ORAL PRESENTATION

MICROMECHANICS OF DIATOM VALVES: LOCULATE AEROLAE AND SANDWICH STRUCTURE

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Diatom valves have pores that vary widely in size, density, structure and arrangement, features that are used to classify and identify diatoms. Recent advances in applied chemistry have increased our knowledge of the composition and organization of molecules in the solid material of which the valves are composed, and developments in nanotechnology have enabled a closer look at how that material is arranged into the laminated porous structure of the diatom cell wall. This enables a new perspective on the relationship between ecological factors and the ultrastructural geometry of diatom valves. In this paper, the mechanical properties of diatom valves with loculate areolae are modeled as laminate sandwich panel structures with porous solid faces and honeycomb cores, composed of biosilica, a solid modelled as an organic/inorganic composite material. The ability of these models to explain diatom valve mechanical properties is confirmed by application to examples in *Coscinodiscophyceae*. Using this approach, hypotheses regarding the relationship between ecological factors and valve microstructure are developed and preliminarily tested. One such hypothesis is that the structure of valves are determined by their mechanical resistance to breakage by predators. An experimental prediction that follows from this hypothesis, through the use of this micromechanical modeling, is that centric species with larger diameter valves will have thicker core layers of higher relative density, and face layers of higher relative density, but not necessarily smaller or less abundant pores, compared to species with smaller diameter valves. This prediction is preliminarily supported by measurements of three or more species.