

IX. *New Peridiniaceæ from the Atlantic.* By GEORGE MURRAY, *F.R.S., F.L.S., Keeper of Botany, British Museum, and* FRANCES G. WHITTING, *former Student of Newnham College, Cambridge.*

(Plates XXVII.-XXXIII.)

Read 19th January, 1899.

THE material described in the following paper was collected by Messrs. Murray and Blackman, during a voyage made in R.M.S. 'Para' (June, July, and August 1897), while engaged in a study of the Coccospheres and Rhabdospheres, and other forms of Phyto-plankton described elsewhere. Previous to this voyage in the 'Para,' and subsequently in the 'Medway' and 'Atrato,' Captain W. Haultain Milner (by the pumping method, employed in all cases cited here) has collected with the greatest success, while other collections have been contributed by Capt. Rudge on the 'Avon,' Capt. Tindall on the 'Elbe,' and Capt. Alex. Turbyne, while a passenger to the Cape on the 'Dunvegan Castle.'

Almost the whole of our previous systematic knowledge of the marine Peridiniaceæ is derived from Stein's 'Infusionsthierie' and Schütt's 'Peridiniaceæ' in the 'Ergebnisse der Plankton Expedition der Humboldt-Stiftung,' these writers having included in their treatment observations of older workers such as Ehrenberg. Stein, however, gives no formal diagnoses of genera and species, though his excellent figures clearly indicate the characters of his forms. Schütt also reserves such diagnoses for a future volume, contenting himself with a morphological exposition of the group, and with figures of his new and other species in the book cited and in his 'Pflanzenleben der Hochsee.' He has supplemented his text and figures, however, by giving the characters of the genera in his 'Peridinales,' in Engler and Prantl's 'Natürlichen Pflanzenfamilien.' Even then, we have been compelled to represent here a few of his species for greater accuracy in certain details.

As yet no one has shown an example of the description of specific characters. In writing these for the present memoir we have found many difficulties, and the chief of these, in spite of Schütt's work, was the determination of what should be generic and what specific characters. In consideration of the fact that we are as yet merely at the beginning of the systematic study of marine Peridiniaceæ, and that the exploration of great tracts of ocean has yet to be undertaken with doubtless many new forms to be revealed, we have decided that it would lead to less eventual confusion if we included characters that at present look like generic characters among the specific. We have done so deliberately in a few cases, having been warned by our experience in the modification of the generic character by the addition of the new species we here describe. It is clear that there are already too many genera, and farther exploration may be

anticipated to confirm this view. For this first attempt at giving specific characters, then, we beg indulgent criticism.

But it may be said that we should first justify our inclusion of the Peridiniaceæ among Phyto-plankton. It is no new step, such workers at Plankton as Cleve and Schütt having done it before us. Whether these Dino-Flagellata be reckoned plants or animals—and in the absence of any absolute criterion we do not presume to assign them definitely to either group—they appear to form much the largest ingredient in the great mass of oceanic vegetation away from coastal waters, and in any study of the balance of animal and plant life in the sea their weight is a solid one in the scale. The argument is a purely physiological one, and is open to the criticism that the Peridiniaceæ may yet be animals effecting for themselves by their own intrinsic chromatophores what the Radiolaria, for example, accomplish by symbiosis with their yellow algal cells. However, this is not the occasion for a discussion of the question, nor does the present limited knowledge of the group justify any definite decision. We have found this form of vegetation predominant on the high seas, and we venture to describe it.

In some of the names assigned to new species we have commemorated the services of Captains Milner and Rudge, Messrs. Jolliffe and Hindmarch, the officers of ships who have done so much in gathering in our material, and Mr. Blackman, who accompanied Mr. Murray on one of the voyages, and to whose judgment we are indebted.

It was one of our objects to endeavour to discover from examination of the tables, drawn up to give the results of each voyage, some evidence of seasonal change. With a seasonal variation of temperature amounting to 5° Fahr. as far south as lat. 18° N., and of course a considerably greater variation farther north, some seasonal change in the Plankton seems inevitable. After a series of comparisons we have come to the conclusion that from the imperfections of the record on some of the voyages, especially those at lowest temperature, we would not yet be justified in stating general results. It will need a much longer series of records to establish any such results.

PTYCHODISCEÆ.

PTYCHODISCUS, Stein.

The only known species, *P. Noctiluca*, Stein, occurs very erratically in our records from lat. 39° N. to lat. 14° S., sometimes very abundant, oftener altogether wanting. We have figured it on Pl. XXVII. figs. 5 *a, b*, in order to show its girdle view, which is lenticular in outline.

P. Noctiluca, var. *fimbriatus*. This new variety differs from the typical form in having both projecting margins of the girdle fimbriate (Pl. XXVII. fig. 5 *c*). It was obtained by Capt. Turbyne in lat. 41° 30' N., long. 11° 10' W.

GLENODINIEÆ.

GLENODINIUM, Ehrenb.

G. trochoideum, Stein, recorded previously from Kiel haven, occurred once only in our collection (lat. 33° 20' N., long. 43° 9' W.).

CERATIEÆ.

CERATIUM, Schrank.

The species of this well-marked genus were present in every observation except two. *C. Tripos*, a species subdivided by some authorities, was present, in one form or other, in almost every gathering throughout the year from home waters to Colon, and is equally steady in the single series of observations down the coast of Brazil. *C. Furca*, *C. Furca*, var. *baltica*, *C. Fusus*, and *C. Candelabrum* appear throughout the records. *C. Limulus* ranges from the Equator to about lat. 41° N., so far as our gatherings show its distribution. *C. gravidum*, a rarer species, and one of quite aberrant form, has much the same range as *C. Limulus*, reaching lat. 38° N. *C. digitatum* occurred twice only, viz., in lat. 16° to 17° N., long. 68° to 69° W. A very distinct new species, which we have named *C. biconicum*, occurred only once in lat. 35° 20' N., long. 37° 20' W.

C. BICONICUM, sp. n. Body divided into two nearly equal limbs, widest at the girdle, each limb conical in shape, and the whole (including girdle) covered with fine punctate markings, streaks free from markings running lengthwise; ends of girdle slightly oblique; distal limb blunt at apex, proximal limb acuminate with irregular elongate foraminal area, and a thin membranous projecting flange near the foramen. (Pl. XXVII. figs. 4 *a*, *b*, *c*.)

The nearest ally of this species is clearly *C. Fusus*, which is much more elongate and thinner in proportion, and possesses a trace of a third limb near the girdle. There is no definite appearance of separate plates in the structure of the limbs or girdle. But for its resemblance to *C. Fusus* there would have been a difficulty in assigning *C. biconicum* to this genus, of which it is decidedly the simplest of its varied forms.

The variations in the species of *Ceratium* are noteworthy from the fact that it would be almost possible to demonstrate a linear series of forms connecting *C. biconicum*, through *C. Fusus*, *C. Furca*, *C. Candelabrum*, and *C. Tripos*, with *C. Limulus*; *C. digitatum* and *C. gravidum* being divergent.

GONYAULAX, Dies.

Gonyaulax birostris and *G. polygramma* appear from our records to have a fairly wide distribution in the Atlantic, the latter ranging from lat. 4° N. to lat. 42° N., and the former being both tropical and temperate. Stein gives both as coming from the "South Sea." In addition to these species we have observed three others, all new.

G. TURBYNEI, sp. n. Body approximately ovate, divided into two nearly equal limbs by the girdle, all its plates covered with punctate markings; proximal limb composed of one row of numerous narrow, elongate, mostly four-sided plates, the arrangement of the plates irregular in the region of the foramen; distal limb composed of two rows of similar plates, those adjacent to the girdle being much larger than the others. (Pl. XXVIII. figs. 4 *a*, *b*.)

It ranges from lat. $16^{\circ} 54'$ S., long. $2^{\circ} 54'$ E., to 47° N. by 13° W., and to long. 72° W. in 16° and 17° N. lat.

GONYAULAX JOLLIFFEI, sp. n. Body divided into two nearly equal limbs, widest at the girdle, ends of girdle oblique; the membrane, including girdle, composed of angular plates covered with fine punctate markings; the proximal limb tapering abruptly, acuminate, apex consisting of a single conical plate; the distal limb very deeply trifid. (Plate XXVIII. figs. 1 *a*, *b*.)

Its nearest ally is evidently *G. polygramma*, as figured by Stein, though its plates approximate to those of *G. birostris* ('Infusionsthier', Abth. iii. plate iv. figs. 16 & 20). Its range is from the Azores to Panama.

G. HIGHLEII, sp. n. Body divided into two approximately equal limbs, widest at the girdle; membrane composed of angular plates, finely punctate; girdle punctate, and ends of same oblique; proximal limb rounded below, tapering above, drawn out into a long unmarked spine which is enveloped in a sheath; foraminal area irregularly oval; distal end armed with two long sheathed spines, which are finely marked for two thirds of their length. (Pl. XXVIII. figs. 2 *a*, *b*.)

Its range is the same as *G. Jolliffei*, though it has not been traced quite so far north.

G. GLYPTORHYNCHUS, sp. n. Body divided into two nearly equal limbs, widest at the girdle; membrane composed of angular plates, faintly punctate; girdle unmarked and with prominent margins, ends oblique; proximal limb conical, but slightly rounded, terminating in a spine marked with two lateral bands of oblique striæ; foraminal area irregularly oval; distal limb armed with two, sometimes three blunt spines, marked externally with exactly transverse striæ. (Pl. XXVIII. figs. 3 *a*, *b*, *c*.)

In the sea between Barbadoes and the Azores (between lat. 18° N., long. 52° W., and lat. 24° N., long. 51° W.

GONIODOMA, Stein.

It will be seen from an inspection of the Tables that *G. acuminatum*, Stein, the only species known hitherto, occurs with great regularity in all the waters traversed. For example, in the Table of 'Para,' Voyage III., we miss it only in three gatherings. In the voyages of the 'Medway' and 'Atrato,' late in the season, it drops out from certain gatherings, and it might appear that we have here an indication of some seasonal change. That this is improbable appears from the fact that we miss it only in tropical waters where there is comparatively little fluctuation of temperature; and in the 'Para' Voyage I. (February–March) it drops out from the record only twice. Moreover, it shares this absence from the 'Medway' gatherings with a number of other common forms such as *Peridinium divergens*, thus pointing to some casual imperfection in the mode of collecting. We have added the following three new species:—

GONIODOMA MILNERI, sp. n. Body unequally divided by the girdle; membrane, including that of girdle, finely punctate; proximal limb the smaller, dome-shaped, but the upper plates forming a projection, the lower plates broad at their bases where they join the girdle, narrowing upward; foraminal area irregularly elongate; distal limb box-shaped, the sides composed of six plates, four of them nearly square, two oblong and a flat bottom, with short spines projecting downward at the junctions of the plates and at the ends of the girdle. (Pl. XXVII. figs. 2 *a, b, c, d.*)

Figs. 2 *a, b* represent the typical form of *G. Milneri*. Figs. 2 *c, d*, representing another form (one encysted), are noteworthy as showing the body divided into more equal halves, this equality being attained by a narrowing downward of the distal limb. The divergence of this form is so great and so fixed as almost to entitle it to specific rank. The species differs from *G. acuminatum* mainly in the typical unequal division of the body and its shape, the projection on the proximal limb, and in the possession of spines. In this last respect it is approached by *G. acuminatum*, var. *armatum*, Schütt. Its range is from the Azores to the Caribbean Sea.

G. FIMBRIATUM, sp. n. Body divided into two limbs almost equal in bulk but of different shapes; membrane finely punctate; girdle projecting at both margins as a fine membrane with a row of acute tooth-like supports; proximal limb narrowing towards the flat base, armed with short spines at the junctions of the plates; distal limb dome-shaped, composed of six plates, broad at the base, narrowing upward, where they join an apical six-sided area. (Pl. XXVII. figs. 1 *a, b.*)

Its range, so far as we can tell at present, is between lat. 40° N., long. 29° W., and lat. 14° N., long. 71° to 76° W.

G. SPHÆRICUM, sp. n. Body spherical and symmetrically divided by the girdle; margins of girdle prominent and unmarked; six plates of distal limb broad at the base where they meet the girdle, narrowing above and converging towards the square, arched, apical plate; the plates of proximal limb nearly the same in shape and arrangement, but differing slightly owing to the presence of the foraminal area; an apical pore present on the proximal plate. (Pl. XXVII. figs. 3 *a, b.*)

This species is at once distinguished from the others by its spherical shape, though the arrangement of its plates proclaims it a true *Goniodoma*. So far as our records show, its distribution is very limited, viz. from lat. 35° N., long. 29° W., to lat. 27° N., long. 41° W.

DIPLOPSALIS, Bergh.

