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Valve Morphology of *Coscinodiscus janischii* Schmidt (Bacillariophyceae)

by

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with 1 plate

Abstract: *Coscinodiscus janischii* Schmidt from Puerto Madryn (Chubut) and Puerto Brown (Tierra del Fuego), Argentina, was studied with light and scanning electron microscopy. Clear differences between *C. janischii* and similar species *C. gigas* Ehrenberg and *C. wailesii* Gran and Angst were observed. Our results show that *C. janischii* fits the description of *Coscinodiscus sensu stricto*, although some of the areolae have distinctive characteristics not previously observed in the genus.

Introduction

The genus *Coscinodiscus* Ehrenberg, with about 400 validly described taxa (Van Landingham 1968), has been revised extensively in the last two decades, based upon observations made with the scanning electron microscope. The result of these revisions has been that many *Coscinodiscus* species have been placed in other genera. In particular, *Thalassiosira* has been expanded through many published studies, including the early works by Hasle (1968) and Fryxell and Hasle (1974).

Simonsen (1975, 1979) established three morphologic groups within the genus *Coscinodiscus*, based on the pattern of labiate processes. Rapid progress in developing a concept of the genus took place following publication of Simonsen's hypotheses. In accordance with Ross and Sims (1973), Fryxell (1978) proposed *Coscinodiscus argus* Ehrenberg as the generictype. Further studies resulted in the splitting of some species of this genus into several others, including: *Psammodiscus* Round and Mann (Round and Mann 1980), *Thalassiosiropsis* Hasle (Hasle and Syvertsen 1985), *Stellarima* Hasle and Sims (Hasle and Sims 1986a), and *Azpeitia* M. Peragallo (Fryxell et al. 1986). Subsequent to the above studies, Hasle and Sims (1986b) emended the diagnosis of the genus *Coscinodiscus*. Finally, and with the purpose of introducing more precise limits among the species, Fryxell and Ashworth (1988) included additional ultrastructural diagnostic characters to the ones classically employed.

In this paper we study the valvar morphology of *Coscinodiscus janischii* Schmidt in order to analyze the position of this species in the genus *C. sensu stricto*. Comparisons are made with the nearest species, *C. gigas* Ehrenberg and *C. wailesii* Gran and Angst.

Materials and Methods

Marine neritic phytoplankton was collected in 50 μm mesh plankton nets from two sites in neritic Argentinian waters: Puerto Madryn, Chubut, 29 Sept. 1981 (sample no. 3621), and Puerto Brown, Tierra del Fuego, 24 Feb. 1963 (sample no. 2396). The samples were preserved in buffered formalin. They were subsequently cleaned of organic matter (Hasle and Syvertsen 1980), and subsamples were mounted in Hyrax for study in a Wild M20 phase contrast light microscope. Other subsamples were mounted on glass coverslips attached to aluminum stubs, sputter coated with gold, and examined under a JEOL JSM T100 scanning electron microscope. The material was added to the collection of the Division Ficologia, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata as "Diatoms from Chubut" and "Diatoms from Tierra del Fuego."

The above material was compared with slides 91, 148, 182, 551, and 848 from the Tempère and Peragallo Collection, 2nd Edition (Tempère and Peragallo 1915) and with slide series 167 from the Frenguelli Collection.

Results

Coscinodiscus janischii Schmidt, 1878
(Pl. 64, Figs. 3, 4)

Cells solitary, coin shaped, 160–240 μm in diameter, 35–40 μm deep about the pervalvar axis. Valves flat, sharply elevated in the marginal area. Areolae pattern radial with spiralling secondary rows more or less evident (Fig. 1). Central area small, hyaline, without any aperture, sharply delimited in the interior part with randomly distributed siliceous granules and bundles of linear markings radiating from its margin (Figs. 3, 6).

Areolae ordered in complete and incomplete rows, the latter originating towards the mid-radius. Central areolae elongated in radial direction (Figs. 2, 3), 2.5–3.5 in 10 μm. Areolae diminishing in size towards the margin, 4–4.5 in 10 μm, becoming loculated and hexagonal only near the periphery (Figs. 4, 9). External cribra delimited by a solid siliceous covering except in the mantle where they are continuous (Figs. 7, 10). Pores of the cribra closed by very delicate sieves, the cribrella (Figs. 3, 8), which are often destroyed during cleaning.

