On White Island, New Zealand, the intensified period of strombolian-volcanian and phreatomagmatic explosive activity that commenced in March 1977 led to eruption of unusually primitive, high-Mg andesites. These are Fo80-93 olivine-saturated rocks that have MgO contents up to 10 percent (Mg# = 65-71) and SiO₂ of 55-58 percent. They have incompatible trace element characteristics that are typical of arc rocks. ¹⁸⁷Sr/⁸⁶Sr, ¹⁴³Nd/¹⁴⁴Nd and ¹⁷⁶Hf/¹⁷⁷Hf ratios (0.7049-0.7053, 0.51282-0.51266 and 0.28301-0.28298, respectively) are consistent with subducted sediment addition and/or crustal input but there is no clear correlation of either isotope ratio with MgO. The rocks have modest (3-10 percent) ²³⁸U excesses at low (²³⁰Th/²³²Th) ratios (0.697 to 0.722). ²²⁶Ra-²³⁰Th disequilibria is also restricted but, unusually, includes both ²²⁶Ra excesses and deficits with (²²⁶Ra/²³⁰Th) = 0.94-1.07. (²¹⁰Pb/²²⁶Ra)₀ ranges from 0.98 to 1.52 requiring gas accumulation that may increase over time and with decreasing MgO. Sr/Y and Tb/Yb ratios are both low and relatively invariant at 8 and 0.3, respectively, and along with the ²³⁸U excesses preclude an origin in which residual garnet was involved. The occurrence of some ²²⁶Ra deficits suggests the presence of residual amphibole during partial melting for some samples. Rapid magma ascent (to preserve the ²²⁶Ra disequilibria) limits the amount of possible melt - wall rock interaction that might reduce source-derived Tb/Yb ratios and in the mantle or raise ⁸⁷Sr/⁸⁶Sr in the crust. The White Island high-Mg andesites did not form by partial melting of eclogite in the subducting Pacific plate. Their primitive, olivine-saturated compositions suggest that their source was peridotitic and experimental data suggest that melting at low temperatures at 0.5-1.5 GPa and in the presence of elevated alkalis can reconcile the high SiO₂ and MgO of the rocks. These conditions appear to be favoured by the location beneath continental, rather than oceanic lithosphere.