

Mineral chemistry of anorthite megacryst and its inclusions from Mt. Fubo, Minami Zao

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Anorthite megacrysts, which are high-calcic plagioclase (An >90 mol%) phenocrysts larger than 10 mm, are characteristic minerals occurring in basalt - andesite from Japanese Islands arc (Kimata et al. 1995). Anorthite megacrysts from Miyakejima contains various inclusions such as native copper (Cu: Murakami et al. 1991), native zinc (Zn: Nishida et al. 1993) and native brass (Zn-Cu alloy: Nishida et al. 1993). In addition, hydrocarbon was also reported from Miyake-jima anorthite (Kimata et al. 1993), which suggests that slab sediments on subducting plates had important role for crystallization of these anorthite megacrysts. These past studies indicate that mineral, melt or liquid inclusions in anorthite megacrysts may afford a clue to the formation process of such minerals. We report the analytical results of sulfide inclusions in anorthite megacrysts from Mt. Fubo (one peak of Minami Zao volcanos). Mt. Fubo is located along the volcanic front and the anorthite megacryst occurs in lavas erupted in the Quaternary period. The chemical analyzes of the anorthite megacrysts (host crystal) and sulfide inclusions were carried out using an electron microprobe analyzer with wavelength dispersive X-ray spectroscopy (EMPA-WDS: JEOL JXA-8230) and/or a scanning electron microscope with energy dispersive X-ray spectroscopy (SEM-EDS: J JEOL JXA-8230). The analytical results show that the anorthite megacrysts from Mt. Fubo contain sulfide inclusions that are droplet-shaped and 30 - 50 micrometer in diameter. The chemical compositions of the sulfide inclusions in anorthite megacrysts are heterogeneous; Fe-rich phase and Cu-rich phase were observed within a single inclusion. Quantitative analyzes suggest that the Fe-rich phase is pyrrhotite [$\text{Fe}_{(1-x)}\text{S}$ ($x=0-0.17$)] and Cu-rich phase is cubanite (CuFe_2S_3), respectively, and these phases contain both Ni and Cu. These sulfide inclusions consisting the two phases may be trapped as fluid inclusions in the host crystals (anorthite megacrysts) at high temperature. The trapped sulfide liquids seem to be separated from silicate melts as monosulfide solid solution ($\text{Fe}_{(1-x)}\text{S}$ - $\text{Ni}_{(1-x)}\text{S}$: Naldrett et al. 1967) or intermediate solid solution (CuFeS_2 : Fleet 2006) and exsolved into pyrrhotite and cubanite in the host crystals upon cooling. The present study indicates that sulfide melts rich in Fe, Cu and Ni were generated within magmas along the volcanic front in Japan.

Keywords: Anorthite, Arc magma, Sulfide, Inclusion