

The Leading City in Volcanic Disasters Prevention

*Kagoshima City
Sakurajima Volcano Disaster
Prevention Measures*

**Disaster Prevention
Measures for Achieving
"the Zero Victim Goal"
in any Major Eruptions**



**Contributing to
the World Through
the "Kagoshima
Model"**



**Disaster Prevention
Education for
"Passing on to" the
Next Generation**



Kagoshima City

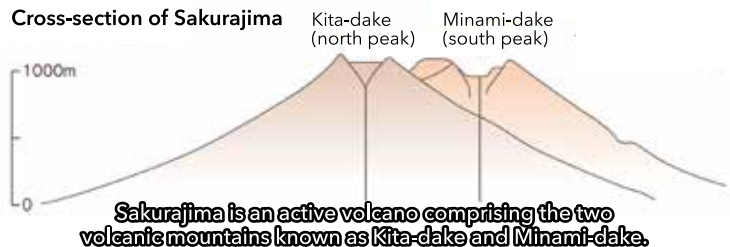
Outline of Sakurajima (History)

Formation of Sakurajima



Approximately 29,000 years ago, a huge eruption occurred in the current northern part of Kagoshima Bay resulting in the formation of the Aira caldera.

Approximately 3,000 years after that, new volcanic activity took place at the southern edge of this Aira caldera, giving birth to Sakurajima. Sakurajima is a composite volcano consisting of Kita-dake (north peak) and Minami-dake (south peak). Minami-dake is currently active.

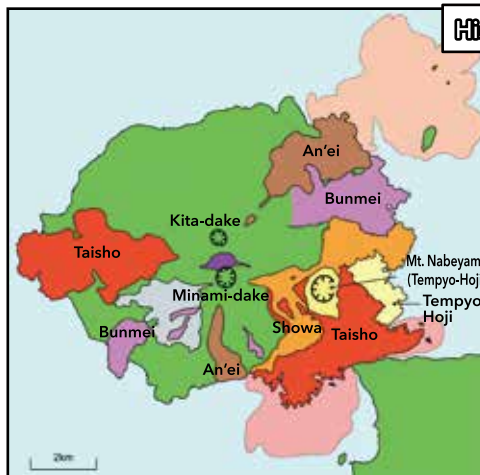


Recurring Major Eruptions

Many major eruptions have taken place on Sakurajima including the following four events with historical records:

- Tempyo-Hoji Eruption (year 764)
- Bunmei Eruption (1471)
- An'ei Eruption (1779)
- Taisho Eruption (1914)

History of Sakurajima's Major Eruptions



Tempyo-Hoji Eruption (764-766)

Bunmei Eruption (1471-1476)

An'ei Eruption (1779-1782)

*Tsunami occurred due to submarine eruption
*Shinjima Island was formed

Taisho Eruption (1914-1915)

Source: Kobayashi, Tetsuo. 2014. "Volcano Sakurajima" Chapter 1. In 100th Anniversary Publication of Sakurajima Taisho Eruption, edited by Steering Committee of the Project commemorating the 100th Anniversary of Sakurajima Taisho Eruption, 18-29.

Damage Caused by Taisho Eruption (1914)



(Photo: Courtesy of Kagoshima Prefectural Museum)

During the Taisho eruption of 1914, the volcanic smoke rose to a height of 18,000 meters and emitted a great volume of pumice and volcanic ash. The buried shrine gate in Kurokami district exemplifies its dreadful power. In addition, the lava flow filled the strait which used to exist between Sakurajima Island and Osumi peninsula. As a result, Sakurajima became connected to the peninsula.

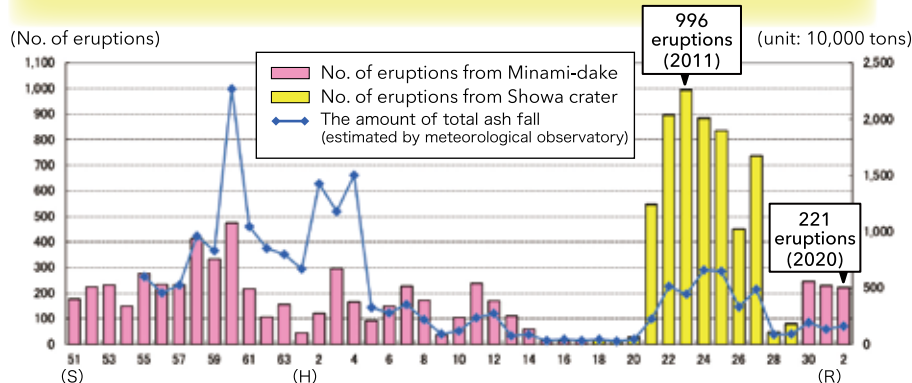
Furthermore, an earthquake of magnitude 7 on the Richter scale caused tremendous damage to the other side of the shore in Kagoshima City. (58 dead or missing)



Outline of Sakurajima (Current Status)

Current Volcanic Activities

Eruptions have repeatedly been occurring on Sakurajima. Residents of the city side often suffer from falling ash.



