CEPHALOPODA OF THE KERMADEC ISLANDS.

BY S. STILLMAN BERRY.

Introduction.

The Kermadec Islands comprise a small archipelago of volcanic origin, situated in the South Pacific Ocean northeast of New Zealand, to which politically they belong. Being off the beaten path of commerce, they have been rarely visited, and it is only very recently, through the activity of various antipodean investigators, that we are beginning to gain any extended knowledge of their fauna.

So far as cephalopods are concerned, the only species of the fauna known until the last year or two are the three octopods which the *Challenger* dredged from very deep water in the neighborhood in 1874, and which were therefore reported upon by Hoyle in 1885–'86.

In the spring of 1913 the present writer received from Mr. W. R. B. Oliver, of Auckland, a small, but what proved to be a very well-worth-while collection of cephalopods taken on Sunday Island, the most important member of the group, by Mr. Oliver himself, Mr. Tom Iredale, and Mr. R. S. Bell, in 1908 and 1910. At the request of the sender this collection was "worked up" and reported upon in the *Transactions of the New Zealand Institute* for June, 1914, but owing to certain exigencies of preparing and publishing the paper, it proved impossible to provide illustrations adequate to the material described.

Some months later and too late to be reported upon simultaneously with the earlier specimens, Mr. Oliver forwarded me another small vial of cephalopods, collected as were some of the most unusual species in the first lot, by Mr. R. S. Bell, in 1910. Being exceedingly anxious to secure additional material of the practically unique *Nematolampas regalis* and *Abraliopsis astrolineata* for further investigation, I overhauled the new specimens with eagerness. Though in this particular my quest was not fulfilled, the disappointment was more than tempered by finding two species of genera not represented in the first collection. In fact, the collections supplement one another in such an interesting way that a report upon the second necessarily involves a greater or less consideration of the first. The present paper, therefore, is practically a monograph of the cephalopod fauna

of the Kermadec Islands as known to date. I have so indicated in the title. At the same time the opportunity appears propitious for publishing a few sketches and other illustrations additional to those given in my earlier paper, and I trust the delay has not robbed them of value.

The new material reported comprises thirteen specimens, which I find to be referable to seven species and the same number of genera and families, as follows:

1 *Argonauta* species (young).
2 *Polypus* species (young).
1 *Onychoteuthis banksii* (Leach) (young).
1 *Lampadioteuthis megaleia* new genus and species.
1 *Abraliopsis* ? (young).
6 *Eucleoteuthis* species (young).
1 *Megalocranchia pardus,* new species.

The two species thus added to the previous list appear to be new to science. One of them is so divergent from anything we know that it is being made the type of a new genus and family. It is somewhat surprising to find this form similar in many superficial peculiarities to the wonderful *Nematolampas regalis* previously described from Mr. Oliver's material, and scarcely inferior in interest to its predecessor, even though the actual relationship of the two does not appear an especially close one. For further observations on these species of a somewhat general interest, I would refer the reader to the concluding remarks offered in connection with the description of *L. megaleia.*

Altogether the results of the exploration of the Sunday Island beaches by Messrs. Oliver, Iredale, and Bell have been without precedent, so far as the littoral capture of cephalopods is concerned, and inevitably causes one to ponder what ultimate harvest this wonderful region holds in store for the teuthologist, that a mere glimpse of wave-bound wrack from a single beach should prove so astonishing.

A complete list of all the cephalopods thus far known from the waters of the Kermadec Islands, with the number of specimens reported on, is given in the following table:

SYNOPSIS OF THE CEPHALOPODA OF THE KERMADEC ISLANDS.

	Depth in fathoms.	Hoyle 1885–86.	Iredale 1910.	Berry 1914.	Berry 1916.
Family CIRROTEUTHIDÆ—					
Stauroteuthis meangensis (Hoyle)	600	1	.....	.....	.....

	Depth in fathoms.	Hoyle 1885–86.	Iredale 1910.	Berry 1914.	Berry 1916.
Family Amphitretidæ—					
Amphitretus pelagicus Hoyle	520	1	.....	.....	.....
Family Argonautidæ—					
Argonauta argo Linné	.....	.....	+	.....	.....
Argonauta nodosa Solander	.....	.....	+	.....	.....
Argonauta (species)	.....	.....	.....	2	1
Family Polypodidæ—					
Polypus oliveri Berry	shore	.....	.....	2	.....
Polypus kermadecensis Berry	.....	.....	.....	1	.....
Polypus (young of various species)	.....	.....	.....	3	2
Moschites challengeri Berry	630	1	.....	.....	.....
Family Spirulidæ—					
Spirula spirula (Linné)	.....	.....	+	.....	.....
Family Onychoteuthidæ—					
Onychoteuthis banksii (Leach)	.....	.....	.....	6	1
Family Lycoteuthidæ—					
Nematolampas regalis Berry	.....	.....	.....	2	.....
Family Lampadioteuthidæ—					
Lampadioteuthis megaleia Berry	.....	.....	.....	.....	1
Family Enoploteuthidæ—					
Abralia astrolineata Berry	.....	.....	.....	1	.....
Abraliopsis (species)	.....	.....	.....	1	1?
Family Ommastrephidæ—					
Sthenoteuthis bartramii (Lesueur)	.....	.....	.....	3	.....
Eucleoteuthis (species)	.....	.....	.....	3	6
Family Cranchiidæ—					
Megalocranchia pardus Berry	.....	.....	.....	.....	1
Family Nautilidæ—					
Nautilus pompilius Linné	.....	.....	+	.....	.....
Nautilus macromphalus Sowerby	.....	.....	+	.....	.....
Total specimens reported		3	5+	24	13

The fauna outlined in the table may conveniently be summarized as follows:

	Families.	Genera.	Species.	Species with photogenic organs.
Octopoda	4	5	7	0
Myopsida	1	1	1	1?
Œgopsida	6	8	8	7
Tetrabranchiata	1	1	2	0
Total	12	15	18	8

New Terms Proposed.

The following taxonomic terms are used for the first time in the present paper:

Moschites challengeri, new name (for *Eledone verrucosa* Hoyle, 1886, in part, not of Verrill, 1881).
Lampadioteuthidæ, new family.
Lampadioteuthis megaleia, new genus and species.
Eucleoteuthis, new genus (for *Symplectoteuthis luminosa* Sasaki, 1915).
Megalocranchia pardus, new species.
Verrilliteuthis, new genus (for *Desmoteuthis* Verrill, December, 1881, in part, not of Verrill, February, 1881).

Systematic Review of the Species.

Order DIBRANCHIATA.

Suborder OCTOPODA.

Family CIRROTEUTHIDÆ.

Genus **STAUROTEUTHIS** Verrill, 1879.

