Past ca. 800 years magma feeding system beneath Zao volcano

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The Zao volcano is an active stratovolcano in northeast Japan, which has many historical eruption records. After the Great East Japan Earthquake, many precursory phenomena of eruption such as volcanic tremors have been detected. Zao volcano has a long-eruption history of ca. 1 million years, and the activities can be divided into six stages, these can be further divided into several sub-stages. The eruption style and magma compositions are different among stages and sub-stages. Here, we will present eruption history and temporal change of magma feeding system after ca. 800 years ago, when the present crater Okama was formed. By the tephro-stratigraphic research, seven eruption episodes (episode 1 to 7) were recognized during past ca. 800 years. First four were during 13th to 16th century, and the other three were in 17th century, 18th century and AD1894 to 1897. The eruptions started by phreatic eruption and followed by magmatic ones in all episodes but the last one. The last one is unique characterized by lacking obvious magmatic eruption products. Except for the last one, the eruption episode continued for several decades with intermittent short dormancies. Proximal facies of the eruption products during past ca. 800 years are well exposed in the cliff surrounding the crater lake Okama. Five sets (unit 1 to 5) of hydrothermal eruption products to pyroclastic surge deposits with agglutinate layers can be recognized. These would be formed during episode 1 to 5 each. Covering these units, thick hydrothermal eruption layers can be observed. These would be formed by episodes 6 and 7. Using systematically collected bomb samples from the unit 1 to 5, we performed petrologic study to reveal the magma feeding system and its evolution beneath Zao volcano. Rocks are medium-K calc-alkaline series olv bg. cpx opx andesites. Petrographic and mineralogic features show that these were formed by mixing between basaltic (containing olivine and An-rich plagioclase) and andesitic (containing Mg#-poor pyroxenes and An-poor plagioclase) magmas. Infusions of the former magma would activate the shallow chamber filled by the latter magma, and these would mix to erupt. The ranges of silica content are similar (57-59% SiO_2) among units, but some other compositions are slightly different among units, which suggests the slight difference of the end-member magmas among units. In each unit, the whole rock compositions gradually change to mafic towards upper. Such compositional change can be explained by the successively increased percentage of the basaltic magma involved in the mixing. Consequently, each eruption episode would correspond to a series of ascent pulses of mafic magma.

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