

## VI. National Project for Prediction of Volcanic Eruptions

### 1. Outlines of National Project for Prediction of Volcanic Eruptions

#### (Brief History)

National Project for Prediction of Volcanic Eruptions was initiated in 1974, according to the recommendation of the Geodetic Council of Ministry of Education, Science and Culture. The aims of the project are to improve volcano monitoring, to promote research on volcanic activity and mechanism of volcanic eruptions and to obtain the ability of forecasting volcanic eruptions. Since then, the project has repeated 6 times as 5-years plan. The project has been carried out by 9 national universities (Appendix 1), Japan Meteorological Agency (JMA), Geographical Survey Institute (GSI), Japan Coast Guard (JCG), National Research Institute for Earth Science and Disaster Prevention (NIED), Geological Survey of Japan (GSJ) and Communication Research Laboratory (CRL).

The Coordinating Committee for Prediction of Volcanic Eruptions (CCPVE) was organized in 1974 in order to exchange information and knowledge, to adjust research programs among institutions and to evaluate volcanic activity and contribute mitigation of volcanic disaster. Since 1974, many volcanic crises have been experienced at Tokachidake, Usu, Iwate, Izu-Oshima, Miyakejima, Unzen, Aso, Sakurajima and so on. For each volcanic crisis, CCPVE has evaluated volcanic activity and issued official statements on activity before eruptions and activity in progress.

The outlines of NPPVE until the fifth 5-years plan were summarized by Watanabe (1999). Now the sixth 5-years plan (1999—2003) is going.

#### (The Sixth 5-years Plan)

The sixth 5-years plan was proposed in 1998 after reviewing on the achievement of project since 1974. The proposal of the plan is consist of three parts: (1) Reinforcement of volcano monitoring and observational research at volcanoes, (2) Promotion of basic research for higher-grade prediction of volcanic eruptions and (3) Strengthening of the scheme for the prediction of volcanic eruptions.

The Geodetic Council was reconstructed into the Subdivision on Geodesy and Geophysics, Council for Science and Technology in 2000. The sixth 5-years plan was reviewed by the subdivision in 2002 and evaluated by experts in the fields of volcanology, seismology, social science, and civil engineering. The main volcanic crises in Japan during the past 5 years were (1) Volcano-seismic crisis at Iwate volcano (1998-2000), (2) Eruption at Usu volcano (2000) and (3) Eruption and active gas emission at Miyakejima volcano (2000-). The main achievements of the current 5-years plan are as follows:

#### (1) Reinforcement of volcano monitoring and observational research at volcanoes

Universities have carried out every year at two target volcanoes the Joint Experiment on Subsurface Structure of Volcanoes and Comprehensive Joint Volcano Observations, respectively, (Appendix 2) and universities and institutions have done the tentative and collaborative observations at volcanoes which indicated volcano crisis, those are, Iwate, Usu and Miyakejima volcanoes.

At Usu and Miyakejima volcanoes, precursory phenomena before eruptions were clearly detected by several kinds of observations, borehole seismometers and tiltmeters, GPS and so on. CCPVE and JMA succeeded in prediction of eruptions at the two volcanoes, and a quick evacuation of inhabitants were executed with no loss of life by local governments. However, it was difficult to predict how volcanoes behave after the onset of eruptions, when the volcano changed the style of activity like the Miyakejima which caused subsequently the collapse of the summit caldera and has continues active gas emission.

It was revealed at Iwate volcano that high-accuracy instruments, bore-hole seismometers, tiltmeters and strainmeters could detect clearly minor movements of intruded magma even at dormant volcanoes when they are waking up.

#### (2) Promotion of basic research for higher-grade prediction of volcanic eruptions

The Joint Experiment on Subsurface Structure of Volcanoes including seismic sounding has provided information on detail structure of volcanoes shallower than 3 km, and the determination of location of volcanic earthquakes was highly improved at Iwate, Bandai, Unzen and Kirishima volcanoes. It, however, is a future problem to detect the magma chamber and study the interior structure by seismic sounding.

