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ON THREE INTERESTING NEW OEGOPSIDS FROM THE BAY OF SAGAMI.

By

Madoka Sasaki, *Rigakushi*.

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With 1 plate and 4 text-figures.  
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In the collection of cuttle-fishes preserved in the Museum of the Science College, Tokyo Imperial University, three interesting species of Oegopsids caught in Sagami Bay are found, which seem to be as yet unclassified, as shown by the following description.

### ***Meleagroteuthis separata*** sp. nov.

*Type*.—A single male specimen obtained by Mr. KUMAKICHI AOKI from a depth of about 400 fathoms at Uchibata, Misaki, March 4, 1898.

The measurements are as follows :

|                                |       |        |
|--------------------------------|-------|--------|
|                                | mm.   |        |
| Dorsal length of mantle.....   | 31    |        |
| Ventral length of mantle ..... | 25    |        |
| Breadth of mantle .....        | 20    |        |
| Ventral length of head .....   | 19    |        |
| Breadth of head .....          | 22    |        |
| Total breadth of fins .....    | 24    |        |
| Length of fins.....            | 14    |        |
| Length of first arm .....      | 52    | 50     |
| "    " second arm .....        | 52(?) | 49 (?) |
| "    " third arm .....         | 56    | 52 (?) |
| "    " fourth arm.....         | 40    | 47     |
| "    " tentacle .....          | 80    | 80     |

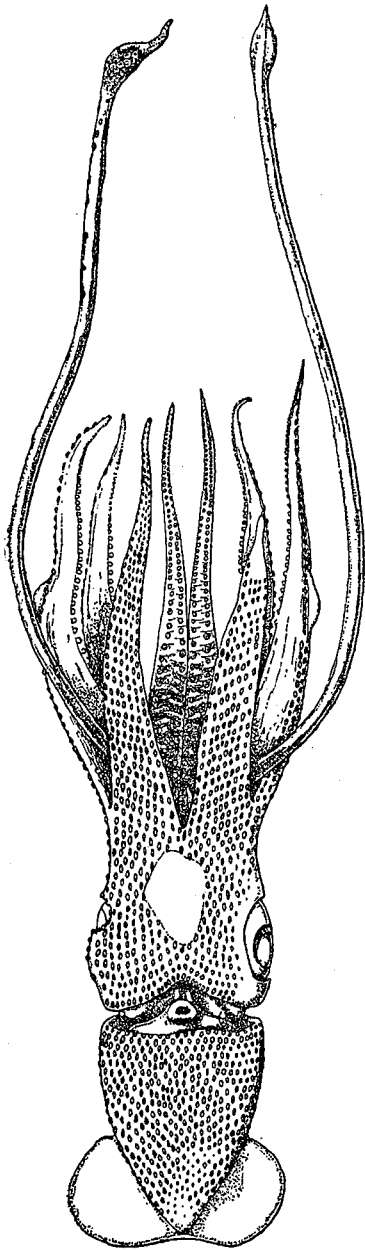


Fig. 1.—*Meleagroleuthis separata* sp. nov.  
ventral aspect with luminous organs  
in approximate position.

The mantle is of a conical shape, broadest a little back from the anterior margin, and the length is about one and a half times greater than the breadth; the dorsal anterior margin projects a little into an obtuse angle in the middle. The fins are semicircular, extending a little backwards beyond the posterior end of the mantle, and their length is a little shorter than half the mantle-length (text-fig. 1).

The head is large, and broader than the mantle-opening, and it is clearly marked from the neck by a boundary edge, the ventral part of which shows a low arch bounding a shallow siphonal groove.

The eyes are very asymmetrical, the eye-opening as well as the eye-ball of the left side being twice or more greater than those of the right side in diameter. On each side of the neck there is a low transverse ridge with an olfactory papilla. The siphon is short and conical, connected with the siphonal groove, by two pairs of dorsal ligaments somewhat submedian in position. The siphonal resisting cartilages are nearly oval in shape, being a little acuminate anteriorly, with an elongate deep median depression; the nuchal cartilage is lanceolate, a little tapering posteriorly. The mantle cartilages corresponding with the siphonal ones are high and linear

but short, being about as long as the siphonal ones.

The arms are subequal and long, the longest arm being about twice as long as the mantle-length, and the order of length seems about  $3 > 2 > 1 > 4$ , though the extremities of some arms are broken in the type specimen. They taper gradually towards the extremities and are nearly quadrangular in section, the outer surfaces being provided with neither webs nor keels; but three dorsal pairs of arms have, along their median lines, a series of horny tubercles, details of which will be given subsequently. The third pair of arms has a short semilunar web in the middle of the outer surface.

The buccal membrane has seven ribs and marginal projections, as usual in the family Histioteuthidae, and three dorsal ribs out of the seven are connected by double ligaments with the lateral sides of the bases of arms, the remaining four being attached by only a single ligament. The inner surface of the buccal membrane is finely wrinkled and of a purplish color.

The umbrella and protective membranes of the arms occur nearly in the same way as those of *M. hoylei* PFEFFER. The membranes of the umbrella between the two dorsal pairs of arms are fairly wide, extending about six or seven mm. up from the bases of the arms, while between the lateral arms, as well as between the third and fourth arms, they are very narrow, and between the ventral pair they are entirely wanting.

The protective membranes of three dorsal pairs of arms are of the usual breadth equally on both sides of the sucker-bearing surface, except at the proximal parts of the arms where they widen, making connective membranes between the bases of the arms, and imitating the umbrella as it occurs in *M. hoylei*, and the membranes of the specimen now before me extend about thirteen mm. up from the bases of all the arms, all the protective membranes of the ventral pair being very narrow.

