Potassium isotopes in major world rivers: Implications for weathering and the seawater budget

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High-precision measurements of K isotopes were not available until recently [1-3]. The largest fractionation observed so far among major Earth reservoirs is between the Bulk Silicate Earth (BSE), defined by basalts, and seawater. The δ^{41}K composition (relative to NIST SRM 3141a) of the BSE is −0.48±0.03‰, while seawater is 0.10±0.07‰. There is no satisfying explanation yet for this ~0.6‰ difference between the BSE and seawater. Rivers are one of the major K inputs to seawater with an estimated annual flux of 1.5 Tmol of dissolved K [4]. However, there are no K isotope data of river water yet. In this study, we survey major world rivers and provide an estimate of the global riverine input of K isotopes in order to understand the seawater budget.

We selected 16 samples from global rivers: the Biobio, Brahmaputra, Congo, Danube, Fly, Ganga, Indus, Itata, Kikori, Mississippi, Pearl, Purari, Red, Rhine, St. Lawrence, and Yangtze rivers. These rivers drain parts of all continents except Antartica and were selected to include a broad range of river basin characteristics. Combined, these rivers account for ~13% of the annual global river input to seawater in term of discharge. We also studied samples of the Fraser River, B.C., Canada, collected monthly from the same location over two years to assess temporal variations in K isotopes. All samples were first filtered through 0.45 micron filters and passed through ion exchange columns before being analyzed using a NEPTUNE Plus MC-ICP-MS [5]. We observed significant K isotopic fractionation ranging from −0.58±0.03‰ to −0.11±0.04‰ in our river survey samples, but no resolvable K isotope variations in the Fraser River time series. Results and implications will be presented at the conference.

[1] Wang and Jacobsen (2016) *Geochim. Cosmochim. Acta* **178**, 223-232. [2] Li *et al.* (2016) *J. Anal. At. Spectrom.* **31**, 1023-1029. [3] Morgan *et al.* (2018) *J. Anal. At. Spectrom.* **33**, 175-186. [4] Garrels and Mackenzie (1971) *Evolution of Sedimentary Rocks*. [5] Chen *et al.* (2018) *Geostand. Geoanalytical Res.* in review.