The different stories told by Hawaiian shield, post-shield, and rejuvenated lavas

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Hawaiian volcanoes lie on two geographical trends (Loa and Kea) and have unique, shield-stage radiogenic isotope signatures that reflect sampling of different components in the deep mantle plume source at the core-mantle boundary [1,2]. Statistically, the volcanoes can be further subdivided into six compositional groups systematically organized parallel to the sharp edge of the Pacific large low shear velocity province. Shield-phase volcanism builds >95% of the volcanic edifice and the higher degree melts provide the best estimate of mantle plume source chemistry. Directly following the shield phase, or after an eruptive hiatus of variable duration (~0·5-2 Myr), Hawaiian volcanoes erupt alkalic post-shield and rejuvenated lavas. These lavas correspond to smaller degrees of partial melting and provide a finer resolution on the compositional variations in the plume system. New data from the Northwest Hawaiian Ridge and northern islands and literature data on such lavas show that >95% of these samples (except Hualalai and Daikakuji) plot on the Kea side of the Pb-Pb boundary [2]. Post-shield lavas form two isotopic groups: 1) Big Island and Maui Nui (<1.7 Ma) compositions that partly overlap the field of shield lavas from their respective volcanoes, and 2) O‘ahu and Kaua‘i (>3.6 Ma) with more depleted signatures. Younger (<2.5 Ma) and NWHR (~13 Ma) rejuvenated lavas define a very homogeneous field. The lack of enriched Loa signatures in Hawaiian alkalic lavas implies either that this enriched material is not sampled by greater depths of melting, that enriched material was exhausted by previous shield-stage melting or that post-shield lavas only derive from melting of the more homogeneous, northeast part of the plume, i.e., the Kea side. All rejuvenated lavas, 13 Ma to present, require the addition of a more depleted component/mantle source (low $^{87}Sr/^{86}Sr$, $^{208}Pb/^{204}Pb$, high $^{176}Hf/^{177}Hf$) than both post-shield and shield lavas. Changes in lava type/chemistry during a Hawaiian volcano's lifetime still have a lot to reveal about deep plume sources and various components involved.

[1] Weis *et al* (2011) *Nature Geosciences* **4**, 831-838. [2] Abouchami *et al* (2005) *Nature* **434**, 851-856.