Influence of Hikurangi Plateau subduction on the Kermadec arc volcanoes Rumble II East and West

TIMM, C.[1], LEYBOURNE, M.[2], WYSOCZANSKI, R.[3], HOERNLE, K.[4], HAUFF, F.[4], HANDLER, M.[5], CARATORI-TONTINI, F.[1] AND DE RONDE, C. E. J.[1]

[1]GNS Science, PO Box 30-368, Lower Hutt, New Zealand (ctimm@gns.cri.nz)
[2]Laurentian University, Sudbury P3E 2C6, Canada
[3]NIWA, Wellington, New Zealand
[4]GEOMAR Wischhofstrasse 1-3, 24148 Kiel, Germany
[5]Victoria University Wellington, New Zealand

The southern Kermadec arc is a rare example where the effects of subducting an oceanic large igneous province, the Hikurangi Plateau (HP), on arc volcanism and element transfer can be studied. The volcanoes Rumble II East (arc front) and West (backarc) are located above the subducting HP, forming a ~23 km arc - backarc transect. Rumble II East rocks are mainly basaltic and include a clinopyroxenite of near Moho and a gabbro of mid crustal origin. Two of the Rumble II East lavas show low Th/Yb and 206Pb/204Pb, but high Ba/Th and 143Nd/144Nd values, suggesting a geochemically depleted source. Most Rumble II East rocks, however, have elevated Th/Yb and 206Pb/204Pb values, but low Ba/Th and 143Nd/144Nd isotopic compositions. Of note, the clinopyroxenite has a HIMU-type Pb, but low Nd isotopic composition, suggesting a hybrid subducting sediment - HP crustal signature. As some lavas have higher 206Pb/204Pb values than subducting sediments, input from the HP and its HIMU-type seamounts plus subducted sediments can explain the observed geochemical compositions. We therefore propose that the clinopyroxenite represents a lower crustal/upper mantle endmember beneath Rumble II East that has interacted with ascending melts. By contrast, Rumble II West lavas are generally more silica-rich and have low Ba/Th and 206Pb/204Pb values, low to elevated 143Nd/144Nd values and elevated Th/Yb. These characteristics suggest some sediment input into a less depleted mantle wedge consistent with the location of Rumble II West behind the arc front. The low Pb and high Nd isotopic ratios do not require input from a Hikurangi component. Although lavas from both Rumble II volcanoes have generally overlapping Cu, Mo and S, bulk rock contents are similar to other Kermadec arc basalts and andesites. Elevated S, Cr and Ni, but low Cu contents in the clinopyroxenite suggest the presence of sulphides in olivine and pyroxenes. Elevated S and Cu contents in the gabbro, however, indicate minor Cu-bearing sulphides. Interaction of ‘wet’ ascending arc melts with sulphide-bearing crustal rocks may therefore produce S-rich and thus chalcophile element-rich magmas beneath arc volcanoes.