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Several patterns of evolution course of magma feeding system in Zao volcano newest stage, NE Japan

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1. Introduction
Based on chemical and textural data of phenocrystic minerals coupled with volcanic stratigraphy, we revealed several patterns of magmatic evolution course in the Zao newest stage. Eruptive products of the newest stage are classified into Komakusadaira agglutinate (ca. 33-12.9 ka), Umanose agglutinate (ca. 7.5-4.1 ka), and Goshikidake pyroclastic rock (ca. 2.0-0.4 ka). Komakusadaira agglutinate is further divided into Komakusadaira pyroclastics, Kumanodake agglutinate, and Kattadake pyroclastic rocks. In this study we will show the case of the Komakusadaira pyroclastics, whose activity is divided into five periods (1-5).

2. Mixing origin of the products
The rocks are calc-alkaline, medium-K mixed basaltic andesite to andesite (55-59% SiO2). In most of SiO2 variation diagrams, data are plotted on linear trends, which is suggesting basically two end-members mixing origin. Based on chemical and textural data, phenocrystic minerals are classified into three groups: (1) felsic end-member derived, (2) mafic end-member derived, and (3) intermediate. The intermediate phenocrysts are considered to be crystallized in mixed magmas. These phenocrysts in most of periods show quenched texture and are small in size, but those in period 2 do not show such texture and the size is similar to that of group 1 phenocrysts.

3. Temporal change of chemical compositions of phenocrystic minerals and whole rock In periods 1 and 5 samples, groups 1 and 2 phenocrysts are dominant and the amount of the latter ones increase toward upper part. In periods 3 and 4, groups 1 and 2 phenocrysts are also dominant but the Mg# or An% of the group 1 phenocrysts gradually increase toward upper part. In period 2, intermediate phenocrysts are dominant with minor amount of groups 1 and 2 phenocrysts in the lower part, and the amount of group 2 and 3 phenocrysts get higher in upper part. Generally, bulk SiO{sub}2{/sub} and incompatible elements contents decrease with time in each period: 58->56, 56.2->55.7, 58->56.2, 58->56.3 and 59->57.8% SiO2 in periods 1 to 5, respectively.

4. Three patterns of magma evolution course of Zao newest activity
Examining above mentioned petrologic features, following three courses of magma evolution have been defined. (1) Basal portion of the colder and high crystallinity felsic magma was withdrawn by the forced injection of the mafic magma and these were mixed in the conduit (periods 1 and 5). The ratio of mafic magma involved in the mixing would increase with time. (2) Intermediate magma formed by the mixing between infused mafic magma and felsic magma at the base of shallow chamber, ascended buoyantly to the chamber top. The intermediate magma erupted, thereby withdrawing felsic magma in upper part of the chamber. The percentage of the intermediate magma involved in the eruptions decreased with time, which corresponds to the increased percentage of the mafic magma which would reactivate the felsic magma (period 2). (3) By repeated injection of mafic magma, the shallow felsic chamber gradually changed in composition toward intermediate (periods 3 and 4). The mixed magma erupted intermittently after the repeated injections.

キーワード: evolution of magma feeding system, magma chamber, mineral chemistry, magma mixing, Zao volcano, northeast Japan
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