

Thallium isotopes limit the amount of recycled material within the proto-Iceland mantle plume

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The Iceland mantle plume has evolved with respect to multiple isotope systems^{1,2}. Baffin Island (Canada), the location of the oldest lavas associated with the Iceland plume, has higher ³He/⁴He and ¹⁸²W/¹⁸⁴W ratios compared to modern Iceland lavas^{1,2}. This evolution may be the result of diffusive chromatographic segregation of core-derived materials². Alternatively, incorporation of subducted materials within the lowermost mantle may have perturbed the isotopic systematics of the Iceland mantle plume³. Thallium (Tl) isotopic compositions are well suited for tracing subducted pelagic sediments and low-*T* altered oceanic crust through the mantle⁴, because of the large differences between the Tl concentration and isotopic compositions of these subducted packages and the upper mantle. We report new Tl isotope compositions for lavas from Baffin Island. After filtering out samples affected by degassing and assimilation, we find the Baffin Island mantle has Tl isotope ratios that are indistinguishable from the average upper mantle⁴ and modern Iceland lavas^{5,6}. This result places a stringent upper limit on the amount of subducted and recycled pelagic sediments and low-*T* altered oceanic crust within the Baffin Island mantle plume. This upper bound is too low to account for the geochemical evolution of the Iceland plume system. Rather, the isotopic evolution of the Iceland plume must be explained by assimilation of other subducted lithologies that are not traceable with Tl isotope ratios and/or core-mantle interactions.

- [1] Mundl-Petermeier et al. (2019) *Chem. Geo.* 525, 245–259.
[2] Kaare-Rasmussen et al. (2023) *Geochem. Prespec. Lett.*, 7–12. [3] Jackson et al. (2020) *PNAS* 117, 30993–31001. [4] Nielsen et al. (2017) *J. Volcanol. Geoth. Res.* 339, 23–40. [4] Nielsen et al. (2007) *EPSL* 264, 332–345. [5] Prytulak et al. (2017) *Chem. Geo.* 448, 71–83.