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H2O inclusions and mineral comopositions of amphibole and phlogopite bearing peridotite xenolith in Pinatubo 1991 dacite

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Spinel peridotite xenoliths are present in the dacites of the Pinatubo 1991 eruption, Luzon Island, Philippines. The Pinatubo volcano is one of the Bataan arc-front volcanoes that are associated with eastward subduction of the South China Sea floor along the Manila Trench (e.g. Defant et al., 199 1). The Pinatubo volcano is located south of the Masinloc massif and east of the Cabangan massif of the Zambales ophiolite complex (Newhall et al., 1996), which encounters southeast of Pinatubo volcano, from 1100 to 2733 m below the surface in geothermal exploration hole PIN-1 (Delfin et al., 1996).
Zoned selvages are present in the contact between peridotite xenoliths and host dacites. Its outer zone consists of calcic amphibole (edenite and magnesiohornblende), phlogopite and plagioclase (andesine and labradorite) and its inner zone consists of fibrous orthopyroxene, olivine and phlogopite growing perpendicularly to the contact. Similar selvages are observed in the other peridotite xenoliths from Iraya and Monglo volcanoes, Luzon arc, Philippines (Arai et al., 1996; Payot et a., 2001), Oshima-Oshima volcano, Northeast Japan arc (Ninomiya & Arai, 1992), Avacha volcano, Kamuchatka arc (Ishimaru & Arai, 2007) and Canary Islands (Klugel, 1998). These selvages are interpreted as reaction products between host magmas and peridotite xenoliths (e.g. Klugel, 1998). Similar Al_2O_3- Mg# (=100 x Mg/(Mg + Fe)) compositions of amphiboles in the selvage to those of phenocrysts in the host dacites (Prouteau & Scallet, 2003) support this interpretation.
Peridotite xenoliths are mainly composed of olivine and orthopyroxene with minor amounts of spinel and calcic amphibole surrounding spinel and orthopyroxene. Small grains of clinopyroxene and phlogopite also surround spinel and orthopyroxene. Many inclusions are observed in olivine. Raman spectroscopy of these inclusions shows that these inclusions are mostly H_2O. H_2O inclusions have been reported from some peridotite xenoliths in subduction zones: from Iraya (Schiano et al., 1995), Lihir, Papua New Guinea (McInnes et al., 2001) and Avacha (Ishimaru et al., 2009). CO_2-H_2O inclusions have been reported from Ichinome-gata, Northeast Japan arc (Roeder, 1965).
Forsterite contents of olivine and Mg# values of orthopyroxene vary from 89 to 92. Al_2O_3contents of orthopyroxene vary within a single thin section. Phlogopite and amphibole inside of peridotite xenoliths have major element chemistry different from those of selvage, suggesting that hydration of peridotite did not result in the reaction with host dacites. All the amphiboles analyzed are calcic amphibole (tremolite and magnesio hornblende). Fe-number of amphiboles is correlated positively with Na+K and Al, and negatively with Si. The same characteristics are also observed in Avacha peridotite xenoliths as presented by Ishimaru and Arai (2008). Some spinels show chemical variation of Cr# (=100 x Cr/(Cr + Al)) and Mg# within a single grain and such feature is similar to that in observed in the Avacha peridotite xenolith. These features of petrography and mineral compositions suggest possible metasomatism in the mantle beneath the Pinatubo by high-SiO_2 aqueous fluid.

Keywords: H2O inclusions, hydrous mineral bearing peridotite xenolith, Pinatubo dacite, metasomatism