### **Ophiomusium simplex** sp. nov.

**Plate I. Figs. 10, 11.**

*Special Marks.* — Most of the lower interbrachial space outside the mouth-shield is occupied by broad genital scales and a great central plate. No under arm-plates beyond the third. Two minute arm-spines set low down. Besides the great interbrachial plate below there are three others along the margin.

*Description of an Individual* (Amboyna). — Diameter of disk 6 mm. Width of arm without spines 1.5 mm.; length of arm 15 mm. Mouth-papillæ seven on each side, and one, spearhead-shaped, at angle of jaw, closely soldered together and forming a slightly raised continuous line. Mouth-shields little longer than broad, pentagonal, with acute angle within, at the corners of

which begin the genital openings ; outer side straight. Side mouth-shields short, wide, with curved sides meeting within ; length 1 mm. Genital scales large, semicircular, somewhat swollen, running from lateral corners of mouth-shield to margin of disk. There are only two under arm-plates besides the small semicircular one at the angle of the mouth-slit ; they are pentagonal, with an angle inward ; lateral and inner lateral sides straight ; outer side slightly curved. Tentacle-scales on second and third plates small, circular, and situated at the inner corners. Side arm-plates swollen, forming the entire covering of the arm beyond the last under arm-plate, with the exception of minute upper arm-plates, which are triangular, with an angle within. Disk covered with closely soldered plates ; in the centre of the upper surface is a pentagonal plate, surrounded by five rudely hexagonal, which are connected with the radial shields by plates somewhat longer than broad, between each pair of which are large angular scales. Radial shields shaped like a rounded pear-seed, much swollen, touching at their middle point, but diverging outward and inward, separated on either side of the point of contact by a small triangular scale ; on the interbrachial disk-margin is an angular, much swollen plate, joining three of similar character, which, with the genital scales, cover the under surface of the interbrachial space ; at the base of the arm above are three small rounded scales. Arm-spines two, minute, blunt, and set low down on the edge of the side arm-plate. Color in alcohol, white.

Amboyna, 100 fathoms, 1 specimen.

### **Ophiomusium lunare** sp. nov.

#### **Plate I. Figs. 4-6.**

*Special Marks.*—Most of the lower interbrachial space outside the mouth-shield is occupied by broad genital scales and a great central plate. No under arm-plates beyond the third. Two minute arm-spines set back from edge of side arm-plate. Only one lower interbrachial plate. No upper arm-plates beyond second.

*Description of an Individual* (Station 219).—Diameter of disk 7 mm. Width of arm, without spines, close to disk 1.5 mm. Length of arm about 20 mm. Mouth-papillæ seven on each side, with one, somewhat larger than the rest, at the angle of the jaw. Mouth-shields large, pentagonal, with an acute angle within, and outer side straight ; length to breadth 1.5 : 1. Side mouth-shields large, long triangular ; sides slightly curved, with narrow ends touching within. Genital scales long, with interbrachial side curved, starting at the inner corner of the genital opening and touching the radial shields with their outer ends. Under arm-plates pentagonal, with an angle inward, and outer side slightly curved ; there are only two besides the small one at the outer end of mouth-slit. Side arm-plates thick, composing the entire covering of the arm, with the exception of the minute triangular upper arm-plate, which has an angle inward, and outer side curved, and disappears on the second or third

joint. The disk is rather flat, covered with microscopically tuberculated plates, well soldered together; the margin is occupied by one large plate, touching the radial shields on either side, and extending below to the mouth-shields; the centre is occupied by six primary plates, one pentagonal, surrounded by five rudely hexagonal. The radial shields are pear-seed shape, and large, having a blunt angle inward, and outer edge much rounded; they touch only at their middle point, and are separated within and without by a small triangular scale. The interbrachial space below is covered by the large marginal plate, already mentioned, and the stout genital scales. Tentacle-scales minute, circular, situated at the inner corners of the second and third plates. Two very small, short, and blunt arm-spines. Color in alcohol, white.

Station 219, depth 150 fathoms, 1 specimen.

### **Ophiomusium scalare** sp. nov.

#### **Plate I. Figs. 1-3.**

*Special Marks.*—Most of the lower interbrachial space, outside the mouth-shield, is occupied by broad genital scales and a great central plate. No under arm-plates beyond the third. Three short, stout, well-defined arm-spines. Disk-plates thick, separated by narrow grooves, and arranged above like steps. Side arm-plates flaring a little outward.

*Description of an Individual* (Station 171).—Diameter of disk 5 mm. Width of arm without spines 1 mm. Length of arm about 10 mm. Mouth-papillæ three on each side, and one at angle of jaw, closely soldered together, forming high continuous ridges, radiating from the mouth. Mouth-shields five-sided, having a long acute angle within, and the outer side straight; length to breadth 1 : 1. Side mouth-shields long, narrow, meeting within; broader without than within, where they join the first side arm-plate; length 1 mm. Genital scales large semicircular, somewhat swollen. Under arm-plates minute, three in number; the first one semicircular, wedged between the side mouth-shields; second and third longer than wide, with acute angle inward, lateral sides straight, and outer side slightly curved. Tentacle-scales round, very small, situated near inner angle of the under arm-plate. Side arm-plates thick, swollen, covering almost the entire arm beyond the disk. Upper arm-plates minute, diamond-shaped. Under surface of disk covered, in the interbrachial spaces, by genital scales, and three large swollen semicircular plates, whose outer edge is curved; upper surface of disk covered with small tuberculous plates, forming a much raised rosette, the central plate of which is pentagonal, the primary plates surrounding it semicircular. Radial shields closely soldered together, and partly separated by an angular plate. In the interbrachial spaces are two large plates, radiating from the central rosette, one five-sided, with an acute angle inward, and joined to the inner edge of the radial shields; the other, which is on the margin of the disk, is a large, nearly square, corrugated plate, and is attached on either side to small oval plates,

which form above the base of the arm two irregular transverse rows, three or four in each row. Three small peg-like arm-spines about one third as long as a joint. Color in alcohol, pale gray.

Station 171, 600 fathoms, 1 specimen.

### **Ophiomusium granosum** sp. nov.

Plate I. Figs. 12, 13.

*Special Marks.*—Most of the lower interbrachial space outside the mouth-shield is occupied by broad genital scales and a great central plate. No. under arm-plates beyond the third. Five short, sharp, well-marked arm-spines. The great lower interbrachial plate is separated by a square one from the mouth-shield. Margin of disk set with small points.

*Description of an Individual* (Station 237).—Diameter of disk 10 mm. Width of arm, without spines, close to disk 2 mm. Mouth-papillæ very closely soldered together, forming a ridge. Mouth-shields triangular, with an acute angle within, and the outer edge curved. They bear minute spines. Side mouth-shields long and narrow; meeting within, where they are narrowest. Genital scales large, angular, longer than wide. First under arm-plate semicircular; second and third triangular, with an acute angle inward. Side arm-plates minutely tuberculous, meeting broadly above and below, and nearly covering the entire arm beyond the disk. Upper arm-plates minute, triangular, with acute angle inward. There are no tentacle-scales. Disk covered with closely soldered plates, having decided furrows between them; the microscopic tuberculation usual in the genus is very coarse, and rises near edge of disk into small points. The margin is occupied by a large, angular, swollen plate, covered with points, which connects the radial shields with the genital scales, and is united to the mouth-shield by a smaller rectangular plate, also carrying points. Radial shields pear-seed shape, diverging inward, where they are separated by a triangular plate. In centre of upper surface of disk is a large pentagonal primary plate, surrounded by five others, quadrangular, and connected with the radial shields by five rudely triangular pieces; in each interbrachial space above are two quadrangular plates, besides that of the margin. Arm-spines five in number, occupying the whole edge of the side arm-plates; they are short, rounded, and delicately tapering. Color in alcohol, gray.

Station 237, 875 fathoms, 4 specimens.

### **Ophiomusium pulchellum** WYV. ТНОМ.

Voyage of the "Challenger." The Atlantic, Vol. II. p. 67, Figs. 18, 19.

Plate V. Figs. 144, 145.

*Special Marks.*—Primary plates bearing a large central tubercle; second pair of side arm-plates wide, and flaring below; lower interbrachial space occupied almost wholly by large genital scales, and a marginal plate like a tubercle.

*Description of an Individual\** (Station 122). — Diameter of disk 4.5 mm. Length of arm about 7 mm. Width of arm close to disk, without spines, 1 mm. Mouth-papillæ closely soldered, forming a straight line on the sides, with one round, bluntly pointed papilla at apex of the jaw. Mouth-shields small, triangular, with a long angle within, outer edge much rounded; length to breadth, .5 : .5. Side mouth-shields large, long, and narrow, meeting within, wider without than within, with outer ends rounded. First under arm-plate of a rude wedge-shape, having the outer edge widest, and curved, long lateral sides slightly re-enteringly curved, and a short blunt angle within; second, third, and fourth plates broader than long, much broader without than within, lateral sides with deep re-entering curve, and outer side strongly curved; fifth plate triangular, and much smaller; beyond which the plates are diamond-shape and minute. Side arm-plates wide and swollen, meeting broadly above and below, beyond the sixth under arm-plate forming almost the entire covering of arm; the second pair are very wide below, flattened and flaring, and form a part of the disk margin. Upper arm-plates small, broader than long, with outer edge gently and inner edge deeply curved; growing rapidly smaller, and almost disappearing beyond the sixth. Disk thick and round, covered with swollen, microscopically tuberculous plates; in the centre are six primary plates, forming a regular rosette, the central one pentagonal, the others hexagonal, and each bearing a large tubercle; in the interbrachial space there is one large square plate, also bearing a tubercle; outside this is a large, much swollen marginal plate, which is much wider without than within, the inner edge being straight and the outer re-enteringly curved. Radial shields large, rudely oval, longer than broad, joined for nearly their whole length; overlapped on their inner ends by one of the primary plates, and separated without by a small, much swollen, semicircular plate; length to breadth 1 : .7. On the lower interbrachial space there are two minute plates, just outside the mouth-shield; then the two great genital scales, which occupy most of the space, and meet within at the mouth-shield, and are separated without by a large thick plate, wedged between them, which extends outward beyond the margin, in form of a tubercle. The first side arm-plate carries two short, thick, blunt arm-spines; the second, which forms part of the margin of the disk, has three spines; the rest have two, all situated low on the outer edge. One large, rounded tentacle-scale on the inner side of each tentacle-pore of the first five under arm-plates. Color in alcohol, white.

By its curious, flaring under arm-plates at the base of the arm, and its short, rapidly tapering arm, this species gets a fanciful resemblance to some of the star-fishes. It is an aberrant species, yet is correctly included by Sir Wyville Thomson under *Ophiomusium*. Its distribution is wide, and embraces the South Atlantic, including the Cape of Good Hope; and in depth from 150 to 1675 fathoms.

Station 87, 1675 fathoms (Wyv. Thom.). Station 122, 350 fathoms, 4 specimens. Station 142, 150 fathoms, 3 specimens.

\* The description is from a specimen larger than the one figured.

**Ophiomusium flabellum** sp. nov.

Plate V. Figs. 141-143.

*Special Marks.*—Basal side arm-plates very flat and wide, encroaching much on the interbrachial space, and bearing stout spines on their outer edge. First under arm-plate similar to those beyond, and furnished with a tentacle-scale. First side arm-plates meeting on median line of lower interbrachial space.

*Description of an Individual.*—Diameter of disk 3.3 mm. Length of arm 3.3 mm. Width of arm close to disk, without spines, 1 mm. Mouth-papillæ closely soldered together, forming a continuous line. Large triangular mouth-frames. Mouth-shields minute, diamond-shape. Side mouth-shields very large, meeting broadly within, with outer ends wide and much rounded, having a re-entering curve on the lateral edge, where stands the tentacle-scale. First, second, and third under arm-plates pentagonal, with a blunt angle within, outer edge slightly curved, and lateral sides re-enteringly curved; the second is largest of the three; the fourth and last is a minute, broad, triangular scale, without a tentacle-pore. The first pair of side arm-plates are swollen, and of such extraordinary size as to meet on the median line of the interbrachial space; the second are smaller, and meet above and below; beyond the fourth under arm-plate they form the entire covering of the arm. Only two minute triangular upper arm-plates, having the outer edge slightly curved. Disk high and round, covered with thick, much swollen plates, whereof the middle are somewhat sunken; the central primary is pentagonal, surrounded by a row of angular plates, of nearly equal size; outside this row, in each interbrachial space, is another angular plate separating the inner ends of the rather long, closely joined radial shields. On the interbrachial margin is a large, much swollen boss, rising high above the other disk-plates, and connecting the neighboring radial shields. On the interbrachial space of the under surface there is but one minute triangular scale, outside the enormous first pair of side arm-plates; these carry on their outer edge three small blunt spines, which look like marginal disk-papillæ; the next pair carry only two spines; and beyond, there is only one, which is blunt and short, and carried low on the outer edge of the plate. Only three pairs of tentacle-pores (including the mouth-tentacles), each with one large rounded scale on the lateral sides of the under arm-plates. Color in alcohol, very pale brown.

This species and *O. pulchellum*, by their large flat side arm-plates of the first pair, and peculiar first under arm-plate, which bears tentacle-scales, are strongly distinguished from others of the same genus.

Off Port Jackson, 30-35 fathoms, 1 specimen.

**OPHIOPYRGUS** gen. nov.

Disk high and dome-shaped, covered with thick swollen plates, and surmounted by a central primary plate, which rises like a cone. Arms slender,



smooth, and tubular, with side arm-plates very large, and upper and under arm-plates small. Basal tentacle-pores very large; those beyond small and situated near sides of arm. An arm-comb. Arm-spines minute, and standing on outer edge of side arm-plate. Two long genital openings in each interbrachial space.

This is the most singular-looking genus yet found among *Ophiuridæ*. With its peg-like central primary plate and dome-like disk it suggests a simple armed crinoid whose head has been broken from the stem. By its heavy, closely soldered plates and peculiar tentacle-pores, it recalls *Ophiomusium*; by its enclosed mouth-tentacles and arm-comb, it brings to mind the deep-sea *Ophioglyphæ*; but it differs pretty widely from both.

### **Ophiopyrgus Wyville Thomsoni** sp. nov.

#### **Plate V. Figs. 135 - 137.**

*Special Marks.* — One minute arm-spine on basal joint; farther out, none; a double arm-comb over top of arm, the upper one consisting of three or four small papillæ on edge of outer end of genital scale; the under, likewise of three or four papillæ, on edge of side arm-plate. Interbrachial space below wholly filled by mouth-shield.

*Description of an Individual* (Station 172). — Diameter of disk, 4 mm. Height of disk 4.3 mm. Length of arm 13 mm. Width of arm 1.2 mm. Mouth-papillæ small, similar, separated, tooth-like; seven or nine to each angle, whereof the innermost is slightly largest. Mouth-shields longer than broad, oval, with a peak inward, occupying the entire interbrachial space below, and bending upwards to half the height of the arm. Side mouth-shields very small and sunken, meeting within, and covering only the inner peak of mouth-shield. First under arm-plate very long axe-shape, with a curved edge outward and a long, tapering point inward, compressed between two large oval tentacle-pores; second plate similar, but smaller; third and fourth plates shorter and still smaller; beyond which the plates are represented by a small knot of a transverse diamond-shape, and growing rapidly less towards end of arm. Side arm-plates large, but not swollen, meeting widely above and below, occupying most of the arm, which acquires thereby a tubular, rapidly tapering form. The side arm-plates belonging to second under plate are wide, and stretch laterally to meet the mouth-shield. Disk as high as wide, rising in a steep dome surmounted by a sugar-loaf projection, which is the central primary plate, and is surrounded by five other primaries, longer than broad, and hexagonal, outside which are small, angular, radial shields, which are joined; in the interbrachial space are one pentagonal and one rounded hexagonal plate, the latter joining the upper edge of the mouth-shield; all the plates are closely soldered, slightly swollen, and, as well as the arm-plates, are microscopically tuberculous. Genital openings long, curved and narrow, extending from inner point of mouth-shield to a point over arm. One minute peg-

like arm-spine, which is found only on the first two or three joints beyond disk, and stands half-way up the side arm-plate. The second pair of mouth-tentacles protrude from very large oval pores covered with four flat rounded scales; the next pores, those of the first arm-tentacles, are similar but smaller; the next still smaller; while those of the fourth under arm-plate are little round holes covered by a single scale. Farther out on arm the pores lie behind and above the rudimentary under arm-plate. Color in alcohol, white.

The large side arm-plates and few disk-plates suggest that this is a young animal. Unfortunately the depth is given as 18 and 240 fathoms; but the character of the animal seems to indicate the latter depth.

Station 172, off Nukualofa, Tongatabu, 18 and 240 fathoms, 2 specimens.

### OPHIERNUS\* gen. nov.

Central portion of disk inside radial shields covered by a thick skin; round the margin a broad band of scaling, interrupted only by radial shields, and covering also the lower interbrachial space, the whole more or less hidden by the skin. Radial shields naked. Teeth, and small, numerous, close-set mouth-papillæ. First under arm-plate rather large, and bearing some of the scales of the second pair of mouth-tentacles. Upper arm-plates covering the whole width of arm. Small smooth arm-spines, arranged along outer edge of side arm-plate. Two large, long genital openings in each interbrachial space.

In the size and function of the first under arm-plate, and in the size and shape of the upper arm-plates, this genus has a slight relation to *Ophioglypha*.

### *Ophiernus vallincola* sp. nov.

Plate VI. Figs. 170-172.

*Special Marks.*—Three small cylindrical pointed arm-spines, less than half as long as an arm-joint, set close together and low down on side arm-plate; mouth-shields rounded and widely separated.

*Description of an Individual* (Station 78).—Diameter of disk 9 mm. Length of arm about 50 mm. Width of arm close to disk, without spines, 1.7 mm. Four small, short, rounded, bead-like mouth-papillæ on either side of the mouth-frames, and usually two at apex under teeth, which are four in number, large and flat, with a rounded cutting edge; besides these there are two little papillæ on the side mouth-shield and two on the first under arm-plate, which may be considered scales of the second pair of mouth-tentacles. Mouth-shields triangular, length to breadth about equal, with blunt angle inward, and outer corners rounded. Side mouth-shields short, broad without, pointed within, lying on lateral sides of mouth-shield, by which they seem widely separated, but the inner narrow points run under the thick skin, and nearly meet

\* *ὄφις*, snake; *ἔρπος*, sprout.

within. First under arm-plate triangular, with inner angle truncated, lateral sides re-enteringly curved, and outer edge rounded; the rest are narrow and rudely pentagonal, those near base of arm having the inner angle truncated, and the outer slightly curved; inner laterals bounded by a re-entering curve; length to breadth .8 : .8. Side arm-plates broad and flat, not meeting below, separated above by the broad upper arm-plates, which are much wider than long, and cover the whole upper surface of arm, having the lateral sides nearly straight, and edge with a slightly re-entering curve. Disk flat and round; central portion covered with a thin, naked, cross-wrinkled skin; along the margin are minute scattered granules, which, with the thick skin, hide the underlying scales. Radial shields longer than broad, much rounded, widely separated; length to breadth 2 : 1.5. Lower interbrachial space covered with a thin skin, on which there is a very scattered granulation. Genital openings wide, extending from mouth-shield to edge of disk. Genital scale not seen. Three small, tapering, cylindrical arm-spines, less than half as long as an arm-joint, set low on the outer edge of side arm-plate. Two small rounded scales on the interbrachial edge of each tentacle-pore. Color in alcohol, greenish-gray.

This species grows to a large size; one with a disk of 20 mm. was similar to the above, except that the mouth-angle was narrower and more prolonged, and bore, on each side of the mouth-frames, eight small, very close-set papillæ. The granulation of the disk was feeble; in many specimens it is wholly wanting. The pair of small mouth-papillæ under the teeth is often wanting.

Station 78, 1000 fathoms, 2 specimens. Station 146, 1375 fathoms, 12 + specimens. Station 156, 1975 fathoms, 1 specimen.

It is with doubt that the two following species are referred to *Ophioceramis*. They are both rather young, and have perhaps not taken on their full characters. Dr. Lütken pointed out the two divisions of Ophiurans, in one of which the side arm-plates, rising in ridges, bear the spines on their *sides*, standing at right angles to the axis; in the other the same plates are flat, and carry their spines on their *outer edge* parallel with the axis. *Ophiothrix* is an exact type of the first, *Ophiolepis* of the second. But there are genera intermediate, where the base of the spine, not crowded against the side arm-plate, as in *Ophiolepis*, stands on the *outer corner* of the edge, and has a lateral motion as far as a right angle, instead of hugging the arm. *Ophiozona* illustrates this intermediate stage, while the third genus of the *Ophiolepis* group—*Ophioceramis*—may be said to bear its spines almost on the sides of the side arm-plates. As hinted above, *O. obstricta* and *O. clausa* differ in various ways from the type, and are placed here waiting further information.