Diplopsalis Lenticula, Bergh, the only species hitherto known, appears only once in our record, viz. in lat. 25° 41' N., long. 49° 31' W. A new species, of very distinct aspect, appeared in our captures of 22nd June, the day of Her Majesty's Jubilee, and in commemoration of the fact we have named it

D. SÆCULARIS, sp. n. Body in the girdle-view an irregular ellipse, divided by the girdle into fairly equal limbs; girdle fimbriate on both margins, with the ends widely oblique; proximal limb composed of irregular four-sided plates, each with a few

scattered punctate markings, two fine spines and a few shorter ones by foraminal area; distal limb composed of one large, somewhat crescent-shaped, apical plate, and other smaller ones bordering the girdle, mostly unmarked, two of them on the ventral side depressed, with the one between them punctate. (Pl. XXVIII. figs. 5 *a*, *b*.)

Figs. 5 *c*, *d*, *e* represent a variety with dome-shaped limbs, almost spherical in general outline; and fig. 5 *f* another variety, in which two horn-like projections take the place of the spines near the foramen.

The whole body of *D. sacularis* has a very delicate and fragile look, and appears translucent from the faintness and fewness of the fine markings. Its range is from lat. 37° N., *i. e.* a little south of the Azores, to the Isthmus of Panama.

PERIDINIUM, Ehrenb.

P. divergens, Ehrenb., like *Goniodoma acuminatum* and *Ceratium Tripos*, has an almost universal record in all our gatherings. Constant though its occurrence was, it was by no means regular in form. The variations in form were such that it is difficult to believe that one species embraces them all. However, they did not occur mixed to any great extent in the gatherings, but mostly one at a time, and in any case always one form predominant, which seems to point to their being not separate species but local varieties. In the voyage of the 'Avon,' Capt. Rudge evidently passed through a shoal of *P. divergens* about 24 hours' steaming from soundings, and in the next gathering but one, when just inside soundings, there was only one *P. divergens* observed, and in place of this species a shoal of *Halosphaera viridis*. The figures (in Pl. XXIX. figs. 4 *a*, *b*) show, in the larger one, an extreme form of *P. divergens* with its contents, and in the other a form near it. *P. Michaelis* has a wide range like *P. divergens*, but occurs much more sparsely. *P. Globulus* also has a wide distribution, ranging from lat. 6° S. to lat. 44° N. in the Atlantic. *P. tristylum* occurs sparingly from the Azores to Panama. We have noted the following new species:—

P. HINDMARCHII, sp. n. Body divided into two almost equal limbs by the girdle, uniformly covered with large 4-5-sided areolæ; girdle similarly marked with one row; ends of girdle very slightly oblique; foraminal area furrowed, elongate, extending into distal limb; proximal limb widely bifurcate; distal limb bluntly conical. (Pl. XXIX. figs. 1 *a*, *b*.)

In *P. Hindmarchii* and in the following species there is no apparent plate-structure, and we assume that the indications of its existence are obliterated by the large areolæ which cover the whole body. The species occurs from about lat. 34° N., long. 39° W., to Panama, but never abundantly.

P. LEIORHYNCHUM, sp. n. Body divided into two approximately equal limbs by the girdle; girdle at one end broad, areolate, and very much narrowed at the other end and without markings; proximal limb composed of irregular plates bordering the

girdle, widely bifurcate, the bifurcations each terminating in an acute spine, with a few minute projections round the foramen; distal limb bluntly conical, partially areolate. (Pl. XXIX. figs. 2 *a*, *b*.)

It occurs in latitudes between 20° and 40° N. and longitudes 30° to 50° W.

PERIDINIUM MILNERI, sp. n. Body unequally divided at the girdle; girdle areolate, with very oblique ends; proximal limb composed of mostly 4-sided plates, with broad, clear, unmarked margins, the areolæ being of irregular shape and size and strongly marked, with projections at the extremity; distal limb lid-like, irregularly areolate. (Pl. XXIX. figs. 3 *a*, *b*.)

It occurs in lat. 29° to 31° N., long. 42° to 44° W.

P. TRIPOS, sp. n. Body widest at the girdle; girdle composed of a single row of large areolæ, ends oblique; proximal limb marked with rows of large areolæ, with three short acute spines at the extremity, foraminal area elongate; distal limb the smaller, areolate, with three short projections at the apex. (Pl. XXX. figs. 4 *a*, *b*.)

It occurs in latitudes from 31° to 14° N. and longitudes 38° to 58° W.

P. DOMA, sp. n. Body widest at the girdle; girdle broader at one end, with 2-3 rows of areolæ, ends oblique; proximal limb composed of large plates irregularly arranged and areolate, foraminal area elongate, furrowed; distal limb dome-shaped, areolate, without distinct plate-structure. (Pl. XXX. fig. 3.)

It was obtained in lat. 34° to 39° N., long. 39° to 32° W.

P. VEXANS, sp. n. Body widest at the girdle, without apparent plate-structure, pitted all over, including girdle; ends of girdle oblique; proximal limb with two small projections near the extremity of the elongate foraminal area; distal limb bluntly conical. (Pl. XXIX. figs. 7 *a*, *b*.)

P. vexans was found in lat. 44° to 47° N., long. 19° to 13° W.

P. TRIOSTRE, sp. n. Body divided into two nearly equal limbs by the girdle, covered with large areolæ varying in size and form; girdle with one row of large areolæ bordered by two smaller rows, ends widely oblique; proximal limb trifurcate, foraminal area with unmarked projecting membrane; distal limb bluntly conical. (Pl. XXIX. fig. 5.)

It was found once only in lat. 25° 41' N. and long. 49° 31' W.

P. BLACKMANI, sp. n. Body equally divided at the girdle; girdle finely areolate, foraminal area in deep narrow furrows; proximal limb widely bifurcate at the extremity, with large four-sided plates bordering the girdle, clear and transparent, but marked with exceedingly delicate areolæ, beyond these plates the limb covered with strongly-marked oval areolæ to the ends of the bifurcations; distal limb conical, with clear plates bordering the girdle as in proximal limb, and beyond them strongly areolate to the apex. (Pl. XXIX. figs. 6 *a*, *b*, *c*.)

This very large and handsome *Peridinium* is of rare occurrence, but we record it from

the Caribbean Sea between Jamaica and Colon and from the Atlantic between lat. 25° N. and lat. 9° N.

PERIDINIUM SPHÆRICUM, sp. n. Body spherical and entirely free from markings, exactly divided into two equal limbs by the girdles; girdle unmarked, ends oblique; plates of both proximal and distal limbs mostly 5-sided, large, and distinct; foraminal area elongate, not depressed, foramen oval; distal limb with apical pore. (Pl. XXX. figs. 1 *a*, *b*.)

This species is closely related to *P. Globulus*, from which it differs in its larger plates and in the body and girdle being entirely free from the markings characteristic of *P. Globulus*. We have represented on Pl. XXX. figs. 2 *a*, *b*, an organism which occurred in one gathering only and puzzled us not a little. It has no discernible girdle, no markings on the plates, but in other respects, especially the shape of the plates and the markings at their junctions and the foraminal plate, it strongly recalls *P. Globulus*. *P. sphæricum* occurs in the Atlantic from lat. 44° N. to lat. 9° N.

P. SPINULOSUM, sp. n. Body ovate, unequally divided by the girdle, ends of girdle meeting exactly, the whole surface strongly areolated with short thick spines at the angles of the 4-sided areolæ; proximal limb larger than distal; foraminal area narrow. (Pl. XXIX. fig. 8.)

This minute species was found in one gathering, lat. 28° N., long. 40° W., in the voyage of the 'Atrato.' This species has a superficial resemblance to *Protoceratium reticulatum*.

PODOLAMPAS, Stein.

Podolampas bipes, Stein, and *P. palmipes*, Stein, occurred with very fair regularity over the region we have examined, but particularly from lat. 40° N. southward.

AMPHIDOMA, Stein.

Amphidoma Nucula, Stein, the only known species, occurred with great constancy throughout the region examined.

OXYTOXUM, Stein.

Oxytoxum Scolopax, Stein, and *O. constrictum*, Schütt, range from the Azores to the Equator in the Atlantic and to Panama in the Caribbean; *O. diploconus*, Stein, from the Azores to Panama; *O. tessellatum*, Schütt, from lat. 35° N. to lat. 14° N. *O. Gladiolus*, Stein, occurs only near the Azores in our gatherings, and *O. reticulatum*, Schütt, from the Azores to lat. 19° N. (Stein gives the Mediterranean as its home). On Pl. XXVII. fig. 7 we have figured *O. constrictum* to show its chromatophores. In addition to these species, we found another which must be recorded as new:—

O. MILNERI, sp. n. Body approximately spindle-shaped, unequally divided by the girdle; the whole membrane, except the girdle, finely punctate; girdle with one row of 4-sided areolæ; proximal limb acutely conical, composed of long, narrow, tapering

plates extending from the girdle to the apex ; apex elongate-acuminate ; distal limb short, bluntly conical, but terminating in an elongate-acuminate apex slightly out of the median line, composed of plates tapering from the girdle. (Pl. XXVII. fig. 6.) Its distribution is from the Azores to Panama.

CERATOCORYS, Stein.

Ceratocorys horrida, the only species known hitherto, is abundant south of lat. 35° N. to lat. 14° S. in the Atlantic and to Panama in the Caribbean. Stein gives it as from Polynesia. Now and then we came upon a variety of it figured on Pl. XXX. fig. 5 *a*, and an encysted state, fig. 5 *b*. The variety (or possibly new species) is distinguished by having its spines in one plane and by the slightly developed distal limb and girdle as seen in the figure.

In the gatherings of the 'Atrato,' lat. 32° N. and lat. 23°–24° N., we found what was undoubtedly the lid-like proximal limb of a *Ceratocorys* which we took to be new and gave it a provisional name. It is represented in Pl. XXX. fig. 6 *d*. In the 'Elbe' collections we found it again in lat. 2° N. and on the Line, the lids being smaller and plainly belonging to younger specimens (fig. 6 *c*). In spite of repeated search for the rest of the organism we had given it up, when fortunately one appeared at the last moment in a gathering from lat. 4°–6° S. We are thus able to give a description of this new species as

C. SPINIFERA, sp. n. Body unequally divided by the girdle and marked with numerous small irregular pits over the plates ; girdle marked by one row of rectangular areolæ, both margins projecting and acutely serrate, but with a fine membrane between the teeth, ends oblique ; proximal limb the smaller, arched and lid-like, composed of four segmental plates with broad, thick, projecting ribs, honeycombed with pits at the junctions ; foraminal area (with foramen at the apex of the limb) on the specially broad rib which runs down to the ends of the girdle, where it is depressed and continues as a furrow on the distal limb ; distal limb much larger than the proximal, composed of 4 (?) plates with six large four-winged spines below, the outer wing decurrent from the girdle, each spine with a stout, central axis giving off to each wing a row of secondary branches near the extremity. (Pl. XXX. figs. 6 *a*, *b*, *c*, *d*).

Its distribution is from lat. 28° N. to lat. 6° S. and evidently very rare, since we have met with it only five times, and in a complete state only once. Its main points of difference from *C. horrida* may be summarized as the arched lid with its broad, projecting, honeycombed ribs, its acutely serrate girdle, and its broader and shorter spines.

On Pl. XXX. fig. 6 *e* there is represented either a younger state of this species in which only two spines have appeared, or a variety with two spines. The whole organism is smaller than typical *C. spinifera*, which favours the former view ; on the other hand, its two spines appear to be as well-developed as the six spines of the type.

A comparison of the magnifications of the figures suggests either a great range in size of this species, or that the form figured (Pl. XXX. figs. 6 *a*, *b*) is not yet mature. Its magnification is $\times 840$, while that of the proximal limb (fig. 6 *d*) is $\times 410$, and it is only slightly larger in the figure.

DINOPHYSEÆ.

PHALACROMA, Stein.

Phalacroma operculatum, Stein, and *P. doryphorum*, Stein, occur pretty constantly over the whole region examined. *P. Mitra*, Schütt, not so abundant as these, occurs, however, over the region from the Azores to Panama. On Pl. XXXI. fig. 7 we have represented this species, since we are not satisfied with the author's presentment of some of its details in his 'Peridiniaceæ,' pl. 4. fig. 18. *P. Jourdani*, Schütt, occurred in one gathering in lat. 17° 58' N., long. 53° 32' W. *P. porodictyum*, Stein, also occurred in one collection, viz. in lat. 37° 44' N., long. 30° 55' W. *P. Globulus*, Schütt, occurs from lat. 35° N. to lat. 20° N., and *P. cuneus*, Schütt, was found once only in lat. 24° 9' N., long. 52° 50' W. Besides these we found four new species.

