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## OPHIUROIDEA COLLECTED IN THE PERU-CHILE TRENCH BY THE USNS "ELTANIN" DURING CRUISE III

LUIZ ROBERTO TOMMASI

### ABSTRACT

*During the year 1962 a series of benthic collections was made in the Peru-Chile Trench by the USNS "Eltanin". These samples contained seventeen ophiuroid species of which the following 9 are new: Ophiothamnus dupla, Ophiacantha savagica, Amphilepis nuda, Ophoernus barracloughi, Gymnophiura concava, Ophiomastus bulufonica, O. tuberculata, Anthophiura dilatata, Theodoria madseni. The collection includes unidentifiable juveniles of at least nine other species.*

### INTRODUCTION

One of the chief purposes of USNS "Eltanin" Cruise III was to obtain samples of the Peru-Chile Trench fauna in order to determine its relationship to the abyssal Antarctic fauna. Prior to the cruise some collections were made by the Lamont Geological Observatory with R/V "Vema" in 1957/58 (Menzies, 1963: 186). In the neighborhood of that region some samples were gathered by H. M. S. "Challenger" and by "Albatross" (Tables 2 and 3).

The gear employed by the "Eltanin" was a 10-feet double beam trawl, a one meter biological trawl, a Phleger corer and a "Ewing-Thorn corer" (Menzies, 1963: 187).

Bottom photographs (Goodell, 1965, pl. I, Fig. 3-1 and 3-2), were taken in the center of the trench west of Trujillo (8°18'S-81°05'W) at 4,225 m depth, and on the eastern slope SW of Lima (13°06'S-77°58'W) at 2,377 m depth. A more sparse benthic fauna is shown in the second group of photos than in the first, but a small suite of photos is not a sufficient basis for drawing conclusions about differences between the fauna of both areas.

Menzies (1963: 197-200) had previously observed that no Antarctic species was found in the trench and tentatively concluded that its fauna (as far south as 25°S) is chiefly composed of cosmopolitan genera and species of low latitudes. One of the most typical cold water isopod genera, *Serolis*, was not found. He concluded that the bottom water is about 0°C temperature and hence is not of Antarctic origin.

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Instituto Oceanográfico, Universidade de São Paulo.

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According to Menzies (1966: 253) the results obtained from the work performed by R/V "Anton Bruun" on the "Milne Edwards Deep" suggest a strong zonation of the abyssal fauna, in spite of the absence of temperature modifications. Such conclusion was based on the photographic analysis and sample taken in a trawl at 500 m interval on the trench walls and floor. Its fauna appears to be richer than that from other trenches, with large populations of *Peniagone* (Holothurioidea) and *Eremicaster* (Asteroidea).

In the present samples I encountered many juvenile specimens and it is often impossible to refer them to known species.

The studied material is deposited in the collections of the University of Southern California, Los Angeles. The types (holotypes and syntypes) are deposited in the United States National Museum, Washington (USNM, E).

Table 1 shows the Ophiuroidea species collected by USNS "Eltanin" in the stations occupied in the Peru-Chile Trench.

#### LIST OF SPECIES AND STATION AT WHICH THEY WERE COLLECTED

##### Ophiacanthidae Perrier, 1891

*Ophothamnus dupla*, sp. n. Station 30

*Ophiacantha savagica*, sp. n. Station 30

*sollicita* Koehler, 1922 (?) Station 48

*antarctica* Koehler, 1900, Station 48

##### Amphiuridae Ljungman, 1867

*Amphipholis dalea* (Lyman, 1879) Station 35, 37, 38, 43

*Amphiura serpentina* Lütken & Mortensen, 1899, Station 40

*Amphiura* sp. a Station 71 (young)

sp. b Station 50 (young)

sp. c Station 63 (young)

sp. d Station 30 (young)

Arms of non identified Ahphiurid Station 71 (young)

##### Amphilepididae Matsumoto, 1915

*Amphilepis nuda*, sp. n. Station 25, 50, 76

##### Ophiloleucidae Matsumoto, 1915

*Ophiernus seminudus* Lütken & Mortensen, 1899 Station 38

*barracoughi*, sp. n. Station 38

##### Ophiuridae Lyman, 1865

*Ophioplinthus brucei* (Koehler, 1908) Station 48

*Ophiura irrorata* (Lyman, 1878) Station 39, 43, 48, 50, 65

*Gymnophiura concava*, sp. n. Station 50

*Ophiomastus bulufonica*, sp. n. Station 30

*tuberculata*, sp. n. Station 30, 63

*Amphiophiura abscissa* Lütken & Mortensen, 1899, Station 30

*Anthophiura dilatata*, sp. n. Station 63

*Theodoria*, sp. n. Station 50 (young)

*Theodoria madseni*, sp. n. Station 48

*Ophiuroglypha* sp. Station 63 (young)

*Ophiocten* sp. a Station 75 (young)

*Ophiocten* sp. b Station 30 (young)

Non-identified young Ophiuridae Station 25, 30, 48, 50, 65, 68 (young)

## SYSTEMATICS

***Ophiothamnus dupla*, sp. n.**

(Figs. 20-23)

Type locality. Station 30 "Eltanin".

Diagnosis Disk covered with well developed scales, some of which bear long and pointed spines with marginal denticles. Radial shields narrow, united lengthwise, a little longer than half disk length. Distal brachial spines transformed into hooks.

Disk. Subpentagonal, 2 mm in diameter with radial depressions. Radial shields deeply sunken. Interradial region convex. Well developed dorsal scales, particularly the interradians primary scales evident. Some dorsal scales of the disk have an elongated spine, vitreous, with sharply pointed marginal denticles. Some spines occur on the disk margin, but are smaller than those of the dorsal side. Interradial ventral areas devoid of spines, broad clearly separated from the arms and jaw, covered with well developed polygonal scales. Radial shields narrow, their length more than one half of the diameter.

Oral and adoral shields forming an elevated ring. Oral shields small with concave distal margin. Adoral shields connected anteriorly and separated completely from lateral plates of arms. They are short, broad, and sub-prismatic. First ventral plate of arms well developed, sub-prismatic, elongated.

Three oral papillae on each side of the jaw, of which the distal is almost twice as large as the proximal. Inside the mouth is another papilla which is more elongated and sharpened. One strong sub-triangular infradental papilla.

Arms. Broken, probably 5-6 times the disk diameter, thin and elongated. Dorsal and ventral plates are visibly separated by lateral plates. Ventral plates decrease sharply along the arm; they are placed on median distal margin of laterals. Plates triangular, except on the first free segment of arms where they are flabelliform. Dorsal plates of arms sub-flabelliform, sub-elliptical. Their size decreases towards extremity of arms, but they are shorter than ventral plates. Four brachial spines tapering and elongated. Superior spine is the largest one, almost as long as one and a half arm segment. The interior spine smaller than one half of segment in length. Towards the distal extremity of arm ventral spines tend to be transformed into a hook, with a well developed set of denticles. One well developed, flattened, sub-lanceolate tentacular scale on each tentacular pore.

Color. Specimens preserved in alcohol are whitish.

Occurrence and material examined. Station 30, 6 specimens. (USNM, E 11367, syntypes).

Discussion. The present specimens differ from the known species of *Ophiothamnus* Lyman, 1869 (*O. vicarius* Lyman, *O. remotus* Lyman and *O. affinis* Ljungman, *O. chariis* Clark, *O. longibrachius* Clark, *O. otho* Clark, and *O. venustus* Matsumoto) in having their radial shields united lengthwise, better development of the dorsal scales of the disk and transformation of the distal brachial spines into a hook. Although

*Ophiiothamnus remotus* Lyman, 1878 has the radial shields united, it differs completely from the present species (see Lyman, 1878, pl. XIV. 1-3).

***Ophiacantha savagica*, sp. n.**

Type locality. Station 30, "Eltanin".

Diagnosis. Five arms. Adoral shields, short and broad. Oral shields with slight median pointed in the anterior margin and with curved distal margin. Three stout papillae on either side of the jaw. Four brachial spines, of which the upper one is smooth, longer than an arm segment; median spines with well developed denticles.

Disk. Pentagonal, 4 mm in diameter, covered by small spines. Radial shields narrow, conspicuously separated distally. Interradial ventral region of disk very narrow, with several spines similar to those on dorsal side. Oral shields slightly elongated with proximal margin slightly pointed medially and distally margin curved. Adoral shields short and broad, not separating oral shield from adjacent lateral plates. Jaw with a conspicuous median depression. One strong lanceolate infra-dental papilla on jaw apex. Three strong and blunt oral papillae on either side of mandible. Distal papilla is slightly longer than proximal. First ventral arm plate subpentagonal or sub-hexagonal.

Arms. Broken in specimen examined. Ventral plates sub-rhombic, broader than long. First ventral plate hexagonal with concave proximal margin. One spiniform tentacular scale. Four brachial spines, of which the uppermost is the longest, its length greater than one arm segment. Median spines stouter than upper spines, with lateral denticles. Dorsal arm plates flabelliform.

Color. Whitish in alcohol.

Discussion. As shown in Tables 1 to 3 the following species of *Ophiacantha* are found in the neighborhood of the Peru-Chile Trench: *O. phragma* Ziesenhenné, 1940; *O. marsupialis* Lyman, 1878; *O. vivipara* Ljungman, 1870; *O. inconspicua* Lütken & Mortensen, 1899; *O. setosa* Lyman, 1878, *O. sollicita* Koehler, 1922, *O. cosmica* Lyman, 1878, and *O. rosea* Lyman, 1878.

*Ophiacantha savagica* differs from *O. vivipara* Ljungman, 1870 in having fewer arms (6-7 in *vivipara*). It differs chiefly from the other species in the area in having fewer branchial spines: *savagica*, sp. n. (4), *rosea* Lyman, 1878 (11), *cosmica* Lyman, 1878 (8), *phragma* Ziesenhenné, 1940 (7-8), *setosa* Lyman, 1878 (7), *inconspicua* Lütken & Mortensen, 1899 (6-8) and *sollicita* Koehler, 1922 (8).

*Ophiacantha setosa* Lyman, 1878, also differs from the present species in having 9-11 oral papillae on each side of the jaw.

*Ophiacantha marsupialis* Lyman, 1878 has three brachial spines but differs from *O. savagica* in having 11 oral papillae on either side of the jaw.

*Ophiacantha inconspicua* Lütken & Mortensen, 1899 has three oral papillae on either side of the jaw, and well developed tentacular scales, but differs from *O. savagica* in the shape of the jaw, the tentacular scale well developed, the shape of the oral and adoral plates and the larger number of brachial spines (6-8).



From the Chilean species *O. iquiquensis* Castillo Alarcón, 1968 it differs in the shape of the oral and adoral shields, of the oral papillae, ventral arms plates.

From the Antartic species *O. paramoedeae* Hertz, 1927 it differs in having shorter disk spines, narrower ventral interradiar areas. It is dedicated to Prof. Dr. Jay Savage.

Occurrence and material examined. Station 30, 1 specimen. (USNM, E 11368, holotype).

***Ophiacantha sollicita* Koehler, 1922 (?)**

(Fig. 1)

*Ophiacantha sollicita* Koehler, 1922: 14, pl. LXXIX, figs 1-3.

Type locality. Marie Island (66°07'S — 65°46'W).

Observations. The specimens examined are badly damaged but the jaw, arms, and dorsal spines are similar to those of this species.

Deographical distribution. This species was collected only by the Australasian Antarctic Expedition, near Marie Island. With the present record its geographical and bathymetric distribution is much broadened.

Bathymetric distribution. From 2,376 to 4,004 m depth.

Occurrence and material examined. Station 48, 1 specimen.

***Ophiacantha antarctica* Koehler, 1900**

(Figs. 2, 3)

*Ophiacantha antarctica* Koehler, 1901: 34, pl. 10, figs. 23-25 (non *Ophiacantha antarctica* Lyman).

*Ophiacantha disjuncta* Koehler, 1911: 48, pl. VI, figs. 9-11, pl. VII, fig. 13; Hertz, 1927: 38, pl. VII, fig. 5; Mortensen, 1936: 252-254, fig. 7. Type locality. 70°71'S — 48°W.

Geographical distribution. According to Fell (1961: 32-34) this species is circumpolar antarctic, occurring only south of the Antarctic circle.

Bathymetric distribution. From 90 to 1,400 m depth.

Observations. Fell (1961) discussed the synonymy of this species and verified it to be most abundant ophiuran at Ross Sea. Seafloor photographs taken in that region show that one third of the total biomass is composed of ophiurans, most of which are *O. antarctica*.

For the first time this species is recorded from north of the Antarctic circle.

Occurrence and material examined. 39 specimens from Sta. 48.

***Amphioplus dalea* (Lyman, 1879)**

(Figs. 4, 5)

*Amphiura dalea* Lyman, 1879: 27, pl. XII, figs. 320-322; Lyman, 1882: 137-138, pl. XVII, figs. 11-13; Lütken & Mortensen, 1899: 154-155, pl. XII, figs. 8-12.

*Amphioplus dalea*; Clark, 1915: 253.

Type locality. 36°44'S — 46°16'W.

Geographical distribution. This species was collected for the first time by H. M. S. "Challenger" — (Station 325) at 36°44'S — 46°16'W, off the La Plata River. Lütken & Mortensen (1899: 154-155) described

"Albatross" material from 10°14'N — 96°28'W and 6°10'N — 83°6'W. Clark (1915: 253) mentions the following localities: off La Plata River; Gulf of Panama, Lower California (SW of Madalena Bay).

Bathymetric distribution. From 2,690 to 4,845 m.

Observations. Lütken & Mortensen (1899) observed some differences between their specimens and Lyman's (1879): chiefly in the ventral plates of the arms, primary scales and number of brachial spines.

