Impacts of acid precipitation and agricultural activities on weathering rates in subtropical China

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Mineral weathering rate is affected not only by natural factors, but also strong human activities. To understand the effects of acid deposition and agricultural activities on silicate weathering, three adjacent watersheds, one forest watershed and two forest-agricultural watersheds located subtropical area, China, were selected. The precipitation, runoff, human input and output have been monitored for five years.The rock and soil were determined.

The results showed that the acid deposition is severe in this area. The H^+ of net direct input and nitrogen transformation from rain were 614-1620 mol ha^{-1} yr^{-1} in the forest watershed. However, the net input H^+ increased to 773-2028 mol ha^{-1} yr^{-1} and 1107-2303 mol ha^{-1} yr^{-1} in the watersheds (FA1 and FA2) with crop land 18% and 24 %, respectively, when the H^+ transformation from applied fertilizer was considered. The mineral weathering rates are 685±87, 754 ±90 and 800±104 kg ha^{-1} yr^{-1} in F, FA1 and FA2 watersheds, respectively, according to mass balance. It is higher in watersheds with agriculture than forest. Furthermore, the watershed has more weathering rate in the more percentage farmland. This is mainly attributed to the H^+ increase of nitrogen transformation from fertilizer. Although addition of H^+ could increase weathering rate, there are no significantly relationship between them. When the rainfall is introduced as another independent variable, there is a multiple linear regression equation among weathering rate, H^+ input and rainfall ($W=0.051x_{H+}+0.443x_{Rainfall}+11.1$, $R^2=0.746$, n=15).

Human have accelerate weathering rates due to bringing amount of proton in the air, rain and soil from industrial and agricultural activities. In a severe acid depostion subtropical area, rainfall and H^+ input are mian controlling factors of weathering rate.

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