Newly found pyroclastic flow deposits in Tokachi-dake volcano, and the magma plumbing system of Ground crater ejecta

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Tokachi-dake volcano is an active volcano located on central part of Tokachi-dake volcanic group, central Hokkaido. The volcanic activity during the last 3000 years can be divided into four stages (Fujiwara et al., 2004). Activity of the first stage occurred mainly from Ground crater and has been most voluminous among the stages. This stage is also characterized by the eruption of a considerable scale of pyroclastic flow. We newly found another pyroclastic flow deposits (Gfl-b) beneath Ground crater pyroclastic flow deposits (Gfl-a) which had been identified. In this paper, we report the revised stratigraphy of Stage 1 and discuss magmatic processes of this stage.

The activity of Stage 1 had been considered to be divided into 2 phases, explosive and effusive phases (Fujiwara et al., 2005). In the explosive phase pyroclastic flow Gfl-a (3100 yBP; Fujiwara et al., 2004) was generated after pyroclastic fall erupted. Gfl-b is identified at the restricted region of northwest foot of Tokachi-dake. Gfl-b can be found beneath Gfl-a and there are two layers of mud flow deposits and three layers of thin soil between Gfl-b and Gfl-a. Gfl-b is composed of one flow unit, containing black scoriae, yellowish white pumices, banded pumices, altered rocks, and sand sized matrix. The surfaces of scoriae are frequently oxidized. Gfl-b also has lapilli pipe structures and upper part of Gfl-b is weakly reddish colored. These facts suggest that Gfl-b emplaced at high temperature. From the results of the stepwise thermal demagnetization analysis, it is confirmed that Gfl-b is a pyroclastic flow deposit emplaced at more than Curie Point. We also reported 14C age of 3440+-40 yBP (13C revised) for a charcoal sample obtained from soil directly on Gfl-b. This indicate that more than 300 years' period was existed between Gfl-a and Gfl-b.

Essential materials are composed of scoria, pumice, and banded pumice, so their whole rock compositions are widely plotted in the first term of explosive phase of Stage 1. After that materials became apparently homogeneous and they have smaller compositional range (Fujiwara et al., 2005). Gfl-b also consists of heterogeneous essential products and has same phenocryst assemblage and compositional range to Stage 1 products. Therefore Gfl-b can be included in Stage 1.

Besides existence of banded pumice, whole-rock chemical compositions of eruptive materials show linear trends on all of the Harker diagrams, indicating mixing of two end-member magmas in Stage 1. Plagioclase phenocrysts of explosive products show bimodal distribution bordered by An66 and that of following lava flow show unimodal distribution consisting of middle range. As a whole, clinopyroxene, orthopyroxene, and olivine show unimodal peaks, Mg-value 73, Mg-value 69, and Fo73, respectively, and many pyroxenes show reversed zoning pattern. These facts indicate following end member magmas; more mafic magma composed of high-An plagioclase and olivine phenocrysts, and more felsic magma composed of low-An plagioclase and two pyroxene phenocrysts. Two magmas mixed before 3400 yBP and relatively small eruption was occurred generating Gfl-b. In 3100 yBP mixing restarted and Gfl-a erupted. The mixing progressed afterward and resulting homogeneous magma was outpoured as lava flow.