The number of volcanic eruptions and the amount of ash fall from Sakurajima



Alert Level of Volcanic Eruptions

Sakurajima is currently at alert level 3, restricting entry into the mountain. According to law, the area within a 2 km radius of the crater is off-limits.



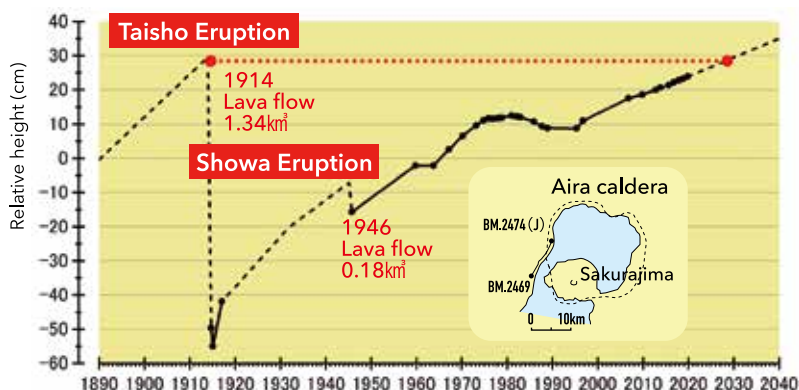
Alert levels of volcanic eruptions and disaster prevention measures

(information from the meteorological observatory)

Access within a 2 km radius of the crater is permanently off-limits on Sakurajima.

| Level | Volcanic activities | Disaster prevention measures |
|--|---|---|
| 5 (Evacuation) | An eruption that could cause great damage to residential areas has occurred, or such similar situation is imminent. | Evacuation from impacted/dangerous residential areas is required. |
| 4 (Evacuation of the elderly, etc.) | An eruption that would cause great damage to residential areas is currently expected (the probability in fact has increased). | Those who require care, including the elderly, should evacuate from the residential areas that are under alert; Residents are required to prepare for evacuation. |
| 3 (Restrictions on entry to the mountain) | An eruption that would cause great impact (including danger to life) on the vicinity of residential areas has occurred or is expected to occur. | Residents maintain ordinary life. Prepare for evacuation of those requiring care depending on the situation. Climbing the mountain peak is forbidden and entering mountain and other dangerous areas is restricted. |
| 2 (Restriction to the surrounding areas of a crater) | An eruption that would impact (including danger to life) the vicinity of a volcano has occurred or is expected to occur. | Residents maintain ordinary life. Entry is restricted to the surrounding areas of the craters. |
| 1 (Be aware that this is an active volcano) | Quiet volcanic activities. Depending on current volcanic activity, emission of volcanic ash is observed within the area of the crater (danger to life would occur). | Restricted entry to the inside of crater depending on the situation. |

Impending Major Eruption of the Taisho Eruption Level



Vertical ground movement of Aira caldera

Source: Kyoto University Sakurajima Volcano Research Center

Now that over 100 years have passed since the Taisho Eruption of 1914, it is estimated that magma of equivalent volume of the eruption has been accumulated in the magma chamber under the Aira caldera. This means it is necessary to prepare for a coming major eruption. Based on this idea, Kagoshima City is now working on countermeasures against such a major eruption.

[Main Component 1] Disaster Prevention Measures for Achieving "the Zero Victim Goal" in any Major Eruptions (1)

Evacuation Facilities / Guidance Signs



Evacuation facilities within Sakurajima include shelters to protect people from falling boulders, evacuation houses and ports used when evacuating by ferry. Respective guidance signs are well equipped.



Guide maps indicating where one currently is



Guidance signs to evacuation facilities

Ash Fall Removal Measures



Volcanic ash accumulated from Sakurajima eruptions is cleaned up by road sweepers and road sprinklers. In addition, in residential areas, designated ash collection plastic bags are provided to citizens free of charge to help mitigate the problem.



Ash collection station



Ash collection plastic bag (kokuhai-bukuro)

Making Requests



Requests made to the national government (relevant ministries)



Achievements of requests (Sabo dam)

Together with the surrounding cities of Sakurajima, including Kirishima, Kanoya and Tarumizu, the "Council of countermeasures against Sakurajima volcanic activity" has been organized. Every year, this council requests national and Kagoshima prefectural governments to improve sabo erosion control facilities and roads.

