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## The Frustular Morphology and Distribution of *Cyclotella gamma* Sov. (Bacillariophyceae)

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Diatom collections from several lentic aquatic habitats in northern lower Michigan were found to contain a large benthic centric diatom. Comparison with type material revealed this diatom to be *Cyclotella gamma* Sov. Specimens ranged in size from 20 to 35  $\mu\text{m}$  and had striae densities of 5 to 8 in 10  $\mu\text{m}$ . Valves are granular externally and possess central and marginal strutted processes internally; as well as a single, well-developed labiate process. The striae are alveolate in nature. *Cyclotella gamma* is probably more common than records indicate which may in part be attributable to its confusion with *C. meneghiniana* Kütz.

INDEX DESCRIPTORS: Diatoms, *Cyclotella*, frustule morphology

### DEDICATION

It is with the greatest respect that I salute the long productive career of John D. Dodd. Because of his love of botany and his unique perception of "the nature of things," many individuals have become psychological captives of life through the microscope. Thank you, Professor Dodd, for providing the support, stability, and, most of all, the freedom, to develop and exercise curiosity.

*Cyclotella gamma* Sov. was first described in 1963 from samples collected in Lake Killebrew, San Juan County, Washington (Sovereign, 1963). This taxon has not been reported from any diatom surveys since the original description even though the frequency of diatom surveys has increased greatly in the past 15 years. During recent surveys in several lakes in northern lower Michigan, a large benthic species of *Cyclotella* was encountered. Careful examination revealed this diatom to be *C. gamma* (although this taxon is probably rather broadly distributed) which is the first report of its occurrence outside the type locality. It is my objective in this paper to discuss the distribution and frustular morphology of *C. gamma*.

### MATERIALS AND METHODS

In the past six years (1974-79) a wide variety of aquatic habitats in northern Michigan were sampled. Many of these samples were taken in conjunction with teaching duties at the University of Michigan Biological Station. Collections were primarily benthic and usually epipelagic or epilithic. In two instances collections were planktonic. Diatoms were cleaned by the hydrogen peroxide method of Werff (1955) and mounted in Hyrax. Samples were scanned and those containing specimens of *C. gamma* were analyzed to determine the relative abundance of this taxon. This analysis included the enumeration of 500 diatom frustules in a microscope. Samples for scanning electron microscopy were cleaned in a similar manner and strewn on a #1 coverglass which was later bonded to an aluminum specimen stub with Tube Coat and coated with 150 Å of gold with a glow discharge sputtering device. Specimens were examined and photographed on an Hitachi HHS-2R scanning electron microscope. For purposes of comparative morphology, isotype specimens of *C. gamma* were obtained from the Sovereign collection at the California Academy of Sciences.

### RESULTS

#### Distribution

Of the 27 aquatic habitats examined, *C. gamma* occurred in the following 7: Douglas and Burt Lakes from episammic communities,

Dog, Cochran and Wycamp Lakes from artificial polyurethane substrates, Lancaster Lake from epipelagic communities, Long Lake from mixed benthic samples and Lakes Huron and Superior from near-shore plankton tows. In all samples analyzed *C. gamma* comprised less than 1% of the total community. These data suggest that this taxon is primarily a benthic form as it rarely appears in the plankton of these lakes. The occurrence of *C. gamma* in the plankton of Lakes Huron and Superior is possibly a phenomenon of periodic suspension of benthic forms. Florin (1970) illustrated a specimen of what appears to be *C. gamma* from Kirchner Marsh in southeastern Minnesota which she identified as *Cyclotella meneghiniana* Kütz.

#### Morphology

Sovereign (1963) in his original diagnosis of this taxon described it as a drumshaped diatom, 18 to 33  $\mu\text{m}$  in diameter with 5-7 striae in 10  $\mu\text{m}$ . Sovereign also characterized *C. gamma* as having an internal membrane "like *Pinnularia*" which caused the appearance of a small circular band crossing the striae.

Specimens from northern lower Michigan range from 20 to 25  $\mu\text{m}$  in diameter, with a striae density of 5-8 in 10  $\mu\text{m}$  (figs. 1-2). The internal siliceous membrane covers  $\frac{1}{2}$  of each stria centripetally (figs. 1, 2, and 4). Scanning electron microscopy reveals the valve surface to be tangentially undulate with scattered granules in the center (figs. 1, 2, and 3). Scattered among the granules are many small pores that do not penetrate the valve and are probably associated with granules on the opposing valve during frustular development. A similar situation has been observed in *C. michiganiana* Skv. and *C. ocellata* Pant. (Lowe, 1975). Striae (intercostae) consist of 2 or 3 rows of pores. An internal view of the valve (fig. 4) reveals 1 to 3 strutted processes located near the margin of the central area which are also visible with the light microscope (figs. 1 and 2). Marginal strutted processes are positioned near the marginal end of nearly every costa. A single well developed labiate process occurs on one costa. This process protrudes well into the valve and is slightly curved at the end (fig. 5)

### DISCUSSION

*Cyclotella gamma* is probably widely distributed as a benthic alga of lentic habitats in the northern United States but its similarities to *C. Meneghiniana* have conceivably contributed to the lack of distribution records. *Cyclotella meneghiniana* has many characteristics in common with *C. gamma* including a very similar valve ornamentation and an overlapping of the size ranges. Both taxa have striae composed of 2 or 3 parallel rows of punctae (Lowe, 1975). The central areas of both are ornamented by 1 to several isolated strutted processes. However, only *C. gamma* has the small granules dispersed over the valve surface

