

The character of the focal zone of the earthquake swarm at Hakone volcano in 2001 obtained by the analysis for seismic waveform

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In Hakone caldera, central Japan, the earthquake swarm occurred between June, 2001 and October, 2001. These hypocenters were distributed over a shallow place under the central cone of Hakone volcano. All of them are microearthquakes or ultra-microearthquakes, though extremely large number of earthquakes (about 15000) occurred. The largest shock was M2.9. Further, the crustal movement that a mountain body seems to expand was detected with this swarm activity simultaneously.

The seismic waves in this swarm activity were observed in detail by the network of seismic stations of Hot Spring Research Institute of Kanagawa Prefecture (HSRI). HSRI has a dense network of observation stations in Hakone caldera and its vicinity area, and observes the earthquakes with accuracy. From these seismic waveforms, all earthquakes can be regarded as the A-type volcanic earthquakes which had clear P- and S-wave. The B-type volcanic earthquakes and the volcanic tremors were not found.

In this study, we analysed these seismic wave records, in order to investigate the character of the focal zone of this earthquake swarm. First, the fault parameters were estimated by applying Brune's model. From these results, we obtained the size of fault and the quantity of stress drop of 499 earthquakes. Next, the reflected S-waves included in the seismic waves were analysed. The distribution of reflecting points was obtained by this analysis.

From this analysis, the character of the focal zone of the earthquake swarm, that is the internal structure of a central cone of Hakone volcano, was made clear. These are as follows;

(1) The focal zone has the complicated structure which is cut in a lot of small faults. It is considered that such structure was formed by influence of the existing internal structure of the central cone.

(2) Most of earthquakes had a quantity of small stress drop in comparison with a normal earthquake. Especially, the earthquakes with very small value of stress drop had a tendency to concentrate on some places. This may show the distribution of the underground water.

(3) There were most of reflecting points between 0.5km and 4km in depth. It seems that the lower limit of reflector distribution harmonized with the hypocenter distribution.

(4) In the middle of July, 2001, a tendency of seismic activity and the character of the focal zone changed sharply. It can be expected that some external force added into the focal zone at that time.