

Bulletin of the Museum of Comparative Zoölogy

AT HARVARD COLLEGE.

VOL. LIV. No. 7.

REPORTS ON THE SCIENTIFIC RESULTS OF THE EXPEDITION TO THE EASTERN TROPICAL PACIFIC, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," FROM OCTOBER, 1904, TO MARCH, 1905, LIEUT. COMMANDER L. M. GARRETT, U. S. N., COMMANDING.

XXII.

NEW GENERA AND SPECIES OF DINOFLAGELLATES.

BY CHARLES ATWOOD KOFOID AND JOSEPHINE RIGDEN MICHENER.

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CAMBRIDGE, MASS., U. S. A.:
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¹ Bull. M. C. Z., Vol. XLVI., No. 4, April, 1905, 22 pp.

² Bull. M. C. Z., Vol. XLVI., No. 6, July, 1905, 4 pp., 1 pl.

³ Bull. M. C. Z., Vol. XLVI., No. 9, September, 1905, 5 pp., 1 pl.

⁴ Bull. M. C. Z., Vol. XLVI., No. 13, January, 1906, 22 pp., 3 pls.

⁵ Mem. M. C. Z., Vol. XXXIII., January, 1906, 90 pp., 96 pls.

⁶ Bull. M. C. Z., Vol. L., No. 3, August, 1906, 14 pp., 10 pls.

⁷ Bull. M. C. Z., Vol. L., No. 4, November, 1906, 26 pp., 4 pls.

⁸ Mem. M. C. Z., Vol. XXXV., No. 1, February, 1907, 20 pp., 15 pls.

⁹ Bull. M. C. Z., Vol. L., No. 6, February, 1907, 48 pp., 18 pls.

¹⁰ Mem. M. C. Z., Vol. XXXV., No. 2, August, 1907, 56 pp., 9 pls.

¹¹ Bull. M. C. Z., Vol. LI., No. 6, November, 1907, 22 pp., 1 pl.

¹² Bull. M. C. Z., Vol. LII., No. 1, June, 1908, 14 pp., 1 pl.

¹³ Bull. M. C. Z., Vol. LII., No. 2, July, 1908, 8 pp., 5 pls.

¹⁴ Bull. M. C. Z., Vol. XLIII., No. 6, October, 1908, 285 pp., 22 pls.

¹⁵ Bull. M. C. Z., Vol. LII., No. 5, October, 1908, 11 pp., 2 pls.

¹⁶ Mem. M. C. Z., Vol. XXXVII., February, 1909, 243 pp., 48 pls.

¹⁷ Mem. M. C. Z., Vol. XXXVIII., No. 1, June, 1909, 172 pp., 5 pls., 3 maps.

¹⁸ Bull. M. C. Z., Vol. LII., No. 9, June, 1909, 26 pp., 8 pls.

¹⁹ Bull. M. C. Z., Vol. LII., No. 11, August, 1909, 10 pp., 3 pls.

²⁰ Bull. M. C. Z., Vol. LII., No. 13, September, 1909, 48 pp., 4 pls.

²¹ Mem. M. C. Z., Vol. XLI., August, September, 1910, 323 pp., 56 pls.

²² Mem. M. C. Z., Vol. LIV., August, 1911, 38 pp.

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No. 7.— *Reports on the scientific results of the Expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, by the U. S. Fish Commission Steamer "Albatross," from October, 1904, to March, 1905, LIEUT. COMMANDER L. M. GARRETT, U. S. N., Commanding.*

XXII.

New genera and species of Dinoflagellates.

By CHARLES ATWOOD KOFOID and JOSEPHINE RIGDEN MICHENER.

THE continued examination of the collections of the Expedition has brought to light a number of new species in addition to those previously described by the senior author (1907). Among them are representatives of two new genera, *Peridiniella*, related to *Peridinium*, and *Berghiella* of indeterminable relationships. Figures, fuller descriptions, and discussion of distribution will appear in a later memoir. A map giving location of stations will be found in the earlier paper (1907) and full data pertaining to them in Mr. Agassiz's account (1906) of the Expedition.

Throughout the descriptions the terms right and left are used as in the organism, not on figures. Transdiameters are measured at the girdle margin, excluding fins, unless otherwise stated. A description of the system of nomenclature of plates will be found in a paper by the senior author (1909).

The following is a list of the species described or discussed in this paper.

DINOFLAGELLIDIA.

DINIFERIDA.

PERIDININA.

CERATIIDAE.

- | | |
|------------------------------|--------------------------------|
| 1. <i>Gonyaulax acuta</i> | 6. <i>Gonyaulax pavillardi</i> |
| 2. <i>Gonyaulax expansa</i> | 7. <i>Gonyaulax reticulata</i> |
| 3. <i>Gonyaulax subulata</i> | 8. <i>Gonyaulax senta</i> |
| 4. <i>Gonyaulax areolata</i> | 9. <i>Gonyaulax paucula</i> |
| 5. <i>Gonyaulax minuta</i> | 10. <i>Gonyaulax inclinata</i> |

- | | |
|--|-------------------------------------|
| 11. <i>Gonyaulax bispinosa</i> | 25. <i>Peridiniella sphaeroidea</i> |
| 12. <i>Amphidoma curtata</i> | 26. <i>Peridinium annulatum</i> |
| 13. <i>Amphidoma depressa</i> | 27. <i>Peridinium corniculum</i> |
| 14. <i>Amphidoma spinosa</i> | 28. <i>Peridinium hyalinum</i> |
| 15. <i>Amphidoma elongata</i> | 29. <i>Peridinium karsteni</i> |
| 16. <i>Amphidoma laticincta</i> | 30. <i>Peridinium nodulosum</i> |
| 17. <i>Amphidoma obtusa</i> | 31. <i>Peridinium pacifica</i> |
| 18. <i>Goniodoma reticulata</i> | 32. <i>Peridinium poucheti</i> |
| 19. <i>Goniodoma crassa</i> | 33. <i>Heterodinium angulatum</i> |
| 20. <i>Protoceratium cancellorum</i> | 34. <i>Heterodinium elongatum</i> |
| 21. <i>Protoceratium globosum</i> | 35. <i>Heterodinium laeve</i> |
| 22. <i>Protoceratium pellucidissimum</i> | 36. <i>Heterodinium lineatum</i> |
| 23. <i>Protoceratium pepo</i> | 37. <i>Heterodinium minutum</i> |
| 24. <i>Protoceratium promissum</i> | 38. <i>Heterodinium spiniferum</i> |

OXYTOXINAE.

- | | |
|----------------------------------|------------------------------|
| 39. <i>Centrodinium expansum</i> | 42. <i>Oxytoxum curvatum</i> |
| 40. <i>Centrodinium porulosa</i> | 43. <i>Oxytoxum recurvum</i> |
| 41. <i>Oxytoxum breve</i> | 44. <i>Oxytoxum robustum</i> |

DINOPHYSIDAE.

- | | |
|-------------------------------------|--------------------------------------|
| 45. <i>Phalacroma circumcincta</i> | 60. <i>Histioneis diomedeeae</i> |
| 46. <i>Phalacroma favus</i> | 61. <i>Histioneis costata</i> |
| 47. <i>Phalacroma fimbriata</i> | 62. <i>Histioneis elongata</i> |
| 48. <i>Phalacroma gigantea</i> | 63. <i>Histioneis hippoperoides</i> |
| 49. <i>Phalacroma limbata</i> | 64. <i>Histioneis hyalina</i> |
| 50. <i>Phalacroma porosa</i> | 65. <i>Histioneis inclinata</i> |
| 51. <i>Phalacroma praetexta</i> | 66. <i>Histioneis inornata</i> |
| 52. <i>Phalacroma pulchra</i> | 67. <i>Histioneis karsteni</i> |
| 53. <i>Phalacroma turbinea</i> | 68. <i>Histioneis panda</i> |
| 54. <i>Dinophysis collaris</i> | 69. <i>Histioneis reginella</i> |
| 55. <i>Dinophysis expulsa</i> | 70. <i>Histioneis rotundata</i> |
| 56. <i>Dinophysis rugosa</i> | 71. <i>Histioneis striata</i> |
| 57. <i>Amphisolenia astragulus</i> | 72. <i>Ornithocercus formosus</i> |
| 58. <i>Amphisolenia quadricauda</i> | 73. <i>Ornithocercus orbiculatus</i> |
| 59. <i>Amphisolenia truncata</i> | |

AMPHITHOLIDAE.

74. *Amphitholus quincuncialis* Kofoid

INCERTAE SEDIS.

75. *Berghiella perplexa*

GONYAULAX Diesing.

The plates in this genus are an apical series of three to six plates (1'-3' to 6'), an incomplete series of anterior intercalaries (0^a-4^a), six precingulars (1''-6''), six girdle plates (1-6), six postcingulars (1'''-6'''), one posterior intercalary (1^p), and one antapical (1''').

Subgenus FUSIGONYAULAX Kofoid.

The *acuta* group.

Biconical species with apical and antapical horns.

GONYAULAX ACUTA, sp. nov.

A large biconical species resembling *G. expansa*, sp. nov., but differing from it in size, form of ventral area and antapical horn, and in surface markings. Length nearly 2 transdiameters, midbody rounded; epitheca abruptly contracted to truncate apical horn, antapex more tapering, acuminate, nearly symmetrical. Girdle descending, displaced 1.5 girdle widths. Ventral area very narrow throughout, deeply indenting epitheca, not widely flaring posteriorly, terminating asymmetrically on right postmargin. Ventral pore on apical 3'. Plate formula 3', 0^a, 6'', 6, 6''', 1^p, 1'''. Apical 1' slender; precingular 6'' quadrangular; postcingular 1''' minute, squarish; posterior intercalary 1^p elongated, carried out on antapical horn; antapical 1''' forming stout antapical spine, most exposed dorsally. Surface areolate with few linear riblets, sparsely porulate.

Length, 100 μ ; transdiameter, 48 μ .

Sta. 4719.

GONYAULAX EXPANSA, sp. nov.

A medium sized biconical species flaring widely at the girdle, resembling *Spiraulax jolliffei* (Murr. and Whitt.) in form. Length 1.7 transdiameters. Epitheca abruptly contracted to a tapering, truncate, apical horn. Antapex acuminate, asymmetrical. Girdle descending, displaced 2 girdle widths.

Ventral area indents epitheca, abruptly widened posteriorly. Ventral pore in apical 2'. Precingular 6'' quadrangular; postcingular 1' very narrow; posterior intercalary not extending on antapical horn; antapical 1'''' a conical asymmetrical horn. Plate formula 3', 0^a, 6'', 6, 6''', 1^p, 1'''''. Surface reticulate, pores in corners of polygons.

Length 75 μ ; transdiameter, 48 μ .

Sta. 4722.

GONYAULAX SUBULATA, sp. nov.

A very small biconical species with overhanging girdle and faint linear markings. Length 1.66 transdiameters. Midbody subrotund, contracted abruptly into a tapering truncate apical horn. Antapex subulate. Girdle descending, displaced 1.6 girdle widths, ends overhanging slightly. Ventral area short, sigmoid, not indenting epitheca, broadly rounded posteriorly, not reaching postmargin. Plate formula 3', 0^a, 6'', 6, 6''', 1^p, 1'''''. Apical 1' very narrow; precingular 6'' quadrangular; postcingular 1''' very minute; posterior intercalary not on antapical horn, short and wide; antapical 1'''' conical, exposed ventrally, terminating in a sharp subulate antapical spine. Surface smooth, sparingly marked with linear vermiculations in which lie the few scattered pores.

