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Subducted serpentinite results in the heavy Mo isotopic composition of the mantle source of arc lavas

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The petrogenesis of basaltic arc lavas with heavy Mo isotopic compositions is controversial. Given that oceanic crust preferentially loses isotopically heavy Mo during subduction at forearc depth, fluids derived from such crust at sub-arc depth cannot account for the heavy Mo isotopic compositions of arc lavas. Serpentinites can contain substantial Mo and volatiles, and are a potential source of isotopically heavy Mo in arc lavas. However, the Mo isotopic composition of serpentinites is poorly constrained. Here we present Mo contents and isotope data for serpentinites from the South Sandwich Trench-Fracture Zone intersection, and high-pressure veins and deserpentinized peridotites from the Alpine orogen. Most of these samples have heavy Mo isotopic compositions ($\delta^{98/95}Mo_{NIST\ 3134}$, ranging from -0.23‰ to 1.84‰) and low Ce/Mo ratios, which are distinct from the composition of eclogite-facies metabasalts and metapelites. This suggests that serpentinites and their derived fluids are the main sources of isotopically heavy Mo in arc lavas. The Mo isotope data and Ce/Pb and Ce/Mo systematics suggest serpentinite-derived fluids or melting of serpentinite diapirs at sub-arc depths can explain the heavy Mo isotopic compositions of arc lavas. Furthermore, subducted serpentinite is the complement of subducted oceanic crust, and this explains why the Mo isotopic composition of the mantle has remained nearly constant since 3.5 Ga.