

Hazardous Earth: Sakurajima and Nyiragongo



Volcano in a Developed Country: Sakurajima, Japan



Sakurajima is a **composite volcano** (also called a **stratovolcano**) located in southern Japan. The volcano has been extremely active since the 1950s; some years, up to **200 eruptions have taken place!**

Sakurajima is on a convergent plate boundary, where the **Pacific plate** subducts beneath the **Eurasian plate**.



Location of Sakurajima (orange icon).



(Source: www.flickr.com/photos/kimon/4506849144/)

This type of plate boundary causes Sakurajima eruptions to be **explosive**, producing lots of **ash**, **pyroclastic flows**, **volcanic bombs** and **poisonous gases**. The lava is **andesitic**, which has a high gas content and is very **viscous** (thick).

Japan is a **developed country**, with a GDP of **4.97 trillion USD** (2018).



Volcano in a Developing Country: Mount Nyiragongo, DRC



Mount Nyiragongo is a **composite volcano** located in the east of the **Democratic Republic of the Congo (DRC)**. The volcano consists of a **huge (2km wide) crater** usually filled with a **lava lake**, and is only 20km away from the city of **Goma**. Nyiragongo is currently classed as **active** (2020).



Location of Nyiragongo (orange icon).



(Source: [wiki](https://www.wikipedia.org))

Nyiragongo is on a **divergent plate boundary**: the **African plate** is being pulled apart into the **Nubian plate** (east) and **Somali plate** (west), causing **lava to rise between**. This results in **non-explosive eruptions** with **basaltic lava** which has a **low viscosity** (runny & fast-flowing - up to 37 mph).

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Impacts of Volcanoes in Contrasting Areas

Impacts in Japan



Developed country

Primary impacts

- Around **30km³** of **ash** erupts from the volcano each year, damaging **crops and electricity lines**. Ash needs to be regularly cleaned up to avoid disruption.
- Ash also causes **poor visibility**, and can make roads **unsafe for driving**, which has the potential to cause **traffic accidents**. It also disrupts air travel.
- **Volcanic bombs** which are thrown over **3km from the volcano** have been known to **crack windshields of cars and aircrafts**, causing major disruption.
- **Lava flows** have destroyed **croplands and hundreds of homes** in the past. Seen on the right, this **3 metre tall gate** was buried by a lava flow in 1914, leaving only the very top visible.
- Particularly **violent eruptions** of Sakurajima have generated strong **earthquakes**. In 1914, an earthquake triggered by **Sakurajima's last major eruption** killed 58 people.
- Huge waves of energy called **shock waves** caused by the volcanic eruption have been known to **shatter hundreds of windows up to 10km away from the volcano**. You can see the **shockwave** moving through the clouds in this [video](https://youtu.be/Tqygdwar93w) (youtu.be/Tqygdwar93w).



Clearing ash from a pavement.
 (Source: www.photovolcanica.com)



(Source: kagoshima-kankou.com/for/attractions)

Secondary impacts

- **Respiratory problems** caused from continual ashfall, such as **asthma**.
- There have been studies linking volcanic emissions in the area to **increased cancer rates**.
- Acid rain caused by **poisonous gases** emitted by the volcano has **damaged crops**.
- **40% of the land surrounding Sakurajima is volcanic soil**, which is extremely fertile. This has led to a strong **tea and rice** industry in the area. Kagoshima, overlooked by the volcano, is the **second largest tea producing region** in Japan.
- The area has become a **major tourist destination** due to its National Park status, the active volcano, scenery, observatories and hot springs. The tourism industry has **created jobs** for locals and brought **money** into the area.



Tourists looking at Sakurajima.



Impacts in the Developing country

Mount Nyiragongo had a particularly devastating eruption in January **2002**, with huge **lava flows** that caused major disruption to the surrounding area.

Primary effects

- 12,500 homes destroyed by **lava flow and earthquakes triggered by volcanic activity**.
- Lava completely covered at least **15%** of the city of Goma and destroyed around **a third**.
- Lava covered up to **80% of the airstrips at the Goma International Airport**.
- Over 200 people were thought to be **killed**, many from **carbon dioxide poisoning** from the volcano. Carbon dioxide poisoning continues to be a threat from the volcano today.
- **Crops and livestock** were destroyed by the lava flows.
- Major disruption to **mains water supplies** caused by the eruption, leading to hygiene issues and drinking water shortages.
- **400,000 people** had to be evacuated from their homes to avoid the lava flow.



