Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG62-P11 Room:Convention Hall Time:May 22 17:15-18:15

Mineralogy of anorthite megacrysts from Take-shima, Kagoshima Prefecture, Japan

MATSUI, Tomoaki[1*], ARAKAWA, Yoji[2], KIMATA, Mitsuyoshi[2], HOSHINO, Mihoko[3], ECHIGO, Takuya[4], NISHIDA, Norimasa[2]

[1]Kagoshima Univ., [2]Univ. Tsukuba, [3]AIST, [4]NIMS

Anorthite megacrysts of about about 1 cm in maximum diameter are found as phenocrysts in the basaltic lavas from Take-shima, Kagoshima Prefecture, Japan. Take-shima is an island located about 40 km SSW of the southern tip of Satsuma peninsula. The island lies at the northeast edge of Kikai caldera, which measures 17 x 20 km^2, and is one of the large calderas in southern Kyushu (Matsumoto, 1943). Most of the caldera except for three islands, Take-shima, Satsuma-Iou-jima and Shin-Iou-jima, lies below the sea level. The anorthite megacrysts occur in the basalt which is supposed to erupt from Magomeyama, pre-caldera volcano in Take-shima. Similar anorthite megacrysts have been found in the basalt from Satsuma-Iou-jima (Ono et al., 1981). The purpose of this work is to understand the mineralogical significances of anorthite megacrysts from Take-shima, and reveal the genetic mechanism behind these megacrysts.

Thin section were made from fragments with anorthite megacrysts, and observed under a high-magnification polarizing microscope, Nikon ECLIPSE E600 POL. A polarizing stereoscope, MEIJI TECHNO EMZ-5POL-2 was also employed to study microstructure and optical property throughout the megacryst in the same view. For mineral identification, X-ray powder patterns were obtained using a RIGAKU Ultima IV Protectus, X-ray diffractometer with monochromated CuKa radiation (40 kV, 40 mA) at Faculyty of education, Kagoshima University. Software PDXL was used for mineral identification. Refinement of cell parameters was carried out using a single-crystal diffractometer, Rigaku R-AXIS RAPID at the Chemical Analysis Center, University of Tsukuba. Chemical analyses were carried out using a JEOL JXA-8530F EPMA (20 kV, 1.0 x 10^{-7} A for qualitative analyses; 20 kV, 1.0 x 10^{-8} A for quantitative analyses and BSE image observation) at the Chemical Analysis Center, University of Tsukuba. ZAF online full matrix corrections were used for quantitative analyses (Reed, 1996). Compositional maps were obtained using a HORIBA XGT-5000 X-ray analytical microscope (50 kV, 1.00 mA) at the Chemical Analysis Center, Kagoshima University.

The megacryst, reaching a maximum size of about 1 cm in diameter, are mainly found as phenocryst in augite-bearing olivine basalt. The anorthite megacrysts show slight optical zoning. Zonal arrangement of opaque minerals and micro-bubble inclusions are common in the specimens. Moreover they often contain several corroded inclusions of olivine, and albite twins occur in every specimen. Though powder X-ray diffraction pattern of the megacryst shows that an ordered P-1 anorthite is the most likely candidate, single-crystal X-ray diffraction data suggests the structure with c = 0.7 nm cell. X-ray analytical microscope and electron microprobe studies reveals that the megacryst is chemically homogeneous, whereas BSE image shows a slight oscillatory zoning. It indicates Anorthite content of the megacryst is about 94 mol%. Because a trifling amount of Fe and excess Si are detected by EPMA, minor end-members of $FeAl_2Si_2O_8$, $CaFeSi_3O_8$ and $[\ ]Si_4O_8$ are incorporated into the present megacryst.

Though further investigation is required for completely understanding the formation of the anorthite megacryst from Take-shima, this new work provides fundamental information about the history of magmatic system related to anorthite megacryst formation under island arc. The presence of oscillatory zoned micro-bubble inclusions implies the oscillation in pressure, temperature or vapor pressure occurred at a certain narrow range around the melting point of anorthite. The textural feature seems to be consistent with limited chemical zonation observed in BSE image. Both the above implication and the presence of corroded olivine inclusions as a nucleus lead to the megacrystallization of chemically almost homogeneous anorthite in host magma, which offers a good example of Ostwald ripening in nature.

Keywords: anorthite, megacryst, Take-shima, oscillatory zoning, Ostwald ripening