The arm-suckers also resemble those of *M. hoylei* in shape and arrangement. They are small and globular, arranged clearly in two series. These two series, in the three dorsal pairs of arms, from their bases to a point about half-way to their tips, are widely separated, the distribution of the suckers in

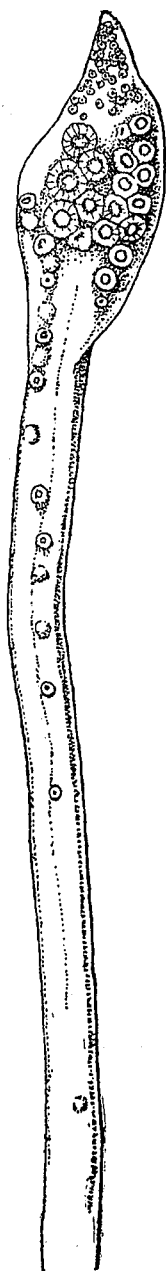


Fig. 2.—*Meleagroteuthis separata* sp. nov.  
distal half of left tentacle,  $\times 7$ .

each series on this part being very thin. But from the middle of the arms to their tips the two series are close to each other, the distribution becoming very thick. The suckers of the right ventral arm are a little smaller than those of the three dorsal pairs and they are arranged from the extreme base of the arm, in a somewhat thicker series than those of the other arms. The left ventral arm shows many different features from all the others, this being probably due to deformity.

The tentacles are slender, being much longer than twice the mantle-length. The stalks show nearly the same character as in *M. hoylei*, being provided with a flat inner surface, but the lateral boundary edges of this surface are not so distinct as to make "Faden" of PFEFFER'S (1912, p. 292) marked by grooves. The clubs at the distal end occupy about one-tenth the length of the tentacle, and are expanded into a spindle-shape. The fact that the two clubs show somewhat different features is probably due to the shrinkage of one of them (text-fig. 2).

The tentacular suckers show the principal characteristics of the present species, distinguishing it from *M. hoylei*. They are clearly divisible into three kinds by their situation: (1) Connective suckers, comprising from nine to ten suckers and from eight to ten fixing tubercles arranged in a single series, which begins on the ventral inner surface at a point about two-thirds from the base of the tentacle, and running diagonally into the dorsal side of the carpal portion, then going farther up to the middle part of the club along its dorsal margin. (2) Suckers of the hand portion, unequal in size, arranged in four longitudinal series; the most ventral series, comprising seven or eight suckers of

small size but a little larger than the connective suckers the next ventral series, composed of five suckers as small as those of the most ventral one; and the third series, which is just median in the club, having three suckers a little larger than any of those of the preceding series. The most dorsal series, which is next to the connective sucker series in the hand portion, has only two or three suckers which are the largest amongst the tentacular suckers, being twice or thrice as large as those of the most ventral series. (3) Suckers of the distal portion are all minute, being much smaller than the connective suckers, and they are not connected to the sucker group of the hand portion as in *M. hoylei*, but are entirely separated from it<sup>1)</sup>, and they are distributed in a very irregular manner, except for their proximal ones which seem to be arranged more or less regularly in five or six series (text-fig. 2).

The tentacular suckers are of much depressed shape, their aperture being comparatively larger than those of the arm-suckers, and they have, along the margin of the aperture, distinct radial muscles, which are most distinctly visible on the largest suckers. The denticulation of the horny rings does not admit of being examined on account of the aperture being filled with the same horny substance as occurs in the arm-suckers.

The series of the horny tubercles runs along each outer median line of the three dorsal pairs of arms as well as along the median line of the dorsal surface of the mantle as occurs in *M. hoylei*. The tubercular series of the first pair of arms is the longest, and beginning at the anterior part of the dorsal surface of the head, it reaches a point a little proximal from the middle of the arms. It comprises ten or eleven large tubercles and some minute ones. The larger ones diminish in size towards the distal end of the series, the most proximal being the largest, and the smaller ones are intercalated among the larger. The series of the second pair is shorter than that of the first pair, beginning at the level of the anterior margin of the umbrella or a little posterior to it, and the number of tubercles in this series is ten or eleven. The series of the third pair is the shortest, with eight or nine tubercles.

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1) Because of this characteristic, the specific name "*separata*" has been given to it.

The tubercular series of the dorsal surface of the mantle is not quite median in position, but deviates into the right side posteriorly. It begins at the projected middle point of the anterior margin of the mantle, and runs straight backwards for some distance; then it curves gradually into the right side, almost reaching the anterior end of the attachment of the right fin. The tubercles are not so many as thirty, as in *M. hoylei*, but only seventeen and are small, being nearly of equal size.

The luminous organs are uniform in appearance, thickly covering the ventral surface of the whole body and are found in less number on the dorsal surface.

On the ventral surface of the mantle, they are thickest in distribution at the anterior region, becoming thinner and diminishing in size towards the posterior end, and they show a regular arrangement in an oblique direction at the anterior half of the mantle. The most anterior transverse row along the edge of the mantle-opening consists of about thirty-eight organs, but of these only about twenty-five are visible from the ventral side. And when they are counted longitudinally along the median line of the ventral surface, though they do not show a quite regular series, the number is about twenty-four.