**Ophioceramis (?) clausa.****Plate VI. Figs. 161 - 163.**

*Special Marks.* — Four arm-spines, the two upper slender and tapering, the two lower stout and blunt. A great marginal scale, which occupies also most of the lower interbrachial space.

*Description of an Individual* (Station 170). — Diameter of disk 4 mm. Length of arm about 18 mm. Width of arm without spines 1.2 mm. Three short, stout, pointed mouth-papillæ, well separated on each side, with one larger and spearhead-shaped at the apex of angle. Mouth-shields broader than long, transverse diamond-shape, with outer angle indented; length to breadth .6 : 1. Side mouth-shields very large and wide, somewhat longer than wide, square without, meeting broadly within, and there forming a deep angle. First under arm-plate broader than long, rounded; the rest are widely separated, twice as broad as long, with outer edge nearly straight, a very obtuse angle or weak curve within, and a small re-entering curve on the lateral sides. Side arm-plates stout, flaring a little outward where they form the spine-ridge, meeting broadly above and below. Upper arm-plates broader than long, wide fan-shape with an angle inward, somewhat swollen, making the arm high and rounded. Disk round and flat, covered with thin, flat, angular scales arranged symmetrically; central primary plate pentagonal, surrounded by five others rounded hexagonal and somewhat smaller; interbrachial spaces filled by three large scales, the two inner ones four-sided, the outer one rounded and lying on the margin, showing little above, but beneath occupying the whole interbrachial space except two small scales outside the mouth-shield. Radial shields regular, longer than broad, wide without, coming by curved sides to a point within, where they are separated by a small triangular scale, but are joined for the rest of their length; they, as well as the other disk-scales, bear a few microscopic tubercles. Four arm-spines; the two upper thin and tapering, and nearly as long as an arm-joint; the two lower shorter, stouter, and more blunt; towards tip of arm there are three, the upper long and slender, as long as two joints; the second similar, but shorter; and the lowest very stout and somewhat curved. One very small rounded tentacle-scale, on the first two pairs of tentacle-pores; beyond there are two. Color in alcohol, pale brown.

Station 170, 630 fathoms, 1 specimen.

**Ophioceramis (?) obstricta sp. nov.****Plate VI. Figs. 164 - 166.**

*Special Marks.* — Five short, nearly equal, blunt, tapering arm-spines. Radial shields separated in the brachial spaces, but touching in the interbrachial.

*Description of an Individual* (Station 192). — Diameter of disk 4 mm.

Length of arm about 12 mm. Width of arm close to disk, without spines, 1.2 mm. Seven small, short, rounded mouth-papillæ to each mouth-angle, the inner one longer and more prominent. Three squarish teeth, the upper one very small. Mouth-shields broader than long, inner angle broad and rounded, lateral corners rounded, and outer edge much curved; length to breadth .7 : .6. Side mouth-shields large, somewhat swollen, square, and wide without; tapering slightly inward, where they just meet. First under arm-plate rounded and conspicuous; the plates beyond are short pentagonal, with an angle inward. Side arm-plates thick and somewhat flaring outward, meeting broadly below and also above beyond the first, which is broader than long, four-sided, with slight re-entering curves on the lateral sides and outer corners rounded; beyond, the plates are pentagonal, with an obtuse angle inward, and lateral and outer sides straight. Disk thin and sunken, and contracted in the interbrachial spaces, covered with small overlapping plates; in centre are six rudely angular primaries, separated in the interbrachial spaces by several minute rounded scales. Radial shields large, longer than broad, swollen, raised above the surrounding scales, having a long angle inward and outer angles rounded; separated their whole length by an inner and outer wedge, each composed of two small quadrangular plates; length to breadth 1.5 : .8: each shield touches that of the neighboring pair by its interbrachial edge, and is separated without by a marginal wedge-like scale. Lower interbrachial space with a row of scales on the margin, the central one being larger with edges rounded, its inner edge touching the mouth-shield. Genital scales short and thick, composed of two or three angular pieces. Five short, blunt, tapering arm-spines, about two thirds as long as an arm-joint, extending along the entire edge of the side arm-plate. One pointed tentacle-scale, so minute as to be seen with difficulty. Color in alcohol, pale brown.

Station 192, 129 fathoms, 1 specimen.

### OPHIOZONA LYM.

#### *Ophiozona stellata* sp. nov.

Plate VI. Figs. 147, 148.

*Special Marks.*—Two short arm-spines placed low on the plate, the lower one twice as long as the upper. Arm somewhat flattened, side arm-plates not swollen. Radial shields small, irregular, widely separated.

*Description of an Individual* (Station 168).—Diameter of disk 9 mm. Length of arm about 35 mm. Width of arm close to disk, without spines, 1.8 mm. Four squarish close-set mouth-papillæ on each side, and two longer and more pointed at angle of jaw. Four short stout teeth, the lowest thickened and rounded. Mouth-shields three-sided, with a long angle within, and outer edge much curved; length to breadth 1.8 : 1.8. Side mouth-shields short and thick, wide without; tapering to a point within, where they just meet. First under arm-plate very small, transverse oval in form; second plate wider

without than within, four-sided, having lateral sides re-enteringly curved and a peak without; those beyond are similar, but nearly pentagonal. Side arm-plates broad and thick, meeting below beyond the fourth under arm-plate and above beyond the second upper arm-plate, which is fan-shaped, with an angle inward. Disk flat and rather thin, covered with stout, rounded, microscopically tuberculous plates, whereof a large primary occupies the centre, with five others about it, separated in the interbrachial space by a radiating row of two or more scales; outside these, again, is a row of ten semicircular plates with small scales between; near each interbrachial margin are two plates side by side; on the lower interbrachial space are three transverse rows of irregularly shaped plates. Genital scales composed of three irregular pieces placed end to end. Genital openings extending from outer edge of mouth-shield to margin. Two short, stout, blunt, tapering arm-spines placed low on the side arm-plate, the lower one twice as long as the upper and about half as long as an arm-joint. One large rounded tentacle-scale on the inner side of the tentacle-pore. Color in alcohol, pale gray.

A young with a disk of 2.8 mm. had arms 5 mm. long. The disk was more arched, and its plates, of course fewer, were microscopically tuberculous. The side mouth-shields were very large and swollen, and the mouth-shields small. The first under arm-plate larger than in the adult, and the rest much smaller proportionately.

Station 168, 1100 fathoms, 12 + specimens. Station 169, 700 fathoms, 12 + specimens.

### **Ophiozona insularia** sp. nov.

**Plate VI. Figs. 149-151.**

*Special Marks.*—Four short, nearly equal arm-spines. Arm high. Side arm-plates swollen, and strongly flaring outward. Radial shields large, rounded triangular, widely separated.

*Description of an Individual* (Station 173).—Diameter of disk 6 mm. Length of arm about 18 mm. Width of arm close to disk, without spines, 1.6 mm. Five short, squarish, close-set mouth-papillæ on each side, one large spearhead-shaped at apex of angle. Mouth-shield longer than broad, with a very deep curve without, and an angle within; length to breadth, 1 : .8. Side mouth-shields short and thick; rather wider without than within, where they meet. First under arm-plate very small, transverse oval in shape; second, third, and fourth plates large and five-sided, with inner angle truncated, small re-entering curves on the lateral sides, and outer edge slightly curved; beyond, they approach a fan-shape, with an angle inward. Side arm-plates broad, swollen, and flaring outward, just meeting below beyond the fifth under arm-plate, and above beyond the fifth or sixth arm-plate, which is fan-shaped, with an angle inward. Disk rounded pentagonal and flat, with a large central plate, and five others round it, separated from each other by a wedge-scale; interbrachial spaces filled by four angular plates, a large one within, outside this

two smaller, and then a squarish marginal plate. Radial shields swollen, longer than wide, three-sided, with angles rounded, separated their entire length by a wedge of three plates, whereof the innermost is largest and connects with a primary plate; length to breadth 1.3 : 1. Lower interbrachial space covered by two very irregular transverse rows of long rounded plates. Genital scales long and narrow, curved and tapering. Four short blunt arm-spines, the three lowest longest, and about half as long as an arm-joint. Two tentacle-scales on the first two pairs of tentacle-pores, a small one within and larger one without; beyond this there is only one large round scale. Color in alcohol, white.

A smaller specimen, whose diameter of disk was 3.5 mm., was similar, except that the disk-plates were fewer and more regular, and the radial shields were scarcely separated.

Station 173, off Matuka, Fiji Islands, 310 fathoms, 3 specimens.

### *Ophiozona antillarum* sp. nov.

Plate VI. Figs. 152, 154.

*Special Marks.* — Two short arm-spines, upper one longer. Arm of medium height. Side arm-plates somewhat flaring outward. Radial shields large, pointed without and within, nearly joined at their middle point.

*Description of an Individual* (Station 23). — Diameter of disk 8 mm. Width of arm, without spines, close to disk 1.8 mm. Four short, rounded, close-set mouth-papillæ on each side, and two longer and sharper at apex of angle. Mouth-shields as long as broad, with an angle within, bounded by re-entering curves, and outer edge much rounded; length to breadth 1.5 : 1.3. Side mouth-shields short and thick, wide without, meeting broadly within. First under arm-plate small, pointed, transverse oval in shape; second plate large pentagonal, with inner angle truncated, lateral sides having a short but deep re-entering curve, and outer edge neatly curved; the plates beyond have a long sharp angle within, and very short lateral sides. Side arm-plates wide, and somewhat swollen, and flaring outward, meeting below beyond the fourth under arm-plate, and above beyond the first upper plate, which is much swollen and narrow fan-shaped, with an angle inward. Disk round, flat, and rather thin; in centre a rosette of six large, irregular, rounded primary plates, the five outer ones separated from each other by pairs of small, thick, angular scales. In the interbrachial spaces are numerous small, and three large plates in a radiating line, two long hexagonal and one larger and rounded on the margin. Radial shields somewhat sunken, longer than wide, with irregularly curved outlines, and a blunt angle within and without, separated at their inner end by a large hexagonal plate, and without by a small triangular plate. Lower interbrachial space filled by three transverse rows of irregular plates. Genital scales long and narrow, and composed of several pieces. Two short, stout,

blunt-pointed arm-spines, the upper one longer, and two thirds as long as an arm-joint. One large round tentacle-scale on each pore. Color in alcohol, white.

Station 23, 450 fathoms, 1 specimen.

### **Ophiozona depressa** sp. nov.

Plate VI. Figs. 155 - 157.

*Special Marks.*—Two nearly equal short arm-spines. Arm low. Side arm-plates slightly flaring without. Radial shields large, oval, and widely separated.

*Description of an Individual* (Station 214).—Diameter of disk 11 mm. Length of arm about 37 mm. Width of arm close to disk, without spines, 1.8 mm. Four short, squarish, close-set mouth-papillæ on each side, the outer one very small, and a pair somewhat more pointed at apex of angle. Mouth-shields longer than broad, with a sharp angle within, and outer side bounded by a deep curve; length to breadth 2 : 1.7. Side mouth-shields short, broad without, tapering inward, where they meet in a point. First under arm-plate very small, transverse pointed oval; next two plates long pentagonal, with a truncated angle within, deep re-entering curve on each inner lateral corner, and a curved outer edge; beyond these the plates are short pentagonal. Side arm-plates low (the arm being flat), little swollen, slightly flaring outward, meeting below beyond the fifth under arm-plate, and above beyond the second upper plate, which is fan-shaped, with an angle within. Disk round and flat; in the centre is a large pentagonal primary plate, round which are five others, smaller and more or less rounded, separated from each other by a triangular scale. These primary plates have a little central boss or tubercle; in the interbrachial spaces is a radiating row of three large elongated plates, the outer and longest being marginal. Radial shields flat, longer than broad, oval, separated their entire length by two large plates; length to breadth 2.5 : 1.7 mm. Lower interbrachial space filled by irregular transverse rows of uneven plates, the outer row long and angular. Genital scales long, narrow, and broken in several pieces. Genital opening not extending to margin of disk. Two short, blunt, tapering arm-spines of equal length, and about half as long as an arm-joint. One large rounded tentacle-scale on the inner side of each tentacle-pore. Color in alcohol, white.

Station 214, 500 fathoms, 3 specimens.

### **Ophiozona nivea** LFM.

*Ophiozona nivea*, Ill. Catal. Mus. Comp. Zool. VIII. No. 2, p. 9, Figs. 85, 86. 1875.

Station 24, off St. Thomas, 390 fathoms, 1 specimen.



**OPHIOTROCHUS** \* gen. nov.

Disk flat and round, covered with thin, more or less granulated scales, and naked radial shields. Arms slender, tubular, each joint constricted at its base; side arm-plates meeting widely above and below; upper arm-plates rudimentary. Scale of second pair of mouth-tentacles lying between side mouth-shield and outer mouth-papillæ. There are teeth and mouth-papillæ; no tooth-papillæ. Smooth arm-spines on outer edges of side arm-plates.

**Ophiotrochus panniculus** sp. nov.

Plate VI. Figs. 158-160.

*Special Marks.* — First arm-joint, outside of disk, much wider than those beyond, and bearing four slender spines; the others having only two. A sparse granulation on the lower interbrachial space.

*Description of an Individual* (Station 218). — Diameter of disk 6 mm. Length of arm 26 mm. Width of arm without spines .8 mm. Two wide, very short, close-set mouth-papillæ, occupying the whole of each side of an angle; and at the apex three more, very small, short, and spiniform. Mouth-shields three-sided, with a long angle inward, and outer corners slightly rounded; length to breadth 1.3 : 1. Side mouth-shields much longer than broad, swelled without like a knob, long and very narrow within, where they nearly or quite meet; they usually bear a few grains. First under arm-plate small and rounded, with a slight peak inward; the rest are somewhat broader than long, pentagonal, with an angle inward, the outer edge rounded, and re-entering curves on the lateral sides. Side arm-plates making together a tubular figure, flaring outward, meeting broadly below and above. Upper arm-plates very minute, and almost disappearing towards middle of arm, situated at the outer junction of the side arm-plates, three-sided, and with a peak within. Disk flat and round, covered with thin delicate scales; six rounded primary plates, separated by a line of scales, may be distinguished in the centre; the rest are more or less angular, and irregularly disposed. Radial shields broader than long, of irregular shape, with rounded angles, narrowly separated by a single line of scales. Interbrachial space below covered with thin scales sparsely set with small grains, which stand also on the margin. Two large genital openings, extending from the outer corners of mouth-shield to margin of disk. On first joint, outside disk, four sharp slender arm-spines, placed high on side arm-plate, the uppermost one as long as an arm-joint, the others progressively shorter; on joints beyond there are only two short spines. One large rounded tentacle-scale on the inner edge of each tentacle-pore; the second pair of mouth-tentacles have a wide flap-like scale hinged on the side mouth-shield,

\* ὄφεις, snake; τροχός, wheel.

and enclosed by the wide outer mouth-papillæ. Color in alcohol, very light gray.

Other specimens had the disk-scales more regularly disposed than in Fig. 159, and the radial shields pear-seed shape with an angle inward.

Station 218, 1070 fathoms, 12 + specimens.

### OPHIOPHYLLUM\* gen. nov.

Disk extremely thin and flat, covered with scales and large radial shields, and bordered by a row of plates which are movable and attached by their inner margins. Mouth-papillæ arranged in a close row; no tooth-papillæ; teeth. Arm-spines thin and broad, standing on outer edge of side arm-plate. Two genital openings in each interbrachial space.

This singular genus has small relationship with any other. The fringe of thin plates is like that found in *Podophora* among echinoderms.

### *Ophiophyllum petilum* sp. nov.

Plate VII. Figs. 179-181.

*Special Marks.* — Fringe-like border of disk consisting of about a dozen very thin plates in each interbrachial space. One arm-spine, which is wide and flat like a plate of the border. No tentacle-scale.

*Description of an Individual* (Station 174). — Diameter of disk 6 mm. Width of arm, without spines, close to the disk 1.2 mm. Six small, short, square, close-set mouth-papillæ on either side of an angle, and three smaller diamond-shaped at the apex. Mouth-shields rather large fan-shaped, with a deep curve without and an angle within; length to breadth 1 : 1.2. Side mouth-shields narrow, bounding the inner angle of the mouth-shield; outer ends square, inner ends tapering and separated. First under arm-plate three-sided, with a rounded angle inward, lateral sides straight, and outer edge curved; the rest are small and pentagonal, with an angle inward. Side arm-plates broad and thin, meeting below beyond the second under arm-plate, and just touching above beyond the third upper arm-plate. Midway of the arm, where it is highly arched, they form most of its covering. Basal upper arm-plates diamond-shaped; those beyond become more or less triangular, with a sharp angle inward, and outer edge slightly rounded. Disk flat and very thin, the centre covered with fine, thin, irregular scales; interbrachial space on margin filled by one large three-sided plate, with an angle inward and outer edge nearly straight. Radial shields large, three-sided, longer than wide, with outer angles slightly rounded, separated their entire length by a cluster of irregular scales larger than those of the centre; in the lower interbrachial

\* ὄφις, snake; φύλλον, leaf.

space are two regular transverse rows of long and narrow plates. Genital scales small, much longer than wide, extending from the outer corners of the mouth-shield to the disk margin. On the margin of the disk there is a fringe-like border of long, thin, rounded scales attached only by their inner margins, about twelve to each interbrachial space. Only one arm-spine, which is attached to lower edge of side arm-plate, and is a broad rounded scale like those on the marginal border. No tentacle-scales. Color in alcohol, pale brown.

Station 171, 600 fathoms, 1 specimen (young). Station 174, 210 - 600 fathoms, 1 specimen.

### OPHIOBYRSA\* gen. nov.

Entire animal clothed in a thick skin, which hides the underlying plates, and is beset on the disk with spines. Arm nearly cylindrical. Side arm-plates projecting as short flap-like spine-ridges, which bear slightly rough spines on their outer edge. Tentacles large and simple. Few or no mouth-papillæ, but at apex of mouth-angle the teeth and tooth-papillæ are represented by a clump of little spines. Two large genital openings in each interbrachial space.

### *Ophiobyrssa rudis* sp. nov.

Plate VIII. Figs. 198 - 200.

*Special Marks.*— Disk closely covered with short spines. Arms very long, tapering, and nearly cylindrical. Six short arm-spines.

*Description of an Individual* (Station 161).— Diameter of disk 28 mm. Length of arm 300 mm. Width of arm without spines 3.5 mm. One small, short, delicately pointed mouth-papilla on each side of the mouth-angle, and at the apex a clump of short, sharp, spine-like papillæ, which occupy the place of teeth. Mouth-shields obscured by thick skin; only their rounded outline may be distinguished. Side mouth-shields and upper arm-plates entirely concealed by thick skin. Side arm-plates project to form a thin, short, flap-like spine-ridge. On the upper surface of the arm there are two longitudinal rows of very short, stout spines arranged in pairs, and usually standing on tubercles. Disk five-sided and rather thin, covered by a thick skin, which is closely and evenly beset above and below with short, stout, smooth, sharp spines or thorns; they are somewhat longer and more numerous near the margin of the interbrachial spaces, and are almost wanting just over the base of each arm. Six equal, short, blunt, flat, somewhat rough arm-spines, partly covered by skin, not so long as an arm-joint, and placed on the edge of side arm-plates. Tentacles large, simple, and round. No tentacle-scales. Color in alcohol, disk yellowish brown; arms the same, but much lighter.

Station 161, 33 fathoms, 2 specimens.

\* ὄφις, snake; βύρσα, skin.

### OPHIOCHITON\* gen. nov.

Disk covered with fine, imbricated scales and small radial shields. Numerous sharp mouth-papillæ, with teeth but no tooth-papillæ. Upper and under arm-plates about as broad as long, and separating the side arm-plates, which project slightly and are rather small. Under plates furnished with a median longitudinal ridge. Arm-spines slender and smooth, arranged on the sides of the side arm-plates, near the outer edge. Two long genital openings in each interbrachial space.

The genus is allied to the true *Ophiarachna*, which, however, has a granulated disk.

#### *Ophiochiton fastigatus* sp. nov.

Plate VII. Figs. 182, 183.

*Special Marks.*—Four slender, smooth, tapering, blunt arm-spines. Scaling of disk very fine, with a few larger rounded plates. Radial shields small and separated. About thirteen mouth-papillæ to each angle.

