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CONDUCTED BY

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PLATES IN VOL. VIII.

II.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R. F. Hoskyn, R.N., commanding.*—Series II., No. 1. *On the Results of Deep-sea Dredging during the Season* 1890–91. By J. Wood-Mason, Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College of Bengal, and A. Alcock, M.B., Surgeon I.M.S., Surgeon-Naturalist to the Survey.

[Plates VII. & VIII.]

On the 18th October, 1890, the 'Investigator' left Bombay for the Andaman Islands, and on the 9th December following she crossed from the Andaman Islands to the Madras coast, reaching Bimlipatam on the 26th December. During these passages fifteen hauls of the trawl were taken in depths ranging from 95 to 1997 fathoms, and numerous deep-sea soundings were made.

Between Bombay and Colombo, in the Laccadive Sea, numerous soundings were taken and four very successful trawlings were carried out. In this sea the bottom appears to be mainly green mud, with a small percentage of Foraminifera shells: in the immediate neighbourhood of the Laccadive Islands there is, of course, a great deal of fine coral detritus. The feature of these hauls were the starfishes, which will be duly noticed in the sequel.

Between Colombo and the Andamans three successful hauls of the trawl besides many soundings were taken. The deep open part of the Bay of Bengal here worked over shows a bottom of *Globigerina*-ooze with numerous water-worn fragments of pumice; but as one proceeds north-eastwards stiff blue mud is met with. The two deep hauls on this course gave a fine lot of starfishes and Holothurians. The third haul (Station 112), in 561 fathoms, must be particularly noticed. The trawl-bag came up crammed with mud of a low temperature, in which the specimens were imbedded. It may be surmised that compression under a great weight of cold mud kept up an approximation to normal bathybial conditions of temperature and pressure, in order to account for the fact that many of the crustaceans taken were found to be alive. Among these three species of Macrurous Decapods—*Aristæus*, sp. n., *Heterocarpus Alphonsi*, Sp. Bate, and *Willemoesia forceps*, A. M.-Edw.—were discovered to be luminous. In the case of *Heterocarpus Alphonsi* clouds of a pale blue highly luminous substance, which not only illuminated the

observer's hands and surrounding objects in the vessel in which the creature was confined, but also finally communicated a luminosity to the water itself, were poured out apparently from below the bases of the antennæ. The *Aristæus* was less, and less persistently luminous in the same region. The *Willemoesia* was luminous at two circumscribed points somewhere near the orifices of the genital glands.

In the Andaman Sea four good hauls were made. The bottom to the north appears to be in general blue mud; to the south there is a good deal of green mud. From experience in this and previous seasons the moderate depths of the Andaman Sea in its southern half appear to swarm with life. Station 114 (922 fathoms) in the Andaman Sea must have a special word of notice. The trawl-bag here again came on board choked with cold mud, out of which a gigantic specimen of *Colossendeis gigas*, Hoek, was washed alive. The ventral surface of the body and the ventral surfaces of all the legs except the ovigerous pair shone with a brilliant blue-green metallic lustre, which died away quickly from the body and part of the legs, but remained very persistently along the fifth and sixth segments of all but the first pair of legs.

Crossing the Bay of Bengal from the Andamans to Madras and on the continuation of the passage northwards to Bimlipatam four successful hauls were carried out; and between the parallels of 11° and 12° N. a continuous line of soundings was taken across the Bay. This section of the Bay shows a flat plain rising very abruptly to land on either side, the bottom being impure *Globigerina*-ooze (except, of course, near the land), with large water-worn fragments of pumice. The features of the deep hauls on this line were the magnificent starfishes and Holothurians.

Considering now the results of our trawling from the bathymetric point of view, without any reference to locality, we find that in the Indian seas the depths most favourable to animal life are the moderate depths at 100 to 400 fathoms. At this limit everywhere we find life to be varied and abundant, the fishes and Crustaceans especially being taken in swarms and in great variety.

The following is the list of the 'Investigator' deep-sea dredging stations during the season 1890–91 :—

Station No.	Position.	Depth in Fathoms.	Nature of Bottom.	Temperature Fahr.	
				Surface.	Bottom.
106	Laccadive Sea, lat. 9° 53′ 34″ N., long. 75° 16½′ E.	1091	Green mud, about 3 per cent. Foraminifera.	83°·5	37°·5
107	Laccadive Sea, lat. 8° 23′ N., long. 75° 47′ E.	738	Green mud.	79·5	41·9
108	Laccadive Sea, lat. 7° 04′ N., long. 76° 34′ 15″ E.	1043	Green mud, with Foraminifera.	80	38
109	Gulf of Manaar, lat. 7° 41′ N., long. 78° 21′ E.	738	Green mud.	81	42
110	Bay of Bengal, lat. 9° 34′ N., long. 85° 43′ 15″ E.	1997	*Globigerina*-ooze, with pieces of pumice.	81·3	35
111	Bay of Bengal, lat. 12° 50′ N., long. 90° 52′ E.	1644	*Globigerina*-ooze.	81	35·4
112	Bay of Bengal, lat. 13° 47′ 30″ N., long. 92° 36′ E.	561	Grey mud.	75·4	44·9
113	Andaman Sea, lat. 12° 59′ N., long. 93° 23′ 10″ E.	683	Blue mud.	76·5	42·9
114	Andaman Sea, lat. 13° 21′ N., long. 93° 27′ E.	922	Blue mud.	80·3	41·2
115	Andaman Sea, lat. 11° 31′ 40″ N., long. 92° 46′ 40″ E.	188–220	Green mud.	83	56
116	Andaman Sea, lat. 11° 25′ 5″ N., long. 92° 47′ 6″ E.	405	Green mud.	82	47
117	Bay of Bengal, lat. 11° 58′ N., long. 88° 52′ 17″ E.	1748	*Globigerina*-ooze, with pieces of pumice.	75·5	35·3
118	Bay of Bengal, lat. 12° 20′ N., long. 85° 8′ E.	1803	*Globigerina*-ooze, with pieces of pumice.	78·6	35
119	Bay of Bengal, off mouth of Kistna River.	95	Brown mud.	80	66·5
120	Bay of Bengal, lat. 15° 56′ 50″ N., long. 81° 30½′ E.	240–276	Brown mud.	79·1	52

Subgrade B. *CŒLOMATA.*

Phylum **VERTEBRATA.**

Class **PISCES.**

By A. Alcock.

The deep-sea fishes collected during the season number fifty species, of which twenty are new to science, while eight more have not before been recorded from India.

Among genera not typically bathybial hitherto unrecorded from Indian seas it is interesting to find *Callorhynchus*?, *Dibranchus*, *Peristethus*, *Physiculus*, *Ateleopus*, and *Neoscopelus*.

Among bathybial genera we have to record for the first time *Argyropelecus*, *Alepocephalus*, and *Nettastoma*.

The forms, five in number, which do not fall into any hitherto described genera are sufficiently important to require a separate notice.

1. *Malthopsis* is a Pediculate from the Andaman Sea very similar in general appearance and morphology to *Malthe* from the American side of the Atlantic, but differing from it in possessing only two pairs of gills.

2. *Halicmetus* is a still more remarkable Pediculate from the Andaman Sea. It is closely allied to *Dibranchus* and *Malthopsis*, but both dorsal fins are entirely wanting and the anal fin is rudimentary.

3. Another most remarkable type is *Lamprogrammus*, an Ophidiid very closely approximate to the Brotuline type, but separated off from it in having no ventral fins, and differing from all other Ophidiids in the structure of the lateral line, which resembles in appearance that of the Halosauridæ. That is to say, the scales of the lateral line are much enlarged, and each one is excavated for the reception of a glandular substance, which is probably luminous in function.

4. *Bathyclupea* is another extremely interesting form, which I have placed among the Physostomi and in the family Clupeidæ, though it differs from all the Physostomes in having the ventral fins, which are rudimentary, subjugular in position, and is unlike other Clupeoids in possessing few pyloric appendages and in having the upper jaw but indistinctly tripartite. I have carefully dissected this form, and have little doubt about its affinities, though I am not certain whether it should be placed apart in a new subfamily of the

Clupeidæ, or even in a new family next to the Clupeidæ. Admitting its present position, it is the first Clupeoid yet discovered in the depths.

5. *Dysommopsis* is a new Murænid closely allied to *Dysomma*, with which singular form it may be included in a new alliance. It differs most conspicuously from *Dysomma* in wanting pectoral fins.

Upon the new species of known genera a few general remarks may be made. Two species of *Dibranchus*—one from the Andaman Sea, the other from the Bay of Bengal—represent here a type hitherto known only from the African side of the Atlantic.

Callorhynchus, *Physiculus*, *Ateleopus*, and with them *Neoscopelus* and *Dibranchus*, may perhaps be looked upon as additional links in the chain which appears to connect the local bathybial fauna of the Bay of Bengal with the fauna on the one hand of the west Atlantic and on the other hand of the Japan seas.

In *Sebastes hexanema*, *Lioscorpius longiceps*, *Peristethus Murrayi*, and *Scopelus engraulis* we have further instances of the existence at moderate depths in the Indian seas of types discovered by the 'Challenger' at similar depths in the seas of the East-Indo-Australian Archipelago, such as our previous experience would lead us to anticipate.

A new species of *Harpodon* deserves a word of remark. It appears to be very near to *Harpodon microchir* from Japan, but differs from it and equally from *Harpodon nehereus* in its more complete squamation, the whole body and the greater part of the head being covered with thin rather deciduous scales.

Lastly, the discovery that the small Brotuline Ophidiid, *Saccogaster maculata*, the male of which is furnished with a bilobed external genital organ, is viviparous, though not particularly appertaining to bathybiology, is interesting enough to call for notice, for it confirms the opinions which have been formed of the function of similar appendages in the males of other Brotuline Ophidiids—e. g. *Dinematichthys iluocœteoïdes*, Blkr., and *Bythites fuscus*, Reinhardt.

The following is the list of the deep-sea fishes obtained during the season :—

Order CHONDROPTERYGII.

Suborder PLAGIOSTOMATA.

Family Scylliidæ.

Scyllium, M. & H.

1. *Scyllium hispidum*, sp. n.

Head broad and depressed. Snout flat and semicircular in outline, the length of its preoral portion is less than half its breadth, not much more than half the distance between the angles of the mouth and twice the interval between the non-confluent nasal valves, each of which bears a small cirrus. Eyes large, with the small spiracles situated behind and below them. A labial fold exists only at each angle of the crescentic mouth. Acutely tricuspid or quincuspid teeth in broadish bands in both jaws. The walls of the buccal cavity and the surface of the tongue are covered with small papillæ.

The entire skin, including that which covers the fins, is closely felted with spines, which are acutely tricuspid, with the middle cusp the longest—exactly resembling, but on a slightly smaller scale, the teeth.

The first dorsal fin, which begins just in advance of the vertical through the posterior limit of the base of the ventrals, is higher than the second, but about equal to it in extent of base. The anal, which terminates exactly opposite to the posterior limit of the second dorsal and very near to the origin of the caudal, is twice the length of either dorsal in extent of base. The pectorals are wide and are much longer and broader than the ventrals, which have a very oblique posterior margin.

Colour in life:—Uniform dull stone-grey.

One young male specimen, 9·5 inches long.

From Station 115, 188 to 220 fathoms.

Suborder HOLOCEPHALA?

2. *Callorhynchus*?, sp.

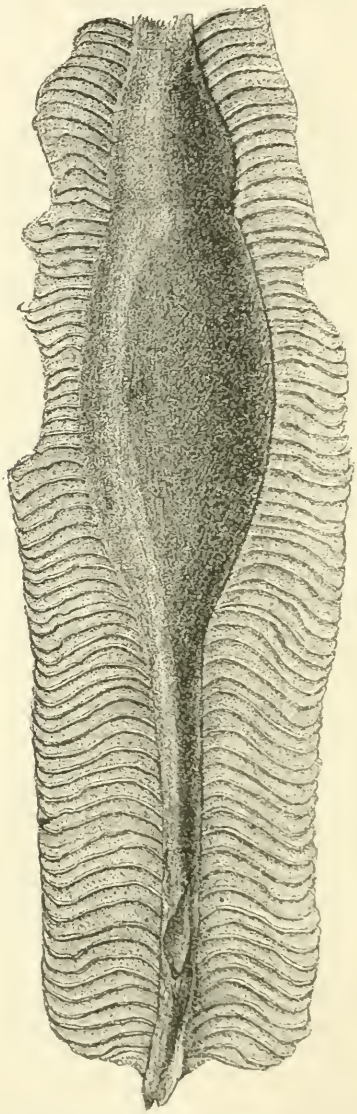
At Station 112, in a depth of 561 fathoms, an empty egg-capsule was dredged which we suppose to be that of either *Chimæra* or *Callorhynchus*, most probably the latter.

It is quite fresh, but has one end broken off. It is of a bottle-green colour and a parchment-like consistence, and measures as it is $5\frac{3}{4}$ inches in length.

It consists of an anterior ovate portion furnished anteriorly

with a bunch of very fine crimped silky hairs, and of a posterior tapering styliform portion, and the whole is surrounded by a broad radially striated or plicated fringe.

Fig. 1.



It is hardly to be supposed that this egg-capsule has drifted from any great distance.

Order ACANTHOPTERYGII.

Family **Scorpænidæ.**

SEBASTES, Gthr.

3. *Sebastes hexanema*, Gthr.

Sebastes hexanema, Günther, 'Challenger' Shore-fishes, p. 40, pl. xvii. fig. B; and 'Challenger' Deep-sea Fishes, p. 18.

Two specimens of this species, which was originally described from the Arafura Sea, 140 fathoms, were taken by the 'Investigator' at Station 115, 188 to 220 fathoms.

LIOSCORPIUS, Gthr.

4. *Lioscorpius longiceps*, Gthr.

Lioscorpius longiceps, Gthr., 'Challenger' Shore-fishes, p. 40, pl. xvii. fig. C.

This also is a hemibathybial species from the Arafura Sea, where it was taken along with the preceding species by the 'Challenger.'

One specimen was taken at Station 115, 188 to 220 fathoms. It has four large pyloric cæca.

Family **Berycidæ.**

MELAMPHAËS, Gthr.

5. *Melamphaës*, sp.

Some small specimens mutilated beyond identification were taken at Station 111, in 1644 fathoms, and Station 118, in 1803 fathoms.

POLYMIXIA, Lowe.

6. *Polymixia nobilis*, Lowe.

Two specimens of this well-known deep-sea Berycoid were taken at Station 115, 188 to 220 fathoms.

Family **Carangidæ.**

BATHYSERIOLA, Alcock.

7. *Bathyseriola cyanea*, Alcock.

Bathyseriola cyanea, Alcock, Ann. & Mag. Nat. Hist. ser. 6, vol. vi. (1890), p. 202.

A single specimen was taken at Station 120, in 240 to 276 fathoms.

Family **Pediculati.**

Halieutæa, C. & V.

8. *Halieutæa nigra*, sp. n.

D. 5. A. 4. C. 9. P. 13. V. 1/5.

Cephalic disk circular, convex anteriorly. Rostral tentacle trilobed. Interorbital space concave; supraorbital margin with long aculeate spines.

Cleft of mouth horizontal, its width being considerably less than half the diameter of the disk; jaws with villiform teeth. Gills $2\frac{1}{2}$. The dorsal surface of the disk and tail bears scattered spines with stellate bases, bifid, trifid, or multifid along the edge of the disk and side of the tail, but elsewhere acicular; the abdominal surface is covered with minute granules only. A few small papillæ along the under surface of the lower jaw; but no other cutaneous appendages. Fins in form and disposition as in *H. stellata*; the length of the pectorals is nearly twice that of the ventrals and about equal to that of the caudal, which is one fourth of the total.

Intestine wide; no pyloric cæca; no air-bladder.

Colour in life:—Uniform blue-black, with jet-black vermicular lines.

One specimen 2·7 inches long, from Station 115, 188 to 220 fathoms.

It is possible, though hardly probable, that this may be an immature form of *Halieutæa coccinea*, mihi. The difference in colour appears not to be an objection, because in a species of *Peristethus* to be described the young are dusky violet in colour, while a large specimen is bright red.

Dibranchus, Peters.

9. *Dibranchus nasutus*, sp. n. (Pl. VII. fig. 1.)

B. 5? D. 6. A. 4. C. 9. P. 12–13. V. 1/5.

Head and anterior part of body forming a large flat semicircular disk as broad as long; tail cylindrical. The broadly expanded snout-bones project far beyond the deep semicircular cavity which lies beneath them, and this lodges a fleshy tentacle, which ends in a pair of spherical lobes surmounted by a median bifid filament. A pair of almost confluent nostrils on each side of the subrostral cavity. Eyes small. Mouth-cleft horizontal, its width is about one third the greatest breadth of the cephalic disk; tongue large, blotched

with dusky pigment; villiform teeth in the jaws only. Gill-cleft a small foramen situated superiorly in the axilla; two gills; no pseudobranchiæ.

Dorsal surface of the cephalic disk and entire surface of the tail covered with stout spines, which are marked with numerous trenchant radiating costæ; those on the tail and in three series along the margin of the disk are widely bifid, those elsewhere are acicular. Under surface of the cephalic disk without spines, but with distant granular tubercles. Fins in form and disposition as in *Dibranchus atlanticus*; the pectorals and caudal are coequal in length, being contained $4\frac{1}{2}$ times in the total, and are slightly longer than the ventrals.

A wide coiled intestine; no pyloric cæca; no air-bladder.

Colours in life:—Blue-black, edge of disk and anterior part of abdomen jet-black.

One specimen 3·2 inches long, from Station 115, 188 to 220 fathoms.

10. *Dibranchus micropus*, sp. n.
(Pl. VII. figs. 2, 2 *a*, 2 *b*.)

D. 5. A. 4. C. 9. P. 15. V. 5?

Head and anterior part of body depressed, forming a disk which is nearly as broad as long and is truncated in front; there are strong, sharp, simple and bifid spines along its margin, and at the subopercular angle a large trifid one.

The broad front, which is so abruptly truncated as to leave no appearance of a snout, is widely but not deeply excavated below for the lodgment of a large fleshy supra-oral tentacle; this is trilobed, the lateral lobes being smoothly hemispherical and the middle (superior) lobe being foliaceous, with a fringed margin. On each side of the subrostral cavity are the large exsert subtubular nostrils. Eyes small.

Mouth-cleft horizontal; its width is contained about $2\frac{1}{3}$ times in that of the disk; jaws with a row or very narrow band of minute teeth. Gill-cleft a small foramen situated superiorly in the axilla and barely wider than the nostril; two gills only.

Entire surface of body closely covered with fine, short, bristle-like spines, which have stellate bases and either simple or bifid points.

Fins in form and position as in *Dibranchus atlanticus*; the pectorals are large, being as long as the caudal, which in the specimens under examination is nearly as long as the rest of the tail; the ventrals are minute.

No pyloric appendages; no air-bladder.

Colour in life uniform blue-black.

Two specimens, the larger of which is 2·6 inches long, from Station 120, 240 to 276 fathoms.

Malthopsis, gen. nov.

As *Malthe*, but with only two gills on each side.

11. *Malthopsis luteus*, sp. n. (Pl. VIII. figs. 2, 2 *a*.)

B. 5. D. 5. A. 4. C. 9. P. 11. V. 1/5.

Head and anterior part of body much depressed, forming a triangular wedge, the base of which is surmounted by a stout, fluted and crenulated, projecting, spinous prolongation of the snout, somewhat as in *Malthe*.

Beneath this nasal prolongation is a deep narrow vault, flanked on each side by a pair of large, almost confluent nostrils, and containing a short, fleshy, clavate tentacle.

Eyes large, lateral, nearly circular; their diameter is about one seventh of the total length, caudal not included; they are strongly convergent and anteriorly are barely half a diameter apart; the anterior limit of the orbit is in the same vertical line with the anterior limit of the mouth.

The mouth-cleft, which is horizontal, is about two thirds of an eye-diameter in width. Teeth villiform, in bands in the jaws and in broad patches on the vomer and anterior ends of the palatines.

Gill-cleft a small foramen, in width about one fifth of an eye-diameter, situated superiorly in the axilla; two gills; no pseudobranchiæ. Suboperculum prolonged and ending in a stout trifid or multifid spine.

Body covered with hard granular adherent plates, each with a large radially-striated conical tubercle in its centre. On the dorsal surface of the cephalic disk they are of moderate size, in contact along the middle line, but distant and slightly sunken laterally; on the ventral surface of the cephalic disk they are small, distant, and sunken; on the rest of the trunk and tail they are large and in close contact throughout.

The form and disposition of the fins is as in *Malthe*; the ventrals are very long, nearly equal to the pectorals, which are equal to the caudal, which is two ninths of the total.

A large siphonal stomach is found, and a wide coiled intestine, opening widely in the middle line between the axillæ. No pyloric cæca; no air-bladder.

Colours in life:—Pinkish yellow; some specimens with a few irregular rings of dark chocolate on the dorsum of the cephalic disk.

There are five abdominal and thirteen caudal vertebræ, the neural spines of the former being coalescent into a trenchant ridge as in *Malthe* and *Halieutæa*.

Ten specimens were taken at Station 115, in 188 to 220 fathoms. They vary in length from 1·4 to 2·9 inches; and in the younger specimens the subopercular spine is relatively much larger and the pectoral fins are of greater relative length —being contained $3\frac{1}{2}$ times in the total length, caudal included.

Halicmetus, gen. nov.

Head and anterior part of body very broad and depressed. Front with a transverse bony bridge and a subrostral cavity lodging a fleshy tentacle. Cleft of mouth horizontal. Villiform teeth in jaws and palatines. Gill-openings small foramina situated superiorly in the axillæ; two gills; no pseudobranchiæ. Head and body with close-set graniform asperities and large granular tubercles. No dorsal fin whatever. Anal fin very short. Pyloric appendages and air-bladder absent.

12. *Halicmetus ruber*, sp. n. (Pl. VIII. figs. 1, 1 *a*, 1 *b*.)

B. 5? D. 0. A. 3. C. 9. P. 11. V. 1/5.

Head and anterior part of trunk depressed, forming a semicircular disk rather broader than long, with a slight convexity in the cranial region. The truncated snout is occupied, as in *Halieutæa*, by a bony rugose orbital bridge, beneath which is a cavity lodging a fleshy tentacle which ends in three lobes, the middle (superior) lobe being crested by a small bifid filament. The eyes are small and convergent.

The nostrils are minute papillæ situated on each side of the rostral tentacle, within the subrostral cavity.

Mouth horizontal, with the lower jaw slightly projecting; its cleft is a little wider than the eye. Villiform teeth in bands in the jaws and on the palatines.

Gill-cleft a small foramen, less than half an eye-diameter in width, situated superiorly in the axilla; two gills; no pseudobranchiæ. The suboperculum ends in a stout multifid spine.

Surface of the body uniformly invested with minute close-set graniform spines, which also cover the eyes up to the

corneal margin. The edge of the cephalic disk bears in addition large finely granular multifid spines in three longitudinal series, and the tail is clad with large granular conical tubercles—of which there are five longitudinal series on each side—in close contact.

Fins in form and position as in *Halieutæa*, *Malthe*, &c., but the soft dorsal, as well as the spinous, is entirely wanting, and the anal is almost rudimentary. The pectorals, which are about a third longer than the ventrals and a little longer than the caudal, are nearly one fifth the total length.

Stomach large, siphonal, much constricted at the pylorus. Intestine coiled and very wide. No pyloric cæca. No air-bladder.

Colour in life uniform light pink.

Two specimens, measuring 2·75 inches in length, from Station 115, 188 to 220 fathoms.

Family Cataphracti.

13. Peristethus, Kaup.

Peristethus Murrayi, Gthr.

Peristethus Murrayi, Günther, 'Challenger' Shore-fishes, p. 52, pl. xxxii. fig. A.

A single adult specimen from Station 115, 188 to 220 fathoms, and two young ones. The young ones in life were of a uniform dusky violet colour, the colour of the adult being red. The young also differ from the adult in having three small upstanding points, disposed in a triangle, on the forehead.

Order ANACANTHINI.

Family Gadidæ.

Physiculus, Kaup.

14. *Physiculus roseus*, sp. n.

B. 7. D. 7/57. A. 55. V. 7.

Head and trunk broad; tail compressed, higher than the trunk anteriorly. Length of the head very nearly one fourth of the total, including the caudal; its breadth, which exceeds its height, is a good deal more than half its length. Greatest height of the body, just behind the origin of the dorsal fin, about one sixth of the total.

Snout depressed, broader than long, obtusely rounded; its

length, which is equal to the major diameter of the eye and slightly exceeds the width of the flat interorbital space, is one fourth that of the head. Nostrils superior, situated immediately in front of the orbit.

Mouth wide, oblique, with the upper jaw overlapping the lower; the maxilla reaches beyond the vertical through the middle of the orbit. Teeth villiform, in broadish bands in the jaws only.

Barbel stout, about as long as the eye.

Gill-openings very wide.

Body and head covered with a thick mucilaginous skin, which is invested everywhere with small deciduous scales, of which there appear to be six rows between the first dorsal fin and the lateral line. The dorsal and anal fins, which are invested with a fold of thick scaleless skin, extend to within an eye-length of the caudal. The first dorsal, which is separated from the second only by a notch, begins in the vertical through the base of the pectoral; its first ray is prolonged and nearly equals the postrostral portion of the head in length. The ventrals arise on flattened bases; their outer ray is prolonged beyond the origin of the anal. The pointed pectorals arise on oblique bases; their length is not quite equal to that of the prolonged ventral ray.

The vent is situated well in advance of the origin of the anal fin, and there is a small postanal papilla. A large air-bladder exists.

Colours in life uniform rose-red.

One specimen, 7 inches long, from Station 115, 188 to 220 fathoms.

Bregmaceros, Thompson.

15. *Bregmaceros*, sp.

Numerous young specimens were obtained at Station 119, in 95 fathoms.

Family Ophidiidæ.

Monomitopus, Alcock.

16. *Monomitopus nigripinnis*, Alcock.

Sirembo nigripinnis, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 384.
Monomitopus nigripinnis, id. ibid. Oct. 1890, p. 297.

One well-preserved specimen, $6\frac{1}{4}$ inches long, from Station 112, 561 fathoms.

NEOBYTHITES, Goode & Bean.

17. *Neobythites macrops*, Gthr.

Neobythites macrops, Günther, 'Challenger' Deep-sea Fishes, p. 102, pl. xx. fig. A.
Neobythites macrops, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 385.

Twenty specimens, varying in length from 4 to 8½ inches, were taken at Station 115, 188 to 220 fathoms.

18. *Neobythites pterotus*, Alcock.

Neobythites pterotus, Alcock, Ann. & Mag. Nat. Hist. Sept. 1890, p. 210, and Oct. 1890, p. 297.

A very fine male specimen, 1 foot long, from Station 117, 1748 fathoms. It differs from the large female captured last year in the Laccadive Sea in having the pectoral fin-rays very much more prolonged—reaching to the tenth anal ray—and spatulate at the ends. In the female the pectoral fin-rays reach only to the first anal ray.

SACCOGASTER, Alcock.

19. *Saccogaster maculata*, Alcock. (Pl. VII. fig. 3.)

Saccogaster maculatus, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 389.

An adult male specimen, just over 3½ inches long, from Station 120, 240 to 276 fathoms. The male has a large bilobed postanal papilla, and into the sulcus between the lobes the seminal duct opens. The female, it now appears from a reexamination of the type described in 1889, has the distended ovaries full of developing embryos, so that we now know *Saccogaster maculata* to be a viviparous fish; and we may conclude that the postanal papilla is an intromittent organ of copulation.

PARADICROLENE, Alcock.

20. *Paradicrolene nigricaudis*, sp. n.

B. 8. D. circ. 90. A. circ. 75. C. 8?
P. 19–20/6–7. V. 2.

Head conoid; its length about 4½ in the total, with the caudal; its height ⅔, its breadth ½ its length; all its bones strong.

Body and tail compressed; the height of the former is nearly one fifth the total, with the caudal. Operculum with a sharp spine above, preoperculum with three flat spines radiating from its angle.

Snout broad and rounded, not overhanging the jaw; its length, which is equal to the major diameter of the eye or to the width of the convex interorbital space, is contained about 4½ times in that of the head. The anterior nostril is a small foramen near the tip of the snout, the posterior is a moderate-sized elliptical opening in front of the angle of the eye.

Cleft of mouth wide, oblique; the dilated scaly extremity of the maxilla reaches half an eye-length behind the vertical through the posterior border of the orbit; the lower jaw is included within the upper in repose, and has a large pore on either side of the symphysis. Villiform teeth in bands in the jaws, palatines, and vomer.

Gill-opening wide; pharyngo-branchial membrane partially pigmented; eleven long gill-rakers on the outer side of the first branchial arch, besides small ones above and below; pseudobranchiæ reduced to two small pinnules.

Body and entire head, including even part of the branchiostegal membranes, covered with small adherent scales, of which there are four rows between the base of the dorsal fin and the lateral line, which is a distinct poriferous groove ending in the posterior fourth of the tail.

Dorsal and anal fins invested in a thick fold of integument, which is scaly in its basal half. The caudal, which is nearly half the length of the head, is adherent to the other vertical fins at its base only. Pectorals very broad, with fleshy scaly bases, pointed, slightly longer than the postrostral portion of the head; the lowermost six or seven rays are incompletely detached from the rest of the fin and from each other at their bases, and are produced each into a long free filament, of which the longest (uppermost) in large specimens is twice the length of the fin. Ventrals separated by a considerable interval; each consists of two separate stout filaments, the outer of which is the longer and exceeds in length the post-orbital portion of the head.

Parietal peritoneum black; stomach siphonal; intestine long and coiled in several wide loops; no pyloric cæca; an air-bladder.

Colours in life :—Chocolate, posterior third of tail, including the vertical fins in that space, black; caudal fin and pectoral filaments milk-white.

Five specimens, the largest nearly 8 inches long, from Station 115, 188 to 220 fathoms.

21. *Paradicrolene multifilis*, Alcock.

Paradicrolene multifilis, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 387.

Several small specimens, slightly differing in unimportant characters—*e. g.* in the colour of the body, which is much darker—from the type, were taken at Station 120, 240 to 276 fathoms.

DERMATORUS, Alcock.

22. *Dermatorus melanocephalus*, sp. n.

This species is very closely allied to *Dermatorus trichiurus* from the Laccadive Sea (Ann. & Mag. Nat. Hist., Oct. 1890, p. 298), from which it differs in the following points:—

All the spines of the head-bones are weak and flexible; the opercular spine is broad, flat, and weak; the preopercular border is double, but smooth and unarmed; the humeral spine is almost obsolete; the length of the snout is one third that of the head, twice the major diameter of the eye, and greater than the width of the interorbital space; the maxilla is not quite two thirds of the head in length; there are only fifteen elongated gill-rakers on the outer side of the first branchial arch; there are no pseudobranchiæ whatever.

Colours in the fresh state transparent grey; head and belly black.

The intestine is long and much coiled, and there are a few rudimentary pyloric cæca in a ring round the pylorus.

Length nearly 8 inches.

One specimen from Station 111, 1644 fathoms, and one from Station 117, 1748 fathoms, both being mature females.

LAMPROGRAMMUS, gen. nov.

Head large, body compressed, both entirely covered with thin, smooth, deciduous scales of moderate size. Head-bones with prominent crests and wide muciparous cavities, unarmed except for a weak opercular spine. Snout not overhanging the jaws. Eye of moderate size. Mouth large; teeth in villiform bands in the jaws, palatines, and vomer. No barbel or hyoid filaments. Gill-opening wide; gill-membranes separate; four gills, eight branchiostegals, no pseudobranchiæ. *Lateral line very conspicuous, with much enlarged scales, each of which bears a glandular (luminous) organ.* Vertical fins confluent; pectoral fins entire; *no ventral fins.*

23. *Lamprogrammus niger*, sp. n.

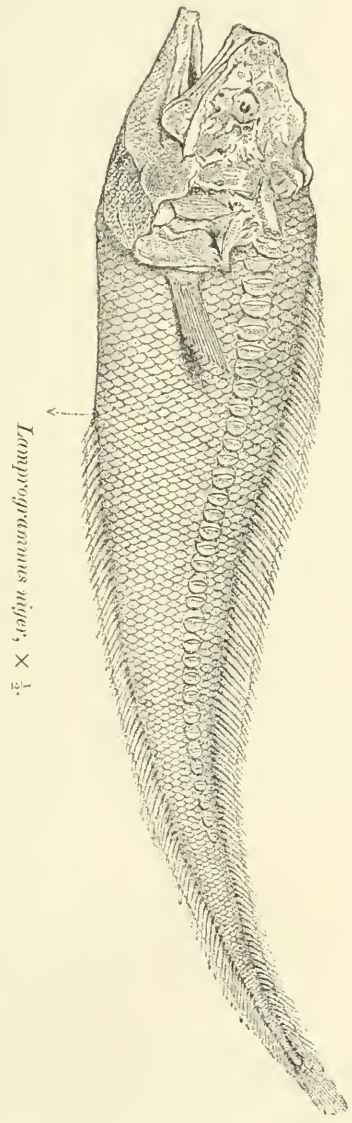
B. 8. D. circ. 110. A. circ. 90. C. 10? P. 17. V. 0.

Tissues fragile. Head large, body compressed, tail compressed and tapering. The head, the length of which is about one fifth of the total, or slightly over half the length of the entire head and trunk in the adult, or a little more than the greatest body-height, has the bones weak and furnished with prominent flexible crests, the intervals between which form wide and capacious muciparous cavities; its only armature is a flat inconspicuous spine on the upper part of the operculum.

