

DESCRIPTIONS OF SEVENTEEN NEW SPECIES OF RECENT CRINOIDS.

By AUSTIN HOBART CLARK,

Collaborator, Division of Marine Invertebrates, U. S. National Museum.

The authorities of the Indian Museum, Calcutta, have recently done me the honor of intrusting to me for study the very important collections of recent crinoids brought together by the steamer *Investigator* during the course of her work in the Indian Ocean. Many of the new species are represented by a considerable number of specimens, and of these cotypes have been retained and deposited in the U. S. National Museum. The types themselves are in the Indian Museum. The completed report on the collection will be published as one of the series of *Investigator* monographs.

I wish here to record my appreciation of the kindness shown me by the authorities of the Indian Museum through the superintendent, Dr. N. Annandale, and by Dr. F. A. Bather, at whose suggestion the collections were sent to me.

Family ZYGOMETRIDÆ.

Genus EUDIOCRINUS P. H. Carpenter.

EUDIOCRINUS ORNATUS, new species.

Centro-dorsal a thin disk, the bare polar area flat, 2.5 mm. in diameter, the cirri arranged in a single marginal row.

Cirri XVIII, 17-18, 10 mm. long; first joint twice as broad as long, second nearly or quite as long as broad, third to fifth twice as long as the proximal diameter, sixth slightly shorter, a more or less marked transition joint; following joints gradually decreasing in length, the terminal joints being only slightly longer than broad; penultimate joint about as long as broad. The third to the sixth joints are very strongly "dice-box shaped," with the distal edge all around produced, except on the dorsal side; from the seventh onward both these features become less marked, and the cirrus becomes somewhat com-

pressed laterally. There are no dorsal spines; opposing spine sharp, prominent, arising from the entire dorsal surface of the penultimate joint, equal to about half the diameter of that joint in height; terminal claw equal in length to the penultimate joint, stout, and strongly curved.

Disk with a few rather large plates along the ambulacra, and well plated in the anal area.

Ends of the basal rays visible as small tubercles in the angles of the calyx; radials projecting slightly beyond the centro-dorsal, gently concave distally; IBr_1 and IBr_2 united by syzygy, forming an oblong syzygial pair from one-third to one-half again as broad as long, the lateral edges straight, barely in apposition basally, the ventro-lateral border slightly produced.

Five arms, 85 mm. long; first brachial oblong, about three times as broad as long; second slightly wedge-shaped, about the same size; third and fourth (syzygial pair) slightly longer on one side than on the other, half again as broad as the median length; next three brachials approximately oblong, twice and one-half as broad as long, the following becoming triangular, as broad as long, and after the proximal fourth of the arm wedge-shaped, as long as broad, and in the terminal portion somewhat longer. The lower brachials have on each side, as far as the lowest pinnule on that side, a slightly produced ventro-lateral edge, corresponding with that on the IBr series; the brachials have a somewhat concave dorsal surface and very prominent distal ends, everted on the proximal, strongly overlapping on the distal, which gives the animal a curiously ornate appearance. Syzygies occur between the third and fourth brachials, again between the eighth and ninth, and distally at intervals of three, more rarely four, oblique muscular articulations.

P_c 5.5 mm. long, moderately stout basally, tapering evenly to the tip, rather strongly prismatic, with twelve joints, the first short, the second not quite so long as broad, the third and fourth squarish, the following gradually increasing in length, being nearly or quite twice as long as broad terminally; P_1 similar to P_c , with the same number of joints, but somewhat stouter and not tapering so rapidly; P_a 8.5 mm. long, much stouter than P_c , gradually tapering from the base to the tip with twelve or fifteen joints, the first three about as long as broad, the following very gradually becoming elongated and about twice as long as broad distally; the pinnule is rounded-prismatic; P_2 similar to P_a ; P_b 6 mm. long, slender, cylindrical, less stout basally than P_c , gradually tapering and becoming very delicate in the terminal portion, with fifteen or sixteen joints, the first short, the second and third about as long as broad, the following gradually increasing in length and becoming nearly or quite three times as long as broad in the terminal portion; P_3 similar to P_b ; following pinnules similar,

gradually decreasing in length to 5 mm., then very slowly increasing, reaching a length of 10 mm. distally. The distal ends of the joints of the lower pinnules are more or less produced and spinous.

Type-specimen.—Cat. No. 7C, Indian Museum; lat. $14^{\circ} 04' 30''$ N.; long. $93^{\circ} 51' 00''$ E.; 41 fathoms.

Cotype.—Cat. No. 25478, U.S.N.M., from the same locality.

Family HIMEROMETRIDÆ.

Genus AMPHIMETRA A. H. Clark.

AMPHIMETRA MORTENSENI, new species.

Centro-dorsal thick-discoidal, the bare polar area flat, 4 mm. or 5 mm. in diameter; cirrus sockets arranged in two closely crowded alternating marginal rows.

Cirri XVIII–XX, 30–42 (usually about 35), 25 mm. to 30 mm. long; first joint short, about three times as broad as long, second and third about twice as broad as long, the following gradually increasing in length to the ninth or tenth, which is nearly, though never quite, as long as broad; next five to seven joints similar, the following gradually decreasing in length, in almost the whole of the terminal half of the cirrus being about one-half again as broad as long; from the twelfth or fourteenth onward sharp median tubercles or small spines are developed on the dorsal side of each joint, those on the last few joints occupying a position slightly proximal to median; opposing spine much larger than the processes on the preceding joints, triangular, the apex median, arising from very nearly the whole of the dorsal surface of the penultimate joint, equal to about half the diameter of that joint in height; terminal claw longer than the penultimate joint, moderately stout basally, but gradually becoming slender distally, moderately curved.

