

Alcock, A. 1894

P.225

From the ANNALS AND MAGAZINE OF NATURAL HISTORY,
Ser. 6, Vol. xiii., March 1894.

INVERTEBRATE
ZOOLOGY
Crustacea

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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 (continued).
By A. ALCOCK, M.B., Surgeon-Captain I.M.S., Superin-
tendent of the Indian Museum.

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[Continued from vol. xi. p. 172.]

OF the species to be described in the sequel some have already been figured in the "Illustrations of the Zoology of H.M. I.M.S. 'Investigator,' Crustaceans," part i., published in 1892, and some in part ii. of the same publication, which I hope will be issued early this year. All the new species not yet figured will, I hope, appear in part iii. of the 'Illustrations,' which is now in preparation and may be expected early next year (1895).

Family Nematocarcinidae.

NEMATOCARCINUS, A. Milne-Edwards.

58. *Nematocarcinus gracilis*, Spence Bate.

Nematocarcinus gracilis, Spence Bate, 'Challenger' Macrura, p. 815, pl. cxxxii. fig. 8.

Several specimens from Station 120, 240 to 276 fathoms.

59. *Nematocarcinus paucidentatus*, ♀

Nematocarcinus paucidentatus, Spence Bate, 'Cr.', p. 816, pl. cxxxii. fig. 9.

Two ovigerous females from Station 115, fathoms. The colour in life was pink, the eggs blue.

60. *Nematocarcinus tenuirostris*, Spence Bate.

Nematocarcinus tenuirostris, Spence Bate, 'Challenger' Macrura, p. 817, pl. xxxii. fig. 10.

A large male from Station 112, 561 fathoms. Colour in life bright orange-pink.

ASTACIDEA.

Family Homaridæ.

NEPHROPS, Leach.

61. *Nephrops andamanicus*, Wood-Mason.

Nephrops andamanicus, Wood-Mason, Illustrations of the Zoology of H.M. I.M.S. 'Investigator,' Crustacea, pl. iv.

The integument, though thin, is strong and firm, and dorsally is everywhere on the body finely granular and slightly pubescent.

The carapace measured to the tip of the rostrum is about half an eye-length short of half the total length, the rostrum measured from the orbital plate constituting about one third of this measurement. The rostrum is broad and concave above and ends in a compressed spine, at the base of which on the under surface is a similar spine, and on each lateral margin another large spine; behind the last the lateral margins of the rostrum extend backwards almost to the cervical groove, each as a ridge formed of three great trenchant procumbent

spines decreasing in size from before backwards ; in the concavity between these ridges is a faint median ridge running up to the terminal spine of the rostrum. Behind the cervical groove the cardiac region is traversed by a broad ridge surmounted by a double row of spinelets, which diminish in size from before backwards, the whole being an evident continuation of the rostrum.

The under surface of the true rostrum behind the single inferior spine is furnished with a fringe of long setæ, which is continued round the orbital margin on each side.

Laterally on the level of the antennæ the frontal region is occupied by a great trenchant wing-like spine, the point of which surpasses the base of the antennary scale and reaches almost to the anterior limit of the eyes ; between this spine and the postrostral ridge on each side are three small spinules disposed in a triangle. On the hepatic region, which is very distinctly delimited, are two spines, a large one ventrally and a small one dorsally. The cardiac and branchial regions are very distinctly demarcated from the gastric and hepatic, the two first forming a section of a much larger cylinder than the two second. The cardiac region is traversed by the already described continuation of the rostrum, and is bounded on each side by a granular or finely spinate ridge. The branchial regions are traversed fore and aft by two similar ridges, one almost parallel with that last described, the other following the curve of the thickened and grooved branchio-stegal margin. All these ridges end anteriorly in minute spines.

The abdominal somites appear to correspond at all points with those of *Nephrops Thomsoni*, Spence Bate, their terga being sculptured in the same way, and the sixth somite and telson being quite similar in spinature.

The eyes are reniform and of huge size, their major diameter being nearly half the length of the rostrum ; the peduncles are very short.

The peduncles of the antennules are shorter than the rostrum ; the first joint viewed from above is spoon-shaped, the bowl forming the floor of the orbit, and the distal end has an inconspicuous spine below ; the second and third joints are subcylindrical and are of nearly equal length, not much more than one third of the first ; distally all three joints are thickly ringed with long cilia ; the inner flagellum is more slender and considerably longer than the outer, the length of the former being three times that of the peduncle ; in the male the outer flagellum has a row of fine setæ in its distal half below.

The stout peduncle of the antennæ reaches almost to the point of the rostrum; the antennal scale is broadly petal-shaped and is closely fringed with long setæ on its inner and front margins; its outer margin does not end in a spine; the second joint has the outer margin sharp, ending in front in a spine, while the third, fourth, and fifth joints have the inner margin sharp and fringed with setæ; the flagellum is nearly one half longer than the entire animal.

