Evolution of lithosphere during oceanic plate reconfiguration along the Baja California margin

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New geochemical and petrological data are reported for mantle xenoliths dredged from the Ferrel Seamount ~150 km off the west coast of Baja California, Mexico. The Ferrel Seamount is located on Miocene oceanic crust (Chon 5, 10 – 13 Ma), atop a segment of the abandoned Pacific-Farallon spreading ridge. The xenoliths, hosted in alkalic basalt, are petrographically 'fresh' coarse-grained spinel lherzolites. Melt depletion indicators, including clinopyroxene modal abundances, Cr/(Cr+Al) in spinel and bulk rock Al_2O_3 show good correlations, which are also matched by a positive $^{187}Os/^{188}Os$-Al_2O_3 correlation, with $^{187}Os/^{188}Os$ ranging from 0.117 to 0.133. Bulk rock and clinopyroxene trace element compositions reveal two-stages of melt refertilization beginning with infiltration by mid-ocean ridge basalt(MORB)-type melts, followed by melt addition from the host alkali basalt. However, the strong melt depletion correlations imply that the $^{187}Os/^{188}Os$ ratios were unaffected by theses processes. Bulk rock highly siderophile element (HSE: Os, Ir, Ru, Pt, Pd, Re) patterns support this contention, being depleted in Pt, Pd and Re relative to Os, Ir and Ru. Modeling of bulk rock trace element and Cr-spinel compositions indicate that the xenoliths experienced ~8-15% partial melt, which occurred significantly prior to melt refertilization, with a mean Re depletion age of ~0.5 Ga.

We interpret the Ferrel spinel peridotite xenoliths to be representative of lithosphere beneath the Pacific-Farallon ridge. The history of significant melt depletion, followed by MORB-melt refertilization and incorporation within the alkali basalt is consistent with the peridotites representing oceanic mantle lithosphere that was subsequently incorporated into the Baja-Guadalupe microplate.