SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 122, NUMBER 14
(End of Volume)

Mary Vaux Walcott Fund for Publications in Botany

A NEW GENUS AND SPECIES OF PLANKTON DIATOM FROM THE FLORIDA STRAITS

(With Four Plates)

BY

PAUL S. CONGER

Associate Curator, Division of Cryptogams
Department of Botany, U. S. National Museum

(Publication 4171)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
JULY 15, 1954

SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 122, NUMBER 14
(End of Volume)

Mary Vaux Walcott Fund for Publications in Botany

A NEW GENUS AND SPECIES OF PLANKTON DIATOM FROM THE FLORIDA STRAITS

(With Four Plates)

BY

PAUL S. CONGER

Associate Curator, Division of Cryptogams
Department of Botany, U. S. National Museum

(Publication 4171)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
JULY 15, 1954

The Lord Baltimore Press
BALTIMORE, MD., U. S. A.

Mary Vaux Walcott Fund for
Publications in Botany

A NEW GENUS AND SPECIES OF PLANKTON DIATOM FROM THE FLORIDA STRAITS

By PAUL S. CONGER[1]

Associate Curator, Division of Cryptogams
Department of Botany
U. S. National Museum

(With Four Plates)

The diatom here described was first found in plankton gatherings in the summers of 1938 and 1939, while I was working at the Carnegie Institution of Washington Marine Laboratory, Dry Tortugas, Fla., but its study was not completed at that time. It was taken in a No. 20 silk bolting-cloth tow net in waters adjacent to the laboratory, in sea water of 60° to 70° F. temperature and approximately 35‰ salinity. The water was so clear that the very presence of plankton would be doubted, and only after a haul of 20 minutes or more could an appreciable quantity be secured.

To the best of my knowledge this form represents both a distinctive new species and a new genus, which may be monotypic.

THALASSIOPHYSA RHIPIDIS Conger, gen. et sp. nov.

Frustula magna, delicatissima, in aspectu zonali hemisphaerica, dimidio mali aurantii longitudinaliter secti similis sed sectores multo tenuiores et numerosiores; valvae tenues, reniformes, in plana vel fere in plana insidentes, marginibus ventralibus vicinis, globulos uniseriatos prope marginem dorselem ubique ferentes, eos fere deficientes in margine ventrali; volumen frustulae in regione zonali fere inclusum; ora angusta vel tenuis.

Mature, fully grown frustules rounded-basket or cradle-shaped, re-

[1] I am indebted to the Carnegie Institution of Washington for sojourn at their marine laboratory at Dry Tortugas, Fla., in the last two summers of its operation, and for opportunity and facilities for collection and study of the diatom herein described.

sembling in general the structure of half an orange cut end to end, a double elbow section of stovepipe, an armadillo or chiton shell, a tropical sun helmet, or an accordion flexed so that the ends held by one's hands lie in the same plane, or but slightly hinged planes; the less fully grown individuals, resembling sectors, less than half, but always more than a quarter, of an orange cut end to end, the intercalary bands of the diatom simulating the sections of the fruit, these intercalary bands being, however, much narrower (thinner) in proportion and more numerous. Girdle-band or connective zone constituting almost the total volume of the diatom, comprised of many intercalary bands, these bands thin, wedge-shaped in pervalvar axis, auriculate-shaped in apical-transapical plane. Shells thin, exceptionally delicate, auriculate-shaped in valvar plane, with almost no rim (mantle), bearing a single row of very small, round beads around the edge, close to the border, except for a clear central space about one-third to one-half the length of the ventral edge, the dorsal edge with a deeply notched line (simulating the notched "channel-raphe" of *Epithemia* in appearance, but not a groove). Apical axis of the shell about one-half again as long as the transapical axis. Shell surface virtually hyaline and structureless, though probably ultrafinely punctate-striate with radiate design. Over-all structure of the frustule dorsiventral, the convex side being the dorsal aspect, the flatter (or valve) side the ventral; in the shells (valves) the notched edge dorsal, the smooth, pore- or bead-free edge, ventral. Pervalvar axis very extended, an arc of a circle as viewed from the narrow-girdle-band side of the frustule, the arc attaining a half circle in fully grown individuals, only very rarely slightly more; extension of the pervalvar axis achieved by interpolation of more intercalary bands, and at the same time revolution of the valves about the line of their adjacent ventral edges until they come to lie in a plane or close approximation thereof, in a position presenting a right-left-hand symmetry, daughter cells and younger stages comprising somewhat smaller angular sectors of a half circle or half sphere, but usually greater than a third of a circle. Frustule with a narrow, half-round-bottomed groove, between the approximated ventral edges of the shells and at right angles to the pervalvar axis, formed by adjunction of narrow edges of the intercalary bands, this groove shallowing and broadening into a slightly wider zone of narrow, closely set intercalary bands (newly forming ones) as it rounds up the sides and over the dorsal area.

