

Estimation of volcanic carbon dioxide emission rate from Kuju Volcano, Japan

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Kuju Volcano is located in Kyushu and one of the active volcanoes in Japan. In order to provide data for construction of a numerical model of the hydrothermal system in the Kuju volcanic area, we tried to estimate volcanic carbon dioxide emission from Kuju Volcano.

We considered four forms of volcanic carbon dioxide emission; from the fumaroles, the bare area around the fumaroles, the flank by the soil gas, and some hot springs at the foot of the volcano. The present activity of Kuju Volcano is thought to return to the level of before 1995 phreatic eruption by the recent observation data (earthquake activity, heat discharge rate etc.). Therefore, we adopted the value of about 166 t/day from the plumes of Kuju Volcano estimated by Ehara et al. (1981). On the other hand, Itoi (1993) shows the distribution of soil gas carbon dioxide concentration in the bare area around the fumaroles. In our previous study (Araragi et al., 2008), the relationship between the soil gas carbon dioxide concentration measured by the Kitagawa Gas Detector Tube System and the carbon dioxide flux measured by a CO₂ flux meter in Kuju Volcano was found. Therefore, the soil gas carbon dioxide concentration values shown by Itoi (1993) were converted into the carbon dioxide flux values by using the relational expression, and the volcanic carbon dioxide emission from the bare area was estimated at about 0.8 t/day. We measured soil gas carbon dioxide concentration at 60 points on the flank of the volcano by the Kitagawa Gas Detector Tube System and collected 15 soil gas samples to conduct the carbon isotope analysis to identify the origin of the soil gas carbon dioxide. As a result, we concluded that the volcanic carbon dioxide emission from the flank was 0 t/day. And for the carbon dioxide emission from the hot springs at the foot of the volcano, the data of the Nagayu Hot Springs area was adopted because Iwakura et al. (2000) indicated that the carbon dioxide of the carbonated water from Nagayu Hot Springs was volcanic. The volcanic carbon dioxide emission from Nagayu Hot Springs was estimated at about 5.0 t/day by using the data of the hot water discharge rate and the average carbon dioxide concentration in the carbonated water. These results show that the volcanic carbon dioxide emissions by the plumes from the fumaroles and by the carbonated water from a hot springs area are dominant in Kuju Volcano.

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