Art. XIX.—*Stellerids and Echinids from the Kermadec Islands.*

By W. B. Benham, D.Sc., F.R.S.

[*Read before the Otago Institute, 1st November, 1910.*]

Mr. Oliver was good enough to place his collection of echinoderms in my hands for identification. In this communication I deal only with the Asterids, Ophiurids, and Echinids, and must leave the Holothurians for a later article. He also sent me useful notes on the colour and habitats of most of those collected.

A good number of species have already been recorded from these islands —some littoral forms by Farquhar (1898 and 1906), and others from the deep sea between the islands in the "Challenger" Reports.

The present collection contains twenty-one species, and includes all those recorded by Farquhar except *Pectinura* (*Ophiopeza*) *danbyi*, together with several species not hitherto met with at the islands.

List of Littoral Echinoderms. (The new records are preceded by the sign x.)

Asteroidea.

x *Astropecten polyacanthus* M. & T.
Asteropsis imperialis Farq.
x *Gymnasteria lissotergum* sp. nov.
Asterina oliveri sp. nov.
Ophidiaster (?) *kermadecensis* sp.nov.
Asterias rodolphi Perr.
x *Asterias edmondi* sp. nov.

Ophiuroidea.

Ophionereis schayeri M. & T.
x *Amphiura squamata* D. Ch.
x *Ophiocoma brevipes* Pet.
x *Ophiothrix oliveri* sp. nov.
x *Ophiura kermadecensis* sp. nov.
Pectinura (*Ophiopeza*) *danbyi* Farq.

Echinoidea.

x *Centrostephanus rodgersii* Ag.
Toxocidaris tuberculatus Lam.
Tripneustes gratilla Ag.
Phyllacanthus dubia Brndt.
Echinometra mathaei Blnvl.
x *Plesianthus testudinarius* Gray.
x *Echinoneus cyclostomus* Leske.
x *Fibularia australis* Desmlns.
x *Brissus carinatus* Lam.

Of the Asterids, only *Astropecten polyacanthus* has been recorded from New Zealand waters, and there is some doubt as to this identification. All the six genera are widely distributed, and the species are closely related to Pacific and Australian forms. *Asteropsis* contains but two species—this one from the Kermadecs, and the other (*A. vernicina*) from Australia.

Of the six species and genera of Ophiurids, only two have been found on our shores—*Amphiura squamata* and *Ophionereis schayeri*—both of which are very widely distributed in the Pacific. The other genera are also common in this ocean.

Of the ten species of Echinids, belonging to as many genera, only two have been found on our shores, and this but rarely—viz., *Centrostephanus rodgersii* and *Toxocidaris tuberculatus*. The whole series is Indo-Pacific, and for the most part is common on the east coast of Australia.

In order to make this list as complete as possible, I here add those obtained by the "Challenger" at Stations 170 and 170a, at a depth of

520 fathoms, between Macauley Island and Sunday (Raoul) Island ; and at Station 171, from a depth of 600 fathoms, north of the latter island. The species peculiar to these stations are marked with the sign x.

Asteroidea.

x *Solaster torulatus* Sladen.
x *Cribella sufflata* Sladen.

Ophiuroidea.

x *Ophioceramis* (?) *clausa* Lym.
,, *obstricta* Lym.
x *Ophiactis cuspidata* Lym.
,, *flexuosa*.
,, *nama* Lym.
x *Ophiacantha cornuta* Lym.
x ,, *vepratica* Lym.
Ophiomitra plicata Lym.
x *Astroschema horrida* Lym.
x ,, *salix* Lym.
x *Ophiomusium scalare* Lym.
Ophiophyllum petilum Lym.
x *Amphiura argentea* Lym.
x ,, *canescens* Lym.
x *Ophiochiton lentus* Lym.

Echinoidea.

Salenia hastigera Ag.
Aspidodiadema tonsum Ag.
x *Trigonocidaris monolini* Ag.
Echinus acutus Lam.

It will be seen that a very considerable proportion of these deep-water species are endemic ; the others are Indo-Pacific. As Mr. Farquhar has already pointed out, the littoral fauna is not at all related to that of New Zealand, but is distinctly Indo-Pacific, with much affinity to the east Australian coastal fauna.

I have not thought it necessary to repeat the synonymy or the references to the earlier literatu e ; both of these matters may be found treated at length in Farquhar's paper (1898).

Asteroidea.

Astropecten polyacanthus Müller and Troschel.

One specimen dredged in 12 fathoms, on gravel bottom, west of Meyer Island (20/4/1908), and a second smaller one dredged in 20 fathoms in Denham Bay, Sunday Island (4/4/08).

The larger individual has the following dimensions : R 87 mm., *r* 15 mm. ; so that R : *r* = $5\frac{4}{5}$. One ray is quite short and stumpy, being in the course of regeneration ; of the original arm only 23 mm. remains, while the new tip is 12 mm. in length.

A small specimen, in which R 10, *r* 4, appears to be the young of this. It is, however, almost too small to be worth describing in detail. There is a single spine on each of the supra-marginals, but the infra-marginals carry only 2 spines in place of the 4 or 5 of the adult.

This is a widely distributed species, not hitherto recorded from the Kermadecs. It is said by Hutton (1872, p. 6) to occur on the New Zealand coast, but I have not seen a specimen.

Distribution.—Red Sea, Indian Ocean (Mauritius, Ceylon, India, Andamans), Pacific (Australia, China, Japan, Fiji, &c.).

Asteropsis imperialis Farquhar. Figs. 1–3.

Farquhar, Linn. Soc. Journ. Zool., vol. 26, p. 193, pl. 13.

I have before me, including the type, three stages in the growth of this species, which in some respects seems partly to bridge over the gap between

Asteropsis of Müller and Troschel and *Dermasterias* of Perrier (1875). Unfortunately, I have not access to Perrier's original paper, but I rely on Sladen's diagnosis of the two genera ("Challenger" Report, p. 355). One difference (I gather both from Sladen and from Bronn's "Thierreichs") lies in the presence of a distinct "composite reticulated meshwork" formed by the abactinal plates in *Dermasterias*, while the skeleton of *Asteropsis* consists of "irregular substellate plates not forming such a network." From the account of the largest specimens given below it will be seen that in the adult of this species such a "composite reticulated meshwork" does exist, but in other features the genera are quite distinct.

The material at my disposal consists of—(*a*) Large specimens, both dried and in alcohol; (*b*) Farquhar's type, which is of intermediate size: (*c*) small ones, dried.

(*a*.) The dried specimens are somewhat compressed and distorted, but the plates are pretty distinctly seen, while in those preserved in alcohol the skeleton is entirely concealed by the tough skin, which is wrinkled on the abactinal surface, and especially near the tips of the rays, but is smooth on the actinal surface. This skin encloses and connects the adambulacral spines so as to form 2 thick membranes on each side of the groove, one lying in the furrow, the other along its margin.

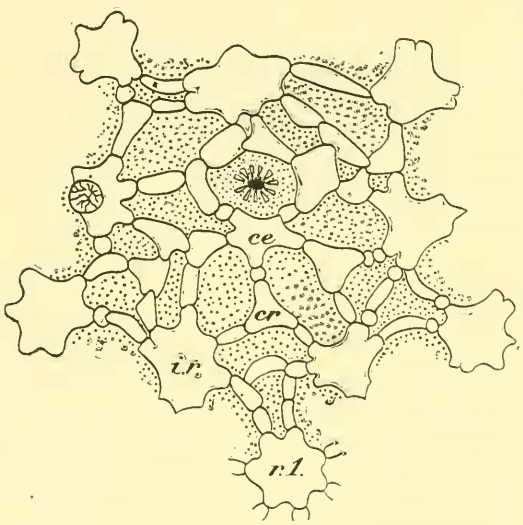

Fig. 1. *Asteropsis imperialis.*

The central portion of the disc (× 2). *ce.*, central; *c.r.*, centro-radial; *i.r.*, interradial; *r1*, primary radial.

Dimensions.—The dried specimens measure R 75, *r* 34; R 70, *r* 31. The alcoholic specimen gives R 56, *r* 24. Thus *r* : R = 1 : 2·20 to 2·33.

The form is stellate, with rounded interbrachial angles. The rays are broad at the base (3 mm.), tapering gradually to a rounded apex. At about midway along the ray is 15 mm. across. The figure given by Farquhar represents well the general appearance of a preserved specimen.

