

1. Volcano Hayli Gubbi Erupted After 12,000 Years - Geography

A long-dormant volcano in Ethiopia erupted after 12,000 years, causing ash plumes across the red sea towards Yemen, Oman, and even parts of India

Afar Depression - Geographical and Geological Significance

Tri-Rift Junction (Afar Triple Junction) - The Afar Depression is one of the few places on Earth where three tectonic plates diverge — the Nubian Plate, Somalian Plate, and Arabian Plate. Such triple junctions are rare and usually associated with intense volcanic and seismic activity.

Danakil Depression Characteristics - Known as one of the hottest, driest, and lowest places on Earth, lying ~120 m below sea level. Features colourful hydrothermal fields (Dallol), salt flats, sulphur springs, active fissures, and young lava fields.

Crustal Thinning and Rifting - Continuous divergence leads to crustal thinning, forming grabens, rift valleys, fissure systems, and basaltic lava flows. The region provides a visible cross-section of continental rifting, revealing processes normally hidden deep underground.

Proto-Ocean Formation Zone - Afar is considered a proto-oceanic basin — the earliest stage where a continent begins to split and form a future ocean. If rifting continues for millions of years, the Horn of Africa will separate, and a new ocean basin will form.

East African Rift System (EARS) - Broader Context

Two Branches - Eastern and Western Rift Valleys

The EARS stretches from the Afar Depression in the north to Mozambique in the south.

1. Eastern branch - More volcanic, runs through Ethiopia, Kenya, Tanzania.
2. Western branch - More seismic, includes deep rift lakes like Tanganyika and Malawi.

