

Volcanic Information and Response of Local Authorities in Case of the 2006 Sakurajima Eruption

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Synopsis

In June 2006, eruption abruptly occurred on the eastern slope of Sakurajima volcano, and activity continued for a month. It was anxious that the activity might be accompanied with pyroclastic flows, but the actual flows were minor. This manuscript describes volcanic information and countermeasures done by local authorities related to this short-term volcano crisis. Quick response of local governments and sooth decision of countermeasures among several organizations were achieved under common understanding on volcanic activity.

Keywords: mitigation of volcanic disaster, volcanic information, crisis management

1. Introduction

Volcano monitoring and volcanic information are essential for mitigation of volcanic disaster, in particular, safety of human life. In Japan, Japan Meteorological Agency (JMA) has the duty on volcanic information, and has been supported by the Coordinating Committee of Prediction of Volcanic Eruptions (CCPVE) which has made integrated evaluation on volcanic activity. However, tragedy might occur even at well-monitored volcanoes. For example, 43 people were killed at Mt. Unzen by pyroclastic flows on June 3, 1991, though volcanic information has been repeated by JMA and warning for pyroclastic flows had been announced 3 days before the accident by CCPVE. Most of the victims were staff of mass media due to incomplete control by local authorities. In case of the 2000 Usu eruption, all the residents and visitors quickly and smoothly evacuated to safe zones 2 days before the eruption according to the order of the city hall and town offices, which instantly corresponded to volcanic alert of JMA based on the evaluation of volcanic activity by CCPVE.

Thus, these two examples demonstrated that it is very important for local authorities to response quickly to volcanic information and decide effective control in

volcano crisis.

Volcanic criss management and information have discussed based on experiences at Usu, Iwate, Miyakejima and other volcanoes among autonomies, JMA and volcanologists at the Sakurajima Workshop on Volcanic Information held in March, 2003. Autonomies commonly recognized that volcanic information from JMA is the trigger of action in crisis management, and expect its improvement. In addition, they are eager for more detailed information and concrete suggestion from volcanologists, as provided at Iwate and Usu volcanoes.

Sakurajima volcano has repeated explosive eruptions at the summit crater since 1955, but the activity became much low during the recent several years. On June 4, 2006, eruption abruptly started on the eastern flank of Sakurajima volcano (Yokoo and Ishihara, 2007), and some of residents and local government worried about the activity. Volcanic information and response for the activity are described and problems in volcano crisis management are discussed.

2. Recent Work for Mitigation of Volcanic Disasters

Japan Meteorological Agency (JMA) strengthened volcano monitoring by establishing regional centers for

volcano watch and information in March 2002, and introduced 'levels of volcanic activity (0-6)' to volcanic information of five volcanoes, including Sakurajima, in November 2003.

Kagoshima Prefecture Government, Kagoshima City Hall, and Osumi River and National Highway Work Office have made effort for mitigation of volcanic disasters at Sakurajima volcano during the past 40 years in cooperation with residents and experts. Recent activities are:

[1] Regional Plan for Mitigation of Volcanic Disasters was revised in 1997, which included volcanic hazard maps, guideline for control and organizing an advisory committee in volcano crisis. Evacuation drill which has been done every January by about five thousands people.

[2] Education of volcanic activity and disaster for citizens, staff of public offices and students through workshops, lectures, textbook, public information, and so on. Volcanologists and staff of JMA have supported these activities as experts.

[3] The Committee on Mitigation of Volcanic Disaster of Sakurajima was organized in 2003, and discussed strategy of mitigation of volcanic hazards. Revised volcanic hazards map was published in March 2006 and delivered to all the families in Sakurajima. Explanation of the map was also done by the city hall for representatives of communities.

Volcano experts and JMA have repeatedly explained the present stage of volcanic activity :

[1] Magma supply beneath the Aira caldera has continued, and more than one cubic kilometers of magma was already stored and amount of magma will reach its critical level for large eruption in a few decades.

[2] Deep seismic activity around Sakurajima and the caldera has increased since 2003. It means that magma tries to move up to the ground surface. Eruptive activity at Sakurajima might resume in a few years (Iguchi, 2006; Ishihara, 2006).