P. BLACKMANI, sp. n. Body divided into two unequal limbs by the girdle, nearly ovate, covered all over (including girdle) with large, well-marked, 4-5-sided areolæ; girdle projecting at both margins as a fine membrane with a row of acute tooth-like supports; proximal limb the larger, composed of two plates, with sail decurrent nearly its whole length, supported by three short spines; plates joined by a serrate suture running lengthwise round the body and corresponding with a similar suture on the distal limb, which also consists of only two plates and is slightly arched. (Pl. XXXI. figs. 4 a, b).

This beautiful *Phalacroma* is by no means common, but occurred often enough to enable us to trace its distribution from the Azores to Panama.

P. HINDMARCHII, sp. n. Body divided into two unequal limbs by the girdle, nearly globular, with a protrusion at proximal end, uniformly marked with minute spherical pits; proximal limb the larger, with sail supported by three spines, the lowest having a round knob at the end; distal limb highly arched. (Pl. XXXI. fig. 5.)

Its distribution is from lat. 34° N. to lat. 14° N. It is closely allied to *P. operculatum*, differing from it principally in the singular protrusion from the proximal limb and in the character of the sail.

P. DOLICHOPTERYGIUM, sp. n. Body very unequally divided by the girdle, and uniformly covered with minute spherical pits; girdle with its margins projecting as a fine membrane supported by a row of spines; proximal limb with sail decurrent its whole length, narrower and projecting laterally on the side bearing the sail; distal limb very slightly arched. (Pl. XXXI. fig. 8 a, b.)

This species occurs from lat. 8° 51' N. to lat. 35° N. It resembles most nearly *P. Mitra*, from which it may be distinguished by its shape, long decurrent sail, and finer markings.

PHALACROMA RUDGEI, sp. n. Body unequally divided by the girdle, with no markings, ovate in side view, of proportionately great breadth in ventral view, with broad flat suture-plates on both limbs; proximal limb with narrow and short sail; distal limb slightly arched. (Pl. XXXI. figs. 6 *a*, *b*.)

It appeared only once in our collections, viz. in lat. 37° 55' N., long. 36° 42' W., where it was found by Capt. Rudge of the 'Avon.'

DINOPHYSIS, Ehrenb.

This genus abounds especially in the Atlantic between the Azores and Barbados. *D. Homunculus*, Stein, occurred very constantly from lat. 48° N. to Panama; *D. rotundata*, Clap. & Lachm., from lat. 41° N. to the Caribbean; *D. hastata*, Stein, occurred from lat. 41° N. to lat. 18° N.; *D. uracantha*, Stein, from lat. 43° N. to Panama; *D. sphaerica*, Stein, from lat. 44° N. to lat. 18° N.; *D. acuta*, Ehrenb., from lat. 49° N. to lat. 29° N.; *D. Sacculus* once only in lat. 41° 30' N., long. 28° W. In addition to these we found one new species, viz. :—

D. RUDGEI, sp. n. Body globular; proximal limb covered with very large circular pits, and with a terminal spear-like appendage and a very small sail; girdle with proximal margin produced and forming a transparent collar, and distal margin prolonged into a short cylindrical funnel. (Pl. XXXI. fig. 9 *a*, *b*.)

It occurred only on the voyage of the 'Avon' in lat. 33° 20' N., long. 43° 9' W.

D. SCHUETTII, nob.

In his 'Peridiniaceæ of the German National Plankton Expedition' (tab. ii. fig. 9). Dr. Schütt has figured under the name of *Dinophysis uracantha*, Stein, a specimen which, on comparison with Stein's figure ('Infusionsthier,' pt. iii. tab. xx. figs. 22, 23), presents manifest differences. We have found an organism (Pl. XXXI. fig. 10) agreeing with Dr. Schütt's figure. It differs from *D. uracantha* in the form of its sail and in having no terminal spine, but with a process supporting a small, narrow membrane at its base, placed on the dorsal side. We have separated it from *D. uracantha* under the above name.

AMPHISOLENIA, Stein.

A. palmata, Stein, occurs from lat. 38° N. to lat. 14° N., and *A. Thrinax*, Schütt, from lat. 29° N. to lat. 27° N.

Another species, described below, which appears to be intermediate in the characters it presents between *A. palmata*, Stein, and *A. Thrinax*, Schütt (in 'Pflanzenleben der Hochsee,' p. 33), occurred in the same place and in the collections made by the 'Elbe.'

A. BIFURCATA, sp. n. Proximal limb composing the body; the distal limb composed of two plates and reduced to a flat membrane; margins of girdle expanded into two frills equal in size and of like appearance; proximal limb elongate, swollen to

three times the ordinary diameter immediately below the foramen, bifurcate below, bifurcations slightly swollen in the middle and each with a small spur near the extremity. (Pl. XXXI. fig. 1.)

From lat. 30° N. and long. 40° W. with the other species, and in lat. 4°–6° S., long. 32° 32' to 30° 39' W. It reaches long. 72° W. in lat. 16° to 17° N.

AMPHISOLENIA INFLATA, sp. n. Proximal limb composing much the greater part of the body, swollen for half its length to 5 times (lateral view), 2–3 times (foraminal view) immediately below foramen, unbranched, without a spur at the extremity; distal limb reduced to a flat membrane; girdle with each margin expanded into a frill, the distal one wider, the proximal decurrent to foramen. (Pl. XXXI. figs. 2 *a*, *b*.) It occurs in lat. 34° to 39° N., long. 39° to 32° W.

HISTIONEIS, Stein.

Owing to our discovery principally of *Histioneis Francescæ* and of such other forms near it as *H. Para*, it is clear that the distinction between Stein's two genera *Histioneis* and *Ornithocercus* disappears. At first we had serious doubts as to the inclusion of *O. splendidus*, Schütt (= *O. splendens*, Schütt, in Engler and Prantl, Nat. Pflanzenfam. Peridin. p. 29), which appeared to have in place of a sail three spines, somewhat like those of a *Ceratocorys*. However, on careful examination we found specimens with an extremely fragile sail of much the same character otherwise as that of *H. magnifica* (see Pl. XXXII. figs. 1 *a*, *b*, *c*) with similar terminal thickenings. This has escaped attention from two causes: (1) it is frequently broken, and represented only by the three main supports hanging down and giving the appearance of *Ceratocorys* spines; and (2) by this species habitually presenting under the microscope its ventral aspect, in which the sail, if present, appears very foreshortened. The distal limb is larger and more arched in *H. splendida* than in any other *Histioneis*, and the two plates composing it are joined by a zigzag suture (see Pl. XXXII. fig. 1 *c*). Its collar and funnel are alike, and in this important character it is distinct from the other species of *Histioneis*. We suggest the establishment of a section of the genus for the reception of such forms under the name *Paraschuetia*, which would be not only descriptive (though barbarously), but also commemorative of Dr. Schütt's great services to the study of phyto-plankton.

H. splendida is a comparatively rare organism in our gatherings, but we found it from lat. 34° 30' N., long. 30° W., to lat. 13° 6' N., long. 78° 44' W.

H. magnifica (Pl. XXXII. fig. 2) is one of the most abundant and constantly occurring Peridiniaceæ in the warm Atlantic, ranging, according to our records, from lat. 44° N. to lat. 14° 44' S. in the Atlantic and to Panama in the Caribbean. It varies greatly in size and in the character of the markings on the sail and funnel. We have represented a fairly typical one in fig. 2 for the purpose of comparison with the other species.

H. remora, Stein, occurred in gatherings from lat. 31° N. to lat. 8° N. in the Atlantic, and to Panama in the Caribbean; *H. biremis*, Stein, from lat. 31° N. to Panama; and *H. crateriformis*, from lat. 31° N., long. 35° W., to lat. 16° N., long. 77° W., *i. e.* practically the same distribution as the other two. Among the new species which we

describe, lat. 35° N. represents the farthest north of *Histioneis Francescæ*; lat. 31° N. of two, viz. *H. Highleii* and *H. Mitchellana*; lat. 30° N. of *H. Helenæ*; lat. 29° N. of *H. Dolon*; lat. 33° N. of *H. Para*; lat. 24° N. of *H. dentata*; and lat. 23° N. of *H. Milneri*. It will be seen, therefore, that these additions to the genus are all, like the species already known, confined to the warm Atlantic. On Pl. XXXII. fig. 6 we have figured *H. biremis*, Stein, a different form from Stein's, though clearly the same species. In our specimens the funnel is of somewhat different shape and quite differently marked, and the sail also differently marked. The latter variation occurs in most species. Our records are rich in new species of this remarkable genus.

HISTIONEIS FRANCESCÆ, sp. n. Body irregularly globular, composed of proximal limb and girdle, slightly compressed laterally, pitted; girdle broad, pitted, distal margin expanded into a large wide funnel with unbranched radiate nervation and entire edge, proximal margin forming a broad pitted collar, open on dorsal as well as on ventral side, one half continued down on ventral side to the sail, the division between end of collar and sail near foramen; sail extending underneath the proximal limb along the junction of the two plates that form the limb, with straight, occasionally branching nervation (the nerves being fairly uniform in size), and pitted, especially near the body, with an entire margin bordered with parallel peripheral lines; distal limb reduced to a small flat membrane at base of funnel. (Pl. XXXII. fig. 3.)

It ranges from lat. 35° 20' N. to lat. 14° to 16° N., long. 58° 32' W. It never occurs plentifully even though it has so wide a distribution, practically from the Azores to Barbados.

It is chiefly on the characters afforded by this singularly beautiful species that the generic distinction between Stein's *Ornithocercus* and *Histioneis* breaks down. The collar open on the dorsal side, with the other characters, brought this species into line with our *H. Para*, *H. biremis*, Stein, &c.; while, on the other hand, in describing it we have to bear in mind the necessity of distinguishing it from *H. magnifica*, the original type of Stein's *Ornithocercus*. It may readily be distinguished from it by the collar open on the dorsal side and by the whole character of the sail, which has no specially stout nerves running down to thickened endings as in *H. magnifica*, but a close-set uniform nervation, with pits near the body.

H. PARA, sp. n. Proximal limb from semi-globular to semi-oval in shape, very little if at all compressed laterally, pitted, with a long, narrow, pointed, flat sail, sometimes pitted near the point only (and in that case with a few transverse thickened bars), decurrent to the extremity of limb or nearly so; girdle broad at the proximal margin, pitted, the proximal margin expanded into a collar, unmarked, but supported by a few upright thickened bars, open on both dorsal and ventral sides, but not decurrent to the sail, which, however, reaches its base; distal margin expanded into a broad funnel with radiating nervation, the nerves unbranched, edge entire; distal limb reduced to a flat membrane. (Pl. XXXII. figs. 4 *a*, *b*, *c*.)

This species was at times fairly plentiful from 28° N. in the Atlantic to Panama in

the Caribbean. It is most nearly allied to *H. Francescæ*, from which it differs in the totally different sail, the plain, unpitted, and not decurrent collar, and the shape of the body. It is constant in all its characters except the markings on the sail and the slightly varying shape of the proximal limb.

HISTIONEIS DENTATA, sp. n. Proximal limb semi-ovate, laterally compressed halfway towards extremity, pitted, with an irregular flat sail; sail narrow in its upper part, but at once widening, then narrowing again irregularly, with large pits of varying size, and with one supporting thickened bar projecting from the extremity of the limb and the sail itself extending beyond it on the dorsal side; girdle pitted, expanding at proximal margin into a collar, with one large, clear, unmarked area on each half, but supported on the dorsal and ventral sides by thickened pitted ends, open at both dorsal and ventral sides and decurrent on one side in a narrow thickened and pitted band past the foramen to the sail; distal margin expanding into a funnel with a dentate edge, and with much thickened, upright, radiate bars, each thickest at the top and toothed in a radial direction; distal limb reduced, but bearing a tuft of upright spines emerging slightly above the funnel. (Pl. XXXIII. figs. 4 *a*, *b*.)

Found only in lat. 24°–25° N., long. 51°–50° W.

H. HIGHLEII, sp. n. Proximal limb pitted all over, hollowed above at the girdle, and continued downward into a long cylindrical extension rounded at the end, giving the whole limb a trifurcate appearance; with sail narrow where it joins the limb, broadening outwards, supported at its upper and lower margins by thickened bars, unmarked except in lower outer corner; girdle pitted, with its proximal margin expanding into a large, high, unmarked collar slightly constricted near the top, open on both dorsal and ventral sides, and bearing as an appendage on the ventral side a membranous expansion like a small sail set above the true one; upper margin of girdle expanded into a funnel narrow and unmarked below, then slightly pitted where it begins to expand, and with radiate thickened bars above, the bars bearing each a minute knob at the top, edge of funnel entire; distal limb almost suppressed, consisting of a minute flat membrane at base of funnel. (Pl. XXXII. fig. 5.)

