

Effects of stream-water chemistry on weathering rates of limestone tablets

Tsuyoshi Hattajji[1]; Yukinori Matsukura[2]

[1] University of Tsukuba; [2] Inst. Geosci., Univ. Tsukuba

Karst landform created by solution of limestone is one of the major topics in geomorphology. Many geochemical studies highlighted mechanism of limestone solution with experiments in laboratory. Few studies, however, have associated solution rates in laboratory with in-situ weathering rates. The present study discusses effects of stream-water chemistry on weathering rate of limestone tablets, comparing weight-loss rate for a laboratory experiment with those for field experiments.

We conducted field experiments at two sites in central Abukuma Mountains: a spring of a granodiorite watershed (GD), and a weir of a limestone watershed (LS). Annual weight-loss rate of tablets for GD (3.3%/y) was 9 times larger than that for LS (0.36%/y). Calcite saturation indices based on concentrations of major cations, pH and alkalinity ranged from -2.6 to -2.8 for GD and from 0 to -0.2 for LS. This contrast of saturation indices between two sites should be the major cause for the difference in weight-loss rates.

An open-system apparatus was composed for the laboratory experiment, in which a solution flows at a low rate (~60 mL/d). Saturation indices of flowing solutions were arranged with those for each site, i.e., GD or LS. Although the weight-loss rate of tablets for LS was almost same as that for the laboratory experiment, the weight-loss rate for GD was 3 times larger than that for the laboratory experiment. The causes of this discrepancy would be (1) difference in CO₂ concentrations and, (2) physical detachment of tablets in the field site (GD).