Beryllium Desorption from Sediments

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Beryllium isotopes have provided a useful tool in the field of geochronology and geomorphology over the last 25 years. The amount of cosmogenic meteoric ^{10}Be and native ^{9}Be absorbed to soils often scales with the residence time and chemical weathering of sediments in a landscape, respectively [2, 3]. Thus, the concentrations in river sediment may be used to quantify the denudation of specific watersheds [1]. When deposited in ocean sediment, these concentrations are thought to record the history of denudation on Earth over the last ~10 Ma. The use of both isotopes often relies on the premise of beryllium retention to sediment surfaces in order to preserve a landscape's erosion and weathering signature. Changes in setting, *en route* from the soil to fluvial system to the ocean, can cause beryllium desorption and may preclude some applications of the $^{10}Be/^{9}Be$ system.

We find that four major processes increase the mobility of beryllium in solution after absorption including: a reduction in pH, an increase in ionic strength and complexation with soluble organic and inorganic species. By both reducing the pH and increasing the ionic strength, competition for adsorption sites increases, liberating beryllium from the sediment surface. In addition, organic and inorganic ligands can complex beryllium causing it to be mobilized. To test which of these properties affect beryllium desorption and to quantify the effect, we prepared separate solutions of beryllium bound to minerals, organic matter, and natural well-described soil samples and measured solute Be concentration before and after adjusting the pH, ionic strength, and inorganic and organic ligand concentrations.

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