Doubly-distilling eclogite in ocean island basalt sources

J. PRYTULAK* AND T. ELLIOTT

Bristol Isotope Group, University of Bristol, Bristol, BS8 1RJ, UK (* correspondence: J.Prytulak@bristol.ac.uk, Tim.Elliott@bristol.ac.uk)

The presence of recycled mafic oceanic crust as lithologically distinct bodies in the source of ocean island basalts should be discernable by their much higher melt productivity compared to peridotite. U-series disequilibria in young, mafic lavas are dependent on the melting rate of their source, which in most cases is primarily controlled by its melt productivity. Thus we use coupled ^{238}U-^{230}Th and ^{235}U-^{231}Pa disequilibria from Pico Island, Azores, to constrain the melting behaviour of the underlying mantle. Recent Pico Mountain lavas show limited variations in their initial activity ratios, with ($^{230}Th/^{238}U$) = 1.22-1.25 and ($^{231}Pa/^{235}U$) = 1.47-1.50. Using these results with a simple, dynamic melting formulation we infer melting rates of $<1x10^{-4}$ kg/m^3/a and melt porosities of <0.7% near the onset of melting. For a plausible range of mantle upwelling rates, this implies that the melt productivity beneath Pico is <6%/GPa. This value is consistent with a garnet peridotite source but not with direct contributions from discrete, highly productive mafic lithologies. Given independent evidence for the involvement of mafic lithologies in Pico magmagenesis, our results point to a scenario in which eclogite initially melts and chemically interacts with the surrounding peridotite. Subsequent remelting of such an incompatible element enriched peridotite carries a geochemical signature of mafic lithologies but not a record of their high melt productivity.

Long-term release of sulfide oxidation products from old tailings impoundments

C.J. PTACEK*, D.W. BLOWES, J.L. JAMBOR, M.C. MONCUR AND M.R. GUNSINGER

Department of Earth and Environmental Sciences, University of Waterloo, Waterloo, ON, Canada, N2L 3G1 (*correspondence: ptacek@uwaterloo.ca)

Sulfide oxidation reactions occurring in mine tailings impoundments can lead to the accumulation of large masses of secondary solids in the shallow tailings zone. Following the completion of sulfide oxidation, the dissolution of secondary minerals provides a continuing source of dissolved metals to infiltrating water. Measurements of masses, mineralogical characteristics and estimates of the potential for leaching of secondary phases were made for solids collected from three weathered tailings impoundments. These measurements were combined with geochemical model calculations to assess the potential for long-term release of dissolved metals. The results suggest that metal release will continue centuries after sulfide mineral oxidation reactions cease. Predictions of long-term release of contaminants from mine wastes require not only accurate prediction of rates of sulfide mineral oxidation, but also accurate incorporation of the stability of secondary accumulations into the predictive models.