Chromatophore single, thin, flat, pale pea green in color, broadly rounded rectangular to broad-elliptical, about two-thirds the total

length of the frustule in the pervalvar-apical plane, suspended by plasma threads from various points of the inner frustular surface, in the central area of the cell, in a plane parallel to, or coincident with, a plane segment to a central sector of the arched pervalvar-apical plane, and cutting the transapical axis perpendicular to it and somewhat below its center.

Nucleus approximately round to elliptical, flat, hyaline, lying adjacent to and dorsally, in the center of the chromatophore, about one-third to one-half the diameter of the chromatophore in size; not visible except in cell division.

Symmetry.—Cell in pervalvar axis, dorsiventrally asymmetrical, laterally symmetrical. Apical axis isopolar, transapical axis heteropolar. Shells symmetrical with respect to the transapical axis, asymmetrical in respect to the apical axis. Plane of cell division between the ventral edges of the shells and cutting the pervalvar axis perpendicular to its center in the plane of the other two axes.

Resting spores not known.

Cell measurements.—Pervalvar length of frustule 200-300 microns; apical axis of shell (long diameter) 130-190 microns; transapical axis of shell (short diameter) 80-100 microns. The greatest variation in shape seen in proportional lengths of apical to transapical axes.

Remarks.—The hemispherical configuration of this diatom represents an extreme extension of the narrower, wedge-shaped (cuneate) symmetry found in many groups of diatoms (e.g., *Licmophora, Gomphonema, Cymbella, Hemidiscus*).

The central, narrow region of extremely thin, closely set intercalary bands across the dorsal surface of the frustule in apical-transapical plane is evidently the growing zone in which new intercalary bands are formed, although by what morphological beginnings such growth is initiated cannot be seen.

The broad-girdle-band view of this diatom is the one that is described as basket-shaped, the narrow-girdle-band view (end view, looking in direction of the apical axis) is fan-shaped.

The frustules of this form are so exceptionally delicately silicified that they are not susceptible to any customary laboratory treatment, but instead collapse under all efforts for permanent mounting, including drying, liquid penetration, and transfer; but they may be readily handled for study while fresh in sea water. The frustules are also so delicate as to be readily soluble and consequently must be handled with great care in liquid preservation. This means not changing the osmotic tension too rapidly, or adding any reagent that might have a tendency to dissolve or separate the delicate intercalary bands.

Type locality.—East shore of Loggerhead Key, Dry Tortugas, Fla.

Occurrence (*distribution*).—This form is ever present (throughout the summer) in rather plentiful numbers in the plankton of this area and is one of the more common components of the phytoplankton population. I have no information of its occurrence through other months of the year, having visited the area only during the summer. Also, I have no material from other places and hence no knowledge of the possible extent of its distribution. One might think it would be found widely in the limy waters of the lower Florida, Gulf, and Caribbean area, a matter which it would be desirable to ascertain. It can be gotten in fair numbers in a short plankton haul at any time during the summer in the above locality, though at all times the water is so clear as to appear practically free of plankton; the very gossamerlike shells of most of the plankton forms are due to the poverty of silica in these waters. It appeared to me, on the basis of collections within a radius of 10 miles, to be more a habitant of the shallower (6 to 15 feet), protected, coral-strand waters (certainly at least more prevalent in these), than of the rough waters and active open-water areas. The east shore of Loggerhead Key running off very gradually for half a mile or more over shallow coral sand and coral-head bottoms, and protected also by the shape and position of the island from the more vigorous sweep of tides, current, and wave action, appeared to represent the ideal habitat for this form. Whether or not it is a habitant of rougher waters and wider areas needs further verification.

