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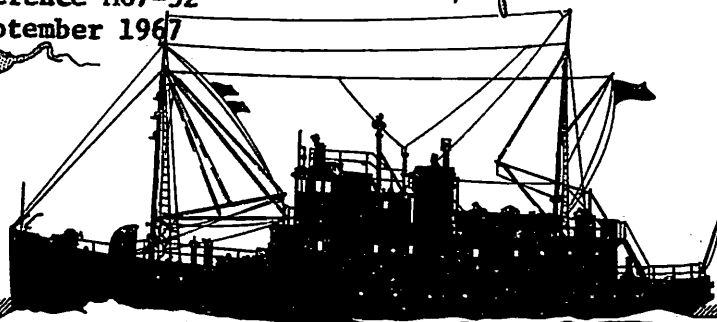
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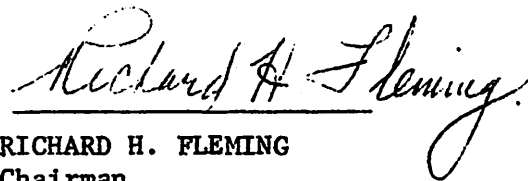
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Technical Report No. 200

NOTES ON PATAGIUM IN THE RADIOLARIAN GENERA HYMENIASTRUM AND DICTYASTRUM,
by Hsin-Yi Ling. *Micropaleontology*, 12(4): 489-492. 1966.

Technical Report No. 201

PHYSIOGRAPHY OF COBB AND GORDA RISES, NORTHEAST PACIFIC OCEAN, by Dean A.
McManus. *Geological Society of America Bulletin*, 78:527-546. 1967.

Technical Report No. 202

ORGANIC CARBON IN SURFACE SEDIMENT FROM THE NORTHEAST PACIFIC OCEAN, by
M. Grant Gross. *International Journal of Oceanology and Limnology*, 1(1):
46-54. 1967.

Technical Report No. 203

CURRENTS AT THE COLUMBIA RIVER MOUTH, by Alyn C. Duxbury. *Photogrammetric
Engineering*, 33(3):305-310. 1967.

Technical Report No. 204

SEDIMENT MOVEMENT ON THE CONTINENTAL SHELF NEAR WASHINGTON AND OREGON, by
M. Grant Gross and Jack L. Nelson. *Science*, 154(3750):879-885. 1966.

Technical Report No. 205

TIDAL PERIOD OSCILLATIONS OF AN ISOHALINE SURFACE OFF THE MOUTH OF THE
COLUMBIA RIVER, by Alyn C. Duxbury and Noel B. McGary. *International
Journal of Oceanology and Limnology*, 1(2):71-84. 1967.

ABSTRACT

A continuous variation in degree of preservation or in developmental stages of patagium is found in specimens of the genera Hymeniastrum and Dictyastrum from a Northeast Pacific bottom sample. The variations are discussed and illustrated. A relationship of this variation to radiolarian ontogeny seems unlikely, although its real significance can not be decided at this time. The taxonomic value of patagium needs critical reconsideration for some of the spumellarian Radiolaria.

Notes on patagium in the radiolarian genera Hymeniastrum and Dictyastrum

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INTRODUCTION

Patagium is "an interbrachial spongy skeleton of different structure, like a web membrane" (Haeckel, 1887, p. 484) or "an interbrachial spongy veil" (Campbell, 1954, p. 34), which can be found in some spumellarian Radiolaria. The presence or absence of patagium has been considered as one of the main diagnostic features for some radiolarian genera.

During the investigation of the Radiolaria fauna in the surface sediments from the Northeast Pacific Ocean, specimens possessing patagium have been recovered. It was noticed that the amount of patagium in these specimens is not constant.

The sample (BB312-56SG) on which the present study is based is the surface sediment (0-3 cm.) of a gravity core from a depth of 2561 m. at 46° 14.5' N. lat. and 126° 00' W. long. The core was collected by the research vessel, *M. V. Brown Bear*, of the Department of Oceanography, University of Washington.

The methods of sample preparation described by Riedel (1957, p. 64) were generally followed, except that, after the chemical treatment of the sample, specimens were picked under a binocular microscope with a camel hair brush (no. 00), and mounted in single specimen slides sealed with Canada balsam.

All slides will be deposited permanently in the Micropaleontology Collection, Department of Oceanography, University of Washington.

ACKNOWLEDGEMENTS

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of Oceanography, University of California at San Diego. Technical assistance by Donald R. Doyle and Shirley J. Patterson is sincerely acknowledged.

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PATAGIUM AND RADIOLARIAN TAXONOMY

The radiolarian genera *Hymeniastrum* and *Dictyastrum* were established by Ehrenberg in 1847 (p. 54) and 1861 (p. 830) respectively, and more precise diagnoses of both genera were given later by Haeckel (1887). The key difference between the two genera is the presence of patagium in *Hymeniastrum* and the absence of it in *Dictyastrum*.