The mouth-parts present nothing remarkable.

The chelipeds are equal and uniform in the female and in small males, and even in large males the preponderance of one side (the right in two specimens) is but slight; their entire length is very nearly half the total length of the animal: the basipodite is fused with the ischiopodite, which is smooth, with a faintly granular ridge on the obtuse inner margin: the meropodite is more than twice the length of the ischiopodite and is triangular in transverse section; the inner surface is smooth, the outer surfaces are slightly granular; the upper and lower borders are sharp and sharply spinate and end in front each in a great spine; the outer border is rounded and is produced in front into a long blunt spine: the carpus is more than half the length of the meropodite and is prismatic in shape, with the angles more sharply granular than the surfaces; three of its angular borders—the two inner and the outer—end in large spines, the last having a second large spine at its proximal end: the entire propodite is at least twice the greatest length of the meropodite, the "finger" constituting about half of the total length of this joint; the "palm" of the propodite has the usual prismatic form, with the angles salient and strongly spinate and the surfaces between the angles smooth or faintly crenulate, but never pubescent; its "finger" portion has a sharply granular surface and bears internally a row of teeth, of which one near the proximal end is conspicuously large, standing between two thick rows of setæ: the dactylopodite is equal and similar to the finger of the propodite, except that (1) its surface distally is rather less granular, (2) instead of one large tooth near the base there are several, and (3) the setæ do not flank the teeth except quite at the proximal end of the joint, but form a long brush all along the under surface of the dactylus.

Of the remaining thoracic legs, all of which are slender and cylindrical, the longest is the fourth pair, which are not quite two thirds the length of the first pair, and the shortest are the fifth, while the second and third are chelate.

The branchial formula is—

Somite.	Podobranchiæ.	Arthro-branchiæ.	Pleuro-branchiæ.
VIII.	1 (rudimentary)	0	0
IX.	1	2	0
X.	1	2	0
XI.	1	2	1
XII.	1	2	1
XIII.	1	2	1
XIV.	0	0	1
	<hr/> 5 (6)	<hr/> 10	<hr/> 4

The first pair of abdominal appendages in the male is modified precisely in the same way as it is in *Nephrops Thomsoni*, Spence Bate; the second and succeeding pairs are also as in *N. Thomsoni*.

Colours in life: dorsum yellowish pink; venter pink in the female, white in the male; chelipeds banded pink and yellow in the female, pink and white in the male. The eggs in an advanced stage of development are dark blue.

Several males of all sizes and ovigerous females from Station 115, 188 to 220 fathoms.

This species has been so beautifully figured under the direction of the late Professor Wood-Mason that it is unnecessary to give a table of dimensions.

The species is undoubtedly very closely related to *N. Thomsoni*, Spence Bate, of which it may prove to be only a variety.

One striking character, as compared with *N. norwegicus*, L., and *N. japonicus*, Can., is the very distinct delimitation of the head from the thorax, distinct though it is in those species.

The Ova and Embryos of Nephrops andamanicus.

The ova of these specimens measure about 3 millim. in their greater diameter, and are of a dark blue colour.

They have been so long immersed in strong spirit, and are consequently so brittle, that, no matter how treated, they do not lend themselves to a satisfactory examination. All the eggs that I have examined contain embryos in an advanced stage of development, but have still abundant food-yolk. The embryos have a globular cephalothorax and a long and distinctly segmented abdomen which ends in a great fan-shaped "tail." All the appendages are present, including those of the abdomen, the latter having the same form as they have in the adult, and those which form the swimmeret

being very distinct beneath the lobes of the above-mentioned "tail." The abdominal somites are quite unarmed.

It would appear from these observations that the young of *Nephrops andamanicus* is hatched in a form not essentially different from that of the adult, and not considerably divergent from that of the larva of *Nephrops norvegicus* figured by Professor Sars.

NEPHROPSIS, Wood-Mason.

62. *Nephropsis Stewarti*, Wood-Mason.

Nephropsis Stewarti, Wood-Mason, J. A. S. B. 1873, vol. xlvi. pt. ii. p. 39, and Ann. & Mag. Nat. Hist. ser. 4, vol. xii. 1873, p. 59; A. Milne-Edwards, Ann. Sci. Nat., Zool. 5^e sér. t. xix. 7, pl. xx. figs. 1-3.

Several fine specimens from Station 115, 188 to 220 fathoms, including an ovigerous female, the eggs of which still consist almost entirely of food-yolk. The eggs of this species are very much smaller and more numerous than those of *Nephrops Carpenteri*, W.-M., briefly described in P. A. S. B. 1885, p. 72.

63. *Nephropsis atlantica*, Norman.