Lava pours into Lake Kivu after burning homes in Goma. (Source: [Jacky Naegelen](#))

Secondary effects

- **Volcanic gases** reacted with atmospheric gases and produced **acid rain**, which damaged farmland and cattle farms.
- There was **homelessness** and **overcrowding** in refugee camps as many could not afford to rebuild their homes. Around **120,000 people were left homeless** in Goma.
- **Cholera** spread in refugee camps due to both overcrowding and **poor hygiene conditions** due to disrupted water. Aid organisations were also worried about the spread of measles in the conditions.
- Lava flows devastated businesses and destroyed shops, destroying sources of **income and access to resources**.
- **Looting** broke out in the city of Goma after people evacuated and left the city relatively empty.



Congolese refugees queue at Lake Kivu after evacuating.



Management of Earthquakes in Contrasting Areas

Due to their contrasting levels of wealth and preparedness, Japan and the DRC have different short-term and long-term strategies to respond to volcanic hazards.

Short-term relief in Japan

Residents surrounding Sakurajima are **told to evacuate** if alert levels are raised. In 2015, alert levels were raised to level 4 (out of 5) and residents at particular risk were evacuated.

Residents were also given **evacuation cards** to identify the areas that residents had evacuated to and monitor who had left the island.

Special **ash bags** are distributed to households when there is particularly **high ashfall**. Residents are expected to clean up the ash in their gardens and in front of their house.

Ash can then be left in **residential ash collection spots** (usually next to communal waste disposal areas) to be collected and disposed of by the council.

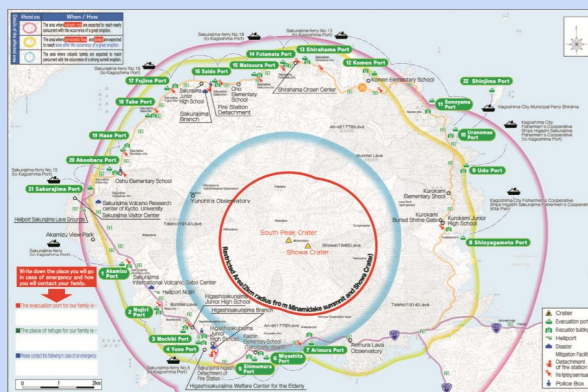


Ash disposal site. (Source: photovolcanica.com)

During times of high ashfall, residents usually **close their windows** or **wear masks outdoors**. Most residents are used to this as it is so common.

When volcanic activity is higher, like in 2015, areas around the volcano are declared off-limits to residents and tourists to protect people from **volcanic bombs** or **poisonous gases**.

There are many **ports** around the island made available for **evacuation** if this is necessary, which can be seen on the map to the right in the green text bubbles.



If people are near the volcano during a time of higher volcanic activity (e.g. volcanic bombs being thrown out of the volcano), they can take cover in **concrete-roofed shelters** built around the volcano. A concrete shelter is usually always within walking distance of all major walkways.



(Source: places.branipick.com/shelter-in-sakurajima/)



Short-term relief in The DRC

An estimated **400,000** people were **evacuated** from the area surrounding the volcano, but evacuation was slow and only began once **plumes of smoke leaving the volcano were visible**. There were also limited evacuation plans in place.

Many residents had not experienced a **volcanic eruption before** and were not aware that lava was dangerous. Many even went towards the volcano to see, which slowed evacuation more.

Because of the slow and disorganised evacuation, around **50,000 inhabitants of Goma became stuck** between two lava flows.

The arrival of **international aid** was **disrupted** by the damaged airport in Goma.

Within a week, the United Nations had sent **260 tonnes of food** to the affected area. Families received **26kg** of rations each.

UK Oxfam sent **33 tonnes** of **water-cleansing equipment** for **50,000 people** in refugee camps.

