Effect of dissolution of minerals on rapid rock weathering: An experimental study

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Water-rock interaction experiments, which have been carried out for specified purposes using different minerals and rocks under controlled conditions, were used to study the effect of dissolution of minerals on weathering of metamorphic rocks of different weathering grades. Samples of sillimanite-garnet gneiss were collected at the Samanalawewa hydropower plant site, southern Sri Lanka. Rock cubes with each side of 1 cm were placed in PE bottles with 500 mL distilled water for 200 days. Electrical conductivity (EC) and pH were measured, while solution was sampled for chemical analysis using ICP-OES. Surfaces of rock samples were observed using SEM-EDS before and after the experiment. EC of the solutions continuously increased and pH fluctuates between 3.5 and 4.5. Concentrations of Na, K, Al and Fe in the solutions promptly started to fluctuate indicating rapid dissolution of minerals such as feldspar and almandine, but the dissolution rates of Si, Ca and Mg were slower for all weathering grades. Trace elements, except Ni, did not show sign of dissolution. Depleted highly weathered rock dissolved a less amount of elements. Observation of surfaces of these minerals correlates with the dissolution of element and clearly indicates the depletion of elements during the water-rock interaction that lead would to rapid weathering.