Nephropsis atlantica, Norman, Proc. Roy. Soc. Edinb. 1881-82, vol. xi. p. 684; Wood-Mason and Alcock, Ann. & Mag. Nat. Hist. ser. 6, vol. vii. 1891, p. 198, fig. 4.

I refer to this species a young male from Station 114, 922 fathoms, which differs from the specimens taken in the Laccadive Sea only in having the third and fourth abdominal pleuræ, as well as the second, armed in front with a spine.

Family ERYONTIDÆ.

WILLEMOESIA, Grote.

64. *Willemoesia forceps*, A. Milne-Edwards.

Willmoesia forceps, A. Milne-Edwards, Bull. Mus. Comp. Zool. vol. viii. p. 64.

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

The late Professor Wood-Mason had noted that "in the male the olfactory branch of the antennules is much thicker than it is in the female." In the Introduction to this paper (Ann. & Mag. Nat. Hist., July 1891, p. 16) this species was stated to be luminous, in mistake for a species of *Pentacheles* (*P. phosphorus*).

PENTACHELES, Spence Bate.

The Indian species of this genus have for the most part the typical peculiarities of shape, spinature, setosity, &c., and I have not therefore mentioned these in the specific descriptions. The species, seven in number, fall into two groups, the one characterized, like *P. obscura*, Spence Bate, by having the carapace uniformly spiny or granular or carious and thickly furry, and the abdominal terga and pleuræ often granular or spicular; the other, like *P. levius*, Spence Bate, having the carapace, except for certain definitely placed large spines, almost or quite smooth, and the abdominal terga and pleuræ also quite smooth as to the surface.

In all of our species in which both males and females have been examined the olfactory flagellum of the antennules is stouter and much longer in the male. The telson of all these species appears quite plainly to be made up by the concrescence of a somite and its appendages. This is apparent on either aspect, but is more plainly manifest on the dorsal aspect, where the anterior fourth or so is seen to represent a tergum carinated like all the other terga, the rest of the telson being formed by the fully extended and adducted appendages.



Sixth somite and telson of *Pentacheles Hextii*.

A tapering groove which traverses the telson in the middle line appears to represent the line of concrescence of the appendages of opposite sides; and on either side of this two longitudinal slightly convergent crests appear to represent the lines along which in each appendage the exopodite has fused with the endopodite.

Synopsis of the Indian Species of Pentacheles.

- I. Carapace with the entire surface, including the median carina, spinate or sharply granular, independently of the usual definitely placed large spines; the lateral borders with 20 to 30 serrations; the posterior border narrow. [The ophthalmic notches shallow, or, if deep, divided into two regions, the anterior of which forms a shallow notch. Antennulary scale variable, usually much larger than the antennal scale.]
1. Abdominal terga and pleura with the surface more or less granular; all the terga including the telson more or less carinate. [Antennulary scale very large.]
2. Abdominal terga and pleura with the surface smooth or finely pitted and the margins quite smooth; only the first five terga carinate. [Antennulary scale diminutive, almost obsolete.] . *P. Beaumontii.*

- { a. Both terga and pleura with the surface markedly and closely granular and with the edges closely and sharply spinate; the carinae of the terga from the second to the fifth inclusive culminating in large procumbent spines. Antennulary scale about twice the size of the antennal scale *P. Heriti.*
- b. Terga and pleura with the surface slightly and more or less distinctly granular, and with the edges quite smooth; the carinae of the terga with the crests eroded, but never forming procumbent spines. Antennulary scale at least four times as large as the antennal scale. First pair of abdominal appendages of the female extremely small.
- { a. Carapace hump-backed; granulation of abdominal terga and pleura conspicuous *P. gibba.*
- { β. Carapace of the usual form; granulation of the abdominal terga and pleura inconspicuous. *P. Carpenteri.*

1. Dorsal sublateral ridges distinct and markedly spinate throughout; [The ophthalmic notches usually deep. Abdominal terga and pleura smooth or slightly pitted as to the surface, the pleura with the edges denticate. Antennular scale, when viewed from the under surface, hardly larger than the antennal scale.]
- II. Carapace with the entire surface, including the median carina, quite or nearly smooth, except for the usual definitely placed large spines; the lateral borders with fewer than 20 serrations; the posterior border broad.
- a. Ophthalmic notches rather shallow; the carinae of the first five abdominal terga end in procumbent spines *P. andamanensis*.
- b. Ophthalmic notches deep; the carinae of the first four abdominal terga only end in procumbent spines *P. phosphorus*.
2. Dorsal sublateral ridges indistinct and smooth or only very faintly denticulate; frontal margin devoid of spines except the usual rostral pair; median carina behind the cervical groove with only two pairs of spines; the carinae of the abdominal terga often indistinct, except that of the fifth, which ends in a procumbent spine of such enormous size that its point overhangs the front edge of the fourth tergum *P. cerata*.