A similar criterion has also been applied to some other spumellarian Radiolaria, such as *Euchitonia* and *Rhopalastrium*, *Trigonastrum* and *Chilonastrum*.

Among the radiolarian assemblages so far investigated from the Northeastern Pacific, the specimens belonging to the genera *Hymeniastrum* and *Dictyastrum* demonstrate a complete sequence of patagium preservation or development stages.

In plate 1, the illustrations are arranged in decreasing order of the amount of patagium. In the first specimen (figure 1), patagium not only completely fills the interbrachial area but also extends slightly over the distal ends of the arms, so that the outline of the specimen is

distinctly triangular in shape. This specimen belongs to the genus *Hymeniastrum*, according to the classification of Ehrenberg (1847), Haeckel (1887), and later workers, such as Schröder (1909), Popofsky (1913), and Campbell (1954). The area occupied by patagium is slightly decreased in figure 2, and is further reduced in figure 3, where patagium extends along only 2/3 of the radius. The area of patagium is further reduced in figure 4, and in figures 5 and 6 only a trace of patagium can be found at the proximal part of the interbrachial area. Finally, in figure 7 patagium is completely absent leaving a free interbrachial area. This last specimen can be referred to the genus *Dictyastrum*, according to the classification scheme of the radiolarian workers listed above.

At least two workers on Radiolaria have already indicated the occurrence of such different degrees of patagium development or preservation. Haeckel (1887, p. 531), in describing a new species, *Hymeniastrum archimedis*, in his *Challenger* Report, stated that the species: "Differs from *Dictyastrum hexagonum* only by [the presence of] the patagium." Thus he undoubtedly realized the close similarity between the two species, but separated them solely on the basis of presence or absence of patagium.

Popofsky (1913, p. 136) observed the different states of patagium preservation or development in *Hymeniastrum euclidis* Haeckel during his study of the Deutsche Südpolar Expedition material. Although stating that "patagium is complete" in his description of the species, he added that "Das in der Textfigure [51] dargestellte Individuum hat noch kein vollständiges Patagium und ist daher wohl als Entwicklungsstadium anzusehen."

The specimen illustrated by Popofsky in his text-figure 51 is comparable to those of figures 2 and 3 of the present paper in the degree of development or preservation of patagium. However, he did not show continuous successive stages of patagium, nor mention that patagium could be completely absent in the end form of this variation series.

It is quite evident from the present study that the degree of preservation or development of patagium varies continuously among the specimens in the genera *Hymeniastrum* and *Dictyastrum*, and that they can not be satisfactorily separated from each other on the basis of the presence or absence of patagium.

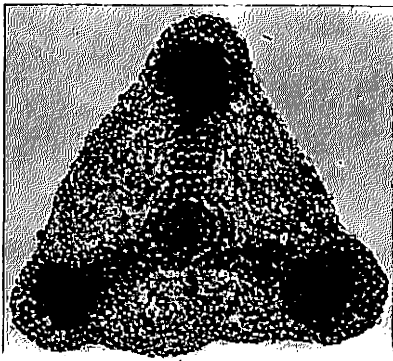
Popofsky further illustrated and discussed in detail the patagium found in another genus, *Euchitonia*. In *Euchitonia muelleri* Haeckel (*loc. cit.*, pp. 137-138, text-figs. 52-54), he noticed that the species shows variation in the arms, which may be either broad or narrow, and in the nature of the central disk, which may be either spiral or concentric, in specimens of similar sizes. In another species, *Euchitonia elegans* Ehrenberg (*loc. cit.*, pp. 138-139, text-figs. 55-57), he found that in the early ontogenetic stages the specimens are smaller in size and no patagium is present, whereas in later stages or in the mature form the length of the arms has greatly increased (up to 200 μ) and patagium has developed.

Thus it is clear how Popofsky, on the basis of these observations, came to his conclusion that the varying extent of patagium is related to the different ontogenetic stages of Radiolaria.

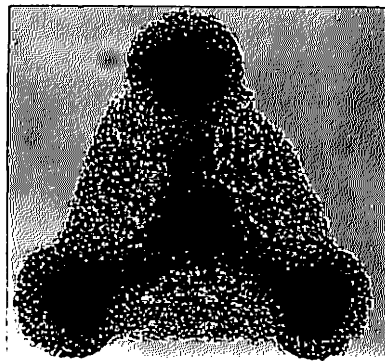
PLATE I

All figures \times 140

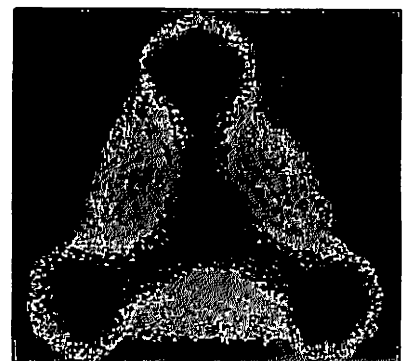
Photomicrographs showing the various degrees of patagium observed in a single sample of the Northeast Pacific bottom sediments (BB312-56SG). 1-7, transmitted light; 2a-7a, phase contrast. A complete intergradational series occurs between 1, a specimen with the maximum amount of patagium and usually classified as belonging to the genus *Hymeniastrum* Ehrenberg, and 7, a specimen without any patagium and usually classified as belonging to the genus *Dictyastrum* Ehrenberg.



