

Mountain building and the geologic carbon cycle: The erosion-hydrology-weathering nexus

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The role of tectonics in steering the evolution of Earth's environment remains debated. For over a century, one of the leading hypotheses for the origin of glacial episodes is that increased erosion associated with orogenesis caused greater rates of removal of carbon into the rock reservoir, via chemical weathering. A number of intriguing twists have been proposed, including the possibility that hydrological response to uplift and exhumation plays a key role. This talk will focus on what we can learn from studies of erosion, hydrology, and biogeochemistry in present-day active orogenic systems, seeking to reveal how carbon cycle fluxes respond to mountain uplift and erosion. Results from two specific sites will be presented — one in the eastern Andes of Peru, and another in the Himalaya of Nepal — followed by a new global synthesis. Taken together, these point to the importance of considering the multiple fluxes in the carbon cycle, beyond silicate weathering alone, and their response to uplift and erosion. In many cases in the present day, the carbon fluxes associated with organic material and the oxidation of sulfide minerals appear most responsive to erosion — suggesting the need to look behind silicate weathering when considering the role of mountain building in the evolution of long-term climate.