Lead Isotopic Evolution of Kīlauea Volcano, Hawai‘i

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Kīlauea lavas display temporal variations in lead (Pb) isotope ratios on time scales of years to centuries [1-3]. These rapid fluctuations in lava chemistry result from changes in the composition of the magma delivered to the volcano from a source within the Hawaiian mantle plume, which is heterogeneous on a small scale. However, the processing of magma within Kīlauea's shallow plumbing system blurs the isotopic signatures of mantle isotopic heterogeneity and masks the timing of melt delivery from the mantle. Here we summarize the results of ~250 high-precision Pb isotopic analyses of Kīlauea lavas and juvenile tephra from prehistoric and historical eruptions. The sample suite extends from the oldest tholeiitc basalts drilled from depths up to 1.6 km on the volcano's flank to the ongoing summit (Halema‘uma‘u) and rift zone (Pu‘u ‘Ō‘ō) eruptions. Mantle processes—from short-term changes in melt transport pathways [3, 4] to the upwelling of small-scale compositional heterogeneities through the melting region [2]—are the dominant control on the Pb isotopic variations. However, these signatures are modulated by shallow magma mixing, depending on the number, size, and interconnectedness of the magma bodies beneath the volcano's summit and rift zones, and the residence time of magma within them. The effects of crustal contamination on the Pb isotope ratios of Kīlauea lavas are generally minor, except for a period of relatively low magma supply between 1912 and 1954, and the 3-week long initiation of the 2008 Halema‘uma‘u eruption following 26 years of repose at the volcano's summit. Highlights of these crustal and mantle processes, and their effects on the Pb isotope ratios of Kīlauea lavas, will be presented.

[1] Pietruszka & Garcia (1999) *J. Petrol.* **40**, 1321-1342. [2] Marske *et al* (2007) *EPSL* **259**, 34-50. [3] Greene *et al* (2013) *Geochem. Geophys. Geosyst.* **14**, 4849-4873. [4] Pietruszka *et al* (2006) *EPSL* **244**, 155-169.