

Studies on the Protozoan Fauna of Shimoda Bay
Genus *Peridinium*: Group Globula.*

By

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[With 23 Text-figures]

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Peridinium globulus and its allies have not subjected to extended morphological study, and have been allocated partly to the Humilia and partly to the Divergentia groups. But my careful studies brought to light a fact that they have distinct characters by which they can be differentiated as a whole from all other groups of the genus, and this led me to establish a new group Globula for following six species: *globula*, *spheroides*, *globifera*, *quarnerense*, *majus* and *saecularis*. First five of them can be found from Shimoda. Though *saecularis* was described by MURRAY and WHITTING in 1899 as a *Diplopsalis*, it has been regarded generally as a doubtful species as it was not found since. But it is apparently a *Peridinium* belonging to this group judging from the original figure reproduced by PAULSEN. All the species collected from Shimoda were studied in comparison with those from Asamushi, and I intend to describe in this paper those found more abundantly from Shimoda than from Asamushi. General considerations on the group are to be given in another paper to be published from Tohoku Imperial University.

Shape, expansion and structural relations of the ventral area are to be regarded as of taxonomical importance according to my principle of subdivision of the genus. The ventral area of this group is characterized by its anterior oblique elongation which connects ventral two ends of the strongly overhanging girdle, and this part consists of distinctly slender anterior halves of the right and the anterior sulcal plates. The flagellar pore is distinctly posterior

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in site, lying in the middle of the expanded posterior part of the ventral area. The posterior sulcal plate is small in size and lateral expansion, and separated much from either of the ventral post-cingular plates. Along the left side of the expanded posterior half is a distinct sulcal list, and the flagellar wing develops remarkably, lying on the right side of the longitudinal furrow s. str. All these structures just considered are given in Figs. 2 and 3.

The present paper is a part of my work carried out on the suggestion of Professor T. FUKUI, to whom the writer expresses his sincere gratitude. I take great pleasure in expressing to Professor S. TAKATSUKI my appreciation of his courtesy and warm-hearted encouragement during the progress of the work. My thanks are also due to Assist. Professor E. SAWANO for facilities given during collection of the materials. My most cordial thanks are extended to Professor T. KABURAKI of Tokyo Imperial University under whose suggestion and guidance the present work was under taken and carried out.

1. *Peridinium globulus* STEIN

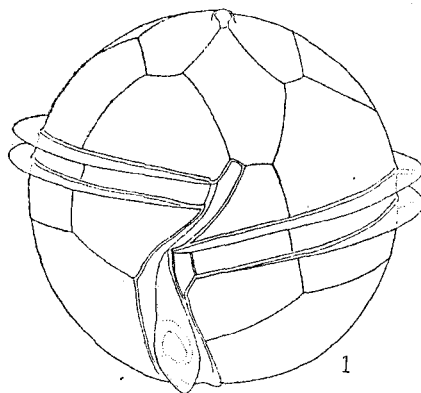


Fig. 1. *Peridinium globulus* STEIN 15×40.

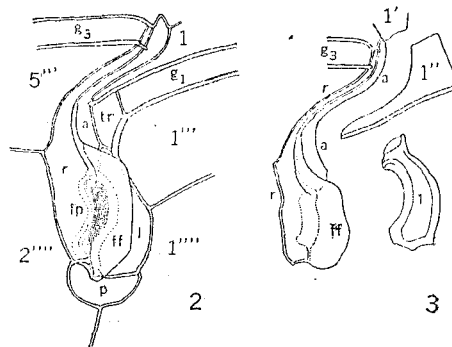
PAUKEN, 1908, p. 42, fig. 51: ABÉ, 1941, fig. 4, in press.
P. globulus globulus, in part, DIWALD, 1939, p. 159, fig. 13 a-c.

I found a single specimen of this, most closely related to that found from Asamushi. From the northern form, this differs in its

more elongated and strongly curved ventral area and in the distinct overhanging of its girdle. In spite of these differences, these two forms may be identical with each other judging from their tall trapezoidal precingular 1', fairly broad precingular row of plates especially in its ventral half except 1', strong anterior elongation of the ventral area and absence of the antapical wings.