From lat. 31° N. to lat. 23° N. in the Atlantic.

H. MILNERI, sp. n. Proximal limb short, stout, curved, faintly and sparsely pitted, and with a row of distinct punctate markings where it borders the girdle, and a similar row parallel to it on the girdle itself, bearing on the ventral side the sail supported by thickened curved bars top and bottom, and bordered with parallel peripheral thickened lines with two lateral flaps beneath; proximal margin of girdle expanded into a wide high collar unmarked in its lower half, but with a reticulum of fine nerves on the upper half, open on the dorsal and ventral sides and supported by thick upright bars at the openings, one side decurrent in a large wide expansion, which meets the sail and forms in fact itself an upper sail with reticulate nervation

and a border like that of the lateral sail; upper margin of girdle forming a long, narrow, tubular funnel expanding slightly above and toothed at the edge; distal limb suppressed, and represented only by a minute membrane at the base of this funnel. (Pl. XXXIII. fig. 1.)

This singular organism occurs from lat. 23° N. in the Atlantic to Panama in the Caribbean:

HISTIONEIS MITCHELLANA, sp. n. Proximal limb short and elongate in a dorsi-ventral direction, deeper on the dorsal side, very faintly marked, bearing the sail on a projecting semicircular thickened bar; sail reticulate and forming two lateral flaps, confluent on its ventral margin with the decurrent edge of collar; proximal margin of girdle forming a large wide collar, unmarked in the lower half, which expands laterally, reticulate above, narrowing again laterally towards the top, where the edge is entire, one side decurrent to the sail and reticulate; distal margin forming a narrow tubular funnel expanding and reticulate above, edge entire; distal limb suppressed, and represented only by a membrane at base of funnel. (Pl. XXXIII. figs. 3 *a*, *b*.)

From lat. 31° N. to lat. 22° N.

H. HELENÆ, sp. n. Proximal limb short, stout, curved, with a row of distinct punctate markings where it borders the girdle, parallel to a similar row on the girdle itself, bearing on the ventral side the sail; sail with faint reticulate markings on its outer portion, which is so curved as to form a lateral flap, bearing also two unmarked, rounded, opposite wings inserted parallel and near to the collar; proximal margin of girdle forming a collar, the upper part of which bears fine reticulate markings, and its edge fine bristles at short intervals, one side decurrent to the sail; distal margin of girdle produced into a long tubular funnel expanding above, unmarked, and with fine bristles projecting from the edge; distal limb suppressed, and represented only by a minute membrane at base of funnel. (Pl. XXXIII. figs. 2 *a*, *b*.)

From lat 30° N. to lat 16° N.

H. DOLON, sp. n. Proximal limb short, stout, curved, very finely punctate, and with a row of distinct punctate markings where it borders the girdle, parallel to a similar row on the girdle itself; bearing a large sail, which is so curved as to form a large transverse hollow like a filled balloon-topsail, marked with parallel peripheral lines, bearing also two opposite side-wings also hollowed, unmarked, inserted near to and parallel with collar; proximal margin of girdle forming a high collar reticulate above, decurrent on one side to the sail and forming in fact an upper sail, marked; distal margin prolonged into a long funnel expanding widely above, unmarked except at the edge, where it is bordered by a band with fine vertical markings; distal limb suppressed, and represented only by a plate at base of funnel. (Pl. XXXIII. figs. 5 *a*, *b*.)

Found in lat. 28° N., long. 40° W.; and again in lat. 29° N. and long. 42° to 44° W.

CITHARISTES, Stein.

Both the known species of *Citharistes* occurred: *C. regius*, Stein, once only, viz. in lat. 31° N., long. $35^{\circ} 30'$ W.; *C. Apsteinii*, Schütt, though never plentiful, occurred from lat. 34° to 39° N. in the Atlantic to Colon in Panama. We have figured *C. Apsteinii* on Pl. XXXI. figs. 3 *a*, *b*. Schütt states that in this species there is a single large dorsal spine bounding the cavity formed by the curve of the body. In fig. 3 *b* we have given a ventral view of *C. Apsteinii*, showing that there are two spines, marked with large pits and expanding above, where they meet the body.

TABLE I.

R.M.S. 'PARA.'—VOYAGE I. (CAPT. MILNER).

	Lat. 41° 30' N., long. 19° 40' W. Temp. 57°. Jan. 30.	Lat. 36° N., long. 28° 40' W. Temp. 62°. Feb. 1.	Lat. 22° 20' N., long. 48° W. Temp. 70°. Feb. 5.	Lat. 18° 50' N., long. 52° 20' W. Temp. 77°. Feb. 6.	Lat. 15° N., long. 57° W. Temp. 78°. Feb. 7.	Lat. 25° N., long. 51° W. Temp. 70°. March 9.	Lat. 30° N., long. 46° 30' W. Temp. 70°. March 10.	Lat. 40° N., long. 31° W. Temp. 62°. March 13.	Lat. 43° N., long. 24° W. Temp. 60°. March 14.	Lat. 46° N., long. 17° W. Temp. 56°. March 15.
	1.	3.	8.	9.	10.	12.	13.	16.	17.	18.
<i>Ceratium</i> <i>Tripos</i> , <i>Nitzsch</i>	*	*	*	*	*	*	*	*	*	*
„ <i>Furca</i> , <i>Dujard</i> . . . . .	*	..	..	..	..	..	..	*	*	*
„ „ <i>var. baltica</i> . . . . .	*	..	..	..	..	..	..	*	..	*
„ <i>Fusus</i> , <i>Dujard</i> . . . . .	*	..	..	..	*	..	..	*	..	..
„ <i>Candelabrum</i> , <i>Stein</i> . . . . .	..	*	..	..	..	..	..	..	..	..
„ <i>Limulus</i> , <i>Gourret</i> . . . . .	..	*	..	..	..	..	..	..	..	..
<i>Gonyaulax</i> <i>polygramma</i> , <i>Stein</i> . . . . .	..	..	..	..	..	*	..	..	..	..
„ <i>Jolliffei</i> , <i>Murr. & Whitt.</i> . . . .	..	..	..	..	..	..	..	..	..	..
„ <i>Highlei</i> , <i>Murr. & Whitt.</i> . . . .	..	..	..	..	..	..	*	..	..	..
<i>Goniodoma</i> <i>acuminatum</i> , <i>Ehrenb.</i>	*	*	..	*	*	*	*	*	..	*
„ <i>Milneri</i> , <i>Murr. & Whitt.</i> . . . .	..	..	*	*	*	..	*	..	..	..
<i>Peridinium</i> <i>divergens</i> , <i>Ehrenb.</i> . . . .	*	*	*	..	*	..	*	..	..	*
„ <i>Michaelis</i> , <i>Ehrenb.</i> . . . .	..	*	..	..	..	..	..	..	..	..
„ <i>tristylum</i> , <i>Stein</i> . . . . .	*	..	..	..	..	..	..	..	..	..
„ <i>Globulus</i> , <i>Stein</i> . . . . .	..	..	..	..	..	..	..	*	*	*
<i>Podolampas</i> <i>bipes</i> , <i>Stein</i> . . . . .	..	*	..	*	*	..	..	..	..	..
„ <i>palmipes</i> , <i>Stein</i> . . . . .	..	*	..	*	..	*	*	..	..	..
<i>Amphidoma</i> <i>Nucula</i> , <i>Stein</i> . . . . .	*	*	..	..	*	..	..	*	..	*
<i>Oxytoxum</i> <i>Scolopax</i> , <i>Stein</i> . . . . .	*	..	..	..	..	..	..	*	..	..
„ <i>Milneri</i> , <i>Murr. & Whitt.</i> . . . .	..	..	..	..	..	..	..	..	..	..
„ <i>constrictum</i> , <i>Schütt</i> . . . . .	..	..	..	*	..	..	..	..	..	..
„ <i>reticulatum</i> , <i>Schütt</i> . . . . .	*	..	..	..	..	..	..	..	..	..
<i>Ceratocorys</i> <i>horrida</i> , <i>Stein</i> . . . . .	..	..	..	*	*	*	..	..	..	..
<i>Phalacroma</i> <i>operculatum</i> , <i>Stein</i> . . . .	*	*	..	*	..	*	..	*	..	..
„ <i>doryphorum</i> , <i>Stein</i> . . . . .	..	*	*	..	..	..	*	*	..	..
„ <i>Mitra</i> , <i>Schütt</i> . . . . .	*	..	..	..	..	..	..	..	..	..
„ <i>Blackmani</i> , <i>Murr. & Whitt.</i> . . . .	..	*	..	..	..	..	..	..	..	..
<i>Dinophysis</i> <i>rotundata</i> , <i>Clap. & Lachm.</i> . . .	..	*	..	..	..	..	..	..	..	..
„ <i>Homunculus</i> , <i>Stein</i> . . . . .	*	*	..	..	..	..	*	..	..	..
„ <i>hastata</i> , <i>Stein</i> . . . . .	..	..	..	..	..	..	..	..	..	..
„ <i>uracantha</i> , <i>Stein</i> . . . . .	..	*	..	..	..	..	..	..	..	..
„ <i>acuta</i> , <i>Ehrenb.</i> . . . .	..	..	..	..	..	..	*	..	..	..
„ <i>sphærica</i> , <i>Stein</i> . . . . .	..	..	..	..	..	..	*	*	..	..
<i>Histioneis</i> <i>magnifica</i> , <i>Murr. & Whitt.</i> . . .	*	*	*	*	..	..	*	..	..	..
„ <i>Helene</i> , <i>Murr. & Whitt.</i> . . . .	..	..	..	..	..	..	*	..	..	..
„ <i>Mitchellana</i> , <i>Murr. & Whitt.</i> . . . .	..	..	..	..	..	..	*	..	..	..
<i>Pyrocystis</i> <i>Noctiluca</i> , <i>J. Murr.</i> . . . .	..	..	..	*	*	..	..	*	..	..
„ <i>fusiformis</i> , <i>J. Murr.</i> . . . .	..	..	..	..	..	..	..	..	*	..
„ <i>Lunula</i> , <i>Schütt</i> . . . . .	..	*	..	..	*	..	..	..	..	..

TABLE II.

R M.S. 'PARA.'—VOYAGE II. (CAPT. MILNER).

	Lat. 44° 50' N., long. 18° 40' W. Temp. 52°. April 9.	Lat. 38° N., long. 24° 10' W. Temp. 61°. April 11.	Lat. 24° N., long. 45° W. Temp. 73°. April 15.	Lat. 21° N., long. 49° W. Temp. 76°. April 16.	Lat. 18° 20' N., long. 52° 40' W. Temp. 79°. April 17.
	19.	23.	24.	25.	26.
<i>Cladopyxis brachiolata</i> , Stein	*	..	*
<i>Ceratium Tripos</i> , Nitzsch	*	..	*
„ <i>Furca</i> , Dujard.	*	..	*	*	..
„ „ <i>var. baltica</i>	*	*	*	..	*
„ <i>Fusus</i> , Dujard.	*
„ <i>Candelabrum</i> , Stein	*	*	..
„ <i>Limulus</i> , Gourret	*
<i>Gonyaulax polygramma</i> , Stein	*
„ <i>Jolliffei</i> , Murr. & Whitt.	*	*
„ <i>glyptorhynchus</i> , Murr. & Whitt.	*	*
<i>Goniodoma acuminatum</i> , Ehrenb.	*
„ <i>Milneri</i> , Murr. & Whitt.	*	..	*
<i>Peridinium divergens</i> , Ehrenb.	*	*	..	*
„ <i>Michaelis</i> , Ehrenb.	*
„ <i>Globulus</i> , Stein	*
„ <i>Blackmani</i> , Murr. & Whitt.	*
<i>Diplopsalis sæcularis</i> , Murr. & Whitt.	*
<i>Podolampas bipes</i> , Stein	*	..	*
<i>Amphidoma Nucula</i> , Stein	*	*
<i>Oxytoxum Scolopax</i> , Stein	*
„ <i>Milneri</i> , Murr. & Whitt.	*
„ <i>reticulatum</i> , Schütt	*
<i>Ceratocorys horrida</i> , Stein	*	..	*
<i>Phalacroma operculatum</i> , Stein	*
„ <i>doryphorum</i> , Stein	*	*	*
<i>Dinophysis hastata</i> , Stein	*
„ <i>uracantha</i> , Stein	*
„ <i>sphærica</i> , Stein	*
<i>Histioneis magnifica</i> , Murr. & Whitt.	*	..	*	..
<i>Pyrocystis Noctiluca</i> , J. Murr.	*	*	..
„ <i>fusiformis</i> , J. Murr.	*	*	..

TABLE IV.

