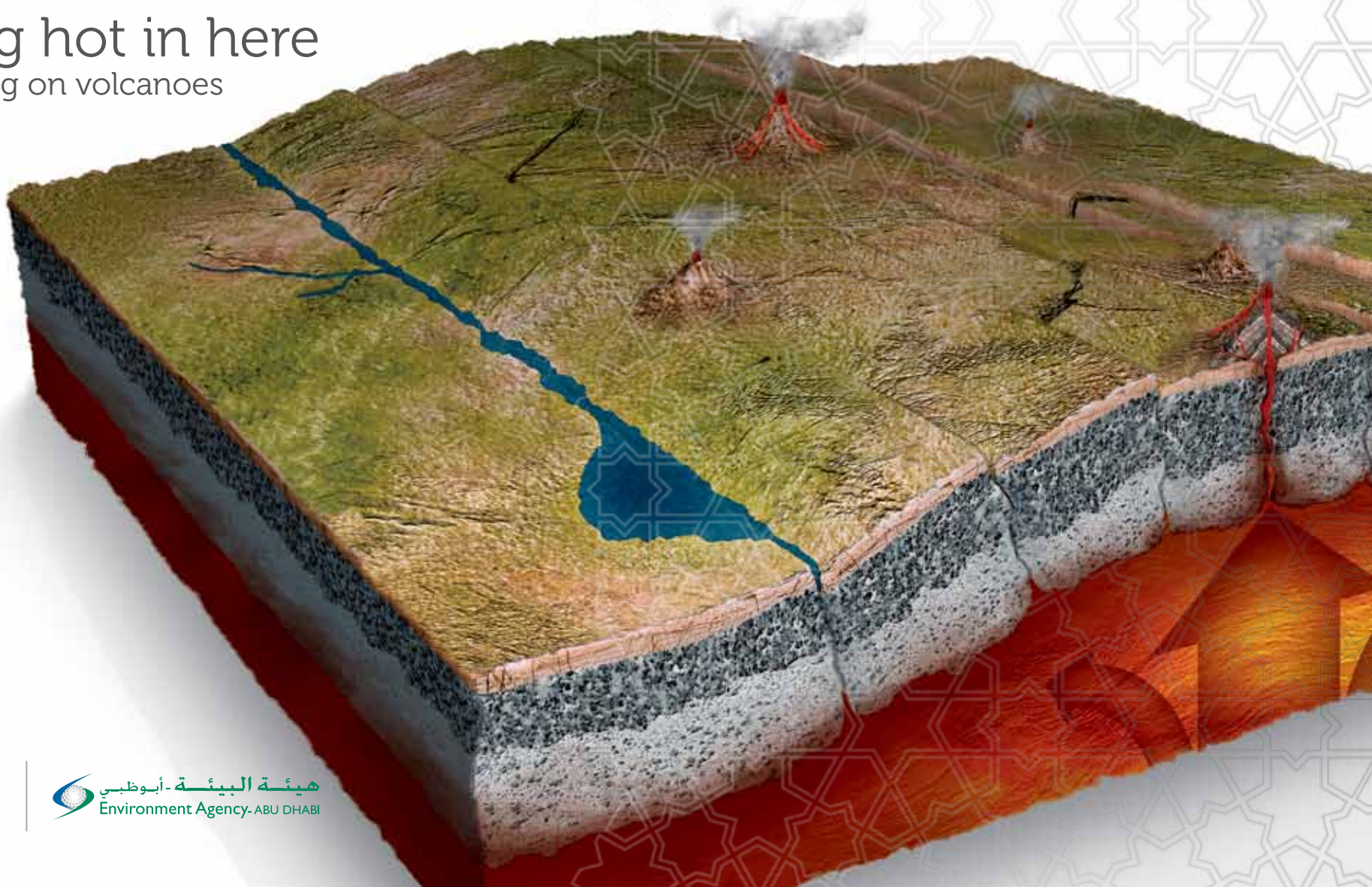


ENVIRONMENTAL ATLAS OF ABU DHABI EMIRATE

It's getting hot in here
A teacher briefing on volcanoes



This teacher briefing is for teachers and other educators to give young people an understanding of volcanoes.

A volcano is usually a cone shaped mountain or hill that opens downward to a pool of molten rock below the surface of the earth.

When pressure builds up, eruptions occur. Gases and rock shoot up through the opening and spill over or fill the air with lava fragments. Some volcanoes even exist underwater, along the ocean floor or sea bed.