Kagoshima city hall introduced this opinion on its monthly public information, with the data as illustrated in Fig.1. A few days later, eruption occurred at the old crater, Showa crater on the eastern flank of Sakurajima volcano, as shown in Photo 1. The Showa crater was formed in 1939 with the generation of pyroclastic flows. The crater extruded about 0.2 km³ of lava in 1946. No eruption occurred after July 1948.

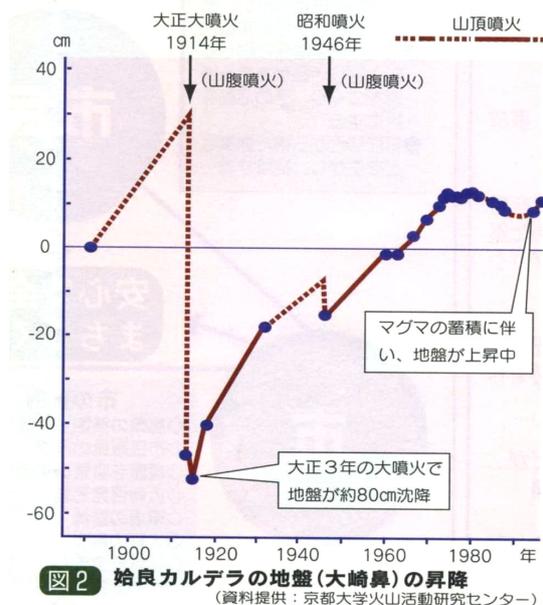


Fig. 1 The relationship between volcanic activity of Sakurajima volcano and the ground deformation of the Aira caldera during the period from 1893 to 1996 appeared on the monthly public information (June 2006) of Kagoshima city. This figure demonstrates that large eruptions in 1914 and 1946 caused depression of the ground due to discharge of magma and that of the ground due to accumulation of magma has been in progress during dormant periods for large eruption in near future.

3. Volcanic Information and Response of Local Authorities

No clear signs of the generation of eruption at the Showa crater were observed except for increase in fumaroles and geothermal activity (Yokoo and Ishihara, 2007)..

3.1 Initial stage

[1] Eruption was confirmed and reported around noon of June 4 (Sunday) by Mr. T. Takayama, a staff of Sakurajima Volcano Research Center (SVRC). SVRC called Kagoshima Meteorological Observatory and Kagoshima Prefecture Government, and reported the activity. The prefecture government instantly established the network for emergency among organizations related to crisis management.

[2] JMA issued volcanic observation report (No.1) at 17:40 on June 4: 'Tiny amount of white-grayish cloud was confirmed around the Showa crater. The level of activity 2, relatively calm eruption continues'. This

message denied not only the event as shown in Photo 1 to be eruption but also the necessity of emergency measures.

[3] From the morning of June 5, many mass media, residents, and visitors called SVRC, probably JMA and local governments. Some ones pointed out difference in view on eruptive activity between JMA and universities, and others told private opinion, for example, “Big eruption will surely come in a week”. In addition, to watch attractive events, visitors and mass media gathered at the foot of the volcano, 2 km from the crater. The area is dangerous once explosive eruption or eruption accompanied with pyroclastic flows occurred. However, no one could control them, since the level of activity was kept at level 2 by JMA.

[4] SVRC started to report this activity on its home page in the night of June 5, and explained the volcanological implication of current activity in a clear and simple manner, using observed photographs and data, not to cause panic and accidents due to rumors.



Photo 1 Eruption at the Showa crater on the eastern flank of Sakurajima (15:20, June 4, 2006), background wall is the rim of the summit crater. The altitude of the Showa crater and the rim of the summit crater are about 800 m and 1000 m, respectively.

3.2 Second Stage

Eruption at the Showa crater had become more violent and height of eruption cloud sometimes exceeded 1 km.

[1] On June 12, JMA issued ‘Volcanic Advisory’ based on the evaluation by the Coordinating Committee for Prediction of Volcanic Eruptions, and rose up the level of volcanic activity from 2 to 3.