65. *Pentacheles gibba* *, sp. n.

Pentacheles, sp. remarkable for its hunch-backed thorax, Wood-Mason, Admin. Rep. Marine Survey of India for 1890-91, p. 19.

The carapace, which is inflated, elevated, and humped in front, is everywhere thin, spiny granular or carious, and thickly setose, and its greatest breadth, which is just behind the cervical groove, is not much more than half its greatest (lateral) length; the median carina ends in a double rostral spine and has its crest irregularly serrated or eroded throughout, in addition to which there is a row of 4 large spines, of which the second may be double, between the rostral spine and the cervical groove, and 10 or 11 spines or double spines between the cervical groove and the posterior smooth, narrowly-moulded edge of the carapace; the frontal margin is finely eroded; the spines of the lateral margins are concealed in setæ of great length, they number about 25 on each side, of which 5 are found in front of the hepatic groove, 3 between the hepatic and cervical grooves, and about 17 behind the cervical groove; the usual dorsal sublateral (branchiostegal) crests are quite wanting, but ventrally the branchial regions are traversed fore and aft by the usual finely serrated ridges. The abdominal terga have the surface rough and spiny and the setæ on the posterior margin remarkably long and close-set; all, including the telson in its front part, are carinated, the edge of the carina in all being irregularly and obtusely denticulated; a broad shallow groove traverses the terga obliquely outwards and backwards on each side of the carina.

The pleuræ have the surface spiny and the setose margin smoothly moulded. The edge of the telson is finely spinate.

The orbital notches are broad and shallow, with the inner edge eroded; the optic peduncles have each a small scrobiculate spine at the frontal level.

The basal joint of the antennules has a single spine at its antero-external angle, and its scale is 4 or 5 times larger than the antennal scale, both scales ending obtusely. All 5 pairs of thoracic legs are chelate (in the female).

The great chelipeds have the usual form and just exceed the body in length; the compressed meropodite has both edges distantly and very finely serrated, the upper edge bearing a single terminal spine; the prismatic carpopodite has a similar

* This species is figured in "Illustrations of the Zoology of the Royal Indian Marine Steamer 'Investigator,' Crustacea," pt. ii. (pl. viii.), to be issued early this year.

terminal spine on the lower edge ; the propodite has the lower edge of the "palm" serrated, the upper edge having a terminal spine ; the dactylopodite, like the opposed "finger" of the propodite, has the usual fine fringe of setæ ; the chelæ of the fifth pair of legs are not quite perfect, owing to the shortness of the pollex.

The first pair of abdominal appendages (in the female) are almost rudimentary.

Colour in the fresh state bright pink.

Two females from Station 114, 922 fathoms.

The largest specimen measures 56 millim. in the mid-dorsal line from the front edge of the carapace to the tip of the telson.

The characteristic features of this species are—(1) the hump-backed carapace, and (2) the thin scabrous integument.

66. *Pentacheles Carpenteri*, sp. n.

Carapace thin, granular, and spicular beneath a very close fine fur ; its greatest breadth, which is in the posterior third, is two thirds its greatest length ; the median carina is crested by a double row of very fine granulation, and bears—(1) a double rostral spine, (2) three spines (of which the first two form a pair) in the middle of the gastric region, and (3) behind the cervical groove a very irregular series of 6 or 7 spines, some of which may be double ; the frontal margin is most conspicuously excised between the orbital notches, and is finely granular but without any large spines except the rostral spine ; the posterior margin is narrow and smooth ; the spinature of the lateral margins is irregular and is concealed by very long setæ, the spines number 4 to 6 in front of the hepatic groove, 3 between this and the cervical groove, and over 20 behind the cervical groove ; two conspicuous spines, one behind the other, stand on a faint ridge that delimits the gastric region on each side ; the dorsal sublateral (branchiostegal) crests are sinuous, but hardly visible even on a denuded carapace.

The abdominal terga and pleuræ are faintly and distantly pustulate ; all the terga except the sixth are strongly carinated, the high crests of the carinæ being strongly emarginate or bicuspid, but never forming spines ; a few tiny denticles at the posterior edge of the sixth tergum are all that represents a carina ; the crest of the anterior part of the telson forms an upstanding spine. The setose margin of the pleuræ is smoothly moulded.

The orbital notches are broad in front, triangular, and very

shallow, with the inner edge finely granular; the ophthalmic peduncles have each a small scrobiculate spine at the frontal level.

The basal joint of the antennules, which is very large, has a single spine at the antero-external angle, its scale is about four times larger than the antennal scale, both ending in spines.

All five pairs of legs are perfectly chelate (in the female).

The great chelipeds are not quite equal in length to the body, and in armature are similar to those of *P. gibba*, the meropodite being finely and distantly serrated on both edges and the propodite having the lower edge of the palm serrated.