Measurements: Length, 69μ . Transverse diameter, 69μ . Breadth of girdle, 5μ .

2. *Peridinium globifera* ABÉ



Peridinium globifera ABÉ

Fig. 2. Ventral area and its surroundings. Fig. 3. Ventral area, partially analysed. 15×40 . 1'—ventral apical plate. 1''—left ventral precingular plate. g_1, g_3 —cingular plates. 1''', 5''''—postcingular plates. 1''', 2''''—antapical plates. a—anterior sulcal plate. l—left sulcal plate. r—right sulcal plate. p—posterior sulcal plate. tr—transitional plate. fp—flagellar pore. ff—flagellar fin.

ABÉ, 1941, figs. 5, 6, in press.

Two different forms, one with a minute tetragonal and the other with a larger pentagonal apical 3', have been allocated since STEIN to *P. globulus*, owing to insufficient characterization of the species. And the latter form of the two was separated in my another paper into this species while the other was regarded as STEIN's original species.

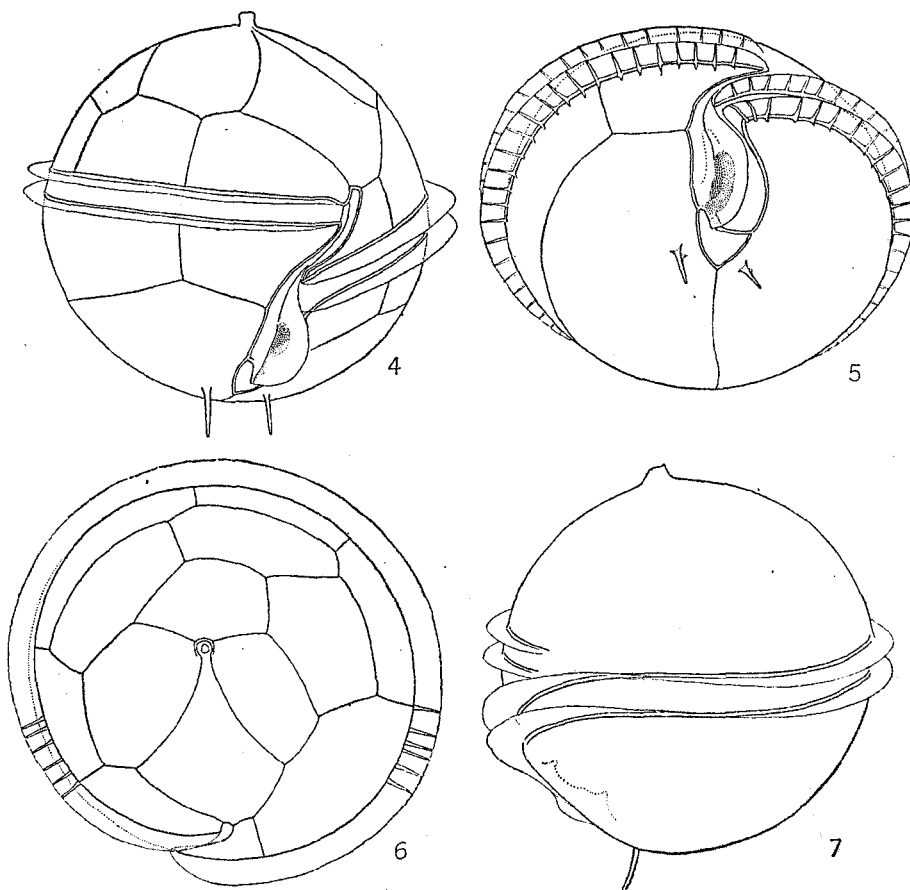
3. *Peridinium quarnerense* (SCHRÖDER) BROCH*Peridinium quarnerense* (SCHRÖDER) BROCH

Fig. 4. Ventral view. Fig. 5. Oblique antapical view. Fig. 6. Apical view. Ribs of cingular list are partially illustrated. Fig. 7. Side view. 15×43.