*Description of an Individual* (Station 232).—Diameter of disk 20 mm. Width of arm, without spines, close to the disk 2.8 mm. Five or six sharp pointed papillæ on each side of an angle, and one shorter and more rounded at the apex. Mouth-shields much broader than long, with lateral corners rounded, a peak within and a lobe without; length to breadth 2.3 : 3. Side mouth-shields very narrow, broader without than within, where they meet. First under arm-plate very small, triangular; the other plates are four-sided, with outer and inner edges nearly straight, and deep re-entering curves on the lateral sides: they are highly arched, forming along the arm a longitudinal ridge. Side arm-plates small, with a rather low spine-ridge, not meeting below or above. Upper arm-plates broader than long, slightly arched, four-sided, broader without than within; inner and lateral sides straight, outer edge slightly curved. Disk flat, with interbrachial spaces somewhat contracted, covered above and below by very minute, thin, overlapping scales; three to five in the length of a mm. and somewhat larger near margin. In each brachial space there is a row of small rounded scattered plates, radiating from the central primary plate; genital scales covered. Radial shields widely separated, long triangular, and small, with an angle within; length to breadth 2 : 1. Four smooth, tapering, blunt, nearly cylindrical arm-spines, placed high on the sides of side arm-plates near the outer edge; lengths to that of an arm-joint 1.8, 1.8, 1.8, 2 : 1.3. Two tentacle-scales on each pore, one large one on the interbrachial and a smaller one on the brachial side. Color in alcohol, pale brown; upper disk inclining to olive.

A smaller specimen with a disk of 13 mm. had arm 70 mm. long. It was similar to the adult, except that there usually were but three arm-spines, and

\* ὄφις, snake; χιτῶν, coat of mail.

the second and third mouth-papillæ from corner of mouth-slit were flat and blunt.

Station 232, 340 fathoms, 6 specimens.

### OPHIOPYREN\* gen. nov.

Disk granulated. Teeth; no tooth-papillæ; numerous mouth-papillæ arranged in a close line. Mouth-frames long and conspicuous. Side mouth-shields small† and widely separated by the mouth-shield. Under arm-plates divided in two parts by a crease or joint. Arm-spines standing on outer edge of side arm-plates. Two genital openings in each interbrachial space.

*Ophiopyren* stands nearest *Pectinura*, from which it is distinguished by the divided under arm-plates and the tendency to minute grain-like papillæ along the genital opening. The peculiar division of the under arm-plates by a crease or soldered joint rises in this way; near the tip of the arm the *inner* piece of the plate occupies most of the space, under form of a long narrow plate having a sharp angle without, where are the tentacle-pores bordered by a narrow rim, and this rim, growing gradually wider and thicker, forms the outer piece as it appears near the base of the arm.

#### *Ophiopyren brevispinus* sp. nov.

Plate VII. Figs. 173-175.

*Special Marks.*—Three very short, blunt arm-spines. Mouth-shields longer than broad, pentagonal.

*Description of an Individual* (Station 173).—Diameter of disk 3.8 mm. Width of arm without spines 1 mm. Thirteen or fourteen mouth-papillæ to each angle, of which the outer one on each side is much the largest, and the rest are short and square, except the one at the apex, which is more pointed. Mouth-shields longer than broad, pentagonal, with long pointed angle within; length to breadth .8 : .5. Side mouth-shields squarish and very short, widely separated by inner angle of mouth-shield. First under arm-plate much broader than long, of an irregular oval form; second plate as long as broad, pentagonal, with a blunt angle inward; third plate similar, but with a sharper angle within; those beyond grow proportionately longer, and become gradually wedge-shape, with a truncated angle inward. Each plate is apparently divided in two parts, the inner one more or less diamond-shaped, the outer made up of the remainder of the plate. Upper arm-plates four-sided, somewhat wider without than within, lateral sides straight, outer side slightly curved. Side arm-plates not swollen, meeting neither above nor below. Disk flat and round,

\* ὄφις, a snake; πύρην, a kernel.

† Their strict homology with the side arm-plates is very plain in this genus, especially in *O. longispinus*.

covered above and below with minute granules, about a dozen in the length of a mm. In lower interbrachial space on the side mouth-shield next the genital opening are three minute grain-like papillæ. Radial shields small, partially covered by granulation, closely joined, much rounded within; just outside them is a row of large granules. Genital opening long, extending from side of mouth-shield to edge of disk; genital scale hidden by granulation. Two short round tentacle-scales on the second under arm-plate; beyond, only one. Three very short, blunt, pointed arm-spines, arranged evenly along the outer edge of the side arm-plate. Color in alcohol, white.

Station 173, off Matuka Bay, Fiji, 300 fathoms, 1 specimen.

### *Ophiopyren longispinus* sp. nov.

Plate VII. Figs. 176-178.

*Special Marks.* — Three slender arm-spines, as long as an arm-joint. Mouth-shields wide heart-shape, broader than long.

*Description of an Individual\** (Station 33). — Diameter of disk 4.5 mm. Width of arm, without spines, close to disk 1 mm. Fifteen or sixteen mouth-papillæ to each angle, of which the outer one, on either side, stands on the side mouth-shield, is larger than and separated from the others, and is sharp and curved; the rest are small, squarish, and close, except the one at the apex, which is sharp and longer. Mouth-shields broader than long, three-sided, outer edge straight, lateral corners much rounded, and an angle inward; length to breadth .8 : 1. Side mouth-shields squarish and large, widely separated by mouth-shields, similar in form and position to the side arm-plates beyond. First under arm-plate small triangular, with an acute angle inward, and outer edge slightly curved; second plate four-sided, wider without than within; third plate as long as broad, much wider without than within, having outer corners rounded. All the plates are apparently composed of two pieces, — an inner, which has a sharp angle outward, and an outer, which comprises the rest of the plate. Side arm-plates broad, not swollen, meeting neither above nor below. Upper arm-plates wider without than within, considerably arched, and with outer corners prolonged in small peaks. Disk round and thick, covered above and below with very minute granulation, 15 or 20 grains in the length of a mm. Radial shields small, of a rounded pear-seed shape, nearly or quite joined, and to be seen only when the granulation has been removed. Genital openings extending from outer edge of mouth-shield to margin of disk. Genital scales hidden by the skin and granulation. On the interbrachial edge of the side mouth-shields are four short rounded papillæ. Three long, very delicate, pointed arm-spines, the middle one a little the longest, upper and under spine of about the same size, and about as long as an arm-joint. One long pointed tentacle-scale on each of the first pair of tentacle-pores; beyond there are two,

\* The description is from a specimen larger than the one figured.

one large and rounded, and one smaller and narrower. Color in alcohol, white.

A smaller specimen (Station 24) was more evenly granulated, and the radial shields were quite hidden. The upper arm-plates were so thin as to show the arm-bones through.

Station 24, 390 fathoms, 3 specimens. Station 33, off Bermuda, 300 fathoms, 1 specimen.

The following four genera are allied. *Ophiacantha* is distinguished by the delicate scales and slender radial shields obscured by skin; *Ophiothamnus*, by its wide naked radial shields, and by the peculiar jaw-cover of three symmetrical pieces; *Ophiomitra* by the coarse disk-plates and scales, and wide naked radial shields; and *Ophiocamax* by the tufts of numerous spiniform mouth and tooth-papillæ, and the scales of the mouth-tentacles borne on a special plate. The old genus *Ophiacantha* embraces the greatest variety of forms, from *O. bidentata* and *O. vivipara*, which come near *Ophiocoma*, to the delicate *O. pentacrinus*, with its thorny, translucent arm-spines and its knotted arms.

#### OPHIACANTHA MÜLL AND TROSCH.

Disk covered by small delicate scales, and long narrow radial shields, the whole nearly or quite obscured by a skin beset with little thorns or stumps. Teeth and mouth-papillæ, but no tooth-papillæ. Numerous arm-spines (5-9), arranged along sides of side arm-plates, which are prominent, and nearly or quite meet above and below. In each interbrachial space two genital openings, beginning just outside the mouth-shield.

#### OPHIOTHAMNUS LYM.

Disk beset with fine thorns or spines, and covered by rather large scales and naked radial shields. Teeth, and stout, close-set mouth-papillæ, but no tooth-papillæ. Numerous (8) thorny translucent arm-spines, arranged along sides of side arm-plates, which are prominent, and nearly or quite meet above and below. In each interbrachial space two genital openings, beginning close outside the mouth-shield. The jaw-cover is in three pieces, arranged symmetrically like the mouth-shield and side mouth-shields.

#### OPHIOMITRA LYM.

Disk covered by large, irregular plates and scales, and wide naked radial shields, the whole naked and beset by thorny stumps or spines. Teeth, and mouth-papillæ, but no tooth-papillæ. Numerous (5-7) thorny translucent arm-spines, arranged along sides of side arm-plates, which are prominent, and nearly or quite meet above and below. In each interbrachial space two genital openings, beginning close outside the mouth-shield.

**OPHIOCAMAX** \* gen. nov.

Disk beset with thorny spines or stumps, and covered by scales or irregular plates and large radial shields. Besides teeth, there are tooth-papillæ and mouth-papillæ, numerous, and all of the same spine-shape; they are arranged in tufts on the mouth-frames and jaw-plate. The spiniform scales of the mouth-tentacles are borne on the edge of a little supplementary plate in a way similar to *Ophioglypha*. Numerous (9) thorny translucent arm-spines, arranged along the sides of the side arm-plates, which are prominent, and meet nearly or quite above and below. In each interbrachial space two genital openings, which begin close outside the mouth-shield.

**OPHIACANTHA.**

TABLE OF SPECIES HEREIN DESCRIBED.

Disk closely beset with grains or minute tubercles. Arm-spines smooth.	Arm- {	Four arm-spines. Disk minutely tuberculous.	} <i>O. tuberculosa.</i>	
		Seven slender translucent arm-spines. Some smooth spines on disk.		} <i>O. vepratrica.</i>
		Ten arm-spines. Outer ends of radial shields naked.		
Disk closely beset with short, smooth, stout spines, sometimes mingled with grains. Eleven thorny arm-spines. Radial shields covered.			} <i>O. rosea.</i>	
Disk beset with small short stumps, or grains, bearing a crown of blunt thorns. Six arm-spines, stout, opaque, and scarcely thorny. Slender tentacle-scales.			} <i>O. imago.</i>	
Disk beset with short slender spines.	} {	Disk-spines with forked heads, and covered with thick skin. Arm-spines scarcely or not at all thorny. One minute short tentacle-scale.	} <i>O. scntosa.</i>	
		Disk-spines simple. Arm-spines not thorny. One or two large long tentacle-scales		} <i>O. stimulea.</i>
		Spines of disk and arms slender and translucent. Arm-spines not thorny. Some thorny stumps on disk.		
Disk beset with stout spines; arms essentially smooth, and about twelve times diameter of disk. Radial shields partly naked, and making narrow radiating ridges.			} <i>O. Troscheli.</i>	
About eleven mouth-papillæ to each angle. Large tentacle-scales . . . . .			} <i>O. cuspidata.</i>	
Seven mouth-papillæ to each angle. Slender spiniform tentacle-scales . . . . .			} <i>O. longidens.</i>	
Seven mouth-papillæ. High disk-stumps, with thorny sides and ends. Arm-spines feebly thorny. Six arms.			} <i>O. nodosa.</i>	
The lowest arm-spine thickened and curved . . . . .			} <i>O. cornuta.</i>	
Eight or more feebly thorny arm-spines. Side arm-plates very prominent. Disk-crochets rather stout.			} <i>O. cosmica.</i>	
Arm-spines very long, not thorny. Side arm-plates large and swollen. Outer side of under arm-plates strongly curved . . . . .			} <i>O. levispina.</i>	
Disk beset with minute grain-like stumps, bearing a crown of blunt thorns. Arm-spines long, slender, translucent, thorny; mounted on very projecting side arm-plates, which meet above.			} <i>O. serrata.</i>	

\* *ὄφεις*, snake; *κάμαξ*, stake.



**Ophiacantha tuberculosa** sp. nov.

Plate VIII. Figs. 204, 205.

*Special Marks.* — Disk wrinkled and beset with coarse grains ; four smooth stout arm-spines.

*Description of an Individual* (Station 210). — Diameter of disk 6.5 mm. Length of arm 32 mm. Width of arm without spines 2 mm. Seven stout blunt mouth-papillæ, whereof the innermost is spearhead-shaped and stands under the teeth, which are four in number, flat and square, with rounded corners. Mouth-shields small, much wider than long, with an obtuse angle within and a little peak without ; length to breadth .8 : 1. Side mouth-shields short, nearly crescent-shape, with the curve outward ; scarcely meeting within. Under arm-plates thick and distinct, four-sided, somewhat broader than long, with outer side curved and the others nearly straight, except second plate, which is nearly pentagonal, with a very obtuse angle within. Side arm-plates slightly projecting, meeting narrowly below and not at all above. Upper arm-plates thick and well marked, four-sided, with outer corners rounded, much wider without than within. Disk contracted in interbrachial spaces, with deep radiating furrows between the narrow radial shields, which are completely hidden, as well as the disk-scales, by the skin and by numerous small conical tubercles, which are larger and closer set on the radial shields. Four stout, blunt, cylindrical, smooth arm-spines ; upper one much largest ; lengths to that of an arm-joint 2, 1.4, 1, 1 : 1. One rather small tentacle-scale, longer than wide, pointed, and not encroaching (as is usual in the genus) on the under arm-plate. Color in alcohol, very pale brown.

This species is one of the most aberrant in the genus ; the arm-spines, smooth and only four in number, and the minute disk-tubercles, instead of thorny grains, remind one rather of *Ophiocoma*. Indeed, *Ophiacantha bidentata* and *O. vivipara*, which somewhat resemble this species, have been described under *Ophiocoma* ; but the general structure is that of a true *Ophiacantha*.

Station 210, 375 fathoms, 1 specimen.

**Ophiacantha vepratrica** sp. nov.

Plate X. Figs. 245-247.

*Special Marks.* — Disk closely beset with grains, among which are a few short spines. Seven not thorny, translucent, slender arm-spines.

*Description of an Individual* (Station 171). — Diameter of disk 6.5 mm. Length of arm about 30 mm. Width of arm without spines 1.8 mm. Mouth-papillæ stout, conical, blunt, three on each side of an angle, and a larger odd one at the apex within, which is similar to the five teeth standing immediately above it. Mouth-shields small, about as long as broad, bounded within by an obtuse angle, and without by a deep curve or truncated angle ; length to

breadth .8 : 1. Side mouth-shields short and rather wide, meeting within. Under arm-plates pentagonal, wider than long, with a very obtuse angle inward, sometimes modified as a curve; lateral sides a little re-enteringly curved, and outer side gently curved. Upper arm-plates wide fan-shaped, with an angle inward. Side arm-plates stout, rather prominent, narrowly meeting above and below, near base of arm. Disk slightly puffed and wrinkled, closely set with small, round, smooth grains, among which, on upper surface, appear a few short stout spines; radial shields and disk-scales hidden by skin and by granulation. Seven regular, slender, cylindrical, tapering, not thorny arm-spines; lengths to that of an arm-joint 2.8, 2.5, 2, 2, 1.5, 1.3, 1 : .8. One pointed, rather large tentacle-scale. Color in alcohol, white.

A smaller specimen had a disk 6 mm. in diameter with grains, but scarcely any spines on it. A young one had a disk 4 mm. in diameter, and arms 16 mm. long. The disk-grains were rough under the microscope; the arm-spines were proportionately longer, and the side arm-plates more prominent, than in the adult; the outer mouth-papilla was larger than its neighbors.

Station 171, 600 fathoms, 2 and 2 young specimens.

### **Ophiacantha granulosa** sp. nov.

**Plate VIII. Figs. 206-208.**

*Special Marks.* — Disk evenly set with smooth grains; outer ends of radial shields naked; ten smooth slender arm-spines.

*Description of an Individual* (Station 201). — Diameter of disk 9 mm. Length of arm 42 mm. Width of arm without spines 3 mm. Seven pointed, rather stout, nearly cylindrical mouth-papillæ. Seven teeth, flat, with a rounded cutting edge. Mouth-shields small, broader than long, with an obtuse angle within, and a curve without; length to breadth .8 : 1. Side mouth-shields large and wide, broader without than within, where they are slightly separated. Under arm-plates much wider than long, of a wide axe-shape, with a curved edge outward, a lobe or a narrow obtuse angle within, and the lateral sides re-enteringly curved. Upper arm-plates rather small, of a wide fan-shape, with an angle inward, and lateral sides re-enteringly curved. Side arm-plates large and moderately projecting, meeting broadly above, near base of arm, but scarcely touching below. Disk slightly puffed, closely and evenly set with smooth grains, about four in the length of a mm., which hide the fine disk-scales, except in the lower interbrachial spaces. Radial shields covered, except their outer ends, which are naked and sunken below the surrounding surface. Ten slender, tapering, cylindrical, translucent arm-spines, which are not thorny; lengths to that of an arm-joint 3.2, 3.2, 2.2, 2, 2, 2, 1.8, 1.3, 1.3, 1 : 1. One rather small, blunt tentacle-scale. Color in alcohol, pale reddish-brown.

A younger specimen, with a disk 4 mm. in diameter and an arm of 18 mm., presented no special variations, except that there were only eight arm-spines, and the under arm-plates were proportionately smaller.

Station 201, 82-102 fathoms, 8 specimens.

**Ophiacantha rosea** sp. nov.

Plate X. Figs. 267, 268.

*Special Marks.* — Disk-scales and radial shields hidden by a thick skin, which is closely beset with very short, stout spines, which sometimes are no higher than grains. Eleven arm-spines, slightly rough under microscope.

*Description of an Individual* (Station 308). — Diameter of disk 17 mm. Length of arm, 68 mm. Width of arms without spines 4.5 mm. Mouth-papillæ irregular; there are usually five on the inner part of the angle, flattened and blunt; and outside these, near end of mouth-slit, a group of from three to six irregular papillæ, short and flattened. Eight or nine teeth, shaped like blunt spear-heads. Mouth-shields and side mouth-shields closely joined and covered with thick skin, so that their outlines are not clear. Under arm-plates shield-shaped, with an angle within, a curve without, and re-entering curves on the lateral sides opposite the large tentacle-scales. Upper arm-plates with distinct outlines, broad fan-shaped, with a rounded or very obtuse angle inward. Side arm-plates, near base of arm, barely meeting above and below, and having a narrow projecting spine-ridge. Disk puffed, densely and evenly beset, with very short, stout, conical spines, which to the naked eye seem nearly like large grains; scales and radial shields entirely covered. Eleven stout, blunt, regular, cylindrical arm-spines, which, under the microscope, are slightly rough. Lengths to that of an arm-joint 3.5, 4.7, 4, 3.8, 3.8, 2.8, 2.5, 2.5, 2.5, 1.2. .8 : 1.3. One very large, thick, pointed tentacle-scale, over 1 mm. long. Color in alcohol, pale rose-pink above; below yellowish.

Specimen from the distant station 145 differed only in having larger spines on the disk. A young one, with a disk of 7 mm. had only seven mouth-papillæ to each angle; the additional papillæ at the outer end of mouth-slit had not yet appeared; the disk-spines were forked and thorny, and the eight arm-spines were rough and almost thorny.

Station 145, 310 fathoms, 8 specimens. Station 308, 175 fathoms, 12 + specimens. Station 236, 420 - 775 fathoms, 1 specimen.

**Ophiacantha imago** sp. nov.

Plate X. Figs. 275, 276.

*Special Marks.* — Disk regularly set with small, short, thick stumps, each bearing a crown of blunt thorns; tentacle-scales small and pointed; six short, opaque, cylindrical, scarcely thorny arm-spines.

*Description of an Individual* (Kerguelen Islands). — Diameter of disk 8 mm. Length of arm 37 mm. Width of arm without spines 1.6 mm. Seven short, stout, blunt, close-set mouth-papillæ; the innermost are a little the largest. Four flat, rather thick teeth, all squarish, except uppermost one, which is pointed. Mouth-shields small, of a rounded diamond-shape. Side mouth-shields short, wide, slightly curved, not meeting within. They and the mouth-

shield are obscured by a thick skin. Under arm-plates somewhat obscured by skin, axe-shaped, with a broad curve without, a narrow angle within, and lateral sides slightly re-enteringly curved. Upper arm-plates long triangular, with an acute angle inward and a curve without. Side arm-plates large, meeting above and below, with a rounded, rather wide, but not very prominent spine-ridge. Disk regularly, but not very closely set with small, short, thick stumps (Fig. 276), each bearing a crown of blunt thorns. Radial shields and scaling hidden. Six cylindrical, opaque, blunt, slightly tapering arm-spines, which, under the microscope, are a little rough, but not thorny; lengths to that of an under arm-plate 3, 2.2, 1.3, 1.2, 1.2, 1 : 1. One minute pointed tentacle-scale. A young specimen from the same locality had a disk 4 mm. in diameter, and arms of 18 mm. The disk-stumps were closer set, and more like grains, and there were nine mouth-papillæ to each angle.

This species is viviparous. It represents in the antarctic zone the arctic *O. anomala*, from which it differs in having a minute slender tentacle-scale and only five arms.

Christmas Harbor, Kerguelen Islands, 120 fathoms, 1 specimen. Royal Sound, Kerguelen Islands, 25 fathoms, 1 specimen. Station 150, 150 fathoms, 6 specimens. Station 151, 75 fathoms, 1 specimen.

### *Ophiacantha sentosa* sp. nov.

Plate IX. Figs. 229-232.

*Special Marks.* — Disk closely beset with short slender spines, with forked heads, encased in thick skin, so that they give the disk a furry look; arm-spines slender and not thorny; one minute rounded tentacle-scale.

