Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10527

Implications for the source of the Marquesas Island OIB from short-lived radiogenic isotope and seismic data

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Short-lived radiogenic isotope systems can provide important information on early mantle differentiation processes and the potential involvement of long-term isolated and/or core-influenced mantle domains as components for ocean island basalts (OIB) [1-3].

Previous studies have shown that OIB worldwide exhibit a negative $^{3}He/^{4}He$-$^{182}W/^{184}W$ correlation [3], possibly resulting from the involvement of primordial material characterized by high $^{3}He/^{4}He$ ratios and negative $\mu^{182}W$ ($^{182}W/^{184}W$ deviation of a sample from laboratory standards in parts per million). Anomalous W isotope compositions in combination with elevated $^{3}He/^{4}He$ ratios have previously been connected to seismically anomalous structures in the lowermost mantle, so-called "(mega) ultra-low velocity zones" [2,3]. Recently, such a structure was discovered beneath the Marquesas Archipelago [4]. Based on elevated $^{3}He/^{4}He$ (up to 14.4 R_A) ratios in combination with other geochemical characteristics, such as Sr, Nd and Pb isotopes, a deep-lying mantle plume source for the Marquesas OIB has been suggested [5], potentially tapping a seismically anomalous region in the lowermost mantle.

Here, we present ^{182}W and ^{142}Nd data for samples from two islands of the Marquesas Archipelago. Despite elevated $^{3}He/^{4}He$ in some of the samples, no resolved negative ^{182}W anomalies have been detected. This contrasts with the broad He-W correlations observed for other hotspots, including those that also have close relationships to ULVZ [6]. In addition, a slightly elevated $^{142}Nd/^{144}Nd$ signature contrasts with analogous data from other Pacific hotspots [7], implying that multiple distinct primitive domains contribute to the isotopic compositions of Pacific OIB. Interpretations for the decoupling of He-W systematics in combination with ^{142}Nd data in samples from the Marquesas Archipelago will be discussed and put in context with seismic observations.

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