The dorsal surface of the mantle is provided with a small number of the organs, which show a most irregular arrangement and are asymmetrical in distribution on both sides, those of the left side being a little thinner in distribution and smaller in size than those of the right side. When the mantle is seen from the right side, the organs show a quite regular arrangement, the series diverging somewhat from the median part of the ventral anterior margin towards the posterior dorsal direction.

The ventral surface of the head is also thickly covered with organs arranged in oblique series. The most posterior transverse row along the anterior boundary edge of the neck consists of twenty-four organs, which is thickest in arrangement in the middle. The number of the organs in the row between both the eye-openings can not be counted, on account of the skin being torn, but judging from the arrangement of the anterior as well as the

posterior regions, it seems to be composed of about twenty organs, as occurs in *M. hoylei*.

The lateral regions of the dorsal surface of the head are provided with organs much smaller and much thinner in distribution than those of the ventral surface. The arrangement is irregular and asymmetrical on both sides, the organs of the right side being more numerous than those of the left side. When the head is seen laterally, the size and distribution of the organs differ greatly between the right and left sides: on the right side, the organs are numerous, becoming rarer towards the dorsal side, and there is found a longitudinal zone entirely free from organs, crossing the eye-opening and extending from the angle between the third and fourth arms to the neck. The margin of the eye-opening of this side is provided with twenty-four organs around the whole edge. The left side of the head has very few and minute organs, which are entirely lacking around the margin of the eye-opening.

The series of the luminous organs of the arms are only the continuation of those of the head, being arranged in some longitudinal series. The outer surface of the right ventral arm is thickly covered with the organs. There are nine series of the organs at the extreme base, which become reduced to six in the middle and to one at the extremity, the series which reaches to the extremity being the second one among the nine series from the ventral side.

On the proximal part of the third pair of arms, there are two series of the luminous organs which are all situated in a more ventral position than the median tubercular series, and the longest one of the two, comprising about forty organs, reaches the extreme end of the arm. The dorsal side of the median tubercular series has only a few organs of small size.

The ventral side of the tubercular series on the second pair of arms is provided also with two series of the luminous organs at the proximal part. The longer series of the two, comprising about thirty-three organs, reaches the extremities of the arms. The organs on the dorsal side of the tubercular series show nearly the same character in distribution as those on the equal surface of the third pair, but much less frequently. The organs of the first



pair are smaller and much rarer in occurrence than those of all the preceding arms, arranged very irregularly.

**Ommastrephes volatilis** sp. nov. (Pl. IV., figs. 1-6)

Local name: *Tobi-ika* (Sagami Prov.).

*Type*.—(I) One male and female specimens, taken by Mr. K. AOKI off Atami, Sagami Prov. on June 24, 1906.

(II) One male and two female specimens, caught by the same collector in the same part of the sea on Sept. 23, 1905. According to the information of the collector, they flew from the sea into the sky and colliding with the sail of his boat, fell down into it.

The following table shows the measurements of these five specimens (in alcohol).

|                          | No. I |       | No. II |       |      |       |     |     |     |     |
|--------------------------|-------|-------|--------|-------|------|-------|-----|-----|-----|-----|
|                          | ♂     | ♀     | ♂      | ♀     | ♀    |       |     |     |     |     |
|                          | mm.   | mm.   | mm.    | mm.   | mm.  |       |     |     |     |     |
| Dorsal length of mantle  | 213   | 208   | 152    | 148   | 148  |       |     |     |     |     |
| Ventral length of mantle | 210   | 205   | 149    | 145   | 145  |       |     |     |     |     |
| Circumference of mantle  | 98    | 93    | 75     | 82    | 73   |       |     |     |     |     |
| Breadth of mantle        | 34    | 33    | 27     | 28    | 27   |       |     |     |     |     |
| Length of head           | 41    | 40    | 33     | 54    | 30   |       |     |     |     |     |
| Breadth of head          | 35    | 34    | 28     | —     | 26   |       |     |     |     |     |
| Length of fins           | 125   | 112   | 85     | 87    | 90   |       |     |     |     |     |
| Total breadth of finns   | 100   | 100   | 75     | 82    | 73   |       |     |     |     |     |
|                          | left  | right | left   | right | left | right |     |     |     |     |
| Length of first arm      | 110   | 108   | 73     | 73    | 70   | 70    | 72  | 72  |     |     |
| „ „ second arm           | 112   | 117   | —      | 85    | 83   | 83    | 85  | 85  |     |     |
| „ „ third arm            | 115   | 114   | 109    | 108   | 86   | 85    | 83  | 83  | 85  | 85  |
| „ „ fourth arm           | 103   | 95    | 100    | 100   | 85   | 85    | 82  | 82  | 75  | 75  |
| Length of tentacle       | 187   | 194   | —      | —     | 180  | 180   | 215 | 214 | 143 | 143 |
| „ „ club                 | 60    | 63    | —      | —     | 55   | 55    | 64  | 68  | 50  | 50  |

The body is fleshy, with smooth skin. The mantle is very slender, the length being about six times the breadth, and it is conical, the broadest part

being the anterior, and has a very narrow posterior portion; the anterior margin is truncate, with neither projection nor emargination. The fins are long and are both together cordate with pointed lateral edges, the post-lateral edges being arched, and attenuated posteriorly, vanishing at some distance (13 mm. in a male with 213 mm. mantle-length) before the extreme end of the mantle (Pl. IV, fig. 1).