BROCH, 1910, p. 183, fig. 3II, III (non I).

DANGEARD, 1927 b, p. 14, fig. 9: SCHILLER, 1929, p. 404, fig. 18 a-c:

PAULSEN, 1931, p. 60, fig. 32 b-d (not a).

Peridinium globulus var. *quarnerense* SCHRÖDER, 1901, p. 18.

P. globulus var. STEIN, 1883, tab. 9, fig. 8.

P. globulus, SCHÜTT, 1895, pl. 15, fig. 48.

P. globulus globulus, in part, DIWALD, 1939, p. 159, fig. 13 d-h.

The present species can be distinguished from *globifera* mainly by its antapical spines which stand at either side and fairly apart from the hind end of the ventral area. The spines have, according to SCHILLER, side wings, but those of our specimens have only short ridges radiating from their base in three directions, which may be rudiments of the wings. The wings, then, are thought to be highly variable in development. Shape and disposition of the dorsal intercalary plate have been highly estimated in the characterization of this species, and the *divergens*- and the *pyriformia*-forms of this plate have been reported to occur respectively from the Mediterranean and the Atlantic. Our form is, in this regard, akin to the Atlantic one, but, as is described in another paper, this character is in reality variable in this group of the genus. PAVILLARD figured a specimen with 6 instead of 7 precingular plates. A similar variation is not rare also in our materials.

Absence or presense of the antapical spine has generally been regarded as of taxonomical importance, and by this character this species can be separated from *globifera*. These two species are so closely related with each other that other minor differences appear to be unworthy of their taxonomical distinction. In spite of these considerations, I intend here to separate them provisionally because of my complete failure of finding any intermediate form between the two, such as one with rudimentary spines.

The ventral area is typical in structure, consisting of an elongated, curved and oblique anterior and a broader posterior portions. Its left sulcal list is very narrow and indistinct, while the flagellar wing is much larger and can be traced anteriorly to the proximal end of the anterior cingular ridge. The posterior sulcal plate is broadly triangular.

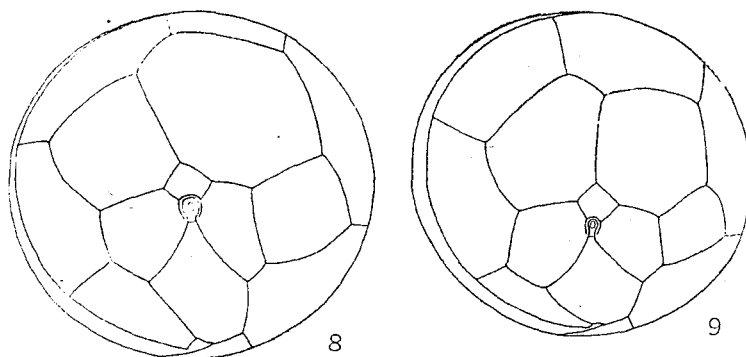
Measurements: Length and transverse diameter, 70 μ . Breadth of girdle, 5 μ .

4. *Peridinium spheroides* DANGEARD

DANGEARD, 1927, p. 5, fig. 3: ABÉ, 1941, figs. 1, 9-11, in press.

Peridinium globulus, MARUKAWA, 1921, fig. 50, pl. 4: PAULSEN, 1931, pp. 59-60, fig. 31: DIWALD, in part, 1939, p. 159, fig. 4 c-e: non KARSTEN, 1907, p. 416, fig. 15, pl. 50: non BROCH, 1910, p. 182, fig. 2: non LEBOUR, 1925, p. 129, fig. 40: nor DANGEARD, 1927, p. 11, fig. 8.

? *P. sphericum* MURRAY and WHITTING, 1899, fig. 1, pl. 30.



