Origin of felsic magma in Aso caldera: Importance of shallow magma degassing

ISOJI MIYAGI[1], TAICHI SUDA[2], HIDEO HOSHIZUMI[1], GENJI SAITO[1], YASUO MIYABUCHI[3], NOBUO GESHI[1]

[1]Geological Survey of Japan, Tsukuba Central 7, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8567, JAPAN
[2]Toray Research Center, Inc., 3-3-7, Sonoyama, Otsu, Shiga, 520-8567, JAPAN
[3]Faculty of Education, Kumamoto University, Kurokami 2-40-1, Kumamoto 860-8555, Japan

Aso caldera repeated four cycles of large pyroclastic-flow eruptions since 270 ka and is still active. The knowledge about the origin and the storage place of huge quantity of felsic magma of Aso is important to mitigate the potential huge disaster in the future. In order to clarify temperature-pressure path during the formation of felsic magma in Aso, we analyzed the concentrations of major elements and volatile constituents of melt inclusions in phenocrysts using EPMA and NanoSIMS, calculated the change in melt composition with depressurization and crystallization using MELTS program, and we estimated magmatic temperature, pressure, and water content by comparing the result of chemical analysis and thermodynamic calculations. Analyzed samples include air fall fragments erupted just prior to Aso 1 and Aso 4 pyroclastic flow, as well as air falls of post Aso 4 stage, and latest felsic magma of Aso erupted 4.1 ka "ACP1". It turned out (1) there are both volatile-rich and -poor mafic melts in Aso, (2) andesitic and dacitic melts are basically unsaturated with volatile components, and those with more silica tend to be richer in volatile components, (3) H2O and CO2 concentration of dacitic to rhyolitic melts basically distributed inside or along the 300MPa solubility curve, and the latter tends to be poorer in CO2. Our data suggest that the basaltic melts with low volatile content are produced by depressurizing the melt that had been rich in volatile components to a pressure of a few km or less underground. This volatile-poor mafic melt probably transferred and accumulated at a depth corresponding to a pressure of 300 MPa and evolved to felsic magma via crystallization and at the same time accumulated volatile elements until it reached to their solubility.