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Compositional variation and magmatic differentiation at the northern Kita-Hakkoda volcanic group

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Since 0.6 Ma, magmatic eruptions have occurred several times at Kita-Hakkoda volcanic group. This study focuses on the activity between 0.4 and 0.2 Ma. Magmatic differentiation process is investigated from whole-rock chemistry and mineralogy along with stratigraphy. This area consists of 12 geologic layers: Hakkoda 2nd Stage Pyroclastic Flow Deposit, Northern Kita-Hakkoda Basaltic Andesite Lavas, Lower Kansuisawa Pumice Flow Deposit, Lower Tamoyachi-dake Andesite Lavas, Upper Kansuisawa Pumice Flow deposit, the Upper Tamoyachi-dake Andesite Lavas, the Tashirotai Lacutrine Deposit, Narusawa Debris Flow Deposit, Maedake Lavas, Narusawa-daichi Andesite Lavas, Okuzuresawa Debris Flow Deposit and Okuzuresawa Pyroclasitic Flow deposit in stratigraphic order. Temporal variation of chemical composition in stratigraphic order is evaluated. The activity initiated with the effusion of differentiated tholeiitic basaltic magma around 0.4 Ma. After a dormancy the activity resumed around 0.2 Ma with effusion of andesitic magma (60wt% SiO_2), followed by a fluctuating activity between tholeiitic basalt and low-silica calc-alkaline andesite magmas. Then, the magma composition jumped to high silica (60wt% SiO_2) calc-alkaline andesite. No evidence for open system process is recorded in phenocrysts in the tholeiitic rocks. Previous studies accounted for the chemical variation of tholeiitic magma by crystallization differentiation, and our new data is consistent with the model. Disequilibrium mineral assemblages in calc-alkaline rocks, e.g., coexistences of magnesian olivine and embayed quartz, and of reversely zoned pyroxenes and normally zoned pyroxenes, implies open system processes. As indicated by linear trends between tholeiitic basalt and the high-silica andesite, magma mixing is a plausible process to produce the series. Stratigraphic chemical variation might be caused by temporal variation in mixing ratios.

Keywords: Magma mixing