Length 48 μ ; transdiameter 27 μ .

Sta. —

Subgenus GONYAULAX.

The *spinifera* group.

Characterized by several asymmetrical antapical spines, absence of linear markings, and rotund body.

GONYAULAX AREOLATA, sp. nov.

A minute rotund species with short apical horn and areolate surface. Length 1.15 transdiameters. Rotund, apical horn less than 2 girdle widths high, apex squarely truncate. Hypotheca hemispherical, bearing 2, 3, or more unequal, acute, finned, antapical spines. Girdle descending, displaced scarcely a girdle width, without overhang, with ribbed lists. Ventral area nearly straight, gradually widened distally, reaching postmargin, with spinous lists. Ventral pore in apical 3'. Plate formula 3', 0^a, 6'', 6, 6''', 1^p, 1'''''. Apical 1' widened below its middle; precingular 6'' quadrangular, postcingular 1''' narrow; posterior intercalary very wide. Surface minutely and densely areolate, few pores.

Length, 40 μ ; transdiameter, 35 μ .

Sta. 4717.

The *polygramma* group.

Characterized by prevalence of linear markings.

GONYAULAX MINUTA, sp. nov.

A minute subspheroidal species with barely suggested apical horn with oblique apex. Length 1.1 transdiameters. Apex tilted to the left. Hypotheca hemispherical. Girdle descending, displaced 1 girdle width. Ventral area not indenting epitheca, terminating posteriorly in broadly rounded expansion. Ventral pore in apical 3'. Plate formula 3', 0^a, 6'', 6, 6''', 1^p, 1'''''. Apical 1' widened posteriorly; precingular 6'' nearly square; postcingular 1' minute, triangular; posterior intercalary wide. Surface smooth or faintly marked with linear striae. Girdle striate. No spines or lists.

Length 20–25 μ ; transdiameter, 18–20 μ .

Sta. 4720.

GONYAULAX PAVILLARDI, sp. nov.

A small rotund or subangular species with predominantly linear markings. Length 1.1 transdiameters. Body rotund, angled at apical-precingular suture. Epitheca gradually contracted into short (1.5 girdle widths) squarely truncate, apical horn. Hypotheca asymmetrically rounded, fuller on left side. Ventral pore on apical 3'. Girdle descending, displaced 1 girdle width, no overhang. Ventral area acutely and deeply indenting the epitheca, nearly straight, its posterior plate subcircular, reaching postmargin, and often bearing several antapical spinules. Plate formula, 3', 0^a, 6'', 6, 6''', 1^p, 1'''''. Apical 1', narrow, widened posteriorly; precingular 6'' quadrangular; postcingular 1''' very slender, less than 0.5 girdle width across; posterior intercalary wide, antapical 1'''' mainly dorsal in exposure. Surface sparingly reticulate with mainly longitudinal markings. Double ribs along sutures. Pores in lines.

Length, 48 μ ; transdiameter, 44 μ .

Sta. 4717.

GONYAULAX RETICULATA, sp. nov.

A small to medium sized species resembling *G. polygramma* Stein but entirely without the characteristic linear markings. Body rounded, in smaller forms scarcely angled at apical-precingular suture. Length 1.3 transdiameters. Epitheca contracted to a stout apical horn with truncate apex. Hypotheca subhemispherical. Girdle descending, displaced 1.5 to 2 girdle widths, no overhang. Ventral pore on apical 3'. Ventral area indents epitheca, slightly curved, enlarged distally to left, reaching postmargin. Plate formula,

3', 0^a, 6'', 6, 6''', 1^p, 1'''''. Apical 1' very narrow, curved to right posteriorly; precingular 6'' quadrangular; postcingular 1' very narrow; posterior intercalary long and narrow. Without lists, with or without two short, finned, antapical spines. Surface coarsely and regularly reticulate. Sutures ribbed, often marked by intercalary bands.

Length, 50 to 65 μ ; transdiameter, 45 to 50 μ .

Sta. 4724.

The *sphaeroidea* group.

Characterized by spherical form.

GONYAULAX SENTA, sp. nov.

A small species of spheroidal form, impressed girdle, and spinous hypotheca. Length 1.1 transdiameters. Epithea with low (0.5 girdle width) squarely truncate apical horn. Hypotheca subhemispherical. Girdle descending, displaced 2 girdle widths, with slight overhang. Ventral area acutely indents epithea, straight and narrow, and scarcely excavated posteriorly, not indenting antapical plate. No ventral pore. Plate formula, 3', 0^a, 6'', 6, 6''', 1^p, 1'''''. Apical 1' minute, not reaching anterior plate of ventral area, apical 3' short; precingular 6'' small, triangular; postcingular 1''' and posterior intercalary small; antapical 1'''' very large. Girdle impressed, with low fins. Surface of epithea minutely and faintly areolated, and with faint scattered reticulations, that of hypotheca without reticulations, abundantly covered with minute spinules, about seventy-five on its ventral face, longest on the antapical plate.

Length, 58 μ ; transdiameter, 52 μ .

Sta. 4683.

GONYAULAX PAUCULA, sp. nov.

A very minute species with subspheroidal form, feebly developed girdle, and smooth surface. Body nearly spheroidal, length 1.1 transdiameters, girdle section circular. Epithea less than hypotheca, its altitude about 0.5 transdiameter. Hypotheca slightly exceeding a hemisphere, its altitude about 0.6 transdiameter. Girdle descending, displaced nearly 1 girdle width, without overhang. Its furrow not impressed, slight ridge at its anterior margin, no posterior structure to mark suture or at most a feeble ridge, as in *Heterodinium*. Ventral area not impressed, not indenting epithea, not spreading distally, its total length 0.6 transdiameter. Plate formula 3', 3^a, 6'', 6 (?), 6''', 1^p, 1'''''. Apical 1' curved or angled to the left. Intercalaries dorsal, 2^a smallest. Precingular 6'' quadrangular, postcingular 1''' nearly

square. Posterior intercalary horizontally elongated. Surface smooth with few scattered pores or numerous small ones.

Length 20 μ ; transdiameter, 18 μ .

Sta. 4720.

Subgenus STEINIELLA (Schütt) Kofoid.

The *fragilis* group.

Characterized by apex carried on to dorsal surface and very fragile theca.

GONYAULAX INCLINATA, sp. nov.

A large, broadly rounded, asymmetrical species with short, slender, oblique, apical horn. Length equals transdiameter. Body rotund, flattened posteriorly. Epitheca contracted abruptly into a short (2 girdle widths), conical, truncate, apical horn tilted (15°) to right. Hypotheca asymmetrical. Antapex concave, with list with numerous spinules. Girdle descending, displaced 2.5 girdle widths, ends not meeting in median line by 1.5 girdle widths. Ventral area deeply and squarely indenting epitheca, nearly straight, scarcely widens distally to postmargin. Plate formula 4', 0^a, 6'', 6, 6''' (?), 1^p, 1'''''. Apical 1' widening posteriorly to square junction with ventral area; precingular 6'' pentagonal; posterior intercalary large; antapical 1'''' relatively small. Surface minutely and prominently reticulate. Pores in angles of areas.

Length, 75 μ ; transdiameter the same.

Sta. 4737.

The *bispinosa* group.

Characterized by two widely separated prominent antapical spines, and premedian girdle.

GONYAULAX BISPINOSA, sp. nov.

A very large, elongated, rotund species with two prominent antapical spines whose fins extend to the girdle. Body elongated, length 1.3 transdiameters. Girdle premedian, epitheca only about half the length of hypotheca. Epitheca convex, no apical horn, greatly elongated apical carries closing platelet on to dorsal face. Hypotheca constricted behind girdle, then expanding to rotund sac-like antapex. Girdle descending, displaced 2 girdle widths, scarcely impressed, with high hyaline lists, no overhang. Ventral area very narrow as far as to the large elliptical posterior plate which does not reach to antapex. Plate formula 4', 1^a (?), 6'', 6, 6''', 1^p, 1'''''. Apical 1' very narrow, 2' and 3' wide, and 4' narrow, precingular 6'' quadrangular; postcingular 1''' short; posterior intercalary and antapical 1'''' very large. Surface smooth,

with prominent spinulate ridges along suture lines and numerous longitudinal striae. Two antapical spines, 2.5 girdle widths long and 0.7 transdiameters apart, each with hyaline fins which run anteriorly to the girdle.

Length 75 μ ; transdiameter, 55 μ .

Sta. 4699.

AMPHIDOMA Stein.

The plate formula of this genus is 6', 0^a, 6'', 6, 6''', 1^p, 1''''.

AMPHIDOMA CURTATA, sp. nov.

Epitheca high, greatly exceeding hypotheca, fuller upon the right side, its altitude 1 transdiameter, its sides convex. Apex truncate, displaced to right. Hypotheca scarcely developed, forming a very low dome, only a girdle width in altitude, fuller upon the right side. Girdle not displaced, slightly impressed no lists. Ventral area acutely indenting epitheca for 0.5 girdle width, extending nearly to antapex without expansion. Plate formula 6 (?), 0^a, 6'', 6, 6''', 1^p, 1''''.

Apical 1' slender, reaching to anterior plate of ventral area. Other apicals short, less than 0.25 transdiameter in length; precingular 6'' slender, its width 1 and its length 5 girdle widths; postcingular 1''' small, squarish; posterior intercalary and antapical 1'''' about equal. Surface finely, faintly and regularly reticulate.

Length 30 μ ; transdiameter, 23 μ .

Sta. 4733.

AMPHIDOMA DEPRESSA, sp. nov.

A minute depressed species, low, top-shaped, with wide intercalary bands. Length equals transdiameter. Body biconical, epitheca exceeding hypotheca, its altitude 0.45 transdiameter, its sides straight, contracted abruptly to a scarcely differentiated apical horn about 0.75 girdle width in altitude. Hypotheca very low, its altitude 0.35 transdiameter, convex, contracted to a low, obtuse, median antapical horn, 1 girdle width across and 0.5 in length. Girdle not displaced, very slightly impressed, without lists. Ventral area acutely indents the epitheca, passing posteriorly 2 girdle widths with little expansion to an acute end, guarded by low lists. Plate formula 6', 0^a, 6'', 6, 6''', 1^p, 1''''.

Apicals 1', 2', 6' narrow, covering about 0.75 of the apex. Apical 1' asymmetrically diamond-shaped, not fully parting precingular 1'' and 6'' and scarcely meeting the ventral area; precingular 6'' pentagonal; postcingular 1''' small rectangular; posterior intercalary crowding on to the antapex. Surface smooth, except for striate intercalary bands along nearly all sutures in precingular, girdle, and postcingular series.

Length, 27 μ ; transdiameter, 27 μ .

Sta. 4733.

AMPHIDOMA SPINOSA (Kofoid).

Murrayella spinosa Kofoid (1907) belongs in this genus.

AMPHIDOMA ELONGATA, sp. nov.

Resembling *A. acuminata* Stein in form but more obtuse anteriorly and with its bluntish antapical horn curved a little ventrally. Body elongated, biconical, its length 2 transdiameters. Epitheca and hypotheca equal in altitude, both with concave sides, except near girdle end on right face of hypotheca which is fuller. Apex somewhat abruptly rounded to small apical closing platelet. Antapex blunt, curved ventrally beyond basal constriction, without acicular spinule of *A. acuminata*. Girdle scarcely displaced, slightly impressed. Ventral area very slightly indenting epitheca, widening to the right to 0.7 girdle width just beyond the girdle and attenuate posteriorly, its total length only 3 girdle widths, guarded by two minute lists. Plate formula 6', 0^a, 6'', 6, 6''', 1^p, 1'''''. Apical 1' an elongate, asymmetrical rhomb, other apicals 0.66 transdiameter in length; precingular 6'' pentagonal; postcingular 1''' small, triangular; posterior accessory large, 2 girdle widths across; antapical 1'''' asymmetrical. Surface smooth, ventral pore on right edge of apical 1'. Faintly striate intercalary band along apical-precingular suture.

