

Magma feeding system of Kutcharo and Mashu volcanoes

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The Kutcharo, Mashu and Akan volcanoes in NE Hokkaido, about 150 km west of the Kurile trench, have produced voluminous felsic pyroclastic deposits. Among the volcanoes, the 20x26 km Kutcharo is the largest. To understand the magma feeding system of Kutcharo and Mashu volcanoes, we examined eruptive products from the volcanoes for bulk rock chemistry (major and minor elements and Sr, Nd isotopic ratios), phenocryst chemical zoning, and chemical compositions of melt inclusions in phenocryst. From a large set of melt inclusion data and backscattered electron images of handpicked phenocrysts, we obtained evidence for repeated basaltic magma injection into a voluminous felsic magma chamber of Kutcharo volcano. Application of MELTS program (Ghiorso and Sack, 1995) on the estimated end-member melt compositions revealed that the voluminous high-K rhyolite magma (g.t. 100 km³) demands crystallization of a large amount of basaltic magma several folds to 10 times larger than the rhyolitic magma, alternatively partially melting of crustal materials about the same amount of the former case. However, the melting of massive crustal materials may be negative because there is no significant difference in Sr and Nd isotopic ratios between basaltic to rhyolitic eruptive products from Kutcharo and Mashu volcanoes and because chemical compositions of phenocrysts in the rhyolitic magma require relatively higher temperature. The voluminous high-K rhyolite magma may be generated from crystallization or subsequent re-melting of large amount of basaltic magma supplied beneath the volcanoes. It is suggested that the basaltic magma was injected intensively beneath Kutcharo causing a thermal structure that had a peak at this volcano and decreased toward Mashu volcano to be formed. This thermal structure may explain the observed difference between the two volcanoes, e.g., the difference in K₂O contents and chemical compositions of mafic phenocryst which indicate higher temperature in Kutcharo relative to Mashu volcano. This research project has been conducted under the research contract with Nuclear and Industrial Safety Agency (NISA).