Radials concealed, or just visible beyond the centro-dorsal; IBr_1 oblong, very short, in close lateral apposition; IBr_2 (axillary) very broadly pentagonal, almost triangular, the lateral edges not quite so long as those of the IBr_1 , about two and one-half times as broad as long; $IIBr$ 4 (3+4); $IIIBr$ 4 (3+4); division series and first two brachials in close lateral apposition and laterally flattened, the dorsal carination only of P_D being visible exteriorly; synarthrial tubercles usually prominent.

Twenty to twenty-five arms 150 mm. long; first brachial slightly wedge-shaped, short, about three times as broad as its exterior length, almost entirely united interiorly; second about the same size, but more pronouncedly wedge-shaped; third and fourth (syzygial pair) oblong, half again as broad as long; next five or six brachials oblong, nearly or quite four times as broad as long, then slowly becoming wedge-shaped and then almost triangular, four times as broad as long, soon becoming wedge-shaped again, and in the outer half of

the arm oblong and very short, though somewhat longer again terminally. The proximal discoidal brachials are somewhat swollen, and most of the brachials have slightly overlapping distal ends. Syzygies occur between the third and fourth brachials, again between the thirteenth and fourteenth to thirty-first and thirty-second (usually somewhere between the sixteenth and twenty-fifth, with sometimes an extra one from two to four or five brachials beyond the first), and distally at intervals of two to thirteen (usually eight to twelve) oblique muscular articulations.

P_D 7 mm. long, moderately stout basally, but tapering rapidly and becoming slender in its distal half, with about twenty-five joints, at first three times as broad as long, becoming twice as broad as long at the sixth, and squarish in the terminal portion; some of the lower joints are bluntly carinate; P_1 10 mm. long, with 30 joints, slightly less stout basally than P_D and tapering somewhat less rapidly; joints at first about twice as broad as long, becoming as long as broad at about the eighth, and somewhat longer than broad terminally; P_2 15 mm. long, stouter than P_1 , tapering evenly to a delicate tip, with 30 joints, at first about half again as broad as long, becoming squarish at the eighth or ninth, and about twice as long as broad at the tip; P_3 22 mm. long, stouter than the preceding, with 30 joints, at first broader than long, becoming squarish about the tenth, and longer than broad terminally; the pinnule is more or less carinate in its proximal half and has a moderate supplementary ridge on the distal half of the outer side; P_4 resembling P_3 , but very slightly longer and slightly stouter and more carinate; P_5 like P_3 ; P_6 10 mm. long, resembling P_1 , but somewhat more strongly carinate proximally; following pinnules gradually decreasing to 7 mm. in length and losing the basal carination, then increasing to 12 mm. distally. On some arms P_5 is small as described for P_6 , and again P_4 may also be small, while occasionally P_2 and P_4 are similar and P_3 is greatly enlarged; sometimes $PP_{2, 3}$, and 4 are as described for $PP_{3, 4}$, and 5 . On one or more of the inner arms of each ray P_3 is often much larger than on the outer, while the adjacent pinnules are reduced.

Type-specimen.—Cat. No. 42B., Indian Museum; Port Blair, Andaman Islands.

Cotype.—Cat. No. 25479, U.S.N.M.; from the same locality.

I have dedicated this species to Dr. Th. Mortensen, of Copenhagen, in recognition of his valuable contributions to the knowledge of the Echinoderms.

Genus HETEROMETRA A. H. Clark.

HETEROMETRA COMPTA, new species.

Centro-dorsal discoidal, the bare polar area flat, slightly convex or slightly concave, about 5 mm. in diameter; cirrus sockets arranged in a single more or less irregular marginal row.

Cirri XVIII–XXIII, 31–35, 23 mm. to 25 mm. long; first joint very short, the next three nearly two and one-half times as broad as long, the following gradually increasing in length to the sixth or seventh, which is about as long as broad; next five to seven joints usually slightly longer than broad (sometimes squarish), the following gradually decreasing in length, the terminal fifteen or rather more being half again to twice as broad as long; at about the fifteenth joint dorsal tubercles are developed, at first involving only the distal portion of the dorsal surface, later arising in a slightly convex line from near the proximal end, the apex being subterminal; these tubercles are narrow, laterally occupying only a small portion of the median part of each joint, and are slightly rounded dorsally; on the last three joints the tubercles become somewhat sharper, more erect, and move to a median position; opposing spine small (though larger than the tubercle on the preceding joint), blunt, arising from the entire dorsal surface of the joint, the apex median or submedian in position, in height equal to about one-third the diameter of the penultimate joint; terminal claw somewhat longer than the penultimate joint, rather stout and strongly curved.

Ends of the basal rays and radials concealed; IBr₁ very short and band-like; IBr₂ (axillary) short, almost triangular, two and one-half times as broad as long; IIBr 4(3+4), in apposition laterally, though not laterally flattened; IIBr₁ entirely united interiorly; IIIBr 2, rarely 4(3+4); IVBr 2, but rarely present.

Sixteen to twenty-five arms 110 mm. long; first two brachials wedge-shaped, three times as broad as long exteriorly, the first interiorly united; following four or five brachials oblong, about four times as broad as long, then gradually becoming wedge-shaped, almost triangular, about three times as broad as long, and less oblique and somewhat longer on the outer portion of the arms. The dorsal surface of the arms is perfectly smooth. Syzygies occur between the third and fourth brachials, again between the thirteenth and fourteenth to twentieth and twenty-first (usually in the vicinity of the fifteenth) and distally at intervals of seven to eleven (most commonly eight or nine) oblique muscular articulations.

