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The pervasive control of large river floodplains over the global dissolved Li isotope flux to the oceans

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During the last (two) decade(s), lithium (Li) and its isotopes have facilitated a mechanistic understanding of chemical weathering and the resulting formation of secondary weathering products under various environmental conditions (Pogge et al., 2017). Lithium is mainly hosted in silicate minerals (Kisakürek et al., 2004) and its two stable isotopes (^{7}Li and ^{6}Li) are largely fractionated during chemical weathering processes. Secondary weathering phases preferentially incorporate ^{6}Li, leaving the dissolved load enriched in ^{7}Li. This results in a systematic isotope difference between the dissolved and solid loads transported by rivers, and bedrocks (eg., Dellinger et al., 2015).

Controls by both water and solid residence times have been invoked to explain the extent of incorporation of Li into secondary weathering product in catchments. However, a yet overlooked characteristic of the Li isotope systematic is the distinct isotope fractionation pathways occurring in 1) purely mountainous or lowland , relatively small catchments and 2) largest rivers featuring floodplains, which are places where weathering-derived materials reside for longer timescale (Dellinger et al., 2015).

To fill this gap, we report dissolved Li content and isotope composition for a set of some of the world largest rivers, covering various climatic conditions and geomorphological settings. We demonstrate that extensive secondary weathering processes fractionating Li isotopes occur in the floodplains of the world's largest rivers. Furthermore, this additional Li uptake in floodplains is the main driver of riverine Li isotopes, virtually obscuring riverine Li isotope signatures inherited from pure mountain and lowland weathering environments. This finding emphasizes how chemistry of large rivers cannot be the simple weighted sum of the weathering signals from their tributaries. Future work should focus on how Li isotope fractionation mechanisms (e.g., phases incorporating Li) in floodplains might be specific to these environments.

Dellinger et al. (2015), *Geochim. Cosmochim. Acta* 164: 71–93

Kisakürek et al. (2005), *Earth and Planetary Science Letters*, 237(3): 387–401

Pogge von Strandmann et al. (2017), *Geochim. Cosmochim. Acta*: 198, 17–31