1. Stauroteuthis meangensis (Hoyle, 1885).

1885. *Cirroteuthis meangensis* Hoyle, Ann. and Mag. Nat. Hist., (5), 15, p. 234.
1885. *Cirroteuthis meangensis* Hoyle, Proc. Roy. Soc. Edinb., 13, p. 111.
1886. *Cirroteuthis meangensis* Hoyle, Challenger Rep., p. 63, pl. 9, figs. 12, 13; pl. 11, figs. 1, 2; pl. 13, figs. 5, 6.
1904. *Stauroteuthis meangensis* Hoyle, Bull. Mus. Comp. Zool., 43, p. 5.

One young specimen was taken by the *Challenger* in 600 fathoms, north of the Kermadec Islands.

Family AMPHITRETIDÆ.

Genus **AMPHITRETUS** Hoyle, 1885.

2. Amphitretus pelagicus Hoyle, 1885.

1885. *Amphitretus pelagicus* Hoyle, Ann. and Mag. Nat. Hist., (5), 15, p. 235.
1885. *Amphitretus pelagicus* Hoyle, Narrative Chall. Exp., 1, p. 271, fig. 106.
1885. *Amphitretus pelagicus* Hoyle, Proc. Roy. Soc. Edinb., 13, p. 113, fig.
1886. *Amphitretus pelagicus* Hoyle, Challenger Rep., p. 67, pl. 9, figs. 7–9.

The type locality of this species is 29° 55′ S. Lat., 178° 14′ W. Long., off the Kermadec Islands. Here one specimen was dredged by the *Challenger* in 520 fathoms.

Family ARGONAUTIDÆ.

Genus **ARGONAUTA** Linné, 1758.

3. Argonauta argo Linné, 1758.

1758. *Argonauta Argo* Linné, Syst. Nat., ed. X, p. 708.
1910. *Argonauta argo* Iredale, Proc. Malac. Soc., 9, pp. 70, 72.
1915. *Argonauta argo* Oliver, Trans. N. Z. Inst., 47, p. 560.

Iredale and Oliver record a few shells of this species washed up on the beaches of Sunday Island. Comparison should probably be made with *A. pacifica* Dall and *A. grandiformis* Perry.

4. Argonauta nodosa Solander, 1786.

1786. *Argonauta nodosa* Solander, Portland Cat., p. 96, No. 2120.
1910. *Argonauta nodosa* Iredale, Proc. Malac. Soc., 9, pp. 70, 72.
1915. *Argonauta nodosa* Oliver, Trans. N. Z. Inst., 47, p. 560.

Both Iredale and Oliver state that animals and shells of this species are occasionally washed to land at Sunday Island.

Argonauta species. Pl. VI, fig. 1.

1914. *Argonauta* sp. Berry, Trans. N. Z. Inst, 46, p. 135.

A very small female without a shell [S. S. B. 420] collected by Bell in 1910 is presumably the same species as the specimens already reported in the paper cited. A photograph of one of the former specimens, showing the hectocotylus *in situ* within the mantle cavity of the female, is now given as fig. 1 on Plate VI.

Oliver (1915, p. 560) suggests that these specimens are to be referred to *A. nodosa* Solander.

Family POLYPODIDÆ.

Genus **POLYPUS** Schneider, 1784.

5. Polypus oliveri Berry, 1914. Pl. VI, fig. 2.

1914. *Polypus oliveri* Berry, Trans. N. Z. Inst., 46, p. 136.
1915. *Polypus oliveri* Oliver, Trans. N. Z. Inst., 47, pp. 560, 564.

As this species has not been figured, the matter is remedied by the photograph reproduced in the accompanying plate.

6. Polypus kermadecensis Berry, 1914.

1914. *Polypus kermadecensis* Berry, Trans. N. Z. Inst., 46, p. 138, pls. 7, 8.

Polypus species (Young).

Two very juvenile Polypi in the second collection cannot yet be determined [S. S. B. 434].

Genus **MOSCHITES** Schneider, 1784.

7. Moschites challengeri new name.

1886. *Eledone verrucosa* Hoyle, in part, Challenger Rep., p. 104 (not of Verrill, Bull. Mus. Comp. Zool., 8, p. 105).

One specimen was dredged off the Kermadecs in 630 fathoms by the *Challenger*, and reported by Hoyle as the Atlantic *M. verrucosa* (Verrill). I have long felt grave doubts as to the correctness of Hoyle's determination. The Kermadec Islands and the eastern coast of the United States are localities so extremely remote and isolated from one another, that such an anomalous distribution for a crawling, bottom-loving species of this sort seems *a priori* at least doubtful. Fortunately we have Hoyle's express statement that the *Challenger* specimen "has the extremity of the hectocotylized arm

formed like that of an *Octopus* rather than like that of an *Eledone*, as shown in Verrill's figure." In the light of our present knowledge that even relatively slight differences in the structure of the hectocotylus are important in distinguishing species, there is evidently available here a sufficient diagnostic character to separate the two forms. A new name therefore seems expedient for the Kermadec species.

Suborder DECAPODA.

Division **MYOPSIDA.**

Family SPIRULIDÆ.

Genus **SPIRULA** Lamarck, 1799.

8. Spirula spirula (Linné, 1758).

1758. *Nautilus spirula* Linné, Syst. Nat., ed. X, p. 710.
1910. *Spirula spirula* Iredale, Proc. Malac. Soc., 9, pp. 70, 72.
1915. *Spirula spirula* Oliver, Trans. N. Z. Inst., 47, p. 558.

Oliver states that dead shells are abundant on the Sunday Island beaches, occasionally with portions of the animal.

Division **ŒGOPSIDA.**

Family ONYCHOTEUTHIDÆ.

Genus **ONYCHOTEUTHIS** Lichtenstein, 1818.

9. Onychoteuthis banksii (Leach, 1817).

1817. *Loligo Banskii* Leach, Zool. Misc., 3, p. 141.
1826. *Onychoteuthis Banskii* Férussac, Annales Sci. Nat., (1), 7, p. 151.
1914. *Onychoteuthis banksii* Berry, Trans. N. Z. Inst., 46, p. 139.

A young specimen of this species is in the present collection [S. S. B. 422].

Family LYCOTEUTHIDÆ.

Genus **NEMATOLAMPAS** Berry, 1913.

10. Nematolampas regalis Berry, 1913. Pl. VII; Pl. VIII, fig. 5.

1913. *Nematolampas regalis* Berry, Biol. Bull., 25, p. 208, text fig. 1.
1914. *Nematolampas regalis* Berry, Trans. N. Z. Inst., 46, p. 140, text figs. 1–4, Pl. IX.

Sketches are now given of one of the curious hood-shaped suckers which appear along the distal regions of the arms, and also of a portion of the gladius (figs. 1–3).

The gladius of this species, as shown by a few fragments extracted from the poorly preserved paratype (S. S. B. 410), is exceedingly slender and consists of little but the narrow rhachis. The wings are narrow and set very obliquely, so that the ventral concavity is unusually narrow and deep. They finally terminate in a very small, delicate, spoon-shaped cone, which is supported by a small,

solid, distinctly bulbous swelling at the extreme base of the slender rhachis (figs. 2, 3).