The first pair of abdominal appendages are relatively very small, in the female.

A female from the Bay of Bengal, Carpenter's Ridge, 1370 to 1540 fathoms; it measures 87 millim. from rostrum to tip of telson in the mid-dorsal line.

The characteristic feature of this species is the remarkable concavity of the frontal margin between the ophthalmic notches and the consequent shallowness of the latter.

67. *Pentacheles Beaumontii** sp. n.

Carapace finely but distinctly granular; its greatest breadth, just behind the middle, is three fourths the greatest length; the median carina is surmounted by a double row of fine granulation and bears—(1) a double rostral spine, and (2) four spines (of which the middle two form a pair) in the front part of the gastric region, these being the only large spines present; the frontal margin has both the inner and the outer angle of the orbital notches produced into large spines, but is otherwise, except for the rostral spines, quite smooth; the smooth posterior margin (which, as usual, is formed by the last thoracic tergum) is peculiar in being nearly straight; the lateral margins are peculiar in having the spines of almost equal size throughout, these numbering on each side 23 or 24, namely 7 or 8 + 3 in front of the cervical groove and 13 behind it; the dorsal sublateral (branchiostegal) ridges are sinuous, very faint, especially in front, and faintly denticulate, while of the two usual ridges that traverse the branchial regions on the ventral aspect the most dorsad on each side is apparent only in front of the cervical groove.

The abdominal terga have the surface smooth or pitted;

* This species is figured in "Illustrations of the Zoology of the Royal Indian Marine Steamer 'Investigator,' Crustacea," pt. ii. (pl. viii.), to be issued early this year.

the first five are carinated, the carinæ of the first three culminating in procumbent spines, that of the fourth not being produced and that of the fifth forming a simple cusp; the sixth tergum has no vestige of a carina, but the telson in its front part has a retrorse spine; a shallow groove traverses the terga obliquely backwards on each side of the carina from the second to the fifth. The abdominal pleuræ have the surface smooth and the setose margin smoothly moulded; all but the sixth have a not very prominent midrib.

The ophthalmic notches are shallow, with smooth edges, and their peduncles bear each a strong spine at the frontal level. The basal joint of the antennules has a single spine at the antero-external angle; the antennular scale is peculiar in being very much shorter than the antennal scale; the former is truncated on a level with the rest of the joint, the latter has the usual form and ends in a spine.

All five pairs of thoracic legs are chelate. The great chelipeds much exceed the body in length; the meropodite, besides the usual terminal claw, has both its edges serrated, the lower edge very conspicuously so, four or five of its serrations in the proximal half forming large spines; the carpopodite has two terminal spines, one above, the other below; the propodite in its palmar portion has both edges strongly serrated, the serrations of the upper edge forming distinct spines.

(In the male) the "pollex" of the fifth pair of legs is much shorter than the dactylus. The first pair of abdominal appendages in the male has the usual spoon-shape.

A single male from off Colombo, 675 fathoms, measures 79 millim. from rostrum to tip of telson in the median line.

The characteristic features of this species are:—(1) the great breadth of the carapace posteriorly, (2) the diminutive size of the antennular scale, (3) the deficient spinature of the median carina of the carapace, (4) the great length of the chelipeds.

68. *Pentacheles Hextii*, sp. n.

Carapace uniformly and thickly setose and covered everywhere with spines and spiny granules; its greatest breadth, which is in its posterior third, is less than two thirds of its greatest length; the median carina ends in a single rostral spine, between which and the cervical groove is a close series of spinules, five or six of which are large, while between the cervical groove and the spiny posterior border of the carapace is a double row of close-set sharp serrations; the frontal margin is serrated throughout, and there is also a spine at

the inner angle of each orbital notch ; the lateral margins are spinate and very thickly setose, the spines numbering about 31, namely 8 + 5 in front of the cervical groove and about 18 behind it ; the border of the cervical groove is strongly spinate and the gastric region is delimited on each side by a row of four large spines ; the dorsal sublateral crests are quite straight and parallel with the lateral margins, each crest having about eighteen strong serrations, and the usual ventral branchial ridges are sharply serrated.

The abdominal terga, like the pleurae, have the surface more or less covered with bead-like granules or globules and setose, the edges of most of the terga being spinate and of the pleurae coarsely toothed ; all the terga, including the telson in its anterior part, are carinated, the carina of the first being indistinct, those of the second to the fifth inclusive culminating in large procumbent spines, that of the sixth being longitudinally grooved or double, with the edges beaded, and that of the telson being obtusely dentate ; the pleurae are traversed each by a salient beaded midrib.

The orbital notches are very deep and are quite peculiar in that the edges, which are rough throughout and strongly spinate in all but the front half of their inner edge, meet across the ophthalmic peduncle so as to completely divide each notch into two parts, namely into a shallow notch in front, behind which the posterior portion of the ophthalmic peduncle is completely isolated ; the ophthalmic peduncles have each a strong blunt spine at the frontal level.