Peridinium spheroides DANGEARD

Figs. 8 and 9. Two different plate patterns of epitheca. 15×40.

DANGEARD (1927) described this species under the name of *P. spheroides* emphasizing correctly one of its characters "l'extrême réduction de la plaque apicale 3" and described as "le sillon longitudinal possède deux marges ailées qui se terminent par des épines en forme d'ailes, incurvées." But recently PAULSEN (1931) identified his species with *P. globulus* of STEIN's original description on the basis of the form of the dorsal middle intercalary plate. Judging from the STEIN's figure reproduced in BRONN's "Tierreich" and by PAULSEN (1908) in "Nordisches Plankton", it seems to me most reasonable to interpret STEIN's species to be wholly different from those described by the two authors on the reasons discussed in other paragraphs.

The body is globular with or without antero-posterior compression or very slightly elongated, and has a minute but abruptly differentiated apical process which lies on the ventral of centre of the epitheca. The ascending girdle is premedian, and its distal end variously overhangs its proximal end. The ventral area is elongated and sigmoid, terminating posteriorly between two hemicircular antapical wings and in front of centre of the hypotheca.

The plate pattern is characterized by the exceedingly small and rhombic dorsal apical plate. As to the shape and disposition of the middle intercalary 2a, I saw two forms one belonging to the so-called *divergens*- and the other to the *pyriformia*-types. In either case, the plate is displaced to the left side of the body not only in regard to the dorso-ventral plane of body but also in relation to the dorsal apical plate. Some of the other plates in the epitheca

