Geological and petrological study of Kariba volcanic group: Elucidation of the volcanic history and changes of magma

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Kariba volcanic group, act in Pleistocene, is situated at the northwestern part of the Oshima Peninsula, southwestern Hokkaido. Volcanic centers of the individual edifice are distributed over the range of about 7 km from north to south and about 10 km from east to west, and present peak is Mt. Kariba, 1520 m height. There are several previous works (Yamagishi and Kurosawa, 1987 and Kaneoka et al., 1987), suggesting that Kariba volcanic group is divided into two edifices; Anatokomae lavas (0.7 Ma) and Karibayama lavas (0.25Ma). Whole-rock compositions were also reported by Nakagawa (1992) and Kosugi et al. (2013). However, volcanic history and petrological characteristics of the Kariba volcanic group have not been discussed. The purpose of the study is to reveal the history of the volcanic edifice and the transition of magma. First, we observed aerial photographs and conducted geological survey (divide each eruptive unit, check geological relationships and degrees of dissection of these units). We also collected samples and determined petrographic features, whole-rock major and trace element compositions and Sr-Nd isotopic ratios. Furthermore, we are analyzing K-Ar ages for 5 samples.

Then, we divided volcanic ejecta of Kariba volcanic group into 12 units according to the estimated eruptive centers and these strata, and these units were sorted into 3 stages by reported K-Ar ages, estimated ages from these strata and degrees of erosion, and petrological characteristics. Stage 1 was a subaqueous activity and lavas flowed down to the westward. Subsequently, activity shifted completely to subaerial condition. The vent positions scattered throughout the edifice during the Stage 2, volcanic centers concentrated into the center of the edifice during the Stage 3. As a result, shield volcano with flat edifice was formed at Kariba volcanic group.

The eruptive rocks are composed of basalt to andesite and are classified as high-K and calk-alkaline series. Mafic inclusions are found in all stages. Negative Nb and Ta anomalies and depleted Sr-Nd isotopic ratio of the rocks are similar to the back-arc volcanoes of northeastern Japan arc, especially to Oshima-Kojima (Kosugi et al., 2013). Petrological characteristics of host rocks are different in each stage. Stage 1 lavas are quartz-biotite-olivine basaltic andesite and their SiO_2 contents concentrate in a narrow range. In addition, Stage1 rocks show high Sr, low Nd isotopic ratios compared to Stage 2 and Stage 3. Stage 2 lavas consist of orthopyroxene-bearing olivine-quartz-amphibole-clinopyroxene-biotite andesite and Stage 3 rocks are orthopyroxene-bearing quartz-clinopyroxene-amphibole-olivine-biotite andesite. Stage 2 and Stage 3 rocks make different trends in many Harker diagrams, and Stage 3 ones are rich in MgO. On the other hand, mafic inclusions have wider compositional range than those of host rocks, and there is no difference among the stages. Existence of mafic inclusions, disequilibrium mineral assemblages such as quartz and olivine, dusty and oscillatory zoning in plagioclase indicate that magma mixing was the main magmatic process. Moreover, different trends of host rocks in each stage indicate that mafic and felsic end-member magmas should be different; Stage1 is basalt and basaltic andesite, Stage 2 and Stage 3 are basalt and andesite but those of Stage 3 are richer in MgO content than those of Stage 2.

Reference

Kaneoka, I., Yamagishi, H., Yahata, M. (1987), Bull. Volcanol. Soc. Japan, Ser. 2, 32, 329-333

Kosugi, A., Nakagawa, M., Seino, T. (2013), Jour. Geol. Soc. Japan, 119, 12, 743-758

Nakagawa, M. (1992), Jour.Fac.Sci., Hokkaido Univ., Ser.IV,23,175,175-197
Yamagishi, H., Kurosawa, K. (1987), Geol. Surv. Hokkaido.

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