Harnessing Nature's Diversity

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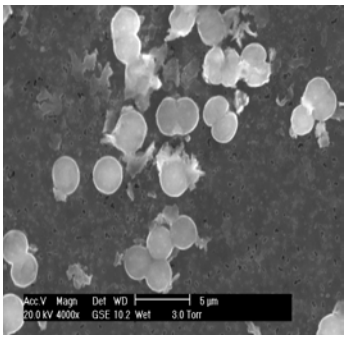
Atmospheric Carbon Management

Managing the amount of carbon dioxide in the atmosphere has usually been thought of from a geochemical perspective. A tantalizing biological phenomenon potentially pertinent to atmospheric carbon dioxide management, however, is that of *whitings*. It has long been known that that cyanobacteria create fine-grain calcium carbonate crystals that can form whitings in oceans and lakes. Their formation creates a large, turbid, white area on or near the water surface. The calcium carbonate crystals precipitate as *mud* from the water column and form a stable bottom sediment. This process, or event, can be created in both the laboratory, where it is presently being studied, and in the field.

Whitings near Andros Island, Bahamas, from NASA Shuttle Mission STS52, 1992 (latitude 25N, longitude 78W).

INEEL Biotechnology researchers are one of the first groups to study cyanobacteria in the context of whiting events. These whiting events are attractive from a carbon management point of view because huge amounts of carbon are involved. Potentially, managing these events holds the promise of a man-controlled biological mechanism for increased trapping of carbon from the atmosphere.



ESEM micrograph of Synechocystis in ASN-III medium.

Increased atmospheric carbon dioxide may contribute to global warming. Carbon dioxide in the atmosphere comes from two sources: (1) natural sources such as oceans (90 billion metric tons), vegetation decay (30 billion metric tons), and plant and animal respiration (30 billion metric tons), and (2) from anthropogenic sources; 5.4 billion metric tons in 1999 (due to fossil fuel combustion, gas flaring, and other industrial sources). Atmospheric carbon uptake mechanisms include photosynthesis and ocean absorption. Oceans absorb nearly all the naturally occurring carbon dioxide and some of the anthropogenic carbon dioxide.

Progress

Our research focuses on selecting species and testing the variables that affect their physiology and calcium carbonate nucleation. This includes calcium complexation and inorganic carbon transport. The key objective is to control microbes such that whitings can be induced at will to remove carbon dioxide from the atmosphere.

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