In the present material only 3 brachial spines occur of which the median is the stoutest one, and in one of the specimens it is about one half longer than the others. The tentacular scales are rare and small. The number of oral papillae varies from 3 to 5. The specimens examined by Lütken & Mortensen were larger than those examined by Lyman and the disks diameter reached 15 mm. In the present material the largest of them has a disk 15 mm diameter. The main differences between the present specimens and those of Lütken & Mortensen are the number of brachial spines, shape of the arms dorsal plates, number of oral papillae and the presence of tentacular scales only in one or two pores of the arm base. But if the characters given by Lyman (1882: 137) as diagnostic of *A. dalea* are to be considered valid, I have no doubt the present specimens belong to that species. The jaw is much more in accordance with Lyman's figures than with Lütken & Mortensen's.

Occurrence and material examined. Station 35 — 2 specimens; Station 37 — 198 specimens; Station 38 — 2 specimens; Station 43 — 3 specimens.

#### ***Amphiura serpentina* Lütken & Mortensen, 1899**

(Figs. 26-28)

*Amphiura serpentina* Lütken & Mortensen, 1899: 143-145, pl. VIII, figs. 1-8, pl. IX, fig. 12; Clark, 1915: 232.

Observations. According to Lütken & Mortensen (1899, pl. VIII, figs. 1-8; pl. IX, fig. 12) this species is quite variable in morphological characters. The smaller specimen here examined resembles specimens illustrated by Lütken & Mortensen (1899: 145, pl. VIII, figs. 6-8) in the shape of the brachial spines, mandible and radial shields. The disk of the larger specimen examined is 12.5 mm in diameter and its arms are about 6 times as long as the disk diameter. The disk of the smaller specimen is 8 mm in diameter, the jaw being broader, the oral papillae stronger and the tentacular scales larger, the gonads have ovules up to 0.5 mm in diameter.

Geographical distribution. 21°15'N — 106°23'30"N — 100°3'W; 7°31'30"N — 79°14'W; 7°15'N — 70°36'W; 7°21'N — 79°35'W; 0°57'30"S — 89°3'30"W.

Bathymetric distribution. From 770 to 1,865 m depth.

Occurrence and material examined. Station 40, 2 specimens.

#### ***Amphiura* sp. (a)**

These are two young specimens with disk diameter of 1 and 2 mm. The larger one closely resembles the Chilean species *A. benthica* Castillo Alarcón, 1965, as its primary scales are very conspicuous and well developed, occupying almost the whole dorsal region of disk; radial shields are in contact and dorsal plates of arms are separated by laterals. Single pair of infradental papillae elongated, sub-pyramidal; oral distal papillae slightly elongated and blunt, placed on margin of second pair of

tentacular pores; proximals are elongated, slightly conspicuous, blunt. There are no tentacular scales. *A. benthica* has one or two tentacular scales, but as the present specimens are juveniles, these scales may not have developed as yet.

Occurrence and material examined. Station 71, 2 specimens.

***Amphiura* sp. (b)**

Disk. Sub-pentagonal, 0.5 to 2 mm diameter. Center of dorsal region occupied by a centro-dorsal scale and by five broad, sub-hexagonal primary scales. Radial shields short, sub-triangular, more or less as broad as long, united for almost all their length and separated proximally only by one narrow triangular scale. Between each pair of radial shields and corresponding primary scale is a sub-pentagonal scale with curved distal margins. In interradial region is a large sub-triangular scale in contact proximally with primary scales and distally with two series of smaller marginal scales. Innermost of these series composed of 3 scales and outermost (which is marginal) of about 6 smaller scales. Interradial ventral covered with small imbricated scales. Oral shields anteriorly sharpened, with a curved distal margin. Elongated adoral shields united anteriorly. Jaw with one conspicuous median depression. Infradental papillae triangular, stout. Distal oral papillae spiniform, elongated, placed in margin of second pair of tentacular pores. Conspicuous oral anterior papilla blunt, slightly elongated.

Arms. Broken in specimen examined. Devoid of tentacular scales or sometimes with a small tentacular scale. Three brachial spines, tapering, not much elongated. Ventral plates of arms with distal margin narrower than proximal. Tentacular pores located in two lateral depressions, not obliterated distally. Dorsal plates of arms sub-flabelliform about as broad as long, proximal margin tapering and distal margin curved. Plates separated from each other by lateral arm plates.

Color. Specimens preserved in alcohol are whitish.

Discussion. The present specimens are certainly young. I was unable to determine them as any of the known species of this genus.

Occurrence and material examined. Station 50, 9 specimens.

***Amphiura* sp. (c)**

Disk. Radial shields about four times as long as wide, pointed anteriorly and each touching the next one at the distal border. Proximally they are separated by a row of scales. Their length is a little less than half the disk diameter. Oral shields sub-oval, more or less as wide as long. Very strong adoral shields, sub-triangular. Distal oral papilla stout, elongated; internal papilla stout and blunt. Short jaw with a median depression. Infradental papillae well developed, strong, variable in shape.

Arms. Ventral arm plates suboctagonal, with a small tentacular scale; dorsal arm plates sub-flabelliform. Three or four brachial spines; towards the arm extremity, with a small denticle on the apex of each spine.

Observations. The specimen is badly damaged. The radial shields are similar to those of *Amphiura serpentina* Lütken & Mortensen, but there are (fewer or more?) tentacular scales. The shape of the adoral shields resembles that of *Amphiura brevipes* Lütken & Mortensen but

this species is devoid of tentacular scales and the ventral plates of the arms have a different form. In Station N.º 30, I found 2 damaged specimens very much similar to the present.

Occurrence and material examined. Station 63, 1 specimen.

**Amphiura** sp. (d)

Observations. The specimen is badly damaged and comprises only two arm fragments, one jaw and half of another. It has only one well developed tentacular scale. The oral distal papilla is subelliptic and very stout, wide, sub-lanceolate. This specimen is similar to *Amphiura profundus* Lütken & Mortensen.

Occurrence and material examined. Station 30, 1 specimen.

NON-IDENTIFIED AMPHIURIDAE

Material from Station N.º 71 included several arms of two different amphiurid species. One has one tentacular scale and three brachial spines and the other larger arms, two tentacular scales and three compressed brachial spines. In the later species, some of the median brachial spines terminate in two small lateral denticles, which resemble the brachial spines of *Amphiodia ascia* Mortensen, 1936.

**Amphilepis nuda**, sp. n.

(Figs. 6, 7)

Type locality. "Eltanin" Station N.º 50.

Diagnosis. Without tentacular scales. First ventral plates of arms longer than broad. Remainder subhexagonal or as broad as long, or slightly longer than broad. Ventral interrational scales of disk barely contiguous.

Disk. Circular or pentagonal, 2-9 mm in diameter. Dorsal scales circular to polyhedral, slightly swollen in some specimens. Radial scales larger than interrational. Primary scales arranged in a circle, the scales broader than long; centrodorsal well developed, circular. Between centrodorsal and primary scale is a ring formed by five subpentagonal scales, interlain with smaller and sub-rectangular ones. Between each primary scale and the centrodorsal there are also two trapezoidal interrational, whose larger base is proximal. Those scales are separated by 2 or 3 others well developed, of which the outermost is prism shaped and the innermost sub-trapezoidal. Marginal imbricating scales smaller than the other disk scale. Radial shields broadened distally, tapering proximally, with concave external margin; shields contiguous distally but proximal two-thirds by about 3 elongated scales. Ventral interrational region of disk (specimens from Station 25) covered by small scales interrational area in remainder (Station 50, 76) naked or with scattered scales. Oral shield wider than long, pointed proximally, rounded distally. Sometimes one is broader than the other. Short and wide jaw, teeth and infradental papilla sub-lanceolate. Elongate anterior oral papillae about one third shorter than posterior papillae. Both have small denticles on outer margin. Smaller individuals have infradental papilla on jaw apex; a larger specimen (Station 50) has oral anterior papillae in such position.



Arms. Broken on specimen examined. Ventral plates of arms as long as broad, or slightly longer than broad. Large tentacle devoid of tentacular scales occupies convexity on each side of ventral plate. The second pair of tentacular pores located between adoral shields, first ventral plate of arms and mandible. First ventral plate of arms elongated. Arms with three spines of which the uppermost is smaller; median spine largest and strongest.

Dorsal plates of arms separated from each other by a lateral plate. First dorsal plate short and wide; remainder are sub-elliptic.

Color. Whitish in alcohol.

Discussion. *A. nuda* differs from other *Amphilepis* species which lack tentacular scales (*A. papyracea* Lyman, 1879, *A. ingolfiana* Mortensen, 1933, *A. scutata* Mortensen, 1933 and *A. mobilis* Koehler, 1904) in that the ventral plates of the arms are far more elongated. In this species the structure of these plates resembles very much that of *A. gymnopora* Hertz, 1927, but differs by lacking a tentacular scale on the second pair of tentacular pores and in the shape of the first ventral plate of the arms.

*A. platytata* Clark, 1911 resembles *A. nuda* in the shape of the first ventral arm plate, and in the absence of scales on the ventral interradial region. It differs from *A. nuda* in the separation of the ventral plates, in the lesser development of the first ventral arm plate of the arms and in the shape of the oral papillae.

Occurrence and material examined. Station 25, 12 specimens; Station 50, 1 individual; Station 76, 11 specimens (USNM, E 11369, holotype).

#### **Ophiernus** Lyman, 1878

Observations. The flattened arms, with wide ventral region and great development of the tentacular pores and radial shields give a very typical aspect to the species of this genus.

#### **Ophiernus seminudus** Lütken & Mortensen, 1899

(Figs. 8, 9, 37, 38)

*Ophiernus seminudus* Lütken & Mortensen, 1899: 105-108, pl. V, fig. 10-20; Clark, 1915: 347.

Type locality. 6°17'N — 82°5'W.

Geographic distribution. From 0°36'S to 10°14'N — 80°21'W to 96°28'W (Lütken & Mortensen, 1899, "Albatross"); Mexico, off Ecuador (Clark, 1915).

Bathymetric distribution. From 2,416 to 4,000 m depth.

Observations. The specimens are badly damaged, particularly the arms. I can observe in one of them the typical structure of the dorsal plates of this species, i. e., the first ones very small, not jointed to the lateral ones, leaving a naked space between them and the laterals. The disk structure agrees well with the description and figures by Lütken & Mortensen (1899), differing only in the shape of ventral plates of the arms which are more elongated on the present species than on the specimens of those authors. These differences do not seem to be sufficient to describe the specimens as a new species.

Occurrence and material examined. Two specimens at Station 38.

**Ophiernus barracloughi**, sp. n.

(Figs. 10, 11, 39-42)

Type locality. "Eltanin" Station n.º 38.

Diagnosis. Radial shields well developed, sub-triangular, covering more than half the dorsal region of the disk. Granules present on central dorsal of the disk and between the radial shields. Well developed tentacular arms pore. No pores on ventral plates.

Disk. Sub-pentagonal, 7.5 in diameter with depressed central region. Radial shields well developed, sub-triangular, with the curved proximal margin and a concavity on distal margin: they occupy more than half disk radius. Disk scales well developed, imbricated. Granules on central region, between radial shields. Ventral interrational region covered with scales similar to those on dorsal side. Oral shield with anterior margin curved and with small curved median expansion on distal side. Adoral shields very elongated, narrow proximally, wide distally. About 6 oral papillae on either side of jaw, of which distal papillae are sub-rectangular, proximal papillae elongated. A small triangular infradental papilla on apex of jaw. Well developed, spatulate teeth.

Arms. Broken in individual examined. Second pair of tentacular pores sublateral on distal ventral region of buccal notch, with about 5 tentacular scales, of which those on distal margin are largest. The number of tentacular scales decreases towards extremities of arms but they are always elongate, narrow. Large circular tentacular pores. Ventral plates very wide with a depression of the distal margin. Owing to condition of preservation brachial spines are very difficult to observe. Sub-pentagonal dorsal plates of arms with a median carina.

Color. Whitish in alcohol.

Discussion. This species resembles *Ophiernus polyporus* Lütken & Mortensen, 1899, but it differs by lacking the small pores on the ventral plates of the arms, a typical character of that species. This species is dedicated to Dr. H. Barraclough Fell.

Observations. Some species of Foraminifera were found in the intestine.

Occurrence and material examined. One individual at Station 38. (USNM, E 11370, holotype).

**Ophioplinthus** Lyman, 1878

Observations. At present three species form the genus *Ophioplinthus* Lyman, 1878, with the following geographical distribution:

*O. medusa* Lyman, 1878 — "Challenger" Station 156 — 62°26'S — 95°44'E — 2,610 m depth. "Valdivia" Station 152 — 63°16'S — 57°51'E — 4,636 m depth.

*O. grisea* Lyman, 1878 — "Challenger" Station 156 — 62°26,S — 95°E — 3,610 m depth. "Valdivia" Station 152 — 63°16'S — 57°51'E — 4,636 m depth.

*O. brucei* (Koehler, 1908) — "Scottia" 66°40'S — 40°35'W; 64°48'S — 44°26'W; 69°33'S — 15°19'W; from 4,00 to 4,400 m depth.

This genus is known from the Antarctic sector of the Indian Ocean (see CLARK, 1911: 21) and from Weddell Sea. The discovery of *O. brucei* in the Peru-Chile Trench considerably extends its area of distribution.

**Ophioplinthus brucei** (Koehler, 1908)

(Figs. 12, 13, 33-35)

*Ophioglypha brucei* Koehler, 1908: 582-583, pl. VIII, figs. 81-82.*Ophioplinthus brucei*; Cherbonnier, 1962: 5.