The snout, which is broad and rounded, does not overhang the jaws; its length is slightly less than the width of the convex interocular space and $2\frac{1}{2}$ times the diameter of the circular eye, which last is about one ninth the length of the head.

Mouth cavernous, with oblique cleft and jaws nearly conterminous in front; the maxilla, which is much dilated posteriorly, is half the length of the head. Villiform teeth in broad bands in the premaxillæ and in very narrow bands in the mandibles, palatines, and V-shaped head of the vomer.

Gill-openings very wide, the gill-membranes not at-



Lamprogrammus niger, × 3.

Fig. 2.

tached to the isthmus; four gills with narrow laminæ and scabrous clavate gill-rakers, which, to the number of about ten, are a little elongated on the outer side of the first arch; no pseudobranchiæ.

Body and head, including the glosso-hyal region and the branchiostegal membranes, covered with deciduous membranous cycloid scales of moderate size.

The scales of the very conspicuous lateral line are adherent and greatly enlarged; they lie beneath a continuous sheath of black skin, which is loopholed over a long narrow groove with raised margins situated along the vertical diameter of each scale. These grooves are filled with an opaque white substance, which probably has a luminous function. The lateral line, in fact, is exactly similar to that of several species of *Halosaurus*.

The dorsal fin, which begins just in advance of the gill-opening, and the anal, which begins almost a head-length behind the same level in the adult, are confluent with the pointed caudal. The narrow, pointed pectorals are as long as the rostrorbital portion of the head. There are no ventral fins whatever.

The stomach is siphonal, with a bulbous pyloric end; the intestine, which is very long, is looped and coiled, the loops being held by a stout mesentery; there are six small cæca in a semicircle round the pylorus; no air-bladder can be detected.

Colours in the fresh state uniform jet-black.

Two females, 15·5 and 11·75 inches long respectively, from Station 112, 561 fathoms; a third specimen from Station 116, 405 fathoms.

This extraordinary form seems almost entitled to rank by itself in a separate subfamily of the Ophidiidæ. In general appearance and in most of its structural details it has the closest resemblance to the typical *Brotulina*; but it differs from them all in its remarkable *Halosaurus*-like lateral line and in the entire absence of ventral fins.

[To be continued.]

III.—*Notes concerning the Anatomy of certain Rotifers.*

By Rupert Vallentin.

[Plates IV. & V.]

It was originally my intention to prepare for publication a series of papers concerning the anatomy of some of our larger species of common Rotifers whose structure I had been able

Dimensions of the type, an adult female in alcohol, somewhat elongated by compression in the stomach of its original collector :—

Head and body 120 millim., tail 68, hind foot 21, ear (above crown) 12 ; heel to front of last foot-pad 9·3 ; length of last foot-pad 2·2 ; hairy part of sole 7.

Skull : basal length 26·5, tip of nasals to back of interparietal 27 ; greatest breadth 16 ; nasals, length 9·1, breadth 3·7 ; interorbital breadth 4 ; interparietal, length 4, breadth 8·3 ; diastema 8 ; length of upper molar series 6·9 ; anterior palatine foramina 6.

Hab. Kia-ting-fu, West Sze-chuen (*A. E. Pratt, Esq.*).

XV.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R. F. Hoskyn, R.N., commanding.*—Series II., No. 1. *On the Results of Deep-sea Dredging during the Season* 1890–91. By J. Wood-Mason, Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College of Bengal, and A. Alcock, M.B., Surgeon I.M.S., Surgeon-Naturalist to the Survey.

[Continued from p. 34.]

Family **Macruridæ**.

Macrurus, Bl.

Subgenus Cœlorhynchus, Giorna.

24. *Macrurus quadricristatus*, sp. n.

B. 6. D. 11. A. circ. 90. P. 16. V. 7.

Head like that of *Trachyrhynchus* and much exceeding the rest of the trunk in all three dimensions ; tail very low, compressed, and tapering.

The head is more than three times the rest of the trunk in length, and nearly one third the total. The depressed snout is exceedingly long and acutely triangular ; its length, which is nearly half that of the head, is more than twice the major diameter of the large oval eye and twice the width of the interorbital space across the middle ; six sevenths of its total

extent is preoral. The suborbital crest is strongly salient and serrated and terminates acutely at the preopercular angle. The posterior half of the head is longitudinally traversed on each side by two strongly serrated ridges, which are either bony crests or the modified spines of scales that are indetachably adherent to the bones beneath; one extends from the interorbital space to the occiput, the other from the supraorbital ridge to the shoulder.

Nostrils situated immediately in front of the eye; the posterior is very large.

The mouth is a small, completely inferior, crescentic orifice; its front limit is in the vertical through the anterior nostril, and the maxilla reaches a little behind the vertical through the middle of the eye. Villiform teeth in bands in the jaws, the outer row in the upper jaw slightly enlarged. Barbel slender, less than half the eye in length.

Gill-opening rather wide, the membranes united quite anteriorly; first gill-cleft very narrow; the gill-rakers are small tubercles; pharyngo-branchial membrane quite black.

Body and head except the glosso-hyal region covered with acutely spinigerous scales; those on the body are of one uniform size throughout, measuring rather over 2 millim. in either diameter in the specimen examined.

A scale from the head bears about three longitudinal serrate or spinate carinæ; one from the side of the body bears five slightly divergent antero-posterior ridges, which are armed with long imbricating aculeate spines, the last in each ridge projecting far beyond the edge of the scale. There are 6 or $6\frac{1}{2}$ scales in a row between the posterior limit of the first dorsal fin and the lateral line. No scaleless fossa on the nape. The first spine of the first dorsal fin is very small, the second is smooth throughout. The interval between the first and the very inconspicuous second dorsal is hardly half the extent of the base of the first. Pectorals narrow and pointed, their length slightly exceeds that of the postorbital portion of the head. Ventrals with the outer ray prolonged.

Stomach large, siphonal; many long slender cæca in a thick cluster round the pylorus; apparently no air-bladder.

Colours in life:—Chocolate; body and tail with numerous broad black cross bands, which do not reach the mid-abdominal line.

Two specimens, measuring one 7, the other 4·5 inches, from Station 115, 188 to 220 fathoms, and a third small specimen from Station 116, 405 fathoms.

Subgenus Macrurus, Bl.

25. *Macrurus nasutus*, Gthr.

Macrurus nasutus, Günther, 'Challenger' Deep-sea Fishes, p. 132, pl. xxx. fig. B.

A specimen of this Japanese form was taken in the Laccadive Sea, Station 107, at 738 fathoms.

26. *Macrurus Wood-Masoni*, Alcock.

Macrurus Wood-Masoni, Alcock, Ann. & Mag. Nat. Hist., Oct. 1890, p. 301.

A male nearly 18 inches long from Station 109, 738 fathoms.

27. *Macrurus investigatoris*, Alcock.

Macrurus investigatoris, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 391.

Numerous specimens from Station 115, 188 to 220 fathoms, and from Station 120, 240 to 276 fathoms.

28. *Macrurus semiquincunciatus*, Alcock.

Macrurus semiquincunciatus, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 392.

One specimen from Station 120, 240 to 276 fathoms.

29. *Macrurus macrolophus*, Alcock.

Macrurus macrolophus, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 394.

Two fine specimens from Station 120, 240 to 276 fathoms. The type appears to have sustained an injury to the tail, as the relative length of the head to the body in these specimens is about 1 : 4½.

30. *Macrurus Petersonii*, sp. n.

B. 7. D. 10–11. A. circ. 135. P. 18–20. V. 8.

Length of head about one fifth total and about seven ninths of the entire head and trunk. The length of the subtrihedral snout is equal to the major diameter of the eye, slightly in excess of the width of the interorbital space, and slightly over one fourth the length of the head.

Mouth inferior, large, the maxilla reaching behind the

vertical through the middle of the orbit. Villiform teeth in a broad band in the upper and a narrow band in the lower jaw, the outer row in the upper jaw considerably enlarged. Barbel a little longer than the eye.

Gill-openings wide, the gill-membranes separate; pharyngo-branchial membrane partially pigmented.

Body and head, except the glosso-hyal region, covered with thin, imbricating, deciduous scales of uniform size, which are spinigerous except in a small area situated immediately behind the base of the first dorsal fin, where they are enlarged, circular, and quite smooth. A scale from the side of the body bears from 15 to 30 equal, distant, semierect spinelets in a shallow quincuncial arrangement. There are six rows of scales between the posterior border of the first dorsal fin and the lateral line.

The dorsal fins are separated by an interval equal to at least twice the basal extent of the first; the first spine of the first dorsal is rudimentary, the second, which is hardly prolonged, is closely and finely serrated. The anal fin begins immediately behind the vertical through the last ray of the first dorsal. Pectorals narrow, pointed; their length equals that of the postorbital portion of the head. Ventrals short, only a little longer than the barbel.

The vent is situated between the ventrals immediately behind their base, the intestine forming a wide loop behind it.

Colours in the fresh state:—Head and iris silvery; body chocolate, with an underlying silvery lustre; throat and belly black; first dorsal fin black, with white base and tip.

Two specimens (one an adult ovigerous female), 9·5 inches long, from Station 115, 188 to 220 fathoms.

I have named this species after Mr. Peterson, the gunner of the 'Investigator,' whose unabating zeal on behalf of our zoological collections led on one occasion to his getting his fingers almost amputated by the dredging-wire, and on another occasion to his falling overboard almost into the mouth of a shark.

Subgenus Mystaconurus, Gthr.

31. *Macrurus heterolepis*, Alcock.

Macrurus heterolepis, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 396.

Very numerous specimens of all sizes were taken at Station 115, 188 to 220 fathoms.

There are seven branchiostegal rays; the mouth-cleft

reaches nearly to the vertical through the posterior border of the orbit; the pectorals reach to the sixth anal ray.

Colours in life:—Head and iris silvery; body pinkish brown, with a silvery sheen; throat and abdomen black, first dorsal, ventrals, and pectorals with black base and white tips, second dorsal and anal white.

Subgenus Malacocephalus, Gthr.

32. *Macrurus lævis*, Lowe.

One specimen of this widely ranging deep-sea form was taken at Station 115, in 188 to 220 fathoms.

It measures a little more than a foot in length.

Bathygadus, Gthr.

33. *Bathygadus longifilis*, Goode & Bean.

Bathygadus longifilis, G. & B., Proc. U. S. Nat. Mus. viii. p. 599; and Günther, 'Challenger' Deep-sea Fishes, p. 157.

Hymenocephalus longifilis, Vaillant, Exp. Sci. Trav. et Talism., Poiss., pp. 218–221, pl. xxiii. fig. 1.

Bathygadus longifilis, Alcock, Ann. & Mag. Nat. Hist., Oct. 1890, p. 302.

A very fine and perfect male specimen, 13·25 inches long, was taken at Station 113, in 683 fathoms. It has the formula

B. 7. D. 12/130. P. 14. V. 8. L. lat. 150.
L. tr. 25 through vent.

The barbel is nearly two thirds the length of the head and much longer than the barbel of the large female specimen caught last year in the Laccadive Sea.

Family **Ateleopodidæ.**

Ateleopus, Schleg.

34. *Ateleopus indicus*, sp. n.

B. 8. D. 8. A.+C. 76. P. 12. V. 2.

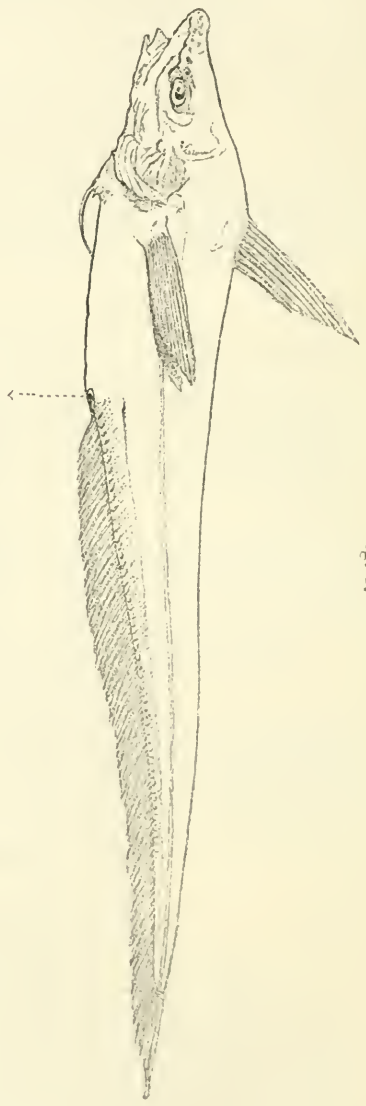
Soft tissues almost gelatinous, skeleton cartilaginous.

Head broad and acutely conical, body and tail much compressed and tapering.

The length of the head is equal to that of the rest of the trunk and is contained about $5\frac{3}{4}$ times in the total; the

greatest height of the body, at the shoulder, is three fourths the length of the head.

The broad, depressed, projecting, marginally inflated snout is one third of the head in length and twice the major diameter of the oval eye; at least half its extent is preoral. The mouth is a small, quite inferior, crescentic orifice, in width equal to the diameter of the eye, its angle barely reaching the vertical through the anterior border of the orbit, though the maxilla reaches nearly to the vertical through the middle of the orbit; it is strongly protractile downwards, and looks as if adapted for suction. There appears to be a narrow band of very minute teeth in the inner aspect of the upper jaw; but the lower jaw is quite toothless.



Atelopus indicus, × 1.

Fig. 3.

The nostrils, which are very large, are situated superiorly immediately in front of the eye.

The gill-openings are narrow, the membranes being united to the isthmus anteriorly; gill-rakers short, coarse, cartilaginous.

Head, body, and fins uniformly invested with a soft, thick, gelatinous, scaleless skin.

A single dorsal fin, the base of which is about three fourths

of a snout-length in extent, beginning almost in the vertical through the base of the pectoral; its height, which about equals the length of the latter, is six sevenths of the length of the head. The anterior rays of the anal fin are barely two thirds the body-height at their origin, the succeeding rays slightly increase in length to the confluence with the caudal; the latter is a little more than half a head-length in extent. The ventrals are jugular; each is in the form of a stiff, slightly flexible, cartilaginous rod, which is formed of two stout rays coherent throughout their whole extent, and not reaching halfway to the vent; a small detached tubercle posterior to this represents a rudimentary third ray.

Stomach long, simple; intestine short and wide; no pyloric cæca; no air-bladder.

Colours in the fresh state:—Mottled dark brown to purple-black; fins black, except the ventral.

One specimen, a foot long, from Station 115, 188 to 220 fathoms.

It will be remembered that the family Ateleopodidæ has hitherto been represented by a single species, *Ateleopus japonicus*, Schleg., from Japan. It is therefore highly interesting to find another and very closely allied species in the Bay of Bengal.

Family **Pleuronectidæ**.

Aphoristia, Kaup.

35. *Aphoristia septemstriata*, sp. n.

D. 97. A. 80. C. 12. V. 4. L. lat. 92–94. L. tr. 40.

The length of the head is not quite one fifth, the height of the body a little more than one fourth, of the total length, without caudal. The length of the snout is about $\frac{2}{5}$ that of the head. Eyes situated almost in contact and almost between the same verticals in the anterior third of the head, their diameter being about one eighth the length of the head. On the left side is a conspicuous tubular nostril on the upper lip, and a small circular nostril in front of the interorbital space; on the right side no nostrils are visible.

Cleft of mouth slightly oblique, its angle hardly reaches behind the vertical through the anterior border of the lower orbit; small teeth on the blind side only.

Gill-openings very narrow; branchiostegal rays and membrane prolonged beyond the opercular edge.

Entire body and head, including the snout, jaws, and eyes up to the corneal margin, covered with small, adherent, ctenoid scales; no lateral line.

The dorsal fin begins above the middle of the upper eye: its longest rays, which are just in advance of the middle of the fin, are a little more than two fifths of the body-height in length and not quite so long as the corresponding anal rays. The distance from the tip of the snout to the origin of the anal fin is about equal to the body-height. The length of the caudal is contained about $7\frac{1}{2}$ times in the total. The ventrals are separated from the anal by an interval equal to the length of the snout.

Colours in the fresh state:—Left side warm brown, with seven complete rather broad cross bands.

Two specimens, nearly 4 inches long, from Station 115, 188 to 220 fathoms.

Order PHYSOSTOMI.

Family Sternoptychidæ.

Argyropelecus, Cocco.

36. *Argyropelecus*, sp. prox. *hemigymnus*, Cocco.

A small specimen was taken at Station 118, in 1803 fathoms; it agrees very closely with *Argyropelecus hemigymnus*, Cocco, from which it differs most conspicuously in having the luminous spots in a continuous unbroken series from the head almost to the base of the caudal; the tail also is not so abruptly constricted off from the abdomen.

This, so far as I know, is the first record of *Argyropelecus* from the Indo-Pacific.

Polyipnus, Gthr.

37. *Polyipnus spinosus*, Gthr.

Polyipnus spinosus, Gthr., 'Challenger' Deep-sea Fishes, p. 170, pl. li. fig. B.

Polyipnus spinosus, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 398.

Eight fine specimens were taken at Station 115, in 188 to 220 fathoms. They have the formula

B. 6. D. 12–13. A. 15–16,

and their length ranges from 2 to 2·5 inches. The scales are quite membranous: one from the side of the trunk measures

7·5 millim. in its vertical and about 2·5 millim. in its antero-posterior diameter; one from the middle of the tail measures about 6·25 millim. in its vertical and not quite 2 millim. in its antero-posterior diameter.

GONOSTOMA, Rafinesque.

38. *Gonostoma elongatum*, Gthr.

Gonostoma elongatum, Günther, 'Challenger' Deep-sea Fishes, p. 173, pl. xlv. fig. B.

One fine mature male was taken at Station 107, in 738 fathoms. It measures 7·75 inches in length. It has the formula

D. 13. A. 30. P. 12. V. 8.

There are no scales, and the fish in the fresh state is uniformly enveloped in thick tenacious mucus. In addition to the luminous organs described by Dr. Günther there is an elliptical organ of moderate size in the middle of the posterior border of the preoperculum on each side, and one of similar shape and size on each side of the mandibular symphysis. There are six large pyloric cæca.

Colours in the fresh state:—Jet-black; luminous organs bright rose-pink, with silvery margins.

CHAULIODUS, Bl. Schn.

39. *Chauliodus Sloanii*, Bl. Schn.

Fine specimens of this well-known bathybial, or nocturnal pelagic, type were taken in the Laccadive Sea, the Andaman Sea, and the Bay of Bengal. One specimen taken at Station 109, 738 fathoms, was a mature female with the enlarged ovaries extending on each side along the entire length of the abdominal cavity, the ova being smallish (a little over half a millimetre in diameter) and very numerous.

The stomach of this specimen was deeply siphonal, the cæcal prolongation extending more than one third the length of the body-cavity. There were three moderate-sized pyloric cæca.

Family **Scopelidæ**.

HARPODON, Le Sueur.

40. *Harpodon squamosus*, sp. n.

B. 17. D. 12–14. A. 13–15. P. 10. V. 9.

Tissues extremely delicate; the paired fins long, feathery, fragile.

The length of the head, measured to the edge of the operculum and not to the end of the produced branchiostegal rays and membrane, is about one fifth, the height of the body between one sixth and one seventh of the total, without the caudal. The vertex of the head with numerous mucous pores.

Snout broad, depressed; its tip is formed by the projecting lower jaw, and its length, including the mandibular element, slightly exceeds the major diameter of the eye, which is about one eighth the length of the head as above limited. The width of the flat interorbital space is twice the vertical diameter of the eye.

Mouth-cleft oblique, wide; the maxilla is nearly two thirds the length of the head as above limited. Introrsely-depressible cardiform teeth in bands in both jaws; one series in the lower jaw enlarged, with barbed hastate tips, and one series in the upper jaw less enlarged; in each palatine an outer irregularly-double row of teeth, of which the anterior and external are enlarged, and a very short inner irregularly-double row; hyoid bone and all the branchial arches toothed.

Gill-openings extremely wide; the branchiostegal rays and membrane much produced beyond the operculum.

Body, posterior part of head, and cheeks covered with deciduous cycloid scales, which are less deciduous on the posterior half of the tail.

The dorsal fin arises within the anterior half of the body (measured with the caudal) just posterior to the vertical through the base of the ventrals. The anal arises about an eye-length behind the vent, which is nearly twice as far from the gill-opening as from the base of the caudal. The fimbriated adipose dorsal is situated far back, above the posterior half of the anal. Caudal deeply forked, with an inconspicuous median lobe. Ventrals long, delicate, and feathery, the longest (middle) rays almost reach to the vent in the adult. Pectorals very narrow and fragile; they arise almost on the same plane with the eyes, and their longest (middle) rays do not quite reach to the dorsal fin.

Stomach with a very long cæcal sac; eighteen large pyloric cæca in a pectinate arrangement.

Colours in life:—Hyaline grey; paired fins and caudal black, visceral peritoneum black, buccal and branchial cavities partially and slightly pigmented.

Numerous specimens, of which several are mature females with gravid ovaries and two appear to be sexually mature males, from Station 120, 240 to 276 fathoms.

The mature females are from 9 to 10·5 inches long, the males from 7·5 to 8·5 inches long.

BATHYPTEROIS, Gthr.

41. *Bathypterois Guentheri*, Alcock.

Bathypterois Guentheri, Alcock, Ann. & Mag. Nat. Hist., Dec. 1889, p. 450.

One well-preserved specimen from Station 112, 561 fathoms.

SCOPELUS, Gthr.

42. *Scopelus engraulis*, Gthr.

Scopelus engraulis, Günther, 'Challenger' Deep-sea Fishes, p. 197, pl. li. fig. C.

Two specimens (one young, the other a mature female nearly 5·5 inches long) from Station 115, 188 to 220 fathoms.

There are seven large pyloric cæca, and an air-bladder is apparently absent.

In the young specimen, which is not quite 2·5 inches long, the diameter of the eye is still contained $4\frac{1}{2}$ times in the length of the head, and is greater than the width of the interorbital space.

NEOSCOPELUS, Johnson.

43. *Neoscopelus macrolepidotus*, Johnson.

Neoscopelus macrolepidotus, Johnson, P. Z. S. 1863, p. 44, pl. vii.
Scopelus macrolepidotus, Günther, Cat. Fish. v. p. 414, and 'Challenger' Deep-sea Fishes, p. 196.

Four fine specimens from Station 115, 188 to 220 fathoms, all sexually mature.

Colours in the fresh state:—Head, iris, sides of tongue, and belly burnished silver, dorsum of body plum-purple, flanks golden.

Family **Stomiatidæ**.

STOMIAS, Cuvier.

44. *Stomias elongatus*, sp. n.

D. 19. A. 21. P. 6. V. 6.

Body compressed, low, its height being one fifteenth of the total without the caudal; the length of the head measured from the tip of the mandible is about one tenth of the same.

Eye circular, its diameter not quite one fourth of the head-length, and equal to the width of the interorbital space.

The widely-distensible mandible projects much beyond the upper jaw. Five large, distant, fixed fangs in each premaxilla, as well as a freely movable one near the symphysis; a few minute, inconspicuous, distant denticulations in the maxillæ; eight or nine moderate-sized laterally-projecting fangs on each limb of the mandible, decreasing in size from before backwards; a fang on each side of the vomer, and two small, distant, incurved teeth on each palatine.

The barbel, which is as long as the caudal fin, is trifid at its extremity. Opercular bones membranaceous.

No scales; the body, which is coated with tenacious mucus, is mapped out into silvery hexagonal areolæ. There are on each side along the ventral surface of the body two rows of small luminous organs; the internal extends from the mandibular symphysis to the base of the caudal, but, owing to the denudation of the integuments of the tail, the number of its constituents cannot be determined beyond the origin of the anal fin, up to which point there are 57, namely, to the base of the pectorals 9, to the base of the ventrals 51, to the origin of the anal 57; the external extends from the base of the pectoral to the origin of the anal, and numbers 45. There is a single luminous organ on the barbel and a row along the base of the branchiostegal rays. The dorsal fin arises at the level of the third anal ray. Caudal pointed, its length is about one twelfth of the total. The pectorals, which arise near the ventral profile, are equal in length to the caudal. The ventrals are very long, reaching to the sixth anal ray.

Colours in the fresh state:—Jet-black, with silvery hexagonal markings.

One specimen, a little over 5 inches long, from Station 107, 738 fathoms.

Family Clupeidæ.

Bathyclupea, gen. nov.

Head and body compressed, the former with the mucous cavities highly developed. Abdomen neither serrated nor keeled. Mouth with the lower jaw strongly prominent. Small teeth in the jaws, palatines, and vomer. Gill-openings very wide, the membranes entirely separate; 7 branchiostegals; pseudobranchiæ large. Body covered with large deciduous scales; lateral line distinct. Dorsal fin situated in the posterior half of the body, arising behind the origin of the elongate anal. Pectorals very large, entire. Ventrals small or rudimentary, *subjugular in position*. Caudal forked. Pyloric appendages in moderate number.

45. *Bathyclupea Hoskynii*, sp. n.

B. 7. D. 10. A. 33. P. 29. V. 6. L. lat. circ. 38.

Soft tissues fragile, bones thin.

Head and body compressed; the height of the latter almost exactly equals the length of the former, which is one third the total without the caudal. The median abdominal line is neither keeled nor serrated. The mucous cavities of the skull are large.

Snout rectangular, formed in front by the lower jaw, which in repose is almost vertical; its length, including the mandibular element, is not quite equal to the diameter of the large lateral circular eye, which is one third the length of the head; the width of the flat interorbital space is half the diameter of the eye. Nostrils small, almost superior.

Mouth wide, its cleft antero-lateral and nearly vertical. The upper jaw, the length of which is two thirds that of the head, has five sixths of its margin formed by the premaxillæ and one sixth by the maxillæ on each side. The last are formed of three parallel longitudinal plates, of which the posterior is slightly movable. Lower jaw excavated beneath by a deep wide mucous channel. Villiform teeth in narrow bands in the premaxillæ, mandible, and palatine, and in an inconspicuous V-shaped patch on the vomer. Tongue large, bilobed.

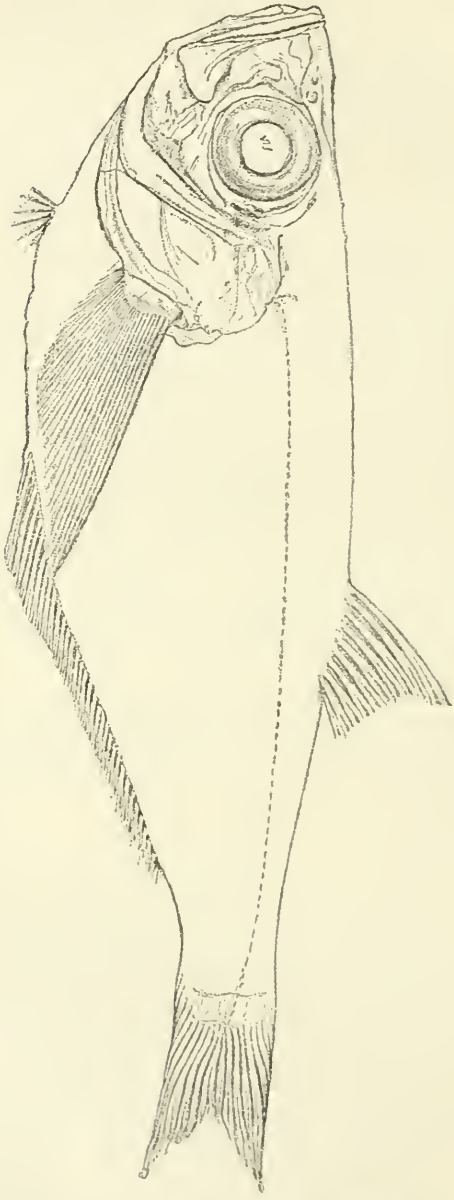
Gill-cleft very wide, the membranes entirely ununited; all the opercular bones well-developed, and the horizontal border of the preoperculum sharply serrated; four gills; the middle gill-rakers on the outer side of the first arch considerably elongated; pseudobranchiæ large.

Head naked.

Body and nape covered with large cycloid scales, deciduous everywhere except on the lateral line. In the largest specimen a scale from the flank measures 10 millim. in the vertical and 7·5 millim. in the antero-posterior diameter. Each scale of the lateral line has a deep pocket on its inner side which opens externally by numerous fine pores.

The dorsal fin commences almost exactly midway between the tip of the snout and the tip of the upper lobe of the caudal fin; the length of its base is equal to that of the snout; it is roughly triangular and its height is a fifth greater than the diameter of the eye. No adipose dorsal. The anal commences about an eye-diameter in advance of the dorsal and extends to within a very short distance (equal to three fourths of an eye-diameter) of the base of the caudal. Caudal

forked, its length about one sixth of the total. Pectorals



Bathyclupea Hoskynii.

Fig. 4.

very large and long (wing-like), extending to the twelfth

anal ray. Ventrals small or rudimentary, in close contact with one another; the short pubic bones, which are in close apposition throughout, are attached to the under surface of the clavicle above the coracoid articulation and pass downwards with such very slight obliquity that the ventral fins come to have a subjugular position.

Stomach large, with a cæcal sac and a bunch of large pyloric appendages. A large air-bladder, from which posteriorly a comparatively long pneumatic duct passes forwards and downwards to the fundus of the (distended) stomach.

Nine abdominal and twenty-two caudal vertebræ.

Colours silvery grey, becoming black on dorsum.

Four specimens (one male and three females), all sexually mature and with the reproductive glands distended, from Station 115, 188 to 220 fathoms. The male is 6·5 inches, the largest female 8 inches in length.

The stomachs of all four distended with small Penæids.

The abnormal position of the ventral fins caused me long to hesitate before bringing this fish within the Physostomous relationship, notwithstanding its unmistakable external and internal Clupeoid characters. It is to be borne in mind, however, that the ventral fins are, if not exactly rudimentary, at any rate very much degenerated organs—the degeneration of the ventrals, the shortening of the abdomen, and the conspicuous hypertrophy of the pectorals being perhaps directly interconnected changes. In this case there is nothing more remarkable in the fact of a degenerated organ having undergone a slight change in position than there is in such an organ finally disappearing, as it has in another Clupeoid, namely *Pristigaster*.

Bathyclupea is further remarkable as being the first Clupeoid reported from the deep-sea; its structural modifications are typically bathybial.

The position of *Bathyclupea* in the family Clupeidæ appears to be between the Clupeina and the Dussumieriina.

Family **Alepocephalidæ**.

Alepocephalus, Risso.

46. *Alepocephalus bicolor*, sp. n.

B. 6. D. 21. A. 28. P. 10. V. 8. L. lat. 62.

L. tr.* $\frac{8}{9}$.

The length of the low head is a little over one fourth, the

* At level of vent.

height of the compressed body nearly one fifth the total without the caudal. The length of the obtusely-pointed depressed snout is contained about 3½ times in that of the head. The eyes, which converge anteriorly, are between one fifth and one sixth of the head-length in diameter, and are more than their own diameter apart. The large nostrils are situated close together immediately in front of the eye.

Mouth-cleft slightly oblique; the maxilla reaches just behind the vertical through the anterior border of the orbit. A row of small teeth in each jaw and on the palatines.

Gill-openings very wide, the membranes entirely separate and overlapping broadly; a great part of the gill-cover is formed by the broad flat branchiostegal rays, which are uncovered by the opercle from their very bases; the opercular bones, which are extremely thin, are invested by the same tough black skin that covers the head; the gill-laminæ are coarse and the gill-rakers on all the arches long and lamellar; pseudobranchiæ small.

Head naked, body covered with large cycloid scales, which are deciduous everywhere but on the lateral line; small scales also invest the bases of all the fins. A scale from the flank measures about 7·5 millim. in the horizontal and about 5·5 millim. in the vertical diameter.

The dorsal and anal fins arise just in advance of the posterior third of the body (measured without the caudal), and the base of the former, which begins a little in advance of the latter, is two thirds that of the latter in extent. Caudal deeply forked, with very numerous rudimentary rays at its base. Pectorals broad, in length a little more than the post-orbital portion of the head. The ventrals arise just abaft of midway between the pectorals and anal; they are broad and reach more than halfway to the anal.

Stomach small, siphonal. The intestine, which, when unravelled, is about 2½ times the entire length of the fish, consists of two portions, which both in structure and arrangement are quite different from one another: the anterior five sixths is thin-walled and of small calibre, and is intricately coiled in a globular mass situated in the anterior fourth of the abdomen, the coils being held by a long mesentery; the posterior sixth is wide, but with walls so thick as to almost block the lumen (in the contracted state), the mucosa in this condition being thrown into numerous wide longitudinal folds; it passes straight down the middle of the abdominal cavity unsupported by mesentery. There are nine large long pyloric cæca in a pectinate arrangement.

In a female with much-enlarged ovaries containing ova

nearly 4 millim. in diameter the ovaries extend back to the wide genital pore, through which they open to the exterior.

Colours in life :—Head, including sclerotic and iris, black; body uniform dull slate-blue; pharyngo-branchial mucous membrane and parietal peritoneum black.