The madreporite is prominent and round, situated rather nearer to centre than to the margin (as 12 is to 20). The anus is surrounded by a circle of short cylindrical spines, about 10 in number, which close over it.

The abactinal skeleton forms an open meshwork, with large papular areas, separated by short rows of narrow flattened ossicles about half as wide as they are long, which radiate from a series of 5- or 6-lobed plates at the nodes of the network. There is a 5-lobed central plate with the anus close to one side; from it radiate outwards short rods, forming a series of wide meshes around it. At the interradial margin of this circle are 5 irregularly stellate plates, one of which bears the madreporite.

These are the primary interradials. Each presents 5 lobes proximally and a large single or feebly notched lobe distally. From the latter a series of paired plates lying side by side pass outwards to the interbrachial margin. At intervals along this double row there are semi-stellate plates with radiating rods on either side (fig. 2).

Outside the interradials is a series of 5 primary radials at the base of the rays. Each is a more or less rosette-shaped plate with 5 to 7 lobes. Along the middle of the ray is a series of similar plates connected together by short rods, which in the distal region of the arm become shorter and shorter, so that the median rosettes come to lie closer together (fig. 2).

Along each side of the radials or median row is a lateral series of similar rosette plates, but of less size; these, however, cease about half-way along the arm. They are connected to the median rosettes by short narrow rods, and when the intermediates cease the rods become broader and shorter, and connect the medians with the supra-marginals. Still further out the radials themselves touch the marginals.

The supra-marginals are large, irregularly oval or pyriform, or even subtriangular, with rounded angles; they are very convex outwards, and are obliquely placed and loosely articulated. I find 11 or 12 along each side.

The infra-marginals have the same general form, but are rather smaller, with the longer axis longitudinal; and, though usually immediately below the supra-marginals, the number is rather greater—12 or 13 (fig. 3).

On the upper surface there are the characteristic "valvate pedicellariae" at the base of each arm; they are of large size, measuring 4·5 mm. in length. As Farquhar has noted, these are not quite regularly arranged —not always paired—as will be seen from the following table (A and B are large, C and D are young forms):—

Specimen.	Ray.	Pedicellariae.
A	1	Paired.
	2	Paired, though unsymmetrical.
	3	Two on one side, none on the other.
	4	Paired.
	5	One on one side, none on the other.
B	1	One only.
	2	None.
	3	Paired.
	4	None.
	5	One small one, on one side only.
C	1	Paired, with a 3rd smaller on the disc, near median plates.
	2	Paired.
	3	One.
	4	,,
	5	,,
D	1	Paired.
	2	,,
	3	,,
	4	,,
	5	One.

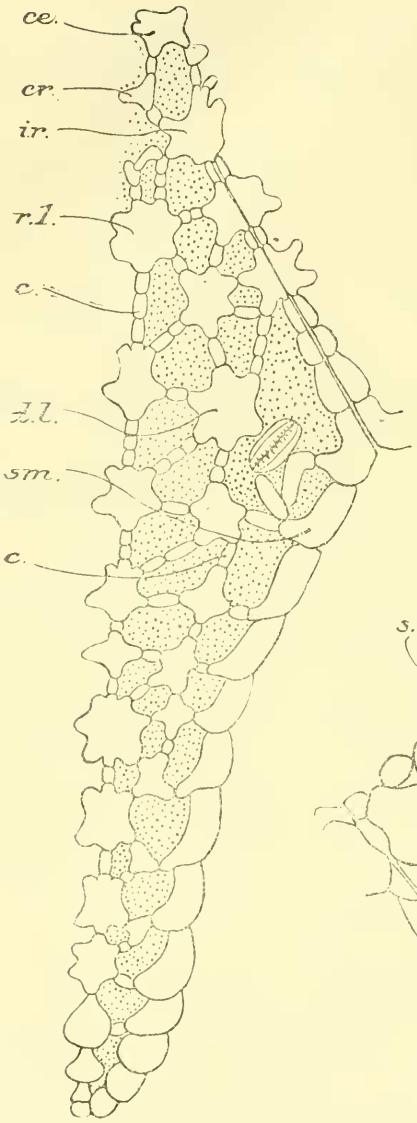

FIG. 2.

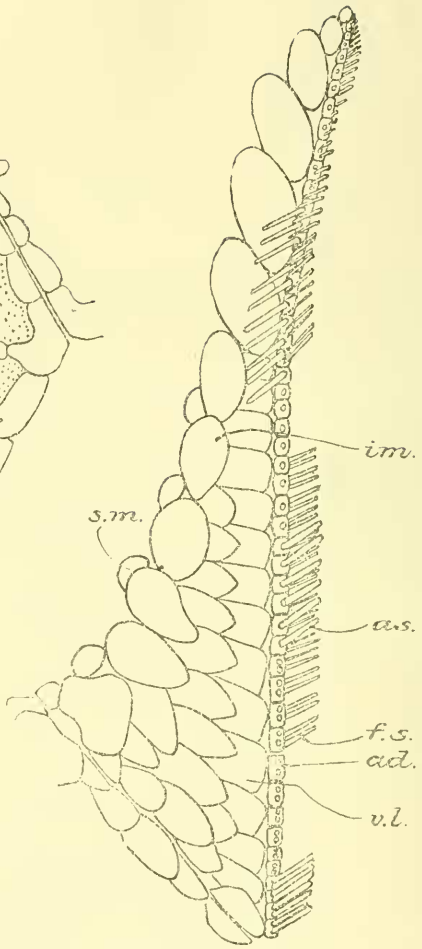

FIG. 3.

Asteropsis imperialis.

Fig. 2. Abactinal surface of half a ray (× 2) denuded of its skin, showing the arrangement of the skeleton. The dotted areas are diagrammatic only, for the purpose of showing up the plates more distinctly. *c.*, connective; *ce.*, central; *c.r.*, centro-radial; *d.l.*, dorso-lateral; *i.r.*, interradial; *r.l.*, primary radial; *s.m.*, supra-marginal.

Fig. 3. Actinal surface of half a ray (× 2). In the proximal region the paired actinal ambulacral spines are inserted; in the middle, both the furrow-spines and the single actinals which are present here; toward the distal extremity the actinal spines are removed, and only the furrow-spines are shown. *ad.*, adambulacral; *a.s.*, actinal ambulacral spine; *f.s.*, furrow-spine; *i.m.*, infra-marginal; *s.m.*, supra-marginal; *v.l.*, ventro-lateral.

The papular areas are occupied by numerous papulae.

The actinal skeleton in the interbrachial area consists of more or less oval imbricating plates, with the longer axis radially directed. There are no pedicellariae on this surface.

The adambulacral armature is formed by 2 rows of spines : the furrow series of 2 spines to each ossicle, cylindrical, blunt-pointed, and close together ; the actinal spines (or outer series) are broader, more conical, and also bluntly pointed. In the proximal half of the arm there are 2 actinal spines to each ossicle, but further out 1 only.

(*b.*) By the kindness of Mr. Edgar Waite, the Curator of the Canterbury Museum, I have been allowed to examine the type of the species. It is in much better condition than mine, as it has evidently been carefully dried, and the skeletal plates are not disturbed. It has faded to a dirty-yellow colour.

The disc-plates are quite distinctly seen through the skin ; the chief ones are lobed as in the above specimens, and are connected by short ossicles so as to form a network ; but the width of the meshes is smaller, the length and number of rods being less than in the above. The distinctly lobed or rosette plates on the arm, both median and lateral, have the same arrangement, and there are the same interbrachial lines of plates. Mr. Farquhar's figure was drawn, I suspect, from the wet specimen, so that the plates are not clearly shown.

I may note that on one side of one arm, which bears a normal pair of pedicellariae, there is a trivalved pedicellaria as shown in Farquhar's figure, situated just in front of one of the normal bivalved pedicellariae, and symmetrical with a small bivalve on the opposite side of this arm.

(*c.*) In the small individuals the short rods connecting the rosette plates are still fewer, or absent, so that the plates are in contact. The supramarginals touch the radials for about half the length of the arms, then there is a single row of intermediates. On the disc the plates are imbricated.

The dried specimens measure R 45, *r* 20 ; and R 40, *r* 19.