Collaboration with Relevant Bodies (Five Party Meeting)



Sakurajima Volcanic Disaster Prevention Council (Five Party Meeting)

Kagoshima meteorological observatory, Osumi branch of the Kyushu Regional Development Bureau, Kagoshima Prefecture, universities (Kyoto University Sakurajima Volcano Research Center and Kagoshima University) as well as municipalities (Kagoshima City and Tarumizu City) have worked together to establish the "Sakurajima Volcanic Disaster Prevention Council" (known as the Five Party Meeting). The council meets every 2 months to exchange information and opinions on volcanic activities.

[Main Component 1] Disaster Prevention Measures for Achieving "the Zero Victim Goal" in any Major Eruptions (2)

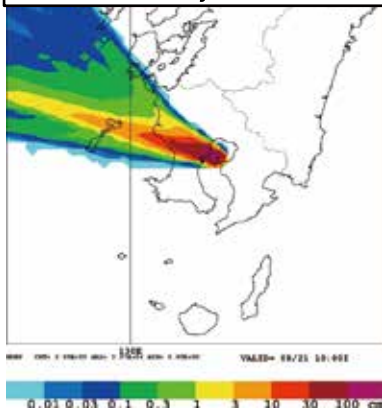
Countermeasures Against Major Sakurajima Eruptions

The measures are being prepared for a major eruption equivalent to the Taisho Eruption. These include an escape from Sakurajima, measures against a large amount of pumice and volcanic ash fall and evacuation for an extended period including the one to neighboring municipalities under assumption of falling and deposit of a great amount of pumice and ash in the city area.



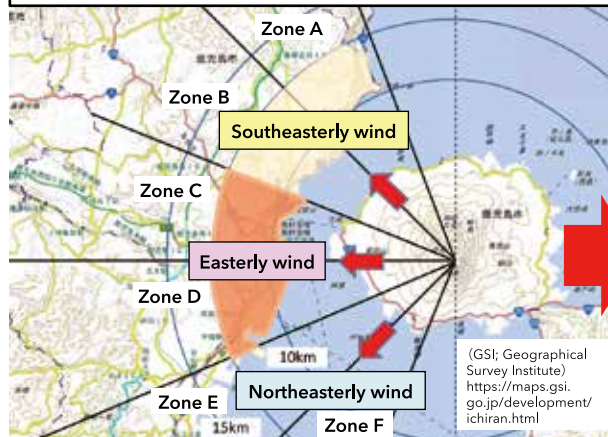
Sakurajima Volcano Evacuation Manual (for residents)

Case simulation under assumption of the worst impact on the city side



Source: materials provided by Shimbori Toshiki, Meteorological Research Institute

The city side is divided into zones to determine areas subject to evacuation notices.



Possible evacuation measures for residents on the city side

[e.g.]
- Issuance of evacuation instructions to zones C & D
- Evacuation support for residents (evacuation by bus)

Evacuate to a nearby city or town as much as possible, taking into account the number of evacuees and the area to be evacuated.



Wide area evacuation to neighboring municipalities

Verification experiment for vehicular travel and removal of rubble from roads under assumption of a large scale pumice and ash fall

In developing measures against a large amount of pumice and volcanic ash fall, the world's first verification experiment of vehicular travel and rubble removal from roads was conducted in July 2018 under assumption of a large amount of pumice and volcanic ash fall. The experiment helped clarify requirements for all-wheel-drive vehicles as well as effective removal methods.



Vehicular travel experiment (pumice)



Vehicular travel experiment (volcanic ash)



Verification experiment of rubble removal from roads

Sakurajima Volcanic Disaster Drill

The Sakurajima Volcanic Disaster Drill has been carried out every year for over 50 years in collaboration with local people and disaster prevention related organizations. This program has contributed to enhancement of awareness of disaster prevention and the effectiveness of its measures.



Evacuation from Sakurajima drill



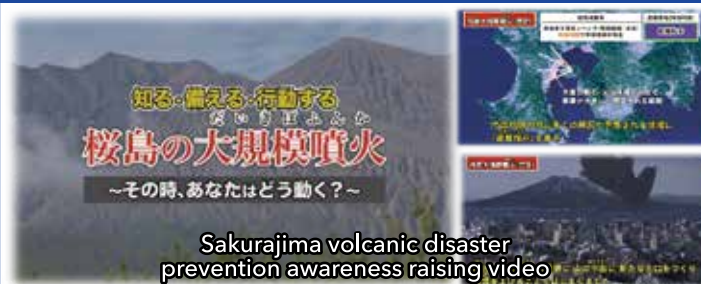
Evacuation within Sakurajima drill



Emergency recovery drill

[Main Component 2] Disaster Prevention Education for "Passing on to" the Next Generation

Raising Awareness of Volcanic Disaster Prevention



Sakurajima volcanic disaster prevention awareness raising video



Sakurajima volcano disaster prevention leaflet

Videos and leaflets on volcanic disaster prevention have been produced to help citizens gain proper knowledge of Sakurajima's past and current status in order to disseminate the importance of preparedness and awareness of the effective measures to ensure protection of lives.

