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Estimation of magma migration in the initial phase of the 2000 Miyakejima eruption (1)

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1. Introduction

In the case of the Miyakejima eruption in 2000, it is confirmed that the large scale dyke intruded from the observations that hypocenter migrate from in the area of Miyakejima to Kozushima and Niijima between June 27. 2000 and July 1. 2000 as well as large ground inflation is measured by nation-wide GPS network. Several dyke intrusion models have been supposed in previous studies, but the detail process in this event has not been unsolved because hypocenter locations cannot be estimated precisely. Hypocenter migration is one of the most important information on magma migration, but is not well determined in this case, because the seismic stations are located in islands where are apart from hypocenter area. It is needed to relocate the hypocenters for improving the insight on the dyke intrusion process.

In this study, we try to relocate hypocenters occurring during June 28 ? July 1 (hereafter, target earthquakes) using the cross correlation (hereafter, CC). After the large scale dyke intrusion concluded, ocean bottom seismometers(OBSs) were installed just above the hypocenters area on July 2. Using OBSs data, the precision in hypocenter was improved very well. We try to relocate the hypocenters of the target earthquakes using waveform similarity with earthquakes (hereafter, reference earthquakes) whose hypocenters are well estimated by OBSs. From above analysis, we try to get more information of large scale dyke intrusion.

2. Data and analysis

We chose 6695 earthquakes for target earthquakes. Hypocentral migration in this period covers the main part of the area of the dyke intrusion from conventional analysis. We checked waveform similarity of the target earthquakes with the reference earthquakes. We used 1-8Hz band pass filtered waveforms of P wave onsets. We calculated CC of June 28-29 with 144 reference earthquakes firstly.

3. Results

Now, we have calculated CC and found out the pairs earthquakes with similar waveform among the target earthquakes and the reference earthquakes. Following results are revealed.

(1)The waveforms of 2110 earthquakes from whole located earthquakes occurring on June 28-29 (2886) have high CC with reference earthquakes. It demonstrates that we can relocate the many hypocenters during the large scale dyke intrusion using waveform correlation.

(2) Many earthquakes during the large scale magma intrusion have similar waveforms with those of a part of reference earthquakes (hereafter, core events) whose hypocenters are closely located at the midpoint between Miyakejima and Kozushima at depth of 8-13km. Seismic activity of the reference earthquakes is characterized by burst-type activity with upward migration. Among the reference earthquakes, the core events are located at the initial point of burst type activity. It may suggest that earthquake generating process such as localized pressurization continues during whole process of the large scale dyke intrusion. Further analysis is required to reveal the detailed process.

(3)The earthquakes which have good correlation with the reference earthquakes occurring in the area of around Kozushima started at 07:00 on June. 28 and there is no such earthquake before the time. This does not contradict the results of precious researches that showed hypocenters migrate northwestward.

4. Future study

We found the good correlation in waveforms of the events of June 28-29 with reference earthquakes, and hereafter we will relocate hypocenters of target earthquakes using CC. In addition, we will read onset of OBSs data which have not been analyzed yet and increase reference earthquakes to analyze waveform correlation. Thus, our last goal is to relocate precise hypocenters precisely and investigate the dyke intrusion in the initial phase of 2000 Miyakejima eruption.

Keywords: Miyakejima volcano, earthquake family, dike intrusion, the 2000 Miyakejima eruption, hypocentral migration