Elemental discrimination between peridotite and pyroxenite melting in MORB and Hawaiian glasses

S. YANG[1], M. HUMAYUN[1], V. J. M. SALTERS[1], D. A. CLAGUE[2] AND M. R PERFIT[3]

[1]NHMFL & Dept. of EOAS, Florida State University, Tallahassee, FL 32310, US (syang@magnet.fsu.edu)

[2]Monterey Bay Aquarium Research Institute, Moss Landing, CA 95039, USA

[3]Dept. of Geol. Sci., University of Florida, Gainesville, FL 32611, USA

Basaltic melts are understood to originate in the mantle as partial melts of spinel or garnet peridotite that may or may not contain pyroxenite veins from recycled crust. The chemical effect of having a two-lithology mantle on the composition of basalt is not well understood at the level of major element abundances. An added complication is that chemical interactions between the core and the mantle may enrich oceanic island basalt (OIB) sources in iron (Fe) relative to manganese (Mn) and mask a "pyroxenite" effect. Systematically higher Fe/Mn ratios in Hawaiian OIBs relative to MORB and Icelandic OIBs may be due to such core-mantle interaction [1] or due to Mn-retention in pyroxenite-rich mantle sources [2]. The discrimination of these two effects is a first-order issue in mantle geochemistry.

We report new, precise measurements of the abundances of 69 elements, including all major elements, determined by laser ablation ICP-MS on glasses of MORB and Loihi seamount OIB. Ga/Al and Ge/Si are not significantly fractionated during crystal-liquid fractionation processes but are sensitive to the source mineralogy. Recently reported partition coefficients for these elements [3] show that Ga/Al is sensitive to the garnet/spinel ratio and effectively discriminates MORB from Hawaiian lavas on the basis of spinel vs. garnet peridotite melting, respectively. Furthermore, Ge is compatible in garnet, incompatible in olivine, pyroxenes do not fractionate Ge/Si. Thus, partial melts (<80%) of garnet pyroxenite of MORB composition have lower Ge/Si than any MORB or Loihi glasses, indicating that pyroxenite partial melts contribute little by mass fraction to Hawaiian or MORB melting. Current peridotite Ge values are known too poorly for modeling the Ge/Si, even in MORBs.

[1] Humayun *et al* (2004) *Science* **306**, 91-94. [2] Sobolev *et al* (2007) *Science* **316**, 412-417. [3] Davis *et al* (2013) *Geochim. Cosmochim. Acta* **104**, 232-260.