Partitioning of V, Sc, Zn, and Fe between upper mantle minerals and hydrous basalts

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V/Sc and Zn/Fe in primitive basalts have been used as fO_2 tracers of sub-arc mantle and MORB source, as mineral/melt partition coefficients (D) of Fe and V are sensitive to fO_2 while Sc and Zn are not [1, 2]. D is a function of the variables temperature, pressure, fO_2, and mineral and melt composition. To better constrain the validity of V/Sc and Zn/Fe as fO_2 tracers of the mantle source, it is necessary to determine exchange coefficients (K) of V/Sc and Zn/Fe (ratios of D, i.e. $K_{V/Sc}=D_V/D_{Sc}$ and $K_{Zn/Fe}=D_{Zn}/D_{Fe}$) between sub-arc mantle minerals (i.e. spinel, garnet, ol, cpx, and opx) and hydrous basalts under the specific mantle conditions.

Experiments to determine $K_{V/Sc}$ and $K_{Zn/Fe}$ have been performed under conditions relevant to the sub-arc mantle (i.e. hydrous system, from 1080℃ to 1300℃, and variable fO_2 from QFM-1.5 to QFM+5). The fO_2 has been controlled using external oxygen buffer assemblages ranging from graphite-H_2O (CCO), Ni-NiO (NNO), MnO–Mn_3O_4 (MnMnO) to Hematite–Magnetite (HM). Despite the effect of mineral and melt compositions, our results reveal that $K_{V/Sc}$ significantly decrease with increasing fO_2, whereas $K_{Zn/Fe}$ show limited but resolvable correlation with fO_2.

In addition, $D_V^{spinel/melt}$ and $D_{Zn}^{spinel/melt}$ ranging from 0 to 29 and 1 to 35, respectively, indicating that spinel is an important host for V and Zn. The results will help us figure out whether the variation of V/Sc and Zn/Fe in arc magmas and MORBs can efficiently reflect fO_2 in the sub-arc mantle and MORB source.

[1] Lee et al. (2005) *Journal of Petrology* **46**, 2313-2336.
[2] Lee et al. (2010) *Nature* **468**, 681-685.