Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.6882

Tectonic and climatic controls on riverine uranium isotope

LAIFENG LI[1], LAURA F. ROBINSON[2], HELENA V. PRYER[2], JEMMA L. WADHAM[2], KATHARINE R. HENDRY[3], JAMES WARD[3] AND GAOJUN LI[1]

[1]Nanjing University

[2]University of Bristol

[3]School of Earth Sciences, University of Bristol

Presenting Author: lilaifengnju@126.com

Riverine uranium isotopes are widely used to trace weathering processes. A variety of factors, including tectonic uplift, physical erosion, rainfall, lithology and glacial cover have been proposed to explain uranium isotope disequilibrium. However, even in catchments with similar physical erosion rates, rainfall and lithology, variations in disequilibrium make it challenging to determine the controlling mechanisms.

Here we present uranium isotope data from Patagonia and Chilean rivers (from 33° S to 49° S) to further explore the disequilibrium associated with tectonic activity and climate on riverine uranium isotopes. Patagonia and central Chile have contrasting tectonic settings and stark climate gradients, providing a unique natural laboratory. Our results show that the catchments with high rainfall and/or significant glacial cover have uranium isotope values close to secular equilibrium indicating a short residence time of river water and congruent weathering of bedrock under high rainfall and/or significant glacial cover. Meanwhile, the correlation between riverine uranium isotopes and slope for catchments with low rainfall is more complicated, with high uranium isotope ratios observed at both high and low slopes. The high uranium isotope ratios for catchments with low slope could result from the long residence time of river water, thus the accumulation of ^{234}U through α recoil ejection. By comparison, active tectonics and higher slope could produce more fresh rocks that contain abundant decay-damaged lattice sites whose dissolution would release more ^{234}U to river water, thus generating the high uranium isotope value.

These complex tectonic and climatic controls on riverine uranium isotope are considered in a wider context to improve our understanding of weathering processes and the uranium isotope record of seawater.