Note on the histology of the hind-gut.—In transverse section the appearance somewhat resembles that of the human vas deferens. Externally there is a thin fibrous coat containing blood-vessels, and internal to this and intimately adherent to it is a thin layer of longitudinally-arranged muscular fibres. Inside this is a layer, averaging about half a millimetre in thickness, of dense, circularly-arranged, muscular fibres. Internal to this is a submucous layer thrown into numerous wide longitudinal folds, and invested by a single row of long columnar epithelium, with numerous large goblet-cells. The submucous coat in all the sections made is everywhere infiltrated with round or oval, deeply-pigmented, highly granular corpuscles, which measure from $\frac{1}{1100}$ to $\frac{1}{2000}$ of an inch in diameter; in shape they resemble large leucocytes, but they are so granular that no nucleus can in any instance be detected.

The thick muscular coat, the dense infiltration of the submucosa with these pigmented granular corpuscles, and the large and numerous goblet-cells of the mucosa characterize this part of the intestine.

Several mature males and females were taken at Station 120, 240 to 276 fathoms. The males are a good deal smaller than the females, of which the largest specimen measures 11·75 inches.

Family **Muræ**nidæ.

Congromuræna, Kaup.

47. *Congromuræna longicauda*, Alcock.

Congromuræna longicauda, Alcock, Ann. & Mag. Nat. Hist., Dec. 1889, p. 455.

A large specimen from Station 120, 240 to 276 fathoms.

Nettastoma, Rafinesque.

48. *Nettastoma tæniola*, Alcock.

Gavialiceps tæniola, Wood-Mason. MS., Ann. & Mag. Nat. Hist., Dec. 1889, p. 460.

This species was described from immature individuals and

was included with *Gavialiceps microps* in a new genus. The examination of full-grown individuals in good preservation shows that this species has no place in the genus *Gavialiceps*, which is a true Nemichthyine form without pectoral fins, but that it ought to be ranked with *Nettastoma*. The following description applies to the adult:—

Head and snout depressed, body cylindrical, tail long and tapering. The length of the head is contained about $1\frac{2}{3}$ times in that of the rest of the trunk, the length of the tail is nearly twice that of the combined head and trunk. The snout forms a long, depressed, tapering beak, from $4\frac{1}{2}$ to $4\frac{3}{4}$ times the length of the eye and a little more than one third the length of the head; and, owing to the projection of the suddenly-expanded head of the elongated vomer beyond the abruptly ending maxillæ, it appears bilaterally notched near the tip.

There is an oval nostril situated laterally nearly midway between the eye and the tip of the snout, and in front of it a subtubular one. Mucous cavities of the head much developed and opening by large pores on the vertex, snout, and cheek.

Mouth with a wide cleft extending behind the level of the posterior border of the orbit. The upper jaw projects beyond the lower, which latter, after tapering gradually, becomes suddenly expanded near the symphysis, in the same way as does the head of the vomer. Small, sharp, close-set teeth in both jaws in several fairly regular longitudinal series, those at the mandibular symphysis enlarged and recurved; three rows of more distant teeth on the elongate limb of the vomer, those of the outer rows being inconspicuous and those of the middle row much enlarged; and a patch of small close-set teeth on the spathulate head of this bone. Tongue fleshy, fixed.

Gill-openings of moderate size, almost meeting in the mid-abdominal line; $3\frac{1}{2}$ gills.

Head and body covered with a thick, velvety, scaleless, deciduous, jet-black skin. Lateral line a row of large pores. The dorsal fin commences a little in advance of the level of the gill-opening.

Stomach with a very long cæcal sac.

Numerous sexually mature males and females nearly 2 feet in length and several young ones, from Station 120, 240 to 276 fathoms.

The young ones are silvery, with pigment only in scattered specks.

All the specimens were alive and very active on reaching the surface.

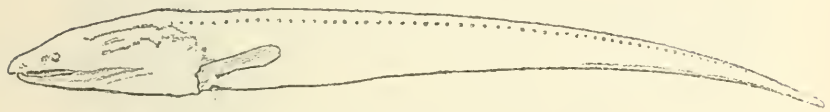
Dysomma, Alcock.

49. *Dysomma bucephalus*, Alcock.

Dysomma bucephalus, Alcock, Ann. & Mag. Nat. Hist., Dec. 1889, p. 459.

A single specimen from Station 120, 240 to 276 fathoms. It was alive on reaching the surface.

Fig. 5.



Dysomma bucephalus, × ½.

Dysommopsis, gen. nov.

Allied to *Dysomma*.

Tail of great relative length, the vent being close to the gill-opening. Eyes small, deeply subcutaneous. Snout studded with pores. Nostrils large, lateral. Mouth wide. Small sharp teeth in a single row in the lower and a double row in the upper jaw; a short row of enlarged teeth in the vomer. Four gills; gill-clefts wide; gill-openings small, situated close together near mid-abdominal line. Heart between the gills. Skin scaleless. Vertical fins confluent, the dorsal beginning a short distance behind the gill-opening. No pectorals.

50. *Dysommopsis muciparus*, sp. n.

Head a little inflated in the branchial region, tapering anteriorly; its length a little more than one eighth of the total. Body compressed and narrow, its greatest height, immediately behind the gill-opening, about two fifths the length of the head. The vent lies with the genital pore in an unpigmented circular depression, which is situated at a distance from the gill-opening equal to the length of the postrostral portion of the head; the tail, which tapers very slightly, is therefore more than four times the combined head and trunk in length.

Snout acutely pointed, overhanging the upper jaw; its length is one fifth that of the head and 2½ times that of the small deeply subcutaneous eye; its surface is densely crowded, like the lips, with minute pores. Nostrils large; the

anterior, which is tubular, is situated near the tip of the snout, the posterior is a valved foramen lying immediately before the angle of the eye.

Mouth wide, its cleft being nearly half the head in length; small, sharp, close-set teeth in a single row in the mandible and a double row in the maxilla; vomer with three large teeth in a longitudinal row.

Gill-openings small, close together near mid-abdominal line; the gill-covers are formed of tough skin, in which branchiostegal rays are faintly apparent; branchial arches weak, gill-laminæ broad.

Skin scaleless, enveloped in thick, very tenacious mucus. Lateral line a row of indistinct pores. Vertical fins confluent, the dorsal beginning halfway between the gill-opening and the vent, the anal immediately behind the vent. No pectoral fins.

The abdominal cavity extends almost to the tip of the tail, its posterior part being occupied solely by the genital glands and air-bladder.

Stomach with a long tapering cæcal sac reaching some distance behind the vent, and with the œsophageal and pyloric openings almost on the same level; intestine forming a single loop, the convexity of which embraces the gastric cæcum. Air-bladder a long nacreous tube extending from the occiput almost to the tip of the tail; much inflated anteriorly and tapering posteriorly to a fine thread.

Colours in life deep purple-black.

Two specimens, 9 and 10 inches long, from Station 120, 240 to 276 fathoms.

They were alive on reaching the surface.

EXPLANATION OF THE PLATES.

Plate VII.

Fig. 1. *Dibranchus nasutus.*
Fig. 2. *Dibranchus macropus*, dorsal view.
Fig. 2 *a*. Ditto, ventral view.
Fig. 2 *b*. Ditto, end-on view.
Fig. 3. *Saccogaster maculata*, ♀.

Plate VIII.

Fig. 1. *Halicmetus ruber*, dorsal view.
Fig. 1 *a*. Ditto, ventral view.
Fig. 1 *b*. Ditto, lateral view of tail.
Fig. 2. *Malthopsis luteus*, dorsal view.
Fig. 2 *a*. Ditto, ventral view.

[To be continued.]

Colella) and the Clavelinidæ (s. str.). Hitherto no true* Distomid has been known to possess free zooids—that is, zooids not completely imbedded in a common test. This new Ascidian, however, combines the structural characters of the Distomidæ with a social form of colony which is only slightly removed from that of the Clavelinidæ.

Further, *Archidistoma aggregatum* is of especial interest because it exhibits the first stage in the evolution of the cœnobitic type of colony from the social Ascidian type, in which the zooids are entirely free and irregularly placed: in *Archidistoma aggregatum*, the clumps of zooids (primitive cœnobia) have no common cloaca, but the cloacas of the individuals are usually situated towards the centres of the groups. The second stage is exhibited in such a Compound Ascidian as *Synoicum turgens* or *Circinalium concrescens*, in which each of the isolated clumps of zooids possesses a common central cloaca.

XXXII.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R. F. Hoskyn, R.N., commanding.*—Series II., No. 1. *On the Results of Deep-sea Dredging during the Season* 1890–91. By J. Wood-Mason, Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College of Bengal, and A. Alcock, M.B., Surgeon I.M.S., Surgeon-Naturalist to the Survey.

[Continued from p. 138.]

Class ASCIDIACEA.

Family Cynthiidæ.

Culeolus, Herdman.

1. *Culeolus* sp. prox. *recumbens*, Herdman.

Eight specimens of varying sizes from Station 110, 1997 fathoms, come very close to this species from the higher latitudes of the Southern Ocean, if they are not identical with it.

These are the only specimens of Tunicata that we have as yet obtained from the deep sea.

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* The position of *Chondrostachys* is uncertain, but its nearest affinity seems to be with *Stereoclavella* rather than with *Oxycorynia*. *Diazona* is separated from the Distomidæ by the presence of internal longitudinal bars in its branchial sac.

Phylum **APPENDICULATA.**

Branch ARTHROPODA.

Class **CRUSTACEA.**

By J. WOOD-MASON.

Grade *MALACOSTRACA.*

Order SCHIZOPODA.

Family **Lophogastridæ.**

GNATHOPHAUSIA, Willem.-Suhm.

1. *Gnathophausia bengalensis*, sp. n.

♀. Closely allied to *G. calcarata*, Sars, from which it differs in the following points:—The carapace covers the whole of the first and a part of the second abdominal somite; the antennal, branchiostegal, and postero-inferior spines appear quite smooth to the naked eye, being only obsoletely or microscopically serrated, the supraorbital spine is readily distinguishable by its shape from the rostral denticles; the upper lateral keels are strongly roof-shaped, and the oblique subdorsal keels more pronounced; the antennal scale is more broadly emarginate at the apex; the pleural lappets of the last abdominal somite are terminated by two very unequal spines (of which the outer is long and sharp and the inner short and blunt), and are separated from one another posteriorly in the mid-ventral line by a long and narrow incision.

Length, from end of rostrum (extreme tip wanting) to apex of telson, 91 millim.; of carapace, from supraorbital to end of dorsal spine, 37 millim.; of abdomen 46·5 millim.; of telson 17·5 millim.

Colour in life deep purple-lake.

A single female, with just-commencing brood-pouch, was taken at Station 117, 1748 fathoms.

2. *Gnathophausia brevispinis*, sp. n.

Gnathophausia gracilis, var. *brevispinis*, W.-M., Ann. & Mag. Nat. Hist. (6) vii, 1891, p. 188, ♂.

♂ ♀. Differs from the Atlantic *G. gracilis*, Suhm, in the rostrum being recurved and shorter than the carapace; in the dorsal crest of the carapace being distinctly foliaceous throughout, and at the base of the rostrum expanded into a subtrian-

gular plate, terminating apically in a strongish forwardly-inclined spine; in the dorsal spine being shorter and more recurved; in the lower of the two postero-lateral spines being reduced to a minute point; in the dorsal spines of the first abdominal somite being subequal, those of the second separated by a distinct transverse groove and the hinder of them more deflexed, and those of the third, fourth, and fifth larger and more distinctly arched anteriorly; in the form of the pleura of the five basal somites, which are expanded at their posterior margin into a thin and rounded foliaceous lobe, having their marginal spines as a consequence closer together.

A single immature female (the last pair of incubatory lamellæ only 3 millim. long), measuring 92 millim. from end of rostrum (extreme tip wanting) to apex of telson, and coloured in life deep purple-lake, was taken at Station 117, 1748 fathoms.

Family Eucopiidæ.

Eucopia, Dana, G. O. Sars.

3. *Eucopia australis*, Dana, Sars.

Eucopia australis, Dana, U. S. Explor. Exped., Crustacea, pt. i. p. 609, Atlas, pl. xi. fig. 11, *a–m*; G. O. Sars, 'Challenger' Schizopoda, 1885, p. 55, pls. ix. and x.

Chalaraspis unguiculata, Willemoes-Suhm, Trans. Linn. Soc. Lond., Zool. ser. 2, vol. i. 1875, p. 37, pl. viii.

A soft and somewhat distorted young female with very incompletely developed brood-pouch, non-pigmented eyes, and eye-peduncles, through the walls of which the subjacent ophthalmic tract is plainly visible by transparence, as in Sars's figure, was obtained at Station 112, 561 fathoms; and a mature, or all but mature, female with integuments of firmer consistence, red-pigmented eyes, and opaque eye-peduncles, at Station 109, 738 fathoms. But whether we have here to do with two distinct species, or only with two different conditions of one and the same species, the material at our disposal is insufficient to enable me to determine.

Family Euphausiidæ.

Thysanopoda, H. M.-Edw.

4. *Thysanopoda microphthalma*, G. O. Sars.

Thysanopoda microphthalma, G. O. Sars, 'Challenger' Schizopoda, 1885, p. 116, woodcut, fig. 3, ♀.

An adult male, without legs, from Station 111, 1644 fathoms, is probably referable to this species.

Order DECAPODA.

Suborder NATANTIA.

PENÆIDEA.

Family Penæidæ.

Subfamily *Penæina.*

No representatives of this group have as yet been found amongst either the infra-littoral or the bathybial fauna.

Subfamily *Parapenæina.*

Obs. Spence Bate's *Artemisia longinaris* belongs here; it is not in the remotest degree related to the Aristæina.

Metapenæus, gen. nov.

Allied to *Parapenæus*, S. I. Smith, differing therefrom in having neither tergo-pleural nor cephalothoracico-pleural suture to its carapace, and in the branchial system, which is invariably furnished with an epipodite in the twelfth somite and with a filamentous vestige of an anterior arthrobranchia in the thirteenth.

Type *Penæus affinis*, H. Milne-Edw.

The first two of the three following species are referred with some confidence to this genus as little-modified deep-sea representatives of it, the third with some doubt, as it lacks the branchial rudiment.

5. [*Metapenæus philippinensis*, var. *andamanensis*, nov.

Penæus philippinensis, Sp. Bate, 'Challenger' Macrura, 1888, p. 261, pl. xxxv. figs. 2, ♀, 3, ♂.

Differs from the specimens described and figured by Spence Bate in its much smaller size and in the median part of the *annulus ventralis* being shorter and devoid of lateral notches. The rostrum is in both sexes almost straight and scarcely ascendant; in the largest female it extends somewhat beyond, in the other females and in a male barely to, the end of the penultimate joint of the antennulary peduncle. The legs of the first pair are furnished with a spine at the ventral apex of their second and third joints. In the female there is a pair of sternal spines between the second pair of legs similar to, but very much smaller than, those present in *M. velutinus*

(Dana). The inner flagellum of the antennules is short and but little longer than the outer, and is unmodified at base in the male. The dorsal carina of the abdomen commences in the second somite as a faint and blunt elevation of the anterior half of the tergum, and is continuous and distinct from the base of the third to the extremity of the last tergum, at which it ends in a single minute point, being cleft so as to terminate in two points in each of the three penultimate terga. In addition to the median carina the three terminal somites present on each side of the middle line a tolerably distinct blunt subdorsal angulation, hence appearing to be tricarinate.

The caudal swimmerets when laid back extend much beyond the apex of the telson, and the outer margin of their exopodites runs out into a spine a good way from the apex of the joint—primitive features which are not noticed in Spence Bate's description, though the former of them is brought out in the accompanying drawings of the typical form.

The largest female measures about 63 millim., the only male about 51 millim., in a straight line from the apex of the rostrum to that of the telson.

One nearly mature male with four females from north of Port Blair, Andaman Sea, in 112 to 244 fathoms, on 29th Nov., 1888.]

6. *Metapenæus coniger*, sp. n.

Differs from the preceding in the following points:—The inner flagellum of its longer antennules is fully twice as long as the outer, and in the male bears at its inner and upper margin near the base a short, stout, and highly indurated spine of a peculiar form, the part from which the spine springs being conically thickened and elevated, with its constituent joints firmly ankylosed together. The three terminal abdominal terga are much more strongly angulated subdorsally. The *annulus ventralis* of the female is built precisely upon the same plan as in *M. philippinensis*, and represents, there is little doubt, a primitive phase in the evolution of the organ, though at first sight it appears to be so strikingly different; its posterior moiety is a roughly semicircular concave plate with prominent raised anterior and lateral margins, and it abuts by its deeply bifid anterior margin against the anterior moiety, which has the form of a short and broad band; its raised anterior border has an outline intermediate between that of a capital T and a capital Ŧ, the ends of the cross stroke of which are in the same curved line with the raised lateral margins, and do not nip the sides of

the grooved downstroke, as in *M. philippinensis*. It is easy to be seen that the condition of parts manifested by the preceding species has been brought about by the expansion, leaf-like, of the ϒ-shaped ridge in all its parts, whereby the anterior ends of the lateral margins have been thrust inwards and backwards against the expanded anterior margin, so that the latter appears to be "held in position by clamp-like lateral processes." The legs of the first pair have a spine on the second and third joints below. There is a very minute pair of sternal spines between the second pair of legs in the female; they are, however, much smaller than in the preceding species, and it is hence possible that they may be really absent or so small as to be readily overlooked in the specimens described by Spence Bate, who expressly states that none are present.

The branchial formula is:—

Somites and their appendages.	Podo-branchiæ.	Arthrobranchiæ. Anterior.	Arthrobranchiæ. Posterior.	Pleuro-branchiæ.		
VIII.	1	1	1	0	=	3
IX.	0	1	1	1	=	3
X.	0 (*ep.*)	1	1	1	=	3+*ep.*
XI.	0 (*ep.*)	1	1	1	=	3+*ep.*
XII.	0 (*ep.*)	1	1	1	=	3+*ep.*
XIII.	0	*r.*	1	1	=	2+*r.*
XIV.	0	0	0	0	=	0
	1+3 *ep.*	+ 5+*r.*	+ 6	+ 5	=	17+*r.*+3 *ep.*

The branchiæ are voluminous and remarkably laxly constructed and feathery, with an unusually well-developed terminal plume. The anterior arthrobranchia of the penultimate somite is represented by a simple filament. The last epipodite (XII.) is branched.

Length, from tip of rostrum to tip of telson, ♂ 77 millim., ♀ 88 millim.; of carapace, from supra-orbital margin to middle of posterior margin in a straight line, ♂ 18 millim., ♀ 20·5 millim.; of abdomen, ♂ 45 millim., ♀ 49 millim.; of inner flagellum of antennules, ♂ 16·5 millim., ♀ 17·5 millim.; of outer flagellum of antennules, ♂ 8 millim., ♀ 7·5 millim.

Nine males and eleven females from Station 119, 95 fathoms. It had previously been obtained in considerable numbers off the Mahánaddi Delta in 68 fathoms (32 ♂ and 26 ♀), and at Station 96, 98 to 102 fathoms (4 ♂ and 10 ♀), the colour of which last was noted as transparent grey irregularly suffused with pink.

Both the preceding are remarkable for the membranous condition of the lower part of the branchiostegite in apparent correlation with the voluminous and feathery character of the branchiæ.

7. *Metapenæus rectacutus* (Sp. Bate).

Penæus rectacutus, Sp. Bate, 'Challenger' Macrura, 1888, p. 266, pl. xxvi. fig. 2 (excl. 2 *z*), ♀.

Two fine females from Station 115, 188 to 220 fathoms.

Colour in life red.

The carapace and abdomen are perfectly glabrous throughout. The former is armed with three spines, an antennal, an hepatic, and a branchiostegal. From the last-named of these a sharp crest curves boldly upwards and backwards, forming the lower boundary of the anterior end of the cervical groove as far as the level of the hepatic spine, whence it is continued nearly to the posterior end of the carapace as a blunt ridge—the cardio-branchial—which, with the branchiostegal crest, marks out the upper boundary of the subjacent branchial chamber; similarly, a sharp crest continued straight upwards and backwards from the hepatic spine accentuates the gastro-hepatic groove.

The 13- to 14-toothed rostrum is neither quite so stout nor quite so straight as represented by Spence Bate. The exopodites of the thoracic legs are rudimentary. The all but equal antennulary flagella are about as much shorter than the carapace, measured from the frontal to the middle of the posterior margin in a straight line, as they are longer than the rostrum measured from the same point in the same manner.

The telson is strongly trifurcate and armed at the sides, in front of the lateral prongs, with three pairs of small movably-articulated spines, which are separated from one another and from the lateral prongs by intervals equal to about twice their own length.

The branchial formula is:—

Somites and their appendages.	Podobranchiæ.	Arthrobranchiæ. Anterior.	Arthrobranchiæ. Posterior.	Pleurobranchiæ.	
VIII.	1	1	1	0	= 3
IX.	0	1	1	1	= 3
X.	0 (*ep.*)	1	1	1	= 3+*ep.*
XI.	0 (*ep.*)	1	1	1	= 3+*ep.*
XII.	0 (*ep.*)	1	1	1	= 3+*ep.*
XIII.	0	0	1	1	= 2
XIV.	0	0	0	0	= 0
	1+3*ep.*	+ 5	+ 6	+ 5	= 17+3*ep.*

The last epipodite (XII.) is simple and unbranched, and there is no vestige of an anterior arthrobranchia in the thirteenth somite.

Length, from rip of rostrum to tip of telson, 113 to 129 millim.; length of carapace 25·5 to 29·5 millim.; of rostrum 21·5 to 24 millim.; of antennulary flagella 23 to 26 millim.

The three preceding species, in common with other infra-littoral allies of littoral forms, seem to be in many respects in a more primitive phase of evolution than their littoral allies. Their primitive characters are (1) that the last abdominal segment is elongate, (2) that the caudal swimmeret is more natatory, as evidenced by its being prolonged far beyond the level of the marginal spine of the exopodite, and (3) that the telson is trifurcate and spinulose at the sides.

In the first two of these characters they recall many of the true deep-sea Penæidæ, many of the Schizopoda (e. g. *Gnathophausia*), and the final larval stages of their own kind; while the lateral prongs and spines of their telson are to be interpreted as the modified vestiges of the larval caudal fork, which, it may be remarked, persists throughout life almost unchanged in at least one Penæid, viz. *Sicyonia furcata*.

Subfamily *Solenocerina*.

Solenocera, Lucas.

8. *Solenocera Hextii*, W.-M.

Solenocera Hextii, Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. 1891, p. 188, ♂ ♀.

Nine males and six females from Station 119, 95 fathoms, including a full-grown pair, which prove that the rostrum of the fully adult female is shorter, broader, and more ascendant than in the juvenile stages, and that that of the male, while retaining the length and breadth it has in youth, is deflexed with the line of the teeth decidedly convex; length of the large female about 75 millim., of the male about 67 millim.

Also a mutilated male from Station 120, 240 to 276 fathoms.

This species has a distinct supra-orbital angle, which is not, however, spinose, a post-orbital spine, a small hepatic spine, and a third spine smaller than this on the edge of the gastro-hepatic crest, but no branchiostegal spine.

The telson is trifurcate.

The common Indian littoral form (? *P. crassicornis*, M.-

Edw.) also is without branchiostegal spines, and, moreover, has the telson simple and unarmed.

The branchial formula is the same in both species, namely:—

Somites and their appendages.	Podobranchiæ.	Arthrobranchiæ. Anterior.	Arthrobranchiæ. Posterior.	Pleurobranchiæ.	
VIII.	1	1	1	0 =	3
IX.	0 (*ep.*)	1	1	1 =	3+*ep.*
X.	0 (*ep.*)	1	1	1 =	3+*ep.*
XI.	0 (*ep.*)	1	1	1 =	3+*ep.*
XII.	0 (*ep.*)	1	1	1 =	3+*ep.*
XIII.	0 (*ep.*)	1	1	1 =	3+*ep.*
XIV.	0	0	0	1 =	1
	1+5 *ep.*	+ 6	+ 6	+ 6	=19+5 *ep.*

Parasolenocera, gen. nov.

Carapace grooved as in *Solenocera*, furnished with supra-orbital, postorbital, and hepatic spines; without post-rostral ridge. Abdomen narrow and elongated, with a conspicuous hump, giving to the body a decided wasp-waisted appearance, dorsally carinated from the base of the third tergum to the apex of the last—the carina very distinctly and increasingly cristiform from the base of the fourth to the apex of the last, where it ends in a sharp decurved spine. Telson trifurcate, as long as the swimmerets. Flagella of antennules foliaceously expanded, tapering gradually to a very fine setaceous point, the inner much the broader and a little the longer, ensheathing the outer.

This genus forms a connecting-link between *Solenocera* on the one hand and *Hymenopenæus*, *Philonicus*, and *Haliporus* on the other.

9. *Parasolenocera annectens*, sp. n.

The strongly ascendant and very slightly upcurved rostrum is regularly and rather gradually produced to a very sharp point, which reaches almost to the end of the penultimate joint of the antennulary peduncle. It is armed with a decreasing series of eight excessively acute teeth, the first of which is placed on the gastric region and about as distant from the second as this is from the fourth of the series.

The first branchiostegal spine when viewed from the side presents itself as a stout, compressed, acute, triangular pro-

longation of the anterior end of the inflated outer wall of the efferent branchial channel, or—what comes to the same thing—of the branchiostegal crest, which is not continued to the anterior margin of the carapace.

The eyes are large and reniform.

A single female from Station 116, 405 fathoms.

Colour in life red.

Length, from apex of rostrum to apex of telson 66 millim.; of abdomen 40 millim.; of carapace, from supra-orbital to posterior margin, 16 millim.; of rostrum, from same point, 8 millim.; of outer antennulary flagellum 19 millim., of inner 21 millim.

Hymenopenæus, S. I. Smith.

10. *Hymenopenæus microps*, S. I. Smith.

Hymenopenæus microps, S. I. Smith, Ann. Rep. Comm. Fish. 1884, p. 413 (69), pl. x. fig. 1; Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. p. 188.

A female from Station 112, 561 fathoms.

Haliporus, Sp. Bate.

This genus is probably identical with *Hymenopenæus*, Smith.

11. *Haliporus æqualis*, Sp. Bate.

Haliporus æqualis, Sp. Bate, 'Challenger' Macrura, 1888, p. 285, pl. xli. fig. 1.

We do not verify the sexual difference between the male and female in the direction of the rostrum, which is armed with from seven to nine teeth, of which those on the gastric region are constantly two.

The propodite of the last pair of legs in the male at all events is more than four times the length of the dactylopodite, while in the penultimate pair it is only twice as long. The almost level crest of the last abdominal somite ends in a small spine. The trifurcate telson is much shorter than the swimmerets.

The outer flagellum of the antennules is at least three times as long as the inner, which are equal in length to the carapace measured from the tip of the rostrum to the middle of the hinder margin.

Four males and a female from Station 115, 188 to 220

fathoms; and one male and a young one from Station 116, 405 fathoms.

Colour in life pink.

12. *Haliporus neptunus*, Sp. Bate.

Haliporus neptunus, Sp. Bate, 'Challenger' Macrura, 1888, p. 291, pl. xlii. fig. 3.

In our specimens the rostrum is sharper and more ascendant, and the crests of the last three abdominal terga are spinose at the extremity, the spine in the first two springing from the bottom of the median cleft.

The telson, which is trifurcate, reaches about midway between the outer and inner lamellæ of the swimmerets when these are laid back.

In addition to an extra-ocular plate and antennal, post-antennal, hepatic, and post-branchiostegal spines, there is a true branchiostegal spine.

There is a still greater disproportion between the propodite and dactylopodite of the last pair of legs than in the last species.

One female from Station 111, 1644 fathoms, and two from Station 117, 1748 fathoms.

Colour in life lurid orange.

Subfamily *Aristæina*.

Aristæus, Duvernoy.

Aristeus, Duvernoy, Ann. des Sc. Nat., Zool. 1841 (ii.), xv. pp. 101 *et seq.*

Hemipenæus, Sp. Bate, 'Challenger' Macrura, 1888, p. 299 (ex parte).

Rostrum three-toothed; carapace without hepatic spine; antennal scale large; mandibular palp thin and foliaceous, with terminal joint triangular; dorsal carina of last three abdominal terga terminating posteriorly in a spine; postero-lateral angles of abdominal pleura simple and unarmed; legs without exopodites; dactylopodites of the last two pairs of legs setaceous.

The branchial formula of *Aristæus virilis*, Spence Bate, is as follows:—

Somites and their appendages.	Podo-branchiæ.	Arthrobranchiæ. Anterior.	Arthrobranchiæ. Posterior.	Pleuro-branchiæ.	
VIII.	1	0	1	0	= 2
IX.	1	1	1	*r.*	= 3+*r.*
X.	1	1	1	*r.*	= 3+*r.*
XI.	1	1	1	*r.*	= 3+*r.*
XII.	0 (*ep.*)	1	1	*r.*	= 2+*r.*+*ep.*
XIII.	0	1	1	*r.*	= 2+*r.*
XIV.	0	0	0	1	= 1
	4+*ep.*	+ 5	+ 6	+ 1+5 *r.*	= 16+5 *r.*+*ep.*

The functional branchiæ are sixteen in number, arranged in two series, an outer and an inner. The outer series consists of eleven, namely podobranchia VIII., anterior arthrobranchia IX., podobr. IX., anterior arthrobr. X., podobr. X., anterior arthrobr. XI., podobr. XI., anterior arthrobr. XII., anterior arthrobr. XIII., posterior arthrobr. XIII., pleurobranchia XIV.; and the inner series of five, namely posterior arthrobr. VIII., posterior arthrobr. IX., posterior arthrobr. X., posterior arthrobr. XI., and posterior arthrobr. XII. The number of functional branchiæ thus corresponds exactly with the description and figures of Duvernoy, while their arrangement differs but slightly therefrom—the difference consisting in posterior arthrobranchia XII. occupying the last place in the inner series instead of the ninth place in the outer series, as in the typical form. There is but one fully developed and functional pleurobranchia, namely that of somite XIV., the remaining five being reduced to minute rudimentary plumes of no functional importance.

Type *Aristæus antennatus*, Duvernoy.

13. *Aristæus virilis* (Sp. Bate).

Hemipenæus virilis, Sp. Bate, 'Challenger' Macrura, 1888, p. 303, pl. xliv. fig. 4, ♂.

Hemipenæus tomentosus, id. ibid. p. 307, pl. xlix. figs. 2, 3, pl. l., ♀.

These two species have been separated by Spence Bate on differences which prove to be sexual.

The remarkable structure of the base of the inner flagellum of the antennules (which probably forms an apparatus for holding the female, and recalls the structure of the same part in our *Metapenæus coniger*) and the thickening of the tissues of the outer apex of the antennal scale (of which the remarkable prolongation of the apex of the same part in *Aristæopsis Edwardsiana* is only an extension) have been indicated by Mr. Spence Bate.

To the above we may add that the rostrum, which in

females and in the young of both sexes ends in a long styliform process extending far beyond the peduncles of the antennules, in the adult male is so shortened as to scarcely pass beyond the end of the first joint of these appendages. The only absolute difference which I have been able to detect between our specimens and Duvernoy's figures and descriptions is in the arrangement of the branchial plumes above described.

Very many specimens of both sexes from Station 115, 188 to 220 fathoms. Several specimens had been previously obtained in the same part of the Andaman Sea in 271 fathoms.

Colour in life red.

14. *Aristæus semidentatus* (Sp. Bate).

Hemipenæus semidentatus, Sp. Bate, 'Challenger' Macrura, p. 305, pl. xlix. fig. 1, ♀.

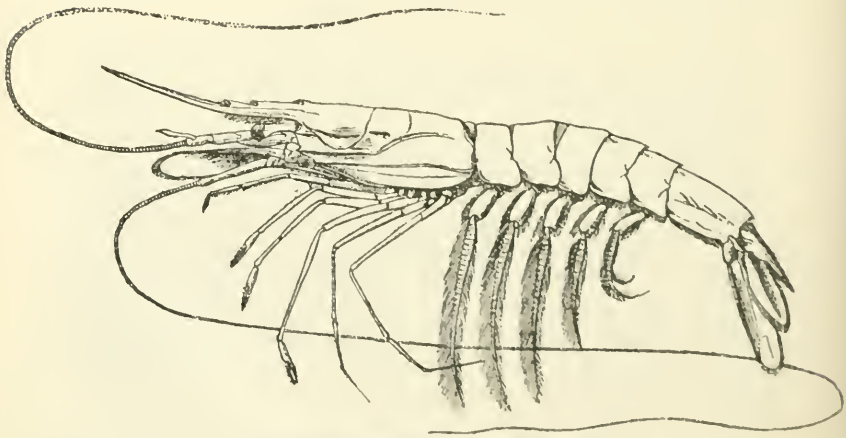
Very many specimens of both sexes from Station 120, 240 to 276 fathoms. Previously obtained in lat. 20° 17′ 30″ N., long. 80° 50′ E., in 193 fathoms, and from the Swatch-of-No-ground in 405 to 285 fathoms.

This species presents precisely the same sexual characters as the preceding, from which, so far as we have been at present able to make out, it only differs in being quite glabrous and as a rule smaller.

15. *Aristæus coruscans*, sp. n.

Body elongate, slender, glabrous. Rostrum long, extending by nearly one half of its length beyond the peduncles of

Fig. 6.



