Diatom Response to Short-Lived Winter Storms and Subsequent Stratification Events in the Sargasso Sea

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Previous studies of biogenic silica production in the Sargasso Sea, conducted during non-bloom periods, have reported a mean rate of 0.42 mmol Si m^{-2} d^{-1} and maximum rate of ~1 mmol m^{-2} d^{-1}; these are among the lowest rates recorded in any ocean habitat. During February and March 2004, we studied the effects of late-winter storms and subsequent stabilization events on the production rate, standing stock and export of biogenic silica in the Sargasso Sea southwest of Bermuda. During that month several alternating storm and stratification events took place, providing pulsed input of nutrients to the euphotic zone. During a mild event, silica production rates in the upper 140m, measured with the radioisotope tracer ^{32}Si, ranged from 2.0 to 13.4 mmol Si m^{-2} d^{-1} with a mean of 5.7. During a stronger event they ranged from 5.8 to 24.6 mmol Si m^{-2} d^{-1} with a mean of 11.8. Dissolved silicic acid concentrations during the stronger episode fluctuated between 0.84 and 1.06 µM, with decreases over 1-2 day periods that were consistent with the measured rates of uptake. These results show that diatoms in the Sargasso Sea can respond to storm-induced nutrient injections by growing rapidly, and producing silica for short periods at vertically integrated rates similar to those observed in coastal areas. This silica production does not accumulate, as biogenic silica concentrations remained relatively low, generally 10-50 nmol Si l^{-1} and the gravitational flux of biogenic silica measured by sediment traps at 200m ranged from 0.2 to 0.5 mmol Si m^{-2} d^{-1}. Diatoms remained a small component of phytoplankton biomass throughout these events, and biogenic silica export was apparently not stimulated to anywhere near the same degree that biogenic silica production was. These results suggest that, given a source of nitrate (from a storm-induced mixing event) and subsequent increase in light availability (from post-storm stabilization), diatoms may become a major component of new production in the Sargasso Sea for periods of a few days. Despite the short duration of these blooms, annual estimates of both biogenic silica production and new production in the Sargasso Sea may need upward revision to account for their effects.

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