Length 35 to 45 μ ; transdiameter, 18 to 23 μ .

Sta. 4720.

AMPHIDOMA LATICINCTA, sp. nov.

A minute spheroidal species with smooth surface. Body almost a perfect sphere, its length not exceeding 1.05 transdiameters. Epitheca and hypotheca equal, hemispherical, the apex slightly contracted and a slight depression sometimes seen at apical-precingular suture. Girdle not displaced, relatively wide, scarcely impressed, without lists. Ventral area not indenting the epitheca, less than a girdle width across at posterior margin of girdle, attenuate, and extending posteriorly less than two girdle widths, with two small lists overhanging flagellar pore. Plate formula 6', 0^a, 6'', 6, 6''', 1^p, 1'''''. Apical 1' narrower than other apicals, asymmetrically diamond-shaped, not parting precingulars 1'' and 6'' to meet the ventral area. Precingulars a trifle shorter than apicals. Postcingular 1''' very minute, nearly rectangular, posterior intercalary elongated laterally, narrow. Surface smooth and structureless except for faint surface lines and intercalary band at apical-precingular suture. Ventral pore at midventral posterior tip of apical 1'.

Length 18 μ ; transdiameter, 17 μ .

Sta. 4720.

AMPHIDOMA OBTUSA, sp. nov.

Body less elongated than in *A. acuminata*, antapex broadly rounded. Length 1.42 transdiameters. Epitheca conical, sides scarcely convex, its altitude 0.6 transdiameters, equalling hypotheca. The latter with nearly straight sides and very broadly rounded antapex. Girdle very shallow, descending, displaced 0.3 girdle width. Ventral area straight, extending posteriorly barely 2 girdle widths to asymmetrically rounded end, scarcely impressed. Plate formula 6', 0^a, 6'', 6, 6''', 1^p, 1. Apical 1' asymmetrically diamond-shaped, extending posteriorly to ventral area; the other apicals shorter, nearly twice the length of the precingulars; precingular 6'' squarish; postcingular 1''' minute, subtriangular; posterior intercalary wide, 1.5 by 2 girdle widths. Surface smooth, faint intercalary band at apical-precingular suture.

Length, 27 μ ; transdiameter, 18 μ .

Sta. 4720.

GONIODOMA Stein.

Theca composed of three apicals, 1' to 3', about a depressed closing platelet, no anterior intercalaries, seven precingulars, 1'' to 7'', six girdle plates, 1 to 6, plus two additional platelets in region of ventral area, five postcingulars, 1''' to 5''', no posterior intercalary, and three antapicals, 1'''' to 3'''''. The ventral area is made up of five platelets in addition to the two in the level of the girdle.

GONIODOMA RETICULATA, sp. nov.

A small spheroidal species with porulate epitheca, and hypotheca very irregularly covered with a coarse, heavy but imperfect reticulum. Differs from *G. acuminata* var. *tener* Schütt (1895) pl. 7, fig. 31, in structure at girdle junction and in surface markings. Body spheroidal, length 1.1 transdiameters. Epitheca exceeds hypotheca, its altitude 0.65 transdiameter, hemispherical, spreading somewhat at the girdle, apical area not projecting. Hypotheca depressed hemispherical, its altitude 0.4 transdiameter. Girdle postmedian, descending, displaced one girdle width, distal end curved posteriorly, impressed, with low, hyaline, irregularly ribbed lists. Ventral area short, 3 girdle widths in length and 1.5 in width, arched to the right, with spinous lists on either side. Apical area triangular with elliptical pit. Ventral pore in anterior margin of precingular 1''. Antapicals 1'''' and 3'''' small, unequal, 1'''' much like a posterior intercalary of *Gonyaulax*. Antapical 2'''' large, quadrangular. Surface of epitheca irregularly marked with areoles of various sizes. Hypotheca with loose, imperfectly anastomosing mesh work.

Length, 40 μ ; transdiameter, 36 μ .

Sta. 4722.

GONIODOMA CRASSA, sp. nov.

A large species with flaring narrow girdle, pointed antapex, and pitted, porulate areas of plates greatly reduced and remainder covered by faint irregular depressions. Body stout, ellipsoidal, with spreading girdle, and antapex abruptly contracted to a stout, asymmetrical, blunt projection. Length 1.07 transdiameters. Epitheca less than hypotheca, dome-shaped, spreading immediately at the girdle, its altitude 0.47 transdiameter. Apex broadly rounded, apical area triangular, with circular, sunken platelet. Hypotheca of similar form but fuller upon the left side and contracted distally to a stout, blunt, asymmetrical projection deflected to the right, 0.07 transdiameter high and 0.14 across its base. Girdle very narrow, 0.038 transdiameter across, descending, displaced distally 2 girdle widths, distal end deflected posteriorly in a sweeping curve and the proximal end abruptly curved in the same direction, deeply impressed, V-shaped. Ventral area short and wide. Apical plates small. Antapicals 1'''' and 3'''' exposed ventrally, and 2'''' dorsally. Surface with faint ridges along sutures, pitted, porulate areas reduced to about one fourth of each plate, remainder with faint depressions of irregular shape and distribution and without pores. No lists or spines. Wall thick.

Length, 94 μ ; transdiameter, 88 μ .

Sta. 4739.

PROTOCERATIUM (Bergh) Kofoid emend.

Plate formula 2', 0^a, 6''(?), 6(?), 6''', 0^p, 3'''''. Apical 1' narrow, mid-ventral, 2' large encircling rest of anterior end. Apical area present as in Gonyaulax, sometimes obscured in the mesh. No anterior intercalaries. Precingular 1' minute (always present?). Postcingular 1''' small. Posterior intercalary probably shifted into antapical group. Antapicals 1'''' and 3'''' nearly bilaterally symmetrical, 2'''' large, dorso-terminal. Surface coarsely and heavily marked with polygonal mesh of heavy ribs.

PROTOCERATIUM CANCELLORUM, sp. nov.

A large, remotely subglobular species with exceedingly coarse mesh. Length 1.08 transdiameters. Girdle section very broadly reniform. Epitheca 0.5 altitude of hypotheca, low dome-shaped, sides only slightly convex. Apex rounded. Hypotheca laterally contracted immediately behind girdle, 0.3 wider dorso-ventrally than transversely, antapex broadly and symmetrically rounded. Girdle descending, displaced scarcely 1 girdle width, without overhang, its furrow deep and narrow, with heavy hyaline non-ribbed lists. Ventral area 0.5 transdiameter in total length, arched to the right with hyaline fin on right margin. Surface with remarkably coarse polygonal meshwork,

wider along meridional sutures, smaller in center of plates. Three rows and an apical group of polygons on epitheca, five and an antapical group on hypotheca. Numerous minute scattered pores.

Length, 85 μ ; transdiameter, 70 μ .

Sta. 4697.

PROTOCERATIUM GLOBOSUM, sp. nov.

A spheroidal species of medium size, with delicate polygonal mesh of medium size, without lists or spines. Body almost perfectly spherical, except for depressed ventral area. Length, 1.11 transdiameters. Epitheca equals hypotheca, both apex and antapex slightly flattened. Apical area minute. Girdle descending, displaced 0.66 girdle width, its furrow scarcely at all impressed, guarded by low, hyaline, ribbed lists. Ventral area impressed, expanding to the right, its length from anterior girdle lists 0.57 transdiameter. Surface covered with a network of irregular polygons, sutures faint. Polygons numerous, about five rows and an apical group on epitheca, and six and an antapical group on hypotheca. No pores. Very translucent.

Length, 58 μ ; transdiameter, 52 μ .

Sta. 4737.

PROTOCERATIUM PELLUCIDISSIMUM, sp. nov.

A minute spheroidal species with apical horn, remarkably large polygonal mesh, and excessive transparency. Body subspheroidal. Length 1.13 transdiameters, girdle subcircular with slight ventral flattening. Epitheca exceeded by hypotheca, its altitude 0.45 transdiameter, subconical, sides somewhat convex, contracted distally into an asymmetrical apical horn 1 girdle width in height and a small, somewhat oblique apex. Hypotheca hemispherical, its altitude 0.6 transdiameter. Girdle descending, displaced 1 girdle width, its furrow not impressed, guarded by hyaline lists with few ribs. Ventral area short and narrow, its length from anterior girdle list but 0.5 transdiameter and its width 1 girdle width, distally contracted. Surface covered with very large polygonal mesh of delicate character. Two rows and an apical group on epitheca, and two and an antapical on the hypotheca. Sutures not visible, antapical list with spinules present. No pores. Excessively transparent.

Length, 50 μ ; transdiameter, 44 μ .

Sta. 4701.

Possibly not a Protoceratium.

PROTOCERATIUM PEPO, sp. nov.

A subellipsoidal species of medium size with coarse mesh. Body subellipsoidal with broadly rounded symmetrical apex and antapex. Length 1.3 transdiameters. Epitheca less than hypotheca, its altitude 0.5 transdiameter, its sides not sufficiently convex to be hemispherical or straight enough for a cone. Apex broadly rounded, apical area small. Hypotheca of similar form to epitheca but longer, its altitude 0.67 transdiameter. Girdle descending, displaced 1 girdle width, its furrow slightly impressed, with very low, hyaline non-ribbed lists. Ventral area very slightly widened to the right, with long hyaline fin on right margin, its length from anterior girdle list 0.65 transdiameter and its greatest width 1.45 girdle widths. Surface coarsely reticulate with rounded polygons, longer along faintly marked sutures, three rows and a distal group on each half of the theca. Ventral pore in small precingular 1''. Numerous scattered minute pores.

Length 46 μ ; transdiameter, 36 μ .

Sta. 4681.

PROTOCERATIUM PROMISSUM, sp. nov.

A large species of elongated form with coarse mesh and light secondary reticulations along tropical sutures. Body elongated almost biconical. Length 1.6 transdiameters, girdle section circular, some ventral flattening. Epitheca less than hypotheca, its altitude 0.75 transdiameter, its sides nearly straight, apex squarely truncate, 1.3 girdle widths across. Hypotheca 0.86 transdiameter in altitude, sides sloping, nearly straight proximally, antapex broadly rounded. Girdle descending, displaced 0.4 girdle width, its furrow deeply impressed, with heavy ridges and very low, hyaline, non-ribbed lists. Ventral area spreading distally, angled on right with low fin, its length from anterior girdle list 0.78 transdiameter. Surface coarsely reticulate with somewhat rounded polygons, larger and longer near faintly marked sutures, smaller and more rounded in center of plates. Faint traces of secondary reticulations in places along the two tropical suture lines. Ventral pore in small precingular 1''. No pores.

Length, 70 μ ; transdiameter, 43 μ .

Sta. 4739.

PERIDINIELLA, gen. nov.

Theca consisting of an apical series of plates (4), an incomplete zone of dorsal intercalaries (3), seven precingulars, six girdle plates, six postcingulars, one posterior intercalary, and one antapical. Resembles *Peridinium* in the dorsal intercalaries, and in number of precingular plates. Resembles *Gonyau-*

lax in form and relations of apical 1', in the plates of the hypotheca, in the absence of an apical notch, and in the presence of a ventral pore. Type species, *P. sphaeroidea*.