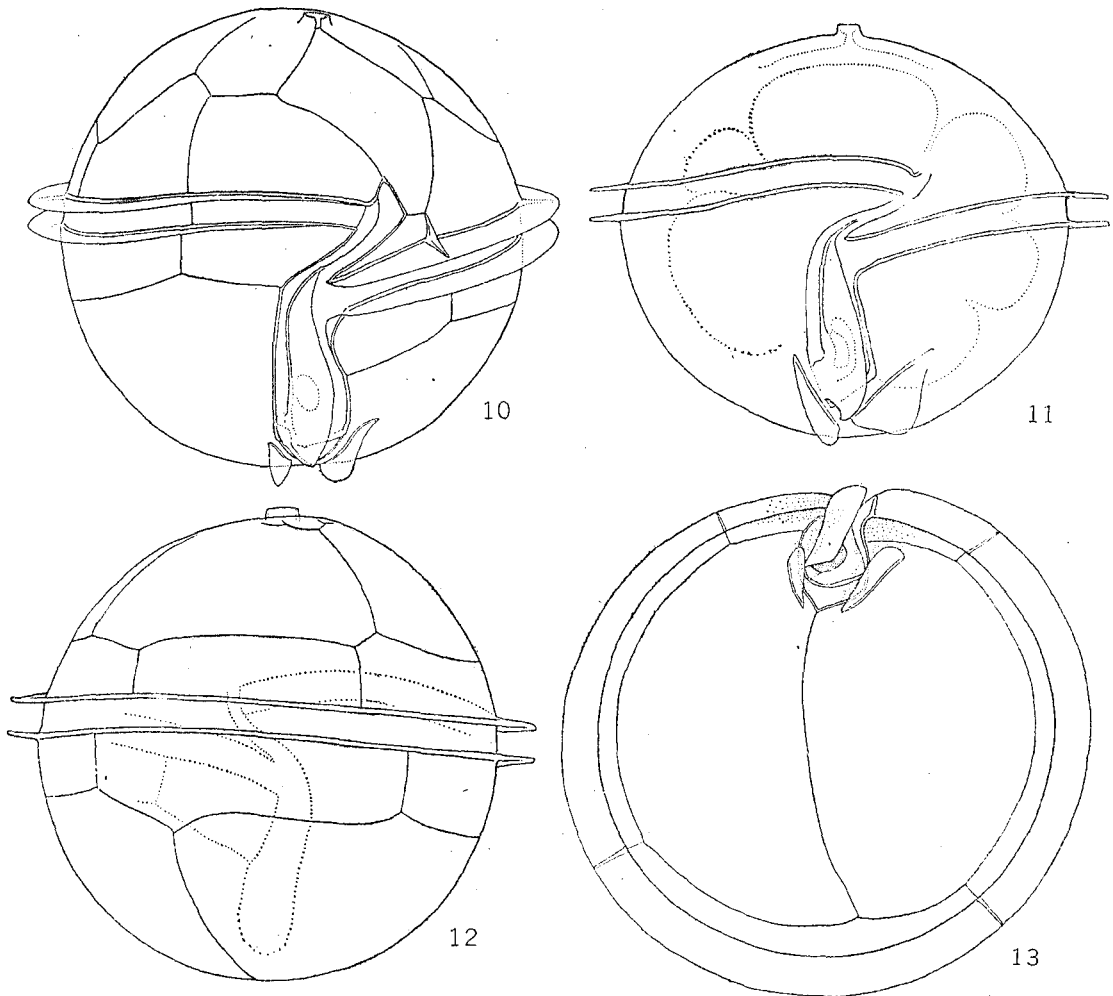
*Peridinium spheroides* DANGEARD

Fig. 10. Ventral view. Fig. 11. Ventral view of a globular specimen.
Fig. 12. Dorsal view. Fig. 13. Antapical view. 15×40.

vary in size according to the difference of the middle intercalary one. In the precingular series, 'the left ventral 1' is the smallest and characteristic of the group in shape. One can see not rarely a small triangular sail or list lying longitudinally along the left side of this plate and stands basally on the anterior cingular list. The hypotheca is covered for the most part by the two antapical plates, and the

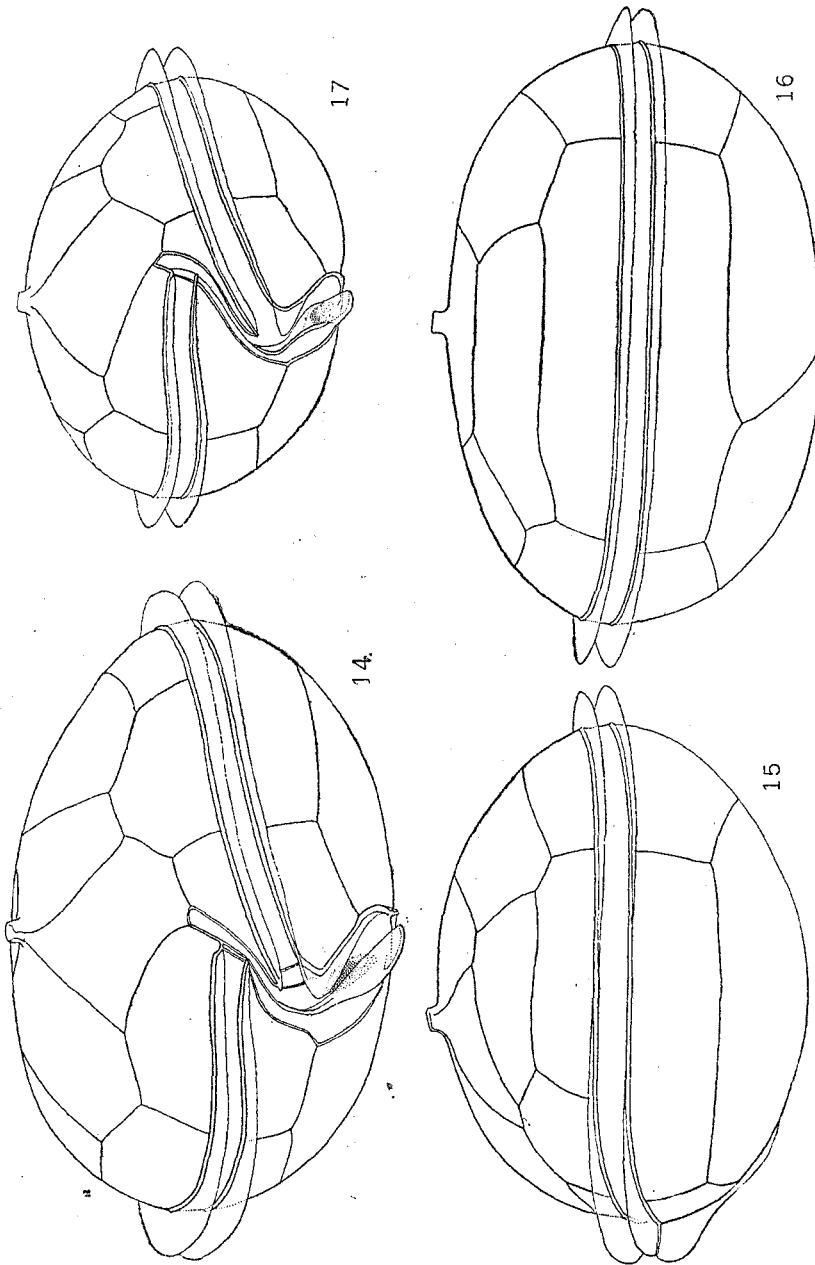
postcingular row is very narrow and mostly 1.5- but partially three-times as broad as the girdle. The cingular wall consists of three plates whose sutures correspond in position to the lateral margins of the two ventral median plates of the precingular series.