Aristæus coruscans, ♀, $\frac{3}{5}$ nat. size.

the antennules, its basal toothed portion almost horizontal, its apical portion long, slender, styliform, straight, and ascendant: the first tooth arises just at the level of the supraorbital margin, its ridge extending as a sharpish and diminishing dorsal crest nearly to the hinder edge of the carapace; the second arises about the length of an eye-peduncle from the first, and the third about half that distance from the second. A long postorbital crest commences close behind the orbital margin, and extends without interruption to the gastro-hepatic groove, where it ends, to reappear again in the interval between the gastro-hepatic and cervical grooves; the crest of the antennal spine is short, extending only to the antennal groove; the long crest of the branchiostegal spine runs horizontally backwards as far as the curved cardio-branchial ridge and groove, which with it demarcates the upper boundary of the subjacent branchial chamber; below the branchiostegal crest a ridge of nearly the same strength delimits the indurated superior from the membranous inferior part of the sides of the carapace and anteriorly runs to the anterior margin, while posteriorly it is continuous with the raised rim of the posterior margin on each side.

The legs are slender and weak.

A fine female from Station 112, 561 fathoms.

Colour in life bright orange.

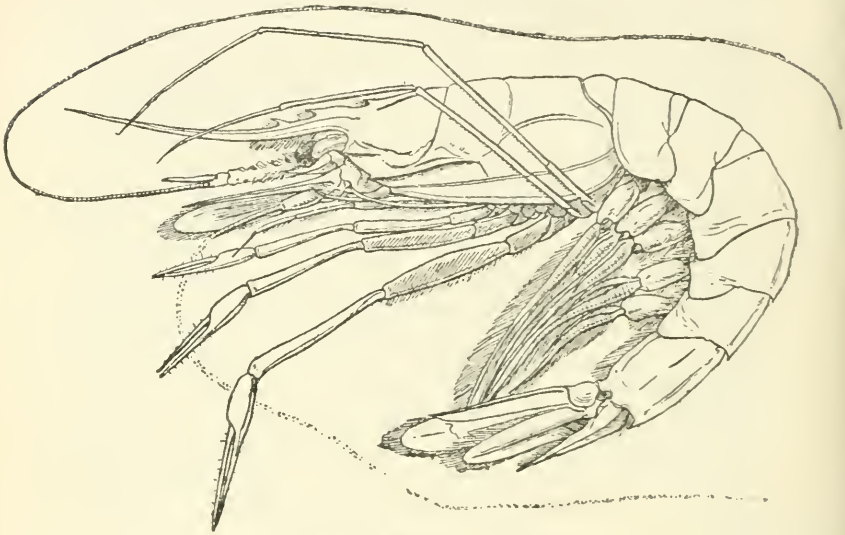
The specimen was strongly luminous when first brought on board.

16. *Aristæus crassipes*, sp. n.

Body pubescent. Rostrum long, extending by fully one half of its length beyond the peduncles of the antennules; its basal toothed portion slightly descendant, its apical portion, which is excessively slender and styliform, ascends in a faint curve to its excessively fine and sharp point; the first tooth arises well to the rear of the orbital margin, the second about the length of an eye-peduncle from the first, and the third about two-thirds of that distance from the second; the crest of the first extends backwards as a blunt dorsal ridge to about midway between the cervical groove and the hinder margin of the carapace; a blunt postorbital crest defines the antennal groove superiorly, and an almost equally blunt short crest to the antennal spine limits it below; the crest of the branchiostegal spine is somewhat stronger and sharper than in the preceding species, but presents similar relations to the cardio-branchial groove, at its junction with which a groove passes off obliquely downwards and backwards towards but not up

to the ridge separating the hard and the soft parts of the sides of the carapace from one another; both gastro-hepatic and cervical grooves are rather more strongly marked than in the preceding species, especially the latter of them, which is

Fig. 7.



Aristæus crassipes, ♀, natural size.

accentuated by a slight thickening of the integument immediately behind it on each side of the middle line; neither, however, actually indents the dorsal ridge, though both appear to do so from the lateral aspect, as is seen in the accompanying figure.

The thick and robust first three pairs of chelate limbs present the most marked contrast to the thin and filiform last two pairs.

A fine female specimen from Station 116, 405 fathoms.

Colour in life crimson.

An equally fine example of the same sex had previously been obtained in lat. 6° 29′ N., long. 79° 34′ E., in 597 fathoms.

Aristæopsis, gen. nov.

Aristeus, Sp. Bate, 'Challenger' Macrura, 1888, p. 309 (non Duvernoy).

Rostrum three-toothed; carapace without hepatic spine;

antennal scale large; mandibular palp robust, with terminal joint bifurcate; dorsal carina of the last four abdominal terga terminating posteriorly in a spine; postero-lateral angles of second or third to fifth abdominal pleura minutely mucronate; legs with or without minute exopodites; dactylopodites of the last two pairs of legs lanceolate, smooth and convex below, flat or concave and fringed with hairs on both edges above.

Branchial formula of *Aristæopsis Edwardsiana* (Johnson):—

Somites and their appendages.	Podobranchiæ.	Arthrobranchiæ. Anterior.	Arthrobranchiæ. Posterior.	Pleurobranchiæ.	
VIII.	1	0	1	0 =	2
IX.	1	1	1	1 =	4
X.	1	1	1	1 =	4
XI.	1	1	1	1 =	4
XII.	1	1	1	1 =	4
XIII.	0 (*ep.*)	1	1	1 =	3+*ep.*
XIV.	0	0	0	1 =	1
	5+*ep.* +	5 +	6 +	6 =	22+*ep.*

It differs from *Aristæus* in having a fully developed (= plume and epipodite) podobranchia XII. and an epipodite XIII., with a regularly decreasing series of pleurobranchiæ, the anterior five of which are degenerate as to their pinnules, but not reduced in length, and hence cannot be called rudimentary.

Type *Penæus Edwardsianus*, Johnson, P. Z. S. 1867, p. 897, ♀ = *Aristeus coralinus*, A. M.-Edw. in 'Challenger' Macrura, 1888, pl. xxxii. fig. 10, ♂.

[*Obs. Funchalia*, which is entered by Spence Bate as a synonym of his *Aristeus* (= *Aristæopsis*), has, as Johnson's description proves, nothing whatever to do with either *Aristæopsis* or *Aristæus*, and probably does not even belong to the Aristæine alliance at all, having, among other things, an unarmed abdomen and the mandibles in the form of "long sickle-shaped shears which cross each other from opposite sides of the mouth." Now all the Aristæine Penæids without exception have an armed abdomen and mandibles which depart little, if at all, from the normal form.]

17. *Aristæopsis Edwardsiana*, Johns.

Penæus Edwardsianus, Johnson, P. Z. S. 1867, p. 897, ♀.
Aristeus Edwardsianus, Miers, P. Z. S. 1878, pp. 308, 309, pl. xvii. fig. 3, mandibular palpus.

Aristeus coralinus, A. M.-Edw. in 'Challenger' Macrura, 1888, pl. xxxii. fig. 10, ♂, antennal scale.

An adult male and an adolescent male with commencing process of the antennal scale, and an adult female, from Station 115, 188 to 220 fathoms.

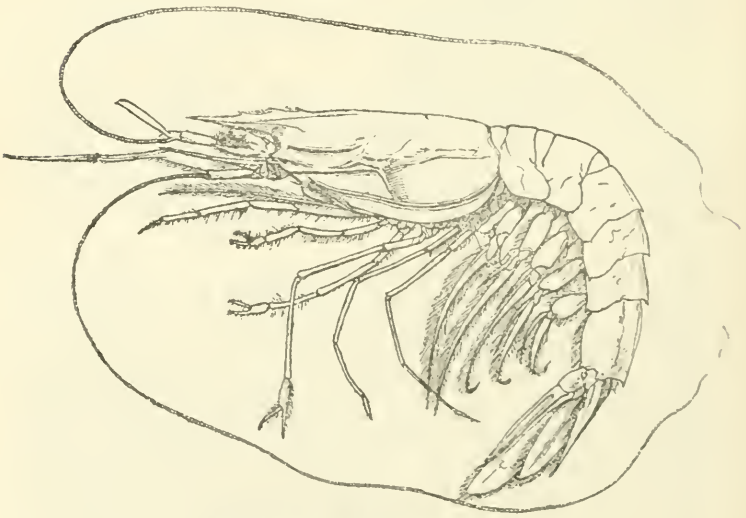
Colour in life deep crimson.

Two males and a very fine full-grown female had been taken off Port Blair in 271 fathoms, and a young specimen in the Gulf of Manaar in 597 fathoms.

Our specimens of the female agree absolutely with Johnson's admirable description.

Adult males present some remarkable sexual differences; not only is their rostrum short and porrect, not extending beyond the apex of the antennulary peduncles, but their antennal scale is prolonged at the apex into a slender cylindrical fleshy process as long as the scale itself. This process,

Fig. 8.



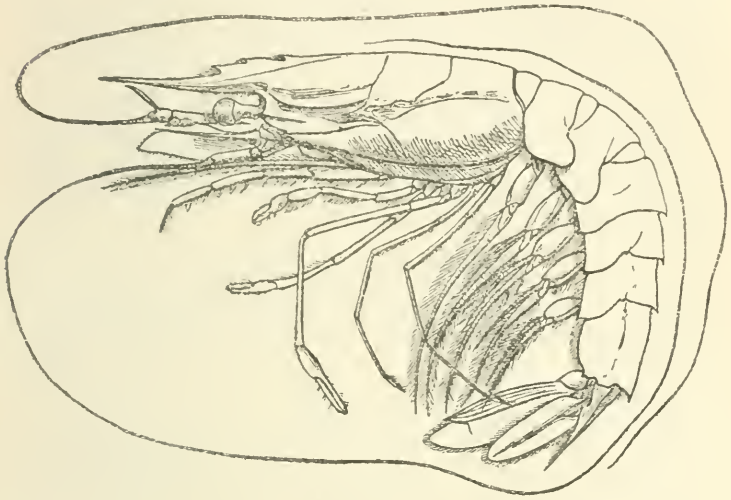
Aristæopsis Edwardsiana, ♂, × ½.

which is an extension of the thickening of the tissues seen in *Aristæus virilis* and others, is longitudinally grooved dorsally and is of uniform width from near the base to the blunt apex.

With growth the rostrum of the female also undergoes considerable reduction in length; but it always exceeds the antennulary peduncle.

The dorsal ridge of the abdomen commences on the second tergum. The second (Atlantic) or third (Indian) to fifth pleura are minutely mucronate; in one of our specimens a very minute mucro can be made out on one of the pleura of the second tergum.

Fig. 9.



Aristæopsis Edwardsiana, ♀. × ½.

18. *Aristæopsis armata* (Sp. Bate).

Aristeus armatus, Sp. Bate, Ann. & Mag. Nat. Hist. (5) viii. 1881, p. 188; id. 'Challenger' Macrura, 1888, p. 312, pls. xlv., xlvi., ♂ ♀.
Aristeus? tridens, S. I. Smith, Ann. Rep. U. S. Comm. Fish. 1884, p. 464, ♂ ♀, (60), pl. x. fig. 1, ♂.

A magnificent example of an apparently adult male from Station 117, 1748 fathoms.

Colour in life deep crimson.

It measures no less than 270 millim. in length from the tip of the rostrum to the tip of the telson.

It exhibits a thickening of the tissues of the apex of the antennal scale, but shows no sign of reduction in the length of the rostrum met with in other species.

The dorsal ridge of the abdomen commences in the third tergum. The abdominal pleura from the third or fourth to the fifth are minutely mucronate.

Mandibles as in S. I. Smith's figures.

The inner branches of the caudal swimmeret when laid back reach to the end of the telson.

ARISTÆOMORPHA, gen. nov.

Rostrum many-toothed; an hepatic spine is present; mandibular palp robust, with terminal joint subbifurcate; antennal scale small; postero-lateral angles of abdominal pleura second to fifth simple and unarmed; dorsal carina of the last four abdominal terga ending in a spine; legs without exopodites; dactylopodites of the last two pairs setaceous; branchial formula as in *Aristæopsis*, according to Spence Bate.

Type *Aristeus rostridentatus*, Sp. Bate.

[19. *Aristæomorpha rostridentata* (Sp. Bate).

Aristeus rostridentatus, Sp. Bate, 'Challenger' Macrura, 1888, p. 317, pl. li., ♀.

A fine female was taken in a previous season off Port Blair in the Andaman Sea, 271 fathoms.]

HEMIPENÆUS, Sp. Bate (p.).

20. *Hemipenæus Carpenteri*, W.-M.

Hemipenæus Carpenteri, W.-M., Ann. & Mag. Nat. Hist. (6) vii. 1891, p. 189, ♀.

A female from Station 106, 1091 fathoms.

Colour in life transparent orange.

It has four spines to the rostrum, the additional spine being developed in front of the normal three.

A young specimen from Station 111, 1644 fathoms, colour in life orange, has the normal number of spines to the rostrum.

A female from the Bay of Bengal, 1300 fathoms, has only two teeth to the rostrum, the apical one being apparently absent.

Having only four females, and those differing, we are not in a position to attempt the determination of the relation of this species to other forms, and so leave it for the present in Spence Bate's genus.

Subfamily? *BENTHESICYMINA*.

GENNADAS, Sp. Bate.

21. *Gennadas parvus*, Sp. Bate.

Gennadas parvus, Sp. Bate, Ann. & Mag. Nat. Hist. (5) viii. 1881, p. 191; id. 'Challenger' Macrura, 1888, p. 340, pl. lix.

Gennadas parvus, Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. p. 189, ♂ ♀.

? *Amalopenæus elegans*, W.-M., *loc. cit.*

One male from Station 108, 1043 fathoms; another from Station 109, 738 fathoms; and a third from Station 111, 1644 fathoms; all of a uniform deep lake-colour.

[To be continued.]

	Castelfranco.		Turin.	Varese.		Novara.		Venice.	
	♂.	♂.	♀.	♂.	♂.	♂.	♀.	♀.	♀.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
om snout to vent	48	43	58	55	54	45	58	56	56
ngth of head	16	15	18	17	17	15	17	18	18
idth of head	15	14	18	18	18	15	18	18	18
ameter of eye	5	4·5	5·5	5·5	5·5	5	5·5	6	6
terorbital width	4	3·5	4·5	4·5	4	3·5	4	4·5	4
om eye to nostril	3·5	3·5	4	4	4	3·5	4	4	4
,, ,, end of snout	7	6·5	8	8	7·5	6·5	8	8	8
mpanum	3	2·5	3·5	4	3·5	2·5	4	3·5	4
om eye to tympanum	2	1·5	2·5	2	2	1·5	2	2	2
re limb	30	28	37	35	35	29	34	37	35
nd limb	84	76	109	95	97	86	103	104	104
bia	28	25	36	33	32	28	35	35	34
ot	26	24	32	31	32	28	34	33	32
ner toe	6	5	7·5	6·5	7	6·5	7	7·5	6·5
ner metatarsal tubercle	2	1·5	2·5	2·5	2·5	2	2·5	2·5	2

XLVII.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R. F. Hoskyn, R.N., commanding.*——Series II., No. 1. *On the Results of Deep-sea Dredging during the Season* 1890–91. By J. Wood-Mason, Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College of Bengal, and A. Alcock, M.B., Surgeon I.M.S., Surgeon-Naturalist to the Survey.

[Continued from p. 286.]

Family **Sergestidæ**.

Sergestes, H. M.-Edw.

22. *Sergestes bisulcatus*, W.-M.

Sergestes bisulcatus, W.-M. Ann. & Mag. Nat. Hist. (6) vii. 1891, p. 190, ♂ ♀.

A mutilated male and female from Station 109, 738 fathoms. Colour in the fresh state deep crimson.

23. *Sergestes mollis*, S. I. Smith.

Sergestes mollis, S. I. Smith, Rep. U. S. Fish. Comm. 1884, p. 419 [75], ♂ ♀, 1886, pl. xx. figs. 3–5, ♂ ♀.

A very fine male from Station 106, 1091 fathoms.

The spine at the distal end of the outer margin of the antennal scale is quite distinct, though small; the upper surface of the ocular peduncle is as if smeared with black pigment; and the subdorsal ridges of the telson bear near their distal end two pairs of very minute spinules.

Colour in life lurid red.

The specimen is very soft and delicate, and its carapace is hence much crumpled.

Total length from tip of rostrum to tip of telson 89 millim.

24. *Sergestes rubroguttatus*, sp. n.

Sergestes ? arcticus, W.-M. Ann. & Mag. Nat. Hist. (6) vii. 1891, p. 190, ♀juv. (nec Kröyer).

♂ ♀. Closely allied to *Sergestes arcticus*, Kröyer (as figured by S. I. Smith in Bull. Mus. Comp. Zool. x. p. 96, pl. xvi. fig. 4, and Rep. U. S. Fish. Comm. 1884, p. 71, pl. viii. fig. 2, 1886, p. 92, pl. xx. figs. 1, 2), differing therefrom in the hepatic spine being so small as to be scarcely visible and sometimes obsolescent, in its longer and slenderer caudal appendages, and in the exopodites of these being without a trace of a spine on the outer margin.

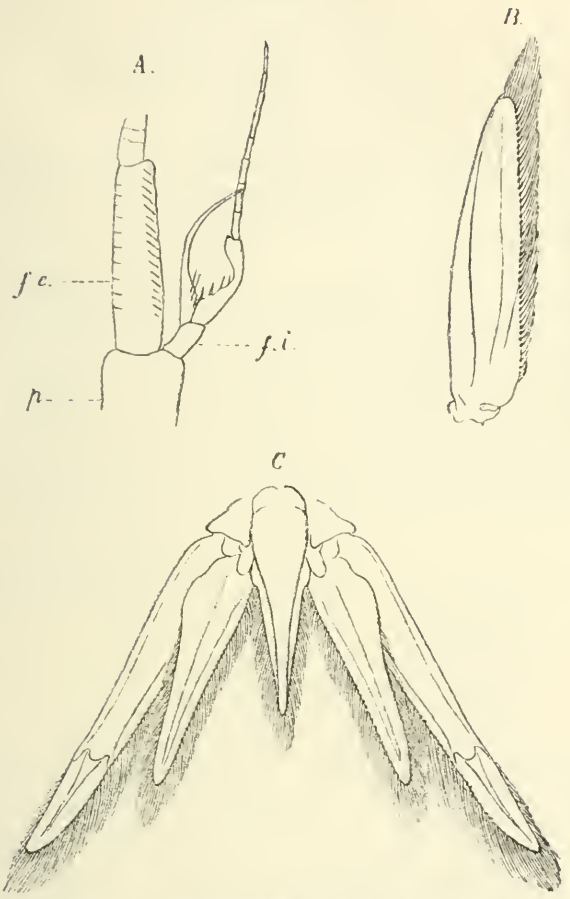
Colour in life hyaline, with blood-red spots.

Total length of a male 48 millim., of carapace from apex of rostrum to middle of hinder margin 15·5 millim., of external maxillipedes 32 millim., of the first pair of legs 25·5 millim., of the second pair 28·5 millim., of the third pair 31 millim., of the fourth pair 19 millim., of the fifth pair 9 millim.

The antennules of the male closely resemble those of *S. Frisii*, Kr. (Vid. Selsk. Skr. 5 Raekke, Naturvidens. og Mathem. Afd. 4 Bd. tab. i. fig. 1 *c*), the only difference being that the hook of the prehensile flagellum is roughened internally by fine, regularly parallel, transverse grooves or ridges instead of granules.

One female from Station 107, 738 fathoms; two males from Station 109, 738 fathoms; one female from Station 110, 1997 fathoms; and one male from Station 117, 1748 fathoms.

Fig. 10.



Sergestes rubroguttatus.

A, a portion of the left antennule of a male, from below, × 16·5. *p*, apex of peduncle; *f.e.*, basal or olfactory portion of external flagellum, with traces of the primitive segmentation indicated on the left and the lines of insertion of the olfactory setæ visible by transparence on the right of the drawing; *f.i.*, inner or prehensile flagellum.
B, left antennal scale, × 5.
C, caudal swimmeret, × 5.

EUKYPHOTES.

Family **Glyphocrangonidæ**.

GLYPHOCRANGON, A. M.-Edw.

Section 1.

25. *Glyphocrangon investigatoris*, W.-M., var. nov. *andamanensis*.

Glyphocrangon investigatoris, Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. p. 191, ♀.

♀. Differs from the typical form in the following points:—It is much larger; the antennal, branchiostegal, and lateral spines of the carapace, especially the last-named, are more strongly developed, and the cervical groove is broader and deeper; the carapace with rostrum is, in proportion to the total length, somewhat shorter; the lateral and subdorsal ridges of the telson are much less distinctly and sharply granulated, being in fact little more than roughly waved; and, finally, the colour in life is uniform pink.

	Variety. millim.	Typical form. millim.
Total length from tip of rostrum to tip of telson	115	91
Length of carapace from middle of posterior margin to tip of rostrum	51	39
Length of carapace from front of the posterior rostral spines to middle of hinder margin	32	25·5
Length of rostrum from front of posterior spine to tip	20	15
Breadth between lateral spines of carapace	28·25	20·5
Length of abdomen	63	51

A young female differs from the above and from young of the same size and age of the typical form in its much longer rostrum, less tuberculate integument, longer and more divergent lateral carapacial spines, in all of which respects it recalls *G. aculeata*, A. M.-Edw.

The total length from tip of rostrum to tip of telson 55 millim., length of carapace from tip of rostrum to middle of posterior margin 26 millim., length of carapace from one of the posterior rostral spines to middle of hinder margin 13·5 millim., breadth between tips of lateral spines of carapace 14·8 millim., length of rostrum from front of one of the posterior spines 12·5 millim., length of abdomen 28·5 millim.

A very fine ovigerous female, with one young female, was taken at Station 115, 188 to 220 fathoms.

Colour in life in both pink; the eggs of the female pea-green. Colour of eyes in spirit dark purple.

26. *Glyphocrangon Smithii*, sp. n.

Very closely allied to *G. aculeata*, A. M.-Edw., from which it is distinguishable at a glance by the much less developed lateral spines of the carapace, the anterior of these being less expanded laterally and the posterior reduced to a minute though excessively acute point.

A comparison of our specimens with Milne-Edwards's type would probably reveal further differences.

Total length from tip of rostrum to tip of telson 77 millim., length of carapace from tip of rostrum to middle of posterior margin 35·5 millim., length of carapace from the front of one of the posterior rostral spines to hinder margin 20·5 millim., breadth between tips of lateral spines of carapace 18·2 millim., length of rostrum from the front of one of its posterior spines 16 millim., length of abdomen 41 millim.

Colour in life bright crimson. Eyes in spirit dark purple.

Two males from Station 112, 561 fathoms.

I have much pleasure in naming this species after Lieut. C. V. Smith, R.N., of the Survey.

Section 2.

27. *Glyphocrangon cæcescens*, sp. n.

Closely allied to *G. sculpta*, S. I. Smith, differing therefrom in the degeneration of its organs of vision, which, though perhaps not much if at all reduced in size, yet have their corneæ opaque yellow in every part except near the antero-lateral margins, where a faint touch of the original purple colour may still be traced; in having three pairs of rostral spines; in the rostrum being lanceolate when viewed from above (thus resembling that of *G. longirostris*, ♀ juv., S. I. Smith, Rep. U. S. Fish. Comm. 1886, pl. ix. fig. 5), and reaching nearly to the end of the olfactory flagellum of the antennules; in the dactylopodite of the legs of the last two pairs being minutely mucronate at the outer apex; in the posterior moiety of the subdorsal carapacial crest not being spinose; in the subdorsal ridges of the telson being minutely and acutely jagged.

Total length from tip of rostrum to tip of telson 65·5 millim., length of carapace from tip of rostrum to middle of

posterior margin 28·5 millim., length of carapace from front of second rostral spine to hinder margin 16 millim., length of rostrum from front of second spine to tip 12·75 millim., length of abdomen 37·5 millim.

Colour in life pale pink, with the corneæ dull yellow.

One male from Station 117, 1748 fathoms.

Section 3.

28. [*Glyphocrangon Gilesii*, W.-M.

Glyphocrangon Gilesii, Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. p. 193, ♀.

We here record a second female, somewhat smaller than the type, which has come to light in the sorting of past seasons' collections. It was taken on April 12th, 1888, 7½ miles east of North Cinque Island, Andaman Sea, in 490 fathoms.]

29. *Glyphocrangon cæca*, sp. n.

♂ ♀. This species differs from all the members of its own section in the enormous development of the spines of the anterior moiety of its lateral carapacial ridges, which are extended beyond the level of the frontal margin as in the species of Section 1, and from all the species of its genus in its greatly degenerate organs of vision, which, besides being somewhat reduced in size, have the corneæ yellow and densely opaque throughout. Both moieties of the lateral and the posterior moiety of the sublateral ridges are thick, blunt, and entire, but all the other ridges are broken up into tubercles; the subdorsal ridge is represented by six spiniform tubercles —three on each division of the carapace—the dorsal by six, of which two are behind the cervical groove and four in front of it; the latter have two closely-parallel rows of much smaller tubercles between them and their fellows of the opposite side; a minute median spinule projects from the anterior end of the gastric region over the gastro-rostral groove; between the anterior ends of the posterior moieties of the dorsal and subdorsal ridges an oblique row of four rather large granules bounds that portion of the cervical groove posteriorly.

With these exceptions the carapace is smooth and bears between its anterior lateral ridge and the gastric region on each side an unusually distinct low oval swelling. The antennal spine is unusually small—scarcely half the size of

the branchiostegal and only about one and a half times as large as the anterior rostral spines. The rostrum, which extends beyond the antennulary peduncle by about the length of the lateral spine of the carapace, is somewhat recurved and is marked on the dorsal surface by two rows of elongate foveæ, which are much more distinct in the female than in the male; its spines are small, especially the posterior, which are rather short and stout. The broadly oval antennal scale all but reaches the level of the end of the antennulary peduncle; the spine of its outer margin is rather well developed and is placed about one third of the way from the base to the apex.

The eyes are in both sexes somewhat reduced, in our only female very unequally so—the right being scarcely half the size of the left, while in our two males they would appear to be quite equal on both sides. From the opaqueness of the corneæ and other marks of degeneration it may with confidence be inferred that this species is quite blind.

The olfactory flagellum of the antennules is much thicker in the male than in the female. The dactylopodites of the last two pairs of legs are of the ordinary form—lanceolate, with the dorsal surface concave and the ventral subcarinate.

Abdomen much as in the preceding and probably other members of the same section; the dorsal ridge of its last tergum is in the female entire, in both males obsoletely notched; the dorsal ridge of the telson seems unusually long.

Colour in life bright pink.

	Male. millim.	Female. millim.
Total length from tip of rostrum to tip of telson	53·5	64
Length of carapace from tip of rostrum to middle of posterior margin	22	25
Length of carapace from front of posterior rostral spine to hinder margin	12·5	15
Length of rostrum from front of posterior rostral spine to tip	10	12
Length of abdomen	31·5	38
Breadth between points of lateral spines	12·3	13·6

Two males and one ovigerous female were taken at Station 112, 561 fathoms.

Family Crangonidæ.

Subfamily *Crangoninæ*.

Crangon, Fabr.

The two following species belong to the same section of the genus as *Crangon Sarsii*, Lilljeborg.

30. *Crangon bengalensis*, sp. n.

♀. Rostrum acuminate triangular, the unarmed tip extending by about half its length beyond the level of the eyes, armed at the sides with three pairs of sharp spines, of which the basal pair is only slightly more distant from the second pair than this is from the third pair. Eyes very short, owing to the reduction in length of the basal joint.

Median dorsal carina of the carapace divided into five forwardly-directed sharp spines; subdorsal carinæ continuous with the sides of the rostrum, also 5-spinose, with a considerable unarmed interval between its foremost spine and the basal rostral spine with which it is continuous; sublateral carinæ 3-spinose in their anterior half, ending abruptly some distance from the extra-orbital spines with which they are in line; lateral carinæ continuous with the antennal spines, unispinose near the anterior end; marginal carinæ entire, unarmed, continuous with the branchiostegal spines. The first abdominal tergum is furnished with six anteriorly spinose carinæ—two dorsal, two subdorsal, and two sublateral—as well as with unarmed rudiments of two lateral carinæ; the second tergum with three similar carinæ, of which one is dorsal and two are subdorsal, as well as with two unarmed sublaterals; the third and fourth terga have only an obtuse median dorsal carina, which in the latter is produced in the middle line posteriorly into a small point, as well as indistinct remains of sublaterals; the fifth and sixth have two posteriorly somewhat divergent sharp dorsal carinæ, which in the latter are minutely unispinose rather behind the second third of their length; the fifth has also two lateral carinæ and the sixth one.

Eyes in spirit dark chocolate-brown.

Total length from tip of rostrum to tip of telson 44 millim.; length of carapace from tip of rostrum to middle of posterior margin 13·5 millim., of abdomen to end of telson 30·5 millim.

One ovigerous female from Station 120, 240 to 276 fathoms.

31. *Crangon andamanensis*, sp. n.

Closely allied to the preceding, from which it differs in the following points:—(1) The two apical pairs of rostral spines are equidistant between the tip of the rostrum and the basal pair; (2) the rostrum is not so acuminate, its terminal portion being more broadly triangular; (3) the subdorsal carinæ of the carapace are only 4-spinose, the sublaterals are 5-spinose, and the laterals are usually bispinose; (4) the dorsal carina

of the second abdominal tergum is bispinose, and the dorsal carinæ of the sixth are 3- or 4-spinose; (5) it is a much larger and altogether finer species.

	Male. millim.	Female. millim.
Total length from tip of rostrum to tip of telson	62	72
Length of carapace from tip of rostrum to middle of posterior margin	18	20
Length of abdomen to end of telson	43·5	50

Colour in life chalky yellow. Eyes in spirit dark chocolate-brown.

Four males and two ovigerous females from Station 115, 188 to 220 fathoms.

Pontophilus, Leach.

32. *Pontophilus gracilis*, S. I. Smith.

Pontophilus gracilis, S. I. Smith, Bull. Mus. Comp. Zool. 1882, x. p. 36, pl. vii. figs. 2–3 *a*; Rep. U. S. Fish. Comm. 1886, pl. xi. figs. 1, 2 (nec Sp. Bate, 'Challenger' Macrura. 1888, p. 487, pl. lxxxvii.).

One fine ovigerous female from Station 112, 561 fathoms, and a small and somewhat mutilated specimen from Station 113, 683 fathoms.

Colours in life transparent cloudy purple, corneæ milky orange. (In spirit rich orange-coloured and opaque.)

33. *Pontophilus abyssi*, S. I. Smith.

Pontophilus abyssi, S. I. Smith, Rep. U. S. Fish. Comm. 1884, p. 19, ♂ ♀, 1886, p. 49, pl. xi. figs. 3–5, ♂ ♀.

A fine female from Station 110, 1997 fathoms.

Colour in life translucent cloudy purple (dark orange in spirit), with the corneæ milky or chalky orange (in spirit Indian yellow and opaque).

Also a mutilated ovigerous female from Station 117, 1748 fathoms. Colour in the fresh state purplish, corneæ dull yellow. (In spirit as in the preceding specimen.)

The eyes in this species are decidedly shorter and less produced at the inner apex than in the preceding.

Prionocrangon, gen. nov.

Integument smooth and polished. Carapace compressed, armed with a short, sharp, ascendant, narrow, triangular

ostrum, with antennal spines and with an arched median, dorsal, spiny crest on the gastric region. There is no trace either of eyes or even of eye-peduncles. First and third pairs of legs of the usual Crangonine form; second pair non-chelate, rather robust, with fringes of long plumose setæ, their dactylopodites minute, setulose; third and fourth pairs rather more robust than, but similar to, the second, with successively more minute and less gressorial dactylopodites, also furnished with long fringes of plumose setæ. Abdomen compressed, smooth, transversely convex, without spines or carinæ. Telson thin and depressed.

34. *Prionocrangon ommatosteres*, sp. n.

The serrated gastric crest is seven-toothed.

The animal measures in length, from tip of rostrum to tip of telson, about 30 millim., of which the carapace from tip of rostrum to middle of hinder margin is about 10 millim.

A single somewhat mutilated specimen from Station 116, 405 fathoms.

[To be continued.]

XLVIII.—*The Biological Import of Amitotic (Direct) Nuclear Division in the Animal Kingdom.* By H. E. Ziegler, Ph.D., Extra-ordinary Professor of Zoology, Freiburg i. B. *

In W. Flemming's most recent paper † we find the following passage:—"As regards the fragmentation of the nuclei of leucocytes—and amitotic nuclear division in general—it appears to me not impossible that the following view could also be held. The leucocytes, like the cells of other tissues, perform their normal physiological reproduction by means of mitosis; those cells only which have come into existence by this process preserve the faculty of continuing to live and of producing similar cells in the same manner. *Fragmentation of the nucleus, with and without subsequent division of the cell, is universally a process in the tissues of Vertebrates, which*

* Translated from the 'Biologisches Centralblatt,' Bd. xi. nos. 12 and 13, pp. 372–389, July 15, 1891.

† W. Flemming, "Ueber Teilung und Kernformen bei Leukocyten und über deren Attraktionssphären," Archiv f. mikr. Anatomie, 37 Bd., 1891.

hump is not yet exhausted. Mouth and fore-gut also have now become more spacious than before, and the mucous membrane of the latter exhibits distinct longitudinal folds. Moreover, the fore-gut by this time (eighteenth day) possesses a layer of distinct circular muscle-fibres, which appear to me to be in no way derived from cells of the mesenchyma, but from the enterocœle-cells which lie closely upon the fore-gut. From the mid-gut an anterior portion is constricted off, which becomes the stomach of the adult, but as yet possesses muscular fibres in its wall just as little as does the remainder of the mid-gut. In the later stages also which were examined by me I failed to trace muscle-fibres in stomach and mid-gut, while in the end-gut from the forty-fifth day onwards longitudinal muscle-fibres were distinctly recognizable.