R.M.S. 'AVON' (CAPT. RUDGE).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
	Lat. 18° 18' N., long. 57° 35' W. Surf. temp. 82°. August 5.	Lat. 21° 6' N., long. 55° 17' W. Surf. temp. 79°. August 6.	Lat. 24° 9' N., long. 52° 50' W. Surf. temp. 79°. August 7.	Lat. 27° 51' N., long. 49° 15' W. Surf. temp. 80°. August 8.	Lat. 30° 37' N., long. 46° 16' W. Surf. temp. 79°. August 9.	Lat. 33° 20' N., long. 43° 9' W. Surf. temp. 79°. August 10.	Lat. 35° 36' N., long. 39° 51' W. Surf. temp. 76°. August 11.	Lat. 37° 55' N., long. 36° 42' W. Surf. temp. 74°. August 12.	Lat. 40° 29' N., long. 32° 45' W. Surf. temp. 71°. August 13.	Lat. 42° 43' N., long. 28° 24' W. Surf. temp. 68°. August 14.	Lat. 44° 27' N., long. 24° 4' W. Surf. temp. 64°. August 15.	Lat. 46° 23' N., long. 19° 17' W. Surf. temp. 63°. August 16.	Lat. 48° 3' N., long. 14° 18' W. Surf. temp. 63°. August 17.	Lat. 49° 24' N., long. 8° 46' W. Surf. temp. 62°. August 18.
<i>Glenodinium trochoideum</i> , Stein	*
<i>Ptychodiscus Noctiluca</i> , Stein
<i>Cladopyxis brachiolata</i> , Stein
<i>Ceratium Tripos</i> , Nitzsch
<i>Furca</i> , Dujard.
" <i>var. baltica</i>
<i>Fusus</i> , Dujard.
<i>Candelabrum</i> , Stein
<i>Limulus</i> , Gourret
<i>Gonyaulax birostris</i> , Stein
<i>Jolliffei</i> , Murr. & Whitt.
<i>polygramma</i> , Stein
<i>Goniiodoma acuminatum</i> , Ehrenb.
<i>Milneri</i> , Murr. & Whitt.
<i>sphaericum</i> , Murr. & Whitt.
<i>Diplopsalis sæcularis</i> , Murr. & Whitt.
<i>Peridinium divergens</i> , Ehrenb.
<i>Michaelis</i> , Ehrenb.
<i>tristylum</i> , Stein
<i>Globulus</i> , Stein
<i>sphaericum</i> , Murr. & Whitt.
<i>Podolampas bipes</i> , Stein
<i>palmipes</i> , Stein
<i>Amphidoma Nucula</i> , Stein
<i>Oxytoxum Scolopax</i> , Stein
<i>constrictum</i> , Schütt
<i>Ceratocorys horrida</i> , Stein
<i>Phalacroma operculatum</i> , Stein
<i>doryphorum</i> , Stein
<i>Mitra</i> , Schütt
<i>Hindmarchii</i> , Murr. & Whitt.
<i>Cuneus</i> , Schütt
<i>Rudgei</i> , Murr. & Whitt.
<i>Dinophysis Homunculus</i> , Stein
<i>uracantha</i> , Stein
<i>acuta</i> , Ehrenb.
<i>sphaerica</i> , Stein
<i>Rudgei</i> , Murr. & Whitt.
<i>Histioneis magnifica</i> , Murr. & Whitt.
<i>Para</i> , Murr. & Whitt.
<i>Pyrocystis Noctiluca</i> , J. Murr.
<i>Lunula</i> , Schütt
<i>Halosphæra viridis</i> , A. Schmidt

¹ One specimen only.² Very abundant.

TABLE V.—R.M.S. 'MEDWAY' (CAPT. MILNER).

		Lat. 42° 35' N., long. 17° 46' W. Temp. 62°. Aug. 28.	Lat. 39° 38' N., long. 23° 27' W. Temp. 68°. Aug. 29.	Lat. 36° 48' N., long. 29° 26' W. Temp. 72°. Aug. 30.	Lat. 33° 15' N., long. 34° 34' W. Temp. 77°. Aug. 31.	Lat. 30° N., long. 39° W. Temp. 77°. Sept. 1.	Lat. 26° N., long. 44° W. Temp. 80°. Sept. 2.	Lat. 23° N., long. 49° W. Temp. 80°. Sept. 3.	Lat. 19° 25' N., long. 52° 25' W. Temp. 80°. Sept. 4.	Lat. 10° N., long. 77° W. Temp. 83°. Sept. 23.	Lat. 9° 35' N., long. 79° 45' W. Temp. 83°. Sept. 23.	Lat. 10°-12° N., long. 79° W. Temp. 82°. Sept. 24 to 25.	Lat. 13° N., long. 78° W. Temp. 82°. Sept. 25.	Lat. 17° 50' N., long. 74°-76° W. Temp. 82°. Sept. 28 to 29.	Lat. 15° 30' N., long. 66° 30' W. Temp. 82°. Sept. 30.	Lat. 14° 30' N., long. 63° 30' W. Temp. 82°. Oct. 1.	Lat. 14° N., long. 61° W. Temp. 82°. Oct. 1.	Lat. 15° N., long. 57° 40' W. Temp. 82°. Oct. 3.	Lat. 19° 30' N., long. 54° 30' W. Temp. 80°. Oct. 4.	Lat. 23° 30' N., long. 50° 30' W. Temp. not given. Oct. 5.	Lat. 28° N., long. 45° 30' W. Temp. 78°. Oct. 6.	Lat. 31° 20' N., long. 41° 50' W. Temp. 78°. Oct. 7.	Lat. 35° 20' N., long. 37° 20' W. Temp. 77°. Oct. 8.	Lat. 38° 40' N., long. 33° W. Temp. 72°. Oct. 9.	Lat. 41° 30' N., long. 28° W. Temp. 70°-67°. Oct. 10.
Ptychodiscus Noctiluca, Stein	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Cladopyxis brachiolata, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ceratium Tripos, Nitzsch	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Furca, Dujard.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" var. baltica	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fusus, Dujard.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Candelabrum, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Limulus, Gourret	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
gravidum, Gourret	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
biconicum, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gonyaulax birostris, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jolliffei, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
polygramma, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Goniodoma acuminatum, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Milneri, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
sphaericum, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Peridinium divergens, Ehrenb.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Michaelis, Ehrenb.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
tristylum, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Globulus, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hindmarchii, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Podolampas bipes, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
palmipes, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Amphidoma Nucula, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Oxytoxum Scolopax, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
diploconus, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Milneri, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
constrictum, Schütt	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
reticulatum, Schütt	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
tessellatum, Schütt	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ceratocorys horrida, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Phalacroma operculatum, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
doryphorum, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mitra, Schütt	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blackmani, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hindmarchii, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dinophysis rotundata, Clap. & Lachm.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Homunculus, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
uracantha, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
sphaerica, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sacculus, Stein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Histioneis magnifica, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Para, Murr. & Whitt.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Francescae, G. Murr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pyrocystis Noctiluca, J. Murr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
fusiformis, J. Murr.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lunula, Schütt	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
bicornis, Blackm.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Halosphæra viridis, A. Schmidt	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

TABLE VI.—R.M.S. 'ATRATO,' VOYAGE I. (CAPT. MILNER).

[illegible]

TABLE VIII.—R.M.S. 'ATRATO,' VOYAGE II. (CAPT. MILNER).

	Lat. 38°-36° 10' N., long. 25°-28° 20' W. Temp. 60°. Jan. 30-31.	1	Pyroboscus Noctiluca, Stein Pyrophacus Horologium, Stein Cladopyxis brachiolata, Stein Ceratium Tripos, Nitzsch Furca, Dugard. " var. baltica " Candelabrum, Stein Fusus, Dugard. " Gravium, Gouvet " Limulus, Gouvet Gonyaulax polygramma, Stein " Joffei, Murr. & Whit. " Highley, Murr. & Whit. " glyptorhynchus, Murr. & Whit. Goniodoma acuminatum, Stein " sphaericum, Murr. & Whit. " Milneri, Murr. & Whit. " fimbriatum, Murr. & Whit. " Diptopalis secularis, Murr. & Whit. Pentidinium divergens, Ehrenb. " Michaelis, Ehrenb. " trisygium, Stein " Hindmarshii, Murr. & Whit. " Globulus, Stein " spinulosum, Murr. & Whit. " sphaericum, Murr. & Whit. " leiohynchum, Murr. & Whit. " reticulatum, Murr. & Whit. " Milneri, Murr. & Whit. " Tripos, Murr. & Whit. " Doma, Murr. & Whit. Podolampas bipes, Stein " palmpes, Stein " Amphidoma Nuclea, Stein Oxytoxum Scelopax, Stein " reticulatum, Schütt " tessellatum, Schütt " diploeus, Stein " sphaeroides, Stein " Milneri, Murr. & Whit. " constitutum, Schütt Ceratocorys horrida, Stein " spinifera, Murr. & Whit. Phalacroma operculatum, Stein " doryphorum, Stein " dolichopterygium, Murr. & Whit. " Mitra, Schütt " Hindmarshii, Murr. & Whit. " Blackmani, Murr. & Whit. Dinophysis rotundata, Clap. & Iachn. " sphaerica, Stein " acuta, Ehrenb. " uracantha, Stein " Homunculus, Stein " Schuettii, Murr. & Whit. Amphisolenia palmata, Stein " bifurcata, Murr. & Whit. " globifera, Stein " Thinnax, Schütt " inflata, Murr. & Whit. Histioneis splendida, Murr. & Whit. " magnifica, Murr. & Whit. " remora, Stein " bitemis, Stein " Highley, Murr. & Whit. " Michelliana, Murr. & Whit. " crateriformis, Stein " Para, Murr. & Whit. " Dolon, Murr. & Whit. " Helene, Murr. & Whit. " Francesae, G. Murr. " Milneri, Murr. & Whit. Citharistes Aysenii, Schütt	Lat. 35°-33° 40' N., long. 29° 50'-31° 20' W. Temp. 62°. Jan. 31.	2	Lat. 33° 40'-31° 50' N., long. 31° 20'-34° 20' W. Temp. 62°. Jan. 31-Feb. 1.	3	Lat. 31° 30'-29° 50' N., long. 34° 40'-37° W. Temp. 64°-67°. Feb. 1.	4	Lat. 28° 30'-27° 10' N., long. 39° 20'-41° 10' W. Temp. 67°-70°. Feb. 2.	5	Lat. 27° 10'-25° 30' N., long. 41° 20'-43° 40' W. Temp. 70°. Feb. 2-3.	6	Lat. 24° 10'-22° 10' N., long. 45° 20'-48° W. Temp. 71°-75°. Feb. 3-4.	7	Lat. 20° 40'-19° N., long. 50°-52° W. Temp. 76°. Feb. 4-5.	8	Lat. 14°-16° N., long. 62° 30'-68° W. Temp. 79°. Feb. 8-9.	9	Lat. 18° N., long. 71°-76° W. Temp. 78°. Feb. 10-11.	10	Lat. 14°-17° 30' N., long. 77° W. Temp. 79°. Feb. 26-27.	16	Lat. 14°-16° N., long. 64°-68° W. Temp. 79°. March 3-4.	20	Lat. 29° 20'-31° 20' N., long. 44° 50'-42° 30' W. Temp. 67°. March 9-10.	21	Lat. 34°-39° N., long. 39° 30'-32° 30' W. Temp. 66°-60°. Mar. 10 & 12 (mixed).	22	Lat. 40° 30'-42° 10' N., long. 29° 10'-22° 30' W. Temp. 59°-57°. March 12-13.	23	Lat. 43° 30'-44° 40' N., long. 22°-19° W. Temp. 54°. March 13-14.	24
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TABLE IX.—R.M.S. 'ATRATO,' VOYAGE III. (CAPT. MILNER).

