Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.23161

Investigation of Melt Evolution and Pyroxenite Signatures beneath the Southern East Pacific Rise (13°S to 23°S): Insights from Olivine Minor and Trace Elements

ANNIE CHIEN, PENG JIANG AND JOHN SINTON

University of Hawai‘i at Mānoa

Presenting Author: achien@hawaii.edu

The Southern East Pacific Rise (SEPR), spanning 13°S to 23°S, shows significant lava compositional heterogeneity on and off its ridge axis. Notably, occurrences of carbon-rich mid-ocean ridge basalt (MORB) signatures in the off-axis Rano Rahi seamounts and Pukapuka Ridge have been claimed to be possibly linked to oceanic lithospheric recycling [1]. The recycling process beneath these regions could generate pyroxenite formation; however, no research has yet reported its presence. Here we use olivine textures and its minor and trace elements as proxies to investigate melt evolution and potential pyroxenite signatures beneath the SEPR. Rano Rahi seamount olivines have overall wider Ni abundance variations under certain Fo (forsterite) than olivines from ridge-axis lavas, while both regions show multiple parallel Ni-Fo variation trends. This suggests that varying parental magmas exist within different regions and that Rano Rahi has more extreme melt sources. Common reverse olivine zonation is observed for both Rano Rahi seamounts and ridge-axis lavas, indicating magma mixing among multiple melt sources. Despite the varying melt sources in these regions, our preliminary olivine dataset analyzing first-row transition element (FRTEs) ratios of Mn/Fe and Zn/Fe only indicate a peridotite source, with no clear evidence for a pyroxenite lithology source (Fig. 1). However, the FC3MS ($FeO/CaO-3*MgO/SiO_2$, all in wt. %) vs. MgO (wt. %) trend (data compiled from previous studies) exhibits a pronounced trajectory in support of a pyroxenite presence (Fig. 2). Further analysis is needed to validate the FC3MS parameter. Our ongoing research will concentrate on samples with FC3MS >0.65 and some samples that show Sr-Nd-Pb isotopic anomalies between 15.8°S and 20.7°S to identify possible pyroxenite signatures. If pyroxenite is absent where oceanic lithospheric recycling was involved, a possible "pyroxenite destruction" [2] process may have occurred beneath the SEPR.

[1] Shimizu, K., A.E. Saal, E.H. Hauri, J.M. Sinton, P.E. Janney, N. Geshi, and R. Hékinian, 2023. High-C content and CO2/Ba ratio of the Earth’s enriched upper mantle. Geochemica Cosmochimica Acta, v. 343, p. 161-179.

[2] Herzberg, C., Vidito, C. and Starkey, N.A., 2016. Nickel–cobalt contents of olivine record origins of mantle peridotite and related rocks. American Mineralogist, 101(9), pp.1952-1966.