P_D 7.5 mm. long, moderately stout basally, but tapering rather rapidly in the proximal half and slender distally, with twenty-five joints, at first twice as broad as long, becoming squarish after the tenth; the first four joints are strongly carinate, this carination decreasing from this point onward and disappearing after the middle of the pinnule; P₁ 13 mm. long, slightly stouter than P_D basally, tapering gradually, and becoming slender in its distal third, with twenty-six joints, at first twice as broad as long, becoming squarish after the ninth and somewhat longer than broad in the terminal portion; the first seven or eight joints are rather strongly carinate and in

addition have a low sharp ridge running along their exterior surface at the base of the carinate processes; P_2 similar to P_1 and of the same length, but the low ridge just described may be traced to about the twelfth joint; P_3 9 mm. long with nineteen joints, similar to the two preceding pinnules, but slightly less stout; P_4 small, 6 mm. long, tapering rapidly in the proximal half and becoming very slender distally, with sixteen joints, at first twice as broad as long, becoming squarish about the ninth, and longer than broad distally, the first six joints carinate like those of the preceding pinnules; P_5 similar, 5.5 mm. or 5 mm. long; P_6 and the following pinnules 6 mm. long with seventeen joints, at first twice as broad as long, becoming squarish about the eighth and twice as long as broad terminally; the pinnules are about as stout basally as the two preceding, tapering rapidly in the proximal half and becoming very slender distally; the carination of the proximal joints is slightly marked on the first four; this carination later becomes restricted to the second and third joint only, and disappears entirely in the outer half of the arm.

Type-specimen.—Cat. No. 4 F. = $8 \frac{9}{6} 1^4$, Indian Museum; Pedro Shoal, north of the Laccadive Islands.

Cotype.—Cat. No. 25480, U.S.N.M.; from the same locality.

HETEROMETRA SINGULARIS, new species.

Centro-dorsal discoidal, the bare polar area flat, 1.5 mm. in diameter; cirrus sockets arranged in a single crowded, more or less irregular marginal row.

Cirri XVII, 21–25, 12 mm. long; first joint short, second about twice as broad as long, third somewhat longer, fourth about as long as broad, next two slightly longer than broad, the following gradually decreasing in length, the terminal fifteen being one-third or one-half again as broad as long; at the seventh subterminal dorsal spines begin to develop which soon become long and prominent; opposing spine large and long, much larger than the spines on the preceding joints, triangular, the apex terminal, arising from the whole surface of the penultimate joint and about equal to the diameter of that joint in length; terminal claw nearly twice as long as the penultimate joint, slender, abruptly curved proximally, becoming nearly straight distally.

Disk with a few calcareous granules in the anal area, especially on the anal tube.

Radials short, oblong, the dorsal surface with numerous prominent rounded tubercles; IBr_1 short, oblong, slightly over four times as broad as long, in close lateral apposition; IBr_2 (axillary) broadly pentagonal, almost triangular, twice as broad as long, the lateral edges shorter than those of the IBr_1 ; $IIBr$ 4(3+4); joints up to and including the second brachial exteriorly and the fourth interiorly,

as well as the first two joints of the first three pinnules, in close apposition and sharply flattened, the lateral edges somewhat produced.

Eleven arms (in the type), 40 mm. long; first two brachials subequal, wedge-shaped, about twice as broad as the exterior length, the first interiorly united; third and fourth (syzygial pair) slightly longer interiorly than exteriorly, nearly three times as broad as the interior length; next four brachials oblong, nearly four times as broad as long, then becoming almost triangular, about three times as broad as long, then gradually lengthening (though remaining almost triangular) to about twice as broad as long, and at a point somewhat beyond the end of the proximal third rather quickly becoming wedge-shaped, almost oblong, about two and one-half times as broad as long. From about the ninth onward the brachials have prominent distal ends, though they do not overlap the bases of the succeeding joints. Syzygies occur between the third and fourth, ninth and tenth, and fifteenth and sixteenth brachials (the second sometimes omitted), and distally at intervals of seven to ten oblique muscular articulations.

P_D 4.5 mm. long, moderately stout basally, but tapering rapidly in the proximal half, and slender distally, with 20 joints, at first about twice as broad as long, becoming squarish after the eighth; the second to the seventh joints are rather strongly carinate; P_1 similar, very slightly longer and stouter; P_2 6 mm. long, considerably stouter and stiffer than the preceding, and rather more strongly carinate basally, with about 20 joints, the first 7 (except for the carinate processes) squarish, the remainder slightly longer than broad, becoming about half again as long as broad distally; the ridge in the distal half of the outer side is but little marked; P_3 3 mm. long, much smaller than any of the preceding, with about 12 joints, at first broad, becoming squarish about the fifth, and nearly twice as long as broad distally; the second-fifth joints are carinate; following pinnules similar and about the same length, the joints becoming gradually longer and the basal carination gradually less; distal pinnules, 5 mm. long. On the arms arising from a IBr axillary, P_1 , P_2 , and P_3 are usually as described for P_D , P_1 , and P_2 , and P_4 is much smaller, as described for P_3 ; but occasionally P_2 is enlarged and similar to P_3 , as described, instead of being small like P_1 .

Type-specimen.—Cat. No. 7A, Indian Museum; southern portion of Malacca Strait.

Genus STEPHANOMETRA A. H. Clark.

STEPHANOMETRA CORONATA, new species.

This species is most closely related to *S. tenuipinna*.

Cirri XXII–XXIII, 25–30, 22 mm. long, resembling those of *S. tenuipinna*; the longest joints are about one-third longer than broad; the ninth, tenth, or eleventh is a well-marked transition joint.

Radials projecting slightly beyond the edge of the centro-dorsal; IBr₁ oblong, short, about three and one-half or four times as broad as long, not in lateral apposition, with a rounded ventro-lateral process in the proximal half; IBr₂ (axillary) broadly pentagonal, twice as broad as long, the lateral edges about half as long as those of the IBr₁, produced into a rounded prominent ventro-lateral process; synarthrial tubercles rather prominent; IIBr, IIIBr, and IVBr (when present) 2; elements of division series and first brachials with prominent rounded ventro-lateral processes.

Thirty-three or thirty-four arms 120 mm. long, in general resembling those of *S. tenuipinna*.

