Special Feature 1

Understanding and Being Prepared for “Volcanoes”

Japan is one of the world’s most volcanic countries, with 111 active volcanoes. While volcanoes are a blessing to our lives, pyroclastic flows and large volcanic rock fragments generated from an eruption leave almost no time for evacuation. They may cause disasters that pose a high risk to human lives. In the 2014 Mount Ontake eruption, a difficult-to-predict phreatic eruption (an eruption driven by rapid vaporization and expansion of water caused by heating or depressurization of underground water) occurred suddenly, affecting many climbers staying near the crater.

Japan has a history of large-scale volcanic eruptions, including the 1707 Hoei Eruption of Mt. Fuji and the 1914 Taisho eruption of the Sakurajima volcano. In the event of a large-scale volcanic eruption, the surrounding regions may be devastated, leaving a long-lasting impact. Since we live in a volcanic country, we need to learn from past disasters and prepare in advance for volcanic disasters that may occur at any time.

In 2023, the “Act on Special Measures for Active Volcanoes” (Act No. 61 of 1973, hereinafter referred to as the “Act on Special Measures for Active Volcanoes”) was partially amended for further strengthening of measures regarding active volcanoes from a precautionary perspective before a volcanic disaster occurs. The amendment led to newly stipulating the establishment of the Headquarters for Volcano Research Promotion and enacting the “Volcanic Disaster Preparedness Awareness Day”. The amended Act will be enforced in April 2024, which will further strengthen and enhance volcano disaster risk management measures in the future.

Against this background, Special Feature 1 of the White Paper on Disaster Management 2024 focuses on the theme “Understanding and Being Prepared for ‘Volcanoes’”. First, Chapter 1 looks back on the situation caused by the disaster at the time of the Mount Ontake eruption, which completed ten years in 2024, as a case study of recent volcanic eruptions in Japan and describes Japan’s volcano disaster risk management measures in light of lessons learned. Next, Chapter 2 summarizes the evolution of Japan’s volcano disaster risk management measures, which have been enhanced and strengthened through the enactment and amendment of the Act on Active Volcanoes. Chapter 3 introduces examples of volcano disaster risk management measures in various regions that coexist with volcanoes and discusses preparedness against volcanic disasters.

Chapter 1 Ten Years After the Eruption of Mount Ontake, Volcano Disaster Risk Management Measures in Light of Lessons Learned

The 3,067 m high Mount Ontake, which straddles Nagano and Gifu Prefectures, is Japan’s second-highest active volcano after Mt. Fuji. This sacred mountain, an object of worship since ancient times, has been chosen as one of the “100 famous mountains of Japan” and is popular with many climbers for its excellent views.

At 11:52 a.m. on September 27, 2014, the area surrounding the summit of Mount Ontake was bustling with many climbers, as it was lunchtime on a weekend blessed with fine weather after a long time, with autumn colors at their peak. At that time, a phreatic eruption suddenly occurred, resulting in human fatalities, with 63 people dead or missing. More than 15,000 personnel conducted rescue and relief operations for victims over 20 days until October 16.

This chapter reflects on the situation immediately after the Mount Ontake eruption and the rescue and relief operations. It describes subsequent volcano disaster risk management measures and the preparedness required of climbers and tourists, etc.

Fig. 1-1 Location and summit map of Mount Ontake

Source: Nagano Prefecture (2020) “Nagano Prefecture Mount Ontake Eruption Disaster Response Records”
(Reference: https://www.pref.nagano.lg.jp/bosai/kurashi/shobo/bosai/bosai/ontakesankiroku.html)
* Mountain cabin names, mountain trails, elevation values, etc., as at the time of the eruption

Section 1 Looking Back on the Mount Ontake Eruption

The records of the situation immediately after the eruption and the rescue and relief operations are summarized below based on the “Nagano Prefecture Mount Ontake Eruption Disaster Response Records” compiled by Nagano Prefecture.

September 27 (Saturday)

11:52 a.m.	Mount Ontake erupts.
12:01 p.m.	A 119-emergency call is made from a mountain cabin to the Kiso Regional Fire Department, reporting that “about 40 people had taken shelter”.
12:36 p.m.	The Japan Meteorological Agency issues a “Near-crater warning” and raises the volcanic alert level from Level 1 (Normal) to Level 3 (Restriction on proximity to the volcano).
Past 1:00 p.m.	Climbers who had taken shelter in the Otaki Summit Lodge begin to descend.
2:20 p.m.	The Nagano Prefectural Police announce, “There is information about approximately 150 people being stranded near the summit”.
Around 7 p.m.	Nagano Prefecture reveals that 7 people were unconscious.
7:25 p.m.	Around 230 people are confirmed to have descended the mountain.
8:30 p.m.	Nagano Prefecture requests the Fire and Disaster Management Agency to dispatch Emergency Fire Response Teams. The Fire and Disaster Management Agency requests Tokyo and its three neighboring prefectures (Yamanashi, Shizuoka, and Aichi) to mobilize High-Altitude Rescue Teams and Mountain Rescue Teams.
10:30 p.m.	35 people (including police officers, etc.) take shelter in a mountain cabin, of whom two are suspected to have fractures. They spend the night in the cabin without descending the mountain.

September 28 (Sunday)

5:30 a.m.	A Self-Defense Force (SDF) helicopter is dispatched, and rescue operations begin.
6:51 a.m.~	Two people seeking help near the summit are rescued and transported by the SDF helicopter. Rescue and relief operations were continued.
7:40 a.m.	Rescue teams (ground rescue teams), consisting of the Nagano Prefectural Police Headquarters Mobile Unit, Emergency Fire Response Teams, Nagano Prefectural Firefighting Mutual Aid Teams, and the Self-Defense Forces, enter the mountain in succession.
11:40 a.m.	The rescue teams (ground rescue teams) entering the mountain make a contact with multiple individuals in need of rescue. First aid is administered to the injured.
12:00 p.m.	The Fire and Disaster Management Agency announces, “There are 37 injured people, including 3 who are seriously injured”.
2:00 p.m.~	The rescue teams (ground rescue teams) discover 6 climbers and begin guiding them down the mountain on foot. Due to the detection of toxic volcanic gases, the rescue operations are suspended. The Nagano Prefectural Police announce that around 30 individuals have been confirmed to need rescue.
7:30 p.m.	The Japan Meteorological Agency issues a near-crater warning and calls for caution against pyroclastic flows within an area of approximately 4 km from the crater.
10:45 p.m.	The Nagano Prefectural Police announce that 4 deaths have been confirmed. By this time, 30 individuals ranging in age from teens to 60s are transported, of whom 10 are diagnosed with airway burns caused by inhaling volcanic ash.

September 29 (Monday)

6:10 a.m. ~	Rescue teams (ground rescue teams) continue to enter the mountain.
7:09 a.m.~	An SDF helicopter is dispatched. Rescue and relief operations continue.
11:25 a.m.	Due to the high concentration of volcanic gases, the rescue teams (ground rescue teams) begin descending the mountain. The search is halted.
4:30 p.m.	The Nagano Prefectural Police announce that an additional 6 deaths have been confirmed.

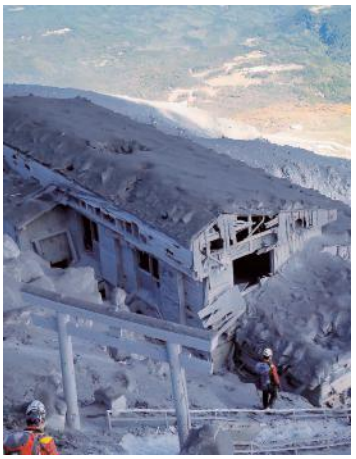
September 30 (Tuesday)

Around 6:12 a.m.	The amplitude of volcanic tremors increases.
6:20 a.m. ~	Rescue teams (ground rescue teams) enter the mountain, but due to the intensifying volcanic activity, rescue and relief operations are temporarily suspended.
12:15 p.m.	As the likelihood of eruption increases, the Nagano Prefectural Disaster Management Headquarters decides to suspend rescue team (ground rescue team) operations for the day.
12:40 p.m.	The rescue teams (ground rescue teams) begin to descend the mountain.
2:20 p.m.	The Nagano Prefectural Disaster Management Headquarters decides to suspend rescue and relief operations by the helicopter as well.

October 1 (Wednesday)

5:10 a.m.	The Nagano Prefectural Disaster Management Headquarters decides to resume rescue and relief operations as there was no major change in the situation despite continuing volcanic tremors.
6:15 a.m.	Rescue and relief operations resume. More than 1,000 personnel, including logistical support teams, engage in rescue and relief operations.
7:23 a.m.~	A large transport helicopter is dispatched. Trapped individuals are rescued one by one.
11:45 a.m.	The Nagano Prefectural Police announced that the cause of death of the 12 people confirmed dead by September 29 was “death by injury” from traumatic shock due to volcanic rock fragments hitting their heads and bodies.

[September 28] Plumes rising from multiple craters
Source: Nagano Prefecture (2020) “Nagano Prefecture Mount Ontake Eruption Disaster Response Records”



[September 28] Severely damaged Mount Ontake Summit Lodge
Source: Nagano Prefecture (2020) “Nagano Prefecture Mount Ontake Eruption Disaster Response

[October 1] Search is on at rocky areas covered with volcanic ash
Source: Nagano Prefecture (2020) “Nagano Prefecture Mount Ontake Eruption Disaster Response Records”

* Continued on the next page

October 2 (Thursday)	
6:00 a.m. ~	Rescue teams (ground rescue teams) continue to enter the mountain. The large transport helicopter suspends take-off due to poor visibility near the summit.
11:26 a.m. ~	Rain is confirmed at the summit. Subsequently, the Nagano Prefectural Disaster Management Headquarters decides to suspend the search operation. The rescue teams (ground rescue teams) that had climbed up to the 9th station are instructed to descend.
2:45 p.m.	The Nagano Prefectural Police announce that, out of the 47 individuals confirmed dead, 46 individuals lost their lives due to "death by injury", caused by volcanic rock fragments hitting the individuals, and the remaining one was "death by thermal injury" caused due to inhalation of hot gases from the eruption.
October 3 (Friday)	
4:55 a.m.	The Nagano Prefectural Disaster Management Headquarters decides to suspend operations for the day due to the rain.
10:30 a.m.	The Nagano Prefectural Disaster Management Headquarters announces that, in addition to the 47 deaths confirmed by October 2, 16 people were still missing.
October 4 (Saturday)	
5:45 a.m.	A helicopter is deployed to survey the area around the summit and mountain trails for possible sediment disaster (landslide disaster), etc.
6:30 a.m.	Rescue and relief operations resume.
3:00 p.m.	Operations for the day end after evacuating 4 trapped individuals.
October 5 (Sunday)	
5:07 a.m.	Due to the approaching typhoon, the Nagano Prefectural Disaster Management Headquarters decides to suspend operations for the day.
October 6 (Monday)	
2:02 p.m.	An SDF helicopter scouts the area near the summit but cannot locate trapped individuals due to poor visibility.
2:05 p.m.	Due to the rain and safety concerns, the Nagano Prefectural Disaster Management Headquarters decides to postpone the resumption of the search.
October 7 (Tuesday)	
6:43 a.m.	Rescue and relief operations resume.
4:31 p.m.	Rescue and relief operations end after 3 trapped individuals are evacuated by the SDF helicopter.
October 8 (Wednesday)	
6:00 a.m.	Rescue and relief operations resume.
3:58 p.m.	Rescue and relief operations end after 1 trapped individuals are evacuated by the SDF helicopter.
October 9 (Thursday)	
6:00 a.m.	A large transport helicopter takes off but is unable to land at the summit due to poor visibility.
9:10 a.m.	The Nagano Prefectural Disaster Management Headquarters decides to suspend all rescue and relief operations for the day due to adverse weather conditions and poor visibility.
October 10 (Friday)	
6:00 a.m.	Rescue and relief operations resume. On this day, the number of people entering the mountain for rescue and relief operations exceeds 500 for the first time.
5:07 p.m.	Rescue and relief operations end.
October 11 (Saturday)	
6:00 a.m.	Rescue and relief operations resume.
4:26 p.m.	Rescue and relief operations end after 1 trapped individuals are evacuated by the SDF helicopter.
October 12 (Sunday)	
6:00 a.m.	Rescue and relief operations resume.
3:06 p.m.	Rescue and relief operations end.
5:00 p.m.	A decision is made to suspend rescue and relief operations for October 13 and 14 due to the expected approach of a typhoon.
October 13 (Monday)	* Rescue and relief operations halted
October 14 (Tuesday)	* Rescue and relief operations halted
6:30 p.m.	A decision is made to deploy the largest number of personnel to re-check areas that have already been searched, by designating operations from October 15 onward as the third phase of rescue and relief operations.
October 15 (Wednesday)	
6:00 a.m.	Rescue and relief operations resume.
11:00 a.m.	Due to deteriorating weather near the summit, a decision is made to suspend search operations of all teams.
October 16 (Thursday)	
6:00 a.m.	Rescue and relief operations resume. 958 personnel enter the mountain, the largest number since the occurrence of the disaster. The number of personnel, including logistical support teams, reaches 1,961, (all personnel entered on foot as helicopters were unable to fly).
8:03 a.m.	Search by visual observation from above is conducted by the Nagano Prefecture Firefighting and Disaster Management helicopter.
9:26 a.m.	Rescue teams (ground rescue teams) arrive at the summit.
2:28 p.m.	Rescue and relief operations end. The rescue teams (ground rescue teams) begin their descent.
5:40 p.m.	A decision is made to end rescue and relief operations.

