Silicon cycling by plant and its effects on soil Si translocation in a typical subtropical area

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To understand how plant Si links with soil Si during soil development, the biomass of distinct plant species and geochemical parameters were studied in three typical watersheds in subtropical China. Si contents of soil, plant and water, as well as Si cycling fluxes among them, were determined. The main soils derived from granite are Orthents, Udepts and Aquepts with ample easily-weatherable silacate minerals. The main plant species are coniferous trees (pine and fir), bamboo, rice, shrubs and grass.

The Si contents are significantly different in the different plant species, ranging from 0.07 g kg^{-1} to 42.62 g kg^{-1}. The adsorption of Si in different plants was 27-11347 mol ha^{-1} yr^{-1} in which rice has the biggest rate, as 3.3 times as bamboo, and is 1-3 orders of other plants. The amount of returned Si from plant to soil was 21.8-9887 mol ha^{-1} yr^{-1}. Therefore, plants play an important role in the Si cycle.

Because of plant-mediated Si, the mineral weathering was accelerated. The weathering rate of silicate was 2750 -5227 mol ha^{-1} yr^{-1} of Si if plant uptake is considered. The contribution of plants for Si release from silicate was 34-67 % in this area.

The net output Si by streams were 1654 - 1744 mol ha^{-1} yr^{-1}. There were no significant difference of Si contents in the stream water and hydrologic output among the three watersheds. Therefore, unlike strong weathering environment in tropical areas[1], Si cycling by plant in a context with abundant primary minerals does not dominate Si loss from soil system.

Plants absorbed water-soluble Si from deep layers and returned phytolith-Si to surface, leading to Si redistribution in the soil profiles. Surface soils under the non-Si enriched plants showed desilification, while under Si enriched plants showed re-silification due to different returned amount of phytolith-Si.

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[1] Derry *et al*. (2005) *Nature* **433**,728-731.