Mathematical simulation of magma-hydrothermal system at Iwodake volcano, Satsuma-Iwojima

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The thermal activity of Iwodake volcano is characterized by the predominant volcanic gas ejection at the summit crater and the heat discharge from high ground temperature area which is distributed widely from the summit crater to hillside of the mountain. The volcanic gas at the summit crater is of magmatic origin and its temperature is observed to be 880C in maximum. The total amount of the volcanic gas discharged from the summit area is estimated to be 150kg /sec from the SO_2 measurement and the chemical composition of the volcanic gas. The heat discharge rate from the high ground temperature area at the hillside, which is distributed around the fumaroles is estimated to be 50MW from the surface temperature measurement. These thermal activities of Iwodake volcano are thought to be continued for more than 800 years. A plausible model to explain the long degassing of large amount of volcanic gas is magma circulation in a conduit which extended from the deep-seated magma reservoir. The continuous active degassing probably causes the hydrothermal system within the volcano because the volcanic gas ascending the conduit from the top of the magma to the surface is diffused to the surrounding formation. The development of such hydrothermal system is studied using the mathematical simulation. The result shows that the overall thermal activity of Iwodake volcano such as the volcanic gas ejection at the summit crater, widely distributed ground temperature anomaly at hillside and hot springs along the coast can be caused by the degassing activity. The important factors in order to induce the wide-ranging hydrothermal system are permeability of the volcanic edifice and the depth of the degassing. The simulation indicate that the permeability of $10^{-13}m^2$ and the degassing at sea level are suitable condition for the Iwodake thermal activity.