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Exploring the origin of the Enigmatic Seamounts: Insights from geochemical and isotopic signatures.

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The Enigmatic Seamounts are two clusters (Naifeh and Plumeria) of 10 unexplored submarine volcanoes, located at around 200 km north of the Northwest Hawaiian Ridge. The ages of approximately 86 Ma, about 70 Ma prior to the formation of the closest Hawaiian volcano, suggest that these seamounts are unrelated to the Hawaiian mantle plume, but rather caused by a different process. In this project, two possible hypotheses are tested for their origin: 1) Cretaceous crust-building; 2) Off-axis volcanism and small-scale convection. Whole rock geochemistry and Sr-Nd-Pb isotopic analyses were conducted to characterize the seamounts geochemically, the mantle source components and the processes involved in their formation. Samples vary from Mugearites to Hawaiites, with high alkalis (5.68-8.74 wt%) and low MgO (0.96-2.68 wt%). Trace elements were compared to canonical ratios (Ba/Rb, K/U, Ce/Pb, Nb/U), and samples outside the ranges were disregarded for further interpretation. REE profiles show high La/Sm_N = 3.27 and La/Yb_N = 9.77, which indicate enrichment in LREE. Measured isotopic ratios show intermediate to low $^{87}Sr/^{86}Sr$ (0.7031-0.7036), intermediate to high $^{143}Nd/^{144}Nd$ (0.5128-0.5131), and high $^{206}Pb/^{204}Pb$ (19.36-20.19), $^{207}Pb/^{204}Pb$ (15.58-15.697), and $^{208}Pb/^{204}Pb$ (39.24-40.01). Isotopic data suggest a FOZO to HIMU-like mantle source component. The elevated radiogenic Pb values overlap with Pacific E-MORB samples. However, the samples more closely resemble both whole rock and isotopic compositions of the Pukapuka ridge and Line Islands, formed by off-axis lithospheric extension and small-scale convection. The new available data indicate the Enigmatic Seamounts were also formed by such processes.