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Experiments for development of new method for measrement of diffusion gas

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1) Introduction

Ascent of magma causes gasification of volatile components in magma, which provides the driving force for explosive eruption. Release of volatiles from magma highly changes its physical properties such as viscosity and density, and thus influences the violence of explosions. Examination of the behavior of volatiles can provide a better understanding of degassing processes and volcanic eruptions.

Carbon dioxide is major constituent of volatile in magma after water and less reactive with ground water and subsurface material after degassing. The emission rate of diffuse CO2 can increase drastically prior to volcanic eruption (Hernandez et al., 2001). Hence, studies of diffuse CO2 have become a powerful geochemical tool for monitoring volcanic activity (e.g. Hernandez et al., 2001; Perez et al., 2011). It is very important to map surface CO2 efflux anomalies and to estimate the total output of this gas regularly in order to have a better understanding of on-going volcanic processes (Salazar et al., 2001). Measurement of diffuse soil CO2 has been usually performed in-situ by means of a portable infrared absorption CO2 analyzer (LICOR-800 system) interfacing to a palm-top computer that processes data. Actually, handling of LICOR-800 system is simple and easy, however, surveillance for spatial distribution by means of this system is time-consuming. In this study, some fundamental laboratory experiments were performed to develop a new chemical method for monitoring flux of diffuse soil CO2.

2) Experiments

A vinyl chloride tube 20cm in diameter and 30cm in height is used for gas diffusion chamber. CO2 gas diffuses through dry sand in the gas chamber. Small fan is equipped for convection of diffuse CO2 in the chamber. A plastic box containing 5M KOH solution is within the chamber to absorb CO2 in the chamber. Some experiments were performed parameterizing CO2 gas flow rate, absorption time, surface area of the alkaline solution and so on.

3) Result and Discussion

Experimental results indicate that absorption for more than 2 hours can get the recovery efficiency of diffuse CO2 gas reach around 1 although the flow rate of CO2 is ten times higher than the diffusion rate at Kusatsu-Shirane and Usu volcanoes. Fan convection in the chamber has very positive impact for absorption of CO2 in the alkaline solution. Further, flow rate of diffuse H2S is estimatable through analysis of dissolved sulfur in the alkaline solution. This method newly enables to estimate diffuse CO2 and H2S flux in a short time, and monitor spatial distribution with high temporal resolution.

4) Refernces

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