The head is as broad as the mantle-opening, with a sharp boundary edge behind. The eye-openings have, at a point a little below the middle of the anterior edge, a deep sinus, of which the dorsal margin is greatly thickened. The siphonal groove is fairly deep, being bounded by a distinct edge, the post-lateral portions of which, projecting a little, embrace the siphon laterally. The foveola in front is distinct, being bounded by a falcate fold posteriorly, but without any other folds either inside or outside. The olfactory crest of each side consists of one transverse and three longitudinal folds, the latter ones extending between the former and the posterior boundary edge of the head (Pl. IV, fig. 2).

The siphon, tapering a little forwards, extends generally to the middle of the head; the collar-like portion of the base is free posteriorly around the viscera, except at the nape where it joins the skin. The siphon is connected with its groove, by two pairs of ligaments, one pair of which is dorsal and the other entirely lateral in position. From between the dorsal pair there projects, in all the specimens examined, a muscular protuberance with a round head.

The arms are thick, long, and of subequal length, the formula being  $3 \doteq 2 > 1 > 4$ ; the longest arm is about half as long as the mantle. The first pair of arms is nearly quadrangular in section at the proximal halves and nearly cylindrical at the remaining distal halves. The second pair is also quadrangular either at the proximal parts or at the distal, and is provided, along the ventral outer edges, with a web as broad as its own protective membranes. The third pair is compressed laterally, being provided, along the whole length of the outer surfaces, with a very high keel, of which the highest

is in the middle, the height being much greater than the thickness of these arms. The fourth pair is quadrangular along the whole length, and has a broad web along the dorsal outer edge. The ventral protective membranes of the second and third pairs, are a little broader than the length of the suckers, but the dorsal membranes of these arms are about equal to their length. Both the protective membranes of the remaining arms are much narrower than all the preceding ones.

The arm-suckers are semicircular and arranged in two series. The size does not show any sexual dimorphism, but varies in the different arms of each individual, the suckers of the second and third pairs of arms being much larger than those of the first and fourth pairs: in a female of 208 mm. mantle-length, 3.2 mm. in I pair of arms, 3.5 mm. in II and III, 2.7 mm. in IV.

The horny rings of the arm-suckers have several distinct teeth along the distal margins; the proximal margins project slightly, forming a narrow border of smooth edge; the shape of the teeth varies in the different suckers: in the third pair of arms, the horny ring of one of the suckers in the second row from the base has ten somewhat pentagonal teeth thickly arranged, of which the lateral ones are much broader than the median and are very oblique; the horny ring in the sixth row has eight strong acute conical teeth, but of these the marginal ones are both obliquely quadrangular and much broader than the others; besides these, there are found five flat semicircular or quadrangular supplemental teeth, alternating thickly with the preceding ones, (Pl. IV, fig. 3a); the horny ring of the fifteenth row has eight slender and acute teeth, of which the marginal ones are a little broader than the remaining ones, and of which the interdental spaces are a little broader than those of the fore-going suckers (Pl. IV, fig. 3c); the horny rings of the remaining suckers, except those more distal than the fifteenth row, show a character intermediate between those above described. The denticulation of all the suckers more distal than the fifteenth row resembles closely that of the fifteenth row, but the number becomes less towards the extremities of the arms.

The hectocotylus is always in the right ventral arm, about two-thirds of the distal part showing the modification (Pl. IV, fig. 1a). Along two-thirds of the proximal part, there are thirty-four suckers arranged in two series; the middle three or four in each series being smaller than the remaining ones, especially with regard to those of the ventral series. The remaining distal part has no normal suckers but fifty sucker-bases, swollen into a transverse membranous shape, and arranged in two series, those of the ventral series being much smaller than those of the dorsal, and each sucker-base being provided with a minute papilla on its top. All these sucker-bases are connected with a median ridge running along between the two series. The distal two-thirds of the ventral protective membrane is enlarged and much thickened with a sculpture on the outer surface; the sculpture is composed of pits and grooves. There are found along the median line of the outer surface about fourteen pits, each sending sideways two grooves. Besides these, many small round or oval depressions and shallow grooves are found, being arranged in a somewhat regular manner (Pl. IV, fig. 4b).

The tentacles are about as long as the mantle, though they show some variation in length, owing probably to some external cause; the stem is a little compressed laterally and nearly quadrangular in section, the inner surface being flattened, with a web running from the base along the dorsal outer edge, extending to the outer surface of the club, where it becomes a little wider and bends towards the dorsal side distally. The clubs, occupying about one-third the whole length of each tentacle, are expanded lanceolately and show a triangle in section, with protective membranes about as broad as the length of the suckers. The suckers of the carpal portion are about twelve in number, arranged sparsely in two or three series, extending downwards to the exact middle of the tentacle, while all the remaining suckers are distinctly in four series. Ten central suckers of the hand portion are about thrice as large as the marginal ones in diameter; the suckers of the distal portion are smaller than the marginal ones of the hand portion and are arranged in about twenty-seven rows and in four series, of which the more

dorsal ones are always smaller than the more ventral. The suckers are nearly semicircular with a broad aperture, but the larger ones, having a very deep cavity, are longer in profile than the smaller suckers, which are shorter, with bottoms raised up to the level of the aperture. The horny ring in the largest sucker has, along the whole margin, about twenty sharp, slightly recurved conical teeth of about equal length, their breadth being a little narrower than the interdental spaces. Those of the marginal suckers show nearly the same characters in denticulation as the largest one, but the teeth of the lower margin are distinctly shorter than those of the upper. Those of the distal and carpal suckers also have teeth resembling those of all the preceding ones in the upper margin, but the edges of their lower margins show an even contour, projecting slightly and forming narrow borders.

