Formation of dunite-harzburgite-lherzolite-plagioclase lherzolite sequences by multiple episodes of melt migration and melt-rock reaction

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Dunite – harzburgite – lherzolite – plagioclase lherzolite (DHL-PL) sequences are observed at ophiolites and massif peridotites; analogous lithological variations are found among grouped abyssal peridotites. This presentation summarizes major and trace element variations across an ~20m wide DHL-PL sequence at Trinity ophiolite [1-3], and a model for formation of DHL-PL sequences involving multiple episodes of melt migration and melt-rock reaction. Major and trace elements of Trinity plagioclase lherzolites suggest an impregnation origin. Depleted residual peridotites were infiltrated by near fractional melts of a depleted mantle source that crystallized in-situ. Trace element variations across the entire DHL-PL sequence suggest a second melt-rock reaction event. REE & HFSE are near-uniform in DHL cpx but increase at the lherzolite-plagioclase lherzolite boundary ~9m from the dunite-harzburgite contact. In contrast, NiO in olivine increases ~3m from the dunite-harzburgite contact. We interpret the spatial offset as reflecting chromatographic fractionation that occurred as plagioclase- and pyroxene-undersaturated boninitic melt percolated from the dunite into plagioclase lherzolite wallrock. Our observations suggest that dunite channels can be sources for pervasive melt-rock reaction as well as melt extraction pathways [4]. Dunite-sourced melts may be particularly influential beneath volcanic arcs and subduction-influenced slow spreading centers where deep conductive thermal regimes limit efficient melt extraction from dunite channel networks. The mechanisms presented here can explain litholotical variability observed in peridotites from a variety of tectonic settings, which may be tell-tale signals of dunite-sourced infiltration events.

[1] Kelemen et al (1992) *Nature* **358**, 635-641. [2] Morgan *et al* (2010) G^3, Q07025. [3] Dygert *et al* (2016) *J.Pet* **57**, 815-838. [4] Kelemen *et al* (1995) *JGR* **100**, 475-496.