

New sources to create elevated concentration of phosphate in tidal flats: demonstration through rock weathering experiments and field observations

Nagata Kohyoh¹, *Muneoki Yoh¹

1. Tokyo University of Agriculture and Technology

The estuary is known to be rich in biological production. It is generally thought that this biological production is supported by nutrients or organic matter from upstream, but little scientific knowledge is available on its causal relationship. In this study, we examine a new hypothesis that phosphate may be supplied from soil particles under anoxic conditions to support biological production in the estuary through weathering experiments and field observations. In a weathering experiment, in which ground parent rock was aerated with CO₂, an increase in phosphate concentration was observed with a concomitant increase in SiO₂ concentration. This indicates that the soil particles release phosphate when subjected to weathering under anoxic conditions. Addition of the reducing agent (hydroxylammonium chloride) accelerated the increase of phosphate concentration and Fe²⁺ concentration, indicating that phosphate is also liberated by the reduction and dissolution of iron (hydroxide) under anoxic conditions. On the other hand, when tidal flat sediment was used as the material, the phosphate concentration did not increase but with the increase in SiO₂ concentration. This is probably because the tidal sediment had already almost completely released phosphate due to weathering. That is, newly deposited soil particles have a higher phosphate supply capacity than old sediments. From the above, it was found that soil particles could be a new source of phosphate under anoxic conditions. A 24-hour field observation was conducted to monitor the inflow and outflow of phosphorus, Fe²⁺, and suspended particles at the exit of a tidal creek of Obitsu River (Chiba Prefecture). The outflows (during ebb tide) of TP (total phosphorus), phosphate, Fe²⁺, and suspended particles were larger than the inflows (during rising tide). This suggests the occurrence of net phosphate production in the tidal flat, which was further utilized to primary production by benthic algae. In this study, it was shown that the active biological production in estuary environments is promoted by phosphate generated in situ from soil particles under anoxic condition.

Keywords: phosphate, tidal flat, biological production

Table.1 干潟におけるフラックス

	流入	流出
TP($\mu\text{mol}/\text{m}^2/\text{day}$)	152	380
リン酸($\mu\text{mol}/\text{m}^2/\text{day}$)	90.9	147
Fe ²⁺ ($\mu\text{mol}/\text{m}^2/\text{day}$)	22.9	32.1
懸濁粒子($\text{g}/\text{m}^2/\text{day}$)	1.93	4.38