Colour.—The colour in life is described by Mr. Oliver as "bright red." The dried ones are still carmine-red ; those in alcohol are bright orange.

Locality.—Oliver states that they are "not common." They occur on rocks near and below low-water mark. Meyer Island (29/2/1908) ; Boat Cove, Sunday Island (1/5/1908). Farquhar's specimen also came from here.

Distribution.—The genus is represented by *A. vernicina* on the Australian coast. For the opportunity of comparing the Kermadec species with this I am indebted to Mr. Etheridge, Curator of the Australian Museum, who was good enough to send me specimens of the Australian species.

Gymnasteria lissotergum sp. nov. Figs. 4 and 5.

Three small starfishes seem to require the formation of a new species.

Dimensions.—R 11, *r* 6·5. The smaller has R 6, *r* 4. The ratio *r* : R is 1 : 1·84 and 1 : 1·5.

Flat, star-shaped, with broad arms (7 mm. at the base), rounded at the tip. The abactinal surface is covered with flat roundish hexagonal plates of relatively large size, pavement-like in their arrangement, and covered by a rough finely granulated skin. Papulae occur in lines between the plates.

The median radial plates are somewhat larger than the laterals, which extend to the tip of the ray. The madreporite is single, small, about half the diameter of any of the other plates of the disc, and situated close to the centre.

Marginals well developed. The supra-marginals are large, flat, squarish, lying on the upper surface. There are 7 on each side, excluding the terminal. In one specimen some few of the supra-marginals bear 1 to 3 quite small blunt spines on the outer edge. In the other specimen they are little evident.

In each interradius a couple of plates, with adjacent sides straight, extend from the primary interradial to the marginals.

At each side of the base of the arm is a small valvate pedicellaria, though not quite regularly disposed, as it may be absent from one side. They are usually carried on one of the small supplementary plates, between the supra-marginal and laterals. In one case there is a pedicellaria on a special plate close to the median row.

On the actinal face the interbrachial areas are formed of small plates similar to those of the upper surface. There are no pedicellariae or papulae on this surface.

The infra-marginals are similar in form and number to the supra-marginals. Each bears a horizontal row of 3 or 4 short conical spines, compressed from above downwards, closely set along the outer edge of the plate. In each group the 2 middle spines are rather longer than the 2 outer ones. There is a gap between the groups, so that the saw-like fringe is interrupted.

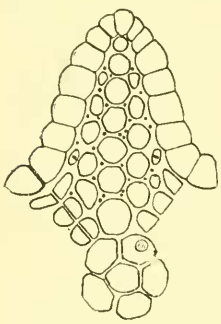

Fig. 4.

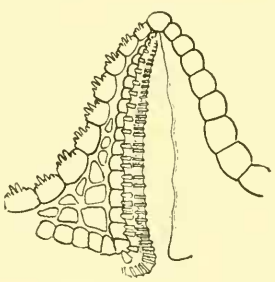

Fig. 5.

Gymnasteria lissotergum.

Fig. 4. The abactinal surface of the disc and of one ray (× 3).

Fig. 5. The actinal surface of one ray (× 3). Details are inserted on one side only.

The adambulacral armature: The series of furrow-spines and the series of actinal spines are united together to form a sort of membrane, so that the groove is margined by 2 membranes on each side. The furrow-spines are 2 to each plate, cylindrical; the actinal spines are solitary over the greater length of the groove, but duplicated on the plates near the mouth, flattened and broad, with very blunt points. There are no special teeth at the oral angles.

Colour.—Mr. Oliver gives the colour as "bright red." When dried they are pale buff, with indications of a richer brown near the apex.

Locality.—Meyer Island: Under stones in rock-pools (19/5/1908); and one was dredged "on coral, 3 fathoms" (1/3/1908).

Distribution.—The genus is Pacific and Indian.

Remarks.—The juvenile form of *G. carinifera* v. Martens, figured by Sladen ("Challenger" Report, pl. 52, figs. 5–8), differs from the present species in the relatively greater size of the plates, in the presence of large spines on the infra-marginals, and none, or very small ones, on the supra-marginals;

also, in that species there are 2 rows of lateral intermediate plates separating the radials from the marginals, while the proportion r : R is different. The arms are blunter, and the adambulacral armature different.

Asterina oliveri sp. nov. Fig. 6.

Of this starfish, which is very common in rock-pools, I have nine specimens, all dried. They have, unfortunately, been a good deal flattened, and the spines rubbed off in places, but the general characters are readily seen by comparison of one with another.

Dimensions.—The largest is R 27, r 23, and from a series of measurements it is found that r : R is about 5 : 7.

The outline varies from stellate to nearly pentagonal, with only slight incurvatures between the rays. Probably in life the centre of the disc is elevated, but it is now depressed. The arms are, naturally, broad, and end bluntly. The madreporite is single, not prominent, much nearer to the centre than to the margin, its mesial edge being a little more than half its own diameter from the centre.

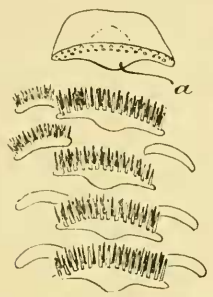

Fig. 6.—*Asterina oliveri.*

A few of the radials and latero-dorsals, on some of which the double rows of spines are shown; one radial is wholly exposed, but of the others only the narrow spiniferous margin is visible (*a*).

The abactinal plates are crescentic, those along the middle of the ray longer than elsewhere, so that they are distinctly conspicuous. On either side of this row the plates are shorter, and this decrease continues towards the middle of the interbrachial area. The spines are in 2 rows on each plate, closely set, cylindrical, fine, and sufficiently long to reach nearly to the neighbouring plate when pressed down.

There are about 14 spines in each row on the mesial (radial) plates; about 10 on the curved interradials of the interbrachial area, but towards the margin they get fewer, there being only some 5 or 6 on these smaller plates.

On the actinal surface each plate carries only 1 spine, shorter than those of the abactinal plates, and a good deal stouter; but on the 5 or 6 rows of plates near the margin, where they are reduced in size, each plate bears 2 spines. The colour of these actinal spines is greenish-blue, with white tip and white base.

The adambulacral armature: The furrow-spines are 2, cylindro-conical, standing side by side in a row. Externally on the actinal face each plate carries 1 spine, longer and stouter, blunt-pointed, and somewhat flattened.

The oral armature: Each interradial couple bears 10 spines (*i.e.*, 5 on each side), arranged horizontally close together. Of these, 4 are long, stout, flattened, and truncated, with 3 on either side rather stouter.

Each of the oral plates, at the angle, bears a single spine on its actinal surface.

Colour.—In life they are black, but in the dried state they are a uniform dark bluish-grey. The lower surface is bluish-green, the spines here being greenish, with white tips.

Locality.—On the east coast of Sunday Island ; common ; rarely noticed elsewhere.

Remarks.—This species differs from our New Zealand *A. regularis* in several points : the spines on the upper surface are finer and more numerous, while in that species also the radials are not prominent. I may state that a good account of our native species is a desideratum, for it exhibits some variations. No one has recognized again Perrier's *A. novae-zealandiae*, which appears to be a variation only. All the Kermadec individuals have 5 arms, whereas *A. regularis* is well known to present 5, 6, or even 7 arms.

This new species is allied, I think, to *A. gunnii* Gray, from the coasts of Australia, Tasmania, and the Cape of Good Hope, which, however, is apparently invariably 6-rayed, and the actinal surface of the adambulacral plates bears 2 spines. Owing to lack of necessary literature I give it a new name, though I am quite prepared to find that this species has already been described.

Ophidiaster (?) kermadecensis sp. nov. Figs. 7–11.

The material consist of several dried individuals, as well as three in alcohol.

Dimensions.—R 82, *r* 12 ; so that *r* : R is nearly 1 : 7. The diameter of the arm about half-way along is 12 mm.

The rays are long, subcylindrical, tapering to a point. The abactinal skeleton is composed of rounded and round-topped plates, covered with

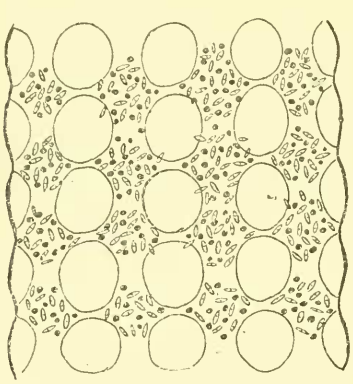

Fig. 7.