P₁ 14 mm. long, stout, stiff, and spine-like, with fourteen joints, the first two somewhat broader than long, the third to the fifth squarish, the remainder becoming gradually elongated and twice as long as broad distally; P₂ and P₃ exactly like P₁; P₄ 10 mm. long with ten joints, resembling the preceding; P₅ 7 mm. long, spine-like as the preceding, but somewhat more slender, with eight joints; following pinnules decreasing gradually in length, P₈ being 5 mm. long with eight joints; subsequent pinnules remaining of similar length, but decreasing in stiffness and increasing in the number of joints, P₁₃ being 5 mm. long with twelve joints, the third squarish, the distal twice as long as broad, only slightly stiffened proximally; distal pinnules slender, 9 mm. long.

Type-specimen.—Cat. No. 18 H= $\frac{451}{A.S.B.}$, Indian Museum; "India."

Cotype.—Cat. No. 25481, U.S.N.M.; from "India."

Family COLOBOMETRIDÆ.

Genus COLOBOMETRA A. H. Clark.

COLOBOMETRA DISCOLOR, new species.

Cirri XVIII–XXII, 29–40 (usually about 35), 25 mm. to 30 mm. long, slender, resembling those of *C. perspinosa*, but with the distal ends of the joints not so strongly spinous.

Radials projecting slightly beyond the centro-dorsal; IBr₁ oblong, slightly over twice as broad as long, the ventro-lateral borders slightly produced into a thin border, by which they are in apposition; IBr₂ (axillary) broadly pentagonal, twice as broad as long, the lateral edges somewhat more than half the length of those of the IBr₁, making with them a straight line, and with the same ventro-lateral projection; a slight constriction is usually present just below the lateral angles.

Ten arms, 80 mm. long, rather slender, resembling in general those of *C. suavis*.

P_a absent; P₁ 6.5 mm. long, small, tapering rapidly to a slender and delicate tip, with 15 or 16 joints; first joint twice as broad as

long, second somewhat longer, third about as long as broad, the fourth similar, the following very gradually increasing in length to about half again as long as broad, and becoming squarish again in the terminal 4 or 5; P_2 15 mm. long, moderately stout and very stiff and spine-like, with about 20 joints, the first about twice as broad as long, the second slightly longer, the third nearly half again as long as broad, the remainder about twice as long as broad; beginning on the second joint there is a faintly indicated, broadly rounded keel running along the middle of the outer side, as on P_1 ; on the third and following joints the distal dorsal edge projects in the line of this keel in a narrow fringe of spines, which broadens on succeeding joints, the spines at the same time becoming longer, and is supplemented by additional spines on the ventro-lateral angles of the joints; P_3 similar to P_2 , usually about 1 mm. shorter; P_4 10 mm. long, resembling P_2 and P_3 , though not quite so stiff, with 15 joints; P_5 and following pinnules very slowly decreasing in length and stiffness, at the same time becoming more slender, with the spines on the distal ends of the joints less and less pronounced; P_9 is 8 mm. long and P_{13} is 7 mm. long, each with 15 joints; from this point the pinnules very gradually increase to 10 mm. in length distally, the distal pinnules being slender, comparatively little stiffened, with 20 to 22 joints, which have moderately everted ends armed with fine spines; the distal pinnules are somewhat compressed laterally.

Type-specimen.—Cat. No. 9C., Indian Museum; lat. $14^{\circ} 04' 30''$ N.; long. $93^{\circ} 51' 00''$ E.; 41 fathoms.

Cotype.—Cat. No. 25482, U.S.N.M.; from the same locality.

Genus CYLLOMETRA A. H. Clark.

CYLLOMETRA TAPROBANES, new species.

Centro-dorsal thin, discoidal, the bare polar area flat, 2 mm. to 3 mm. in diameter; cirrus sockets arranged in a single, slightly irregular, crowded marginal row.

Cirri XX–XXI, 25–29, 12 mm. or 13 mm. long; first joint short, the next about two and one-half times as broad as long, the following slowly increasing in length to the fifth or sixth, which is twice as broad as long, and the tenth or twelfth, which is half again as broad as long, and still further increasing, so that the antepenultimate and one or two of the preceding joints are about as long as broad; fifth to seventh and succeeding joints with the distal dorsal edge prominent, forming a low transverse ridge which slowly moves anteriorly, attaining a median position on about the twelfth, and gradually narrows distally, becoming reduced to a small median tubercle on the last twelve; opposing spine prominent, rather slender, median, equal in height to about one-half the diameter of the penultimate

joint; terminal claw slightly longer than the penultimate joint, moderately slender, and moderately curved, rather more proximally than distally.

Radials projecting very slightly beyond the centro-dorsal, slightly separated distally; IBr_1 oblong or slightly trapezoidal, four times as broad as long; IBr_2 (axillary) broadly pentagonal, twice as broad as long; synarthrial tubercles moderately developed.

Arms 10, about 80 mm. long, resembling those of *C. studeri*; distal ends of the brachials very slightly, if at all, produced.

P_a absent; P_1 4.5 mm. long, small and slender, with about 14 joints, the first short, the second slightly longer, the third squarish, those in the distal portion being half again as long as broad; P_2 8 mm. long, stouter and stiffer than P_1 , though not especially enlarged, with 15 to 17 joints, the first short, the second and third squarish, the remainder one-third to one-half again as long as broad, becoming again somewhat shorter at the extreme tip; the joints in the distal half have slightly enlarged distal ends; P_3 6 mm. long, less stout than P_2 , but similar to it, with 14 joints; P_4 5 mm. long, slightly less stout than P_3 , but similar, with 12 joints; P_5 and following pinnules 4 mm. long, about as stout as P_4 , but not stiffened, with 12 joints, the third squarish, the remainder longer than broad, becoming half again as long as broad in the distal half; the distal ends of the component joints are slightly everted and spinous; distal pinnules slender, 7 mm. long, the joints smooth.

