Hawaiian Post-Shield Basalts Through Time

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The Hawaiian-Emperor chain is the surface expression of the Hawaiian mantle plume and records volcanic activity dating as far back as >81 Ma. The chain is divided into the Emperor Seamounts (81-47 Ma), Northwest Hawaiian Ridge (NWHR, 47-6 Ma), and Hawaiian Islands (<6 Ma). Hawaiian volcanism evolves through four stages as a volcano traverses the Hawaiian plume: alkalic pre-shield, tholeiitic shield (80-90% volcano volume), alkalic post-shield (~1%), and silica-undersaturated rejuvenated (<0.1%). Here, the isotopic compositions (Pb-Hf-Nd-Sr) of post-shield basalts from 13 NWHR and young Emperor Seamount volcanoes (~8.5-55 Ma[1,2]) are investigated to (1) bridge the >3000 km gap between the Hawaiian Islands and old Emperor Seamounts, and (2) establish how the Hawaiian volcanic stage paradigm continues back in time. NWHR post-shield basalts tend to have more depleted isotopic signatures than shield-stage basalts at the same volcano, a relationship similar to that observed between shield and post-shield basalts on the Hawaiian Islands. Unlike rejuvenated basalts, which present consistent isotopic compositions through time, post-shield basalts preserve the Loa and Kea affinity identified in the shield stage. The seamounts Jingū (55 Ma[2]), Unnamed (33 Ma[1]), Academician Berg (32 Ma[1]), and Townsend Cromwell (~34 Ma) have the lowest $^{143}Nd/^{144}Nd$ and $^{176}Hf/^{177}Hf$ of the NWHR. This indicates a larger proportion of a depleted component in the older NWHR volcanoes compared to the younger volcanoes, aside from Loa-trend Daikakuji (47.5 Ma[1]), which exhibits the most radiogenic Pb and Sr isotopic compositions observed from a NWHR post-shield basalt. The least radiogenic Sr isotope ratio is from Jingū, a young (~55 Ma[2]) Emperor Seamount volcano, and plots between the fields defined by Hawaiian Island and post-shield basalts erupted at the oldest Emperor Seamount (Detroit, ~76 Ma). These multi-isotopic trends highlight the different mantle source compositions required between the oldest Emperor Seamounts and the younger Hawaiiian basalts and support a direct compositional link between Hawaiian post-shield lavas and their respective shield stages.

[1] Jicha *et al* (2018) *Geol*. **46(11)**, 939-942. [2] Dalrymple & Garcia (1980) Init. Rep. DSDP **55**, 685-693.