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The Variation of Volcanic Tremor During Active Stage in the 1986 Izu-Oshima Eruption

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Izu-Oshima is one of the most active volcanoes in Japan. The latest eruption of Nov. 1986 exhibited a curious eruption sequence; the strombolian type eruption started on 15 Nov. at the central vent and it had continued for 4 days. Then after it ceased, subplinian type fissure eruptions occurred inside and outside the caldera where several hundreds meters to few kilometers away from the central vent. Lava flows were associated with these two eruption episodes. Petrologically compositions of these two kinds of lava are completely dissimilar; magma from the central vent is basaltic with narrow range of chemical composition, which is almost same as that of the previous stages while magma from the fissures is evolved one with wider variations of composition [Aramaki and Fujii, 1988]. This means that two distinct magma sources, which were chemically separated but mechanically coupled, should have existed prior to the eruption. The most important issue concerning this eruption is how the mechanical interaction between two magma sources took place and evolved. Throughout the eruption sequence, remarkable activities of seismic tremor have been observed. In this presentation we report evolution of tremor sources to characterize the interaction based on the recently recovered seismic records and we propose a reinterpretation of the eruption sequence.

We analyzed volcanic tremor in Nov. 1986 on digitized seismic records of 7 stations in the Island. The aim of this analysis is to estimate the movement of two kinds of magma associated with the change of the eruption styles. Firstly root mean square amplitudes of the filtered seismic signals and their spectrum were calculated. The tremor style changed from continuous mode to intermittent, sporadic mode at the period between the summit eruption and the fissure eruptions. The dominant frequency also changed around the same time. Secondly to derive the location of tremor source, Amplitude Inversion Method [Battaglia and Aki, 2003, Ogiso and Yomogida, 2012] was applied. In this procedure seismic activities were separated from the tremor signals by using long-term changes of the amplitude. Remarkable change of the tremor sources was observed after the cessation of summit eruption and before the start of fissure eruptions. The clustering of the tremor source to the fissure sites occurred about 24 hours prior to the surface eruption. At the same timing, tilt meters exhibited consistent change [Yamamoto et al, 1987]. This suggests evolved magma had been already injected into the shallow underground in the same direction of the fissures and time-delay to the initiation of eruption may be curing time for segregation of vesiculated magma. Based on the results, we discuss why the eruption style changed in terms of mechanical interactions.