Cyanobacteria blooms induced precipitation of calcium carbonate and dissolution of silicate in Florida Bay

JIA-ZHONG ZHANG

[1]Ocean Chemistry and Ecosystems Division, Atlantic Oceanographic and Meteorological Laboratory, National Oceanic and Atmospheric Administration, Miami, Florida 33149, USA, jia-zhong.zhang@noaa.gov

Florida Bay, located at the southern end of the Florida peninsula, USA, is one of the largest coastal lagoons in the world. Data from bimonthly survey over a decade (1999-2012) in Florida Bay revealed the high silicate waters persistently occurred in the north central bay. Silicate concentrations in these waters were at minimum in early spring (20-60 μM in January to April) and increased during summer and reached an annual maximum (100-200 μM during late summer or early fall). It returned to low values during winter. The seasonal variation of dissolved silicate occurred annually in the same region of the bay. The terrestrial freshwater runoff is ruled out as a source of dissolved silicate in these waters because most freshwater runoff flows into the eastern bay where low silicate concentrations were observed year-round. Furthermore, these high silicate waters are relatively high in salinity.

Observed spatial and temporal pattern in dissolved silicate concentration in Florida Bay is coincided with that of cyanobacteria bloom in the bay. Since 1991, expansive, persistent and recurring cyanobacteria blooms have become an annual biological feature, exhibiting distinct spatial and temporal pattern. They developed in the north-central bay in summer and spread southward in fall. The cyanobacteria blooms drew down dissolved inorganic carbon and increased seawater pH and the saturation state of calcite [1], causing in situ precipitation of calcium carbonate and dissolution of silicate minerals in sediments.

During the peak of cyanobacteria blooms, silicate dissolution in Florida Bay varied from 0.9 x 10^7 to 6.9 x 10^7 mole per month over the study period, depending on the extent of cyanobacteria bloom in a given year. Concurrent calcium carbonate precipitations in the cyanobacteria bloom region are between 0.9 x 10^8 to 2.6 x 10^8 mole per month. It is estimated that 30-70% of atmospheric CO_2 uptake in bloom waters was ended up as calcium carbonate precipitation and remainders of CO_2 influx were used for the production of biomass.

[1] Zhang & Fischer (2014) Carbon dynamics of Florida Bay: spatiotemporal patterns and biological control, *Environ. Sci. Technol.* **48**, 9161-9169.