A Budget of Radiogenic Calcium in Himalayan Catchments

JESSE DAVENPORT*[1], GUILLAUME CARO[1] AND CHRISTIAN FRANCE-LANORD[1]

[1]CNRS-CRPG, 15 rue Notre Dame des Pauvres, 54500 Vandœuvre-lés-Nancy, France

An important region where climate-tectonic interactions can be seen firsthand is the Himalaya. Here, the interplay between these processes creates a scenario that is pivotal to the understanding of Earth surface dynamics. Despite decades of research in this region, key questions remain such as the magnitude of silicate versus carbonate weathering and the magnitude of organic carbon burial and silicate weathering as sinks of CO_2 in the Himalaya.

Approaches to scale silicate weathering using Sr isotopes are uncertain due to the geochemical and petrological nature of Himalayan lithologies that have experienced metamorphism, exchanging radiogenic Sr between silicates and carbonates. Using the ^{40}K-^{40}Ca isotopic system was considered as a solution to circumvent this unusual geochemistry because analyses of carbonates, both outisde of and from within the Himalaya, show no radiogenic enrichments in ^{40}Ca whereas silicates, contingent upon their age and K/Ca ratio, show radiogenic enrichements. Thus, the clear delineation between a carbonate signal (at ε^{40}Ca = 0) and a completely independent silicate signal lends us the ability to trace the evolution between silicate and carbonate in the dissolved load from source to sink.

To this end, along with significant improvements in mass spectrometry, we have analysed a suite of 40 rivers draining the main litho-tectonic units of the Himalayas. Our results show that Himalayan carbonates/dolomites exhibit no radiogenic ^{40}Ca excess despite highly variable ^{87}Sr/^{86}Sr signatures ranging from 0.73 to 0.85. The silicate fraction of bedload sediments is variably radiogenic from +1 to +4, with ε^{40}Ca roughly correlating with the ^{87}Sr/^{86}Sr ratio. The dissolved load ranges from +0.1 in carbonate dominated catchments to ~+12 ε-units in rivers draining predominantly silicate formations of the Lesser Himalaya. Both the major element and ^{40}Ca budgets are ambigous due to questions of end-members and secondary carbonate precipitation. Budget calculations show that the ε^{40}Ca variability of the silicate end-member hampers accurate derivation of silicate weathering fluxes/rates.