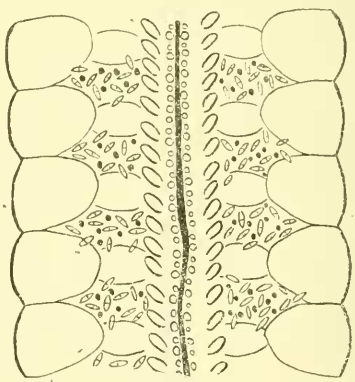

Fig. 8.

Ophidiaster (?) *kermadecensis.*

Fig. 7. A portion of a ray, abactinal surface (× 4). No attempt is made to show the granulation of the skin, nor the fact that the papular areas are depressed below the level of the upper surface of the plates, which have their outlines too sharply marked in the figure.

Fig. 8. A portion of a ray, actinal surface (× 4). See remarks under previous figure.

a tough skin presenting small, unequal-sized, closely set, low, rounded granulations, so that the skin looks shagreened.

There are 7 rows of plates, all practically alike in form and size—that is, a median (radial), a lateral (adradial) on each side, and the two marginals.

The papular areas are large, and are continuous with one another in a longitudinal direction. Numerous pores, as many as 15 to 20, are

scattered over each area. The granulations of the skin of these areas is finer than on the plates.

Characteristic pedicellariae (those termed by Perrier "pédicellaires en salière" and by Sladen "entrenched"), in the form of shuttle-shaped pits, are likewise scattered over the whole of these areas in considerable numbers; I counted as many as 15 to 20 in some areas. They are, however, not confined to these places, but encroach upon the edges of the plates. They are set close together, almost touching, with their long axes in all directions (fig. 11).

The plates on the disc have the same arrangement as in *Ophidiaster ophidianus*, as described and figured by Ludwig (1897). The circular madreporite is larger than the interradials, and a little nearer the margin than to the centre.

The actinal surface is covered by the same skin as the upper surface. The adambulacral plates are separated from the infra-marginals by a single row of small plates (the ventro-laterals), every alternate plate being connected with a marginal by an upwardly directed process, while the other plates are horizontally arranged. Papular areas with pedicellariae

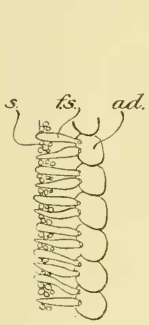

FIG. 9.

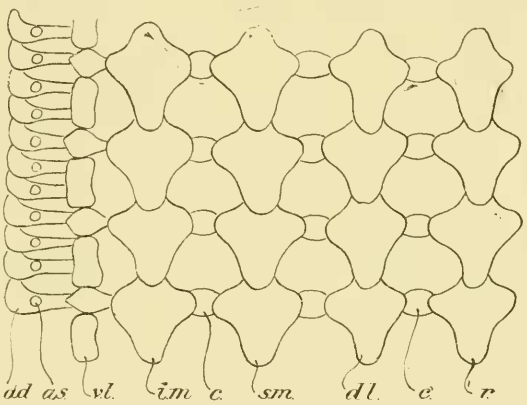

FIG. 10.

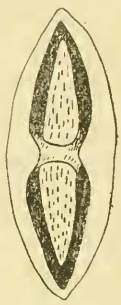

FIG. 11.

Ophidiaster (?) *kermadecensis.*

Fig. 9. A portion of the side of the ambulacral groove, seen from mesial aspect after the removal of the opposite wall (× 4). *ad.*, adambulacral; *f.s.*, furrow-spine; *s.*, the granulations of the skin pushing between the furrow-spines.

Fig. 10. The skeleton of one side of portion of a ray (× 4) after treatment with potash and somewhat flattened out. *ad.*, adambulacral; *a.s.*, pit for actinal ambulacral spine; *c.*, connective; *d.l.*, dorso-lateral; *i.m.*, infra-marginal; *r*, radial; *s.m.*, supra-marginal; *v.l.*, ventro-lateral.

Fig. 11. An "entrenched pedicellaria" (much enlarged).

occur outside the latter. The adambulacral armature presents 2 furrow-spines on each plate, closely pressed against the side of the furrow, with the tips outwardly directed. The granular skin pushes furrowwards between them. The actinal spines are much thicker, shorter, and stouter, and somewhat clavate in form. There is one to each plate.

As Sladen mentions "super-ambulacral plates" in his diagnosis of *Ophidiaster*, as opposed to some other genera of the family, I examined into their occurrence here: they exist as short rods passing from the upper surface of the ambulacrals to the ventro-laterals.

Colour.—In life this species is deep orange. Mr. Oliver remarks, "Its colour renders it very conspicuous, and it does not try to conceal itself. This seems to be a good case of 'warning coloration,' the starfish evidently being distasteful to fish." &c. I do not know whether he made any experiments to support this suggestion, which on the usual view of coloration seems plausible. When dried the colour turns to a dirty pale orange-brown; in alcohol to chocolate-brown.

Locality.—Meyer Island (20/5/1908). It has already been recorded and sufficiently described from Raoul (Sunday) Island by Farquhar (1897), who did not give it a specific name.

Remarks.—I have doubts as to whether this is really an *Ophidiaster*, for according to Ludwig's analysis of the skeleton (1897) of the Mediterranean species, *O. ophidianus*, there should be 2 rows of ventro-lateral plates. I do not know whether a similar careful analysis has been made for other species, but Ludwig lays stress on this point, for he separates, under Gray's name *Hacelia*, *H. attenuata* on account of the presence here of 3 ventro-laterals. Possibly, therefore, the Kermadec species deserves a new generic title.

The arrangement of the arm-plates in 7 regular longitudinal rows is a characteristic of *Ophidaster* which is shared by *Hacelia*, whereas in *Linckia* the dorsal arm-plates are not regularly disposed, though in a recent paper Koehler (1910) describes *L. dubiosa*, in which the dorsal surface has the appearance of *Ophidiaster*, while the arrangement of the adambulacral spines in contiguous rows is held to be a feature of *Linckia*.

I have been rather puzzled by the "entrenched pedicellariae," for in Bronn's "Thierreichs," as also in Delage's "Zoologie Concrète," the diagnosis of *Ophidiaster* includes the "absence of pedicellariae." Nevertheless, Sladen describes two species (*O. tuberifer* and *O. heliostichus*) in which these are present, and Ludwig adds several others with "pédicellaires en salière." This diagnosis is thus misleading, for it is one of the apparent distinctions between this genus and *Linckia*.

I am not sufficiently familiar with the literature to do more than express my doubts as to the validity of referring this Kermadec species to the genus *Ophidiaster*. I am informed that a specimen was sent to Professor Bell, of the British Museum, for identification, and it was stated by him that he did not know the species, and that it was probably new to science; hence the detailed account above given. At the same time, I have not seen Perrier's account of *O. germani*, from Lord Howe Island and New Caledonia, and it may turn out to belong to this species, or to one of Lutken's from Tonga.

Asterias rodolphi Perrier.

Perrier, Ann. Mag. Nat. Hist. (4), vol. 17, p. 34 (1876).

Farquhar (1897) has already given a full description of this species, which was collected at Raoul (Sunday) Island, where the type was found so far back as 1854.

The present collection was made at Sunday Island "under stones at low-water mark." It consists of seven specimens in alcohol. They all have 7 arms.

Measurements were made on three individuals, with the following result: R 95, r 18; R 80, r 14; R 48, r 8; hence the ratio R : r is between 5 and 6 : 1.

Colour.—In life the starfish is dark purple; in alcohol it is pale red, with the interbrachial areas dark brown.

Asterias (Stolasterias) edmondi sp. nov. Figs. 12 and 13.

Two dried specimens and one in alcohol appear to require the formation of a new species, and I give it the above name in commemoration of the great work of Edmond Perrier on the echinoderms.

Dimensions.—R 33, *r* 7; and R 26, *r* 5·5. The larger has 8 rays, the smaller 7.

The remarkable feature about this species is the naked central area, provided with only a few scattered small plates. It recalls *S. alexandri* Perrier (1905); but in that species the naked area is traversed by 5 radial rows of small plates, even when young.

