Investigating the modern and paleo-weathering regimes of sedimentary deposits using boron isotopes

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Chemical weathering is an Earth-shaping process in terrestrial landscapes that responds directly to tectonics and climate. However, due to the complexity of its interactions with climate and current limitations of traditional geochemical methods, it is difficult to determine how chemical weathering responds to climate over millennial timescales.

The use of isotopic proxies in sedimentary records like boron (B) isotopes may be used to understand how clay formation, and by proxy, pedogenesis has responded to past climatic variations. This is because B isotopic fractionation only occurs during precipitation of secondary products, while primary cogenetic minerals have very similar $\delta^{11}B$ values and can be used as source tracers [1]. To interpret sedimentary records, we need to understand how the signal is transferred from where isotopic fractionation occurs to the depositional environment. In the present study, we analyze sedimentary deposits along the course of the modern Murrumbidgee River, NSW Australia, and in adjacent paleochannel systems (deposition ages: 12 – 100 kyr) using boron isotopes ($\delta^{11}B$) in bulk, sand-, and clay-sized fractions.

Results from the modern system collected to date indicate an increase in B isotope fractionation in clay-sized minerals along the course of the river, likely resulting from more intense weathering conditions on the alluvial plain. Paleochannel deposits will be used to explain how chemical weathering conditions have varied over the last glacial cycle in response to climate.

[1] Lemarchand, D., et al. (2012) Geochim Cosmochim Ac **98**, 78–93.