**Disk.** Pentagonal, disk diameter 8.5-15 mm. Primary scalles regularly well developed. Among them occur some smaller, irregular scales. Radial shields well developed, measuring about 1.75 times of disk radius. Shields of each pair separated from each other by several scales, of which the median is largest. Shields with distal margin broadened, truncated, and proximal margin elongated, pointed. On median dorsal interradiar margin of the disk is one narrow sub-triangular scale which is joined in their lateral margins with the radial shields. Between radial shields is a depression occupied by two small dorsal arm plates. Interradiar ventral region of disk covered with well developed, irregular scales. Oral shields irregular, sub-pentagonal, sometimes jointed with one large ventral scale, and sometimes with two to four small scales. Distal margins of shields generally truncate, sometimes slightly concave. Adoral shields narrow, elongated, proximally contiguous, their contour being generally irregular and with curved distal margin. Jaw with a depression, which occupies almost all its ventral surfaces. Five or six narrow, elongated, contiguous oral papillae. Distal papilla longest, proximal papilla shortest. Two proximal papillae on either side sub-pyramidal, located on apex of jaw.

**Arms.** About twice the disk diameter, pointed. Three or 4 first pairs of lateral arm plates are so stout that the part of the arm connected to disk is wider than the free one. First ventral arm plate sub-pentagonal or sub-oval with its base turned towards oral region. Second ventral plate is sub-rhombic, largest of all. Proximal margin slightly convex. Ventral plates separated from each other. Lateral plates well developed. First lateral plate wider than long. Dorsal arm plates sub-rhombic, with proximal half elongated bearing a small elevation on distal margin. First plates contiguous but soon afterwards become separated. Only three pairs of tentacular pores, of which the first one is well developed and others very small. Three brachial spines. Two ventral spines separated from the uppermost which is about twice as long as the other.

**Color.** Specimens preserved in alcohol show some light brown patches all over their bodies.

**Discussion.** The present specimens differ from Koehler's figures in structure of oral shield and shape of radial shields. But this variation is inside the morphological variation of Koehler's species.

**Observations.** The gonads and the digestive tract of the individuals examined were empty.

**Occurrence and material examined.** Station 48, 8 specimens.

**Ophiura** Lamarck, 1816

Matsumoto (1915; 1917) placed the genus *Ophiura* Lamarck, 1816 within the Ophiomastinae which are characterized by having the second tentacular pore placed outside the buccal notch. Within the subfamily he recognized two groups, one with the basal lateral plates much widened and the bursal notches very reduced or absent, and the other group with normal lateral plates and with quite conspicuous bursal notches. He considered Ophiomastinae as "an almost unbroken series

of paedomorphism of which the terminal members are such genera as *Astrophouri*, *Ophiophycis*, *Ophiomisidium*, *Ophiotypa*, *Ophiomastus*, *Anthophouri*, *Aspidophouri*, *Ophiopyrgus*, etc.... if I am right, the Ophiomastinae as well as *Ophiomusium* must have been derived from the other Ophiolepidinae by neoteny"...

*Ophiura* resembles very much *Amphiophiura* Matsumoto, 1915 and *Stegophiura* Matsumoto, 1915, mainly by the presence of arm-combs in all of them. *Amphiophiura* Matsumoto is quite different from *Ophiura* Lamarck by the great development of its oral shields and *Stegophiura* Matsumoto differs from *Ophiura* for the dimorphism and the large number of brachial spines.

***Ophiura irrorata* (Lyman, 1879)**

(Figs. 14-17, 43-48)

*Ophioglyphu irrorata* Lyman, 1878: 73; Lyman, 1882: 47, pl. V, figs. 7-9. *Ophiura irrorata*; Clark, 1911: 62-64; Matsumoto, 1917: 227-278; Koehler, 1922: 380; Clark, 1915: 320-321; Djakonov, 1954: 120-121, fig. 43; Madsen, 1955: 11.

Type locality. 36°48'S — 19°24'E.

Geographical distribution. Cosmopolitan at great depths (Clark, 1911: 63).

Bathymetric distribution. From 1,085 to 3,435 m depth.

Observations. It is quite possible that Madsen (1955: 11) is right and that this species might include several others. I believe that a good procedure is the analysis of the oral and dental plates (see Murakami, 1963). The statistical analysis of some morphometric characters would also be worthwhile.

This species and also *Ophiomusium lymani* W. Thompson, 1873 are the ophiurans of the widest known geographical distribution, corresponding in this particular to *Amphipholis squamata* (Delle Chiaje, 1928) and *Ophiactis savignyi* (Muller & Troschel, 1842) of the littoral tropical and subtropical fauna.

Occurrence and material examined. Station 30, 1 specimen. Station 43, 5 specimens. St. 48, 6 specimens (1 tetra-radiate). Station 50, 27 specimens. Station 65, 1 specimen

***Ophiura* sp.**

Disk. Sub-pentagonal, 0.5 to 2 mm in diameter. Central region occupied by a great sub-pentagonal centrodorsal scale, surrounded by primary sub-hexagonal scales. Outside circle formed by primary scales is another formed by 10 sub-triangular scales, 5 of which are radial, their proximal edges touching the primary scale and their distal edges separating proximally the radial shields. The other five are interradiat, their proximal edges placed between two primary scales and base, distal edges joined to a large sub-trapezoidal marginal scale. The latter has a median elongated depression. This scale connects to a series of three small ventro-lateral scales, which in turn connect to oral shield, placed in an oblique position. Small radial shields sub-triangular, with distal edge curved. Sub-pentagonal oral shields convex, with distal edge truncate and proximal edge pointed. Short adoral shields broader and contiguous anteriorly. One strong sub-triangular infradental papilla, on jaw apex and 3 or 4 oral papillae, of which 2 or 3 proximal



ones are small and sub-triangular. Distal papilla elongated, narrow. Jaw excavated medially.

Arms. Broken in specimens examined. Arm segment elongated. First and second dorsal plates initially sub-rhombic. They decrease sharply in size along the arm. Ventral plates sub-flabelliform, separated. First pair of tentacular pores with 4 or 5 tentacular scales, second with 3. Three small pointed spines.

Color. Whitish in alcohol.

Discussion. Undoubtedly the present specimens are young. I believe they belong to the genus *Ophiura* as they present no thick epidermis covering the disk scales, no granules or spines on the disk, second tentacular pores located outside the buccal notch, small and compressed brachial spines, the tentacular pores in more than three segments of the arms, flattened disk and a rudimentary arm-comb. I was unable to relate this species to any other already known in the genus.

Occurrence and material examined. Station 50, 6 specimens.

### ***Gymnophiura* Lütken & Mortensen, 1898**

Observations. From the discussions and figures of Lütken & Mortensen (1899), Hertz (1927), Mortensen (1933) and Fell (1960) I can verify that the main distinctive character of this genus, i. e., the presence of a thick epidermis, is lacking in many dried specimens, or does not exist at all! It seems that the combination of characters pointed out by Hertz (1927) could define far more correctly the species belonging to this genus: "with well developed tentacular pores only in the segments of the third basal part of the arms". The puzzle is that several species of *Ophiura* Lamarck would then fall in this definition of *Gymnophiura*!

The facts lead me to agree once more with Clark (1911: 36), that a revision of the genus *Ophiura* Lamarck is needed. The genus, besides being at present a vast one, with more than 100 species, evidently comprises quite distinct groups. This sometimes causes difficulty in placing correctly one species in this genus or the neighbouring genera, as in the case of *Gymnophiura* Matsumoto, 1915.

This problem arose with the specimen described below. The location of the second oral pore outside the buccal notch leads to its placement in the sub-family Ophiurinae Lyman, 1865 (=Ophiomastinae Matsumoto, 1915). The disk covered by naked scales and the absence of a thick epidermis removes it from *Gymnophiura* Lütken & Mortensen, 1897 and from *Ophiopleura* Danielssen & Koren, 1877. On the other hand on dried specimens of *Gymnophiura* the scales on the disk are neatly visible (see pl. VI, figs. 5, 8, 10 in Hertz, 1927, "Valdivia"). Besides this, the cylindrical and pointed arms, the presence of tentacular pore well developed only at the arm's base, the presence of an arm-comb definitely places the specimens in this genus. The tentacle-pores restricted to a few basal arm-joints, the disk distinctly higher than the arms, the arm-combs, the large primary plates resemble that of *Aspidophiura* Matsumoto, 1915, but this genus has only 3 arm-spines and 1 or no tentacle scales. There is one character which separates the present specimen from the known species of the genus *Gymnophiura*, namely the number of brachial spines. In the present individuals there are only 3 and in other species of *Gymnophiura* 5 to 7. They resemble closely the figures of *G. chuni* Hertz, 1927. Hertz (1927)

verified a relationship of this genus to the *Ophiocten* groups on the one hand and to *Amphiophiura* — *Ophiuroglypha* (= *Ophiura*) on the other hand.

***Gymnophiura concava*, sp. n.**

(Figs. 50-52)

Type locality. "Eltanin", Station n.º 50.

Diagnosis. Radial shields well developed about 1.75 times disk radius, swollen, separated by 2 to 3 globular scales of which proximal largest. Three to 4 rudimentary dorsal plates at arm base, of which only two are located on radial depression of disk. Centrodorsal scales evident. On marginal interrarial dorsal region of disk is an elongate curved scale, which joins laterally the swollen scales that surround radial shields and proximally with one smaller scale. Three small brachial spines.

Disk. Pentagonal, 7 mm in diameter, depressed dorsally in interrarial and concave ventrally. Disk scales well developed, swollen, large centrodorsal scales, circular, compressed. Radial shields well developed, their length about 1.75 times of disk radius, ovoid, separated by 2 to 3 swollen scales of which proximal is largest. Dorsal marginal interrarial joins laterally with swollen scales which surround radial shields. Proximally there is one scale also well developed, but smaller. Ventral interrarial scales of disk slightly irregular, swollen. Oral shield well developed, elongate, almost half length of ventral curved distally. Adoral shields narrow, contiguous anteriorly, joined distally with first lateral free plate of arms, which is inserted between oral shield and first ventral plate of arms. Eight to nine oral papillae at either side of jaw, of which those on apex are more elongated, blunt and strong. They progressively decrease in size becoming wider, apex curved. Two distal papillae elongated, narrow and contiguous. Teeth lanceolate.

Arms. Broken in specimen examined. First arm plate sub-rhombic, with lateral edges truncate obliquely. Second ventral plate subpentagonal, well developed, larger than third and articulated to first by means of a truncate edge, connecting to third by pointed distal margin. Ventral plates from fourth onwards separated from one another. First three dorsal arm plates rudimentary, subelliptical, scarcely swollen in distal margin. From there on the sixth plates, flabelliform, with proximal edge truncate. From seventh on their proximal region extends, becoming pointed, and usually from 14th-15th on they are separated from one another. Second pair of tentacular pores with 6 strong tentacular scales, free edge curved. Distal scale largest, almost double length of previous ones. There are 7-8 tentacular scales on 3rd pair of pores. After this tentacular pores very small, with only one tentacular scale. Three small brachial spines. Uppermost largest, middle spine progressively smaller.

Color. Whitish in the individual preserved in alcohol.

Discussion. Owing to the great resemblance of the present specimen to *G. chuni* Hertz, 1927 and *G. micracantha* (Clark, 1911) I am not sure to place this specimen in the genus *Gymnophiura*. It differs basically from those two species in the smaller number of brachial spines and by the larger and swollen scales located between the radial shields.

Occurrence and material examined. Station 50, 1 specimen. (USNM, E 11371, holotype).

**Ophiomastus bulufonica, sp. n.**

(Fig. 54)

Type locality. "Eltanin", Station N.º 30.

Diagnosis. Oral shield well developed, occupying more than half interradial ventral region of disk and articulated dorsally to one marginal scale. Dorsal arm plates very small. First plate elevated, sub-trapezoidal; remainder compressed, sub-triangular. Two brachial spines. Two small tentacular scales on all pores.

Disk. Circular to sub-pentagonal, 1.5 to 2.5 mm in diameter. Dorsal region completely covered by pentagonal centrodorsal plate and by other primary plates. There is one marginal interradial scale which joins dorsally with radial shields and ventrally with the oral shield. Oral shields sub-pentagonal, well developed, occupying more than half ventral interradial region of disk. In one of the largest specimens shields short, stout, conspicuously contiguous proximally. Oral shields touching lateral plates. Jaw elongate, with depression on median distal region. Oral papillae narrow, elongate, juxtaposed. Jaw apex with one small stout triangular infradental papilla. Smaller specimens with depressed buccal region.

Arms. About 1 ½ times the disk diameter. Ventral plates well developed only on first three segments. From then on plates reduced, widened distally, pointed proximally, with a lateral concavity. Well developed tentacular pores only on first three segments of arms. Two small stout slightly pointed tentacular scales. Distal scale slightly larger than proximal. Two small, pointed brachial spines. Dorsal plates of arms very small; first subprismatic, elevated, remainder sub-triangular, compressed.

Color. Whitish in alcohol.

Discussion. Fell (1960: 31) believes that some species of *Ophiomastus* are juveniles of other ophiuran species. This may be the case in the present species, for the broken oral shield of some specimens resembles that of some species of *Ophiurolepis* Matsumoto, 1915 and also of *Theodoria* Fell, 1961.

*O. bulufonica* resembles *O. bispinosus* Mortensen, 1925 in the number of brachial spines, but differs from it in having two tentacular scales on all its pores, and compressed dorsal arm plates. *O. admiral* Fell, 1958 has two brachial spines but differs from *O. bulufonica* in having only one sub-circular tentacular scale. *O. bulufonica* differs from *O. stellamaris* Fell, 1952 in having 2 brachial spines. It differs from *O. tegulitius* Lyman, 1878, as this latter species has a more elevated hemispherical disk and tentacle scales of a different structure.