Type-specimen.—Cat. No. $\frac{5542}{7}$, Indian Museum; off Colombo Light House, Ceylon; 26½ fathoms.

Cotype.—Cat. No. 25483, U.S.N.M.; from the same locality.

Family THALASSOMETRIDÆ.

Subfamily THALASSOMETRINÆ.

Genus CROTALOMETRA A. H. Clark.

CROTALOMETRA ANNANDALEI, new species.

Centro-dorsal columnar, the tip truncated conical as in *Asterometra*, 5 mm. long by about 5 mm. broad at the base; cirrus sockets arranged in ten columns of usually three each, the columns of adjacent radial areas being closely crowded and more or less alternating, the two columns of each radial area being separated by a slightly concave median area of about half their width; polar area with five more or less marked interr radial ridges which terminate in five small tubercles about the apex.

Cirri comparatively slender, XXX, 62–79, 65 mm. long; first three joints approximately equal, short, about twice as broad as long, the following gradually increasing in length, becoming squarish on the fifth or sixth and half again or nearly twice as broad as long on the

eighth or ninth; next three or four joints similar, the length then very slowly decreasing, the joints in the middle of the cirrus being squarish and those in the distal part about twice as broad as long; eighth, ninth, or tenth a transition joint; shortly after the transition joint the median part of the distal dorsal edge begins to become prominent; this very slowly increases in height, arising from progressively more and more of the dorsal surface of the joints, which become progressively more and more carinate, so that in the terminal forty-five or fifty the dorsal surface is produced into a sharp, thin keel, straight in front, convex posteriorly, the outer edge parallel with the median line of the cirrus, in height equal to about one-third the diameter of the joints which bear them; opposing spine small and blunt, arising from the entire surface of the penultimate joint, the apex subterminal or central, in height equal to about one-third the diameter of the penultimate joint; terminal claw small, about equal in length to the penultimate joint, stout, and moderately curved. The cirri are rounded in the basal third, then becoming strongly compressed laterally and, when viewed from the side, somewhat broader.

Ends of the basal rays visible as dorso-ventrally elongated tubercles in the angles of the calyx; a deep and narrow cleft between the radials and the centro-dorsal; radials very narrow, convex proximally, concave distally, with a small, sharp tubercle in the median part of the proximal border; IBr_1 about three times as broad as long, the proximal border convex, the distal concave, in close lateral apposition, and extending rather well up into the angles of the calyx; the lateral edges are more or less denticulate, and there is a low, though sharp, serrate median keel; IBr_2 (axillary) slightly longer than broad, shield-shaped, the posterior border produced into a rounded projection incising the IBr_1 , the anterior edges concave, the anterior angle somewhat produced, the lateral edges rather strongly denticulate; it bears a sharp serrate median keel in the proximal two-thirds; $IIBr\ 4\ (3+4)$, strongly convex dorsally, in close apposition and sharply flattened like the IBr series, the lateral edges somewhat produced and strongly denticulate; $IIBr_{3+4}$ centrally constricted with the lateral angles produced as in the other species.

Twenty arms, 115 mm. long; first brachial short, slightly longer exteriorly than interiorly, interiorly united, somewhat incised by the second, which is nearly twice as large and has a rounded posterior projection; these two brachials, like the IBr_1 and $_2$, have a slightly marked median carination; third and fourth brachials (syzygial pair) not quite so long as broad, somewhat constricted centrally; next five or six brachials almost oblong, about twice as broad as long, the surface rather strongly concave, then becoming wedge-shaped and soon triangular, nearly as long as broad, and after the middle of the arm wedge-shaped again and about as long as broad. The arms are

at first evenly rounded dorsally, but after the basal third they gradually become compressed and more sharply rounded dorsally, and in the outer half very narrow and very sharply rounded dorsally, though not really carinate; after the basal third of the arm the brachials develop slightly projecting and finely spinous distal edges. The dorsal (but not the dorso-lateral) side of the fourth and following brachials is covered with fine short spines, which gradually become coarser after the proximal third of the arm and tend to arrange themselves into longitudinal lines; joints of the division series and arm bases with strongly denticulate borders. Syzygies occur between the third and fourth brachials, again between the twenty-fifth and twenty-sixth to thirty-fifth and thirty-sixth (usually in the vicinity of the twenty-ninth) and distally at intervals of five to seventeen (usually seven to ten) oblique muscular articulations.

P_D 12 mm. long, moderately stout in the proximal half, but becoming slender distally, with about twenty joints, all of which are approximately as long as broad, and the basal two-thirds of which are strongly carinate; P_1 10 mm. long, similar to P_D , but less stout basally; P_2 6 mm. long, much more slender than P_1 , tapering evenly from the base to the tip, with fifteen joints, the proximal four or five squarish, then longer than broad, and about twice as long as broad terminally. P_3 similar, 6 mm. long; P_4 and following pinnules 5 mm. long with about thirteen joints, less slender distally than the preceding; the joints have slight overlapping spines developed on the distal edge along the dorsal crest; distal pinnules 10 mm. long, rather slender, with about twenty joints, the first short and crescentic, the second trapezoidal, about as broad distally as its median length, the following half again as long as broad, the terminal four or five disproportionately small; the dorsal crest is sharp and somewhat spinous.

Type-specimen.—Cat. No. 20A. = $\frac{84.0.2}{6}$, Indian Museum; Malay Archipelago; 30 fathoms.

Cotype.—No. 25484, U.S.N.M.; from the same locality.

This species is named for Dr. N. Annandale, the superintendent of the Indian Museum, through whoses courtesy the exceptionally interesting collections of that institution have been sent to me for study.

Subfamily CHARITOMETRINÆ.

Genus CRINOMETRA A. H. Clark.

CRINOMETRA PULCHRA, new species.