Valve mantle vertical, possessing two rings of areolae with continuous cribra cover and siliceous ridge-like irregularities around their margins (Fig. 10). Microrimoportulae placed in one ring on the mantle, 2–4 areolae distant, 2 in 10 μm (Fig. 12). Two macrorimoportulae, 120–135 ° apart, located in or close to the ring of microrimoportulae (Fig. 11).

Data about the distribution of this species along the coast of Argentina are reported elsewhere (Ferrario 1981).

Comparisons With Other Material

Coscinodiscus janischii from the Tempère and Peragallo Collection was scarce and generally broken. Specimens were markedly similar to the cells observed along the Argentine coasts, particularly with respect to the following: diameter, general view of the valve with a narrow outstanding marginal area with hexagonal areolae, areolae pattern, density and shape, and type of central area.

Comparison with the Frenguelli material (Frenguelli 1928) allowed us to establish clear differences with respect to general view of the valve, type of central area, and size and shape of the areolae in different parts of the valve.

Discussion and Conclusions

The analysis of some classical works, such as Schmidt (1878, pl. 64, Figs. 3, 4), Rattray (1890:543), Peragallo and Peragallo (1897–1908:432, pl. 118, Fig. 4), and Hustedt (1928:459, Fig. 257) allowed us to establish similarities between the observations on our material and the descriptions and illustrations of these authors. The comparison was made following the classic criteria that emphasized areolae size and array, presence or absence of a particular structure in the central area, and diameter and general aspect of the valves.

As can be seen from our results, we assume the material from Puerto Madryn and Puerto Brown to be conspecific with the material in the Tempère and Peragallo Collection. Based on this conclusion we consider the differences with Hustedt's illustrations to be a difference in drawing, since this author takes into account the material from the Tempère and Peragallo Collection.

In accordance with the criteria of Rattray (1890) and Takano (1976) among other authors discussed, we have noticed that *Coscinodiscus janischii* easily can be confused in the light microscope with other large species, such as *C. gigas* and *C. wailesii*. Because of the similarities we think it useful to establish the most outstanding differences between these taxa.

Coscinodiscus gigas does not have the narrow and clear marginal area observable in the light microscope. Areolae are smaller in the center and increase in size towards the periphery. Microrimoportulae are closer to one another and located in the transition between the mantle and valve surface (Takano 1976:134, Figs. 5, 6). Macrorimoportulae are relatively smaller and less coiled (Takano 1976, Figs. 14–16); Fryxell and Ashworth 1988, Fig. 28), and the mantle is deeper with a lattice pattern of hexagonal areolae (Takano 1976, Figs. 5, 6; Fryxell and Ashworth 1988, Fig. 24).

Coscinodiscus wailesii was recently examined by Schmid and Volcani (1983). According to their paper *C. wailesii* does not have a narrow marginal area (LM). Areolae are smaller, almost regular in size throughout the valve, and always hexagonal (Schmid and Volcani 1983:388, Figs. 2, 3). There are no solid siliceous coverings enclosing the external cribra of the areolae (Schmid and Volcani 1983, Fig. 30). The central area is larger with bundles of siliceous thickenings reaching the margin (Schmid and Volcani 1983, Fig. 2). Microrimoportulae have a very different distribution pattern, being scattered on the valvar surface as well as being present in a ring at the juncture of the mantle and valve and in an additional ring in the free border of the mantle (Schmid and Volcani 1983, Fig. 10).

The results obtained on the valvar morphology of *C. janischii* allow us to include this species in the genus *Coscinodiscus sensu stricto*, taking into account the limits established by Hasle and Sims (1986b) for the emended genus. However, the presence of poroid-like areolae (Fig. 5) on the surface of the material studied suggests the need to widen the limits of variability of areolar structure in the genus.

