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Are benthic fluxes important for the availability of Si in the Gulf of Finland?

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Abstract

We estimated the efflux of dissolved silicon (DSi) from sediments in the Gulf of Finland and compared it to sedimentation fluxes, burial of Si and existing data on Si loading and stocks, reassessing the reliability of existing Si budgets. Benthic fluxes of DSi measured *in situ* and *in vitro* were several times higher than estimates from diffusion calculations. The spatial variability in the open Gulf of Finland was relatively small, while both very high and low fluxes were measured from coastal areas. Fluxes were highest in late summer and lowest in early spring. In our re-assessed budget we present a new lower estimate for Si burial in the sediments, ca 6 Gmol a^{-1} and show that more than half of the sedimentation flux of Si is released back into the water column. Changes in the efficiency of internal DSi recycling may thus affect the prevalence of siliceous phytoplankton within the ecosystem, and the diatom spring bloom may be regulated by the functioning of this internal recycling pump. We also show that the seasonal variation in benthic DSi fluxes and dissolved phosphate fluxes is similar, and that a tentative connection between hypoxia and high DSi efflux exists.

Keywords

Silicon, sediment, Baltic Sea, benthic flux

1. Introduction

The supply of silicon (Si) is an important qualitative factor for the phytoplankton communities in most water bodies. If Si is available in sufficient amounts, Si-requiring phytoplankton, mainly diatoms (Bacillariophyceae), may be one of the most prolific primary producers (e.g. Willen 1991, Reynolds 1994). As cold-water specialists, diatoms generally