Thallium isotopic constrains on generation of EMII and HIMU ocean island basalts in the South Pacific.

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A recent study of basalts from St. Helena [1] suggested that the Tl isotopic system can be used as a powerful tracer to detect contributions of altered upper oceanic crust (AOC) in the creation of mantle heterogeneities. In order to further test the application of Tl isotopes in studies of mantle heterogeneities we measured samples from the Cook Austral Islands (Mangaia, Tubuai, Rurutu) in the South Pacific, which define the end member mantle component HIMU. In addition we analyze EMII mantle type samples from Tahaa (Society Islands). The majority of samples from the Cook Austral Islands have Tl isotope compositions similar to or lighter than typical upper mantle values. This range of Tl isotope compositions is similar to that observed for St. Helena and supports the interpretation that the HIMU mantle source region carries a significant component of AOC. As observed for St. Helena, there are no correlations between radiogenic isotopes and Tl isotopic compositions.

In contrast, the Tl isotope compositions from Tahaa lavas display significant correlations with radiogenic isotopes. Shield lavas have radiogenic Sr isotope values and Tl isotopic composition that are predominantly heavier than average upper mantle. Such values are similar to those found in Hawaiian picrites [2] and suggests a pelagic clay component in the EMII mantle source. In comparison young, post erosional lavas are characterized by unradiogenic Sr isotopes and very light Tl isotope compositions similar to AOC. These temporal variations in Tl and radiogenic isotopes implies a strong heterogeneity of the mantle plume that is most likely caused by variations in the dominant recycled component. We argue that our new data clearly show that the thallium isotope system is a powerful monitor of sediments and AOC additions to OIB source regions.

[1] Blusztajn et al., (2018) Chem. Geol.476,292-301.
[2] Nielsen et al., (2006) Nature, 439, 314-317.

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