

Eruption history of pre-Goshikidake, Zao volcano

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Introduction

Zao volcano is an active stratovolcano in NE Japan, and has a long-eruption history of ca. 1 million years. At the beginning of the newest stage (ca. 35 ka to present), horseshoe shaped Umanose caldera was formed in the summit area. The Goshikidake, the youngest cone, has grown up in the caldera from ca. 2 ka and now its relative elevation are about 110m and bottom diameter is about 850m. The present crater lake Okama is in the western part of the Goshikidake and its diameter about 360 m. The Okama has been active since ca. 0.8 ka and the pre-crater was southeast ward of the Okama. Former studies showed that the cycles from phreatic to phreatomagmatic eruptions repeatedly occurred, delimited by dormant time. We examined the eruption history during ca. 2 to 0.8 ka based on near vent facies features.

Pre Okama-Goshikidake

Previous study subdivided Goshikidake pyroclastic rocks into 5 units by angular unconformities. Unit 1, 2, 3 were formed during ca. 2 ~ 0.8 ka. We define an edifice composed of unit 1~3 products as the pre-Goshikidake. The unit 1~3 products are well exposed in the southern part of the Goshikidake. Our study is based on observation of the products exposed in this area.

unit1

The maximum total thickness of unit 1 is about 20 m. Based on the lithofacies, we subdivided unit 1 products into 7 layers. Layer 1 and 2 are composed of lapilli-tuff. The matrix is hydrothermally altered clay. Layer 1 and 2 are different in color. Layer 3, 5, 7 are composed of strongly stratified thin layers of tuff to lapilli-tuff, showing various kinds of lamination and sagging. Matrix color is gray in layer 3, and reddish brown layer 5 and 7. Layer 4 and 6 are composed of tuff-breccia, including reddish ~ gray colored scoria.

unit2

The maximum total thickness of unit 2 is about 20 m. These products are subdivided into 4 layers. Layer 1, 4 are composed of strongly stratified thin layers of tuff to lapilli-tuff, showing various kinds of lamination and sagging. The matrix is gray to red-radish ash and scoriaceous bombs and volcanic blocks concentrated parts are sometimes observed. Layer 2 is composed of agglomerate with various amounts of volcanic bombs and scoria. Layer 3 is composed of strongly laminated tuff, its lower is gray and upper is red in color.

unit3

The maximum total thickness of unit 3 is about 20 m. These products are subdivided into 7 layers. Layer 1, 3, 5 are composed of gray colored tuff, and change in quality with small scoria little bit. Layer 2, 4 are composed of strongly stratified thin layers of tuff to lapilli-tuff, showing various kinds of lamination and sagging. The matrix is radish~red-radish ash and scoriaceous bombs and volcanic blocks concentrated parts are sometimes observed. Layer 7 include both facies. Layer 6 is scoria fall deposit with ~2 m scoria in the scoriaceous matrix. This is observed in southeast and gets thin rapidly to southwest.

The eruption sequence of pre-Goshikidake

Based on these observations, layer 1, 2, 3 of unit 1, layer 3 of unit 2, layer 1, 3, 5 of unit 3 would be by phreatic eruption products, while layer 4, 5, 6, 7 of unit 1, layer 1, 4 of unit 2, layer 2, 4 of unit 3 would be formed by the phreatomagmatic eruption. Layer 7 of unit 3 include both types. The layer 2 of unit 2 would be vulcanian type like eruption, layer 6 of unit 3 would be scoria fall products.

In the unit 1, the activity began by phreatic eruptions and changed to phreatomagmatic eruptions. The

unit 2 activity is characterized by repeat of phreatomagmatic eruptions. In the middle part, vulcanian type like and phrenetic eruptions would occur. In the unit 3, the cycle of phrenetic to phreatomagmatic eruptions repeated several times. The strombolian type eruption additionally occurred in the climax.

The migration of the crater location

The crater of unit 1 would be located slightly eastward of pre-crater, based on strike and dip data of unit 1 products. The unit 2 and 3 products were erupted from the pre-crater, revealed by tracking the unit 2 and 3 layers to the eruption center ward. Considering the present crater is in west ward of the pre-crater, the crater migrated stepwise from east to west past ca. 2 ky.

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