*Description of an Individual* (Station 298). — Diameter of disk 16 mm. Length of arm 80 mm. Width of arm without spines 3 mm. Mouth-papillæ nine or eleven, to each angle of which the innermost odd one is stoutest and spearhead-shaped, and is similar to and continuous with the teeth; the outermost is very small and rounded, and the others are stout, conical, and pointed. Mouth-shields small, wider than long; bounded within by an obtuse angle, and without by a curve. Side mouth-shields wider without than within, where they meet, of moderate width, and extending well beyond mouth-shield on either side. Under arm-plates slightly swollen, much wider without, where they are gently curved, than within, where they present a peak, and are separated from the next plate; lateral sides re-enteringly curved opposite tentacle-pores. Side arm-plates moderately prominent, meeting below, and beyond fourth joint, above also. Upper arm-plates about as long as broad, narrow fan-shaped, with an angle inward. Disk puffed, covered with a thick skin, which obscures the radial shields and scaling, except a patch near mouth-shield; the surface is closely set with small spines, about .8 mm. long, whose ends are forked, but which are more or less cased in skin. Seven regular tapering arm-spines, smooth, or bearing a few

minute thorns; the upper one somewhat longer; lengths to that of an arm-joint 4, 3, 2.8, 1.6, 1.6, 1.6:1.2. One small, blunt, pointed tentacle-scale. Color in alcohol, disk above dull chocolate-brown, lower side and arms pale brown.

The only essential variation noted was in a larger specimen, with a disk of 18 mm., which had sometimes as few as seven mouth-papillæ to an angle.

Station 298, 2225 fathoms, 4 specimens.

### **Ophiacantha stimulea** sp. nov.

Plate IX. Figs. 225-228.

*Special Marks.*—Disk closely set with small simple spines. Arm-spines not thorny. One or two large long tentacle-scales.

*Description of an Individual* (Station 164).—Diameter of disk 7 mm. Length of arm 35 mm. Width of arm without spines 2 mm. Ten or twelve pointed, flat, rather thin mouth-papillæ, of which the two innermost are largest, the others about equal. Teeth similar to innermost mouth-papillæ, but larger. Mouth-shields wider than long, rather small, bounded without by a curve and within by an obtuse angle. Side mouth-shields somewhat curved, rather narrow within, where they meet, wide without. Under arm-plates wider without, where they are bounded by a gentle curve, than within, where they present an obtuse angle; lateral sides slightly re-enteringly curved. Upper arm-plates fan-shaped, with an angle inward. Side arm-plates stout and prominent, meeting narrowly above and below, near base of arm. Disk a little puffed, with a constriction in each interbrachial margin, closely set with small simple spines, which, under the microscope, are seen to be slightly rough at their tips; just over each arm they are much shorter, and extend to the first upper arm-plate. Radial shields and scaling wholly obscured by thick skin and spines, except on a small patch next mouth-shields. Seven regular, not thorny, nearly cylindrical, rather slender arm-spines, which taper slowly to a blunt point; lengths to that of an arm-joint 2, 3, 2, 1.5, 1.5, 1.5, 1:.8. Tentacle-scales long, pointed, and rather wide; two on each of first two or three pores, and one on those beyond. Color in alcohol, white.

Station 164, 950 fathoms, 1 specimen.

This species is distinguished from *O. segesta* by more numerous and different mouth-papillæ and by stouter arm-spines.

### **Ophiacantha segesta** sp. nov.

Plate X. Fig. 271.

*Special Marks.*—Disk beset with short, smooth, slender spines, mingled with minute thorny stumps; arm-spines not thorny.

*Description of an Individual* (Station 56).—Diameter of disk 3.5 mm. Length

of arm 15 mm. Width of arm without spines 1 mm. Seven regular, sharp, conical mouth-papillæ to each angle, whereof the innermost is much the largest, and resembles the teeth, which are stout, blunt, spearhead-shaped. Mouth-shields small, wider than long, with a point within and a curve without. Side mouth-shields wide, thick, and somewhat curved. Under arm-plates thick and swollen, pentagonal, with an angle inward and outer side widest. Upper arm-plates thick and swollen, short fan-shaped, with an angle inward. Side arm-plates large, meeting widely above and below, swelling gradually to form the spine-ridges, which are not narrow or abrupt. Disk thickly set with small, slender, smooth spines (Pl. X. Fig. 271), among which appear minute thorny stumps and crochets. Sealing and radial shields hidden, except outer tips of the latter. Seven smooth, tapering, cylindrical arm-spines near base of arm, of which the two upper ones are much the longest, attaining a length of 1.7 mm. : the lower ones are short and stout. At tip of arm the lowest spine is slender, a little curved, and slightly rough on its edge. One small pointed tentacle-scale. Color in alcohol, white.

A young and immature specimen, but distinctly characterized by its spiny disk. Station 56, 1075 fathoms, 1 specimen.

### *Ophiacantha Troscheli* sp. nov.

Plate IX. Figs. 222-224.

*Special Marks.*—Narrow, ridge-like radial shields, which are partly naked. Disk beset on radial shields and centre with short, scarcely thorny spines, and in the interbrachial spaces with grains. Arms long and sinuous. Five or six stout, nearly smooth arm-spines.

*Description of an Individual* (Station 33).—Diameter of disk 7 mm. Length of arm 84 mm. Width of arm without spines 1.8 mm. Seven stout, short, blunt-pointed mouth-papillæ to each angle, of which the innermost, standing under the teeth, is sometimes represented by two. Six or seven short blunt teeth. Mouth-shields small, with an angle within and a curve without; length to breadth .8 : 1.2. Side mouth-shields wide, with curved sides, extending well beyond mouth-shield on either side and meeting within. Under arm-plates rather thick and somewhat obscured by skin; rudely pentagonal, with an obtuse angle inward; first plate longer than broad, irregular, compressed, six-sided; second plate also longer than broad, curved without and wider than within. Upper arm-plate rather thick, yet showing the median ridge of the underlying arm-bone; four-sided, outer side curved or wavy, and wider than inner one, lateral sides nearly straight; length to breadth 1.2 : 1.2. Side arm-plates not meeting above near base of arm, and barely touching below; projecting very slightly even near end of arm, so that the knotted or bead-like outline usual in the genus is not seen. Disk set with numerous, essentially smooth spines about 1 mm. long, which stand mostly in centre and on radial shields; interbrachial spaces sparsely granulated. Radial shields naked for a

large part of their length, long, narrow, joined, raised above surrounding surface; scaling hidden. Five or six essentially smooth, tapering, and nearly equal arm-spines, of which, however, the upper one is much the stoutest; lengths to that of an arm-joint 1.8, 1.6, 1.5, 1.5, 1.5 : 1.2, or 2.2, 1.6, 1.5, 1.3, 1.3, 1.3 : 1.2. Tentacle-scales flat, pointed, and rather small. Color in alcohol, pale brown.

The species stands near the typical *O. setosa* in respect to form of disk and length of arm; but it differs from this and most others of the genus in having naked radial shields and side arm-plates, which do not project to give a knotted look to the arm.

Station 33, off Bermudas, 300 fathoms, 1 specimen. Two specimens from the "Blake" expedition, dredged in 101 fathoms by A. Agassiz, showed no important variations. The disk-grains were larger and more numerous.

### *Ophiacantha cuspidata* sp. nov.

Plate X. Figs. 248-250.

*Special Marks.*—Disk beset with thorny stumps; eight rather long, stout, and feebly thorny arm-spines: about eleven long slender mouth-papillæ.

*Description of an Individual* (Station 344).—Diameter of disk 9 mm. Length of arm 63 mm. Width of arm without spines 3 mm. Ten or sometimes eleven long, flat, rather slender and irregular mouth-papillæ, of which the outer one has often a spatula shape. Teeth long, spearhead-shaped. Mouth-shields small, long pentagonal, with a wide obtuse angle within; length to breadth 1 : 1. Side mouth-shields small, narrow, and crowded, meeting within. Under arm-plates wider without than within, where they touch the next plate; bounded without by a rounded angle or a somewhat deep curve, within by a more gentle curve, and on the lateral sides, opposite tentacle-scales, by re-entering curves. The second plate is narrower within, and has a wavy outer edge. Upper arm-plates fan-shaped, with an angle inwards; the lateral corners are sharp, and the lateral sides slightly re-enteringly curved. Side arm-plates moderately prominent, meeting narrowly above, but not below at base of arm. Disk moderately thick, not puffed, closely set with stout little stumps each bearing a crown of five or six minute thorns. Radial shields and disk-scales hidden by skin and the thorny stumps, except that the position of each radial shield is usually marked by a shallow furrow. Eight stout, long cylindrical arm-spines, tapering to a blunt point and set with fine thorns; lengths to that of an arm-joint 3.6, 5, 3, 2, 2, 2, 1.8, 1.4 : 1. On first pore two tentacle-scales; on the rest a single large pointed scale. Color in alcohol, dark straw.

A young specimen with a disk of only 1.5 mm. had an arm of 10 mm. The disk armature was little crochets with two or three prongs; the arm-joints were of course more constricted, and the upper and under arm-plates were widely separated; there were four or five arm-spines, whereof the first or second was much the longest; to each mouth-angle seven papillæ, whereof the lateral were bead-like and had not yet become long and slender.

Station 344, 430 fathoms, 12 + and 5 young specimens.

**Ophiacantha longidens** sp. nov.

Plate X. Fig. 274.

*Special Marks.* — Disk closely set with slender stumps, each bearing a crown of three to five long delicate thorns; arm-spines translucent and thorny; seven long slender mouth-papillæ; tentacle-scales spiniform.

*Description of a Specimen* (Station Cebu, Philippines). — Diameter of disk 4 mm. Width of arm without spines 1 mm. Seven mouth-papillæ to each angle, of which the lateral are long, spine-like, and blunt; and the innermost one is of a blunt spearhead form, like the four teeth above it. Mouth-shield small, wider than long, bounded by a curve without, and an angle within. Side mouth-shields small, narrow, meeting within. First under arm-plate small and rounded; second of an irregular transverse diamond-shape, wider than long, having the lateral corners sharp, and a slight lobe without (Fig. 274); those immediately beyond are similar, having a wide axe-shape, with a clean curve without. Upper arm-plates small, of a wide fan-shape, with the angle inward, and lateral corners sharp. Side arm-plates rather large, meeting above and below, with a well-marked spine-ridge. Disk round, slightly puffed, densely set with slender, minute stumps, each bearing a crown of three to five long slender thorns. Scaling and radial shields hidden, except the outer tips of the latter. Seven flattened, translucent, thorny, rather blunt arm-spines; lengths to that of an arm-joint 2, 2, 1.7, 1.7, 1, 1, .8 : .7. One spiniform tentacle-scale. Color in alcohol, above, mottled brown; below, white with brown markings on arms.

Cebu, Philippines, 95 - 100 fathoms, 1 specimen.

**Ophiacantha nodosa** sp. nov.

Plate X. Figs. 258 - 261.

*Special Marks.* — Six arms; seven long mouth-papillæ to each angle; disk closely set with coarse, stout stumps having thorny ends and sides.

*Description of an Individual* (Station 3). — Diameter of disk 7 mm. Width of arm without spines 2.3 mm. Seven narrow mouth-papillæ, the outer one longest. Teeth long and narrow, though stouter than mouth-papillæ. Mouth-shield small pentagonal, with a wide angle inward; length to breadth .7 : .7. Side mouth-shields long, narrow and curved, meeting within and extending without much beyond the mouth-shield. Under arm-plates pentagonal, with a strongly curved outer side, and lateral and inner lateral sides re-enteringly curved; length to breadth (third plate) .8 : 1. Upper arm-plates broad, transverse diamond-shape, widely separated. Side arm-plates stout and prominent, meeting freely above and below. Disk densely set with coarse stumps, which bear a crown of strong thorns and are also usually thorny on their sides. Radial shields and scaling hidden, except the outer tips of the former.



Seven or eight slender, feebly thorny arm-spines; the upper one longest (3 mm.), the three lowest about equal. Tentacle-scales long, large, and pointed. Color in alcohol, gray.

Station 3, 1530 fathoms, 1 specimen.

The only specimen was a disk with the bases of the arms and a few arm-spines. The characters were, however, distinct.

### **Ophiacantha cornuta** sp. nov.

#### **Plate X. Fig. 266.**

*Special Marks.*—Disk-scales distinct and rather large, closely beset with small stumps, having a slender trunk bearing a crown of six or eight minute thorns. Lowest arm-spine thickened and curved.

*Description of an Individual* (Station 171).—Diameter of disk 5.5 mm. Width of arm without spines 2 mm. Seven mouth-papillæ to each angle, of which the three innermost are long, cylindrical, and pointed; the odd one at angle of jaw being largest. Mouth-shields much wider than long, with a curve without and an obtuse angle within; length to breadth .6 : 1.2. Side mouth-shields wide and stout, broadly joined within. Under arm-plates much wider than long, slightly curved without, having a little peak within, and the very short lateral sides re-enteringly curved; length to breadth .6 : 1.2. Upper arm-plates small, much wider than long, almost of a transverse diamond-shape, and lower than the ridge of the side arm-plates, which are large, meeting broadly above and below, and have an unusually narrow projecting spine-ridge continuous over the top of the arm. Disk, including radial shields, covered by distinct imbricated scales, two or three in the length of a mm., closely beset and partly obscured by little stumps consisting of a slender trunk bearing a crown of six or eight minute thorns. Eight translucent arm-spines, all sharp and strongly thorny, except the lowest, which is thickened, curved, and slightly rough. Towards end of arm this spine is more curved and proportionately larger, and stands below three very slender arm-spines (Pl. X. Fig. 266). Tentacle-scale flat, stout, pointed. Color in alcohol, white.

This specimen was plainly not fully grown, and was imperfect by loss of some arm-spines, etc., but the adult does not probably differ much, while the hooked lowest arm-spine and character of disk mark it well as a species. A young individual (Fiji Islands), with a disk of 3 mm. and arms 14 mm. long, presented no variations beyond those of age, except that the lowest arm-spine was rather less curved; there were four spines besides this, the uppermost being sometimes as long as 1.7 mm.

Station 170, 520 fathoms. Station 171, 600 fathoms. Fiji Islands, 520 fathoms.

***Ophiacantha cosmica* sp. nov.**

**Plate X. Figs. 251 - 254, 262 - 265, 269, 270.**

*Special Marks.* — Eight or more feebly thorny arm-spines. Side arm-plates only moderately prominent. Disk crochets rather coarse.

*Description of an Individual* (Station 157). — Diameter of disk 18 mm. Length of arm 100 mm. Width of arm without spines 4 mm. Seven mouth-papillæ to each angle, whereof the innermost is broad and flat, like the teeth; the others are short, pointed, and very stout; outside these, and a little higher in mouth-slit, is often a rounded scale of the second mouth-tentacle. Besides these, there are, on the mouth-frames, from two to four small, peg-like papillæ. Mouth-shields wide heart-shape, with angle inward; length to breadth 2 : 3.5. Side mouth-shields rather narrow, somewhat curved, meeting within, closely joined to surrounding parts. Under arm-plates wide pentagonal, with outer side curved, and laterals a little re-enteringly curved. Upper arm-plates wide fan-shaped, with an angle inward, which in the basal plates is truncated. Side arm-plates stout and moderately prominent; meeting below, near base of arm, but not above. Towards end of arm they meet above and below, and are more prominent, so as to give it a somewhat knotted look. Disk full, and rising considerably above the arms; densely and evenly set with small stumps, which, being freed of skin, are seen to be composed of five or six thorns, of different lengths, soldered side by side; these stumps appear also on the first two upper arm-plates. Radial shields and disk-scales hidden. Eight even, translucent, cylindrical arm-spines, which taper to a blunt point and are under the microscope slightly rough but not thorny; lengths to that of an arm-joint 3.5, 3.5, 2.8, 2.5, 2.5, 2.2, 2, 2 : 1.5. Tentacle-scales rather small, longer than broad, pointed. Color in alcohol, straw.

The specimen just described is unusually large for this division of the genus, which leads one to think that the bulk of those now known are immature, and therefore to be treated with all the more caution. The young of *Ophiacantha* differs from the adult as follows: 1. the arm-spines are fewer, longer, and more slender and thorny; 2. the side arm-plates are much larger and more projecting, giving a strongly knotted or beaded look to the arm; 3. the mouth-papillæ are often less numerous and more slender; 4. the armature of the disk is more delicate, and the stumps or spines more thorny. Thus, a younger specimen from the same station had a disk of 6 mm. in diameter and an arm 33 mm. long. There were seven slender arm-spines, the upper ones much the longest, and bearing fine thorns on the lower part of the shaft; the arms were decidedly knotted, though not so much so as in some other species (e. g. *O. serrata*). The disk-stumps had a short trunk which supported a crown of four or five thorns, and resembled Fig. 265, of Plate X.

Another specimen (Station 122) was a little larger than the foregoing, and resembled it. There were eight scarcely thorny arm-spines, the three uppermost much the longest, 3.3 mm. (Pl. X. Fig. 262). The disk was closely and evenly

set with slender stumps, having a trunk surmounted by a crown of rather long thorns (Fig. 263). Station 218 furnished specimens remarkable for the number of arm-spines, with a disk of only 7 mm. and arms of 32 mm. There were eleven arm-spines, the uppermost being 2.3 mm. long, the lowest 1 mm., and the rest intermediate (Pl. X. Fig. 264); the disk-stumps were as in Station 122, but stouter (Fig. 265). The great number of arm-spines in rather small individuals is a grave variation; but others from the same quarter of the globe (Station 191) were normal in this respect. A specimen off Tristan d'Acunha had a disk 7 mm. in diameter and the arm about 37 mm. long. The outermost mouth-papilla on either side was wide (Pl. X. Fig. 269), and the next two were longer than usual. The upper arm-spine was 3 mm. long, and feebly thorny for its whole length.

*Ophiacantha cosmica* appears in the entire southern hemisphere, from the Brazil coast, by the lone Island of Tristan d'Acunha, the antarctic zone, off New Guinea, and between Juan Fernandez and the South American coast, where it lives in 2225 fathoms. Off Brazil it is found in only 350 fathoms. Its extreme variations are described above, and are not very great.

Stations 122, 350 fathoms, 12 + specimens. Off Tristan d'Acunha, 1000 fathoms, 2 specimens. Station 146, 1375 fathoms, 2 specimens. Station 147, 1600 fathoms, 12 + specimens. Station 153, 1675 fathoms, 11 specimens. Station 156, 1975 fathoms, 3 specimens. Station 157, 1950 fathoms, 2 specimens, and 2 young. Station 158, 1800 fathoms, 2 specimens. Station 191, 800 fathoms, 7 specimens. Station 218, 1070 fathoms, 10 specimens. Station 298, 2225 fathoms, 2 specimens. Station 299, 2160 fathoms, 9 specimens.

### *Ophiacantha levispina* sp. nov.

#### Plate X. Fig. 277.

*Special Marks.* — Disk closely beset with fine stumps bearing crowns of minute thorns; seven slender, not thorny arm-spines; outer side of under arm-plates strongly curved.

*Description of an Individual* (Station 214). — Diameter of disk 6 mm. Length of arm 36 mm. Width of arm without spines 2 mm. Mouth-papillæ seven or nine to each angle, whereof the outer one on either side is broad and scale-like, while the other five or seven are sharp and conical. Mouth-shields broad heart-shape, with the point inward; length to breadth 1 : 1.3. Side mouth-shields rather narrow, of nearly equal width, meeting within. Under arm-plates wider than long, with a slight peak within, and the outer side (especially little way out on arm) very strongly curved. Upper arm-plates very small, sunken below the ridge of side arm-plate, of a rounded fan-shape, with an angle inward. Side arm-plates large, meeting broadly above and below, with a spine-ridge which swells gradually from the plate, and does not form a steep narrow crest. Disk densely beset with very fine, thorny stumps, similar to Fig. 263, Plate X., but with a more slender trunk; radial shields and scaling hid-

den. Seven long, slender, translucent arm-spines, essentially smooth, only the lower ones being slightly rough under the microscope. Lengths to that of an arm-joint 3.5, 3.5, 3.5, 2.8, 1.8, 1.3, .8 : .8. Tentacle-scales narrow and sharp. Color in alcohol, white.

The great size of the side arm-plates and the number and length of the arm-spines mark this as an immature specimen, but the specific characters are not found in any other.

Station 214, 500 fathoms, 1 specimen.

### ***Ophiacantha serrata* sp. nov.**

**Plate X. Figs. 272, 273.**

*Special Marks.* — Disk closely and evenly set with minute grain-like stumps bearing a crown of blunt thorns; arm-spines long, slender, strongly thorny, translucent, mounted on steep, narrow, much projecting side arm-plates.