PERIDINIELLA SPHAEROIDEA, sp. nov.

A spheroidal species with shallow furrows, and plates with coarsely reticulated patches. Body nearly spherical, its length 1.07 transdiameters, girdle section circular, apex not elevated. Epitheca equals hypotheca. Girdle descending, displaced 1.4 girdle widths, its ends not meeting mid-ventrally by 1 girdle width, scarcely impressed, guarded by slightly everted ridges. Ventral area scarcely indenting epitheca; extending about 0.6 distance to antapex, terminating in subcircular area occupied by posterior plate of ventral area, nowhere deeply impressed. Plate formula, 4', 3^a, 7'', 6, 6''' (?), 1^p, 1'''''. Apical 1', narrow, asymmetrical, bearing at its apex a subcircular closing platelet, and joining the ventral area posteriorly as in most species of *Gonyaulax*. Anterior intercalaries 1^a-3^a symmetrically located on dorsal face as in *Peridinium*. Precingular 7'' quadrangular. Postcingular 1''' (?) less than 1 girdle width across and 2 in length. Posterior intercalary large, asymmetrically located, as is also the antapical 1'''''. Ventral pore midway between apex and proximal end of girdle at suture between apical 2' and precingular 1'', next to apical 1'. Surface with smooth intercalary bands along meridional and tropical sutures, which isolate patches of coarse irregular reticulations which show a tendency towards a quadrilateral form. No lists or spines.

Length, 52 μ ; transdiameter, 50 μ .

Sta. 4604.

PERIDINIUM ANNULATUM, sp. nov.

A large species with long, annulated apical and antapical horns. Belongs in the group with *P. fatulipes* Kofoid (1907), pl. 5, fig. 30, (syn. *P. tumidum* Okamura (?), *P. tessellatum* Karsten) and *P. kofoidi* Fauré-Fremiet (1908), pl. 16, fig. 12. It differs from *P. fatulipes* in greater elongation, narrower hypotheca, wider postmargin of ventral area, less spreading antapical horns, and in having the apical horn ringed with transverse riblets and the posterior horn similarly adorned for a greater distance. It differs from *P. kofoidi* in the long ventral notch which is not figured by Fauré-Fremiet, in the apical rings, in the much wider ventral area, and in the angle formed between the antapical horns (22° in *P. annulatum* and 52° in *P. kofoidi*). Length 1.66 transdiameters; width of narrowest part of hypotheca 0.45 transdiameter in girdle; length of antapical horns 0.5 transdiameter. Girdle not descending, its distal end curved anteriorly, not impressed, with hyaline, ribbed lists. Three dorsal anterior intercalary plates. Ventral area very wide, 0.22 transdiameter across, not deeply excavated and barely reaching postmargin.

Ventral notch long, narrow, its length 0.22 transdiameter. Surface finely and faintly reticulated with pores near nodes. Sutures marked by light rib. No intercalary bands seen.

Length, 74 μ ; transdiameter, 44 μ .

Sta. 4705.

PERIDINIUM CORNICULUM, sp. nov.

A small, spheroidal species with very small, elongated apical horn, transverse ascending girdle, displaced one girdle width, and two slender antapical spines. Differs from *P. globulus* Stein and *P. quarnerense* (Br. Schröder) Broch in less displaced girdle, longer apical horn, and straighter ventral area; from *P. globulus* var. Karsten in longer apical, structure at girdle junction, and in two instead of four antapical spines; from *P. nodulosum* in size, in longer apical, and in surface markings. Midbody nearly spherical, length 1.04 transdiameters. Epitheca exceeds hypotheca, both hemispherical. Altitude of epitheca (excluding horn) 0.6, and of hypotheca (excluding spines) 0.38 transdiameter. Apical horn abruptly differentiated, a flaring tube 1.55 girdle widths in length and 0.33 to 0.66 in diameter with ventral notch running its whole length and widening distally, tilted to right. Antapical spines solid, finned, 2 girdle widths in length and 2 apart at base, slightly spreading, arising from edges of ventral area. Girdle and ventral area as in *P. nodulosum*. Surface faintly reticulate, sutures marked by single rib with striae on one side giving a pinnate appearance to these tracts.

Length, of midbody, 51 μ , total, 67 μ ; transdiameter, 55 μ .

Sta. 4619.

PERIDINIUM HYALINUM, sp. nov.

A minute, plain, ellipsoidal species with equatorial, scarcely displaced girdle, without horns or spines. Resembles somewhat Fauré-Fremiet's *P. indéterminé* (1908), pl. 16, fig. 18, but differs in the absence of apical projection, distal asymmetry of central area, and in having a very slight displacement of the girdle. Body ellipsoidal, its length 1.16 transdiameters. Girdle section circular with slight ventral depression. Epitheca slightly exceeded by hypotheca, its altitude 0.5 transdiameter, subhemispherical, with slight suggestion of apical contraction. Ventral notch 0.6 girdle width long. Hypotheca hemispherical, its altitude 1.05 transdiameters. Girdle equatorial, descending, displaced only 0.4 girdle widths, its furrow very shallow, with low ridges but no lists. Ventral area nearly straight, reaching postmargin, slightly expanded to the left, with low lists on either side. Three dorsal anterior intercalary plates. Surface smooth and hyaline.

Length, 30 μ ; transdiameter, 27 μ .

Sta. 4720.

PERIDINIUM KARSTENI, sp. nov.

A large species resembling *P. multistriatum* Kofoid (1907), pl. 30, figs. 40, 41, but differing in proportions and in form of the girdle. Body widely expanded at girdle, rounded pentagonal in ventral view with concave antapex and very short, acute antapical horns, the right slightly longer. Apex inclined ventrally. Epitheca a little less than hypotheca, its dorsal altitude 0.4 transdiameter, contracted distally to a small, short, apical horn. Hypotheca broadly rounded to region of short antapical horns. Distance between their tips 0.3 transdiameter, length of right 1 and of left 1.5 girdle widths. Postmargin irregularly concave, but the arc very shallow. Girdle descending, displaced 4 girdle widths, the proximal end ascending in a very abrupt curve, and the distal descending in a sweeping one from the right margin. Furrow impressed, with low ribbed lists. Ventral area 3 girdle widths wide, expanding just behind distal end of girdle, reaching postmargin. Three dorsal intercalary plates. Apical 1', the rhomb plate, 3.5 girdle widths across. Ventral notch 2 girdle widths long. Surface with very wide, striate, intercalary bands and reduced reticulate-porulate areas of plates as in *P. multistriatum*. Width of dorsal postcingular band 0.27 transdiameter.

Length, 55 μ ; transdiameter, 60 μ .

Sta. 4670.

PERIDINIUM NODULOSUM, sp. nov.

A small spheroidal species with minute apical horn, ascending girdle without overhang, and surface with scattered nodular elevations. Differs from *P. globulus* Stein in wider girdle without proximal curvature, and from *P. quarnerense* (Br. Schröder) Broch, in absence of overhang and less displacement of girdle, and from both in the surface markings. Body almost spheroidal. Length, excluding horn and spines, 1.05 transdiameters. Girdle section circular, with little ventral flattening on hypotheca. Epitheca equals hypotheca, both hemispherical. Apical horn minute, 0.4 girdle width across, and less in height. Ventral notch minute. Girdle ascending, without proximal or distal curvature, displaced 1 girdle width, with feeble marginal ridges, and very low (0.2 girdle width) hyaline fin. Ventral area curved, narrow, flagellar pore posteriorly located. Two antapical spines on postmargin of ventral area each 1.2 girdle widths in length, the right more distal in origin, both finned. The right side of ventral area with long low fin. Three dorsal intercalaries. Apical 1' very broad, in contact with both precingular 1'' and 6''. Surface with scattered elevated nodules of irregular shape.

Length, of midbody, 42 μ , total 49 μ ; transdiameter, 38 μ .

Sta. 4706.

PERIDINIUM PACIFICA, sp. nov.

A small species resembling *P. pellucidum* Bergh but with much displaced girdle and proportionately greater girdle section. Body very broadly pyriform, contracted to small apex, but with scarcely any differentiated apical horn. Length, excluding spines, 1.08 transdiameters. Epitheca exceeds hypotheca, its altitude 0.76 transdiameter, hemispherical near girdles, contracted to conical apex. Ventral notch 1.5 girdle widths long. Hypotheca low, dome-shaped, contracted distally to narrow postmargins. Two equal, solid, subulate antapical spines 1.5 girdle widths in length, 2.5 apart at base and 3 at apex, rise from slight rounded projections. Postmargin with shallow arch. Girdle ascending, displaced 2 girdle widths, scarcely completing the circuit, proximal end posteriorly deflected, furrow not impressed, with low hyaline, non-ribbed lists. Ventral area spreading to the right and reaching postmargin, without lists or spines. Three dorsal anterior intercalary plates. Surface porulate and minutely areolate, with striate intercalary bands 1 to 1.5 girdle widths across.

Length, midbody only, 62 μ , total, 66 μ ; transdiameter, 57 μ .

Sta. 4732.

PERIDINIUM POUCHETI, sp. nov.

A small species with rotund body, short apical horn, short, close set, hollow antapical horns, ascending girdle and indenting postmargin. Differs from *P. pallidum* Ostenfeld in more rotund body, closer set, shorter antapicals. Differs from *P. adriaticum* Broch (1910), p. 192, fig. 8, in the same particulars, in less postmarginal excavation, and in greater displacement of girdle. It resembles *P. pellucidum* Bergh (1881) pls. 15, fig. 46, 47, in form of body but differs from it in greater extent of cavity in antapicals, more displaced girdle and stouter apical horn. Belongs to subgenus *Protoperidinium* rather than *Euperidinium*. Body elliptical with short, stout, apical, and slightly developed, partially hollow, subulate antapical horns. Total length 1.6, apical horn 0.2, antapicals 0.27 transdiameters. Girdle section circular. Epitheca equals hypotheca in total altitude, broadly hemispherical, contracted to tapering apical horn 1.5 girdle widths in height and 0.8 across apex. Ventral notch 1.3 girdle widths in length. Hypotheca subhemispherical, notched about 0.6 girdle width by postmargin. Antapical horns 0.27 transdiameter between centers of bases and 0.37 between tips, tapering subulate, distally formed of solid spines. Girdle ascending, displaced nearly 1 girdle width, not impressed, with ribbed, hyaline lists. Ventral area narrow, straight, with hyaline lists, but no posterior spinules. Surface finely and evenly reticulate throughout.

Length, 58 μ ; transdiameter, 36 μ .

Sta. 4709.

HETERODINIUM ANGULATUM, sp. nov.

Bears a general resemblance to *H. hindmarchi* f. *maculata* Kofoid (1907), pl. 7, fig. 42, but differs in having both shoulders angled, the excavation between the antapical horns wider and less arched, the surface more coarsely reticulate. Length 1.33 transdiameters on anterior girdle list. Epitheca exceeds hypotheca, both shoulders almost right-angled, abruptly contracted to tapering apical horn. Hypotheca with symmetrical, slightly incurved, tapering, obtuse antapical spines, with the arched postmargin flattened in the central part. Anterior girdle list salient, shelf-like, posterior deficient. Surface very coarsely reticulated with irregular, porulate polygons. Wide intercalary bands smooth, or wholly, or partially reticulate with fine quadrangles.

Length, 85 μ ; transdiameter, in girdle, 50 μ , on anterior ridge, 60 μ .

Sta. 4691.

