Anthropogenic perturbations of N, P and Si cycles and its impacts on primary production in coastal waters

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Summary

Fluxes of nutrients to the coastal waters have been changed by human activity. In addition, the N:P:Si ratios of these inputs have been perturbed. Changes in these nutrients inputs seem to have significant impact on coastal ecosystem in long time scale. Riverine inputs of N and P to the coastal water have been increased considerably by human activity. While riverine Si fluxes are predominantly controlled by mineral weathering and have been altered little by human activity. Thus, resulting changes in the ratio of N:P:Si can be expected to yield a succession of phytoplankton assemblage such as displacement of diatoms by other phytoplankton species and consequently affect primary productivity in coastal waters. In order to elucidate the impact of changing nutrient inputs on plankton productivity in the coastal water, characteristics of riverine inputs of N, P and Si to the coastal zone, effects of damming of a major river on nutrients fluxes, and responses of phytoplankton growth and relative species abundance to changing N:P:Si supply ratio have been studied in an enclosed Hamana Bay.

In Miyakoda River, a major river system flowing into the Hamana Bay, concentration of dissolved nutrients and ratio of N, P and Si were perturbed by N and P discharge from human activity and phytoplankton nutrient consumption at Miyakodagawa-dam reservoir. Low P flux relative to N and Si seems to make phytoplankton production toward P limitation in the Hamana Bay. Nutrient enrichment incubation experiments using natural phytoplankton assemblage of the Hamana Bay revealed that decreasing flux of Si relative to N and P would increase abundances of dinoflagellates and prymnesiophytes. The N:P:Si consumption ratio varied with phytoplankton growth phase and diatoms took up silicate even after the N depletion suggesting resting spore formation. Diatoms showed some growth under P limitation, probably by using P stored in the cells.