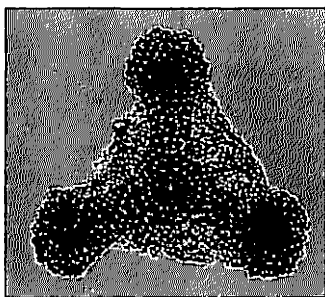
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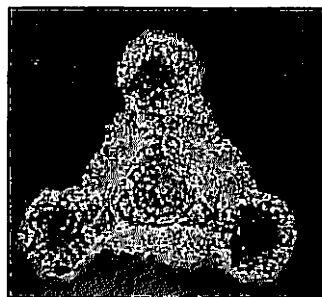
2



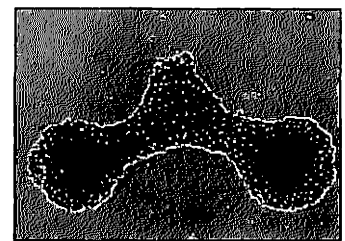
2a



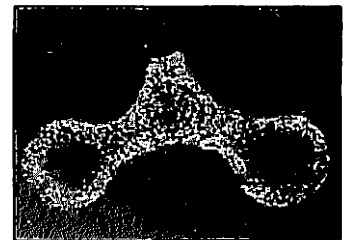
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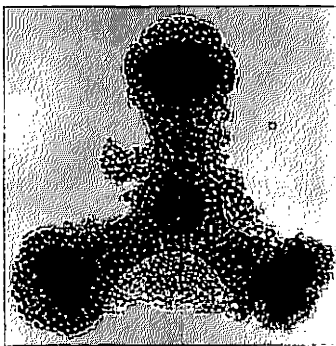
3a



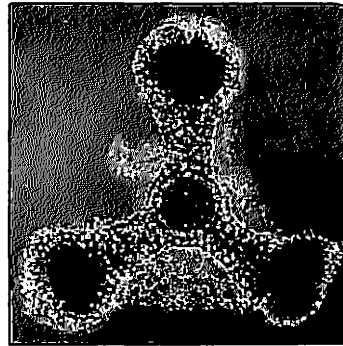
6



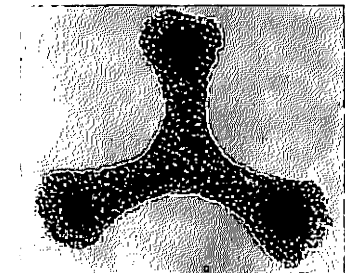
6a



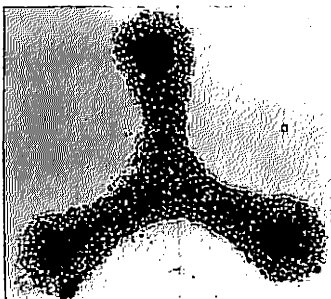
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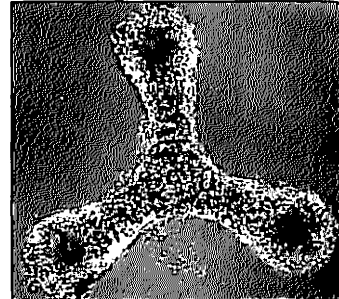
4a



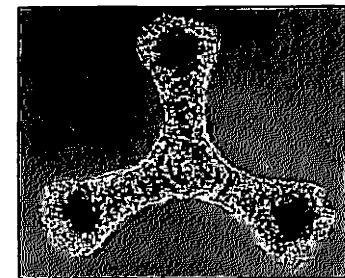
7



5



5a



7a

The present observations and the illustrations from the Northeast Pacific bottom fauna, however, reveal that different degrees of patagium are found in specimens of similar or comparable size. (Note that the magnifications of all the photomicrographs in plate 1 are the same.) Although the use of the size of a specimen in the Radiolaria as the measure of the different developmental stages, as Popofsky considered feasible, is still a questionable practice, even if this practice is accepted, then the specimens here illustrated may be considered as of the same ontogenetic stage, though not completely identical. Therefore, it seems quite unlikely that the development of patagium actually represents the ontogenetic development of Radiolaria.

Because a detailed study of the radiolarian fauna in the sediments from the Northeast Pacific Ocean is still far from complete, it is beyond the scope of this paper to propose here, on the basis of the present observations, any emendation of Radiolaria taxonomy, although it would seem to be quite necessary. It is also premature to consider what might cause the various stages or extent of patagium in some of the spumellarian Radiolaria.

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