LII.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R. F. Hoskyn, R.N., commanding.*—Series II., No. 1. *On the Results of Deep-sea Dredging during the Season* 1890–91. By J. Wood-Mason, Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College of Bengal, and A. Alcock, M.B., Surgeon I.M.S., Surgeon-Naturalist to the Survey.

[Continued from p. 362.]

[Plate XVII.]

Phylum **ECHINODERMA.**

Class **ASTEROIDEA.**

The Asteroidea form a good collection, which we have arranged under twenty-three species, sixteen genera, and eight families. Of these twenty-three forms nine appear to correspond with species described in the 'Challenger' Report, while fourteen seem to be new to science.

Except as regards life-coloration and distribution we have not been able to learn anything very new concerning the Asteroidea of the deep sea. Most of them appear to live, like their shallow-water relatives, upon Mollusca. In the stomachs of some of our specimens the carapaces of Crustacea have been found. The Porcellanasteridæ, so far as our rather limited

observation goes, seem to live, like many Holothurians, on the organic matter to be found in ocean mud.

Several illustrations of the wideness of ocean-range of deep-sea species are furnished by our collection of Asteroidea.

We must here express our indebtedness to Mr. Percy Sladen's very valuable Report on the 'Challenger' Asteroidea, without which indeed we should hardly have ventured upon the examination of our collection.

Order PHANEROZONIA.

Family Archasteridæ.

Pararchaster, Sladen.

1. *Pararchaster semisquamatus*, Sladen.

Pararchaster semisquamatus, Sladen, 'Challenger' Asteroidea, p. 7, pl. ii. figs. 1 and 2, pl. iv. figs. 7 and 8.

One specimen from Station 111, 1664 fathoms.

Colour in the fresh state uniform salmon-red.

Pontaster, Sladen.

2. *Pontaster hispidus*, sp. n.

Near *Pontaster mimicus*, Sladen.

Rays 5. R=nearly 7 *r*.

Rays elongate, tapering; abactinal surface plane; interbrachial arcs acute.

Abactinal surface of disk and rays covered with close-set paxillæ of two forms; the majority are small and are surmounted by a few small granules, but a large number on the disk and along the central axis of the ray are larger and are surmounted by numerous small granules surrounding a long central spine.

Marginal plates closely covered with capillary spinelets; the supero-marginals, about 44 in number, are almost confined to the lateral aspect of the ray, are tumid above the general abactinal plane, and are armed each with a long stout spine; the infero-marginals, which are larger than the supero-marginals, alternate with these, and are armed each with a long stout spine, and sometimes with a smaller finer spine below this.

Adambulacral plates with a prominent semicircular furrow, margin bearing about ten widely radiating spinelets, and with a strong actinal boss bearing a long stout spine. Mouth-

plates short, broad, tumid, each plate edged with about seven spinelets, which increase in length from periphery to centre, and armed actinally with about six unequal irregular spinelets.

Actinal interradial areas small, the plates covered with capillary spinelets; there are one or two inconspicuous multivalve pedicellariæ in each area. Similar pedicellariæ, but smaller, occur in the interbrachial arcs between the supero- and infero-marginal plates.

Anal aperture subcentral, surrounded by paxillæ with long central spinelets, which form a close palisade.

Papularia compact, well-defined, tumid, each with from 12 to 16 very close-set papulæ.

Madreporiform body small, round, convex, situated close to the margin of the disk, with a single large paxilla to its central side.

Colour in the fresh state uniform pale orange-pink.

Station 106, 1091 fathoms, and Station 108, 1043 fathoms; numerous specimens, of all stages of growth.

Dytaster, Sladen.

3. *Dytaster exilis*, Sladen.

Dytaster exilis, Sladen, 'Challenger' Asteroidea, p. 65, pl. ii. figs. 3 and 4.

Several specimens from Station 117, 1748 fathoms, and Station 118, 1803 fathoms. This species was also dredged in the year 1888 in the Bay of Bengal in 1924 fathoms.

Colour in the fresh state salmon-pink.

4. *Dytaster anacanthus*, sp. n.

Rays 5. R=6·25 *r*.

Disk small, irregularly inflated; rays long and tapering; interbrachial arcs rather acute.

Abactinal surface densely crowded with paxillæ formed of narrow tabulæ surmounted by close-set granules; those in the centre of the disk and in a narrow band along the middle of each ray are smaller than elsewhere.

The supero-marginal plates, about 45 in number, are entirely vertical and lateral, and are uniformly covered with papilliform granules without any large spines or tubercles. The infero-marginal plates correspond in number and arrangement with the supero-marginals, which are exactly superposed; they are uniformly covered with papilliform granules

and bear medially, except in the peripheral third of the ray, each a long adpressed styliform spine.

Adambulacral plates rather long, each with a furrow-series of six obtuse spinelets, and with a mass of small spinelets, which form often three longitudinal series, actinally. Mouth-plates large, prominent, the suture between each pair widely open; the innermost mouth-spine of each plate much enlarged; actinally each plate is covered with numerous small spinelets in about three longitudinal series.

Actinal interradial areas small, the plates covered with small papilliform spinelets.

Madreporiform body situated near the margin of the disk and almost entirely concealed by paxillæ.

Anal aperture small, central.

Colour in the fresh state uniform light rose-madder.

Station 117, 1748 fathoms.

Persephonaster, gen. nov.

Allied to *Plutonaster*, Sladen.

Disk rather large, flat; rays rigid.

Marginal plates more or less covered with papilliform spinelets, and bearing each one or more strong rigid spines; the supero-marginals, which form a broad massive border on the abactinal surface of the ray, directly superposed on the infero-marginals, plate to plate.

Abactinal area with close-set paxillæ, which on the rays are arranged in transverse rows without any definite median series; papulæ distributed everywhere between the paxillæ.

Actinal interradial areas large, with intermediate plates extending far along the ray.

The adambulacral plates bear a furrow-series of obtuse, compressed, slightly radiating spinelets, and actinally two or more longitudinal series of papilliform spinelets.

Madreporiform body small, rather concealed, situated distant from the margin of the disk.

Anal aperture subcentral.

No pedicellariæ.

5. *Persephonaster croceus*, sp. n.

Plutonaster, sp., Wood-Mason and Alcock, Ann. & Mag. Nat. Hist. 1891, vii. p. 13.

Rays 5. $R = 4{\cdot}5\ r$.

Rays moderately long, rigid.

Abactinal surface of disk and rays with close-set spinose paxillæ, which become small and crowded towards the subcentral anal aperture; those of the rays are somewhat obscurely arranged in transverse series.

The whole abactinal surface is perforated with close-set papulæ. The supero-marginal plates are 31 in number and are directly superposed on the infero-marginals, plate to plate; each plate is coarsely granular in the middle and covered near the margin with capillary spinules, and bears two rigid spines, one at the abactinal, the other near the actinal end, the former being the smaller and often bifid. The infero-marginals correspond, plate to plate, with the supero-marginals; they are uniformly covered with papilliform granules, which are largest in the middle of the plate, and each bears near its abactinal end a stout rigid spine, beneath which is an obliquely vertical row of three or four slender movable spines.

Adambulacral plates with a slightly convex furrow-margin, armed with a comb of six or seven longish compressed spines; actinally there are two longitudinal series of small, inflated, longitudinally-grooved (barleycorn-shaped) spines, four in each series. Mouth-plates small, tumid, with close suture; each plate with a furrow-series of about seven spines, the most adcentral of which is of enormous relative size, and with two longitudinal series of close-set papilliform spinelets on the actinal surface.

Actinal interradial areas large, the intermediate plates extending halfway along the rays; each plate closely covered with "barleycorn" spines.

Madreporiform body small and inconspicuous, situated about two diameters from the margin of the disk.

Ambulacral groove extremely broad and open; tube-feet large, conical.

Colour in the fresh state olive-yellow, marginal plates pink, tube-feet red.

Station 109, 738 fathoms.

6. *Persephonaster rhodopeplus*, sp. n.

Rays 5. $R = 3{\cdot}5\ r$.

Rays rather short, rigid.

Abactinal surface of disk and rays covered with very close-set tabulate paxillæ surmounted by numerous flat-topped granules; the paxillæ are very small and crowded towards the subcentral anal aperture; those of the rays are arranged

in transverse curved rows. The whole abactinal surface perforated with close-set papulæ.

The supero-marginal plates number about 28, and are directly superposed on the infero-marginals, plate to plate; they are covered with granules, which are largest in the middle of the plate, and are armed with rigid spines—those in the interradia with one, those along the rays with one, two, or three in a vertical series. The infero-marginals correspond, plate to plate, with the supero-marginals; they are almost smooth in the middle and covered with papilliform granules round the edge, and are armed with from two to four stout adpressed spines, situated in a median vertical series, of which the most abactinal is the largest.

Adambulacral plates with a strongly convex furrow-margin which is armed with six or seven short, truncated, longitudinally-grooved spinelets; the actinal surface with two longitudinal series of similar spinelets—about five in each series; these spinelets are almost clavate sometimes. Mouth-plates small, very narrow, with widely open suture; each plate with a furrow-series of about ten small spinelets, the most adcentral of which is much enlarged; the actinal surface with eight or nine truncated, longitudinally-grooved spinelets in a single longitudinal series.

Actinal interradial areas large, the intermediate plates extending much more than halfway along the ray; in the interradial areas each plate has a clump of from six to eight truncated or clavate grooved spinelets; along the rays the intercalated plates have usually two longitudinal series of similar spinelets—about four in each series.

Madreporiform body small and inconspicuous or concealed, situated about midway between the centre and the margin of the disk.

Ambulacral groove very broad and open; tube-feet large, conical.

Colour in the fresh state "crushed-strawberry," sometimes with a golden suffusion; marginal plates pink, tube-feet blood-red.

Stations 107 and 109, 738 fathoms.

Pseudarchaster, Sladen.

7. *Pseudarchaster mosaicus*, sp. n.

Near *P. tessellatus*, Sladen.

Rays 5. R=4 *r*.

Disk large; rays tapering; interbrachial arcs wide, rounded.

Abactinal area covered with hexagonal tabulate paxillæ, which in the centre and in the interradial areas of the disk are much smaller than elsewhere, and which on the rays are arranged in longitudinal rows, those of the central row being of predominant size. The papulæ surround the paxillæ.

The marginal plates are short and broad. The supero-marginals, about 42 in number, occupy on each side more than one third of the abactinal surface of the ray, and are uniformly covered with large granules without other armature. The infero-marginals correspond in number, size, and disposition with the supero-marginals, plate to plate, and are uniformly covered with spine-like granules, of which two or three in a longitudinal row near the suture with the supero-marginal plate are enlarged.

Ambulacral plates with a furrow-comb of five long radiating spines, and actinally two irregular longitudinal series of small spines, of which one in each series is much enlarged, except in the distal half of the ray, where one in the outer series only is enlarged; outside these is a third irregular row of very minute spinelets. Mouth-plates small and inconspicuous, each with a furrow-series of six equal moderate-sized spinelets, and with numerous irregularly arranged spinelets on the actinal surface, one of these being much enlarged.

Actinal interradial areas large, the intermediate plates extending to about the tenth infero-marginal; they are arranged in columns, and their surface is covered with spines, of which one in each plate is much enlarged.

Anal aperture small, subcentral.

Madreporiform body very small, situated midway between the margin and the centre of the disk.

Colour in the fresh state uniform pink.

Station 115, 188 to 220 fathoms.

Family **Porcellanasteridæ**.

Porcellanaster, Wyville-Thomson.

8. *Porcellanaster cæruleus*, Wyville-Thomson.

Porcellanaster cæruleus, Wyville-Thomson, Voy. Chall. Atlantic, vol. i. p. 378, figs. 97 and 98; Sladen, 'Challenger' Asteroidea, pp. 134–138, pl. xx.

One specimen from Station 113, 683 fathoms.

Colours in the fresh state:—Abactinal membrane dull blue, epiproctal tube and marginal plates light orange-pink, tube-feet and cribriform organs bright orange.

9. *Porcellanaster*, sp. prox. *cæruleus*, Wy.-Thoms.

Numerous small specimens from Station 111, 1664 fathoms, and Station 117, 1748 fathoms, may perhaps be the young of *P. cæruleus*. The epiproctal tube is of great length, the abactinal membrane, which is fragile, has the spinelets confined to a very narrow band in the middle of each interradial space, and the supero-marginal plates, though strongly bossed, are unarmed.

STYRACASTER, Sladen.

10. *Styracaster horridus*, Sladen.

Styracaster horridus, Sladen, 'Challenger' Asteroidea, pp. 150–152, pl. xxiii. figs. 5–7, pl. xxvii. figs. 17–20.

Specimens from Stations 117, 1748 fathoms, and 118, 1803 fathoms.

In our specimens only a few of the adambulacral plates, near the adcentral end of the ray, have four spines in the furrow-series, the majority have three, and the most distal only two. Specimens with the stomach distended show no epiproctal elevation; but those with the stomach empty have a distinct elevated cone, in one case bilobed.

Colour in the fresh state pale yellowish pink.

11. *Styracaster clavipes*, sp. n.

Agrees with *S. armatus* very closely, but differs in the following particulars:—There are five cribriform organs in each interbrachial arc; the infero-marginal plates are not much longer than broad; the terminal plate of the ray is markedly inflated; the median spines of the coalescent supero-marginal rays are comparatively short and blunt.

In general "habit" it is well distinct from *S. armatus*, Sladen, of which species there are in the 'Investigator' collection two fine specimens dredged in 1888, in 1840 to 1924 fathoms, in the Bay of Bengal.

Colour in the fresh state pale yellowish pink.

One specimen from Station 117, 1748 fathoms.

HYPHALASTER, Sladen.

12. *Hyphalaster tara*, sp. n.

Rays 5. R=2 *r*.

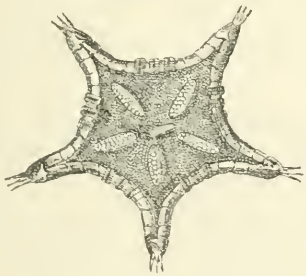
Rays short, squat, slightly inflated terminally. Disk large, strongly inflated, with a short, tapering, epiproctal tube.

Interbrachial arcs extremely wide, each with three large papillar cribriform organs.

Abactinal area covered with a toughish membrane, beset with numerous paxillæ of two kinds. Those in the middle of the radial areas of the disk are large and are surmounted by ten to fifteen or more granular spinelets; they extend in a tapering band from near the base of the epiproctal tube to near the base of the ray, and the five tapering bands show as a conspicuous rosette on the disk. The paxillæ elsewhere are small and are surmounted by but three or four spinelets. There are apparently no papulæ.

Marginal plates highly granular, unarmed, forming a perpendicular wall. Supero-marginals 6, excluding the terminal; they hardly meet in the middle line along the ray; the last plate, like the last infero-marginal, is a very small inconspicuous triangular scale, wedged in almost beneath the large upturned terminal plate; this last forms a tumid boss armed with four large acute spines. The infero-marginals correspond in number and arrangement with the supero-marginals, but are rather smaller.

Fig. 11.



Hyphalaster tara, natural size.

Adambulacral plates large, each with a furrow-series of five or six compressed lanceolate spinelets arranged in a fan-like comb. Mouth-plates large, tumid actinally, the suture widely open; the margin of each bears seven compressed lanceolate spinelets, of which the adoral one is much enlarged.

Actinal interradial areas extensive, with broad scale-like imbricating plates arranged in about nine columns parallel to the radial axis; some of the plates have small deciduous spikelets.

Ambulacral furrows broad.

Madreporiform body marginal.

Colour in the fresh state white, tube-feet pink.

Station 110, 1997 fathoms; Station 117, 1748 fathoms.

Family **Pentagonasteridæ**.

Paragonaster, Sladen.

13. *Paragonaster*, sp. prox. *ctenipes*, Sladen.

Young and rather mutilated examples from Station 117, 1748 fathoms.

Colour in the fresh state pale yellowish pink.

14. *Paragonaster*, sp.

A remarkable species in a mutilated condition was taken at Station 117, 1748 fathoms.

It is characterized by having the papulæ aggregated into distinctly circumscribed inflated papularia, one at the base of each ray. The paxillæ over the papularia are singularly large and prominent.

Order CRYPTOZONIA.

Family **Zoroasteridæ**.

Zoroaster, Wyville-Thomson.

15. *Zoroaster*, sp.

A single specimen, not identifiable with any described species, was taken at Station 108, in 1043 fathoms. It has suffered so much abrasion that we are unwilling now to describe it. It is characterized by the relative smallness of the disk and great length of the rays, and by its very numerous pedicellariæ, which are of two kinds, the smaller ones occurring in clusters and bunches.

In the fresh state it was coloured orange-pink, and was covered with a thick coat of mucus.

Family **Asteriadæ**.

Asterias, Linn.

16. *Asterias mazophorus*, sp. n.

Disk small, circular, marked off from the rays by a deep transverse groove. Rays long, semicylindrical, much constricted laterally at the base; their abactinal surface with small plates in longitudinal and transverse rows, the spaces between the plates being filled with papulæ in oval plots of

five to nine. The plates are covered with membrane, widely placed on which are beautiful forceps-like pedicellariæ. Near the middle of each plate is a long, stout, acute, movable spine, the base of which is buried in a large, fleshy, papillose eminence.

Marginal plates distinct, clothed and armed like the abactinals, and separated by similar groups of papulæ.

Actinal aspect of the rays almost completely occupied by the ambulacral groove, a single series of very narrow distant plates intervening between the adambulacrals and the inferomarginals. The intervals between these intermediate plates are filled each with a large papula, round which is a ring of forceps-like pedicellariæ.

Adambulacral plates very small, each armed with two spines which form a double palisade along the margin of the wide ambulacral groove. Inside this, *i. e.* within the ambulacral groove, is a more or less regular row of forceps-like pedicellariæ.

The mouth-plates are recognizable by their longer furrow-spines. In the angle of each extremely narrow interbrachial arc, behind the mouth-plate, is a crowd of pedicellariæ.

Madreporiform body rather large, radially striated.

Anal aperture indistinct.

Tube-feet quadriserial, ending in a sucker.

Colour in the fresh state deep orange-yellow, with large chestnut-brown blotches.

One specimen from Station 115, 188 to 220 fathoms.

Family **Pterasteridæ**.

Marsipaster, Sladen.

17. *Marsipaster hirsutus*, Sladen.

Marsipaster hirsutus, Sladen, 'Challenger' Asteroidea, p. 487, pl. lxxviii. figs. 3 and 4, pl. lxxix. figs. 4–6.

One small specimen with ova in the nidamental cavity.

Colour in the fresh state transparent hyaline grey.

Station 110, 1997 fathoms.

Hymenaster, Wyville-Thomson.

18. *Hymenaster nobilis*, Wyville-Thomson.

Hymenaster nobilis, Wyv.-Thoms. Journ. Linn. Soc., Zool. vol. xiii. p. 73, fig. 11; Sladen, 'Challenger' Asteroidea, p. 495, pl. lxxxvii. figs. 1–3.

A magnificent specimen, with a major diameter of nearly 8 inches, from Station 117, 1748 fathoms.

Colour in the fresh state plum-purple.

Family Echinasteridæ.

Dictyaster, gen. nov.

Disk large, and flat like the short rays.

Abactinal surface covered with tough membrane, beneath which are narrow plates bearing stout spinelets, and forming a wide-meshed irregular network, the meshes of which are occupied by large groups of papulæ.

Marginal plates, especially the supero-marginals, small and inconspicuous, the infero-marginals each with a short comb of stout spines; the intervals between the plates with groups of papulæ.

Actinal interradial areas large, covered with a smooth thick membrane, beneath which is a reticulum of irregular plates.

Adambulacral armature forming a double palisade along the furrow. Tube-feet in a double row, their tips ending in a sucker.

Madreporiform body small. Anal aperture subcentral. No pedicellariæ.

19. *Dictyaster xenophilus*, sp. n.

Plectaster, sp., Wood-Mason and Alcock, Ann. & Mag. Nat. Hist. Jan. 1891, p. 14.

Rays 5. $R = 2{\cdot}5\ r$.

The whole animal invested in a thick coriaceous membrane.

Disk and rays flat and broad; interbrachial arcs wide.

Abactinal surface with narrow plates, bearing large coarse spines solitary or in rows of two or three, and forming a wide-meshed reticulum, the meshes of which are occupied by papulæ in large crowded groups.

Infero-marginal plates alone at all distinct, not in contact one with another; each bears a hinged comb of from three to five large coarse spines along its actinal margin.

Adambulacral plates covered by the general thick coriaceous investment; the narrow ambulacral groove is bounded on each side by a double series of stout palisade-like spines, those in the outer series being about half as numerous but about twice as big as those in the inner series. Mouth-plates hardly differentiated.

Actinal interradial areas large, with an irregular network of unequal plates beneath the smooth coriaceous membrane. A symbiotic Chætopod is often found on the interradial areas on which also it often lays its eggs.

Madreporiform body small, somewhat sunken, situated almost in the centre of an interbrachial arc.

Anal aperture small, subcentral.

Tube-feet in a double row, their tips ending in a sucker.

Colour in the fresh state chestnut-brown.

From Station 115, 188 to 220 fathoms.

This remarkable species has been frequently found by us in the Andaman Sea at about 250 fathoms.

Family Brisingidæ.

Brisinga, Asbjornsen.

20. *Brisinga insularum*, sp. n.

Allied to *B. coronata*, Sars.

Rays 13, long, stout, with ovarian regions much inflated, and the transverse calcareous ridges well developed. Disk comparatively large.

Ambulacral tube-feet separated by a pair of horizontal spines.

Colour in the fresh state bright cinnabar-red.

Station 108, 1043 fathoms.

21. *Brisinga bengalensis*, sp. n.

Rays 14, long, slender, with hardly conspicuous ovarian inflations, and little developed transverse calcareous ridges. Disk small, margin strongly bevelled, depressed abactinally.

Ambulacral tube-feet separated by a pair of horizontal spines. Mouth-spines very long and broad, dagger-shaped, closely felted with pedicellariæ.

Colour in the fresh state bright cinnabar-red.

Station 112, 561 fathoms.

22. *Brisinga andamanica*, sp. n.

Rays 15, long, slender, with hardly conspicuous ovarian inflations, and transverse calcareous ridges little developed. Disk of moderate size.

Ambulacral tube-feet separated by a pair of horizontal

spines. Mouth-spines of moderate length, narrow, closely felted with pedicellariæ.

Colour in the fresh state bright cinnabar-red.

Station 116, 405 fathoms.

Freyella, Perrier.

23. *Freyella benthophila*, Sladen.

Freyella benthophila, Sladen, 'Challenger' Asteroidea, p. 641, pl. cxi. figs. 5–8.

Specimens from Stations 110, 1997 fathoms, and 118, 1803 fathoms.

Colour in the fresh state bright cinnabar-red.

This species was taken in 1888 in the Bay of Bengal, in 1520 and 1590 fathoms.

Class **ECHINOIDEA.**

Order CIDAROIDA.

Family **Cidaridæ.**

1. Porocidaris, Desor.

A small specimen with a test of 8 millim. diameter from Station 116, 405 fathoms.

Colour : madder, with white points.

Order DIADEMATOIDA.

Family **Echinothuridæ.**

2. Phormosoma, Wyville-Thomson.

Scores of fine specimens of a large species were taken in the Andaman Sea at Stations 115 and 116, in 188 to 405 fathoms.

Family **Arbaciidæ.**

Podocidaris, A. Agassiz.

3. *Podocidaris ?prionigera*, A. Agassiz.

Porocidaris prionigera, A. Agassiz, 'Challenger' Echinoidea, p. 59, pl. xxxiv. figs. 14 and 15.

Specimens from Station 112, 561 fathoms.

The same species was dredged in the Bay of Bengal at 1590 fathoms in the year 1888.

Family **Temnopleuridæ (?).**

PRIONECHINUS, A. Agassiz.

4. *Prionechinus Agassizii*, sp. n.

This species differs from *Prionechinus sagittiger* in the following particulars:—The test is thick; there are five complete pairs of buccal tentacles; and the ambulacral plates have three pairs of pores and one primary tubercle to each plate. The pairs of pores are in one simple vertical series in triplets concentric with their tubercle, so as to be slightly wavy, especially below the ambitus, where in the region of the actinostome they are very distinctly zigzag.

Both ambulacra and interambulacra are made up of two rows of simple plates, those of the ambulacra being of the same height, but only between one half and one third the breadth of those of the interambulacra.

The median interambulacral grooves and the slightly depressed poriferous zones divide the test into segments like those of a peeled orange.

Diameter of test 13·8 millim., of actinostome 6·5 millim., of periproct 3 millim.

From Station 111, 1644 fathoms.

Two fine specimens were dredged in the Bay of Bengal, at 1840 fathoms, in the year 1888.

Order SPATANGOIDA.

Family **Spatangidæ.**

HOMOLAMPAS, A. Agassiz.

5. *Homolampas glauca*, sp. n. (Pl. XVII.)

Differs from *Homolampas fulva*, A. Agassiz, (1) in being more depressed, (2) in having the posterior end of the test truncate and unnotched, and (3) in the narrower ventral plastron.

Colour in the fresh state brownish green.

Four specimens from Station 111, 1644 fathoms, the largest measuring 93 millim. in length.

Class HOLOTHUROIDEA.

Of Holothurians very numerous specimens of twelve species and nine genera were obtained, and they have in large part been identified by Surgeon I. H. Tull Walsh, I.M.S., who has given a list of most of the 'Investigator' deep-sea Holothuroidea in the Journ. As. Soc. Beng. vol. lx. pt. ii., 1891, pp. 197–204, to which we refer for names of species and notices of two new genera.

In the Andaman Sea *Benthodytes* appears to live in large colonies at moderate depths; and besides *Benthodytes*, *Pannychia*, *Eupyrgus*, and a new type of Deimatidæ, according to Mr. Walsh, were found.

On the *Globigerina*-ooze of the greater depths of the Bay of Bengal Holothurians, especially of the bathybial order Elasipoda, seem to find an optimum, and specimens of the following were trawled:—*Peniagone* (1803 fathoms), *Deima*, two species (1644 to 1803 fathoms), *Orphnurgus* (561 fathoms), *Euphronides* (1803 fathoms), *Benthodytes*, two species (1748 to 1803 fathoms), and *Apodogaster* (561 fathoms), the last being a new genus of the Psychropotidæ established by Mr. Walsh.

In the Laccadive Sea numerous Holothurians were taken between 738 and 1091 fathoms—*Deima*, *Benthodytes*, and *Eupyrgus*.

Class OPHIUROIDEA.

Of this class numerous specimens, of thirteen species and seven genera, were collected.

In the Andaman infra-littoral down to 400 fathoms, just as in the Andaman littoral zone, brittle-stars have been found to be in this, as in previous seasons, very numerous, especially where the bottom contains many *Globigerina*-shells and much coral-detritus. A beautiful pink *Ophiothrix* is very common here, the swabs often coming up completely encrusted with it.

In the opener parts of the Bay of Bengal, where, along with increasing depth and distance from land, the bottom comes to be made up largely of the shells of Foraminifera, a good many Ophiuroids were taken, up to the greatest depth in which the trawl was worked.

In the Andaman Sea, besides the multitude of *Ophiothrix*, were found *Ophioglypha* (405 fathoms) and a beautiful species of *Ophiernus* with disk of deep purple and rays of bright scarlet (683 fathoms).

In the Bay of Bengal four species of *Ophioglypha* were taken in 561 to 1803 fathoms, two species of *Ophiomusium* in 1748 to 1997 fathoms, a species of *Ophiomastus* in 1997 fathoms, and two species of *Ophiacantha* in 1644 to 1803 fathoms.

In the Laccadive Sea brittle-stars were seldom seen; two good specimens of the same beautiful purple and scarlet *Ophiernus* as that recorded from the Andaman Sea were taken in 1043 fathoms, and a single small specimen of a species of *Amphiura* in 1091 fathoms.

Class CRINOIDEA.

On muddy bottoms in the Andaman Sea some small and rather damaged specimens of two species of Comatulæ were trawled. These were *Eudiocrinus*, from 922 fathoms, and *Antedon*—a ten-armed species—from 188 to 220 fathoms.

Phylum MOLLUSCA.

Branch A. Glossophora.

Class GASTROPODA.

Family Naticidæ.

1. *Sigaretus*, sp.

Numerous specimens were found at Station 119, in 95 fathoms, and a few at Station 120, in 240 fathoms. This species is characteristic of the infra-littoral of the Bay of Bengal at and near the 100-fathom line from the Mahánadi to the Kistna. The operculum is without a basal prolongation.

2. *Natica* (*Naticina*), sp.

Specimens were met with in the Andaman Sea at 405 fathoms, in the Bay of Bengal in 240 to 276 fathoms, and in the Laccadive Sea at 738 fathoms. This species has twice been found in the stomach of a starfish.

3. *Natica*, sp.

Three dead shells from the Andaman Sea, 683 fathoms.

Family **Trochidæ**.

4. *Solariella metallica*, sp. n.

A brilliantly nacreous species, ornamented with two spiral rows of conical tubercles and four smooth carinæ on the base, exclusive of a faintly granulated one which bounds the umbilicus. From 738 fathoms in the Gulf of Manaar (Station 109). The glistening metallic lustre of the whole exterior is largely though not entirely due to the erosion of the delicate external layer of the shell.

Fig. 12.

Solariella metallica.—*a*, from the front; *b*, from the base. Natural size.

Family **Strombidæ**.

5. *Rostellaria delicatula*, Nevill.

Rostellaria delicatula, Nevill, Journ. As. Soc. Beng. vol. l. (1881) pt. 2, p. 262; Wood-Mason and Alcock, Ann. & Mag. Nat. Hist. (6) vii. p. 16.

Many specimens in various stages of growth from Station 119, 95 fathoms.

This form, already noticed to be characteristic of the Bay of Bengal infra-littoral at and near the 100-fathom contour from Arrakan to the Godávari, is now found off the Kistna Delta, about seventy miles further south.

Family **Pleurotomidæ**.

6. *Pleurotoma symbiotes*, sp. n.

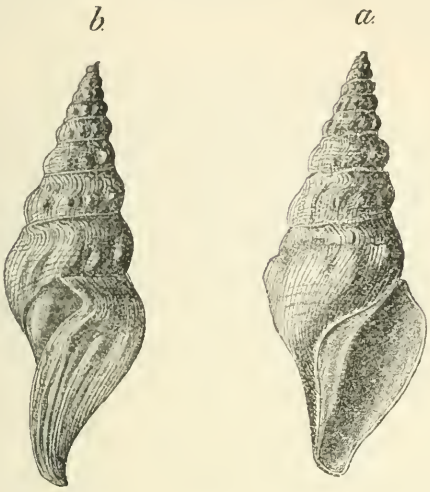
Two living specimens from the Laccadive Sea, 1043 fathoms (Station 108).

They were encrusted all over with an *Epizoanthus*.

The shell is remarkable for its peculiar glistening white

outer layer, with which is most beautifully contrasted the pale cinnamon interior.

Fig. 13.



Pleurotoma symbiotes.—*a*, from in front; *b*, from the side. Natural size.

Dead and eroded shells of four species of Pleurotomids were taken at the following stations:—112, 561 fathoms; 113, 683 fathoms; 115, 188 to 220 fathoms.

Family **Pterotracheidæ.**

7. *Carinaria*, sp.

At Station 118, 1803 fathoms. Probably from the surface.

Family **Pleurobranchidæ.**

8. *Pleurobranchus*, sp.

At Station 116, in 405 fathoms, a species coloured dark purple.

Family **Pleurophyllidiidæ.**

9. *Pleurophyllidia*, sp.

At Station 120, 240 to 276 fathoms.

Class SCAPHOPODA.

Dead shells of two species of (10) *Dentalium* and of a species of (11) *Cadulus* were dredged at Station 113 in the Andaman Sea.

Class CEPHALOPODA.

Specimens of three species of Cephalopods were obtained, namely (12) *Cirroteuthis*, in the Gulf of Manaar, at 738 fathoms; (13) *Inioteuthis*, in the Andaman Sea, at 188 to 120 fathoms; and (14) a *Loligo*-like form from the same station.

The *Cirroteuthis* was jet-black in colour during life, and imparted to the spirit in which it was preserved a purple hue, which has permanently stained the paper label accompanying the animal.

The *Inioteuthis* was of an iridescent purple and green colour in life.

Branch B. LIPOCEPHALA.

Class LAMELLIBRANCHIATA.

Family Pectinidæ.

15. *Amussium*, sp.

Specimens of *Amussium* were obtained in the Andaman Sea at 683 and 922 fathoms, in the Bay of Bengal at 561, 1748, and 1803 fathoms, and in the Laccadive Sea at 738 fathoms. They appear to belong to four species.

Family Arcidæ.

16. *Arca* (*Barbatia*), sp. conf. *pteroessa*, Smith, or *ectobarbata*, Dall.

Five specimens from Station 111, 1644 fathoms.

17. *Limopsis*, sp.

Two species were dredged, one in the Andaman Sea in 683 fathoms, the other in 1043 fathoms in the Laccadive Sea.

Family Ledidæ.

18. *Malletia*, cf. *arrouana*, Smith.

From the Laccadive Sea at 1091 fathoms.