The **£150,000 package** mainly contained **water purification kits** to provide **clean water** for **drinking** and **sanitation**. This stopped people from drinking contaminated water from Lake Kivu and helped to reduce the spread of **cholera** in some refugee camps.



British Aid arriving in the DRC. (Source: [BBC](#))

The World Health Organisation and Médecins Sans Frontières (MSF) conducted emergency **measles vaccinations** to **28,000 children** to stop the spread in refugee camps.

Refugee camps were set up to temporarily house the displaced populations. The image to the right was taken in the Itig refugee camp, which held **7,000 people**. Shelters were made out of **scrap metal collected from lava flows**.

There was **poor communication** between **agencies** and refugees. With supplies low, many people began to travel **back to the affected area** within a matter of days to collect **belongings and supplies** from their homes, even though it was not yet safe to do so. Many people walked across hot lava that was not yet solidified and cooled to get home.



A shelter in the Itig camp made from scrap metal. (Source: [reliefweb.int](#))

Governments around the world gave **\$35 million** in aid for refugees.



Long-term Responses to Earthquake Hazards

Planning +

Japan ●

- **Annual disaster drills** for residents and emergency services to practice evacuation.
- There is a **2km zone** surrounding the volcano that is prohibited from entering as it is too dangerous.
- **Thorough evacuation plan** with multiple designated ports available for evacuation.

The DRC ▬

- Retraining of officials with **precise evacuation plans** and designated **communities to target**.
- Training of **community officers** who can relay information to vulnerable communities if there is an eruption.

Preparation

- **Numerous shelters have been built** surrounding the volcano that are clearly signposted in case of an eruption.



- Large **concrete channels** divert lahars (mudflows formed during a volcanic eruption) away from **developed areas**.



(Source: appliedvolc.biomedcentral.com)

- Warning levels on a **scale of 1-5** that tells people when to evacuate. People are encouraged to have evacuation kits including **hard hats** to stop injuries from volcanic debris.

- **30 new signs** that detail **early warning signs** and **evacuation routes** have been put up in areas at high risk.

- Evacuation drills take place in communities and schools to prepare people for another eruption.



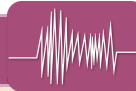
(Source: cafod.org.uk)

- **Community-level distribution of leaflets to vulnerable people** containing accessible information on eruptions. The leaflets include information on **evacuation routes**, local **shelters**, and general advice detailing what to do in case of an emergency.

- The **International Federation of Red Cross and Red Crescent societies** has expressed a need for **more funding** so that further educational materials can be released to communities in need.

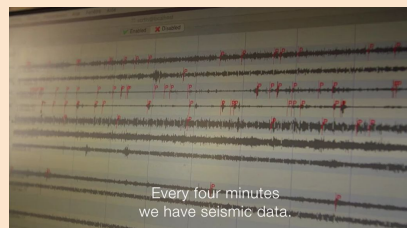


Prediction



- Volcanoes can be **closely monitored** to predict if an eruption is likely:
- **Aircraft fly above Sakurajima** and measure the **gases** it gives off. Higher levels of some gases, like **sulphur dioxide**, can indicate if an eruption is likely. They can also use **infrared technology** to see if there are any hotter areas, indicating rising magma.
- **Seismometers** measure **earthquakes and tremors**. Many earthquakes within a short timeframe indicate an eruption is imminent.
- **Boreholes** within the volcano measure **water temperature**. If magma rises, it gets **hotter underground** and therefore heats up the water.
- **Tiltmeters** can detect if there are any **bulges or swellings** under the surface of the volcano, indicating rising magma.
- Knowledge from similar volcanoes has encouraged vulcanologists to measure **carbon dioxide emissions** from the volcano and within **Lake Kivu** to predict if levels will become lethal (as people can **die from carbon dioxide poisoning**).
- There is an observatory for the volcano, The **Observatoire Volcanologique de Goma**, which constantly monitors the volcano.
- **The large lava lake** in Mount Nyiragongo is visible from above, so the levels of it can be carefully monitored to see if an eruption is impending.

This video from the BBC details how scientists **monitor** the volcano. Much of the technology is similar to the methods in Sakurajima (seismometers, temperature levels etc.):



(Source: www.bbc.co.uk/news/av/world-africa-41656368)

