Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.38262

Controls on riverine $\delta^{41}K$ in tropical silicate weathering systems

GIANCARLO DEFRANCESCO[1], RYAN MCKENZIE[2,3], WINNIE XUEFEI FAN[4], FANG-ZHEN TENG[4], CHRIS TSZ LONG CHEUNG[1] AND ZHENGWEI LIANG[5]

[1]The University of Hong Kong
[2]University of Hong Kong
[3]Swire Institute of Marine Sciences
[4]University of Washington
[5]East China Institute of Technology

The weathering of silicate minerals plays a key role in atmospheric CO_2 draw-down over geologic time. Low latitudes are ideal regions for enhanced chemical weathering due to warm temperatures and ample precipitation. Lithium isotopes (δ^7Li) are an established proxy used to track weathering processes in geologic time. Recently, potassium isotopes ($\delta^{41}K$) have been proposed as a potential alternative to δ^7Li as they are both fractionated by clay mineral formation during incongruent weathering. However, $\delta^{41}K$ exhibits potential advantages over δ^7Li with a narrower crustal isotopic range, an increased natural abundance, and low affinity for absorption. Unlike ^6Li, the lighter ^{39}K is primarily incorporated into illite over other secondary clay minerals, leaving the upstream dissolved load isotopically heavier due to illite's ability to form quickly in high relief environments with short residence times and at lower temperatures than other clay minerals. Floodplain environments with lower relief, higher precipitation, and higher temperatures support the formation of other clay groups, leaving the relative abundance of illite lower than upstream counterparts and lowering the $\delta^{41}K$ value. Here, we report new riverine $\delta^{41}K$ dissolved load data in the context of δ^7Li values of the same samples from Southeast Asian rivers that encompass various lithologic and morphological environments to refine the utility of these proxies. Our $\delta^{41}K$ values range from -0.65 to +1.95‰, with numerous samples well above the global riverine average of -0.38‰. We also observe a disconnect between $\delta^{41}K$ and δ^7Li within some watersheds. While some localities yield low $\delta^{41}K$ and high δ^7Li values, others samples yield low $\delta^{41}K$ and low δ^7Li values, indicating other controls on the proxy signals such as basin relief and watershed lithology may play a larger role than currently hypothesized.