



Melting Glaciers Can Trigger Volcanic Eruptions

[Source: IE](#)

Why in News?

A study presented at the 2025 Goldschmidt Conference in Prague has highlighted a potential link between **melting glaciers and an increase in volcanic activity**, particularly in regions like West Antarctica.

Note: Goldschmidt is the foremost annual, international conference on geochemistry and related subjects, organized by the European Association of Geochemistry and the Geochemical Society.

What are the Key Findings of the Study on Melting Glaciers and Volcanic Eruptions?

- **Subglaciated Volcanoes:** [Volcanoes](#) located under **glaciers and ice sheets, known as subglaciated volcanoes**, are found in regions such as Iceland, British Columbia, and Antarctica.
 - These volcanoes are sensitive to glacier retreat, which reduces the pressure that suppresses volcanic activity.
 - The greatest threat is in **West Antarctica**, where around 100 volcanoes lie beneath ice. As ice melts, volcanic activity may increase over decades to centuries.
 - Other regions at risk include North America, New Zealand, and Russia, due to ice melt and climate shifts.
- **Melting Ice and Volcanic Activity:** Ice sheets exert pressure on [magma](#) chambers beneath volcanoes, suppressing their eruption.
 - As glaciers and ice caps melt, the resulting **reduction in pressure allows underground gases and magma to expand**, increasing the likelihood of explosive eruptions.
 - This phenomenon, known as **glacial unloading**, was first proposed in the 1970s.
 - Precipitation, influenced by climate change, can seep underground and interact with magma systems, potentially triggering eruptions.
 - **Examples:** During Iceland's last major **deglaciation (~15,000 to 10,000 years ago)**, volcanic activity was 30-50 times higher than present rates.
- **Climate Effects of Volcanic Eruptions:**
 - **Short-Term Cooling:** Volcanic eruptions can temporarily cool the Earth by emitting **ash and sulfur dioxide into the atmosphere**, blocking sunlight.
 - Sulfur dioxide reacts with water in the [stratosphere](#), forming **sulfuric acid aerosols that reflect solar radiation**, leading to surface cooling.
 - **Example:** Mt. Pinatubo (1991) cooled the Northern Hemisphere by ~0.5°C for over a year.
 - **Long-Term Warming:** Repeated eruptions emit greenhouse gases like CO₂ and methane, fueling global warming and creating a feedback loop of glacier melt triggering eruptions, and eruptions further accelerate warming and glacier retreat.

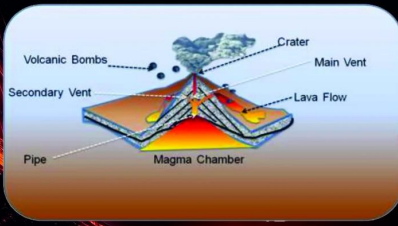
Glaciers

- **Glacier:** A large, slow-moving mass of ice formed from compacted layers of snow.

- **Formation:** Snow accumulates over time, compresses into firn, and then into dense glacial ice, a process that can take over a century.
- **Types:**
 - *Alpine glaciers* flow down mountain valleys.
 - *Ice sheets* (larger than 50,000 sq. km) exist only in Greenland and Antarctica.
 - *Ice caps* (<50,000 sq. km) are dome-shaped and found in high-latitude regions.
 - *Icefields* are smaller than ice caps and influenced by underlying terrain.
- **Glacial Ice Coverage:** ~10% of land surface (15 million+ sq. km).
- **Sea Level Impact:** If all glaciers and ice sheets melted, global sea level would rise by more than 195 feet (60 meters).
- **Largest Glacier by Area:** *Sheller Glacier* (Antarctica)
- **Longest Glacier:** *Bering Glacier* (Alaska).
- **Blue Glacial Ice:** Older glacial ice appears blue or turquoise because it absorbs all other colors of the light spectrum, scattering only blue. Its compact, dense crystalline structure enhances this effect, unlike the loose structure of regular freezer ice.

