Impact of magma differentiation on Mo stable isotope signatures

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The precise Mo stable isotopic composition of the bulk silicate eath (BSE) coupled with existing experimental calibration for metal-silicate isotopic fractionation [1] can provide key constraints on core formation temperature conditions. However, the precise estimate of the BSE $\delta^{98/95}$Mo is currently hampered by the limited number of terrestrial silicate rocks analysed and their heterogeneous Mo isotope composition (more than 0.1‰ variation [2-4]). The large isotopic variations observed among analysed earth silicate rocks likely result from the effect of post-core formation processes such as mantle melting, mineral fractionation, partial melting, crustal assimilation and/or metamorphism. Therefore, a detailed investigation of the impact of each of these processes on Mo isotopes is necessary to precisely estimate the BSE composition.

Here we investigate the effects of magma differentiation on $\delta^{98/95}$Mo using a suite of fresh MORB glasses from the Pacific-Antarctic ridge already well constrained in terms of major and trace element concentrations (including Cl and S), as well as Sr, Nd Hf, Pb, He [5] [6] and S [7] isotopes. Preliminary results reveal limited isotopic variation with $\delta^{98/95}$Mo ranging from -0.07‰ to -0.02‰ with a mean of -0.04 ± 0.03‰ (2 s.d., n=7) relative to NIST SRM 3134. Although the heaviest signature obtained correspond to the most mafic sample analysed, no clear correlation between $\delta^{98/95}$Mo and indices of differentiation (e.g. MgO = 4.6-8.4 wt. %) can be resolved. The restricted range of $\delta^{98/95}$Mo along with the absence of variation with differentiation suggest limited effect of mineral fractionation on Mo stable isotopes. Finally, no distinct correlation can be observed between $\delta^{98/95}$Mo and Cl/K and/or δ^{34}S values [8] precluding any significant effect of hydrothermally altered crust assimilation on $\delta^{98/95}$Mo [8]. Further analyses should refine these interpretations.

[1] Hin *et al* (2013) *EPSL* **379**, 38-48. [2] Burkhardt *et al* (2014) *EPSL* **391**, 201-211. [3] Siebert *et al* (2003) *EPSL* **211**, 159-171. [4] Liang *et al* (2013) *Goldschmidt Conf.* #5365. [5] Hamelin *et al* (2010) *GRL* **37**, L10303. [6] Hamelin *et al* (2011) *EPSL* **302**, 154-162. [7] Labidi *et al* (2014) *GCA* **133**, 47-67.