Geophysical Research Abstracts, Vol. 7, 10051, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10051

Strategy of eruption forecasting and related risk communication during some recent major volcanic eruptions in Japan

H. Okada (1), T. Ui (2), and Y. Katsui (3)

1. Institute of Seismology and Volcanology, Hokkaido University, Sapporo 060-0810, JAPAN
2. Crisis & Environment Managing Policy Institute Kansai, Chikusa 3-7-4, Takarazuka, Hyogo 665-0072, JAPAN
3. Professor Emeritus of Hokkaido University, N24W14, Sapporo 001-0024, JAPAN

1. Episodic development of forecasting and mitigating natural hazards — retrograde historical perspective

Recent gigantic tsunami hazard in Indian Ocean on December 26, 2004 raised worldwide serious concern in public as well as in professionals on the preparedness for natural hazard mitigation especially for early warning, public awareness and efficient communication. Volcanologists were automatically tracing back in mind the worst history at Mt. Pelee in 1902 and Mt. Nevado-del Ruiz in 1985 (20yrs ago). Clearly there were many ways to save lives and there exists similarities among the case stories.

In Japan, hazard forecasting and mitigation researches can be well explained by the step-wise episodic development triggered by major natural hazards. The three major epoch making events were the Great 1891 Nobi Earthquake of M8.0 that created Imperial Earthquake Investigation Committee (IEIC) in 1892, the Great 1923 Tokyo Earthquake of M8.0 that encouraged the foundation of Earthquake Research Institute of Tokyo University, and the recent Great Kobe Earthquake, just 10 years ago.

In this report, we will focus our discussion on eruption forecasting and related mitigation efforts concerning the 4 dome building eruptions of Mt. Usu in 1910, 1943-45, 1977-1982, and 2000. Fusakichi Omori and Takeshi Minakami were the well-known representative volcanologists in each early epoch.

1. Recent four dome building eruptions of Mt. Usu in the 20^{th} century — consequences of scientists' preparation

An IEIC report on Mt. Usu was timely published 4 months before the 1910 eruption. About 15,000 people had successfully evacuated a full day before the 1910 outburst based of the prompt advise by a local police chief, Mr. Sei'ichi Iida, who had a sufficient knowledge of Mt. Pelee and Torishima which erupted in 1902, and took a chance of the lecture given by Omori. Scientists participated also in evacuation cancellation based on jointly conducted field investigation together with disaster officials.

Omori conducted the first in-situ seismometrical observation near the erupting crater, and reported the finding of a volcanic tremor, a seismic swarm consists of numerous small earthquakes, and a ground deformation of upheavals/subsidence due to magma intrusion. Based on the combined research by seismic, geodetic, and visual observation, Omori finally proposed an early version of "inflation/deflation model" and an establishment of a volcano observatory.

During 1943-1945 activity, Minakami's B-type earthquakes, now known as a swarm of hybrid earthquakes associated with the dome growth, and distinctive ground deformation (including Mimatsu's radial fissure) were the definitive eruption precursors to the eruption. Minakami's A-type earthquakes occurring at the south flank had been a puzzling issue, however similar but more extensive events took place later prior to its 2000 eruption, indicating their volcanotectonic nature. Re-evaluation of base surge producing eruption became useful information at the 2000 eruption.

The 1977-1978 eruption and the following 3 years long Usu-Shinzan crypto-dome formation was a turning point to utilizing a modern technology for volcano monitoring, such as seismic telemeter network and EDM. Despite of improved scientific understanding (especially eruption history, historical pyroclastic flows, precursors, doming dynamics, detection of the end of activity), serious difficulties between scientists and the local society were encountered; (1) early evacuation cancellation under disagreement, (2) anxiety of possible nuee at the increased activity, and (3) small surge generating eruptions in 1978.

Four years before this eruption, volcanologists compiled a volcanic hazard manual, and only 4 months before Usu Volcano Observatory (UVO) was established legislatively. Coordinating Committee for Prediction of Volcanic Eruptions (CCPVE) was first tested by this crisis. Frequent and extensive scientific briefings made by the scientists (volcano geology/geophysics), and the JMA staffs served to create better social relationship in the area.

1. Tetrahedron strategy of wise people supported by officials, journalists and scientists, and the roll of scientists

As soon as eruptive activity had passed away at the end of 1978, new difficulty arose in the area. Local officials and business people in the spa resort town insisted that the eruption was finally over, so we would like to focus all of our power only on the recovery of the town, do not tell us even a word of possible hazard, because there will be another guaranteed 30 years ahead. The period of refusal of volcano hazard map started.

This difficulty was luckily solved by the combined efforts of the decade-long collaboration between scientists, a certain local officials/people and journalists. The scheme of people's wise action supported by the basic safety triangle consist of officials, media and scientists forms tetrahedron mitigation strategy. First move was clearly due to the impact of Mt. Ruiz disaster on scientists. Then Mt. Unzen disaster (43 killed) in 1991 clarified the risk of pyroclastic flow, and effective communication was gradually built up in the area.

Local people including businessmen started to visit volcano observatory and asked questions; such as "hazard map is really useful?", or asked at the town symposium; "how many days before you can provide us eruption forecast? Without those knowledge, we, local firemen couldn't make a plan what to do?". Such serious questions in the area encouraged scientists' further work.

The Abuta mayor finally made a historical turning decision immediately after the tsunami disaster (over 200 killed) at Okushiri Island, Hokkaido in 1993. The International Workshop on Volcano Commemorating the 50^{th} Anniversary of the Formation of Showa-Shinzan was finally held in 1995 in the area, and a hazard map was distributed to all homes.

1. Comparison of risk communication during some volcanic crises in Japan

National Government had experienced bitter lesson at the initial risk management at the time of Kobe Earthquake in 1995, and examined strategy and the role of Government. So, as soon as eruption forecasting was issued at Mt. Usu in 2000, Government Local Headquarter (GLHQ) was immediately set up 2 days before the eruption at Date city and successfully coordinated pre-eruption evacuation of the people, and further risk management after the start of the eruption. Scientists stayed at GLHQ and participated various advices.

With the help of huge amount of wide data, we are presently reconstructing detailed actual processes of emergency managements at the GLHQ before and during the 2000 eruption. For example, a possible scenario of pyroclastic flow, or even a small rock avalanche and resulting small tsunami at caldera lake Toya foreseen was openly discussed, and then dispatched to the community by the scientists' lecture at the GLHQ. Those specific risk terms were never used in the 33 official bulletins issued by JMA in the preceding 3 days. Scientists also participated advices for evacuation cancellation and emergency operation in the risk areas.

Risk management and the role of scientists can vary significantly case by case at different volcanoes and different conditions. Comparison of recent case stories among Mt. Unzen in 1990-1995, Mt. Iwate in 1995-2001, Miyakejima in 2000-present and Mt. Asama in 2004-present may provide us further important clues for the better tetrahedron relationship and more efficient support for the community's needs.