Production and Distribution of Volcanic Disaster Prevention Materials



Volcanic disaster prevention materials have been produced and distributed to all elementary schools in Kagoshima City in order to learn how to cope with volcanic disasters as well as how to enjoy the natural blessings and culture of Sakurajima.

Classes Conducted by Dispatched Volcano Experts



Eruption experiments using cola

Lectures by volcano experts

Volcano experts are dispatched to elementary schools to provide lectures on the formation of Sakurajima and its eruptive history. Classes detailing experiments to learn about eruption mechanism are also provided.

Experience Visiting Sakurajima



Ash-buried Kurokami Shrine Gate

Elementary school children and their guardians from the city side are taking part in a hands-on learning program to visit the Sakurajima Visitor Center, Ash-buried Kurokami Shrine Gate and Sabo erosion control facilities.



Sakurajima Visitor Center

Sakurajima International Volcanic Sabo Center

Training to Develop Volcanic Disaster Specialists



Evacuation Planning Training in Kagoshima City

Training to develop volcanic disaster specialists has been held for those who are related to volcanic disasters all over Japan. Training includes ash removal measures, evacuation planning and observation of a Sakurajima volcano disaster drill.



Map exercise

Drill observation

[Main Component 3] Contributing to the World Through the "Kagoshima Model"

Organizing International Volcanic Conferences

The Kagoshima International Conference on Volcanoes was held in 1988, the Asian Active Volcano Summit was held in 1998, and the IAVCEI (International Association of Volcanology and Chemistry of the Earth's Interior) Scientific Assembly was held in 2013.



Kagoshima International Conference on Volcanoes



Asian Active Volcano Summit



IAVCEI 2013

Participation in Volcano-related Conferences and Information Dissemination

[International conferences]

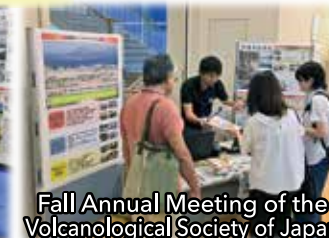


Cities on Volcanoes (CoV conference)

[Domestic conferences]



National Conference on Disaster Prevention



Fall Annual Meeting of the Volcanological Society of Japan

Kagoshima City participates in both domestic and international volcano-related conferences and actively disseminates information on the volcanic disaster prevention measures taken by Kagoshima City.

Promotion of Exchange of Information on Volcano Disaster Prevention, and Support for Overseas Media Coverage

[Promotion of exchange of information]



Lecture by the governor of Suleman



Discussions with Prefectural officials of Suleman Prefecture

[Media coverage]



TV (France)



TV (Canada)

Kagoshima City concluded a memorandum of understanding regarding information exchange of volcano disaster prevention with Suleman Prefecture, Indonesia. The City also deals with overseas media coverage regarding endeavors on volcanic disaster prevention.

Network of Municipalities for Enhanced Volcanic Disaster Prevention



Requests made to the national government (relevant ministries)



Online training sessions

The Network of Municipalities for Enhanced Volcanic Disaster Prevention (151 municipalities) has been established by encouraging cities, towns and villages in volcanic hazard areas across Japan in order to request the national government to improve and strengthen its volcanic research, monitoring and observation systems. The network also shares information on volcanic disaster prevention measures.

* The number of municipalities is as of October 2021

The Framework of Leading City in Volcanic Disaster Prevention

Sakurajima has been continuously active for the long period of 60 years and has greatly affected the residents' lives as well as agricultural production on Sakurajima and its surrounding areas. This active volcano, Sakurajima, is a part of Kagoshima City. There are approximately 600,000 citizens living at the foot of Sakurajima and its opposite shore in Kagoshima city. The area has been working on volcanic disaster prevention measures from both the tangible and intangible aspects and has made efforts to improve them through various trial and error processes.

Our city's efforts in volcanic disaster prevention are effective measures supported by our long years of experience and achievements. We believe that we can contribute to mitigating the damage caused by volcanic disasters in Japan and abroad by further improving these measures and disseminating them to the world as a model for volcanic disaster prevention.

With this in mind, citizens, local communities, businesses, research institutions, and the government will work together to raise the level of comprehensive disaster prevention capability for Sakurajima. Kagoshima City is determined to expand the number of tourists and other related populations visiting the area by communicating the charm of the volcano and our efforts in cutting-edge volcanic disaster prevention.



(Established in March 2019)

Disaster Prevention Measures for Achieving "the Zero Victim Goal" in any Major Eruptions

Disaster Prevention Education for "Passing on to" the Next Generation

Contributing to the World Through the "Kagoshima Model"

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For more information, please visit the Kagoshima City website.

Kagonma Bosai kun



Kagoshima City Sakurajima eruption disaster prevention

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