Silicate-induced phosphate release from surface sediment in eutrophic lakes

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With 5 figures and 5 tables

Abstract: The magnitude and implications of Si-induced release of P from surface sediment in eutrophic lakes from Southern Finland was studied by means of laboratory experiments and field observations. In the laboratory experiments, the impact of different-sized additions of dissolved Si (0–50 mg/l sed. Si) on the desorption of P in four lake sediments was quantified with the aid of linear regression. Additions of Si principally seemed to induce release of P (max. 300 µg/l interstitial water) adsorbed to Fe-oxides, and the magnitude and pattern of the process was thus mainly governed by the availability of Fe-oxides and of P adsorbed to these. In the sediments relatively richer in Al-oxides, resorption of released P occurred, diminishing the Si-induced effects at the lower concentrations of added Si. The field data on the temporal variation in the dissolved Si concentration and diatom composition of the water column in three lakes was used to estimate the potential maximal size of the Si pulses reaching the sediment in situ (28–97 mg/l sed. Si). When the regressions from the laboratory experiments were combined with these Si pulses and with data on the dissolved P in the water column, estimates for the Si-induced release of P from the surface sediment into the water column (0.2–1.4 mg m⁻² d⁻¹ P) were obtained (with Fick’s Law). These Si-induced P fluxes may be of local and temporal significance in eutrophic lakes with sediments rich in Fe-bound P, particularly if massive diatom and cyanobacterial blooms accompanied by high pH values occur.

Key words: Nutrient release, interstitial water, resorption, Si-pulses.

Introduction

The influence of silicate on the desorption of phosphate in the sediment surface layer has recently been proposed as a potential influence on the internal

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