

jungen Exemplar (112 mm Schalenlänge) von San Mateo del Mar und jenem von Colima ist die Grundfarbe der Rückenschale dunkelbraun, und in den etwas helleren Areolen liegen die gelben Augenflecken, während die gelben Ringe ganz fehlen oder sehr undeutlich sind. Plastron gelb und mitten braun, ohne scharfe Abgrenzung der beiden Farben. Dagegen ist beim Exemplar von Colima das ganze Plastron schwarzbraun und bloß von einem schmalen gelben Saum umgeben. Zeichnung auf dem Kopf sehr variabel, wie schon von Günther l. c. aufmerksam gemacht wurde. Beim größten Exemplar waren noch die natürlichen Farben erhalten, und zwar zeigten die Flecken und Bänder ein intensives Schwefelgelb mit zinnoberroten Rändern.

6. On the Structure of *Gonyaulax triacantha* Jörg.

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(With 3 figures.)

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The minute size and the rarity of many of the Peridinidae have rendered the determination of their thecal structure, upon which their classification rests, a matter of considerable difficulty, and has left the relationships of not a few forms in a state of uncertainty.

One of these imperfectly known forms has been *Gonyaulax triacantha* originally described by Jörgensen¹. From Herlö Fiord, without figures or determination of the thecal structure and questionably referred by him to the genus *Gonyaulax*. A little later Cleve² describes as *Ceratium hyperboreum* this same organism from samples of plankton from Spitzbergen and figures it, without, however, showing the number and arrangement of the thecal plates. Unfortunately one of his sketches (Pl. VIII fig. 14, lower figure) is misleading, for, as Paulsen³ has suggested, this figure is reversed, being one of the ventral face drawn from the dorsal side, and thus transposing the bilateral asymmetry of the hypotheca and the tropism of the girdle. Later Cleve⁴ refers his *Ceratium hyperboreum* to *Gonyaulax triacantha* though Paulsen⁵

¹ Jörgensen, Dr. E., Protophyten und Protozoen im Plankton aus der norwegischen Westküste. Bergens Mus. Aarb. No. VI. 1899.

² Cleve, P. T., Notes on some Atlantic Plankton Organisms, Kongl. Svensk. Vetén-Akad. Handl. Bd. 34. No. 1. 1900.

³ Paulsen, O., Plankton investigations in the waters round Iceland in 1903, Medd. f. Komm. f. Havundersögelser, Ser. Plankton, Bd. 1. No. 1. 1904.

⁴ Cleve, P. T., Plankton tables for Sweden. Bull. Cons. Perm. Expl. de la Mer, Année 1903—1904. p. 154.

⁵ *ibid.* p. 90.

retains Cleve's specific name but assigns the species to the genus *Gonyaulax* while Levander⁶ cites the species as *Ceratium* (?) *hyperboreum*.

The fullest account of this obscure form, thus far published, is given by Paulsen⁷ who discusses the synonymy in part and definitely assigns the species to the genus *Gonyaulax* since the longitudinal furrow reaches the apical pore and there is but a single antapical plate. He gives a ventral, lateral, antapical and a partial dorsal view of the theca but unfortunately his figures fail to give in any case all of the plates. Those of the epitheca are left quite incomplete, and on the ventral face of the hypotheca they are differently represented in his figures *a* and *c*. As thus figured by Paulsen the ventral face of this organism bears a striking resemblance to that found in species of the genus *Heterodinium*, in its midventral extension of the much narrowed longitudinal furrow upon the epitheca to the apical pore and in the median deflection of this furrow to the left, in the widened posterior end of the furrow, in the posterior deflection of the distal end of the posterior list of the girdle and its connection with the divergent suture line on the right face of the hypotheca, and in the reticulated wall of the theca. These resemblances led me⁸ in the absence of knowledge of its plates, to suggest the inclusion of *G. triacantha* in the newly established genus, *Heterodinium*.

Since the publication of this paper I have fortunately had the opportunity to examine this rare species in some collections from Alaska made by the U. S. Str. Albatross in the summer of 1905. In one collection made at Loring (55° 40' N, 133° 35' W), Sept. 15, there is a considerable number of *Gonyaulax triacantha*, including some empty loricae, upon which the thecal structure can be determined fully and accurately. I am indebted to Hon. Geo. M. Bowers, Commissioner of the U. S. Bureau of Fisheries, for this material and permission to publish this note upon it.

The accompanying figures indicate the number and arrangement of the plates which are unquestionably those of *Gonyaulax*, as follows: there are three tapering apicals, (1—3), five praecingulars, (4—8), the girdle plate, five postcingulars, one cuneate accessory (14) at the left of the longitudinal furrow plate of the hypotheca, a single antapical (15), and the longitudinal furrow plate (16). In one specimen I was able to distinguish a minute accessory plate in the epitheca near the midventral line anterior to the girdle at the left of the longitudinal furrow.

⁶ *ibid.* p. 148.

⁷ *l. c.* p. 21, 22, fig 5.