The arms are long and narrow, being in the larger individual 5 mm. across the base; so that L : B equals 28 : 5—*i.e.*, its length is more than five times its breadth.

The whole starfish is much more delicate in build than *A. rodolphi*. The central abactinal region is almost bare, appearing as a thin membrane

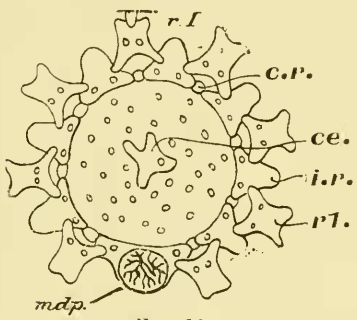

Fig. 12.

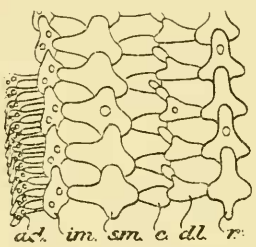

Fig. 13.

Asterias edmondi.

Fig. 12. The central area of the disc (× 4). *ce.*, central; *c.r.*, centro-lateral; *i.r.*, inter-radial; *mdp.*, madreporite; *r1*, primary radial.

Fig. 13. The skeleton of a ray, half only (× 4). *ad.*, adambulacral; *c.*, connective; *d.l.*, dorso-lateral; *i.m.*, infra-marginal; *s.m.*, supra-marginal; *r.*, radial.

with minute, isolated, roundish plates or granules roughly arranged in 3 or 4 incomplete concentric circles. In the larger one there is in the centre a quadrilobed plate (the central) bearing a spine, which plate is absent in the smaller specimen. The diameter of this area is 5 mm. It is surrounded by a ring of more or less pentagonal or quinque-lobed plates, interradial in position (*i.r.*), each bearing 2 spines. One of these is, of course, the madreporite, which is relatively of large size. Lying outside this circle are the 7 primary radials. The radials are 3-lobed, 2 lobes being proximal and resting on the *i.r.* Between the *i.r.*, and almost entirely concealed by them, are the centro-radials.

The arm-skeleton consists of a median series of triradiate plates, every alternate one bearing a spine, and, like all the spines, these are surrounded at their base by a cushion of pedicellariae.

On each side of the median series is a row of transversely arranged plates, slightly lobed at the outer end, each of which is connected by means of one or two smaller plates with 2 vertical rodlike plates. These in their turn

abut upon the upper end of the large supra-marginals, every third of which bears a spine, which projects laterally, forming a fringe along the side of the arm. The infra-marginals are horizontally extended, each bearing 2 spines, obliquely set, one slightly above the other. The spines are cylindrical, short, and relatively stout, with rounded roughened tip, those at the margin somewhat flattened from above downwards.

The adambulacral armature consists of a single series at the proximal portion of the groove (about one-third of its length), but further away from the mouth each plate bears 2 spines, the inner being slenderer than the outer, but of the same length.

The individual in alcohol has 3 small regenerating arms.

Colour.—In life it is bright blue ; when dried it is pale grey.

Locality.—Cast up on Denham Bay beach, Sunday Island ; and also found under stones below low-water mark at Coral Bay.

Remarks.—I find no reference, in the literature at my disposal, to any starfish of this subgenus *Stolasterias* having a naked central area ; but, as I have mentioned, *S. alexandri* is nearly naked at this point. It is a curious exception to the general rule of development of the plates of the disc formulated by Ludwig that the centrale is the first to appear—at any rate, in the Mediterranean species.

I may state that I have a very small specimen of *A. calamaria*—less than the smaller of the two above described—in which the disc-skeleton is already well developed.

Ophiuroidea.

Oliver writes, in explanation of the condition of the Ophiurids, " I had great difficulty in preserving the brittle stars and holothurians ; they were all obtained at Meyer Island or at Coral Bay, and often two or three days would elapse between the time the specimens were collected and my return to camp, so I was forced to put them into spirit before they were quite dead, with the result that they broke themselves up."

Ophionereis schayeri Müller and Troschel.

This species has already been recorded from the islands by Farquhar (1906). Oliver states that it is " very common in sand and mud, under stones, in rock-pools, and about low-water mark."

This common New Zealand brittle star is highly variable in coloration, which Farquhar has suggested may be protective. This author has given a full account of its anatomical features (1894) and a list of references (1898), and in another paper its distribution (1906), so that I need not add anything further.

Locality.—Meyer Island ; and elsewhere on these islands (Haylock).

Distribution.—New Zealand (from Auckland to Dunedin), Chatham Islands, Australia (east coast), Tasmania, Juan Fernandez, and probably Galapagos.

Amphiura squamata Delle Chiaje.

I have given the full synonymy and references in my report on the Echinoderms from the subantarctic islands (1909) ; but recently Lyman Clark (1909) has suggested that this southern form—at any rate, that from Australia—is a distinct species, and places it in the genus *Amphipholis* (= *Amphiura*) as *A. australiana*. But if it turns out that our New Zealand

species is identical with that from Lord Howe Island it seems to me that Hutton's name *parva* (1879) should take precedence of Clark's. I have not re-examined the identity of our form.

The specimens collected by Mr. Oliver are juvenile: the largest of the five individuals measures 2 mm. across the disc: the arms are about $3\frac{1}{2}$ times this diameter.

Locality.—Coral Bay, Sunday Island: "In mud, under stones."

Distribution.—New Zealand, Auckland Islands, North Atlantic, Mediterranean, Cape of Good Hope, south-east Australia, Chile, Gough Island, Lord Howe Island.

Ophiocoma brevipes Peters.

I believe this to be Peters's species, but, as a detailed account is not accessible to New Zealand naturalists, I append a full account of these specimens.

The material consists of two specimens in alcohol.

Dimensions.—Disc, 28 mm. in diameter; arms, about 100 mm. from the base, but, as they are curled a good deal, it is impossible to give accurate measurements. The breadth of the arm at the base is 5·5 mm., and over the spines 11 mm.

The whole of the circular disc is covered with a thinnish skin, with minute, closely set, rounded granules, about 8 or 9 in the length of a millimetre. The disc bulges between the arms, which are set at the edge, and are not inserted in a notch.

The adradials are entirely covered, as is also the interbrachial actinal area, with this granulation.

The orals are large, hexagonal, with curved sides; sometimes the angles are obsolete. The radial diameter is a little greater than the transverse (L = 3·5 mm.; *br* = 3 mm.). The greatest breadth is near the outer side, and the mesially directed angle is acuter than the aboral angle.

The side mouth-plates are triangular, project externally, and are dark in colour. Buccal papillae pale, 5 on each side: the outer ones are long, conical, and pointed at the apex; the inner ones are slightly shorter and rounder.

Dental papillae form a somewhat triangular group, of which one series of 4 are quite small, and lie more superficially than the buccal papillae: 2 others are nearly in line with the latter, and similar to them in shape: 8 or 9 others form two curved rows below; of these, 4 or 5 lie in an upper row, the 2 outer ones of which are smaller than the other 3; while the lower row consists of 4, about equal in size, and arranged so as to alternate with those of the upper row. There is some variation in the details, even at the five angles of one and the same individual, especially with regard to the outermost series, which may be absent; while, on the other hand, there is sometimes an additional pair of small ones in line with the buccal papillae.

Teeth are 4 in number.

Upper arm-plates are twice broader than long, transversely oval, with convex distal margin; they meet one another broadly.

Under arm-plates are somewhat shield-shaped—that is, quadrangular, with the proximal margin less broad than the distal. The latter is convexly rounded and the lateral margins more or less excavated, while the

proximo-lateral angles are bevelled off. The length of the plate is about equal to the breadth of the distal margin.

The side arm-plates just appear dorsally and ventrally.

There are 2 tentacle-scales.

The arm-spines are usually 4, over the greater part of the arm, but near the base may be 5 or even 6, while in the distal portion the number sinks to 3. The spines are flattened, smooth, bluntly truncated: the upper two are shorter and broader than the lower two.

In one individual I noted that for two-thirds of the arm there are 3 spines, and 4 nearer the base; the 3 are subequal, but the middle one is slightly the longer. Towards the base the uppermost (the 4th) is broader, shorter, and flatter, and truncated. The upper spine is equal in length to about 2 upper plates; the lowest to nearly $2\frac{1}{2}$ plates.

