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Comparative Study of Proximal Eruptive Events in the Large-scale Eruptions of Sakurajima Volcano: An-ei Eruption vs. Taisho Eruption

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The An-ei eruption (1779−1782 A.D.) and Taisho eruption (1914−1915 A.D.) were large-scale eruptions of Sakurajima Volcano. The latter, the largest eruption in Japan during the 20th century, produced about 1.5 km^3 DRE of andesitic magma. In both cases, flank eruptions from two sides of the volcano caused pumice fall and lava flows. The An-ei eruption occurred on the northeastern and southern flanks (An-ei NE and An-ei S eruptions, respectively) and the Taisho eruption occurred on the western and eastern flanks (Taisho W and Taisho E eruptions, respectively).

In the An-ei NE, two fissures are recognized from the alignments of craters: the main fissure (5 km long) and a minor fissure (1 km long). A large pyroclastic cone consisting of welded pyroclastic materials was formed along these fissures on the upper to middle flank slopes. Old drawings of the An-ei eruption show that a large amount of pyroclastic materials fell from the eruption column in the proximal area. Thus, the cone was considered to have formed simultaneously with the Plinian eruption. The presence of many cracks and a horse-shoe shaped depression on the cone is attributed to the deformation and collapse of the pyroclastic cone due to gravitational instability on the flank slope of the volcano. A stratigraphy of the eruption products shows that many lava lobes were formed after the initial Plinian eruption. In the An-ei S, the existence of a deformed pyroclastic cone sticking on the steep upper slope below the summit crater and clastogenic lava flows on the downslope indicate the syn-Plinian deposition of pyroclasitc materials on the steep slope. After then, effusion of lavas and some explosions occurred from the chains of craters on the middle flank slope.

The An-ei eruption progressed continuously in three stages. The initial Plinian eruption for up to two days on the upfissure (Stage 1) was followed by lava flows on the downfissure (Stage 2). Then, submarine eruption occurred intermittently for about two years on the NE offshore (Stage 3). In the case of the Taisho eruption, initial Plinian eruption (Stage 1) was followed by lava flows associated with the intermittent Vulcanian eruptions (Stage 2) and then, gentle lava outflow continued for more than 1.5 years in the Taisho E in Stage 3. In both eruptions, progress from an explosive pyroclastic eruption at a higher flank in Stage 1 to the effusion of lava at a lower flank in Stage 2 could be explained by the propagation of a radial dyke.

Although the pyroclastic cone of the An-ei NE and Taisho W are large in scale, the syn-Plinian clastogenic flow and cone collapse of the Taisho W were extensive. On the other hand, the cone of the An-ei S and Taisho E are small in scale. The cone of the An-ei S was deformed on the steep slope. From these variations, the intensity and duration of the Plinian eruption and the gradient of the flank slope would result in the various morphologies of the resultant cone.

Concerning the growth of the edifice of Sakurajima Volcano, the proximal process in which the pyroclastic materials plaster the flank slope in Stage 1 does not contribute to the growth of the summit area, but to that of the flank slopes. The intense proximal deposition of pyroclastic materials during the initial vigorous Plinian eruption and the following lava flow mean that a rapid response against fires caused by pyroclast fallout and lava flows from multiple craters on eruptive fissures is needed to minimize damage in future eruptions.

Key words: Plinian eruption, proximal deposition, pyroclastic cone, clastogenic lava

1. Introduction

Sakurajima Volcano is located in southern Kyushu. It is composed of two volcanic edifices, Kitadake (1117 m a.s.l.) and Minamidake (1040 m) (Fig. 1). There have been

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