The umbrella is very narrow. The buccal membrane has seven ribs, projections, and connectives, of which the dorsal-most is divided into two branches near the arm-bases, the inner surface being papillate. The outer lip is thin: the inner, thick and papillate. The so-called aquiferous pores between the arms and buccal membrane are four in number, between the first and second, and between the third and fourth, pairs.

The radula comprises seven series of somewhat thick teeth, the median tooth being tricuspid, the lateral bicuspid, and both the marginals unicuspid. The lateral teeth are about as long as the median, and the outer marginal a little longer than the combined length of the two succeeding medians (text-fig. 3).

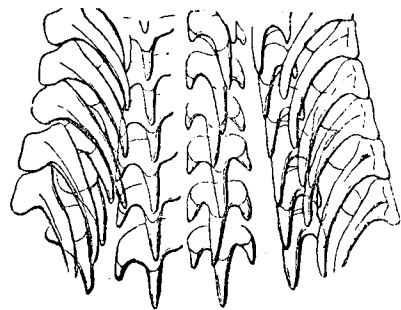


Fig. 3.—*Ommastrephes volatilis* sp. nov.  
camera drawing of radula,  $\times 60$ .

The gladius is shorter than the mantle-length and is composed only of rhachis, lacking lateral vanes, but at the posterior part, narrow, wing-like lateral expansions from the rhachis are found, the length of which are about one-fifth of the whole length, making a shallow cone posteriorly (Pl. IV, fig. 6).

The present species resembles in many respects all the species of *Ommastrephes* hitherto known (*O. sagittatus*, *O. hawaiiensis*, *O. sloani*), to which it seems to stand in the nearest relationship among the Oegopsida, especially is this so with regard to the fact that the hectocotylus is only in the right ventral arm, and the siphonal groove has the foveola in front, bounded posteriorly by a crescentic pocket-like fold without any folds outside. Characters distinguishable from these species are shown in the following key, which was made by means of a comparison of the specimens whose mantle-lengths are about 148-215 mm.

1. Foveola of siphonal groove with several longitudinal folds within. Breadth of mantle about 18-30% of its length. Fins together distinctly broader than their length. Horny rings of arm-suckers provided with several sharp teeth on their distal margins, without any quadrangular supplemental teeth alternating with the preceding ones. Horny ring of largest tentacular sucker generally with quadrangular supplemental teeth alternating with sharp, ordinary teeth. Hectocotylus showed only by the degeneration of suckers and the swelling of the sucker bases .....  
 ..... *O. sagittatus*, *O. hawaiiensis*, *O. sloani*.

2. Foveola of siphonal groove without longitudinal folds within, but smooth. Breadth of mantle 16-19% of its length. Fins distinctly longer than their total breadth, attenuated posteriorly. Horny rings of arm-suckers varying in denticulation in different suckers of each arm; largest sucker of II arm provided with quadrangular supplemental teeth alternating with long, sharp, ordinary teeth. Horny ring of largest tentacular sucker with only sharp, and without any supplemental, teeth. Hectocotylus shown not only by the degeneration of suckers and the swelling of sucker bases, but also by the thickening and enlarging of ventral protective membrane and by sculpture composed of pits and transverse grooves on outer surface .....  
 ..... *Ommastrephes volatilis* n. sp.

**Symplectoteuthis luminosa** sp. nov. (Pl. IV., figs. 7-13).Local name: *Suji-ika* (Sagami Prov.)

*Type*.—Three male and seven female specimens, taken six miles off Misaki coast, in 700 fathoms, Aug. 5, 1906. Their measurements are as follows:

|                          | ♂     | ♂     | ♂     | ♀     | ♀     | ♀     | ♀   | ♀     | ♀     | ♀       |
|--------------------------|-------|-------|-------|-------|-------|-------|-----|-------|-------|---------|
|                          | mm.   | mm.   | mm.   | mm.   | mm.   | mm.   | mm. | mm.   | mm.   | mm.     |
| Dorsal length of mantle  | 143   | 154   | 166   | 120   | 122   | 141   | 151 | 151   | 155   | 157     |
| Ventral length of mantle | 138   | 151   | 191   | 116   | 120   | 139   | 147 | 148   | 151   | 155     |
| Circumference of mantle  | 60    | 92    | 102   | 75    | 82    | 86    | 97  | 98    | 92    | 97      |
| Breadth of mantle        | 31    | 33    | 35    | 24    | 28    | 28    | 32  | 33    | 33    | 33      |
| Dorsal length of head    | 27    | 33    | 34    | 19    | 31    | 28    | 33  | 32    | 32    | 32      |
| Breadth of head          | 30    | 34    | 34    | 23    | 28    | 28    | 32  | 31    | 32    | 30      |
| Length of fins           | 69    | 72    | 83    | 52    | 54    | 66    | 71  | 76    | 75    | 78      |
| Total breadth of fins    | 76    | 80    | 90    | 62    | 72    | 73    | 90  | 87    | 81    | 85      |
|                          | L. R. | L. R. | L. R. | L. R. | L. R. | L. R. |     | L. R. | L. R. | L. R.   |
| Length of first arm      | 46 46 | 51 51 | 54 55 | 32 31 | — 45  | 43 43 | —   | 50 50 | 50 50 | 50 50   |
| „ „ second arm           | 53 53 | 57 55 | 60 59 | 36 36 | 49 49 | 50 50 | —   | 54 54 | 57 57 | 57 57   |
| „ „ third arm            | 50 50 | 55 55 | 56 56 | 35 36 | 47 47 | 49 49 | —   | 54 53 | 55 57 | 56 56   |
| „ „ fourth arm           | 48 50 | 53 55 | 56 60 | 36 36 | 47 47 | 49 49 | —   | 54 54 | 55 55 | 57 57   |
| Length of tentacle       | 68 70 | 75 75 | 96 96 | 60 60 | 68 68 | 70 70 | —   | 85 80 | — 63  | 100 102 |
| „ „ club                 | 32 32 | 35 35 | 40 38 | 23 23 | 32 32 | 31 31 | —   | 35 35 | — 32  | 38 38   |