The basal joint of the antennules has two spines at its antero-external angle, and the scale is a good deal longer than the antennal scale, both ending in spines.

All five pairs of thoracic legs are perfectly chelate in the female, but in the male the dactylus of the fifth pair is much longer than the pollex.

The length of the great chelipeds is less by half the length of the telson than that of the body ; the meropodite has both edges spinate, the upper most markedly so ; the carpus has the upper edge faintly serrate and has two terminal spines, one above, the other below, and the propodite in its palmar portion has both edges spinate.

The first pair of abdominal appendages have the usual forms and modifications of shape in both sexes—in the male spoon-shaped, in the female uniramous and setose.

Colour in life pink.

Three males and a female from Station 115, 188 to 220 fathoms.

The measurements from rostrum to tip of telson in the

middle line are, for the female 97 millim., for the largest male 80 millim.

The characters of this species are :—(1) the extremely spiny nature of the integument, and (2) the peculiar formation of the ophthalmic notches, which superficially are divided into two portions by the meeting of the edges across the ophthalmic peduncle.

69. *Pentacheles andamanensis*, sp. n.

Carapace with few distant spinules ; its greatest breadth, which is in front of the cervical groove, is two thirds its greatest length ; the median carina ends in a double rostral spine, between which and the cervical groove is a row of four spines, of which the penultimate is double, and between the cervical groove and the broad posterior margin are three pairs of spines ; the frontal margin is smooth, with a spine on the inner side of each orbital notch ; the lateral margins are spinate and sparsely setose, the spines numbering 5+3 in front of the cervical groove and 6 behind it ; the gastric region is bounded on each side by a sinuous row of 6 large spines, and the cardiac region by an oblique spiny ridge ; the branchial regions are traversed dorsally by a very slightly sinuous five-toothed sublateral ridge, and ventrally by the two usual serrated ridges.

The abdominal terga are smooth, all including the front part of the telson are carinated, the carinæ of the first five culminating in procumbent spines, that of the sixth being double with beaded edges, and that of the telson being simple ; the first five terga are obliquely and faintly grooved on each side of the median carina. The pleuræ are smooth, with the setose margin denticulated ; all are strengthened by a salient midrib.

The orbital notches are broad, smooth-edged, rather shallow ; the ophthalmic peduncles have a strong spine at the frontal level.

The basal joint of the antennules has two spines at the antero-external angle ; its scale is hardly larger than the antennal scale, the former ending in a spine, the latter obtusely pointed.

All five pairs of thoracic limbs are chelate (in the female) ; the great chelipeds are less in length than the body by three fourths the length of the telson ; the meropodite has both edges smooth, except for two spines near its proximal end and one terminally on the upper edge ; the carpopodite has a terminal spine of the usual claw-like shape above ; the edges

of the propodite are smooth, except for a subterminal tubercle on the upper edge.

Colour in life bright pink.

A female from Station 108, 1043 fathoms, measures 50 millim. from rostrum to tip of telson in the median line.

70. Pentacheles phosphorus *, sp. n.

Carapace above nearly smooth, pubescent, especially at the lateral margins and below; its greatest breadth, which is just in front of the cervical groove, is more than two thirds of its greatest length; the median carina ends in a double rostral spine, between which and the cervical groove is a line of four spines, of which the penultimate is double, and behind the cervical groove are three pairs of spines, the last pair standing rather wide apart from each other on a distinct bifurcation of the carina; the frontal margin is smooth, except for a single spine at the inner angle of each orbital notch; the posterior margin is broad; the lateral margins are setose and spinate, the spines numbering 6 (very rarely 7) + 3 (rarely 4) in front of the cervical groove and 6 or 7 behind it; the gastric region is bounded on each side by a sinuous row of six large spines, and the cardiac region by an oblique, low, denticulate ridge; the branchial regions are traversed dorsally by a perfectly straight seven-toothed sublateral ridge, and ventrally by the two usual serrated crests.

The abdominal terga are smooth, all, including the anterior part of the telson, are strongly carinated, the carinae of the first four culminating in procumbent spines, that of the fifth being, like that of the telson, simple, and that of the sixth being double, with the edges crenulated; the terga from the second to the fifth inclusive are obliquely and very deeply cleft on each side of the median carina. The abdominal pleurae have the surface smooth and the setose margin denticulate; each is strengthened by a very salient midrib.

The orbital notches are broad and deep, smooth-edged, and broadly rounded behind; the ophthalmic peduncles have a small tubercle at the frontal level.

The basal joint of the antennules has a single spine at the antero-external angle; its scale is not very much larger than the antennal scale, both ending in very sharp spines.