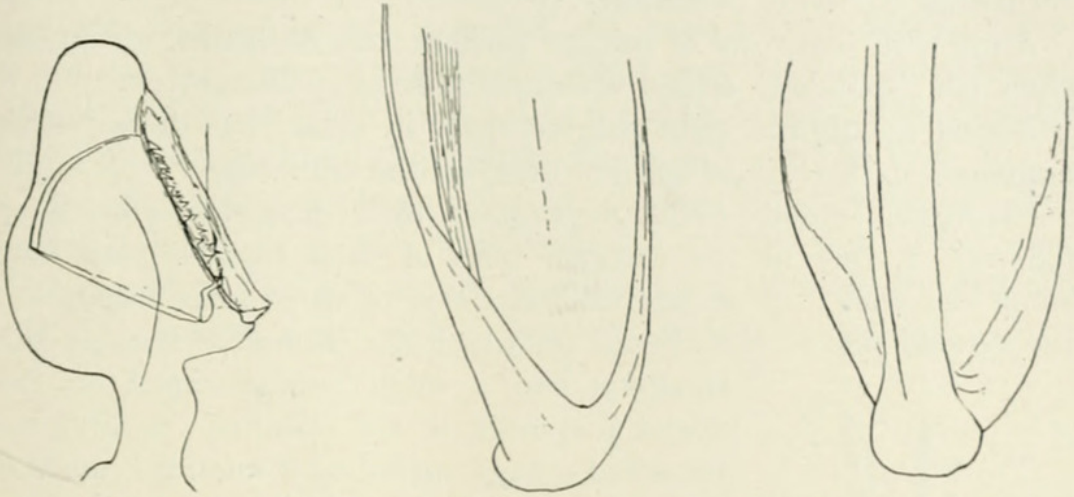

Fig. 1. Fig. 2. Fig. 3.

Fig. 1.—*Nematolampas regalis*, camera sketch of sucker from distal portion of right third arm [409], from mount in balsam, × 70.
Fig. 2.—*Nematolampas regalis*, oblique ventral view of posterior extremity of gladius [410], camera drawing, × 20.
Fig. 3.—Oblique dorsal view of same, same scale.

Family **LAMPADIOTEUTHIDÆ** new family.

Squids of small size, with terminal, sagittate fins. Arms with two rows of suckers. Tentacle clubs with four rows of suckers. No hooks present on either arms or tentacles. Buccal membrane eight-pointed. Gladius with lateral wings, but no terminal cone. Luminous organs present in the pallial chamber, on the eyeball, along the stalk of the tentacles, and at the base of the tentacles.

For the present the characters of the new family must be drawn from those of the type genus alone, so no doubt important emendation must later take place.

I would tentatively place the *Lampadioteuthidæ* between the *Lycoteuthidæ* on the one hand and the *Enoploteuthidæ* on the other. The group cannot be referred to the *Lycoteuthidæ* on account of the entirely different construction of the gladii. Some teuthologists may prefer to place it with the *Enoploteuthidæ*, but it seems to me that the complete lack of hooks or modified suckers on either tentacles or arms produces an anomaly fatal to this arrangement. Of course a fuller knowledge of the anatomy of all these forms than is now possible is as likely as not to bring about an entirely different classification, but I think the one adopted is for the meanwhile the most reasonable.

Genus **LAMPADIOTEUTHIS** new genus.

Body loliginiform. Fins broad, subsagittate, terminal; slightly surpassing the body posteriorly.

Arms with two rows of minute suckers, but no hooks. Tentacle clubs not expanded; armed with four rows of small suckers.

Buccal membrane eight-pointed, pale in color, but dotted with numerous dark chromatophores between the trabeculæ.

Photogenic organs richly developed; their distribution being as follows: 1. One at the extreme base of each tentacle and four along the stalk. 2. A longitudinal series of three large organs on the ventral side of the eyeball (of which the median is notably the smallest) and a single similar organ on the eyelid just back of the opening. 3. Five intrapallial organs, including 2 anal, 2 branchial (very large), and 1 abdominal organ. No luminous organs have been identified anywhere in the outer integument of the arms, head, or mantle.

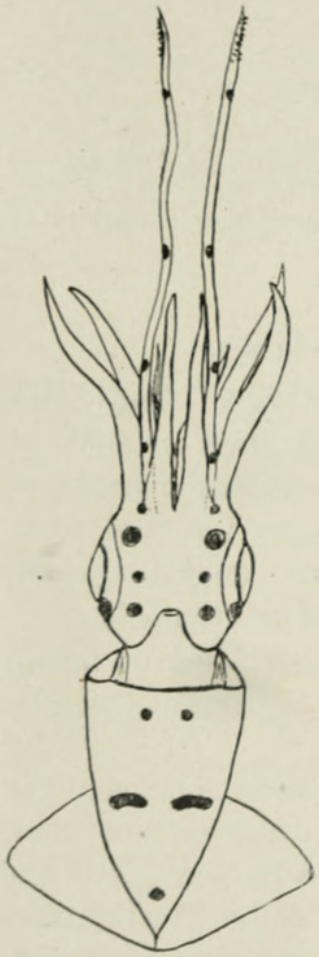

Fig. 4.—*Lampadioteuthis megaleia*, semi-diagrammatic representation of entire animal from the ventral aspect, to show the distribution of the photocgeni organs, about natural size.

Gladius comprising a rapidly tapering rhachis, free in front, but with delicate, somewhat broadly angular wings along its posterior two-thirds.

Type.—The following species.

11. **Lampadioteuthis megaleia** new species. Pl. VIII, figs. 1–4.

Animal small. Mantle firm, fleshy, cylindroconic in outline; in front rather flaring, thence tapering quickly to a point. Fins large and fairly thick in proportion to the small size of the body; slightly more than half as long as the mantle; each fin about a fifth longer than wide; strongly united in the median line posteriorly, where they extend slightly past the tip of the mantle; triangular, the posterior margins nearly straight and converging to a very obtuse point; anterior margins almost straight on the outward edges, but somewhat squarely arcuate in front, and thence descending toward the body so as to form small lobes.

Head large, almost as wide as the flaring mantle opening, and wider than the body is

near the middle; strongly compressed; flattened above, somewhat depressed below between the large, rounded eyes. Funnel broad, rather flat and short, not extending to the middle of the eyes; valved, the valve appearing as a very delicate, crescentic, pocket-like membrane on the inner dorsal wall a little way behind the aperture. Funnel organ not easily made out in the material available, although the Λ-shaped median organ of the dorsal wall is evident (fig. 6).