Plate Dynamics in EARS

The African Plate is splitting into two major tectonic blocks

1. Nubian Plate (west)
2. Somalian Plate (east)

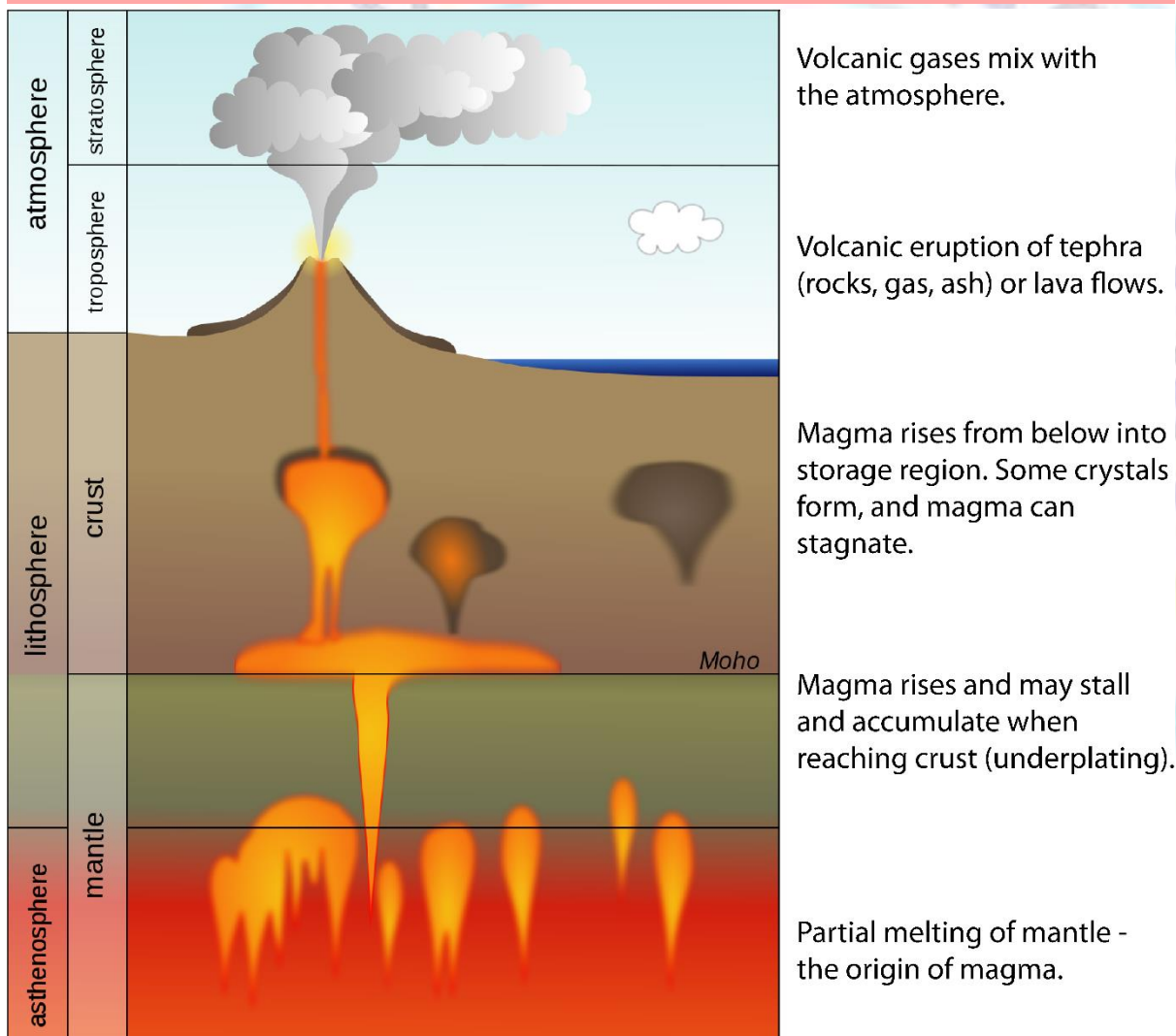
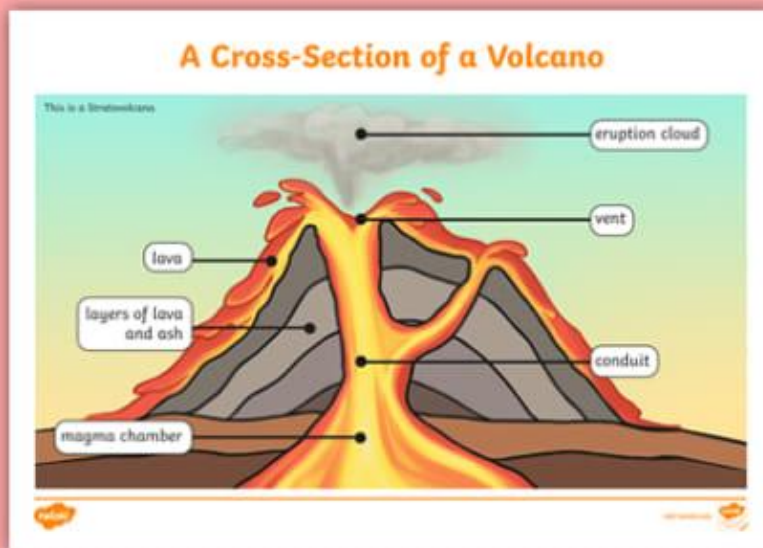
The rift boundary between the two is marked by continuous earthquakes, block faulting, and volcanism.

Hayli Gubbi Volcano - Location and Relevance

Geographical Setting

Located ~800 km northeast of Addis Ababa within the Afar volcanic province, one of the most active volcanic belts globally. Part of Ethiopia's extensive chain of basaltic shield volcanoes.

Tectono-Volcanic Significance - Its eruption patterns help scientists study the interaction between mantle plumes and rift dynamics. Acts as a window into magma storage, crustal deformation, and early oceanic crust formation.



Gas Expansion – As magma rises, pressure decreases → dissolved gases expand violently (exsolution), providing the explosive force of eruptions.

Transition from Magma to Lava – Once magma reaches the surface, it is called lava.

1. **Basaltic lava** (common in Ethiopia) is hot, fluid, and spreads over wide areas.
2. **Silica-rich lava** (andesitic/rhyolitic) is viscous and forms domes, pumice, and explosive eruptions.

Consequences of Volcanism

Positive Effects

Understanding Earth's Interior – Volcanic rocks reveal mineral composition, pressure–temperature conditions, and mantle chemistry. Gas emissions help scientists track magmatic evolution and geochemical cycles.

