Molybdenum isotopes and mantle source components: Heard Island

JANE BARLING*; ALEX N. HALLIDAY

Department of Earth Sciences, Oxford University, OX1 3AN, UK (*correspondence: jane.barling@earth.ox.ac.uk)

Metal stable isotopes can provide information on mantle components and processes complementary to information provided by radiogenic isotopes. Molybdenum (Mo) isotopes have particular potential in this respect. Subduction may return isotopically fractionated Mo to the mantle, while equilibrium fractionation of Mo isotopes between mantle phases may result in mantle derived magmas differing from bulk mantle if residual phases carry isotopically distinct Mo.

Subduction zone processes produce magmas that have both light and heavy Mo relative to MORB [1]. However, while mass balance suggests that the net isotopic composition of subducted Mo should be lighter than mantle Mo [1,2], correlations between radiogenic and Mo isotopic compositions in MORB suggest that recycled crustal components have isotopically heavy Mo [3]. To date Mo isotopes in OIB overlap with MORB and extend to lighter values. They do not correlate with radiogenic isotope indicators of subducted material. Instead, the lightest Mo occurs in small degree partial melts and is inferred to reflect a residual phase retaining isotopically heavy Mo at low degrees of partial melting [4].

To try to identify isotopically fractionated Mo recycled via subduction, we have analysed Mo isotope compositions in Heard Island lavas whose extremely well-correlated radiogenic isotopes are inferred to result from simple binary mixing between two mantle components: an enriched component characterised by a Nb-anomaly indicative of continent derived material, and a less enriched component with high $^{3}He/^{4}He$ [5,6]. $\delta^{98/95}Mo$ varies from +0.01 to +0.39‰ and correlates with radiogenic isotopes and trace element ratios involving Nb. The lighter $\delta^{98/95}Mo$ values are found in the enriched end-member, consistent with recycling of subducted isotopically light sediment-derived Mo, whereas the less radiogenic mantle end-member with high $^{3}He/^{4}He$ is characterised by Mo that is heavier than any values as yet reported for the mantle. This suggests a multi-stage or multi-component origin for this end-member in order to account for both the high $^{3}He/^{4}He$ and the isotopically heavy Mo.

[1] Willbold & Elliott (2016) *CG* **449** 253-268. [2] Yang *et al*., (2017) *GCA* **205**, 168-186. [3] Bezard et al., (2016) *EPSL* **453** 171-181. [4] Liang *et al*., (2017) *GCA* **199**, 91-111. [5] Barling *et al*., (1994) *J. Pet* **35**, 1017-1053. [6] Hilton *et al*., (1995) *Nature* **373**, 330-333.