The Nagano Prefectural Disaster Management Headquarters searches afresh for the six missing individuals from July 29 to August 6 of the following year (2015). On July 31, one missing individual is found.

Source: Compiled by the Cabinet Office based on Nagano Prefecture (2020) "Nagano Prefecture Mount Ontake Eruption Disaster Response Records"

(Reference:
https://www.pref.nagano.lg.jp/bosai/kurashi/shobo/bosai/bosai/ontakesankiroku.html)

[October 4] The volcanic ash hampers movement, and merely moving around drains your strength
Source: Nagano Prefecture (2020) "Nagano Prefecture Mount Ontake Eruption Disaster Response Records

[October 7] A transport helicopter arrived at Ichinoike
Landing on the muddy ground required a high level of skill
Source: Nagano Prefecture (2020) "Nagano Prefecture Mount Ontake Eruption Disaster Response Records"

[October 10] View towards the summit from near the Otaki Summit
Source: Nagano Prefecture (2020) "Nagano Prefecture Mount Ontake Eruption Disaster Response Records"

[October 16] The largest number of personnel mobilized since the occurrence of the disaster to thoroughly search the area around the summit
Source: Nagano Prefecture (2020) "Nagano Prefecture Mount Ontake Eruption Disaster Response Records"

Section 2 Volcano Disaster Risk Management Measures in Light of the Learnings from the Mount Ontake Eruption

In the 2014 Mount Ontake eruption, a difficult-to-predict phreatic eruption suddenly occurred, killing many climbers in the vicinity of the crater. The local governments at the foot of Mount Ontake enforced entry restrictions until necessary safety measures could be implemented, even after the volcanic alert level was lowered to Level 1. Subsequently, safety measures for climbers, such as establishing evacuation facilities and a prefectural disaster management radio communications system, were implemented. As a result, on July 29, 2023, nine years after the 2014 eruption, the entry restrictions on the mountain trail connecting the Otaki summit and the Kenga-mine peak of Mount Ontake were lifted, and climbing from both the Nagano and Gifu Prefecture trailheads was made possible. In Nagano Prefecture, Kiso Town, and Otaki Village, the following initiatives have been implemented to improve volcano disaster resilience and awareness in light of the learnings from the Mount Ontake eruption.

(Initiatives related to structural and non-structural measures)

In 2018, Nagano Prefecture, Kiso Town, and Otaki Village formulated the “Mount Ontake Disaster Risk Management Capability Strengthening Plan”, intending to steadily improve safety in terms of both the hard and soft measures based on a full understanding and recognition of the fact that Mount Ontake is an active volcano. Based on this plan, the following initiatives have been implemented:

- Evacuation facilities (such as evacuation shelters) are constructed at the summit of Kenga-mine and Hatcho-darumi, in preparation for a sudden eruption, and the roofs of mountain cabins are reinforced with shock-resistant, high-performance fabric materials, utilizing subsidies for the construction of fire and disaster risk management facilities
- Evacuation promotion facilities are designated to support the formulation of evacuation implementation plans for these facilities
- The ground is leveled, and ropes are installed to ensure the safety of the mountain trails as evacuation routes. Also, signs are installed to communicate the status of restrictions and evacuation routes, as well as warnings
- To ensure a means of communication with climbers at the summit, disaster management radio communication speakers are installed, and patrol personnel are stationed during certain periods of the climbing season

Evacuation facility set up on Mount Ontake (Otaki Village)
Source: Nagano Prefecture

(Initiatives to increase awareness of volcano disaster prevention)

In light of the Mount Ontake eruption, the “Nagano Prefecture Volcano Disaster Risk Management Review Committee” was established in Nagano Prefecture in June 2016 to discuss the direction and specific measures for promoting the awareness necessary for living with volcanoes. The committee discussed two main points - “Information dissemination at visitor centers, etc.” and an “Awareness-raising system for volcano disaster risk management utilizing human resources”.

In August 2022, two “Mount Ontake Visitor Centers” (“Yama Terrace Otaki” constructed by Nagano Prefecture in Tanohara, Otaki Village, and “Sato Terrace Mitake” constructed by Kiso Town in the Mitake area) were opened as bases to hand down records and memories of the Mount Ontake eruption, and to disseminate volcano information to climbers.

Concerning the “Awareness-raising system for volcano disaster risk management utilizing human resources”, Nagano Prefecture launched the “Mount Ontake Volcano Meister System” in FY2017 as a new initiative utilizing human resources for volcano disaster risk management, in light of the importance of enhancing information dissemination for climbers and tourists in the Mount Ontake area and preserving the memories of the eruption.

As of March 2024, 28 Volcano Meisters have been certified. They implement various initiatives, including activities for awareness-raising, such as disaster risk management education and regional revitalization, using the Mount Ontake Visitor Centers as their base of operations.

Mount Ontake Visitor Center, Nagano Prefecture
“Yama Terrace Otaki”
Source: Nagano Prefecture

Mount Ontake Visitor Center, Kiso Town
“Sato Terrace Mitake”
Source: Nagano Prefecture

Mount Ontake Volcano Meister conducting an on-site lecture (Nagano City)
Source: Nagano Prefecture

Mount Ontake Volcano Meister raising awareness on safe mountain climbing with “Arukuma”, Nagano Prefecture’s official mascot (Kiso Town)

(Promotion of volcanic research)

In 2016, Nagano Prefecture, Kiso Town, and Otaki Village requested Nagoya University to establish a research facility to enhance volcano disaster risk management measures for Mount Ontake. In response, Nagoya University opened the Mount Ontake Volcano Research Facility in July 2017 within the Mitake Branch Office in Kiso Town (currently, the facility has been relocated to the Mount Ontake Visitor Center in Kiso Town). The facility plays a role in enhancing the ability to assess volcanic activity at Mount Ontake through the latest volcanic research, thus improving regional disaster resilience, developing human resources and disseminating knowledge on volcano disaster risk management.

Mount Ontake Volcano Research Facility, Nagoya University (now located at the Mount Ontake Visitor Center, Kiso Town)
Source: Kiso Town, Nagano Prefecture

Section 3 Preparedness of Climbers

In light of the learnings from the 2014 Mount Ontake eruption, the Act on Active Volcanoes was amended in 2015, requiring climbers to strive to prepare for their safety. It is advisable to consider the following points when climbing and visiting the mountain for sightseeing[1].

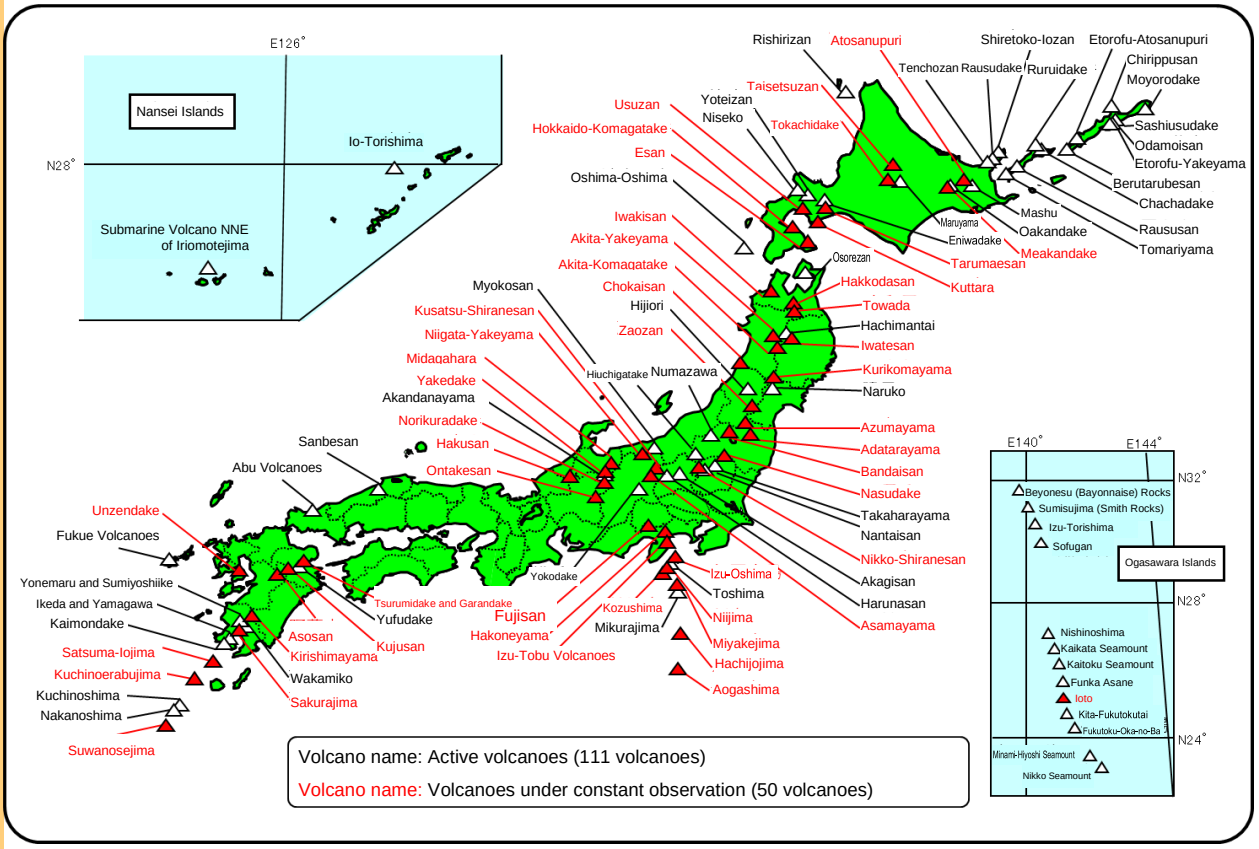
(1) Gather volcano information

Previously, volcanoes that are active or erupting at present were called “active volcanoes”, while those not erupting at present were called “dormant or extinct volcanoes”.

However, given that the lifespan of volcanic activity is long, and a dormant period of several hundred years is merely a brief ‘sleep’, the prevailing approach is that all volcanoes with a record of eruption or the possibility to erupt in the future will be classified as “active volcanoes”.

Based on this approach, in 2003, the Coordinating Committee for the Prediction of Volcanic Eruptions redefined active volcanoes as “those that have erupted within the last 10,000 years or those currently exhibiting active fumarolic activity”. As of April 2024, 111 active volcanoes have been selected by the Policy Committee of the Headquarters for Volcano Research Promotion[2].

