# Mechanism of the eruption of Miyakejima on July 8, 2000, based on the crustal deformation data.

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## 1.Introduction

The first summit eruption of the 2000 Miyakejima eruptive activity took place on July 8, 2000. Since the eruption was followed by a caldera formation and a significant volcanic gas emission from the summit, it probably deeply relates to these activities. It is important to clear up the eruption process to reveal mechanisms of the caldera formation and the gas emission. We investigated the eruption process on the basis of crustal deformation associated with the eruption, which was clearly observed by a borehole tiltmeter and GPS networks of NIED.

## 2.Crustal deformation before the eruption and its interpretation

Tilt changes to the summit began one day before the eruption, and the change accelerated. The largest tilt change was 27micro radian. Baseline length between GPS stations shortened about 7 cm in the same period. The crustal deformation can be explained by a spherical deflation source, 0.5 km deep, beneath the summit with a volumetric change of -10^6m3. In the same period, a rapid decrease of geomagnetic total intensity was observed on the summit, which is interpreted by a decrease of magnetization, 1 km deep, beneath the summit (Sasai et al., 2001).

Furuya et al. (2003) showed that there existed a void, 1.7 km deep, beneath the summit just before the eruption. Since a collapsed summit was recognized on July 9, the accelerated deflation of a spherical source suggests an accelerated collapse of the void.

Based on the past studies, we can interpret the accelerated deflation of the spherical source as follows. Before the eruption, a void was formed by subsidence of material in a conduit beneath the summit. The void of internal pressure was sustained by fluid pressure and restitution of pillars. As the fluid flow out and the pillars partially collapse, the void deflates and stress of pillars gradually increases. When stress of a pillar exceeds its failure stress, the pillar collapses. The collapse increases stress of the other pillars, and the collapse and deflates are promoted. The model can also explain the decrease of magnetization by accelerated collapse of magnetized pillars. We speculate that the eruption is not an expulsion of a high-pressure magma or gas, but a consequence of a collapse of the void.

## 3.Crustal deformation at the eruption and its interpretation

Tilt change occurred at the eruption shows that the summit relatively uplifted. Baseline length between GPS stations increased about 2 cm at the same time.

The amount of collapsed material on the summit on July 9 was estimated to be 56x10^6m3(Geshi et al., 2002), which is almost equal to the volume of the void (Furuya et al., 2003, JGR). Therefore, we assume an upward single force on the surface and a spherical inflation source beneath it as a source model for the crustal deformation. The single force expresses a load on the surface due to the collapse, and the spherical source expresses an inflation of the void filled by the collapsed material. We assumed the intensity of single force to be 1.26x10^12N, corresponding to the amount of collapsed material (density 2300kg/m3).

We found that the crustal deformation can be interpreted by the single force and a spherical inflation source 2.9 km deep with the volumetric increase of 1.2x10^6m3. Although single source model can also explain the deformation, we must assume a much larger single force than the amount of collapsed material. Therefore, it is difficult to explain only by the collapse of the summit.

## 4. Summary

We investigated the crustal deformation associated with the summit eruption of Miyakejima on July 8, 2000 to reveal its eruption process. Before the eruption, there existed a void beneath the summit, and the collapse of the void accelerated from one day before the eruption. We speculate that the eruption is a consequence of the collapse of the void. At the eruption, the summit collapsed and the void was filled with the collapsed material.