At some volcanoes, ground deformation and geo-electromagnetic changes associated with volcanic earthquakes and tremors were observed and the mechanism of volcano-seismic events was discussed in relation to volcanic fluid.

At Fuji volcano, seismic activity of deep low-frequency earthquakes increased in fall of 2000, and the Subdivision on Geodesy and Geophysics, Council for Science and Technology reported a proposal on the reinforcement of monitoring and research at Mt. Fuji (2001). According to the proposal, a collaborative study among different institutions, including social science, was initiated in 2001 as 3-years plan. The aims are how to evaluate eruption potential at dormant volcanoes and how to inform of volcanic activity to publics. The research plan includes (1) the reinforcement of volcano monitoring, (2) research on volcanic structure and history of volcanic activity by geophysical methods, drilling of volcanic edifice and geological survey, and (3) analysis and design of volcanic information from viewpoint of social science.

#### (3) Strengthening of the scheme for the prediction of volcanic eruptions.

JMA established four regional centers for volcano monitoring and volcanic information in 2002 by reconstructing volcano sections at

meteorological observatories and weather stations in order to improve the ability on monitoring and evaluation of volcanic activity. In case of volcano crises at Usu and Iwate volcanoes, communication among scientists, local governments and inhabitants has been frequently and effectively done through social education and making volcanic hazard maps before crises, and evacuation was quickly and smoothly executed at Usu volcano.

In summer of 2003, the recommendation of seventh 5-years (2004-2008) will be proposed from the Subdivision on Geodesy and Geophysics, Council for Science and Technology.

#### **Appendix 1. Institutes and Observatories of National Universities Participating in the National Project for Prediction of Volcanic Eruptions**

- 1) Research Center of Seismology and Volcanology, Hokkaido University (Usu Volcano Observatory)
- 2) Earthquake and Volcano Observatory, Hirosaki University
- 3) Research Center for Prediction of Earthquakes and Volcanic Eruptions, Tohoku University
- 4-1) Volcano Research Center, Earthquake Research Institute, University of Tokyo
- 4-2) Laboratory for Earthquake Chemistry, University of Tokyo
- 5) Volcanic Fluid Research Center, Tokyo Institute of Technology (Kusatsu-Shirane Volcano Observatory)
- 6) Research Center for Seismology and Volcanology, Nagoya University
- 7-1) Aso Volcanological Laboratory, Institute for Geothermal Science, Kyoto University
- 7-2) Sakurajima Volcano Research Center, Disaster Prevention Research Institute, Kyoto University
- 8) Institute of Seismology and Volcanology, Kyushu University (Shimabara Earthquake and Volcano Observatory)
- 9) Nansei-toko Observatory for Earthquakes and Volcanoes, Kagoshima University

#### **Appendix 2. Target Volcanoes for the Joint Experiment on Subsurface Structure of Volcanoes and the Comprehensive Joint Volcano Observations in the Sixth 5-years Plan**

Fiscal year	Joint Experiment	Comprehensive Joint Observation
1999	Izu-Oshima	Iwate
2000	Iwate	Satsuma-Iwojima & Kuchinoerabujima
2001	Usu	Unzen
2002	Hokkaido-Komagatake	Fuji
2003	Fuji	Kusatsu-Shirane

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#### **References**

Watanabe, H. (1999) Outlines of National Project for Prediction of Volcanic Eruptions, Reports on Volcanic Activities and Volcanological studies in Japan for the period from 1995 to 1998, 60-64.

\*\*Subdivision on Geodesy and Geophysics, Council for Science and Technology (2001) Report on reinforcement of monitoring and research at Mt. Fuji, 19p.

\*\*Subdivision on Geodesy and Geophysics, Council for Science and Technology (2002) Reviews on the Sixth 5-years plan for Prediction of Volcanic Eruptions, 79p.

(\* in Japanese with English abstract      \*\* in Japanese)