Fig. 1-2 Distribution of active and continuously monitored volcanoes



Source: Japan Meteorological Agency

1 Cabinet Office website: “Preparation Before Climbing Volcanic Mountains” (Reference: https://www.bousai.go.jp/kazan/kazan_sonae/index.html)

2 Japan Meteorological Agency website: “What is an Active Volcano?” (Reference: https://www.data.jma.go.jp/vois/data/tokyo/STOCK/kaisetsu/katsukazan_toha/katsukazan_toha.html)

The Japan Meteorological Agency has equipped 50 active volcanoes with seismometers, surveillance cameras, and other monitoring devices to detect eruption precursors. The Agency also receives data from relevant organizations (such as universities, research institutions, and disaster management agencies of local governments) for 24-hour monitoring and observation of volcanic activity (hereinafter referred to as “continuously monitored volcanoes”). In addition, the Agency conducts systematic and dynamic monitoring as needed, including other volcanoes, and issues accurate volcanic warnings, forecasts (volcanic alert levels), and other related information. If the mountain you are about to visit is an active volcano, it is important to check this information beforehand[3].

The volcanic alert levels are indicators based on which “areas where caution is needed” and the “disaster response to be implemented by residents, etc.” are announced by classifying into 5 levels according to the status of volcanic activity. The system is now operational at all 49 continuously monitored volcanoes except for Iwo Jima, which has no nearby residents or climbers. In addition, it is important to know where to evacuate in the event of an eruption using volcano disaster risk management maps. These volcano hazard maps allow for easy visual identification of areas that may be affected by volcanic hazard factors (such as large volcanic rock fragments and pyroclastic flows), with additional information necessary for disaster risk management, such as evacuation shelters, routes and methods, and means of communicating information with residents or temporary visitors.

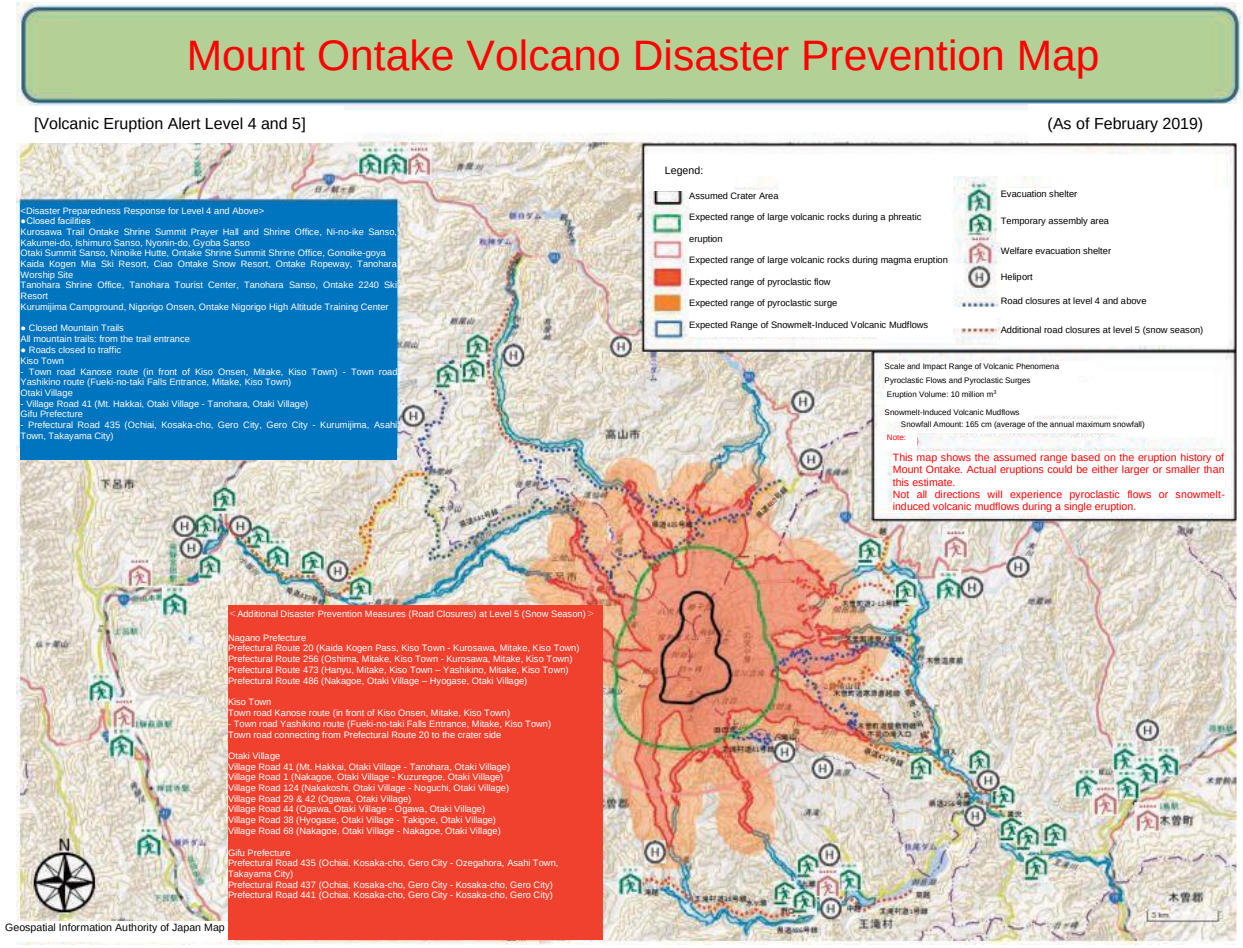
Fig. 1-3 Volcanic alert levels

Type	Name of Warning	Target Area	Volcanic Alert Levels & Keywords			Explanation		
						Expected volcanic activity	Action to be taken by residents	Action to be taken by climbers
Emergency Warning	Eruption warning (residential area) (a.k.a. Residential Area Warning)	Residential areas and non-residential areas near the crater	Level 5	Evacuate		Eruption or imminent eruption that may cause significant damage to residential areas.	Residents must evacuate from residential areas in the danger zone (target areas and evacuation method to be determined according to the situation).	
			Level 4	Evacuate the elderly, etc.		Possibility or increasing possibility of eruption that may cause significant damage to residential areas.	Residents within the alert area should prepare for evacuation. Evacuate the elderly and persons requiring special care in the event of a disaster (target areas to be determined according to the situation).	
Warning	Eruption warning (near crater) (a.k.a. Crater Area Warning)	Non-residential areas near the crater	Level 3	Do not approach the volcano		Eruption or possibility of eruption that may significantly affect areas near residential areas (possible threat to life in such areas).	Residents can go about daily activity as normal (Stay alert for changes in volcanic activity. Restrict mountain access). Depending on the situation, prepare to evacuate the elderly and persons requiring special care in the event of a disaster.	Restrictions on entry to dangerous areas, including prohibitions on mountain climbing and mountain access (scope of restrictions to be determined according to the situation).
		Near the crater	Level 2	Do not approach the crater		Eruption or possibility of eruption that may affect areas near the crater (possible threat to life in such areas).	Residents can go about daily activity as normal. (Collect information on volcanic activity, verify evacuation procedures, participate in disaster management drills, etc. depending on the situation).	Access to areas near the crater restricted, etc. (scope of crater area restrictions to be determined according to the situation).
Forecast	Eruption forecast	Inside the crater	Level 1	Potential for increased activity		Little or no volcanic activity. Possibility of volcanic ash emissions, etc. within the crater as a result of volcanic activity (possible threat to life in such areas).		No restrictions (access to inside the crater restricted as necessary, etc.)

Source: Japan Meteorological Agency website
(https://www.data.jma.go.jp/vois/data/tokyo/STOCK/kaisetsu/level_toha/level_toha.htm)

3 The volcano information, including volcanic warnings and forecasts (volcanic alert levels) issued by the Japan Meteorological Agency, can be checked on the “Information Page for Volcanic Mountain Climbers”.
(Reference: https://www.data.jma.go.jp/vois/data/tokyo/STOCK/activity_info/map_0.html)

Fig. 1-4 Example of volcano disaster risk management map (Mount Ontake)



Source: Compiled by the Cabinet Office based on data from the Mount Ontake Volcanic Disaster Risk Management Council (https://www.ontake-volcano.jp/wp/wp-content/themes/responsive_261/pdf/bousaitaisaku/ bosaimap.pdf)

(2) Submit notification for mountain climbing

At the time of the Mount Ontake eruption, there were delays in identifying missing persons, partly because many climbers did not submit a climbing notification[4]. Ensuring that climbers submit a climbing notification when entering a mountain helps protect their lives and speeds up the overall rescue and relief operations in the event of a disaster. As a result, a provision making it obligatory for climbers to make the best efforts to submit a climbing notification was added to the Act on Active Volcanoes. Furthermore, it was included in the Act that local governments will consider facilitating the submission of climbing notifications, for example, by introducing online submission. Some local governments have already introduced online applications or other submission methods. Therefore, when planning to climb an active volcanic mountain, it is advisable to check in advance the website of the local government of the region where you will go mountain climbing.

4 Cabinet Office Website “Promotion of Future Volcano Disaster Risk Management Measures in Light of the Mount Ontake Eruption (Report)” (Working Group for the Promotion of Volcano Disaster Prevention, Disaster Management Implementation Committee, National Disaster Management Council) (March 26, 2015)
(Reference: https://www.bousai.go.jp/kazan/suishinworking/pdf/20150326_hokoku.pdf)

Fig. 1-5 Example of how to submit a trekking itinerary

Mountain Climbing in Nagano Prefecture Requires Submission of a “Trekking Itinerary”!

When using designated hiking trails in Nagano Prefecture, submission of a trekking itinerary plan is required.
By preparing a trekking itinerary in advance, you can understand the characteristics of the mountain, make adqueate preparations, and enjoy a safe and pleasant climb!
The submission of a trekking itinerary also helps in ensuring swift rescue operations in case of an emergency.

For Climbers:
In Nagano Prefecture, to prevent the spread of COVID-19, a “Mountain Entry Advisory” has been issued

- Enroll in mountain insurance to prepare for emergencies.
- Ensure you have appropriate clothing and equipment for hiking before you begin.
- Please cooperate in preventing the spread of the swine fever virus.

How to Submit a Trekking Itinerary

In Nagano Prefecture, for personal information protection and **swift rescue operations**, **online submissions are recommended**.
Please submit your trekking itineary using one of the following methods and carry the completed plan with you on the day of your hike!

Online Submission

Nagano Electronic Application Service (opens external site in a new window)

- You can attach the trekking itinerary you created as a file.
- If you need to modify the itinerary, please submit it again via the Nagano Electronic Application.
  * The latest submission will be considered the updated plan.
- If you cancel the hike, no additional input is needed, and there is no need to submit a descent notification.

Source: Nagano Prefecture website
(https://www.pref.nagano.lg.jp/kankoki/smartphone/tozankeikakusho.html)

(3) Carry volcano disaster risk management measures equipment

For many of those who lost their lives in the Mount Ontake Eruption, the cause of death was “death by injury” from traumatic shock resulting from volcanic rock fragments hitting their heads or bodies. It is, therefore, important to carry a helmet to protect oneself. In addition, after an eruption, fine volcanic ash particles may be suspended in the air, making it difficult to open your eyes. It is advisable to carry goggles, a mask to prepare against ash fall, and a headlight, as volcanic ash can block sunlight, making the surroundings dark.

It is advisable to carry portable essential items such as rain gear, towels, emergency food, drinking water, communication devices like mobile phones and spare batteries, climbing maps, and a compass in case of a volcanic disaster and as preparation for unexpected situations.

(4) Always be alert while climbing

First and foremost, avoid approaching dangerous areas such as fumaroles or hollows around the crater. If you notice any anomaly, immediately descend and promptly contact the municipality or police.

In light of the learnings from the Mount Ontake eruption, a “Working Group for the Promotion of Volcano Disaster Prevention” has been set up under the “Disaster Management Implementation Committee” of the National Disaster Management Council.

This group cited how evacuation facilities, such as evacuation shelters and buildings, should be developed, stating that taking shelter in mountain cabins effectively protected oneself from volcanic rock fragments that fell around the crater during the Mount Ontake eruption[5]. Therefore, it is crucial to use tools such as a volcano disaster risk management map to identify evacuation locations in advance in the event of an eruption. The Japan Meteorological Agency issues eruption notices to quickly and clearly inform climbers and residents when an eruption occurs so that they can take protective action. If an eruption notice is issued while climbing or if you are caught in an eruption, it is important to temporarily evacuate to a nearby mountain cabin, evacuation shelter, or behind a rock, etc., where your head and body can be protected.