An active stratovolcano

The Formation of Volcanoes

Volcanoes form when magma reaches the Earth's surface, causing eruptions of lava and ash⁽¹⁾. They occur at destructive and constructive plate boundaries⁽²⁾. The immediate effects of volcanic eruptions can be devastating, but they may be beneficial in the long term⁽³⁾.

1. Magma rises through cracks or weaknesses in the Earth's crust.
2. Pressure builds up inside the Earth.
3. When this pressure is released, eg as a result of plate movement, magma explodes to the surface causing a volcanic eruption.
4. The lava from the eruption cools to form new crust.
5. Over time, after several eruptions, the rock builds up and a volcano forms.

Inside a Volcano

The magma chamber is a collection of magma inside the Earth, below the volcano⁽⁴⁾. The main vent is the main outlet for the magma to escape. Secondary vents are smaller outlets through which magma escapes. The crater is created after an eruption blows the top off the volcano⁽⁵⁾.

States of a Volcano

Volcanoes can be described in terms of activity and can be:

- > still **active** and erupt frequently
- > **dormant** (temporarily inactive but not fully extinct)
- > **extinct** (never likely to erupt again)

Shield volcanoes

Shield volcanoes, so named for their gently sloping sides⁽⁶⁾, are formed by the eruption of thin, runny lava that can flow a great distance from a vent, but not generally explode catastrophically. Shield volcanoes are usually found at constructive or tensional boundaries⁽⁷⁾. Eruptions tend to be frequent but relatively gentle⁽⁸⁾.

Composite volcanoes

Composite volcanoes (Stratovolcanoes) are made up of alternating layers of lava and ash⁽⁹⁾ (other volcanoes just consist of lava). They are usually found at destructive or compressional boundaries⁽¹⁰⁾. The eruptions from these volcanoes may be a pyroclastic flow rather than a lava flow⁽¹¹⁾. A pyroclastic flow is a mixture of hot steam, ash, rock and dust. A pyroclastic flow can roll down the sides of a volcano at very high speeds and with temperatures of over 400°C⁽¹²⁾.

Supervolcanoes

A supervolcano is a volcano on a huge scale. It is different from a volcano

because it erupts at least 1,000 km³⁽¹³⁾ of material (a large volcano erupts around 1 km³⁽¹⁴⁾) and it forms a depression, called a caldera⁽¹⁵⁾ (a volcano forms a cone shape). A supervolcano often has a ridge of higher land around it and erupts less frequently, however such eruptions would be able to cause severe cooling of global temperatures for many years afterwards because of the huge volumes of sulfur and ash erupted⁽¹⁶⁾. They are the most dangerous type of volcano.

Submarine volcanoes

Submarine volcanoes and volcanic vents are common features on certain zones of the ocean floor⁽¹⁷⁾. Some are active at the present time and, in shallow water, disclose their presence by blasting steam and rock debris high above the surface of the sea. Many others lie at such great depths that the tremendous weight of the water above them results in high, confining pressure and prevents the formation and explosive release of steam and gases.

Subglacial volcanoes

A subglacial volcano is a volcanic form produced by eruptions beneath a glacier. Today they are most commonly found in Iceland and Antarctica⁽¹⁸⁾. Their shape tends to be characteristic and unusual, with a flat top and steep sides.

Volcanic Eruptions

Eruptions can cause lateral blasts, lava flows, hot ash flows, mudslides, avalanches, falling ash and floods⁽¹⁹⁾. When magma reaches the Earth's surface it is called lava⁽²⁰⁾. When the lava cools, it forms rock. Volcanic eruptions can happen at destructive and constructive boundaries, but not at conservative boundaries.

The Earth's crust is made up of huge pieces called plates⁽²¹⁾, which fit together like a jigsaw puzzle. These plates sometimes move. The friction causes earthquakes and volcanic eruptions near the edges of the plates⁽²²⁾. An eruption occurs when pressure in the magma chamber forces magma up the main vent, towards the crater at the top of the volcano.

Volcanic eruptions can send ash high into the air, over 30km above the Earth's surface⁽²³⁾. Common volcanic gases include water vapor, carbon dioxide, sulfur dioxide, hydrogen chloride, hydrogen fluoride and hydrogen sulfide⁽²⁴⁾.

Large volcanic eruptions can reflect radiation from the Sun and drop average temperatures on Earth by around half a degree. There have been several examples of this over the last century⁽²⁵⁾.

Volcanic Hot Spots

In many locations the hot molten magma from deep within the Earth rises up through the crust to reach the surface⁽²⁶⁾. This sometimes happens in the middle of plates. When a hot spot forms in the middle of a plate, it remains constant, as the plate continues to move over it. The result is that a trail of volcanoes is left behind, with older volcanoes moving away from the hot spot, and newer ones forming over top of the hot spot.