HETERODINIUM ELONGATUM, sp. nov.

A small species of elongated form, coarse reticulations and small, close set antapical horns, somewhat resembling *H. hindmarchi* Murray and Whitting (1899), pl. 29, fig. 1, but relatively longer and with smaller, sharper, closer set antapical horns. Body elongated, its length twice the transdiameter in girdle. Epitheca slightly exceeds hypotheca, conical, with obliquely truncate apex but no apical horn, its sides nearly straight. Hypotheca more angular, antapical horns symmetrical, their length a little less than 0.25 and the distance between their tips 0.42 transdiameter in girdle. Girdle descending, displaced 1 girdle width, without overhang; excavated beneath epitheca, posterior list feebly suggested by salient angle. Ventral area contracted anteriorly, spreading abruptly into shovel-shaped area, terminating at post margin which is denticulate. Surface coarsely reticulate with large, irregular polygons, sutures marked by ridges.

Length, 68 μ ; transdiameter, in girdle, 35 μ , on anterior ridge, 44 μ .

Sta. 4732.

HETERODINIUM LAEVE, sp. nov.

A large, smooth species with oblique girdle, dorso-ventrally flattened body, low epitheca, with unequal, asymmetrical antapical horns curved to the left and ventrally, somewhat resembling *H. inequale* Kofoid (1906), pl. 18, figs. 9, 10, but differing in greater asymmetry, and longer more curved antapical horns. Length, to middle of antapical margin, 1.18 transdiameters. Epitheca low, its middorsal altitude 0.32, and midventral 0.27 transdiameter, its anterior outline nearly semicircular, apical area to the right, ventral pore swung far to the left. Girdle plane oblique, passing from dorso-anterior

obliquely posteriorly to the ventral face. Hypotheca scarcely contracted to the horns, but slightly excavated ventrally. Antapical horns wide-set, long, tapering, both curved to the left and ventrally, with points slightly incurved, the left about twice the length of the right which may be as long as 0.4 transdiameter. Girdle scarcely displaced, with low anterior ridge and no posterior one. Ventral area straight, very narrow, less than 0.5 girdle width across and 0.28 transdiameter long. Surface with few scattered pores in lines along sutures.

Length, 155 μ ; transdiameter, 92 μ .

Sta. 4739.

HETERODINIUM LINEATUM, sp. nov.

A bizarre form with elongated body and very large pores curiously elongated in antero-posterior direction. Body ellipsoidal, its length 1.8 transdiameters measured in the girdle. Girdle section circular. Epithea equals hypotheca, with convex, rounded sides and scarcely elevated apex. Hypotheca more angular, longer on left side. Girdle median, descending, displaced less than its width, posterior ridge deficient especially distally. Anterior ridge heavy, salient. Ventral area expanding distally into a large pentagonal plate. Ventral pore half way between apex and girdle, reniform, to right of bent mid-ventral line. This species is peculiar in that the anterior intercalary plate 1^a of the left shoulder is pushed forward to a minute contact with the apical region and might thus be called an apical plate, in which series it would seem to have a normal position. In all other particulars the species conforms to well known Heterodinium characters and it therefore seems best to retain it as an aberrant species of the genus. Sutures marked by heavy ridges (in old thecae), pores in subregular horizontal rows, elongated to about twice their width. Low lists on lateral apical sutures, lists about antapical plate with spinules at nodes.

Length, 60 μ ; transdiameter, in the girdle, 33 μ , on anterior ridge, 40 μ .

Sta. 4701.

HETERODINIUM MINUTUM, sp. nov.

A minute species of subspheroidal form, premedian, displaced, overhanging girdle, two acicular antapical spines and smooth porulate surface. Body subspheroidal, pot-shaped. Length equalling transdiameter on anterior girdle ridge and on greater expansion of hypotheca. Epithea less than hypotheca, only 0.4 transdiameter in girdle in height, low dome-shaped, apex not protruding save by its bounding ridge. Hypotheca with globular form up to girdle but with equatorial expansion 0.33 of transdiameter in girdle behind anterior girdle ridge. Girdle descending, displaced about 1.5 girdle widths, with ends overhanging in midventral region 1 girdle width, distal

end slanted posteriorly on ventral face. Anterior ridge salient, shelf-like; posterior wholly deficient throughout, its position suggested by a line of pores. Ventral area occluded between girdle ends, sigmoid, fan-shaped toward postmargin where it bears two symmetrically placed, ventro-posteriorly projecting acicular spines, a girdle width in length. Another spine and fin guard the left margin of the area. Surface wholly smooth, except for faint reticulations in girdle. Distribution of pores, which are separated by groups of pore-free intercalary bands, suggests the plate arrangement. Anterior intercalary 1^a on left shoulder marked by but a single pore.

Length, 40 μ ; transdiameter, in girdle, 35 μ , on anterior ridge, 40 μ .

Sta. 4697.

HETERODINIUM SPINIFERUM, sp. nov.

With the general form of *Peridinium fatulipes* Kofoid. Length 1.6 transdiameters in girdle. Epitheca subconical, with tapering apical horn and angled right shoulder, exceeding hypotheca which has two spreading, attenuate, subulate antapical horns, 0.42 transdiameter in girdle in length. Girdle slightly descending, displaced only 0.25 girdle width, its anterior ridge projecting, shelf-like, the posterior almost wholly deficient. Ventral area spreading, fan-shaped. Ventral pore nearly midway between truncate apex and girdle, at anterior end of elongated, pointed, smooth median area. Surface coarsely and irregularly reticulate, postmargin denticulate.

Length, 80 μ ; transdiameter, in girdle, 50 μ , on anterior list, 60 μ .

Sta. 4695.

CENTRODINIUM EXPANSUM, sp. nov.

A large species resembling *C. elongatum* but differing in its greatly expanded girdle, and relatively shorter and less twisted antapical horn. Body elongated, laterally compressed, with blunt apex and elongated asymmetrical antapex. Length 2.85 transdiameters. Girdle section elliptical, major axis dorso-ventral 1.12 transdiameters in length. Epitheca, in dorsal view, less than hypotheca, tapering, conical, deflected to the left, with apex unevenly truncated and inclined to the left, widely flaring at the girdle, its altitude 1.2 transdiameters. In lateral view the epitheca resembles that of *C. elongatum*, but is a little higher, fuller along dorsal margin, and with a more rounded apex. Hypotheca in lateral view similar to that of *C. elongatum* but with shorter horn. Its total length 1.3, length of horn 0.7 transdiameters. Horn twisted 90°, curved to dorsal side with a claw-like tip concave on the right face. Girdle premedian, descending, displaced one girdle width, deeply impressed, with stout salient ridges. Fins upon either side of the elongated ventral area. Surface smooth, sparingly porulate.

Length, 107 μ ; transdiameter, 41 μ ; dorso-ventral diameter, 46 μ .

Sta. 4711.

CENTRODINIUM PORULOSA, sp. nov.

An elongated, abundantly porulate species of small size, with little distal asymmetry, approaching *Murrayella* in some respects. Body elongated, laterally compressed, with blunt, squarish apex and pointed curved antapex. Length 3.3 transdiameters. Girdle section elliptical with longer axis dorso-ventral. Epitheca less than hypotheca, its length 1.45 transdiameters, conical with truncate apex in ventral view, asymmetrical in lateral view, with apex deflected ventrally. Apex bluntly rounded, 1 girdle width in dorso-ventral and 0.8 in transverse diameter. Hypotheca tapering, asymmetrically conical in both lateral and ventral view, the acute antapex slightly deflected ventrally and to the left. Girdle premedian, displaced 0.45 girdle width, narrowed a little distally, not deeply impressed, with heavy marginal ridge but no lists. Ventral area tapering, less than a girdle width across, extending 5 girdle widths beyond girdle. Surface abundantly porulate with coarse pores, with interspersed areoles. Faint lines along sutures.

Length, 70 μ ; transdiameter, 20 μ ; dorso-ventral diameter, 23 μ .

Sta. 4729.

OXYTOXUM BREVE, sp. nov.

A minute species of the *O. sphaeroideum* group somewhat resembling Stein's fig. 13, (1883), pl. 5. It differs from it, however, in proportions, and in absence of any trough-like depression in the girdle region. Body broadly ovoidal with projecting epitheca and acute apices. Length 1.4 times greatest transdiameter which is located some distance behind the girdle. Epitheca a minute pointed dome, 0.4 greatest transdiameter in greatest altitude, and 0.5 in greatest basal transdiameter. Hypotheca globular, with pointed antapex, its transdiameter at posterior margin of girdle 0.8 of greatest transdiameter which is 0.57 of total length from apex. Girdle descending, narrowing distally to 0.8 its initial width, very slightly displaced, not impressed or marked in any way by ridges or lists, merely the sloping shoulder of girdle plates whose vertical extent nearly equals that of the superposed but smaller epitheca. Ventral area reduced to a minute notch in hypotheca. Surface smooth.

Length, 20 μ ; transdiameter, greatest, 14 μ , at posterior edge of girdle, 11 μ .

Sta. 4733.

OXYTOXUM CURVATUM (Kofoid).

Described by Kofoid (1907), pl. 1, figs. 1, 2, as *Prorocentrum curvatum*. An analysis of its plates shows that it is a peculiar *Oxytoxum* with its epitheca reduced to a mere terminal button and the girdle to a surrounding shelf, without any anterior list or rib. The flagellar pore and ventral area which is very small, are on the concave face. The ventral area is scarcely deeper than the width of the small apex.

OXYTOXUM RECURVUM, sp. nov.

A medium sized species resembling *O. cristatum* Kofoid (1907), pl. 10, fig. 64, but with long, spinulate apex curved to the left and dorsally, and a fuller hypotheca. Body irregularly and asymmetrically biconical, girdle 0.46 of total length from apex. Length 0.48 transdiameter. Epitheca a low cone whose completed altitude would be 0.5 transdiameter, with a somewhat abruptly continued apex in the form of an elongated, tapering, curved, or even recurved horn, deflected to the left and dorsally, its length attaining in some cases 0.5 transdiameter. Hypotheca 1 transdiameter in altitude, its dorsal outline straight, the laterals and ventral convex, contracted dorsally to a stout, acute antapical horn, 1.4 girdle widths in length. Girdle descending, displaced 1 girdle width. Ventral area very short. Hypotheca ribbed. Length, 75 μ ; transdiameter, 40 μ .

Sta. 4724.

OXYTOXUM ROBUSTUM, sp. nov.

A stout species of medium size allied to *O. compressum* Kofoid but differing from it in absence of lateral compression, and in higher epitheca. Body nearly biconical in ventral view. Length 1.6 transdiameter. Girdle section circular. Epitheca 0.5 to 0.75 altitude of hypotheca, 0.67 transdiameter in altitude, with subconical outline in lateral view, and with concave sides, rounded apex and flaring girdle in ventral view. Hypotheca conical with acute apex curved ventrally, its total ventral altitude 1 transdiameter. Antapical spine scarcely differentiated. Girdle descending, displaced 1 girdle width, its proximal end excavating a rounded pit in margin of epitheca, deeply impressed, without lists. Ventral area 1 girdle width across and 3.5 in total length. Sutures marked by single ribs on hypotheca and by smooth intercalary bands with bounding ribs on main sutures of epitheca. Girdle ribbed, surface of plates finely and regularly reticulate.

Length, 97 μ ; transdiameter, 60 μ .

Sta. 4679.

PHALACROMA CIRCUMCINCTA, sp. nov.