The body is fleshy and the skin smooth. The mantle is conical, the broadest portion being in the anterior margin, and one-third of the posterior portion is more attenuated than usual. The emargination of the ventral anterior edge and the projection of the dorsal edge are both very slight. The fins which do not reach the extreme end of the mantle, are both together rhomboidal, with slightly concave latero-posterior edges, and are notched at the anterior attachment (Pl. IV, fig. 7).

The head is as broad as the mantle-opening, with a sharp boundary edge posteriorly. The siphonal excavation is deep and acuminate in front, being marked by a distinct boundary edge, of which the post-lateral parts project forming thick folds which embrace the siphon laterally. At the apex, it has a small rhomboidal foveola which has about eight faint longitudinal folds within, and outside the foveola, two or three small oblique folds are

seen in each side. The olfactory crest of each side consists of one transverse and three longitudinal folds, the latter stretching between the transverse fold and the posterior boundary edge of the head. Each eye-opening, at the middle of the anterior edge, has a distinct sinus, of which the dorsal margin is thickened (Pl. IV. fig. 8). The siphon tapers a little forwards, and reaches the middle of the head; the collar-like portion of the base is free posteriorly around the viscera except at the nape where it is fixed to the skin, and the ventral margin is highly arched with a thin membranous border. The siphonal resisting cartilages are triangular, with a spindle-shaped elevation in front; the groove is  $\perp$ -shaped, the longitudinal part curving towards the ventral side anteriorly. The middle portion of the cartilage is joined by the ligament to the mantle cartilage, and the posterior margin is also connected at the middle with the same. The dorsal connective ligaments of the siphon are in two pairs, one pair of which is median in position and the other lateral. The resisting cartilage of the nape is elongate and expanded anteriorly, with a pair of thick submedian ridges, which extend some distance backwards beyond the collar-like portion of the siphon, with another faint longitudinal ridge running between them.

The arms are subequal, the formula of length being about  $2 \doteq 4 \doteq 3 > 1$ ; the longest arm is about one-third the length of the mantle.

The first and second pairs of arms are about quadrangular in section; the former pair has a narrow web along each proximal half of both outer edges, while the latter pair is provided only along the ventral outer edge with a web, broader than the preceding ones and extending from the base of the arm up to the extreme end. The protective membranes of both sides of the first pair, as well as the dorsal membrane of the second pair, are a little narrower than the length of the suckers; while the ventral membrane of the second pair is slightly broader than the preceding ones, being as broad as the length of the suckers.

The third pair is compressed laterally, being provided along the whole median line of the outer surface, with a keel as high as the thickness of the



arm and highest towards a point one-third from the base of the arm. The ventral protective membranes are very broad, being about thrice as wide as the length of the suckers, while the dorsal membranes are narrower than the length of the suckers.

The fourth pair is nearly quadrangular, with a narrow web along the ventral outer edge, and a broad one along the dorsal, the proximal part of the dorsal web being as broad as the thickness of the arm; the protective membranes of both sides are alike about half as broad as the length of the suckers.

The arm-suckers are semicircular, with a broad aperture and oblique stalk, and they are arranged in two series; the horny rings have sometimes blunt, sometimes sharp, teeth on the distal margin, surrounded by a papillary area with numerous striations radially arranged. The horny ring of one of the suckers in the fourth row from the base on the second arm of a male whose mantle-length is 116 mm, has a large, thick, triangular tooth with acute point at the most distal edge, and on each side of it, seven flattened teeth somewhat thickly arranged and of much smaller size, some of these being blunt and some sharp; the horny ring of a sucker from the sixth row shows characters nearly equal to the preceding ring, but all the teeth of this ring have much blunter cusps, and the marginal tooth on each side is very much thicker, being as large as the median one (Pl. IV, fig. 9a); the horny ring of a sucker from the tenth row has, on the distal margin, nine teeth which are much narrower and sharper than those of the preceding rows (Pl. IV, fig. 9b).

The size of the suckers varies a little in the different arms of each individual, as the following table shows:

|                                              | ♂   | ♂   | ♀   | ♀   | ♀   |
|----------------------------------------------|-----|-----|-----|-----|-----|
|                                              | mm. | mm. | mm. | mm. | mm. |
| Mantle-length .....                          | 154 | 166 | 120 | 122 | 151 |
| Diameter of largest sucker of first arm..... | 2.1 | 2.5 | 1.3 | 2   | 2.5 |
| "    "    "    "    " second arm.....        | 3.4 | 3.8 | 2   | 2.5 | 3.5 |
| "    "    "    "    " third arm.....         | 2.5 | 2.8 | 1.7 | 2.2 | 2.8 |
| "    "    "    "    " fourth arm.....        | 1.8 | 2   | 1.2 | 1.5 | 2   |

The hectocotylus is in the left ventral arm, of which one-third of the distal portion shows modification to a greater degree; the suckers of the proximal eleven rows are of normal size and appearance, and those of the remaining distal sixteen rows are very minute, without the usual shape of suckers, but papilla-like, with swollen bases (Pl. IV, fig. 10).