Colour.—The colour in alcohol is very dark brown, nearly black, with many small pale spots (or, rather, dots), more or less circular, closely set, rather more densely and of larger size near the centre, and often disappearing towards the base of the arms. They are fewer over the adradials, especially along the middle of each, so that here there is a linear dark space. The arms are sometimes neither spotted nor banded, except towards the tips. The upper arm-plates are almost black, but in one individual the arms are banded. The arrangement is as follows: A few of the plates at the base of the arm are marked with a central cream-coloured oval spot, larger or smaller, at irregular intervals, but generally 2 or 3 such plates occur consecutively. Further away from the disc groups of 2 or 3 plates may be nearly wholly of this creamish tint, separated by more or fewer dark plates. Still nearer the tip groups of 3 or 4 plates are marbled with cream, and the intervening ones are grey, with dark margins, so that the ends of the arms are crossed by pale and darker bands. The actinal interbrachial areas are similar to the actinal surface, but the spots are larger and closer, so that this region appears paler, and there results a dark network on a pale ground. The orals and side mouth-plates are dark brown, but the madreporite is cream-coloured. The under arm-plates are pale brown, but close to the disc are cream. Some of the spines have a pale streak along the upper and lower margins.

Locality.—Coral Bay; in mud, under stones.

Distribution.—Lord Howe Island (Clark, 1909), Philippines, Pelew Islands (Lyman, 1874), Amboyna and New Guinea (Clark, 1908), Kingsmill Islands (Lyman), Sandwich Islands (Lyman, *O. insularia*).

Ophiothrix oliveri sp. nov. Figs. 14–17.

Material: Three specimens.

Dimensions.—Diameter of disc, 14 mm.: length of arm, about 82 mm. therefore the arm is about six times the disc-diameter.

General Colour.—Violet, with paler under-surface: when in alcohol, very dark: when dried, much paler.

The disc is pentagonal, with excavated interradial edges when dried, but bulging here when in alcohol.

The abactinal surface is covered with a thin skin, strengthened by small conical granules, which when dried are seen to be glassy spinules terminated in 3 or 4 (rarely 6) points, the length of the spine being about three times its breadth.

The adradial, the blunt tip of which is free and slightly raised, is also covered with spinules, though more sparsely than elsewhere.

The actinal interbrachial area is naked except for a small triangular patch of spinules which encroach from its margin.

The orals are remarkably small, and only that carrying the madreporite is at first noticeable, owing to its larger size. They are transversely rhomboid, situated close to the outer margin of the actinal region, near the genital clefts, leaving the whole of the angle-pieces, as well as the conspicuous perforation between them, exposed.

The torus is broad. There are no buccal papillae, but a large series of 16 dental papillae, which form a vertically oval patch, arranged in four horizontal rows of 4 in each row.

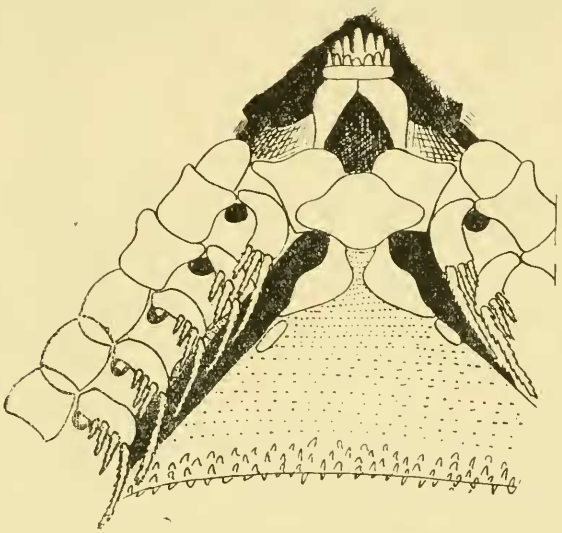

Fig. 14.—*Ophiothrix oliveri.*
Actinal surface of portion of the disc (× 5).

The upper arm-plates are naked, transversely oval, with the proximal margin straight. This margin has a raised median prominence, pale in colour, while the distal margin has a small peak, also pale. The successive plates are in contact (fig. 15).

The under arm-plates are subquadrate, broader than long, the proximal margin nearly straight, the distal concave, the lateral borders convex (fig. 17).

The arm-spines are 8 in number, glassy, flattened, and feebly thorny along the edges. The lowest spine (1st) is the smallest, being only a little longer than the scutellum or tentacle-scale, just outside which it lies. The next 2 are successively longer, while the 4th, 5th, and 6th are the longest: these approximately equal four lengths of a dorsal arm-plate. The 7th and 8th are successively shorter; the 7th is nearly twice the breadth of a dorsal plate, while the uppermost is rather less than the length of this plate. The spines are violet (fig. 16).

The arms are (in alcoholic specimens) coloured with violet bands, alternating with paler, somewhat greenish, bands of less width. The violet

bands occur over the whole of one plate and the half of each of the two neighbouring plates, fading out gradually. The pale band occupies one plate. In the dried specimen the arms are uniformly violet dorsally.

Locality.—In sand under stones near low-water mark, Coral Bay, Sunday Island (July, 1908). Not common. Nothing is said of the colour when alive.

Remarks.—I supposed for some time that this was *O. caespitosa* Lyman, which was obtained at Port Jackson during the "Challenger" expedition; but from this it differs in (1) the absence of combs at the base of the arm, of which, however, no mention is made in the text, though in the figure

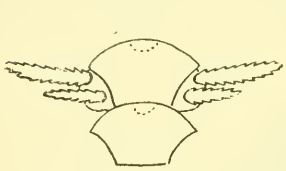

Fig. 15.

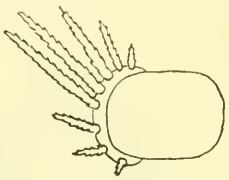

Fig. 16.

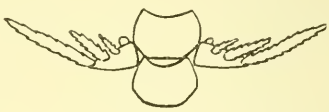

Fig. 17.

Opiothrix oliveri.

Fig. 15. Two upper arm-plates, lateral plates and spines (× 4).
Fig. 16. Transverse section of an arm, showing the series of spines on one side (× 4).
Fig. 17. Two lower arm-plates, with lateral plates and spines (× 4).

they are shown; (2) in the form of the under arm-plates; (3) the proportional lengths of the arm-spines; (4) the colour is said to be faint greenish above (in alcohol), the arms banded with lighter and darker yellowish-brown. It is also distinct from *O. coerulea* Hutton.

Variety.

Two specimens, also from Coral Bay, differ in one or two features, which do not appear to be of specific importance.

Disc, 8 mm. in diameter; arms, about six times as long.

In alcohol they are purplish-red; when dried the disc is very pale purple; the arms are marbled with white spots on a reddish, or in some places purplish, ground, though about every 3rd or 4th dorsal plate is uniform reddish. The spinulation of the disc is less profuse, so that the outlines of the plates are recognizable, and the interbrachial patch of spinules on the actinal surface reaches to the orals.

The under arm-plate is somewhat angular at its lateral margin, instead of being a convex curve.

The oral is longer, in a tangential direction, in proportion to its radial diameter, and the sides a little more excavated.

Although the disc is smaller than in the type, the width of the arm is much greater than in that.

The number of dental papillae is 12, though perhaps some smaller ones were overlooked.

Ophiura kermadecensis* sp. nov.

I have three dried specimens, of which one is quite small; the other two of about the same size, with a disc-diameter of 4 mm.; the arm is 7 mm.

*I have used *Ophiura* Lamk. (= *Ophioglypha* Lyman), in accordance with Bell's demonstration of its historical usage. He has shown, too, that Lyman's usage of *Ophiura* (= *Ophioderma* Müll. & Tr.) is wrong. Both Bronn's "Thierreichs" and Lyman Clark follow Bell (Ann. Mag. Nat. Hist. (6), viii, 1891, p. 339).

in length, but the tip is broken, so that probably it is really twice the diameter of the disc. There are also four other specimens in alcohol.

