

桜島における BL 型地震群発活動に伴う地盤変動

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Ground Deformation Associated with BL-type Earthquake Swarms at Sakurajima Volcano

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Sakurajima volcano experiences, in addition to repeated vulcanian eruptions, intermittent small eruptions similar in style to strombolian eruptions. These strombolian-like eruptions are associated with swarms of BL-type earthquakes dominated by low frequency components (1–3 Hz). Ground deformation associated with BL-type earthquake swarms was detected by water-tube tiltmeters and extensometers in an underground tunnel. Tilt and strain records were corrected by BAYTAP-G to account for the tidal effect. Gradual tilt change of crater-side-up (20–320 nrad) and extension of the ground (8–170 nstrain) continued for 3–30 hours before the BL swarms. The inflation was temporarily suspended for 0.5–19 hours, and was then followed by deflation associated with BL swarms. The degree of tilt and strain change was in the same order as that for vulcanian eruptions; however the duration of inflation processes is longer than that of a vulcanian explosion (by several minutes to several hours). The inflation rates (2–28 nrad/h, 2–16 nstrain/h) prior to BL swarms are smaller than those prior to vulcanian eruptions (20–90 nrad/h, 10–50 nstrain/h). In the deflation process, tilt change of crater-side-down (40–300 nrad) and contraction of the ground (20–160 nstrain) continued for 1–6.5 hours and was accompanied by BL swarms. The deflation rates (17–113 nrad/h, 12–57 nstrain/h) accompanying BL swarms are small. The deflation rates of 1/3 of the vulcanian eruptions exceeded the upper limit of the deflation rate that accompanied the BL swarms. The depth of the source of pressure that is thought to induce the ground deformation associated with BL swarms is estimated to be 3–4 km for both inflation and deflation processes (assuming the Mogi source to be horizontally located at the center of crater). No difference in depth is detected for vulcanian eruptions. Volcanic gases were emitted in the inflation process prior to BL swarms, however volcanic gas emission stopped in the inflation process prior to vulcanian eruptions. It is inferred that prior to vulcanian eruptions, the top of the conduit is plugged by a lava dome derived from cooled and degassed magma, and the internal pressure rapidly increases. In contrast, prior to BL swarms, the upper conduit is loosely choked and the internal pressure gradually increases due to the intrusion of new magma from a deeper source. The difference in inflation rates may be caused by the degree of choking of the upper conduit. BH-type earthquakes dominated by high frequency components (5–8 Hz) occurred alongside inflation prior to a BL swarm. The inflation rate almost reached the maximum rate prior to BL swarms that occurred without pre-BH-type earthquakes. It is inferred that a high inflation rate due to choking of the conduit is the cause of BH-type earthquakes.

Key words: ground deformation, BL-type earthquake swarms, Sakurajima volcano

1. はじめに

火山噴火に先行して火山体内にマグマが貫入することにより、噴火地点周辺の地盤が隆起・伸張し、噴火開始とともにマグマの放出により地盤が沈降・収縮することが多くの火山において観測されている。1980年5月18日に山体崩壊を伴う大噴火が発生したセントヘレンズ火山

では噴火の約1カ月前から1.5~2 m/日の速度で北側斜面がせり出し、山体が膨張していたことが光波測量により検出された(Lipman *et al.*, 1981)。小規模な噴火についても、同様に噴火に先行して火山体の隆起・伸張が見られる。浅間火山では2004年9月1日の爆発的噴火を含む4回の中規模爆発的噴火の3.5~29時間前から西側

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