Cirri XX–XXIV, 18–20, moderately slender, 30 mm. to 40 mm. long.

Ends of the basal rays visible as rather large tubercles in the angles of the calyx; radials concealed, or at most forming a $\swarrow\searrow$ -shaped ridge over the ends of the basal rays; IBr_1 very nar-

row, chevron-shaped or crescentic, or entirely concealed; $I\text{Br}_2$ (axillary) large, rhombic, half again to twice as long as broad, the edges all around smooth and prominent, with a moderate rounded median carination; $I\text{IBr}$ 2, the first very short, the axillary rhombic, about twice as broad as long; $II\text{IBr}$ 2, similar to the $I\text{IBr}$, developed interiorly in 1,2,2,1 order. The division series are perfectly smooth dorsally, in close lateral apposition and sharply flattened; the edges of the component joints are slightly prominent, and the axillaries have a slight broadly rounded median ridge, most pronounced on the first. One specimen has one $I\text{IBr}$ series, and one $II\text{IBr}$ series 4 (3+4).

Thirty arms, 150 mm. long, resembling, except in ornamentation, those of the other species of the genus; after the third or fourth brachial strongly overlapping distal ends are developed, the middle of which is swollen into a broad tubercle which may extend backward to the proximal end of the joint; after the thirtieth brachial this gradually disappears.

The pinnules are essentially as in the other species of the genus.

Type-specimen.—Cat. No. 25473, U.S.N.M.; from *Albatross* Stations Nos. 2319–2350, off Havana, Cuba; depth between 33 and 279 fathoms.

CRINOMETRA MARGARITACEA, new species.

Cirri XX, 13–15, 20 mm. long.

Ends of the basal rays visible in the angles of the calyx, bearing one or more long tubercles; radials concealed; $I\text{Br}_1$ very short, five or six times as broad as long, the edges parallel and slightly curved; $I\text{Br}_2$ (axillary) rhombic, about two and one-half times as broad as long; $I\text{IBr}$ 2; $II\text{IBr}$ 2, developed interiorly, but never present in the full series. The division series and first two brachials are slightly convex dorsally and are in close lateral apposition and sharply flattened laterally; the first eighteen or twenty brachials are also sharply flattened laterally. The axillaries and preceding joints are separated in the outer part of their contiguous surfaces, forming rhombic water pores; the first and second brachials are similarly separated interiorly. The ornamentation consists of moderately large blunt tubercles distributed evenly over the surface of the division series, becoming gradually less marked after the second brachial and disappearing altogether at about the end of the proximal fourth of the arm. The $I\text{IBr}$ and $II\text{IBr}$ series and the first two brachials have a low but prominent rounded narrow median carination; this is continued onto the arm bases in the shape of prominent median tubercles on each joint which disappear at about the end of the proximal fourth of the arm.

Twenty-one to twenty-nine arms, resembling in structure those of other species of the genus.

The pinnules are of the type common to most of the species of the genus, but are somewhat more slender, the genital pinnules not being so much expanded.

Type-specimen.—Cat. No. 25472, U.S.N.M.; from *Albatross* Station No. 2154, off Havana, Cuba; 310 fathoms.

CRINOMETRA CONCINNA, new species.

Cirri XX, 14–18 (usually 15 or 16) 25 mm. to 30 mm. long.

Ends of the basal rays visible in the angles of the calyx, bearing one or more long tubercles; radials concealed; IBr₁ very short often more or less concealed by the centro-dorsal, curved and band-like or narrowly crescentic; IBr₂ (axillary) rhombic to approximately triangular, two and one-half times as broad as long, the lateral edges as long as those of the IBr₁, and often, like them, reduced to a point; IIBr 2 (once 4 (3 + 4) and twice 4 united in two synarthrial pairs in eight specimens); IIBr 2, developed interiorly; edges of the joints to the third brachial everted and raised, usually broken up into high blunt tubercles which intermingle more or less with similar high blunt, more or less confluent tubercles on the dorsal surface of the joints; division series (except the IBr) and first two brachials usually with a high, rather narrow, median ridge, higher than the tubercles on the dorsal surface of the joint; this is sometimes partially or entirely broken up into two or three dorso-ventrally elongate tubercles, larger than any of the others on the joints. The proximal edge of the axillaries and the inner proximal edge of the second brachial are curved upward, while the distal lateral angles of the joints preceding the axillaries, and the inner distal angle of the first brachials, are cut away, leaving prominent openings, which serve as water pores. The division series are only very slightly convex dorsally, and are in very close lateral apposition; the first sixteen brachials are flattened laterally.

Thirty arms 150 mm. long, resembling those of other species of the genus; the lower brachials to about the fifteenth have strongly everted distal ends, which are usually more or less crenulate, or may be tubercular; there is usually a prominent central tubercle, dorso-ventrally elongate, and also some more or less obsolete tubercles on the dorsal surface; from the fifteenth onward the brachials are almost perfectly smooth dorsally.

Type-specimen.—Cat. No. 25476, U.S.N.M.; from *Albatross* station No. 2342, off Havana, Cuba; 201 fathoms.

CRINOMETRA INSCULPTA, new species.

Cirri XX, 15–18, 25 mm. to 30 mm. long.