In association with the reduction in breadth of the postcingular row, the slender anterior part of the ventral area is shorter than in other species and very oblique, and the remaining posterior part is inversely elongated, lying nearly in longitudinal direction. The finer structure of the ventral area is described in another paper (ABÉ, 1941). The antapical wing is semicircular in shape and lies along but slightly removed from the lateral margin of the posterior sulcal plate. Shape, size and position of the wing are subject to individual variation. But in any case, one can not see any spine nor a rib in it, and the left-side one of the two wings is always larger than the other, and they are removed variously in different individuals from the posterior sulcal plate.

Measurements: Length, 65–87 μ . Transverse diameter, 63–88 μ . Dorso-ventral diameter, 61–86 μ . Breadth of girdle, 5 μ .

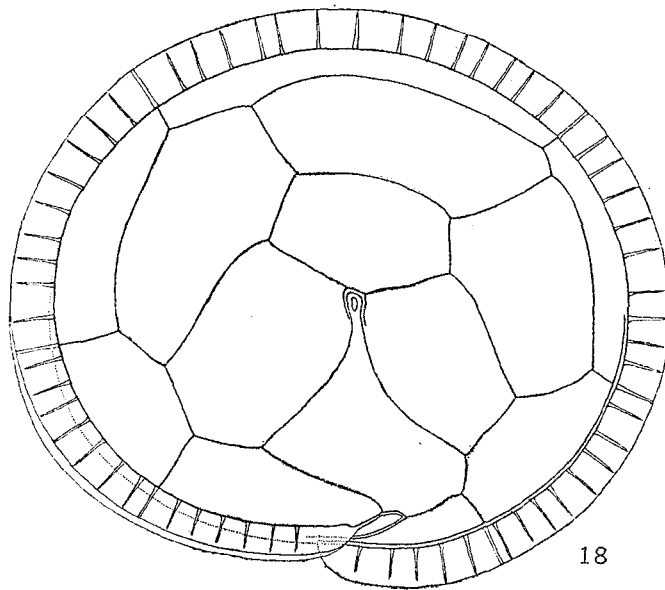
This species can be distinguished from other members of the group not only by its plate pattern but also by the general structure of the ventral area. Even in those specimens whose plate pattern is unknown, the straight posterior part of the ventral area and the two small antapical wings serve enough to separate this from any other species. But in this regard, it is to be taken into consideration that the exceedingly hyaline antapical wings might have been overlooked or misinterpreted and consequently neglected to be illustrated by most of the former investigators. From these, it seems to me probable that *P. sphericum* MURRAY and WHITTING (1899) appears to correspond to this species judging from the facts that the figure illustrated by them suggests the existence of large intercalary plates divided by a middorsal suture, and that it has a long ventral area with a median longitudinal ridge suggestive of the basement of the elongated flagellar fin. But undetailed figure of the authors forces me to think still some uncertainties as to their identification. MARUKAWA (1912 b) illustrated this species correctly (Pl. 5, Fig. 50.) and described its occurrence in the western coast of Honshu (Chiba-prefecture) and also of Shikoku (Tokushima-prefecture). *P. globulus* figured by KARSTEN (1907) may be a different species closely related to *P. spheroides* because of its well developed antapical spines and wings.