Funnel locking cartilages straight, simple, pointed anteriorly, but rounded truncate at the other end, and otherwise of nearly even width; grooves shallow, simple, straight; margins raised and reflexed (fig. 7). Slender ridges on the mantle correspond as usual.

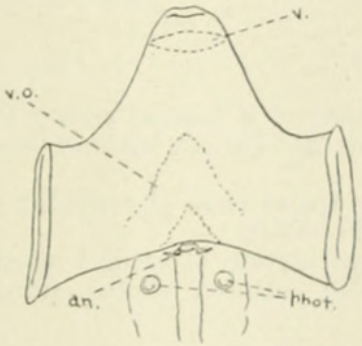

Fig. 6.

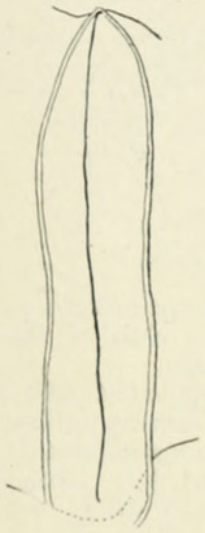

Fig. 7.

Fig. 6.—*Lampadioteuthis megaleia*, outline sketch of the funnel region [416], × 2½; an., anus; phot., anal photophores; v., valve; v.o., median pad of funnel organ.

Fig. 7.—*Lampadioteuthis megaleia*, camera outline of left funnel cartilage, [416], × 8.

Sessile arms little attenuate, the longest over two-thirds as long as the mantle; unequal; somewhat mutilated in the specimen at hand, but the formula of relative length apparently 3 = 2, 4, 1; dorsal arms notably shorter and less robust than the remainder. Outer margin of ventral and third arms keeled, the second pair more obscurely so, and the dorsal pair merely angled. On all the arms except the dorsal pair the keel terminates in a very delicate, transparent carina of membrane. The third arms in particular bear a strongly trabeculate hyaline membrane along their ventral margins, though all the arms possess well-developed swimming membranes homologous with these. Sucker-bearing portion of arms compressed; the suckers

in two rows, minute on all the arms, but excessively so on the ventral pair. On a horny ring from one of the distal suckers of the left third arm, I count seven teeth along the upper margin, the central ones especially being long, slender, closely spaced, and rather bluntly pointed.

Tentacles cylindrical, over twice as long as the arms; robust at base, thence tapering rapidly to the slender club, which is scarcely or not at all expanded (Pl. VIII, fig. 3). Suckers of club in four much compressed rows; minute; basin-shaped; the horny rings of the largest armed with 9–13 slender acute teeth along the upper semi-circumference (figs. 8, 9).

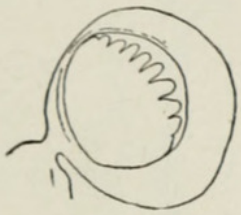

Fig. 8.

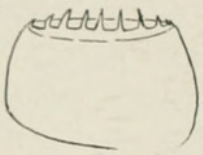

Fig. 9.

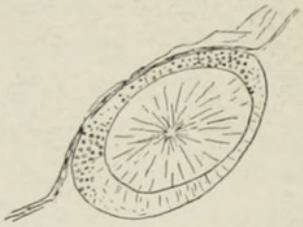

Fig. 10.

Fig. 8.—*Lampadioteuthis megaleia*, oral view of a median sucker from the left tentacle club of the type [416], × 70, camera outline from a mount in balsam.

Fig. 9.—*Lampadioteuthis megaleia*, nearly apical view of a similar sucker [416], × 70, camera outline from a mount in balsam.

Fig. 10.—*Lampadioteuthis megaleia*, optical section of second photophore from base of left tentacle of type [416], camera sketch from mount in balsam, × 15.

Buccal membrane eight-pointed; the lappets light colored, but the delicate intervening membranes dotted on the outside with dark, wine-colored to brownish chromatophores.

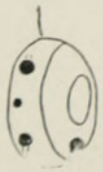

Fig. 5.

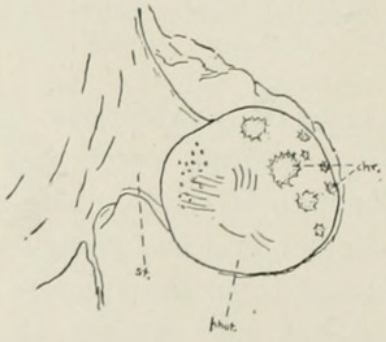

Fig. 11.

Fig. 5.—*Lampadioteuthis megaleia*, left eyeball, seen from below in outline, showing position of photophores, × 1⅓.

Fig. 11.—*Lampadioteuthis megaleia*, basal photophore from left tentacle of type [416], seen in optical section, × 15, camera sketch from mount in balsam; chr., chromatophores; phot., photogenic organ; st., stalk of same.

Subocular photophores large, circular in outline, whitish; four in number on each eye; three, of which the median is somewhat the smallest, occupy the usual *situs* on the ventral periphery; the fourth is larger than any of these, and situated just within the boundary of the pupil, at a point almost exactly behind the centre of the lens (fig. 5).

A series of four large ovoid photophores appears embedded in the stalk of each tentacle below the club, the three proximal ones occupying the proximal half of the tentacle, the distal one somewhat isolated from the others and near the club. At the extreme base of the tentacle borne on a short stalk on its outer side appears a spherical photophore, which is almost wholly concealed in preserved specimens by the tentacular sheath. It is distinctly larger than even the most proximal of the organs just described, and judging from its outward appearance only I think it will prove to be entirely different in structure text fig. 11 (Pl. VIII, fig. 4).

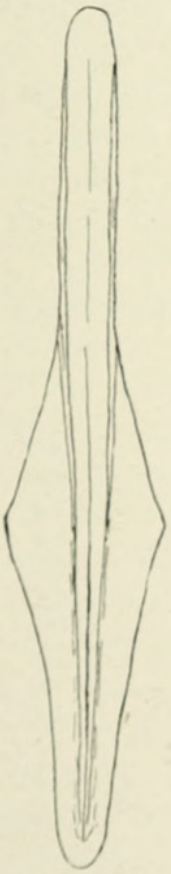

Fig. 12.

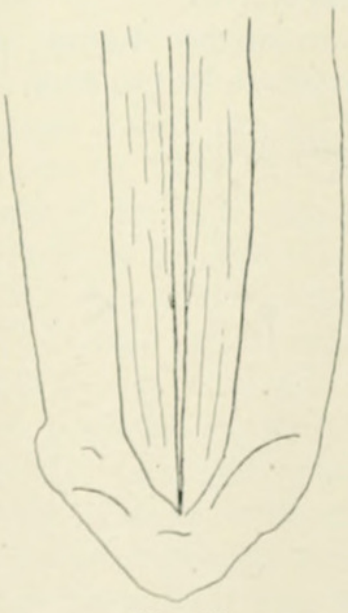

Fig. 13.

