Thallium isotope systematics in volcanics from St. Helena Island. Constraints on the origin of the HIMU reservoir.

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It is generally accepted that subduction of the oceanic crust plays an important role in creation of mantle heterogeneity. HIMU (stands for high $\mu = (^{238}U/^{204}Pb)$) is rare and probably not volumetrically large mantle component, which mainly occurs at St. Helena in the Atlantic and in the Cook-Austral Islands in the South Pacific. Previous studies that use radiogenic isotopes have specifically invoked subducted hydrothermally altered oceanic crust (AOC) as a significant component in the source of HIMU.

Thallium isotopes can be used to identify the involvement of sediments rich in Mn oxides or AOC because these two components exhibit high Tl concentrations and highly fractionated Tl isotope compositons, whereas the upper mantle is depleted in Tl and homogenous with respect to Tl isotopes. Here we report Tl isotope data for a suite of St. Helena lavas previously characterized by Hanyu et al (2014) to investigate if the HIMU mantle reservoir can be linked to AOC. Samples show large Tl isotopic variation, from $\varepsilon^{205}Tl$ =-9.8 to $\varepsilon^{205}Tl$ =+3.9 and do not correlate with Sr, Nd or Pb isotopes. Eight samples have $\varepsilon^{205}Tl$ lighter than the mantle value, with the lightest values similar to those observed for modern AOC. Mixing calculations indicate that the Tl isotope variations can be explained by addition of relatively small amounts (<10%) of the AOC into the mantle. Our results, therefore, support previous studies that inferred AOC as a significant component in the HIMU mantle reservoir.

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