Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18984

Estimating the rates of chemical weathering of ultramafic rocks in small tropical watersheds

DAINTY CLARICE V. RABANG[1], JHONARD JOHN L. GARCIA[1], MARK M. TAN[1], RODRIGO C. ECO[1], CARLO A. ARCILLA[1], CARLOS PRIMO C. DAVID[1] AND DANIEL E. IBARRA[2]

[1]National Institute of Geological Sciences, University of the Philippines

[2]Department of Earth Environmental and Planetary Sciences, Brown University

Presenting Author: dvrabang@up.edu.ph

Silicate chemical weathering, combined with the subsequent carbonate burial in oceans, plays a vital role in the natural negative feedback mechanism between the atmosphere and the geosphere. Compared to other rock types, ultramafic rocks containing magnesium- and calcium- rich silicates such as olivine, pyroxene, and serpentines sequester CO_2 more efficiently during chemical weathering. Despite its high potential of atmospheric carbon consumption, the ultramafic chemical weathering rates and atmospheric carbon sequestration potential of tropical watersheds, like those in the Philippines, are poorly studied. Here, we present estimates of chemical weathering rates of 16 tropical ultramafic watersheds in Palawan, Philippines. The rivers draining these watersheds were monitored monthly over a year for their discharge, physico-chemical parameters, and major and minor geochemistry. Chemical weathering rates were estimated by quantifying the fluxes of cations and bicarbonate. The watersheds are mainly composed of harzburgite and dunite bedrock covered by nickel laterite soil of up to 30 meters in thickness. The streams are magnesium-bicarbonate type and slightly basic due to their interaction with the ultramafic soils and bedrock. Concentration-discharge relationships reveal that the watersheds behave chemostatically, with the runoff acting as the primary control for the bicarbonate fluxes. Overall, we show that the chemical weathering fluxes of Mt. Bulanjao streams are comparable to the other rivers draining ultramafic areas in Luzon Island, Philippines and California. Mt. Bulanjao's carbon consumption (5.9×10^6 mol/km^2/yr) is roughly 20 times higher than the average area-normalized global CO_2 consumption rate (2.5×10^5 mol/km^2/yr). This demonstrates the significance of ultramafic rock weathering in the context of the global carbon cycle.