	1	2	3	4	5	6	7	8	9	10	16	20	21	22	23	24																																																											
Lat. 41°-39' 10" N., long. 20° 10'-23° W.	Lat. 38° 30'-35° 50' N., long. 23° 50'-28° 10' W.	Temp. 60°. April 9-10, 1898.	Temp. 60°-62°. April 10-11.	Lat. 35° 50'-32° 20' N., long. 28° 10'-33° 40' W.	Temp. 63°-65°. April 11-12.	Lat. 32° 20'-28° 50' N., long. 33° 40'-38° 20' W.	Temp. 65°-68°. April 12-13.	Lat. 28° 50'-25° 40' N., long. 38° 20'-43° W.	Temp. 68°-69°. April 13-14.	Lat. 25° 40'-22° 20' N., long. 43°-47° 30' W.	Temp. 69°-70°. April 14-15.	Lat. 2° 20'-19° 10' N., long. 47° 30'-51° 50' W.	Temp. 70°-76°. April 15-16.	Lat. 19° 10'-16° N., long. 51° 50'-56° W.	Temp. 77°. April 16-17.	Lat. 16°-14° 30' N., long. 56°-58° W.	Temp. 78°. April 17.	Lat. 14°-15° 30' N., long. 63° 30'-67° 10' W.	Temp. 78°. April 19-20.	Lat. 16° 20'-17° 20' N., long. 69° 30'-72° W.	Temp. 80°. April 20-21.	Lat. 13°-17° N., long. 76° W.	Temp. 81°. May 7-8.	Lat. 17° 30'-15° 50' N., long. 68°-70° W.	Temp. 81°. May 11-12.	Lat. 16°-20° N., long. 58°-54° W.	Temp. 80°-78°. May 15-16.	Lat. 22°-24° N., long. 53°-51° W.	Temp. 71°. May 16-17.	Lat. 27°-28° 30' N., long. 49°-47° W.	Temp. 71°. May 17-18.	Lat. 30° 30'-32° N., long. 44° 30'-42° W.	Temp. 70°. May 18-19.	Lat. 33°-34° N., long. 42°-40° W.	Temp. 70°. May 19.	Lat. 43°-44° N., long. 23°-20° W.	Temp. 62°-58°. May 22-23.	Lat. 44° 30'-47° N., long. 19°-13° 30' W.	Temp. 58°-55°. May 23-24.																																				
Ptychodiscus Noctiluca, Stein	Pyrophacus Hovologium, Stein	Cladopyxis brachiolata, Stein	Ceratium Tripos, Nitzsch	" Furca, Dujard.	" var. baltica	Candelabrum, Stein	Fusus, Dujard.	gravidum, Gouret	Limulus, Gouret	Gonyaulax polygramma, Stein	" Jolliffei, Murr. & Whitt.	" Highleyi, Murr. & Whitt.	" gyptorhynchus, Murr. & Whitt.	Goniadoma acuminatum, Stein	" sphaericum, Murr. & Whitt.	" Milneri, Murr. & Whitt.	" fibriatum, Murr. & Whitt.	Diplopsalis secularis, Murr. & Whitt.	Peridinium divergens, Ehrenb.	" Michaelis, Ehrenb.	" tristylum, Stein	" Hindmarshii, Murr. & Whitt.	" Globulus, Stein	" spinulosum, Murr. & Whitt.	" sphaericum, Murr. & Whitt.	" leiorhynchum, Murr. & Whitt.	" reticulatum, Murr. & Whitt.	" Milneri, Murr. & Whitt.	" Tripos, Murr. & Whitt.	" Dona, Murr. & Whitt.	Podolampas bipes, Stein	" palmipes, Stein	Amphidoma Nucula, Stein	Oxytoxum Scolopax, Stein	" reticulatum, Schütt	" tessellatum, Schütt	" diploconus, Stein	" sphaeroideum, Stein	" Milneri, Murr. & Whitt.	" constrictum, Schütt	Ceratocorys horrida, Stein	" spinifera, Murr. & Whitt.	Phalacroma operculatum, Stein	" doryphorum, Stein	" dolichopterygium, Murr. & Whitt.	" Mitra, Schütt	" Hindmarshii, Murr. & Whitt.	" Blackmani, Murr. & Whitt.	Dinophysis rotundata, Clap. & Lachn.	" sphaerica, Stein	" acuta, Ehrenb.	" uracantha, Stein	" Homunculus, Stein	" Schuettii, Murr. & Whitt.	" bifurcata, Murr. & Whitt.	" globifera, Stein	" Thrinax, Schütt	" inflata, Murr. & Whitt.	Histioneis splendida, Murr. & Whitt.	" magnifica, Murr. & Whitt.	" remora, Stein	" brennis, Stein	" Highleyi, Murr. & Whitt.	" Mitchelliana, Murr. & Whitt.	" crateriformis, Stein	" Para, Murr. & Whitt.	" Dolon, Murr. & Whitt.	" Helena, Murr. & Whitt.	" Francesae, G. Murr.	" Milneri, Murr. & Whitt.	Citharistes Apsteinii, Schütt	Pyrocystis Noctiluca, J. Murr.	" Lunula, Schütt	" fusiformis, J. Murr.	" bicornis, Blackm.

EXPLANATION OF THE PLATES.

PLATE XXVII.

- Fig. 1. *Goniodoma fimbriatum*, Murr. & Whitt.: *a*, ventral view; *b*, dorsal view. $\times 840$.
 Fig. 2. *Goniodoma Milneri*, Murr. & Whitt.: *a*, side view; *b*, ventral view; *c*, encysted form opening; *d*, the same closed. $\times 420$.
 Fig. 3. *Goniodoma sphaericum*, Murr. & Whitt.: *a*, ventral view; *b*, view of proximal limb. $\times 860$.
 Fig. 4. *Ceratium biconicum*, Murr. & Whitt.: *a*, dorsal view; *b*, ventral view; *c*, side view. $\times 400$.
 Fig. 5. *Ptychodiscus Noctiluca*, Stein: *a*, view of proximal limb; *b*, dorsal view; *c*, var. *fimbriatus*, view of proximal limb. $\times 760$.
 Fig. 6. *Oxytoxum Milneri*, Murr. & Whitt. $\times 530$.
 Fig. 7. *Oxytoxum constrictum*, Schütt. $\times 860$.

PLATE XXVIII.

- Fig. 1. *Gonyaulax Jolliffei*, Murr. & Whitt.: *a*, dorsal view; *b*, ventral view. $\times 470$.
 Fig. 2. *Gonyaulax Highlei*, Murr. & Whitt.: *a*, ventral view; *b*, dorsal view. $\times 840$.
 Fig. 3. *Gonyaulax glyptorhynchus*, Murr. & Whitt.: *a*, dorsal view; *b*, ventral view; *c*, ventral view of form varying as to spine on proximal limb. $\times 840$.
 Fig. 4. *Gonyaulax Turbynei*, Murr. & Whitt.: *a*, ventral view; *b*, dorsal view. $\times 840$.
 Fig. 5. *Diplopsalis sæcularis*, Murr. & Whitt.: *a*, ventral view; *b*, distal limb; *c*, *d*, *e*, *f*, views of forms varying from the typical one represented in *a* and *b*. $\times 420$.

PLATE XXIX.

- Fig. 1. *Peridinium Hindmarchii*, Murr. & Whitt.: *a*, dorsal view; *b*, ventral view. $\times 500$.
 Fig. 2. *Peridinium leiorhynchum*, Murr. & Whitt.: *a*, ventral view; *b*, lateral view. $\times 600$.
 Fig. 3. *Peridinium Milneri*, Murr. & Whitt.: *a*, dorsal view; *b*, ventral view. $\times 840$.
 Fig. 4. *Peridinium divergens*, Ehrenb.: *a*, dorsal view; *b*, ventral view of variety. $\times 500$.
 Fig. 5. *Peridinium tirostre*, Murr. & Whitt.: ventral view. $\times 420$.
 Fig. 6. *Peridinium Blackmani*, Murr. & Whitt.: *a*, dorsal view; *b*, side view; *c*, ventral view. $\times 370$.
 Fig. 7. *Peridinium vexans*, Murr. & Whitt.: *a*, ventral view; *b*, dorsal view. $\times 840$.
 Fig. 8. *Peridinium spinulosum*, Murr. & Whitt. $\times 600$.

PLATE XXX.

- Fig. 1. *Peridinium sphaericum*, Murr. & Whitt.: *a*, dorsal view; *b*, ventral view. $\times 860$.
 Fig. 2. ? *Peridinium Globulus*, Stein. $\times 860$.
 Fig. 3. *Peridinium Doma*, Murr. & Whitt.: ventral view. $\times 800$.
 Fig. 4. *Peridinium Tripos*, Murr. & Whitt.: *a*, dorsal view; *b*, ventral view. $\times 840$.
 Fig. 5. *Ceratocorys horrida*, Stein: *a*, side view; *b*, encysted. $\times 420$.
 Fig. 6. *Ceratocorys spinifera*, Murr. & Whitt.: *a*, ventral view; *b*, dorsal view (both $\times 840$); *c*, proximal limb, young state ($\times 620$); *d*, proximal limb, mature state ($\times 410$); *e*, form with two spines only ($\times 840$).

PLATE XXXI.

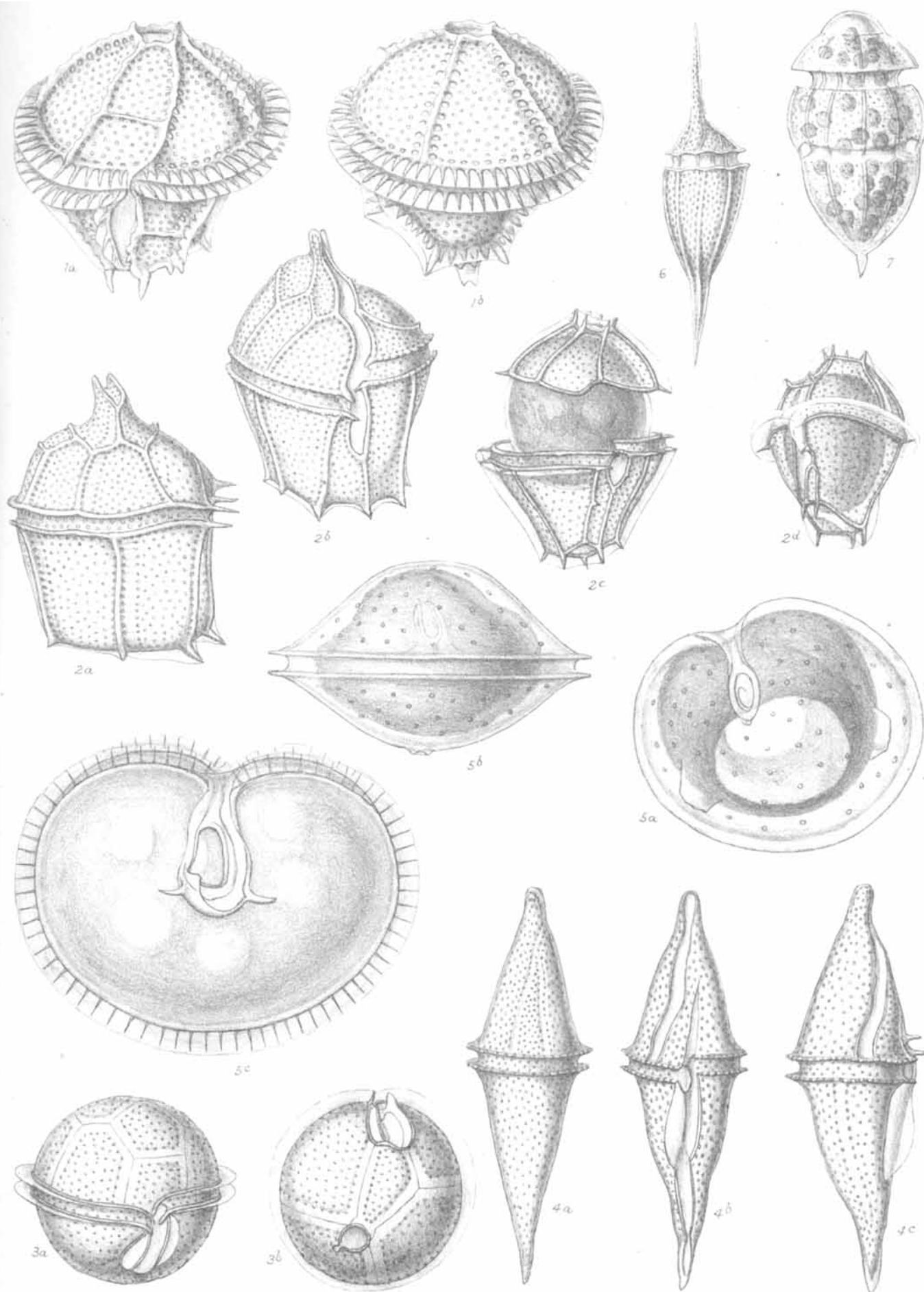
- Fig. 1. *Amphisolenia bifurcata*, Murr. & Whitt.: *a*, complete ($\times 160$); *b*, ventral view; *c*, side view; *d*, *e*, terminations of proximal limb ($\times 610$).
- Fig. 2. *Amphisolenia inflata*, Murr. & Whitt.: *a*, lateral view; *b*, ventral view. $\times 420$.
- Fig. 3. *Citharistes Apsteinii*, Schütt: *a*, side view; *b*, ventral view. $\times 840$.
- Fig. 4. *Phalacroma Blackmani*, Murr. & Whitt.: *a*, view of distal limb; *b*, side view. $\times 420$.
- Fig. 5. *Phalacroma Hindmarchii*, Murr. & Whitt.: side view. $\times 500$.
- Fig. 6. *Phalacroma Rudgei*, Murr. & Whitt.: *a*, side view; *b*, ventral view. $\times 420$.
- Fig. 7. *Phalacroma Mitra*, Schütt: side view. $\times 420$.
- Fig. 8. *Phalacroma dolichopterygium*, Murr. & Whitt.: *a*, side view; *b*, ventral view. $\times 410$.
- Fig. 9. *Dinophysis Rudgei*, Murr. & Whitt.: *a*, side view; *b*, optical section. $\times 500$.
- Fig. 10. *Dinophysis Schuettii*, Murr. & Whitt. $\times 840$.

