Geologic and petrologic characteristics of the ca. 30-ka eruptive products of the Zao volcano

Yoshinori Takebe[1]; Masao Ban[1]

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

The newest stage of the Zao volcano began at about 30ka, and eruption has continued for the past 30ky. At about 30ka, a horse shoe shaped Umanose caldera (1.7 km in diameter) was formed by explosive eruptions, which is the largest among the newest stage. In this study we examined the geologic and petrologic features of eruptive products of this activity. The eruptive products are divided into the Komakusadaira pyroclastic rock and the Kumanodake pyroclastic rock. While the former distributes along the top of the caldera wall, the latter distributes in a restricted area of the eastern part of Kumanodake.

The basal layer of the Komakusadaira pyroclastic rock is tuff breccia and the overlying pyroclastics can be divided to thirteen layers (unit A-M). The tuff breccia (ca10m in thichness) is composed of white clay matrix with accessory lithics and minor amount of scoria. Units A (ca1m) and D (ca3m) are base-surge deposits, composed of planar bedded or cross-stratified ash. Unit B (ca5m) is volcanic breccia, composed of lithic fragments and scoria in brown ash matrix. Unit C (ca1m) is agglutinate with coarse-grained lava spatter and scoria. Unit E (ca4m) is base-surge deposits, mainly composed of cross-stratified fine-grained scoria. Unit F (ca15m) is poorly sorted agglutinate, consists of laterally elongated large scoriaceous fragments (20 cm to mater sized) in moderately bedded (laterally discontinuous), fine-grained scoria matrix. Units H, K, L, M are poorly sorted agglutinates, consists of large scoria fragments (10 to 30 cm) in sand-size scoria. Units G, I, J are agglutinates composed of coarse-grained scoria. Kumanodake pyroclastic rock (ca50m) is composed of variable amounts of volcanic sand and scoriaceous fragments. Repeated normal grading can be observed.

Rocks of the Komakusadaira pyroclastic rocks are olv-bg.-cpx-opx basaltic-andesite to andesite. Plagioclase phenocrysts in the basal tuff breccia and unit A usually show oscillatory zoning, while those in units B-M show honey-comb texture. Glass inclusions can be also found in pyroxene phenocrysts and those sometimes constitute dusty zones. Olivine phenocrysts always have reaction rims of pyroxenes. Olivine is more frequent, and pyroxenes are fewer in the Kumanodake pyroclastic rock.

Bulk silica contents of scoria from the basal tuff breccia is ca.57.5% and those slightly decrease to 56.1-56.5% in units A-C, 55.8-56.2% in units E-F, and ca. 55.8% in the overlying units. Although samples of the Komakusadaira pyroclastic rocks are plotted on the same trends in most co-variant diagrams, unit F-M samples plotted in slightly higher parts than the other samples at same silica contents in Ba-, Sr-silica diagrams. Silica contents of the Kumanodake pyroclastic rocks are similar to those of the Komakusadaira pyroclastic rocks, the former have quite higher contents than the latter in Cr, Ba, Sr compositions and Ba/Zr ratio, suggesting different magma genesis of these two pyroclastic rocks.

An-poor (An62-72) and An-rich (An80) plg, Mg#-poor (Mg#,66-70) and Mg#-rich (Mg#,74-78) px phenocrysts coexist in the tuff breccia and unit A samples. Most of the plagioclase and pyroxene phenocrysts in units B-C have intermediate An (An78-84) or M# (Mg#,68-72). Subordinate amounts of An-poor plg, Mg#-poor px, Fo-poor (Fo68-70) olv phenocrysts are also found in these units. In addition to phenocryst found in units B-C, An-rich (An88-92) plg and Fo-rich (Fo78) olv phenocrysts appear in units E-F and the overlying units. It is probable that the Komakusadaira products were formed by mixing between mafic magma containing Fo-rich olv + An-rich-plg phenocrysts and andesitic magma containing Mg-poor px + An-poor plg phenocrysts. The intermediate An plg, Mg# px and Fo-poor olv crystallized form the mixed magma. The increase in Ba and Sr contents from unit C to F attributes to the injection of new basaltic magma at around eruption of unit E.