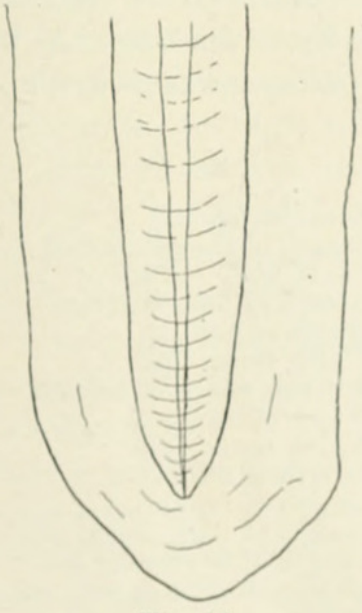

Fig. 14.

Fig. 12.—*Lampadioteuthis megaleia*, camera drawing of gladius of type [416], dorsal aspect, × 3.
Fig. 13.—*Lampadioteuthis megaleia*, ventral view of posterior extremity of gladius [416], × 18, camera sketch.
Fig. 14.—Dorsal view of same, same scale.

In addition to the above are the following intrapallial luminous organs: 1. A roundish, swollen, brownish organ on each side of the cavity, a little behind the anus. 2. A very large, elongate-pyriform, bright, silvery organ at the base of each gill, near the middle of the cavity. 3. A bright silvery tubercle, larger than the anal organs, but very much smaller than the branchial, situated behind the viscera in the medio-ventral line nearly at the tip of the body (fig. 4).

Gladius of simple Enoploteuthid structure, the rhachis free in front and broadest at the apex; thence tapering quite rapidly to a narrow point; wings thin and delicate, sharply angled in front of their middle, where each is about three times as wide as is the stem at the same level; they extend along the posterior two-thirds of the gladius, terminating around the point of the rhachis to form a slight posterior concavity, which is hardly spoon shaped, and is certainly not to be called a cone (figs. 12–14).

Color in alcohol: mantle brownish white, dotted with pale chromatophores; head and ventral aspect of the funnel darker, due to the more numerous dark chromatophores; eyes dark slate color, the lenses pearly white; arms and tentacles pale like the mantle.

Type.—A rather poorly preserved female (?) [S. S. B. 416]. It is minus one tentacle, and a little macerated, but is in good enough condition to be described as above.

Type Locality.—A beach on Sunday Island, where the single specimen was picked up by Mr. R. S. Bell in 1910.

Measurements.

	mm.
Total length	85
Length of mantle, dorsal	30
Tip of body to base of dorsal arms	39
Length of fins, extreme	17
Width of fin	14
Width across fins	30
Anterior width of mantle	15
Width of neck	7
Width across eyes	14
Length of head	10
Length of funnel	9
Length of right dorsal arm	17
Length of left dorsal arm	15+
Length of right second arm	13+
Length of left second arm	20+
Length of right third arm	16+
Length of left third arm	21+
Length of right ventral arm	22
Length of left ventral arm	22
Length of right tentacle	24+
Length of left tentacle	47
Length of club of left tentacle	7

Remarks.—In spite of its wholly dissimilar gladius, this little species reminds one more strongly of the two Lycoteuthid genera, *Lycoteuthis* and *Nematolampas*, than any other group, and this is probably due to the one fact, more than any other, that the photogenic complexes are so strikingly similar. That of the *L. megaleia* is accordingly summed up in the accompanying table, which also repeats the figures for *L. diadema* and *N. regalis* given in my earlier paper.

Position of Photophores.	*L. diadema.*	*N. regalis.*	*L. megaleia.*
On eyes:			
Ventral periphery	10	10	6
Lateral	.....	.....	2
On arms:			
Tips of dorsal arms	.....	2	.....
Tips of dorso-lateral arms	.....	2	.....
Ventro-lateral arms	.....	62+	.....
On tentacles:			
At base	.....	.....	2
Along the stalk	4	4	8
Within pallial chamber:			
Anal	2	2	2
Branchial	2	2	2
Abdominal[1]	4	4	1
Posterior extremity of body	.....	2	.....
Total	22	90+	23

Although in each of the three species subocular, tentacular, and intrapallial organs are well developed, the table helps to emphasize differences which may be more important than the similarities. Then again, although I have not yet had opportunity to work out the histology of any of these structures in *Lampadioteuthis*, the external appearance of its tentacular photophores is not at all like the deep-seated organs of the Lycoteuthids, while the curious organs protruding from the base of the tentacles fail to resemble anything known to me. The single pair of enormous silvery photophores at the base of the gills is also distinctive as contrasted with the belt of five smaller organs possessed by the Lycoteuthid genera.

The occasion is very tempting to add a little generalizing on the possible significance of such striking differences in the luminous pattern of cephalopods, especially since the constituent organs are so evidently polyphyletic in origin, but this had best be reserved for some future opportunity.

[1] I have followed prevailing usage in classifying the series of three organs situated between the branchial pair in *Lycoteuthis* and *Nematolampas* as abdominal, though it seems to me more rational to consider them in relation with the branchial organs than with the isolated posterior organ.

At any rate it is remarkable that the Sunday Island beaches should yield so extensive a series of bizarre types, and that with the exception of an ommastrephid every squid collected there is the possessor of systems of dermal organs which we must assume are photogenic.

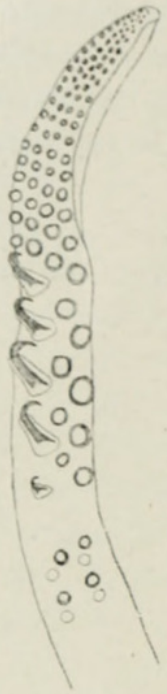

Fig. 15.—*Abralia astrolineata*, inner face of right tentacle club of type [408], × 8, mainly a camera drawing.

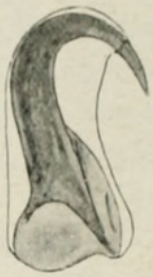

Fig. 16.—*Abralia astrolineata*, lateral view of third hook from base of right tentacle club [408], × 30, camera drawing from mount in balsam.

Family **ENOPLOTEUTHIDÆ**.

Genus **ABRALIA** Gray, 1849.

12. Abralia astrolineata Berry, 1914.

1914. *Abralia astrolineata* Berry, Trans. N. Z. Inst., 46, p. 145, pl. 10.

An illustration of the tentacle club of this species is supplied in fig. 15, and of a hook therefrom in fig. 16.

The statement on p. 145 of the original description regarding the discrepancy in the number of hooks on the two tentacle clubs of the type specimen is just reversed; the right club shows a fifth hook, the left only the four large ones.

Genus **ABRALIOPSIS** Joubin, 1896.

13. ? Abraliopsis hoylei (Pfeffer, 1884). Pl. IX, fig. 1.