PLATE XXXII.

- Fig. 1. *Histioneis splendida*, Murr. & Whitt.: *a*, side view; *b*, ventral view; *c*, view of distal limb, &c. $\times 310$.
- Fig. 2. *Histioneis magnifica*, Murr. & Whitt.: side view. $\times 500$.
- Fig. 3. *Histioneis Francescæ*, G. Murr.: side view. $\times 680$.
- Fig. 4. *Histioneis Para*, Murr. & Whitt.: *a*, side view; *b*, ventral view; *c*, side view of form with sail varying from type. $\times 680$.
- Fig. 5. *Histioneis Highlei*, Murr. & Whitt. $\times 620$.
- Fig. 6. *Histioneis biremis*, Stein: side view. $\times 420$.

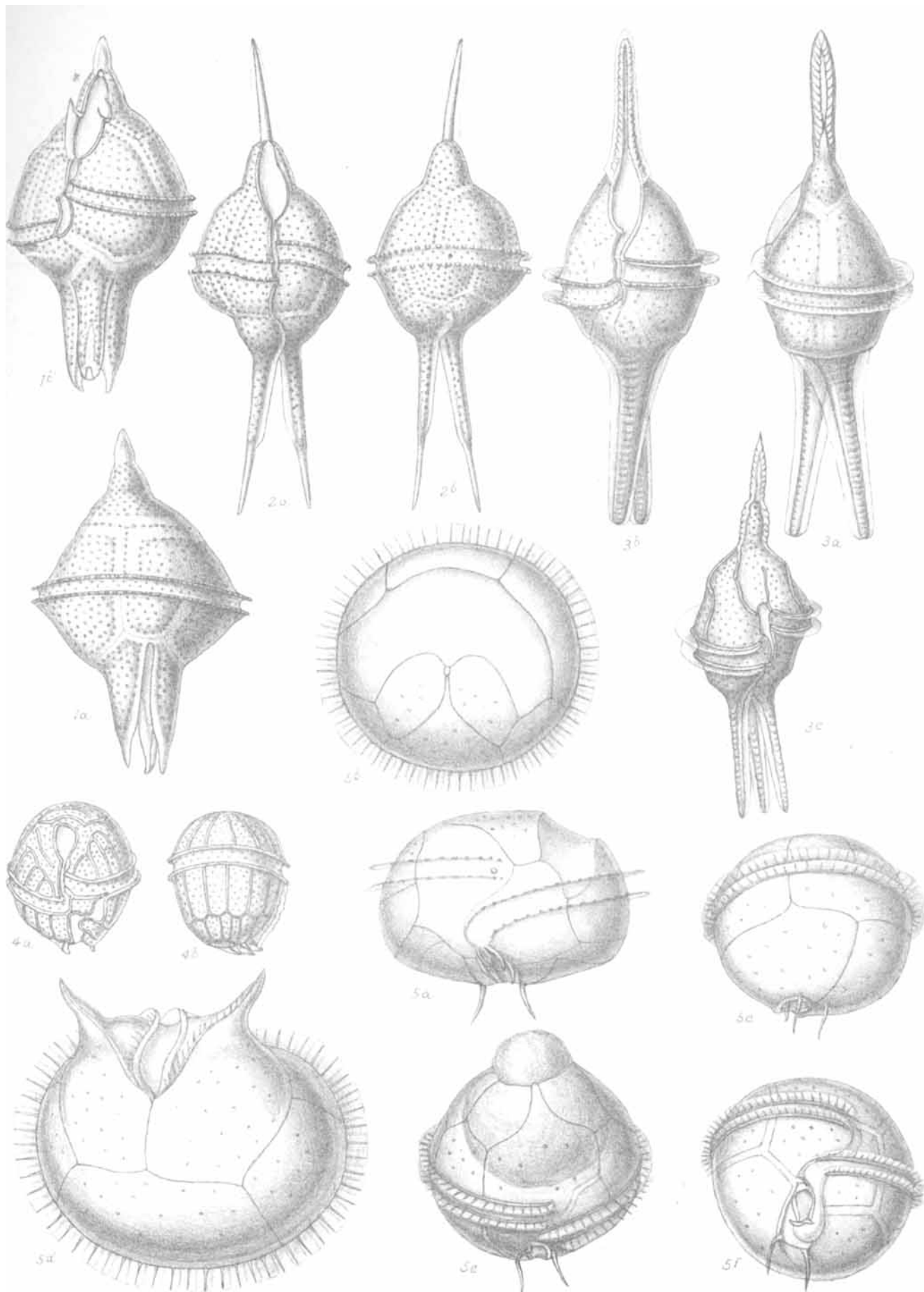
PLATE XXXIII.

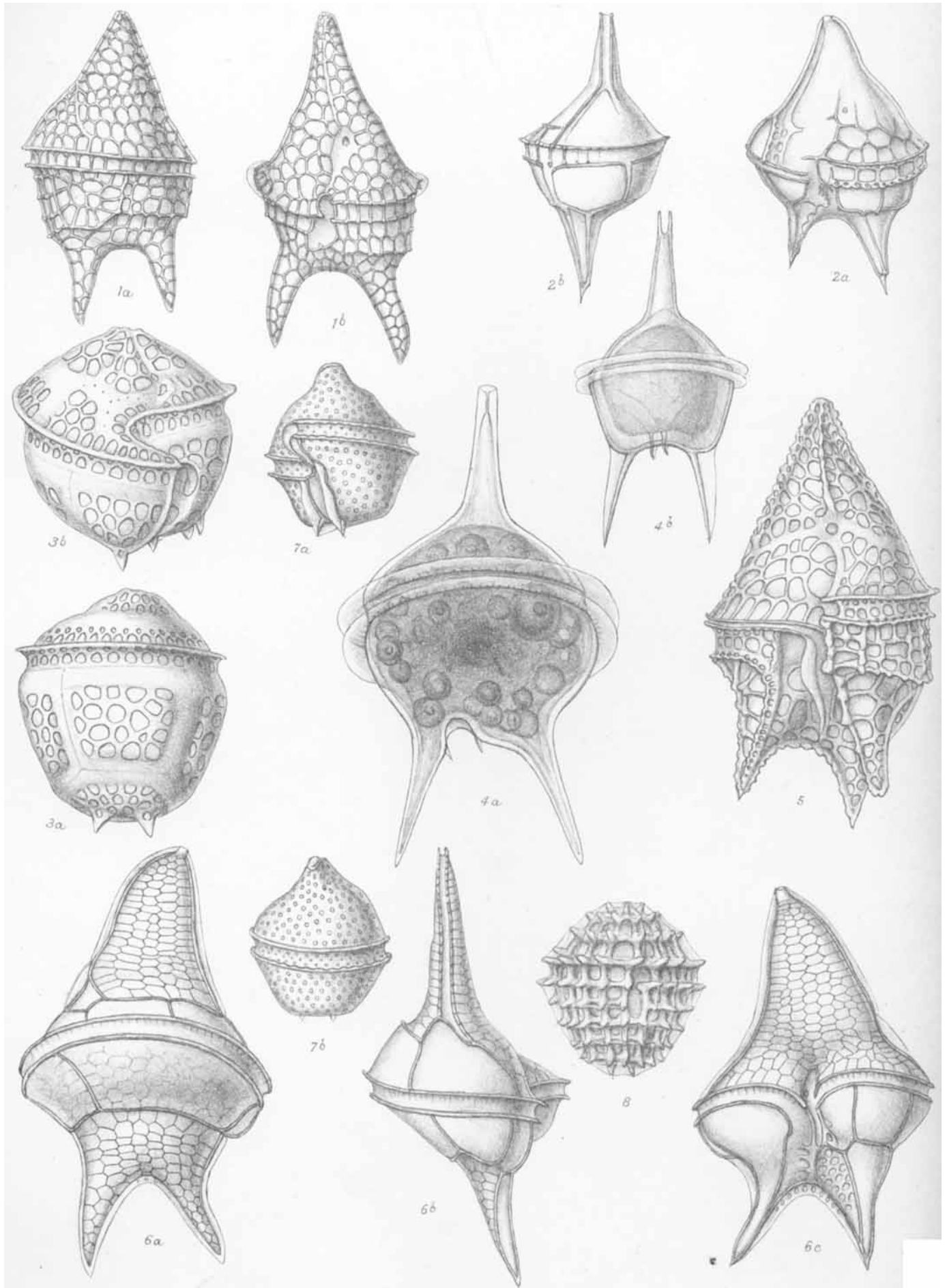
- Fig. 1. *Histioneis Milneri*, Murr. & Whitt.: *a*, side view; *b*, ventral view. $\times 420$.
- Fig. 2. *Histioneis Helenæ*, Murr. & Whitt.: *a*, side view; *b*, ventral view. $\times 420$.
- Fig. 3. *Histioneis Mitchellana*, Murr. & Whitt.: *a*, side view; *b*, ventral view. $\times 600$.
- Fig. 4. *Histioneis dentata*, Murr. & Whitt. *a*, side view; *b*, ventral view. $\times 840$.
- Fig. 5. *Histioneis Dolon*, Murr. & Whitt.: *a*, side view; *b*, ventral view. $\times 600$.