*Description of an Individual* (Station 219). — Diameter of disk 6 mm. Length of arm about 32 mm. Width of arm without spines 1.8 mm. Seven flat, rather blunt mouth-papillæ, not crowded; the innermost one much larger and squarish; besides these, the first under arm-plate bears two tentacle-scales, one to each of second pair of mouth-tentacles. Four flat teeth, similar in shape to the innermost mouth-papilla. Mouth-shields much wider than long, of a transverse diamond-shape, with lobe-like angles. Side mouth-shields straight and narrow, nearly or quite meeting within. First under arm-plate small and rounded, and bearing on its inner edge two tentacle-scales; second plate long axe-shaped, with a curve without, a well-marked angle within, and lateral sides re-enteringly curved; third plate proportionately shorter and with the inner side a very obtuse angle. Upper arm-plates small, of a wide fan-shape, with the angle inward. Side arm-plates large, meeting widely above and below, rising very suddenly to form a high, narrow spine-ridge, so that the arm has the look of a series of short cylinders alternating with burrs (Fig. 272). Disk densely and evenly beset with minute grain-like stumps, bearing a crown of blunt thorns (Fig. 273). Scaling and radial shields covered, except outer tips of the latter. Nine long, slender, translucent, strongly thorny arm-spines; lengths to that of an arm-joint 4, 4, 4, 3.2, 2.7, 2.5, 1.8, 1.8, 1.3 : 1. One small spiniform tentacle-scale. Color in alcohol, white mottled with pale brown.

The small number of teeth and large side arm-plates show the specimen to be young, but the specific marks are good, and would be carried forward to the adult, which doubtless has ten or a dozen long, glassy, thorny arm-spines, with side arm-plates not so exaggerated in their projection.

Station 219, 152 fathoms, 1 specimen.

**Ophiacantha vivipara** Ljn.

*Ophiacantha vivipara*, Tvänne Nya Ophiurid. Öf. Kong. Akad. p. 471. 1870.

Marion Island, 50–75 fathoms, 12 + specimens. The following three places in the Kerguelen Islands: Christmas Harbor, 120 fathoms, 12 + specimens; Balfour Bay, 20–60 fathoms, 1 specimen; Royal Sound, 25 fathoms, 12 + specimens. Station 151, 75 fathoms, 8 specimens. Station 313, 55 fathoms, 12 + specimens. Station 314, 70 fathoms, 1 specimen. Station 320, 600 fathoms, 7 specimens.

**Ophiacantha bidentata** Ljn. MS.

*Asterias bidentata* RETZ., Dissertatio, p. 33. 1805.

*Ophiacantha spinulosa* MÜLL. and TROSCH., Syst. Asterid. p. 107. 1842.

Dr. Ljungman showed me at Stockholm the original of Retzius, which is, without question, this species.

Station 45, 1240 fathoms, 8 specimens. Station 46, 1350 fathoms, 12 + specimens. Station 49, 83 fathoms, 6 specimens.

**OPHIOTHAMNUS** LYM.**Ophiothamnus remotus** sp. nov.

Plate VIII. Figs. 201–203.

*Special Marks.*—Disk-scales coarse and angular. Side mouth-shield very large, and meeting broadly within. Very few short spines on disk.

*Description of an Individual* (Station 142).—Diameter of disk 3.3 mm. Length of arm 11 mm. Width of arm without spines 8 mm. Seven flat close-set mouth-papillæ; the odd one, at the apex, being short spearhead-shaped, the rest squarish. Mouth-shields small, three-sided, with a point inward, and the outer corners rounded; length to breadth .4 : .3. Side mouth-shields very wide and large, meeting broadly within, and enveloping the mouth-shield on all sides but one. First under arm-plate small and wedge-shaped, with inner end rounded; the rest are pentagonal, with an obtuse angle inward, and outer corners somewhat rounded; the second plate is larger than those beyond. Side arm-plates meeting broadly above and below, constricted within, swelling outward into a thickened spine-ridge. Upper arm-plates wider than long, irregular oval, with a slight peak within. Disk rather thick, covered above with coarse angular scales, whereof there are but two radiating rows in each interbrachial space; radial shields wide pear-seed shape, with a rounded angle inward, joined their whole length, except their inner ends, which are separated by a wedge-scale; interbrachial spaces below with a marginal constriction, and usually covered by four large rounded scales; there are a few short smooth disk-spines. Seven slender, translucent, sharp, not

thorny arm-spines; lengths to that of an arm-joint 1.3, 1.3, 1, 1, .6, .4, .4 : .5. Beyond the basal joints there are but six spines, whereof the upper are shorter than those described above. One very small, narrow, pointed tentacle-scale. Color in alcohol, nearly white.

Station 142, Agulhas Bank, 150 fathoms, 4 specimens.

*O. vicarius* bears a general resemblance to this species, but is distinguished by narrower side mouth-shields and by long and numerous disk-spines.

### Ophiothamnus vicarius LYM.

*Ophiothamnus vicarius*, Bull. Mus. Comp. Zool. I. No. 10, p. 342. 1869.

Station 23, 450 fathoms, 8 specimens.

## OPHIOMITRA.

### TABLE OF SPECIES HEREIN DESCRIBED.

Radial shields depressed; along their outer corners and along margin of disk are large, somewhat swollen plates, wider than long; the median interbrachial space filled by smaller plates or scales. Five to eight arm-spines. In alcohol, each interbrachial space contracts, forming a depression or crease.	Mouth-papillæ inclined to strong spiniform. Arm-spines stout. Outer edge of under arm-plates swollen, and in large specimens turned down. Five or six arm-spines.	} <i>O. plicata</i>
	Eight spines, less stout than in <i>O. plicata</i> , and disk-scales finer. Tentacle-scales jagged or thorny.	} <i>O. Sarsii</i> .
	Radial shields widely separated, the large disk-plates running along their entire interbrachial margin. Under arm-plates not swollen. Under arm-spine thickened, and beyond middle of arm bent.	} <i>O. chelys</i> .
	Outer edge of under arm-plates swollen. Tentacle-scales thorny. Under arm-spines straight.	} <i>O. carduus</i> .
	Upper arm-plates long and slender. Marginal disk-plates large, and much swollen. Central disk-scales fine, and bearing minute thorny stumps.	} <i>O. dipsacos</i> .

### *Ophiomitra plicata* sp. nov.

Plate VIII. Figs. 209-212; Plate IX. Figs. 233-235.

*Special Marks.* — Mouth-papillæ thick, spiniform. Arm-spines five or six, stout and cylindrical. Outer edge of under arm-plates swollen and in large specimens turned down. Disk-spines stout and conical.

*Description of an Individual* (Station 205). — Diameter of disk 16 mm. Length of arm about 132 mm. Width of arm without spines 5 mm. Mouth-papillæ nine to each mouth-angle; stout, spiniform, about equal, blunt. Teeth similar to mouth-papillæ, but shorter and flatter. Mouth-shields small, as long as broad, with an irregular outline; the outer margin more or less thickened and curled downwards; length to breadth 2 : 2. Side mouth-shield broad, thick, and closely joined to the surrounding parts. Under arm-plates broader than

long, broader without than within, separated by transverse depressions; outer edge much thickened and curled downwards. Near end of arm they are wide pentagonal, with an angle inward and the outer edge scarcely thickened. Side arm-plates slightly projecting near base of arm; meeting narrowly below, and scarcely or not at all above. Upper arm-plates wider than long, irregular in shape, with a curved outer side and an obtuse or irregular angle inward; length to breadth about 1.5 : 3.5. Disk (in alcohol) thick, rising well above the arms, and with a deep constriction and furrow in each interbrachial space. Along the outer portion of the interbrachial edge of each radial shield lie three or four plates, broader than long, and running diagonally outward; the rest of the disk is occupied by coarse, irregular, overlapping scales, beset with short, stout, blunt, smooth, conical spines, which form an irregular line over the base of each arm. Radial shields sunken, much longer than broad, narrowest within, rounded and swollen without; length to breadth 5 : 2; separated by one or more narrow scales. Five stout, cylindrical, rather short arm-spines, tapering to a blunt point, with thorns on all sides; lengths to that of an arm-joint 3.7, 4, 3.7, 3, 2.5 : 2. Two thirds out on the arm, the second spine is much longer and attains a length of 8 mm. Tentacle-scales very stout, and thickened at the base; pointed at the tip. On each of the first pair of pores there usually are three, on the rest only one. Towards tip of arm the scale becomes spiniform. Color in alcohol, pale brown.

Station 205, 1050 fathoms.

Smaller specimens (Station 214, Pl. IX. Figs. 233-35) presented considerable variations: with a disk of 10 mm. the arm was 60 mm. long; there were only seven mouth-papillæ to each angle; the disk-spines were thorny, the upper arm-plates narrow; the outer edge of the under arm-plates was somewhat swollen, but not curled down; the first tentacle-pore had only one or two scales; there were six comparatively long arm-spines, whose lengths to that of an arm-joint were 5.2, 3, 2.8, 1.8, 1.8, 1.5 : 1.3. Other specimens (Station 170), with disks from 12 mm. to 9 mm. in diameter, had smooth disk-spines, like 205, and six arm-spines, and upper and under arm-plates, like 214. The number of mouth-papillæ to each angle varied from seven to ten, without reference to size of specimen.

Station 170, 630 fathoms, 6 specimens. Station 205, 1050 fathoms, 1 specimen. Station 214, 500 fathoms, 3 specimens.

### **Ophiomitra Sarsii** sp. nov.

**Plate VIII. Figs. 216, 217.**

*Special Marks.*—Eight stout cylindrical arm-spines. Tentacle-scales flat, tapering, jagged. Scaling of disk finer than in *O. plicata*.

*Description of an Individual* (Station 146).—Diameter of disk 15 mm. Length of arm about 100 mm. Width of arm without spines 4.5 mm. Seven or eight thick pointed mouth-papillæ to each angle. Seven teeth of similar form, but

more blunt and flat. Mouth-shields small, as long as broad, with an irregular outline; outer margin more or less thickened and turned downward; length to breadth 2:2. Side mouth-shields broad and thick, and closely joined to surrounding parts. Under arm-plates broader than long, broader without than within, separated by slight transverse depressions; outer edge thickened, especially at its middle point. Midway on the arm, they are wide pentagonal, with an obtuse angle inward, and the outer edge not thickened. Side arm-plates slightly projecting, meeting near base of arm narrowly below and scarcely or not at all above. Upper arm-plates separated by transverse creases, thick, wider than long; widest without, where they are bounded by a gentle curve; inner side making a deep irregular curve. Disk (in alcohol) thick, rising well above the arms, with a deep constriction and furrow in each inter-brachial space. On margin of disk and along outer interbrachial edge of radial shields lie three or four wide plates larger than the rest, which are coarse, irregular, overlapping scales, beset with short, stout, smooth, often club-ended spines, which are found also on edge of disk over the arms. Radial shields pear-seed shaped, with point inward, sunken, outer end rounded, separated widely by a broad wedge of scales; length to breadth 4:1.8. Near base of arm eight stout, glassy, blunt, cylindrical, very thorny spines, of which the under are nearly as long as the upper; lengths to that of an arm-joint 2, 3.8, 3, 2.8, 2.8, 2.8, 2.5, 2.5:1.7. Two thirds out on the arm there are only four spines, of which the second is much the longest, 5.5 mm. Two tentacle-scales on the first pore, one on the others; stout, pointed, flattened, cloven or jagged on the edges; farther out they take on the form of stout, very thorny spines. Color in alcohol, dull gray.

A smaller specimen with a disk of 10 mm. varied little, except that the upper arm-plates were narrower and thinner, and the disk-scales smaller and beset with few spines. This species differs from *O. plicata* in the cloven or thorny tentacle-scales and in the greater number of arm-spines.

Station 146, 1375 fathoms, 3 specimens.

### Ophiomitra chelys.

*Ophiacantha chelys* Wyv. THOM., Voyage of the "Challenger." Atlantic, Vol. II. p. 64, Figs. 16, 17.

Plate IX. Figs. 239-241.

*Special Marks.*—Radial shields widely separated; along their entire inter-brachial margin run large disk-plates. Under arm-plates not swollen. Tentacle-scales large and flat. Under arm-spine thickened and curved.

*Description of an Individual* (Station 84).—Diameter of disk 9 mm. Length of arm about 85 mm. Width of arm near base 2.8 mm. Mouth-papillæ usually eleven to each angle, of which the central one within is wide and flat; the three next on either side are stout and pointed, and the outer ones are irregular, compressed, and sometimes broken. Teeth similar in shape to the odd inner-



most mouth-papilla.\* Mouth-shields small, as long as broad, shield-shaped, with a well-marked obtuse angle inward and outer margin sometimes turned down; length to breadth 2 : 2.3. Side mouth-shields broad and thick, a little widest at outer ends. Under arm-plates large, thick, and regular, much wider than long, reaching at their outer edge entirely across the arm; cleanly curved without, re-enteringly curved on sides, and having a little peak within where separated from next plate. First plate small, narrow wedge-shaped. Upper arm-plates somewhat swollen, widely separated, wider than long, bounded without by a gentle curve, and within by an obtuse angle or a deep curve. Side arm-plates prominent and meeting freely above and below. Disk thick and rising well above the arms, with a very deep, narrow constriction and furrow in each interbrachial space. The space between this furrow and the radial shields is on either side occupied by four large plates running diagonally inward, whereof one or more are often broken in two. The central disk is sunken, and covered by small, coarse, irregular scales, which, with the larger plates, are sparsely beset with short, blunt, usually smooth stumps or spines, which form also an irregular clump over each arm. Radial shields deeply sunken in a furrow, widely separated by a high ridge of irregular scales, much longer than broad, presenting an acute angle inward; length to breadth 3 : .8. Near base of arm six stout, very thorny, glassy, blunt, cylindrical arm-spines, the lowest ones much the stoutest; lengths to that of an arm-joint 3.6, 3.6, 2.8, 1.7, 1.7, 1.7 : 1.2. Two thirds out on the arm the spines are more slender, and the second much longer, attaining to 5 mm. The under spine is marked by its thickness; beyond base of arm it is somewhat curved. Tentacle-scales large, thick, pointed, flattened, sensibly smooth, except towards end of arm, where they bear two or three microscopic thorns. Color in alcohol, dull straw.

It is not easy to say how much of the peculiar creasing of the disk and sinking of the radial shields is due to the contraction of the animal drawn from a depth and immersed in strong alcohol, and how much is natural. Of nine specimens one had radial shields much wider and more nearly on a level with the disk; but in the rest the radial shields were deeply sunken. Six specimens from the "Blake" expedition (Agassiz and Sigsbee, 1878) seemed a variety of this species. They were from 480 to 860 fathoms, near Cuba. All had the radial shields not at all sunken and of a broad pear-seed shape; only the centre of the disk bore stumps, which were little articulated cylinders bearing a crown of thorns. The largest specimen, with a disk of 8 mm., had seven arm-spines, which were stouter than in "Challenger" specimens and shorter, their lengths being 2, 3, 2.2, 2, 1.5, 1.5, 1.2; and the lowest spine, though thick, was scarcely or not at all curved. The other specimens were young, and had long slender arm-spines, and the under one curved. The "Challenger" specimen from Station 33 resembled these.

Station 3, 1530 fathoms, 3 specimens. Station 33 (var. ?) 300 fathoms, 3 specimens. Station 84, 1124 fathoms, 3 specimens.

\* The nomenclature of the various papillæ of the mouth is of course conventional. In most cases the lowest tooth may also be called the innermost mouth-papilla.

Sir Wyville Thomson *loc. cit.* records his specimen from Station 87. This was never sent me; the only *Ophiomitra* from Station 87 being the allied species *O. carduus*, which does not agree with his figure and description of *O. chelys*. The statement (p. 65) that the arm is only three and a half times the diameter of the disk is plainly a misprint.

### *Ophiomitra carduus* sp. nov.

Plate IX. Figs. 236-238.

*Special Marks.* — Outer edges of under arm-plates swollen. Tentacle-scales strongly thorny. Under arm-spine straight.

*Description of an Individual* (Station 87). — Diameter of disk 10 mm. Width of arm without spines 2.8 mm. Mouth-papillæ nine to eleven to each angle, of which the inner central one has a flat spearhead-shape; the others irregularly conical with blunt points; several of them much larger, and resembling the innermost one; others, especially the outermost, small, crowded, and ill-defined. Mouth-shields small, broader than long, with an obtuse angle within and a truncated angle or a broken curve without, outer edge somewhat indented; length to breadth 1.7 : 2.2. Side mouth-shields very broad and curved on their outer edge, almost crescent-like. Under arm-plates near base of arm large, much wider than long, with a small swelling at their outer edge, which is gently curved and reaches nearly across the arm; lateral sides re-enteringly curved, with a peak within, where each plate is widely separated from its neighbor by the side arm-plates. Upper arm-plates somewhat swollen, bounded without by a gentle curve, and within by an obtuse angle or a deep curve. Side arm-plates stout and prominent, meeting broadly below, and, beyond the third plate, above also. Disk moderately thick, rising somewhat above the arms, with a deep constriction in each interbrachial space. The area between this constriction of the radial shields is occupied on either side by four or five transverse plates running diagonally inward, whereof one or more are often broken in two. Central disk somewhat sunken and covered with coarse, irregular, overlapping scales, which, with the larger plates and edge of disk, are closely beset with little cylinders bearing a crown of thorns. Radial shields of an irregular pear-seed shape, with an angle inward, wavy, scarcely sunken, very wide, separated by a broad wedge of scales forming a median hump or ridge; length to breadth 3.7 : 2. Near base of arm, six rather stout, thorny, glassy, blunt cylindrical arm-spines, the lowest ones shortest and stoutest, but not curved; lengths to that of an arm-joint 3.3, 3.3, 2.1, 1.8, 1.8, 1.7 : 1.3. Beyond first pair of pores the tentacle-scales are cloven, or have a long point, with one or more side thorns; towards middle of arm these thorns become stronger and the scale more pointed. Color in alcohol, dull straw.

A smaller specimen, with a disk of 8 mm., had arms about 65 mm. long. The disk-stumps were more thorny than in the larger one, and the tentacle-scales, beyond middle of arm, were short spines, with several sharp, slender

side thorns. It is to be noticed that the size and shape of the tentacle-scale, when specimens of the same size are compared, give a pretty constant character in *Ophiacantha* and *Ophiomitra*.

Station 87, 1675 fathoms, 2 specimens.

### *Ophiomitra dipsacos* sp. nov.

Plate VIII. Figs. 213-215.

*Special Marks.*— Upper arm-spines long and slender, marginal disk-plates large and swollen; central disk-scales fine, and bearing minute thorny stumps; arm wide.

*Description of an Individual* (Station 24).— Diameter of disk 10 mm. Width of arm without spines 3.4 mm. Mouth-papillæ nine to eleven to each angle, whereof the innermost odd one is flat spearhead-shaped; and the two outer ones on each side are ill-defined, being sometimes small papillæ, or again forming a sort of curled sheath to the mouth-tentacle; the other papillæ are pointed and flattened. Mouth-shields as long as broad, small, having an obtuse angle within, and a truncated angle or a deep curve without; outer edge often a little curled; length to breadth 2:2. Side mouth-shields wide, with outer side strongly curved. Under arm-plates, near base of arm, large, much wider than long, with an outer edge gently curved and slightly thickened, and reaching nearly across the arm; lateral sides re-enteringly curved, with a peak within, where each plate is separated from its neighbor by the side arm-plates. Upper arm-plates slightly swollen, bounded without by a gentle curve, and within by a deep curve or truncated angle; they are separated by side arm-plates, which are prominent, and meet freely above and below. Disk thick and puffed, rising well above the arms, with a constriction and furrow in each interbrachial space. The area between this constriction and the radial shields, on either side, is occupied by four transverse plates running diagonally inward, and outside these is a similar larger plate forming the margin of the disk. Central disk covered with fine overlapping scales, eight or ten on a line between central point and inner angle of radial shield; they are sparsely beset with minute stumps bearing a crown of thorns. On the disk margin, over each arm, a few small grains or stumps. Radial shields of a wide pear-seed shape, with an angle inward, nearly or quite joined without; separated within by a broad wedge of scales; length to breadth 2.8:1.7. Near base of arm six strongly thorny, glassy, cylindrical arm-spines, whereof the two upper ones are very long, slender, and tapering, and the lowest is thick and blunt; lengths to that of an arm-joint 5, 7, 3.5, 2.5, 2, 1.8:1.3. Two large pointed tentacle-scales on first pore; one on each of those beyond; toward middle of arm, the scales are more elongated and pointed, and have one or two microscopic thorns. Color in alcohol, very pale brown.

Station 24, 390 fathoms, 1 specimen.

**OPHIOCAMAX** gen. nov.**Ophiocamax vitrea** sp. nov.

Plate VIII. Figs. 218-221; Plate IX. Figs. 242-244 (young).

*Special Marks.* — Mouth-papillæ numerous, spine-like, arranged in a tuft. Tentacle-scales blunt spiniform, two or three to each pore. Disk covered above with rounded, equal, thin scales set thickly with minute thorns and crochets.