All five pairs of thoracic limbs are chelate. The great chelipeds are longer than the body; the meropodite has in

* This species is figured in "Illustrations of the Zoology of the Royal Indian Marine Steamer 'Investigator,' Crustacea," pt. ii. (plate viii.), to be issued early this year.

its proximal half two or three large spines on the upper margin and one or two smaller ones on the lower, distally it is finely serrated below and bears above the usual subterminal claw; the carpopodite has two subterminal claws, one above, the other below; the propodite in its palmar portion is finely serrated below and has a subterminal spine, or two, above. In the male the fifth pair of thoracic legs are not quite perfectly chelate owing to the shortness of the pollex.

The first pair of abdominal appendages in both sexes have the usual shapes and modifications, namely spoon-shaped in the male and uniramous and setose in the female.

Colour in life uniform bright pink.

Numerous specimens of both sexes from Stations 112 and 116, 561 and 405 fathoms. The largest female measures 119 millim. in the middle line from the rostrum to the tip of the telson; the males are smaller. One of the large females was luminous at two points between the basal joints of the last pair of thoracic legs, where there is a glandular organ very like that found in the females of the common species of *Penaeus*. In the introduction to this paper (Ann. & Mag. Nat. Hist., July 1891, p. 16) this species was confused with *Willemoesia forceps*, A. M.-Edw., which was therefore wrongly stated to be luminous.

Pentacheles phosphorus has been also dredged in the Andaman Sea at 375 and 500 fathoms; in the Bay of Bengal, off the Kistna Delta, at 678 fathoms; in the Gulf of Manár at 675 fathoms; and in the Laccadive Sea at 740 fathoms. It is by far the commonest of the Indian species of the genus.

71. *Pentacheles cerata* *, sp. n.

Pentacheles, sp. "distinguished by the huge spine which springs forwards from the middle of the fifth abdominal tergum," Wood-Mason, Admin. Rep. Marine Survey of India, 1890-91, p. 19.

Carapace remarkably smooth, slightly pubescent, especially towards the margins; its greatest breadth, which is just in advance of the cervical groove, is less than two thirds of its greatest length; the median carina ends in a double rostral spine, between which and the cervical groove is a line of four spines, the penultimate one being double; immediately behind the cervical groove is a pair of spines, and at the hinder edge of the carapace another larger and more widely separated pair; the frontal margin is perfectly smooth; the

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lateral margins are slightly setose and spinate or serrate ; there are 6 + 2 spines in front of the cervical groove, and 3 succeeded by some not very distinct serrations behind it ; within the cervical groove the gastric region is delimited on each side by a single spine ; the dorsal sublateral (branchio-stegal) ridges are sinuous, the anterior half being smooth and very faint, the posterior half being more distinct and slightly serrate.

The abdominal terga are smooth ; the first is very inconspicuously carinated, the second, third, and fourth are indistinctly carinated, except in front, where there is a small procumbent spine on each, but the fifth has a very strong carina, which culminates in a monstrous spine reaching beyond the anterior margin of the fourth ; the sixth tergum has a simple double carina ; the anterior part of the telson is also carinated. The pleuræ are smooth, their setose margin is very faintly and distantly denticulated.

The orbital notches are narrow, very deep, nearly the same width throughout, and smooth-edged ; the ophthalmic peduncles are perfectly smooth. The basal joint of the antennules has two spines at the antero-external angle ; its scale is not much larger than the antennal scale, both ending in spines.

All five pairs of thoracic legs are chelate (in the female). The great chelipeds exceed the body in length ; the mero-podite is perfectly smooth, except for a subterminal tubercle on the upper edge ; the carpopodite has two distinct sub-terminal spines, one above, the other below ; the propodite is smooth, except for a subterminal spine above.

The first pair of abdominal appendages have the usual form in the female.

An ovigerous female from Station 114, 922 fathoms, measures 79 millim. in the middle line from rostrum to tip of telson.

The characteristic feature of this species is the huge spine on the fifth abdominal tergum.

Family Parapaguridae.

PARAPAGURUS, S. I. Smith.

72. *Parapagurus abyssorum*, A. Milne-Edwards, Henderson.

Parapagurus abyssorum, A. Milne-Edwards, MS. ; Henderson, 'Challenger' Anomura, p. 87, pl. ix. fig. 2.

This species has been frequently dredged in the Bay of Bengal between 1644 and 1997 fathoms.

In colour in the fresh state it varies from pure pink to salmon-red.

It sometimes occurs in clean *Dentalium* shells, but usually inhabits the shell of a *Trochus* which is incrusted usually with a species of *Epizoanthus*, but sometimes with a solitary species of Actiniid.

73. ? *Parapagurus monstrosus*, sp. n.

