Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11792

Mantle vs. crust: Untangling influences on melt stable O isotopic composition via tandem olivine-glass δ^{18}O analyses at Kama'ehu Volcano, Hawai'i

MOLLY JEAN CUNNINGHAM[1], AARON J. PIETRUSZKA[2], MICHAEL O. GARCIA[3] AND ILYA N. BINDEMAN[4]

[1]University of Hawai'i at Mānoa
[2]University of Hawai‘i
[3]University of Hawai‘i at Mānoa
[4]University of Oregon

Presenting Author: mollyjc@hawaii.edu

The stable oxygen isotopic ratio of ocean island basalts reflects the interplay of deep and shallow magmatic processes such as melting of a heterogeneous mantle source and crustal contamination. For Hawaiian volcanoes, it is thought that the mantle-derived O isotopic signature is commonly overprinted by assimilation of hydrothermally altered, ^{18}O-depleted components [1,2]. It is also thought that the youngest Hawaiian volcano, Kama‘ehuakanaloa (Kama‘ehu; formerly LÅ ‘ihi), experiences widespread contamination by seawater-influenced materials in its shallow magmatic plumbing system [3,4]. New O isotopic analyses of Kama‘ehu glasses, however, challenge this understanding. The distribution of glass δ^{18}O is bimodal with one higher-δ^{18}O cluster (5.6 ± 0.2‰) corresponding to the North Rift Zone (NRZ) and one lower-δ^{18}O cluster (5.3 ± 0.3‰) corresponding to the South Rift Zone (SRZ). Samples from the summit region occupy intermediate δ^{18}O values (5.5 ± 0.1‰). Though NRZ values extend to higher values (6.0‰) and SRZ values extend to lower values (5.0‰), all regions have sample medians consistent with simple melting of the Kama‘ehu mantle source (5.6 ± 0.2‰; [5]). These data indicate that 1) contamination processes at Kama‘ehu are insufficient to obscure lavas' mantle-derived δ^{18}O for most samples; and 2) extreme δ^{18}O values are anomalous and may be explained by assimilation of altered crustal materials with variable O isotopic composition. To confirm these interpretations, olivine δ^{18}O measurements will be made on samples with the extreme glass δ^{18}O. Paired analyses of olivine, an early-crystallizing phase, and glass, an eruption-quenched phase, elicit snapshots of melt δ^{18}O at, respectively, earlier and later chapters of differentiation, allowing shifts in isotopic composition to be attributed to mantle vs. crustal processes. By distinguishing controls on magmatic δ^{18}O at Kama‘ehu, this study will yield more robust estimates of the oxygen isotopic composition of the Hawaiian plume, with implications for the presence of ancient subducted crust in the Pacific mantle.

[1]Garcia et al. (1998), *J. Petrol* 39, 803-817

[2]Wang et al. (2008), *Earth Planet. Sci. Lett.* 269, 377-387

[3]Kent et al. (1999), *Geochim. Cosmochim. Acta* 63, 2749-2761

[4]Pietruszka et al. (2011), *Earth Planet. Sci. Lett.* 304, 280-289

[5]Eiler et al. (1996), *Earth Planet. Sci. Lett.* 144, 453-468