Family **Cuspidariidæ.**

19. *Cuspidaria*, sp.

Four species, all from the Andaman Sea between 188 and 405 fathoms.

Family **Verticordiidæ.**

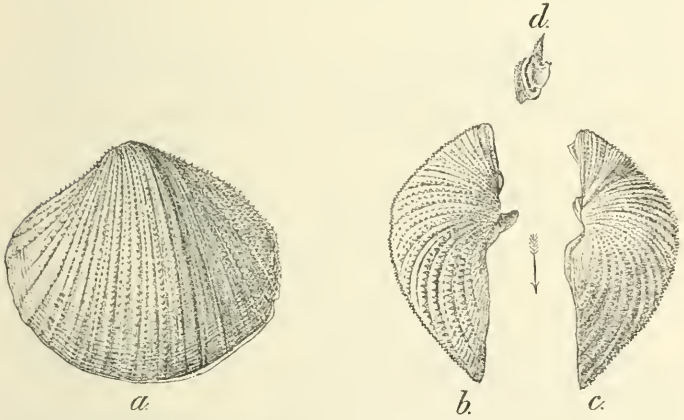
20. *Verticordia* (*Euciroa*) *eburnea*, sp. n.

Allied to *Euciroa elegantissima*, Dall.

The shell in the dry state is of a beautiful ivory-white externally, discoloured slightly at the ventral margin by the epidermis; internally it rivals *Trigonia* in its pearly lustre.

The external surface is traversed from beak to ventral margin with numerous ridges which bear sharp fluted conical spinelets. These ridges are best and most regularly developed about the middle of the shell, being few and wide apart and ventrally incomplete anteriorly, while posteriorly they are irregularly crowded together. The intervals between

Fig. 14.



Verticordia (*Euciroa*) *eburnea*.—*a*, from the left side; *b*, dorsal view of the right valve; *c*, the same of the left valve; *d*, ossicle still attached to the ligament of the right valve. All natural size.

the ridges are finely granulated. The left valve is slightly smaller than the right, into which it fits ventrally, and has only one tooth—a posterior lateral. The right valve has a posterior lateral tooth, which is anterior to that of the opposite

valve, and an anterior tooth in the form of a broad and stout-based projecting massive hook, which is received into a notch of the left valve lying beneath the umbo between the ligamentary fossa and the lunule. Except for a mere film joining the valves externally in the usual position the ligament is internal. A stout, convex, posteriorly-bifid ossicle connects the ligaments of the valves with one another.

Most striking is the curious lunule, which suggests in-turned ears.

A fine living specimen from Station 115, 188 to 220 fathoms, measuring in length 37 millim., in height 33·2 millim., and in thickness 26·8 millim.

21. *Verticordia*, sp.

From the Bay of Bengal, in 1997 fathoms.

Family **Tellinidæ**.

22. *Tellina*, sp.

Two species were dredged, one from the Bay of Bengal at 561 fathoms, the other from 922 fathoms in the Andaman Sea.

Subgrade *CŒLENTERATA*.

Phylum **NEMATOPHORA**.

Class **SCYPHOMEDUSÆ**.

Order PEROMEDUSÆ.

Family **Periphyllidæ**.

Periphylla, Steenstrup.

1. *Periphylla*, sp.

A large species, with the internal organs rather ragged, from Station 120, 240 to 276 fathoms.

Order DISCOMEDUSÆ.

Family **Ephyridæ** (Collaspidæ).

Atolla, Hæckel.

2. *Atolla Wyvillii*, Hæckel.

Atolla Wyvillii, Hæckel, 'Challenger' Deep-sea Medusæ, pp. 113–123, pl. xxix.

Two specimens from Station 116, 405 fathoms, and one from Station 120, 240 to 276 fathoms.

Class ANTHOZOA.

Subclass ALCYONIOMORPHA.

Order PENNATULIDA.

At Station 115, 188 to 220 fathoms, a fine specimen of a *Pennatula* was obtained; it is of a remarkable rich orange colour, the pigment being insoluble in alcohol.

At the same Station was dredged a large specimen of an *Umbellula* near to *U. Carpenteri*, Kölliker.

At Station 118, in 1803 fathoms, some small specimens of an *Umbellula* of a bright pink colour occurred.

Subclass ACTINIOMORPHA.

Order ACTINIARIA.

Family Actinidæ.

Eight species of bathybial Actiniaria were obtained during the season between 240 and 1997 fathoms. Among them is an *Epizoanthus* encrusting a shell of a living Pleurotomid, from the Laccadive Sea; and a remarkable rigid cup-shaped form with a non-retractile peristome, from the mud of the Bay of Bengal.

Order MADREPORARIA.

MADREPORARIA APOROSA.

Family Turbinolidæ.

Flabellum, Lesson.

1. *Flabellum japonicum*, Moseley.

Flabellum japonicum, Moseley, 'Challenger' Deep-sea Madreporaria, p. 168, pl. vii. figs. 3, 3 *a*, pl. xvi. fig. 12.

A series of ten specimens (five living and five dead)—the smallest of which measures ·95 by ·85 of an inch, the largest 3 by 2·25 inches in the diameters of the calicular orifice—was taken at Station 109, 738 fathoms.

In the smaller specimens the corallum is wide and shallow, with the primary and secondary costæ well marked, the columella abundant and formed of contorted fascicles, the fifth

cycle of septa incomplete and inconspicuous, and the pedicle very prominent.

In the larger specimens the calicle is deep and more compressed, the primary and secondary costæ are inconspicuous, while in the other cycles in place of costæ there are shallow furrows, the columella is a small smooth dense plug in the very bottom of the calicle, the fifth cycle of septa is complete, and the pedicle is a small obtuse point.

The difference between the two extremes is so marked that, but for the possession of a fairly well-graded series, it might fairly have been regarded as specific. The inside of the dry corallum is, like the soft tissues of the polyp, of a dark madder-colour.

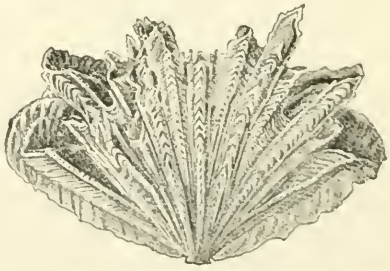
2. *Flabellum laciniatum*, Philippi.

Phyllodes laciniatum, Philippi, Neues Jahrb. für Mineral. &c., 1841, pp. 663 and 664, pl. xi. B. fig. 2.
Flabellum laciniatum, Edw. & H., Ann. Sci. Nat. (3) ix. p. 273; Hist. Nat. Corall. ii. p. 92.
Flabellum laciniatum, Seguenza, Mem. Ac. Torin. (ii.) xxi. p. 485, tav. x. fig. 7.
? *Flabellum laciniatum*, Duncan, Proc. Roy. Soc. xviii. p. 293; id. Trans. Zool. Soc. viii. p. 323, pl. xxxix. figs. 11, 14–18.
? *Flabellum laciniatum*, Lindström, Svensk. Ak. Handl. xiv. ii. p. 12.

A single specimen, in very fair preservation, from Station 116, 405 fathoms, which we name with some confidence from Philippi's description.

We are not able, however, to identify it with Prof. Martin Duncan's figures, which appear to represent young and therefore not unequivocally determinable forms of *Flabellum*.

Fig. 15.



Flabellum laciniatum, Phil., natural size.

We agree with Prof. Moseley ('Challenger' Deep-sea Madreporaria, p. 170) in considering that his *Flabellum ala-*

bastrum is specifically quite distinct from *Flabellum laciniatum*. In the latter the calicle is more wedge-shaped, not laterally compressed in the middle, and less conspicuously pedunculate, and its margin is much more deeply indentated between the septa; the columella is a mere rudiment in the bottom of the calicle, and the lateral costæ are much more nearly horizontal and are extremely prominent, forming with their corresponding septa conspicuous lateral wings. The dry corallum, like the living polyp, is of a dark madder-colour.

Our specimen measures about 2 inches in the major and 1·2 in the minor diameter of the calicular orifice.

Phylum **PORIFERA.**

Class **SILICOSPONGIÆ.**

In the Andaman Sea, Station 115, 188 to 220 fathoms, proved a harvest-field for Sponges, as for Fishes, Crustaceans, and Echinoderms. Here a large number of *Hexactinellida* was obtained, including numerous huge specimens, over two feet in length, of a *Semperella*, a large *Pheronema*, and two species of *Hyalonema*.

The depths of the Bay of Bengal yielded many Hexactinellid forms, among which we recognize (1) an Asconematoid forming a thin-walled, shallow, broad-lipped cup, composed of a felt of long spicules, from 1997 fathoms, (2) a fine specimen of an *Aulochone* from 1803 fathoms, (3) a small *Hyalonema* from 1997 fathoms, and (4) several species of Euplectellids.

Grade A. PLASTIDOZOA.

Class **RETICULARIA.**

In such examination as has been made of the ocean-deposit brought up by the sounding-tube and trawl during the season the only notable Foraminifer discovered is a large species of *Hormosina*, which combines some of the characters of *Hormosina ovicula*, H. B. Brady, with some of those of *Hormosina monile*, H. B. Brady. The test, which is long, slender, and tapering, is composed of numerous subpyriform segments arranged in a straight line in a very close-set diminishing series; the walls are smooth, thick, and strong, with a compact finely arenaceous texture; colour red-brown.

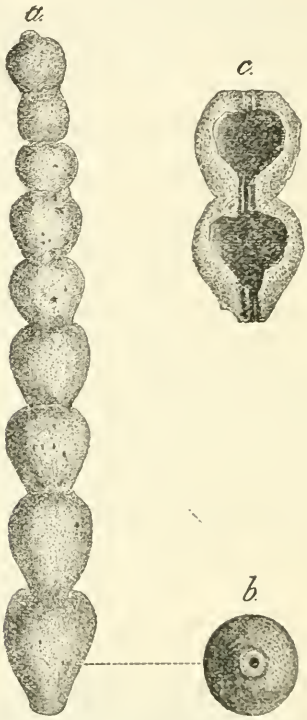
The largest fragment measures 8·5 millim. in length.

The cavities of the chambers have the form of a short, flat-topped pear.

Several specimens from the Bay of Bengal at 561 fathoms (Station 112).

For this species we propose the name *Hormosina Bradyi*, after our late friend Dr. H. B. Brady, F.R.S.

Fig. 16.

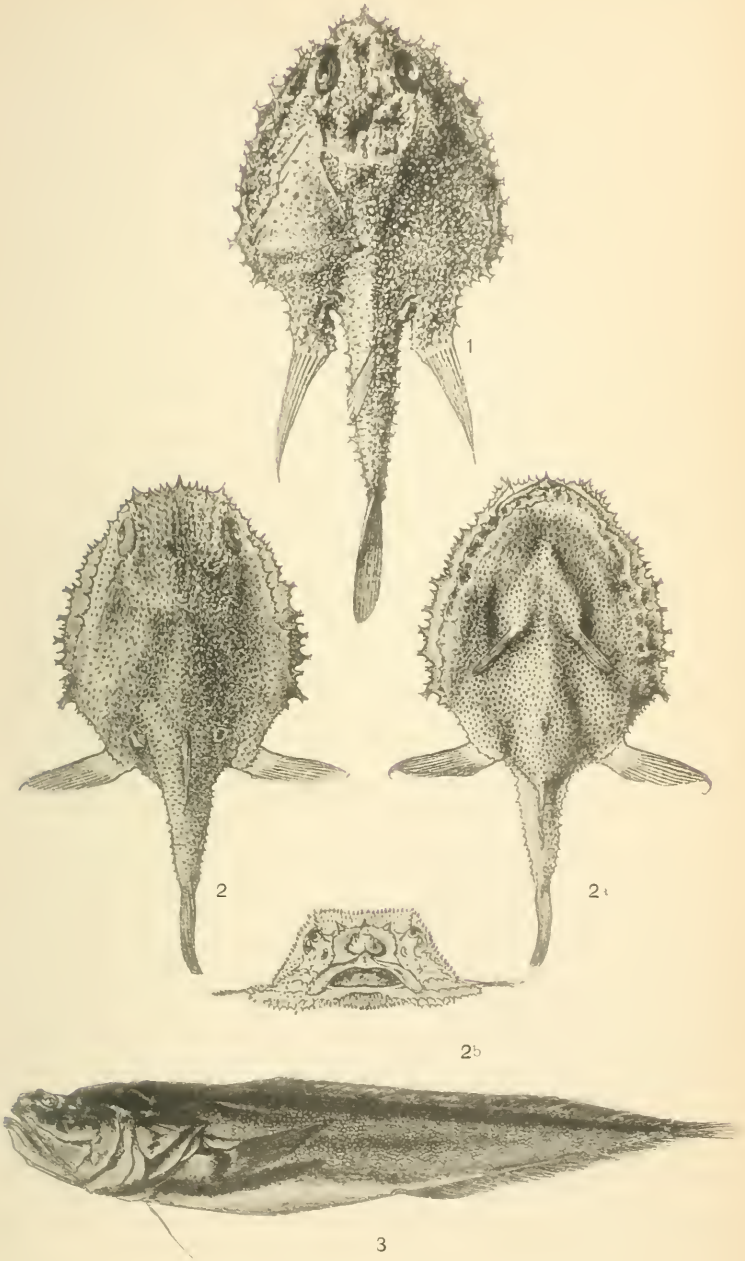


Hormosina Bradyi.—*a*, lateral view; *b*, oral view; *c*, two consecutive chambers in longitudinal section. ×.

EXPLANATION OF PLATE XVII.

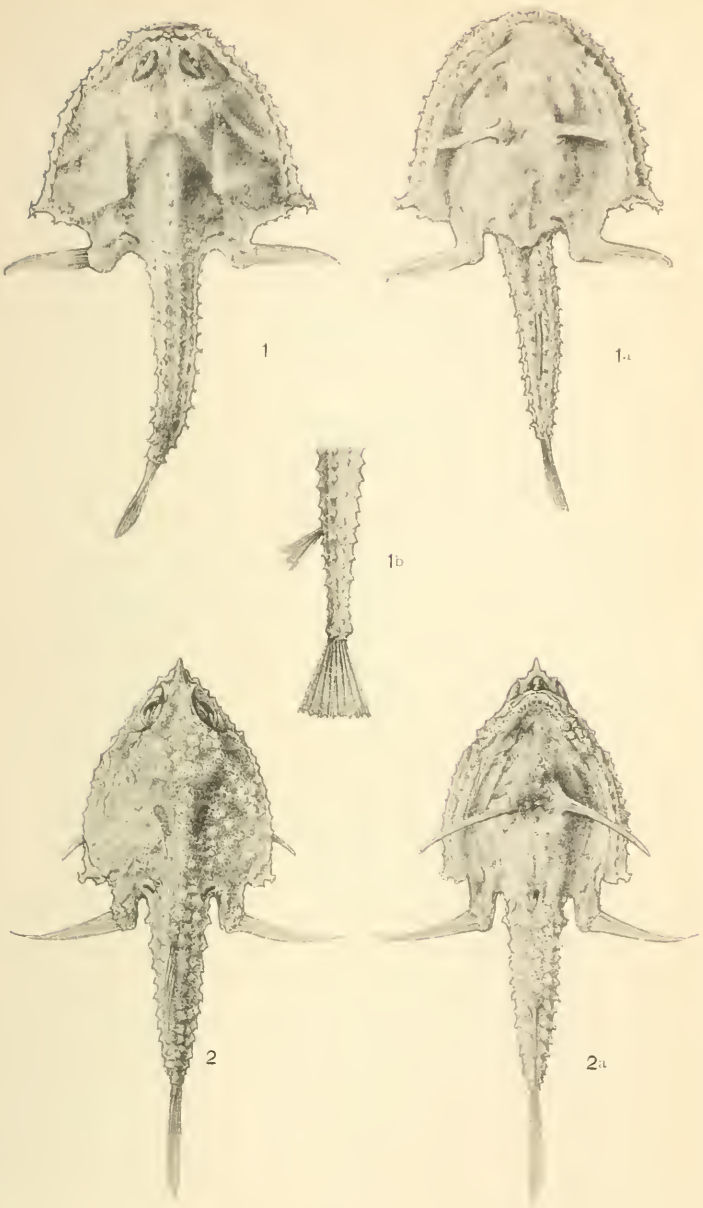
Fig. 1. *Homolampas glauca*, from the abactinal side. Nat. size.
Fig. 2. Ditto, from the actinal side. Nat. size.

[To be continued.]



A. C. CHOWDRY DEL.

INDIAN DEEP-SEA FISHES.



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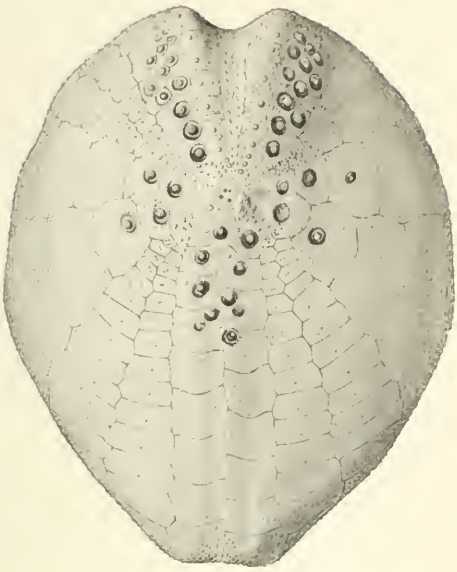

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HOMOLAMPAS GLAUCA. W-M & A

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

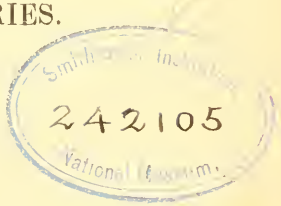
ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, Ph.D., F.L.S.

VOL. IX.—SIXTH SERIES.



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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 52. APRIL 1892.

XLI.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R. F. Hoskyn, R.N., commanding.*—Series II., No. 1. *On the Results of Deep-sea Dredging during the Season* 1890–91. By J. Wood-Mason, Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College of Bengal, and A. Alcock, M.B., Surgeon I.M.S., Surgeon-Naturalist to the Survey.

[Continued from vol. viii. p. 362.]

[Plates XIV. & XV.]

Family **Psalidopodidæ**, fam. nov.

Olfactory flagellum of antennules simple. Mandible deeply divided into molar and incisive processes and furnished with a 2-jointed palp. The exopodite of the first maxillipede is a broad and abruptly incurved falciform plate which does not terminate in a flagellum, and is not expanded at the outer margin into a process. The exopodites of the second and third maxillipedes are undivided, porreet, and membranous flagella. The thoracic appendages from the second to the eighth inclusively have the third (ischiopodite) and fourth (meropodite) joints fused, and are hence all 6-jointed with

the exception of the third pair, in which the sixth and seventh joints are in addition fused, and there are hence only five distinct joints; those of the fourth pair are formed as in the Crangonidæ, but, instead of terminating in a subchela, end in two equal and movable blades forming a scissors-like organ; those of the fifth pair, which are the shortest and weakest of the limbs, bear a probably expansile pencil of setæ at the distal end of the propodite, which is the functional last joint of the limb, the dactylopodite being reduced to a minute rudiment; the sixth, seventh, and eighth pairs form a backwardly increasing series of walking legs; the five last pairs are devoid of all traces of epipodites and exopodites.

The thorax is firmly articulated to the abdomen by a strong hinge.

In addition to the functional gills, which are five pleurobranchiæ attached to the posterior thoracic somites from the tenth to the fourteenth inclusively, there is present, on the arthrodial membranes of the thoracic appendages from the ninth to the thirteenth inclusively, a series of five small conical papillæ, which correspond both in number and in position to the arthrobranchiæ of the Glyphocrangonidæ, and are, there is little doubt, to be interpreted as vestiges of gills of the same category.

The body is exceedingly spiny and terminates in front in a powerful recurved rostrum, which is toothed on all its four margins.

Psalidopus, gen. nov.

Body moderately compressed, in shape somewhat like *Palæmon*. Integument firmly chitinized though thin, covered throughout dorsally, from the apex of the rostrum to the end of the sixth abdominal somite, with long symmetrically arranged needle-shaped spines, and between the spines with microscopically small setæ, which are evenly and regularly distributed, and give to the surface a minutely granulated appearance up to the base of the caudal swimmeret, upon which they become developed into a furry pubescence.

The carapace is produced in front into a long ascendant curved rostrum fully twice its own length measured from the frontal to the posterior margin in a straight line; its anterior margin is armed on both sides with four spines, which may be termed the antennulary, antennal, branchiostegal, and subbranchiostegal spines respectively, and with a stout blunt subtriangular deflexed process, against the inner margin of which the rudimentary eye-peduncles are firmly retracted;

a distinct marginal raised rim extends from the subbranchiostegal spines backwards on each side, increasing towards the posterior margin, being especially well-marked posterolaterally, where it rises into a strong and bold ridge, forming at each end of the carapace the posterior boundary of a deep groove; the ridge with the groove concentric therewith constituting the thoracic element of a strong thoracico-abdominal hinge.

The branchiostegites are abruptly inflected, and their free margins, which are closely applied to the bases of the legs, are widely but obtusely angulated inwards opposite to the interval between the first and second pairs of legs anteriorly, while posteriorly they give off a triangular process which abuts against the posterolateral face of the eighth thoracic sternum, and thus serves not only to keep the two elements of the thoracico-abdominal hinge in constant relation of apposition with one another, but also to divide that which answers to the afferent branchial cleft in *Astacus* into two parts, an inferior and a superior: in the former of these the free margin of the carapace is in such close contact with the leg-bases as to leave no passage for water to enter; the latter, on the contrary, is a wide and rigidly-patent oval aperture placing the branchial chamber of its own side in direct communication with the subabdominal cavity, and forms the exclusive inlet for the water required for respiration: whence it follows that all the water which enters the branchial chambers must do so by way of the subabdominal cavity, and that during life a constant circulation must be maintained in this cavity; in the female, in which the special afferent branchial apertures are larger than in the male and the subabdominal cavity forms a spacious brood-pouch, the constant circulation of water in the latter must secure a more perfect aeration of the eggs than would otherwise occur; there is no doubt, in fact, that we have here to do with a mechanism for securing the due aeration of the eggs similar to that which exists in *Encephaloides Armstrongi* and other deep-water Brachyura (Ann. & Mag. Nat. Hist. (6), vii. pp. 259, 266, et 267), wherein the branchial cavities communicate with the brood-cavity by means of canals in the hinder angles of the cephalothorax and, the ordinary direct channels being closed, water for respiration is derived from the brood-cavity.

The rostrum is compressed, and presents four longitudinal spiny ridges—one dorsal, two lateral, and one ventral; the spines of these are all sharp, slender, forwardly curved and inclined, and decrease in length from the base towards the obsoletely bifid apex of the rostrum. The dorsal ridge is

continued to the posterior margin of the carapace; its spines are larger, more compressed, and less inclined, though more curved, than those of the rostrum, and subequal, with one or two shorter and slenderer ones intercalated between them here and there. In addition to the dorsal ridge the carapace bears on each side four other longitudinal rows of spines: the first of these runs quite close and subparallel to the dorsal ridge from one end of the carapace to the other; the second commences with the antennulary spine, curves slightly downwards and then slightly upwards to the cervical suture, whence it takes a straight course to the hinder margin, running parallel to the dorsal ridge; the third consists of the antennal spine and of two spines on the posterior half of the cephalic portion of the carapace; the fourth, of five or six spines commencing with the branchiostegal spine, and runs along the middle of the prominent efferent branchial canal, and like the second has its spines connected by a ridge.

The surface of the part of the branchiostegite coinciding with the subjacent branchial chamber is raised into a longitudinally oval convex-topped elevation, which is fringed at the edges with strong spines and bears an irregular row of five or six along its middle. Between the branchial elevation and the almost horizontally inflected portion of the carapace are some smaller spines roughly in the same straight line with those on the efferent branchial canal.

The abdomen is armed along the middorsal line with a spiniferous ridge similar to that of the cephalothorax and extending almost without interruption from the base to the apex, being absent only in the basal half of the fifth tergum, on the sides of its terga and pleura with symmetrically arranged spines similar in form to those of the dorsal ridge, and on the edges of each of its pleura with several exceedingly long and slender needle-like spines, besides smaller ones; the number, form, arrangement, size, and direction of these spines, which vary within small limits in all of the above respects from specimen to specimen, will be best understood by reference to the accompanying figures. The first abdominal somite is produced in front on each side at the junction of the tergum with the pleuron into a short, stout, bifid, and incurved process, which forms the abdominal element of the thoracico-abdominal hinge, and is received into the groove in the hinder margin of the side of the carapace already described. The pleura of the second abdominal somite are much more expanded in the female than in the male. The telson is elongate-triangular or obclavate in outline, its margin being at first rounded and then tapering in

straight or very slightly concave lines to the triangular apex; its dorsal surface, which is covered with a furry coating of minute appressed spinules, is transversely convex and traversed longitudinally by a deep groove, while its ventral surface is deeply excavated gutter-like and glabrous.

The eye-peduncles are very small and immovably retracted outwards against the extraorbital angle, being ankylosed at base to the ophthalmic sternum; a distinct constriction limits off a wider and almost spherical apical or corneal portion from a narrower basal portion; the latter bears on its inner and inferior side, near the base, a minute papilla; the corneal portion is smooth and polished, and does not exhibit the slightest trace either of superficial faceting or of subjacent pigmentation; the eyes appear, in fact, to be in exactly the same degenerate condition as those of *Nephropsis Stewarti*, and it is certain can be capable at most of appreciating differences in the intensity of the light.

The peduncle of the antennules is subcylindrical; its first joint is about equal to the two remaining joints taken together, crested on the infero-internal margin, the crest running into an acicular spine some distance from the apex, and produced at its outer base into an oval digitate scale-like process; the second and third joints subequal, the latter armed with an acicular spine about the middle of its extero-superior face; flagella equal in length, the outer the thicker (much the thicker in ♂), and bearing olfactory filaments to within a short distance of its extremity.

The second joint of the antenna is armed with three spines on the outer apex; the scale is a narrow, firmly chitinized, oblong plate, with an acute triangular somewhat inturned point; it is strengthened and stiffened not only by its greatly thickened outer margin, which terminates some distance from the apex of the part in a prominent spine, but also by a stout midrib and a slight thickening of the apical and inner margins. The flagellum is very long.

The mandible is very distinctly divided into molar and incisive processes by a deep and almost rectangular notch, in which the palp is lodged. The incisive process is a thin, excessively sharp, and slightly recurved knife-like plate. The stout molar process may be described either as an irregular four-sided prism with one angle broadly rounded off or as an irregular three-sided prism with one side convex; its trapezoidal or subtriangular masticatory surface is concave with sharp edges. The palp is robust, two-jointed; the apex, with the greater part of the inwardly directed outer edge of its oval terminal joint, is beset with stiff setæ.

The coxopodite of the first maxillæ is much shorter and wider than the basipodite; the endopodite is a short, simple, and undivided finger-shaped joint with a few setæ on its outer apex, and the exopodite appears to be represented by a firmly chitinized round conchoidal plate, the convex face of which is turned downwards and backwards.

The coxopodite of the second maxillæ is but little shorter but much narrower than the basipodite, not extending nearly so far towards the middle line; the basipodite is subdivided; the endopodite differs from that of the first maxillæ only in being somewhat larger; the anterior lobe of the scaphognathite is much broader than the posterior lobe, in which the apical fringe is developed into excessively long and fine setæ.

In the first maxillipedes the coxopoditic plate is rudimentary and furnished with limp hairs, the functional jaw being entirely formed by the basipodite; the endopodite is a narrow slightly curved and knife-like pointed plate, the exopodite is a broad and abruptly incurved falciform plate, and the epipodite is two-leaved.

The second maxillipedes have only five distinct joints, the third and fourth joints of the typical malacostracous limb being indistinguishably fused together; the first joint bears a triangular epipodite, the second a long, tapering, undivided and membranous exopodite, the third is about as long as the second, but only about half its thickness, the fourth is short, about half as long as the third, the fifth is broadly subtriangular and does not enter into the formation of the functional jaw, which is wholly formed by the very short and broad wedge-shaped sixth joint.

The external maxillipedes present only five distinct joints, the sixth and seventh, as well as the third and fourth, joints being indistinguishably fused together. The first and second, which are ankylosed together, are short, stout, and subequal: the first bears a small oval and subpedunculated hard process, probably representing an epipodite; the second, a flagellar exopodite, similar to that of the second maxillipedes; the third joint, forming the functional jaw, is an obclavate compressed sclerite, and is strongly curved to the configuration of the underlying appendages; its inner margin bears no fringe of setæ; the fourth and fifth joints are slender, cylindrical, and fringed with narrow, transverse, scale-like rows of setæ on the inner edge; the fourth is a little shorter than the third and exactly half of the fifth, which latter is almost straight, and tapers beyond the middle of its length very slightly and gradually to a bluntish point bearing a few stiff setæ.

The legs of the first pair are built upon the same plan as

those of the Crangonidæ, which they closely resemble, and from which they chiefly differ in their scissors-like extremity. They present but six distinct true joints, one of the blades of the terminal scissors having to be interpreted as a movably articulated prolongation of the propodite, and the third and fourth joints being all but indistinguishably fused together. The first two joints are short. The third joint, which is strongly curved like the corresponding joint of the external maxillipede, increases slightly in thickness from the base to the apex, where its upper margin is prolonged into a sharp needle-like spine preceded by a few spinules. The fourth joint, short and obconic, also bears a similar spine in corresponding position. The fifth joint, or propodite, is oblong and somewhat compressed, it bears at the distal end two equal and movably articulated toothed knife-like blades—one answering to the fixed prolongation of the propodite, the other to the dactylopodite of the typical crustacean chela,—which are evidently capable of playing upon one another like the blades of a pair of scissors or shears.

The legs of the second pair are also only six jointed, the third and fourth joints being all but indistinguishably fused together. They differ remarkably in form from the preceding. The first two joints are as in the legs of the first pair. The third joint is a cylindrical rod armed with a few minute spinules on the upper margin, which terminates in a sharp spine. The fourth joint is also cylindrical, but shorter and much thinner than the preceding, and unarmed. The fifth joint, likewise cylindrical, is about half as long as the preceding and tapers slightly to its apex, where it bears a compactly coned pencil of possibly expansile setæ. The sixth joint is a minute, transversely elongated, nodular rudiment, lodged in a notch of the upper and outer margin of the distal end of the propodite.

The three remaining pairs of legs are quite different from their predecessors, and are substantially alike, differing from one another only in length and in the degree to which the fusion of their third and fourth joints has been carried. They are typical ambulatory limbs. The second only slightly exceeds the first, while the last, owing mainly to the great elongation of its propodite, greatly exceeds the second in length. They are roughly cylindrical and are armed below and on the contiguous parts of their sides throughout with sharp spinules, which in the fourth joint or meropodite assume an arrangement in two rows on the ventral edges of the joint, while the apices of the meropodite and of the obconic carpopodite each bear one median dorsal and at least one

lateral outstanding spine larger than the rest. In the last of these legs the third joint is fixedly united to the fourth, the division between the two perfectly retaining its primitive distinctness; in the second the union is more perfect, but the division may be readily made out on the inner side; while in the first the union is more perfect still, and the primitive distinctness of the parts is scarcely traceable; so that the fusion of the two joints in question becomes more and more perfect as we pass from behind forwards until at last it is no longer possible to distinguish them. The compound joint is curved, like its predecessors in the series, to fit the convex ventral surface of the thorax. Their terminal joint forms a stoutish curved and acuminately-pointed claw. There is no trace either of epipodites or of exopodites on any of the legs.

The protopodites of the abdominal appendages are long, being more than half the length of the rami in the first pair, and less than half their length in the succeeding pairs. The apical half more or less of their carinated outer margin is armed with small spines, which increase in length towards the apex, near to which there is usually a single spine that is much larger than the rest. Near their base on the posterior face a transverse suture divides them into a long distal and a short and incomplete proximal joint. Their rami are all long-lanceolate and undivided membranous plates, with the exception of the inner ramus of the first pair; this is in both sexes only about one third the length of the outer and is pyriform or obclavate in outline; flat and flexible and fringed with setæ on both edges in the female, it appears convex and stiff and glabrous and somewhat subulate or acuminate in the male, owing to the apical half more or less of its edges being folded up into a sort of tube, and owing to the fringe of its outer margin being reduced to short and simple setæ; the outer ramus of the first pair is in both sexes narrower than either of the rami of the succeeding pairs. In the appendages of the second to the fifth pairs inclusively the inner ramus is shorter and narrower than the outer, and is furnished near its base on the inner side with a short cylindrical *appendix interna*, provided at its apex with minute hooks for attachment to its fellow of the opposite side. In the second pair in the male there arises from the inner ramus, in front of and slightly internal to the *appendix interna*, a tapering finger-shaped *appendix masculina*, and the second joint of the protopodite is subdivided by a false joint into two approximately equal parts.

The rami of the sixth pair of abdominal appendages are firmly chitinized, rigid, oval plates, the outer almost twice the

width of the inner; the former is strengthened by a stout midrib and by a thickening of the outer margin, which terminates a good way from the apex in a prominent spine of the same size and character as that of the antennal scale; an inflexible diæresis extends inwards from the base of this spine up to the midrib. The inner ramus is strengthened by a similar midrib, from near the base of which a ridge extends obliquely inwards and backwards to the inner margin.

