# Geochemistry and origin of sulfide minerals in peridotite xenoliths from the North Island, New Zealand

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Pliocene-Quaternary hawaiite from the Ngatutura volcanic field of the North Island, New Zealand contains anhydrous Group I mantle xenoliths composed of dunite, wehrlite, harzburgite and clinopyroxenite. Detaild petrological and geochemical studies of these xenoliths have identified that they are derived from the cumulus mantle composed of meta-cumulates. Some xenoliths have secondary metasomatic clinopyroxenes with large amounts of fluid inclusions. Most xenoliths display no significant reaction with the host magma.

Trace amounts of sulfide minerals are present in primary minerals (olivine, clinopyroxene and orthopyroxene) of all rock types, but abundant in metasomatized xenoliths including secondary clinopyroxenes. Three types of sulfide grains (enclosed, interstitial and vein) were oberved. The size of these grains ranges from 1 to 85μm. The enclosed sulfides form rounded and elongated inclusions in olivine, clinopyroxene and orthopyroxene. These sulfides consist mainly of pyrrhotite and Ni-poor (5-10wt% Ni) monosulfide solid solution (MSS) with minor pentlandite, chalcopyrite and bornite. Chalcopyrite mostly occurs as a marginal part of Ni-poor MSS and contains exsolution products of bornite. The chalcopyrite is Cu deficient (27-29wt% Cu), compared to ideal $CuFeS_2$ stoichiometry. The interstitial sulfides have irregular shape with curvilinear or linear boundaries of silicate minerals. There is no difference in sulfide phase between the interstitial and enclosed sulfides. The vein sulfides occur as fracture fillings and were observed in one xenolith. It was difficult to determine the precise compositions of vein sulfides because of their small sizes, but they seem to be MSS or pyrrhotite from the back-scattering electron image.

Based on the textual and chemical characteristics, the sulfide minerals in primary mineral were probably formed from an immiscible sulfide liquid coexisting with a silicate melt forming cumulus mantle. In contrast, the sulfide minerals in secondary clinopyroxenes may be crystallized from metasomatic fluid or melt. These results indicate that metasomatic process controls the heterogeneous distribution of sulfide minerals within the upper mantle.