Resembling *P. vastum*, but differing in greater elongation of body, position of girdle, and surface markings. Length 1.36 dorso-ventral diameters. Body asymmetrically elliptical in lateral outline which the girdle scarcely modifies. Girdle 0.42 to 0.44 of total length from apex. Girdle lists horizontal, low, hyaline, without ribs, less than girdle width in height. Low sagittal fin on both epitheca and hypotheca, incomplete dorsally. Ventral fins low, 1 to 1.5 girdle widths in height, sometimes reticulated. Surface minutely and closely pitted by somewhat irregular pits, about 35 across the side at girdle, larger next to girdle.

Length, excluding fins, 88 μ ; total, 96 μ ; dorso-ventral diameter, excluding fins, 70 μ , total 90 μ .

Sta. 4671.

PHALACROMA FAVUS, sp. nov.

A medium sized species somewhat resembling *P. mitra* Schütt but differing from it in having the body contracted dorsally as well as ventrally into a stout antapical horn. Length 1.2 dorso-ventral diameters at girdle. Antapical horn 0.25 total length and nearly 2 girdle widths across. Cuneate in dorsal view. Epitheca a low dome. Dorso-ventral diameter at anterior collar less (dorsally) than at posterior. Girdle lists at 40°, wider than girdle, regularly and closely ribbed. No sagittal fin on anterior and dorsal margins. Ventral fin regularly and heavily ribbed with incomplete riblets. Fission spine club-shaped, two girdle widths in length, ventral fin decurrent behind it. Surface coarsely and regularly covered with honeycomb mesh or coarse pits, 24 on the face at the girdle, spinulate near sagittal suture.

Length, 77 μ ; dorso-ventral diameter, 62 μ ; greatest transverse diameter, excluding fins, 50 μ .

Sta. 4737.

PHALACROMA FIMBRIATA, sp. nov.

A very large species with biconical (in dorsal view) body, with high epitheca, wide ribbon-like sagittal fins and very coarsely reticulated body. In dorsal view the body is biconical with apices truncated at suture area. In lateral view the body has rounded ends and flaring girdle. Epitheca very high, its altitude 0.5 dorso-ventral diameter (excluding fins), apex broadly rounded, somewhat nearer ventral than dorsal surface. Hypotheca longer, 0.85 dorso-ventral diameter at girdle (excluding fins), antapex inclined ventrally, broadly rounded. Girdle 0.42 of total length from apex (excluding fins). Ribbed sagittal fins completely encircling the body on either side of suture, higher on right side and posteriorly where it is 2 girdle widths across, and laterally reflexed. Girdle with wide, horizontal, ribbed lists. Surface coarsely reticulate with large polygons with heavy bounding mesh, 10 behind girdle on right face, polygonal areas minutely porulate.

Length, 130 μ , including fins, 152 μ ; dorso-ventral diameter, 80 μ .

Sta. 4613.

PHALACROMA GIGANTEA, sp. nov.

A huge species with delicate theca somewhat resembling *P. striata* Kofoid, but larger, relatively wider at girdle, and with smaller fins. Body shaped somewhat as in *P. striata* but more symmetrical posteriorly. Length 0.87 to 0.99 dorso-ventral diameter at girdle. Transdiameter exceeding (in some

specimens measured) dorso-ventral 1.1. Almost spheroidal posteriorly, flaring at the girdle, especially in dorsal region. Epitheca low, conical or dome-shaped. Girdle lists nearly equalling or exceeding girdle width in height, nearly horizontal, hyaline, non-ribbed, or with numerous straight riblets. Ventral fin short, little over a girdle width in height, hyaline, with one secondary spine, fission spine only 2 girdle widths behind girdle. Low sagittal fin, 0.2 girdle width wide, with numerous minute imperfect riblets. Surface simply porulate or with small, irregular, but well defined, polygonal mesh, each opening with central pore.

Length, 150 μ ; dorso-ventral diameter 148 μ ; transverse, 165 μ .

Sta. 4734.

PHALACROMA LIMBATA, sp. nov.

A large species resembling *P. pulchra*, sp. nov. but with girdle over 0.3 of total length from apex. Body almost circular in lateral view. Length 1.06 times dorso-ventral diameter; transdiameter 0.38 total length, greatest at girdle. Outline not interrupted by girdle. Two low fins about a girdle width in height, with numerous incomplete riblets along sagittal suture. Ventral fin 1.75 girdle widths in height. Antapical spine 3 girdle widths long, basally composed of anastomosing mesh. Girdle lists without ribs, less than 1 girdle width in height. Surface pitted in center of lateral faces, areolate peripherally. Pores less numerous than areoles.

Length, excluding fin, 75 μ ; total, 100 μ ; dorso-ventral diameter, excluding fins, 68 μ , total 89 μ .

Sta. 4667.

PHALACROMA POROSA, sp. nov.

A small rotund species resembling *P. rotundata* Clap. et Lach., but with epitheca more flattened and very prominent pores. Body subcircular in lateral outline, much flattened anteriorly, and often sac-like posteriorly. Length 1.1 times dorso-ventral diameter, transdiameter (in individual measured) 0.28 dorso-ventral diameter. Epitheca not exceeding 1 girdle width in height. Girdle lists equal, low, less than girdle width in height, hyaline, ribbed near dorsal suture ribs. Ventral fin hyaline, increasing in height from 1 to 2 girdle widths posteriorly, abruptly terminating behind secondary spine which is longer than the double fission spine. No sagittal fins, but well developed widely displaced (in individual examined) bounding ribs in thecal wall. Surface covered centrally on each side with delicate or strong tracery of polygonal mesh, peripherally free from mesh. Pores large and prominent, centrally located in heavier meshes, about 12 under girdle on one face, two rows in girdle, and marginal row along sagittal ridges.

Length, 51 μ ; dorso-ventral diameter, 43 μ ; transverse, 28 μ .

Sta. 4721.

PHALACROMA PRAETEXTA, sp. nov.

A small species somewhat the shape of *P. vastum* Schütt and *P. circumcincta*, sp. nov. with slightly premedian girdle and Protoceratium-like, coarse reticulations. Body subcircular in lateral view, in dorsal view biconical with broadly rounded ends. Length, 1.13 times dorso-ventral diameter. Transdiameter, in wide individual measured, equalling dorso-ventral. Girdle indents the epitheca, its posterior ridge about equatorial. Girdle lists low, horizontal, ribbed, 0.5 girdle width high. Ventral fins very small, less than girdle width in height, with single weak spine at fission line. Surface heavily reticulate with distinct Protoceratium-like mesh, 15 behind girdle, of somewhat irregular pore-free polygons. Girdle heavily reticulate. Girdle ribs from nodes.

Length 60 μ ; dorso-ventral diameter 55 μ ; transdiameter, 51 μ .

Sta. 4742.

PHALACROMA PULCHRA, sp. nov.

A variable species with outline in lateral view subsemicircular posteriorly, somewhat flattened anteriorly, the outline scarcely broken by the girdle. Length about equalling greatest dorso-ventral diameter, rarely 1.3, in which case the antapical region is slightly drawn out. Epitheca, measured from base of anterior collar, never over 0.3 of total length and usually much less. Collars low and spreading, without ribs. Posterior spine of ventral fin somewhat exceeding 0.35 of total length of body in length. Posterior spine long, attaining 0.4 of total length. Ventral, posterior, and low dorsal fin sometimes united in continuous sagittal structure, rarely with reticulations or secondary riblets. Surface smooth with regularly spaced pores, 12 across the side, or finely reticulate.

Length, with spines 74 μ , without 51 μ ; dorso-ventral diameter 51 μ .

Sta. 4699.

PHALACROMA TURBINEA, sp. nov.

A medium sized, elongated, top-shaped, very coarsely reticulate species resembling remotely *P. reticulata* Kofoid. Remarkable for the large size of the meshes. Body elongated, spreading at girdle. Length 1.86 dorso-ventral diameters. Girdle section (in individual measured) subcircular, transdiameter 1.21 dorso-ventral diameters. Sides in lateral view concave, tapering to rounded antapex 1.5 girdle widths across. Epitheca a low cone, 2 girdle widths high, with rounded apex. Surface non-porulate, with Protoceratium-like mesh of huge dimensions, 5 across face at girdle, 28 on right side of hypotheca, and 11 on right side of epitheca. The sagittal region has a broad, ladder-like series of rectangular meshes, 14 on dorsal and 12 on ventral

face, 1 girdle width wide on ventral and 2 to 3 on dorsal face. Low fins with spinules at nodes are found on the straight ribs at the sides of the ladder. Girdle fins spinulate, girdle ribbed. Ventral fins scarcely elevated above general sagittal fin.

Length, 69 μ ; dorso-ventral diameter, 36 μ ; transverse, 43 μ .

Sta. 4681.

DINOPHYSIS COLLARIS, sp. nov.

A small species of squarish outline and thin body. Length, excluding spines, 1.05 greatest dorso-ventral diameter. Epitheca very wide dorso-ventrally, 0.8 of dorso-ventral diameter of body, apex concave. Ventral outline convex, posterior and dorsal broadly rounded, the latter concave just posterior to girdle. Anterior and posterior collars approaching horizontal position, abundantly (18 on side) ribbed. Ventral, posterior, and dorsal fins connected in complete sagittal fin; dorsal low, with spinules, posterior carried out in two stout spine-like projections with reticulate skeleton, their length about 0.25 of dorso-ventral diameter; the ventral with skeleton of numerous anastomosing ribs, its greatest width posterior, about 0.4 dorso-ventral diameter. Transverse diameter about 0.35 the dorso-ventral. Surface uniformly covered with small, irregular polygons of heavy mesh.

Somewhat resembles *D. triacantha* with duplicated antapical spine.

Length, excluding spines, 58 μ ; dorso-ventral diameter, 55 μ .

Sta. 4671.

DIXOPHYSIS EXPULSA, sp. nov.

A small species, in lateral view with broadly rounded, sac-like outline, widening posteriorly, with marked lateral constrictions behind girdle. Length 1.14 times greatest dorso-ventral diameter. Epitheca low, convex anteriorly, its dorso-ventral width 0.57 of dorso-ventral diameter of body. About 0.35 of the length from the apex the sides of the epitheca are impressed by a trough-like constriction which decreases the transverse diameter at that level over ten per cent. Immediately behind this region the bulging sides attain a transdiameter equalling or even exceeding that just behind the posterior collar, as shown clearly in dorsal or ventral view. Collars without ribs, low, at 45°, anterior one 0.78 diameter of posterior. Ventral fin simple, 0.14 of length of body in width, its length 0.66 that of body, without ribs other than the double fission rib. Surface centrally faintly reticulate, with scattered pores centrally located in some of the meshes.

Length, 55 μ ; dorso-ventral diameter, 48 μ .

Sta. 4717.

DINOPHYSIS RUGOSA, sp. nov.

A medium sized species of unique form and structure approaching *Histioneis* in form of anterior collar. Body rotund, pear-shaped, its greatest diameter twice that at base of posterior collar, and located about 0.33 of length (excluding ventral fin only) from posterior end. Anterior collar sessile, but high, funnel-shaped, and flaring more dorsally than elsewhere, with 10–12 ribs on a side and some basal reticulations, its height 0.25 and opening 0.55 of the greatest dorso-ventral diameter of midbody, oblique, sloping to the right and ventrally. Posterior collar low, erect, slightly flaring, heavily and finely reticulated to the very margin, its height about 0.13 and its opening 0.7 of the greatest dorso-ventral diameter. Both right and left ventral fins heavily reticulated the right low, its height 0.08, and its length 0.75 of greatest dorso-ventral diameter. The left fin continued posteriorly beyond the antapex 0.46 of the greatest dorso-ventral diameter, to an acute point. Fission ribs at level of posterior third of body, slanting at 20° from horizontal. Total length of left fin 1.5 and greatest width about 0.25 of the greatest dorso-ventral diameter. Surface finely, deeply, and regularly pitted.