Relationships.—This diatom is of uncertain relationships. After considerable study and comparison, it does not fit satisfactorily in any of several genera superficially similar, and it seems best, or necessary, that it be put into a genus by itself. It is well, however, to call attention here to its several close simulations, in case other observers may note affiliations which I have overlooked.

It was first thought, because of its shape and general structure, to be an *Amphora,* but the rounded appearance of the valve and particularly the absence of any observable raphe discouraged this connection.

In girdle view the complete frustule looks very like *Hemidiscus Hardmanianus* (Grev.) Mann (Report on the diatoms of the *Albatross* voyages, etc., Contr. U. S. Nat. Herb., vol. 10, pt. 5, p. 316, 1907), as pictured in Schmidt's Atlas der Diatomaceenkunde, pl. 439, fig. 2, 1940, and in Ann. Mag. Nat. Hist., ser. 3, vol. 16, p. 2, pl. 5, figs. 1-4, 1865 (under the name *Palmeria Hardmaniana* Grev.). The valve is not greatly unlike this species in shape; it has the general shape of members of the genus. However, the valve of *Thalassiophysa*

rhipidis is much more rounded at the ends, and it does not show the radiate structure characteristic of members of the genus *Hemidiscus.* The mantle is likewise different in that it is not wider on the dorsal than on the ventral edge, in contrast to *Hemidiscus,* in which it is wider on the dorsal than the ventral edge, thus giving a wedge shape to the girdle aspect of the valve. Unlike the very slightly wedge-shaped intercalary sections of my form, the additive result of which is the hemispherical frustule described, the valve itself is perfectly flat with almost no mantle, which is, as far as can be seen, of even width all around. *Hemidiscus* derives much of the hemispherical shape of its frustule from the considerable width of the wedge-shaped mantle on the dorsal side of its shell. Members of *Hemidiscus* do not exhibit the close beading around the dorsal edge of the valve as in my form. Although these points have been noted and compared there is really no serious question of my form belonging to this genus.

The valve shape and markings of my species more closely resemble *Auricula,* and it is possible it should be placed there, but if so it is certainly widely different in general appearance from the well-known species of that genus. Most nearly suggestive of the valve shape of my form is *Auricula complexa* Greg. as shown in Peragallo's Diatomées Marines de France, pl. 42, figs. 14, 15.

This new form would doubtless have been observed earlier were it not for its gossamerlike frailty and tendency to collapse or be destroyed in preservation, and the need, therefore, to examine it promptly in freshly collected material. Because of this extreme frailty, and the inability in consequence to mount or preserve it well, there is no type specimen or type material. It must be collected and seen in fresh material.

Morphology and development.—The vegetative reproductive or morphological changes of this diatom are very interesting. They are deliberate, orderly, and precise and are very delicate in visible aspect.

The nucleus, or nuclear area, is not visible in ordinary examination of the mature cell because it is so hyaline and because it is obscured by the broad chromatophore in close proximity to which it lies. Judged from the morphological changes, and from its general position in other diatoms, it is undoubtedly in the center of the cell, supported by the very delicate and almost transparent plasma threads that radiate from this area and attach to all parts of the inner periphery of the frustule.

It is possible that the nucleus or nuclear area might be made visible by staining. Unfortunately I did not attempt this, when I was in

position to obtain living material, as I have since wished I had. The extreme delicacy of the diatom and ease of its collapse suggest that very careful vital staining would be required, and that only staining of very freshly collected living material would be feasible.

The nuclear area, even in its hyaline state, probably largely occupied by the nucleus itself, looking at the cell in the direction of the apical axis, can be seen in a certain stage of the cell development or vegetative reproductive process, namely, at that time when the nucleus and chromatophore have divided and the new daughter chromatophores lie in an angular position, each in its separate part of the dividing cell. At this time the nucleus forms a small, weblike mass across the angle of the chromatophore and is distinguished from the latter by its hyaline character as contrasted with the green of the chromatophore.