The circular disc is covered with larger and smaller subcircular plates. There is a distinct centrale, with convex roughened surface, surrounded by 5 quite small interradial scales, and then 5 larger radial plates, flat, but with the distal margin somewhat raised, so as to form a convex prominence; coloured pinkish. These radial plates are separated from one another by interradial rows of small convex plates. An outer circle of 10 flat plates, with prominent outer margins, radially and interradially placed with 1 or 2 small convex plates between them. The adradials of 2 neighbouring arms are separated by 1 large subquadrate plate (fig. 20, *m*), with its longer axis tangential and the outer border somewhat raised; and 3 or 4 smaller plates along its mesial margin separate it from other plates of the disc. In one specimen the number of smaller plates on the disc is less than in the one figured.

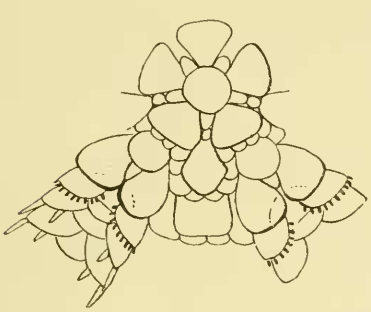

Fig. 18.

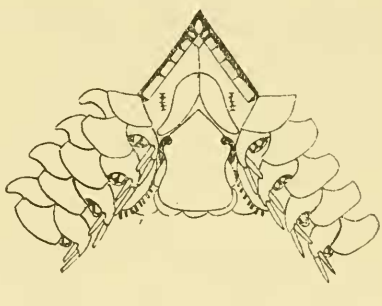

Fig. 19.

Ophiura kermadecensis.

Fig. 18. Abactinal surface of a portion of disc and base of one ray (× 10).
Fig. 19. Actinal surface of portion of disc and base of rays (× 12).

The adradials are exposed, touch one another, and are somewhat pyriform, with a rounded, raised convexity on its distal margin, which, as in the other plates, is pinkish and roughened.

The interbrachial area is occupied by one large quadrate, vertically disposed, plate (fig. 20, *i.b.*), edged on each side by a long narrow plate, and below by 3 rounded plates, which are interposed between it and the oral.

The orals are large, 5-sided, the radial axis being nearly twice the transverse. The two proximal edges are short, and enclose an angle directed towards the mouth. The lateral margins are long and nearly parallel to one another, and the distal or outer edge is convexly rounded. The oral is thrust outwards from the mouth so that its distal margin reaches the edge of the disc, leaving the whole of the 1st and 2nd adambulacrals (*i.e.*, the angle-piece and side mouth-plates) exposed.

There are 4 small quadrate buccal papillae on each angle-piece; a median and a pair of lateral angular papillae; no teeth and no dental papillae.

The arm is cylindrical, tapering, nearly circular in section, inserted in the margin of the disc, with a comb of short spines on each side of the base. This comb consists of 7 spines, of which the lowest is the smallest; they are conical and sharply pointed. The inner series consists of 5 spines.

Put generally, the under arm-plates are small, sub-pentagonal, with the proximal margin produced into an angle, intervening between the two lateral arm-plates.

The 1st under arm-plate is diamond-shaped; the breadth is greater than its length: the sides are slightly excavated for the pedal pore. The 2nd and 3rd are pentagonal, broader than long. The 4th, 5th, and 6th are somewhat pentagonal, but tend towards a triangle, owing to the rounding-off of the sides and angles. The following plates are transversely oval or pentagonal, with a pronounced angle or peak proximally. The plates get smaller and smaller, but do not disappear, at any rate, before the 20th joint, at which the longest arm is broken.

The side arm-plates meet ventrally after the 5th under arm-plate, where they just touch; but beyond this point the line of union increases in extent, so that soon it coincides with the length of the side arm-plate.

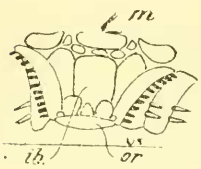

Fig. 20.

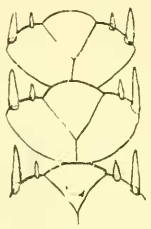

Fig. 21.

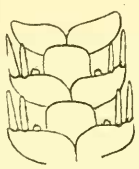

Fig. 22.

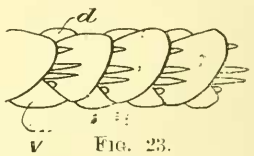

Fig. 23.

Ophiura kermadecensis.

Fig. 20. An interbrachial area, seen from the side (× 8). *i.b.*, the large interbrachial plate; *or*, the oral; *m*, marginal.
Fig. 21. Portion of the upper surface of an arm (× 10).
Fig. 22. Portion of the lower surface of an arm (× 10).
Fig. 23. Portion of an arm, seen from the side (× 8). *d*, upper arm-plate; *v*, lower arm-plate.

The upper arm-plates are roughly triangular, with rounded convex distal borders and with the apex directed proximally. They decrease in size till about the 10th, when they disappear, or are so closely and intimately united with the laterals that the suture is indistinguishable.

The side arm-plates carry 3 spines, which spring from the distal border; they are short, cylindro-conical, adpressed to the sides, and with a length about one-third that of the lateral plate. Of these spines, the two lower are rather closer together than the third, which is smaller than they.

There is 1 tentacle-scale throughout the greater portion of the arm; but 2 scales to the first two pairs of pores.

Colour.—In life Mr. Oliver describes the colour thus: "Upper surface of the arms red: the basal portion white, with a red central line; disc pink above: 2 plates [adradials] near the arms are white edged with red: under-surface yellowish." In the dried state they are buff, with pinkish tint on some of the disc-plates.

Locality.—Dredged in 12 fathoms, on gravel bottom, off Meyer Island, and in about 20 fathoms off Denham Bay (5/3/1908). He adds that they are not common.

Remarks.—In the small size and the fewness of the interbrachial plates, with 3 arm-spines, this new species bears some resemblance to *Ophioglypha minuta* Lyman, but in details it differs sufficiently to entitle it to be specially named. *O. minuta* was obtained off the south of Australia.

Echinoidea.

Phyllacanthus dubia Brandt.*

Three dried specimens were forwarded to me, which have the following dimensions:—

Number of *i.r.* Plates.	Diameter.	Height.	Longest Spine.
	Mm.	Mm.	Mm.
6	42	23	44
5	32	..	36
6	45	..	48

The spines are nearly uniform in diameter, broadest a little above the base, whence there is a gradual, though slight, decrease towards the tip, and a less decrease towards the neck. Those near the ambitus are more nearly cylindrical. The two upper spines of any vertical row on each interambulacrum are nearly of the same length; the 4th spine is about half this; the others diminish as they approach the peristome. The spines are always worn or corroded.

Locality.—Meyer Island (24/4/1908, 18/5/1908); also Sunday Island (Farquhar, 1906; coll., Haylock). Oliver writes that they "are very rare. The specimens collected are all small, and were found in a rock-crevice near low-water mark. Two or three others were seen in deep water (2 or 3 fathoms)."

Distribution.—New South Wales, Tasmania, Bass Strait, Lord Howe Island, New Caledonia.

Centrostephanus rodgersii A. Agassiz.

Mr. Oliver states that this species is "fairly plentiful among rocks at low water."

The diameter of the corona in these specimens is 80 mm.: height, 35 mm.; longest spine, 55 mm.

The corona when dried is purplish-brown. The colour of the spines when alive is dark purple.

Mr. Farquhar (1906) includes this in our New Zealand fauna, as there is a specimen in the Dominion Museum which is said to have been collected at Wellington; but it is by no means certain that the locality is correct, or that it was found on our coast.

Locality.—Coral Bay, Sunday (Raoul) Island (July, 1908); also Meyer Island.

Distribution.—East and south coasts of Australia, New Caledonia, Lord Howe Island.

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* After the MS. had gone to press I had the opportunity while at the Australian Museum, by the kindness of Mr. Coleman, of seeing Döderlein's Ber. ub. d. von Herrn Prof. Semon bei Amboina und Thursday Isl. gesammelten Echinoidea, 1902, wherein the author takes the view that the three species, *P. imperialis* Lamk., *P. dubia* Brandt, *P. parvispina* T.-Wood, are not distinguishable from one another, and refers the species to the genus *Leiocidaris* Desor., which he regards as including *Cidaris*, *Phyllacanthus*, *Rhabdocidaris*. I have, however, taken a conservative view, as I note that Lyman Clark and other recent writers retain *Phyllacanthus*; while a recent discussion as to the proper names of Cidarids warns me, an outsider, to beware of rushing in where Baxter, Clark, Mortensen, and others have trodden.

Toxocidaris tuberculatus Lamarck.

