Geochemical evolution of Hawaiian magmatism from 49 Ma to 25 Ma

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We measured major and trace element concentrations, and Sr, Nd and Pb isotope ratios of 95 samples of volcanic rock from 16 of the Hawaiian-Emperor seamounts between Koko (50 Ma) and Pearl & Hermes Reef (25 Ma). This 1500 km long section of the Hawaiian-Emperor Chain includes the 'bend' and is intersected by the older (80-90 Ma) Wentworth Seamount Chain and the Mendocino Fracture Zone. We combined our results with published data, to examine the long-term evolution of Hawaiian volcanism since 80 Ma.

The samples include both tholeiitic shield and alkalic post-shield lavas. Most have trace element and age-corrected isotope compositions within the range of young (< 5 Ma) Hawaiian volcanics. Lavas from Daikakuji Seamount (47 Ma) have a wide range in composition, and include the earliest lavas with Loa-type Pb isotope compositions. The absence of Loa-type lavas from the older Emperor Seamounts could result from the Loa source being located south of the Kea source in the Hawaiian plume. Kea-type lavas may therefore have covered older Loa-type lavas along the NNW-SSE oriented Emperor Seamount Chain, prior to the change in plate motion at 50 Ma. However, a Loa-type signal has not been found in lavas from seamounts between Kammu (44 Ma) and Pearl & Hermes Reef. Neither the presence of the Mendocino FZ nor changes in Hawaiian plume flux appear to have affected lava compositions. Lavas from the isolated volcanoes from the low-volume region between Abbott and Helsley Seamounts have similar compositions to young lavas from the Hawaiian Islands. Hawaiian seamounts with ages of 49 – 25 Ma were all built on oceanic crust that was 50 – 95 My old at the time of seamount construction. None have Sr and Nd isotope compositions as depleted as those from older Emperor Seamounts that were formed on younger (< 40 Ma) oceanic crust, consistent with a role for lithosphere thickness on the composition of Hawaiian-Emperor magmatism.