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Os Isotope Systematics in Java and Flores, Indonesia

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The Re-Os isotope system is potentially a very sensitive tracer of crustal recycling processes at convergent margins due to the highly radiogenic nature of sediment and altered oceanic crust relative to the mantle. Fluxing of overlying mantle wedge with slab-fluids during subduction would therefore be expected to impart a radiogenic Os isotope signature to the arc mantle and magmas generated therefrom, assuming that Os is sufficiently mobile in slab-derived fluids. Recent studies of arc mantle xenoliths show that arc mantle is anomalously radiogenic in Os relative to other depleted mantle (e.g. abyssal peridotites and xenoliths of intra-plate continental and oceanic lithospheric mantle), suggesting that Os is indeed fluid-mobile during subduction processes (Brandon, 1996; Widom, 1999).

Re-Os studies of arc magmas are complicated by very low Os abundances, and the resulting likelihood that crustal contamination processes have affected the Os isotope signatures of erupted magmas. A recent study of Re-Os isotope systematics in lavas from western Java indicates very low Os abundances and extremely radiogenic Os in arc magmas, that have been interpreted to reflect either shallow-level crustal contamination or radiogenic slab-derived Os in the mantle wedge (Alves et al. 1999). Our study has focused on higher Os abundance arc magmas from central and eastern Java and Flores. These samples have been previously analyzed for Sr-Nd-Pb isotopes and B/Be ratios, and hyperbolic mixing trends in isotope ratio vs. B/Be space have been interpreted to reflect Indian Ocean MORB and OIB-type mantle that has been affected by variable contribution of a homogeneous slab-derived fluid (Edwards et al., 1993).

We have analyzed a suite of 15 samples from 4 volcanoes on Java and Flores, that span a wide compositional range from low-K tholeiitic to medium-K calc-alkaline to high-K leucititic compositions. Re and Os concentrations range from 57 to 282 ppt, and 0.5 to 278 ppt, respectively. Re/Os ratios range from 0.2 to 396 and vary negatively with Os concentration. $^{187}Os/^{188}Os$ ratios range from 0.1388 to 0.7882. If we consider only the samples with > 10 ppt Os, however, there is a more limited range in $^{187}Os/^{188}Os$ from 0.1388 to 0.1732. In this sample subset, the high-K leucititic samples (SiO_2 = 43.9 - 45.5%) are the least radiogenic in Os, with $^{187}Os/^{188}Os$ = 0.1388 - 0.1401. These samples have low B/Be (1-5) indicative of mantle relatively unaffected by slab-fluid addition. Low-K tholeiitic and medium-K calc-alkaline samples with SiO_2 = 46.9 - 54.8% and intermediate B/Be (9-19) are more radiogenic in Os, with $^{187}Os/^{188}Os$ = 0.1607 - 0.1629. One medium-K calc-alkaline sample with SiO_2 = 59.8% and B/Be = 104 (indicative of a substantial slab-fluid component), has the most radiogenic Os isotope signature with $^{187}Os/^{188}Os$ = 0.1732.

Although crustal contamination processes cannot be ruled out even for the samples with > 10 ppt Os, the general correlation of increasing $^{187}Os/^{188}Os$ with increasing B/Be is consistent with radiogenic Os being added to Indian Ocean and/or OIB-type mantle wedge during slab dewatering. The lack of correlation of $^{187}Os/^{188}Os$ with B/Be in the whole data set (including <10 ppt Os samples) suggests that the highly radiogenic Os isotope signatures ($^{187}Os/^{188}Os$ > 0.18) are most likely due to crustal contamination processes. The low Os abundance samples from our study have lower $^{187}Os/^{188}Os$ for a given Os abundance than those found in western Java (Alves et al. 1999), possibly reflecting greater degrees of contamination of the western Java magmas due to the thicker and more continental-like crust beneath western Java than that beneath eastern Java and Flores (Hamilton, 1979).

Alves S, Schiano P & Allègre CJ, *Earth and Planet. Science Lett.*, **168**, 65-77, (1999).
Brandon AD, Creaser RA, Shirey SB & Carlson RW, *Science*, **272**, 861-864, (1996).
Edwards CMH, Morris JD & Thirlwall MF, *Nature*, **362**, 530-533, (1993).
Hamilton W, *U.S. Geol. Survey Prof. Paper*, **1078**, 345 pp., (1979).
Widom E & Kepezhinskas P, *Trans. Am. Geophys. Union (EOS)*, **80**, 354, (1999).