The tentacles show some individual variation in length, according to the state of preservation, but they seem to be about half as long as the mantle; the stalk is a little compressed laterally and is nearly quadrangular in section, the inner surface being flattened and bounded laterally by sharp edges, which are continuous with the protective membranes of the club. The clubs are lanceolate, occupying from one-half to one-third the whole length of the tentacles, each having a web on the outer surface; the continuation of the web begins as a ridge at each extreme base of the tentacles, and is expanded on the clubs, bending towards the dorsal sides distally. The suckers are arranged in four series and are unequal in size, eight or ten central suckers of the hand portion being much larger than the others. They are semicircular, with large apertures; the papillary area has numerous horny striations of the same character as in the arm-suckers. In the carpal portion, two mammillary protuberances are found in the dorsal side of the sucker-bearing surface, and the suckers which exist more proximally than those protuberances, show an individual variation in number from two to eight. The largest central sucker of the hand portion is about as large as the marginal ones twice in diameter, and is about equal to the largest sucker in the arms; this sucker has, in all the specimens examined by me, only a single triangular tooth of large size on the distal-most edge of the horny ring (Pl. IV, fig. 11a); the marginal suckers have about twenty triangular teeth along the whole edge of the ring, sometimes with a number of supplemental teeth alternating with them (Pl. IV, fig. 11b).

The buccal membrane is finely wrinkled and has seven ribs, projections, and connectives; the dorsal connective is divided into two branches near the bases of the first pair of arms, and has no membranous septum below, so

that all the aquiferous pores between the first pair of arms, as well as between the first and second arms of both sides, are continuous with each other. Besides the pores of the dorsal side, there are also found pores between the lateral arms, as well as between the third and fourth arms, but in some specimens, those between the lateral arms of the left side are not found.

The radula comprises seven series of teeth; the median tooth being tricuspid, the lateral bicuspid and both marginals unicuspid; the outer marginal teeth are very narrow, the length

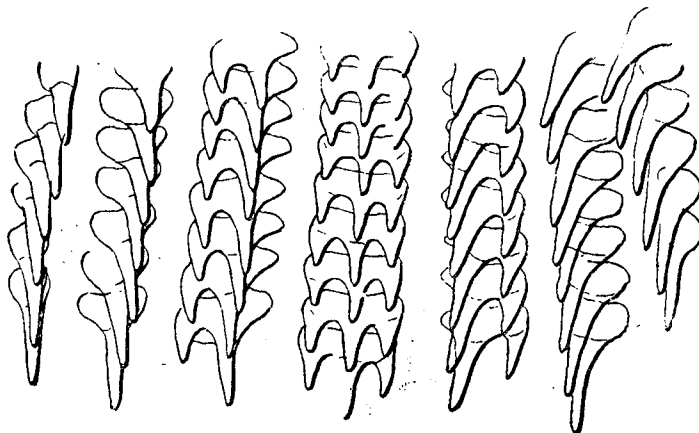


Fig. 4.—*Symplectoteuthis luminosa* sp. nov. camera drawing of radula,  $\times 60$ .

being equal to the combined length of the two succeeding median teeth (text-fig. 4).

The gladius is very narrow, without lateral vanes, but at the posterior end, there is a slightly expanded portion, the length of which is about one-fifth of the whole, and which forms a cone posteriorly (Pl. IV, fig. 13).

On the ventral surface of the head, a paler macula is found at the base of each ventral arm, and on the ventral surface of the mantle, there is also a pair of longitudinal zones of the same character, which runs along the whole length of the mantle, dividing laterally the same surface into three equal areas, and, curving slightly outwards anteriorly, enlarged at the extreme anterior ends. Those maculae and zones seem, judging from their histological structures, to be phosphorescent organs. When the mantle is flayed, a long white substance which has always another brownish substance along the median line, appears along each paler zone. The white substance is not con-

tinuous along the whole length, but is divided into three pieces: the foremost of oval shape, is the smallest, the middle is the longest, stretching from a little behind the anterior mantle-margin to about the level of the middle of the fin, and the last is about eight times as long as the first, and does not reach the extreme end of the mantle but is one length distant from it.

Under the skin of the paler maculae on the head, is also found the same substance as seen in the paler zones on the mantle, but it is a little thicker and is transversely oblong. Such substances of the mantle, as well as of the head, are all situated in the depressions of the muscles at those places, and the skin covering them is a little thicker than that covering the remaining parts (Pl. IV, fig. 12).

The principal differences of the present species from *S. oualaniensis* (LESSON), with which it stands in the nearest relationship, are as follows:

1. Luminous organ absent. Hectocotylised left ventral arm much thicker and longer than right ventral arm, with 14 suckers and broad protective membranes greatly thickened; about  $\frac{3}{5}$  of the distal part of whole length is bare but only with a narrow longitudinal ridge. Horny ring of largest tentacular suckers with a large tooth in each of 4 corners and 5 small teeth between each larger succeeding 2.....*Symplectoteuthis oualaniensis* (LESSON).

2. Luminous organ present. Hectocotylised left ventral arm a little shorter than right ventral one, and as thick as the latter, and provided with about 24 normal suckers along proximal part; protective membranes as broad and thick as those of right arm; distal  $\frac{1}{3}$  of whole length not bare but with 34 minute tubercles each on a swollen base. Horny rings of largest tentacular suckers with only a large tooth on upper-most edge .....  
 ..... *Symplectoteuthis luminosa* sp. nov.