Vegetative division, just casually mentioned above, probably takes place, as in many diatoms, mainly at night, most of the cells found during the day being in a more mature state. Vegetative division occurs almost entirely only in cells that are well matured, or of a full hemispherical shape. The first evidence of division is a readily seen slight constriction in the middle of both sides of the broad, pale-green chromatophore. The final resulting halves of the original chromatophore, assume each a right-angular shape with the adjacent faces lying in an apical-transapical plane and extending upward toward the dorsal surface of the cell, the inner side of the angle thus being upward with the nuclear area subtending its vertex. The nucleus and nuclear mass must evidently have divided previously to, or simultaneously with, the division of the chromatophore, to occupy this position as a faint hyaline web across the angle of the newly formed chromatophore. Both subsequently and slowly flatten out as the newly formed daughter cells grow and expand to maturity, attaining again the hemispherical shape. Tension and stretching of the plasma threads play a major role, or appear to be the chief mechanism involved, in bringing these changes about. The daughter cells finally separate as a result of expanding internal pressure which forces them apart. The presence of such internal pressure as a functional agent in the dividing cell process is occasionally evidenced by a snapping apart of the newly formed cells, if one is so fortunate as to be observing them just at the critical moment or brings to bear a micro-needle upon such a cell in a state of being just about to divide, when a slight touch will cause it to spring apart.

Deposition of the new valves back to back in a central apical-transapical plane, cutting perpendicularly the pervalvar axis, is seen to be

occurring as the divided chromatophores assume their angular positions within the new daughter halves. Formation of the new valves becomes more and more evident as a line of increasing density in this central section of the cell, and if the cell be turned at a slight angle, there becomes evident in perspective two new sets of short plasma threads connecting the edges of the new chromatophores to the edges of the newly forming valves, as shown in the accompanying illustration (pl. 4, figs. 3, 4, 7, and 8).

Very close to the newly forming valves in this central region, and almost imperceptible, is a condensed, seemingly striate section of very narrow width, like a considerable number of compressed pleats or folds of a camera bellows or accordion, which are evidently potential or elementary intercalary bands of the prospective new cells. There is, of course, a set of these on either side of the new valves in the central region, one set, that is, in each of the new daughter cells.

This process is carried out with such great precision of cellular mechanics, and this is such a beautiful and advantageous form in which to view this sequence, that it is regrettable that the species is not a somewhat more robust or at least a more available one. It would seem a good one in which to study at least some phases of diatom cell division, to the above cursory discussion of which much remains yet to be added.

Derivation of name.—I have chosen for the generic name of this beautiful diatom a combination of the Greek word "thalassios," meaning "of the sea," since it is so characteristically a marine plankton form, and the Greek word "physa," meaning "bellows," from the great resemblance of its finely folded or pleated appearance to that of an accordion, fireplace bellows, or camera bellows. Especially in certain perspective views from both the apical end and side of the not fully matured cell does one get a typical folded and wedge-shaped effect of a fireplace bellows, as in plate 2, upper left figure.

As a species name for this form I have taken the Greek word "rhipis," meaning "fan," from its fine resemblance to a lady's folded fan, in apical end view as shown in the first (upper) four figures of plate 1. This is a very frequently observed and characteristic view.

Thus the name *Thalassiophysa rhipidis* seems best to indicate the particular features of this diatom.

Importance.—This diatom, in spite of its great delicacy and watery-like consistency, is sufficiently frequent to be an important constituent of the plankton population, and, in an area where the water is very clear and the plankton is in general tenuous and phantomlike,

it is a probably not insignificant factor in the biochemistry and economy of the sea.

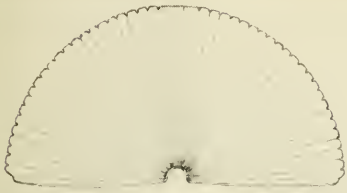
It has no really close forms in structure and appearance, and it possesses a simple beauty which in my opinion would cause it to rate high in this respect among the diatoms.

