

Diffuse degassing survey at the Higashi Izu monogenetic volcano field, Japan

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The Higashi-Izu monogenetic volcanic group, which consists of more than 60 volcanoes, overlies the polygenetic volcanoes in the eastern part of the Izu peninsula, Japan, which are distributed over the area of 350 km². Some of the monogenetic volcanoes are located on northwest–southeast alignments, suggesting that they developed along fissures. Recent volcanic activity occurred offshore, e.g., at the Izu-Oshima volcano, which erupted in 1986 and a submarine eruption of the small new Teishi knoll off eastern Izu Peninsula in 1989 (Hasebe et al., 2001). This study was carried out to investigate the possible relationship of diffuse CO₂ emission and the recent seismic activity recorded NE of Higashi Izu monogenetic volcanic field, to quantify the rate at which CO₂ is diffusely degassed from the studied area including Omuroyama volcano and to identify the structures controlling the degassing process. Measurements were carried out over a three day period from 8-10 July 2013. Diffuse CO₂ emission surveys were always carried out following the accumulation chamber method and spatial distribution maps were constructed following the sequential Gaussian simulation (sGs) procedure. Soil gas samples were collected at 30-40 cm depth by withdrawal into 60 cc hypodermic syringes to characterize the chemical and isotopic composition of the soil gas. At Omurayama volcano, soil CO₂ efflux values ranged from non-detectable to 97.5 g m⁻² d⁻¹, while at the seismic swarm zone ranged from 1.5 to 233.2 g m⁻² d⁻¹ and at the fault zone ranged from 5.7 to 101.2 g m⁻² d⁻¹. Probability-plot technique of all CO₂ efflux data showed two different populations, background with a mean of 8.7 g m⁻² d⁻¹ and peak with a mean of 92.7 g m⁻² d⁻¹. In order to strength the deep seated contribution to the soil gases at the studied are, carbon isotopic analysis were performed in the CO₂ gas. Soil gases (He, CO₂ and N₂) showed a clear mixing trend between air composition and a rich CO₂ end member, suggesting the influence of a deep magmatic reservoir on the soil degassing at the studied area. To estimate the total diffuse CO₂ output released from Omurayama, the average of 100 simulations was considered, giving an average of 22 ± 2 t d⁻¹ of diffuse CO₂ released by Miharayama. Regarding to the geochemical transects along the Amagi Road and perpendicular to the fault, CO₂ efflux values >9xBackground were observed close to the location of the fault. These results show possible linear positive anomalies may be caused by the presence of the active fault which has a higher porosity than surrounding soils, allowing an increased flux of CO₂ to reach the surface from depth.

References:

Hasebe et al., 2001. Bull. Volcanol., 63, 377.