**Explanation of Plate IV.**

*Ommastrephes volatilis* sp. nov. —

Fig. 1. Dorsal view of male,  $\times 1/2$ .

Fig. 2. Lateral aspect of the same,  $\times 1/2$ .

Fig. 3. Camera drawing of horny rings from third left arm,  $\times 30$ . a) From sucker of sixth row from base of arm; b) from sucker of tenth row; c) from sucker of fifteenth row.

Fig. 4. Hecotocotylus,  $\times 1/2$ . a) Inner aspect; b) lateral aspect showing sculpture.

Fig. 5. Camera drawings of oblique-lateral view of horny ring from largest tentacular sucker,  $\times 13$ .

Fig. 6. Ventral aspect of gladius,  $\times 1/2$ .

*Symplectoteuthis luminosa* sp. nov. —

Fig. 7. Ventral view of male,  $\times 1/2$ .

Fig. 8. Lateral aspect of head of female,  $\times 1/2$ .

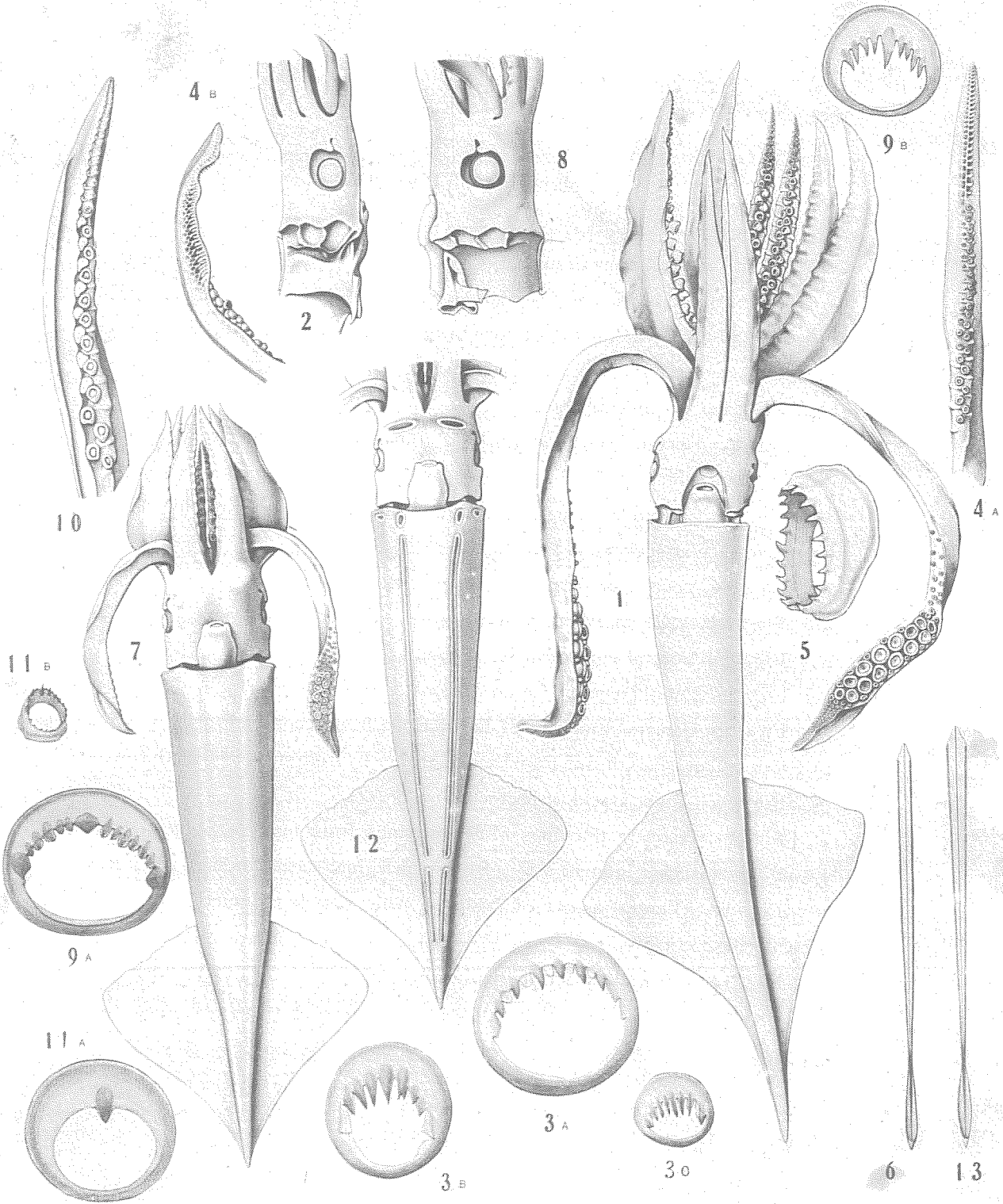
Fig. 9. Camera drawings of horny rings from second left arm,  $\times 30$ . a) From sucker of sixth row from base of arm; b) from sucker of tenth row.

Fig. 10. Inner aspect of hectocotylus,  $\times 5/4$ .

Fig. 11. Camera drawings of horny rings from tentacle,  $\times 30$ . a) From largest sucker in inner row; b) from marginal sucker in hand portion.

Fig. 12. Ventral aspect of body of male showing luminous organs after flaying,  $\times 1/2$ .

Fig. 13. Ventral aspect of gladius,  $\times 1/2$ .



Nagasawa del.