Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SVC55-P21 会場:3 階ポスター会場 時間:5 月 1 日 18:15-19:30

新燃岳２０１１年噴火の３日前に発生した奇妙な地震・空振・地殻変動現象
Strange seismic, infrasonic, and geodetic phenomena observed 3 days before the 2011 eruption of Shinmoe-dake volcano

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Shinmoe-dake volcano started its climatic events on January 26 at 14:49. Some precursory phenomena have been found in petrologic studies. The ash from a phreatic eruption on January 19 contained fresh pumice fragments indicating ascent of new magma to a shallow depth (Miyabuchi et al., 2013; Suzuki et al., 2013). Petrologic analyses of the eruption products from the climatic events showed evidences of magma mixing in two stages before the eruptions; Suzuki et al. (2013) estimated the times of the first and second mixing to the eruption as >14 days and 0.7-15 hours, respectively, while Tomiya et al. (2013) conclusively proposed 0.4-3 days and several hours, respectively, and suggested that the first mixing likely triggered the eruption.

On the other hand, no clear precursory signals have been identified in geophysical observations. Considering the above petrologic studies, we reexamined the seismic, infrasonic, and geodetic data in a few weeks to the eruption, and particularly focused on a sequence of strange phenomena on January 23, three days before the eruption. It was the only notable phenomena recognized in several days to the eruption, but has not been reported elsewhere.

Nakada et al. (2013) referred to the JMA report (2012) that volcanic tremor was first recorded at 01:27 on 19 January and continued from the 19 January afternoon to the morning of 23 January. In fact, the tremor started to be recorded at stations around the summit of Shinmoe-dake at 12:45 on 18 January and increased significantly after the phreatic eruption at 01:27 on the 19th. If there was any sign indicating rise of new magma to the shallow depth before the phreatic eruption, the tremor could be the candidate.

On January 23, there was a clear infrasound signal continuing from 4:11 to 4:53 with an amplitude about 1 Pa and a sharp peak frequency at 1.8 Hz. The events was nearly aseismic and the regional seismic stations recorded infrasound shaking of the ground. The bad weather condition prohibited visual observation to see if any surface activity accompanied. At 6:00, the tremor power increased at stations on the north flank while it decreased at a station on the west flank, indicating some change of the source. The tremor power decreased from 8:00 to 8:30, stayed at the low level until 13:15, and then recovered to the previous level by 14:00. It was more distinct at stations close to the summit of Shinmoe-dake; the power decrease was more than an order of magnitude at the nearest station, SMN, 700 m from the summit. After the recovery the tremor stayed nearly same levels until the small eruptive event on the 26th before the main event. During the quiescent period of the tremor, gradual tilt up toward the summit was detected by a broadband seismometer at station SMN. Although, seismic activity except the tremor was low around the days, the quiescent period had more seismic events including relatively low-frequency ones.

Although causal relations among these events or their relation to the magma mixing are totally unclear, the sequence of phenomena on January 23 is potentially important to understand the processes leading to the climatic events of the Shinmoe-dake eruption.

キーワード: 噴火, 微動, 空振, 前駆減少, 傾斜
Keywords: Eruption, Tremor, Infrasound, Precursor, Tilt