Strongylocentrotus tuberculatus, Farquhar, Ramsay, &c.

Three individuals were collected. The largest has the following dimensions :—Diameter, 83 mm. : height, 39 mm. : spines, 45 mm. : poriferous zone—above, 6 mm. ; below, 8 mm. : coronal plates, 20 mm.

There are 10 or 11 pairs of pores in an arc ; but below the ambitus, where the zone widens out, the pores are pressed together into a nearly horizontal line of 7 pairs in the widest, decreasing towards the peristome.

Colour.—When alive the "colour of the spines is greenish-brown." When dried they are dark olive-brown, greenish towards the base, with a rosy tinge near the tip. The rosy tip is much more distinct in the spines below the ambitus and around the peristome, perhaps because they have been less bleached. They are here more distinctly green, more truly olive, than above the ambitus; those immediately round the peristome being decidedly green. The test when dried is pale brown.

Locality.—Sunday Island (9/11/1908). Mr. Oliver writes. "This is the most abundant sea-urchin on the Kermadec Islands. Occurs everywhere among the rocks, from low-water mark down, in rock-pools. It was also seen at Macauley Island and French Rock. Continued westerly winds during the winter months shifted the sand from the low flat beach on the north of Sunday Island towards a boulder coast, burying the rocks for a considerable distance along the shore to above the level of low tide. This had the effect of driving thousands of these sea-urchins inshore, where a large proportion perished."

This species has already been recorded from these islands by Farquhar (1906), who received specimens from Mr. Haylock. There is a specimen in the Dominion Museum said to have been collected at Wellington ; and I am informed that at one time there was a specimen in the possession of Mr. Suter which had been collected at Mokohinou, Auckland.

Distribution.—New Zealand, New South Wales, Lord Howe Island, Japan, China.

Remarks.—I have followed Hamann (in Bronn's "Thierreichs") in placing this species in the genus *Toxocidaris*, which Agassiz erected for those species of *Strongylocentrotus* in which the poriferous zone assumes a "petaloid" form below the ambitus.

It appears that the colour of the spines is very variable. Agassiz (1872, p. 450) says, "The colour of the spines varies from dark violet to black." Ramsay (1885, p. 46) gives them as "uniform olive to olive-brown," and refers for the first time to the flattening of the spines below the ambitus. Agassiz and Clark (1907, p. 122) write that the Japanese specimens "are all (with one exception) large and of a very deep reddish-purple colour."

As Agassiz' account of the spines of *S. erythrogrammus* agrees better with that presented by my specimens—viz., "olive brown, tipped with violet" —I hesitated as to the correctness of my identification, especially as he remarks that the test of *S. tuberculatus* "when dry and denuded is usually greenish, the lower surface whitish." He makes no reference, however, to the colour of the other species ; but from the petaloid widening of the poriferous zone, and the character of the spines and their proportions, I believe that I am correct in placing these specimens under this species.

Tripneustes gratilla L. Agassiz.

T. variegatus, Farquhar, &c.

Of this species I received four dried individuals and two preserved in alcohol. The largest has a diameter of 77 mm., and its height is 35 mm.

Colour.—Oliver notes, "Colour of the spines white to purplish-white." When dried they are white, tipped with pale-reddish tint. The dried test is purplish-red. The ambulacral areas are paler, the interambulacrals darker.

"The short spines distinguish it readily from the other regular echinids of the Kermadecs."

Locality.—Sunday Island (July, 1908): "Large ones were seen in 2–5 fathoms of water in Denham Bay." "Numbers of these sea-urchins were killed by the encroachment of sand on the boulders on which they were living, during the winter months, when strong westerly winds prevail." It has been recorded also by Farquhar (1898).

Distribution.—Australia, Lord Howe Island, Fiji, Sandwich Islands, Japan.

Echinometra mathaei Blainville.

E. lucunter, auct.*

Four specimens were sent to me.

Oliver states that the "colour of the spines is white or grey." I find that they are white in the dried specimen, tipped with pale green, with a green axis, as seen on breaking them across. They are superficially ribbed. The smaller spines are wholly green.

Locality.—South Bay, Sunday Island (7/11/1908). Farquhar (1898) has already recorded this species. Oliver says that it is "very rare." They were found "in crevices of rocks and in rock-pools between tide-marks."

Plesianthus testudinarius Gray.

Echinanthus testudinarius, auct.

A single dead test was obtained, dredged in 12 fathoms, on rock and gravel bottom. It had evidently been dead for some time before being collected, for the actinal surface has several patches of polyzoan colonies on it, some flustroid and one tubuloid. The abactinal surface is also corroded, the tubercles being in parts obliterated. The whole surface is quite friable, and easily brushed away when an attempt was made to clean it.

The length of the individual is 115 mm.; the greatest width is at the level of the anterior pair of ambulacra, and is 97 mm.; height, 27 mm.; length of the postero-lateral ambulacrum, 39 mm.; width of the poriferous zone, 3 mm.; interporiferous area, 15 mm.; length of the antero-lateral ambulacrum, 37 mm.; width of poriferous zone, 3 mm.; of interporiferous area, 13·5 mm.

Locality.—Meyer Island, in 12 fathoms (20/5/1908).

Distribution.—Australia, Lord Howe Island, Sandwich Islands, Gulf of California.

* Lyman Clark (1909, p. 520) points out that Loven has already shown that the Indo-Pacific species of *Echinometra* should be termed *E. mathaei*, and that of *Tripneustes* *T. gratilla*.

Echinoneus cyclostomus Leske.

A single specimen, denuded of spines, was found under stones in rock-pool.

Locality.—Meyer Island (29/2/1908).

Distribution.—Australia, Kingsmill Islands, Zanzibar.

Fibularia australis Desmoulins.

A large number of this little urchin was obtained. Most of them are dried and denuded tests, but there are five in alcohol. They vary in length from 6 mm. to 13 mm.; the largest has a breadth of 11 mm. and a height of 4·5 mm.

Locality.—Sunday Island; dredged in 5 to 10 fathoms. "Dead tests washed up on the beaches in plenty; live ones rarely dredged on sandy bottom, in Denham Bay."

Distribution.—Australia, Sandwich Islands, Kingsmill Islands, Japan.

Brissus carinatus Lamarck.

The material at my disposal consists of one large broken individual and a smaller denuded juvenile test. The larger one measures 72 mm. in length; the other dimensions cannot be given. The postero-lateral ambulacrum is 24 mm. in length, the antero-lateral 21 mm. The subanal fasciole is transversely elongated, heart-shaped.

The colour is uniform purplish-brown.

Mr. Oliver writes, "One live specimen was encountered under a large stone in a rock-pool at Meyer Island, but unfortunately was broken by the crowbar in moving the stone."

The smaller individual, which was washed ashore on Denham Bay beach, is white, having evidently been bleached. There are only a few spines remaining. In outline is recalls Agassiz' figure of *Platybrissus* rather than *Brissus*. It is regularly ovoid, rather narrower posteriorly. The anterior end is rounded when seen in profile, and the posterior end is higher than the anterior, and nearly vertical. There is no keel, which may be due to its youth.

Length, 25 mm.; breadth, 18 mm.; height, 13 mm. The greatest height is at about the level of the posterior ends of the hinder ambulacra: the greatest breadth is nearly at the middle of the animal's length. The lateral margins of the test are nearly parallel. The apical area is near the anterior end, about one-quarter of the total length.

The 4 ambulacra are only slightly sunken: the antero-lateral nearly at right angles to the middle line, slightly curved backwards at first, then outwards and forwards.

The poriferous zone is nearly of the same width throughout. The form of the peripetalous and subanal fascioles is similar to that in the larger specimen. There are some large tubercles at the anterior region of the abactinal surface.

It appears from Bell's study of the species (1879) that it is highly variable; and he points out that Agassiz' figure of *B. carinatus* contradicts his text in regard to the relative lengths of the antero- and postero-lateral ambulacra.

I am not sure that this is the juvenile form of *B. carinatus*, but my literature is insufficient to enable me to trace out its identity.

Distribution.—"*Brissus carinatus* ranges over the entire circumtropical littoral zone" (Bedford, 1900). It has been recorded from Port Jackson, Society Islands, east India, Philippines, Malay, Sandwich Islands, Kingsmill Islands, Japan.

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