The well-calcified anterior portion of the carapace is convex, smooth, and polished, with the gastric region and the hepatic regions sharply circumscribed by deep incisions; the frontal margin is sinuous and at the sides is carried far in advance of the inconspicuous, broadly rounded, faintly carinated rostrum, these lateral projections reaching almost to the level of the distal end of the basal joint of the antennæ; the posterior portion of the carapace is extremely thin, but is quite appreciably and uniformly calcified; its surface is smooth and bears some long scattered hairs.

The eye-stalks are short and stout, less than one third the length of the carapace, and gradually increase in diameter towards the expanded corneæ; dorsally they are crested by a line of long hairs; the ophthalmic scales are acute. The antennular peduncles exceed the eye-stalks by the whole length of the terminal joint. The antennal peduncles are but slightly longer than the eye-stalks; their basal joint is expanded and has the usual strong spine at the antero-external angle; the antennal acicle is doubly curved, with the inner margin setose and strongly serrated; its point reaches just beyond the origin of the flagellum; the last is not far short of twice the length of the body.

The chelipeds are most remarkably unequal, the right exceeding the left in bulk many times and in length by somewhat more than its dactylopodite; both are pubescent above, and the right is sharply granular above and slightly so below. In the right cheliped the meropodite and carpopodite are also pubescent below, and the margins of the latter, like those of the propodite and like the upper margin of the dactylopodite, are closely and sharply serrated. The left cheliped is hardly more massive than the corresponding portion of the second or third leg, and is smooth throughout. In the second and third legs the upper borders of the merus, carpus, and propus are crenulate or bluntly serrate, and, like the upper border of the long sinuous dactylus, hairy.

The gill-elements have the form of small filaments, similar in shape to, but smaller and far more delicate than, those of *Parapagurus abyssorum*.

In the male the first pair of abdominal legs are small, curved, rigid rods; the second pair are well developed, and the third, fourth, and fifth, which are long and delicate, are present on the left side only. The female has not been dredged.

Several specimens were taken at Station 120 in 240 fathoms, living in dead shells of a small *Natica*.

A large male measures about 19 millim. in length.

PYLOCHELES, A. Milne-Edwards.

74. *Pylocheles scorpio*, sp. n.

The form of the body is long and slender, the cephalothorax being almost cylindrical. The carapace is long and narrow, its greatest length being more than twice its greatest breadth; the portion in front of the cervical groove is strongly calcified and is smooth and polished, while the portion behind the cervical groove is much less strongly calcified dorsally, where it is also pitted and striated, and laterally is quite membranous; the thickened and moulded frontal margin is remarkably excavated behind the eye-stalks, a small rostrum projecting into the excavation; the lateral projections of the branchial regions are not visible from above.

The abdomen is long and narrow, its length, which is nearly twice that of the carapace, being four times its greatest breadth, all the somites being distinct and symmetrical. The abdominal terga after the first are rectangular plates, with the margins thickened and strongly setose, and the surface pitted and hairy; the terga of the first and sixth somites, of the telson, and of the fifth somite in the middle of its posterior third are considerably the more strongly calcified.

The long eye-stalks taper acutely from a broad base to the small bead-like unpigmented cornea; their dorsal surface is thorny and hairy towards the edges, and their length is less than that of the antennular peduncles by rather more than the terminal joint of the latter.

The antennular peduncles when moderately extended measure more than half the carapace in length; in the female the upper flagellum tapers to a lash from a stout inflated base, and is nearly as long as the peduncle, while the lower flagellum is a fine short filament.

The antennary peduncle exceeds the eye-stalks by rather more than half the length of its terminal joint; the basal joint has the front edge serrated; the acicle is thorny and hairy, and its point reaches just beyond the level of the

corneæ; the flagellum (in the female) is about half the length of the body and is fringed with long hairs.

The chelipeds are equal; their length being about equal to that of the abdomen and their upper surface being hairy throughout; the ischium and merus, which together make up nearly half their total length, meet together from opposite sides in a perfectly straight line across the mouth-parts, the line of apposition being closely and sharply toothed. Except for this line of teeth and for a few hardly distinguishable roughnesses on the upper border of the short carpus and of the long cylindrical propodite the surface of the chelipeds is smooth, the propodite being also highly polished.

The second and third thoracic legs are not much longer than the chelipeds; the propodite in both is subcylindrical and a little more than twice the length of the dactylopodite, and in both all the joints are smooth, with the margins hairy.

The fourth and fifth legs are subchelate, the cheliform parts are swollen and hairy, and the propodites have the usual beaded patch.

The abdominal appendages (in the female) conform to the type; the appendages of the penultimate segment have the dorsal surface of both exopodite and endopodite covered with a pavement of bead-like granules arranged in close rows, resembling a stridulating organ.

Colour in the fresh state dull chalky red.

A female 28 millim. long was dredged at Station 116 in 405 fathoms.

[To be continued.]