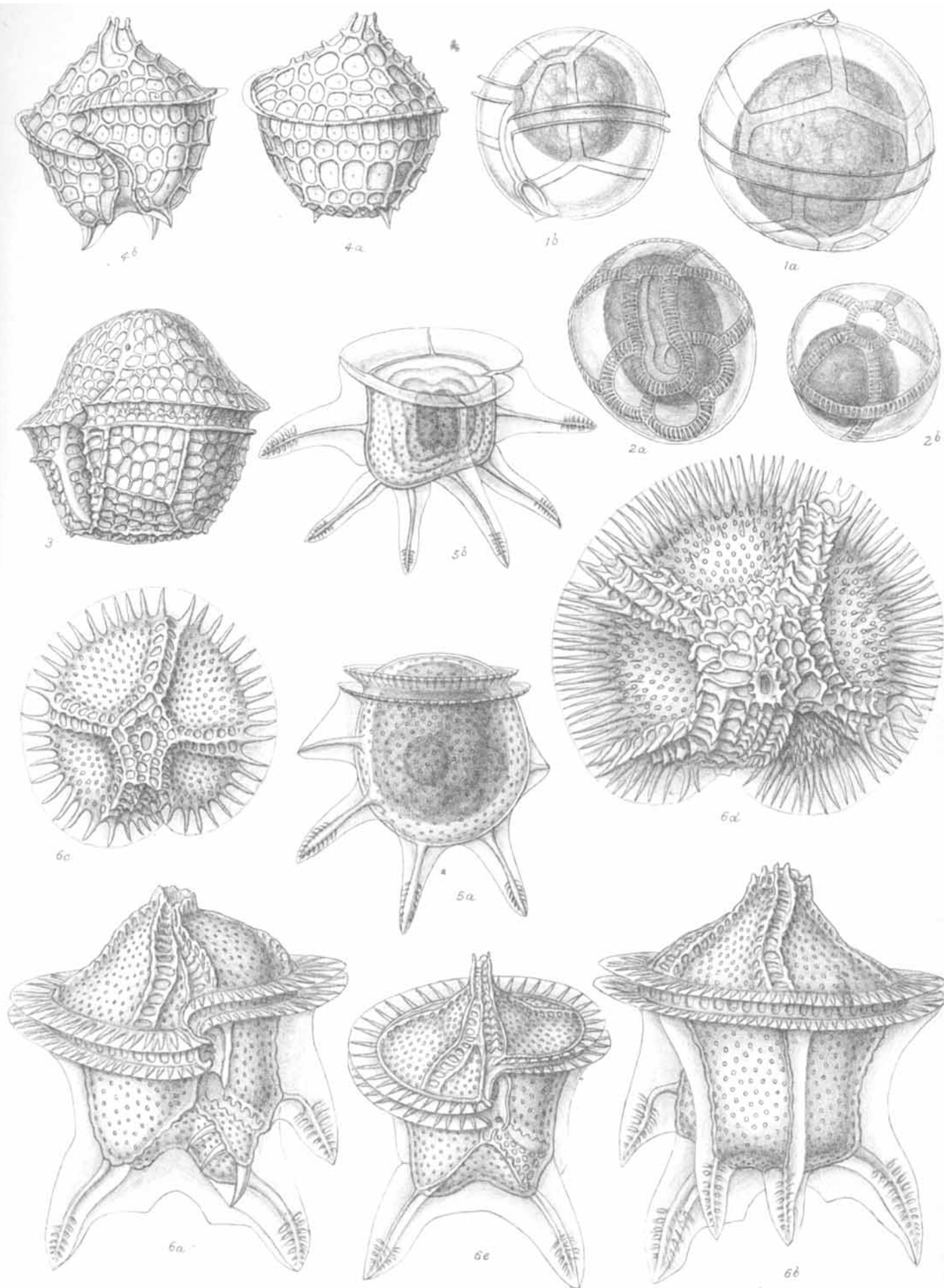


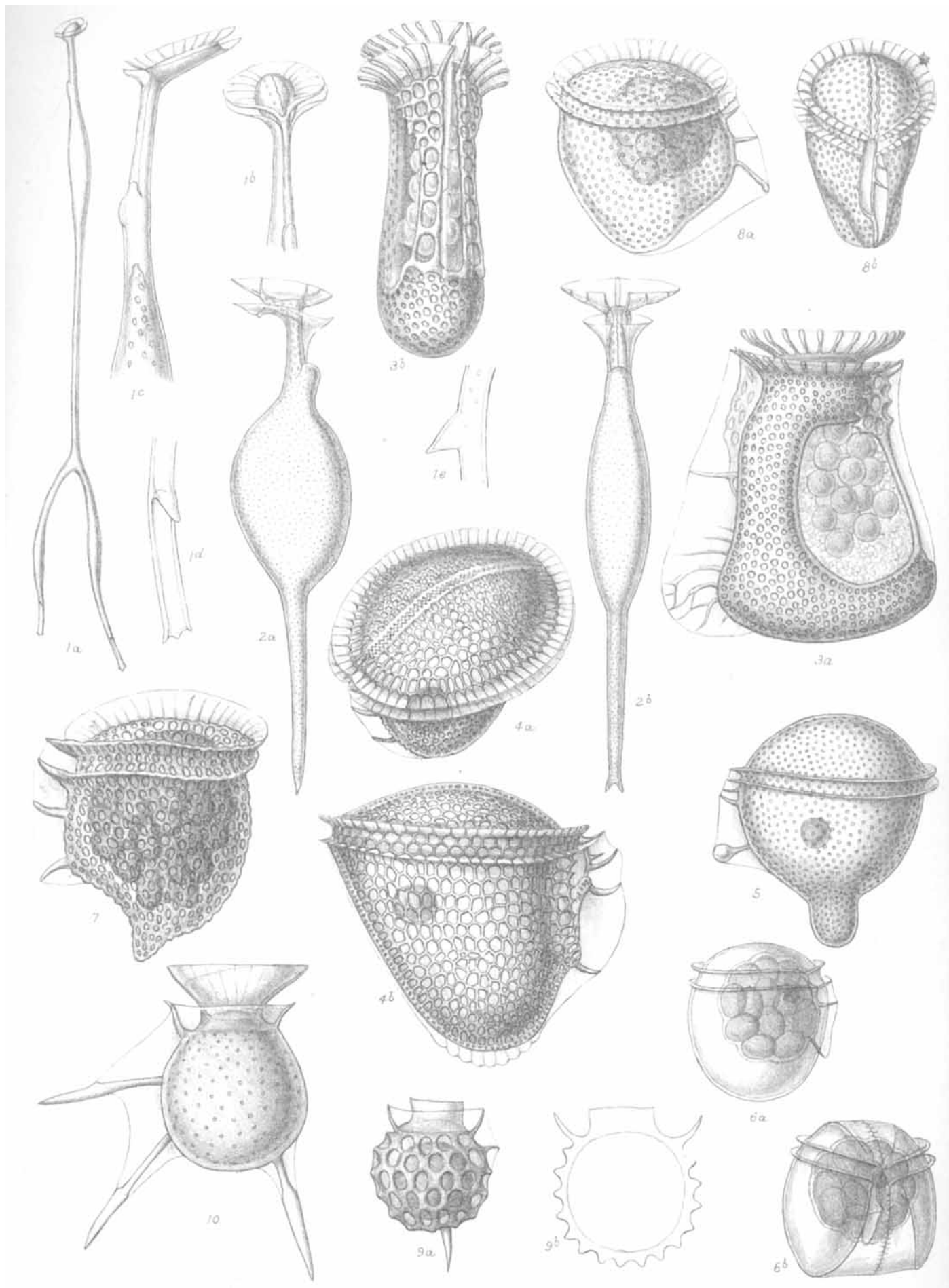
P. Highley del. et lith.

Hanhart imp.





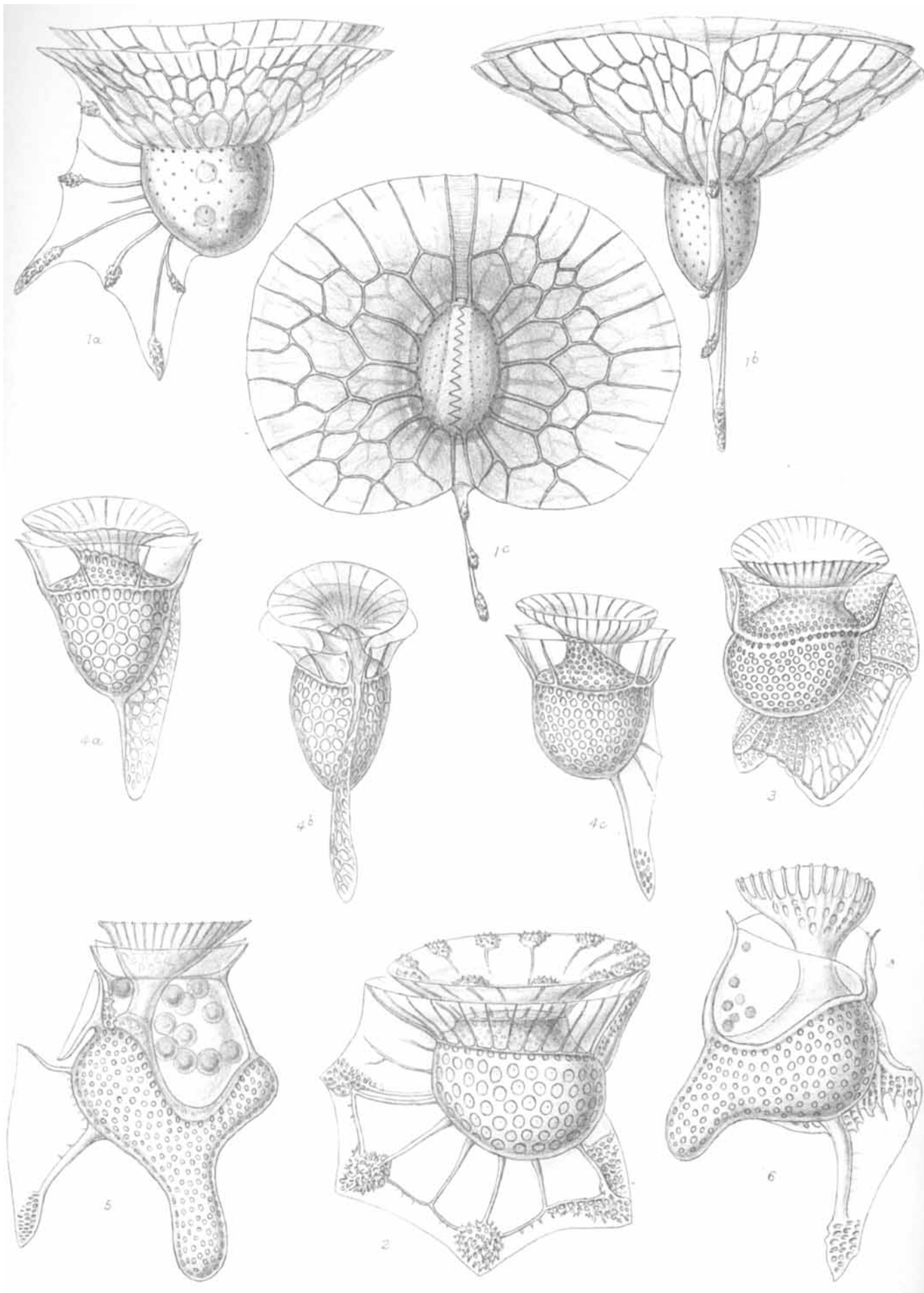




P. Highley del. et lith.

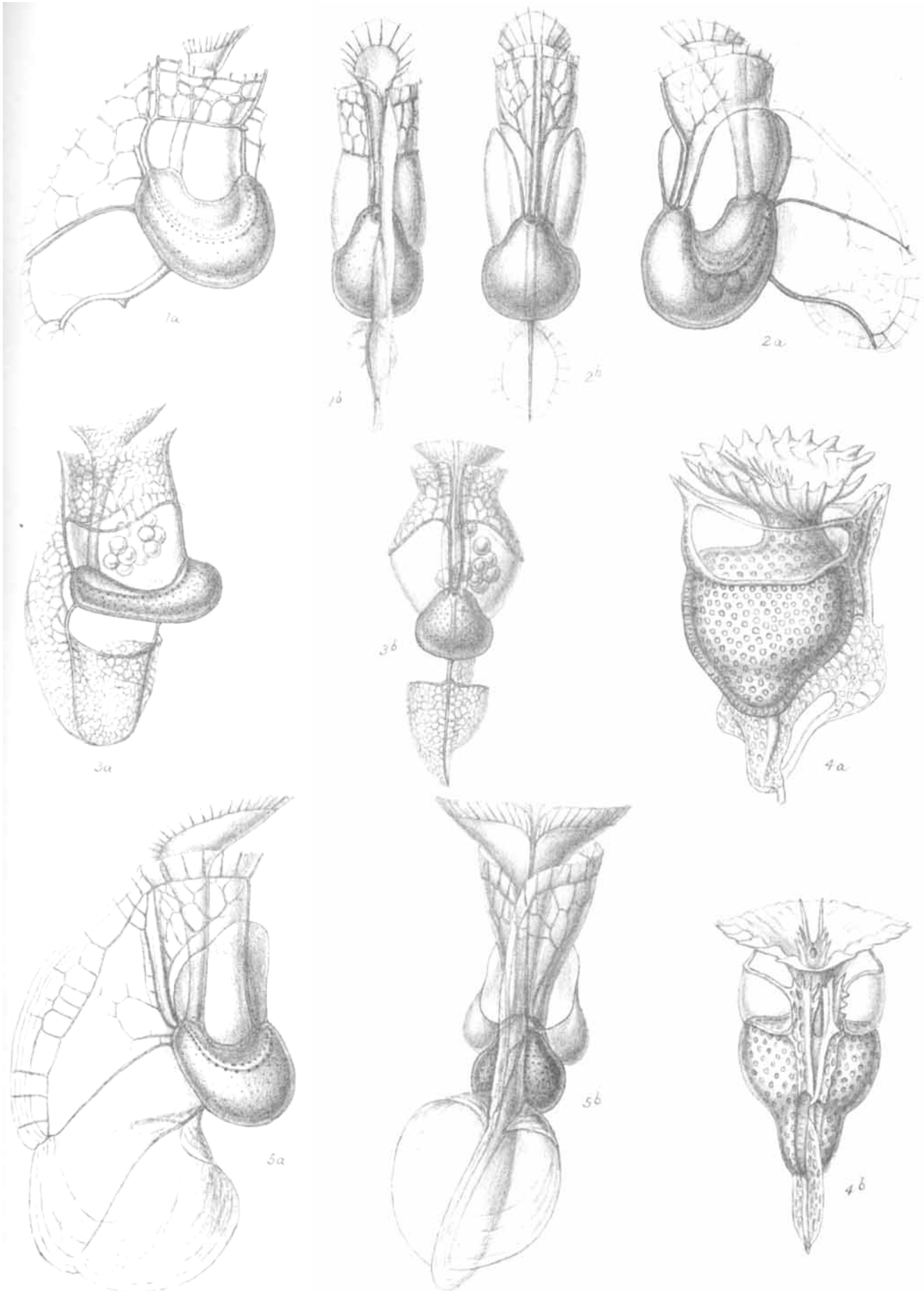
Hannart imp.

NEW PERIDINIACEÆ



P. Highley del et lith.

Hanhart imp.



P. Highley del. et lith.

Hanhart imp.

NEW PERIDINIACEÆ