



Elevated Pt, Pd and Au concentrations in high-Ca boninites, northern Tonga arc: evidence for residual monosulfide solid solution

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Fresh glassy lava samples from the Tofua arc, Fonualei rifts, and Mangatolu triple junction at the north end of the Tonga-Kermadec arc - backarc system were dredged during the Northern Tonga Vents (NoToVe) cruise by RV Southern Surveyor in 2004. We present major and trace elements and low-level platinum-group element (PGE; Ir, Ru, Rh, Pt, Pd) and gold analyses (Ni sulfide fire assay, tellurium coprecipitation, ICP-MS finish) for samples ranging from picrite to dacite. Samples from volcano F appear to be intermediate to felsic differentiates of a boninitic suite similar to volcano A. The boninites reflect aggregate degrees of partial melting of approximately 40-50% of depleted MORB mantle, possibly due to two-stage melting of already-depleted MORB mantle, with major inputs of fluid-mobile large ion lithophile elements (LILE). The Tofua suite shows no sign of interaction with the Samoan plume, notably having Nb abundances < 0.2 ppm. Samples from the Mangatolu triple junction are boninitic, but display Nb contents 5 to 10 times higher than in the arc front, indicating an input of Samoan plume material with OIB character. PGE and gold concentrations in the most primitive boninites and tholeiites are extremely high, with Pd concentrations as great as 20 ppb. Ir and Ru are depleted in the same lavas, showing concentrations of approximately 0.1 and 0.5 ppb, respectively. PGE distributions require that the only sulfide phase retained in the restite during melting of the depleted source mantle was monosulfide solid solution. Sulfide liquid cannot have been present in significant amounts, in light of the high Pd concentrations. Retention of solid sulfide during melting requires that the boninites were generated at high pressures by large fluxes of slab-

derived H₂O that introduced substantial amounts of sulfide into the mantle wedge.