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Geochemical Characterization of the Pacific Oceanic Crust: Keys for Interpreting Hawaiian Deep-Mantle Source Compositions

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The magmatic composition of Hawaiian lavas can be influenced by post-eruption alteration and contamination from other sources. The volcanoes of the Hawaiian-Emperor Chain were formed by the Hawaiian mantle plume via partial melts that passed through Cretaceous oceanic crust. Understanding the composition of the crust, including the role of alteration and its potential to contaminate mantle-derived lavas, is critical when making interpretations of Hawaiian deep mantle-source characteristics. We present trace element and isotopic compositions for 10 samples from Oceanic Drilling Project Site 843 (~110 Ma), located 330 km west of Kailua-Kona, that represent the oceanic crust through which Hawaiian lavas (< 6 Ma) erupted. We use step-wise chemical leaching to remove secondary alteration minerals, yielding sample residues that are better proxies for the original magmatic compositions of samples. Radiogenic isotope ratios of Pb, Sr, Nd, and Hf were measured for unleached samples, and leached residues (9-12 steps), and leachates were analyzed for trace element concentrations. Our results show that most elemental changes induced by leaching occur in the first four steps with the removal of Cs, Rb, Th, U, Pb, and light rare earth elements (LREE; La to Sm). Heavy REE were not appreciably affected. Leached residues have lower LREE concentrations, higher radiogenic $^{143}Nd/^{144}Nd$, and lower radiogenic $^{87}Sr/^{86}Sr$, relative to unleached samples. Leaching affected radiogenic Pb ($^{208}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, and $^{206}Pb/^{204}Pb$) heterogeneously and had no effect on radiogenic $^{176}Hf/^{177}Hf$ within analytical uncertainly, reflecting the highly mobile and immobile nature of these elements, respectively. We are further investigating the changes in $^{143}Nd/^{144}Nd$, seldom previously observed, studying the mineralogical composition, obtained via x-ray diffraction, of unleached samples and their leached residues to determine which mineral phase(s) is/are removed via the leaching procedure. We will assess the composition of the less radiogenic $^{143}Nd/^{144}Nd$ leached phase(s), to assess the source of the change: primary minerals, secondary alteration minerals, and/or adsorption of non-radiogenic Nd from seawater. In parallel, this investigation examines the efficiency of the leaching technique on Cretaceous mid-ocean ridge basalt compositions. Collectively, these data constitute a reference for assessing oceanic crust contamination in Hawaiian basalts, while also assessing alteration effects on geochemical compositions.