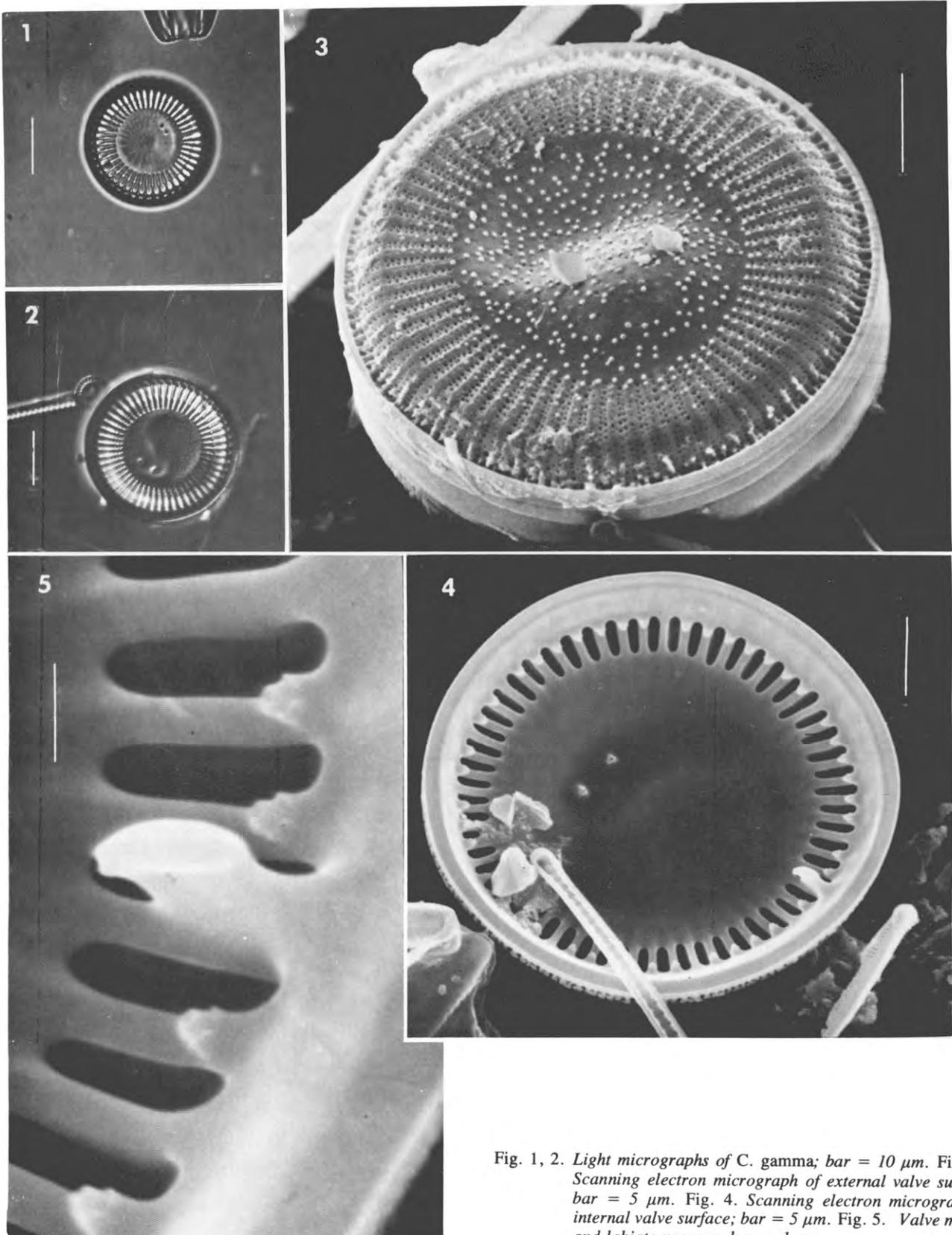


Fig. 1, 2. Light micrographs of *C. gamma*; bar = 10  $\mu$ m. Fig. 3. Scanning electron micrograph of external valve surface; bar = 5  $\mu$ m. Fig. 4. Scanning electron micrograph of internal valve surface; bar = 5  $\mu$ m. Fig. 5. Valve margin and labiate process; bar = 1  $\mu$ m.

which have been a constant feature of northern lower Michigan specimens. Internally both taxa have marginal strutted processes on the costae and a single well developed labiated process. *Cyclotella meneghiniana* does not possess the internal siliceous membrane that covers a large portion of the striae in *C. gamma* which facilitates taxonomic separation with light microscopy.

*Cyclotella gamma* is morphologically most closely related to species of this genus with alveolate striae (Lowe, 1975). These species include among others *C. michiganiana* Skv., *C. operculata* (Ag.) Kütz., *C. kutzingiana* Thwaites and *C. comensis* Grun.

#### ACKNOWLEDGMENT

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#### REFERENCES

- FLORIN, M.B. 1970. Late-glacial Diatoms of Kirchner Marsh Southeastern Minnesota. Beih. Nova Hedwigia 31: 667-728.
- LOWE, R.L. 1975. Comparative ultrastructure of the valves of some *Cyclotella* species. J. Phycology 2: 415-424.
- SOVEREIGN, H.E. 1963. New and rare diatoms from Oregon and Washington. Proc. Cal. Acad. Sci. 31: 349-368.
- WERFF, A. VAN DER 1955. A new method for concentrating and cleaning diatoms and other organisms. Int. Ver. Theor. Angew. Limn. Verh. 12: 276-7.