ORAL PRESENTATION

REFINING MARINE DIATOM PALEOPRODUCTIVITY ESTIMATES FOR THE SOUTHERN OCEAN

Jonathan Warnock and Reed Scherer

Department of Geology and Environmental Geosciences, Northern Illinois University, DeKalb, Illinois 60115 USA

Potential remediation of increasing atmospheric pCO_2 levels is a topic of great interest to science and society. Researchers are looking to enhanced marine diatom productivity as a potentially viable mechanism of sequestering excess carbon, through artificial fertilization of oligotrophic surface waters. Although most organic matter associated with diatoms is rapidly degraded, some carbon is bound within the siliceous frustules, providing silica-linked carbon flux. Understanding how diatoms, notably of the Southern Ocean, have responded to and affected past pCO_2 levels is an important part of development, planning, and justifying further fertilization experiments. It is well-known that the fossil record of marine diatoms reflects only a small percentage of primary productivity, with syndepositional taphonomic loss resulting from both dissolution and fragmentation by zooplankton grazing, and postdepositional fragmentation largely from compaction. Stratigraphic records of paleoproductivity will provide an understanding of how diatoms responded to changing climates and pCO_2 concentrations, but improving paleoproductivity proxies requires a better understanding of diatom taphonomy.

Here we present the initial results of a morphologically based diatom serial dissolution experiment. Seven Southern Ocean diatom species grown in culture (*Chaetoceros dicheata, Eucampia antarctica, Fragilariopsis kerguelensis, F. nana, Proboscia alata, Pseudo-nitzschia subcurvata,* and *P.-n. turgiduloides*) have been exposed to caustic conditions, and allowed to completely dissolve. Samples of the dissolving diatoms and the dissolution medium were taken throughout the process at scheduled intervals and analyzed via scanning electron microscopy for changes in morphology, e.g. areolae expansion, surface area loss, and frustule thinning. The dissolution medium was analyzed to determine the level of silica in solution, thus linking quantified morphological changes to quantified losses of silica. By using standard Battarbee chambers, the number of frustules completely dissolved was monitored throughout the process. Thus, the data generated include quantified morphological change associated with each level of dissolution, and the relative susceptibility of diatoms grown under identical conditions to dissolution. Additionally, atomic force microscopy was utilized to measure changes in roughness of the valve surface as dissolution progresses as well as the amount of force required to break a valve. The ultimate goal of the project is to link dissolution-induced changes in morphology from core material to the numbers of diatoms lost to solution, thus removing the preservational bias from accumulation records and deriving paleoproductivity.