5 Cabinet Office (2015) “Guide to Enhancing Evacuation Shelters, etc. on Active Volcanoes” (Reference: https://www.bousai.go.jp/kazan/shiryo/pdf/201512_hinan_tebiki3.pdf)

Section 1 The Act on Special Measures for Active Volcanoes and its Amendments in Light of the Mount Ontake Eruption

The Act on Active Volcanoes was enacted in 1973 as the “Act on Evacuation Facilities in Areas Surrounding Active Volcanoes” against the backdrop of an urgent need for measures against volcanic rock fragments and ashfall in the wake of the successive eruptions of Sakurajima volcano. Subsequently, in 1978, in response to the disaster caused by the large amounts of volcanic ash during the Mount Usu eruption, the Act was renamed the “Act on Special Measures for Active Volcanoes” and amended by adding measures related to improving public facilities for ash removal and prevention of ash fall. Thus, the Act on Active Volcanoes was enacted and amended to directly address situations where damage is caused by eruptions, with a focus on structural measures such as improving evacuation facilities. The Act has been implemented on a limited basis in some volcanic regions where eruptions have occurred.

In the wake of the 2014 Mount Ontake eruption that had caused severe damage, including many deaths and injuries in the vicinity of the crater, there was a renewed awareness of various priorities related to volcano disaster risk management measures, including the importance of promptly detecting and communicating progression of volcanic phenomena and the necessity to develop alert and evacuation systems not only for residents but also for climbers, as well as discussions incorporating expert knowledge specific to each volcano, which is indispensable to achieve what is necessary.

Based on this, the Act on Active Volcanoes was amended in July 2015, clearly stating that measures for active volcanoes will apply to residents in the volcanic regions and also to climbers, and the following measures were implemented.

- Relevant prefectures and municipalities were required to establish councils to hold necessary discussions to develop alert and evacuation systems according to the status of expected volcanic phenomena (hereinafter referred to as the “Volcanic Disaster Risk Management Councils”).
- Matters concerning the alert and evacuation systems, including the transmission of information, alerts, and forecasts on volcanic phenomena and their progression, notices and alerts issued by heads of municipalities regarding evacuation measures to be taken by residents, climbers, and tourists, etc., as well as evacuation sites, evacuation routes, and other matters, were required to be included in the local disaster management plans.
- In doing so, it was required to hear the opinions of the Volcanic Disaster Risk Management Councils, which include the Central government, relevant local governments, and volcano specialists, so that the discussions could be conducted by incorporating expert knowledge.
- Owners of facilities for attracting visitors, where residents, climbers, tourists, etc. gather, were required to prepare evacuation implementation plans.
- The Central and local governments were required to strive to strengthen the collaboration among volcano research institutions and nurture and retain volcano specialists. Local governments were required to strive to keep track of information on climbers, tourists, etc., while climbers, tourists, etc., were required to strive to take measures on their own to protect themselves, such as gathering volcano information.

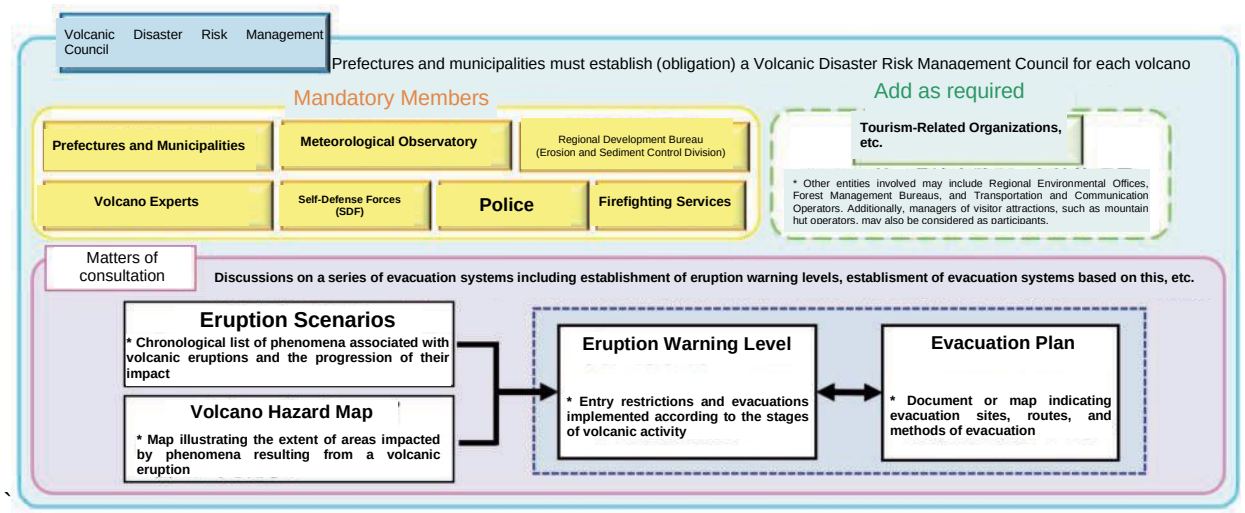
Thus, after the 2015 amendments, the Act on Active Volcanoes became an Act that promotes measures for active volcanoes more comprehensively. It aims to enhance structural measures implemented so far, such as improving evacuation facilities, and non-structural measures, such as developing alert and evacuation systems.

Volcanoes often straddle more than one prefecture and municipality. Since volcanic disasters are expected to have a far-reaching impact, relevant national institutions and local governments must respond coherently in the event of an eruption, ensuring that the smooth evacuation of residents, climbers, etc., is not hindered. In addition, since each volcano has different characteristics, such as topography and nature of the eruption, the establishment of the Volcanic Disaster Risk Management Councils was mandated to develop alert and evacuation systems according to the nature of the disaster. The Volcanic Disaster Risk Management Councils have been established for 49 out of the 50 volcanoes that are continuously monitored at present by the Japan Meteorological Agency (JMA), excluding Iwo Jima, which has no residents or climbers in the vicinity. Relevant prefectures and municipalities play a central role in the Councils, with the participation of specialists with expert knowledge of volcanic phenomena. The relevant parties build a “face-to-face relationship” during normal times and engage in proactive discussions on an ongoing basis on volcano disaster risk management measures, such as joint discussions on the necessary disaster management, by sharing an “image of disaster management” in the event of an eruption.

Furthermore, the phenomena accompanying an eruption continue progressing in a complex manner, and each eruption has different characteristics, even for the same volcano.

Therefore, enhancing the monitoring and research systems and taking disaster risk management measures based on scientific knowledge across various academic fields for each volcano is essential.

Fig. 2-1 Members of the Volcanic Disaster Risk Management Councils and matters of consultation



Source: Cabinet Office data

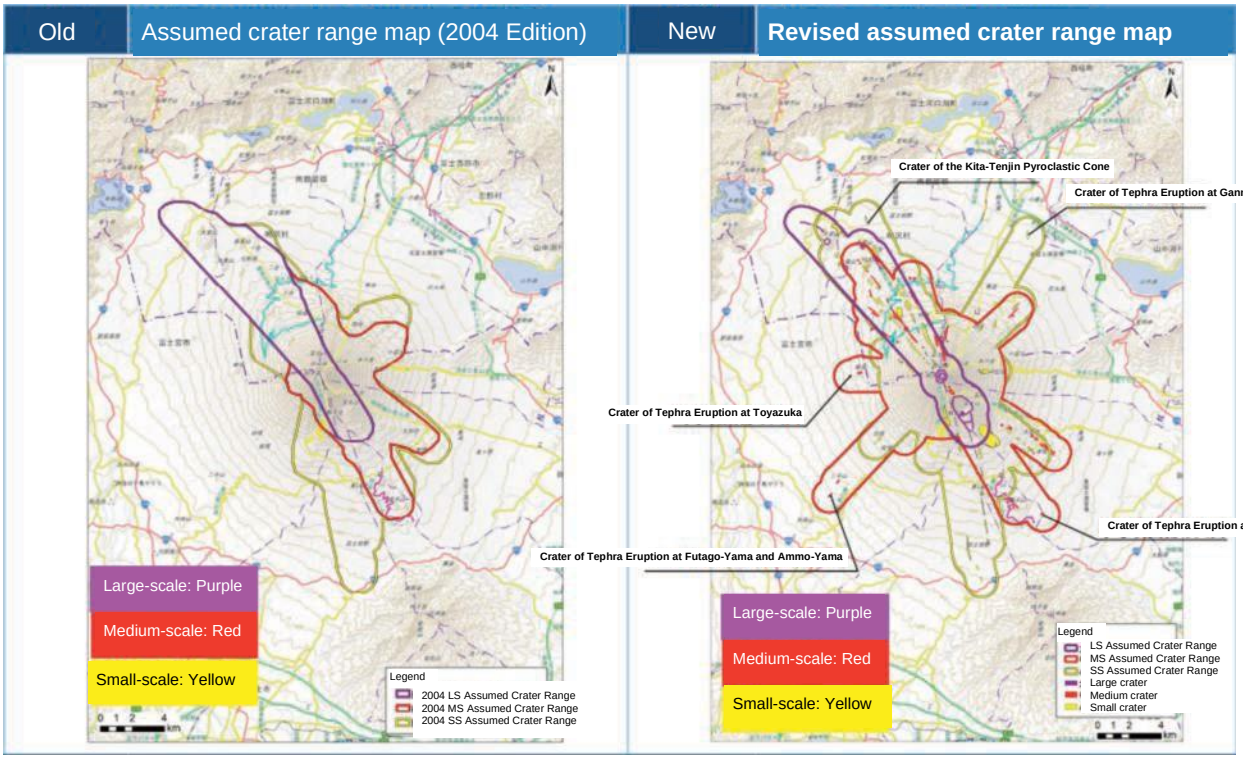
Section 2 Recent Trends Concerning Volcanoes and Amendments to Laws from a Precautionary Perspective

As mentioned in the previous section, after the amendments to the Act on Active Volcanoes in light of the Mount Ontake eruption, volcano disaster risk management measures have been implemented in each volcanic region, but given the recent situation surrounding volcanoes in Japan, there is a movement to strengthen the measures for active volcanoes further.

For example, on Mt. Fuji, the identification of a new crater location near the urban area of Fujiyoshida City (the crater of the gan-no-ana volcanic ejecta) has resulted in the expansion of the expected crater range. In addition, simulations that form the basis of volcano hazard maps have expanded the impact areas of various volcanic phenomena, and municipalities that could be affected by lava flows and snowmelt-type volcanic mudflows have been newly added. In response, the Mount Fuji Volcanic Disaster Risk Management Council revised the Mt. Fuji Hazard Map in 2021 and the evacuation plan based on it in 2023.

(Fig. 2-2).