5. *Peridinium majus* DANGEARD

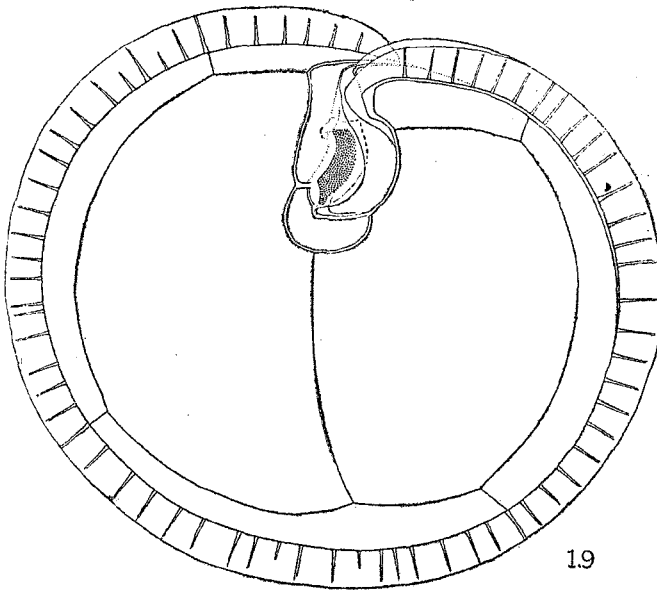


Peridinium majus DANGEARD

Fig. 14. Ventral view of larger form. Fig. 15. Side view. Fig. 16. Dorsal view. Fig. 17. Ventral view of smaller form. 15×40.



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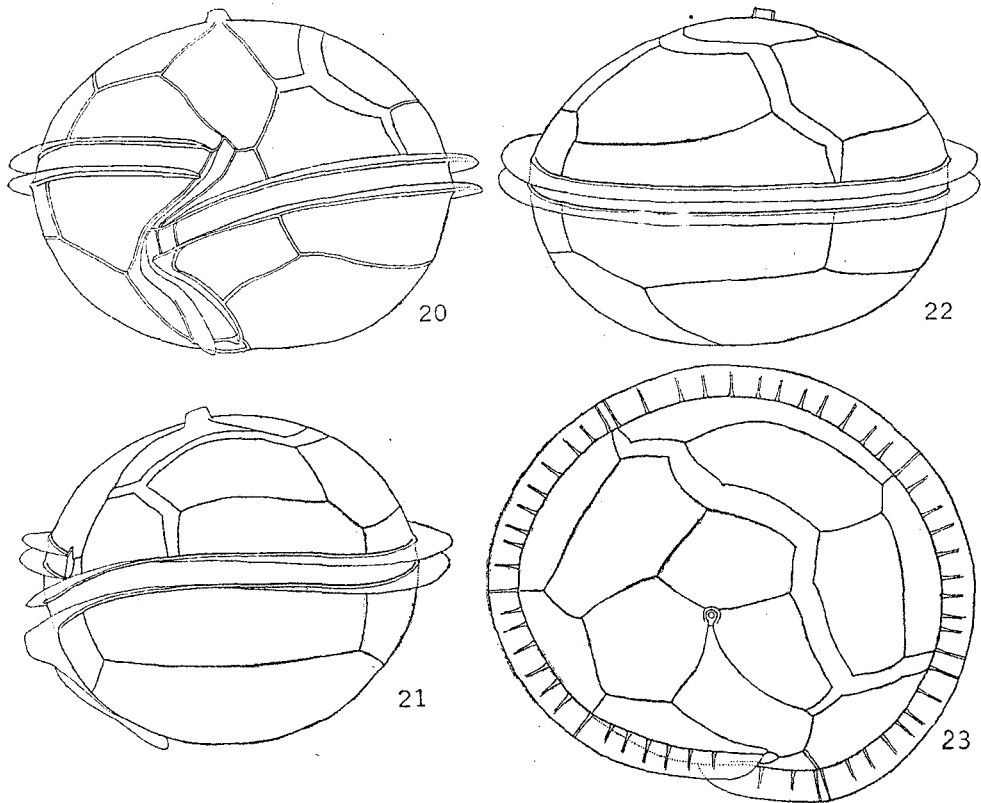