Ends of the basal rays visible in the interradi al angles as a cluster of high tubercles, with difficulty separable from the similarly modified

surface of the surrounding skeletal elements; radials concealed; IBr_1 usually concealed except in the angles of the calyx; very short; IBr_2 (axillary) triangular, three or four times as broad as long; IIBr 4 (3+4) and 2, usually both in the same specimen, but the former always in the majority; IIIBr 2 (1 + 2), or 2 after a IIBr 2 series (rarely, when developed exteriorly, 4 (3 + 4) or 4 (1 + 2; 3 + 4)), developed interiorly in 1, 2, 2, 1 order, but never present in the full series. The elements of the division series are in close apposition, no water-pores being present. The division series and lower brachials are but slightly convex dorsally, and are in close lateral apposition and sharply flattened. The elements of the IBr series are thickly and evenly covered with prominent tubercles resembling those on the dorsal pole of the centro-dorsal. These sometimes arrange themselves in a more or less linear series in the median line, or there may be a more or less distinct median keel, which, however, is never very well marked. This evenly tubercular ornamentation may encroach somewhat upon the lower elements of the IIBr series, and always extends a considerable distance up into the angles of the calyx and between the IIBr series, narrowing to a point anteriorly, as does the somewhat similar ornamentation in *Mariametra subcarinata*. The elements of the IIBr and IIIBr series and the lower brachials have more or less (usually strongly) crenulate or tubercular edges, and the dorsal surface usually bears a few small scattered tubercles; along the median line they bear large and prominent, dorso-ventrally elongate, narrow, dorsally rounded tubercles, which form a conspicuous narrow carination. The lower brachials have very strongly tubercular or dentate distal ends, in the center of which is a single large tubercle, these large tubercles forming a median line of prominent tubercles, which continues the carination of the division series out onto the arms, gradually dying away and disappearing at about the end of the proximal fourth. The prominent eversion of the distal edges of the brachials becomes distally less and less strongly dentate, at the same time becoming less and less erect, until at about the twentieth brachial it becomes merely a moderately marked, finely spinous overlap, and so continues to the ends of the arms. The brachials to about the twentieth are sharply flattened laterally.

The pinnules are as in other species of the genus.

Type-specimen.—Cat. No. 25477, U.S.N.M.; from *Albatross* station No. 2753, off the windward coast of St. Vincent; 281 fathoms.

CRINOMETRA GEMMATA, new species.

Cirri XX, 12–15, 20 mm. to 25 mm. long.

Ends of the basal rays visible as elongate tubercles in the angles of the calyx, usually covered with short, fine spines; radials concealed, or just visible over the ends of the basal rays; IBr_1 very

short and band-like, of uniform height, strongly curved, the proximal edge everted and dentate, and with a row of small pointed tubercles, sometimes more or less confluent, midway between the anterior and posterior borders; IBr_2 (axillary) rhombic, twice and one-half as broad as long, the anterior and posterior angles approximately equal, the lateral edges about equal to those of the IBr_1 ; IIBr 4 (3+4) (in one specimen twice 2); IIIBr 2 (1+2), but only present in a single instance, developed interiorly. The division series are in close lateral apposition and are sharply flattened laterally; they are strongly convex dorsally, so that the dorsal portion of P_D is exposed. The division series and arms to the fourteenth or eighteenth brachial are thickly covered with numerous uniform, small, sharp, conical tubercles, which exhibit a tendency to arrange themselves in horizontal rows; these are more numerous and more slender along the edges of the division series. Seen without a glass, the proximal portion of the animal has the appearance of being finely and evenly granulated.

Nineteen to twenty-one arms, 100 mm. to 125 mm. long, resembling, except for the basal ornamentation as described, those of other species of the genus.

The pinnules are essentially as in the other species.

Type-specimen.—Cat. No. 25474, U.S.N.M.; from *Albatross* station No. 2330; off Havana, Cuba; 121 fathoms.

Family ANTEDONIDÆ.

Genus PSATHYROMETRA A. H. Clark.

PSATHYROMETRA MIRA, new species.

Centro-dorsal conical, rounded at the apex, 4 mm. broad at the base and 4 mm. high, divided into five radial areas by five shallow interradi al furrows, each equal in width to nearly or quite the diameter of the adjacent cirrus sockets; cirrus sockets closely crowded, regularly arranged in two converging columns in each radial area, with a single socket, the remnant of a third column, between the distal ends of the first sockets of the outer columns, which come together just beneath it.

Cirri XL, lacking in both specimens.

Ends of the basal rays visible as small tubercles in the angles of the calyx, but with difficulty separable from the general surface of the centro-dorsal and radials; radials even with the edge of the centro-dorsal in the median line, but extending up in the angles of the calyx and entirely separating the bases of the IBr_1 ; IBr_1 oblong, slightly over twice as broad as long, evenly rounded dorsally and laterally; IBr_2 (axillary) broadly pentagonal, about as long as broad, the lateral edges not quite so long as those of IBr_1 , convex, the lateral angles somewhat produced outward.

Ten arms, all broken off at the base in the two specimens at hand; first brachial slightly wedge-shaped, about twice as broad as its exterior length, entirely free interiorly; second brachial considerably larger, approximately oblong, not quite so long as broad; third and fourth brachials (syzygial pair) not quite so long as broad; the remainder of the arms and the pinnules, so far as can be judged from the fragments, are similar to those in other species of the genus. The synarthrial tubercles are very slightly marked.

Type-specimen.—Cat. No. 9G= $\frac{76.12}{9}$, Indian Museum; lat. $11^{\circ} 31' 40''$ N., long. $92^{\circ} 46' 40''$ E.; 188–220 fathoms.

Cotype.—Cat. No. 25485, U.S.N.M.; from the same locality.

Genus MASTIGOMETRA A. H. Clark.

MASTIGOMETRA MICROPODA, new species.

Centro-dorsal low hemispherical, 4 mm. in diameter at the base, the polar area slightly convex or flattened; cirrus sockets closely crowded, very numerous, in four or five alternating rows.

Cirri L–XC, 16, about 10 mm. long; first two joints short, rather over twice as broad as long, third as long as broad to about one-third longer than broad, fourth and fifth slightly longer; succeeding joints subequal, about as long as broad; third to sixth joints slightly “dice-box shaped,” the remainder with the ventral surface practically straight and the dorsal with a slight median concavity (in lateral view); no trace of dorsal spines or overlap; cirri becoming somewhat compressed in the distal two-thirds, and therefore appearing very slightly broader in lateral view; opposing spine represented by a slight tubercle, terminally situated, which may be obsolete.

