New Constraints on the Petrogenesis and Time Scales of High Mg Andesite Evolution, White Island, New Zealand

*AU: * Schaefer, B F*
EM: Bruce.Schaefer@sci.monash.edu.au
AF: Monash University, School of Geosciences, Clayton, Vic 3800, Australia
AU: Turner, S P
EM: sturner@els.mq.edu.au
AF: Macquarie University, GEMOC Dept of Earth and Planetary Sciences, Sydney, NSW 2109, Australia
AU: Wood, B J
AF: Macquarie University, GEMOC Dept of Earth and Planetary Sciences, Sydney, NSW 2109, Australia
AU: Heyworth, Z
AF: Monash University, School of Geosciences, Clayton, Vic 3800, Australia

Unusually primitive, high Mg andesites have been erupting since 1977 on White Island, which lies off shore of New Zealand in the southern part of the Tonga-Kermadec island arc. They are Fo80-93 olivine saturated rocks which have MgO contents up to 10% (Mg# = 65-71) with SiO_2 of 56-58% and contained 1.4-4.4% H_2O. $^{143}Nd/^{144}Nd$ and $^{176}Hf/^{177}Hf$ ratios of 0.51282-0.51266 and 0.28301-0.28298, respectively, are consistent with subducted sediment addition and there is no clear correlation of either isotope ratio with MgO. They have incompatible trace element characteristics that are typical of arc rocks and flat rare earth element patterns. Sr/Y and Tb/Yb ratios are both low and relatively invariant at 8 and 0.3 respectively and along with the ^{238}U- ^{230}Th disequilibria preclude an origin in which residual garnet was involved. The occurrence of ^{226}Ra deficits and the preservation of a negative correlation between ($^{226}Ra/^{230}Th$) and ($^{230}Th/^{238}U$) suggest the presence of residual amphibole during partial melting followed by rapid magma ascent. Recent compilations of peridotite experimental data suggest the presence of high MgO (7-10%) magmas will equilibrate with high SiO2 contents (52-57%)when melting takes place at shallow levels and hence do not require an eclogitic component. This would suggest that the source of the high-Mg andesites from White Island was peridotitic with a small component of amphibole rather than eclogitic. Such observations are also consistent with the U-series disequilibria data.