?1884. *Enoploteuthis Hoylei* Pfeffer, Ceph. Hamburg Mus., p. 17, fig. 22–22b.
?1896. *Abraliopsis Hoylei* Joubin, Bull. Soc. Sci. Ouest, 5, p. 33, etc.
1914. *?Abraliopsis hoylei* Berry, Trans. N. Z. Inst., 46, p. 148.

The specimen previously recorded [S. S. B. 400] is now figured on Pl. IX, fig. 1.

Abraliopsis (?) species. Pl. IX, fig. 3.

A small abralioid in the second collection offers some interesting peculiarities [S. S. B. 419], and I am not certain that it represents the same species as the preceding, though this will quite likely prove to be the case in the end.

The only doubtful character is that each arm of the ventral pair appears to terminate in a slender filament instead of the usual beaded photophores, but these filaments are quite badly damaged in the specimen so that their exact nature is difficult to make out. The two rows of hooks on the ventral arms persist even onto the

base of the filaments. Otherwise the specimen is a fairly typical *Abraliopsis*.

The tentacle club much resembles that of the preceding, as described in my former paper. There are four large slender hooks in the ventral row, and three (or four ?) small ones in the dorsal row, the latter being succeeded proximally by two minute suckers. The distal portion of the club is occupied by the usual four rows of small suckers. I can make out only two suckers in the fixing apparatus (figs. 17, 18).

Fig. 17.—*Abraliopsis* (?), inner face of right tentacle club of young specimen [419], × 15, free-hand sketch from mount in balsam. The arrangement and number of the distal suckers is only approximated.

Fig. 18.—*Abraliopsis* (?), lateral view of large hook from left tentacle club [419], × 30, camera drawing from mount in balsam.

The photogenic organs of the mantle are distributed longitudinally in bands and lines. There is a conspicuous, clearly defined space free of photophores along the medio-ventral line. Bounding this on either side is a roughly triserial, band-like aggregation of photogenic organs, the central members of which tend to be larger than the lateral ones. This band is succeeded laterally by a single series of large and small photophores, more or less in alternation. A weak series of small organs is then followed by a very distinct single line of photophores, beyond which the organs are scattering and less regular. There are eight rows on the ventral aspect of the head, and the rudiments of perhaps as many on the funnel. Each central arm bears two rows.

The two terminal photophores of the subocular group are conspicuously larger than the three median ones, and of the latter the central organ is in its turn a little the largest.

Family OMMASTREPHIDÆ.

Genus STHENOTEUTHIS Verrill, 1880.

14. Sthenoteuthis bartramii (Lesueur, 1821).

1821. *Loligo bartramii* Lesueur, Jour. Acad. Nat. Sci. Phila., 2, p. 90, pl. 7.
1880. *Sthenoteuthis Bartramii* Verrill, Trans. Conn. Acad. Sci., 5, p. 223.
1914. *Sthenoteuthis bartramii* Berry, Trans. N. Z. Inst., 46, p. 148.

Genus **SYMPLECTOTEUTHIS** Pfeffer, 1900.

[**Symplectoteuthis oualaniensis** (Lesson, 1830).]

1830. *Loligo oualaniensis* Lesson, Zool. Voy. Coquille, p. 240, pl. 1, fig. 2.
1900. *Symplectoteuthis oualaniensis* Pfeffer, Synops. Œgops. Ceph., p. 180.

It now appears that my reference of certain of the Kermadec squids to this species was premature (see further note below), despite the fact that the islands lie well within its probable range.

Genus **EUCLEOTEUTHIS** new genus.[2]

15. Eucleoteuthis species (young ?).

1914. *Symplectoteuthis oualaniensis* Berry, Trans. N. Z. Inst., 46, p. 148 (not *Loligo oualaniensis* Lesson, 1830).

With the exception of the smallest, which may prove to be a genuine *Symplectoteuthis*, six quite small and rather poorly preserved Ommastrephids in the second collection sent me [S. S. B. 421] are apparently referable here. A reëxamination of the similar specimens previously reported as *S. oualaniensis*, in the light of Sasaki's recent work (see appended footnote), shows that these likewise should be included in the newer genus. On all, with the single exception noted, the supposed photogenic tissue is evident as a pair of narrow whitish bands running along the ventral aspect of the body, much as in *E. luminosa*, though apparently not interrupted as in that species. In some of the specimens a pale oval macula may be made out near the mantle margin and just outside the line of the bands, but in no case have the maculæ at the base of the ventral arms been identified. Numerous other differences in the outline of the photogenic organs, their distribution, the shape of the fins and body, and the proportions

[2] In a recent paper ("On three interesting new œgopsids from the Bay of Sagami," *Jour. Coll. Agric.*, Tohoku Imper. Univ., Sapporo, v. 6, pp. 131–150, pl. 4), Madoka Sasaki describes and beautifully illustrates a very remarkable luminous squid from 700 fathoms, off Misaki, Japan, to which he attaches the name *Symplectoteuthis luminosa*. The creature is absolutely unique among described cephalopods in the fact that the principal photogenic organs, instead of being small spherical or ovoid cysts as in most œgopsids, take the form of a pair of narrow, zone-like bands, extending with but two interruptions along the ventral aspect of the mantle for nearly its entire length. A pair of smaller maculæ of similar character lie outside the terminal segments of the bands near the anterior margin, and a larger, ovoid, transverse organ appears at the base of each ventral arm. While the photogenic property of these curious structures does not appear to have been observed in the living animal, Sasaki infers such a function from their histology. It seems to me that these characters, coupled with several minor features, among which may be noted the unidentate horny rings of the larger tentacular suckers, are sufficient to quite preclude the proper reference of this species to *Symplectoteuthis*, a genus not known to possess any luminous properties, and in which the larger tentacular rings are multidentate. Having conveyed these opinions to Prof. Sasaki and ascertained that he has no present intention of altering his original disposition of the species, I now propose, with his courteous permission, the new genus *Eucleoteuthis*, with *S. luminosa* Sasaki as type.

of the arms are evident, so that it seems possible that an undescribed species of the genus is before us. The largest of the specimens, however, has a mantle length of only 41 mm., and since we know nothing of the younger stages of *E. luminosa*, while the condition of our own material leaves much to be desired, a more detailed consideration of the speciology will best be deferred for the present.

Family CRANCHIIDÆ.

Genus MEGALOCRANCHIA Pfeffer, 1884.

16. Megalocranchia pardus new species. Pl IX, fig. 2.

Small; elongate cask-shaped. Mantle thin, smooth, saccular, membranous, much inflated; its greatest circumference near the middle, thence tapering slightly anteriorly and more so behind, where it comes to an acute point between the fins; maximum width of mantle distinctly less than half the length. Fins small, about three-tenths as long as the body; thin; semicircular; barely continuous around the point of the mantle, which they exceed for about a third of their length; posterior cleft deep and very narrow. Anterior margin of the mantle trilobate, being conspicuously indented (almost cleft) in the dorso-median line, as well as to a less degree at either side of the funnel, the clefts marking the three points where the mantle is firmly attached to the head and funnel.

