The vanadium isotopic composition of the BSE: constraints from peridotites and komatiites

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In order to apply vanadium (V) isotopes to studies of accretion and evolution of the solar system[1] and redox variation of the terrestrial Earth, it is important to constrain the V isotopic composition of the Bulk Silicate Earth (BSE). We present $\delta^{51}V$ ($\delta^{51}V = [(^{51}V/^{50}V)_{sample}/ (^{51}V/^{50}V)_{AA} - 1] \times 1000$) for ten mantle peridotite xenoliths from Pleistocene basalts and one harzburgite from Holocene Haer volcano at Tariat in central Mongolia, four 1.98 Ga mafic-ultramafic rocks from NW Russia, and ten komatiites from six localities ranging in age from 2.41 to 3.48 Ga.

The average of $\delta^{51}V$ value for the fertile spinel lherzolites is -0.91 ± 0.02‰ (2SE, n = 8). There is no resolvable V isotopic difference for the moderately to highly refractory peridotites. The average of $\delta^{51}V$ value for komatiites is -0.91 ± 0.02‰ (2SE, n = 10). The $\delta^{51}V$ values for the 1.98 Ga volcanic rocks range from -0.76 ± 0.04‰ to -0.82 ± 0.06‰, and the average is -0.80 ± 0.03‰ (2SE, n = 4), which may reflect the effect of magma differentiation.

The averages of $\delta^{51}V$ values for these mantle peridotites and komatiites are identical within their respective analytical uncertainties, suggesting that the mantle has homogenous V isotopic compositions. We estimate that the $\delta^{51}V$ value of the BSE is -0.91 ± 0.01‰ (2SE, n = 18) based on the mantle peridotites and komatiites. V isotopic difference between the inferred BSE and primitive MORB[2] (-0.84 ± 0.02‰, 2SE, n = 22) indicates small V isotopic fractionation during mantle partial melting. Our results provide a robust estimate of V isotopic composition of the BSE, which is important for further study on comparison of V isotopic compositions between the Earth and extraterrestrial materials.

[1] Nielsen et al. (2014), ***EPSL*** **389**, 167-175. [2] Wu, F. *et al.* (2018), submitted to ***EPSL***.