Length, of body 43 μ , total, 74 μ ; greatest dorso-ventral diameter, of body, 42 μ , total, 50 μ .

Sta. 4705.

AMPHISOLENIA ASTRAGALUS, sp. nov.

Allied to *A. bidentata* Br. Schröder but with less ventral curvature of the antapical region and a distinctly foot-like antapex. Length forty times greatest dorso-ventral diameter. Well differentiated midbody extending posteriorly one half total length from head. Greatest dorso-ventral diameter 0.4 of total length from head, about three times same diameter distally. Flagellar pore 0.12 of total length from head. Head subglobular, its dorso-ventral diameter less than that of midbody, and three times that of neck. Furrow ribbed, lists very wide, ribbed. Antapex foot-like with distinct heel and ventral extension, varying in position between horizontal and posterior deflection of 45°, armed distally with two short, stout, terminal spines. The antapical region is curved a little to the left.

Length 650 μ ; transdiameter, 16 μ .

Sta. 4713.

AMPHISOLENIA QUADRICAUDA, sp. nov.

Belongs to the *A. thrinax* group but has three ventral branches instead of two (*A. thrinax* Schütt) or four (*A. quinquecauda* Kofoid). Body expanded into fusiform midbody about 0.2 of the total length in length, its greatest dorso-ventral diameter located at 0.25 of total length from the head, and five

times that of same diameter distally. Branches, seen in lateral view, 0.33, 0.25 and 0.18 of total length in length. Axis straight in direct lateral view. Flagellar pore 0.09 of total length from head. Head thin, flat, its length equalling greatest width of midbody, and five times that of neck. Fins wide, ribbed. Antapical region curved to left and ventrally, with curved foot-like antapex bearing stout spine at heel and two distally.

Length, 790 μ ; dorso-ventral diameter, 45 μ .

Sta. 4695.

AMPHISOLENIA TRUNCATA, sp. nov.

Body in lateral view rectilinear. Length forty times greatest dorso-ventral diameter. Slenderly fusiform, greatest dorso-ventral diameter one third of total length from head, about twice dorso-ventral diameter of antapex, diminishing very gradually in either direction. Flagellar pore removed from apex 0.11 of total length. Head thin, flat, elevated 40° from horizontal, furrow sparingly and coarsely ribbed, lists hyaline, without ribs. Antapex in lateral view rectilinear and squarely truncate, without spines, lists, enlargement, or asymmetry.

Length, 640 μ ; dorso-ventral diameter, 16 μ .

Sta. 4733.

HISTIONEIS DIOMEDEAE, sp. nov.

Belongs to the *para* group, with stout, posteriorly curved extension of the midbody at base of anterior collar. Most resembles *H. reticulata* Kofoid (1907), pl. 15, fig. 95, but differs from it in being much larger. The measurements given (1907, p. 205) for this species should read, length, 57 μ ; dorso-ventral diameter (total) 42 μ . It has also an entirely different outline in dorsal view. In *H. reticulata* the midbody has nearly a semicircular posterior outline; in *H. diomedae* the body is laterally contracted giving to the antapex concave sides and a blunt prolongation, in the dorsal view. In *H. reticulata* the midbody is abruptly angled at the junction of the posterior collar and in lateral view this line forms a sweeping curve. In *H. diomedae* the sides, in dorsal view, slope regularly at an angle of 45° and the line of junction in lateral view shows a median elevation. Length of midbody 1.08 its dorso-ventral diameter. Transdiameter 0.7 dorso-ventral, epitheca 0.52, horn 0.45 dorso-ventral diameter. Anterior collar sessile, 0.78 dorso-ventral diameter of midbody from dorsal to ventral lip, with numerous simple ribs and marginal riblets. Posterior collar almost same diameter as midbody, bagging out slightly along lateral line of attachment, 0.35 dorso-ventral diameter in height, lightly reticulate on dorsal and ventral regions, with dorsal and ventral ribs only. Ventral fin somewhat as in *H. garretti* Kofoid, but its margin with a protruding, bluntly rounded point at the fission ribs, and concave thence to

the elongated posterior spine whose length is 0.35 dorso-ventral diameter. The fin is continued beyond this spine on the dorsal face, its surface smooth, or irregularly reticulate, with a coarse, heavy, and (posteriorly) finely areolated mesh. Surface of midbody coarsely and regularly pitted. Phaeosomes spheroidal or ellipsoidal.

Length, of midbody, 54 μ , total, 115 μ ; dorso-ventral diameter, of midbody, 48 μ , total 80 μ ; transdiameter, 36 μ ; phaeosomes, diameter of spheroidal ones 3.5 μ , ellipsoidal, 1 by 2.5 μ .

Sta. 4699.

HISTIONEIS COSTATA, sp. nov.

A small species resembling *H. paulseni* Kofoid (1907), pl. 15, fig. 94, but differing from it in its stalked, rugose, oblique anterior collar, more rotund body, and in the dorsal inclination of its posterior ribs. Body rotund, slightly depressed anteriorly, without dorsal concavity, oblique ventrally at base of inner collar which stands on a very slight eminence. Length of midbody 0.86 dorso-ventral diameter. Anterior collar stout, distinctly stalked, diameter of neck nearly 0.25, of opening 0.91 dorso-ventral diameter of midbody. Apex very oblique, heavily ribbed, with ends of ribs projecting beyond margin, basally reticulate. Posterior collar a trifle wider than midbody, slightly inflated, lower on right side, with simple dorsal, ventral, and horizontal ribs, and low, hyaline distal frill, without other markings. Ventral fin, in individual examined, low, reticulate, fission rib 0.33 dorso-ventral diameter in length, standing at 45° from horizontal, posterior spine 0.6 dorso-ventral diameter in length, directed obliquely dorso-posteriorly. Postmargin of fin approaching horizontal, its whole surface unmarked. Surface of body coarsely and deeply pitted, with scattered pores.

Length, of midbody, 26 μ , total, 67 μ ; dorso-ventral diameter, of midbody, 30 μ , total 40 μ .

Sta. 4604.

HISTIONEIS ELONGATA, sp. nov.

Resembles *H. remora* Stein but differs from his figure (1883), pl. 22, fig. 11, decidedly in form of the midbody, and in details of collars and fins. Midbody elongated in postero-dorsal direction, its longer axis deflected posteriorly about 40° from the horizontal, this axis 1.45 times the one at right angles to it. Scarcely concave on antero-dorsal surface, slightly wider dorsally. Anterior collar rises from rounded eminence, distinctly stalked, length of stalk 0.37 of longer axis of midbody. Apex of funnel very asymmetrically sloped to right and ventrally, distally ribbed, its opening 0.83 of longer axis of midbody. Posterior collar as in *H. remora* but with distal hyaline frill and greater asymmetry of horizontal bar. Ventral fin greatly elongated, ribbed on both

margins, its length, from lip of posterior collar, 3.35 times longer axis, its greatest width at level of postmargin of midbody 0.8 of longer axis. Fission ribs 0.5 of longer axis in length, at 40° from horizontal. Fin with distal, transverse lattice between marginal ribs. Phaeosomes very large, spheroidal and minute ellipsoidal.

Length, of longer axis, 26μ , total antero-posterior of midbody, 26μ , of whole organism 115μ ; greatest dorso-ventral extent 38μ ; phaeosomes, spheroidal, 5μ , ellipsoidal, 0.5 by 1.2μ .

Sta. 4722.

HISTIONEIS HIPPOPEROIDES, sp. nov.

Resembling *H. reginella*, sp. nov. but with larger midbody, lateral pouches less developed, not reticulated distally, and anterior collar not widely dilated distally. Midbody enlarged postero-dorsally, to twice its antero-posterior thickness ventrally, deeply concaved in the middle, the dorsal hump slightly higher than the ventral. Collars and fins much as in *H. gubernans* Schütt (1895), pl. 5, fig. 23, except that they are larger and more reticulated and the inner collar tapers gradually to a small oblique opening only 2.2 its diameter at midbody, with very little distal flare. The outer collar has lateral extensions (saddle bags) between the horizontal bar and the midbody, the total transdiameter through them being 1.5 transdiameters of the midbody. This collar is covered with a coarse network beyond the horizontal bars, in which a second distal encircling bar is irregularly outlined. The ventral fin extends postero-ventrally, the fission ribs and the posterior rib being subparallel and at 30° and 40° respectively from the horizontal. It bears a marginal band of elongated reticulations and coarser inner network. The ventro-posterior spine bears a transverse fin as in *H. dolon* Murr. and Whitt., somewhat wider than the midbody.

Length, antero-posterior, of midbody, 30μ , total, 90μ ; dorso-ventral diameter, of midbody, 37μ , total, 68μ .

Sta. 4590.

HISTIONEIS HYALINA, sp. nov.

A small species of simple structure resembling the less developed forms of *H. cymbalaria* Stein, but much smaller and with midbody of different shape. Midbody pyriform with long axis horizontal, but slightly concave anteriorly and enlarged dorsally, its dorso-ventral diameter 1.8 times its greatest antero-posterior one. No elevation at base of inner collar. Collars as in simplest form of *H. cymbalaria* as figured by Stein (1883), pl. 22, fig. 10, complete hyaline extension beyond horizontal ribs, and with a single bifurcated vertical spine in addition to the dorsal and ventral ones. Inner collar with dorsal flare, reticulate distally. Ventral and posterior fins as in *H. cymbalaria* except

that the dorsal spine at the fission plane is curved without bifurcation to junction with the posterior one. Fin to dorsal side of posterior spine curved anteriorly. Phaeosomes spheroidal.

Length, antero-posterior, of body, 12 μ , total, 53 μ ; dorso-ventral diameter of midbody, 22 μ , including fin, 25 μ ; phaeosomes, 1 μ .

Sta. 4720.

HISTIONEIS INCLINATA, sp. nov.

A minute species of simple structure slightly resembling *H. crateriformis* Stein, but differing from his (1883), pl. 22, figs. 5 and 6, in shorter and less antero-dorsal concavity on midbody, and in details of fin and collar structure. Body subcircular, slightly concave antero-dorsally, epitheca considerably elevated at base of anterior collar. Length and dorso-ventral diameter equal. Antero-dorsal concavity less than 0.5 dorso-ventral diameter. Anterior collar 0.35 dorso-ventral diameter in height, its apex very oblique with few heavy longitudinal ribs. Posterior collar 0.5 dorso-ventral diameter in height with dorsal and ventral sagittal ribs and simple convex transverse bars with distal hyaline margin. Ventral and postero-ventral fins 0.35 dorso-ventral diameter in height, terminating in broadly rounded lobe anterior to antapex. Surface of midbody with fine regular mesh in central part of face, smooth peripherally, about 12 prominent pores on right face. Phaeosomes spheroidal.

Length, of midbody, 17 μ ; total, 29 μ ; dorso-ventral diameter of midbody, 13 μ , total, 18 μ .

Sta. 4720.

HISTIONEIS INORNATA, sp. nov.

