

## **Garnets in Miocene Andesites from Northland, New Zealand: Tracers of Lower Crustal Subduction Processes**

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Andesites of a Miocene continental arc assemblage on the eastern side of the Northland Peninsula contain abundant garnets in close association with partially assimilated mafic xenoliths of lower crustal origin. Andesitic hosts vary between metaluminous pyroxene-bearing high-MgO basaltic andesites, low-MgO biotite-hornblende andesites and weakly peraluminous hornblende-andesites. They show characteristics of being product of complex open system processes. Garnets are found as 0.1-10mm single euhedral to resorbed crystals but most commonly as aggregates of 2 or more annealed crystals. They occur in various andesite units as well as within mafic gabbro, amphibolite, hornblendite and garnetite xenoliths. Their petrographic and compositional relationships with the andesite hosts imply that garnets are not phenocrysts but xenocrysts resembling those within the associated xenoliths. Garnets show the highest grossular contents and greatest compositional variations found so far within a calc-alkaline suite and vary between at least 3 end-members of  $\text{Alm}_{23}\text{Gross}_{27}\text{Pyrope}_{34}$ ,  $\text{Alm}_{45}\text{Gross}_{45}\text{Pyrope}_{67}$  and  $\text{Alm}_{12}\text{Gross}_{23}\text{Pyrope}_{56}$ . Major element and more pronounced trace element zoning patterns reveal a multistage petrogenetic link between the garnet end-members and provide, together with their mineral association and geothermobarometry, important constraints on the nature and history of dynamic processes and thermal events within the lower crust in a subduction zone setting.