Occurrence and material examined. Station 30, 10 specimens (USNM, E 11372, syntypes).

**Ophiomastus tuberculata, sp. n.**

Type locality. Station 30, "Eltanin".

Diagnosis. Centrodorsal scale conical, elevated. Two brachial spines quite separate from each other. One sub-circular tentacular scale.

Disk. Sub-circular, 1-2 mm in diameter. Dorsal region covered by elevated conical centrodorsal scale. Primary scales sub-pentagonal. Radial shields wide and short. One primary scale inserted between members of each pair of radial shields. Marginal region occupied by one en-



larged plate articulated ventrally to oral shield. Oral shield small, sub-trapezoid, more or less marginal. Adoral shields quite developed, broad distally and contiguous proximally. Oral papillae contiguous, not clearly observed. One stout and triangular infradental papilla on jaw apex.

Arms. About twice the disk diameter. Arm segments elongated, especially fifth segment. Ventral plates small, located on distal region of segment. Basals slightly enlarged. Pores evident only on first four arm segments; pores with one sub-circular tentacular scale. Two small, pointed brachial spines, one on distal ventral edge, the other on distal dorsal edge of segment. Brachial spines with marginal and vitreous denticles.

Color. Whitish in alcohol.

Discussion. The structure of the primary scales and chiefly the centrodorsal resembles that of *Ophiopyrgus* Lyman, 1878, but the jaw structure is not the same. The species does not appear to be closely related to any of its congeners.

Occurrence and material examined. Station 30, 1 specimen, Station 63, 1 specimen. (USNM, E 11373, holotype).

***Amphiophiura abciissa* (Lütken & Mortensen, 1899)**

(Figs. 18, 19)

*Ophioglypha abciissa* Lütken & Mortensen, 1899: 117-118, pl. II, fig. 1-2, pl. V, fig. 3.

*Amphiophiura abciissa*; Matsumoto, 1915: 78; Clark, 1915: 310.

Type locality. 5°36'40"N — 80°56'50"W.

Geographical distribution. 5°36'40"N — 80°56'50"W, off Cocos Island (Clark, 1915).

Bathymetric distribution. 245 m depth.

Observations. The present specimens agree well with the description and the figures of Lütken & Mortensen, mainly as regards superposition of the radial shields, the presence of a secondary genital arm-comb, the dorsal basal plates of the arms, and shape of the jaw.

Several specimens have a porous region in the middle of the primary scales, which is more evident in the young specimens. These young animals have the oral shield already well developed, occupying the entire ventral interradiation region of the disk. Four specimens have a concavity on the dorsal region of the disk. I can also observe a superposition of the radial shields on the smallest specimens, whose disk is 2 mm in diameter. The largest one is 8 mm in disk diameter.

Occurrence and material examined. Station 30, 14 specimens.

***Anthophiura dilatata*, sp. n.**

(Fig. 53)

Type locality. Station 63, "Eltanin".

Diagnosis. Primary scales elevated. Centrodorsal scale star-shaped; radial shields joining in their whole length, a little wider than long, centrodorsal surrounded by five large plates, central region broad, elevated.

Disk. One to 2.5 mm in diameter. Sub-circular, elevated, particularly centrodorsal scale which resembles a pentagonal flower with short, broad petals; central region broad, elevated. Primary scales sub-elliptical, with truncate and curved edges, forming a ring around centrodorsal scales, without inserted scales on interradiation region. Radial shields short,



sub-hexagonal or pentagonal, measuring about  $\frac{1}{3}$  disk diameter. Ventral interradiial region covered by 3 scales, of which the median is sub-rectangular with distal edge slightly wider than proximal. Innermost scale pentagonal, smaller than outermost which is sub-trapezoidal, with distal margin curved, projecting. Sub-pentagonal oral shield well developed, projecting, occupying more than one half of ventral region (except jaw). Adoral shields short broad, contiguous proximally. Bursal notch narrow, reaching disk margin. Jaw excavated medially. One small triangular infradental papilla. One or two small oral proximal papillae and one distal elongated papilla occupying  $\frac{2}{3}$  of jaw.

Arms. About three times disk diameter. The dorsal plate only present on the first free segment of arms. Anterior half pointed, distal curved. Arm segments narrow proximally, broadened distally. With three brachial spines. Median spine longest, but not reaching  $\frac{1}{3}$  of proximal segment. Ventral plates small, visible only in first 5 segments, located on median distal region of segment. Tentacular pores progressively smaller, having a small spiniform tentacular scale.

Color. Whitish in alcohol.

Observations. The size and shape of the centrodorsal scale is the same in the smaller as in the larger individuals. The smaller specimens have only two brachial spines.

Discussion. It differs from *A. axiologa* Clark in the shape of the centrodorsal scale and the other primary scales that are smaller, in the ventral interradiial scales of the disk and in the smaller size of the ventral arm plate. From *A. challengerii* Fasmer, 1930, by its smaller radial shields and from *A. ingolfi* Easmer, 1930 by its larger primary plates.

Occurrence and material examined. Station N.º 63, 15 specimens. (USNM, E 11374, syntypes).

**Theodoria sp.**

(Fig. 56)

Disk. Circular, 3 mm in diameter, covered by well developed primary scales especially the centrodorsal. Six primary scales, varying in shape from sub-elliptic to sub-hexagonal, with slight median depression. Outside circle formed by primary scales and in radial and interradiial position are 10 small sub-triangular or sub-elliptical scales. Radial shields sub-hexagonal to sub-oval, separated interradially by a large scale which connects ventrally with the oral shield. Ventral interradiial region of disk occupied by this scale and by two to four elongated lateral scales. Oral shield pentagonal. Adoral shields elongated, about three or more times in length than in width, proximally contiguous. Jaw stout elongated, excavated centrally with 4 to 5 dental papillae on either side. Papillae stout, sub-triangular, distal ones elongated. One triangular infradental papilla on jaw apex.

Arms. Broken on specimen examined. Dorsal and ventral plates separated from each other by lateral arm plates. First ventral plate sub-hexagonal, slightly pointed anteriorly, longer than wide. Plates decrease rapidly in size, having progressively their distal margin curved and the proximal pointed. Dorsal arm plates sub-rectangular with a projection on distal margin. Two small, strong brachial spines. First and second dorsal plates contiguous, remainder separated by lateral plates. Tentacular pore well developed on first three arm segments; pores very

small, almost invisible on the fourth. First pore with 5 sub-triangular tentacular scales, second and third pores with one.

Color. Whitish in the samples preserved in alcohol.

Discussion. The present specimen is juvenile since its bursal slits are not open. Fell (1961) established *Theodoria* for the species close to *Ophiurolepis* which have 3 pairs of tentacular pores, excavated jaw and a rudimentary arm-comb. The present specimen probably belongs to this genus and is related to *Theodoria relegata* (Koehler, 1922); it resembles also *Ophiurolepis inconveniens* Hertz, 1926, in the dorsal side of the disk and in the dorsal plates of the arms, but it differs from this species in the greater development of the oral shield.

Occurrence and material examined. Station N.º 50, one specimen.

***Theodoria madseni*, sp. n.**

(Figs. 63-67)

Type locality. Station 48, "Eltanin".

Diagnosis. Disk plates irregular, thick, with some small depressions. Dorsal arm plates elevated, more or less round in distal region. First two ventral arm plates approximately as long as wide. Others wider than long.

Disk. Ten mm diameter, triangular. Dorsal scales irregular, thick, with some small central depressions. Scales separated by deep depressions. Radial shields short, sub-oval to sub-triangular. Jaw long, deeply excavated. Adoral shields separated by excavation of middle of jaw. They are irregularly elevated in shape. Oral shields fragmented. Five to 6 sub-elliptical to sub-rectangular oral papillae.

Arms. Broken in specimen examined. First two dorsal arm plates elevated, sub-globular, contiguous or separated. In other arm joints dorsal plates sub-globular, slightly elongated and not contiguous. First two ventral arm plates approximately as wide as long, others wider than long. Five-six small tentacular scales on first tentacular pore, 3-4 on second, only one on third. Three short arm spines.

Discussion. The present specimen resembles *Ophiurolepis brevirima* Mortensen, 1936, in the shape of the disk scales which are thickened and the genital slits which do not overtake the first segment of the arms. On the other hand it differs from that species in the shape of the dorsal arm plates, which resemble those of *Ophiurolepis olstedi* Madsen, 1955 although they do not form hooks, and those of *Ophiurolepis partita* (Koehler, 1908); though they are not divided. The depth in which this specimen was collected is far greater (3,883 — 4,004 m) than the lowest limit of the bathymetric distribution of *O. partita* (200-750 m). Four isolated hydroids were found fixed to the arms and disk of the specimen.

Occurrence and material examined. Station 48, one specimen (USNM, E 11375, holotype).

***Ophiuroglypha* sp.**

(Figs. 57-60)

Disk. Sub-circular, 1.5-3 mm in diameter, covered almost completely by swollen, well developed primary scales. Radial shields small, sub-pentagonal, separated proximally by a small gibbous scale, distally by first

dorsal arm plate. Centrodorsal scale sub-pentagonal, primary sub-pentagonal, wider than long. Only one marginal interrarial scale, which is joined dorsally with a small sub-pentagonal scale and ventrally with one sub-prismatic scale. This latter is only an interrarial ventral scale in contact with oral shield. Oral shield sub-pentagonal, pointed proximally. Adoral shields wide, sub-elliptic or sub-triangular. Three elongated oral papillae at each side of jaw, which have a strong median depression. Infradental papilla triangular, stout.

Arms. About  $1 \frac{1}{2}$  as long as disk diameter. Dorsal arm plates small, projected. First second dorsal plates in contact, remainder separated by lateral plates. Second or third plate is the smallest; first plate small, about same size as fifth. First ventral plate bell-shaped, separated from the second by lateral plates. Remainder are sub-elliptical. First pair of tentacular pores with 3 or 4 small scales; others with small spiniform scales which become progressively more pointed near distal extremity of the arm.

Color. Whitish in alcohol.

Observations. These specimens are undoubtedly juveniles. I refer them to *Ophiuroglypha* Hertz, 1928, as they have swollen disk scales and three brachial spines, of which the median is transformed into a hook. There is some resemblance to the figure of *Ophiurolepis inconveniens* Hertz, 1927.

Occurrence and material examined. Station 63, 7 specimens.

#### NON-IDENTIFIED YOUNG OPHIURIDAE

Station 25: 2 specimens (Figs. 61, 62, 71), perhaps 2 different species (*Ophiurolepis* ?).

Station 30: 1 specimen.

Station 48: 2 specimens (Figs. 73, 74).

Station 50: 9 specimens (Figs. 68-70, 72), perhaps 3 species.

Station 65: 1 specimen.

Station 68: 1 specimen.

#### **Ophiocten** sp. (a)

(Figs. 76-79)

Observations. The present specimen is badly damaged, devoid of its disk. The jaw and arm plate structure is much like the figure of *Ophiocten pacificum* Lütken & Mortensen (1899, pl. III, fig. 5-7). Only some basal dorsal plates of the arms are preserved. I found small spines and this character leads me to refer this specimen to *Ophiocten*. The present specimen was collected at 31°10.5'S — 71°56.4'W, 3,100 m depth in a far more southern location (30°S) than *Ophiocten pacificum* Lütken & Mortensen, 1899 and from a little deeper position than the "Albatross" specimens. Clark (1915: 328) describes specimens of this species collected off Washington State, California, Lower California, Gulf of Panama, Galapagos Islands and Japan, in depths ranging from 825 to 2,416 m.

Occurrence and material examined. Station 75, 1 specimen.

**Ophiecten** sp. (b)

(Fig. 75)

Observations. I found one disk at Station n.º 30, with neither the dorsal face nor the oral shields, belonging to an ophiuran, probably of the genus *Ophiecten* (or *Ophiuridae*?). Figure 75 shows the jaw of this specimen.

## DISCUSSION

The ophiuran fauna of the Peru-Chile Trench is still largely unknown. Of the 17 species described here, 9 are new. Besides these, 16 young *Ophiuridae* were represented.

Bussing (1965: 224) studying mid-water fishes observed a ... "major faunal break at about 20°S which corresponds with the boundary between Pacific equatorial water and transition water... The Peru-Chile species apparently restricted to waters north of 20°S are tropical or equatorial species. The species occurring only in the southern Peru-Chile Trench south of 20°S may be transition forms that characteristically inhabit the ecotone between equatorial and sub-Antarctic waters or may be sub-Antarctic forms near the northern limit of their range. Other Peru-Chile species range from equatorial to Antarctic waters"... *Neopilina* also was collected on the northern part of that trench, but not on the southern part (Menzies, 1963).

*Cyclamine orbicularis*, a typical Antarctic foraminiferan, occurs both in the northern and southern part of the trench (Bandy & Rodolfo, 1964: 83). This pattern was also found for such ophiurans as the Antarctic species *Ophiacantha sollicita* Koehler and *Ophiacantha antarctica* Koehler (the northern occurrence is in 14°S Lat.).

From the comparison of tables 1-3 it may be observed that *Ophiura irrorata* occurred from the north down to the region 16°S — 74° W; *O. lymani* from the south to 46°S — 75°W, but at a greater depth. Southern species (*Ophiacantha sollicita*, *Ophiacantha antarctica*) and northern species (*Ophiura irrorata* and *Amphiura serpentina*) occurred from 13°S — 78°W as far as 16°S — 74°W.

The stations north of 15°S Lat. suggest the existence of a fauna much richer in species than that to the south of this latitude, including at several places a high density (Station 37). The species found both in higher density and at most stations was *Ophiura irrorata* (Lyman), from 1,171 to 5,314 m and *Amphioplus dalea* (Lyman) from 5,234 to 6,250 m depths.

