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Exploring riverine chemical fluxes and weathering processes in Sarawak, Malaysia Borneo

CHRIS TSZ LONG CHEUNG[1], RYAN MCKENZIE[1], BRIAN BEATY[2], SHARVEEN RAVICHANDRAN[3], ABDULMAJID ALI MUHAMMAD[3], NOAH J. PLANAVSKY[2] AND RAMASAMY NAGARAJAN[3]

[1]University of Hong Kong
[2]Yale University
[3]Curtin University Malaysia

Presenting Author: ctlc@connect.hku.hk

The weathering of silicate minerals on continents regulates atmospheric CO_2 over multimillion-year timescales. An important means to study silicate weathering processes is via the study of river chemistry. Southeast Asia features some of the most favorable conditions for chemical weathering on Earth's surface; however, river systems in this region remain poorly studied. Here, we present new elemental, Li isotopic (δ^7Li), and clay mineralogical data from 22 riverine localities across the state of Sarawak, Malaysia, Borneo. Our results show that, for samples east of the Lupar Line, a strong negative correlation between dissolved Li concentrations and isotopic (δ^7Li_{diss}) values is present ($r^2 = 0.66$). Western samples in Sarawak show a very weak positive correlation ($r^2 = 0.13$). Moreover, the dissolved load features high variability in isotopic compositions (δ^7Li_{diss} = +11.4 to +33.7 ‰) when compared to the lower spread in the suspended load (δ^7Li_{susp} = -4.2 to +3.2) across all sampling sites. There is also a moderate to low negative correlation between δ^7Li_{susp} and δ^7Li_{diss} ($r^2 = 0.41$) where heavier dissolved values correspond with lighter suspended values. This indicates that the primary control on δ^7Li_{diss} values in Sarawak is the uptake of the lighter ^6Li isotope during silicate weathering and secondary clay formation. The largest river in Sarawak, the Rajang River, features the heaviest δ^7Li_{diss} value at +33.7 ‰. This is markedly heavier than the currently known global riverine average of +23 ‰ [1] and notably closer to the global seawater value of +31 ‰ [2], thus highlighting the potential for Southeast Asian rivers to deliver heavy Li isotopes to the ocean.

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[2] Misra, S. & Froelich, P. N., 2012, Lithium Isotope History of Cenozoic Seawater: Changes in Silicate Weathering and Reverse Weathering: Science, 335, 818-823.