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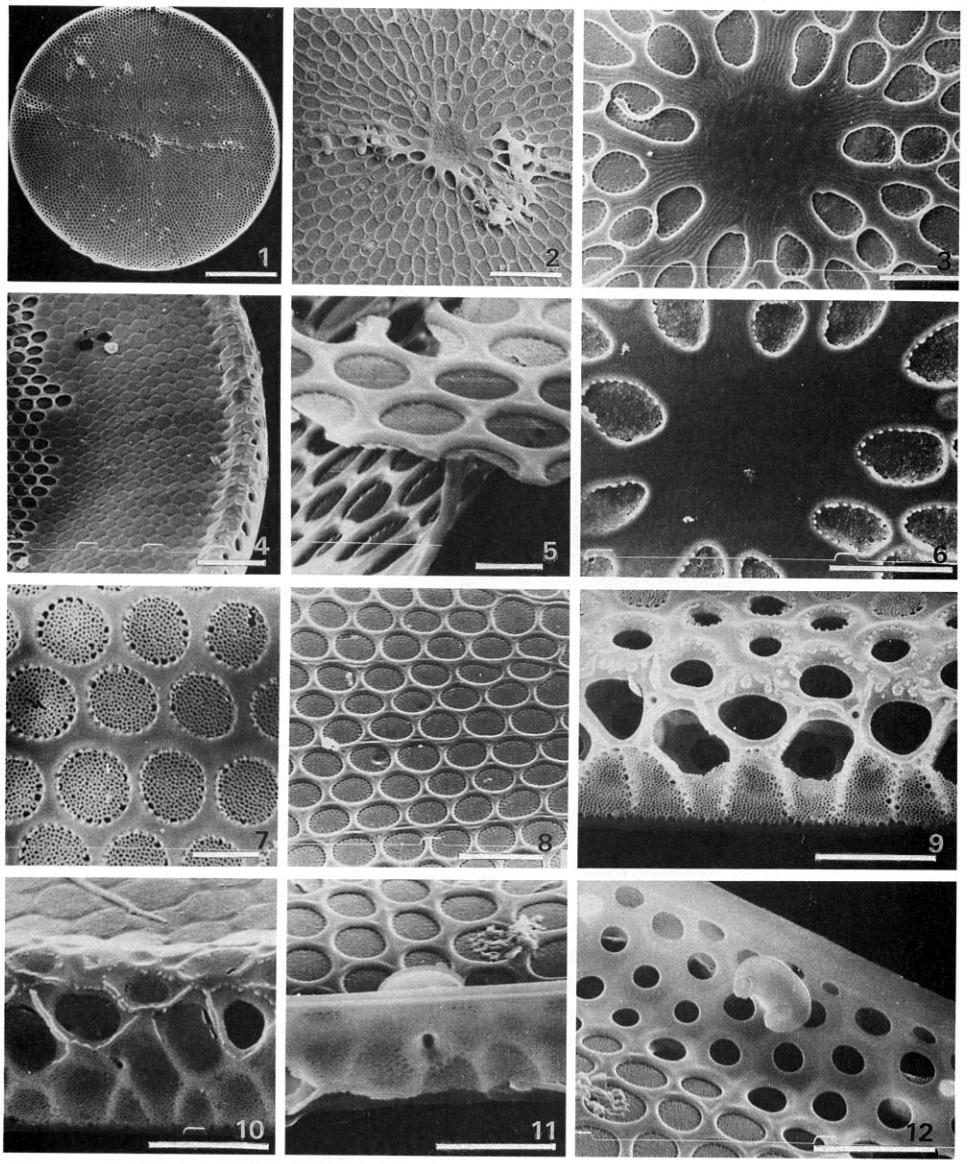
Explanation of Plate

Plate 1, Figs. 1–12

FIGURES 1–12. *Coscinodiscus janischii*. FIGURE 1. Valvar surface showing elevated marginal area and radial areolae pattern with spiralling secondary rows (internal view). Scale bar = 50 μm. FIGURE 2. Central area showing randomly distributed siliceous granules and bundles of linear markings radiating from its margin (internal view). Scale bar = 10 μm. FIGURE 3. Areolae around central area elongated in radial direction, showing polygonal cribral pores closed by cribrella (internal view). Scale bar = 5 μm. FIGURE 4. Marginal area with areolae becoming hexagonal only near the periphery. Scale bar = 10 μm. FIGURE 5. Broken valve showing structure of areolae. Scale bar = 2 μm. FIGURE 6. Central area (external view). Scale bar = 5 μm. FIGURE 7. Cribra of circular areolae delimited by solid siliceous covering (mid-radius, external view). Scale bar = 2 μm. Figures 8–12: Scale bar = 5 μm. FIGURE 8. Circular areolae (mid-radius, internal view). FIGURE 9. Detail of the loculate areolae in marginal region. FIGURE 10. Mantle showing a microrimoportula opening surrounded by continuous cribral coverage. FIGURE 11. External opening of a macrorimoportula surrounded by continuous cribral coverage. FIGURE 12. Interior of mantle showing a macrorimoportula and the neighboring microrimoportulae.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