Geological and petrological studies at Nigorikawa Volcano, southwestern Hokkaido.

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1.Introduction

Nigorikawa volcano, in southwestern Hokkaido, has a small caldera with funnel-shaped structure that was formed by approx. 14 ka explosive eruptions. To reveal the eruption sequence and magma plumbing systems of the Nigorikawa caldera-forming eruption, we carried out field surveys and ^{14}C dating and determined petrological features (componentry, rock description, whole-rock, mineral composition, etc.) of the eruption deposits.

2.Lithofacies of Nigorikawa ejecta

The Nigorikawa caldera-forming products are divided into two stages separated by soil layer (Calendar age of this soil is 12,850-12701 (2s) y.B.P.). The first Stage1 can be subdivided into six units (Unit-1~6, in ascending order). Stage2 is composed of one unit (Unit-7). Units 1~4 consists of alternating layers of base surge and pumice fall deposits (Unit-1, 3 are base surges and Unit-2, 4 are pumice fall). Unit-5 is a the largest pyroclastic-flow deposit and is rich in accidental lithic fragments. Unit-6 is a pyroclastic surge deposit containing accretionary lapilli. Unit-7 is a thin (<50 cm), relatively small pyroclastic-flow deposit distributed in east of the source caldera.

3.Petrologic feature

The juvenile material of the Nigorikawa products consists of white, gray, and banded pumices. The gray pumices can be separated into 2 types, a Low-Ba and a High-Ba type, visible on a plot of Ba vs. SiO_2 diagrams (High-Ba type: Ba >600 ppm). The white pumice is common in all units, while the low-Ba type gray pumice and banded pumice are recognized in Unit-2 or above. High-Ba gray pumice is a rare component and was ejected after Unit-2 (mostly in Unit-3). The phenocryst assemblage of white pumice is plagioclase, amphibole orthopyroxene, magnetite, ilmenite, and quartz with trace amounts of clinopyroxene. Although both types of gray pumices have a similar phenocryst assemblage to the white pumice, the gray pumices are richer in clinopyroxene and amphibole showing reaction rims.
Compositional plots of white pumice (SiO_2 = 61-64wt.%), low-Ba gray pumice (SiO_2 = 53-61wt.%) and banded pumice (between white and low-Ba gray pumices) form a linear trend on Harker diagrams.
High-Ba gray pumice (SiO_2 = 55-56wt.%) shows a distinct compositional field from the previously mentioned linear trend.
The plagioclase cores in all units show a wide compositional range (An47-95) with a bimodal peak of An54 and An76-80. Orthopyroxene cores for Unit-2~6 pumices have a common peak around Mg# 66. However, low-Ba gray pumice in Unit-7 is unique and larger in Mg# (Mg#68-70).

4.Discussion

Alternating layers of silt rich base surge Unit-1~4 probably represent an unstable, pulsating, wet eruption column during a Plinian eruption. The presence of abundant accidental lithics in the largest Unit-5 suggest vent enlargement and main caldera formation occurred in this phase. Unit-6, containing accretionary lapilli, seems to be a product of phreatomagmatic eruption by magma-water interaction. After a remarkable dormancy, the volcano restarted explosive activity to generate a small pyroclastic flow (Unit-7).
The linear trend between white pumice, low-Ba gray pumice, banded pumice and disequilibrium coexistence of two pyroxenes with considerably different Mg# can be explained by mixing of felsic and low-Ba mafic end members. On the other hand, the compositional trend of high-Ba gray pumice can be

interpreted as a mixing line between the mixed magma of felsic and low-Ba mafic end members, and high-Ba mafic end magma. White pumice is common in all units and low-Ba gray pumice appears after Unit-1. These data infer that white pumice magma erupted first from the upper felsic part of zoned magma chamber, and then, low-Ba mafic magmas erupted with mixing from the lower part. In Unit-3, high-Ba mafic end member injected and interacted with the mixed magma consisting of felsic and low-Ba end members. Since no significant change of petrological feature exist in the white pumice, we therefore, suggests that the same felsic end magma even in Unit 7. However, pyroxene in the low-Ba gray pumice of Unit-7 has a higher Mg# than that of Unit-2˜6, which implies that a new mafic magma intruded at Unit-7.

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