The effect of melt/lithosphere interactions on MORB chemistry through the example of the easternmost Southwest Indian Ridge

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Melt-lithosphere interactions modify the mineralogy and chemistry of the axial lithospheric mantle at intermediate to slow and ultraslow spreading ridges. These interactions also probably modify the chemistry of MOR basalts adding complexities to the geochemical signature inherited from the mantle source.

The melt distribution in the easternmost part of the Southwest Indian Ridge (between 61 and 67°E) is very heterogeneous, with corridors of ultramafic seafloor where plate separation is accommodated by large offset normal faults [Sauter, Cannat et al., 2013]. These ultramafic corridors also expose rare gabbros, impregnated peridotites and basalts. This is a good laboratory to study the effect of melt/lithosphere interactions on MORB chemistry because the melt supply is very low and therefore the volume ratio of through going melt to axial lithospheric mantle is also low.

Basalts from the easternmost SWIR represent a global end-member for MORB major element compositions [Meyzen et al., 2003], with higher Na_2O and Al_2O_3 wt%, and lower CaO and FeO wt% at a given MgO. We propose that these major element compositions could result from extensive melt-rock interactions in the thick axial mantle lithosphere.

The mineralogy and chemistry of samples of impregnated peridotites collected in the ultramafic corridors provide the basis for this hypothesis. The impregnating melt reacted with residual olivine and orthopyroxene to form plagioclase and clinopyroxene. The REE composition of calculated melts in equilibrium with clinopyroxenes for these samples is similar to that of the associated basalts. The inferred primary melt composition has a very low MgO content consistent with very low degrees of mantle melting.

Based on this SWIR end-member example, we examine the possible effects of similar processes operating in more magmatic regions of the global MOR system.