Head very short and broad, the length contained in the width (measured to include the eyes) nearly four times; width of head between the eyes less than the depth of the eyeball. Eyes very large and protruding; elevated on short, massive, slightly movable stalks; eyeball ovate in outline, projecting obliquely downward; lid opening of fair size, not puckered. The ventral surface of the eyeball is occupied by a large, semicircular, photogenic organ, which forms a bluntly conical projection toward one side; another smaller organ of crescentic outline lies within the concavity of the latter (fig. 19).

Funnel large, thin-walled; broad at base, extending well past the base of the ventral arms, and entirely covering the ventral surface of the head between the eyes; aperture ample. Funnel organ well developed; the large hepatiform medio-dorsal organ bears on each lobe a finger-like papilla, which bends inward at the base so that it lies almost transversely; the two smaller lateral organs are roughly circular, and each has a slight indentation on the front inner margin (fig. 20).

Arms short, robust, the longest but little more than a quarter as

long as the mantle; unequal, the order of length distinctly 3, 4, 2, 1. Umbrella wanting. Ventral arms with a frill-like keel on the outer angle; keel of third arms confined to distal portion, and obscure or

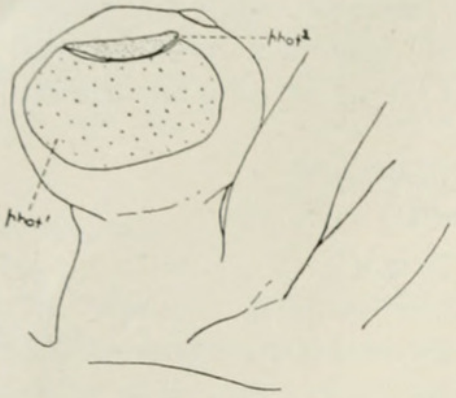

Fig. 19.

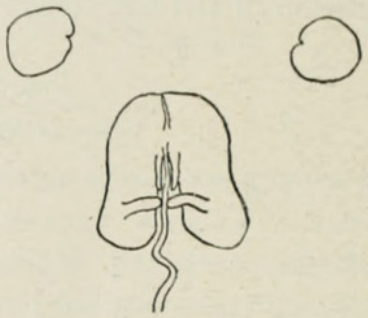

Fig. 20.

Fig. 19.—*Megalocranchia pardus*, part camera outline of right eye of type [415], ventral aspect, × 5½; phot.[1], phot.[2], photogenic organs.
Fig. 20.—*Megalocranchia pardus*, outline of funnel organ [415], much enlarged.

wanting on the two dorsal pairs. All the arms have a delicate trabeculate swimming membrane on either margin of the sucker-bearing area, but this attains much its best development on the third pair. Suckers biserial, closely placed in each row, but the series slightly separated from one another on all but the ventral arms, where they are relatively close together; number of suckers varying from 14 pairs on one of the dorsal arms to 16½ pairs on the ventral arms. Sucker apertures wide, the horny rings weakly dentate on the upper semicircumference and with only rudiments of teeth below; even at their best, the denticles appear rather as strong crenulations than teeth; about 18 were counted on a ring from one of the larger suckers of the right third arm (fig. 21).

Tentacles short, stout, the longer about a third again as long as the longest arms, or about two-fifths the length of the mantle; larger and thicker than any of the arms. Clubs slightly expanded; armed with four crowded rows of suckers, largest near the middle, but diminishing in size both distally and proximally, where they continue down the stalk a little more than half way to the base. A horny ring from one of the largest suckers on the club shows about 26 conical, round-pointed, sometimes curved teeth, which are smallest on the inferior margin (fig. 22).

Color of preserved specimen brownish cream; chromatophores brown; eyes bluish black; subocular photophores bronze, surrounded by a bluish ring. Chromatophores large, scattered, elongate

oval in outline, conspicuously spotting the entire mantle, though somewhat paler ventrally than dorsally; an underlying bilateral arrangement is evident, particularly in the case of the larger chro-

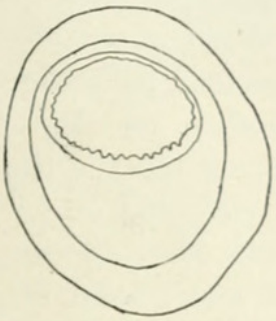

Fig. 21.

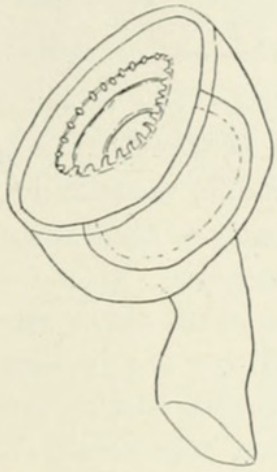

Fig. 22.

Fig. 21.—*Megalocranchia pardus*, sucker from right third arm of type [415], × 28, camera outline from mount in balsam.
Fig. 22.—*Megalocranchia pardus*, one of the larger suckers from the right tentacle club of the type [415], × 60, camera drawing from a mount in balsam.

matophores; there also seems to be a certain tendency to an arrangement in zigzag lines in a transverse direction, most apparent on the ventral aspect. There is a single series of chromatophores along the medio-dorsal line, exactly overlying the gladius, which appears as a translucent line beneath; 21 of the organs can be counted to the point where the translucent area expands.

Type.—The unique type [S. S. B. 415] is in an excellent state of preservation.

Type Locality.—A beach on Sunday Island, Kermadec Group (R. S. Bell, 1910).

Measurements.

	mm.
Total length	75
Length of mantle, dorsal	50
Extreme length of fins	14
Maximum width of mantle	22
Width across fins	13
Width across eyes	15
Length of head	4
Length of funnel	13
Length of right dorsal arm	7
Length of left dorsal arm	7.5
Length of right second arm	9
Length of left second arm	9
Length of right third arm	13
Length of left third arm	13

	mm.
Length of right ventral arm	10
Length of left ventral arm	10
Length of right tentacle	21
Length of right tentacle club	5
Length of left tentacle	16
Length of left tentacle club	5

Remarks.—The elucidation of the compact little group of squids, of which *M. pardus* is a typical example, has been for me one of the most difficult taxonomic problems encountered in the study of the cephalopoda. All the species are represented in collections by such scanty material, are so similar to one another, and the characters which separate them appear of such a trivial nature, that the described forms are in sore need of careful checking up by someone having access to the type specimens of the older species. At the same time, the species are quite well set apart from other Cranchiids, so that a synopsis of the genus would include only the following:[3]

1. *Megalocranchia maxima* Pfeffer 1884.
2. *Taonius abyssicola* Goodrich 1896.
3. *Helicocranchia fisheri* Berry 1909.
4. *Desmoteuthis pellucida* Chun 1910.
5. *Megalocranchia pardus* Berry 1915.