⁸ Kofoed, C. A., *Dinoflagellata* of the San Diego region. I. On *Heterodinium*, a new genus of the Peridinidae. Univ. of Calif. Pubs. Zool. Vol. II, No. 8. p. 341—368, Pls. 17—19. 1906.

A comparison of my results with Paulsen's (: 04) figures reveals some discrepancies in our respective accounts. The small postcingular at the left side of the theca as figured by Paulsen is omitted by me, and the wide postcingular at the right is divided at the angle of the antapical into two plates. I believe Paulsen's figure to be in error in these details.

The thecal walls are finely reticulate with areoles 2—4 μ in diameter which do not appear to be porulate. The reticular mesh varies considerably in its development in different individuals and in some shows more prominent sublinear longitudinal striae. In the individual shown in the figure the reticulations were very regular and no longitudinal striae appeared. On the dorsal side faint traces of broad intercalary bands could be noted on a deep focus on the wall along the suture lines in a few

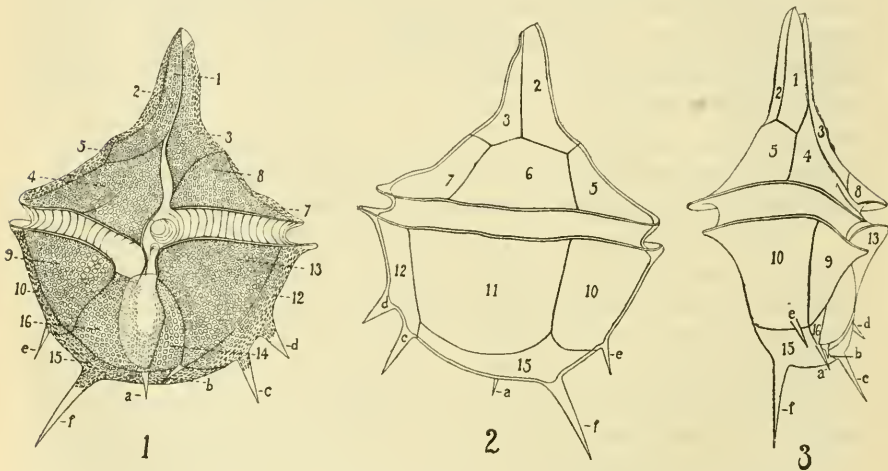


Fig. 1. Ventral view of fully developed theca of *Gonyaulax triacantha*.

Fig. 2. Dorsal view.

Fig. 3. Diagrammatic lateral view. 1—3, apical plates; 4—9, praecingular plates; 10—13, postcingular plates; 14, accessory; 15, antapical; 16, longitudinal furrow plate; a—f, spines of the hypotheca. Zeiss Apochr. 2 mm. Comp. Oc. 12. $\times 1000$.

cases. The individuals also vary in the degree of development of the spinous processes of the hypotheca, and in the extent to which the reticulations extend upon their bases.

The contraction of the epitheca into the apical horn is very abrupt forming a subhorizontal shoulder in which it is difficult to follow suture lines. This contraction is usually more pronounced than is shown in the figures. The spines of the hypotheca are solid projections often provided with wide smooth or denticulate fins. In fully armed individuals there

are six of these spines located as follows. A minor one (*a*) at the posterior end of the fin at the left of the longitudinal furrow plate near the median line; another (*b*) at the junction of plates 12, 13, 14 and 15; one (*c*) at the junction of 11, 12 and 15, on the left antapex, near which on the suture line between 11 and 12 is an accessory spine (*d*). Another minor spine (*e*) is found on the opposite side to this pair, at the junction of 9, 10 and 15. The major spine (*f*), on the right antapex, is located near the junction of 9, the longitudinal furrow plate. (16), and the antapical (15) upon which it is apparently located. The spines are often very short and minute.

On the suture line between plates 14 and 16 arises a broad delicately reticulate fin which overhangs the longitudinal furrow and covers nearly one half of it. It is not usually developed to the degree shown in the figure in most individuals.

The contents of the theca are very dense, due to the closely packed chromatophores. The presence of many empty thecae in my material is indicative of the escape of the contents, a very common phenomenon in this genus when sporulation occurs. In one instance an empty theca was noted which showed the evidences of recent division along suture lines running from the right shoulder to the left antapex.

The entire absence of any midventral area and pit and of a left intercalary plate of the epitheca of this organism precludes its inclusion in the genus *Heterodinium*. It is unquestionably a *Gonyaulax* with thecal plates typical of that genus. Its occurrence in Alaskan waters, and the previous records of its appearance in the Plankton off the coasts of Norway, Iceland, Shetland Islands, and Finland, indicate that it is a boreal neritic species of wide distribution. I find no characters in Alaskan forms which would justify even a varietal distinction from the Atlantic form.

The removal of the species *triacantha* from the genus *Heterodinium* leaves the distribution of the known species of that genus exclusively in tropical and warm temperate waters as will be seen in my (: 06) table of their distribution.

Berkeley, California, Jan. 10, 1906.

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