*Description of an Individual* (Station 219). — Diameter of disk 17 mm. Width of arm without spines 4.4 mm. About thirty long, spiniform, equal papillæ to each angle, set in two or three ranks; of which half a dozen are arranged under the teeth, and may be considered tooth-papillæ; and three on either side are borne on a small plate or scale, at outer corner of mouth-slit, and cover the second mouth-tentacle. Seven broad flat teeth, with a rounded cutting edge. Mouth-shields small, broader than long, with an obtuse angle within and a truncated angle without, bearing a few short spines; length to breadth 1.5 : 2. Side mouth-shields exceptionally large and wide, meeting broadly within, having their inner sides gently curved. Under arm-plates with a wide, slightly curved, somewhat swollen outer edge, and a narrow projection within, where they join the next plates; on each lateral side a sharp re-entering curve, where the tentacle issues; length to breadth 2 : 2.6. Side arm-plates near base of arm not meeting below and scarcely above; forming broad, abrupt, but not very high ridges. Upper arm-plates slightly swollen, about as broad as long, with a gentle curve without and a deep curve within. The whole arm is sparsely set with minute points. Disk flat and even, closely set with fine short spines which are sharp and thorny or forked. Radial shields flat and regular, triangular, with an angle inward, bearing a few spines like those of the disk, and separated by a row of the same; length to breadth 4 : 2.5. Near base of arm nine slender, slightly flattened, glassy arm-spines, whereof the three lowest are very small. Unlike those of *Ophiacantha*, these spines are not hollow. Lengths to that of an arm-joint 3, 3, 3.6, 4, 3, 1.6, 1.2, .8, .6 : 2. Three stout, club-shaped, spiniform tentacle-scales on the first pore, and usually two on those immediately beyond. Color in alcohol, straw.

A younger specimen (Station 192, Pl. IX. Figs. 242-244), with a disk of 12 mm., had the upper arm-plates longer; the basal under arm-plates did not touch each other; the scaling of the disk was distinctly marked; there were three tentacle-scales on the basal pores; the arm-spines were seven; lengths to that of an arm-joint 2.2, 4.4, 3, 2.2, 2, 1.5, 1.2 : 1.5.

Station 192, 129 fathoms, 1 specimen and young. Station 201, 102 fathoms, 1 specimen. Station 204, 100 fathoms, 1 specimen. Station 219, 152 fathoms, 2 specimens.

**OPHIOSCOLEX MÜLL. AND TROSCH.****Ophioscolex dentatus** sp. nov.

Plate VII. Figs. 184 - 186.

*Special Marks.*—Three or four short, blunt, flattened arm-spines. Numerous mouth-papillæ, whereof the outer are flat spiniform. One tentacle-scale.

*Description of an Individual* (Station 142).—Diameter of disk 15 mm. Length of arm about 55 mm. Width of arm, without spines, close to disk 2.7 mm. There are seven mouth-papillæ on each side of an angle and one small and pointed at apex of jaw; the three outer are flat spiniform, and much the largest and longest. On removing the skin the mouth-shield is seen to be wide triangular, having an obtuse angle within and outer corners rounded. Side mouth-shields long, narrow, and meeting within. Arms covered by a thick skin completely hiding the plates, which are obscurely indicated below by transverse furrows. On removing the skin, the under arm-plates appear longer than wide, with a curve without and a re-entering curve within; the side arm-plates small and meeting neither above nor below, while the upper plates are only indicated by thin films of slightly calcified skin. Disk round and rather flat, covered with a soft naked skin variously wrinkled above and below.\* Genital openings wide and long, extending from the mouth-shield to the edge of the disk. Three or four short, blunt, flattened arm-spines, equally spaced, about as long as an arm-joint; the upper and undermost usually a little the longest. One small rounded tentacle-scale on the inner side of the pore. Color in alcohol, light gray.

Station 142, off Agulhas Bank, 150 fathoms, 12 + specimens.

**Ophioscolex tropicus** sp. nov.

Plate VII. Figs. 190 - 192.

*Special Marks.*—Seventeen to nineteen small, short, pointed close-set mouth-papillæ, occupying the entire margin of each mouth-angle. Whole animal covered by a thick skin, through which appear the lower and side arm-plates, the mouth-shields, and (indistinctly) the scaling of the lower interbrachial space.

*Description of an Individual* (Station 24).—Diameter of disk 8 mm. Width of arm close to disk, without spines, 1.3 mm. Eight or nine short, close-set, rounded mouth-papillæ, occupying the whole length of each side, and one larger and more pointed at apex of jaw. Mouth-shields much broader than long, in shape transverse oval; length to breadth .6 : 1.2. Side mouth-shields long, curved and narrow, broader without, tapering inward, where they do not quite meet. First under arm-plate very small, nearly square, the others larger, long hexagonal, with outer side curved, lateral sides re-enteringly curved, and three inner sides short. Side arm-plates broad and thin, meeting near base of arm neither above nor below. The place of the upper arm-plates is occupied by thick skin,

\* It is not often so regularly wrinkled as in Fig. 185.

through which may be distinguished the upper side of the arm-bones. Disk flat and thin, covered with a thick, slightly wrinkled skin, which conceals the radial shields and the fine scaling, though the latter may be distinguished in the lower interbrachial spaces. Genital scales quite hidden. Genital opening extending from the mouth-shield to the margin of the disk. Three cylindrical, stout, nearly equal, pointed arm-spines, about as long as an arm-joint. One small rounded tentacle-scale on inner side of the tentacle-pore. Color in alcohol, gray.

I admit this species to *Ophioscolex* with some hesitation. The mouth-papillæ are different in shape and arrangement; but the absence of upper arm-plates and the characteristic covering of smooth skin suggest its position.

Station 24, off St. Thomas, 390 fathoms, 1 specimen.

### OPHIOLEBES\* gen. nov.

Disk and arms stout, and covered by a thick skin, which bears grains or stumps, and hides more or less the underlying plates. Arm-spines short, blunt, thorny, covered by thick skin, and arranged on the sides of the side arm-plates, which project but slightly. Long stout mouth-papillæ, and teeth; no tooth-papillæ. Jaw-covers large and wide, making a circle by their connecting ends.† Arm-plates rather small, but normal, nearly as in *Ophiacantha*. Two genital openings in each interbrachial space.

*Ophiolebes* includes Ljungman's *Ophiactis clavigera*, besides the two species here described.

### *Ophiolebes scorteus* sp. nov.

Plate VII. Figs. 196, 197.

*Special Marks.* — Four short blunt arm-spines covered with thick skin, the upper one longest. Five feeble mouth-papillæ to each angle. Radial shields like ridges and set with grains.

*Description of an Individual* (Station 145). — Diameter of disk 7.5 mm. Length of arm about 23 mm. Width of arm close to disk, without spines, 1.5 mm. There may be seen on each angle the outlines of five small mouth-papillæ, two widely separated on the sides and one longer and more slender at the apex, all covered by a thick skin, which, when removed, shows them as long, cylindrical, and stout. The mouth-shields, whose outlines may be vaguely seen, are small triangular, with an angle inward and outer edge curved. Side mouth-shields hidden by skin, which, when removed, shows them long and narrow, meeting within, and nearly or quite joining without, between first and second arm-plates, so as to form a continuous line about the mouth. First under arm-plate diamond-shape; the rest are pentagonal, with an angle inward

\* *ὄφις*, snake; *λέβης*, basin.

† The *jaw-cover* is the internal plate which roofs over the open angle above each pair of mouth-frames in the interbrachial space.

and a notch without, but are hidden by thick skin. No side or upper arm-plates visible, but, on removing the skin, the latter are seen to be small triangular, and separated by the side plates. Disk round and arched, covered by a thick skin which in the centre is irregularly wrinkled. Radial shields like long narrow ridges covered with a thick skin and set with small flat grains; the brachial and interbrachial spaces have the skin more or less wrinkled, and often with a few grains; the lower interbrachial spaces have the same thick, somewhat wrinkled skin. There are on the first three joints three arm-spines; beyond this there are four; they are short, stout, and microscopically thorny, with blunt points, and are covered with thick skin; the upper spines being longest. No tentacle-scales. Color in alcohol, white.

Station 145, 310 fathoms, 12 + specimens.

### *Ophiolebes vestitus* sp. nov.

Plate X. Figs. 255-257.

*Special Marks.*— Disk covered by thick skin and set with short stumps, or grains, bearing a crown of blunt thorns. Arm-spines short, stout, opaque, thorny. Mouth-papillæ stout, blunt, spiniform.

*Description of an Individual* (Station 308).— Diameter of disk 10 mm. Length of arm 50 mm. Width of arm without spines 2.3 mm. Nine mouth-papillæ, of which the lateral are stout, blunt, cylindrical, crowded, somewhat movable, and with rough ends; the innermost is flat and squarish, like the teeth. Mouth-shields small, wider than long, with a lobe without and an obtuse angle inward; length to breadth 1 : 1.2. Side mouth-shields somewhat curved, extending beyond mouth-shield, wider without than within, where they meet. Under arm-plates pentagonal, with a rounded angle inward. Upper arm-plates fan-shaped, with a truncated angle inward. Side arm-plates meeting narrowly above and below, projecting but slightly. Disk a little puffed, covered by thick skin, and sparsely but regularly beset with short stumps or grains bearing a crown of blunt thorns. Six stout, cylindrical, blunt, thorny arm-spines; lengths to that of an arm-joint 1.8, 1.2, 1, .8, .8, .8 : .8. One small, narrow, pointed tentacle-scale. Color in alcohol, white.

A young specimen with a disk of 4 mm. had arms 10 mm. long. The disk-stumps were longer, and like very short thick spines. The arm-spines were less thorny. In this stage it is very near the Ophiuran described by Ljungman as *Ophiactis clavigera*, which has the same habits also, and is doubtless the young of a form of *Ophiolebes*, like the present one. It differs in having the disk-scales and part of the radial shields naked.

That *O. clavigera* is of a novel type is shown by the fact that Ljungman considered it an extreme modification of *Ophiactis*, while Lütken deemed it nearer *Ophiacantha*.

Station 307, 140 fathoms, 3 specimens. Station 308, 175 fathoms, 7 specimens. Station 310, 400 fathoms, 1 specimen.

## OPHIOSCIASMA \* gen. nov.

Disk covered with thick soft skin finely granulated. Arms very slender, with lower and side plates imperfectly calcified, and no upper plates. Mouth-papillæ and teeth represented by a bunch of spines, or thorns, at apex of jaw. Arm-spines arranged on sides of side arm-plates. Two large genital openings in each interbrachial space.

A singular genus, which, by its disk covered with soft skin and lack of upper arm-plates, is allied to *Ophioscolex*, but differs by its granulation, and its extremely slender, knotted arms.

*Ophiosciasma attenuatum* sp. nov.

Plate VII. Figs. 193-195.

*Special Marks.*—Disk beset with a very fine but not continuous granulation. Arms very slender, knotted, and at centre of the joints diaphanous. Three small nearly equal arm-spines.

*Description of an Individual* (Station 122).—Diameter of disk 6 mm. Length of arm 45 mm. Width of arm without spines .6 mm. Mouth-papillæ, teeth, and tooth-papillæ combined in form of a clump of seven or eight sharp thorns or spines, standing round the apex made by the juncture of the long narrow mouth-frames. Mouth-shields of a transverse diamond-shape, very small, sometimes scarcely visible, more or less hidden by thick skin. Side mouth-shields very narrow and slender, meeting within. Under arm-plates very thin, and in their central part transparent, so that their outlines are vague; longer than broad, with outer side slightly curved and lateral sides re-enteringly curved; length to breadth .5 : .4. Side arm-plates reduced to a strip, like a double cord, running along the side of the joint. No upper arm-plates. The arm-bones are but slightly calcified, except at their thickened ends, so that their more slender central shaft is translucent. The arm thus presents a beaded appearance, with swellings where the ends of the arm-bones form joints and support the arm-spines. Disk covered with a thick skin, which above is beset with fine grains, and which partially obscures the mouth-papillæ and the arm-spines. No radial shields or disk-scales visible. Three small, blunt, nearly equal arm-spines, not so long as an arm-joint, seen to be microscopically rough when free of skin, and standing nearly at right angles to arm. Tentacles large, simple, and fleshy; no tentacle-scales. Color in alcohol, very pale yellow.

Station 122, 350 fathoms, 1 specimen.

\* ὄφιοι, snake; σκιάσμα, shadow.



**OPHIOGERON** \* gen. nov.

Disk covered by a naked skin. Mouth-angles naked, except a few small teeth on jaw-plate. Under arm-plates small, and with a large tentacle-pore on either side. Side arm-plates somewhat flaring, and carrying thorny arm-spines covered with skin. No upper arm-plates.

This genus is somewhat allied with *Ophiomyxa*, and with *Ophioscolex*.

**Ophiogeron edentulus** sp. nov.

Plate VII. Figs. 187-189.

*Special Marks.* — Two or three feeble, pointed teeth; otherwise the mouth-angle quite naked. Two short stout arm-spines, which, stripped of skin, show longitudinal rows of hooked thorns.

*Description of an Individual* (Station 175). — Diameter of disk 3 mm. Length of arm about 14 mm. Width of same close to disk, without spines, 1 mm. Mouth-angles quite naked, except one small pointed papilla at apex of jaw and two or three more that represent teeth. Mouth-shields rounded triangular; length and breadth about equal, with an angle within and outer side rounded. Side mouth-shields rather large, curved, longer than wide, broadest within, where they meet. First under arm-plate narrow, five-sided, with inner edge straight, a broad angle without, and re-entering curves on the lateral sides, second plate similar, but narrower and with the angle inward. Those beyond are further modified by having the outer and inner sides curved. Side arm-plates broad and meeting below, beyond the second under arm-plate; flaring somewhat toward their outer edge. The arm-plates and mouth-shields are more or less obscured by thick skin. Along the upper side of the arm the central ridge of the arm-bones shows through the skin. Disk flat and thin, completely covered with a naked wrinkled skin. Two short tapering arm-spines, which when stripped of skin present longitudinal rows of slightly hooked thorns. No tentacle-scales, but large pores from which long smooth tentacles protrude. Color in alcohol, grayish.

Station 175, 1350 fathoms, 2 specimens.

\* *ὄφις*, snake; *γέρων*, an old man.

## DESCRIPTION OF PLATES.

Those which have no authority appended are new species. In Plates III. and IV. some of the details are blurred by careless printing; the reader is therefore cautioned to compare figures with descriptions.

## PLATE I.

- Fig. 1. *Ophiomusium scalare*, below; ♂.  
 Fig. 2. " " above; ♂.  
 Fig. 3. " " arm-joints; ♂.  
 Fig. 4. " *lunare*, below; ♂.  
 Fig. 5. " " above; ♂.  
 Fig. 6. " " arm-joints; ♂.  
 Fig. 7. " *validum*, Ljn., below; ♂.  
 Fig. 8. " " above; ♂.  
 Fig. 9. " " arm-joints; ♂.  
 Fig. 10. " *simplex*, below; ♂.  
 Fig. 11. " " above; ♂.  
 Fig. 12. " *granosum*, below; ♂. Tentacle-holes omitted next second and third under arm-plates.  
 Fig. 13. *Ophiomusium granosum*, above; ♂.  
 Fig. 14. " *laqueatum*, below; ♂.  
 Fig. 15. " " above; ♂.  
 Fig. 16. " " arm-joint; ♂.  
 Fig. 17. " *cancellatum*, below; ♂. There should be small papillæ along the genital opening.  
 Fig. 18. *Ophiomusium cancellatum*, above; ♂.  
 Fig. 19. " *corticosum*, below; ♂.  
 Fig. 20. " " above; ♂.  
 Fig. 21. " *armigerum*, below; ♂. There should be papillæ along the genital opening.  
 Fig. 22. *Ophiomusium armigerum*, above; ♂. There should be an arm-comb of small papillæ.  
 Fig. 23. *Ophiomusium serratum*, below; ♂.  
 Fig. 24. " " above; ♂.  
 Fig. 25. " " arm-joint; ♂.

## PLATE II.

- Fig. 26. *Ophioglypha inornata*, above; ♂.  
 Fig. 27. " " below; ♂.  
 Fig. 28. *Ophiomusium archaster*, below; ♂.  
 Fig. 29. " " above; ♂.

- Fig. 30. *Ophioplinthus medusa*, below ;  $\frac{3}{4}$ .  
 Fig. 31. " " above ;  $\frac{3}{4}$ .  
 Fig. 32. *Ophiomusium archaster*, arm-joints ;  $\frac{3}{4}$ .  
 Fig. 33. *Ophioplinthus grisca*, below ;  $\frac{3}{4}$ . The side-mouth-shields should be visible.  
 Fig. 34. " " above ;  $\frac{3}{4}$ .  
 Fig. 35. *Ophioglypha Dschayesi*, below ;  $\frac{3}{4}$ .  
 Fig. 36. " " above ;  $\frac{3}{4}$ .  
 Fig. 37. " " arm-joints ;  $\frac{3}{4}$ .  
 Fig. 38. " *confragosa*, above ;  $\frac{3}{4}$ .  
 Fig. 39. " " below,  $\frac{3}{4}$ .  
 Fig. 40. *Ophioplinthus medusa*, arm-joint ;  $\frac{3}{4}$ .  
 Fig. 41. *Ophioglypha intorta*, below ;  $\frac{3}{4}$ .  
 Fig. 42. " " above ;  $\frac{3}{4}$ .  
 Fig. 43. " " arm-joints ;  $\frac{3}{4}$ .  
 Fig. 44. " *brevispina*, below ;  $\frac{3}{4}$ .  
 Fig. 45. " " above ;  $\frac{3}{4}$ .  
 Fig. 46. " " arm-joints and comb ;  $\frac{3}{4}$ .  
 Fig. 47. " *ambigua*, arm-joints and comb ;  $\frac{3}{4}$ .  
 Fig. 48. " " below ;  $\frac{3}{4}$ .  
 Fig. 49. " *flagellata*, below ;  $\frac{3}{4}$ .  
 Fig. 50. " " above ;  $\frac{3}{4}$ . The disk-scales cannot be seen unless the specimen be dry.  
 Fig. 51. *Ophioglypha flagellata*, arm-joints ;  $\frac{3}{4}$ .  
 Fig. 52. " *ponderosa*, below ;  $\frac{3}{4}$ .  
 Fig. 53. " " above ;  $\frac{3}{4}$ .  
 Fig. 54. " " arm-joints ;  $\frac{3}{4}$ .  
 Fig. 55. " *jejuna*, below ;  $\frac{3}{4}$ .  
 Fig. 56. " " above ;  $\frac{3}{4}$ .  
 Fig. 57. " *confragosa*, arm-joints ;  $\frac{3}{4}$ .

## PLATE III.

- Fig. 58. *Ophioglypha Lacazei*, below ;  $\frac{3}{4}$ .  
 Fig. 59. " " above ;  $\frac{3}{4}$ .  
 Fig. 60. " " arm-joints ;  $\frac{3}{4}$ .  
 Fig. 61. " *undulata*, below ;  $\frac{3}{4}$ .  
 Fig. 62. " " above ;  $\frac{3}{4}$ .  
 Fig. 63. " *imbecillis*, below ;  $\frac{3}{4}$ .  
 Fig. 64. " " above ;  $\frac{3}{4}$ .  
 Fig. 65. " *radiata*, below ;  $\frac{3}{4}$ .  
 Fig. 66. " " above ;  $\frac{3}{4}$ .  
 Fig. 67. " *lapidaria*, below ;  $\frac{3}{4}$ .  
 Fig. 68. " " above ;  $\frac{3}{4}$ .  
 Fig. 69. " " arm-joints ;  $\frac{3}{4}$ .  
 Fig. 70. " *variabilis*, below, young ;  $\frac{3}{4}$ .  
 Fig. 71. " *lepida*, below ;  $\frac{3}{4}$ .  
 Fig. 72. " " above ;  $\frac{3}{4}$ .

- Fig. 73. *Ophioglypha lepida*, arm-joints ;  $\frac{1}{4}$ .  
 Fig. 74. " *aqualis*, notch ;  $\frac{1}{4}$ .  
 Fig. 75. " " arm-joints ;  $\frac{1}{4}$ .  
 Fig. 76. " *ferruginca*, below ;  $\frac{1}{4}$ .  
 Fig. 77. " *Ljungmani*, above ;  $\frac{3}{4}$ .  
 Fig. 78. " *variabilis*, below ;  $\frac{1}{4}$ .  
 Fig. 79. " " above ;  $\frac{1}{4}$ .  
 Fig. 80. " *licnosa*, below ;  $\frac{5}{2}$ .  
 Fig. 81. " " above ;  $\frac{5}{2}$ .  
 Fig. 82. " " arm-joints ;  $\frac{5}{2}$ .  
 Fig. 83. " *convexa*, below ;  $\frac{5}{2}$ .  
 Fig. 84. " " above ;  $\frac{5}{2}$ .  
 Fig. 85. " *bullata*, Wv. Thom., below ;  $\frac{1}{4}$ .  
 Fig. 86. " " " above ;  $\frac{1}{4}$ .