A very minute, unadorned species resembling *H. inclinata* but with different proportions of body and fins, unlike any previously described species. Body rotund, flattened anteriorly, antero-dorsal concavity slight, nearly horizontal, its length 0.55 of dorso-ventral diameter. Flagellar pore well forward on antero-ventral curve. Length 0.8 dorso-ventral diameter. Inner collar on slight eminence, its length 1.05 dorso-ventral diameters, neck very long and slender, opening oblique, 0.5 dorso-ventral diameter. Posterior collar very large, its opening 1.22 dorso-ventral diameters, inflated, with simple dorsal, ventral and horizontal ribs and very low hyaline frill anterior to horizontal bars. Ventral fin 1.5 dorso-ventral diameters in length and about 0.35 in height, rounded and recurved posteriorly with stout ventral spine. Fission ribs 0.33 dorso-ventral diameter in length. Fins and body absolutely smooth and hyaline. A single row of pores at base of posterior collar, 10 on right face.

Length, of midbody, 15 μ , total, 33 μ ; dorso-ventral diameter, of midbody, 16 μ , total, 18 μ .

Sta. 4720.

HISTIONEIS KARSTENI, sp. nov.

A small species resembling *H. para* Murr. and Whitt. (1899), pl. 32, fig. 4, but much smaller, with narrower, more ventrally located, broadly rounded apical projection, smaller anterior, and non-ribbed posterior collar, and greater dorsal and posterior development of the sagittal fin. Body very rotund, with bluntly and symmetrically rounded anterior projection on epitheca, 0.3 dorso-ventral diameter in height and of the same width. Length 1.1 dorso-ventral diameters. Anterior collar sessile, with 7 heavy ribs, its height about 0.25, and opening 0.82 dorso-ventral diameter. Posterior collar of same diameter as midbody, its height dorsally 0.55 dorso-ventral diameter, with dorsal and ventral vertical ribs but no other markings. Ventral fin low, heavily reticulate, fission ribs 0.25 dorso-ventral diameter in length, slanting at 45° from horizontal. Posterior fin with median posterior spine 0.66 dorso-ventral diameter in length. Fin terminating acutely, with arched postero-ventral and sigmoid dorsal margins, faintly reticulated on both sides of spine and extending dorsally at base beyond spine 0.27 dorso-ventral diameter. Surface of midbody coarsely and deeply reticulated, 15 meshes behind girdle. Scattered pores.

Length, of midbody, 28 μ , total, 56 μ ; dorso-ventral diameter, of midbody, 26 μ , total, 30 μ .

Sta. 4619.

HISTIONEIS PANDA, sp. nov.

A medium sized species resembling *H. navicula* Kofoid, but smaller, with more concave midbody, smaller inner collar, and laterally expanded posterior collar. Body greatly elongated dorsally, with deeply concaved anterior and convex posterior surfaces, the depth of the concavity equalling the antero-posterior thickness of the middle of the body. Body somewhat expanded dorsally. Distance between dorsal and ventral ends 4 times thickness of middle and 2 times its antero-posterior extent. Anterior collar elongated, slender, its height equalling, and apex 0.4 of dorso-ventral extent of midbody. The apex is very oblique, notched on left ventral margin. Posterior collar also with oblique, but contracted opening, about 0.5 of dorso-ventral extent of midbody, expanding dorsally. On the lateral faces spreading horizontally nearly 0.33 of dorso-ventral extent of midbody in saddle-bag fashion. Dorsal ribs low, horizontal bars, sinuous, sagged posteriorly. Both collars faintly reticulate with polygonal mesh antero-dorsally. Ventral fin very low, its ventral margin vertical, straight. Fission ribs directed posteriorly, 0.33 dorso-ventral extent of midbody in length, posterior member continuous by marginal arch with short posterior spine, the arch pinnate. The fin extends posteriorly 0.55 dorso-ventral extent of midbody, and its dorsal frill is ventrally protruded as in *H. pulchra* Kofoid. Surface smooth, a double row of pores along junction of posterior collar.

Length, greatest antero-posterior extent of midbody, 20 μ , total 80 μ ; dorso-ventral extent of midbody, 41 μ , total, 42 μ .

Sta. 4724.

HISTIONEIS REGINELLA, sp. nov.

Most resembles *H. gubernans* Schütt, but differs from it in its relatively larger, more rotund midbody, and greatly sacculated posterior collar. The body is broadly and symmetrically rounded posteriorly in lateral view, with flattened anterior margin, slightly elevated at base of inner collar. In dorsal view the body is contracted anteriorly. The collars and fins are superficially as represented by Schütt (1895), pl. 5, fig. 23, with a number of differences in details. The inner collar is not so wide distally, is coarsely reticulate within the distal zone of radial ribs. The posterior collar is considerably larger, sparingly ribbed distally, and bears on each side, well toward the ventral face, a pendant sac-like expansion, over 0.75 of the dorso-ventral diameter of the midbody in length. The apices of these sacs are reticulated. The ventral and postero-ventral fins are similar to those of *H. gubernans* except that both dorsal and ventral margins are curled to the right. Phaeosomes ellipsoidal.

Length, antero-posterior of midbody, 23 μ , total, 55 μ ; dorso-ventral diameter of midbody, 19 μ , total, 33 μ . Phaeosomes, 2.5 μ .

Sta. 4681.

HISTIONEIS ROTUNDATA, sp. nov.

A minute species with midbody of *H. remora* Stein and collars and fins resembling those of *H. para* Murr. and Whitt., but differing from the species figured by Stein (1883), pl. 22, fig. 11, in more rotund midbody, shorter and wider postero-ventral fin, shorter anterior collar, and longitudinally ribbed posterior collar. From Murray and Whitting's (1899), pl. 32, fig. 4, species it differs in the narrower neck of midbody, slenderer stalk of anterior collar, and wider ventral fins. Body almost spheroidal, with mound-like elevation at base of anterior collar. Anterior collar low, 0.5 dorso-ventral diameter of midbody in height, its apical diameter about equal to that of midbody, with a few short ribs. Posterior collar nearly vertical, 0.3 to 0.5 dorso-ventral diameter in height, with 5 aciculate ribs on the side. Ventral fin 2 dorso-ventral diameters from lip of posterior collar to antapical end, swelling ventrally posterior to fission spines, tapering to blunt antapex, with stout bowed posterior rib, 0.8 dorso-ventral diameter in length. Fin faintly reticulate basally. Surface minutely areolate, with 11 pores on right face.

Length, of midbody, 17 μ , total, 38 μ ; dorso-ventral diameter, of midbody, 13 μ , total, 16 μ ; transdiameter, 13 μ .

Sta. 4720.

HISTIONEIS STRIATA, sp. nov.

Resembling *H. gubernans* Schütt but differing from his (1895), pl. 5, fig. 23, in its smaller size, much smaller collars, and proportions of ventral fin. Midbody rotund, more symmetrical than in *H. gubernans*, postero-dorsal concavity well developed, horizontal, its length 0.55 dorso-ventral diameter. Length 0.92 dorso-ventral diameter. Anterior collar elongated, its length 1.2 and opening 0.3 dorso-ventral diameters, neck stout, opening oblique, with several distal riblets. Posterior collar not so wide as midbody, its height 0.9 to 1 and its opening 0.85 transdiameter, constricted dorsally at level of arched horizontal bars, its distal frill high, with about 6 vertical distal riblets on each face. Ventral fin as in *H. gubernans* and *H. reginella*. Marginal rib with distal frill and scattered distal riblets. Postero-ventral spine horizontal, distally recurved, the fin upon its dorso-posterior margin recurved ventrally as in *H. reginella*. Surface smooth, 7 pores behind posterior collar and 3 midway below. Phaeosomes ellipsoidal. The distal riblets of the collars and fins give the organism a striate appearance.

Length, of midbody, 15 μ , total, 42 μ ; dorso-ventral diameter, of midbody, 16 μ , total, 31 μ ; phaeosomes, 1 by 1.5 μ .

Sta. 4720.

ORNITHOCERCUS FORMOSUS, sp. nov.

A large and handsome form not closely resembling any known species. General outline of whole in lateral view rectangular with concave postmargin. Body subcircular in lateral view, fuller in postero-dorsal region. Squarish toward the girdle, its length about equal to its dorso-ventral diameter. Transdiameter 0.7 dorso-ventral. Anterior collar 0.83 dorso-ventral diameter, with simple ribs mostly complete, with reticulate mesh near base. Posterior collar basally expanded, with stouter ribs and heavy reticulations reaching margin in dorsal and ventral quadrants. Ventral fin running straight posteriorly from lip of posterior collar, with coarse irregular reticular mesh filling the fin and also the minor right fin which is short and rectangular in form. The postmargin of the sagittal fin is crescentic with feebly developed marginal rib, nearly submerged radial riblets and a very stout dorso-posterior spine in the dorsal lobe of the crescent with fine mesh on its dorsal wing. Dorsal margin straight. Surface regularly and deeply pitted with porulose pits.

Length, of body, 40 μ , total, 90 μ ; dorso-ventral diameter, of body, 40 μ , total 50 to 63 μ .

Sta. 4697.

ORNITHOCERCUS ORBICULATUS, sp. nov.

A large species resembling *O. serratus* Kofoid, but with entire, orbicular, sagittal fin. Body subcircular in lateral view, obliquely flattened anteriorly and excavated antero-dorsally. Its length a trifle less than its greatest dorso-

ventral diameter. Anterior and posterior collars subequal in dorso-ventral diameter. Anterior with simple, straight major ribs and minute peripheral riblets, or with sparse, irregularly curved and anastomosing ribs and reticulations. Posterior with stouter simple ribs. Form and proportions about as in *O. serratus* Kofoid. Sagittal fin complete, with straight dorsal margin and circular outline to ventral lip of posterior collar, with seven or eight major simple, or basally bifurcated ribs breaking distally into feebly developed marginal reticulations. Surface coarsely reticulate, each polygon or pit with pore, 15 behind girdle.

Length, of body, 65 μ , total, 115 μ ; dorso-ventral diameter, of body, 70 μ , total, 115 μ .

Possibly a phase in thecal reconstruction.

Sta. 4617.

BERGHIELLA, gen. nov.

With the form of a spheroidal *Gonyaulax* with very abruptly differentiated low cylindrical apical horn with truncate apex. Girdle with hyaline lists, descending, displaced less than a girdle width, not impressed. Ventral area not delimited posteriorly. Absolutely no trace of subdivision of theca into plates or regions. Type species *B. perplexa*.

BERGHIELLA PERPLEXA, sp. nov.

Body, excluding apical horn, a short ellipsoid with vertical axis (excluding horn) 1.12 transdiameters, with horn 1.25. Girdle section circular. Apical horn low, stout, apex squarely truncated, its height 0.16, its diameter at base 0.24, and at apex 0.19 transdiameters. Girdle equatorial, posterior list of proximal end half way between base of apical horn and antapex, the epitheca thus slightly exceeds hypotheca; descending, displaced distally 0.33 girdle width, not impressed, its sides formed by thin hyaline structureless lists, 0.6 girdle width in height. A narrow crease runs forward from the junction of the girdle-ends nearly to base of apical horn. Ventral area suggested by short posterior extensions of the posterior list at the two ends of the girdle. A small pore (flagellar pore?) lies in this territory. Surface without trace of sutures, or marked reticulations, minutely and evenly flecked by the faintest suggestion of areoles. A single line of pores anterior to the girdle. Contents highly vacuolated, completely filling the theca. Nucleus elongated, reniform.

Length, 65 μ ; transdiameter, 50 μ .

Stage of growth, relationships, and even orientation problematical.
Sta. 4670.

AMPHITHOLUS QUINCUNCIALIS (Kofoid).

Described by oversight as *Amphilothus quincuncialis* in my earlier (1907) paper.

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