Sulfate pools in the weathered substrata of a forested catchment

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The mitigating effect of decreasing anthropogenic SO4 deposition on acidified soils and waters can be delayed by the release of previously stored soil SO4. We investigated SO4 pools and desorption in the weathered substrata (0.5-10 m depth) of a forested catchment on granite to quantify the importance of these layers to SO4 dynamics. Solid-phase materials from 10 boreholes to a maximum depth of 10 m were analyzed for water- and phosphate-extractable SO4, SO4 desorption, cation-exchange capacity (CEC), pH, and dithionite- and oxalate-extractable Fe (Fe-d and Fe-o) and Al (Al-d and Al-0). Seven of the investigated boreholes were used to monitor water table depth and to obtain samples for measurement of solution SO4 concentrations. The storage of phosphate-extractable SO4 in the weathered substrata was estimated at 90 kmol ha(-1), of which approximate to 50 kmol ha(-1) were water soluble, Sulfate pools and their desorption behavior were highly variable, which could partly be explained by the variation of pH and extractable Fe and Al contents of the samples, Sulfate concentrations in groundwater were dependent on the depth of groundwater table and corresponded with the depth gradients of solid-phase SO4. The SO4 pools of the substrata were apparently regulating solution concentrations. Thus, groundwater acidification in such aquifers will not be easily reversed by decreasing SO4 deposition because of the release of previously stored SO4.

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