American Mineralogist, Volume 88, pages 1825–1831, 2003

Trace element partitioning between mantle wedge peridotite and hydrous MgO-rich melt

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ABSTRACT

Magmas erupted at convergent margins consist of components from both mantle wedge and subducted slab. In an effort to quantify the relative contributions of these sources, we have determined 19 trace element partition coefficients (*D* values) for orthopyroxene and clinopyroxene, in equilibrium with spinel and hydrous high-MgO melt under conditions appropriate to melting in the mantle wedge, i.e., 1.3 GPa, 1245 °C, and f_{O_2} of NNO + 1. All trace elements are more incompatible in clinopyroxene during hydrous melting than during anhydrous melting of fertile and depleted peridotite. Orthopyroxene *D* values are relatively insensitive to pressure, temperature, and phase composition. The new *D* values are used to calculate the trace-element composition of the mantle wedge, which produced primitive South Sandwich Islands and St. Vincent (Lesser Antilles) arc basalts. Both sources correspond to previously depleted mantle that has been enriched in LILEs and LREEs by slab-derived fluids. In the case of the South Sandwich Islands, the calculated source is in very close agreement with dredged fore-arc lherzolites. Our partitioning data confirm that hydrous melting of wedge peridotite itself cannot produce the characteristic enrichments of LILEs over REEs and HFSEs. Our estimates of the slab component in South Sandwich Islands and St. Vincent are consistent with estimates from other arcs, derived by alternative methods.