

## An experimental study on the correlation between chemical weathering rate, physical weathering rate, and rock hardness

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Weathering of a rock in stream water often progresses by interplay between the weakening of grain boundary due to dissolution (chemical process) and the detachment of grains due to abrasion by water and collision of other rocks (physical process). Rock hardness is expected to be a controlling factor of these processes. The purpose of the present study is to understand how the chemical process and physical process are correlated each other and how these processes are affected by the rock hardness. Three Berea sandstone samples differing in hardness (Leeb hardness) were prepared. Each sample was soaked in water and a ball was repeatedly collided, and the way at which weathering progresses was monitored. Total weathering rate (physical weathering rate plus chemical weathering rate) was determined from temporal change in total weight of the sample. Chemical weathering rate was determined from temporal change in solute concentration in water. Physical weathering rate was calculated by subtracting the chemical weathering rate from the total weathering rate. The results showed that total weathering rate decreased with increasing rock hardness. The quantitative ratio of "physical weathering / chemical weathering" increased with decreasing Leeb hardness, and the physical weathering rates were 4-371 times greater than the chemical weathering rates. The physical weathering rate was found to be exponentially correlated to Leeb hardness.

Keywords: Chemical weathering rate, Physical weathering rate, Rock hardness