Three species, *Amphiophiura abscissa* Lütken & Mortensen, *Ophiernus seminudus* Lütken & Mortensen and *Amphiura serpentina* Lütken & Mortensen, which were collected by the "Albatross" in deep regions near the northern part of the Peru-Chile Trench (Lütken & Mortensen, 1899) were not sampled on the southern part of that trench.

*Ophiacantha antarctica* Koehler is not viviparous, but its eggs are large and the species probably has planktonic lecithotrophic larvae (Mortensen, 1936). In the bursa of *Ophiacantha sollicita* Koehler I also found large eggs. Perhaps the two northern parts of the trench may be explained by the transportation of larvae and even young specimens by the



prevailing currents in that region, heading northwards (see Murontsev, 1963). *Ophioplinthus brucei* Koehler was first caught in the Weddell Sea and now for the first time outside of Antarctic region. Between 13° and 16°S Lat. there is a transition region between "north" and "south" ophiuran species.

Of the 26 ophiuroid species observed in this trench, 19 species belong to the Ophiuridae family (73%).

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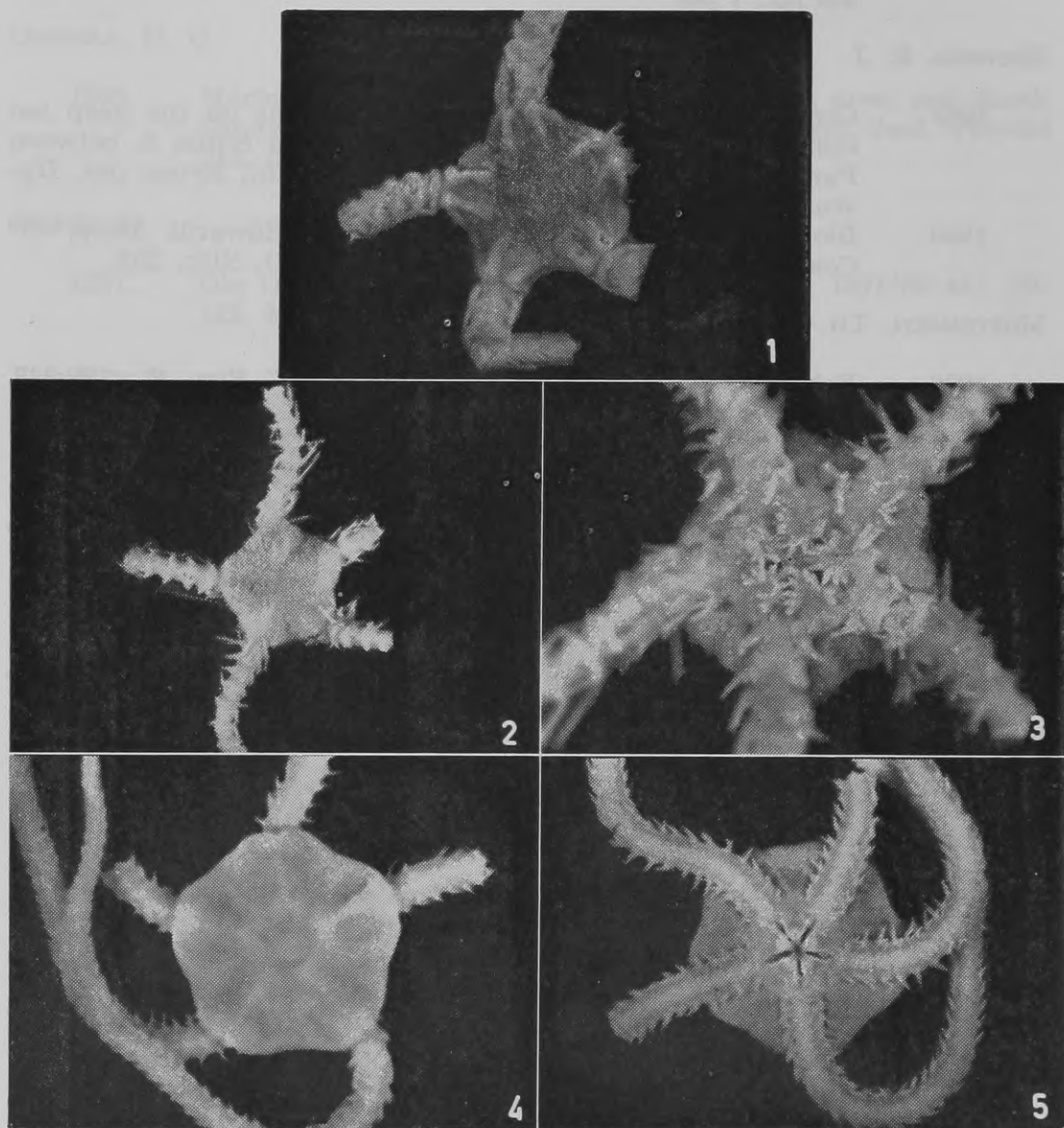
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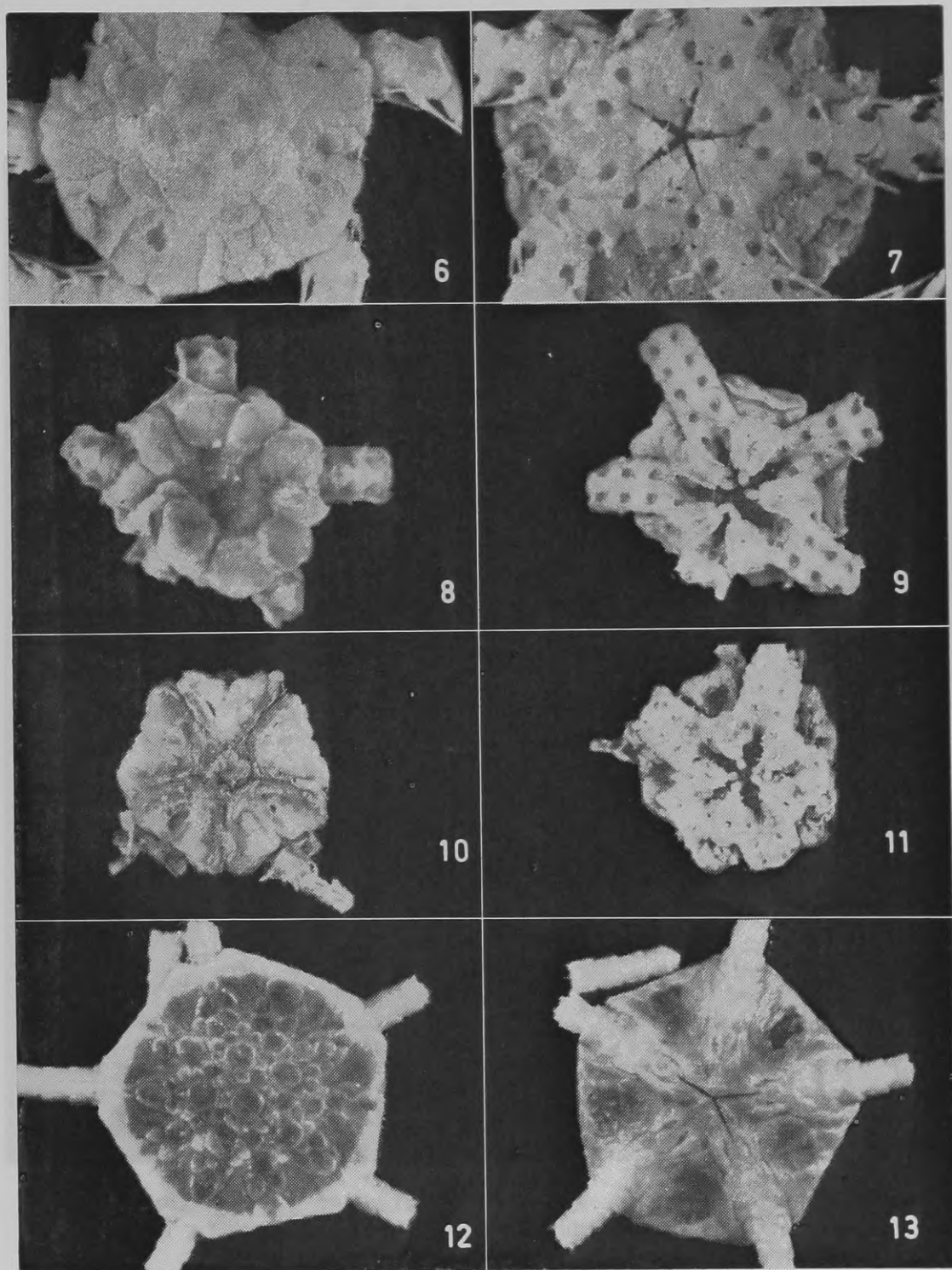
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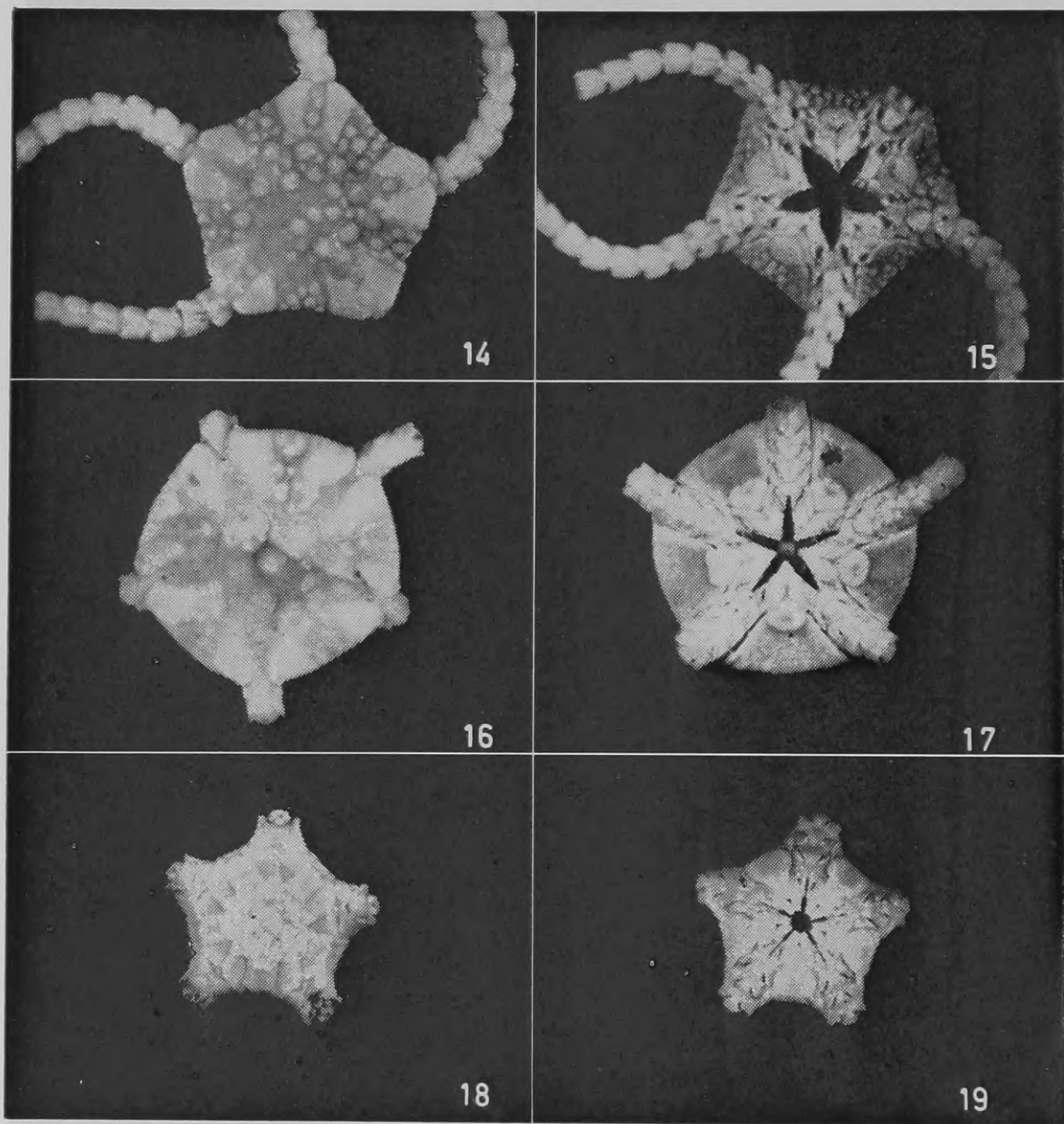


1, *Ophiacantha sollicita*, dorsal view. *O. antarctica*: 2, dorsal view; 3, ventral view. *Amphioplus dalea*: 4, dorsal view; 5, ventral view.