The second of these is little known, is unique in several respects, and may eventually prove to belong elsewhere. On the other hand, the first, third, and fourth are apparently not strongly differentiated, and it is with these that the present species requires special comparison to justify its separate recognition. The specimen most certainly represents a species different from *M. fisheri;* the only other *Megalocranchia* with which I have had opportunity for comparing it, but to Chun's *pellucida* it seems exceedingly close. The description and figures of the latter are not now available to me, but from my notes made therefrom a few years ago, I feel that the differences, though so slight, are nevertheless too great for uniting the species. In reaching this conclusion I place reliance upon the almost stalked eyes of *M. pardus*, the immense development of the funnel, and the denticulation of the horny rings.

[3] The species described as *Desmoteuthis tenera* Verrill (*Trans. Conn. Acad. Sci.*, 5, p. 412) now seems to me to be improperly grouped with the cask-shaped, round-finned forms cited above. As I have shown in a former paper (*Science*, N. S., 36, pp. 643–646), the genus *Desmoteuthis* falls into the absolute synonymy of *Taonius*, so can no longer be used here. I would therefore propose for the reception of *D. tenera* the new genus *Verrilliteuthis*. To name the group for the master of American teuthologists requires no excuse save possibly an apology for the resulting barbarism.

Order TETRABRANCHIATA.

Suborder NAUTILOIDEA.

Family NAUTILIDÆ.

Genus **NAUTILUS** Linné, 1758.

17. Nautilus pompilius Linné, 1758.

1758. *Nautilus Pompilius* Linné, Syst. Nat., ed. X, No. 283, p. 709.
1910. *Nautilus pompilius* Iredale, Proc. Malac. Soc., 9, p. 72.
1915. *Nautilus pompilius* Oliver, Trans. N. Z. Inst., 47, p. 558.

Oliver reports a broken shell washed up on the beach at Sunday Island.

18. Nautilus macromphalus Sowerby, 1848.

1848. *Nautilus macromphalus* Sowerby, Thes. Conch., p. 464, pl. 98, figs. 4, 5.
1910. *Nautilus macromphalus* Iredale, Proc. Malac. Soc., 9, p. 72.
1915. *Nautilus macromphalus* Oliver, Trans. N. Z. Inst., 47, p. 558.

Oliver reports a broken shell washed up on the beach at Sunday Island.

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—— 1914. Notes on a collection of cephalopods from the Kermadec Islands. Transactions New Zealand Institute, Vol. 46, pp. 134–149, text figs. 1–4, pls. 7–10. June, 1914. (Gives notes on 9 species, including *Polypus oliveri*, *P. kermadecensis*, and *Abralia astrolineata*, new species.)

Hoyle, William E. 1885. Diagnoses of new species of Cephalopoda collected during the cruise of H. M. S. "Challenger."—Part I. The Octopoda. Annals and Magazine of Natural History (5), Vol. 15, pp. 222–236, March, 1885. (*Amphitretus pelagicus*, new genus and species.)

—— 1885*a*. Brief notice of the "Challenger" Cephalopoda. Narrative Challenger Expedition, Vol. 1, pp. 269–274, [1–7], figs. 106–109, 1885. (Figure of *Amphitretus pelagicus*.)

—— 1885*b*. Preliminary report on the Cephalopoda collected by H. M. S. "Challenger." Part I. The Octopoda. Proceedings Royal Society of Edinburgh, Vol. 13, pp. 94–114, cuts, August, 1885.

—— 1886. Report on the Cephalopoda collected by H. M. S. "Challenger" during the years 1873–1876. Voyage of the Challenger, Vol. 16, pp. i–vi, 1–246, 9 figs. in text, pls. 1–33, 1886. (Three species, *Cirroteuthis meangensis*, *Amphitretus pelagicus*, and *Eledone verrucosa*, reported from near the Kermadecs.)

Iredale, Tom. 1910. On marine Mollusca from the Kermadec Islands and on the Sinusigera apex. Proceedings Malacological Society, London, Vol. 9, pp. 68–79, March 1910. (List reprinted in Proc. N. Z. Inst., 1910, p. 57, *fide* Oliver; five species of shell-bearing cephalopods listed.)

Oliver, W. R. B. 1911. Notes on reptiles and mammals in the Kermadec Islands. Transactions New Zealand Institute, Vol. 43, 1910, pp. 535–539, July, 1911. (Mentions a fragment of an undetermined giant squid cast up on the beach, p. 536.)

—— 1915. The Mollusca of the Kermadec Islands. Transactions New Zealand Institute, Vol. 47, pp. 509–568, pls. 9–12, July, 1915. (Gives a *résumé* of previous records, the cephalopods on pp. 558–560.)

Explanation of Plates VI, VII, VIII, IX.

Plate VI.—Fig. 1.—*Argonauta* species, female. Mantle laid open to show the male hectocotylus *in situ* within the cavity [S. S. B. 403] (× 1¼).

Fig. 2.—*Polypus oliveri* Berry, female. Dorsal aspect of type [S. S. B. 405], about natural size.

Plate VII.—Fig. 1.—*Nematolampas regalis* Berry. Distal portion of right third arm of type [S. S. B. 409], photographed by reflected light from a mount in balsam (× 2).

Fig. 2.—*Nematolampas regalis*. Proximal portion of same preparation (× 8½).

Fig. 3.—*Nematolampas regalis*. Median portion of the terminal filament of the right third arm (× 8½), photographed from the same preparation.

Plate VIII.—Fig. 1.—*Lampadioteuthis megaleia* Berry. Dorsal aspect of type [S. S. B. 416] (× 1¼).

Fig. 2.—Ventral aspect of same, same scale.

Fig. 3.—*Lampadioteuthis megaleia*. Tentacle club of type, from mount in balsam (× 7).

Fig. 4.—*Lampadioteuthis megaleia*. Base of tentacle from same preparation (× 7), showing the two basal photophores.

Fig. 5.—*Nematolampas regalis* Berry. Subocular photophores from right eye of paratype [S. S. B. 410] (× 7); photograph of inner surface from mount in balsam.

Plate IX.—Fig. 1.—*Abraliopsis hoylei* Pfeffer ?. Ventral aspect of immature female [S. S. B. 400] (× 2).

Fig. 2.—*Megalocranchia pardus* Berry. Ventral aspect of type [S. S. B. 415] (× 2).

Fig. 3.—*Abraliopsis* (?), species. Ventral integument of very young specimen [S. S. B. 419], showing the distribution of the photogenic organs; photographed by reflected light from a mount in balsam, stained with Delafield's hæmatoxylin (× 6).

Note.—I am indebted to my friends, Edward A. Cornwall and Leroy Childs, for most of the photographs used in the accompanying plates. Thanks are likewise due to both Messrs. Iredale and Oliver for many incidental favors.