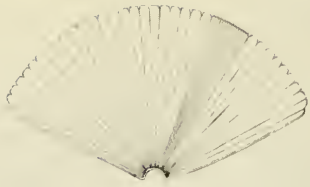
PLATES

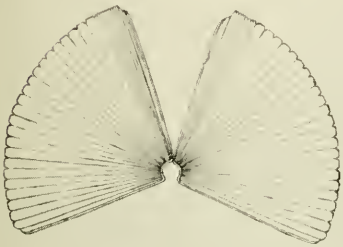
Plate 1

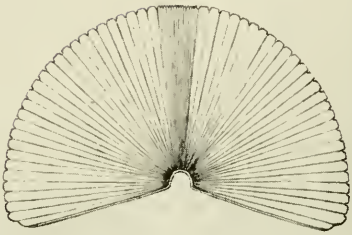
Thalassiophysa rhipidis

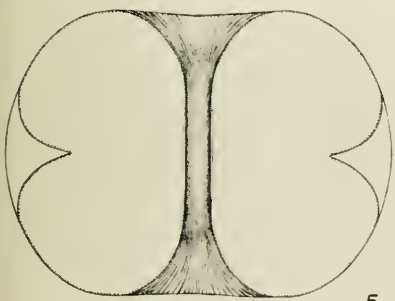
Figs. 1-4, Cell in apical aspect, various views. Fig. 5, Ventral view of mature cell (pervalvar view), showing the two halves with their ventral edges approximate and forming the ventral groove. Fig. 6, Dorsal (pervalvar) aspect of mature cell. Fig. 7, Single valve (in apical-transapical view). Fig. 8, Single valve, with a few intercalary bands showing across the notch. Magnification: All figures approximately 240 diameters.