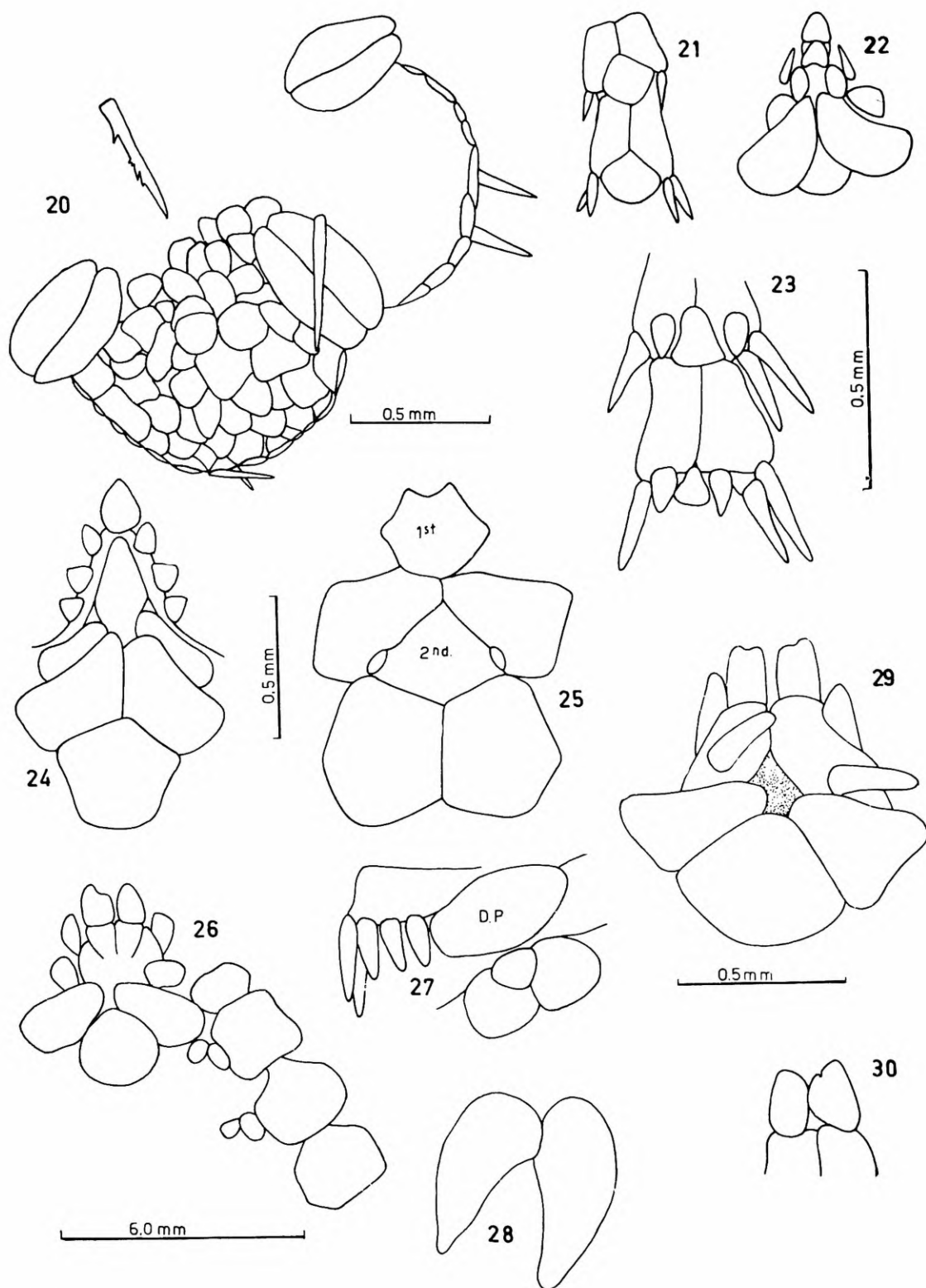




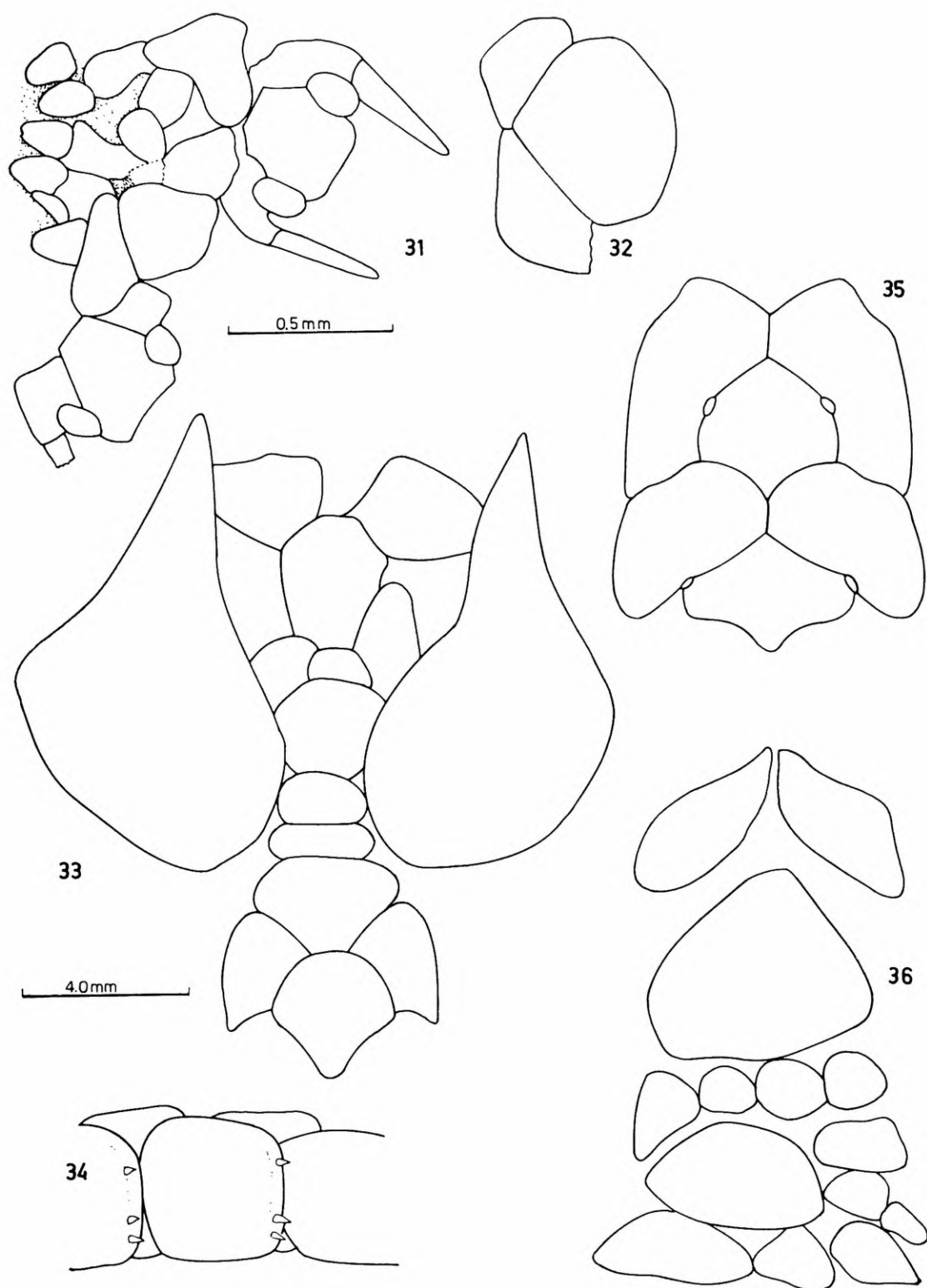
*Amphilepis nuda*: 6, dorsal view; 7, ventral view. *Ophiernus seminudus*: 8, dorsal view; 9, ventral view. *O. barracloughi*: 10, dorsal view; 11, ventral view. *Ophioplinthus brucei*: 12, dorsal view; 13, ventral view.



*Ophiura irrorata*: young specimen: 14, dorsal view; 15, ventral view; adult: 16, dorsal view; 17, ventral view. *Amphiophiura abscissa*: 18, dorsal view; 19, ventral view.

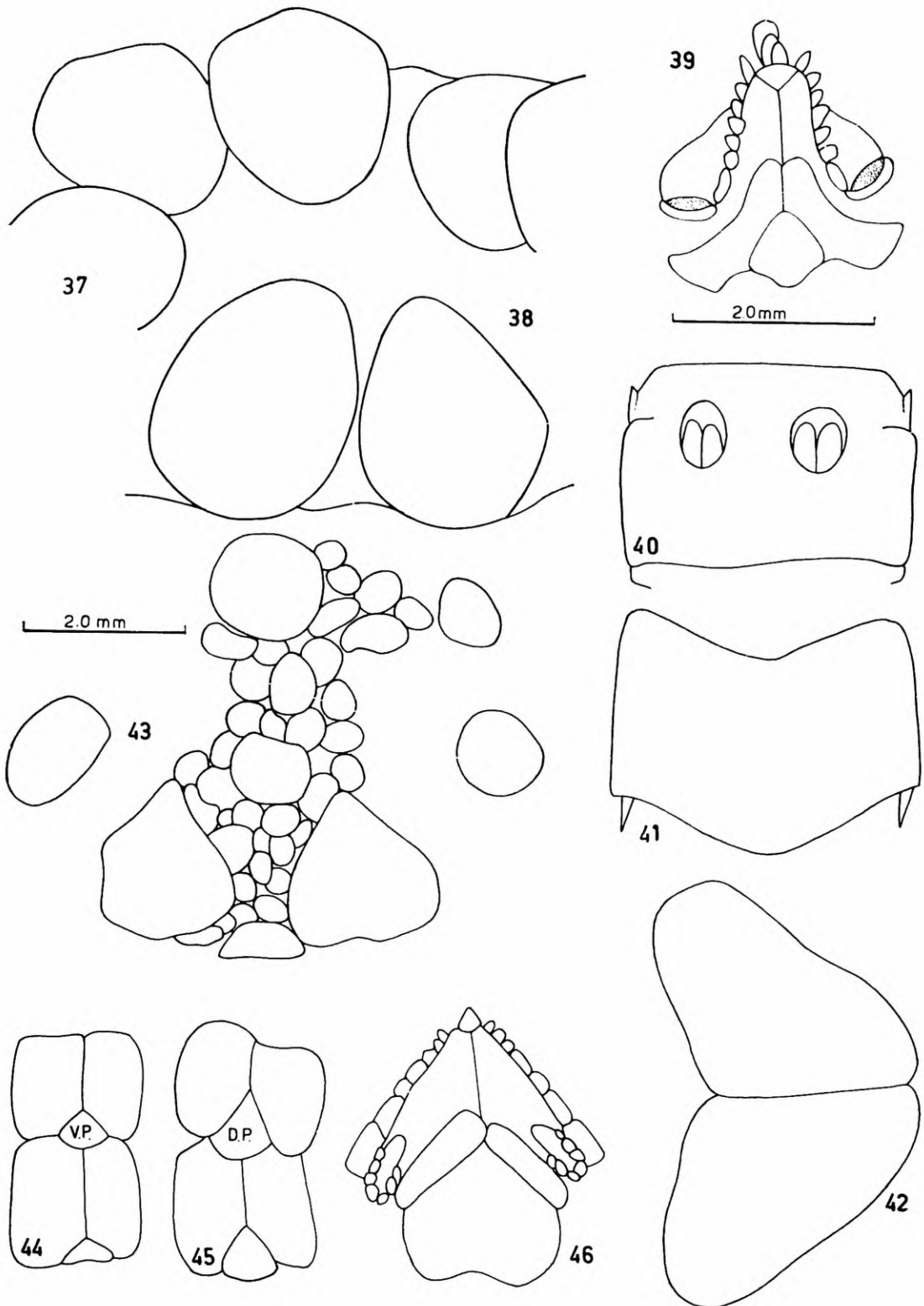


*Ophiothamnus dupla*: 20, dorsal view, disk; 21, dorsal view, arm; 22, mandible; 23, ventral view, arm. *Ophiacantha savagica*: 24, mandible; 25, 1st and 2nd ventral plates of arm. *Amphiura serpentina*: 26, mandible and first ventral plates of arm; 27, brachial spines (D.P. = dorsal plate); 28, radial shields. *Amphiura* sp. (c): 29, mandible; 30, infradental papillae.

