Petrological characteristics of the 2004 products at Asama Volcano

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The 2004 eruption of Asama Volcano started on Sep. 1st, 2004 at the vent on the summit of the volcano. Several swarms of Vulcanian eruptions occurred every few days to few weeks. The time of eruption was recorded by Japan Meteorological Agency based on seismicity and air shock observation even when the summit was cloudy. During these eruptions, fine ash particles and lapilli pumices and dense blocks were scattered by wind to distal area, and large bombs larger than several centimeters in diameter attacked the proximal area (less than 4 km). We sampled ash particles and lapilli blocks for almost all events (on Sep. 1, 14, 15, 16, 17, 23, 25, 29, Oct. 10, and Nov. 14), and we also did field survey and sampling of large bombs in the proximal area on Sep. 13 and Oct. 29. We investigated whole rock and glass compositions in laboratory as well as crystal compositions. Here we report the compositional evolution of magma during the eruption and propose a model of magma ascent system in the 2004 eruption of Asama Volcano.

The ash samples consist of several types of particles (glassy and crystalline particles with different colors as well as free crystals). The ash particles have phenocrysts of plagioclase and pyroxenes occasionally. There are two types in color; glassy grains consist of brown and white particles, and crystalline particles consist of black and white ones. Dark colored particles have plagioclase, pyroxenes, Fe-Ti oxide minerals, and silica minerals as groundmass microlites, and light colored particles have silica minerals and cordierite (or aluminous silicates) as microlites.

The proportion of the dark glassy particles increased until Sep. 17 when successive eruption occurred. In addition, the glass composition of dark colored glassy particles correlates well with repose intervals between eruptions; the longer the repose, the higher the SiO2 content of matrix glass. The variation trend of the glass composition can be accounted for by evolution of melt during crystallization at shallow depth below the volcano with low H2O content of magma. These observations indicate that these dark colored particles represent the essential magma of the 2004 eruption, and crystallization of microlite occurs as a function of time after magma reached near the surface, or of magma ascent rate.

On the other hand, white or light colored particles appears frequently after Sep. 23, as well as increase in proportion of white blocks in lapilli size blocks and in bombs of proximal area. The glass compositions of these white particles and blocks are very similar to the minimum composition in Qz-Ab-Or system at near 1 atm (Blundy and Cashman, 2001). As some parts of the large blocks consist of pyroclastics with similar appearance to most the products of Asama volcano, and have laminated structure similar to sedimentary rocks, they are likely originated from pyroclastic deposits beneath the volcano. Other parts of the blocks have mingling structure with dark colored andesite; the essential products of the 2004 eruption. These features in addition to microlite assemblage indicate that hot essential magma heated and partially melted the pyroclastic deposit just below the vent. Wide variety of glass composition in the products after Sep. 23 may indicate mixing of the two melts in the later stage of the 2004 eruption.

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