

Petrological features of the peridotite xenoliths in the 1991 Pinatubo dacite and mantle metasomatism by subducted ocean

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We observed peridotite xenoliths in the dacite of the 1991 pyroclastic flow deposit of Pinatubo volcano, which is located at the volcanic front of the Luzon (Bataan) arc, Luzon island, the Philippines. The Luzon arc is associated with eastward subduction of the South China Sea plate along the Manila Trench. We also found olivine xenocrysts and xenoliths of amphibolite and granitic rocks in the dacitic deposits. The largest xenolith was up to 14 cm across among about 200 collected samples. Selvage of hornblendite, up to 5 mm width, is common between the peridotite and the dacite host.

Arai et al. (1996) classified peridotite xenoliths from Iraya volcano, Batan Island, the Philippines, into coarse grained (C) and fine grained (F) types depend in terms of olivine grain size. The C-type xenoliths are equivalent to ordinary mantle xenoliths from various localities and the F-type xenoliths are quite different in texture, its individual grains being hardly visible by the naked eye and the fine-grained (≤ 0.1 mm) part occupying >10 % by volume (Arai and Kida, 2000). They interpreted that the F-type peridotite was possibly formed from the C-type one by recrystallization assisted by SiO₂-rich fluid or melt originated from subducting slab. Such peculiar F-type xenoliths can be observed in the peridotite xenoliths from Avacha volcano on the volcanic front of the Kamchatka arc, Russia (Ishimaru et al., 2007) and at Tubaf and Edison volcanos, Tabar-Lihir-Tang-Feni island arc, which occur in the fore-arc region of the New Ireland intra-oceanic island arc, Papua New Guinea (McInnes et al., 2001). According to their definition, the F-type peridotites occupy about 50 % of 40 Pinatubo samples. Almost all of the Pinatubo C-type xenoliths are spinel harzburgites (olivine + orthopyroxene + amphibole + spinel \pm clinopyroxene \pm phlogopite) except a wehrlite and a dunite samples. CO₂-bearing saline fluid inclusions were observed in all samples (Kawamoto et al., 2013).

The Sr-Nd isotopic compositions of amphibole from the primary C-type xenolith containing least amounts of fine-grained part are consistent with the most depleted values of the range of andesite and dacite ($^{87}\text{Sr}/^{86}\text{Sr} = 0.70419 - 0.70425$, $^{143}\text{Nd}/^{144}\text{Nd} = 0.512863 - 0.512924$; Castillo et al, 1991; Bernard et al, 1991). Their compositional variation is within a range of South China Sea oceanic basalt (Tu et al., 1992). Multi-element chondrite-normalized patterns of the amphiboles show depleted signatures with enrichment of Ba, Rb, U, in Pb. These enriching elements are considered as fluid mobile during dehydration of subducting mantle, oceanic crust and sediment (e.g. Tatsumi et al., 1986; McCulloch & Gamble, 1991). The present Sr-Nd isotopic and geochemical signatures of the amphibole suggest that the Pinatubo C-type mantle xenoliths have also been metasomatized by aqueous fluids released from subducted oceanic crust beneath the volcanic front.

References; Arai et al., *Sci. Rep. Kanazawa Univ.*, 41, 25-45, 1996; Arai & Kida, *Is. Arc*, 9, 458-471, 2000; Bernard et al, in Newhall & Punongbayan (eds.) *Fire and mud: PHILVOLCS*, 767-798, 1991; Castillo & Punongbayan, in Newhall & Punongbayan (eds.) *Fire and mud, PHILVOLCS*, 799-806, 1991; Ishimaru et al., *J. Petrol.*, 48, 395-433, 2007; Kawamoto et al., *PNAS*, 110, 9663-9668, 2013; McCulloch & Gamble, *EPSL*, 102, 358-374, 1991; McInnes et al., *EPSL*, 188, 169-183, 2001; Tu et al., *Chem. Geol.*, 97, 47-63, 1992.

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