Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SVC47-02 Room:303 Time:May 26 09:15-09:30

Mixing, end-member components and origin of felsic and mafic magmas erupted by Aira caldera-forming eruption

HINATA, Hironobu[1*] ; TATSUMI, Yoshiyuki[1] ; SUZUKI-KAMATA, Keiko[1] ; TANI, Kenichiro[2] ; KIMURA, Jun-Ichi[3] ; CHANG, Qing[3]

[1]Department of Earth and Planetary Sciences, Graduate School of Science, Kobe University, [2]Department of Geology and Paleontology, National Museum of Nature and Science, [3]Department of Solid Earth Geochemistry, Japan Agency for Marine-Earth Scienc and Technology

Aira caldera, located in southern Kyushu, is a collapse caldera with ˜20 km in diameter and was formed by a caldera-forming eruption occurred at ˜29 ky ago. The Aira eruption effused voluminous white pumices basically formed from homogeneous felsic magma. They show the following disequilibrium petrographic features: (1) dark pumice (Arakawa et al., 1998) and banded pumice erupted along with the white pumice, and (2) cores of the plagioclase phenocrysts possess wide compositional range in both An content and Sr isotope composition. These suggest that the Aira eruption was caused not only by the felsic magma but also by the mafic magma, generated from different sources.

The An content of the plagioclase cores ranges from An_{33} to An_{88}. These phenocrysts can be divided into two types such as high-An (type-A: An $>$70), low-An (type-B: An $<$60) based on An contents of their cores and rims. Sr isotope ratios of the type-A and B phenocrysts coincide with those of the dark pumice and the white pumice, respectively. These values are distinct from Shirahama basalt which is assumed to be derived from upper mantle and basement rocks such as the Shimanto sedimentary rocks and the Takakumayama granite. Therefore, the mafic and felsic magmas which crystallized type-A and type-B plagioclase are not simply derived from upper mantle and basement rocks, respectively.

U-Pb dating of the zircon crystals in the white pumice shows concordant ages ranging from 249 to 2517 Ma. The age range is identical to those of the zircons from the basement rocks (Shimanto sedimentary rocks). However, no older zircons in white pumice show overgrowth structure. It is thus likely that older zircon is not source material but one of end-member components.

End-member components for magmas were estimated using element partitioning data (Bindeman et al., 1998; Bindeman and Davis, 2000). The mafic magma (SiO_2 = 59 wt.%, Sr = 391, $^{87}Sr/^{86}Sr$ = 0.7066) which crystallized the type-A plagioclase can be derived from mixing between the basement rocks (Shimanto sedimentary rocks) and the basaltic magma (Shirahama basalt) derived upper-mantle. The felsic magma (SiO_2 = 75 wt.%, Sr = 103, $^{87}Sr/^{86}Sr$ = 0.7060) which crystallized the type-B plagioclase was derived from the middle-lower crustal rocks based on the Sr isotope ratio. The composition of the dark pumice in the Ito ignimbrite can be explained by mixing between the mafic and the felsic magmas. Therefore, it is possible to propose that a cryptic magma should contribute to felsic magma production in association with Aira eruption.

Keywords: Aira caldera, caldera-forming eruption, magma mixing, end-member components, zircon, plagioclase