The variation of Sr isotopes ($^{87}Sr/^{86}Sr$ and$\delta^{88/86}Sr$) in river waters after Typhoon Morakot at a small catchment, southwestern Taiwan

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Radiogenic Sr isotope ($^{87}Sr/^{86}Sr$) is a robust tool for provenance identification in hydrology, affected mainly by chemical weathering and climatic changes. Owing to technical improved MC-ICP-MS, stable Sr isotopes ($^{88}Sr/^{86}Sr$) in natural materials have become available recently. In this study, weekly river waters, bed loads and suspend particles were collected through dry and wet season from a small drainage catchment (161 km^2), Hou-ku River in southwestern Taiwan, to study effects of intense rainfall event (2000 mm/3 days, Typhoon Morakot). Dissolved major/trace elements, hydrogen, oxygen, and strontium isotopes ($^{87}Sr/^{86}Sr$ and $\delta^{88}Sr$) in river waters were measured to investigate changes on chemical and isotopic characteristics after the typhoon events. For a better constrain on the end member compositions, carbonate phases were chemically removed before acid digestion. Radiogenic and stable Sr isotopes in carbonate and residual phases were measured precisely. Dissolved major elements indicates that the watershed was predominated by silicate weathering, but trended toward carbonate weathering after the rainfall. This event causes all elemental concentrations to drop; however, respective element/chloride ratios were increased 2 to 10 folds. High dissolved $^{87}Sr/^{86}Sr$ was evident in dry season, but low ratio after the rainfall event. Both carbonate and residual phases show higher radiogenic Sr isotopes in the suspend particles (0.70987 – 0.71043 and 0.72591 – 0.72729, respectively) than the bed loads (0.70954 – 0.71013 and 0.72047 – 0.72134, respectively). Stable Sr isotopes show no significant variation ($\delta^{88}Sr$ = 0.24 – 0.31 ‰) after the event. However, all solids show lower $\delta^{88}Sr$ (0.05 – 0.17 ‰) than the river waters, preferential leached of heavier Sr. In summary, the extreme rainfall event did not alter Sr isotopes ($^{87}Sr/^{86}Sr$ and $\delta^{88}Sr$) in river waters; contain higher stable isotopes than the associated sediments.

Mg isotopes: Insights into weathering in a tropical volcaniclastic regolith

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Mg is an important constituent of silicates and a major nutrient and its stable isotopes have been shown to fractionate during geochemical and biological reactions. Mg isotope ratios therefore hold promise as a useful tracer of (bio)geochemical processes in the critical zone. We present preliminary results on the Mg isotopic composition of porewater and stream water (baseflow and stormflow), along with elemental data from depth profiles (1.0 - 9.3 m) in bulk regolith and exchangeable cations taken at 4 sites along a topo-sequence in a well-constrained catchment over volcaniclastic bedrock at the Luquillo Critical Zone Observatory, Puerto Rico..

Mg and K concentrations corrected for rain input and evapotranspiration indicate weathering contributions to pore water solutes. Pore water concentrations are relatively invariant with time below 0.5 m depth (2.0 m depth in the deepest profile). Above these depths, Mg concentrations vary in space and time, with all profiles showing overall higher concentrations in the surface layers, suggestive of biological influence. In contrast, $\delta^{26}Mg$ values in the deepest profile show a clear trend towards heavier $\delta^{26}Mg$ with increasing depth (-0.83‰ to -0.18‰) suggesting mixing between atmospheric Mg at the surface and a dissolving, isotopically heavier phase at depth. An excursion towards heavier $\delta^{26}Mg$ at the soil-saprolite interface (-0.7‰, ~1m depth) indicates a change in controlling processes. A similar heavy excursion is present at the same depth in 3 of the 4 profiles.

Stream water at baseflow is isotopically heavier than the pore waters and becomes progressively lighter with increasing stage. These results may indicate that watershed export of Mg is dominated by deep-weathering processes during baseflow with contributions from rain and shallow soils during storms.

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