VOLCANOES

A volcano is a vent or a fissure in the crust from which lava (molten rock), ash, gases, rock fragments erupt from a magma chamber below the surface



- **Types: On basis of -**
 - **Periodicity of Eruption:**
 - **Active volcano:** Recently Erupted
 - **Dormant Volcano:** Potential for eruption, no imminent signs
 - **Extinct:** No recent eruptions, low possibility in future
 - **Nature of Eruption:**
 - **Hawaiian:** Calmest types (low gaseous content)
 - **Strombolian:** Formation of large gas bubbles in magma
 - **Vulcanian:** More explosive
 - **Plinian eruptions:** Magma's volatile gases rise via a narrow conduit
 - **Icelandic:** Often build lava plateaus
 - **Shape of Volcanoes:**
 - **Shield volcanoes:** Composed of basaltic lava, low slope
 - **Cone volcanoes (Cinder Cones):** Most abundant
 - **Composite cones (stratovolcanoes):** Formed by layers of diverse materials.
- **Volcanic Features:**
 - **Extrusive :**
 - **Crater:** Cone-shaped vent for magma
 - **Caldera:** Large, crater-like depression
 - **Volcanic Plateaus:** Leveled areas from fissure eruptions
 - **Intrusive:**
 - **Batholiths:** Central core of a volcanic mountain.
 - **Dyke:** Vertical intrusion cutting across country rock bedding.
 - **Sills:** Tabular intrusions along sedimentary bedding.
 - **Laccoliths:** Magma injection along horizontal sedimentary bedding.
 - **Minor:**
 - **Geysers:** Underground water above 100°C, powered by magma, results in powerful eruptions with steam and diluted minerals.
 - **Hot Springs:** Heated water flows quietly along fault zones.
- **Distribution of Volcanoes:**
 - Subduction zones (Circum Pacific Belt)
 - Divergence zones (Mid Atlantic Ridge)
 - Intra-plate oceanic volcanism (Hawaiian chain)
 - Mid-continental belt and volcanoes in Mediterranean region
- **Volcanoes in India:**
 - No volcanoes in Himalayas
 - Barren Island (Only active volcano)
- **Products of Volcanic Eruption:**
 - **Gases:** H, C, O, S, N, CH₄, NH₃
 - **Solid:** Pyroclastic materials
 - **Liquid:** Lava



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Volcano Facts

The Bad

- • • • • **Ash**
 - Causes respiratory problems
 - Triggers **lightning**
- • • • • **H₂O (water vapour)**
 - Largest contributor to **greenhouse gas** effect on earth
- • • • • **CO₂ (carbon dioxide)**
 - **Toxic** in large amounts >10%
 - Contributes to **global warming**
- • • • • **SO₂ (sulfur dioxide)**
 - Dissolves in water vapour to form damaging **acid rain**
- • • • • **H₂S (hydrogen sulfide)**
 - **Highly toxic** gas that smells like rotten eggs

The Good

Source of materials

Metals, **precious gems**, and construction material

Power Generation

Geothermal and hydroelectric opportunities

Rich volcanic soils

Yay coffee! The **best coffee** grows in volcanic soils

92,000

People killed in the deadliest volcano in **Indonesia** in **1815**

20

Volcanoes are **erupting** right **Now**

Supervolcanoes can plunge the world into an **ice age**

Krakatoa eruption **ruptured** eardrums within **50 KM** radius

2X more **ash** by weight erupted from Mt. St Helens (USA) in 1980 than garbage the entire US produces in 1 year

\$2.2 Billion worth of electrical energy wasted by Krakatoa volcano in **1883, Indonesia**

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

Q. Consider the following statements: (2018)

1. The Barren Island volcano is an active volcano located in the Indian territory.
2. Barren Island lies about 140 km east of Great Nicobar.
3. The last time the Barren Island volcano erupted was in 1991 and it has remained inactive since then.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 and 3
- (c) 3 only
- (d) 1 and 3

Ans: (a)

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