Fig. 2-2 Expansion of the expected crater range of Mt. Fuji



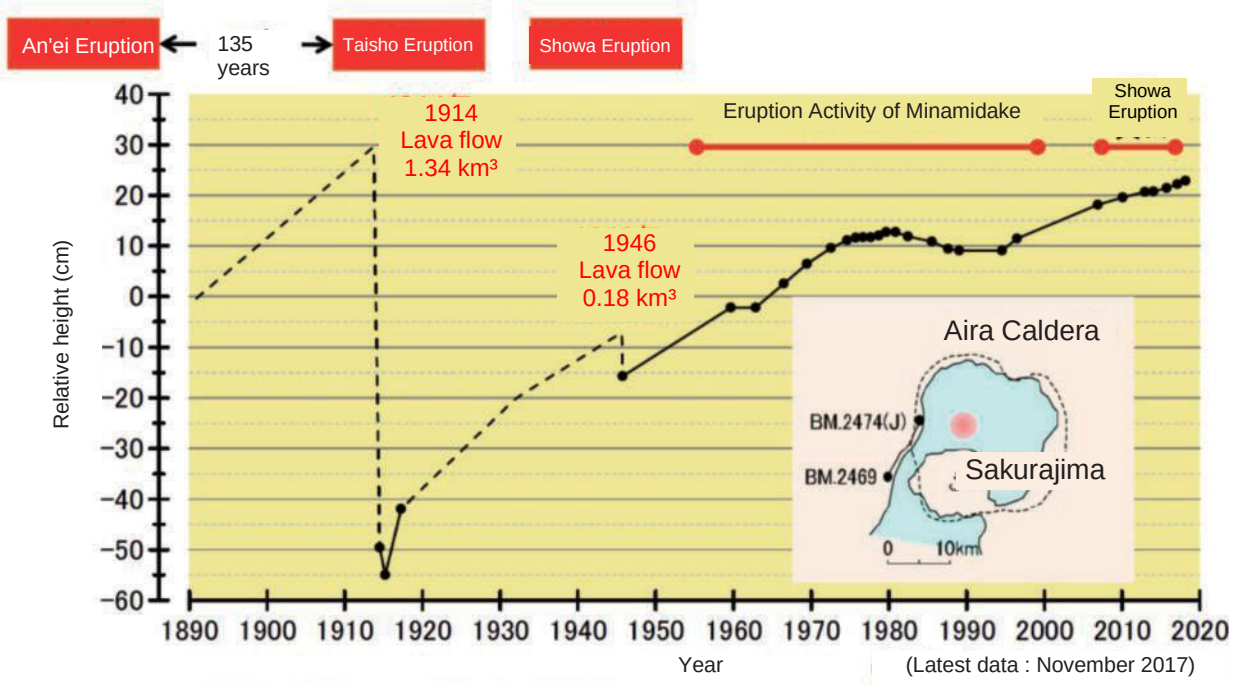
Source: Shizuoka Prefecture website
(Reference: https://www.pref.shizuoka.jp/_res/projects/default_project/_page_/001/030/023/20210326_fujisan_013houkokusyo_setumeisiryou02.pdf)

The possibility of a large-scale eruption has also been pointed out at Sakurajima. During the Taisho eruption, which is considered the largest volcanic eruption of the 20th century in Japan, the eruption began at 10:05 a.m. on January 12, 1914, on the western flank of Sakurajima, followed 10 minutes later by an explosion from the eastern flank with a loud noise. The lava flow buried several settlements on the island's western side and blocked the 400 m wide and 72 m deep Seto Strait on the eastern side, connecting the island to the Osumi Peninsula by land.

Sakurajima Taisho eruption (from the Kagoshima city center side)
* When lava flows began to flow down the mountain on the morning of January 14, 1914
Source: Kagoshima Prefectural Museum

As 110 years have passed since the Taisho eruption, it is estimated that the same amount of magma has accumulated in the underground magma chamber as at the time of the Taisho eruption (**Fig. 2-3**) and that we have entered a period when we need to be vigilant against the next large-scale eruption.

Fig. 2-3 Magma accumulation in the Aira Caldera



Changes in the Relative Elevation of BM.2474 with Reference to BM.2469 Over Time

Source: Volcanic Activity Research Centre, Disaster Prevention Research Institute, Kyoto Universitv.
(Reference: https://www.bousai.go.jp/kazan/senmonka/pdf/dai5kai/siryo2_2.pdf)

In view of the recent situation surrounding volcanoes in Japan, the Act on Active Volcanoes was amended in 2023 by parliamentary legislation (enforced in April 2024) from a precautionary perspective before an eruption occurs to further strengthen measures for active volcanoes and ensure the safety of lives and physical safety of residents, climbers and others.

The six main points of the amendments are introduced below.

(1) Assistance from heads of municipalities in preparing evacuation implementation plans (Article 8 of the Act)

When volcanic phenomena occur, it is crucial to reliably communicate information such as volcanic warnings and evacuation instructions to residents and climbers and ensure the safety of users in facilities that are frequented by the general public (e.g., mountain cabins, ropeway stations, accommodation facilities), as well as facilities frequented by persons requiring special care and time to evacuate (e.g., elderly care facilities, hospitals, schools) to ensure quick and smooth evacuation.

Hence, the 2015 amendments to the Act on Active Volcanoes required such facilities, and facilities with names and locations mentioned in the Municipal Disaster Management Plan (hereinafter referred to as “evacuation promotion facilities”), to prepare and publish an evacuation implementation plan specifying matters concerning disaster management systems and evacuation guidance, evacuation drills, and disaster risk reduction (DRR) education for users, and conduct evacuation drills based on this plan. However, as it stands, these efforts have not progressed at some facilities due to problems such as lack of know-how on the part of facility administrators, etc., to prepare evacuation implementation plans or smaller facilities, finding the preparation process itself burdensome.

In view of the above, the amended Act clearly states that heads of municipalities may provide the necessary information and advice, as well as any other assistance, and if necessary, may request Volcanic Disaster Risk Management Councils for opinions when owners or administrators of evacuation promotion facilities prepare an evacuation implementation plan.

(2) Keeping track of information on climbers, etc. (Article 11 of the Act).

It is important to keep track of information on climbers with the help of climbing notifications, etc., to facilitate the collection and consolidation of information on victims and quick identification and safety confirmation of climbers who might have been caught in the eruption, during rescue and search operations in the event of volcanic phenomena. Climbers must also be aware of certain risks when entering a volcanic mountain, such as the possibility of a sudden eruption, and take the necessary measures to ensure their safety. Against this background, although there have been provisions that make it mandatory for local governments to keep track of information on climbers and for climbers to take measures to ensure their safety, these efforts must be further promoted.

The Act on Active Volcanoes amendments have also added provisions related to necessary information and its importance and have improved its content, mandating reasonable efforts.

In concrete terms, the additions made it mandatory for local governments to make efforts to keep track of information on climbers, such as the date of entry and travel routes, to ensure smooth and quick evacuation of climbers and to give due consideration to facilitating the provision of information, such as introducing online submission of climbing notifications.

At the same time, considering that information such as date of entry and travel routes is crucial for rescue operations in the event of volcanic phenomena, climbers were mandated to endeavor to provide said information to local governments, as well as collect information on the possibility of volcanic eruptions, ensure means of communication with relevant parties, and take necessary measures for smooth and quick evacuation.

In light of these amendments, further efforts are expected to improve the climbing notifications' submission rate.

(3) Prompt and accurate communication of information (Article 12 of the Act)

The Act on Active Volcanoes stipulates that when it is necessary to protect the lives and physical safety of residents from volcanic eruptions, the Japan Meteorological Agency must notify relevant prefectures of the information on volcanic phenomena. The prefectures receiving the information must issue the necessary notifications or requests to designated local administrative bodies, local public bodies, and relevant municipalities. The Act also stipulates that the heads of municipalities who receive a notification from a prefecture must communicate the information to residents, climbers and other groups. It is important to communicate information for smooth and quick evacuation of residents, etc., particularly in the event of volcanic phenomena.

For this reason, the amendments to the Act clearly state that information necessary for smooth and quick evacuation in the event of volcanic phenomena shall be promptly and accurately communicated to residents and others through information and communication technology and other means.

(4) Nurturing and sustained securing of volcano specialists (Article 30 of the Act)

Human resources with expert knowledge of volcanoes are necessary for a scientific understanding of volcanic phenomena and appropriate disaster risk management measures. Based on the 2015 amendments to the Act on Active Volcanoes, efforts are being made to nurture volcano specialists; however, the Central and local governments need to work more closely together to secure personnel with expertise on volcanoes.

To this end, the amendments to the Act clearly state that the Central and local governments must strive under mutual collaboration to improve education to allow the acquisition of specialized knowledge and skills concerning volcanoes and endeavor to nurture and continuously secure human resources by ensuring opportunities to demonstrate abilities, among other things.

For example, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) has implemented the "Next-Generation Volcano Research and Human Resource Development Comprehensive Project" since FY2016 to nurture volcano researchers with extensive knowledge and high-level skills related to volcanoes. From FY2024, a program to nurture volcano researchers and professionals who can be immediate contributors will be implemented, which will also target working professionals and practical workforce in local authorities, etc., who wish to become volcano researchers. In addition, the Cabinet Office holds meetings in which volcano specialists participating in Volcanic Disaster Risk Management Councils across the country can exchange information across different councils. These meetings also provide a platform for young specialists to share and exchange opinions on challenges they face in advancing volcano disaster risk management measures. They are also used as opportunities for training specialized personnel.

Local governments are also expected to consider initiatives that consider the intention behind the abovementioned amendments. An example of an innovative initiative by local governments is the "Volcano Disaster Risk Management Officer", a post specializing in countermeasures against volcanic eruptions of Mt. Fuji, established by Yamanashi Prefecture.

This officer is expected to be a valuable human resource, playing the twofold role of an administrative officer and a volcano specialist by planning and operating various plans for Mt. Fuji volcano disaster risk management measures, disaster management drills, training courses, etc.

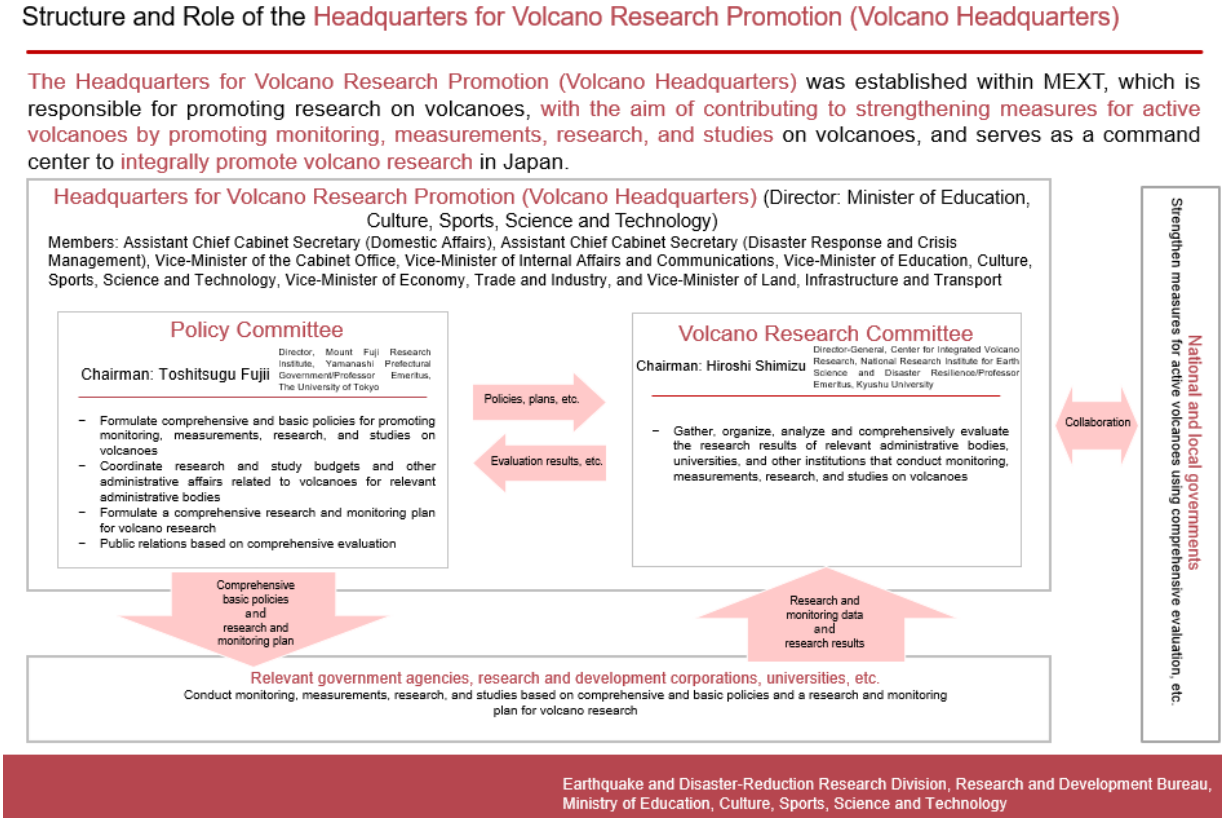
(5) The Headquarters for Volcano Research Promotion (Article 31 ~ 36 of the Act)

Volcanic phenomena are diverse and unpredictable, and since a large-scale eruption causes far-reaching and massive damage over a long period, it is important to conduct monitoring and research on volcanoes and properly assess volcanic activity to reduce the risk of volcano disaster.

