Olivine Evidence for the Source and Origin of Hawaiian Rejuvenated Volcanism

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Rejuvenated volcanism is among the least understood and most controversial aspects of oceanic island volcanism. In Hawaii, it occurs hundreds of kilometers downstream from the ascending mantle plume stem after a 0.5 to 2 Myr hiatus in eruptive activity. Rejuvenated lavas are geochemically distinct (isotopically depleted but enriched in incompatible elements) compared to those from the underlying shield. The depleted source for rejuvenated lavas is thought to be part of the Hawaiian mantle plume (1-3). Controversy continues regarding the source lithology (peridotite vs. pyroxenite), depth of melting (3-5 GPa) and the geodynamic cause for widespread coeval rejuvenated magmatism. Two new models offer alternative explanations that can be evaluated using olivine composition from age dated samples. The small-scale convection model (4) advocates a dramatic temporal variation in pyroxenite component (0 to 60%) at moderate depths during the the 0.7 to 2.5 Myr of rejuvenated volcanism. Alternatively, rejuvenated volcanism may be related to melting a previously unmelted, chemically distinct peridotite source derived from a thermal boundary layer at the base of the mantle at 5 GPa (5). Preliminary results for olivines from rejuvenated lavas from the South Kauai Swell show no temporal increase in the pyroxenite component. The olivine results are consistent with melting at moderate pressures of a peridotitic source [6] that may be derived from a deep mantle thermal boundary layer. Additional results will be presented for the larger and well dated Koloa (Kauai) and Honolulu (Oahu) suites of rejuvenated lavas.

[1] Frey *et al* (2005) *Geochem. Geophys. Geosyst.* **6**, doi: 2004GC000757 [2] Fekiacova *et al* (2007) *Earth Planet. Sci. Lett.* **261**, 65-83 [3] Garcia *et al* (2010) *J. Petrol.* **51**, 1507-1540 [4] Ballmer *et al* (2011) *Nature Geosci.* **4**, 457-60 [5] Hofmann & Farentani (2013) Geochem. Geophys. Geosyst. doi:10.1002/2013GC004942 [6] Matzen *et al* (2013) *J. Petrol.* **54**, 2521-45