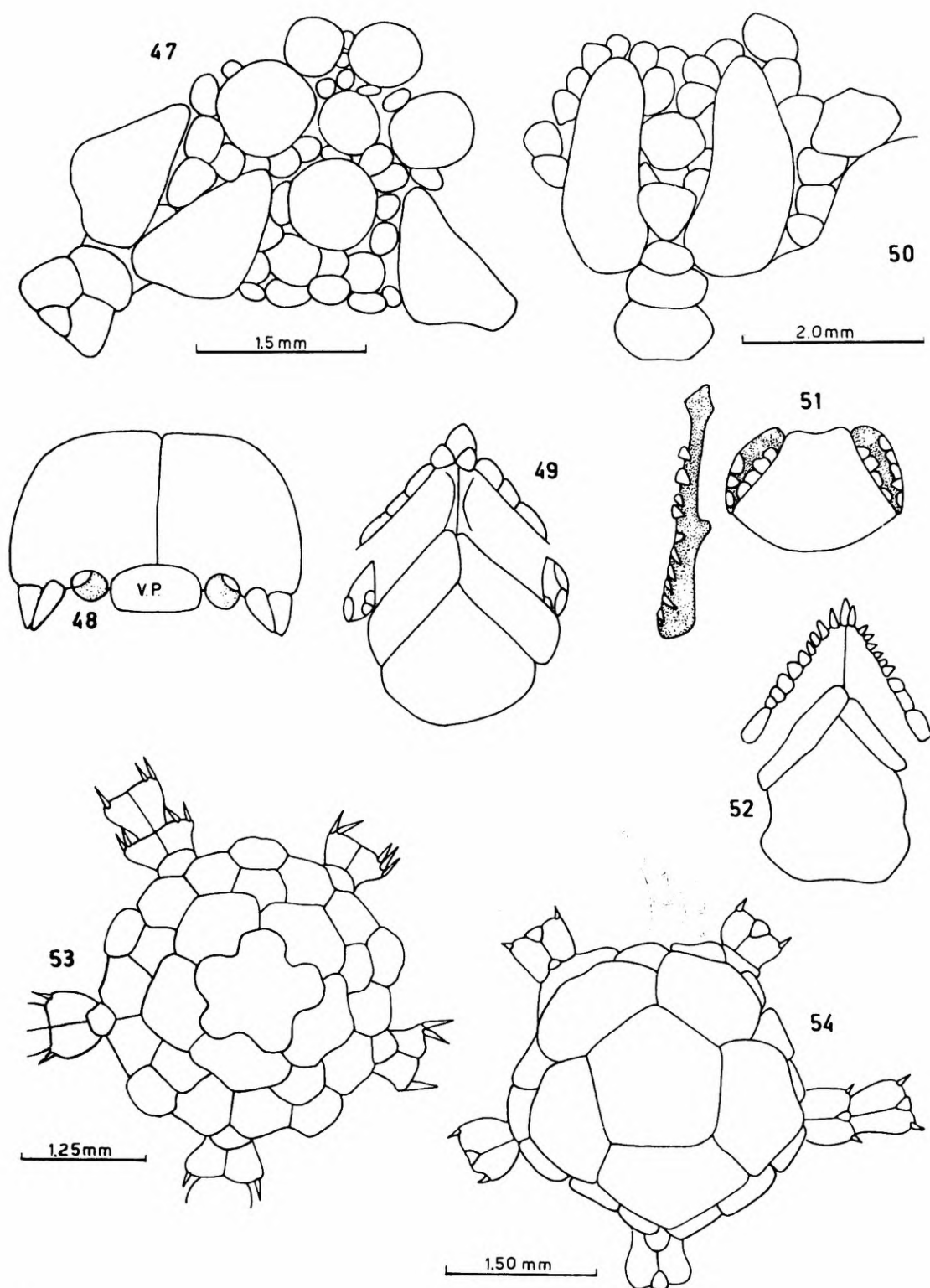


*Amphiura* sp. (d): 31, mandible and ventral plates of arm; 32, dorsal plates of arm. *Ophioplinthus brucei*: 33, radial shields and dorsal plates of arm; 34, brachial spines; 35, ventral plates of arm; 36, oral and adoral shields and interradii ventral plates of disk.

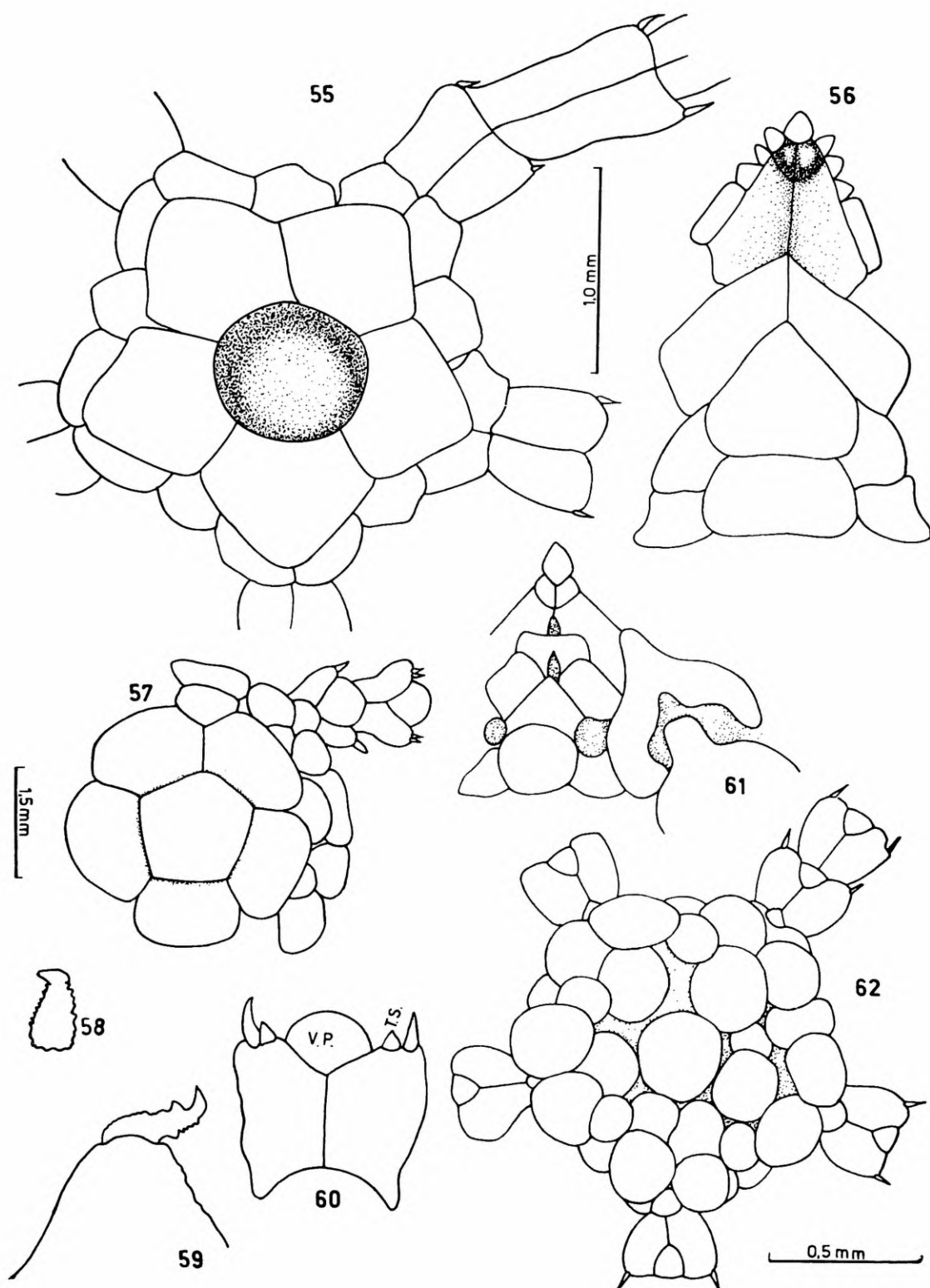




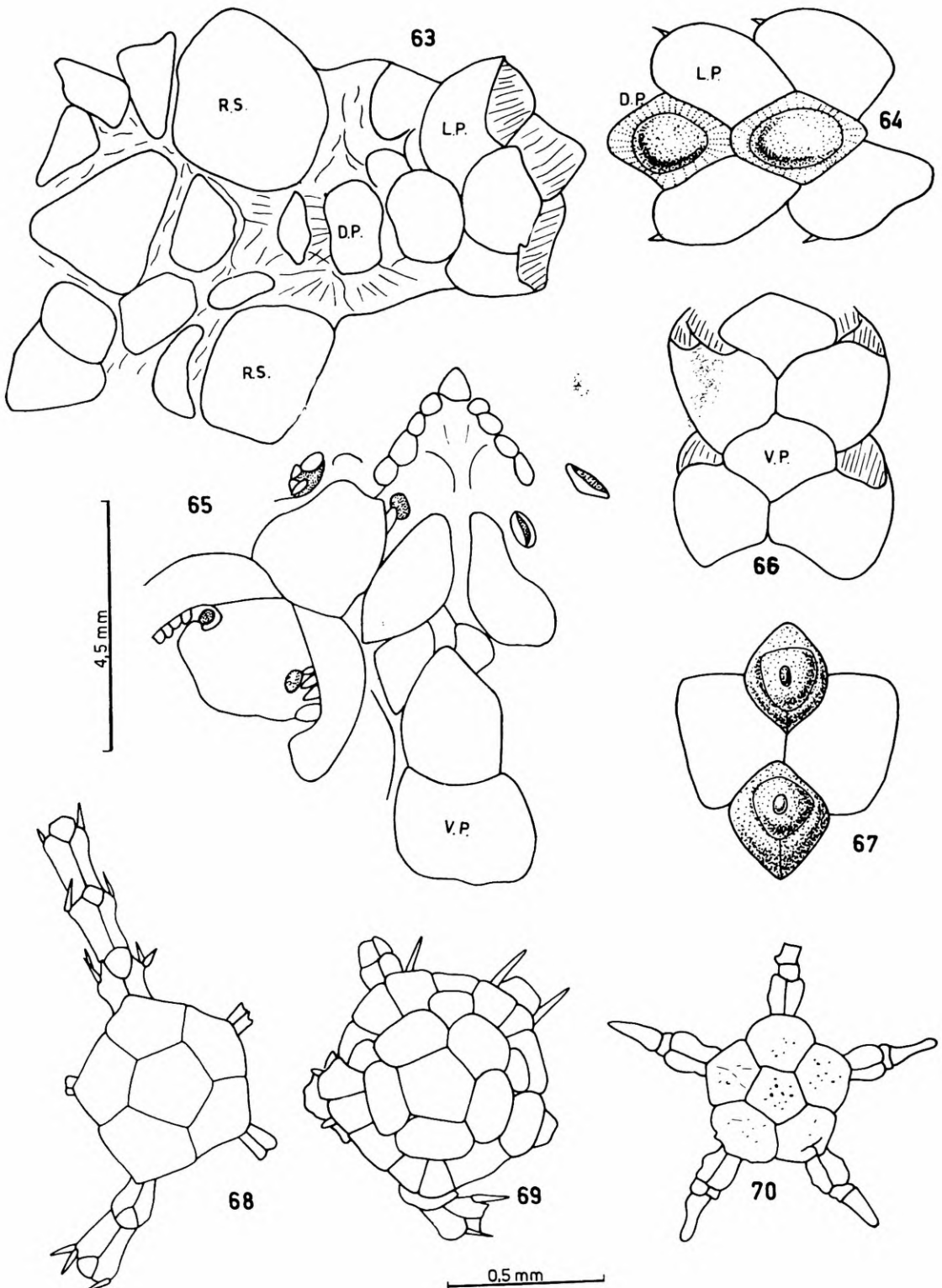
*Ophiernus seminudus*: 37, 38, radial shields. *O. barraclooughi*: 39, mandible; 40, ventral plate and tentacular scales; 41, dorsal plate of arm; 42, radial shields. *Ophiura irrorata*: 43, radial shields; 44, ventral plates of arm; 45, dorsal plates of arm; 46, mandible.



*Ophiura irrorata*: 47, radial shields and disk of a young specimen; 48, *idem*, ventral plates; 49, *idem*, mandible. *Gymnophiura concava*: 50, radial shields; 51, bursal notch and 2nd pair of tentacular pores; 52, mandible. 53, *Anthophiura dilatata*, dorsal view. 54, *Ophiomastus bulu-fonica*, dorsal view.

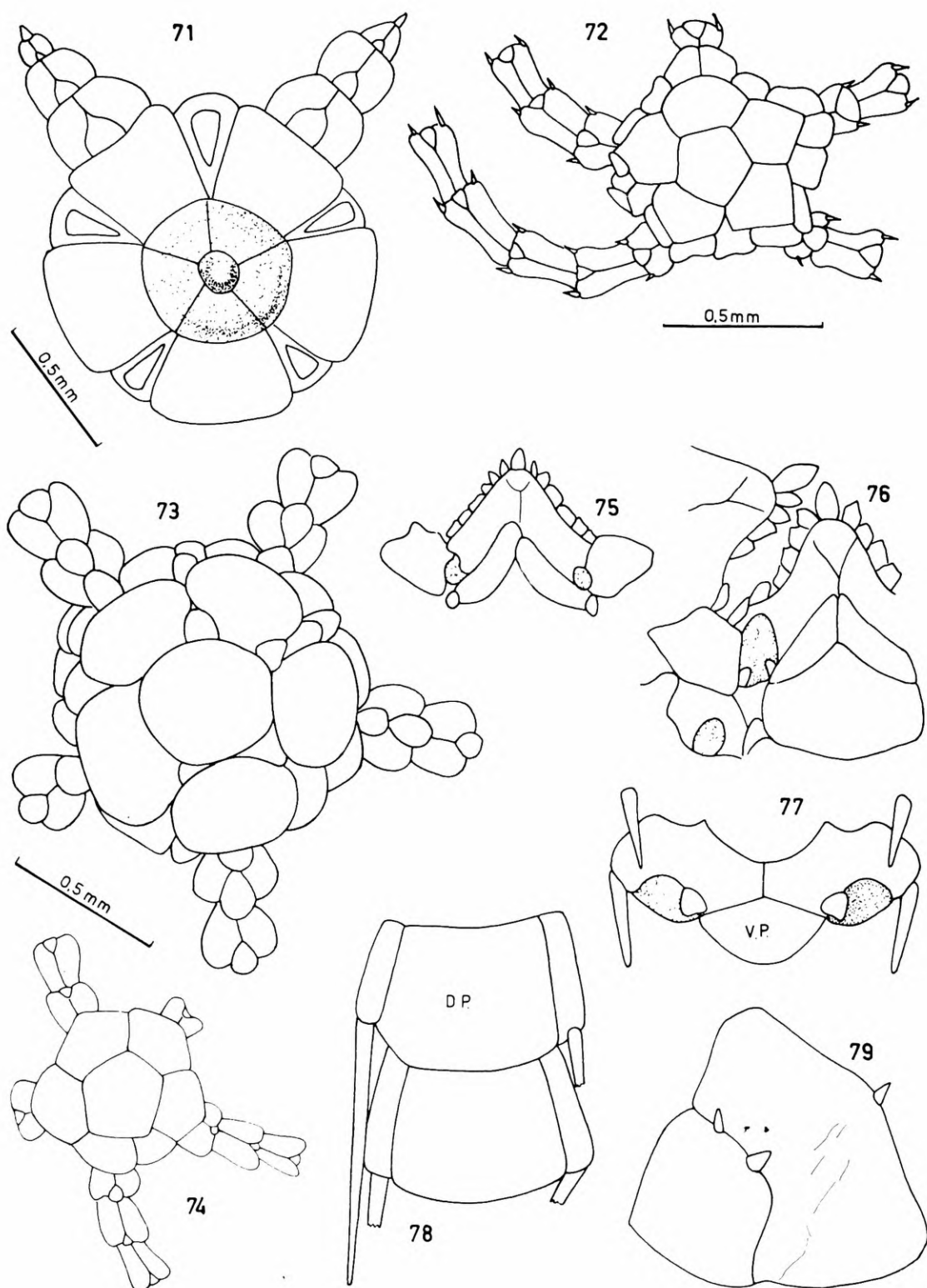


55, *Ophiomastus tuberculata*, dorsal view. 56, *Theodoria* sp., mandible. *Ophiuroglypha* sp.: 57, dorsal view of disk; 58, 59, brachial spines modified into hooks; 60, ventral plate (V.P.) and tentacular scale (T.S.). 61, 62: young specimens of Ophiuridae from Station 25.



