

Decoupling Surface Production from Deep Remineralization and Benthic Deposition: Empirical Evidence and Modeling Challenges

Robert A. Armstrong

Marine Sciences Research Center, Stony Brook University, Stony Brook, NY 11794-5000, USA, rarmstrong@notes.cc.sunysb.edu

Global models of the oceanic carbon cycle have two moving parts: a production part, which calculates primary (organic matter) production in the ocean's mixed layer, and an export-and-remineralization part, which is used to partition primary production into that which is remineralized within the mixed layer and that which is exported to the deep ocean. Recent evidence suggests that the connection between surface production and deep remineralization and deposition is far from linear, and that the transfer may be mediated by mineral "ballasts" - carbonate and silicate minerals that are heavier than seawater, allowing efficient sinking of organic matter, and that may also protect organic carbon from degradation on its way to the seafloor.

The fact that mineral ballasts may be produced by a diverse group of phytoplankton and zooplankton species raises significant challenges for the modeling community. Specifically, we must be able to model mechanistically the competition between phytoplankton species that do and do not produce mineral ballasts, and we must be able to accommodate mineral-secreting zooplankton. Suggestions on how we might meet these challenges are offered.