Geochemistry of Lithium in the Ganga (Hooghly) River estuary, India: Solute-particle interaction and implications for seawater Li isotope composition

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Measurements of Li and major elements were carried out in the dissolved and particulate phases of samples that were collected over six periods for two years (2012 and 2013) from the Ganga (Hooghly) River estuary. The dissolved Li concentrations show conservative behaviour in the estuary. However, the fractions of exchangeable Li in the particulate phases show a linear increase with salinity. This result, coupled with the observation that Li shows significant to strong positive correlation with Fe and Mn in the particulate phases, suggest that ion-exchange between the dissolved phases and the clay minerals and Fe-Mn oxyhydroxides may be important in the geochemical cycling of Li in the estuary.

As implied by the conservative beahviour of dissolved Li, the solute-particle interaction does not seem to be important in modifying the dissolved Li fluxes from the Ganga River. However, given that fractionation of Li isotopes due to scavenging of Li from solutions is known to be significant, the solute-particle interaction may potentially change the isotopic composition of the dissolved Li being delivered to the oceans. An important implication of our results is that application of oceanic Li isotope composition (δ^7Li) as a tracer of silicate weathering on the continents would require an assessment of the impact of estuarine processes on δ^7Li of dissolved Li.

The dissolved Li flux from the Hooghly River estuary accounts for ~0.4% of the Li flux to the oceans from the global rivers. The dissolved Li contribution of the Hooghly River is about two times higher than its contribution (~0.2%) to the global river water flux. Measurement of δ^7Li is being planned in the dissolved, particulate and the exchangeable phases of the Hooghly River estuary samples to critically evaluate the role of the solute-particle interaction in modifying the riverine δ^7Li in the estuary.