Petrology of the ultramafic xenoliths with K-feldspher veinlet from Hamada nephelinite, SW Japan arc

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We foumd a small veinlet of K-feldspher without hydrous minerals cross-cutting an Opx porphyroclast in a lherzolite xenolith from Hamada nephelinite volcano, SW Japan arc. The Hamada nephelinite is a small single lava flow (~0.05 km^3) located by the Japan Sea coast in Chugoku district and erupted in late Miocene (5.75±0.20 – 6.10±0.19 K-Ar ages, Uto et al., 1984). The ultramafic and mafic xenoliths are included in this nephelinite lava flow. The ultramafic xenoliths are mainly composed of dunite - wehrlite and clinopyroxenite, rarely lherzolite and websterite (Fujii, 1974). The Fo content of Ol (82-83) and Mg/(Mg+Fe*) ratio (= 0.87 – 0.89; Fe*, total Fe) of Cpx are slighly lower than in tipical mantle peridotite. The calculated quilibrium temparature of lherzolite is rather low (~800°C; Wells, 1977; Witt-Eickschen & Seck 1991). Chondrite normalized REE and some trace-element pattern of Cpx in lherzolite is slightly LREE-depleted, while the host nephelinite has highly LREE-enriched pattern (Tatsumi et al., 1999).

The K-feldspar is Ca-free and homogeneous in composition in the veinlet (Or_{85}, K_2O = 13.5 wt%). Innumerable small euhedral to anhedral Ol and few Cpx grains are formed between the K-feldspar veinlet and host Opx. The same assemblage of Ol and Cpx is found surrounding the Opx grains in the lherzolite.

The texture and mineral chemistry suggest that the K-feldspar veinlet is not a reaction product between mantle peridotite and the host nephelinite. Althogh it is hydrous, an absarokite magma (SiO_2 47.72 wt%; K_2O 3.41 wt%; Tatsumi & Koyaguchi, 1981) found in Katamata volcano about 60 km SW from Hamada volcano is a possible metasomatic agent.

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Isotope signatures of microbial processes in sulfidic hot springs

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Anaerobic, acidic, sulfidic, thermal springs (AASTS) represent potentially important settings for the earliest organisms on Earth, and the chemolithotrophs and phototrophs inhabiting them are excellent candidates for Earth's earliest sustainable microbial communities. If environments similar to AASTS were more widespread on the early Earth, the paleo-significance of these autotrophs for the global biogeochemical cycling of carbon and sulfur could be immense.

We are presently examining the linkage between coupled biogeochemical cycling of sulfur, carbon and other nutrients and the metabolic activities of autotrophic communities in AASTS from several localities in the Philippines. We have examined one particular locality in detail (Lipayo #1, Negros Oriental, Philippines), where we showed the gradient of pO_2, pH and T to be accompanied by changes in microbial community composition from those dominated by anaerobic, acidophilic and S oxidizing bacteria (e.g., Desulfurella multipotens, Hydrogenobacter acidophilus, Aquificales) to those dominated by cyanobacteria (e.g., Microcystis aerugosa), Cyanidium caldarium (red algae), Deinococcus geothermalis within a 10-meter flow interval. The same interval showed a monotonic decline of H_2S and increase in $SO_4^{=}$, fluctuation in $S_2O_3^{=}$, and no significant shift in $\delta^{34}S$ of either H_2S or $SO_4^{=}$. The relative values of $\delta^{13}C$ of DIC, bulk biomass, and component fatty acids near the hot spring vent area is consistent with the dominance of organisms that fix carbon using the reverse tricarboxylic acid cycle.