Thallium isotopes as tracers of subducted Hawaii-Emperor Ridge in Kamchatka arc lavas

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Due to the high concentrations of Tl and distinctive Tl isotopic compositions of pelagic sediments and altered oceanic crust (AOC) compared with the upper mantle coupled with negligible stable isotope fractionation during igneous processing, Tl isotopes have great potential to trace recycling processes at subduction zone volcanism[1,2,3]. Because pelagic sediments display dramatically higher Tl concentrations than AOC, the signature of recycling AOC in arc lavas is rarely seen.

Previous studies of Central Kamchatka arc lavas have concluded that subducted AOC dominate the source region due to influence from the Hawaii-Emperor Ridge that is subducted underneath this portion of Kamchatka[4]. This study investigates the Tl concentration and Tl isotope compositions of volcanic rocks from Kamchatka arc, togther with sediments and basalts from DSDP Site 192 located on the Hawaii-Emperor Ridge outboard of the Kamchatka trench. All lavas (except those that clearly underwent degassing) exhibit Tl isotope compositions either indistinguishable from or significantly heavier than normal mantle and sediments outboard of the Kamchatka arc. Instead basalts from DSDP Site 192 generally have heavy Tl isotope compositions that are very similar to values found for the Hawaii-Emperor seamounts investigated.

[1] Nielsen et al., 2016 Geochim. Cosmochim. Acta., 181, 217-237

[2] Nielsen et al., 2017 J. Volcanol. Geoth. Res., 339, 23-40

[3] Shu et al., 2017 Geochim. Cosmochim. Acta., 217, 462-491

[4] Churikova et al., 2001 J. Petrol., 42, 1567-1593