

No REE fractionation in an intensely humid tropical lake catchment developed over Deccan Traps, India

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Rare Earth Elements (REE: La–Lu) behave coherently during earth-surface processes and hence are widely used for the provenance of different earth materials. The fractionation of REE during basalt weathering and sedimentary processes is underexplored. To determine the degree of REE fractionation, the bedrock outcrops ($n = 16$), surface soils ($n = 43$), and aquatic sediments ($n = 43$) were collected from a small monolithic catchment (Dhom Lake, Raigad). The lake catchment (area 4.9 km^2) is situated in the deeply weathered Konkan coastal belt, Deccan Traps, India. The bulk materials were pulverized, acid-digested, In-doped, and later geochemically characterized using Q-ICPMS at IISER Bhopal. The sub-alkaline basaltic composition of bedrock samples is confirmed by the scatter plot of Nb/Y vs Zr/TiO₂. The surface soils (CIA ~ 44 –86 (mean 62), WIP ~ 13 –62 (mean 37)) and aquatic sediments (CIA ~ 45 –95 (mean 70), WIP ~ 8 –54 (mean 27)) are the first-cycle weathered products as suggested by a statistically significant inverse correlation of CIA–WIP ($r = -0.95$, $p < 0.0001$). No REE fractionation in these weathered products is evident from the bedrock-normalized flat REE pattern plots having insignificant geochemical anomalies ($\text{Ce}_N/\text{Ce}^* \sim 1.10 \pm 0.13$ and $\text{Eu}_N/\text{Eu}^* \sim 1.00 \pm 0.04$). The statistically significant correlations of ΣREE –CIA ($r = 0.67$, $p < 0.0001$), ΣREE –HFSE ($r > 0.5$, $p < 0.05$), ΣREE –Fe₂O₃ ($r = 0.63$, $p < 0.0001$), and ΣREE –TiO₂ ($r = 0.86$, $p < 0.05$) indicate the incorporation of REE in the weathered products owing to relative enrichments of weathering-resistant heavy minerals such as ilmenite. A poor ΣREE –Al₂O₃/TiO₂ correlation ($r = 0.28$, $p < 0.05$) suggests a negligible control of grain-size sorting. This exercise highlights no REE fractionation during basalt weathering and grain-size sorting in contrast to that observed elsewhere.