GEOCHEMISTRY OF ORGANIC PARTICULATES IN SHALLOW WATER CONTINENTAL SHELF ENVIRONMENTS

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By

Anond Snidvongs

Dissertation Committee:

Stephen V. Smith, Chairman
Marlin J. Atkinson
Yuan-Hui Li
Fred T. Mackenzie
Robert A. Kinzie III

ABSTRACT

Net ecosystem production of organic and inorganic phosphorus, nitrogen and carbon in the upper Gulf of Thailand was estimated by mass transport models. Human activities within 50 km from the coast supply about 50% of the P and 40% of the N requirements of the bay. Up to 40% of the total N input may be derived from N_2 fixation by dense population of planktonic cyanobacteria *Trichodesmium* observed near the bay head. The upper Gulf of Thailand is a net consumer of DIP but a net producer of CO_2. This opposite trend occurs because the bay consumes high C:P ($\approx$400:1) terrestrial organic material while producing low C:P ($\approx$100:1) planktonic organic matter.

Organic diagenesis in the upper Gulf of Thailand sediments was studied using an electron balance approach. Generally, O_2 reduction alone can explain benthic respiration in most parts of the Gulf of Thailand except at stations located less than 15 km from river mouths where organic matter input is high. At these locations, SO_4^{2-} reduction is required to balance the budgets. Sediment denitrification is a minor reaction in terms of organic carbon respiration but can be an important N sink. Net denitrification in sediments near river mouths may be limited by the nitrification step which is subsequently limited by O_2 uptake across the sediment-water interface. In other parts of the bay, denitrification is limited by low sediment organic content.

The same model is also applied to Tomales Bay (California) sediments where oxidant limitation is more severe. On average, Tomales Bay sediments require about 18 meq m^{-2} d^{-1} of oxidants, in addition to O_2, NO_3^- and SO_4^{2-}, in order to balance the

electrons generated by organic carbon oxidation. This electron imbalance is explained by minor reduction reactions and groundwater nutrient input to the bay.

Respiratory CO_2 regenerated in the Gulf of Thailand sediments reacts with $CaCO_3$. In oxic sediments, the coupling between organic carbon respiration and $CaCO_3$ dissolution is near 1:1. In the SO_4^{2-} reducing zone, the coupling is about 0.4:1 (assuming FeS formation). $CaCO_3$ dissolution rate in oxic sediments is about 100 times faster than the rate in the SO_4^{2-} reducing zone with the same degree of undersaturation.