Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.31494

Diverse Volatile Origins Along the East Pacific Rise Determined from Near-EPR Seamount Nitrogen and Noble Gases

MOLLY K ANDERSON[1], PETER H BARRY[1], KAN LI[1], JOSHUA CURTICE[1], MICHAEL W. BROADLEY[2], VÉRONIQUE LE ROUX[1,3], FORREST HORTON[1], MARK D KURZ[1] AND JOHN SINTON[4]

[1]Woods Hole Oceanographic Institution
[2]University of Manchester
[3]Université de Lorraine
[4]University of Hawai‘i at Mānoa

There is significant geochemical variability in the East Pacific Rise (EPR) mantle, due to complex interactions between subduction-derived and/or deep mantle-derived heterogeneities within the upper mantle. However, the extent to which these heterogeneities dictate the volatile budget of the EPR remains unclear. Nitrogen and noble gas isotopes are sensitive tracers of the volatile history of geochemical reservoirs. This study examines the origin and distribution of volatiles in the northern and southern EPR mantle by pairing nitrogen and noble gas abundances and isotopes with Pb, Sr, and Nd isotopes of well-characterized basalt glasses from two geochemically heterogeneous, near-EPR seamount regions (8°20’ N chain and the Rano Rahi region between 15°-19° S). Significant $\delta^{15}N$ variability exists in these locations; the 8°20’ N seamounts range from -3.0 (±0.2) to +0.6 (±0.4)‰, and Rano Rahi seamounts range from -1.8 (±0.1) to +2.9 (±1.7)‰. $\delta^{15}N$ values of all seamount lavas are higher than average MOR mantle (-5 ± 2‰; [1]), indicating that all of the seamount lavas derive from subduction-influenced and/or less degassed portions of the mantle. The most incompatible element enriched basalts (EMORB) from both locations possess higher $\delta^{15}N$ values (> -1‰) than other lava types, often corresponding with high $^{87}Sr/^{86}Sr$, implicating subduction-related input into the mantle as a key mechanism responsible for forming EPR EMORB. $^{3}He/^{4}He$ values span the entire MORB range away from plumes, and are generally higher in the south (8.2 – 10.5 R_A) than in the north (5.8 – 9.0 R_A). Similarly, Rano Rahi lavas are generally characterized by a Ne isotope anomaly consistent with a solar component in the southern EPR mantle ($^{20}Ne/^{22}Ne$ ranges from 10.1-12.1 and $^{21}Ne/^{22}Ne$ from 0.030-0.050) similar to the Kerguelen plume trend. These findings support a model whereby subduction processes and portions of the less degassed primitive mantle have each contributed variably to the development of widespread mantle heterogeneity beneath the EPR. More specifically, the southern EPR volatiles appear to be influenced more by less degassed portions of the primitive mantle than the north, while the northern EPR volatiles are more heavily influenced by subduction.

[1] Marty & Dauphas (2003), *EPSL* 206, 397-410