Considering the need to promote monitoring, measurements, research, and studies on volcanoes in a unified manner on the national level, the “Headquarters for Volcano Research Promotion” (hereinafter referred to as the “Volcano Headquarters”) was newly established as a special body within MEXT. Two committees, namely, the Policy Committee and the Volcano Research Committee, have been set up at the Volcano Headquarters. The Policy Committee will formulate comprehensive and basic policies and a research and monitoring plan for volcano research. Based on this plan, relevant administrative bodies, universities, and other institutions will monitor, measurements, research, and studies. The Volcano Research Committee will gather, organize, analyze and comprehensively evaluate the research results.

In this way, the Volcano Headquarters is expected to serve as the command center in promoting volcano research in Japan in a unified manner, thereby strengthening volcano disaster risk management measures.

Fig. 2-4 The structure and role of the Headquarters for Volcano Research Promotion



Source: Ministry of Education, Culture, Sports, Science and Technology website
(Reference: https://www.mext.go.jp/a_menu/kaihatu/jishin/1285728_00005.html)

(6) Volcanic Disaster Preparedness Awareness Day (Article 37 of the Act)

August 26 has been newly designated as “Volcanic Disaster Preparedness Awareness Day” to increase public interest and understanding of measures for active volcanoes. The date has been derived from August 26, 1911, when Japan’s first volcanic observatory was established on Mount Asama and observations were started.

Volcanic observatory on Mount Asama
Source: Japan Meteorological Agency

It was stipulated that on “Volcanic Disaster Preparedness Awareness Day”, the Central and local governments must endeavor to conduct events suitable to the intention behind the Day, such as disaster management drills[6]. At the local government level, the events are expected to be conducted creatively according to the local circumstances, such as coordinating with disaster management drills and events, etc., held in connection with the “Disaster Preparedness Day” on September 1 to make the events more effective.

Since FY2022, the Cabinet Office has been implementing a support program to study and implement volcano disaster management drills and based on the results obtained through this support, in August 2023, the Cabinet Office prepared and published on its website the “Guide for Planning and Operation of Volcano Disaster Management Drills in Local Governments, etc. (First Edition)” and a “Collection of Case Studies for Volcano Disaster Management Drills in Local Governments, etc. (First Edition)” to support the planning of drills, etc.[7]

It is expected that initiatives such as disaster management drills in volcanic regions will be promoted while also using these materials.

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6 Japan Meteorological Agency has published a special website for “Volcano Disaster Awareness Day” to promote volcano disaster risk management so that more people can prepare for volcanic disasters while learning about the appeal and benefits of volcanoes.
A special “Volcanic Disaster Preparedness Awareness Day” website has been published on the Japan Meteorological Agency website.
(Reference: Japan Meteorological Agency “Volcanic Disaster Preparedness Awareness Day” Special website: https://www.data.jma.go.jp/vois/data/tokyo/kazanbosai/ index.html)

7 Cabinet Office website (Reference: https://www.bousai.go.jp/kazan/shiryo/index.html)

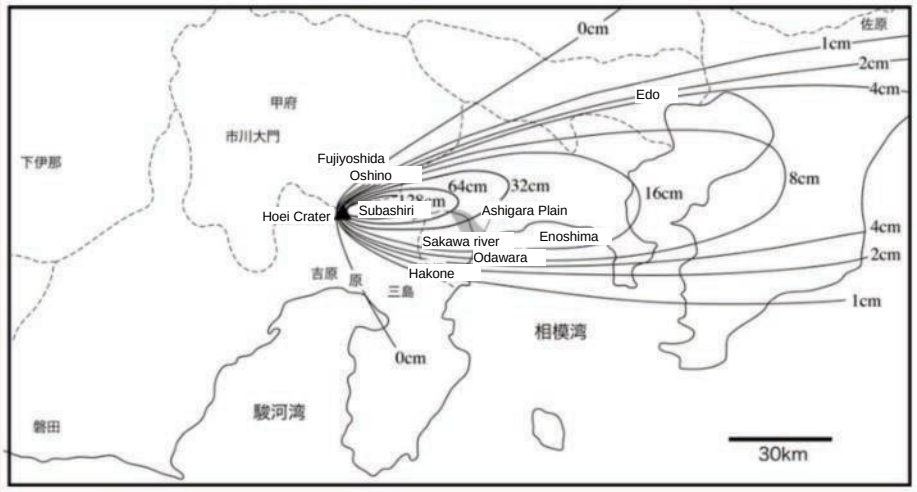
[Column]
Learning from Past Eruptions - Overview of the Hoei Eruption of Mount Fuji -

The Hoei eruption began shortly before noon on November 23, 4th year of the Hoei era in the old Japanese calendar (December 16, 1707). The plume rising from the crater that opened on Mount Fuji's southeastern slope reached the stratosphere. It is said that the sky above the eastern side of the crater was covered by the plume, casting everything around into darkness. The eruption continued intermittently for 16 days until the early hours of December 9. Carried by westerly winds, volcanic ash fell as far as Edo and the Boso Peninsula area.

In the areas surrounding Mount Fuji, eruptive materials such as volcanic rock fragments and volcanic ash rained down, causing numerous houses to collapse under the weight of earthquakes. However, no pyroclastic or lava flows reached villages, and since it was winter and there were no climbers, there are no records indicating a large number of fatalities or injuries1. However, the surrounding fields were buried several meters in many areas, making cultivation impossible for a long period afterward. Additionally, volcanic ash accumulated on the riverbeds of the Sakawa River and other rivers located east of Mount Fuji. During heavy rains, large amounts of volcanic ash flowed down from the mountains, repeatedly causing inundation with a long-lasting impact.

During this eruption, even regions far from the volcano experienced an impact on residents' lives and health due to the volcanic ash. For example, there are records of an outbreak of cold in Edo caused by an increase in the number of people suffering from throat ailments due to dry winds blowing the volcanic ash that fell on the city2. Furthermore, if modern cities were to experience a wide impact of volcanic ash, the impact would not be limited to health and would also significantly affect daily life and socio-economic activities, such as restricted travel by cars and trains, power outages, and suspension of water supply. In light of these anticipated impacts, relevant government ministries and agencies, including the Cabinet Office and local governments, are currently working together to discuss the challenges and countermeasures for widespread ash fall following the eruptions of Mount Fuji.

Mount Fuji has experienced eruptions of various scales and types besides the Hoei eruption. For example, the Jogan eruption in the Heian period is said to have caused a large lava flow that reached Lake Motosu. Although it is unknown when or what type of eruption may occur at Mount Fuji in the future, measures are being taken to prepare for potential eruptions, including the creation of hazard maps and the formulation of evacuation plans, putting to use this history of past eruptions and experiences of that time.



Map showing the main location names associated with the Hoei eruption

The location of the Hoei crater (▲) and the isopachs of the ash fall are also shown. The dashed lines indicate modern-day prefectural borders.

Source: National Disaster Management Council (2011) "Learning from the History of Disasters: Volcanoes"

1: National Disaster Management Council (2006) "Report on the Hoei Eruption of Mt. Fuji in 1707" p.161.

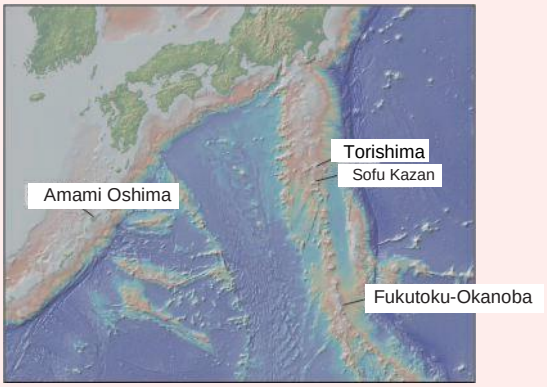
2: National Disaster Management Council (2006) "Report on the Hoei Eruption of Mt. Fuji in 1707" p.78.

[Column]
Understanding Submarine Volcanoes - Underwater Volcanic Activity -

Japan is a “country of volcanoes” with active volcanic activity due to plate subduction and is known to have 111 active volcanoes at present, most of which are on land, where volcanic activity can be monitored. Many unknown active submarine volcanoes are believed to be lying dormant in the seas. Research on submarine volcanoes lags significantly behind land-based volcanoes, raising concerns that unexpected volcanic eruptions could lead to more severe volcanic disasters.

Against this background, the Japan Agency for Marine-Earth Science and Technology (hereinafter referred to as JAMSTEC) is promoting research to understand submarine volcanoes and the Earth’s interior in an integrated manner, with the aim of predicting disasters from submarine volcanoes and assessing their impact on the Earth’s environment, thereby mitigating disasters.

In recent years, JAMSTEC has focused on the waters around the Izu and Ogasawara Islands, which are volcanically active, as a key target for research. JAMSTEC aims to understand volcanic activity through detailed analysis of collected volcanic samples and subsurface structural data obtained using “KAIMEI”, JAMSTEC’s submarine, wide-area research vessel, and other ships. The explosive eruption of Fukutoku-Okanoba in August 2021, in which a large amount of pumice drifted ashore in various parts of Japan, causing an unexpectedly significant impact on fishing operations and other activities, is still fresh in memory. JAMSTEC conducted a detailed analysis of the pumice, revealing that the explosive eruption was caused by basaltic magma that penetrated the magma chamber from deep beneath the volcano. In October 2023, when earthquake activity intensified around Torishima Island and a tsunami occurred, JAMSTEC conducted an emergency survey voyage in the surrounding waters using the “KAIMEI” vessel and confirmed the presence of a caldera-like seafloor topography near the center of the Sofu Seamount. JAMSTEC is analyzing the relationship between this caldera-like seafloor topography and a series of earthquake and tsunami activities.



Volcanic observatory on Mount Asama
Source: JAMSTEC

Photos of the coastline of the Nansei Islands (Amami Oshima, Kagoshima Prefecture) in October 2021 and the pumice that drifted ashore (Minami-Daito Island, Okinawa Prefecture) Source: JAMSTEC

Chapter 3 Living with “Volcanoes”

Section 1 Initiatives for Volcano Disaster Risk Management Measures in Each Region

As described in Chapter 2, Section 1, each volcanic area has established a Volcanic Disaster Management Council, with local governments taking the lead in developing alert and evacuation systems. Since each volcano is different in terms of phenomena that occur during eruptions, topographical characteristics, location concerning residential areas, and tourist and climber traffic, it is important to consider the characteristics of each volcano rather than take a uniform nationwide approach when establishing a disaster management system. Since the number of regions and local governments in Japan that have experienced a volcanic eruption in recent years is limited, many Volcanic Disaster Management Councils in volcanic areas that have not experienced eruptions face challenges in implementing volcano disaster risk management measures.

The Cabinet Office holds the “Liaison and Collaboration Conference of Volcanic Disaster Management Councils” once a year, where members of each Volcanic Disaster Management Council gather under one roof, transcending the boundaries of the Councils. These conferences are expected to strengthen cooperation in promoting volcano disaster risk management measures within each Volcanic Disaster Management Council and with volcano specialists and related administrative organizations by sharing the challenges each council or local government faces and exchanging information on advanced initiatives.

Next, we will introduce volcanic areas promoting unique volcano disaster risk management measures based on their experiences with volcanic eruptions.

(Sakurajima: Kagoshima-shi, Kagoshima)

Kagoshima City holds the “Comprehensive Disaster Management Drill for Sakurajima Eruption” jointly with Kagoshima Prefecture, assuming that a large-scale eruption on the scale of the Taisho eruption (see Chapter 2, Section 2) is imminent at Sakurajima.

This exercise has been held annually since 1971 and has been held 54 times as of 2024. Since FY2020, the evacuation drill has been conducted in two parts — a resident evacuation drill in November and an evacuation shelter experience and exhibition drill in January.

The November evacuation drill for residents includes alerts from Kagoshima City to the entire Sakurajima area via prefectural disaster management radio, discussions for evacuation in each town, and evacuation actions in response to evacuation instructions regarding disaster prevention measures before and after raising volcanic alert levels.