Scattered calcareous granules are present along the disk ambulacra, and single interradiial plates may be present between the IBr_1 .

Radials even with the edge of the centro-dorsal; IBr_1 very short, five or six times as broad as long, of uniform height, not quite in apposition basally, the lateral edges diverging distally; IBr_2 (axillary) triangular, about half again as broad as long, the anterior angle somewhat produced, the proximal border as long as the proximal edge of the IBr_1 .

Ten arms, probably about 80 mm. long, their structure being the same as in *M. flagellifera*. The distal intersyzygial interval is three oblique muscular articulations.

P_1 15 mm. long, much stouter basally than the succeeding, though tapering to an exceedingly slender and delicate flagellate tip; P_2 9 mm. long; following pinnules gradually decreasing in length. The pinnules are of the same proportions and structure as are those of *M. flagellifera*.

Type-specimen.—Cat. No. 14 H., Indian Museum; “?India.”

Cotype.—Cat. No. 25486, U.S.N.M.; “?India.”

The only specimen in the collection with a definite locality is a small and much broken one, which was dredged off Colombo Light, Ceylon, in 26½ fathoms.

Family PENTACRINITIDÆ.

Genus HYPALOCRINUS A. H. Clark.

HYPALOCRINUS SPRINGERI, new species.

Stem slender, 4 mm. in diameter, rounded-pentagonal in cross section, the sides smooth, flat, or very slightly convex; interarticular pores extending to the eighth node; internodals, 10 (rarely 9 or 11) of equal size, each face slightly over twice as broad as high; nodals slightly longer than the internodals, the small transversely oval cirrus sockets touching the distal (lower) border and extending upward to the proximal fourth of the joint face; neither the supra- nor infra-nodals are modified in any way.

Cirri slender and delicate, twelve times the diameter of the stem (48 mm.) in length, with 50 joints; first joint very short, the following gradually increasing in length to the fourth, which is twice as broad as long, and further increasing to the sixth, which is about as long as broad; following joints slightly longer than broad, but in the terminal fourth becoming again about as long as broad; from the twentieth or twenty-third joint onward small but prominent median dorsal tubercles are developed; terminal claw small and blunt, conical, twice as long as broad at the base, slightly longer than the preceding joint.

Infrabasals present, resembling those of *Isocrinus decorus*; basals prominent externally, rhombic in outline, just contiguous by their lateral angles, strongly convex exteriorly, bearing from one to three prominent tubercles; in dorsal view the basals form a figure similar to that made by the basals of *Isocrinus decorus*; radials large, strongly convex proximally, slightly concave distally, about half again as broad as long, ornamented with a few coarse, high, tubercles, irregularly placed; IBr_1 oblong, about twice as broad as long, without ornamentation; the lateral edges are just in apposition, but are not flattened; they are cut away somewhat anteriorly and posteriorly, forming small rhombic pores on the lines of articulation between the IBr_1 and the radials, and the IBr_1 and $_2$; IBr_2 (axillary) short and broad, triangular, twice and one-half as broad as long, the anterior edges everted and produced into a high scalloped ridge; IBr_1 and $_2$ united by syzygy; IIB 2, the distal edges of the joints standing out in high prominent scalloped ridges; IIIBr 4 (3+4), the distal edges of the IIIBr₁, ₂, and ₄ forming high scalloped vertical ridges.

About twenty-five arms 140 mm. long, the terminal 30 mm. being slender and with only very rudimentary pinnules, as in *Metacrinus*

and in *H. naresianus*; first brachial very obliquely wedge-shaped, the distal edges forming a straight line with those of adjacent first brachials, and standing out in a high scalloped vertical ridge or bearing two or three high tubercles, the interior edges entirely united; second brachial smaller, wedge-shaped, about twice as long outwardly as inwardly, the distal edge everted as in the preceding; following brachials obliquely wedge-shaped, about twice as broad as long, after about the twelfth becoming oblong, at first half again as broad as long, gradually increasing in length, after about the middle of the arm being about as long as broad, and in the terminal portion half again as long as broad; the great eversion of the brachials gradually dies away as the joints become oblong, giving place to a slight prominence of the distal edge of the brachials, which in the terminal portion of the arm becomes a rather strong overlap. Syzygies occur between the second and third or third and fourth brachials (more rarely between the fourth and fifth), again between the fifteenth and sixteenth to thirty-first and thirty-second (usually in the vicinity of the twentieth), and distally at intervals of from four to nineteen oblique muscular articulations, the interval being long in the proximal, short in the distal part of the arm.

The pinnules are in general like those of *H. naresianus*.

Type-specimen.—Cat. No. $\frac{1}{7}$, Indian Museum; lat. $13^{\circ} 47' 49''$ N., long. $73^{\circ} 07' 00''$ E.; 636 fathoms.

Cotype.—Cat. No. 25487, U.S.N.M.; from the same locality.

This species is dedicated to Mr. Frank Springer, the eminent authority on the Crinoidea.

HYPALOCRINUS ORNATUS, new species.

In general like *H. springeri*, but a smaller and more delicate species.

Stem as in *H. springeri*, but only 3 mm. in diameter; cirri proportionately more slender, 30 mm. long (ten times the stem diameter) with 40 joints, the dorsal tubercles commencing at about the seventeenth; basals as in *Isocrinus decorus*, without ornamentation; radials without dorsal ornamentation, but with the distal edges everted and produced into a high, thin, scalloped overlapping ridge; IIBr 4 (3+4).

Eighteen to twenty arms, about 95 mm. long from the radials.

Type-specimen.—Cat. No. $\frac{8524}{6}$, Indian Museum; Andaman Sea; 200 fathoms.

Cotype.—Cat. No. 25488, U.S.N.M.; from the same locality.

