Parental magma variations at Kilauea Volcano: Reassessing the role of Ni in basaltic systems

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Previous studies have shown an excellent positive, linear correlation between Ni and MgO in basaltic lavas [1]. This is not observed in Kilauea basalts, which exhibit a large range of Ni for a given MgO (e.g. a factor of two at 7.0 wt.% MgO). To better understand the cause of this variation, we analyzed olivine crystals and their host lavas from the long-lived (1983-present) Puu Oo eruption and compared them with lavas from Kilauea's East Rift Zone (ERZ) and summit eruptions from 1924-1983. These lavas were derived from geochemically distinct parental magmas [4, 5].

Whole-rock Ni variation for Kilauea eruptions shows two distinct fields: high-Ni and low-Ni. Puu Oo whole-rock Ni generally varies by a factor of two for a given MgO content and defines the low-Ni field. ERZ and summit lavas are distinct from the Puu Oo eruption and define a "high-Ni" field (up to 50% greater Ni for a given MgO). Early lavas from the Puu Oo eruption (Ep. 1-15, 1983) have Ni values that overlap the two fields, and represent the mixing of geochemically distinct magmas. High precision electron microprobe analyses of olivine show NiO variations that represent different parental magmas. Olivines in lavas from the ERZ eruptions (prior to 1983) and early Puu Oo episodes are generally higher in NiO (up to 0.20 wt.%) than similar forsterite olivines erupted from 1984-present. No other compatible transition metal (Cr, Zn, Mn) clearly shows this distinction. To explore the potential cause of the Ni variation we calculated the pyroxenite component in the parental magmas for these lavas using the methods of [6]. Preliminary results show that the ERZ and early Puu Oo lavas are derived with a somewhat higher fraction of pyroxenite component (0.59-0.72) in the source than later Puu Oo lavas (0.49-0.64). This may account for the high-Ni and low-Ni geochemical fields observed for Kilauea.

[1] Hart and Davis (1978) *EPSL* **40**, 203-219 [2] Wright, T.L. (1971) USGS Prof. Paper. [3] Hoffman *et al* (1984) *Contrib. Min. Pet*. **88**, 24-35 [4] Marske, J.P, (2014) unpub. data. [5] Garcia *et al* (2003) *J. Petrol*. **44**, 2313-2339 [6] Gurenko *et al* (2009) *EPSL* **277,** 514-524