

Multiproxy investigation of ophiolite weathering in the Indo-Burma range of northeast India

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The weathering of silicate minerals regulates climate on million-year timescales. Ophiolites, which consist of obducted oceanic crust, host a suite of ultramafic-mafic rocks that are more susceptible to chemical weathering than more felsic rock types. Accordingly, ophiolite weathering may have influenced climate in deep geologic time. The lithium and strontium isotopic composition of rivers and ancient marine deposits ($\delta^7\text{Li}$ and $^{87}\text{Sr}/^{86}\text{Sr}$) have been used to trace silicate weathering on a range of timescales. These two isotopic proxies record different aspects of weathering processes. While crustal rocks show a narrow range of $\delta^7\text{Li}$ values, preferential incorporation of ^6Li occurs during secondary clay mineral formation from incongruent weathering leaving riverine dissolved load enriched in ^7Li . Radiogenic ^{87}Sr is enriched in the relatively older continental crust compared to juvenile oceanic crust and has been used to track continental weathering. Here we present new geochemical data collected in tributaries of the Irrawaddy River basin with sources in the Nagaland-Manipur Ophiolite Complexes of the Indo-Burma range, northeastern India. We test the hypothesis that the weathering of ultramafic terrains generated by arc-continent collisions yield high weathering rates and can drive rapid atmospheric carbon drawdown. We collected river water, bedrock, bedload, and suspended sediment to measure major cations, anions, trace elements, $^{87}\text{Sr}/^{86}\text{Sr}$, $\delta^7\text{Li}$, and clay mineralogical compositions to gain insight into silicate weathering processes in the region. Our samples yield $\delta^7\text{Li}_{\text{diss}}$ values that range from ~21 to 31‰, markedly heavier than the global riverine average of ~23‰, while our $^{87}\text{Sr}/^{86}\text{Sr}$ values range from 0.7061-0.7114 placing them below the global Sr riverine average of 0.7119. Our $\delta^7\text{Li}_{\text{diss}}$ measurements indicate that rivers draining ultramafic lithologies in warm humid climates are likely experiencing higher degrees of chemical weathering intensity and clay mineral formation yielding anomalously high $\delta^7\text{Li}$ values compared to other drainages comprised of more felsic lithologies. Additionally, these juvenile mafic lithologies are reflected in the relatively lower $^{87}\text{Sr}/^{86}\text{Sr}$ ratios due to the age of the bedrock.