## PLATE IV.

- Fig. 87. *Ophioglypha elevata*, below ;  $\frac{1}{4}$ .  
 Fig. 88. " " above ;  $\frac{1}{4}$ .  
 Fig. 89. " " arm-joints ;  $\frac{1}{4}$ .  
 Fig. 90. " *rugosa*, below ;  $\frac{1}{4}$ .  
 Fig. 91. " " above ;  $\frac{1}{4}$ .  
 Fig. 92. " *costata*, below ;  $\frac{1}{4}$ .  
 Fig. 93. " " above ;  $\frac{1}{4}$ .  
 Fig. 94. " " arm-joints :  $\frac{1}{4}$ .  
 Fig. 95. " *albata*, below ;  $\frac{1}{4}$ .  
 Fig. 96. " " above ;  $\frac{1}{4}$ .  
 Fig. 97. " " arm-joints ;  $\frac{1}{4}$ .  
 Fig. 98. " *palliata*, below ;  $\frac{1}{4}$ .  
 Fig. 99. " " above ;  $\frac{1}{4}$ .  
 Fig. 100. " " arm-joints ;  $\frac{1}{4}$ .  
 Fig. 101. " *undata*, below ;  $\frac{1}{4}$ .  
 Fig. 102. " " above ;  $\frac{1}{4}$ .  
 Fig. 103. " *orbiculata*, below ;  $\frac{5}{2}$ .  
 Fig. 104. " " above ;  $\frac{5}{2}$ .  
 Fig. 105. " " arm-joints ;  $\frac{5}{2}$ .  
 Fig. 106. " *irrorata*, below ;  $\frac{1}{4}$ .  
 Fig. 107. " " above ;  $\frac{1}{4}$ .  
 Fig. 108. " " arm-joints ;  $\frac{1}{4}$ .  
 Fig. 109. " *Loveni*, below ;  $\frac{1}{4}$ .  
 Fig. 110. " " above ;  $\frac{1}{4}$ .  
 Fig. 111. " " arm-joints ;  $\frac{1}{4}$ .  
 Fig. 112. " *fraterna*, arm-joints ;  $\frac{1}{4}$ .  
 Fig. 113. " *ornata*, above ;  $\frac{5}{2}$ .  
 Fig. 114. " " arm-joints ;  $\frac{5}{2}$ .  
 Fig. 115. " *sculptilis*, below ;  $\frac{1}{4}$ .  
 Fig. 116. " " above ;  $\frac{1}{4}$ .

## PLATE V.

- Fig. 117. *Ophioglypha minuta*, below ;  $\frac{4}{1}$ .  
 Fig. 118. " " above ;  $\frac{6}{1}$ .  
 Fig. 119. " " arm-joints ;  $\frac{6}{1}$ .  
 Fig. 120. " *solida*, below ;  $\frac{7}{1}$ .  
 Fig. 121. " " above ;  $\frac{7}{1}$ .  
 Fig. 122. " " arm-joints ;  $\frac{3}{1}$ .  
 Fig. 123. " *inermis*, below ;  $\frac{5}{2}$ .  
 Fig. 124. " " above ;  $\frac{5}{2}$ .  
 Fig. 125. " " arm-joints ;  $\frac{5}{2}$ .  
 Fig. 126. *Ophiocten pallidum*, below ;  $\frac{3}{1}$ .  
 Fig. 127. " " above ;  $\frac{3}{1}$ .  
 Fig. 128. " " arm-joints ;  $\frac{3}{1}$ .  
 Fig. 129. " *amitinum*, below ;  $\frac{4}{1}$ .  
 Fig. 130. " " above ;  $\frac{4}{1}$ .  
 Fig. 131. " *umbraticum*, below ;  $\frac{4}{1}$ .  
 Fig. 132. " " above ;  $\frac{4}{1}$ .  
 Fig. 133. " *hastatum*, notch ;  $\frac{3}{1}$ .  
 Fig. 134. " " arm-joints ;  $\frac{3}{1}$ .  
 Fig. 135. *Ophiopyrgus Wyville-Thomsoni*, below ;  $\frac{6}{1}$ .  
 Fig. 136. " " " above ;  $\frac{6}{1}$ .  
 Fig. 137. " " " profile view ;  $\frac{6}{1}$ .  
 Fig. 138. *Ophiomusium Lütkeni*, below ;  $\frac{3}{1}$ .  
 Fig. 139. " " above ;  $\frac{3}{1}$ .  
 Fig. 140. " " arm-joints ;  $\frac{3}{1}$ .  
 Fig. 141. " *flabellum*, below ;  $\frac{6}{1}$ .  
 Fig. 142. " " above ;  $\frac{6}{1}$ .  
 Fig. 143. " " arm-joints and edge of disk ;  $\frac{6}{1}$ .  
 Fig. 144. " *pulchellum*, Wyv. Thom., below ;  $\frac{4}{1}$ .  
 Fig. 145. " " " " above ;  $\frac{4}{1}$ .

## PLATE VI.

- Fig. 147. *Ophiozona stellata*, below ;  $\frac{4}{1}$ .  
 Fig. 148. " " above ;  $\frac{4}{1}$ .  
 Fig. 149. " *insularia*, below ;  $\frac{6}{1}$ .  
 Fig. 150. " " above ;  $\frac{4}{1}$ .  
 Fig. 151. " " arm-joints ;  $\frac{6}{1}$ .  
 Fig. 152. " *antillarum*, below ;  $\frac{4}{1}$ .  
 Fig. 153. " " above ;  $\frac{4}{1}$ .  
 Fig. 154. " " arm-joints ;  $\frac{4}{1}$ .  
 Fig. 155. " *depressæ*, below ;  $\frac{3}{2}$ .  
 Fig. 156. " " above ;  $\frac{3}{2}$ .  
 Fig. 157. " " arm-joints ;  $\frac{3}{2}$ .  
 Fig. 158. *Ophiotrochus panniculus*, below ;  $\frac{4}{1}$ .  
 Fig. 159. " " above ;  $\frac{4}{1}$ .

- Fig. 160. *Ophiotrochus panniculus* arm-joints ;  $\frac{7}{4}$ .  
 Fig. 161. *Ophioceramis? clausa*, below ;  $\frac{7}{4}$ .  
 Fig. 162. " " above ;  $\frac{7}{4}$ .  
 Fig. 163. " " arm-joints ;  $\frac{7}{4}$ .  
 Fig. 164. " ? *obstricta*, below ;  $\frac{7}{4}$ .  
 Fig. 165. " " above ;  $\frac{7}{4}$ .  
 Fig. 166. " " arm-joints ;  $\frac{7}{4}$ .  
 Fig. 167. *Ophiomastus tegulitius*, below ;  $\frac{1^0}{4}$ .  
 Fig. 168. " " above ;  $\frac{1^0}{4}$ .  
 Fig. 169. " " disk and arm in profile ;  $\frac{1^0}{4}$ .  
 Fig. 170. *Ophiernus vallincola*, below ;  $\frac{1}{4}$ .  
 Fig. 171. " " above ;  $\frac{1}{4}$ .  
 Fig. 172. " " arm-joints ;  $\frac{1}{4}$ .

## PLATE VII.

- Fig. 173. *Ophiopyren brevispinus*, below ;  $\frac{3}{4}$ .  
 Fig. 174. " " above ;  $\frac{3}{4}$ .  
 Fig. 175. " " arm-joints ;  $\frac{3}{4}$ .  
 Fig. 176. " *longispinus*, below ;  $\frac{1^0}{4}$ .  
 Fig. 177. " " above ;  $\frac{1^0}{4}$ .  
 Fig. 178. " " arm-joints ;  $\frac{1^0}{4}$ .  
 Fig. 179. *Ophiophyllum petilum*, below ;  $\frac{6}{4}$ .  
 Fig. 180. " " above ;  $\frac{6}{4}$ .  
 Fig. 181. " " arm-joints ;  $\frac{6}{4}$ .  
 Fig. 182. *Ophiochiton fastigatus*, below ;  $\frac{7}{4}$ .  
 Fig. 183. " " above ;  $\frac{7}{4}$ .  
 Fig. 184. *Ophioscolex dentatus*, below ;  $\frac{5}{4}$ .  
 Fig. 185. " " above ;  $\frac{5}{4}$ .  
 Fig. 186. " " arm-joints ;  $\frac{5}{4}$ .  
 Fig. 187. *Ophiogeron edentulus*, below ;  $\frac{6}{4}$ .  
 Fig. 188. " " above ;  $\frac{6}{4}$ .  
 Fig. 189. " " one spine ;  $\frac{5^A}{4}$ .  
 Fig. 190. *Ophioscolex tropicus*, below ;  $\frac{1}{4}$ .  
 Fig. 191. " " above ;  $\frac{1}{4}$ .  
 Fig. 192. " " arm-joints ;  $\frac{1}{4}$ .  
 Fig. 193. *Ophiosciusma attenuatum*, below ;  $\frac{6}{4}$ .  
 Fig. 194. " " above ;  $\frac{6}{4}$ .  
 Fig. 195. " " arm-joints ;  $\frac{6}{4}$ .  
 Fig. 196. *Ophiolobes scortcus*, below ;  $\frac{4}{4}$ .  
 Fig. 197. " " above ;  $\frac{4}{4}$ .

## PLATE VIII.

- Fig. 198. *Ophiobyrsa rudis*, below ;  $\frac{3}{4}$ .  
 Fig. 199. " " above ;  $\frac{3}{4}$ .  
 Fig. 200. " " arm-joints ;  $\frac{3}{4}$ .

- Fig. 201. *Ophiothamnus remotus*, below ;  $\frac{1}{2}$ .  
 Fig. 202. " " above ;  $\frac{1}{2}$ .  
 Fig. 203. " " arm-joints ;  $\frac{1}{2}$ .  
 Fig. 204. *Ophiacantha tuberculosa*, below ;  $\frac{1}{2}$ .  
 Fig. 205. " " above ;  $\frac{1}{2}$ .  
 Fig. 206. " *granulosa*, below ;  $\frac{1}{2}$ .  
 Fig. 207. " " above ;  $\frac{1}{2}$ .  
 Fig. 208. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 209. *Ophiomitra plicata*, below ;  $\frac{1}{2}$ .  
 Fig. 210. " " above ;  $\frac{1}{2}$ .  
 Fig. 211. " " a single upper arm-spine ;  $\frac{1}{2}$ .  
 Fig. 212. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 213. " *dipsacos*, below ;  $\frac{1}{2}$ .  
 Fig. 214. " " above ;  $\frac{1}{2}$ .  
 Fig. 215. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 216. " *Sarsii*, below ;  $\frac{1}{2}$ .  
 Fig. 217. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 218. *Ophiocamax vitrea*, below ;  $\frac{1}{2}$ .  
 Fig. 219. " " above ;  $\frac{1}{2}$ .  
 Fig. 220. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 221. " " one spine ;  $\frac{1}{2}$ .

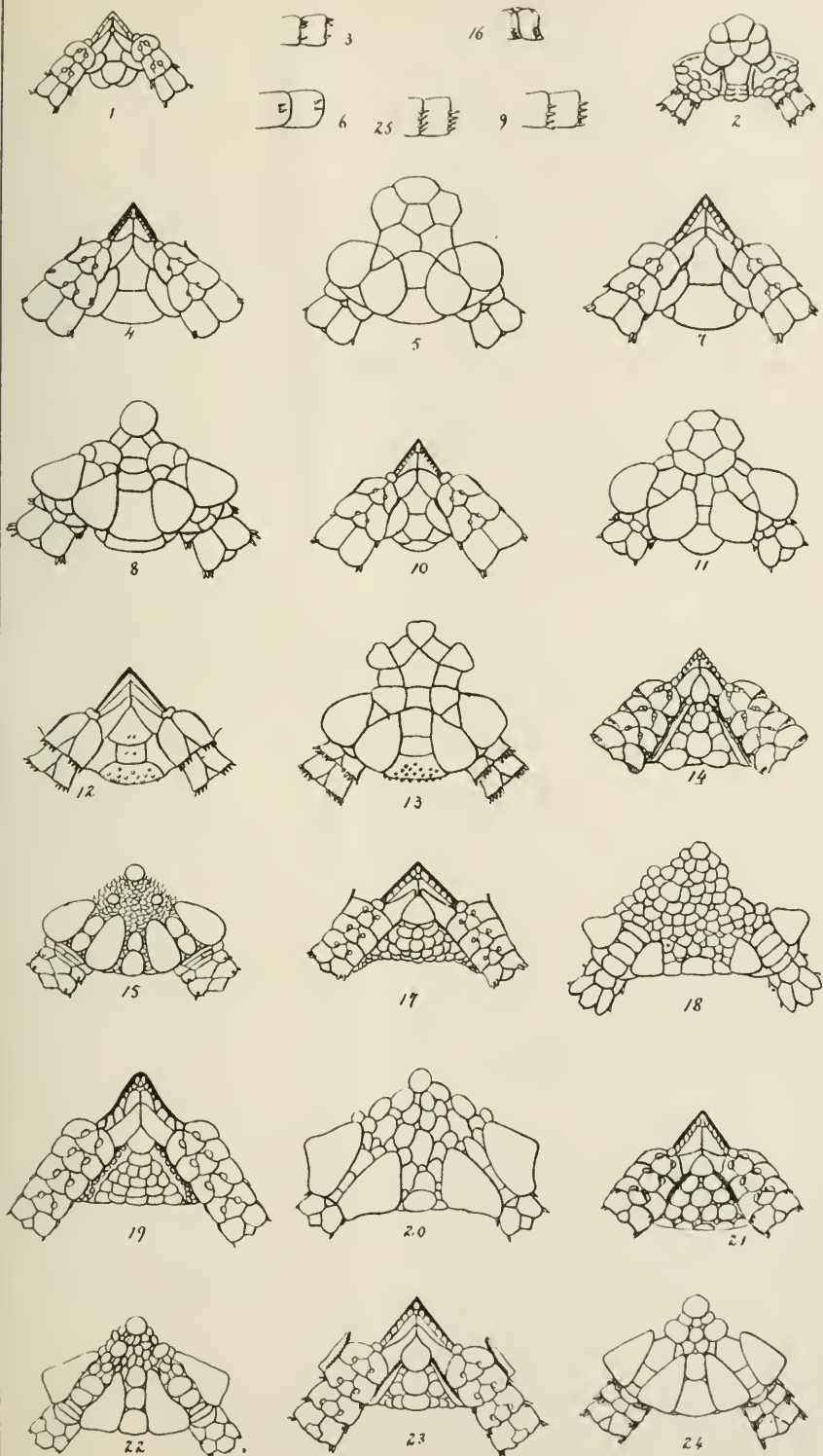
## PLATE IX.

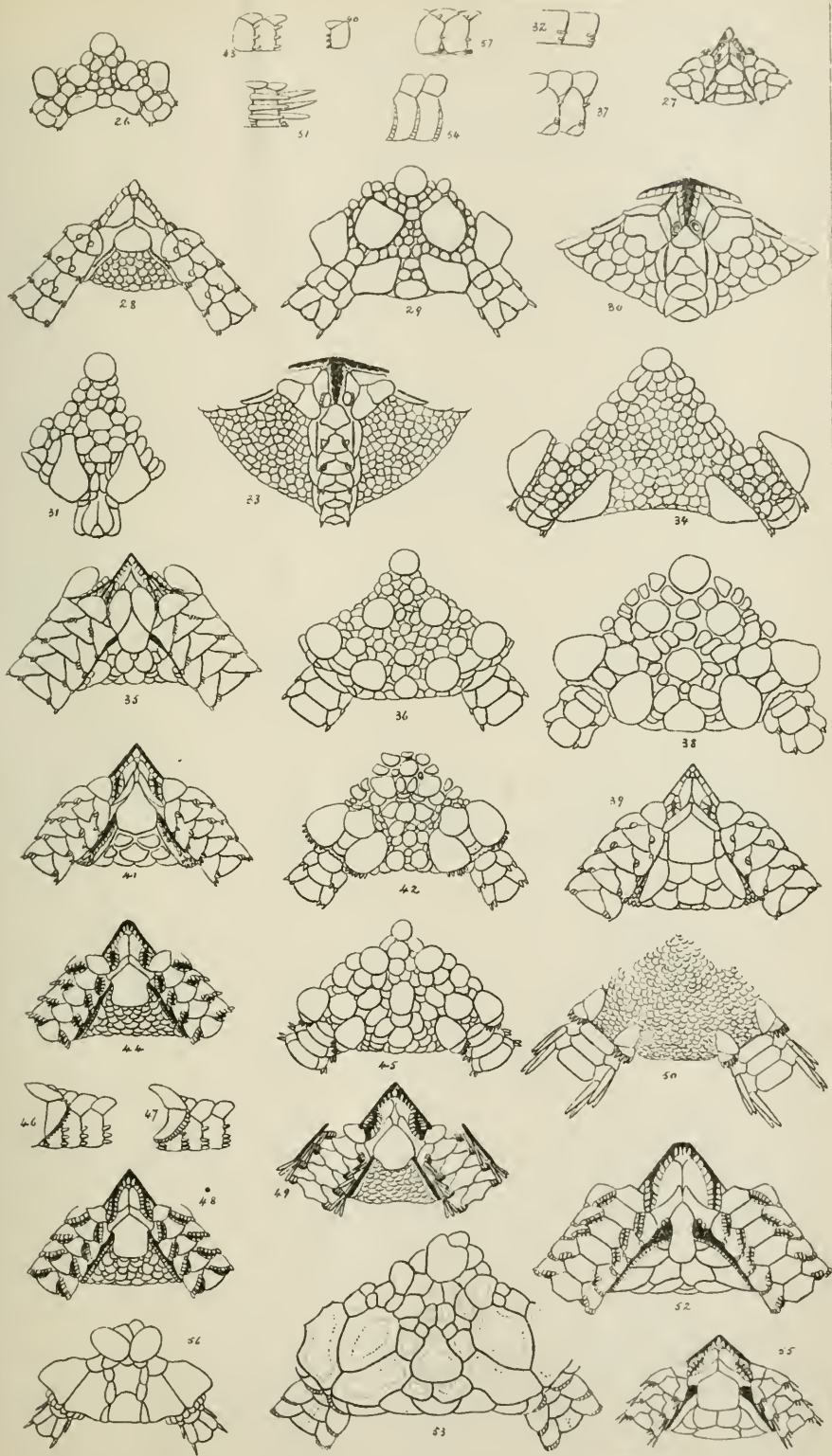
- Fig. 222. *Ophiacantha Troscheli*, below ;  $\frac{1}{2}$ .  
 Fig. 223. " " above ;  $\frac{1}{2}$ .  
 Fig. 224. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 225. " *stimulea*, below ;  $\frac{1}{2}$ .  
 Fig. 226. " " above ;  $\frac{1}{2}$ .  
 Fig. 227. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 228. " " single disk-spine ;  $\frac{1}{2}$ .  
 Fig. 229. " *sentosa*, below ;  $\frac{1}{2}$ .  
 Fig. 230. " " above ;  $\frac{1}{2}$ .  
 Fig. 231. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 232. " " disk-spines stripped of skin ;  $\frac{1}{2}$ .  
 Fig. 233. *Ophiomitra plicata*, (young) below ;  $\frac{1}{2}$ .  
 Fig. 234. " " " above ;  $\frac{1}{2}$ .  
 Fig. 235. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 236. " *carduus*, below ;  $\frac{1}{2}$ .  
 Fig. 237. " " above ;  $\frac{1}{2}$ .  
 Fig. 238. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 239. " *chelys*, below ;  $\frac{1}{2}$ .  
 Fig. 240. " " above ;  $\frac{1}{2}$ .  
 Fig. 241. " " spine diagram ;  $\frac{1}{2}$ .  
 Fig. 242. *Ophiocamax vitrea*, (young) below ;  $\frac{1}{2}$ .  
 Fig. 243. " " " above ;  $\frac{1}{2}$ .  
 Fig. 244. " " " spine diagram ;  $\frac{1}{2}$ .