Volcanism

When hot molten magma escapes from the Earth's core becoming cooler, and forming hard rocks, we refer to this process as volcanism⁽²⁷⁾. Volcanism takes place both above the surface of Earth, as well as beneath its surface. When molten lava escapes the Earth and reaches the surface geologists say that it is extrusive volcanism.

When molten magma cools and hardens beneath the surface of the Earth, we say that it is intrusive volcanism⁽²⁸⁾. In some cases, molten magma cools and hardens deep beneath the surface of the Earth, far below the crust. When this happens, scientists call it plutonic volcanism⁽²⁹⁾.

Extrusive Volcanism

When volcanic activity takes place above ground, so that hot molten magma is released onto the landscape, we say that the volcanic activity is extrusive⁽³⁰⁾, meaning it is on the exterior, or outside of the Earth. Magma that reaches the surface is known as lava.

Lava flows are extraordinarily hot, and destructive. In many cases, these lava flows are slow and continuous but volcanoes can also erupt with unbelievable force and power. These types of eruptions can send lava, rock, and hot ash, known as pyroclastic material shooting outward for hundreds of square miles, in some cases, even sending up a worldwide cloud of dust and ash.

Volcanic Activity

In order to be considered active, a volcano must have erupted within the last few thousand years. On the Earth today there are around 560 active volcanoes⁽³¹⁾. Each week 15 - 20 of these volcanoes will erupt. Each year two or three volcanoes erupt that were previously thought to be dead.

Volcanoes And Plant Life

When volcanoes erupt, the immediate effect on the landscape, trees and other plants are

burned, buried, and destroyed. While the immediate effect of volcanoes on plant life is negative, the long term effect is very positive. Magma from the Earth's core contains a rich source of nutrients that plants need to survive. Each time a volcano erupts, it brings these nutrients with it. When volcanoes explode, spreading ash around a large area, this ash acts as a fertilizer, enriching the soil⁽³²⁾. It is no surprise that the soil near volcanoes is among the richest and most fertile on Earth.

Volcanoes And Land Formation

Volcanoes create an almost infinite variety of landforms and terrain. However, geologists have noticed patterns when studying these different terrains, that allow them to group them into categories, based on how they are the same, and how they are different. These four landform types are called lava flows, volcanic peaks, calderas, and volcanic necks⁽³³⁾.

Lava Flows

Lava flows get their name from the manner in which the hot molten lava flows outward parallel to the surface of the Earth⁽³⁴⁾. The result is a large flat lava covered plain. As additional lava flows escape from a volcano or fissure, they create layers of lava rock left behind from the many different flows.



A volcanic eruption



A lava flow is a moving outpouring of lava, which is created during a non-explosive effusive eruption. When it has stopped moving, lava solidifies to form igneous rock. The term lava flow is commonly shortened to lava.

The following definitions are provided for the educator's reference. Young people should have the opportunity to explore definitions through individual activities. Some definitions may have been deliberately simplified for a young audience.

Ash

Volcanic ash consists of small bits of pulverized rock and glass created by volcanic eruptions less than 2 millimetres diameter.

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Avalanches

An avalanche is a sudden, drastic flow of snow down a slope.

Caldera

A caldera is a cauldron-like volcanic feature usually formed by the collapse of land following a volcanic eruption.

Crater

A volcanic crater is a circular depression in the ground caused by volcanic

activity. It is typically a basin, circular in form within which occurs a vent (or vents) from which magma erupts as gases and lava.

Fissures

A fissure vent, also known as a volcanic fissure or simply fissure, is a linear volcanic vent through which lava erupts, usually without any explosive activity.

Glaciovolcano

A subglacial volcano, also known as a glaciovolcano, is a volcanic form produced by eruptions beneath the surface of a glacier or ice sheet.

Lava

Lava refers both to molten rock expelled by a volcano during an eruption and the resulting rock after solidification and cooling.

Magma

Magma is a mixture of molten or semi molten rock that is found beneath the surface of the Earth.

Magma Chamber

A magma chamber is a large underground pool of liquid rock found beneath the surface of the Earth.

Molten

Made liquid by heat.

Pyroclastic Flow

A pyroclastic flow is a fast-moving current of superheated gas and rock which reaches speeds moving away from a volcano of up to 700 km/h.

Tensional

Tensional stress is the stress that tends to pull something apart. It is the stress component perpendicular to a given surface, such as a fault plane.

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A volcanic ash plume consists of small pieces of pulverized rock and glass created by volcanic eruptions.