

Continuous Monitoring of Soil CO₂ Concentration at the Summit of Mt. Mihara of Izu-Oshima Volcano

Hidefumi Watanabe[1]

[1] Earthq. Res. Inst., Univ. Tokyo

(Introduction)

In order to conduct mid-term prediction of eruptions, we need to clarify precursory processes, especially, magma accumulation process and the way of magma achievement of the conditions to start rising up toward eruption. We have detected the secular re-inflation of Izu-Oshima volcano since 1990 after the last eruption in 1986-87 (Watanabe, 1998), and further revealed that the volcano has repeated inflation-deflation cycles resulting a net inflation and the accelerated inflation has been accompanied by the elevation of shallow seismic activity in the caldera region (Morita and Watanabe, 2005). We naturally suppose that the volcano inflation is caused by the supply of magma from depth. However, what is the origin of the deflation? There are two possible processes causing the deflation; magma drain back and the contraction of accumulated magma due to degassing. If the latter is the case, the inflation-deflation cycle indicates the accumulation and relaxation of magma beneath the volcano and closely related to the way of magma achievement of the conditions to start its rising up toward the eruption. Consequently, the observed inflation-deflation cycles might give us an invaluable clue to understand the precursory processes.

(Continuous monitoring of soil CO₂ concentration)

For monitoring of the degassing of basaltic magma accumulated beneath volcano, CO₂ is most helpful because CO₂ has a low solubility in magma and separate from melt at the earliest stage after accumulation. On 28 September 2005, we started the continuous monitoring of soil CO₂ concentration at the summit of Mt. Mihara of Izu-Oshima volcano. We also measure the ambient temperature and the 1m-depth temperature at the nearby fumaroles area. Measured data are stored every 5 minutes in a logger and accessed via radio LAN system. All the instruments are powered by solar battery, and have been working without any trouble.

(Variations of soil CO₂ concentration and seismic activity in the caldera)

CO₂ concentration data showed temporal variations in the range of 0.1-2.8vol% and the following features. 1) Soil CO₂ concentration sometimes increased with duration of several hours to days. 2) Decrease of 1m-depth temperature followed that of soil CO₂ concentration with delay of several hours, suggesting that both the soil CO₂ and high temperature fumaroles are fed by volcanic gas emanating from depths. 3) There occurred several correlated increase of the soil CO₂ concentration and the seismic activity in the caldera. 4) There occurred peculiar seismic events (with a predominant frequency of about 1Hz) originating from very shallow depths beneath the summit in the period of elevated CO₂ concentration (4, 15 and 21 November 2005, and 20 January 2006). These low frequency events might have been generated by rapid flow of volcanic gas beneath the summit.

(Conclusion)

We could observe temporal variations of soil CO₂ concentration in relation to the elevation of shallow seismic activity in the caldera. We also detected peculiar low frequency seismic events during the periods of elevated soil CO₂ concentration. We will install more seismic stations around the summit to accurately determine hypocenters of the low frequency events and to elucidate their generation mechanisms.