Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SVC063-14 Room: 201B Time: May 24 14:00-14:15

Pre-eruptive volatile contents of magma and eruptive dynamics on the 1914 eruption of Sakurajima volcano

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Volatile contents and major compositions of eruptive materials provide key information on igneous and volcanic phenomena. To explore the pre-eruptive magmatic processes of the 1914 Plinian eruption of Sakurajima volcano, we analyzed volatile contents and major compositions of melt inclusions and host minerals including in pumices.
Major compositions of pyroxenes, plagioclase and melt inclusions were analyzed by using EPMA (JEOL JXA-8800M). The core compositions of ortho- and clinopyroxene phenocrysts showed bimodal distributions, with the boundaries of Mg# of 69 and 73, respectively. The high-Mg# pyroxenes had a normal zoning, while low-Mg# pyroxenes showed reverse zoning. The range of Mg# was broad for the low-Mg# pyroxenes (typically 68-73), whereas that of the high-Mg# pyroxenes was narrow (typically 75-77). These suggest that mafic magmas having high-Mg# pyroxenes were repeatedly injected and mixed with a shallow-stored silicic magma with low-Mg# pyroxenes. The pyroxene phenocrysts contained plagioclase as a mineral inclusion. The range of An content of the plagioclases was 52-83. When the host pyroxene shows high-Mg#, the An content was more than 75.
The FT-IR analyses on melt inclusions were carried out using a Nicolet iN10. The analytical results showed the wide ranges of H_2O and CO_2contents. The highest CO_2content was found in a melt inclusion trapped in a high-Mg# pyroxene (1.5 wt% H_2O, 790 ppm CO_2). Melt inclusions in the low-Mg# pyroxenes were relatively depleted in CO_2(0.7-2.5 wt% H_2O, 0-650 ppm CO_2). The CO_2content had a clear, positive correlation with the Mg# of the host pyroxene. These results may indicate that a CO_2-rich mafic magma had injected into, and mixed with, a CO_2-poor silicic magma after degassing. The volatile saturation pressures of the silicic magma (low-Mg# pyroxenes) is calculated to be 500-1200 bars (2-5 km in depth), whereas that of the mafic magma is >1700 bars (>6.5 km in depth).