The stable vanadium isotope composition of the bulk silicate Earth

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We have developed the first analytical method capable of producing accurate stable vanadium isotope ($^{51}V/^{50}V$) compositions to a precision useful for geologic problems [1, 2]. Vanadium exists in multiple valence states (V^{2+}, V^{3+}, V^{4+}, V^{5+}) and its partitioning is directly related to changing oxidation states. Stable vanadium isotopes are expected to respond to oxidation-reduction processes, although this has yet to be demonstrated. USGS reference materials display significant, resolvable isotope variation [2] and the system appears to have great potential for a variety of geologic applications including studies of oceanography, igneous petrology, oxygen fugacity, cosmochemistry, and hydrocarbon genesis. The first step to enable the application of new 'non-traditional' stable isotope systems is to estimate and define the bulk silicate earth (BSE). Here we present measurements of peridotites, suites of Mid-Ocean ridge basalts, picrites and other primitive mantle-derived magmas to permit an initial estimate of BSE. Our results support an analytically significant difference between terrestrial and extraterrestrial material [2, 3].

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Mechanisms controlling the release, transport and attenuation of mercury in riverine sediments

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The release and transport of Hg at industrial sites are controlled by a complex series of interrelated physical and biogeochemical processes. This study evaluated mechanisms controlling the release and transport of soluble and particulate forms of Hg from contaminated river sediments and the effectiveness of amending the sediments with reactive media to stabilize Hg. The sediment was characterized using sequential extractions and synchrotron radiation based techniques. Long-term column experiments, 6-8 months in duration, were conducted under variable flow conditions. During the early stages of the experiments, concentrations of Hg in the column effluent increased sharply after periods of flow stagnation, whereas, during later stages, the releases were lower and spikes were not observed after stagnations. The observed releases were not correlated to the masses of Hg released in the sequential extraction analyses. Reactive media, including clay, C, S and Fe bearing media, were added in batch style experiments as single-media additions or in combinations. Amendment of the sediments reduced the aqueous Hg concentrations by 50 to >99%. Under continuous saturated flow conditions, concentrations of Hg in the column effluent were maintained in the low ng L^{-1} range for the amended sediment. Following periods of stagnation, concentrations of Hg increased in the column containing the unamended sediment and the sediment amended with clay, whereas sediment amended with C, S, and Fe bearing media showed no increases. These results indicate that large decreases in Hg concentrations can be achieved under varying flow conditions through the addition of reactive media.