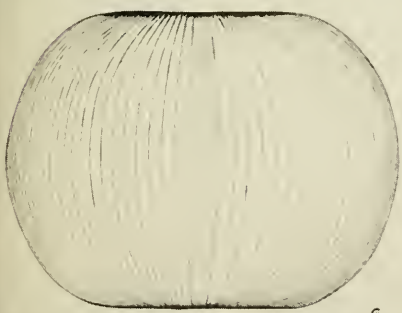

1

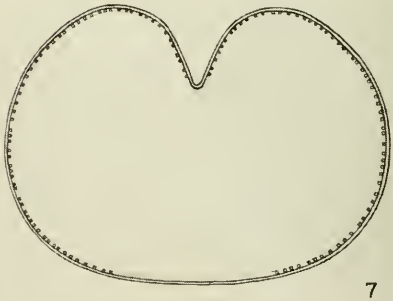

2

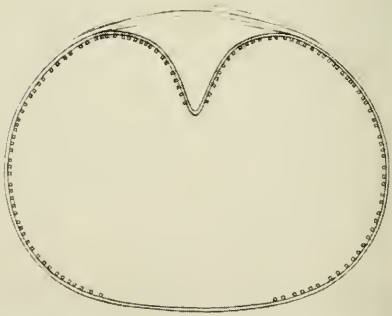

4


3

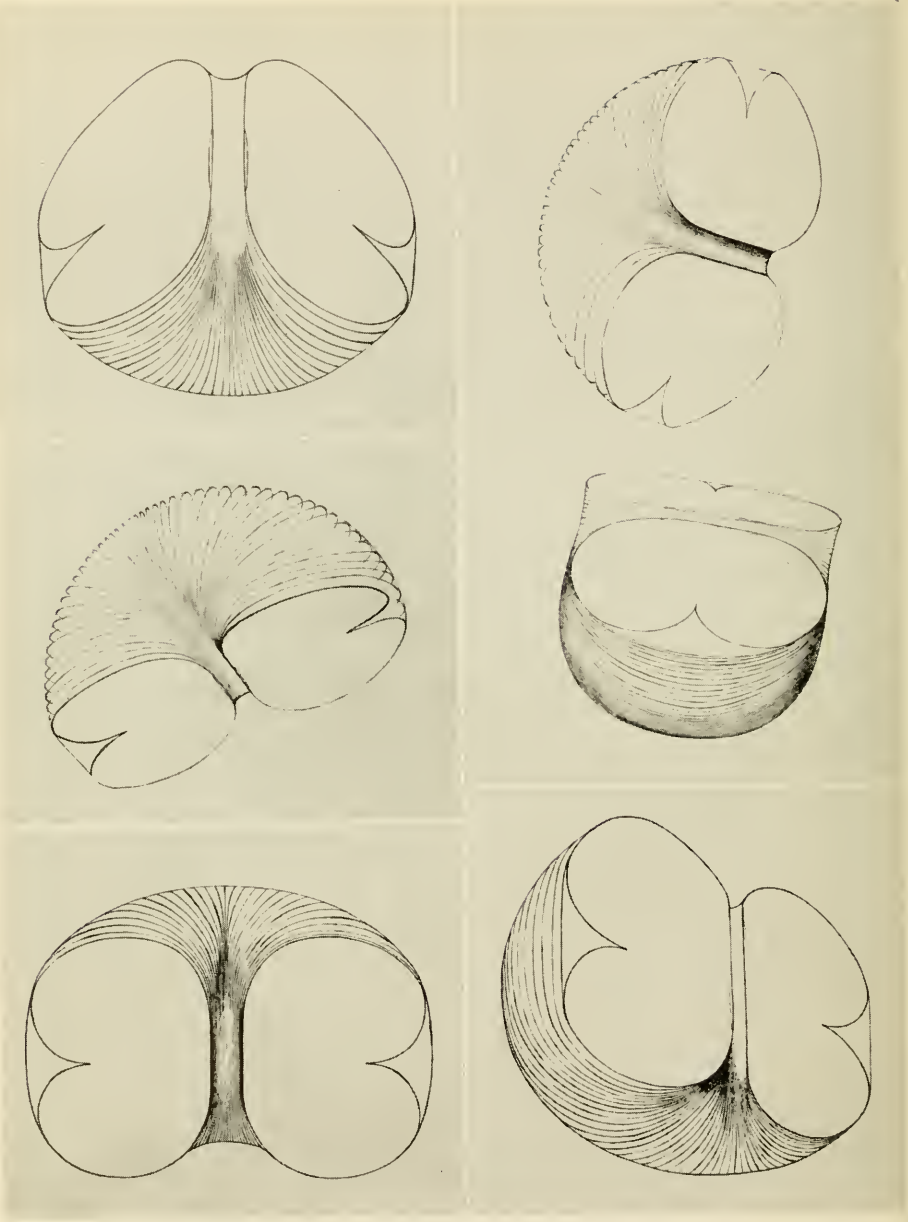

5


6


7

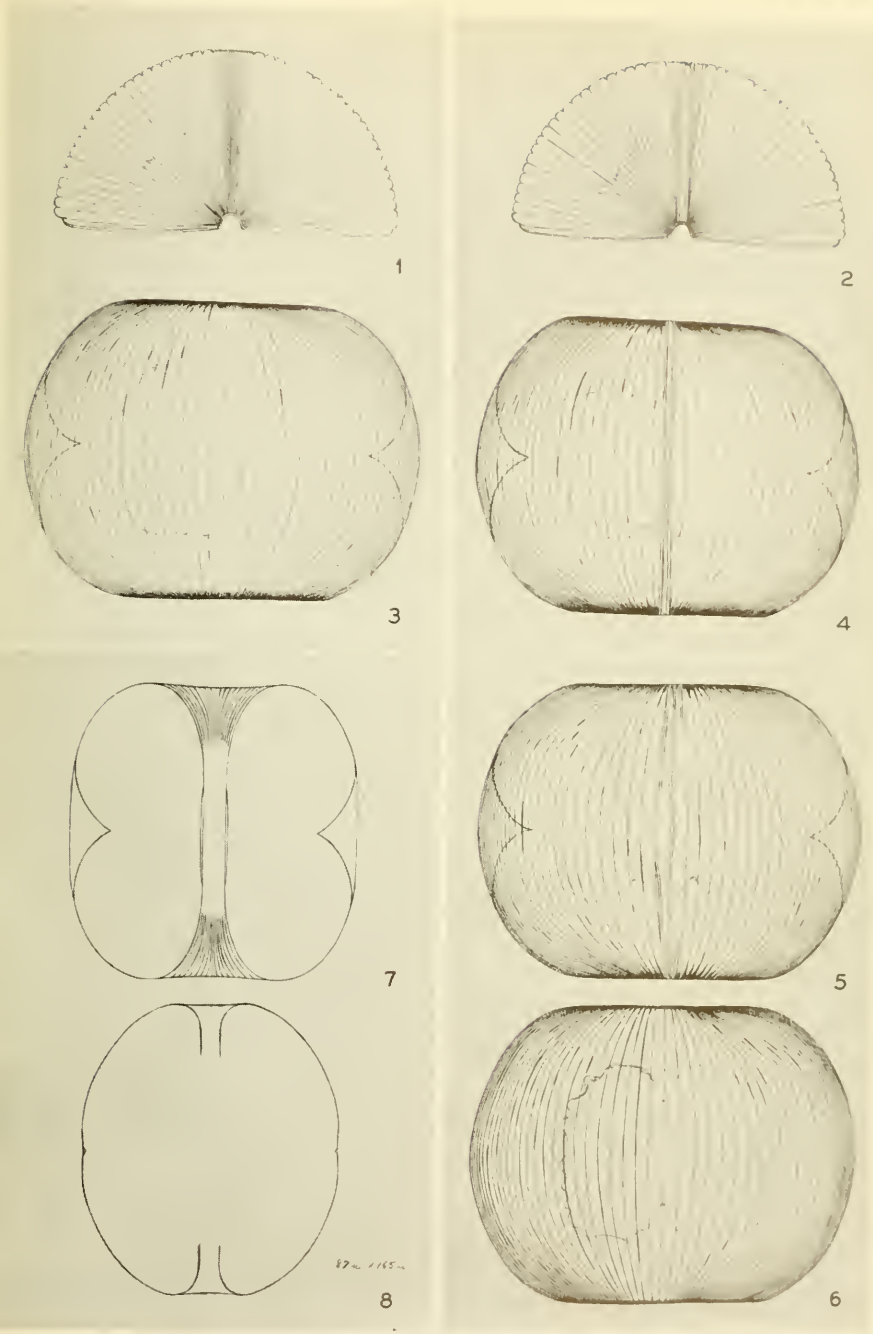

8

(See legend on opposite page.)



THALASSIOPHYSA RHIPIDIS

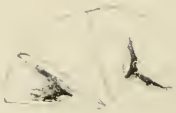
Various typical views of well-matured cells. Magnification: All figures approximately 240 diameters.



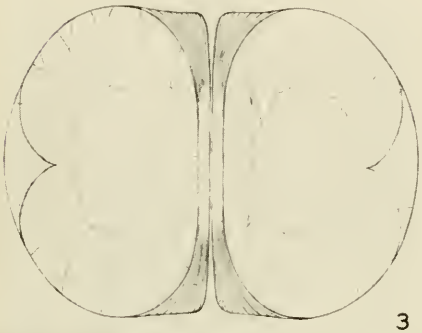
THALASSIOPHYSA RHIPIDIS

Figs. 1-6, Various exterior views of the dividing cell, with chromatophore body dimly outlined within. Figs. 7-8, Ventral aspects of a narrower frustule of the same species. Magnification: All figures approximately 240 diameters.

1

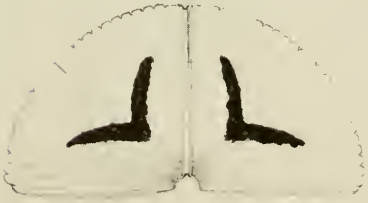


2



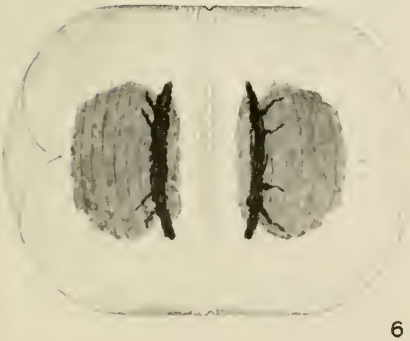
3

4

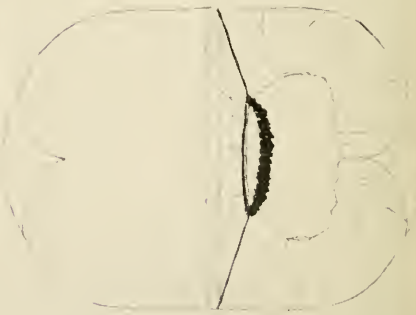


5

7



6



8

(See legend on opposite page.)

Plate 4

Thalassiophysa rhipidis

Fig. 1, A dividing cell in apical aspect. Fig. 2, A cell in process of division with one side collapsed. Fig. 3, Ventral view of a cell in late stage of division; chromatophore outlined with plasmic thread attachments. Fig. 4, Ventral perspective view, showing chromatophore in color, beginning central membrane of newly forming valves, and plasmic thread attachments. Figs. 5 and 6, Apical and pervalvar aspects of mature dividing cells respectively showing chromatophore bodies colored. Figs. 7 and 8, Outline sketches of the same cells as figures 5 and 6 showing, respectively, chromatophore arrangements, nucleus, and plasmic thread attachments. Magnification: All figures approximately 240 diameters.