

Evolution of magma plumbing system beneath Tokachi-dake volcano during the last 3500 years

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The magma evolution of Tokachi-dake volcano during the last 3500 years has been revealed. In previous study, it is known that the volcanic activity of this volcano during the last 3500 years can be divided into four stages (Stage I-IV), and that the magma mixing between two end member magmas occurred in the first stage, Stage I (Fujiwara et al., 2004, 2005, 2006). However, the transition of magma system from 3500 yBP to the latest stage had not been discussed.

Juvenile products erupted in the last 3500 years show slightly different trend on some Harker diagrams of whole rock variation. Products of Stage I and II show low MnO, P₂O₅, and Sr trend, and those of Stage III and IV show high MnO, P₂O₅, Sr trend. On the whole, SiO₂ content is getting lower from the end of Stage I to Stage II, and inversely, it is getting higher from Stage III to IV.

Products of Stage I and II, which show identical trend on Harker diagram, have similar mineral chemistry as follows. Plagioclase show wide compositional range, An₅₀₋₉₄, and clinopyroxene and orthopyroxene show unimodal peak, Mg# = 72 and 69, respectively. Olivine show strong peak of Fo₇₀ (low-Fo olivine), and minors show more magnesian composition, Fo₇₅₋₇₇ (high-Fo olivine). However, although plagioclase and clinopyroxene do not show notable compositional change, there exist more magnesian orthopyroxene (Mg# = 71-72) from Stage III. In addition, the modal composition of high-Fo olivine remarkably increases from this stage.

Considered from our analysis, the magma plumbing system was notably changed between Stage II and III. Compositional variation from the end of Stage I to Stage II probably mean compositional change from upper to lower part of single layered magma chamber, but in Stage III and IV, we cannot explain these variations by such a simple magma system. From Stage III, another andesitic magma containing high-Mg# orthopyroxene and another basaltic magma containing more abundant high-Fo olivine have been mixed with previous magma.