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Peridinium majus DANGEARD

Fig. 18. Apical view of larger form. Fig. 19. Antapical view of the same. 15×40.

[Sc. Rep. T.B.D. Sect. B.



Peridinium majus DANGEARD

Fig. 20. Ventral view of a smaller form different from Fig. 17. Fig. 21. Side view. Fig. 22. Dorsal view. Fig. 23. Apical view. Peculiar differentiation occurs in this specimen in regard to its sutural addition. 15×40.

DANGEARD, 1927 b: ABÉ, 1940, figs. 12-17, in press.

Glenodinium lenticula POUCHET, 1883, p. 442, pl. 20-21, fig. 35.

Peridinium globulus, in part, BROCH, 1910, p. 182, fig. 2, larger forms:

LINDEMANN, 1924, p. 224, fig. 37₁; in part, LEBOUR, 1925, p. 129, fig. 40, larger forms: DIWALD, in part, 1939, p. 159, fig. 13 i.

P. ovatum var. *major* DANGEARD, 1927 a, p. 6, fig. 4 a-d.

We can see from Shimoda a smaller and a larger forms, both corresponding to DANGEARD's *majus* (*P. ovatum* var. *major*). The body is elegantly ovoidal in apical, side and ventral views respectively, and the minute apical process is differentiated abruptly. Both the apical process and the hind end of the ventral area lie

ventral to the centre of either epitheca or hypotheca. The epitheca is divided into plates of subequal size, and the dorsal intercalary 2a is left pentagonal. The cingular list has equidistant ribs, and the girdle forms a distinctly ascending spiral. The ventral area bends abruptly at the proximal end of the girdle, and both the slender anterior and the broader posterior parts are distinctly oblique in direction of elongation. The flagellar pore is longitudinal but lies diagonally within the broader posterior part of the ventral area. The hypotheca is covered by far the major portion with the two subequal antapicals. The sutural zones are regular in major cases, but very rarely I saw an individual with very irregular zones such as illustrated in Figs. 20-23. But similar irregularity is not rare in other groups of the genus.

The larger (Figs. 14-16, 18, 19) and the smaller (Figs. 17, 20-23) forms can not be distinguished from each other by any character but for the size.

Measurements: Length, 70 (57-61 μ). Transverse diameter, 105-110 (75-80) μ . Dorso-ventral diameter, 90-93 (66-70) μ . Breadth of girdle, 5 μ .

If POUCHET's Fig. 35 of *Glenodinium lenticula* is of dorsal view as was elucidated, its girdle must be distinctly descending. But such a structural relation of the girdle has not been either reported in literatures nor observed by myself. This must be due to his misinterpretation of the ventral view. And if this supposition is correct, it corresponds exactly to our smaller form.

For literatures consulted, see the following paper:

- ABÉ, T. H., 1941: Notes on the Protozoan Fauna of Mutsu Bay.
Genus *Peridinium*: Subgenus *Protoperidinium*. 2. Group Globula.
—Sci. Rep. Tohoku Imp. Univ., in press.
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