Kagoshima prefecture governor decided to hold the

advisory committee (the Coordinating Committee for Countermeasures of Sakurajima Eruption) on June 14.

[2] On June 13, concrete countermeasures for the eruption were seriously discussed among the prefecture government, the city hall, JMA, Osumi River and National Highway Work Office and Sakurajima Volcano Research Center (SVRC).

The city hall and prefecture government worried about panic of society and influence on industry. They hoped that set-up of dangerous zone would be minimized. JMA and SVRC hoped to set up dangerous zone supposing largest eruption expected in a few months. SVRC showed the map as illustrated in Fig. 2, where flight range of volcanic bombs, up to 2 km, and paths of pyroclastic flows were empirically drawn supposing small to moderate size of eruption.

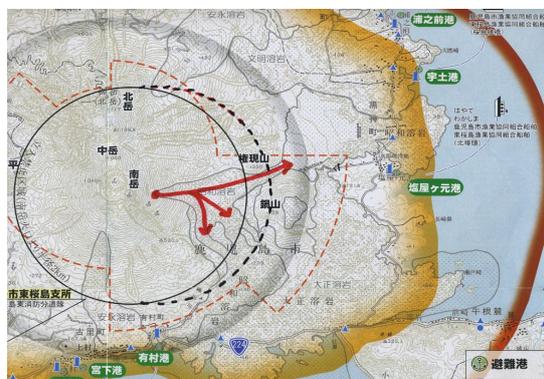


Fig. 2 A revised volcanic hazards map proposed by Sakurajima Volcano Research Center. The red dot and three lines with arrow indicate the location of the Showa crater and expected paths of pyroclastic flows. Broken lines are expected flight range (2 km) of volcanic blocks from the crater.

The five members agree to decide control zone according to this map: Extend the off-limit zone eastwards by 0.5 km, and to make gates on roads leading to affected area by pyroclastic flows or mud flows.

[3] On June 14, the advisory committee for volcano crisis of Sakurajima was held open to public, and the plan of control proposed by the 5 members was authorized. The mayor of Kagoshima decided extension of the off-limit zone and traffic regulations.

[4] Evacuation drill was done on June 16, and the revised hazards map was delivered on June 23. JMA pulled down the level of activity from 3 to 2 on August 18, 2006.

4. Discussion and Summary

Local governments quickly responded to the unexpected eruption and decided the counter-measures. Residents of Sakurajima volcano calmly accepted the activity, and little confusion occurred in local society.

[1] Staffs in crises management division of local governments and others understood the state of Sakurajima volcano and countermeasures in volcano crisis, as discussed for three years at the Committee on Mitigation of Volcanic Disaster of Sakurajima.

[2] The advisory committee was quickly held by the prefecture governor and decided measures open to mass media. Citizens could know directly the action of the local governments.

[3] The eruption started soon after the new volcanic hazard map and monthly public information were delivered by the city hall. Most of residents of the volcano were not surprised.

However, volcanic information and its content should be improved, including terminology of eruption. On the onset day of eruption, JMA stuck to the special definition of eruption at Sakurajima : minimum height of volcanic cloud of Sakurajima eruption is 1km, and did not use 'eruption', but expressed as 'emission of tiny amount of volcanic cloud'. Some of confusion

occurred not only in local society, but also in volcanological community.

It should be noted also that the occurrence of eruption could not be identified by instruments, but confirmed by the volcano expert. Much confusion might be caused if identification of eruption delayed one day or more. We should note that cooperation of residents is much important for quick response to volcanic activity.

References

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火山情報と自治体の防災対応：2006年桜島噴火の例

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要 旨

2006年6月に桜島の中腹の昭和火口から突如噴火がはじまり、約1ヶ月間噴火活動が続いた。火砕流の発生が懸念されたが、ごく小規模なものであった。本稿は、この活動に関連した火山情報と地元関係機関の防災対応について解説している。関係機関の連携のもと円滑な防災対応がなされた背景には、桜島のハザードマップ作成等の共同作業を通じて得られた火山活動に関する知識の共有がある。

キーワード:火山災害の軽減, 火山情報, 危機管理