Petrogenesis of Siquieros FZ & Off-Axis Seamounts: Os Isotopic and Trace Element Constraints

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The Os isotope system tracks mantle petrologic history involving melt depletion and subsequent re-fertilization particularly in settings where basaltic magma chamber processing can be circumvented or minimized (i.e. peridotites — abyssal or xenolithic, ophiolites, and primitive lavas). The 8°20'N seamount chain is a nearly continuous feature (~160 km long) paralleling the Siqueiros Fracture Zone that may have formed over ~3 Ma. Olivine-phyric picrites and basalts that range from D-MORB to alkali basalts from the Siqueiros Transform and seamount chain have been less affected by magma chamber processing than perhaps any basalts in this area of the EPR. Comparative study can reveal the role of mantle composition and melt generation on basalt chemistry and oceanic lithosphere formation free from the homogenizing effects of MOR axial magmatism.

Siquieros picrites and basalts with MgO contents ranging from ~10 to >20 wt % and typical D-MORB trace element patterns have Os contents that range from 16 to 64 ppt and $^{187}Os/^{188}Os$ that range from 0.1359 to 0.1278. These Os isotopic values include one of the lowest ever measured for MORB —a result of olivine phenocryst inheritance and minimal magmatic residence. The 8°20'N seamount samples collected during the 2016 OASIS cruise by comparison are comprised of lavas that range from primitive (high-MgO) D-MORB to extremely enriched E-MORB and alkali basalts (LaN/SmN ranging from ~0.5 to 2.5) – in some cases within the same seamount. Surprisingly, these geographically restricted lavas have a compositional range as great as that documented for seamounts between 5°N and 15°N within 60 km of the EPR axis. Geochemical data indicate that mantle sources varied within the chain as well as within individual seamounts and suggest melting-mixing between at least two end-member sources, one similar to or more depleted than the source of the Siquieros picrites and the other an enriched ocean island (OIB-like) source typical of enriched heterogeneities in the EPR mantle.