Evolution of magma feeding system of the Komakusadaira pyroclastics in Zao volacano, NE Japan

Yoshinori Takebe[1]; Masao Ban[1]

[1] Earth and Environmental Sci., Yamagata Univ.

The newest stage of the Zao volcano in central part of NE Japan began at about 30 ka. The Komakusadaira activity was the first and largest activity in the newest stage. This activity can be divided into seven episodes (episodes 1 to 7) by repose times. The eruptive products are mainly composed of base surge deposits and agglutinates. The eruptive products belong to medium-K calc-alkaline series, and all of these are mixed rocks. In this study, we inferred the evolution of magma feeding system based on the detailed petrological features of the pyroclastics.

Rocks are olv-bearing-cpx-opx basaltic-andesite to andesite (episodes 1, 2, 3, 4 and 6) and olv-cpx-opx basaltic-andesite to andesite (episodes 5 and 7). Olivine phenocrysts usually have reaction rims of pyroxene, and pyroxene phenocrysts always have glass inclusions. Plagioclase phenocrysts with the honey-comb structure and dusty zone are dominant in every episode. Oscillatory zoned or clear plagioclase phenocrysts can be observed subordinately. The proportion of clear type slightly increased in episodes 5 and 7.

The range of the silica contents of rocks from episodes 1 to 4 are narrower (56-57 %) than those from episodes 5 (56-58 %), 6 (55-57 %) and 7 (56-59 %). The silica contents of rocks in episodes 1, 3, 4 and 5 decrease temporally within each episode. Rocks from all episodes plot on a linear trend in each SiO_2 variation diagram other than Cr, Ni-SiO_2 diagrams. In the Cr, Ni-SiO_2 diagrams, rocks from episode 5 and 7 have higher Cr and Ni contents than those of the other episodes, and plot on a linear trend different from that drawn by rocks from the other episodes.

High-Mg olivine phenocrysts (Fo=78-84) can be seen in episodes 1, 3 and 4, while low-Mg olivines (Fo=70) are observed in episode 2. In episodes 5 and 7, both types can be observed but the high-Mg olivines occur only in the silica-poorer rocks. Low-Mg pyroxene phenocrysts (opx-Mg#=63-71, cpx-Mg#=67-74) can be observed in all episode other than episode 2. The pyroxene phenocrysts in episode 2 have intermediate Mg# (opx-Mg#=68-74, cpx-Mg#=70-76). The pyroxenes with intermediate Mg# (medium-Mg) occur in episodes 3 and 4 as well, and these pyroxenes show strong normal zoning. More than half of the pyroxene phenocrysts are the medium-Mg type in episodes 3 and 4, but the proportion of this type phenocryst decreases temporally. The clear plagioclase phenocrysts show high-An (An=90) content, while the oscillatory zoned ones show low-An (An=60-70). Plagioclase phenocrysts with the honey-comb structure and dusty zone have medium-An (An=75-85) content.

Silica contents of glass inclusions in low-Mg pyroxene phenocrysts show higher value (65-75 %), while those in medium-Mg phenocrysts show lower (59-64 %). The exception can be seen in the glasses in episode 2, whose silica contents are higher (65-70 %)

It is estimated that the low-An plagioclase and low-Mg# pyroxene phenocrysts were derived from the felsic end-member magma, while the high-An plagioclase and high-Mg olivine phenocrysts were from the mafic end-member magma. The estimated chemical compositions and temperature of felsic magmas are similar (SiO_2=60 %, 950 degrees) among the episodes. Whereas, the mafic end-members in episodes 1 to 4 are estimated to be low-Cr and low-temperature magma (SiO_2=52.8 %, 1150 degrees), and those in episodes 5 and 7 to be high-Cr and high-temperature magma (SiO_2=50.9 %, 1200 degrees).

The medium-An plagioclase, medium-Mg# pyroxene, and low-Mg olivine phenocrysts would be derived from the intermediate magma (SiO_2=56.5 %, 1000 degrees), which was formed by mixing between the two end-member magmas. Since most of the phenocrysts are these types in episodes 2 to 4, the intermediate magma would have constituted a magma chamber in the depth during in these periods.