Soil Fertility – Weathering of volcanic ash produces soils rich in potassium, phosphorus, iron, and micronutrients.

Fertile volcanic regions support dense populations (e.g., Java, Italy's Campania).

Climate Regulation (Short-Term Cooling) – Sulphur dioxide in large eruptions forms sulphate aerosols that reflect solar radiation.

Examples – Pinatubo 1991 caused global cooling of $\sim 0.5^{\circ}\text{C}$ for 1–2 years.

Geothermal Energy Source– Rift zones like Ethiopia harness geothermal power – clean, renewable energy.

Negative Effects



Air Pollution and Health Hazards – Volcanic gases (SO_2 , CO_2 , H_2S) cause **respiratory illnesses, eye irritation**, and acid rain. Ash particles can contaminate water supplies and damage crops.

Associated Natural Hazards

Earthquakes– triggered by magma movement.

Pyroclastic flows – High-speed avalanches of hot ash and gas; extremely lethal.

Lava flows – Slow but destructive to infrastructure.

Lahars – Volcanic mudflows that can bury towns.

Landslides from unstable volcanic slopes.

Aviation Hazards

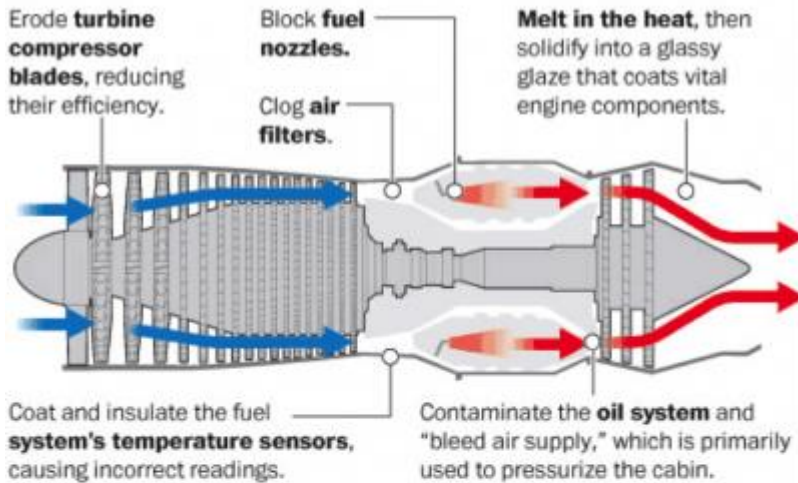
Fine ash can melt in jet engines, causing engine failure (e.g., Eyjafjallajökull 2010).

Thick ash clouds reduce visibility and disrupt air traffic for days to weeks.

Economic Losses

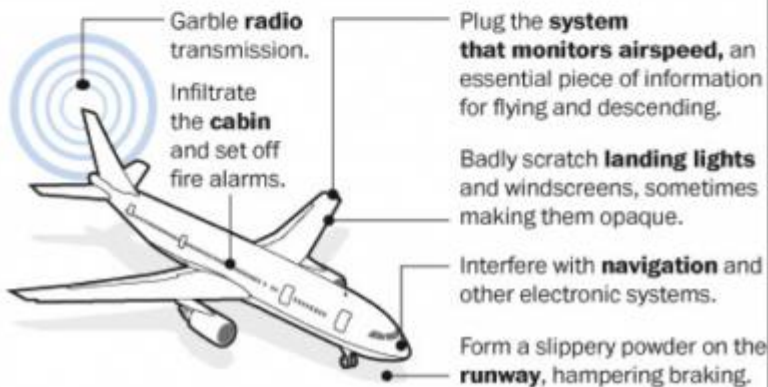
Damage to agriculture, livestock, settlement areas. High rehabilitation costs and long-term land degradation.

In the engine, ash can:



Source -

Elsewhere on the plane, ash or its static discharge can:



<https://www.newindianexpress.com/nation/2025/Nov/24/massive-ash-cloud-drifts-toward-northern-india-as-ethiopia-s-hayli-gubbi-erupts-after-10000-years>