In addition, to pass on the lessons learned from the Taisho eruption to the next generation, drills are conducted at all elementary and junior high schools on Sakurajima Island, which have been designated as evacuation promotion facilities, as well as drills involving cooperation between the fire department, the police, the Self-Defense Forces, and other organizations involved in disaster management.

Evacuation actions at an elementary school
Source: Kagoshima-shi, Kagoshima

Volcanic Disaster Management Liaison Conference, which brings together involved organizations
Source: Kagoshima-shi, Kagoshima

The evacuation shelter experience and exhibition drill in January simulate life after evacuation from Sakurajima Island to the city center. It is conducted every year with changes to the target areas. At the evacuation center, which serves as the venue for the drill, visitors can experience an evacuation shelter and study exhibits prepared by organizations involved in disaster management.

Briefing for residents at the venue of the drill
Source: Kagoshima-shi, Kagoshima

Evacuation shelter experience and exhibition drill in session
Source: Kagoshima-shi, Kagoshima

In response to the continuous volcanic activity at Sakurajima, Kagoshima City has formulated the "Kagoshima City Model City Framework of Volcanic Disaster Risk Reduction"[8] order to expand the population that is involved in disaster preparedness, including non-resident population, by having residents, local communities, business operators, research institutions, and the government work together to raise the level of comprehensive disaster resilience for Sakurajima, and by communicating the appeal of the volcano to the world.

As one of its key initiatives, this framework promotes volcanic disaster risk reduction education to "pass on" to the next generation so that all citizens can learn about the origins of Sakurajima, the blessings of the volcano and the culture that surrounds it, develop an interest and attachment to Sakurajima, and understand and learn how to respond in the event of a volcanic disaster. For example, the "Sakurajima Visit Experience" program provides opportunities for sixth-grade students from urban areas to set foot on Sakurajima and receive on-site explanations from volcano experts.

As part of its global contribution through the "Kagoshima Model," the city accepts Japanese and overseas visitors to participate in the Comprehensive Management Disaster Drill for Sakurajima Eruption mentioned above. They are building a support system for responding to volcanic disasters in other volcanic areas.

Scenes from "Sakurajima Visit Experience"
Source: Kagoshima-shi, Kagoshima

(Izu Oshima: Izu Oshima Geopark, Oshima, Tokyo)

Izu Oshima Geopark, recognized as a Japanese Geopark in 2010, uses its abundant resources that reveal traces of earth activities to promote disaster risk reduction education from the perspective of a Geopark. Many Japanese Geoparks include topographical and geological features formed by volcanic activity.

8 "Kagoshima City Model City Framework of Volcanic Disaster Risk Reduction" on Kagoshima City's website (Reference: https://www.city.kagoshima.lg.jp/kikikanri/kazan/topcitykousou.html)

When a site is designated as a Japanese Geopark, the kind of disaster management and risk reduction activities conducted based on the experience and knowledge of disasters caused by the crustal movement, seismic activity, volcanic activity, etc., are also investigated, meaning that volcanic disaster risk reduction education and dissemination of knowledge about volcanoes are part and parcel of a Geopark's activities[9]. All the geosites that are the highlights of the Izu Oshima Geopark were created by past eruptions of Izu Oshima so that each geosite may speak of possible eruption disasters (e.g., various phenomena caused by volcanic eruptions and the scale of eruptions). Through initiatives such as disaster prevention classes, hands-on learning for local children and students, and guided tours for tourists, the Geopark provides opportunities to learn and understand the disasters and the bountiful blessings that volcanoes bring. Such Geopark activities are expected to have various effects, including developing the ability to act on one's judgment in response to the risk of disasters, passing on disaster culture to the next generation, and disseminating information to other areas.

The Regional Disaster Prevention Plan of the town of Oshima, Tokyo, also stipulates the dissemination of knowledge and information on volcanic disaster risk reduction through the activities of the Izu-Oshima Geopark. Since the dissemination of information on disasters is often seen as counterproductive to tourism, including sightseeing, as it can cause reputational damage, positioning it as a public plan in this manner is an effective way of raising public awareness about volcanic disaster preparedness.

Educational travel observation tour
Source: Oshima, Tokyo

Parent-child volcano experiment class in session
Source: Oshima, Tokyo

Located in Hokkaido's Nishi-Iburi region, Mt. Usu erupted every few decades. Under the theme of coexistence with the volcano, people who have correctly studied the nature and characteristics of Lake Toya and the Usu Volcano area and pass on the memories of past eruptions, as well as the wisdom to mitigate a disaster to the next generation, both within and outside the community, in preparation for the next eruption that is sure to occur, are certified as "Toya-Usu Volcano Meisters," a title limited to the region. The "Toya-Usu Volcano Meister System" was started in 2008 to become a leader in regional disaster prevention, improving regional disaster resilience, and promoting the area's attractiveness. As of 2023, 70 Volcano Meisters have been certified and are engaged in disaster risk reduction education, lecturing at study groups, and providing support.

Volcanic activity in the past has shaped the current landscape of the Usu Volcano area, including Lake Toya and Showa-Shinzan. It has also created hot springs and other resources and industries. With a proper understanding of the disasters that volcanoes can bring, the local community enjoys the volcano's blessings while walking the path of coexistence. The area's many blessings also attract tourists who reside in areas unfamiliar with volcanoes. By having guides pass on their wisdom of past eruption disasters and disseminate knowledge on volcanic disaster risk reduction to tourists (especially students on school field trips), the system is helping deepen public interest and understanding of volcanoes.

9 The Japan Geopark Committee (JGC) recognizes Geoparks in Japan in accordance with the Operational Guidelines for UNESCO Global Geoparks. Japanese Geoparks consist of UNESCO Global Geoparks and Japanese National Geoparks aspiring to become UNESCO Global Geoparks. As of May 2023, 46 Geoparks have been recognized.
(Reference: Japanese Geoparks Network https://geopark.jp/geopark/)

Education activities for disaster risk reduction conducted by Toya-Usu Volcano Meisters
(Left: at the summit of Mt. Usu, right: on the Konpira-yama footpath)
Source: Toya-Usu UNESCO Global Geopark

Section 2 Coexisting With "Volcanoes"

Once a volcano starts erupting, it can cause enormous damage and majorly impact people's lives. As described in the previous section, although measures are being pushed in volcanic areas, including efforts to inform and raise public awareness about volcanic disasters, awareness of volcanic disaster risk reduction among climbers who visit volcanoes is not necessarily high. For example, a 2021 online survey of mountain climbers (in a multiple-choice format) found that 17.6% of all respondents were "highly aware" of "volcanic eruptions," a relatively low level compared to awareness of other risks such as sudden change in weather and heatstroke, which are often encountered when climbing (Fig. 3-1).

Fig. 3-1 Assessment of risks encountered during mountain climbing

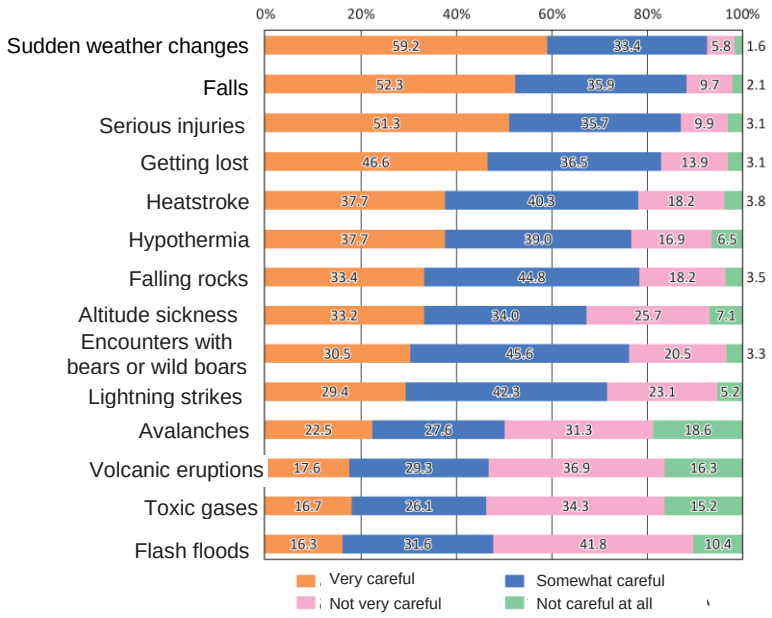


Fig. 13 Evaluation of Risks Encountered During Mountaineering

* WEB survey of people who climb at least once a year (n=960)

Source: Compiled by the Cabinet Office based on Shinya and Naoya (2022) "Awareness on Volcanic Eruptions: Based on a Questionnaire Survey of 'Mountaineers' and Residents of the Tokyo Metropolitan Area" (Research Survey Reports in Information Studies. Interfaculty Initiative in Information Studies, The University of Tokyo 38, 39-77)
(Reference: https://www.iii.u-tokyo.ac.jp/manage/wp-content/uploads/2022/03/38_2.pdf)

As per an online survey of mountain climbers and residents of the Tokyo metropolitan area (residents of Tokyo and Kanagawa Prefectures), the level of awareness regarding the information on volcanoes was higher among climbers than among residents of the Tokyo metropolitan area for many items, with the level of awareness of residents in the Tokyo metropolitan area on information such as eruption alerts and eruption alert levels being only about two-thirds that of climbers (Fig. 3-2). This document states that the reason is that residents of the Tokyo metropolitan area do not live near volcanoes and have little access to such volcano information.