*Theodoria madseni*: 63, radial shields (R.S.); 64, lateral plates (L.P.) and dorsal plates (D.P.) of arm; 65, mandible and 1st ventral plates (V.P.); 66, ventral plates (V.P.) of arm; 67, dorsal plates of arm extremity. 68, 69, 70: young specimens of Ophiuridae from Station 50.





71, young specimen of Ophiuridae from Station 25. 72, *idem* from Station 50. 73, 74, *idem*, from Station 48. 75, mandible of ? *Ophiecten* sp. *Ophiecten* sp.: 76, mandible; 77, ventral plates (V.P.); 78, dorsal plates (D.P.); 79, brachial spines.

Table 1. List of stations with collected species

Station	Locality and device	Nearest Hydrographical Station and Depth	Species
25	4°53' - 4°51'N 80°28' - 80°27'W Menzies' Trawl	Between E - 3 - 2 2,489 m	Ophiuridae (perhaps two species) <i>Amphilepis nuda</i>
30	00°00'N - 81°45'W Menzies' Trawl	Between E - 3 - 2 and E - 3 - 4 1,171 m	<i>Ophiothamnus dupla</i> <i>Ophiacantha savagica</i> ? <i>Ophiocten</i> sp. (b) <i>Ophiuridae</i> (young) <i>Ophiomastus bulufonica</i> <i>Ophiomastus tuberculata</i> <i>Ophiura irrorata</i> <i>Amphiophiura abscissa</i> <i>Amphiura</i> sp. (d)
35	8°19' - 8°21'S 81°02.5' - 81°14.1'W 10' Blake's Trawl	Between E - 3 - 4 and E - 3 - 5 6,250 m	<i>Amphioplus dalea</i>
37	08°11' - 08°10'S 81°08' - 81°10'W 10' Blake's Trawl	Between E - 3 - 5 and E - 3 - 6 6,006 m	<i>Amphioplus dalea</i>
38	8°19.8' - 08°18.5'S 81°4.6' - 81°05'W Menzies' Trawl	Between E - 3 - 5 and E - 3 - 6 5,746 - 5,948 m	<i>Amphioplus dalea</i> <i>Ophiernus seminudus</i> <i>Ophiernus barracloughi</i>
40	13°10' - 13°07'S 77°56.5' - 77°57'W Menzies' Trawl	Between E - 3 - 5 and E - 3 - 6 3,404 - 3,495 m	<i>Amphiura serpentina</i>
43	13°15' - 13°13.5'S 78°06' - 78°06.5'W Menzies' Trawl	Between E - 3 - 6 and E - 3 - 7 5,234 - 5,314 m	<i>Amphioplus dalea</i> <i>Ophiura irrorata</i>
48	14°13' - 14°09'S 77°06' - 77°09'W Menzies' Trawl	Between E - 3 - 7 and E - 3 - 8 3,883 - 4,004 m	<i>Ophiacantha sollicita</i> <i>Ophiacantha antarctica</i> <i>Ophioplinthus brucei</i> <i>Ophiura irrorata</i> <i>Ophiuridae</i> (young) <i>Theodoria madseni</i>

Table 1 (continued)

50	16°12' - 16°10'S 74°40'S' - 74°41'W Menzies' Trawl	Between E - 3 - 8 and E - 3 - 10 2,599 2,858 m	<i>Amphiura</i> sp. (b) <i>Amphilepis nuda</i> <i>Theodoria</i> sp. <i>Ophiura irrorata</i> <i>Ophiuridae</i> <i>Ophiura</i> sp. <i>Gymnophiura concava</i>
63	25°44' - 25°43'S 70°58'W Phleger corer	Between E - 3 - 14 and E - 3 - 15 1,863 1,965 m	<i>Anthophiura dilatata</i> <i>Amphiura</i> sp. (c) <i>Ophiuroglypha</i> sp. <i>Ophiomastus tuberculata</i>
65	25°43' - 25°42'S 61°07'W (off Taltal, Chile) Menzies' Trawl	Between E - 3 - 15 and E - 3 - 16 3,149 3,257 m	<i>Ophiuridae</i> (young) <i>Ophiura irrorata</i>
68	25°42'S 71°22'W Phleger corer	Between E - 3 - 15 and E - 3 - 16 5,783 - 5,797 m	<i>Ophiuridae</i> (young)
71	31°05' - 31°06.5'S 71°44'W Menzies' Trawl	Between E - 3 - 16 and E - 3 - 18 179 187 m	<i>Amphiura</i> sp. (a) <i>Amphiuridae</i> (perhaps 2 species)
75	31°10' - 31°14'S 71°14' - 71°58'W Phleger corer	Between E - 3 - 16 and E - 3 - 18 1,932 - 3,142 m	<i>Ophiocten</i> sp. (a)
76	31°13'S 72°21'W Menzies' Trawl	Between E - 3 - 16 and E - 3 - 18 3,541 m	<i>Amphilepis nuda</i>

Table 2. U. S. F. C. S. "Albatross"

Station 3400 - Lat. 0°36'S - Long. 86°46'W, 2,417 m. Bottom temperature 2.22°C.

*Ophiozona contigua* (< *Ophiozonella*)  
*Ophiozona alba* (< *Ophizonella*)  
*Ophiernus seminudum*  
*Gymnophiura mollis*  
*Ophioglypha obtecta* (< *Amphiophiura*)  
*Ophioglypha tumulosa* (< *Ophiura irrorata*)  
*Ophioglypha plana* (< *Ophiura*)  
*Ophioglypha divisa* (young) (< *Homalophiura*)  
*Ophiocten pacificum*  
*Ophiomusium glabrum*

Station 3402 - Lat. 0°57'30"S - Long. 89°3'30"W, 769 m. Bottom temperature 5.7°C.

*Ophiernus annectens*  
*Amphiura serpentina* var. c  
*Asteronyx dispar*

Station 3404 - Lat. 1°3'S - Long. 89°28'W, 704 m. Bottom temperature 6.2°C.

*Ophiomusium Diomedae*  
*Amphiura papillata* (< *Amphioplus papillatus*)  
*Ophiacantha inconspicua* (? young)

Station 3405 - Lat. 0°57'S - Long. 89°38'W, 106 m. Bottom temperature 15.55°C.

*Ophionereis* sp. (arm)  
*Ophionereis nuda*  
*Ophiothrix galapagensis*  
*Sigsbeia lineata*

Station 3406 Lat. 0°16'S Long. 90°21'W, 1,007 m. Bottom temperature 5.2°C.

*Ophiactis profundis*  
*Ophiothamnus laevis*  
*Asteroschema sublaeve*

Station 3407 Lat. 0°4'S Long. 90°24'30"W, 1,618 m. Bottom temperature 2.9°C.

*Ophiomusium Lymani*  
*Ophiactis duplicata*  
*Ophiacantha inconspicua*  
*Asteronyx dispar*

Station 3408 Lat. 0°12'30"N Long. 90°32'20"W, 1,256 m. Bottom temperature 4.2°C.

*Ophiacantha inconspicua*

Station 3410 Lat. 0°19'N Long. 90°34'W, 605 m. Bottom temperature 4.2°C.

*Ophiacantha inconspicua*

Station 3411 Lat. 0°54'N Long. 91°9'W, 2,173 m. Bottom temperature 2.3°C.

*Ophioglypha divisa* (< *Homalophiura*)  
*Ophiomusium Lymani*



Table 3. H. M. S. "Challenger"

Station 296 - Nov. 9, 1875. Lat.  $38^{\circ}6'S$  Long.  $88^{\circ}2'W$ . 3.336 m. Bottom temperature  $1.2^{\circ}C$  red clay.

*Ophiotholia supplicans*

*Ophiomusium Lymani*. Also Station 45, 50, 76, Tristan da Cunha, 169, 191, 235.

Station 298 - Nov. 17, 1875. Lat.  $34^{\circ}7'S$  Long.  $73^{\circ}56'W$ . 4.067 m. Bottom temperature  $1.3^{\circ}C$  grey mud.

*Ophiacantha sentosa*

*Ophiacantha cosmica*. Also Station 122, off Tristan da Cunha 146, 147, 156, 157, 158, 191, 218, 298, 299.

Station 299 Dec. 14, 1875. Lat.  $33^{\circ}31'S$  Long.  $74^{\circ}43'W$ . 3.948 m. Bottom temperature  $1.1^{\circ}C$  grey mud.

*Ophioglypha lacazei*. Also Station 160 (*< Amphiophiura*)

*Ophiomusium armigerum*. Also Station 83, 106 (same sp.?) 332.

*Amphilepis patens*

*Ophiacantha cosmica*. Also Station 122, off Tristan da Cunha, 146, 147, 153, 156, 157, 158, 191, 218, 298.

Station 304 Dec. 31, 1875. Lat.  $46^{\circ}53'S$  Long.  $75^{\circ}11'W$ . 823 m. sand.

*Ophioglypha Lymani*. Also Station 305, 307, 308, 311, 313 (*< Ophiura*)

Station 305 - Jan. 1, 1876. Lat.  $47^{\circ}48'S$  - Long.  $74^{\circ}48'W$ . 219 m. mud.

*Ophioglypha Lymani*. Also Station 304, 307, 309, 311, 313 (*< Ophiura*)

Station 307 - Jan. 4, 1876. Lat.  $49^{\circ}24'S$  - Long  $74^{\circ}23'W$ . 269 m. Bottom temperature  $7.6^{\circ}C$ . mud.

*Ophioglypha Lymani*. Also Station 304, 305, 306, 309, 311, 313 (*< Ophiura*)

*Ophiolebes vestitus*. Also Station 308, 310.

*Astrotoma agassizii*. Also Station 148, 307, 308, Strait Magellan, 309, 313.

*Gorgonocephalus pourtalesii*. Also Station Christmas Harbour, Kerguelen Is. 150, 151, 308, 313. 314 (*< G. chilensis*)

Table 3 (continued)

Station 308 - Jan. 5, 1876. Lat. 50°10'S - Long. 74°42'W. 320 m. mud.

- Ophiobates vestitus*. Also Station 307, 310.  
*Ophiactis asperula*. Also Station 311, 312, 315.  
*Phioglypha Lymani*. Also Station 304, 305, 307, 309, 311, 313  
 (< *Ophiura*)  
*Ophiacantha rosea*. Also Station 145, 236.  
*Ophiomyxa vivipara*. Also Station 142, 313, 314.  
*Ophiocreas carnosum*.  
*Astrotoma agassizii*. Also Station 148, 307, 309. Strait  
 Magellan, 313.  
*Gorgonocephalus pourtalesii*. Also Station Christmas Harbour,  
 Kerguelen Is. 150, 155, 307, 313,  
 314 (< *G. chilensis*)

Station 309 - Jan. 8, 1876. Lat. 50°56'S - Long. 74°15'W. 73 to 256 m. mud.

- Ophioglypha Lymani*. Also Station 304, 305, 307, 311, 313  
 (< *Ophiura*)  
*Astrotoma agassizii*. Also Station 148, 307, Strait Magellan, 313.

Station 310 - Jan. 10, 1876. Lat. 51°30'S - Long. 74°3'W. 731 m. Bottom  
 temperature 7.9°C. mud.

- Ophiobates vestitus*. Also Station 307, 308.  
*Asterochema rubrum*.

Station 311 - Jan. 11, 1876. Lat. 52°50'S Long. 73°53'W. 448 m. Bottom  
 temperature 7.7°C. mud.

- Ophioglypha lymani*. Also Station 304, 305, 308, 309, 313  
 (< *Ophiura*)  
*Ophiactis asperula*. Also Station 308, 312, 315.

Station 312 - Jan. 13, 1876. Lat. 53°38'S Long. 70°5'W. 18 to 27 m. mud.

- Ophiactis asperula*. Also Station 308, 311, 315.

Station 313 - Jan. 20, 1876. Lat. 52°20'S - Long. 68°0'W. 100 m. Bottom  
 temperature 8.8°C. sand.

- Ophioglypha Lymani*. Also Station 304, 305, 307, 308, 309, 311  
 (< *Ophiura*)  
*Ophiacantha vivipara*. Also Station off Marion Islands, Christmas  
 Harbour, Balfour Bay and Royal Sound,  
 Kerguelen Islands, 150, 151, 314, 315,  
 320.  
*Ophiomyxa vivipara*. Also Station 142, 308, 314.  
*Astrotoma agassizii*. Also Station 148, 307, 308, 309, Strait  
 Magellan.  
*Gorgonocephalus pourtalesii*. Also Christmas Harbour, Kerguelen  
 Islands, 150, 151, 307, 308, 314  
 (< *G. chilensis*).

Straits of Magellan

- Astrotoma agassizii*. Also Station. 148, 307, 308, 309, 313.