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Tracing elemental release from estuarine particulates using metal stable isotopes

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Rivers are the dominant source of many elements to the ocean, supplying material in both dissolved and particulate forms [1]. In the estuarine environment riverine particulates may release elements through exchange or dissolution of labile phases, or remove elements through the formation of clays or carbonates. Radiogenic isotopes in estuarine waters point to release from particulates but these isotopes are dominated by mixing, and cannot identify the particular source [e.g. 2,3].

Here we present Sr, Nd and Fe stable isotope data for estuarine particulates and water from the Borgarfjörður estuary in Iceland. River waters possess low Fe and Nd concentrations, and are thus highly sensitive to loss or gain during estuarine transfer. Neodymium, Sr and Fe show variations in water that are inconsistent with simple conservative mixing with seawater or colloidal flocculation. Rather the dissolved concentrations of each show a substantial increase at the Maximum Turbidity Zone (MTZ) in the low salinity region of the estuary. Particulate concentrations are higher in the MTZ where the longer residence time of particulates facilitates the breakdown of labile material. Isotope and elemental shifts in the waters are consistent with particulates being the elemental source, where release from the exchange complex or constituent phases can be distinguished using their stable isotope composition [4]. Increased particulate concentrations at the MTZ are a common feature of many rivers [e.g. 5], and it remains to be seen how widespread such elemental release is in other rivers.

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