Fig. 3-2 Awareness of information regarding volcanoes

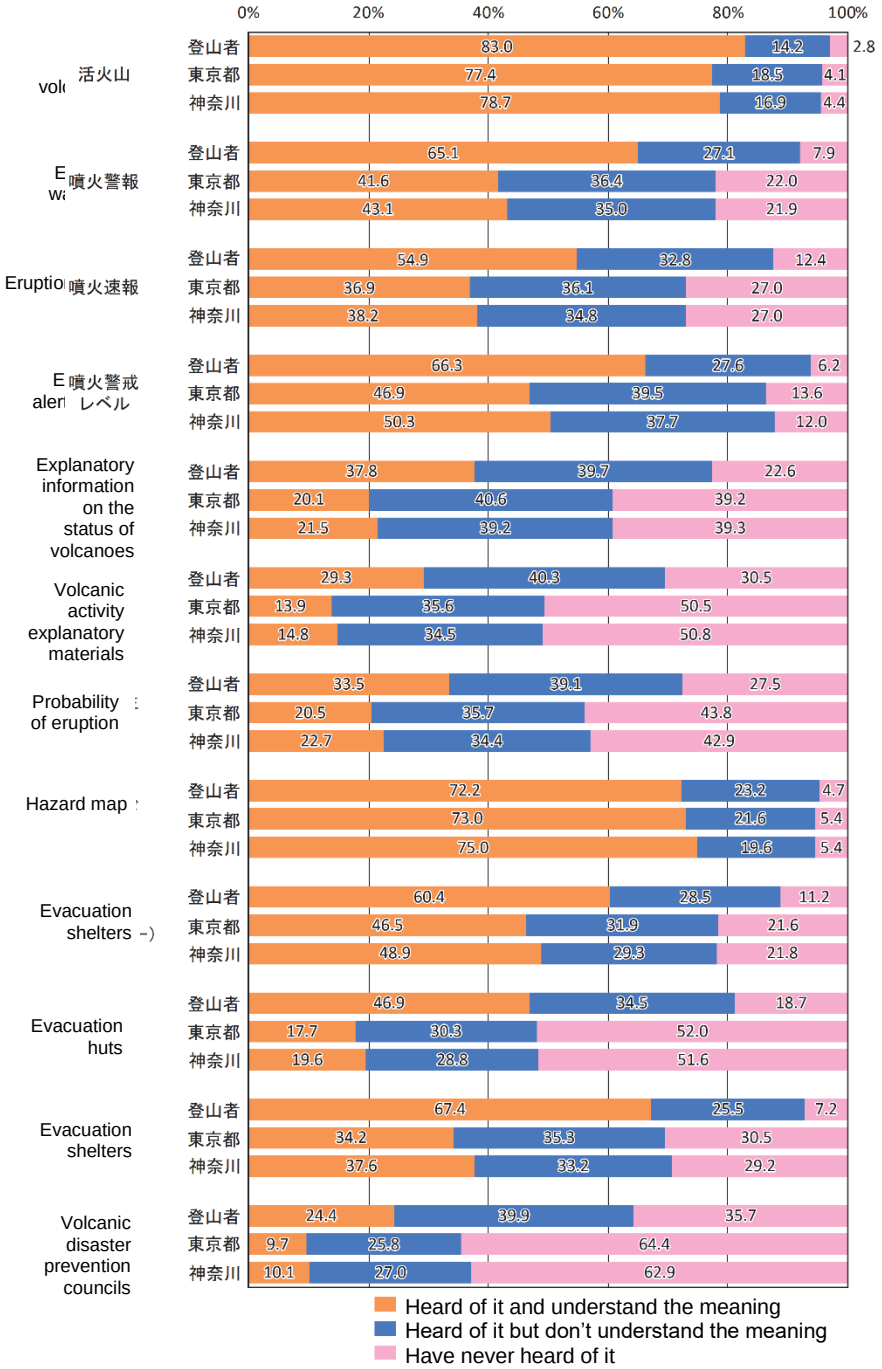
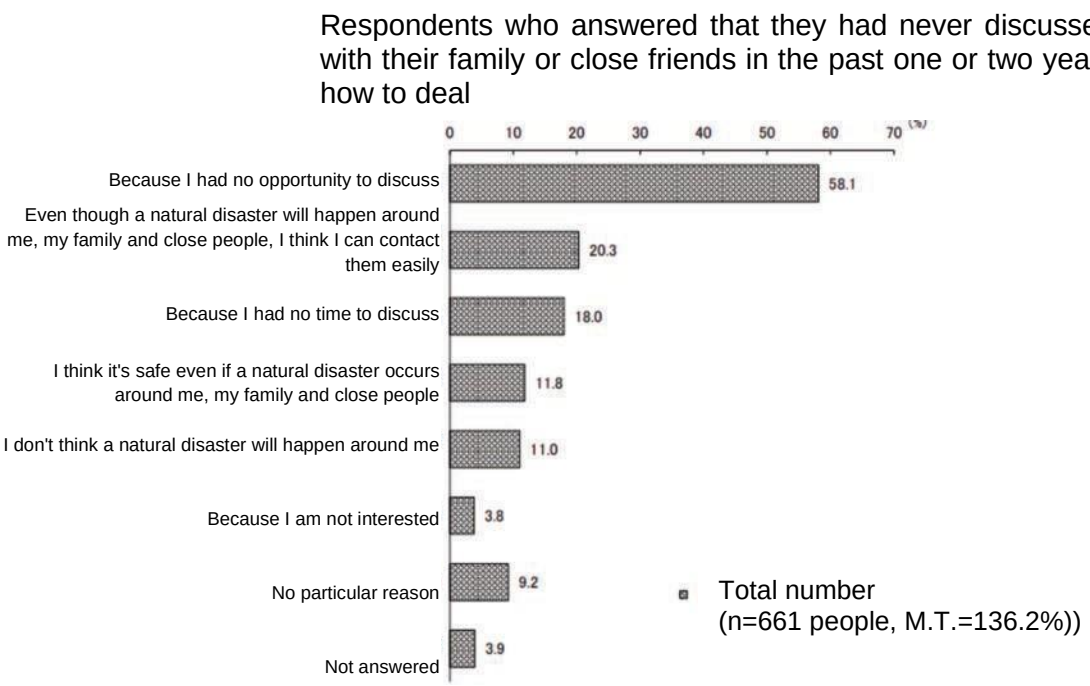


Fig. 23. Awareness of information about volcanoes (mountain climbers n=2,000, Tokyo and Kanagawa n=2,500)

Source: Compiled by the Cabinet Office based on Shinya and Naoya (2022) "Awareness on Volcanic Eruptions: Based on a Questionnaire Survey of 'Mountaineers' and Residents of the Tokyo Metropolitan Area" (Research Survey Reports in Information Studies. Interfaculty Initiative in Information Studies, The University of Tokyo 38, 39-77)
(Reference: https://www.iii.u-tokyo.ac.jp/manage/wp-content/uploads/2022/03/38_2.pdf)

In the “Public Opinion Survey of Disaster Prevention” conducted by the Cabinet Office in September 2022, respondents who answered that they had “never” discussed how to respond in the event of a natural disaster such as an earthquake, tsunami, volcanic eruption, typhoon and heavy rain (36.9% of all respondents) were asked the reason behind their answer (in a multiple-choice format). An overwhelming majority (58.1%) chose “Because I had no opportunity to discuss” (Fig. 3-3). These results suggest that if people have less access to volcano information, they will lose opportunities to prepare for volcanic disasters. Therefore, we must strengthen efforts to reach the public, considering the characteristics of volcanic disasters and regional differences.

Fig. 3-3 Reasons why respondents answered “they had never discussed how to deal with natural disasters with their families or close people”

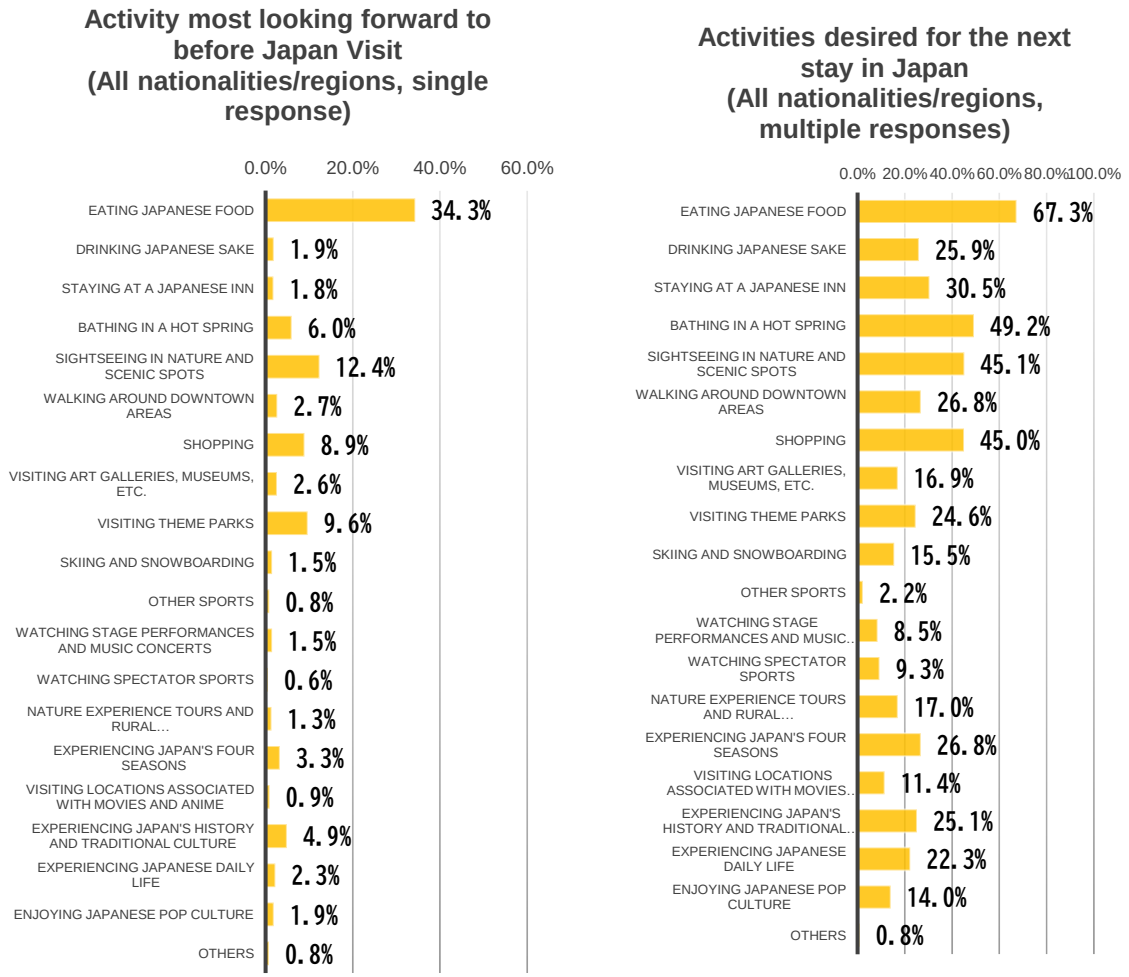


Source: Cabinet Office “Public Opinion Survey on Disaster Management” (Survey in September 2022)

On the other hand, volcanoes bring us abundant and irreplaceable blessings. The majestic mountainous shape created by volcanic activity, caldera lakes that form in craters, waterfalls created by the difference in elevation, and other unique landscapes bring delight and relaxation to visitors. In addition, hot springs produced by the heat from volcanoes are one of Japan’s biggest tourism resources.

According to the Japan Tourism Agency’s Survey on Consumption Trends of Foreign Visitors to Japan, 12.4% of respondents answered “Nature/scenery sightseeing” as the activity that most motivated them to visit Japan (in a single response format), second only to “Eat Japanese food,” while 6.0% of respondents answered, “Bathe in a hot spring”. In addition, around 50% of respondents answered both “Nature/scenery sightseeing” and “Bathe in a hot spring” as activities they would like to do on their next stay in Japan (in a multiple-choice format), which ranked higher than other activities, suggesting that the blessings of volcanoes are also an important tourism resource for foreign visitors to Japan (Fig. 3-4).

Fig. 3-4 Surveys on intention of visiting Japan



Source: Compiled by the Cabinet Office based on Japan Tourism Agency "Survey on consumption trends of foreign visitors to Japan" (2023 Estimated Annual Value (Aggregate Results) [Sightseeing and Leisure Purpose])
(Reference: https://www.mlit.go.jp/kankocho/tokei_hakusyo/gaikokujinshohidoko.html)

In addition, the vast plains created by lava flows and sector collapses, and the volcanic ash that falls and accumulates on the ground have excellent drainage and make suitable soil for agriculture over a long period. Furthermore, the strata created by volcanic activity contain many crevices which store a lot of water inside them. The people who live near volcanoes use the springs and groundwater produced by the volcanoes for domestic purposes, and also for agriculture, livestock farming, and industries. Due to these characteristics, some volcanoes have long been objects of worship, often regarded for their historical and cultural value.

The blessings of volcanoes
Source: Fujinomiya-shi, Shizuoka

In this manner, the people living around volcanoes and others who visit these areas, including tourists, enjoy the blessings of volcanoes in Japan, one of the most volcanic countries in the world. To coexist with volcanoes, which pose a threat of disasters and provide bountiful blessings to surrounding areas, we must properly understand the characteristics of volcanoes and be prepared in the unlikely event of an eruption. As described in the previous section, various volcano disaster risk management initiatives are implemented in each volcanic area. People need to have correct knowledge about volcanoes and make necessary preparations for volcano disasters by using opportunities such as volcano disaster management drills, disaster preparedness classes, and guided tours held in each area, as well as by using various websites or other means to gather information.

Section 3 Conclusion

The Act on Special Measures for Active Volcanoes, which serves as the basis of volcano disaster management measures in Japan, was amended in 2015 in the wake of the Mount Ontake eruption disaster and was further amended in 2023 from the perspective of preventing volcanic disasters before they occur. The recent amendments have advanced volcano disaster risk management measures by establishing the Volcano Headquarters to centralize volcanic research and studies in Japan, enhancing human resource development with specialized knowledge of volcanoes, and designating “Volcanic Disaster Preparedness Awareness Day”. As introduced in Section 1 of this chapter, disaster risk management measures and initiatives toward coexistence that consider the characteristics of volcanoes are being advanced in all areas surrounding volcanoes. However, once a volcanic eruption occurs, it can cause immeasurable damage and severely impact society. For Japan, one of the world’s most volcanically active countries, it is essential for citizens to have the correct knowledge about volcanoes, which present both the threat of disasters and bountiful blessings and to prepare effectively for volcanic disasters. Raising each citizen’s awareness of volcano disaster risk management is necessary to achieve this. Considering the societal impacts of volcanic eruptions, public-private collaboration must be strengthened to promote disaster risk management measures across all sectors.