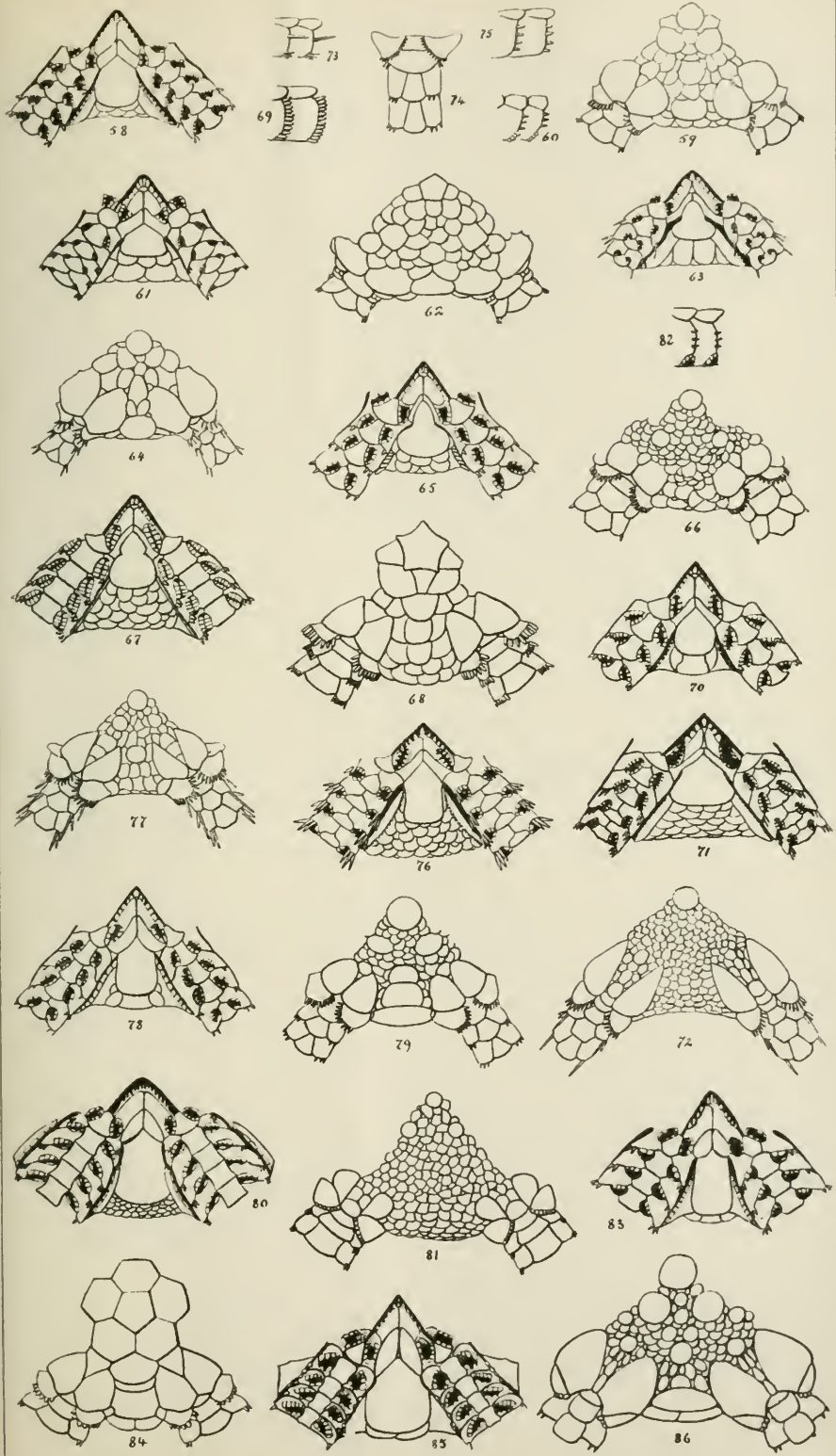
## PLATE X.

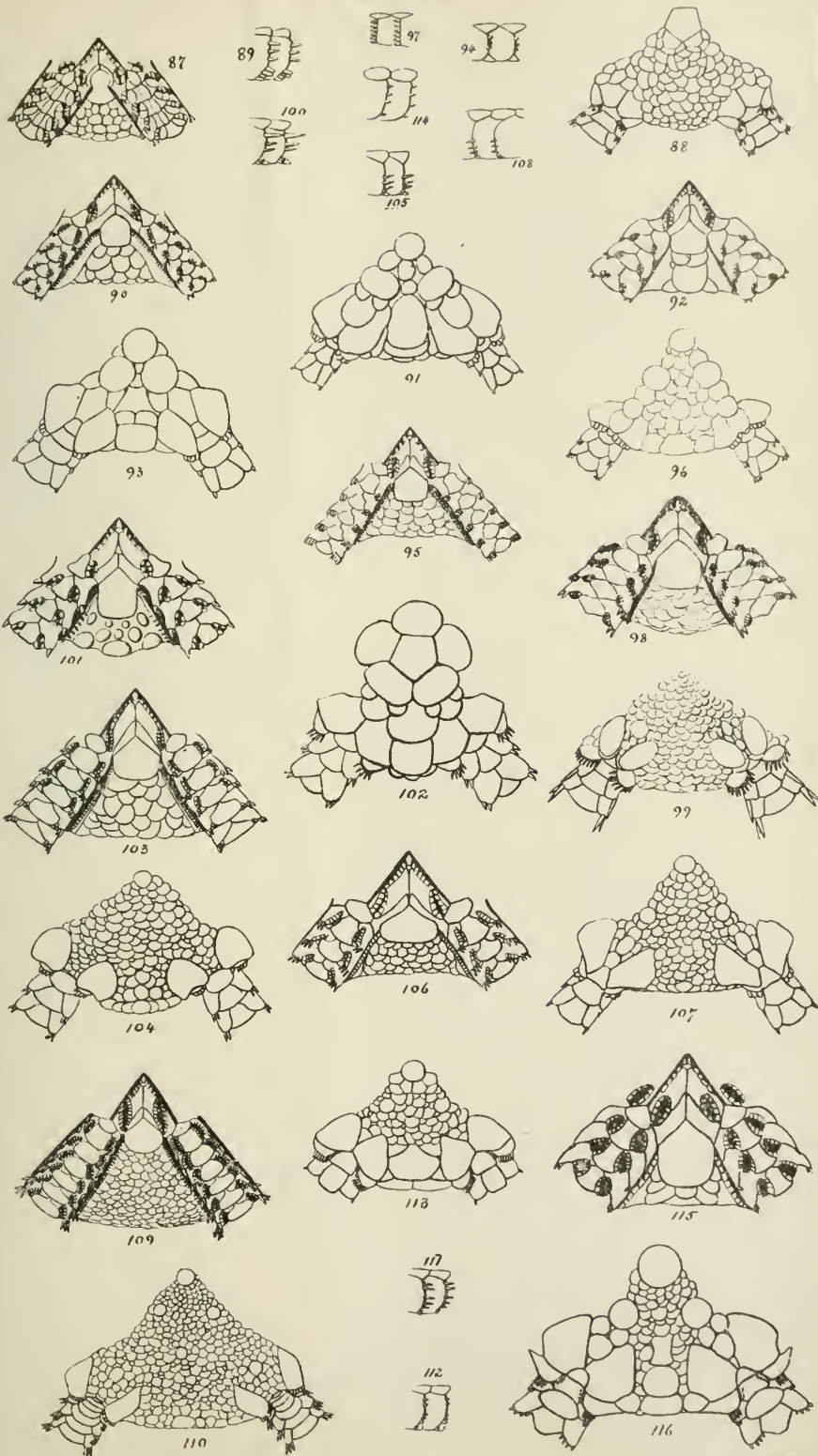
- Fig. 245. *Ophiacantha vepratice*, below ;  $\frac{5}{4}$ .  
 Fig. 246. " " above ;  $\frac{5}{4}$ .  
 Fig. 247. " " spine diagram ;  $\frac{5}{4}$ .  
 Fig. 248. " *cuspidata*, below ;  $\frac{5}{4}$ .  
 Fig. 249. " " above ;  $\frac{5}{4}$ .  
 Fig. 250. " " spine diagram ;  $\frac{5}{4}$ .  
 Fig. 251. " *cosmica*, below ;  $\frac{2}{3}$ .  
 Fig. 252. " " above ;  $\frac{2}{3}$ .  
 Fig. 253. " " spine diagram ;  $\frac{2}{3}$ .  
 Fig. 254. " " disk-spine ;  $\frac{2^A}{1}$ .  
 Fig. 255. *Ophiolobes vestitus*, below ;  $\frac{4}{3}$ .  
 Fig. 256. " " above ;  $\frac{4}{3}$ .  
 Fig. 257. " " arm-spine ;  $\frac{8}{7}$ .  
 Fig. 258. *Ophiacantha nodosa*, below ;  $\frac{8}{7}$ .  
 Fig. 259. " " above ;  $\frac{8}{7}$ .  
 Fig. 260. " " disk-spine stripped of skin ;  $\frac{6^0}{7}$ .  
 Fig. 261. " " an upper arm-spine ;  $\frac{2^0}{1}$ .  
 Fig. 262. " *cosmica*, spine diagram ;  $\frac{7}{4}$ .  
 Fig. 263. " " disk-spine ;  $\frac{3^B}{1}$ .  
 Fig. 264. " " spine diagram ;  $\frac{7}{4}$ .  
 Fig. 265. " " disk-spine ;  $\frac{3^B}{1}$ .  
 Fig. 266. " *cornuta*, arm-joints ;  $\frac{7}{4}$ .  
 Fig. 267. " *rosca*, arm-spines ;  $\frac{4}{3}$ .  
 Fig. 268. " " an under and a side arm-plate ;  $\frac{4}{3}$ .  
 Fig. 269. " *cosmica*, a mouth-angle ;  $\frac{5}{4}$ .  
 Fig. 270. " " arm-spine ;  $\frac{1^0}{1}$ .  
 Fig. 271. " *segesta*, arm-spines ;  $\frac{1^0}{1}$ .  
 Fig. 272. " *serrata*, arm-spines ;  $\frac{5}{4}$ .  
 Fig. 273. " " disk-grain ; much enlarged.  
 Fig. 274. " *longidens*, a mouth-angle and two under arm-plates ;  $\frac{1^0}{1}$ .  
 Fig. 275. " *imago*, arm-spines ;  $\frac{4}{3}$ .  
 Fig. 276. " " disk-grain ;  $\frac{1^0}{1}$ .  
 Fig. 277. " *levispina*, arm-joint ;  $\frac{4}{3}$ .

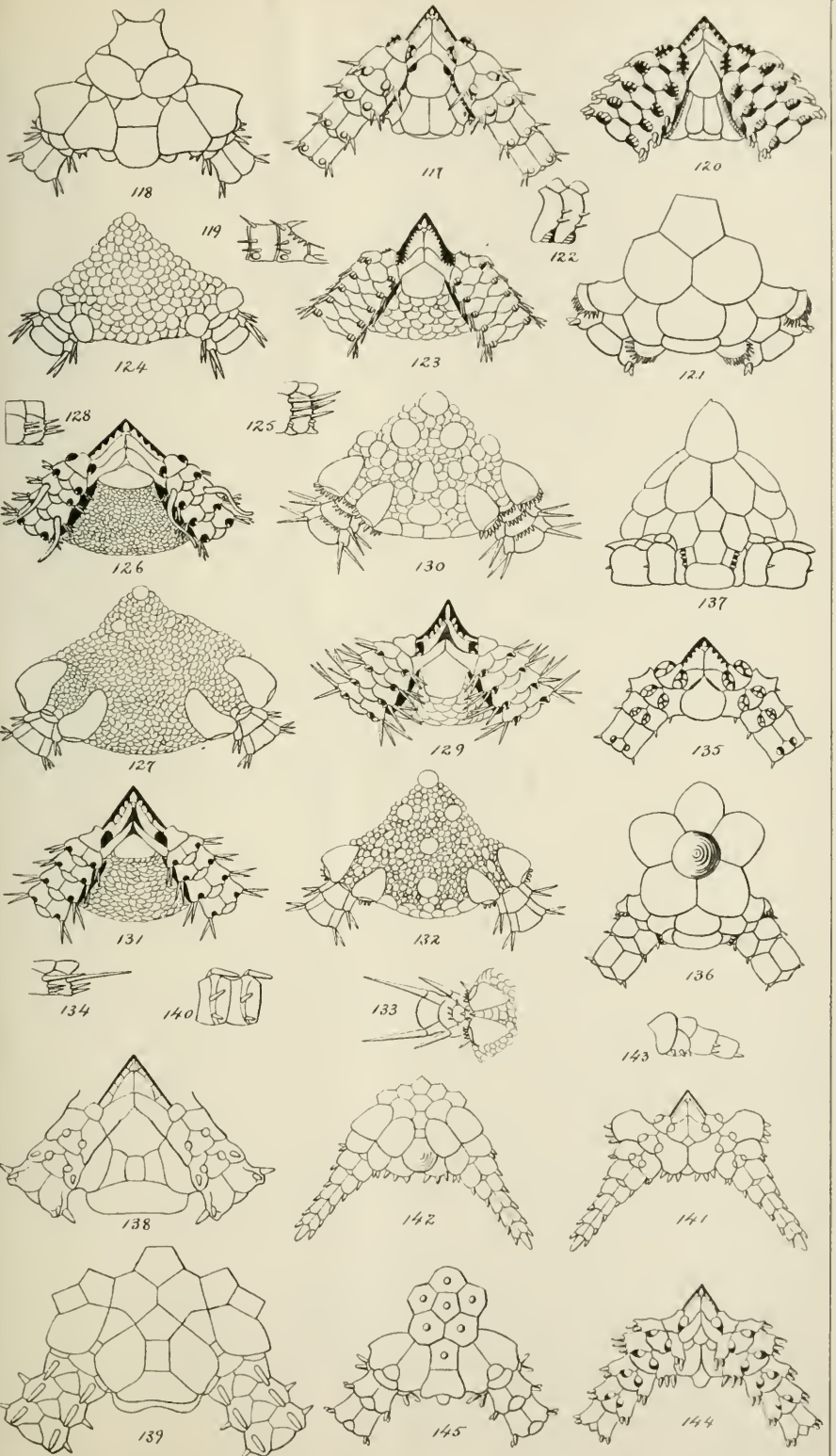


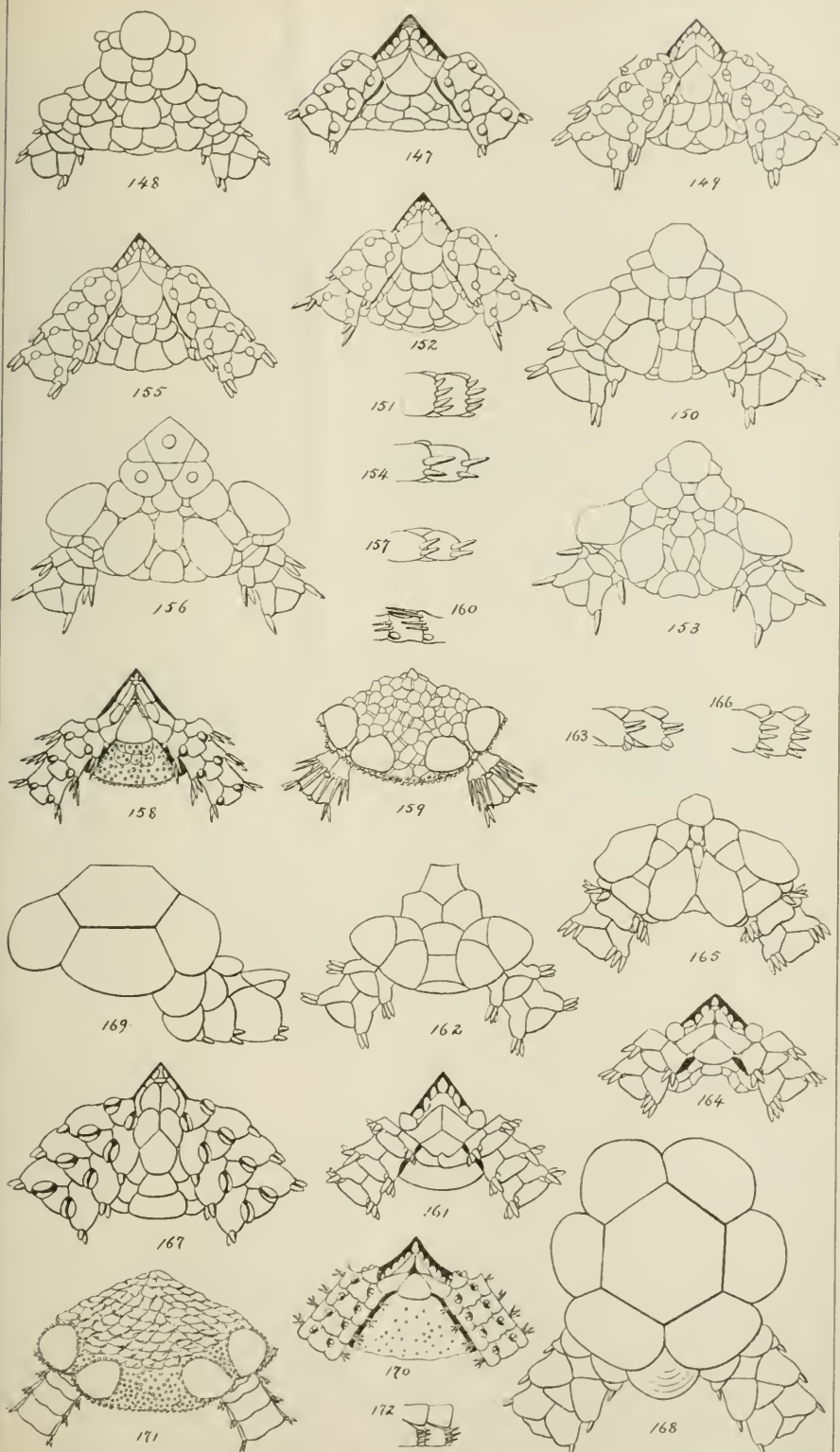


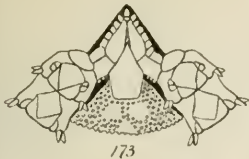




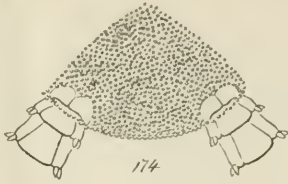




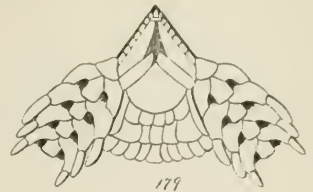




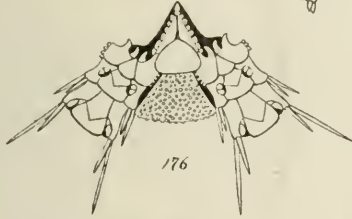
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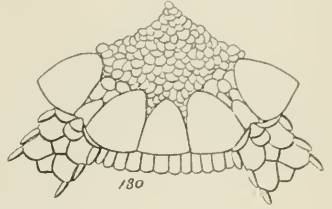
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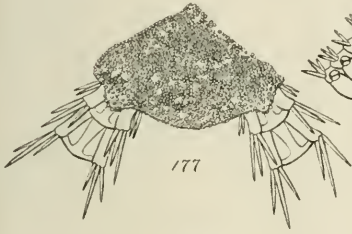
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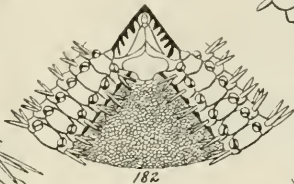
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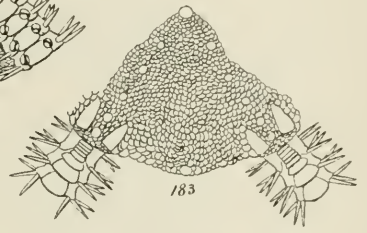
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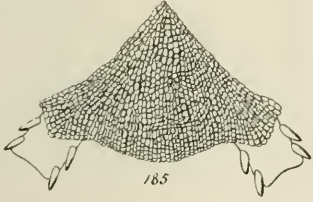
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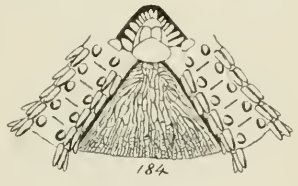
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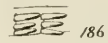
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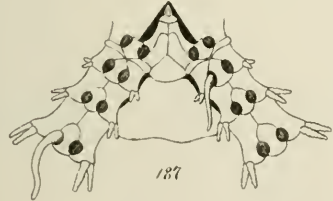
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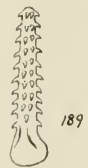
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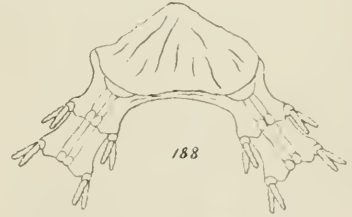
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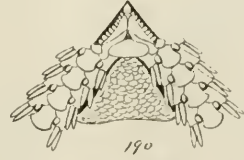
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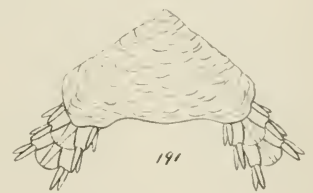
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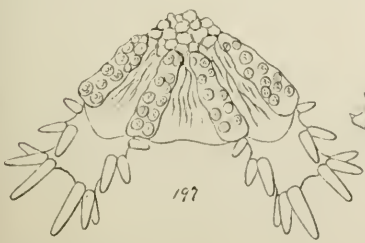
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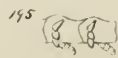
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