The legs of the first to the third pairs of opposite sides touch one another in the middle line, and their sterna are hence invisible without dissection; those of the last two pairs, on the contrary, are wider apart and their sterna are plainly visible and have the form of an inverted T, the cross stroke of which is, in the hinder and larger of the two, produced forwards, between the bases of the legs of the last pair and over its own down-stroke, as an acute angular (♂) or semicircular (♀) plate, beneath the sides of which the genital apertures can in the male be concealed.

The branchial formula is as follows:—

Somites and their appendages.	Podo-branchiæ.	Arthro-branchiæ.	Pleuro-branchiæ.	
VII.....	0(*ep.*)	0	0	=0+*ep.*
VIII.....	0(*ep.*)	0	0	=0+*ep.*
IX.....	0(*ep.r.*)	*r.*	0	=0+*r.*+*ep.r.*
X.....	0	*r.*	1	=1+*r.*
XI.....	0	*r.*	1	=1+*r.*
XII.....	0	*r.*	1	=1+*r.*
XIII.....	0	*r.*	1	=1+*r.*
XIV.....	0	0	1	=1
	2*ep.*+*ep.r.*	+5*r.*	+5	=5+5*r.*+2*ep.*+*ep.r.*

35. [*Psalidopus Huxleyi*, sp. n. (Pl. XIV. figs. 1, 2, 7.)

♀. Stouter. Thoracic and abdominal sterna unarmed. No tubercle between the last spine of the dorsal ridge and the posterior margin of the carapace.

Colour in life brilliant old-ivory white or straw-colour.

	millim.
Total length from apex of rostrum to tip of telson in a straight line	141
Length of rostrum from supra-orbital margin in a straight line	51·5
Length of carapace from supra-orbital to posterior margin	28·5
Length of abdomen from middle of anterior margin of first tergum to tip of telson	63
Length of telson	19·5
Length of antennal scale	21
Width of „ „	6
Length of antennulary flagella	37

A single ovigerous female was taken on April 12, 1888, 7½ miles east of N. Cinque Island, Andaman Sea, in 490 fathoms.

It carried twelve very large eggs, which in spirit measure no less than 3·8 × 2·7 millim.]

36. *Psalidopus spiniventris*, sp. n.
(Pl. XIV. figs. 3–6 *a*, 8; Pl. XV. figs. 1–10.)

♂ ♀. Slenderer. Two posterior thoracic and all the abdominal sterna with an erect spine in the middle line. A conical tubercle between the last spine of the dorsal ridge and the posterior margin of the carapace.

Colour in life deep-sea pink with white points.

	Male. millim.	Female. millim.
Total length from apex of rostrum to tip of telson in a straight line	106	128·5
Length of rostrum from supra-orbital margin in a straight line (tip gone in male)	40	51·5
Length of carapace from supra-orbital to posterior margin	20	25
Length of abdomen from middle of anterior margin of first tergum to tip of telson	47	59
Length of telson	15	18
Length of antennal scale	16	19
Width of ,, ,,	3·3	5
Length of antennulary flagella	37	35

An adult male and female, with one young specimen, were obtained at Station 116, 405 fathoms.

A small pair, in which the rostrum is much larger in the female than in the male, have come to light in the sorting of past seasons' collections. They were taken 8 miles S.E. of Cinque Island, Andaman Sea, in 500 fathoms.

Colour in life "more of a boiled lobster tint" [*i. e.* than other Crustaceans obtained at the same time and described in the same notes as pink and blood-red], "deepest on the spines" (*G. M. Giles*).

EXPLANATION OF THE PLATES.

Plate XIV.

Fig. 1. *Psalidopus Huxleyi*, ♀, from the left side. Nat. size.
Fig. 2. The caudal swimmeret of the same, from above. Nat. size.
Fig. 3. *Psalidopus spiniventris*, ♀. Peduncle of the left antennule, from above. ×4.
Fig. 4. Left antennal scale of the same, from above. Nat. size.

Fig. 5. Left leg of the first pair of the same, from the outside. ×4.
Fig. 6. Left leg of the second pair of the same, from the outside. ×4.
Fig. 6*a*. Apex of propodite of same, to show the rudimentary nodular dactylopodite.
Fig. 7. *Psalidopus Huxleyi*, last thoracic sternum with bases of legs of last pair of female. Nat. size.
Fig. 8. *Psalidopus spiniventris*, last thoracic sternum with leg bases of male. Nat. size.

PLATE XV.

Figs. 1, 1 *a*. *Psalidopus spiniventris*, mandible. ×5.
Fig. 2. First maxilla. ×5.
Fig. 3. Second maxilla. ×5.
Fig. 4. First maxillipede. ×5.
Fig. 5. Second maxillipede. ×5.
Fig. 6. Third maxillipede. ×2.
Fig. 7. Left abdominal appendage of the first pair in female. ×2.
Fig. 8. Left abdominal appendage of the second pair in female. ×2.
Fig. 9. Left abdominal appendage of first pair in male. ×2.
Fig. 10. Left abdominal appendage of second pair in male. ×2.

XLII.—*Description of a new Genus and some new Species of Heterocera from Central America.* By HERBERT DRUCE, F.L.S.

Fam. Ægeriidæ.

ÆGERIA, Fabr.

Ægeria armasata, sp. n.

Primaries and secondaries hyaline, with a slightly yellowish tinge, the costal, outer, and inner margins of the primaries edged with yellowish brown, the veins of both wings yellowish brown, those of the secondaries being the darkest; the fringe of the secondaries dark brown. The underside of both wings light yellow. The palpi and front of the head yellow; the antennæ dark brown, yellowish at the base; the thorax and abdomen blackish brown, with a yellow line at the base of the abdomen; the anal tuft yellowish brown; the legs orange, banded with black.

Expanse $1\frac{1}{4}$ inch.

Hab. Mexico, near Durango city (*Becker*).

A fine species, very distinct from all others known to me.

Ægeria mardia, sp. n.

This species is allied to *Ægeria tryphoniformis*, Walker,

LII.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R. F. Hoskyn, R.N., commanding.*—Series II., No. 1. *On the Results of Deep-sea Dredging during the Season* 1890–91. By J. Wood-Mason, Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College of Bengal, and A. Alcock, M.B., Surgeon I.M.S., Surgeon-Naturalist to the Survey.

[Continued from p. 275.]

Family **Acanthephyridæ**.

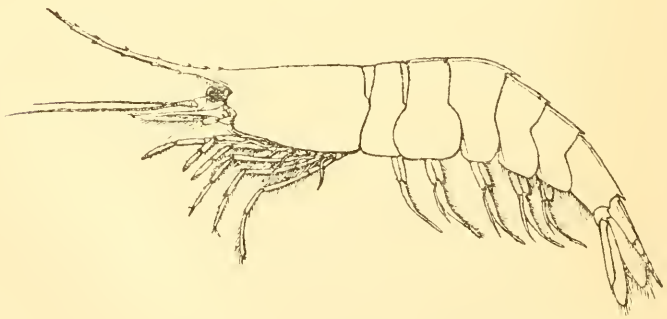
Acanthephyra, A. Milne-Edwards.

37. *Acanthephyra sanguinea*, sp. n.

♀. Closely allied to *A. Agassizii*, S. I. Smith, ♂ (*A. purpurea*, A. M.-Edw., ♀), from which it differs in the minute size of the spines of the anterior margin of the carapace, which are so small as to be scarcely discernible by the unaided eye; (?) in the armature of the telson, which bears only five pairs of dorsal spinules besides three longer and subequal terminal ones; in its longer and slenderer rostrum, which is fully twice the length of the antennal scale; and in its less elongated abdomen.

Colour in life deep crimson.

Fig. 1.



Acanthephyra sanguinea, ♀, nat. size.

Length, from tip of rostrum to tip of telson, 92 millim.; of carapace, from supraorbital to posterior margin, 18 millim.; of rostrum, from same point to tip, 26·5 millim.; of antennal scale 13 millim.; of abdomen 50 millim.; of telson 14·5 millim.

One female from Station 106, 1091 fathoms, one immature in fragments from Station 107, 738 fathoms, and a third from Station 117, 1748 fathoms.

♂. A male of about the same size as that of *A. Agassizii* figured by Prof. S. I. Smith was obtained in a previous season 7½ miles east of North Cinque Island, in the Andaman Sea, in 490 fathoms. It has a decidedly less elongated abdomen than *A. Agassizii*; its carapace has much the same shape, but the rostrum shows no signs of becoming porrect and reduced in length as in that species, for although it is broken off just in front of the third tooth of the lower series, it still extends fully to the end of the antennal scale.

Length, from supraorbital margin to tip of telson, 83 millim.; length of carapace, from supraorbital to posterior margin, 23·25 millim.; of antennal scale 15·25 millim.; of abdomen to tip of telson 59 millim.; of telson 17·25 millim.

38. *Acanthephyra armata*, A. M.-Edw.

Acanthephyra armata, A. M.-Edw. Ann. d. Sc. Nat. Zool. (6) xi. 1881, 4, p. 12, et Rec. Fig. Crust. 1883; Spence Bate, 'Challenger' Macrura, 1888, p. 744, pl. cxxv. fig. 2, ♂ var.

One fine male from Station 116, 405 fathoms.

Colour in life crimson.

Length, from tip of rostrum to tip of telson, 144 millim.; of carapace, from supraorbital to posterior margin, 35 millim.; of rostrum, from same point, 34 millim., from front of inferior spine to tip 17 millim.; of antennal scale 26 millim.; of abdomen to tip of telson 75 millim.; of telson 18 millim.

It differs from Milne-Edwards's figure in the following points:—The rostrum is of the same length as the carapace; its basal spines are only four in number; the spine of its inferior margin arises midway between its base and its apex, and is much more nearly opposite to the middle than to the apex of the antennal scale. The branchiostegal spine is continued backwards along the side of the carapace as a very strong ridge half as long as the antennal scale. The fringes of the legs are greatly developed, reminding one of those of the last two pairs of legs in *Sergestes*. The spines of the third to the sixth abdominal terga are equal.

It differs from the specimen figured and described by

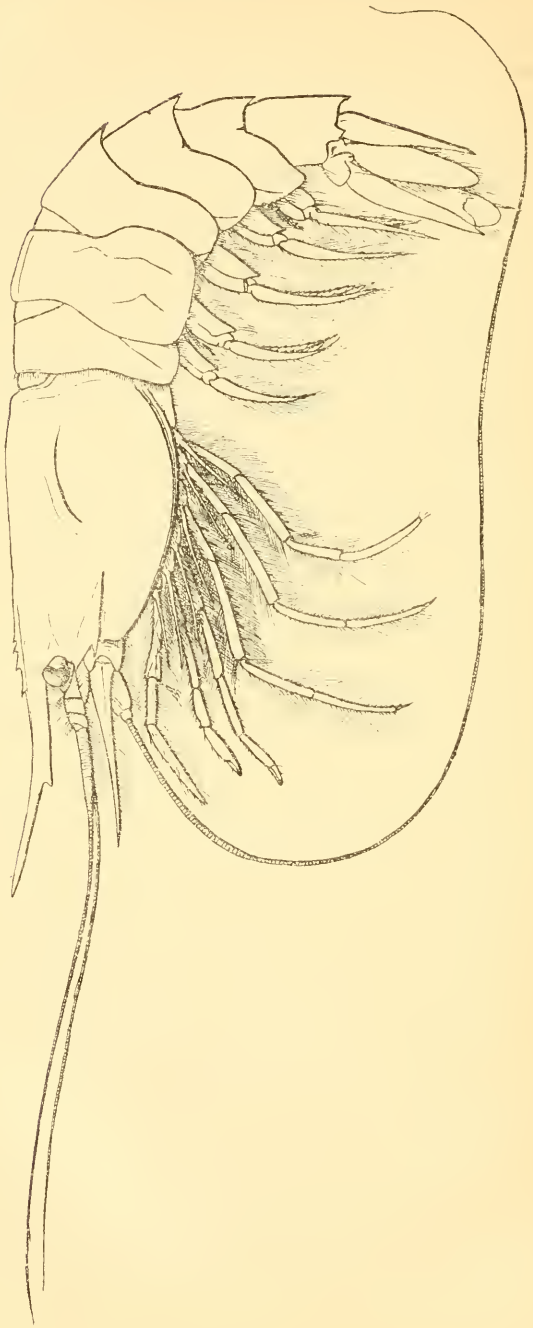


Fig. 2.

Acanthephyra armata, ♂, var., nat. size.

Spence Bate in the form and the armature of the rostrum, in the smaller spinous processes of the abdominal terga, and in the more highly developed fringes of the legs. The dactylopodite of the last pair of legs is incorrectly represented by Spence Bate as equal to those of the two preceding pairs.

39. *Acanthephyra microphthalma*, S. I. Smith.

Acanthephyra microphthalma, S. I. Smith, Proc. U. S. Nat. Mus. 1885, p. 502; Ann. Rep. Comm. Fish. 1886, p. 65, ♂ ♀, pl. xiii. fig. 3, ♂.
Acanthephyra longidens, Spence Bate, 'Challenger' Macrura, 1888, p. 735, pl. cxxiv. fig. 4, ♂.

Two males from Station 117, 1748 fathoms.

Colour in life deep crimson.

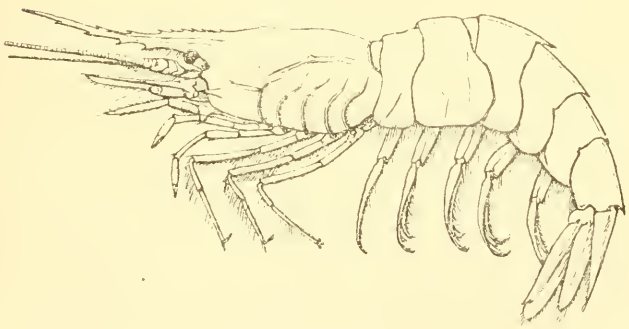
In one specimen the rostrum is armed with five teeth, and probably also in the other, in which it is broken off just beyond the fourth tooth.

40. *Acanthephyra eximia*, S. I. Smith.

Acanthephyra eximea, S. I. Smith, Rep. U. S. Comm. Fish. 1884, p. 32, 1886, pl. xiv. fig. 1, ♂.
Acanthephyra Edwardsii, Spence Bate, 'Challenger' Macrura, 1888, p. 747, pl. cxxvi. fig. 1, ♂.

♀. Differs from the male in its longer and more styliform

Fig. 3.



Acanthephyra eximia, ♀, nat. size.

rostrum, which extends by about one third of its length beyond the antennal scale.

Colour in life crimson.

Length, from tip of rostrum to tip of telson, 100 millim.; of carapace, from supraorbital to posterior margin, 22·5 millim.; of rostrum, from same point to apex, 26 millim.; of antennal scale 15 millim.; of abdomen, from base to tip of telson, 53·5 millim.; of telson 14·5 millim.

One specimen from Station 116, 405 fathoms.

♀ juv. Differs from the above in the rostrum only extending by a portion of its unarmed tip beyond the extremity of the antennal scale.

Length, from tip of rostrum to tip of telson, 58 millim.; of carapace, from supraorbital to posterior margin, 13·75 millim.; of rostrum, from same point to apex, 11 millim.; of antennal scale 9·75 millim.; of abdomen, from base to apex of telson, 35 millim.; of telson 10 millim.

Colour in life bright red.

One specimen from Station 112, 561 fathoms.

♀ jun. Much smaller than the above, the rostrum slightly ascendant, straight or only very faintly curved, short, extending about to the end of the second third of the antennal scale.

Length of carapace 10 millim.; of rostrum 5·25 millim.

Rostrum $\frac{7}{4}$-toothed.

Colour in life deep crimson.

One much younger specimen, with another of the same age as that from Station 112, from Station 109, 738 fathoms.

The above series of specimens proves that the rostrum increases in length from extreme youth to adolescence.

An adolescent male was taken in a previous season 8 miles south-east of Cinque Island, in the Andaman Sea, in 500 fathoms.

Rostrum $\frac{7}{4}$-toothed.

Colour in life deep transparent blood-red.

41. *Acanthephyra brachytelsonis*, Spence Bate.

Acanthephyra brachytelsonis, Spence Bate, 'Challenger' Macrura, 1888, p. 753, pl. cxxvi. fig. 7, ♀; Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. p. 195, ♂.

One adolescent male from Station 113, 683 fathoms.

Colour in life bright red.

Two adolescent males and one young female were taken in a previous season 7½ miles east of North Cinque Island, in the Andaman Sea, in 490 fathoms.

Our series of specimens proves that the rostrum undergoes great changes in form and in length from youth to maturity.

Fig. 4.

Acanthephyra brachytelsonis, ♂, nat. size.

In our youngest specimen it is short and porrect, scarcely extending beyond the second third of the length of the antennal scale, and being much shorter than the carapace. In a somewhat older specimen it is decidedly ascendant, though still straight, and longer—reaching to the apex of the antennal scale—though still much shorter than the carapace. In a still older specimen it has almost completely attained the length and the upward curvature it has in adolescent specimens, though it is still distinctly shorter than the carapace. It is as long or longer than the carapace in all our adolescent specimens of both sexes, except the two largest, and in these, which are males, it is slightly shorter than the carapace; whence it may with some confidence be inferred that, as in *A. eximia*, *A. Agassizii*, S. I. Smith, and *A. angusta*, Spence Bate, it does not surpass the antennal scale in fully developed males. It is from $\frac{5-11}{3}$-toothed.

In all our specimens the eye is much as in Spence Bate's figure of *A. angusta*, not as in his fig. 7, pl. cxxvi., in which the so-called ocellus is represented as round and separate from the rest of the eye.

It appears to us probable that *A. angusta* is the adult male of *A. brachytelsonis*, the difference between the two in the number of the rostral spines being explained by the loss of the apical spine of the lower series in the process of reduction of the rostrum from the adolescent to the adult condition in the former; and possible that *A. brachytelsonis* itself will prove to be identical with *A. eximia*, since the former differs from the latter only in having one spine less on the inferior margin of the rostrum, and since Spence Bate includes amongst the specimens referred by him to the former individuals with the same number of spines as in the latter.

42. *Acanthephyra curtirostris*, W.-M.

Acanthephyra curtirostris, Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. p. 195, ♂.

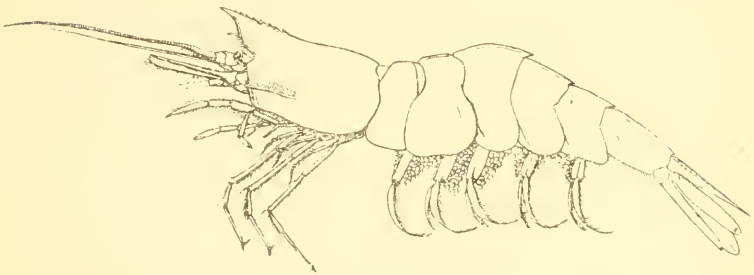
♀. Differs from the male only in its slightly more produced rostrum.

♂ ♀. The rostrum is $\frac{8-9}{1}$-toothed.

♂. The telson bears 9–10 pairs of dorsal spinules and 5 somewhat longer apical ones, the median of which is apparently fixed.

	♂ (type). millim.	♀ (type). millim.
Length from tip of rostrum to tip of telson	83	c. 77
Length of carapace from supraorbital to posterior margin	19	17·75
Length of antennal scale	14	13·5
Length of abdomen to end of telson	56·5	c. 53
Length of telson	18	——

Fig. 5.



Acanthephyra curtirostris, ♀, nat. size.

One young male from Station 108, 1043 fathoms, and an adult male and an ovigerous female from Station 114, 922 fathoms.

Colour in life deep crimson, as in all previously obtained specimens.

Hoplophorus, Milne-Edwards.

As in *Acanthephyra* the crest of the fourth abdominal tergum is notched near its hinder end.

43. *Hoplophorus gracilirostris*, A. Milne-Edwards.

Aplophorus gracilirostris, A. M.-Edw. Ann. Sc. Nat. Zool. (6) xi. 4, p. 6, 1881, et Rec. Fig. Crust. 1883, ♂.

Hoplophorus Smithii, Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. p. 194, 1891, ♂ juv.

One male from Station 112, 561 fathoms.

Colour in life bright red.

As compared with our previous specimens it is larger, measuring about 62 millim. in length from the tip of the rostrum to the tip of the telson; the rostrum is a trifle shorter, but bears the same number of teeth, and the antero-

inferior angle of the first abdominal pleuron is decidedly produced.

The right eye-peduncle has been neatly and cleanly excised without injury to any of the surrounding parts.

Another male from Station 115, 188–220 fathoms, is larger still, measuring about 77 millim. in length. The rostrum is still shorter and bears only $\frac{11}{7}$ teeth. The antero-inferior angle of the first abdominal pleuron is much as in the preceding specimen.

The left antennule has been cut clean off at the articulation between the basal and the second joints of the peduncle.

The latter of these specimens agrees exactly with Milne-Edwards's figure of *H. gracilirostris* in Rec. Fig. Crust., this being so, and all our specimens belonging without doubt to one species, *H. Smithii* is no longer maintainable as a distinct species and must be suppressed.

Our series proves that the rostrum in the male decreases in length from adolescence to maturity, as in some *Acanthephyræ*; but whether it is shorter than the carapace in very early life, subsequently growing to the length it has in the adolescent animal, there is at present no evidence to show.

An ovigerous female was taken in a former season in the Bay of Bengal, in lat. 19° 35′ N., long. 92° 24′ E., in 272 fathoms. It measures about 59 millim. in length. The rostrum, which is weak and somewhat deformed, and moreover has lost its tip, is only $\frac{10}{4}$-toothed. The pleura of the first and the second abdominal terga are soft and membranous and larger than in the male, more especially the latter of the two; and they form the lateral walls of a capacious incubatory pouch for the eggs. The appendages are smaller and are attached much further below the level of their sterna than in the male, being carried downwards towards the edges of the pleura by pillar-like prolongations of their bases, especially the anterior pair, which are attached quite close to the edges of the pleura. The two anterior abdominal sterna too appear to be more strongly arched upwards, whereby the height and hence the capacity of the pouch is still further increased.

The eggs are few in number, only eighteen having been found beneath the abdomen of our specimen, and large, measuring 2·4 and 1·6 millim. in major and minor diameters respectively.

Family **Alpheidæ**.

Genus Alpheus, Fabricius.

44. *Alpheus*, sp.

A male and an ovigerous female from Station 115, 188–220 fathoms

A larger male was taken in a previous season in the Bay of Bengal, in lat. 20° 17′ 30″ N., long. 88° 59′ E., in 193 fathoms.

Colour in life transparent blood-red.

As each of these specimens wants one of the great chelæ, we reserve the description of the species until complete specimens shall be available.

Family **Pandalidæ**.

Dorodotes, Spence Bate.

45. *Dorodotes reflexus*, Spence Bate.

Dorodotes reflexus, Spence Bate, 'Challenger' Macrura, p. 678, pl. cxvi. fig. 3; Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. 1891, p. 195, ♂ ♀.

Three females (two of them ovigerous) and three immature specimens from Station 111, 1644 fathoms.

Colour in life bright pink; legs crimson; carapace transparent, greasy.

Heterocarpus, A. Milne-Edwards.

46. *Heterocarpus Alphonsi*, Spence Bate.

Heterocarpus Alphonsi, Spence Bate, 'Challenger' Macrura, 1888, p. 632, pl. cxii. fig. 1; Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. 1891, p. 196, ♂ ♀.

Four males and four females (one ovigerous) of different ages from Station 112, 561 fathoms.

Colour in life bright pink.

The specimens were highly luminous when brought on board (see Introduction, vol. viii. p. 16).

This species had previously been taken in lat. 6° 32′ N., long. 79° 37′ E., off Colombo, in 675 fathoms (one male); in lat. 6° 29′ N., long. 79° 34′ E., in 597 fathoms (one very large ovigerous female); and twice in the Andaman Sea, in 500 fathoms (one male and two females).

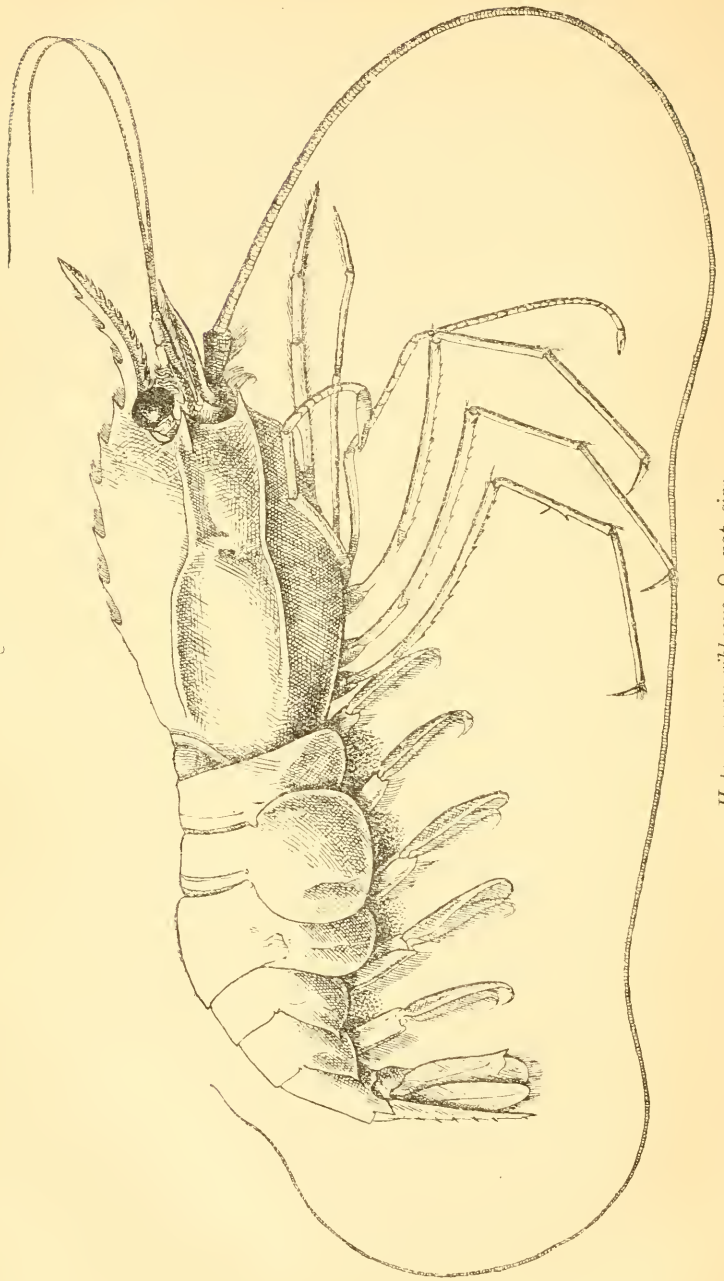


Fig. 6.

Heterocarpus gibbosus. ♀, nat. size.

47. *Heterocarpus carinatus*, S. I. Smith.

Pandalus carinatus, S. I. Smith, Bull. Mus. Comp. Zool. x. 1882–83, p. 63, pl. x. figs. 2–2*f*, et pl. xi. figs. 1–3, ♀.
Heterocarpus ensifer (A. M.-Edw.), = *Pandalus carinatus* (S. I. Smith), A. Milne-Edwards, Rec. Fig. Crust. 1883, ♀.

One small specimen from Station 155, 188–220 fathoms.

48. *Heterocarpus? gibbosus*, Spence Bate.

Heterocarpus gibbosus, Spence Bate, 'Challenger' Macrura, 1888, p. 634, pl. cxii. fig. 2, juv.

Eight males and four ovigerous females from Station 115, 188–220 fathoms.

Colour in life pink, with the legs pink and white.

One pair (the male with deformed rostrum) from Station 120, 240–276 fathoms.

This species had previously been obtained off Port Blair in 271 fathoms (two males), and in lat. 20° 17′ 30″ N., long. 88° 50′ E., in 193 fathoms (one young specimen with a still longer rostrum than in Spence Bate's figure).

Spence Bate described the species very imperfectly from an immature specimen.

We give a figure of an adult female measuring 138 millim. in length from tip of rostrum to tip of telson in a straight line.

PANDALUS, Leach.

49. *Pandalus* prox. *quadridentatus*, A. M.-Edw.

Pandalus quadridentatus, A. M.-Edw. Rec. Fig. Crust. 1883.

One fine male from Station 112, 561 fathoms.

Colour in life bright pink.

The rostrum is armed with $\frac{5}{16}$ teeth.

One immature specimen with imperfect rostrum from Station 116, 405 fathoms.

Colour in life red.

It has the same number of teeth on the base of the rostrum as the male from Station 112.

50. *Pandalus* prox. *martius*, A. M.-Edw.

Pandalus martius, A. M.-Edw. Rec. Fig. Crust. 1883.

Many specimens of both sexes, immature as well as adult, from Station 115, 188–220 fathoms.

Colour in life pink; eggs light blue.

There are only 7–8 teeth on the base of the rostrum.

51. *Pandalus*, sp.

One pair (the female ovigerous) from Station 112, 561 fathoms.

Colour in life light pink.

One ovigerous female from Station 115, 188–220 fathoms.

One ovigerous female from Station 116, 405 fathoms.

Colour in life pink.

A small species, allied to some European forms, of which we have no specimens for comparison.

[To be continued.]

LIII.—*Remarks on Australian Slugs.*

By T. D. A. Cockerell, F.Z.S., Institute of Jamaica.

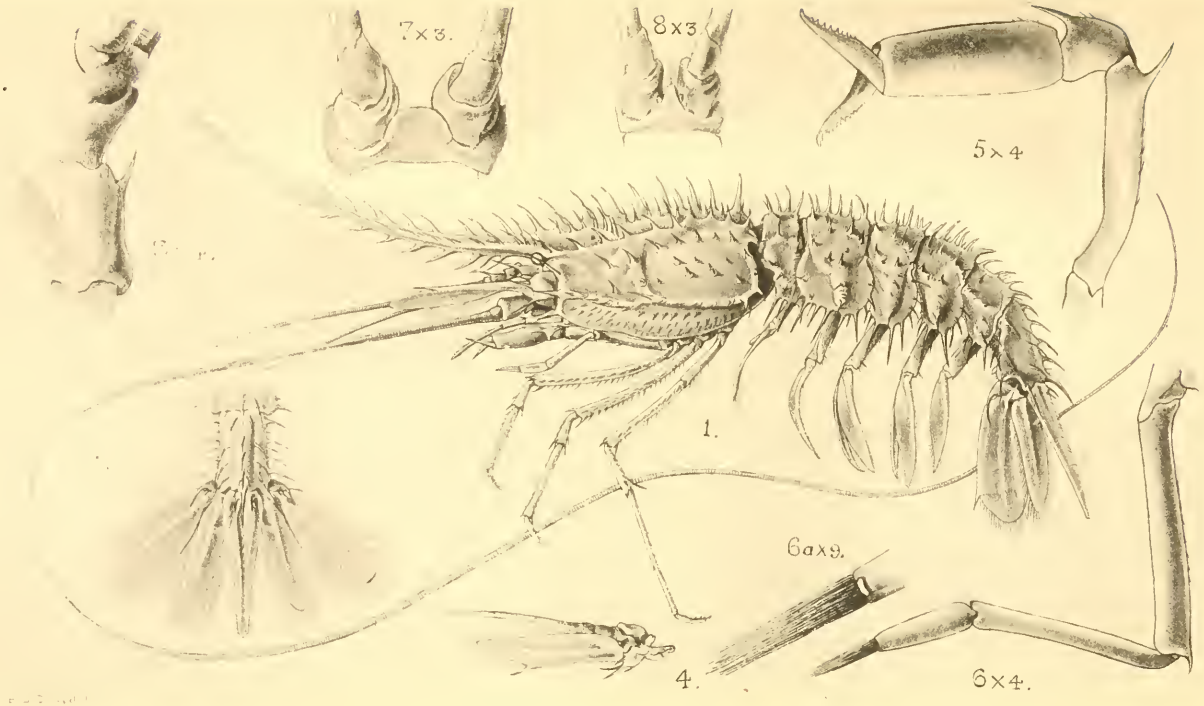
As my own idea of "courteous criticism" is very different from Mr. Hedley's, I shall not attempt to reply to the opinions regarding my conduct expressed in this Magazine, pp. 169–171 (Feb. 1892).

With regard to matters of fact it is not quite the same, as, if Mr. Hedley's statements were not contradicted, they might pass as valid among those not specially acquainted with slug-literature. I will therefore discuss them one by one.

(1). *Limax megalodontes.*—Any one may see by reference to my paper that I expressed much doubt as to its being an *Aneitea*. It seemed to me very unlikely that *L. flavus* could have been in Australia at such an early date; but later, having read some observations by Mr. Musson, I expressed the opinion that it might be *L. flavus* after all (Brit. Nat. 1891, p. 120).

