

Seismic Exploration on Usu volcano with Active Sources in 2001 - Outline of the Experiment -

Hiromu Okada[1], # Hiromitsu Oshima[2], Research Group for Seismic Exploration on Usu Volcano Hiromu Okada

[1] UVO - Inst. Seism. Volcan., Hokkaido University, [2] Usu Volcano Observatory, Hokkaido Univ

Seismic exploration on Usu volcano was conducted by 9 national universities of Japan and Sapporo Metrological agency in November 2001 to reveal P-wave velocity structure beneath Mt. Usu and to discuss about the unresolved aspects such as eruption mechanism and magma plumbing system. We summarize the volcano logical setting and outline of the experiment in this report.

Mt. Usu erupted four times during 100 years, in 1910, 1943-1945, 1977-1982, and 2000. Noticeable characteristics common to these four eruptions are formation of a new mountain (lava dome or cryptdome) with remarkable ground deformation and violent earthquake swarm due to dacitic magma. These four eruptive activities, however, have different features. The 1977-1982 eruption occurred at the summit crater, whereas the 1910, 1943 and 2000 eruption took place at the northern foot, the eastern foot and the western foot of the volcano. The duration of precursory earthquakes and eruptive activities are also different among them. Geophysical structure of volcano edifice and basement is an important factor in these differences because the structure influences magma intrusion process. The exploration of the structure is dispensable to understand magma intrusion processes and volcanism of the volcano. The velocity structure is especially important to discuss the mechanical process of magma intrusion, which is reflected by numerous earthquakes associated with eruptive activities.

We deployed 114 seismic stations along NW and NE trending profiles crossing the whole volcano, and we covered volcano edifices and its surrounding region with 174 seismic stations for 3D seismic tomography. The stations were spaced 250-500 m along both profiles, 500-1000 m in area less than 5 km from the summit, and 2-4 km outside of the area. Each seismic station was equipped with a vertical-component seismometer having a resonant frequency of 2Hz (L-22D, Mark Products Co. Ltd.) and a digital data logger (DataMark LS8000SH, Hakusankogyo Co. Ltd.) with a data sampling frequency of 250Hz. Encircling the whole volcano, 7 shot points were deployed on two profiles. Two hundred fifty kg of dynamite fired in 70m deep borehole at both edge of NW profile, and 200-kg charge detonated in 50m deep borehole for 5 shot points. Geographical location of shot points and seismic stations were determined by rapid static GPS survey with a positioning error less than 1m and static GPS survey with the error of 10 cm respectively.

Charge explosions were carried on schedule time between 01:30 and 02:05 on 5 November, and good seismic records were obtained. The analysis committee has picked the arrival time of the first phase with polarity of ground motion. The committee presents preliminary three-dimensional P-wave velocity structure in this session.

Acknowledgements: We are grateful to office of Date City, Sobetsu Town, Abuta Town, Toyoura Town and Toya Village for their help through this experiment. Special thanks are also due to JR Hokkaido for coordinating the train schedule in this experiment.