Characterization of Plinian products of Usu 1977 eruption

Kazuki Nakamura[1], Hiromitsu Taniguchi[2]

[1] Inst. Min. Petro. Econ. Geol., Tohoku Univ., [2] CNEAS, Tohoku Univ

The diversity of ejecta produced by explosive eruption depends mainly on the difference of phenomena during magma ascends in the conduit. It seems that the morphology and structure of pumice records the phenomena, so the analysis of pumice should be useful to obtain the knowledge on the phenomena.

In a history time, Usu-Volcano erupted five times that accompanied an eruption column. The eruptions produced various types of pumices. In this study, the Plinian products of 1977 eruption, especially the Big. I (Katsui et al., 1978), will be characterized. Special attention will be given to the lithofacies of the deposit, proportion of particles, morphology and the texture of pumice. To know the dependence of eruption magnitude, the products of 1663 eruption, which is about 22 times as large as 1977 eruption (Yokoyama et al., 1973), will be also taken in the consideration.

In 1977, four large eruptions that produced eruption column occurred, i.e., Big. I, II, III and IV (Katsui et al., 1978). According to Niida et al. (1982), the Big. I column grew up step by step, and then became weak rapidly. The sediment of this column consists of 4 fall units with a clear boundary. They should correspond to earlier gradual growth and later rapid decrease.

The 1977 eruption has various types of pumice in morphology and in color. Some of them are elongated form with a fibrous texture, and the other almost pumice are spherical or ovoid form. Based on color, they are classified into 3 types, i.e., white, bright-gray and dark-gray pumice. Although there are some types of pumice in morphology and color, the bulk chemical compositions of them were almost identical to each other. This suggests that the difference of color was not caused by the difference of bulk chemistry and that they were produced using the same magma.

Compared with white, bright-gray and dark-gray pumice, it was found that the proportion of crystals in the groundmass of white pumice was lower and the porosity was larger. Irregular shape of the bubbles due to the presence of crystals in the groundmass suggests that the bubble was formed after the crystallization in groundmass. Because the texture of groundmass should reflect the cooling rate of magma, i.e., ascending rate in the conduit, white pumice should be produced by the magma that ascended rapidly. The fact that gray pumice has lower porosity may suggest the presence of obstruction by the crystals in the groundmass.

The outline of elongated pumice and white pumice is more elongated, although that of gray pumice is irregular. This may be caused by the difference of effective viscosity due to the crystallization in the groundmass.

Based on the analysis of types of rock fragment in the Big. I deposit, it was found that much white pumice, elongated pumice and much accessory products characterized the deposit of climax stage. This may suggest that the increase of eruption rate induced the increases of accessory products, elongated pumice and white pumice.