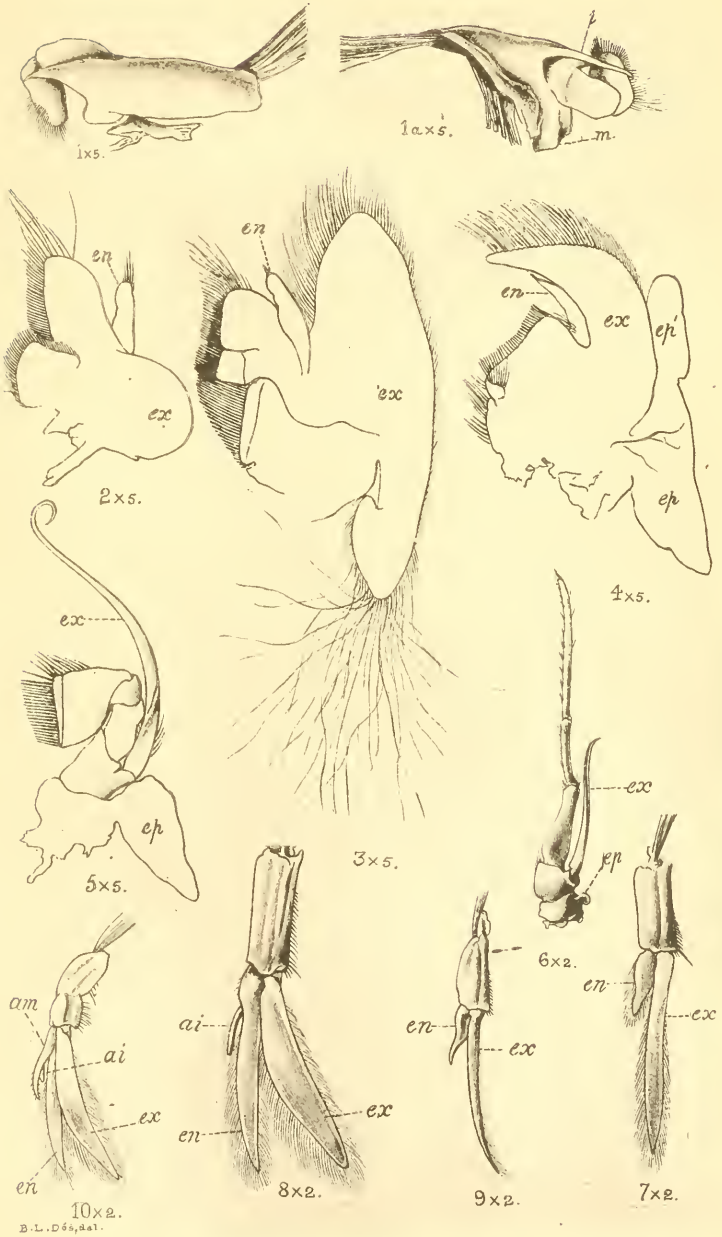
(2). "The conclusion has forced itself upon me," says Mr. Hedley, that all the Australian *Limaces* have been introduced from Europe. I have said nothing to the contrary, except that I provisionally regard the *Amalia* as endemic. It *may* be *gagates*, but writers have usually considered it distinct, and nobody has satisfactorily proved the supposed identity. It was Mr. Hedley himself who named an Australian species *Limax queenslandicus*, and regarded it as distinct until Dr. Simroth said it was *laevis*.

(3). I think anybody reading my paper will see that when



1, 2, & 7 PSALIDOPUS HUXLEYI.

3—6, & 8 P. SPINIVENTRIS.



PSALIDOPUS SPINIVENTRIS

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, Ph.D., F.L.S.

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PLATES IN VOL. XI.

Apteryx Haasti is "Roa-Roa" and it is not known by the name of "Kiwi." The name "Roa-Roa," however, is applied to several species of *Apteryx*, and specially to *Apteryx maxima* of Stewart Island. I would, however, again refer Mr. Rothschild to Sir Walter Buller's second volume, p. 330, where he will find that the native names for the *South-Island* types in Christchurch, N. Z., are both "Roa" and "Roa-Roa" as well as "Kiwi Karuai."

To the best of my knowledge *Apteryx Haasti* has hitherto been found *only* in the *South Island*, and in that district alone in which *Apteryx australis* and *A. Oweni* both occur, which so far seemed very significant. Its occurrence in the North Island is to me a new and most interesting fact, and, if substantiated, would certainly go far to upsetting the opinion I at present hold that *Apteryx Haasti* is a hybrid. Is Mr. Rothschild quite certain of the localities of his specimens and of the accuracy and *bona fides* of his collector? I shall look forward with much interest to learn the actual localities whence have come his specimens, also if the young specimens of *A. Haasti* which Mr. Rothschild has had alive at Tring were reared by him, or if he has had eggs from a pair of these birds when confined by themselves. Does *Apteryx Haasti* occur in the localities in which *A. Bulleri* (=*A. Mantelli*) is found? Or can Mr. Rothschild himself have mistaken large west-coast specimens of *A. Oweni* for *A. Haasti*?

Henry O. Forbes.

1 Philbeach Gardens,
Jan. 6, 1893.

XXII.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R. F. Hoskyn, R.N., commanding.*—Series II., No. 1. *On the Results of Deep-sea Dredging during the Season* 1890–91. By J. Wood-Mason, Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College of Bengal, and A. Alcock, M.B., Surgeon I.M.S., Surgeon-Naturalist to the Survey.

[Continued from vol. ix. p. 370.]

[Plates X. & XI.]

Family **Pasiphaïdæ**.

Pasiphaë, Savigny.

52. *Pasiphaë sivado* (Risso).

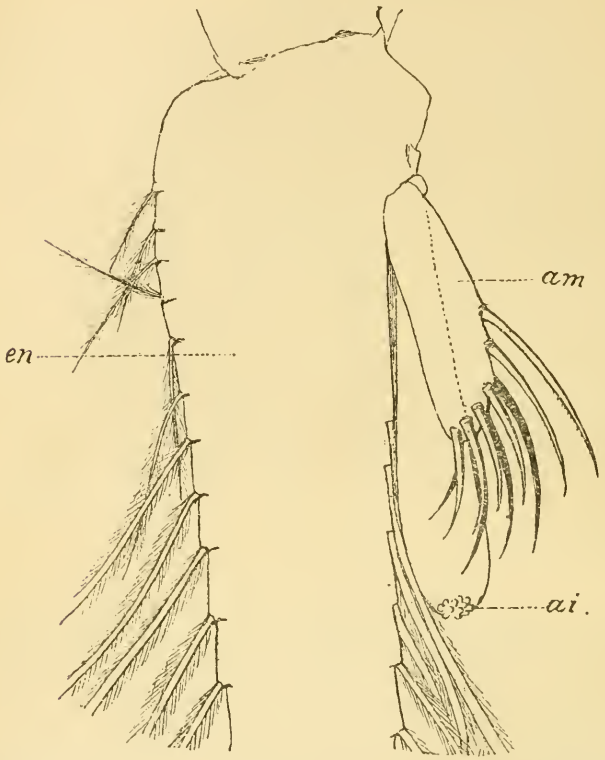
Pasiphaë sivado, Savignyi, et *brevirostris*, Milne-Edwards, Hist. nat. des Crust. vol. ii., 1837, p. 426, et Atlas du Règne Anim. de Cuvier.

Crust. pl. xxii. fig. 3; Bell, British Stalk-eyed Crust. 1853, p. 312, woodcut; Heller, Crust. Südl. Europ. 1863, p. 243, pl. viii. figs. 4–6; Wood-Mason, Ill. Zool. 'Investigator,' pt. i., Crust. pl. iii. fig. 6, ♂*.

Two males were taken on November 29th, 1888, north of Port Blair, Andaman Sea, in 200 fathoms.

They differ from a Mediterranean specimen of the female

Fig. 1.



Pasiphaë sivado (Risso), ♂.—Basal portion of endopodite of second abdominal limb of the right side from in front. *en*, endopodite; *ai*, appendix interna; *am*, appendix masculina; the spines of the hinder row are shaded to distinguish them more clearly from those of the front row. Magnified.

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* 'Illustrations of the Zoology of H.M. Indian Marine Surveying Steamer 'Investigator,' under the command of Commander A. Carpenter, R.N., D.S.O., and of Commander R. F. Hoskyn, R.N.'—Part I., Fishes, Plates I.–VII., under the direction of A. Alcock; Crustaceans, Plates I.–V., under the direction of J. Wood-Mason. Published under the authority of the Director of the Royal Indian Marine. Calcutta: printed and sold by the Superintendent of Government Printing. 1892.

in the collection of the Indian Museum in their slenderer form, in the minuteness of the postfrontal spine, which is only about as large as the apical half of that of the female, and in their shorter abdominal pleura. In the female these are longer and squarer, and those of opposite sides are abruptly bent inwards near the lateral margins so as to overlap one another ventrally, completely closing the subabdominal cavity at all events when the abdomen is partially flexed, and entirely concealing from view the four intermediate pairs of appendages, which are laid forwards upon the sternal region, thus forming, there is little doubt, an incubatory cavity for the eggs. In our specimens of the male, which are preserved with the abdomen and its appendages fully extended, the pleura are not bent inwards, being kept straight by the extended limbs, but at each end of some of them a short longitudinal crease is distinctly to be made out, indicating that the male, in common with the female, possesses the power of closing the subabdominal cavity.

The *appendix masculina* is armed at the extremity with two curvilinear rows of slender and moderately curved spine-like setæ, one row slightly in front of the other; the front row, consisting of six spines, commences about the middle of the inner margin and extends to the inner apex of the part; the hinder row, consisting of four, commences opposite to the interval between the third and fourth spines of the front row, extending to the same level.

Total length, from anterior end of carapace to tip of telson, 48 millim.; of carapace, from middle of anterior to middle of posterior margin, 15 millim.; of antennal scale 6·25 millim.; of abdomen, from base to tip of telson, 32 millim.; of its sixth tergum 7·75 millim.; of telson 5 millim.; breadth of thorax across branchial regions 3·5 millim.; of abdomen across hump 3 millim.

53. *Pasiphaë unispinosa*, sp. n.

Pasiphaë unispinosa, W.-M., Ill. Zool. 'Investigator,' pt. i., 1892, Crust. pl. iii. fig. 7, ♀.

Differs from *P. sivado* in the following points:—The body is not quite so strongly compressed. The carapace is longitudinally convex in the mid-dorsal line and is furnished on each side with a blunt lateral carina, which commences just behind the eye and extends downwards and backwards to the hepatic region, whence, after giving off a branch obliquely downwards and backwards towards the inferior margin, it is

continued in a nearly straight line along the branchial region almost to the posterior margin; its sides bulge so as to throw the narrow dorsal region into relief as a blunt carina, and its postfrontal spine is rather larger. The abdominal hump appears to be more strongly developed; the sixth abdominal tergum is deeper, more strongly arched both above and below, and is not produced to a spine in the middle of its posterior margin, which, when viewed from above, appears quite straight. In the first pair of legs the basipodite is furnished at the apex with one spine, but the meropodite is unarmed; in the second pair there is also a spine at the apex of the basipodite, but only one on the lower margin of the meropodite. Both eye-peduncles and corneæ are more elongated.

Length, from anterior end of carapace to tip of telson, 57 millim.; of carapace, from middle of anterior to middle of posterior margin, 16·5 millim.; of antennal scale 7·0 millim.; of abdomen, from base to tip of telson, 40·0 millim.; of its sixth tergum 9·2 millim.; of telson 7·0 millim.; breadth of thorax across branchial regions 6 millim.; of abdomen across hump 4 millim.

Two females were taken on April 11th, 1888, 7 miles S.E. by S. of Ross Island, Andaman Sea, in 265 fathoms.

Phye *, gen. nov.

Differs from *Pasiphaë* in the carapace and abdomen being more or less extensively and distinctly carinated dorsally, in the former being armed in front with a pair of branchiostegal spines, and in the telson being forked at the extremity.

Includes *P. princeps*, S. I. Smith ('Albatross' Crust. 1884, p. 37, pl. v. fig. 2, ♀, et 1886, p. 78, ♂ ♀, Western Atlantic, 444–1342 fathoms); *P. acutifrons*, Sp. Bate ('Challenger' Macrura, 1888, p. 871, pl. cxli. fig. 3, South of Japan, 775 fathoms, and Coast of Patagonia, 245 fathoms); *P. forceps*, A. M.-Edw. (Miss. Sc. du Cap Horn, Crust., 1891, p. 51, pl. vi. fig. 2, Straits of Magellan, 326 metres); and the following:—

54. *Phye Alcocki*, W.-M.

Parapasiphaë Alcocki, W.-M., Ann. & Mag. Nat. Hist. (6) vii., 1891, p. 196, ♂; et Ill. Zool. 'Investigator,' pt. i., 1892, Crust. pl. iii. fig. 5.

From *P. princeps* and *P. acutifrons* it differs in the form of the postfrontal spine (which is thin and foliaceous, terminates abruptly in front in a strongly sinuous and almost vertical edge, and extends nearly to the posterior slope of the carapace

* Θρῆτταν ἧ ὄνομα Φύη.—Arist., Ath. Pol. 14.

as a backwardly diminishing carina, which is sharp and foliaceous in its anterior half and blunt in its posterior half); in the pigment of the eyes being brown instead of black; in the sixth abdominal tergum alone being distinctly carinated; and probably in the relative proportions of its different parts.

From *P. princeps* it differs in the telson being shorter than the sixth abdominal somite and in the meropodites of the first pair of legs being armed with three spines upon their lower margin.

From *P. acutifrons* it differs very markedly in the form of the postfrontal spine, and, according to Spence Bate's figure, in the strongly arched outer margin of the antennal scale.

From *P. forceps* it differs no less markedly than from *P. acutifrons* in the form of the postfrontal spine, and, besides, in its more unequal and absolutely much longer antennulary flagella; in the notch at the extremity of the telson being acutangular and fringed to the bottom on each side with minute spinules; in the point of the fixed arm of the claws of the first pair of legs being simple; and probably in other details.

Of the three, *P. princeps* is the one to which it is most nearly related.

Length, from middle of frontal margin to tip of telson, 59 millim.; of carapace, from middle of frontal to middle of posterior margin, 18 millim.; of abdomen, from base to tip of telson, 41 millim.; of telson 8 millim.; of sixth abdominal somite 9·75 millim.; of antennal scale 8 millim.

Parapasiphaë, S. I. Smith.

a. Antennal and branchiostegal spines absent..... Sect. *Parapasiphaë*.

The following species come into this section:—

1. *Parapasiphaë sulcatifrons*, S. I. Smith, 'Albatross' Crust., 1884, p. 40, pl. v. fig. 4, pl. vi. figs. 1-7, ♂ ♀. Western Atlantic, 515 to 2949 fathoms.
2. *Parapasiphaë cristata*, id. ibid. p. 44, pl. v. fig. 3, ♀. Western Atlantic, 1628 fathoms.

b. Antennal and branchiostegal spines present ..... Sect. *Eupasiphaë*.

To this section belong the following:—

55. *Parapasiphaë* (*Eupasiphaë*) *latirostris*, W.-M.

Parapasiphaë latirostris, Wood-Mason, Ann. & Mag. Nat. Hist. (6) vii. 1891, p. 196, ♀.

We give a figure of this fine species the size of nature (fig. 2, p. 166).

56. *Parapasiphaë* (*Eupasiphaë*) *Gilesii*, sp. n.

Parapasiphaë Gilesii, Wood-Mason, Ill. Zool. 'Investigator,' Crust. pl. iii. fig. 8, ♀, × 2.

Rostrum slender, acute, awl-shaped, slightly compressed, slightly curved, ascendant, extending by rather more than

Fig. 2. *Parapasiphaë latirostris*, nat. size.

one third of its length beyond the extremities of the eye-peduncles. Postfrontal ridge cristiform, armed throughout from the base of the rostrum to the posterior slope of the carapace with minute forwardly-inclined denticles, the first of which is placed well on the base of the rostrum and is more than double the size of any of the rest, which are subequal;

it is divided by a distinct cervical groove into two lobes, the anterior of which is somewhat the higher and longitudinally somewhat the more convex of the two.

The anterior margin of the carapace bears on each side two spines—the one smaller, situated just behind the edge of the orbital sinus, and answering in all probability to the antennal spine of the Penæidea; the other larger, which arises from the margin itself, opposite to the insertion of the antenna, and is, there is little doubt, a true branchiostegal spine. About midway between the branchiostegal spine and the obtuse extra-orbital angle on each side the anterior margin projects a process of about the same size and shape as the latter, and hence presents an angularly sinuous or zigzag outline between the two spines. The branchiostegal spine is continued backwards along the side of the carapace as a well-defined slightly upwardly concave ridge; this is subacute nearly as far as the hepatic region, and thence blunt to its abruptly upcurved extremity near the hinder end of the carapace; it curves upwards for a short distance from its origin, then descends almost imperceptibly to about the middle of its length, whence it rises by a no less gentle ascent to its upturned extremity; it emits three branches—one, faint, from the hepatic region, upwards and forwards towards a point in the anterior margin which is just internal to the antennal spine; a second, as well-defined as itself, from the point at which it is intersected by the cervical groove, straight downwards and backwards towards the inferior margin; and a third, equally well-defined, from a point a little to the rear of that from which the second is given off, upwards, inwards, and backwards, so as to mark out the upper boundary of the subjacent branchial chamber.

The terga of the abdominal somites are increasingly carinate from the second to the fourth; the carina of the fourth is faintly notched, as in *Acanthephyra*, and terminates posteriorly in a strong spine. Those of the remaining somites are transversely rounded.

The telson, which wants its extreme tip, agrees, as far as it is preserved, with the description of that of *Parapasiphaë sulcatifrons*, S. I. Smith.

The eye-peduncles are compressed from above downwards and bear on the inner and upper margin, at a short distance from the edge of the cornea, a small conical tubercle, which is directed inwards and slightly forwards; the compressed hemispherical and distinctly faceted cornea occupies the whole width of their apex, upon which it is somewhat obliquely set; and their pigment is bright brown in spirit.

The peduncle of the antennules agrees with Prof. S. I.

Smith's description of that of *P. sulcatifrons*; but the inner flagellum of these organs is only about one half the length of the carapace measured from the apex of the rostrum to the middle of the hinder margin in a straight line, and less than one third the length of the outer flagellum; this is much stouter than the inner and expanded at the base in the usual manner.

The thoracic limbs differ in the relative proportions of their parts and in armature from those of *P. sulcatifrons* to an extent and in a manner which will be best appreciated by comparison of the figures of the two species.

Length, from apex of rostrum to end of caudal appendages, 49 millim.; of carapace, from apex of rostrum to middle of hinder margin, 19·5 millim.; of outer flagellum of antennules 34·5 millim., of inner 9·5 millim.; of antennal scale 7·25 millim.; length of abdomen from base to end of telson 27·5 millim., of its sixth somite 5·5 millim., of telson (tip wanting) 6·5 millim.

A single female was taken on Jan. 15th, 1888, off Cinque Island, Andaman Sea, in 650 fathoms.

Psathyrocaris, gen. nov.

Psathyrocaris, Wood-Mason, Admin. Rep. Marine Survey of India, 1890-91, p. 19.

Integument thin and delicate; all appendages and processes of extraordinary fragility.

Body moderately compressed.

Carapace shortly rostrate, longitudinally carinate for a longer or shorter distance in backward continuation of the dorsal crest of the rostrum; its anterior margin unarmed—antennal and branchiostegal spines being absent,—at first broadly arched, then narrowly emarginate between the blunt triangular extraorbital angle and the antero-lateral angle on each side; its sides distinctly ridged, the ridging varying with the species; the efferent portion of the branchial chamber relatively spacious.

Antennules and antennæ broken off in all the specimens near the base.

Eye-peduncles and corneæ depressed, the latter hemispherical, occupying the whole width of the extremities of the former, on which they are set quite square. The usual papilla is present close to the edge of the corneæ on each side.

Mandibles (Pl. XI. fig. 1) of typical Pasiphaïdean form, with a very large two-jointed palp.

First maxillæ (Pl. XI. fig. 2) with the inner lacinia (*cx*)

pointed and recurved towards the outer (*bp*), and with a small triangular process on the inner margin of the endopodite (*en*) as in *Parapasiphaë*.

Second maxillæ (Pl. XI. fig. 3) with well-developed inner (*cx*) and middle (*bp*) laciniæ, the latter of which is bilobed, thus differing from those of all * previously described genera, in which both laciniæ are reduced to a quite rudimentary condition; and with a relatively very large and powerful scaphognathite, in correlation to the spacious efferent branchial channel.

First maxillipedes (Pl. XI. fig. 4) with well-developed endopodite (*en*) and middle (*bp*) and inner (*cx*) laciniæ, the latter of the two last of which, though decidedly weaker, is nevertheless produced inwards to the same level as the former, and is fairly well fringed, thus also differing from all previously described genera, in which indeed little besides the exopodite of these jaws remains, the laciniæ being both reduced to a more or less scanty fringe of weak setæ and the endopodite to a minute projection of the inner margin of the exopodite, whilst the epipodite when present is smaller (*Parapasiphaë*) or altogether wanting (*Pasiphaë*). The exopodite gives off from its inner margin just below the true apex a pedunculated oval plate, which serves as the occlusor apparatus of the efferent branchial aperture and, in correlation with the large size of that aperture, is much larger than in any other genus.

Second maxillipedes (Pl. XI. fig. 5) almost exactly as in the Penæidea, seven-jointed, the division between the second and third joints being still quite distinct at the edges; furnished with a short tapering exarticulate exopodite (*ex*), which scarcely exceeds the third joint in length; and with a complete podobranchia (*ep* + *br*), thus contrasting strongly with those of previously described genera, in which the corresponding appendages are weaker and but six-jointed, the second + third being indistinguishably fused into one, there is never any trace of an exopodite, and the podobranchia is represented at most by a small epipodite and may be entirely wanting.

Third maxillipedes (Pl. XI. fig. 6) four-jointed †, as in *Pasiphaë*, *Phye*, and *Parapasiphaë*, furnished at the base with a rudimentary epipodite, and, quite close to the base of the second joint (2 + 3 + 4), with a minute tapering exarticulate exopodite, similar to, but much smaller than, that of the second maxillipedes, and lodged in a groove in the side of the joint.

* Except *Leptochela*, which would appear to have fully developed second maxillæ.

† *Leptochela* has five, and is so far less modified than any other genus.

The first and second pairs of legs are dissimilar both in form and structure.

The first pair is the shorter, and their claws are shaped much as in *Pasiphaë*. The inner edge of the dactylopodite is unarmed, but is raised into a sharp lamellar cutting-edge; that of the prolonged part of the propodite, on the other hand, is armed throughout with minute acicular spines of tolerably uniform size and all slanting towards the apex of the joint.

The second pair is much the longer, and their claws differ in form in the different species and would appear to be unequal on the two sides. The inner edge of both dactylopoditic and propoditic elements of these claws is armed with minute spines similar to those of the first pair, and, in addition, at intervals with much longer ones (three or four times as long) of the same form.

The third and fourth pairs of legs are alike. They are greatly reduced in thickness, but little if anything in length, forming long setaceous filaments of excessive tenuity and fragility.

The fifth pair of legs is the shortest of all and is much stouter than the third and fourth and much slenderer than the first and second; it is, in fact, in point of thickness about intermediate between the two sets of legs. They are set on and directed in the manner which seems characteristic of the family. Their propodite bears at the distal end of the lower surface a conspicuous whisp of longish setæ, which is directed towards the apex of the joint, while the dactylopodite is covered below with a dense brush of short spiny setæ, and is evidently intended to fold back against the propoditic whisp, so as to form therewith a sort of prehensile subchela.

All the legs possess the full number of joints and all are furnished with exopodites. The exopodites of the first pair of legs are small and inconspicuous, but those of the second to the fifth pairs are long and excessively fine articulated setaceous filaments, which form a gradually increasing series to the fourth, the fifth being suddenly much longer and fully equalling in length the third or fourth pairs of legs. They are all very sparsely clothed with long, lax, obsoletely plumose setæ, and are all produced at the base into a little tongue-shaped spur.

The first to fifth pairs of abdominal appendages are remarkable for the enormous inequality of their two branches, as well as for the excessive tenuity of the outer branch, which, in the case of the second pair, is in one species no less than twenty-four times the length of the inner, which is quite minute; the exopodites of the abdominal appendages, in fact,

closely resemble those of the legs, differing therefrom only in being somewhat stouter, more distinctly articulated, and more richly provided with more strongly plumose setæ.

Abdomen transversely rounded, not carinate, dorsally.

Telson quadrangular, tapering gradually from base to apex, terminating in a minute fixed median spine and two unequal pairs of articulated lateral spines; its dorsal spines obsolescent.

There are twelve functional branchiæ and two epipodites on each side distributed as follows in *Psathyrocaris fragilis*:—

Somites and their appendages.	Podo-branchiæ.	Arthro-branchiæ.	Pleuro-branchiæ.	
VII.	0 (*ep.*)	0	0 =	0+*ep.*
VIII.	1	0	0 =	1
IX.	0 (*ep.*)	2	0 =	2+*ep.*
X.	0	1	1 =	2
XI.	0	1	1 =	2
XII.	0	1	1 =	2
XIII.	0	1	1 =	2
XIV.	0	0	1 =	1
	1+2*ep.* +	6 +	5 =	12+2*ep.*

Psathyrocaris has hence one more gill—and that a complete podobranchia consisting of plume and epipod attached to the second maxillipedes—than in *Parapasiphaë*, the least modified of the genera so far described, in which the corresponding gill is reduced to a rudimentary epipod.

57. *Psathyrocaris fragilis*, sp. n. (Pls. X., XI.)

Colour in spirit very dark reddish purple or wine-red above, the ventral surface and legs lighter, the thoracic and abdominal exopodites and antennæ colourless.

Thirteen specimens, all more or less broken, though admirably preserved as to their soft tissues, were taken at Station 120, 240 fathoms.

In dealing with a single species it is impossible satisfactorily to define the specific characters, and, as the results of the dredgings carried out during the season 1891–92 contain several additional species, including a fine ovigerous female of one of them, we have thought it better to defer the specific description of the present species until we shall have thoroughly examined our new material. Meantime the characters of the genus will suffice for those of the species, especially as they are accompanied by detailed figures.

EXPLANATION OF THE PLATES.

Plate X.

Fig. 1. *Psathyrocaris fragilis*, ♀, from the left side. Nat. size. Both the legs of the second pair are figured, to show their inequality.
Fig. 2. Rostrum of the same. Enlarged.
Fig. 3. The caudal swimmeret of another specimen, from above. × 3.
Fig. 4. A leg of the fourth pair of another specimen. × 4.
Fig. 5. An abdominal appendage of the second pair of another specimen. × 5.

Plate XI.

Fig. 1. *Psathyrocaris fragilis*. Mandible. × 9.
Fig. 2. First maxilla. × 9.
Fig. 3. Second maxilla. × 9.
Fig. 4. First maxillipede. × 9.
Fig. 5. Second maxillipede. × 9.
Fig. 6. Third maxillipede. × 4·5.

[To be continued.]

XXIII.—Aglia tau, *a connecting-link between the* Ceratocampidæ *and* Saturniidæ, *and the Type of a new Subfamily*, Agliinæ. By Alpheus S. Packard.

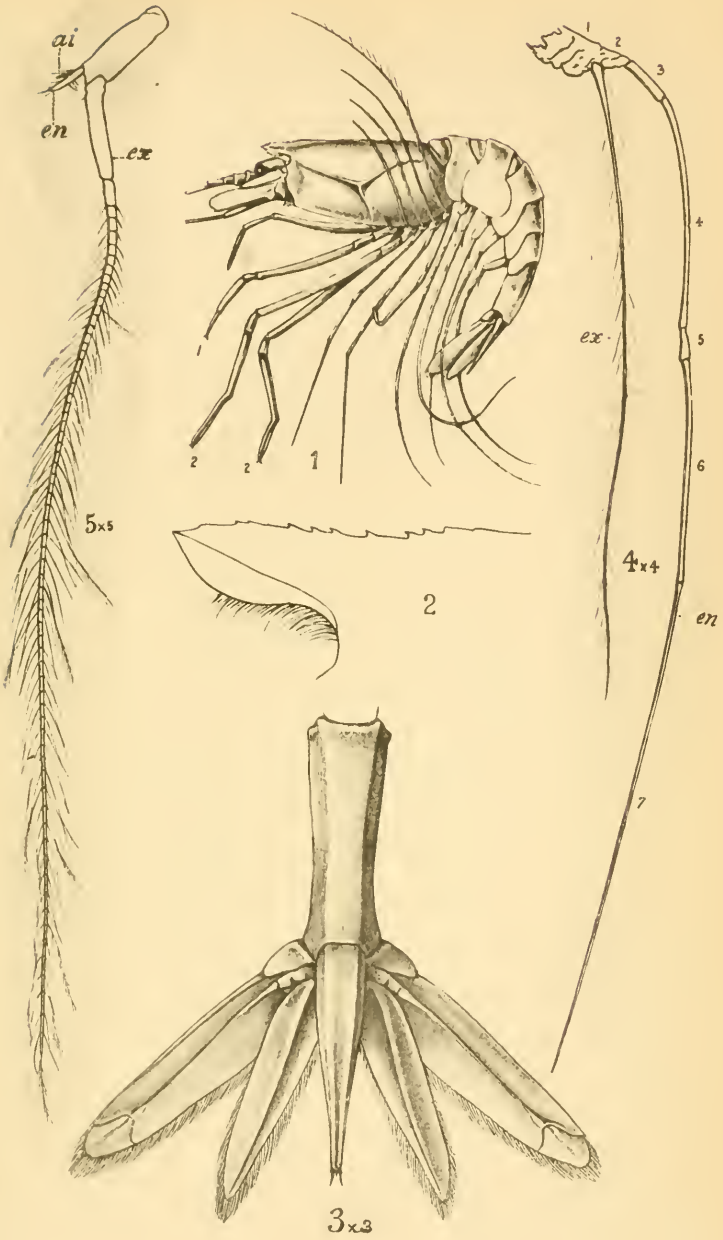
In this European Bombycine moth we have a most interesting form surviving side by side with *Saturnia*, which seems to be the most generalized form of its family. *Aglia* appears to be a Ceratocampid in its earlier larval stages, the caterpillar in its final stage, however, and the moth being closely related to the Saturnians. It seems quite reasonable to suppose that the Saturnians have directly descended from a form like *Aglia*, and we could scarcely expect a clearer demonstration of the origin of one family from another by direct genetic descent.

The transformations of this form, originally figured in Duponchel and Guenée's 'Iconographie' * (tom. ii.), have been more fully elaborated by Mr. Poulton †.

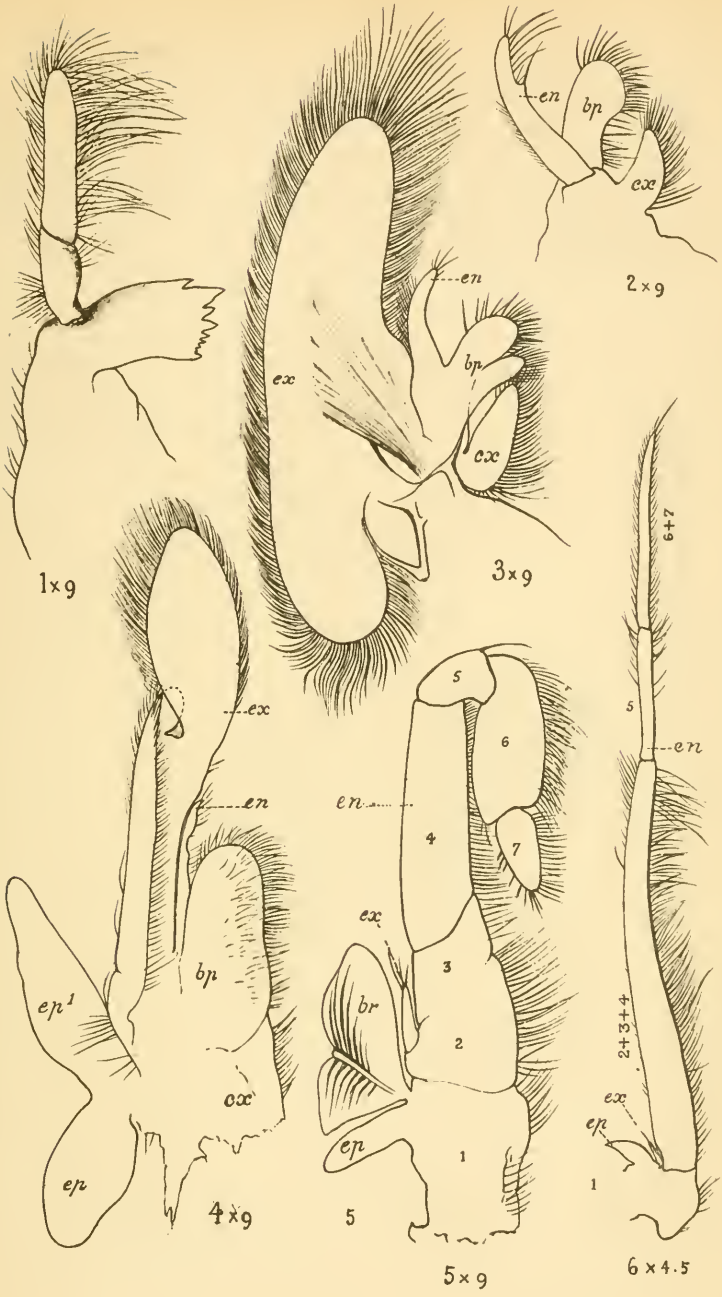
Having received, through the kindness of Dr. Heylaerts, a young larva of *Aglia tau* in its third stage, I have been able

* Guenée states that, after attaining its full size, "elle se retire à la surface de la terre, entre des mousses et des débris de végétaux qu'elle attache avec de la soie, et elle s'y change en une chrysalide grosse, courte, d'un brun foncé saupoudré de grisâtre, et dont l'anus est terminé par un faisceau de pointes recourbées."

† Trans. Ent. Soc. London, 1888, pp. 555–568, pl. xvii. figs. 1–7.



PSATHYROCARIS FRAGILIS.



PSATHYROCARIS FRAGILIS.