

Hypocentral migration associated with magma intrusion in the 2000 Miyakejima eruption

MATSUYAMA, Ryotaro^{1*} ; MORITA, Yuichi¹ ; SAKAI, Shin'ichi¹ ; UEDA, Hideki²

¹ERI, Univ. of Tokyo, ²NIED

A dike intrusion is a phenomena that large amount of magma emplaces in the shape of vertical plane. It is much controlled by tectonic stress. A dike intrusion process is one of the important key informations to understand the relation between tectonic stress and volcanoes. In the case of the Miyakejima eruption in 2000, it is confirmed that a large scale dike intruded beneath sea floor from the following observations; Hypocenters migrate from inland area of Miyakejima to the area near by Kozushima and Niijima. Large ground inflation is measured by nation-wide GNSS network. However, the detail process in this event has been unsolved because hypocenter locations cannot be estimated precisely. Therefore, we try to relocate hypocenters and to reveal the dike intrusion process of the 2000 Miyakejima eruption in this study.

Because hypocenters migrated to the offshore of Miyakejima, hypocenters could not be located precisely from the data recorded at inland of islands surrounding hypocenter area. Eight days after the initiation of the activity, ocean bottom seismometers(OBSs) were installed just above hypocenters. The hypocenter locations was improved very much using the OBSs data. However, analysis of OBS's data did not cover a whole period of the activity. We try to relocate hypocenters that has no OBS's data (approximately 30,000 events) relative to the reference hypocenters (approximately 3000 events) that are located precisely using OBSs data. In our analysis, we modify Double Difference method to give constraints not to move the reference hypocenters and apply it to all earthquakes occurring during 26 June and 31 August, 2000. We also use the velocity structure that is smoothly varying in the depth because of prevention of artificial hypocenter concentration.

From the relocated hypocenters, we find out the following features in the seismic activity associated with the 2000 Miyakejima eruption. 1) There are two groups in the seismic activity. One is the hypocenters aligned from the summit of Miyakejima to the point around 8km off the coast line (near coast activity), the other is the seismic activity distributed on a sub-vertical plain located beneath sea floor at the area surrounded by Miyakejima, Kozushima and Niijima (main activity). The alignment of the hypocenters match with the direction of the maximum tectonic stress. 2) The near coast activity began with an initiation of the volcanic activity and concluded on July 1st. The seismicity in this area was active only in the first week of the whole volcanic activity, and earthquakes did not occur after the period at all. 3) The main activity lasted during two months, and it was accompanied with gradual ground deformation measured by nation-wide GNSS network that represents a large scale of dyke intruded at hypocentral area. The vertical section of the hypocenters shows that the vertical alignment changes at the depth of 12 km where the structure discontinues is implied from a seismic survey. 4) In the later periods of the activity, there are many earthquakes at the area next to the main activity. Their focal mechanisms were strike slip types that agree with the direction of tectonic stress.

Considering the features of the hypocentral distribution mentioned above and other observational facts, we can conclude that there are two types of the magma flow during the 2000 Miyakejima eruption. One is horizontal emplacement just after an initiation of the volcanic activity and the other is gradual upward migration from deep zone to the main activity. Because the coast activity was inactive after July 1st, we suppose that the two magma flow is independent during almost whole period except at the beginning of the activity. In other words, the magma that generate the main activity is not supplied horizontally from Miyakejima but from just beneath hypocenter area.

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